XIII INTERNATIONAL CONGRESS OF ACAROLOGY

August 23-27, 2010, Recife-PE, Brazil

ABSTRACT BOOK

13th

INTERNATIONAL CONGRESS OF ACAROLGY

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ABSTRACT BOOK

Organized by G.J. de Moraes, R.C. Castilho & C.H.W. Flechtmann

Organization of the Abstracts:

Abstracts of all presentations of the congress are here organized according to the alphabetic order of the family name of the first author.

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Thursday 26, Afternoon, Room 3

1 - The complex of spider mite pests of papaya (*Carica papaya*) in Mexico

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Papaya is cultivated in tropical lowlands in Mexico. During the last 30 years, the surface destined to this crop has increased progressively, mostly with the cultivar Maradol, developed in Cuba. This cultivar has replaced old materials, such as "Criollo" and "Cera". Cultural practices have moved from traditional to intensive, from self consumption to an export commodity. Early records in Mexico of tetranychid mites (Tetranychidae) attacking papaya refer to three species: *Eotetranychus lewisi*, *Eutetranychus banksi* and *Tetranychus urticae*. A sudden increase in the severity of mite attack has been observed in wide areas. Thus, surveys to identify mite species and to estimate their population fluctuations were carried out on papaya in the States of Guerrero, Veracruz and Yucatan, Mexico. As a result of those surveys, *Tetranychus merganser* was collected in addition to the above mentioned mite species. This mite had been collected previously in China, Mexico and USA, mostly on plants of no economic importance and never causing great injury. By contrast, it was associated to most outbreaks during our surveys on papaya. This species has been found also associated to prickly pear (*Opuntia* spp.) in Mexico. We postulate that *T. merganser* has recently expanded its host range, increasing its importance, seemingly as a result of indiscriminate use of pesticides that decimated populations of natural enemies.

Thursday 26, Afternoon, Room 5

2 - Insulin cascade in *Rhipicephalus* (*Boophilus*) *microplus* embryo cells

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Insulin is the only IrP that binds with high affinity to a heterodimer receptor tyrosine kinase (RTK) called the insulin receptor (IR) and stimulates a signaling pathway that includes PI3K and AKT. Besides its metabolic role, insulin signaling pathway (ISP) is widely described as crucial for vertebrate and invertebrate embryogenesis, development and cell survival. In such cascade, Phosphatidylinositol 3-OH Kinase (PI3K) is hierarchically located upstream Protein Kinase B (PKB). To study the insulin-triggered pathway and its possible roles during embryogenesis we used a culture of embryonic *Rhipicephalus* (*Boophilus*) *microplus* cells (BME26). Recent discoveries by our research group point that the insulin signaling pathway (ISP) is present and plays important roles on *Rhipicephalus* (*Boophilus*) *microplus* ticks, embryos and BME26 embryo cell line. Exogenous insulin increased glycogen content in a dose-dependent manner on BME26 cells. Moreover, the expression level of PI3K's regulatory subunity (p85) increased in the presence of insulin, as determined by Real Time RT-PCR. When PI3K inhibitors (Wortmannin or LY294002) were added these effects were reversed. Additionally, PI3K inhibition increased the expression level of two insulin-regulated downstream targets from glycogen metabolism (GSK3b) and gluconeogenesis (PEPCK) pathways. GSK3b expression was increased in ovaries and especially high in partially engorged females. Though p85 and GSK3b presented different expression profiles during embryogenesis, GSK3b activity showed strong correlation with glycogen content during the same period. Interestingly, the GSK3b specific inhibitor SB216763 was able to inhibit GSK3b enzymatic activity on egg homogenates. Therefore, its activity must be tightly regulated, which is achieved by several mechanisms including phosphorylation, protein complex formation and subcellular distribution. Any change in this multifunctioning

protein can promote phenotypes such as altered formation or impairment of embryo development. The RNA interference was used to analyze role of GSK3 during ovary formation and embryogenesis in partially engorged female ticks and this silencing affected both oviposition and hatching. This study shows that the PI3K inhibitors LY294002 and Wortmannin were able to block the effects on glycogen accumulation promoted by insulin in BME26 cells. Moreover, these chemicals also reverted the increase in transcription of PI3K regulatory subunit p85, when compared to cells stimulated with bovine insulin. Many studies demonstrate that PI3K is the only mutual target of these inhibitors. A possible role for PI3K during embryogenesis is also suggested, based on the p85 relative expression observed in ovaries and laid eggs. Taken together, our results suggest that insulin responsive machinery is present in *R. microplus* cells, and that PI3K activity is required for such signaling. This research was financially supported by the Brazilian INCT- Entomologia Molecular / CNPQ, FAPERJ and CAPES.

Wednesday 25, Morning, Room 4

3 - Catalog of eriophyoid mites (Prostigmata: Eriophyoidea) of Mexico

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Mites of the superfamily Eriophyoidea include species of economic importance. Some of them feed on their hosts producing characteristic damages (galls, erinea, discoloration, chlorosis, etc.), causing up to 90% yield loss. Approximate 3,442 species have been described around the world. In Mexico, 32 species have been reported, corresponding to 0.96% of the total number of species described around the world. Most records in Mexico were not formally published. The main objective of the present study was to elaborate a catalog of Mexican eriophyoid mites, including data on distribution, damage, host diversity, taxonomy, synonymies and sources of query. All information was obtained directly from original publications and scientific Mexican collections; in addition, collections were done in different Mexican states. The classification by Amrine *et al.* (2000) was used. Two hundred thirty species of 40 genera were cataloged, representing all three families of the superfamily: Phytoptidae (25 species), Eriophyidae (169) and Diptilomiopidae (36). These mites are represented in all states of the country. It is estimated that at least 25% of the species found may be new to science. They were found in 407 samples of 240 plants. Most of the species were recorded from the natural vegetation, followed by crops, ornamentals and finally forest species with the 55, 20, 15 and 10% respectively. Most of the eriophyoids found was apparently vagrant (about 60%), whereas those producing galls and the erinea were represented by about 15% each; about 6% caused mechanical damage, 3% caused malformations and 1% were involved with virus transmission. *Trisetacus ehmanni*, *Retracus johnstoni*, *Cosetacus camelliae*, *Colomerus gardeniella*, *Eriophyes insidiosus*, *Aceria cactorum*, *A. annonae*, *A. ficus*, *A. granati*, *A. guerreronis*, *A. lycopersici*, *A. mangiferae*, *A. tulipae*, *A. tosichella*, *A. kenyae*, *A. sheldoni*, *Aculus tetranothrix*, *A. fockeui*, *Aculops lycopersici*, *Calepitrimerus muesebecki*, *Phyllocoptruta oleivora*, are considered species of economic importance in Mexico. *Trisetacus pini*, *T. alborum*, *T. sylvestris*, *Nalepalla tsugifoliae*, *Epitrimerus abietis*, *E. taxodii*, *Notallus nerii*, *Abacarus sacchari*, *A. sporoboli*, *Phyllocoptruta sakimura*, *Acareliptus cocciformis*, *Spinacus pagonis*, *Paraphytoptus erythrinae*, *Aceria cinerae*, *A. coccolobi*, *A. eriobotryae*, *A. fraxini* and *A. guazamae* are some of the new records for the country. This catalog corresponds to preliminary results of an on-going research project to study the diversity and some aspects on the biology of the superfamily Eriophyoidea in Mexico.

Tuesday 24, Afternoon, Auditorium - Poster

4 - Arthropods associated with *Tetranychus tumidus* in an organically-grown orchard of *Solanum quitoense* in Santa María de Dota, Costa Rica

H. Aguilar & P. Murillo

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Quito orange (*Solanum quitoense* Lam.), known as "naranjilla" in Costa Rica, has been grown extensively in this country in the last few years in association with passion fruit, *Passiflora ligularis* Juss. It is grown organically in areas above 1500 m above sea level. *Tetranychus tumidus* Banks, a spider mite found in both crops, is causing a significant degree of damage. In a study carried out on a farm in Santa Maria de Dota, San Jose Province, at 2077 m above sea level, where the farmer wanted to establish an IPM system with no use of pesticides, the Mediterranean fruit fly, *Ceratitis capitata* Wied. (Insecta: Diptera: Tephritidae) emerged as the major entomological concern, being the spider mite the second key pest in the orchard. In spite of this scenario, the grower still intended to manage his orchard without using pesticides, relying in the occurrence of natural enemies to maintain pests at low densities. Several natural enemies have been identified feeding on *T. tumidus*, i.e. *Holobus pygmaeus* (Solier) (Insecta: Coleoptera: Staphylinidae), S*tethorus* sp. (Insecta: Coleoptera: Coccinellidae), *Scolothrips* sp. (Insecta: Thysanoptera: Thripidae). Likewise, some mites have also been found associated with this spider mite, such as *Balaustium* sp. (Erythraeidae), whose nymphs and adults were observed feeding avidly on all developmental stages of *T. tumidus*, and unidentified species of phytoseiid (Phytoseiidae), which occurs in relatively low numbers. There is a special interest among growers and professionals in developing programs to augment the natural enemy densities and maintain the spider mite populations in manageable numbers.

Thursday 26, Afternoon, Room 3

5 - Distribution and damage caused by *Abacarus* sp. (Acari: Eriophyidae) associated to sugarcane in Costa Rica

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During 2008, sugarcane entomologists observed new symptoms on the foliage of sugarcane in a plantation located in the province of Puntarenas. Leaves were checked and mites were seen, collected, and sent to personnel of the Quarantine Laboratory at the Juan Santamaria International Airport. Damage on leaves was associated with an eriophyid mite, whose taxonomic characters showed it to belong to the genus *Abacarus*. A sample of those mites was sent to experts abroad in order to elucidate whether or not, this was one of the three *Abacarus* species already known worldwide. As a result, it was determined as a new species, which is in the process of being described. Initially, growers thought these symptoms were caused by fungal diseases known as "rusts"; e.g. *Puccinia kuehnii* (Krüger) Butler and *P. melanocephala* H. Sydow & P. Sydow, which, at a certain distance, look similar. However, with the use of a hand lens, uredinospores produced by both fungi can be easily appreciated, which helps with the damage recognition. Mites, on the other hand, can be also seen with a 10 X hand lens. Later on, the presence of *Abacarus* sp. was also detected in other areas of Costa Rica, where sugarcane is grown, such as Grecia, in Alajuela Province, and San Isidro de El General, in San Jose Province. Further work should be conducted to determine more of the ecological features related to this mite, as well as the degree of damage produced in the cultivars commercially grown in Costa Rica. Description of damages and differences between mite attack and the rusts are given.

Wednesday 25, Afternoon, Auditorium - Poster

6 - *Polyphagotarsonemus latus*: a conundrum in biodiesel investigation in Costa Rica?

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Considering all concerns with the exploitation of fossilized resources worldwide, there is a major interest in some nations to seek other viable sources to produce combustibles. One of these possible sources is *Jatropha curcas* L. (Euphorbiaceae), which has been considered a good candidate. A multidisciplinary team is conducting a research in Costa Rica to evaluate the possibility of *J. curcas* for producing biodiesel. Essays to evaluate its agronomic features have been initiated in the Fabio Baudrit Experiment Station, located in the Province of Alajuela, at 900 m above sea level. However, those tests, since the beginning, have been in jeopardy because of a strong and permanent attack caused by the broad mite, *Polyphagotarsonemus latus* (Banks), mostly during the rainy season, which has caused a preoccupation among all those involved in the project. At this time, with all other variables in check, the major inconvenience in this investigation is *P. latus*, which has become a true barrier in the development of the plants; in other words, it could be the limiting factor in the research of this new biodiesel source in Costa Rica. Development of damage and explanations of prominent symptoms are presented.

Thursday 26, Afternoon, Room 2

7 - The effect of ground cover management on the biological control of *Tetranychus urticae* Koch (Acari: Tetranychidae) in clementines

E. Aguilar-Fenollosa[1], M.V. Ibáñez-Gual[2], S. Pascual-Ruiz[1], T. Pina[1], M.A. Hurtado-Ruiz[1] & J.A. Jacas[1]

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Fruit scarring caused by *Tetranychus urticae* Koch (Acari: Tetranychidae) is one of the main pest problems faced by Spanish clementine growers as this mite can result in complete downgrading of the fruit. Generalist phytoseiid mite predators, which are common in citrus orchards, both on the ground cover and on trees, can play an important role in regulating *T. urticae* populations. A previous study to evaluate the acarofauna associated with weeds in citrus orchards showed that Poaceae had the most favorable Phytoseiidae: *T. urticae* ratio. This result could be related to the availability of a superior alternative food (e.g. pollen) on plants of that group. In the present study, we compared the effect of a sown cover of *Festuca arundinacea* (Poaceae) to traditional alternatives (bare soil and indigenous wild cover). Mite populations have been monitored fortnightly for up to 3 years in four commercial citrus orchards where the three ground management systems were established in 1 ha plots. As expected, the sown cover of *F. arundinacea* resulted in the lowest populations of *T. urticae* on the trees. Mechanisms explaining these results could be related both to the abundance and diversity of the beneficial acarofauna associated to the different covers (with the *F. arundinacea* cover having the most abundant and diverse phytoseiid fauna) and to the selection of host-feeding specialist strains of *T. urticae* in the *F. arundinacea* cover.

Thursday 26, Afternoon, Auditorium - Poster

8 - Voracious feeding habits of *Lasioseius penicilliger* (Acari: Ascidae) on *Haemonchus contortus* infective larvae (L_3) and free-living nematodes

L. Aguilar-Marcelino[1,3], M.T. Quintero Martinez[2], P.M. de Gives[1], M.E.L. Arellano[1], E. Liébano-Hernández[1], G. Torres-Hernández[3], I.C. del Prado[3] &. M.G. Camacho[3]

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Nematodes are a very important concern in the livestock and agriculture industry and in public health. *Haemonchus contortus* is a ruminant parasitic nematode considered as one of the major problems affecting livestock and sheep industry around the world. Chemotherapy is used to control

nematode pests; however, the presence of anthelmintic resistance causes inefficiency of such chemical drugs. Natural nematode antagonists have recently gained interest in organic production systems as useful tools of biological control. A number of nematode antagonists in nature are being identified as fungi, bacteria, virus, predatory nematodes and nematode predatory mites. Acari represent the most abundant group of chelicerate arthropod species and they are well adapted to a variety of environments worldwide. *Lasioseius penicilliger* is a nematode-feeding mite that has being evaluated against some plant parasitic nematodes and it has displayed a high predatory activity and has being considered as a possible potential control agent of crop pests. This research was aimed at determining the *in vitro* reduction percentage of *H. contortus* infective larvae and the free-living nematodes *Panagrellus redivivus* and *Rhabditis* sp. when exposed to that mite species. The confrontation (mites/nematodes) was carried out on 2 cm diam. plastic watchmaker Petri dishes (WPD) containing 2% water agar during 5 days. Three series of ten water agar WPD were formed as follows: Series 1, were additioned with 1500 *H. contortus* infective larvae and five *L. penicilliger* adult mites each. Series 2 were added with 1000 *P. redivivus* plus 5 mites. Series 3 a thousand specimens of *Rhabditis* sp. plus 5 mites were put on every plate. Observations on a microscope (x4) were performed everyday. Viability and voracity activity on nematodes was daily revised and recorded. At the end of the confrontation, WPD of each series were washed with tap water and the liquid containing both mites and nematodes was recovered in Eppendorf tubes. Ten 5 microliter aliquots were taken and the quantification of both populations was carried out. Voracious feeding activity of mites was observed against the three species of nematodes under study. The results showed reductions of 75.4% for *H. contortus*, 78.8% for *P. redivivus* and 68.9% for *Rhabditis* sp. This is the first record of a predatory mite feeding on an animal parasitic nematode.

Wednesday 25, Morning, Room 6

9 - Trigynaspid mites (Acari: Mesostigmata) associated with the Mediterranean pine engraver beetle, *Orthotomicus erosus* (Coleoptera: Scolytidae), in Iran

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Bark beetles of the family Scolytidae are important pests of fruit, ornamental and forest trees, especially conifers. One of the most destructive scolytids which attacks pine trees in weakened and relatively weakened forests in Tehran region and adjacent areas, is the Mediterranean pine engraver beetle, *Orthotomicus erosus* (Wollaston, 1857), which may kill the infested trees in a few months. Some studies on mites associated with elm and fruit tree bark beetles have been carried out in Iran, in which only six mesostigmatic families, including Ameroseiidae, Ascidae, Celaenopsidae, Laelapidae, Phytoseiidae and Trematuridae, have been reported. During 2006-2010 investigation on mites associated with the Mediterranean pine engraver beetle in pine forests of Tehran region, mites of two trigynaspid families, Celaenopsidae and Cercomegistidae, were collected; two species of *Pleuronectocelaeno* Vitzthum, 1926, and an unidentified cercomegistid mite. This is the first record of the cohort Cercomegistina, superfamily Cercomegistoidea, and family Cercomegistidae from Iran, first record of its association with bark beetles in Asia, and second record of the family from Asia, after Lebanon. Adult females, males and immature stages of these trigynaspid mites were found in the galleries. The food habits of these mites have not yet been investigated clearly, but they may feed on dead organic substrates, nematodes, fungi, other mites and immature stages of bark beetles living in these habitats.

Tuesday 24, Afternoon, Auditorium - Poster

10 - Ultrastructure of supracoxal glands of *Falculifer rostratus* (Falculiferidae, Psoroptidia, Astigmata, Actinotrichida)

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Astigmatic mites are well known to present a pair of so-called supracoxal glands. These glands consist of a few very large cells containing numerous mitochondria associated with deep infoldings of the cell membrane, an arrangement characteristic of cells performing transcellular ion transport. The glands open into podocephalic glands and represent the only podocephalic glands in *F. rostratus*. Present knowledge on these glands obtained from other astigmatic mites is completed and the glands are compared with other transporting tissues occurring in actinotrichid mites such as genital papillae, Claparède organs, axillary organs and coxal glands.

Thursday 26, Morning, Room 4

11 - Anatomy of the *Brevipalpus* mites (Tenuipalpidae, Prostigmata, Actinotrichida)

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A review on the anatomy of *Brevipalpus* mites including histological and ultrastructural details is presented. Focus is laid on the sensory system, gnathosoma, alimentary system, prosomal glands and genital organs. With regard to the sensory system, sensilla on the gnathosoma as well as the eyes presenting well developed rhabdomeric microvilli have been studied. The gnathosoma is composed of the stylophore with stylettiform mobile digits and the infracapitulum including mouth and pharynx and bearing the pedipalps. Some details on muscles and cuticular structures are added to the present knowledge. The alimentary system, starting with the preoral cavity and mouth, consists furtheron of a pharynx functioning as a strong pump, esophagus, ventricle, a pair of caeca, and postventricular gut inlcuding a postcolon functioning as an excretory organ and the anal atrium ending with the anus. The prosomal glands are present with an unpaired tracheal gland and paired podocephalic glands the latter including a coxal gland devoid of a sacculus and two acinous glands. Details on the female and male genital system are presented including oogenesis and spermatogenesis. The results are compared with those obtained from other prostigmatic mites.

Tuesday 24, Afternoon, Auditorium - Poster

12 - On the female genital system of Saxidromidae (Prostigmata, Actinotrichida)

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Saxidromidae are mites regarded as an early derivative taxon within Prostigmata, perhaps close to the border between Prostigmata and "Endeostigmata" or, alternatively, close to the base of Parasitengona. It is known, that these mites exhibit a very peculiar mating behaviour. In recent studies, the male genital system has revealed remarkable peculiarities including the presence of synspermia, until recently only known from some spiders. In the present study, the female genital system is described to provide a broader basis for further interpretations on the reproductive system of these peculiar mites.

Wednesday 25, Afternoon, Auditorium - Poster

13 - Relationship between *Polyphagotarsonemus latus* (Acari: Tarsonemidae) and *Papaya Ringspot Virus-P*

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The broad mite, *Polyphagotarsonemus latus*, is a cosmopolitan species that affects several crops in tropical and temperate areas. Main damage caused by the infestation of this species is the reduction or deformation of young leaves, buds, fruits and flowers. When *P. latus* feeds on young papaya leaves, they exhibit chlorosis and down curled distorted areas. In Mexico, the damage caused by this mite is called "monkey´s hand" because the leaf area of the young papaya leaves is reduced leaving only the veins visible. This symptom is similar to the damage caused by the infection of *Papaya Ringspot Virus-P* (PRSV-P). As *P. latus* and PRSV-P cause similar damage to papaya leaves, the aim of this investigation was to determine the actual role of the mite and the virus in the development and severity of foliage symptoms. Experiments were carried out to determine the comparative effect of the feeding activities of the mite and the artificial infection of PRSV-P in papaya plants. Diagnosis of PRSV-P was done by RT-PCR. The results showed that *P. latus* reduced the leaf area of young papaya leaves but not as much as when these were infected with PRSV-P. When mites and virus were inoculated simultaneously in the same plant, the damage observed on leaves was similar to plants infected only by PRSV-P. Additional results also suggest that *P. latus* was not able to transmit PRSV-P from infected to healthy papaya plants.

Wednesday 25, Afternoon, Auditorium - Poster

14 - Molecular detection of *Hepatozoon* spp. in the crab-eating-fox (*Cerdocyon thous* L.) in Brazil

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Hepatozoon spp. are tick-borne apicomplexan parasites that infect numerous domestic and wild carnivores, diagnosed in many regions of the world. In Brazil, canine hepatozoonosis was first described in Rio de Janeiro, and more recently in other states, infecting dogs, cats, and the crab-eating-fox *Cerdocyon thous*. In the present study, we examined 59 crab-eating-foxes from the wildlife in the state of Espírito Santo, southeastern Brazil. All animals were hit by vehicles passing through the highway ES-060, which crosses an Atlantic rainforest reserve, located between the cities of Guarapari and Vila Velha. The animals were collected by the Rodosol company and taken to the University of Vila Velha - UVV, where they underwent post-mortem examination, and samples of liver, lung and blood were collected. Ticks were also collected and preserved for identification. Organ samples were submitted to DNA extraction followed by PCR assays targeting the 18S rRNA gene of *Hepatozoon* spp. and *Babesia* spp.. Samples from 9 animals were positive to the *Hepatazoon*-PCR assay, whereas 21 animals were positive to the *Babesia*-PCR assay. After DNA sequencing and Blast analysis, all PCR products, including those generated by the *Babesia*-PCR, were most similar to *Hepatozoon* sequences available in GenBank. All 21 positive samples to *Babesia*-PCR were 99.2% similar to *H. americanum* (AF176836). Among the *Hepatozoon*-PCR positive samples, 8 were 98% similar to *Hepatozoon* sp. strain curupira (AY461377), and 1 was 98.4% similar to *Hepatozoon* sp. strain 744C (EU430234). All ticks found on the foxes were identified as *Amblyomma cajennense* nymphs and *Amblyomma* sp. larvae. Our results confirm previous studies that also obtained amplification of *Hepatozoon* DNA by *Babesia*-PCR assays. In the state of Espírito Santo, crab-eating-foxes are infected by different *Hepatozoon* species. Further molecular analysis and phylogenetic studies will be performed to better characterize these agents. So far, the tick species associated with these *Hepatozoon* agents is not known in Brazil. This research was financially supported by FAPESP, São Paulo, Brazil.

Wednesday 25, Afternoon, Auditorium - Poster

15 - Molecular detection of *Coxiella* sp. in the soft tick *Ornithodoros rostratus* (Acari: Argasidae) in Brazil

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The genus *Coxiella* belongs to the family Rickettsiaceae, order Rickettsiales, and the gamma subdivision of Proteobacteria. The single species recognized in this genus, *Coxiella burnetii*, is an obligate intracellular bacterium that is the etiological agent of Q-fever worldwide. There are genomic variations among *C. burnetii* strains from different sources, including goats, sheep, humans, and ticks. *Coxiella burnetii* has been reported to infect more than 40 tick species, which are also implicated in enzootic maintenance of the agent. The tick species that are the most frequent vectors of *C. burnetii* belong to the genera *Ixodes*, *Rhipicephalus*, *Amblyomma* and *Dermacentor*. The present study evaluated by PCR the presence of DNA of tick-borne pathogens of the genera *Borrelia*, *Rickettsia*, *Coxiella*, and the Anaplasmataceae family in soft ticks collected in the environment of the Pantanal area of Nhecolandia farm, state of Mato Grosso do Sul, Brazil. A total of 23 ticks were collected (20 nymphs and 3 adult females) in 2009, all identified as *Ornithodoros rostratus*. By PCR, 4 nymphs showed to be positive for Anaplasmataceae (PCR targeting the 16S rDNA gene), 4 nymphs for *Borrelia* (gene flagellin), and 20 nymphs and 1 female for *Coxiella* (capsular polysaccharide biosynthesis protein gene). No tick was positive for *Rickettsia* (citrate synthase gene). PCR products were DNA sequenced and compared to corresponding sequences in GenBank. The *Coxiella* sequences generated from *O. rostratus* were closest to *Coxiella burnetti* (CP001020) - 95% similarity; and to a *Coxiella* symbiont from *Carios capensis* (DQ150580) - 94%. The Anaplasmataceae sequences generated from *O. rostratus* were closest to an alpha-proteobacterium uncultured agent (FJ754837) - 96%. These results confirm the occurrence of the genus *Coxiella* in Brazil. Since the *Coxiella* agent of *O. rostratus* presented only 95% similarity with *C. burnetii*, it is a new strain, probably a tick symbiont, as indicated by the very high infection rate among the 23 tick specimens tested (>90%). The pathogenicity of this novel *Coxiella* strain to vertebrates is unknown. Analysis of the *Borrelia*-PCR positive samples are still in process, as well as phylogenetic analysis of the sequences generated in the present study. This research was financially supported by FAPESP.

Tuesday 24, Afternoon, Auditorium - Poster

16 - Survey of the fauna of predatory mites on *Jatropha curcas* L. and other species of the same genus in the State of Alagoas, Brazil

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Jatropha curcas L. is a crop with great potential for oil production, especially in northeast Brazil, where widespread cultivation of this crop may significantly increase pest problems, including mites. Species of *Jatropha* have been observed attacked by mites of different species. The objective of this work is to determine the mite species associated with *Jatropha* in the State of Alagoas. Initially, samples of 3 *Jatropha* species were collected: *J. curcas* (Jatrofa), *Jatropha* sp. (pinhão branco) and *J. gossypiifolia* L. (pinhão roxo), found in the region as part of the natural vegetation or as ornamentals. Samples were collected biweekly at three sites (Sítio Limoeiro, in the municipality of Limoeiro de Anadia; Batinga and Bananeiras, both in the municipality of Arapiraca). At each sampling time, 3 basal, 3 median and 3 apical leaves were collected from each of 5 plants. Samples were taken to a laboratory where mites were counted and mounted in Hoyer´s medium for later identification. So far, 1,886 mites were found, about 75%, on *J. gossypiifolia*. This plant proved to be an important mite reservoir; in all samples 2 *Tetranychus* species (Acari: Tetranychidae) and one *Neoseiulus* species (Acari: Phytoseiidae) were consistently found, especially on the basal leaves. Leaves of this species

are glabrous, differently from leaves of *Jatropha* sp., onto which low levels of a single species of phytophagous mite, *Tetranychus* sp., and a phytoseiid species were found. On *J. curcas*, a greater diversity of mites, especially predaceous phytoseiids (a species of *Amblyseius* and 2 species of *Neoseiulus*) were found. *Iphiseiodes zuluagai* Denmark & Muma and *Phytoseiulus macropilis* (Banks) were also found on this plant. Other mites found were: 2 morpho-species of Oribatida, *Tydeus* (Tydeidae) and *Polyphagotarsonemus latus* (Banks) (Tarsonemidae). The results have so far indicated the presence of important phytophagous and predatory mites on those plants. They have also indicated the presence of predators that could be playing a role in the control of the phytophagous species.

Friday 27, Morning, Room 3

17 - The coconut mite *Aceria guerreronis* Keifer (Acari: Eriophyidae) in the sub-arid coastal region of Dhofar, Oman

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The eriophyid mite, *Aceria guerreronis* Keifer, has been reported as an important pest of coconut fruit in most coconut-growing areas of the world, particularly in South Asia, South & Central America, Tropical Africa and The Caribbean. The mite was also observed in the late 1980s in coconut plantations in the sub-arid coastal plain of Dhofar (Oman), a south-eastern region separated from the desert by the Dhofar Mountains. However, its distribution, prevalence and dynamics were poorly known. Surveys were conducted to understand the importance, the phenology and some aspects of the bioecology of the coconut mite in this region. First results indicate a widespread distribution of the pest with high incidence (100% of the palms and 82% of the nuts across all the sites), particularly in areas where coconut plantations are concentrated. Higher prevalence of the coconut mite was observed during the hotter season between February and May with over 1000 mites/fruit. Damage caused by the mite to the coconut fruit in Dhofar was severe (c. 25% of mid-age nut surface scarred) but varied with variety. Among natural enemies found associated with the coconut mite in Dhofar were the phytoseiid mites *Neoseiulus paspalivorus* De Leon and *Cydnoseius negevi* Swirski & Amitai, and several pathogenic fungi including *Hirsutella thompsonii* Fisher. The potential for IPM is discussed.

Tuesday 24, Afternoon, Room 2

18 - Host-specificity and host-switching among varroa mites: impact in invasion success

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Mites in the genus *Varroa* are external parasites of social honeybees. Their primary hosts are the cavity-nesting Asian honeybees (mostly *Apis cerana*), which are found throughout Asia. More than 25 distinct genetic 'groups' of varroa mites have been recorded on these bees and they form part of a large complex of mites that embraces 4, but possibly 7, distinct species. Members of each mite group are intimately associated with a particular genotype of Asian honeybee and the biography of varroa mites and Asian honeybees is very similar, inferring a long period of co-evolution between the mites and bees. Varroa mites were reported to have first switched-host to the Western honeybee, *A. mellifera*, during the mid-1900's, following the introduction of that bee into Asia by humans to improve honey yields and crop pollination. The mites that switched-host were subsequently moved out of Asia on *A. mellifera* as part of global trade and they are now found in most beekeeping countries, a notable exception is Australia. They have also developed into the most serious pests ever of *A. mellifera*. DNA studies have shown that the mites that switched-host to *A. mellifera* came from just 2 groups of mites, a J and K group (short for Japan and Korea), which form part of the *V. destructor* species on Asian honeybees. Their spread since switching host can be traced to the

artificial movement of *A. mellifera* by humans. Individual mites of each group on *A. mellifera* show almost no genetic variation, irrespective of where they are now found. This suggests that these two genetic populations of mites on *A. mellifera* were the result of two severe genetic bottlenecks that occurred at the time of the initial host-switches, one in Japan and the other in or near the Korean Peninsula. Until recently, other variants of the J and K groups present on Asian honeybees as well as members of all other varroa mite groups on Asian honeybees had not switched-host to *A. mellifera*, primarily because they lacked the ability to successfully reproduce on that bee, a trait that allowed individuals of the J and K clones to successfully colonize *A. mellifera*. However, during the last several years new variants of the J and K groups of *V. destructor* have been found to have successfully switched host and colonised *A. mellifera* in north-east Asia, as have mites from a J (for Java) group of *V. jacobsoni* in Papua New Guinea (PNG). These new findings suggest that successful colonization of *A. mellifera* by varroa mites is dependent on the mites being able to successfully reproduce on *A. mellifera* and that the likelihood of this occurring increases with longer exposure of different mite populations on Asian honeybees to *A. mellifera.* These recent findings have shed new light on the invasion success of varroa mites and reinforce the need for proper quarantine in the trade of *A. mellifera*, particularly when moving that bee out of Asia.

Thursday 26, Afternoon, Auditorium - Poster

19 - Control of *Brevipalpus phoenicis* (Geijskes, 1939) (Acari: Tenuipalpidae) using a mixture of lime sulfur and hexythiazox on a citrus orchard

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The *Brevipalpus phoenicis* mite is one of the most important pest of citrus crop for being a leprosis virus vector which is one of the most serious diseases of Brazilian citrus. The objective of this work was to evaluate the efficiency of hexythiazox and lime sulfur mixture on the *B. phoenicis* mite control in citrus orchard. The experiment was carried out in Santa Adelia County, Brazil, between February and April of 2004 in a 16 years old citrus orchard of the 'Pera' orange variety, grafted on 'Cleopatra'. The ten treatments were replicated 4 times in the randomized block design. Each experimental unit consisted by three citrus trees in a row. The following treatments were established (all in mL or g c.p./100 L of water): (1) hexythiazox WP of 3, (2) hexythiazox WP of 1.5, (3) lime sulfur of 4000, (4) lime sulfur of 3000; (5) lime sulfur of 2000, (6) hexythiazox WP of 1.5 + lime sulfur of 4000, (7) hexythiazox WP of 1.5 + lime sulfur of 3000, (8) hexythiazox WP of 1.5 + lime sulfur of 2000, (9) cyhexatin 500 CS of 50 and (10) a control (without application). The spray applications were made with a tractor-mounted sprayer with handy spears, using up to 13 liters solution per tree. Surveys of the mite population were made before and 3, 9, 18, 30, 61 and 93 days after the spray. For this purpose, we collected, at random, eight fruits of the central plot tree, located inside their canopy. These fruits were brought to the laboratory to remove mites with a sweeping machine in order to quantify them under a stereomicroscope. The data were submitted to F test and means compared by Tukey test and the products efficiency calculated by Schneider-Orelli formula. It was observed that all treatments using hexythiazox and lime sulfur mixture were highly effective in the *B. phoenicis* control as long as sprayed, obtaining efficiency percentages above 99.5% at 18 days after application. Treatments with hexythiazox and lime sulfur mixture had their effectiveness prolonged for a longer period compared to treatments with lime sulfur only. The mixtures also were more effective in the treatments with only hexythiazox due to the rapidly reduction of mite population, therefore contributing directly to decrease the citrus leprosis virus spread.

Thursday 26, Afternoon, Auditorium - Poster

20 - Period of protection of citrus plants against *Brevipalpus phoenicis* (Geijkes, 1939) (Acari: Tenuipalpidae) provided by acaricides used in citrus orchard

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The control of citrus leprosis in Brazilian citrus orchards is exclusively done with acaricide sprays to control its vector, *Brevipalpus phoenicis*, which represents a substantial part of the citrus production costs. The aim of this study was to compare the period of protection of citrus plants against *B. phoenicis* provided by spirodiclofen spray with the period of protection provided by other acaricides. The experiment was carried out in Bebedouro-SP, from August to December 2004 in a 17 years-old 'Natal' variety citrus orchard, in rows of 7 x 8 m apart. The experiment was in a completely randomized block design with seven treatments and four replicates. Each experimental unit consisted of three plants in a row. The following treatments were used (in mL c.p./100 L of water): (1) spirodiclofen 240 CS of 20, (2) spirodiclofen 240 CS of 25, (3) azocyclotin 500 CS of 50, (4) cyhexatin 500 CS of 50; (5) fenbutatin oxide 500 CS of 80, (6) propargite 720 CS of 100, and (7) control. Spraying was done with a tractor-mounted sprayer with handy spears, using 12 liters of solution per tree. The surveys of mite population were done 7, 14, 31, 47, 61 and 98 days after the application. To quantify the mite at the respective treatments, 10 fruits were taken from the central part of the canopy of the plant in the middle of the plot for examination under a 10 X pocket magnifying glass to count the mites on the whole fruit surface. The data were submitted to F test, means were compared by Tukey´s test and the efficacy of the products was calculated by the formula of Schneider-Orelli. The results revealed that spirodiclofen treatments provided a highly efficient control of *B. phoenicis* up to 98 days after application, reaching a 99.6% and 100% efficiency at 20 and 25 mL c.p./100 L doses, respectively.

Tuesday 24, Afternoon, Auditorium - Poster

21 - Evaluation of Neem extracts and sulfur in the control of *Oligonychus ilicis* (McGregor, 1917) (Acari: Tetranychidae)

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Oligonychus ilicis (McGregor, 1917) (Tetranychidae) is considered one of the main phytophagous pest-mites of coffee plants (*Coffea* spp.). These mites usually live in the superior surface of the coffee leaves, where it spins web favoring the adherence of dust, debris and exuviae, giving the leaves a dirty aspect. Due to its feeding behavior, leaves loose shine becoming tan, causing heavy reduction in the plants photosynthesis potential. Chemical control is the more conventionally method used against this mite; however, the intense use of the pesticides with incorrect application can select resistant population. So the use of less toxic alternatives, as Neem (*Azadirachta indica* A. Juss.) extract and inorganic products, as sulfur, in the correct dosage, represents an alternative for pest control that can cause less environmental impact, especially the preservation of species of predatory mites, taking into account the biological control as a tactic used in integrated pest management programs. The objective of the present work was to evaluate the topic and residual effects of Neem extracts, Neem oil and sulfur (Kumulus DF 800g a.i./kg) on *O. ilicis* in coffee plantations. Tests were performed with extracts obtained by drying the leaves, pounded and placed in water for 24 hours for extraction. The plants were collected in the southern region of Minas Gerais. The treatments used were: check (water), Neem leaves with 2, 4 and 6% of concentration, Neem leaves with 2, 4 e 6% of concentration plus sulfur (Kumulus DF – 5 kg/hectare), Neem oil with 4% of concentration, Neem oil with 4% of concentration plus sulfur (Kumulus DF – 5 kg/hectare) and sulfur (Kumulus DF – 5 kg/hectare). The leaves were placed on a sponge constantly wet with distilled water and a thin layer of hydrophilic cotton was placed around the leaves. The leaves were divided in two parts with cotton, using two plates per treatment (four replications), and 10 females per replication. Spraying was conducted using a Potter tower at a pressure of 15 lb/pol^2; each coffee leaf received 1.5±0.5 mg/cm^2. The efficiency was evaluated 72 hours after application. The results were: Neem oil plus sulfur and sulfur showed 100% of efficiency; Neem oil 92% of efficiency; leaves extracts with 2, 4 and 6% concentration plus sulfur showed 92, 100 and 97%, respectively, and the extracts of Neem leaves 2, 4 and 6% concentration showed 32, 57 and 73% of efficiency, respectively. Thus, these products can be used as an alternative control or in rotation with other acaricides in coffee red spider mite control. This research was financially supported by Consórcio Café.

Tuesday 24, Afternoon, Auditorium - Poster

22 - Survey of plant-living mites on *Vitis vinifera* L. 'Cabernet Sauvignon' var. at FEPAGRO Agroindústria, Fazenda Souza, Caxias do Sul, Rio Grande do Sul, Brazil

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Mites have recently become one of the major problems in vineyards at Rio Grande do Sul, causing damages and decreasing grape yield. The objective of this study is to enhance the knowledge about mite populations associated with the 'Cabernet Sauvignon' variety of *Vitis vinifera*. Samples were taken twice a month between January 2009 and February 2010, at "FEPAGRO Agroindústria", of "Fundação Estadual de Pesquisa Agropecuária do Rio Grande do Sul" (FEPAGRO), Caxias do Sul, Brazil. At each sampling date, leaves of 30 randomly chosen plants (conducted vertically, under a system locally known as "espaldeira") were collected, one from each of the upper (L1), medium (L2) and lower (L3) plant strata. Samples were placed in hermetic plastic bags and stored in a thermal box for transport to a laboratory, where they were kept under refrigeration until examined under a binocular stereomicroscope. Mites found were stored in 70% ethanol, and later mounted in Hoyer's medium for subsequent identification, under a compound microscope. Until now, a total of 5604 mites (4460 phytophagous and 1144 predators) were registered. The highest density of phytophagous mites was observed in the second fortnight of February (n= 314), and the lowest, in January 2009 (n= 35) and first fortnight of February 2009 (n= 14). Predator population increased from the second fortnight of February 2009 (n= 10) to April 2009 (n= 554). A significant difference was observed between the abundances of predators and phytophagous mites (t test, $p = 0.047$) for the whole observation period. Abiotic data suggest that phytophagous mite abundance was highly influenced by hot and dry weather, known as ideal for their development, as evidenced by the time when peak populations occurred (February 2009 and January-February 2010). The high abundance of phytophagous mites in May (n= 843) is possibly related to ideal conditions of temperature and humidity for their development at that time, atypical for this time of the year in the region. Predators showed seazonality patterns similar to that of phytophagous mites, with gradual increase of abundance from the second fortnight of February 2009. Despite of that, the increase of the abundance of predatory mites could also have been influence by the adopted cropping system, which involved mowing the spontaneous vegetation between grape lines in the beginning of April 2009. This action could have forced predatory mites to leave the spontaneous vegetation and migrate to grape plants.

Tuesday 24, Afternoon, Auditorium - Poster

23 - Fluctuation of the population of mites associated with *Vitis vinifera* L. var. 'Semillon' at FEPAGRO Agroindústria, Fazenda Souza, Caxias do Sul, Rio Grande do Sul, Brazil

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Phytophagous mites have been traditionally known as secondary pests in vineyards in Rio Grande do Sul, Brazil. However, in the last few years, their importance has increased. The objective of his study is to enhance our knowledge of the mite populations associated with the grape (*Vitis vinifera*) variety 'Semillon'. Samples were taken twice a month between January of 2009 and February 2010 at "FEPAGRO Agroindústria", of "Fundação Estadual de Pesquisa Agropecuária do Rio Grande do Sul" (FEPAGRO), Caxias do Sul, Brazil. At each sampling date, leaves of 30 randomly chosen plants (conducted horizontally above the ground, under a system locally known as "latada") were collected, one from each of the upper (L1), medium (L2) and lower (L3) plant strata. Samples were placed in hermetic plastic bags and stored in a thermal box for transport to a laboratory, where they were kept under refrigeration until examined under a binocular stereomicroscope. Mites found were stored in 70%

ethanol and later mounted in Hoyer's medium for subsequent identification, under a compound microscope. Until now, a total of 5347 plant-living mites were collected (80% phytophagous and 20% predatory mites). There was no significant difference between the total abundance of predators and phytophagus mites (t test, p = 0.172) for the whole observation period. Phytophagous mites presented irregular growing abundance pattern from February to May 2009; smallest mite densities were registered in April (n= 125) and largest, in May (n= 814). These organisms seem to be possibly influenced by hot and dry weather; highest abundance was observed in May 2009 (n= 1318). These same conditions seem to have influenced the increased abundance registered in January and February 2010. Lowest phytophagous abundances were registered from September to December 2009 (n= 133). Low abundances could be strongly related to the high precipitation indices registered in this period. Predators showed irregular abundance throughout the sampling period; a peak of 794 individuals was registered in April 2009 and 276 individuals spread over the remaining months. In this vineyard, the predatory mite abundance seems to be influenced directly by the cropping system, mites moving to grape plants after the natural vegetation between lines was mowed.

Monday 23, Afternoon, Room 5

24 - Trends in the taxonomy and description of species of the predatory mite superfamily Tydeoidea (Acari: Prostigmata)

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The family Tydeidae Kramer was created in 1877 and since 1952, with 6 genera, underwent drastic taxonomical changes resulting in 62 genera belonging to 4 families and about 9 subfamiles, in the superfamily Tydeoidea, namely: Triophtydeidae, Tydeidae (Australotydeinae, Tydeinae, and Pretydeinae), Iolinidae (Tydaeolinae, Pronematinae, and Iolininae) and Ereynetidae (Ereynetinae, Lawrencarinae and Speleognathinae). Tydeoids are small and delicate and therefore many of their characteristics, though easy to observe, are difficult to figure adequately. Therefore photography was introduced in 2003 to present these characters more clearly. However, this requires well-prepared specimens and expensive photographic equipment for the best quality. Characters to separate species include, amongst others, number of striae between certain dorsal and ventral setae, arrangement of setae on prodorsal shield, shape of some dorsal and leg setae, coxal glands, pattern of striae surrounding genital opening and chaetotaxy of leg segments. Originally, members of the family Tydeidae were considered beneficial, preying on pest species especially their eggs. However, this view changed, considering them as pests for example, causing serious damage to grapevine in Russia and citrus in Morocco. Recent studies fortunately reinstate them as beneficials, either as "sanitizing" agents, alternate prey or predators of eriophyids (ex. *Homeopronematus anconai*). Not much is known about the feeding habits of the families Triophtydeidae and Iolinidae, however, members of the Pronematinae may also be potential eriophyid predators and some species were found in association with other arthropods. Some members of the family Ereynetidae are parasites of snails, slugs and amphibians. As these small members of this superfamily are also contributing towards plant protection, detailed descriptions and accurate identifications are of paramount importance for biological control purposes and to keep track of their geographic distribution.

Tuesday 24, Afternoon, Auditorium - Poster

25 - Chromatographic analysis (RP-HPLC) of *Rhipicephalus microplus* hemolymph infected by fungi

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Reversed-Phase High Performance Liquid Chromatographic (RP-HPLC) analysis was performed with hemolymph of *Rhipicephalus microplus* engorged females, infected with the

entomopathogenic fungi *Metarhizium anisopliae* (*Ma*), *Beauveria bassiana* (*Bb*) or a non-entomopathogenic fungus, *Fusarium oxysporum* (*Fo*). Ticks were immersed in or inoculated with a 10^8 conidia ml^{-1} suspension. Hemolymph samples were collected 24h and 48h after treatment, by a limited cut on the cuticle of the posterior dorsal region of the tick using a hypodermic needle. After gentle pressure on the ticks' body, the exuding hemolymph was immediately placed in a tube containing 30µl of protease inhibitor cocktail (Inhibit_ Sigma-Aldrich) and 82µl saline buffer (1.5M NaCl; 50mM EDTA; phenylthiourea). The hemolymph was then centrifuged at 5040g for 10 min and hemocytes were separated from the cell-free hemolymph; after that, the samples were stored at -80°C. The protein amount was determined using the Lowry modified method. The cell-free hemolymph was filtrated using a 100KDa (H100KDa) and 10KDa (H10KDa) membrane (Amicon®). The H100KDa and hemocytes were analyzed through 15% SDS-PAGE and stained by the silver-stain method. Hemocytes inoculation *Ma*, *Bb* and *Fo* for 24h had different profile, with proteins smaller than 66KDa; H100KDa profile, however, did not differ among samples collected from groups treated with entomopathogenic or non-entomopathogenic fungi. The membrane filtrates of 10KDa and 100KDa were examined by RP-HPLC using an analytical C-18 column (Shimadzu, serie CLC-M, 100 A°, 5 mm, 4.6 £ 250 mm). This filtrated was eluted using a linear gradient of 0-90% acetonitrile for 50 min at a flow rate of 0.6 ml/min. Column effluent was monitored by absorbance at 220nm and 280nm. The results showed altered H100KDa total protein amounts. However, H10KDa 24h after inoculation with *Bb*, *Ma* or *Fo* had a large peak in comparison to the non-treated control group, the retention time was approximately 38 minutes. Peaks were absent or reduced 48h after infection with entomopathogenic fungi suggesting tick's immunosuppression; while peaks increased in ticks infected with *F. oxysporum*. Further studies are needed to identify peptides that are produced when engorged females are infected with entomopathogenic fungi as well as inquire whether they exhibit antimicrobial activity.

Wednesday 25, Morning, Room 6

26 - The Acari on the vegetation of mixed-forest plantings at the petroleum basin of Urucu, Amazonas, Brazil

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This study aimed to produce the first data on mite communities occurring in the vegetation of mixed-forest plantings (fruit-tree species and hardwood species) established in gaps originated from oil prospection activities at Petrobrás Oil Plant "Base Operacional Geólogo Pedro de Moura (BOGPM)", Coari, Amazonas, Brazil (04°53'S/ 65°11'W). Five plant species commonly used in such plantings were examined for their potential as host species to mites (and other invertebrates): *Inga edulis*, *Vismia guyanensis*, *Bellucia grossularioides*, *Myrcia fallax* and *Bertholetia excelsa*. Seven plantings on successional stages ranging from a few months to 5, 10 and 13 yeas old were selected. As control site, an area of upland forest (Ombrófila Densa) was sampled. Fauna was collected in October/2004 (dry season) and April/ 2005 (rainy season), from leaves washed in ETOH 80% (5 samples/plant species/site/season) and the captured mites were identified to family level. Overall, more invertebrates were captured in the dry season (5157) than in the rainy season (1461), invertebrate group diversity remained seasonally similar (between 6 and 9 groups), but faunal composition was differentiated. Acari was the dominant invertebrate group among all plant species in both seasons, its relative abundance being higher in the dry season (83% of total fauna) than rainy season (69%). *I. edulis* was the most important host to Acari and other invertebrates, followed by *V. guyanensis*, *B. grossularioides*, *M. fallax* and *B. excelsa*. Of the 4256 mites captured in the dry season, 63.8% were on *I. edulis* and 31.2% on *V. guyanensis*. Of the 1008 Acari captured in the rainy season, 40.2% were on *I. edulis* and 32.6% on *V. guyanensis*. Prostigmata was dominant on all plant species, with a relative abundance (for the dry and rainy seasons, respectively) of 82% and 53.4%, followed by Mesostigmata (8.5% and 19.1%), Oribatida (7.5% and 23.3%) and Astigmata (2% and 4.2%). On *B. grossularioides*, Prostigmata dominance was subtle (45%), followed by Mesostigmata (39%), Oribatida

(15%) and Astigmata (1%). On *M. fallax*, the mite community was balanced: Prostigmata and Mesostigmata were co-dominant (36%), Oribatida (15%) and Astigmata (13%). Tendency to increasing numbers of Prostigmata in the youngest or more disturbed plantings, and increasing numbers of Mesostigmata and Oribatida in mature plantings was observed. Eriophyidae were the most numerous and with Tenuipalpidae were the most frequently found, especially on *I. edulis* and *V. guyanensis*. They dominated in the youngest planting and in the forest. Other families included: Cunaxidae, Phytoseiidae, Tetranychidae, Eupodidae, Tydeidae, Ascidae, Galumnidae and Haplozetidae. Cunaxidae, Ascidae and Galumnidae abundances increased in mature plantings. These findings point out the potentially relevant role of plant mites as indicators of the level of entropy of such systems.

Wednesday 24, Afternoon, Auditorium - Poster

27 - The Acari community in mixed plantings at the petroleum basin of Urucu, Amazonas, Brazil

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Edaphic invertebrates play an important role in nutrient cycling and soil mineralization mechanisms, their communities being highly sensitive to anthropic actions. Among the organisms that constitute such communities, the Acari are the second largest group of soil colonizing arthropods. They are highly diverse in their feeding habits and reproductive strategies and are present in large numbers in superficial organic matter as well as in the superficial horizons of the soil. They represent between 60% and 95% of total catch and are being broadly utilized as indicators of edaphic conditions in natural and managed systems. The objective of this study was to monitor the invertebrate soil fauna with emphasis on Acari communities, within sites where a process of artificial regeneration is being conducted through the installation of mixed plantings (a combination of fruit-tree species and hardwood species), aiming to investigate their potential as edaphic indicators. The study was conducted in artificial gaps originated from the oil prospection activities and are located at Petrobrás Oil Plant "Base Operacional Geólogo Pedro de Moura (BOGPM)", municipality of Coari, State of Amazonas, Brazil ($04^0$53'S/ $65^0$11'W). The faunal collections were taken between the years 2004 and 2008, in two periods of the dry season (October 2004 and October 2008), and of the rainy season (April 2005 and May 2007). Two mixed plantings in different successional stages were selected: 5 (Jazida 18) and 13 years old (RUC 1). As control sites, two areas of upland natural forest of the type "Ombrófila Densa" were sampled. The fauna was collected by pitfall traps (10 traps/site/season exposed for 48h) and the captured mites were identified at the suborder level. Identification at family level is in progress. The highest abundance and relative density occurred in the Forest sites where in general, Mesostigmata and Astigmata were the dominant groups. In the younger planting (Jazida 18), there was dominance by Prostigmata followed by Oribatida and together, these two groups represented up to 91% of total arthropods (Acari and others) captured during the rainy season. Although Acari abundance showed increasing numbers throughout the study, their densities oscillated between seasons. Invertebrate faunal composition was also seasonally differentiated. The site RUC 1 (13 years) presented the lowest faunal abundance among the four studied sites; its highest densities occurred during the dry season. Oribatida was the dominant group followed by Mesostigmata in the dry season and by Prostigmata in the rainy season. However, throughout the study there was a drop in Oribatida dominance, which in turn led to a better faunal distribution among groups, thus reflecting the higher ecosystem stability of the older planting. These results confirm the potential role of Acari as indicators of the levels of recovery of such systems.

Friday 27, Morning, Room 3

28 - Recent advances in biological control research on coconut mite using *Neoseiulus baraki* in Sri Lanka

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Biological control is considered as the most sustainable and environmental friendly approach for the control of coconut mite, *Aceria guerreronis* Keifer (Acari: Eriophyidae). Considering certain biological, morphological and behavioural aspects, it is speculated that *Neoseiulus baraki* Athias-Henriot (Acari: Phytoseiidae) can be utilized in an augmentative biological control against the coconut mite. In Sri Lanka, several researches have been done on *N. baraki* to evaluate it as a potential biological control agent against the coconut mite. Two methods, a tray-type arena and a sachet-type rearing unit have been developed to mass rear *N. baraki*. A 240-fold increase and a 120-fold increase of *N. baraki* can be achieved by tray-type arena and the sachet-type rearing method respectively in 6 weeks. A single inundative release of laboratory-reared *N. baraki* in the field was effective in increasing *N. baraki* populations and reducing the coconut mite populations on the nuts. Release of *N. baraki* at the rate of 5000 mites per palm at 2- and 4-month intervals was effective in improving the quality of the harvested nuts. Prospective and limitations in using *N. baraki* to control the coconut mite are discussed.

Tuesday 24, Afternoon, Auditorium - Poster

29 - Control of *Tetranychus urticae* (Acari: Tetranychidae) with essential oils of *Piper aduncum* L. and *Piper arboreum* Aubl.

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The species *Tetranychus urticae* Koch is of economical importance, since it attacks many cultures. Its control has been done through repeated applications of synthetic chemical products, which can lead to the development of more resistant mites. As an alternative, products of vegetal origin are promising sources for the production of new acaricides. Essential oils obtained from various aromatic vegetal species have shown themselves to be potentially active to many types of arthropods. Because of that, they are considered a very strong option in the control of agricultural pests. Commercial products based on essential oils are being developed successfully in the integrated pest management. The genus *Piper* includes species that present proved acaricide activity. This way, the objective of the present study was to evaluate the toxicity of the essential oils of *Piper aduncum* L. and *Piper arboreum* Aubl., against *T. urticae*. Laboratory experiments were conducted at: 26±1°C, 65±10% RH and photophase of 12h. Glass recipients with capacity of 2.5L were used as fumigation chambers. A Petri dish (9cm) with three disks of *Canavalia ensiformes* (L.) (2.5cm) leaves put on a moistened paper filter disk was put in each fumigation chamber. In each leaf's disk, 10 female adults of the two-spotted spider mite were put. The essential oils and the positive control (eugenol) were applied in paper filters stuck to the cover of the fumigation chambers. The concentrations used varied from 6.4×10^{-5} to 1.2µL/L air. The evaluations were realized after 24h and the data about mortality and oviposition were submitted to the analysis of the variance and the averages compared by the Tukey test to 5% of probability. The LC_{50} were obtained through the Probit's analysis. To reach high mortality rates, close to 100%, the concentrations used were 0.31µL/L air to *P. aduncum* and 1.2µL/L air to *P. arboreum* and eugenol. Oviposition deterrence was observed in concentrations of 6.4×10^{-5}, 3.1×10^{-3} and 0.32µL/L air to the eugenol and the oils of *P. aduncum* and *P. arboreum*. When compared to the LC_{50}, it was possible to observe that the *P. aduncum* oil was more toxic to the mite, presenting a LC_{50} of 0.01µL/L air, while the LC_{50} of the *P. arboreum* oil was of 0.66µL/L air. The results indicate that the essential oils of *P. aduncum* and *P. arboreum* present toxicity and are efficient to the control of *T. urticae*.

Tuesday 24, Afternoon, Auditorium - Poster

30 - Tick diversity (Acari: Ixodidae) of the Semidecidual forest and Atlantic rain forest remnants in the State of Paraná

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From March 2004 to February 2006 the diversity of ticks on wild birds and small mammals of the Semidecidual and Atlantic Rain Forest remnants of the State of Paraná, in the municipalities of Londrina (23º27'S, 51º15'W – area 1), São Jorge do Oeste (25º41'S, 53º03'W – area 2) and Adrianópolis (24º39'S, 49º00'W – area 3), was studied. A total of 1246 birds belonging to 156 species, 28 families and 9 orders were checked. From that total, 67 birds (5.38%), belonging to 32 species (20.51%) were parasited by 162 ticks. The ticks were identified as *Amblyomma longirostre* (Koch, 1844) (n= 101), *Amblyomma parkeri* Fonseca & Aragão, 1952 (n= 20), *Amblyomma aureolatum* (Pallas, 1772) (n= 1), *Amblyomma ovale* (Koch, 1844) (n= 1), *Amblyomma* sp. (n= 36) and *Haemaphysalis juxtakochi* Cooley, 1946 (n= 3). In area 1, a total of 3215 ticks was found free in the environment; they were identified as *Amblyomma incisum* Neumann, 1906 (n= 76), *Amblyomma brasiliense* Aragão, 1908 (n= 47), *Amblyomma dubitatum* Neumann, 1899 (n= 1), *Amblyomma scalpturatum* Neumann, 1906 (n= 1), *Amblyomma* sp. (n= 3082) and *H. juxtakochi* (n= 9). In area 2, no free living ticks were found. In area 3, a single male of *Amblyomma cajennense* (Fabricius, 1787) and *A. brasiliense* were found. In area 2, no small mammals were captured. In other areas, 103 small mammals were checked, belonging to the orders Rodentia (Muridae) and Didelphimorphia (Didelphidae); 99 ticks were collected from them. The ticks were identified as *Ixodes schulzei* Aragão & Fonseca, 1951 (n= 55), *Amblyomma ovale* Koch, 1844 (n= 24) and immatures of *Amblyomma* (n= 20). Comparing the diversity of species of ticks among biomes, a richness of 6 tick species per bird and 7 tick species in the free environment were observed. For the birds, *A. longirostre* was the only species present in the 3 areas; in addition it was also the most prevalent species (prevalence index of 8.04, 12.50 and 11.54 %, in areas 1, 2 and 3, respectively).

Monday 23, Afternoon, Room 3

31 - Effect of sulfur, powdery mildew and a predatory mite on the egg production and mortality of two-spotted spider mite in strawberry

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The co-occurrence of powdery mildew, *Podosphaera aphanis*, and the two-spotted spider mite, *Tetranychus urticae*, on strawberry plants requires a strategic use of fungicides to control powdery mildew without harming predatory mites and other beneficial organisms. Sulfur has been used for two centuries to manage powdery mildew and is the only fungicide approved for use in organic strawberry production in Norway. However, there are contrasting reports in the literature about the effect of sulfur on predatory mites and two-spotted spider mite from field studies. Controlled laboratory experiments were therefore conducted on strawberry leaf disks to study the main as well as the interacting effects of sulfur on *P. aphanis*, *T. urticae* and the predatory mite *Phytoseiulus persimilis*. The following seven treatment combinations were used: 1) Sulfur + *P. aphanis* 2) Sulfur + *T. urticae* 3) Sulfur + *P. persimilis* 4) Sulfur + *P. aphanis* + *P. persimilis* 5) Sulfur + *P. aphanis* + *T. urticae* 6) Sulfur + *P. persimilis* + *T. urticae* 7) Sulfur + *P. aphanis* + *P. persimilis* + *T. urticae*. Another similar set of seven treatments, with water instead of sulfur (controls) was also used. Leaf disks were dipped in a sulfur (Thiovit Jet) solution or water and inoculated with *P. aphanis* after the sulfur/ water had dried on the leaf surface. In treatments with mites, five female *T. urticae* and one female *P. persimilis* were added per leaf disk. Preliminary analysis of the results showed that only the predatory mite and sulfur significantly

($P \leq 0.05$) affected egg production and mortality of *T. urticae*. In the treatment that combined sulfur + *P. aphanis* + *P. persimilis* + *T. urticae* a significantly reduction in *T. urticae* egg production occurred. However, there was no significant effect on egg production and mortality of *T. urticae* in the three-way or two-way interactions of sulfur, powdery mildew and predatory mite. There was no significant effect of sulfur on mortality of *P. persimilis*, and sulfur did not seem to affect the efficiency of this predatory mite. Powdery mildew did not affect *T. urticae* probably because the mildew was not well developed due to inoculation at the same time as the mites were added. In another experiment, however, mites were released on leaf disks that had well developed powdery mildew, and here a negative effect of the mildew on *T. urticae* egg production was clearly seen. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Tuesday 24, Afternoon, Auditorium - Poster

32 - Study on phytoseiid mites (Mesostigmata: Phytoseiidae) in apple and almond orchards from some regions of western and southwestern of Iran

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Phytoseiids are importance predatory mites. In this study, apple and almond orchards of 13 localities of western and southwestern parts of Iran (Hamedan, Kurdistan and Chaharmahal va Bakhtiari Provinces) were selected to sample mites of this family. During this survey, the specimens were collected from aerial parts of the trees and from soil and litter underneath them (30 samples of tree parts and soil, collected randomly). Phytoseiids were collected from the aerial parts of plants by shaking them over a white tray; soil and litter samples were extracted in Berlese funnel. The collected mites were preserved in 70% ethanol and later mounted in Hoyer's medium and kept at 50ºC during one week for clearing and drying. Specimens were identified under a phase contrast OLYMPUS BX_{50} microscope. Eight species of three different genera in three subfamilies were identified: *Neoseiulus marginatus* (Wainstein, 1961); *Neoseiulus zwoelferi* (Dosse, 1957), *Neoseiulus* Hughes, 1948 (male); *Typhlodromus bagdasarjani* Wainstein & Arutunjan, 1967; *Typhlodromus iranensis* (Denmark & Daneshvar, 1982); *Typhlodromus persianus* McMurtry, 1977; *Typhlodromus torbatejamae* (Denmark & Daneshvar, 1982); *Phytoseius plumifer* (Canestrini & Fanzago, 1876).

Thursday 26, Afternoon, Auditorium - Poster

33 - Study of some genera of parasitic mites (Acari: Parasitengona) associated with some medicinal plants from Hamedan Province, Iran

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A survey was carried out on the fauna of parasitic mites associated with some medicinal plants from Hamedan Province in 2009. Specimens were collected from the aerial parts of some medicinal plants by shaking them over a white tray. Collected organisms were taken to a laboratory, where they were examined for parasitic mites under a binocular microscope. Most mites were extracted from aphids. All mite specimens were mounted in Hoyer's medium on microscopic slides, which were dried at 50ºC for a week before being identified under a phase contrast OLYMPUS BX_{50} microscope. The specimens collected were identified as: *Echium* sp.: *Erythraeus* (*Zaracarus*) (Southcott, 1995) from larval thrips, *Bursaustium* (Von Heyden, 1826), *Azarithrombium* (Berlese, 1903) from larval thrips. *Glycihiza glabra*: *Erythraeus* (*Zaracarus*) (Southcott, 1995) from aphid. *Balaustium* (Von Heyden, 1826) and *Erythraeus* (*Zaracarus*) *euckermannini* (Saboori *et al*., 2004) from aphid. *Melilotus* sp.: *Erythraeus* (*Zaracarus*) from aphid. *Tragopogon* sp.: *Erythraeus* (*Zaracarus*) (Southcott, 1995) from *Aphis craccivora*. *Rosa canina* L.: *Abrolophus* (Berlese, 1891) from aphid. *Achillea miliofolium*: *Erythraeus* (*Erythraeus*) (Latreille, 1806) and *Hauptmannia* (Oudemans, 1910) from aphid + *Allothrombium* (Berlese, 1903) from aphid. *Cichorium intybus*: *Paratrombium* (Bruyant, 1910) from aphid and *Monotrombium* (Zhang, 1995) unknow host + *Grandjanaella* (Southcott, 1961). *Centaura viragata* var.

Sauarrosa: *Erythraeus* (*Erythaeus*) (Latreille, 1806) from larval thrips. *Rumex acetosa*: *Erythraeus* (*Erytraeus*) (Latreille, 1806) from aphid. *Galium verum*: *Abroluphus* (Berlese, 1891).

Thursday 26, Afternoon, Auditorium - Poster

34 - Functional response of *Orius albidipennis* (Hemiptera: Anthocoridae) to *Tetranychus urticae* (Acari: Tetranychidae): effect of host plant morphological feature

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Effect of host plant on the functional response of *Orius albidipennis* females to densities of eggs or adult females of *Tetranychus urticae* was investigated using cucumber and strawberry plants that differ in leaf morphological features. The functional response experiments of predatory bugs on eggs and adult females of *T. urticae* were examined over 24 and 8 h periods, respectively. Logistic regression analysis revealed that *O. albidipennis* predation fitted reasonably well to both type II and III functional response models. Predators showed type II response to adult females of *T. urticae* on both host plants but they showed type III response to *T. urticae* eggs on their host plants. Attack rates (*a*) of predatory bug to adult females of *T. urticae* on cucumber and strawberry were 0.031 and 0.047 h^{-1}, respectively. Moreover, attack coefficient *b*, which describes the changes in attack rate with prey densities in a type III response ($a = b N$), of *O. albidipennis* to *T. urticae* eggs on cucumber and strawberry was 0.001 and 0.004 h^{-1}, respectively. Predator handling times (T_h) to adult females and eggs of *T. urticae* on cucumber were higher than those on strawberry, with estimated values of 0.94 vs.1.54 and 0.81 vs. 0.76 h for adult females vs. eggs of *T. urticae*, on cucumber and strawberry, respectively. The results suggested that the efficiency of a biological control agent can be affected by different host plants.

Tuesday 24, Afternoon, Auditorium - Poster

35 - Toxicity of plant essential oils to *Tyrophagus putrescentiae* (Schrank) (Acari: Astigmata)

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The use of biorational insecticides based on plant essential oils is an alternative to control mites in stored products, such as *Tyrophagus putrescentiae* (Schrank). The toxicities of essential oils from *Cinnamomum zeylanicum*, *Eugenia uniflora*, *Eugenia uvalha*, *Melaleuca leucadendra*, *Piper marginatum* and *Schinus terebinthifolius* were compared through fumigation tests. Mites were enclosed in small screened cages and transferred to fumigation glass chambers with 2 L capacity. The oils were applied in filter paper straps and fixed at the inner wall of the chambers. Mite mortality was assessed after 48 hours of exposure, comparing with phosphine at 3.42 mg/L of air. The mortality data were submitted to normality test and homocedasticity, and the means compared by the Tukey's test at 5%. From this assay, concentration-response curves were estimated for the most toxic oils and eugenol. The methodology was the same and the data were submitted to Probit analysis using the Polo-PC program. The LC_{50} and LC_{90} values were estimated and the toxicity ratios calculated using the lethal ratio test. The results showed that oils of *C. zeylanicum*, *S. terebinthifolius* and *E. uvalha* caused high *T. putrescentiae* mortality compared to the mortality caused by phosphine (100%). The estimates of LC_{50} and LC_{90} showed eugenol as the most toxic treatment to *T. putrescentiae*, with LC_{50} equal to 0.23 µL/L of air and LC_{90} equal to 14.51 µL/L of air. The potential of plant-derived essential oils as alternatives to synthetic acaricides in the control of pest mites in stored products is promising and may be part of a new generation of biologically active compounds with potential for use in sustainable pest

management.

Monday 23, Afternoon, Room 5

36 - Spider mites (Acari: Tetranychidae) description: problems and requirements

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The quality of species description, including illustrations, is a crucial issue for taxonomical studies of mites. Before the considerable work done by Pritchard & Baker in 1955, "A revision of the spider mite family Tetranychidae", there was no well recognized international standard guideline for species description. Thus, relevant diagnostic morphological characters are quite often lacking in the descriptions of tetranychid mites. Since that time, the number of described taxa has greatly increased and the overall level of the descriptions has been improved. At the same time, the quality of optical tools (microscopes) has been considerably improved over the course of years. It has allowed to observe and to draw morphological tiny details that were undistinguishable before and has lead to more accurate descriptions of some structures such as the aedeagus, the empodium etc. The experience of the acarologist and his knowledge of the systematic of the Tetranychidae remain essential for species description because the morphological characters that must be examined and described may vary according to the genus to which the specimen examined belongs. Our presentation will consist in treating these different issues through varied illustrated examples. In addition, for a few genera, some recommendations including the major relevant genus-dependent taxonomic characters that must be described will also be provided for acarologists that would like to dedicate to the description of tetranychid mites.

Thursday 26, Afternoon, Auditorium - Poster

37 - Prey consumption rates of the male predator *Euseius mesembrinus* on different instars of *Oligonychus punicae*: prey density and exposure time effect

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Mexico ranks first in terms of avocado production globally. To gain insights into the potential of biological control of *Oligonychus punicae* Hirst, one of the most destructive pest mite species on avocado in northeastern region of Mexico by the adult males of *Euseius mesembrinus* (Dean), a native predatory mite of this region, prey consumption rates and functional responses of the adult male of this predaceous mite in terms of both prey densities (1, 2, 4, 8, 16, 32, 64, or 80 mite individuals of each prey stage, i.e., larval protonymphal, deutonymphal and adult stage) and exposure times (2, 4, 6, 8, 10 or 24 hours) were assessed on leaf arenas under laboratory conditions of 24±2°C and 12L:12D photophase. Due to similarities of data on all prey stages we report those on protonymphal stage. There was a significant effect (ANOVA, $p<0.5$) of prey consumption rate based on prey density, exposure time and the interaction between these two factors. Tukey mean separation test revealed significant ($p<0.05$) differences in consumption rates between 24 hour exposure time (highest rate of 2.25 individual prey killed per predator) in comparison to other exposure periods. There were significant differences ($p<0.05$) among the consumption rates at low prey densities of 1, 2, 4, and 8 prey individuals, but no differences among higher prey densities of 16, 32, 64 or 80 prey individuals. In terms of the effect of interactions among prey densities and exposure times with respect to prey consumption rates we found a significant difference ($p<0.05$) between prey consumption rates at 2 and 24 hour exposure time and no significant differences among the consumption rates during other exposure times (4, 6, 8, and 10 hour). With regard to prey densities, there were significant differences ($p<0.05$) between prey consumption

rates among all initial mite prey densities except between densities of 1 and 2 prey per arena. Functional responses of the adult male predator to varying prey densities at all exposure times were type II based on Holling, Woolf transformation as well as Livdahl and Steven´s modules. The highest value for the attack coefficient ($a´$ = 1.07, i.e., more than 100% attack rate due to predator random search) and the lowest value for the handling time (T_h = 0.02) occurred on the prey larval instar at 6 hr exposure time. The highest prey consumption rate (15.5 preys) occurred on larval stage at density of 64 prey individuals per arena at 24 hour exposure time. These data demonstrate the relevance of the adult male predator on this prey mite species. More studies on consumption capacities of phytoseiid adult male predatory mites should reveal the relative potential of the partial predatory population of phytoseiid predators and their probable impact on biological control of spider mites.

Wednesday 25, Afternoon, Auditorium - Poster

38 - Developmental biology of avocado brown mite: effect of substrate

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The main avocado cultivars of current use in Mexico are Hass, Fuerte, Choquete, Collins, Nabal, Atlixco, Bacon and Puebla, with the Hass variety being considered as the most desired and accepted cultivar, both for the consumption and for the production. *Oligonychus punicae* (Hirst), the avocado brown mite (ABM), is probably native to Guatemala and southern Mexico. This mite occurs on all three major avocado cultivars (Has, Fuerte and Criollo) in Mexico. The aim of this research is to compare the developmental biology of ABM on these three avocado varieties under constant laboratory conditions of 25±0.5°C, 12:12 L:D, and 70±10% RH. Three stocks of AMB were established in laboratory from adult individuals ABM originated from the leaves of Hass, Fuerte and Criollo varieties from three corresponding 20 year old avocado orchards in Uruapan, in the state of Michoacan, Mexico. Standard life table methodology was used to generate growth and longevity parameters for ABM on leaves of each avocado variety. Mean developmental periods from egg to adult of ABM were 7.78, 7.74, and 9.45 days on the Hass, Fuerte and Criollo varieties, respectively. ABM developed significantly (ANOVA, Tukey´s mean separation test, $p \leq 0.05$) longer on Criollo in comparison to other two varieties. There were no significant differences among the mean durations of preoviposition, oviposition, postoviposition and adult longevity of ABM across different avocado varieties. The average daily fecundity of ABM was statistically similar on different avocado varieties. However, the mean total fecundity of this mite was higher on the Fuerte cultivar in comparison with the other two varieties. ABM had higher values of the finite rate of increase (λ), the capacity to increase (r_c), and the intrinsic rate of natural increase (r_m) on the Hass variety in comparison with the other two varieties. The value of the net reproductive rate (Ro) on the Hass variety was more than twice those on other two varieties. Furthermore, this mite had the shortest cohort time (T_c), generation time (T_g), and the doubling time (T_2) on the Hass variety as compared to the Fuerte and the Criollo varieties. Female/male sex ratio was identical on the Hass and the Fuerte varieties which in turn was higher as compared to the value on the Criollo cultivar. Therefore, on the basis of these findings we could deduce that among the substrates tested, the Hass variety is the best for the population growth of ABM. These laboratory data support our general field observations that Hass variety suffers the heaviest infestations as compared to other two varieties.

Thursday 26, Afternoon, Auditorium - Poster

39 - *Phytoseiulus longipes* fitness in response to temperature

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Life table parameters of *Phytoseiulus longipes* Evans at four different constant temperatures were estimated. Furthermore, life table comparisons were made with *Phytoseiulus persimilis* Athias-Henriot,

and *Typhlodromus occidentalis* Nesbitt. Experiments were initiated at 20±1°C, 25±1°C, 30±1°C, and 35±1°C, with *P. longipes* eggs, and at 25°C with *P. persimilis* and *T. occidentalis* eggs. The photoperiod was 14L:10D and RH was 80±7% for all experiments. Intrinsic rate of natural increase, r_m, was estimated by $\sum e^{-rx} l_x m_x = 1$. r_m increased from .210 at 20ºC to .366 at 25°C, to .549 at 30°C and declined to .393 at 35°C. The finite rate of growth increased from 1.234 times per individual per day at 20°C to 1.726 at 30°C and declined to 1.481 at 35°C. The net reproductive rate (Ro) increased from 27.97 times per individual per generation at 20ºC to 47.8 at 30°C, and decreased to 13.8 at 35°C. Mean generation time (T_g) decreased with rising temperature. Immature stages of *P. persimilis* completed their development in 5.11 day, *P. longipes* in 5.23 days and *T. occidentalis* in 6.38 days. *P. persimilis* had the longest oviposition period (22.38±4.37 days) and *T. occidentalis* the shortest (19.08±.98 days). The preoviposition period was shortest in *P. longipes* and longest in *T. occidentalis*. There were no significant differences (5%) among three species. *P. persimilis* had the highest mean total and mean daily fecundities (60.3 and 2.69, respectively). Those for *P. longipes* were 53.61 and 2.59 egg, respectively. For *T. occidentalis*, these values were 34.48 and 1.84, respectively. The intrinsic rate of increase (r_m) was .260, .366, and .374 for *T. occidentalis*, *P longipes*, and *P. persimilis*, respectively. Although all three predators in this study had approximately equal oviposition periods, the mean total and mean daily fecundity were lowest in *T. occidentalis* and highest in *P. persimilis*, with values for *P. longipes* slightly lower than those for *P. persimilis*. In addition, immature developmental time was longest in *T. occidentalis* and shortest in *P. persimilis*. Development time of the above variations among the three predators resulted in the observed differences in r_m among them. Therefore, vital parameters such r_m, Ro, and T_g for *P. longipes* are obtained optimally at 30°C. At 25°C, this species is very similar to *P. persimilis* in terms of mean daily fecundity, oviposition period, and developmental period. Considering the prey specificity of *P. longipes* and its adaptation to dry environments, this species seems promising for biological control of some *Tetranychus* species in areas with these types of climatic conditions.

Thursday 26, Afternoon, Auditorium - Poster

40 - *Phytoseiulus longipes* developmental biology: effect of temperature

M.H. Badii[1], J.A. McMurtry[2], E. Cerna [3] & Y. Ochoa[4]

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The value of *Phytoseiulus longipes* Evans as a predator of tetranychid mites has been documented by different authors. This paper reports developmental periods of the immature stages of *P. longipes* at four different constant temperature regimes under laboratory conditions. Experiments were conducted at 20±1°C, 25±1°C, 30±1°C, and 32±1°C, photoperiods of 14L:10D, and RH of 80±7%. The mean total developmental times from egg to adult were 8.58, 5.23, 3.74, and 3.26 days at 20, 25, 30 and 35°C, respectively. Male immature stages in general tended to develop slightly faster than females. This is in accordance with the assumption that mating process is mostly dependent on the male's effort which includes searching for the mate. At each temperature, the developmental periods of the immature stages of *P. longipes* differed significantly (1% level) from one another within each sex. Developmental times of each stage differed significantly (1% level) between temperatures. However, within each temperature, there were no significant differences (5% level) in developmental periods between sexes. In this study, the developmental period of *P. longipes* was only about ½ of that reported for its prey *Tetranychus pacificus* at the same temperature (25°C). There was a significant (5% level) quadratic relationship between developmental time and temperature. Moreover, there was a significant (1% level) linear relationship between speed of development and temperature. For each stage and all stages combined, the time to develop decreased curvilinearly with increasing temperature, while the speed of development rose linearly with rising temperature. The threshold temperatures of development of immature stages of *P. longipes* ranged from 9.6°C to 11.74°C. Larval stages required the lowest and the egg stages required the highest number of degree-days for development.

Mean adult longevities were 54.61, 34.12, 17.92 and 11.01 days at 20, 25, 30, and 35°C, respectively. The mean duration of different adult periods, i.e., pre-oviposition, oviposition, post-oviposition and total longevity, generally declined with rising temperature. The mean total number of eggs/female and the mean number of eggs/female/day rose with increasing temperature up to 30°C. It appeared that the optimum temperature was ca. 30°C, at which both the mean total fecundity and the mean daily fecundity peaked. At temperatures below or above this apparent optimum, mean total and mean daily fecundities decline. Multiple mating was not necessary for these females to deposit their full complement of eggs.

Thursday 26, Afternoon, Auditorium - Poster

41 - Spatial pattern and reproductive response in a predator-prey system

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A number of predatory attributes such as functional and numerical responses of the predators to changes in prey density, rate of development, searching efficiency, prey specificity and predator distribution in relation to that of the prey, interact and eventually determine the ability of the phytoseiid predators to regulate densities of their prey populations. Furthermore, analysis of the spatial distribution during successive time intervals, provide some useful insights into the ecological processes affecting the dynamics of the populations. The aim of this study was to investigate and to determine the response of the predatory mite *Phytoseiulus longipes* to spatial variation in the population of its prey *Tetranychus pacificus* on bean seedlings under laboratory conditions. Thirty lima bean seedlings each with two leaves and each leaf with a surface area of 16 cm^2 were planted individually in a wooden tray (60 x 46 x 10 cm^3). Different sets of six plants (out of 30) were chosen at random, and six different densities of gravid female prey (0, 2, 4, 8, 16, and 32) were established on these plants. This process was repeated five times. One hundred gravid female mite predators were introduced singly to the soil in the center of the wooden tray. The number of adult predator/plant was counted at the end of 12, 24, 36, and 48 hours. Then each plant was cut, and the number of predator eggs/plant was also counted. This experiment was conducted under laboratory conditions at 25±3 °C, 82±7% RH and 14L:10D cycle. The seedling received no fertilizer. Mean number of female predator/plant after each exposure period increased with increasing initial prey densities indicating an aggregative and non-random allocation of the searching efforts to increasing female prey densities. A similar pattern was also observed for reproductive response of the predator i.e., higher rate of predator reproduction association with higher prey densities. Aggregative behavior of the predators (spending more resources in terms of time and energy in patches of high reward rate and vice versa) has been reported by numerous authors. All these works point to the relevance of increased predator searching efficiency in patches of high prey densities and emigration of the predators from areas of low prey densities which indeed function as refugia harboring low number of prey safe from predator attacks so preventing prey extinction and allowing local population growth of the prey thereby promoting stability of the predator-prey systems.

Thursday 26, Afternoon, Auditorium - Poster

42 - Partial fitness of *Phytoseiulus longipes*: effect of food

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The role of phytoseiid mites in regulating and in controlling tetranychid mites has been demonstrated. Some phytoseiids are “generalized” predators, i.e., they consume a wide range of food such as mites, scale crawlers, pollen, honeydew, and mildew. A few of the phytoseiids are “specialized” predators feeding only on tetranychid mites. A number of studies have stated that presence of alternative food should help phytoseeids to survive periods of prey scarcity. A study was conducted to

evaluate the effect of different prey mite species on development of the immature stages and on survival and oviposition of adult predator female *Phytoseiulus longipes* Evans. The experiments were conducted in units, consisting of 1-dr Titeseal® (15 x 45mm) vials each with a white plastic stopper perforated for ventilation. A double layer of tissue paper (4cm²) was used with the stopper to prevent the escape of prey or predator from the vial. The vial arenas were used in lieu of leaf arenas to minimize the variation due to different substrates. P. *longipes* completed its development on *Tetranychus pacificus* McGregor (5.41 days), *Oligonychus punicae* (Hirst) (6.46 days), and *Panonychus citri* (McGregor) (7.04 days), but not on *Petrobia harti* (Ewing). Females oviposited while feeding on *T. pacificus*, with a mean daily fecundity of 2.54 eggs per female and *O. punicae*, with a mean daily fecundity of 1.25 eggs per female, but not on *P. citri* or *P. harti*. The highest percent survival (96% on day 15th) was observed on *T. pacificus*, followed by *O. punicae* (81% on day 15th) and *P. citri* (74% on day 15th). The longevity of *P. longipes* on *P. harti* (vial arenas) and on pollen (leaf arenas) was the same as that on leaves with no food (0% on day 15th). The provision of 10% sucrose solution and clover honey doubled the longevity of *P. longipes* females compared with no food.

Tuesday 24, Afternoon, Auditorium - Poster

43 - Morphological characteristics of primary culture of hemocytes of the tick *Dermacentor* (*Anocentor*) *nitens* (Acari: Ixodidae)

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Cell culture of different tick organs and tissues constitute an important tool for the study of the vector-pathogen relationship, besides supplying substratum for production of immunogens and still to substitute the use of animals in experimentations. Hemocyte cultures have long viability and good sensibility to virus, turning possible the culture of other pathogens as parasite protozoa and rickettsiae. The aim of this study was to describe the morphological characteristics of tick hemolymph cells of *Dermacentor* (*Anocentor*) *nitens* cultivated *in vitro*. Engorged females of *D.* (*A.*) *nitens* were collected from a horse in the husbandry sector of "Universidade Federal Rural do Rio de Janeiro". The ticks were washed in running water and surface-sterilized by immersion in 70% ethanol and 0,1% benzalkonium chloride. Later, they were transferred to a fresh sterile glass Petri dish and incubated at 28 °C and 85%. Hemolymph extraction was done in the first day of oviposition, starting by the amputation of one or more legs with scalpel blade. Hemolymph was collected with the help of a 100 µl micropipette, using Leibovitz's L-15B culture medium supplemented with 20% of inactivated fetal calf serum, 10% of tryptose phosphate broth, 0.1% fraction V bovine albumin, 1% of glutamine and 0.1% of gentamicin antibiotic, at pH 6.8. Cells were then passed to a culture tube of 10 cm^2 with coverslip and incubated at 28 °C. In the seventh day of cultivation, the coverslip with stuck cells was removed, air dried, fixed in methanol for 3 minutes and stained with Giemsa solution for 45 minutes. During observation under an inverted phase-contrast microscope, the hemocytes were already stuck and presented cellular multiplication after two hours of incubation. In the observation of the stained hemocytes, we found prohemocytes, granulocytes, plasmatocytes and spherulocytes. Prohemocytes were small, round or oval cells with little cytoplasm surrounding the nucleus. Plasmatocytes were elongated and fusiform, with filamentous pseudopods in the extremities. Granulocytes were highly pleomorphic and had numerous granules of variable density. Spherulocytes were small, round or oval, with or without granules. Most of the cells possessed vacuoles, with voluminous and hyperchromatic nuclei, some being binucleate. The study demonstrated the great cellular diversity of the hemolymph of *D.* (*A.*) *nitens*, allowing future studies in the interaction of several pathogens with this vector.

Tuesday 24, Afternoon, Room 6

44 - Anatomy and fine structure of pedicels and pedicelar glands in phoretic deutonymphs of Uropodina (Acari: Mesostigmata)

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Morphological adaptations to phoresy in Uropodina are one of the most spectacular among mites. Phoretic deutonymphs attach to the arthropod carrier by means of an elastic, stalk-like pedicel projecting from the anal opening. The material that builds the pedicel is secreted by pedicelar glands located in the rear part of idiosoma, posteriorly to the alimentary canal. Both, structure and chemistry of the pedicelar glands and the pedicel were not studied in detail (Faasch 1967). Therefore, we examined the pedicel and pedicelar gland structure in phoretic deutonymphs of two species, *Uropoda orbicularis* (Müller, 1776) and *Uroobovella marginata* (C. L. Koch, 1839), by means of light and electron microscopy (SEM and TEM). The general organization of the glands and their ducts, the ultrastructure of gland cells, as well as chemical composition and morphology of pedicels are described.

Tuesday 24, Afternoon, Auditorium - Poster

45 - Incidence and seasonal occurrence of mites on coconut in West Bengal, India

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Coconut is an important crop in West Bengal especially in South 24-Parganas District. The coconut perianth mite, *Aceria guerreronis* Keifer is becoming a serious threat to its cultivation. This mite lives underneath the tepals, attacking the epidermis and causing serious damage that lead to considerable yield reduction. The same habitat was found to be shared by several other mites during one year study in coconut orchards in South 24 Parganas District of West Bengal, India, during 2007-2008. In total, 12 species of 9 families were found, including mites of different feeding habits mainly predatory and phytophagous mites. The predatory species collected were *Amblyseius largoensis*, *Neoseiulus paspalivorus* (Acari: Phytoseiidae); *Lasioseius* sp., *Proctolaelaps* sp. (Acari: Ascidae) and *Cheyletus malaccensis* (Acari: Cheyletidae); the phytophagous species were *Aceria guerreronis* (Acari: Eriophyidae); *Polyphagotarsonemus latus*, *Steneotarsonemus furcatus* (Acari: Tarsonemidae) and *Oligonychus indicus* (Acari: Tetranychidae); the fungivorous and the pollen feeding species, respectively, were *Tyrophagus putrescentiae* (Acari: Acaridae) and *Neocypholaelaps* sp. (Acari: Ameroseiidae). *Dermatophagoides pteronyssinus* (Acari: Pyroglyphidae) is the accidentally occurring mite. *Neoseiulus paspalivorus* was the predominant predator, while *A. guerreronis* was the predominant phytophagous species. Both were found throughout the year. The highest levels of those species occurred in April and June, respectively. *Polyphagotarsonemus latu*s was also found throughout the year, but it was found in highest levels in October. *Tyrophagus putrescentiae*, *Neocypholaelaps* sp. and *D. pteronyssinus* were always found in very low numbers. The occurrence of *N. paspalivorus* and other predators suggested the possibility of biological control of *A. guerreronis* and other injurious mites in West Bengal, India.

Wednesday 25, Afternoon, Auditorium - Poster

46 - Molecular detection of *Borrelia burgdorferi* sensu lato in *Ixodes pararicinus* ticks (Acari: Ixodidae) in Uruguay, South America

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Borrelia burgdorferi sensu lato (s.l.) complex is the causal agent of the tick-borne Lyme Borreliosis (LB), a common disease in the USA, Europe and Asia, where *Ixodes* species of the *ricinus* complex (eg., *Ixodes ricinus*, *Ixodes scapularis*, *Ixodes pacificus* and *Ixodes persulcatus*) are primary vectors. LB is a multisystemic infectious disease, affecting organs and systems of the body, specially the skin, joints, nervous system and heart. *B. burgdorferi* s.l. is a gram negative extracellular bacteria belonging to the order Spirochaetales. Clinical cases of LB have been described in South America. However, no local strain of *B. burdorferi* s. l. has been identified. In the present study, 20

Ixodes parariciinus ticks (10 males, 10 females) collected from wild deer (*Mazama gouazoupira*) in Uruguay were molecularly tested for the presence of *Borrelia* DNA extraction with the guanidine isothiocyanate protocol and tested by polymerase chain reaction (PCR) targeting the borrelial flagellin gene (*fla*) using the primers FlaRL and FlaLL, which amplify a 658-bp fragment of *Borrelia* spp. The resulting products were visualized on a 1.5% agarose gel, stained with ethidium bromide and bands visualized under UV light. Two specimens were positive by PCR (2 male ticks). PCR products were purified and DNA-sequenced in an automatic sequencer. Sequences obtained were submitted to BLAST analysis to determine similarities to other sequences available in GenBank. The two PCR-positive ticks (10% infection rate) were shown to be infected by a novel *B. burgdorferi* s.l. agent, which were most similar (98% identity; 610/617) to *B. burgdorferi* s.s. strains from the northern hemisphere. This is the first report of a *B. burdorferi* s.l. strain infecting ticks of the *ricinus* complex in the southern hemisphere. This research was financially supported by FAPESP, São Paulo, Brazil.

Tuesday 24, Afternoon, Auditorium - Poster

47 - Effects of *Agave sisalana* juice on mortality and irritability of the mite *Brevipalpus phoenicis*, vector of the citrus leprosis virus (CiLV)

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This study aimed to assess the mortality and the irritability of *Brevipalpus phoenicis* (Acari: Tenuipalpidae) subjected to different concentrations of agave juice. It was conducted at the Acarologia Laboratory of UNESP – Universidade Estadual Paulista, Câmpus Jaboticabal, Departamento Fitossanidade, Jaboticabal, SP, Brazil, in January 2010. Orange leaf discs were immersed in mixtures of 25, 50, 75 and 100% *Agave sisalana* juice or distilled water (control). After the discs dried, 10 specimens of *B. phoenicis* were transferred onto each disc. Mortality and irritability of mites were evaluated 12, 36 and 60 h later. A completely randomized experimental design was adopted, with 5 replicates; means were compared by Tukey test at 5% probability. The number of live mites decreased with increasing concentrations of *A. sisalana* juice, but irritability was not observed (evaluated by determining the number o mites glued to the a sticky barrier around each disc). Concentrations of 50% or higher caused 100% mortality of the mites 36 hours after application. The results obtained in this study are probably due to slightly acid pH of *A. sisalana* juice (pH= 5.0), associated with the tannins, alkaloids, saponins and coumarins that it contains.

Tuesday 24, Afternoon, Auditorium - Poster

48 - Mortality and irritability of *Brevipalpus phoenicis* on orange leaves treated with tanned juice of *Agave sisalana* (Perrine)

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This study aimed to assess the number of *Brevipalpus phoenicis* mites alive, dead (efficiency) and retained in the adhesive barrier (irritability) subjected to different concentrations of tanned juice of agave in a period of 12 hours after treatment of the orange leaves. The bioassays were performed at the Laboratory of Acarologia, of UNESP – Universidade Estadual Paulista, Câmpus Jaboticabal, Departamento Fitossanidade, Jaboticabal, SP, Brazil, in January 2010. Orange leaf discs were treated by immersion in grout prepared with 25, 50, 75 and 100% *Agave sisalana* tanned, fermented juice and distilled water (control); then 10 *B. phoenicis* mites were placed on each disk and the observations of live mites,

mortality and irritability were conducted 12h later. The experimental design was a completely randomized design with 5 replicates. Means were compared by Tukey test at 5% probability. The number of live mites decreased when discs were treated with 75 and 100% of tanned *Agave sisalana* juice; also, at those concentrations mite irritability was observed. Twenty-three percent of the mites died at 100% *Agave sisalana* tanned juice. The results obtained in this study are probably due to the slightly acid pH of the tanned juice of *Agave sisalana* (pH = 4.0) associated with tannins, alkaloids, saponins and coumarins found in the juice.

Tuesday 24, Afternoon, Auditorium - Poster

49 - Efficiency of *Agave* juice application on *Tetranychus urticae* Koch and toxicity symptoms in cotton (*Gossypium hirsutum* L. r *latifolium* Hutch)

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This work aimed to evaluate the efficiency of fresh and fermented juice from two agave genotypes to control cotton spider mite and gauge their phytotoxic effects on cotton plants. The juices used in the applications came from Monteiro county, PB, and originated from two agave genotypes (*Agave sisalana* and irs 11648 hybrid). The first application was done 24 hours after extraction (fresh juice) and the second, 35 days later (fermented juice). The treatments were: T = control (untreated plants); FJAS = fresh juice of *Agave sisalana*; FJAH = fresh juice of 11648 hybrid; FJAS = fermented juice of *Agave sisalana*, and FJAH = fermented juice of 11648 hybrid. We evaluated the efficiency of agave juice on *Tetranychus urticae* control, the effect against its Phytoseiidae predator and its phytotoxicity to cotton plants at 10, 35 and 65 days after seed germination. The experiment was in a completely randomized design with 5 replicates, to evaluate the effects on plants and phytotoxicity, and with 10 replicates to evaluate the effect on mites. Means were compared by Tukey´s test at 5% probability level. The efficiency was calculated by Abbott's formula, based on live mite population from each treatment and transforming the data into percentage survival. The phytotoxicity was rated on a scale based on the variation of symptoms. The efficiency of agave juice on both mites, two hours after application, was higher than 91%, and the phytotoxicity to cotton plants varied from very mild to mild 10 to 35 days after emergence; the phytotoxicity was stronger at 65 days, when the juice was applied to both sides of the leaf. Thus, juices were effective for spider mite control, but showed a phytotoxic effect on leaves; the fermented agave hybrid juice applications reached 100% efficiency of mite control. Juices also caused high Phytoseiidae mortality. These results might be due to the slightly low pH of the juices and to the amount of tannins, alkaloids, saponins and coumarins that they contained.

Tuesday 24, Morning, Room 4

50 - Argasid ticks (Acari: Argasidae) from the Neotropical region

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More than 80 species of Argasidae occur in the Neotropical region and approximately 186 species included into this family are known in the world. The taxonomic study of the Argasidae has been made difficult mainly because of inadequate generic characters. A phylogenetic analysis of the relationships at the generic and subgeneric levels in the Argasidae was proposed in 1990's, in which the subgenus *Argas* (*Carios*) Latreille was elected as a valid genus. Besides *Carios*, this analysis included the previously recognized genera *Antricola* and *Nothoaspis*, and *Argas* (*Chiropterargas*), *Otobius*, *Ornithodoros* (*Alectorobius*), *O.* (*Reticulinasus*) and *O.* (*Subparmatus*). Although this classification has not been accepted by some researchers who consider that additional evidences are needed from studies of morphology, life histories, host

associations and molecular taxonomy. Because of this, we have partially adopted it for 31 species of *Carios* (previously included in *Alectorobius*), but we retain other species in the *Ornithodoros* until the issue can be solved with further studies. Considering that many species are known only from larval descriptions, chaetotaxy associated with other morphological characters have been used to separate genera and species supported by the molecular sequences. Except for *Carios* and *Ornithodoros* that are morphologically the closest genera, the others could be easily separated by distinct morphology for both larvae and nymphs. Regarding both genera, larvae and nymphs present few characters of differentiation. However, the dorsal plate and the dorsal surface of the tarsi are sufficient to separate the larvae. The presence or absence of mammillae as well as dorsal surface of tarsi and presence or absence of slight dorsal humps are good characters to separate nymphs. Besides, the camerostome is well-developed as a depression that receives the capitulum in nymphs of *Carios* but it is rudimentary in nymphs of *Ornithodoros*. Based on sequences and on morphology of the immature stages, six genera and 83 species occur in the Neotropics, as follow: *Antricola* (n= 17), *Argas* (n= 12), *Carios* (n= 31), *Nothoaspis* (n= 1), *Ornithodoros* (n= 21), and *Otobius* (n= 1). This research was financially supported by FAPESP.

Tuesday 24, Afternoon, Auditorium - Poster

51 - Compared morphology of larvae of *Carios mimon* and *Ornithodoros rostratus* (Acari: Argasidae) by using light and scanning electron microscopy

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The argasid ticks *Carios mimon* (Kohls, Clifford, Jones, 1969) and *Ornithodoros rostratus* Aragão, 1911 are aggressive to animals and humans and their bites are extremely painful causing itching, inflammation and blisters. Although the role in tick-borne diseases is still unknown for *C. mimon*, the species *O. rostratus* could be experimentally infected in laboratory and may participate in the maintenance of rickettsiae of the spotted fever group. In the present study we compared the morphology of larvae of these closely related species, based on light and scanning electron microscopy, as a contribution to the diagnostic features for further studies of their vectorial capacity. Sample of 10 unfed larvae of each species were mounted in Hoyer's medium on slides and examined under a Zeiss MC80DX light microscope for morphological analyses and morphometry. Five specimens of each species were prepared for scanning electron microscopy (SEM). The micrographs were taken using a Digital Scanning Microscope ZEISS/LEO 440 and the images were prepared with Adobe Photoshop v.6, and CorelDRAW v.12. *C. mimon* has 14 pairs of setae on the dorsum of the idiosoma; dorsal plate triangular or piriform; ventrally with 7-8 pairs + 1 on valves and 1 unpaired posteromedian seta; basis capituli with lateral angles slightly rounded; hypostome with rounded apex, dental formula 2/2 on basis, 3/3 to third portion then 4/4 to apex; Haller's organ with capsule aperture small, placed laterally and transversely slit-like. *O. rostratus* has 13 pairs of dorsal setae; dorsal plate as large as wide, elongate, but not piriform; ventrally with 7 pairs + 1 on valves and 1 unpaired posteromedian seta; basis capituli with auriculae; hypostome with rounded apex, dental formula exclusively 2/2; Haller's organ with capsule aperture transversely slit-like, large, occupying all dorsum and with many small setae. Similarities with other closely related species are also discussed. Part of this research was financially supported by FAPESP and Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq.

Tuesday 24, Morning, Room 2

52 - Travels by tea: the tale of a *Tuckerella*

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Tuckerella japonica Ehara appears strongly associated with tea and, due to certain cultural practices in tea production, has in fact become a world traveller, with tea as its close companion. The history of tea production and culture in the USA provides the backdrop for this traveller's tale. Or should that be tail? *Tuckerella japonica* was described in 1975 from Japan from the Muku tree, *Aphanathe aspera* (Thunb.) (Ulmaceae); however, collections made since the original description indicate that tea, *Camelia sinensis* L. (Theaceae), is a preferred host. The mite lives on older stems with bark and on fruit when present, but avoids the green shoots and leaves that make up the harvestable portion of the plant. *Tuckerella japonica* is morphologically similar to *T. flabellifera* Miller, described from Tasmania in Australia from *Bedfordia salicina* (Labill.) D.G. (Asteraceae). These two species have historically been misidentified as each other, creating inaccuracies in the collection records. The implications of this in terms of host plant lists and world distribution are discussed further, along with their morphological separation.

Monday 23, Afternoon, Room 5

53 - A defining moment in flat mite taxonomy: Tenuipalpidae in detail

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Traditionally, flat mite taxonomists placed a great deal of significance on the chaetotaxy of the dorsal opisthosoma. Despite the recognised diagnostic importance of this character system, a consistent interpretation of these variations has been slow to develop. Flat mite taxonomy is currently in a state of flux. A standard system of notation based on that of Grandjean (1939), first applied to the Tenuipalpidae by Quiros-Gonzalez (1985) [and applied to sister families Tuckerellidae (Quiros-Gonzalez & Baker 1984) and Tetranychidae (Lindquist 1985)], is slowly being adopted generally across the world. Without the adoption of a standard system, it is simply not possible to make any meaningful morphological comparisons between taxa. However, the problem runs deeper than this. In order to better understand the evolution and phylogeny of the Tenuipalpidae and its place within the superfamily, we also need to develop new character systems for the family. Lindquist (1985) recognised this ensuing problem, pointing out that until the comparative homologisation of certain characters is accomplished for representative taxa within the superfamily Tetranychoidea, a great deal of character state data of potential significance to the systematics, phylogeny and classification of these groups will remain unknown. Dorsal chaetotaxy remains the major character system used for flat mite separation simply because it has received the most attention. As more and more taxa are described, gathering data on other systems will ultimately be too great a task to undertake. Here we discuss new characters and propose a set of minimum requirements that should be adopted for future descriptions of species and/or genera within

the family Tenuipalpidae, and within the entire superfamily Tetranychiodea.

Tuesday 24, Afternoon, Room 4

54 - Advances in tick phylogenetics

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Since the early nineties, when the first studies of tick relationships based on analyses of molecular gene sequences were published, our understanding of tick systematics has made giant progresses. Complementary approaches based on the analysis of mitochondrial and nuclear individual genes contributed to a still undergoing complete rearrangement of what we knew as "tick classification". As genomics and proteomics may soon provide us with superior taxonomic molecular tools, there seems to be a need for summarizing strengths and weaknesses of our overall present knowledge of tick systematics. In this presentation we will follow the history of molecular tick taxonomy during the past 20 years.

Thursday 26, Morning, Room 1

55 - *Amblyomma cajennense*: a case of not too cryptic speciation

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In the past 20 years the advent of molecular techniques for the reassessment of the taxonomic status of some tick species and genera has lead to major discoveries and systematic amendments. Molecular methods are easy to implement and are available to those who have little knowledge of morphological tick taxonomy. Nevertheless, in-depth morphological examinations still have an important role to play and should not be forgotten in favor of, apparently, easier laboratory methods. In this talk we will present studies on tick systematics carried out by combining molecular and morphological analyses. We will focus on a number of studies on the genus *Amblyomma* from the Old and the New World and describe in more detail, a recently completed study of the taxonomic status of *Amblyomma cajennense*, the Cayenne tick, in the New World. This work clearly illustrates the importance of investigating simultaneously all aspects of taxonomy. Molecular phylogenetic analyses brought to light the occurrence of several mutually exclusive genetic clades compatible with the existence of cryptic species within *A. cajennense*. A morphological thorough examination of the genetically distinct groups revealed, however, that each of them was characterized by fixed and previously overseen phenotypic features. The enthusiasm for DNA barcoding methods and other purely molecular systematic assays for the delimitation of species are sometimes justified, but caution should be exercised against disregarding the wealth of information provided by morphology.

Friday 27, Morning, Room 4

56 - Habitat distribution of soil Mesostigmata – how much do we know?

F. Beaulieu

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Mesostigmata are the most abundant and species-rich group of predatory arthropods in many soil-litter systems. Nevertheless, their taxonomy, biology and ecology remain poorly known in most soil types of any geographic regions except some parts of Europe. Here I review the studies examining the distribution of soil Mesostigmata across natural or disturbed habitats. Based on this knowledge, their potential as bioindicators of soil quality is assessed.

Thursday 26, Morning, Room 2

57 - Weather factors affecting European red mite, *Panonychus ulmi* (Koch), density in apple orchards in India

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European red mite, *Panonuchus ulmi* (Koch) (Tetranychidae) has attained a status of serious apple pest since one and a half decade in Himachal Pradesh, a north western Himalayan state of India. At present, 85% of the orchards have been found infested by this pest. Adults and immatures of this mite suck cell content from leaves resulting into fading of leaves and yield of poor quality fruits. No specific studies on the effect of weather factors on *P. ulmi* density have been carried out under Indian conditions. Given the severity of the pest, studies were carried out to determine the effect of abiotic factors on its population density. They were carried out from March to December, 2008 and 2009 at experimental orchards of Regional Horticultural Research Station, Mashobra, Shimla (21°1'N, 71°1'E; 2286 m amsl). Observations were recorded on 50 leaves selected randomly from each compass direction at weekly interval on five infested apple trees. Population count of mobiles and eggs were determined with the help of mite brushing machine. Meteorological data were recorded throughout the year from Meteorological Observatory of RHRS, Mashobra. Data was analyzed and correlation and regression analysis was carried out to determine the relationship of weather parameters on buildup of mite population. Immatures and adults appeared in last week of March and second week of April during 2008 and second and third week of March during 2009, respectively. Temperature range (2008 = 13.8 °C – 15.4 °C; 2009 = 13.3 °C - 12.7 °C) was almost same during both the years but high humidity between 62.5 – 79.0% played a major role for early emergence of mite during 2009. Slow increase in mite population was recorded from May to July in both years. A sharp increase in mite and egg population was recorded from July onwards and peak population was reached in first week of September 2008 (73.0 mite/leaf). Temperature ranging from 18.2 to 16.9 °C and relative humidity varying from 90.8 to 73% contributed for the flaring up of mite population in 2008, whereas, during 2009 peak population was observed in the second week of September (68.66 mites/ leaf). Low humidity (70.02 to 73.0%) and presence of predatory mites in the orchard helped keeping mite population relatively lower than previous year during July - August 2009. Significant reduction in mite population was recorded in both the years from September to first week of December. During 2008 and 2009, all mite stages showed significant positive correlation with humidity, except adult mites in 2009 due to presence of predatory mites in apple orchard. Partial correlation worked out between all stages of mites and meteorological parameters indicated negative correlation with rainfall and significant positive correlation with humidity.

Thursday 26, Afternoon, Room 6

58 - Response of horticultural mineral oils and some new acaricides to European red mite, *Panonychus ulmi* (Koch), infesting apple in temperate region of India

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Among one and half dozen insect pests of economic importance infesting apple, European red mite, *Panonychus ulmi* (Koch) (Acari: Tetranychidae), is the most serious in temperate region comprising Himachal Pradesh, Jammu & Kashmir, Uttrakhand and NE states of India. *P. ulmi* infestation results in poor quality fruits during the season besides affecting following year crop yield. Earlier, in the absence of good acaricides, the available insecticides were used to manage this pest which provided short term control of motile stages only up to 10-12 days and mite multiplied in great numbers as it had no ovicidal effect on winter and summer eggs. Use of strong insecticides poses a resistance threat and killing of biotic agents in the orchards. Considering the severity of the pest in apple orchards, three Horticultural Mineral Oils (HMOs) viz. Mak All Season, Orchol-13 and Rilso (2% each) were used at pink bud stage of apple bud development for observing their impact on hatchability of winter eggs. The twigs containing sizable population of eggs were cut before and after 7 and 30 days after spray and brought to the laboratory for examination under a

stereomicroscope. Each treatment was replicated five times and each replicate consisted of 10 twigs. In an another experiment carried out during summer, the effect of these HMOs using 1% concentration each and acaricides, hexithiazox 0.005% (Maiden 5.45%), fenpyroximate 0.005% (Sedna 5 SC) and propargite 0.057% (Omite 57EC) was evaluated under field conditions against motile stages of *P. ulmi* in apple orchards in district Shimla, Himachal Pradesh, India. The average pre count and post count of mites per leaf was taken before and 7 and 30 days after spray with the help of mite brushing machine. Treatments were replicated five times and each replicate consisted of 30 leaves. Data was subjected to statistical analysis. Observations taken on hatching of winter eggs showed that all HMOs' at 2% were almost equally effective in controlling winter eggs when sprayed at pink bud stage recording 5-8% eggs hatch up to 30 days as against 74-80% eggs hatch in untreated plants. Spray of HMOs and acaricides during summer revealed that Mak All Season provided long term control of motile stages (91.6%) up to 30 days followed by Orchol-13 (88.4%) and Rilso (85.6%) whereas, fenpyroximate 0.005% gave 98.2% control of motiles. Hexthiozox and propargite 0.057% provided 95.9 & 95.7% mortality of motiles, respectively and were found statistically at par with each other. On untreated plants an increase of 53.4% mite population was recorded. Observations recorded on the effect of HMOs and acaricides on summer eggs of *P. ulmi* clearly indicated that HMOs were highly effective against summer eggs compared to acaricides and prevented 96% egg hatch. HMO application proved superior to acaricides in apple orchards as it managed all stages of *P. ulmi* including winter and summer eggs on long term basis.

Friday 27, Morning, Room 1

59 - The Catalogue of Life: building a global taxonomic backbone and seeking to cover all known organisms

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The Catalogue of Life is a global programme to establish an electronic species checklist and taxonomic hierarchy covering all known organisms, operated by the Species 2000 and the ITIS organisations. The Catalogue is free to use and has been published in ten annual checklist editions since 2001 (at www.catalogueoflife.org). It now lists 1.25 million species of Plants, Animals, Fungi and Micro-organisms, and is widely used as a taxonomic backbone or index, both by individuals and by international programmes such GBIF and Encyclopedia of Life. It is recognised by the UN Convention on Biological Diversity. The current Species 2000 system harvests and integrates taxonomic expertise and opinion from a growing array of 77 expert taxonomic databases around the world, uses peer review to select preferred treatments, and is governed as a not-for-profit federation owned and operated by the supplier organisations themselves. There are two main challenges in the second phase of the programme. The first is to build a robust and sustainable infrastructure for assembling and serving the Catalogue, especially to organisations that are coming to depend on the service. The second is to focus taxonomic and database attention on the missing and patchily covered groups needed to complete the Catalogue, and this includes the mites. This is especially important as some of the missing groups are nonetheless economically and ecologically significant, where it would be valuable to assemble comprehensive catalogues. A significant start has been made with the recent inclusion of four Brazilian Mite global species databases in the Catalogue, coming from ESALQ, University of São Paulo. It is hoped that this presentation can be linked to a small side-meeting/workshop during the Congress, at which taxonomic expertise and existing databases with taxonomic coverage can be identified, along with a gap analysis and ideas for extending this coverage.

Wednesday 25, Afternoon, Room 2

60 - New perspectives on the employment of entomopathogenic fungi as alternative control of ticks

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Ticks are parasites of serious concern for humans, domesticated and wild animals. They are mostly controlled by chemical products. Chemical acaricides are toxic to animals, cause environmental contamination, and lead tick populations to chemical resistance. Entomopathogenic fungi infect arthropods naturally and cause enzootic episodes in the environment. Studies in the laboratory have shown that these fungi cause high mortality rates in all developmental stages of several tick species, and also reduce the oviposition of infected engorged females. When fungi are applied in the field, tick control is not expressive due to many factors, including the biotic and climatic ones. In order to increase the efficacy of fungal agents for biological control purposes under natural conditions, several points need consideration: 1) identification of effective isolates (virulent, tolerant to high temperatures, tolerant to ultraviolet irradiation, etc); 2) understanding of the main factors that affect virulence of the fungal isolates toward the target arthropod; 3) comprehension of the role of toxic metabolites to the pathogenicity of fungal isolates; 4) comprehension of the immune response of ticks to the infection caused by entomopathogenic fungi. This study aims at discussing results of recent researches on biological control of ticks and connecting these results to the development of fungal formulations; also, we discuss how formulated fungi may be used in programs for biological control or integrated management for ticks' control.

Tuesday 24, Afternoon, Room 1

61 - Heritability and artificial selection on ambulatory dispersal in *Tetranychus urticae*

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Dispersal, hereby defined as an active or passive attempt to move from a natal/breeding site to another breeding site, is a key process in the fields of conservation and evolutionary biology. Understanding the evolution of dispersal and the motivations behind the distinct phases of dispersal can help us understand how dispersal affects the distribution of genetic diversity through space among populations and, as such, how dispersal is involved in important issues related to e.g. risk of species extinction and biodiversity preservation. Furthermore, studying correlations between dispersal behavior and other life-history traits closely related to fitness allows us to understand the genetic basis of evolutionary constraints arising from trade-offs between traits. Using the model species *Tetranychus urticae* Koch, we attempted to artificially select for genetically differentiated lines of ambulatory dispersers. The objective of the study was three-fold: (1) determine whether ambulatory dispersal is a heritable trait; (2) select on high (HD) and low (LD) dispersal if the trait was found to be heritable; (3) determine whether selection resulted in a trade-off between dispersal propensity and other life-history traits. The study was conducted under controlled laboratory conditions and selection took place over ten generations. Heritability was calculated using a parent-offspring regression (n = 43 families, mean = 8 offspring per family). Selection started by introducing 150 mated, 2-day old females onto a bean patch linearly connected via parafilm to 5 remaining patches. After 48 hours we selected 40 females that had arrived on patches 5 and 6 for the HD line, and 40 females on patches 2 and 3 for the LD line, and 40 randomly chosen females as a control line. After ten generations, we tested fecundity, developmental time, longevity, and sex-ratio. Three independent replicates of this procedure were produced. Although we found high and significant heritability ($h^2 = 0.52 \pm 0.05$, linear regression, $p<0.001$), we did not find a response to selection nor a difference between treatments in life-history traits after ten generations of selection. These results contrast with other studies (Yano, 2002 and Li & Margolies, 1993) which found a positive response to selection on dispersal behavior. We hypothesize that there are multiple mechanisms which underlie the selection response: density, patch-condition, and genetic drift may have influenced our results. We suggest further studies to take these issues into consideration to be able to distinguish between selection on dispersal and on other, confounding, factors.

Tuesday 24, Afternoon, Auditorium - Poster

62 - Acaricide activity of the *Citrus* essential oils on *Tetranychus urticae* (Acari: Tetranychidae)

F. de S. Born[1], N. de C. Ribeiro[1], M.J.C. de Araújo[1], P. de S. Botelho[2], M.M. de Moraes[2], I. de A. Neves[2] & C.A.G. da Câmara[2]

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The species *Tetranychus urticae* Koch, or two-spotted spider mite, is considered one of the most important pests in the whole world, since it attacks various cultures. Although the biological control is also done, the most common treatment for this mite's control is the chemical one. This methodology has caused some prejudicial effects, because of its indiscriminate use, resulting in unwanted impacts to the environment and raising the possibility of the development of resistant species. As an alternative to this type of control, products of natural origin deserve some emphasis, because of both the safety aspects and the conservation of the agroecosystem's balance. Among these products, the essential oils of vegetal origin, due to their volatility and, consequently, to their fumigant action, can be used in the pest control in closed environments. The objective of the present study was to evaluate the acaricide potential of the essential oils of the *Citrus reticulata* Blanco and *Citrus sinensis* Osbeck x *Citrus reticulata* Blanco leaves, against *T. urticae*, in laboratory essays, at 26±1 °C, 65±10% RH and photophase of 12h. For the experiments, fumigation chambers were used (2.5L). In each chamber, a Petri dish (9cm) was placed, containing each one a moistened paper filter disk and three disks of *Canavalia ensiformes* (L.) (2.5cm) leaves, with 10 female adults of the *T. urticae* in each disk. The essential oils and the eugenol (positive control) were applied on the paper filter in concentrations varying from 6.4 x 10^{-5} to 2.0µL/L air. The mortality and oviposition data were evaluated after 24h of exposition and submitted to the analysis of the variance and the averages compared by the Tukey test at 5% of probability. The LC_{50} was obtained through the Probit's analysis. Different susceptibilities of the mite to the oils were observed. The eugenol and the "cravo" tangerine (*C. reticulata*) and "murcot" tangerine's essential oils (*C. sinensis* x *C. reticulata*) led to a very high mortality rate, close to 100%, in the concentrations of 1.2; 0.4 and 4.0µL/L air, respectively, and the lowest concentrations used capable to reduce the females' oviposition were 6.4 x 10^{-5}; 12.5 x 10^{-3} and 1.0µL/L air to eugenol, cravo e murcot tangerine. The LC_{50} obtained demonstrate that the essential oil of the cravo tangerine was the most toxic (0.01µL/L air), when compared to LC_{50} estimated to the murcot tangerine (1.89µL/L air). The results suggest that the *C. reticulata* and *C. sinensis* x *C. reticulata*'s essential oils are very useful and efficient to the integrated management of the two-spotted spider mite. However, new studies must be made to evaluate the costs/benefits of its utilization.

Tuesday 24, Afternoon, Auditorium - Poster

63 - Toxicity of aromatic species' essential oils on *Tetranychus urticae* (Acari: Tetranychidae)

F. de S. Born[1], N. de C. Ribeiro[1], M.J.C. de Araújo[1], P. de S. Botelho[2], M.M. de Moraes[2], I. de A. Neves[2] & C.A.G. da Câmara[2]

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The species *Tetranychus urticae* Koch is a pest which is economically important, since it attacks many cultures around the world. Its control is done mainly through repeated applications of conventional acaricides. These acaricides, used in the attempt of reducing the impacts provoked by these mites, are frequently toxic to the organisms which are not the target of the product, such as the mites' natural enemies. Therefore, the two-spotted spider mite has been the target of programs of integrated pest management, emphasizing the need of developing alternatives of control, especially with agents with fumigant action to be used in greenhouses. The large diversity of aromatic plants and its essential oils constitute a rich source of biologically active products, which are very effective as acaricides. This way, the objective of the present study was to evaluate the toxicity of the essential oils of two species of aromatic herbs over *T. urticae*. The experiment was made in laboratory, under conditions of 26±1°C, 65±10% RH and photophase of 12h. The toxicity tests were made with fumigation chambers with capacity of 2.5L in

which Petri dishes (9 cm) were put with a moistened paper filter disk and three disks of *Canavalia ensiformes* (L.) leaves (2.5cm) organized in an equidistant way. Ten female adults of the two-spotted spider mite were put in each leaf's disk and the positive control (eugenol) and the thyme (*Thymus vulgaris* L.) and basil (*Ocimum basilicum* L.) essential oils leaves were applied on paper filters in concentrations between 6.4 x 10^{-5} and 1.2µL/L air. The data about mortality and oviposition were registered after 24h of exposition and submitted to the variance analysis with averages compared by the Tukey test, at 5% of probability. The LC_{50} were obtained through the Probit's analysis. The eugenol and the thyme and basil leaves caused almost 100% of mortality when concentrated at 1.2, 0.32 and 0.29µL/L air, respectively. The eugenol's and essential oils' concentrations that reduced the females' oviposition were 6.4 x 10^{-5}; 0.001 and 3.6 x 10^{-3}µL/L air. Both species' essential oils presented the same toxicity over the two-spotted spider mite. The LC_{50} obtained for both oils were 0.02µL/L air, while the eugenol's LC_{50} was 0.4 x 10^{-2} µL/L air. These results indicate that the *T. vulgaris* and *O. basilicum* essential oils are constituted of biologically active substances with fumigant potential to be used in the *T. urticae*'s control.

Tuesday 24, Afternoon, Auditorium - Poster

64 - Fumigant action of *Citrus aurantium* L. and *Citrus sinensis* Osbeck essential oils on *Tetranychus urticae* (Acari: Tetranychidae)

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The two-spotted spider mite, *Tetranychus urticae* Koch, is a pest which is economically important in various cultures in different parts of the world. Its control has been done through repeated applications of chemical products, which can lead to the development of more resistant species. The indiscriminate utilization of these products can cause contaminations in the environment. Therefore, the search for alternative methods of control, mainly with fumigant action for use in greenhouses has been one of the priorities for many researchers. The essential oils of some plants are a good option, since, because of their high volatility, they can be used as fumigants in the mites control. Among the vegetal species known for the high production of essential oils, the ones of the genus *Citrus* are some of the most remarkable. Their biological properties, such as antimicrobial, antifungal, insecticide and acaricide, are well known. In this context, this work aims to investigate the acaricide activity of the *Citrus aurantium* L. and *Citrus sinensis* Osbeck leaves' essential oils over the *T. urticae*. The experiments took place in laboratory, under the following conditions: 26±1°C, 65±10% RH and photophase of 12h. Petri dishes (9cm) with three disks of *Canavalia ensiformes* leaves (L.) (2.5cm) containing ten adult females of *T. urticae*, exposed on paper disks of moistened filters, were put in fumigation chambers (2.5L). The essential oils and the eugenol (positive control) were applied in concentrations varying from 6.4 x 10^{-5} to 2.0µL/L air. The mortality and oviposition data were evaluated after 24h of exposition and submitted to the analysis of the variance and the averages compared by the Tukey test to 5% of probability. The LC_{50} was obtained through the Probit's analysis. The results show different activity of the essential oils on the two-spotted spider mite. To the mite's mortality rates next to 100%, concentrations of 1.2; 0.6 and 2.0µL/L air were used both to eugenol and "mimo" (*C. sinensis*) and "lima" (*C. aurantium*) orange oils, respectively. The necessary concentrations to reduce oviposition were 6.4 x 10^{-5}; 0.05 and 0.4µL/L air to eugenol and "mimo" and "lima" oranges. The mimo orange's oil was the most toxic (LC_{50}=0.12µL/L air) when compared to the lima orange (LC_{50}=1.13µL/L air). The results indicate that the essential oils of *C. sinensis* and *C. aurantium* leaves present acaricide activity, and can be very efficient in the control of the two-spotted spider mite. However, new studies must be made to evaluate the costs/benefits to its utilization in integrated pest management programs of the two-spotted spider mite.

Tuesday 24, Afternoon, Auditorium - Poster

65 - Fumigant activity of essential oil of *Lippia gracilis* present in the hinterlands of Pernambuco against *Tetranychus urticae* Koch (Acari: Tetranychidae)

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The two-spotted spider mite, *Tetranychus urticae*, is considered a major pest in the world, occurring in tropical and temperate regions, and indoor and outdoor. The interest in using as an alternative to conventional acaricides, plant products have been intensively investigated in recent years, mainly by the observed effects such as repellence, feeding inhibition, growth inhibition, changes in sexual behavior and sterilization, and mortality in immature or adult stages. Plant products in general are used primarily in the form of aqueous or organic extracts, powders and/or fixed and volatile oils. Due to their high volatility, essential oils of various plant species have been evaluated for its effectiveness against various types of arthropods. This study aims to evaluate the fumigant action of essential oil from leaves of *Lippia gracilis* on the two spotted spider mite. Known popularly as the "alecrim da chapada", this plant is characterized by its strong aroma and medicinal use. To obtain the essential oil, leaves were collected from plants in the Chapada do Araripe, municipality of Ouricuri-PE. Bioassays were conducted under laboratory conditions of 26±1°C, 65±10% RH and 12h photophase. Petri dishes (9cm) with three leaf disks of *Canavalia ensiformis* (L.) (2.5cm) containing ten mites (adult female), laid out on disks of moistened filter paper, were placed in fumigation chambers with a capacity of 2.5L. We used concentrations ranging from 6.4x10-5 to 1.2µL/L air of the eugenol (positive control) and essential oils of *L. gracilis*. The data on mortality and oviposition were assessed 24 hours after the mounting of the bioassays and were submitted to statistical analysis of variance and subsequently the means were compared by Tukey test ($P<0.05$). The program POLO PC was used to estimate LC50. The concentration of 1.2mL/L air promoted 83.3% mortality of the mites when subjected to *L. gracilis* oil. Oviposition data showed significant differences in posture from 0.2mL/L air for *L. gracilis* oil and 6.4x10-5µL/L air for eugenol, when compared with the control. As expected, the mites were more sensitive to eugenol than *L. gracilis* oil. The estimated LC50 for eugenol was 0.004µL/L air, while for the *L. gracilis* oil was about 50 fold larger. The relative toxicity observed in these preliminary data for the leaf oil of the *L. gracilis*, associated with a reduction of posture, makes it promising for control of two-spotted spider mite. However, more research and experiments are needed under field conditions to evaluate the cost/benefit to its use in the integrated management of this pest.

Tuesday 24, Afternoon, Room 2

66 - How much environmental conditions drive the invasive potential of *Tetranychus evansi*

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The pace of movement of species from their native ranges to new geographical areas is continuously increasing. When arriving to new habitats, alien species often become invasive with tremendous economic and environmental consequences. In the last ten years, invasive species have motivated a growing number of studies to understand invasion processes. To this end, genetic markers and more recently also computational approaches have proved to be valuable tools to determine colonization routes, source populations, number and size of introductions. However, while genetic approaches are useful in describing the invasion history, what makes a species or population to become invasive once a propagule arrives to a new geographical area, remains poorly understood. We address these issues here by studying the tomato spider mite, *Tetranychus evansi*. This species originated from South America and has recently emerged as a new threat to solanaceous crops in Africa and in the Mediterranean basin. Using mitochondrial (COI) and nuclear (ITS) sequences generated from *T. evansi* samples spanning the current geographical distribution area we demonstrated that the invasion results from multiple cryptic introductions with two main mite lineages having arrived in Europe which have differential invasive potential. When a CLIMEX model distribution was developed using both South American and invaded areas, records to predict the global expansion of the species, the species distribution appears to be limited by cold

stress in a large part of North America and Europe. Recent research has revealed that adaptive evolution plays a crucial role in many invasions and we address these questions here by examining biological traits that appeared as crucial for the success of the invasion of *T. evansi* in temperate climates, considering that the species is not able to diapause and its ability to exploit plants in a new environment. We experimentally compared life-history parameters of mites collected from both the introduced and native areas which were subjected to different environmental conditions. We show that the invasion success of *T. evansi* could result from the occurrence of a particularly successful invasive population which might have served as source to colonize remote areas. Dissecting biological traits which can favor the mite invasion potential, not only helps to understand the invasion process itself, but in the case of an agricultural pest, as *T. evansi*, it ultimately should help to build up management strategies.

Thursday 26, Afternoon, Auditorium - Poster

67 - GSK-3 activity regulation by calcium in embryonic cell BME26

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Rhipicephalus (*Boophilus*) *microplus* is a bovine ectoparasitic tick present in tropical and subtropical areas in the world. Ticks are obligatory hematophagous arthropods and important vectors of both human and animal diseases. The enzyme glycogen synthase kinase-3 (GSK-3) plays important roles in protein synthesis, glucose metabolism, cell proliferation and differentiation, microtubule dynamics, cell motility, and apoptosis by phosphorylation of many substrates. Therefore, its activity must be tightly regulated, and is achieved by several mechanisms including phosphorylation, protein complex formation and subcellular distribution. Our group has characterized the GSK-3 during *R. microplus* embryogenesis. The cloned sequence showed high similarities to enzymes already described for other organisms. Recent reports suggest that GSK-3 activity is modulated by calcium homeostasis. More recently GSK-3 activity was detected in embryonic cells (BME26) lysates and inhibited when EGTA was present. This result suggests a relation between Ca^{2+} levels concentration and GSK-3 activity. Low calcium concentration in cytosol is maintained by coordinated function of transporters and channels including Ca^{2+}-ATPases (SERCA). SERCA was immunodetected in tick eggs and BME26 cells using western blotting. Thapsigargin, a SERCA inhibitor, was able to increase GSK-3 expression, by growing the concentration of calcium in cytoplasm. These data suggest a link between GSK-3 activity, Ca^{2+} concentration and SERCA activity. Calcium and thapsigargin cause apoptosis in BME26 cells and recently studies showed GSK-3β is a key enzyme in apoptotic signaling. Apoptosis caused for calcium and thapsigargin can involve GSK-3 as demonstrated in other studies. Further studies would to be realized for demonstrated GSK-3 involvement in apoptosis induced by calcium.

Wednesday 25, Afternoon, Auditorium - Poster

68 - Rickettsial infection in *Amblyomma* spp. ticks in Americana, São Paulo State, Brazil

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Brazilian spotted fever (BSF) is an acute, potential lethal febrile disease, caused by the bacterium *Rickettsia rickettsii*, which is vectored mainly by the tick species *Amblyomma cajennense*. In the present study, a better understanding about epidemiological diagnosis of rickettsial infection in *Amblyomma* spp. ticks at risk and alert areas for BSF were done in Americana municipality, São Paulo State, southeastern Brazil. From July, 2009 to April, 2010,

3,252 free-living adult ticks were collected through 70 field trips (weekly, from 9:00 to 12:00 a.m., using CO_2 trap devices) Ticks were identified as *Amblyomma cajennense* (2,213) and *Amblyomma dubitatum* (1,039). Adult ticks were submitted to hemolymph test and PCR. Positive ticks in both tests will be confronted using a random factorial scheme for acarological research results, considering both major found species. Each adult tick was desiccated in order to remove salivary glands for DNA extraction, using the GT protocol (chloroform and guanidine isotiocianate), and further tested by PCR using primers CS-62/CS-462, which target a 401-bp fragment of the *Rickettsia* citrate synthase gene (*gltA*). Samples positive for the *gltA*-PCR were also tested by a second PCR using primers Rr190.70 / Rr190.602, targeting a 532-bp fragment of the rickettsial outer membrane protein A gene (*ompA*), which is specific for spotted fever group *Rickettsia* species. Visualization of PCR results were done by electrophoresis agarose gel at 2% and ethidium bromide stain. Until now, hemolymph tests showed 20.04% (108/539) individual ticks to contain *Rickettsia*-like structures. By the *gltA*-PCR, rickettsial DNA was detected in 2.71% (9/332) *A. cajennense* and 16.90% (48/284) *A. dubitatum*. From the 23 samples, none was positive for the *ompA*-PCR. Further tests are in progress, including DNA sequencing of PCR products and testing the remaining tick salivary gland samples.

Tuesday 24, Afternoon, Auditorium - Poster

69 - A catalog of the mite family Ascidae (Acari: Mesostigmata)

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Mites of the family Ascidae are found in several habitats, mainly in litter, stored food and flowers. They are mostly known for their predatory habit, feeding on mites, insects and nematodes, but many species are also known to feed on fungi, pollen and nectar. Some are parasitic on cockroaches and moths. The objective of this work was to list the known species of this family, compiling relevant taxonomic information about them. For each valid genus, references are provided for its original description, redescriptions, synonymies and family in which it was originally placed. For each species, references are also provided for the corresponding original description, redescriptions, synonymies and different nomenclatural combinations for the epithet, type depository, type locality and habitat, and relevant remarks. A key to all the genera and data on zoogeographical distribution of the species are presented. Ascidae species have been described from all zoogeographic regions of the world. A total of 849 valid species belonging to 39 genera are mentioned in the catalog. The most numerous genera are *Lasioseius* Berlese (179 species), *Asca* von Heyden (118) and *Proctolaelaps* Berlese (116). The genera *Africoseius* Krantz, *Digamasellus* Berlese, *Laelaptoseius* Womersley, *Lindquistoseius* Genis, Loots & Ryke, *Protogamasellopsis* Evans & Purvis, *Tangaroellus* Luxton, *Zygoseius* Berlese were removed of this family.

Tuesday 24, Afternoon, Auditorium - Poster

70 - Redescription of *Lasioseius floridensis* (Acari: Ascidae)

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Efforts have been dedicated in Brazil to the search for prospective predatory mites to control most important plant pests in the country. A leaves of gerbera infested by the broad mite [*Polyphagotarsonemus latus* (Banks)] was recently received in our laboratory from a sample collected at Mogi das Cruzes, State of Sao Paulo, Brazil. Two predatory mites were found in association with that pest, one of which was identified as *Lasioseius floridensis* Berlese, 1916. *Lasioseius* Berlese is the most specious genus of Ascidae; most species of this genus have been described from the Neotropics (Mexico, Central and South America and the Caribbean region). Species of this genus have been reported to prey on nematodes, mites, and to feed on fungi. A study has been conducted in our laboratory to evaluate the possible role of this mite as a predator of the broad mite. *Lasioseius floridensis* Berlese, 1916 was first described from Lake City,

Florida, USA, in moss; it is considered the senior synonym of *Borinquolaelaps dentatus* Fox, 1946, described from Puerto Rico, and *Lasioseius scapulatus* Kennett, 1958, described from California, USA. The objective of this work was to redescribe *L. floridensis* based on specimens collected in Mogi das Cruzes, given the scanty morphological information about it in the literature. Measurements of different structures of all post-embryonic stages are provided. This species is similar to *Lasioseius subterraneus* Chant, 1963, differing from it by details of the epistome and ornamentation of the dorsal shield. *Lasioseius floridensis* is also similar to *L. latinoamericanus* Mineiro, Lindquist & Moraes, 2009, *Lasioseius queenslandicus* (Womersley, 1956), *Lasioseius sewai* Nasr & Abou-Awad, 1987 and *Lasioseius sugawarai* Ehara 1964, differing from them by the shape of the spermatheca.

Thursday 26, Morning, Room 6

71 - Efficacy of *Metarhizium anisopliae* for the control of the two-spotted spider mite, *Tetranychus urticae*, attacking bean plants

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Tetranychus urticae is the most important mite pest of crops worldwide. It is has been reported on more than 200 host plant species, including beans and many vegetables. Due to problems related to the use of synthetic pesticides, effort has been turned towards alternative biological control agents, including entomopathogenic fungi. Therefore, the efficacy of the *Metarhizium anisopliae* isolate ICIPE78 on the population density of *T. urticae* infesting bean (*Phaseolus vulgaris*) plants in a greenhouse was assessed. Potted bean plants were artificially infested with *T. urticae* and treated with two different fungal formulations and with a synthetic acaricide (Dynamec® active ingredient abamectin). Mite density was evaluated two days before spraying and weekly for five weeks post-spraying. The number of pods per plant, number of seeds per pod and the dry weight of seeds per plant was also evaluated in each treatment. Results showed that fungal formulations and the acaricide reduced the population density of mites as compared to controls. There were significant differences in *T. urticae* population densities between the treatments at postal sampling dates post-spraying, in top and middle leaves. At 3 weeks post-spraying the mite densities were near zero in the treated leaves, compared to 9.23 and 9.84 mites/cm^2 on top and middle leaves of the control, respectively. At 5 weeks post-treatment, there were no more leaves in the control. Yields were respectively 10.5 and 10.8 higher in the fungal and acaricide treatments than in the control. There were no significant differences in mite densities between the fungal and the acaricide treatments. Results of this study underline the potential of the *M. anisopliae* isolate ICIPE78 as an alternative to acaricides for *T. urticae* management.

Thursday 26, Afternoon, Auditorium - Poster

72 - Simulation model of a mass rearing of predatory mites: II. The pest population – *Tetranychus urticae*

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Tetranychus urticae Koch (Tetranychidae) is a mayor pest of rose crops in Colombia and one of the principal strategies of management is the use of chemical acaricides. However this pest has developed resistance to various chemicals, because of its haplodiploid genetic system. As a consequence, farmers have evaluated the use of alternative pest controls, as the predatory mite *Phytoseiulus persimilis* (Phytoseiidae), which has been successful in reducing the pest population. However, Colombia does not have a commercial offer of this predator, which is a problem for the implementation of the use of biological control of *T. urticae* with *P. persimilis*. A mass rearing production system of the predatory mites under greenhouse conditions has been implemented, but

the complexity of the system, biotic and abiotic variables that affect the production, do not permit to identify the cues of the process to be optimized. In this paper a simulation software was developed to optimize the production of phytoseiid mites. The Delphi 6.0 was used to develop the software that is based on the population ecology theory of supply – demand ratio to regulate the increase of population of mites and plants. The functional response and the metabolic pool were used to measure the resources acquisition and allocate those resources within the population, respectively. Some population parameters of plants and mites were estimated under controlled conditions, while others were taken from the literature. This simulation model was a good fit to real data, therefore it allowed studying the effect of different variables on population of mites and plants. The model estimated a population of 30,000 *T. urticae* per bean plant (*Phaseolus vulgaris*) and it was possible to see the top-down effect of the pest on the plant development. It was also possible to evaluate the effect of the initial density of the pest on their own increase and the age structure of pest population that permits to calculate the quantity of mites available for the predatory mites. Finally, the model allowed the study of trophic interactions and the estimation the maximum possible production of *T. urticae* on bean plants under greenhouse conditions in a mite mass rearing system.

Wednesday 25, Afternoon, Auditorium - Poster

73 - Heavy metals in soil mites

R.O. Butovsky

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Motorways and industrial plants may cause expressed toxicological effects, being the primary source of various toxic emissions, e.g. heavy metals, in ecosystems. The study of acarological communities was undertaken in ten roadside and six ecosystems located at the vicinity of chemical and metallurgical plants in Central Russia, Belgium and the Netherlands. In Acari communities, I observed the decrease of abundance of oribatid mites and increase of relative abundance of acarid, gamasid, tarsonemid and pygmephorid mites. Thus, the roadside community was treated as a pioneer community, characteristic for the early stages of litter decomposition. Roadside stress increased or stabilized species diversity in some groups of mites (e.g. species of Mesostigmata). We observed both highly sensitive (oribatid mites) and highly tolerant (acarid and gamasid mites). Heavy metal contents in mite species was species- and group-specific as related to the regulation of Zn and Cu as an essential metals. Metal concentrations in soil arthropods were weakly related to metal concentrations in soil. Complicating factors were organic matter content, pH, heavy metal availability to living organisms. In general the copper and zinc contents decreased as follows: Mesostigmata, Oribatei, Prostigmata.

Thursday 26, Morning, Room 6

74 - Predation and life table of *Sancassania polyphyllae* (Acari: Acaridae) feeding on entomopathogenic nematodes and insect host tissues

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Sancassania polyphyllae is associated with larvae of the white grub, *Polyphylla fullo* (Coleoptera: Scarabaeidae), and feeds on the infective juveniles of entomopathogenic nematodes of the families Steinernematidae and Heterorhabditidae, important biological control agents of soil insect pests. We conducted laboratory studies to (1) compare the predation of *Steinernema feltiae* and *Heterorhabditis bacteriophora* (Rhabditida: Steinernematidae, Heterorhabditidae) by *S. polyphyllae*, (2) determine whether entomopathogenic nematodes alone were an adequate diet for development of *S. polyphyllae*, (3) determine the life table of *S. polyphyllae* feeding on *S. feltiae* and *H. bacteriophora*, and tissues of larvae of the insects *P. fullo* and *Galleria mellonella*

(Lepidoptera: Pyralidae). This study showed that *S. polyphyllae* consumed more infective juveniles of *S. feltiae* than of *H. bacteriophora*. *S. polyphyllae* successfully completed its development and reproduced when fed on entomopathogenic nematodes. Total developmental period of *S. polyphyllae* that fed on the insect tissues was significantly shorter than those that fed on live infective juveniles of entomopathogenic nematodes. The total and daily fecundity of *S. polyphyllae* feeding on *P. fullo* and *G. mellonella* was significantly higher than those on *S. feltiae* and *H. bacteriophora*. The net reproductive rate (R_0) was the highest (588.3 ♀ / ♀) when *S. polyphyllae* fed on *P. fullo*. The longest mean generation time (T_0) occurred on *H. bacteriophora* (12.6 days) and the shortest occurred on *P. fullo* (10.5 days). *S. polyphyllae* fed on *P. fullo* (r_m = 0.61) and *G. mellonella* (r_m = 0.55) had the highest intrinsic rate of increase (r_m), whereas the mites that fed on *S. feltiae* (r_m = 0.45) and *H. bacteriophora* (r_m = 0.41) had the lowest.

Tuesday 24, Morning, Room 1

75 - Behavior of *Varroa destructor* in worker cells of Africanized honey bees

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The ectoparasitic mite *Varroa destructor* is currently the most important pest of the honey bee *Apis mellifera*. Many reports exist of severe damage and loss of thousands of honey bee colonies caused by infestation with varroa mites, especially in temperate areas of Europe and Asia. At first sight the brood cell would appear to provide an ideal environment for mite reproduction, with its stable temperature and humidity, accessible food source, and absence of predators or competitor species. However, the time available for mite reproduction is limited and the changes occasioned by the bee´s development limit the space available for the foundress mite and its descendants. Because mite reproduction occurs within the sealed cell, the direct observation of varroa activity inside the cell is difficult. A video observation method using transparent polystyrol cells containing naturally reared and infested brood was used to analyze the behavior of varroa mites in worker brood of Africanized honey bees (AHB) (Cylindrical transparent polystyrol cells with internal dimensions of 5.1 mm diameter x 14 mm long for workers were used). We recorded how mites feed on the larva and pupa, construct a fecal accumulation site and how the bee larva carried out some longitudinal movements around the cell. The feeding activity of the foundress mite varies during the course of the cycle. On the prepupa mites were found to feed often (0.3 ± 0.2 bouts h^{-1}) for a period of 8.7 ± 8.4 min h^{-1} and there was no preference for a specific segment as a feeding site. On the opposite, during the pupal stage mites fed less often (0.1 ± 0.1 bouts h^{-1}) for a period of 6.2 ± 4.0 min h^{-1} and almost always at a particular site (92.4%). On pupa, 83.7% of the feeding was on the 2nd abdominal segment (n= 92), and only few perforations were found on the thorax. Varroa shows a preference for defecation in the posterior part of the cell (cell apex), close to the bee´s anal zone. We found a high correlation between the position of the feeding site on the pupa and the position of the fecal accumulation on the cell wall. Most infested cells have only one fecal accumulation site and it was the favorite resting site for the mite, where it spent 24.3 ± 3.9 min h^{-1}. Longitudinal displacements were observed in 28.0% (n = 25) of the analyzed bee larva. Turning movements around the cell, from the bottom to the top, were carried out by these larva, mainly during the second day (47.7 ± 22.5 min h^{-1}), just before pupation, with a total time of 874.9 ± 262.2 min day^{-1} (n = 7 individuals). In conclusion, these results in worker brood of Africanized bees demonstrate significant adaptations on behalf of varroa mites in parasitizing the developing bee inside the capped brood cells.

Friday 27, Morning, Room 4

76 - Effects of forest management practices on soil mite community composition

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Relatively little is known about how mite communities in soil respond to various forest management practices. In this presentation we will summarize the existing literature dealing with studies of soil mites and forest practices in North America, and we will present data from one such study as an example. Prescribed fire is a commonly used management tool in longleaf pine and slash pine forests of the southeastern Atlantic and Gulf coastal plains. Much research has focused on effects of prescribed fires on vegetation structure and plant community, but much less is known about fire effects on invertebrate consumer groups, and this is particularly true for soil-dwelling organisms. This is unfortunate because soil invertebrates are known to perform critical functions in soil ecosystems, and they make up a substantial fraction of the total biotic diversity in most systems. We sampled soil microarthropods from the forest floor (O-horizons) and from mineral soil (A-horizon) of plots where prescribed fire return interval has been manipulated for the past 48 years. Experimental fire frequencies included annual fire, fire every 4 years, and reference plots that had been unburned for 48 years. Preliminary results suggest that sub-order level mite taxonomic richness was highest in the plots burned every four years and lowest in the annually burned plots (there was practically no O-horizon material in the annually burned plots). The oribatid mites, one of the most abundant and diverse suborders of Acarina, were identified to the genus level for further analysis. Preliminary results suggest a substantial degree of habitat specificity among oribatid genera with 13 genera collected exclusively from the O-horizons in the 4-year fire interval plots, and 12 genera collected exclusively from the O-horizons in unburned reference plots. This degree of habitat specificity suggests that a mosaic of burned and unburned patches will be required to maintain total diversity of the mite community. We also conducted an ordination analysis of the oribatid mites, and these results will also be presented.

Thursday 26, Afternoon, Room 5

77 - Action of acaricides (synthetic and natural) on the reproductive system of *Rhipicephalus sanguineus*

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Ixodidae female reproductive system is today a target for studies concerning the control of these individuals. In this sense, the research group of the Brazilian Center of Studies on Ticks Morphology (BCSTM) is currently testing the effects of acaricides of synthetic and natural sources on the process of reproduction of *Rhipicephalus sanguineus* females. The results have shown that contrarily to what is reported in the literature, the synthetic acaricides act not only in the nervous system but also in the salivary and in the reproductive tick systems, inhibiting two processes of vital importance: feeding and reproduction. The results have also shown that contrarily to what is recommended by manufacturers of synthetic acaricides, dosages that would be much lower and much less harmful to non-target organisms and the environment could still be enough to reduce harm caused by ticks. With regard to chemical control using plant products, some of them such as the extract obtained from neem (*Azadirachta indica*) leaves, which are used and consumed in the diet of humans and other animals in some countries of the world, showed interesting results for tick control. Similarly to the results obtained with the administration of diets enriched with esters derived from castor oil (*Ricinus communis*) to the hosts (rabbits), neem has been shown able to destroy the germ cells (oocytes) of *Rhipicephalus sanguineus* females causing intense vacuolation, loss of germinal vesicle (cell nucleus) and chorion disorganization (protective membrane surrounding the oocyte), culminating in the total inviability of these cells and/or their death as well as the failure to produce new individuals. In the specific case of neem and the esters extracted from castor oil, if they come to be used as an alternative method for tick control, non-target organisms and the environment will be greatly benefited. This research was financially supported by FAPESP (Grant no 07-59020-0) and CNPq (Grant no 308733/2006-1).

Tuesday 24, Afternoon, Auditorium - Poster

78 - Ultrastructure of the midgut of adult female *Amblyomma cajennense* Fabricius (Acari: Ixodidae) in several feeding stages and subjected to three infestations

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The digestive tract of *Amblyomma cajennense* as well as other tick species is divided into the anterior, median and posterior intestines, responsible for digestion of blood ingested during the meal on the host. In the present study, we analyzed the midgut of females in a semi and fully engorged stages of *A. cajennense* collected on rabbit and subjected to three infestation levels, to demonstrate the changes undergone by the epithelial cells. The results showed that during the feeding period the outermost layer of the intestine is composed of muscle fibres, as observed in the semi-engorged and engorged ticks in the first infestation and semi-engorged in the second infestation. The cytoplasm of the digestive cells of feeding females, and those of the semi-engorged and fully engorged females in the first, second and third infestations showed some intact cells with preserved organelles whereas other cells were disorganized. Large lipid droplets and protein granules were observed in the cytoplasm of the cells of the intestine in all phases of feeding process. Cytoplasmic spherocrystals were only observed in the semi- engorged and engorged females in the first and second infestations. Intense vacuolation was observed in the digestive cells of the midgut of semi-engorged and engorged females in the second infestation and those engorged in the third infestation. The data showed that the gut of *A. cajennense* female ticks undergo considerable changes during the feeding period, which become more pronounced in reinfestation. These changes are probably due to the host immune response that returns antibodies to the ectoparasite, which then acquires resistance to those products.

Thursday 26, Afternoon, Room 4pe

79 - Studies on the biology of native predators associated with *Raoiella indica* (Acari: Tenuipalpidae) in Florida, USA: implications on their potential as biological control agents of this exotic species

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In Florida, some predatory natural enemies including *Amblyseius largoensis* (Muma) (Acari: Phytoseiidae), *Ceraeochrysa claveri* Navas (Neuroptera: Chrysopidae), *Stethorus utilis* (Horn) (Coleoptera: Coccinellidae), *Bdella distincta* (Barker and Bullock) (Acari: Bdellidae) and *Aleurodothrips fasciapennis* (Franklin) (Thysanoptera: Phlaeothripidae) have been observed feeding on the invasive species *Raoiella indica* Hirst (Acari: Tenuipalpidae). Among these, *A. largoensis* increased in numbers after the arrival of *R. indica* in south Florida. We evaluated the development and reproduction of *A. largoensis* feeding on pollen, *R. indica*, and other microarthropods inhabiting coconuts in Florida. The intrinsic rate of increase (r_m) of *A. largoensis* fed with *R. indica* was significantly higher than those fed with the other food sources ($F = 34.18$; $df = 2, 58$; $P<0.001$). *Amblyseius largoensis* showed higher survival and reproductive rates, and shorter developmental times when fed solely on *R. indica* compared with single other food sources. Other Florida native predators develop and reproduce poorly or cannot complete development feeding on the invasive species. Results of these studies suggested that *A. largoensis* can play a role in controlling *R. indica* in Florida.

Wednesday 25, Afternoon, Auditorium - Poster

80 - Oribatid mites (Acari: Oribatida) in a sheep pasture with a history of infestation by *Moniezia expansa* (Rudolphi) (Cestoda: Anoplocephalidae) in Ilhéus-BA, Brazil

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Oribatid mites are frequently the dominant arthropod group in superficial soil layers, reaching from some thousands to hundreds of thousands of individuals per square meter in forests, grasslands and pastures. About a hundred species of Oribatida have been globally reported as intermediate hosts of cestodes of veterinary significance in pastures. Members of the oribatid genera *Galumna* and *Scheloribates* have been reported as hosts of *Moniezia expansa* (Cestoda: Anoplocephalidae) in the States of Rio de Janeiro and São Paulo, although the species to which they belong have not been identified. Based on the importance of the moniesiosis in ovines, knowledge of the oribatid mites acting in the transmission of cysticercoids in a specific area can be of particular interest. This work was conducted in a sheep pasture with a history of infestation by *M. expansa* in the municipality of Ilhéus, State of Bahia, Brazil, to identify the oribatid species that potentially acted as intermediate hosts of *M. expansa*. Nineteen soil samples taken from the top five-centimeter layer were collected for extraction and parasitological exam of the mites in laboratory. Eight-hundred-fifty-one adult specimens of Oribatida, pertaining to sixteen families, twenty-two genera and twenty-eight species were registered. The average number of mites estimated in the pasture was about fourteen thousands individuals per square meter. Based on the size (mites larger than 0.5 mm) and the affiliation to poronotic Brachypylina groups, the oribatid mite species defined as presenting the higher probability to be infected in area, to be proved in future studies, were: *Pergalumna australis*, *Pergalumna* sp.1, *Pergalumna* sp.4 and *Galumna* sp.14 (Galumnidae). No case of infection by *M. expansa* cysticercoids was recorded in the samples collected.

Tuesday 24, Morning, Room 6

81 - Catalogue of the mite family Rhodacaridae Oudemans (Acari: Mesostigmata)

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The Rhodacaridae Oudemans are free living, cosmopolitan, edaphic mites, which are considered in the literature to be predators. The taxonomic concept of this family has changed considerably over time, making it very difficult for non-taxonomists to decide which species really belong to this family. Even taxonomists sometimes find it difficult to determine whether a given species belongs to this family or not, because many of the old descriptions are not sufficiently detailed. Also, the family placement of some genera has been very unstable. We therefore present a synopsis of all the genera and subgenera in the superfamily Rhodacaroidea, arranged in families as we presently understand them. The families included are Digamasellidae, Halolaelapidae, Laelaptonyssidae, Ologamasidae, and Rhodacaridae. We also present a review of all published descriptions and re-descriptions of genera and species reported to belong to the Rhodacaridae. This was done by first constructing a spreadsheet containing standardized information for all of the species considered to belong to this family. A characterization of each genus considered to belong to this family was then prepared, and a dichotomous key for identification of the genera was constructed. Finally, a list of species within each genus was compiled, giving relevant taxonomic information about the respective types and providing references concerning nomenclatural changes in the literature, synonymy and redescriptions of each species. In total, 147 species and one subspecies are listed in this work, arranged in 15 genera. The most diverse genera are *Afrogamasellus* Loots & Ryke and *Rhodacarus* Oudemans, with about 22% and 20% of the total number of valid species respectively. Five of the genera are monotypic. Taxonomic confusion surrounds some groups of species, especially in the genus *Rhodacarus*. It appears that *Rhodacarus calcarulatus* Berlese, *R. coronatus* Berlese, *R. pallidus* Hull, *R. reconditus* Athias-Henriot and *R. roseus* Oudemans have often been misidentified, and all of these species are in need of detailed revision. *Afrogamasellus* (*Foliogamasellus*) Karg, 1977 is newly synonymised under *Afrodacarellus*

Hurlbutt, 1974.

Thursday 26, Afternoon, Auditorium - Poster

82 - Predation potential of *Gamasiphis paulista* Castilho, Moraes & Narita (Acari: Ologamasidae)

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Ologamasidae are cosmopolitan mites mentioned as predators of soil organisms, although nothing is known about their potential as biological control agents. The objective of the work was to evaluate the predation and reproduction potential of *Gamasiphis paulista* Castilho, Moraes & Narita on nymphs of Collembola sp. (Hexapoda: Entognatha) and *Tyrophagus putrescentiae* (Schrank) (Acari: Acaridae). The study was conducted in a laboratory where the experimental units (each consisting of a transparent plastic Petri dish, 2.7 cm in diameter x 1.2 cm high) were maintained at 25 ± 1ºC, 97 ± 3% RH and in the dark. Initially, 10 Collembola sp. or 30 *T. putrescentiae* were transferred to each experimental unit. Immediately afterward, a gravid adult female of *G. paulista* was transferred from the stock colony to each unit. Each test had 30 replicates. The units were examined daily for 10 consecutive days to determine the number of prey killed and of eggs laid by the predator as well as its survivorship. At each day, prey killed were replaced and eggs laid were discarded. The average number of prey killed/day and the average number of eggs laid/day by *G. paulista* were: Collembola sp. – 3.3 and 1.2; *T. putrescentiae* – 10.9 and 1.7. Survivorship of the predator in predation tests was always 90% or higher. The mite showed good potential as a predator and deserves further study of its potential for predation on other soil pests.

Wednesday 25, Afternoon, Auditorium - Poster

83 - Population dynamics of phytophagous mites (Acari: Eriophyidae, Tenuipalpidae, Tetranychidae) in three rubber tree clones (*Hevea brasiliensis* Muel Arg., Euphorbiaceae) in southern Bahia State, Brazil

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Several works have reported the different infestation levels of pest mites on rubber tree clones. The knowledge about clone resistance and the period of occurrence of pest mites could help growers in managing their crops, adopting control measures when necessary. The aim of this work was to verify the period of occurrence and the densities of three phytophagous mites, *Calacarus heveae* Feres, 1992, *Tenuipalpus heveae* Baker, 1945 and *Eutetranychus banksi* (McGregor), 1914, on the *H. brasiliensis* clones FX 2784, FX 3864, and MDF 180. Samplings were carried out in the rubber tree crop of "Plantações Michelin da Bahia", Igrapiúna, State of Bahia, with an average interval of seven days between sampling times, between October 2008 and April 2009. Ten rubber trees of each clone were selected and seven leaves were collected from around the canopy of each tree. The number of mites of species was counted in three areas of 1 cm^2, on the upper surface of the leaflets, for *C. heveae* and *E. banksi*, and on the lower surface for *T. heveae*, where these mites occur naturally. The peak occurrence of *C. heveae* was in January and March, and the highest densities occurred on clones FX 2784 (2.6 mites/cm^2) and MDF 180 (1.8 mite/cm^2). *Tenuipalpus heveae* reached the highest levels on clone FX 2784 (1.7 mite/cm^2) in March and April, and was the most numerous mite species in the clone FX 3864 (1.4 mite/cm^2). *Eutetranychus banksi* was found only on clone FX 2784, with the highest density observed in January (0.4 mite/cm^2). We conclude that FX 2784 was the least resistant clone and that highest mite infestation occurs in the first four months of the year.

Tuesday 24, Afternoon, Auditorium - Poster

84 - A new species of *Cocoseius* (Acari: Phytoseiidae) from Brazil

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The family Phytoseiidae is a group of predatory mites. Species of this group have been widely studied and used for the control of pest mites. Eighty-eight genera are presently placed in this family. One of these, *Cocoseius* Denmark & Andrews, has been reported only from Arecaceae, in tropical and subtropical regions of North, Central and South America, apparently always in humid environments, at most about 100 km from the Atlantic Ocean. Species of this genus are characterized by having most dorsal shield setae elongate, setiform and serrated; seta *z6* present and setae *s6*, *Z1*, *S2* and *S5* absent; ventrianal shield with one or three pairs of preanal setae; macrosetae (knobbed) present only on genu, tibia and tarsus of leg IV; cervix of spermatheca trumpet-shaped; fixed digit of chelicerae with few distal teeth; peritreme extending anteriorly to level of *z2*. Only two species have been assigned to this genus, *Cocoseius elsalvador* (Denmark & Andrews), from *Cocos nucifera* L. in El Salvador, *Sabal palmetto* (Walter) in Florida (USA) and *Acrocomia intumescens* Drude, *C. nucifera* and *Euterpes* sp. in Pernambuco (Brazil), and *Cocoseius palmarum* (Gondim Jr., Moraes & McMurtry), from *Euterpe* sp. in Pernambuco. The present work refers to the discovery of a new species considered to belong to this genus, collected from *Syagrus romanzoffiana* (Cham.) Glassman in a disturbed patch of the Atlantic Forest, next to the southern coast of the State of São Paulo. Mites were mounted in Hoyer's medium and examined under phase-contrast microscopy. The placement of this species in *Cocoseius* requires its re-definition, to include mites with 2 preanal setae and longer periteme, extending to the level of seta *j3*. This new species further differs from the known species of this genus by having macrosetae with diminute knobs. A key to the three species presently placed in *Cocoseius* is presented.

Tuesday 24, Afternoon, Auditorium - Poster

85 - Phytoseiidae (Acari: Mesostigmata) from natural ecosystems of the State of São Paulo, Brazil

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This work refers to a study of the phytoseiid mites collected from two natural ecosystems of the State of São Paulo, Cerrado and Atlantic Forest, on plant species belonging to different botanic families. In this study, 40 known species are reported, three of which are new records for Brazil [*Arrenoseius morgani* (Chant), *Amblydromalus congeae* (De Leon) and *Amblydromalus laetus* (Chant & Baker)] and six are new records for the State of São Paulo [*Amblyseius euterpes* Gondim Jr. & Moraes, *Amblyseius tamatavensis* Blommers, *Proprioseiopsis pentagonalis* (Moraes & Mesa), *Paraphytoseius santurcensis* De Leon, *Phytoseius averrhoae* De Leon and *Phytoseius marumbus* El-Banhawy]. Measurements of different structures are given for the species corresponding to these new records and for other ten species for which measurements for the respective populations of the State of São Paulo are not given in the literature [*Amblyseiopsis largoensis* Muma, *Proprioseiopsis dominigos* (El-Banhawy), *Amblydromalus manihoti* (Moraes), *Amblyseius villacarmelensis* Moraes, *Euseius alatus* De Leon, *Euseius ho* (De Leon), *Typhlodromalus aripo* De Leon, *Typhlodromus peregrinus* Muma, *Phytoseiulus macropilis* (Banks) and *Leonseius regularis* (De Leon)]. This study also comprises the description of nine new species and three new genera.

Thursday 26, Afternoon, Auditorium - Poster

86 - Effect of photoperiod and light intensity on sporulation and germination of *Neozygites floridana* (Entomophthorales: Neozygitaceae) isolates from Brazil and Norway

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The two-spotted spider mite, *Tetranychus urticae* Koch, is an important pest in several crops around the world. The control of this pest usually involves extensive application of pesticides, with possible negative impact on human health and the environment. Biological control of this pest with predatory mites and fungal pathogens offers a desirable solution to this problem. *Neozygites floridana*, an important pathogen of spider mites (Tetranychidae), causes field epizootics in *T. urticae*. Production of conidia from disease-killed cadavers is important for development of the disease in the field and one factor that regulates this process is light. The aim of this study was to determine the effect of photoperiod and light intensity on sporulation and germination of *N. floridana* isolates from Norway and Brazil. The two countries have different photoperiods and light intensities during the growing season when the epizootics of this fungus are observed. The experiment was conducted by placing individual cadavers of each isolate (Brazil and Norway) on three square photo-etched coverslips (18x18 mm) inside transparent plastic chambers lined with wet filter papers to achieve 100% relative humidity. These chambers were put in climatic incubators where the condition of each treatment was set. The treatment for each isolate consisted of two light intensities: 40 and 208 µmol m^2s^{-1} and two temperatures: 18 °C and 23 °C and three photoperiods: 24h of continuous light, 12h dark preceded with 12h light and 24h continuous dark. Results show that 24 h with a light intensity of 208 µmol $m^{-2}s^{-1}$ inhibits sporulation of both isolates at both temperatures compared to both 12h of light and full darkness. For the low light intensity of 40 µmol $m^{-2}s^{-1}$, no effect of photoperiod on sporulation was observed. However, the effect of photoperiod and light intensity on germination of spores was different. At both light intensities, a photoperiod of 24h of light strongly inhibited germination of both isolates at both temperatures. Contrary to our expectations, inhibition of germination was strongest for the Norwegian isolate under these conditions than the Brazilian isolate. No inhibition of germination was, however, observed for any of the light intensities, temperatures or isolates at a 12 h photoperiod or full darkness. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Wednesday 25, Afternoon, Auditorium - Poster

87 - Associated microorganisms affect the performance of *Tetranychus evansi* Baker and Pritchard (Acari: Tetranychidae) on tomato

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Interactions between arthropods and microrganisms have been receiving attention due to the impact of these symbiotic associations in promoting their macrosymbionts. Microsymbionts can confer benefits to its macrosymbiont, such as the supply of nutrients, resistance to pathogens, the ability to overcome plant defenses and detoxification. We studied the association between the mite *Tetranychus evansi* Baker and Pritchard, a pest of tomato, and microorganisms, specifically whether the associated microorganisms interfered with the performance of the mite. Mites treated with antibiotics (0.2% tetracycline hydrochloride) were compared with untreated mites. Polymerase chain reaction (PCR) confirmed the presence of fragments of bacterial DNA in untreated mites, whereas mites treated with tetracycline did not contain such fragments. Microbiological analysis confirmed the results obtained by the PCR. The effect of microflora on the performance of *T. evansi* was evaluated by comparing the oviposition of treated and untreated mites on tomato leaves. The rate of oviposition of untreated mites was 2.8 times higher than that of treated mites. We conclude that *T. evansi* is associated with endosymbionts, and that this association is apparently beneficial to the mite. This research was financially supported by FAPEMIG.

Wednesday 25, Afternoon, Auditorium - Poster

88 - Negative interactions between spider mites and aphids mediated by feeding behaviour and honeydew

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One of the most important issues in ecology is to understand the causal mechanisms that structures and shapes ecological communities. Insect herbivores induce a wide variety of trait changes in plants. They are specialized for using particular tissues of the plants and the quality of resources within and among plants is highly variable. There is much research focused on direct trophic interactions (prey-predators and host-parasitoids) but the potential of non tropic, indirect and facilitative interactions has been ignored. It is possible for guilds of phytophagous insects that one guild alters the chemistry or the morphology of plants for other or later guilds. So, under low herbivory conditions, early feeding guilds could affect the population's dynamics and the community organization for later feeders. Among the herbivore arthropods that feed on strawberry the main pest is *Tetranychus urticae* Koch (Acari: Tetranychidae) and also several species of aphids such as *Aphis gossypii* Glover, *Aphis fabae* Scopoli, *Myzus persicae* (Sulzer), *Macrosiphum euphorbiae* Thomas and *Chaetosiphon fragaefolli* Cockerell. Both guilds coexist, especially during autumn and spring, and feed on undersides of strawberry leaflets. However, well-developed colonies of both groups are not usual in field. Our hypothesis is that there exist negative interactions between spider mites and aphids. To test this hypothesis spatial coincidence in field between both herbivores was analyzed using Griffith Index (Ic). Also under controlled conditions of temperature, humidity and light (25±1 °C, 60-70% and 14:10, respectively) were analyzed: 1) the rate of increase of *T. urticae* and *C. fragaefolli* at densities 20:0 - 10:10 and 0:20 individuals/leaflet (n= 20 for each treatment), respectively, 2) the effect of honeydew on *T. urticae* preference and 3) the effect of strawberry leaflets previously damaged on *C. fragaefolli* preference (n = 15 for each treatment). Data were analyzed with ANOVA and Kruskal-Wallis. Ic was low (0 – 0.3) when the percentage of infested leaflets by spider mites was 25%, GI was variable (0-1) between 25% and 50% and up 50% spatial coincidence becomes complete. The rate increase of *T. urticae* diminished due to the *C. fragaefolli* interaction. The rate increase of *C. fragaefolli* did not change due to the spider mites interaction but a migratory behaviour to the upper side of leaflet was observed. Strawberry discs with honeydew and leaf damage by *T. urticae* was not preferred by *T. urticae* and *C. fragaefolli*, respectively. In this work, the negative interaction between these guilds could be attributed to some repellent compound in aphid honeydew and by tissue disorder due to spider mites. Changes induced by one of these herbivores reduce the resource availability for the other one. This results in a tendency to avoid each other.

Thursday 26, Afternoon, Auditorium - Poster

89 - Gamasids (Acari: Mesostigmata) mites associated with bark beetles in Mexico

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In Mexico, little is known about the relationship of the Mesostigmata (Acari) with bark beetles. This restrict knowledge is reflected in the number of genera and species reported in previous works for the country, only seven species. Samples were collected from 15 Mexican states. A total of 34 species of Gamasida were registered, included in nine families: Ascidae, Digamasellidae, Macrochelidae, Phytoseiidae, Parasitidae, Trematuridae, Uropodidae and Veigaiidae. *Proctolaelaps subcorticalis*, was the species found in a larger number of states (six). Nine new species were recorded for Mexico, *Trichouropoda hirsuta*, *T. ovalis*, *T. polytricha*, *T. shcherbakae*, *Dendrolaelaps neocornutus*, *Macrocheles bodreauxi*, *Pseudoparasitus* sp.1, *Trichouropoda* sp. 1 and *Nenteria* sp.1. The Gamasida found are associated with 28 species of Scolytinae, among, which the most outstanding genus is *Ips*, with seven species, of which *I. bonansei*, *I. mexicanus* and *I.*

integer occur more frequently; *Dendroctonus* genus is frequently found with other species: *D. frontalis*, *D. adjuntus* and *D. mexicanus*, in which they are associated with six species. Other genus hosts are: *Scolytus* (3 spp.), *Hylurgops* and *Xyleborus* (2 spp.), *Hylastes*, *Phloeoterus*, *Phoestribus*, *Pithyopthorus*, *Platipus* and *Stegomerus* (1 sp.). These species, in turn, are associated with 17 hosts, mainly *Pinus* (12 spp.) where the greatest diversity is 76%, outstanding *P. hartwegii*, *P. montezumae* and *P. quadrifolia*; *Quercus* sp. (1 sp.) 6%, and other plant species *Lonchocarpus pardiflorus* (Leguminosae) and some hardwoods like tree *Bursera instabitis* and *Prunus capuli* (18%). The greatest number of Gamasida species was found in the State of Mexico, with 18 (53%), followed by Jalisco and Chihuahua, with 7 (20%) and Baja California with five species (15%). The records for Baja California, Querétaro, Nuevo León and Veracruz are new to the country. It is important to note that the major diversity so far recorded occurred in the northern states, mainly due to climatic conditions (mainly mild) and the greater diversity of plant hosts where they are concentrated. Each family showed a preference for a particular binding site on the insect body, the thorax being generally occupied by Ascidae and Parasitidae under the elytra and the zone of elytral decline, Trematuridae in the ventral area, between coxae I and II. The information generated permits the amplification of the registered diversity records, learn about their biology, ecology and behavior as well as to understand their relationship with the bark insect groups, which every day gain great importance in forest systems, not only in our country but worldwide, based on the ecological services they provide to the environment and humanity. However, this work allowed us to extend the registration records of Mexican Gamasida with such associations, since it increased by 26 the number of species (76.47%). This is the first work addressing this problem in Mexico.

Tuesday 24, Afternoon, Room 4

90 - Microsatellite markers in *Ixodes scapularis*: preliminary data

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The tick *Ixodes scapularis* is the vector of several pathogens of medical and veterinary interest. Its taxonomic status was the object of a long lasting debate that is progressively being solved by using a number of molecular tools. Microsatellite markers have rarely been used for the study of the population genetics of *I. scapularis* and not at a sufficiently wide geographical scale. In this presentation we present preliminary data obtained by combining microsatellite and other molecular markers in analyses of the special and temporal genetic structure of selected populations of *I. scapularis.*

Wednesday 25, Morning, Room 3

91 - Management of two spotted spider mite, *Tetranychus urticae* Koch, on carnation with the help of biopesticides and the predator *Neoseiulus longispinosus* Evans (Acari: Tetranychidae, Phytoseiidae)

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Carnation holds a prominent place and a good market among the various cut flowers in India. This crop can be successfully grown in open fields and under polyhouse conditions, but during dry conditions its production is hampered by the attack of two spotted spider mite, *Tetranychus urticae* Koch. This is a polyphagous pest that feeds on a large number of crops. High infestation of this pest on carnation results in loss of chlorophyll, curling and bronzing of foliage, stunted growth, production of small, unattractive flowers and ultimately yield loss. High doses and indiscriminate use of pesticides for the management of this pest has led to development of resistance along with accumulating pesticide residues which are harmful to human

health and causes environmental pollution. Keeping in view the adverse effects of these chemicals, some ecofriendly alternative approaches were used in the present study for the management of that mite pest. Different combinations of predator and biopesticides were tested in four different modules at weekly intervals. These combinations were made by using the predatory phytoseiid mite *Neoseiulus longispinosus* Evans and some botanicals viz., Neem based insecticides, Econeem and the fungus *Verticillium lecanii*. The Vth module was a conventional method of control and comprised only the chemical Profenofos. After three weeks of application, the Vth module was found to be the most effective and it was stastiscally at par with the module III in which only predatory mite was used at weekly intervals for the management of the mite pest population. These results show the effectiveness of this predatory mite against two spotted spider mite and its potential use in the mite management programme on carnation under polyhouse in the future. The presentation of this work was made possible by a grant provided by TWAS – The Academy of Sciences for the Developing World.

Wednesday 25, Morning, Room 4

92 - Eriophyoid mites (Acari, Eriophyoidea) of the family Phytoptidae Murray, 1877 from angiosperms: some tendencies of morphological evolution and ancient associations with higher taxa of Magnoliophyta

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The family Phytoptidae is represented by two separate phylogenetic lineages of relict eriophyoid mites which evolved independently on gymnosperms and angiosperms. Phytoptids from conifers are characterized by the lack of the setae *ve* (except *Pentasetacus*) and retainence of three setae on their prodorsal shield: paired *sc* (except *Boczekella*) and unpaired *vi*. The ancestors of the phytoptids inhabiting angiosperms (subfamilies Phytoptinae, Novophytoptinae and Sierraphytoptinae including *Prothrix*) lacked setae *vi* and retained four setae on their prodorsal shield (*ve* and *sc*). Probably they lived inside natural shelters (leaf sheaths, basis of leaves) on proangiosperms and later colonized plants from the most ancient taxa of Magnoliophyta. Among phytoptids from angiosperms the equally-annulated worm-like mites from subfamily Phytoptinae living on monocots have the largest set of plesiomorphies (*Acathrix* from palms and group "*caricis*" of *Phytoptus* from sedges). They are closely related to mites of the derived genus *Oziella* which also inhabit monocots and possess fused femur and patella on their legs. Phytoptines from dicots include evolutionarily-developed forms which have undergone much reversed morphological transformation connected with: 1) transition to free-living mode of life on exposed foliar habitats and 2) reverse transition to hidden-life style inside the buds and leaf sheaths. Unequally-annulated vagrant forms might have originally appeared. The second step was connected with appearance of a peculiar group of secondary equally-annulated species "*avellanae*" of the genus *Phytoptus*. Subfamilies Novophytoptinae and Sierraphytoptinae probably originated from phytoptinae-like ancestors. Evolution of mites of the subfamily Novophytoptinae was connected with adaptation to endoparasitism inside air-cavities of their monocotyledonous hosts and as a result they acquired "sack-like" form of opisthosoma and extremely long *sc*, lost *c1* and *φ*, and their external genitalia moved caudal from the coxae. We hypothesize that the other subfamily, Sierraphytoptinae, arose in the course of transition of ancient phytoptines to exposed foliar habitats of relict arboreous dicots (*Trochodendron*, *Nothofagus*) and monocots (Arecales). As a result, vagrant forms of phytoptids appeared and evolved parallel on dicots (Sierraphytoptini) and monocots (Mackiellini). The described putative way of evolution of phytoptids on angiosperms is a hypothesis which should be checked. It is necessary to look for transitional forms on plants from ancient groups of Magnoliophyta, to analyze morphology and revise some taxa within Phytoptidae, investigate life cycles and postembryonic development and study molecular phylogeny of phytoptids. The territories of Gondwana (in the first place South America, which was apparently a primary center of origin and diversity of ancient phytoptids) are the most promising regions to search relict forms. On the score of remoteness of these regions and large work which should be done within the project of

reconstruction of phytoptids phylogeny, its successful realization could be possible only with intensive collaboration between acarologists from different continents.

Tuesday 24, Afternoon, Room 4

93 - Host-specificity as a factor of genetic divergence in ticks: case studies in *Ixodes uriae*, *Ixodes ricinus* and *Rhipicephalus microplus*

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The evolutionary patterns of ticks had long been cast in term of host-association until 1996 when Klompen et al. (Ann. Rev. Entomol. 41:141-161) reviewed the molecular phylogenies to conclude that *"much of the existing host-association maybe explained as artefacts of biogeography and ecological specificity"*. Does this imply that the ticks exploiting diverse host species within localities are necessarily true generalist? Very few studies have clearly addressed that question. We have so far investigated the possibility for host-dependent structure for three ticks (Ixodidae) using population genetics analytical tools and microsatellite markers. *Ixodes uriae* is a subpolar tick that exploits colonial seabirds as hosts. Such hosts spend most of the year on sea and come back to land only at reproduction time (for about 2 months) where they form dense multi-specific colonies where bird species are mixed in mosaic patterns. Ticks were sampled on chicks of kittiwake, puffin and common guillemots in sub-arctic regions, and so in colonies spread all around the Pacific Ocean. Population genetics of these ticks revealed occurrence of host-races within the *I. uriae* species. Interestingly, the demographic functioning of ticks populations also depend on the host-species considered. A complementary data set using mitochondrial markers revealed that the evolution of specialized host races is recent. *Ixodes ricinus* is the vector of Lyme disease in Western Europe and is also considered a generalist ectoparasite that indifferently exploits birds, small and large mammals (including humans). However, when sampling adults on hosts and genotyping them at microsatellite loci, one could evidence a pattern of assortative mating indicative of host-dependent population structure. The tropical cattle tick, *Rhipicephalus* (*Boophilus*) *microplus* used to be an Asian ectoparasite of *Bos indicus* before human beings spread both *Bos taurus* cattle and their parasites across continents. We analysed the evolutionary issues of *R. microplus* in New Caledonian Island and tests for a potential host-dependent population structure of the tick across two local habitats: European races of *Bos taurus* and individuals of a cervid invasive species, the rusa deer. Again, we found a host-dependent population structure for this Ixodidae parasite. Altogether, these results indicate that ticks (at least Ixodidae) may well very frequently diversify through evolution of specialized host-races. This research was financially supported by French Ministry of Ecology (Invabio2) and French National Agency for Research (Young Researcher).

Tuesday 24, Morning, Room 2

94 - Invasion of tropical cattle tick *Rhipicephalus microplus* in New Caledonia: demographical traits, recurrent invasions of acaricide resistance genes in cattle and adaptive colonisation of a new ecological niche

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Rhipicephalus microplus causes large economic losses in tropical agrosystems because of its recurrent invasive successes, explosive demography on bovine herds, vector competence for diverse pathogens and recurrent development of acaricide resistance. Its ecology and the physiological bases of the acaricide resistances it developed as well as alternative measures of tick control have been intensively studied for decades. By contrast, the population genetic structure among nearby *R. microplus* populations and the remarkable ability of the cattle tick to quickly adapt to new environmental heterogeneity has not received much attention yet. We have investigated these issues in a small and isolated Pacific island, New Caledonia, that *R. microplus* colonized in 1942. Since its introduction, this cattle tick has developed resistance to all chemicals used to control its

demography and has colonized an invasive and non-bovid species, rusa deer (*Cervus timorensis rusa*). Using microsatellite markers, we studied the population genetics of this tick in 2003. By sampling in *Bos taurus* herds, we detected bottleneck's signature that confirms the rarity of colonization events of the island by *R. microplus* (Koffi et al. 2006 Molecular Ecology 15: 4603-11). This also allowed characterizing the tick's migration patterns, populations' sizes and reproductive strategy in this habitat (Koffi et al.2006; Chevillon et al. 2007 Infection Genetics and Evolution 7:298-324). Such a population structure explains thus the wide variety in physiological bases of acaricide resistance among ticks found on *Bos taurus* within this island (Chevillon et al. Veterinary Parasitology 147: 276-288). We also investigated the population genetic structure within rusa deer's habitat as well as among cattle and rusa deer habitats. We evidenced that cattle ticks and deer ticks were not only genetically different from one another but that (i) they were differing in demographical functioning, and (ii) such a divergent evolution has taken place within the short history of *R. microplus* in the island (< 250 tick generations). Overall these analyses illustrated the population characteristics underlying the remarkable adaptive ability of *R. microplus.* This research was financially supported by French Ministry of Ecology (Invabio2) and French National Agency for Research (Young Researcher).

Tuesday 24, Afternoon, Room 3

95 - Assessment of an integrated pest mite and disease management program on Florida citrus utilizing horticultural mineral oil foliar sprays

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Four cooperators with 2.38 to 5.22 hectare blocks of either 'Hamlin' or 'Valencia' oranges were switched to 224 °C horticultural mineral oil (HMO)-only foliar spray programs applied at 46.8 liters/hectare for three years. HMO applications varied from one to three applications per location each year. The HMO-only foliar spray programs were compared to the grower standard programs of copper + HMO + acaricides for control of the fungal pathogen, *Mycosphaerella citri* Whiteside and suppression of the citrus rust mite, *Phyllocoptruta oleivora* (Ashmead) and the pink citrus rust mite, *Aculops pelekassi* (Keifer) and the spider mites, *Eutetranychus banksi* (McGregor) and *Panonychus citri* (McGregor). First year transition from the standard fungicide-insecticide-acaricide programs resulted in active citrus rust mite development and multiple HMO treatments were required for their control. Subsequent rust mite populations in years two and three did not develop in three of the four sites using the HMO-only foliar spray programs. Spider mite densities in the four HMO blocks never reached levels of economic injury. No secondary arthropod or disease problems developed in any of the four HMO-only blocks through March 2003. The percentage of greasy spot infected leaves was significantly greater in each block most years compared to the grower spray programs. However, there were no differences in leaf retention, tree canopy vigor or yields between the HMO-only foliar spray and the standard pesticide programs. Comparative effects between the HMO and grower spray programs on beneficial mites in the families: Phytoseiidae, Stigmaeidae, and Tydeidae are reported.

Thursday 26, Morning, Room 4

96 - An overview of *Brevipalpus* mites (Acari: Tenuipalpidae) and the plant viruses they transmit

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The economic significance of the family Tenuipalpidae has risen from essential obscurity to that of considerable importance within the last four decades. One or more species within the genera: *Brevipalpus*, *Cenopalpus*, *Dolichotetranychus*, *Raoiella* and *Tenuipalpus* are recognized as serious economic plant pests. However, only three species within the genus *Brevipalpus* are known to vector one or more cytoplasmic or nuclear type of plant

viruses that include: citrus leprosis, coffee ringspot, green spot on passion fruit and orchid fleck virus. Related viruses have been identified in numerous ornamental plants that are vectored by *B. phoenicis*. Affected plant species, the current known distributions of both the viruses and mite vectors are summarized in this paper. Many *Brevipalpus* species are parthenogenetic (thelytokous) with females producing females, and males are rarely found in some species. The life cycle and developmental times for the three *Brevipalpus* species are reviewed in relation to transpiration and tendencies of *B. phoenicis* to aggregate around damaged areas of fruit and leaf surfaces. Cryptic species within *B. phoenicis* have been identified in Florida on *Hibiscus* and in Honduras on *Citrus sinensis* within recent years using molecular methods. More intensive research is needed to identify the extent of cryptic species within *B. phoenicis*, *B. obovatus*, and *B. californicus* as well as the viruses they vector throughout the western hemisphere and elsewhere.

Tuesday 24, Morning, Room 6

97 - Analysis of association of phytoseiid mites and plants

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During a study conducted from 2005-2007, 51 species of phytoseiid mites were collected from 361 samples of shrubs and trees belonging to 126 species, in four agro-climatic regions of southern Karnataka, India. Association of the mites with their plant hosts and agro-climatic regions were analysed using the collection data. The number of phytoseiid species a plant species can harbor ranged from 1 to 9 species. While 25% of the plant species had only one mite species, the majority (57%) had two to four phytoseiid species and 18% harbored more than 5 species of phytoseiid mites. Similarly, the number of plant species a phytoseiid species can colonize ranged from 1 to 46. Of the 51 species of phytoseiid mites collected, 27% were found on one plant species, 53% were found on 2-10 species of plants, and 20% were found on more than 10 species of plants. Thus, a plant species harbors on an average 3.07 phytoseiid mite species, and a phytoseiid mite species colonizes on an average 6.95 plant species. Of the phytoseiid mites collected in the four agro-climatic regions, 86% were collected from only one or two agro-climatic regions, indicating specificity of distribution of some species in a particular agro-climatic region. Whereas 6% were collected from three agro-climatic regions, 8% were collected from all the four agro-climatic regions, indicating that only few species of phytoseiids are able to adapt to wider agro-climatic situations. *Amblyseius largoensis* (Muma), *Euseius ovalis* (Evans) and *Euseius prasadi* Chant and McMurtry were collected on 30, 45 and 23 plant species, respectively, whereas *Okiseius himalayana* Gupta, *Amblyseiulella heveae* (Oudemans) and *Amblyseius indirae* Gupta were collected on only one plant species each. When this is compared with the earlier host records from India, similarity in number of plant species harboring these mites was obvious. *A. largoensis* has been recorded from 64 plant species, whereas *E. ovalis* and *E. prasadi* have been recorded from 38 and 32 plant species, respectively. Similarly, *O. himalayana*, *A. heveae* and *A. indirae* each have been recorded from one plant species.

Tuesday 24, Afternoon, Auditorium - Poster

98 - Fauna of phytoseiid mites (Acari: Phytoseiidae) associated with plants in southern Karnataka, India

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A study was undertaken to record the phytoseiid mites (Acari: Phytoseiidae) on different plant hosts in four agro-climatic regions of southern Karnataka, India, *viz.* southern dry region, transitional region, hilly region and coastal regions, from 2005 to 2007. Phytoseiid mites on 126 host plants were collected. The phytoseiids collected comprised of fifty one species which belonged to 14 genera under 3 subfamilies. Of the 51 species collected, 29 are already known, five have been assigned near to the already known species and remaining 17 are probably new to science. The 29 species of phytoseiids include the following which have been

reported earlier from Karnataka: *Neoseiulus longispinosus* (Evans), *Neoseiulus baraki* (Athias-Henriot), *Paraphytoseius orientalis* (Narayanan, Kaur and Ghai), *Transeius tetranychivorus* (Gupta), *Amblyseius adhatodae* Muma, *Amblyseius indirae* Gupta, *Amblyseius largoensis* (Muma), *Euseius alstoniae* (Gupta), *Euseius chitradurgae* (Gupta), *Euseius ovalis* (Evans), *Typhlodromus* (*Anthoseius*) *rhododendroni* Gupta and *Typhlodromus* (*Anthoseius*) *rickeri* Chant; the following are reported for the first time from south India: *Neoseiulus paspalivorus* (De Leon), *Okiseius himalayana* Gupta, *Amblyseiulella heveae* (Oudemans), *Paraphytoseius scleroticus* (Gupta and Ray), *Typhlodromips syzygii* (Gupta), *Amblyseius guajave* Gupta, *Amblyseius shoreae* Gupta, *Proprioseiopsis peltatus* (van der Merwe), *Phytoscutus salebrosus* (Chant), *Euseius prasadi* Chant and McMurtry, and *Typhlodromus* (*Anthoseius*) *divergentis* (Chaudhri, Akbar and Rasool) and the following are new records for Karnataka state: *Amblyseius channabasavannai* Gupta and Daniel, *Amblyseius paraaerialis* Muma, *Gynaeseius ricini* (Ghai and Menon), *Phytoseius kapuri* Gupta, *Phytoseius rachelae* Swirski and Shechter, and *Phytoseius roseus* Gupta.

Thursday 26, Afternoon, Auditorium - Poster

99 - Phoretic forms of mites (Acarina) found on European earwigs, *Forficula auricularia* (Insecta, Dermaptera), collected from some regions of Poland

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The European earwig (*Forficula auricularia* L.) is an insect commonly found in various habitats in Poland, e.g. orchards and parks, where it lives under bark of dead and live trees, and in husbandry buildings, houses, apiaries (i.e. beehives) and neighbouring areas. Earwigs feed and develop on food of plant and animal origin, which are also often occupied with mites. Results of earlier studies and field observations of these arthropods show that a lot of earwigs are usually infested with mites (Chmielewski 2009). Collecting of earwig samples for present investigations were conducted during the summer-autumn seasons (2004-2008) in some regions of Poland (Białowieża National Park, Karpacz, Krynica Morska, Puławy). Adult earwig specimens were examined under stereoscopic microscopy. The external mites were separated from the insects, counted, mounted on microscopic slides and determined using suitable keys and descriptions. Average prevalence of mites on adults of earwigs, mean abundance (number of mites per insect) and the respective ranges were calculated. Some material was used for photo-documentation (SEM) of observed phoresy. Acarological analyses of material (268 live adults) collected from various insect populations show that 72.6 (21.3-91.9) % of them contained external mites (1645 specimens), mainly Astigmata. The earwigs were infested usually with hypopi of Anoetoidea (mostly *Histiostoma polypori*, and *H. feroniarum*) and Acaroidea (e.g. *Acarus farris*, *Caloglyphus berlesei*). Representatives of other mite groups (e.g. mesostigmatids, trombiculids) attached to body surface of earwigs were observed sporadically and usually as single specimens only. Mites were located mainly on the lateral side of anterior part of thorax and on the posterior end of the abdomen (cerci), hardly ever on the ventral side of body, sometimes on the legs, but in general very rare on distal, movable body parts (tarsi, mouth parts, antennae). Abundance of phoronts amounted to 8.4 (1-102) mites per insect. Juvenile stages of host insects were usually free of mites. The results showed that phoretic relations between these two groups of arthropods are a very common phenomenon and play very important part in spreading and survival of some acaroid and anoetoid mite species. Data presented here together with previously published observations by the author on mites associated with earwigs in Polish beehives and their vicinity are evidence that phoretic relationship between mites and earwigs seem to be a common phenomenon in various regions of this country. Białowieża, Karpacz and Krynica Morska are new places for which the occurrence of phoretic mites on *F. auricularia* is reported in Poland.

Wednesday 25, Afternoon, Room 1

100 - Predator-prey role reversals and the ontogeny of antipredator behavior

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There are many examples of role reversals in predators and prey, with adult prey attacking vulnerable young predators. Thus, juvenile prey that escape from predation become predators when they reach adulthood and juvenile experience with predators may affect their predation behavior when adult. Using a predator-prey system consisting of two species of predatory mites, we show that juvenile prey that experienced adult predators turn into adults that kill juvenile predators at a faster rate than prey without this experience. The increased attack by adult prey was specifically aimed at the species of predators that they had experienced; attack rates on juveniles of another species of predator did not increase as a result of juvenile experience. This shows that juvenile experience in this arthropod carries over to the adult stage. It suggests that prey can recognize juveniles of a species whereas they only had experience with adults; hence they can generalize cues to the species level. Interestingly, the responses of juvenile and adult prey to this cue are different; whereas juveniles should try avoiding it to reduce risk of predation, adults seek it out and kill juvenile predators with a vengeance. We show that the presence of killed juvenile predators deters adult predators, resulting in a reduced predation risk for juvenile prey. Hence, by killing juvenile predators, adult prey can reduce the predation risk of their offspring, and this infanticide is triggered by experience with predators early in life.

Thursday 26, Afternoon, Auditorium - Poster

101 - Primary culture of embryonic cells of *Amblyomma cajennense, Amblyomma dubitatum, Amblyomma rotundatum, Ixodes schulzei* and *Rhipicephalus sanguineus* (Acari: Ixodidae)

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Ticks are some of the most important vectors of infectious diseases to human and animals, such as rickettsiosis, protozoosis, spirochaetosis and differents viroses. In this regard, *in vitro* tick cell cultures are an important tool to isolate and study the causal agents of these diseases. Then, the objective of this study was to isolate and to establish a primary culture of embryonic cells of the ticks *Amblyomma cajennense*, *A. dubitatum*, *A. rotundatum*, *Ixodes schulzei* and *Rhipicephalus sanguineus*. The primary cultures were obtained by washing and surface-sterilizing 18-21 days old egg masses by using ethanol, antibiotic, and antimicotic agents. That range of ages was considered optimal in previous tests for *A. cajennense*. Eggs were gently crushed and the cells were suspended in 4 differents media: L-15, L-15 modified with addition of nonessential aminoacids, vitamins and minerals (Munderloh & Kurtti, 1989) adapted to pH 6.4 and pH 7.2, TC-100, and SF-900. The growth of cells was observed in all culture media. Primary cultures were prepared with minimal contamination and the cultures could be maintained for at least 2 months. Cultured cells formed incomplete monolayers and they tended to grow in clusters. Subculturing were difficult and the cell growth was slow but its viability was maintained for 3 serial *in vitro* passages. Most cultures presented non-adherent cells. Only few cells showed characteristics of adherent spreading cells. The better growth was obtained with modified L-15 (pH 7.2) for all species, and SF-900 for *A. cajennense* only. The best adhesion was observed for *A. cajennense* and *A. dubitatum*, although all have been successful. Some adherent cells dettached after the first day of culture medium. The addition of yeast extract did not show detectable effect in cell growth. This research was financially supported by FAPESP (2007/57749-2), CNPq (309919/2007-0).

Wednesday 25, Morning, Room 1

102 - Mass ballooning behaviour in the spider mite *Tetranychus urticae* Koch

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Tetranychus urticae (Acari: Tetranychidae) is a phytophagous mite that can form huge colonies of several thousand individuals. These mites construct a common web to protect the colony from external aggressions. When mite densities are high, plants become overcrowded and food resources become scarce, individuals gather at the plant apex to form a balloon made by mites and silk threads. Our hypothesis is that this balloon could be a structure facilitating group dispersion by wind or animal transport. In this study, we first determined (1) the conditions of balloon formation, (2) the dynamics of balloons' formation, and (3) the genetic relatedness of the individuals within the balloon. Luminosity (+), relative humidity (-) and food deprivation were the major inducing factors driving to balloon formation. Flows of mites to the balloon at any given time depend on the total "flow-up" made in the past. This may due to the accumulation of silk threads over time that participates into a recruitment process. This recruitment promotes the aggregation of mites into the balloon. Balloons were of variable size and were composed mainly of immature stages. The balloon's core was mainly composed of dead mites. The balloon seems to have a life time; it grows at the beginning of the formation, as mites aggregate. Over time, mites become trapped inside the balloon because of the complex network of silk threads. Only recently arrived individuals are still alive. The production of a collective structure such as the balloon could be influenced by the degree of relatedness between individuals. Ongoing genetic studies using twenty microsatellite loci, aim at estimating the degree of relatedness of individuals inside the balloon. Because dead individuals are found in the balloon core, kin selection is thought to interfere with the process. The genetic characterization of both individuals being part of the balloon and those remaining on the plant leaf will help to understand the dispersion strategy of *T. urticae*.

Tuesday 24, Morning, Room 6

103 - The diversity and abundance of mites on Solanaceae plants of Northwestern and Central Anatolia, Turkey

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A survey was conducted in north western (Bursa – Yalova cities) and central Anatolia (Ankara city) of Turkey, during 2008-2009 to evaluate the diversity and abundance on six solanaceous plants, namely tomato (*Solanum lycopersicum* L.), eggplant (*S. melongena* L.), pepper (*Capsicum annum* L.), thorn apple (*Datura stramonium* L.), black nightshade (*S. nigrum* L.) and climbing nightshade (*S. dulcamara* L.). Forty plant parasitic, predatory and neutral mite species were found, belonging to 15 mite groups namely Eriophyidae, Tetranychidae, Bdellidae, Anystidae, Cheyletidae, Erythraeidae, Phytoseiidae, Stigmaeidae, Ascidae, Parasitidae, Ameroseiidae, Acaridae, Tydeidae, Tarsonemidae and Oribatida. Among a total of 40 species, the plant parasitic mites *Tetranychus urticae* Koch (Tetranychidae) (59.9%) and *Aculops lycopersici* (Massee) (Eriophyidae) (11.3%), the predators *Pronematus ubiquitus* (McG.) (Tydeidae) (6.6%), *Neoseiulus bicaudus* (Wain.) (2.7%) and *Typhlodromus* (*Anthoseius*) *recki* Wain (1.85%) (Phytoseiidae) and the neutrals *Tydeus kochi* (Banks) (3.7%) and *Tydeus* sp. (2.5%) (Tydeidae) were predominant species and corresponded to more than 88% of the mite specimens collected during the survey. The remaining mites were determined as *Phytoseius finitimus* Rib., *Euseius finlandicus* (Oud.), *Amblyseius andersoni* (Chant), *Neoseiulus barkeri* Hug., *Neoseiulus aurescens* Ath.-Hen., *Neoseiulus californicus* (McG.), *Phytoseiulus persimilis* Ath.-Henr., *Typhlodromus* (*T.*) *athiasae* Por., *Typhlodromus* (*T.*) *tubifer* Wain. (Phytoseiidae), *Tetranychus turkestani* Uga.-Nik., *Eotetranychus*

sp., *Schizotetranychus* sp. (Tetranychidae), *Arctoseius semiscissus* Berlese, *Asca* sp. (Ascidae), *Ameroseius* sp. (Ameroseiidae), *Parasitus* sp. (Parasitidae), *Tarsonemus* spp. (Tarsonemidae), *Tyrophagus putrescentiae* Sch., *Tyrophagus longior* (Ger.), *Tyreophagus* sp. (Acaridae), *Spinibdella* sp., *Cytinae* sp. (Bdellidae), *Zetzelia mali* Ewing (Stigmaeidae), *Cheyletus* sp. and *Cheletogenes ornatus* Can.-Fan. (Cheyletidae). According to the analysis of species similarity, Sorenson's similarity index was found 0.58, indicating a medium similarity between the two regions; despite, the number of mite species did not differ between the regions. Also, the biodiversity data were separately evaluated for each plant species in this study. Most mite species was found on black nightshade (23 species), followed by tomato (17), climbing nightshade (16), pepper (16), eggplant (15) and thorn apple (13). Furthermore, the mite abundances of eggplant (32.6%), tomato (18.9%) and black nightshade (17.6%) were higher than those of climbing nightshade (6.1%), thorn apple (10.2%) and pepper (14.6%). *T. urticae* was mostly present on all plants especially eggplant. Thus, the mite diversity and abundance varied among Solanaceous plants and the results were evaluated in depth in the text.

Thursday 26, Afternoon, Auditorium - Poster

104 - Mites (Arachnida: Acari) associated to passalid beetles (Coleoptera: Passalidae) in Colombia

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Mites are associated with other organisms to be transported, to prey or to parasitize. The majority of the mite species associated with passalid (Coleoptera: Passalidae) beetles are considered to be phoretic, producing no negative impact to the health of its carrier under natural conditions. However, they can benefit the carrier by feeding on fungi or other animals that they find on the passalid bodies or in the galleries where they inhabit. More than 200 species, grouped in 68 genera and 21 families, have been reported associated to pasalids in the world, of which 49 genera and 17 families have been reported in America. In this work, mites associated with these beetles in Colombia were determined taxonomically using samples taken from the Coleoptera-Passalidae Collection of the Natural Institute of Sciencies at the National University in Bogotá. A total of 120 passalid beetles were examined, grouped in 10 genera and 41 species. Information such as abundance, specificity and adhesion spots on passalid bodies, were recorded. A total of 1233 mites were found distributed in 10 families and 23 morphospecies, 8 of which were identified to genera. Uropodidae was the predominant family. It was not possible to determine the Acaridae, Anoetidae and Uropodidae to genera because they were represented by immatures. Identification of Ascidae was also not possible due to lack of taxonomic keys. The genus *Heterocheylus* was found associated to the *Passalus* genus exclusively. All mites studied in this work present evidence of phoretic association with passalid beetles. Some morphospecies and genera have specific distribution on the body of the carrier as well as a distribution of micro-habitats of surfaces of each region of the body of the passalid beetle. This is the first record of Diplogynidae and Anoetidae from Colombia. As part of the work, an illustrated key for families of mites associated with passalid beetles in America and some comments about the families present in Colombia are presented.

Wednesday 25, Afternoon, Auditorium - Poster

105 - Mites (Arachnida: Acari) present in necromass of *Espeletia pycnophylla angelensis* Cuatrecasas (Asterales: Asteraceae)

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Mites are microarthropods with a high capacity of adaptation to different ecosystems, going from very dry to very humid places. In this work, we examined the groups of mites that inhabit the necromass of *Espeletia pycnophylla angelensis* (known in Colombia as Frailejón) in the El Paramillo High plateau, Pueblo Viejo Natural Reserve, Colombia in July, 2009. Ten extractions of necromass were made in different individuals and patches (not burned, 6 and 8 years after the burning). The extraction of the arthropodofauna from the necromass was made by using a pipe of approximately 11cm of diameter and 16 cm of length, placed in Winkler traps for 48 hours. Sixty samples were examined in which 326 individuals were counted, grouped in 17 families and 27 morphospecies, 20 of which were determined up to genus and one, to species. The order Oribatida dominated, with 6 families, 10 morphospecies (one undetermined), 8 genera and one species, followed by Mesostigamata, with 7 families, 11 morphopecies (one undetermined), 7 genera, and finally Trombidiformes (Prostigmata), with 4 families, 4 morphospecies and 4 genera. The representative families were Oppidae, Scheloribatidae, Parasitidae, Ascidae, Ceratozetidae, and Phytoseiidae. Due to the fact that the knowledge of the acarofauna in Colombia is still low, the representatives' finding of these families allows adding new information, potentially important, for future researches on distribution, diversity, among others.

Wednesday 25, Afternoon, Auditorium - Poster

106 - Mites (Acari: Arachnida) found as food source for frogs in the Colombian Caribbean

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A large number of frogs has been reported in the tropics to include mites in their diet, given that mites are a significant source of nutrients and alkaloids. In this study, we evaluated the mites consumed by frogs in Caribbean Colombia. In every site of study, three samples were manually collected during an average of six days through night tours between 18:00 and 23:00 hours, for a total of 18 samples, collecting a minimum of 10 frogs per locality. Every frog was dissected to extract the stomach content. Mites were found in 8 individuals of *Engystomops pustulosus*, 2 of *Pleurodema brachyops*, 5 of *Rhinella marine* and 4 of *Pseudopaludicola pusilla*, in total 11 families, and 9 genera. The most abundant mite morfoespecies belonged to the family Trhypochthoniidae, genus *Archegozetes*. This represents a contribution to the information about diets of Anura and the possible distribution of mite families in Colombia

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Wednesday 25, Afternoon, Auditorium - Poster

107 - Feeding damage by *Estigmene acraea* (Drury) (Lepidoptera: Arctiidae) increase resistance to the *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) in *Carica papaya* cv Maradol

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In Chiapas, Mexico, papaya crop is attacked by *Polyphagotarsonemus latus* (broad mite), considered one of its most important pests. Its control, however, implies an excessive use of pesticides that in turn generate several environmental hazards. In search of alternatives for the control of this pest, papaya plants were evaluated in the phenological stages in which they had 3, 5, and 7 pairs of true leaves (PTL). They were subjected to feeding damage from larvae of *E.*

acraea (for two hours) in order to stimulate the possible liberation of volatile compounds that could have a detriment effect on mite populations. Likewise, variables of vegetative growth of the plants were measured: number of leaves and stem diameter, to relate them with mite damage. Capture and identification of volatile compounds was done through the CG-EM technique. The experiment was conducted under controlled conditions; the experimental design used was a tri-factorial arrangement with repeated measurements with 3 treatments and 12 replicates. Data transformation was done through the Ln formula (Y+0.5), and were later subjected to a variance analysis with the SAS 8.01 software. Treatment means were compared with Tukey's multiple range test at α 0.05 probability. Significant differences were registered for the population variables corresponding to females, eggs, and larvae of *P. latus* when the papaya plants with 3 and 5 PTL were subject to damage by *E. acraea*, in the first five weeks of the experiment. The phenological variables number of leaves and stem diameter, evaluated for the three stages of the experiment, were significantly affected by damage from *P. latus*, mainly in the stages of 5 and 7 PTL. The volatile compounds liberated by papaya plants with 3 PTL were: 1,3 dichlorobenzene, Benzil alcohol, 2-nonen-1- ol, Benzil isocyanate, Cyclodecanol, 2,3 Dichloro anisole, and Benzil isothiocyanate. A greater liberation of volatile compounds was seen when the damage was caused by *E. acraea* larvae than in the case of healthy plants damaged solely by *P. latus*. The results suggest that plants respond defensively to feeding by larvae of *E. acraea*, but only during the first five weeks.

Thursday 26, Afternoon, Auditorium - Poster

108 - Structural and biochemical characterization of a new inorganic pyrophosphatase from the cattle tick *Rhipicephalus* (*Boophilus*) *microplus*

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Soluble inorganic pyrophosphatase (sPPase, EC 3.6.1.1) is an essential metal-dependent enzyme that converts pyrophosphate into orthophosphate. This enzyme is represented by two families: PPase Family I (Mg^{2+}-dependent) and Family II (Mn^{2+}-dependent), distributed among living organisms which typically produce either one or the other. These characteristics make sPPases a clear example of the convergent evolution of an essential catalytic activity. In the present work, we report the cloning of a cDNA with 1023 bp encoding the sPPase from *R. microplus* (RmPPase) and the characterization of the protein. The *R. microplus* cDNA encodes a putative protein of 341 aa with theoretical molecular mass and pI values of 38.7 kDa and 5.56, respectively. The alignment of RmPPase with other PPase sequences revealed the conservation of three Asp residues, characterizing the family I PPase signature (PDOC00325), and 10 other residues surrounding the active-site. Moreover, potential phosphorylation site on RmPPase were predicted by SCAN PROSITE including casein kinase II phosphorylation and N-myristoylation sites. We have done a further characterization of this enzyme, showing that RmPPase mRNA is present in the fat body, midgut and ovary, in two developmental stages, partially and fully engorged females. However, higher transcription levels were found in the ovary of females. Structurally, a remarkable characteristic of RmPPase was the presence of Cys residues in 138 and 339 positions, differing from other family I PPases with solved structure. Taken together the data describes the structural and biochemical characteristics of a new family I PPase in *R. microplus*. This research was financially supported by INCT-Entomologia Molecular, FAPERJ, CNPq and CAPES.

Wednesday 25, Afternoon, Auditorium - Poster

109 - Detection of coffee ringspot virus (CoRSV) in the mite vector by RT-qPCR

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The mite *Brevipalpus phoenicis* (Geijskes, 1939) (Acari: Tenuipalpidae) is responsible for the transmission of coffee ringspot. There is a great interest in the study of *Brevipalpus* transmitted viruses (BrTVs), and the interaction between them, their vectors and hosts. Electron microscopy analyses suggest that CoRSV replicates in the mite tissue, what would characterize a persistent propagative virus-vector relationship. This study aimed to establish a transcriptase quantitative polymerase chain reaction (RT-qPCR) method to evaluate and compare the replication capacity of the virus in the vector. Total RNA was extracted from a sample of 100 mites reared in symptomatic plants for CoRSV using two different methods: CTAB and Nucleo Spin RNA XS Kit (Macherey-Nagel) and quantified in a NanoDrop 8000 (Thermo Scientific). The RNA extracted with the kit was more concentrated and presented less variation between samples, and hence, this protocol was chosen as the standard for further analyses. The cDNA was synthesized from 5uL of RNA using random primers. Five different dilutions of the cDNA were tested (1:1, 1:10, 1:100, 1:1000 and 1:10000) with two primer pairs (CoRSV1 and CoRSV2) that amplify regions of the viral replicase in five different concentrations (10 nM; 30 nM; 60 nM; 90 nM and 120 nM). Two 2 uL of cDNA were used for the reaction with Sybr Green (ABI) in a 7500 Fast Real Time PCR System (Applied Biosystems). These tests allowed the optimization of the procedure, with 30 nM of the primers and 1:10 dilution of cDNA. The efficiency of the primers CoRSV1 and CoRSV 2 is of 88.8% and 83.98%, respectively, and hence, CoRSV1 will be used in the experiment. Based on these results, the experiments will be conducted to determine whether or not the virus replicate in the mite. This research was financially supported by FAPESP and FACEPE.

Tuesday 24, Afternoon, Auditorium - Poster

110 - Preliminary data on the ixodofauna of *Vanellus chilensis* (Molina, 1782) taken from the UFRRJ, Seropédica campus, with new host record for *Amblyomma cajennense*

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The prevalence of parasitic infections and in particular of ectoparasites, is directly related to behavior and habitat can influence the biology and ecology of wild birds. The degree of infestation of bird ectoparasites can strongly affect the health of these animals. High-riding requires high availability of energy, and ectoparasitism can significantly affect the bird hosts especially in times of greater demand of energy. The southern lapwing, *Vanellus chilensis* (Charadriiformes: Charadriidae), is a cosmopolitan inhabiting the soil in areas such as field, river banks, marshes, mangroves, reefs and open areas, including urban areas, where they interact with various animals. Its geographic distribution is broad, extending from Central America to Tierra del Fuego, including all the Brazilian territory. However, despite been a common species, found in several ornithological surveys of different environments, there is little information about the parasitism of *V. chilensis* by ticks. Thus, it was aimed to investigate the occurrence of ticks on *V. chilensis* on the campus of UFRRJ, as these birds co-inhabit this region with capybaras and horses, known hosts of ticks that are important vectors of pathogenic agents. To date 13 specimens of *V. chilensis* were captured using mist nests armed in the morning between November 2009 and January 2010. Of the 13 birds caught, 7 were young and 6 were adult specimens; 3 of the adult birds had ticks. Of 7 nymphs collected, one molted in the laboratory and was identified as *Amblyomma cajennense*; the remaining nymphs did not molt and were identified as *Amblyomma* sp. All ticks collected were found around the beak, indicating the existence of a possible grooming behavior, as the ticks were observed only in areas of the body which the birds cannot reach. The absence of ixodids on the young birds may also be associated with grooming of parents on their offspring. In general, wild birds found in regions of the Atlantic Forest have been recorded as hosts of immature stages of several species of ixodid, mainly *Amblyomma*. Therefore, these preliminary data are relevant not only for the knowledge of biodiversity, but also for the better understanding of ecological relationships between ticks and their host birds. The

record of parasitism of *V. chilensis* by *A. cajennense* is useful for mapping the tick range of distribution and for understanding how that tick disperses, important for public health concerns, given its role as a vector of pathogens.

Thursday 26, Afternoon, Auditorium - Poster

111 - Predation and oviposition of *Amblyseius herbicolus* (Chant) (Acari: Phytoseiidae) on *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae)

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The broad mite, *Polyphagotarsonemus latus* (Banks 1904), is an important pest of high value crops. Generally, its control is based on chemical applications, with all problems derived from misuse. An alternative to chemical control is biological control. Due to damage caused and the difficulty of control, *P. latus* is considered the key pest of chili pepper in different growing regions. The phytoseiid *Amblyseius herbicolus* (Chant, 1959) is frequently found associated with *P. latus* on chili pepper plants in the Zona da Mata, Minas Gerais, Brazil. Despite this record, little is known about its predation ability and performance when fed on broad mite. Predation and oviposition rates of *A. herbicolus* on *P. latus* stages were studied in laboratory. The predator was able to feed on all stages of *P. latus*; the highest predation rate was on pupae (75.58 individuals/day) and the lowest on adult mites (34.7 individuals/day). Intermediate values were obtained for eggs (63.47 individuals/day) and nymphs (62.75 individuals/day). *A. herbicolus* managed to lay eggs when fed on all stages of *P. latus* but oviposition rate was variable according to stage. Oviposition rate was higher in the diet of adults (1.42 eggs/day) and larvae (1.12 eggs/day) and lower on pupae diet (0.66 eggs/day). An intermediate value was obtained on eggs diet (0.92 eggs/day). According to these results, *A. herbicolus* may have potential as a biological control agent of *P. latus*.

Tuesday 24, Afternoon, Auditorium - Poster

112 - The ixodid fauna from Itaboraí, Cachoeiras de Macacú and Guapimirim, municipalities included in the area of petrochemical complex of Petrobras (Comperj), State of Rio de Janeiro, Brazil

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The installation of the petrochemical complex of Petrobras (Comperj) in Rio de Janeiro will produce great ecological changes in the region, not only due to direct environmental modifications, but also because of the increase of regional human population density. This project is part of the Epidemiological Monitoring Plan Process Deployment (Comperj) presenting as an objective, to evaluate the direct and indirect risks to the human population in relation to biological vectors and hosts of biological agents causing emerging zoonoses or diseases, such as leishmaniasis, leptospirosis and the Brazilian spotted fever, endemics in the region. This study resume the preliminary results related to the tick fauna in the municipalities of Cachoeiras de Macacú, Guapimirim and Itaboraí, belonging to the metropolitan region of Rio de Janeiro. Samples were collected monthly in each municipality between August 2009 and March 2010, collecting arthropods directly on dogs, horses, cattle or trapping them in the environment. In total, 2,546 specimens were captured as follow: 495 (19.4%) specimens in Cachoeiras de Macacú [65 *Amblyomma cajennense* (13 females and 52 males), 112 *Rhipicephalus sanguineus* (42 females, 43 males, 22 engorged females and 5 nymphs), 25 *Rhipicephalus microplus* (1 female, 24 engorged females and 1 nymph), 43 *Dermacentor nitens* (5 females, 25 males, 7 engorged females and 6 nymphs) and 250 unidentified larvae], all recovered from 16 canines, 10 horses, 3 bovines and from the environment; 462 ticks (18.1%) from Guapimirim [173 *Amblyomma cajennense* (58 females and 91 males), 2 females of *Amblyomma aureolatum*, 4

Amblyomma ovale (1 female, 2 males and 1 engorged female), 215 *Rhipicephalus sanguineus* (52 females, 112 males, 40 engorged females and 21 nymphs), 7 *Dermacentor nitens* (1 male and 6 engorged females), 41 nymphs of *Amblyomma* sp. and 10 unidentified larvae] all from 33 canines, 11 horses and from the environment; 1,589 ticks (62.4%) were collected in Itaboraí [34 *Amblyomma cajennense* (9 females, 22 males and 3 engorged females), 160 *Rhipicephalus sanguineus* (24 females, 95 males, 26 engorged females and 15 nymphs), 12 *Rhipicephalus microplus* (11 engorged females and 1 nymph), 197 *Dermacentor nitens* (22 females, 44 males, 32 engorged females and 99 nymphs) and 1,124 unidentified larvae] from 23 canines, 17 horses, 2 bovines and from the environment. The knowledge of tick's fauna is relevant to the study and control of pathogens transmitted by them, especially in areas with occurrence of zoonoses vectored by these arthropods.

Tuesday 24, Afternoon, Auditorium - Poster

113 - Mite (Acari) diversity on peach trees in different production systems in the State of Rio Grande do Sul, Brazil

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A study was conducted to determine the mite fauna of peach trees cultivated under "conventional" and "integrated" systems, in Pelotas and Bento Gonçalves municipalities, State of Rio Grande do Sul, southern Brazil. For each location and each production system, peach cultivars were 'Chimarrita' and 'Maciel', except for the conventional orchard in Bento Gonçalves, where 'Chimarrita' was the only cultivar; additionally, an organic orchard was included in the investigation in Pelotas, where the cultivar was 'Ametista'. In both areas, leaf samples were taken monthly, from February to April 2008 and from September 2008 to January 2009. In Pelotas, samples were taken from 14, 15 and 12 plants from each of the conventional, integrated and organic management orchards, respectively. In Bento Gonçalves, samples were taken from 15 plants of each cultivar, irrespective of the type of management. From each plant, 7 leaves of the median part of a branch of the median vertical third of the plant canopy were collected (1.6 to 1.8 m from the soil surface). In June and July, when plants had no leaves, sections of branches were sampled, to determine mite density; two 15 cm long sections were taken from the median vertical third of the canopy of each plant. In the laboratory, samples were examined under a stereomicroscope, counting separately the mites found on each leaf surface and on the total extension of the branch sections. On the leaves, 15 mite species were found, of which 7 were predators (6 Phytoseiidae and one Stigmaeidae), 6 were phytophagous (Tetranychidae) and two were generalists (Tydeidae and Acaridae). The phytoseids *Neoseiulus californicus* (McGregor) and *Euseius brazilli* (El-Banhawy) were the most abundant predatory mites, except for the organic orchard, in which *N. californicus* was not found. Of the tetranychids *Panonychus ulmi* (Koch), *Tetranychus urticae* Koch and an unidentified species of *Tetranychus* were the most abundant phytophagous mites. Independently of the production system and the cultivar, more than 80% of the mite specimens on leaves were identified as *Tydeus* sp. This was the only mite species found on branches.

Wednesday 25, Afternoon, Auditorium - Poster

114 - Serologic survey for rickettsiosis in bats of the city of São Paulo, Brazil

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Blood sera samples were collected from 451 bats captured within the city of São Paulo from April 2007 to November 2008, and individually tested by indirect immunofluorescence assay (IFA) against antigens derived from five *Rickettsia* species reported to occur in Brazil: the spotted fever group

(SFG) - *R. rickettsii*, *R. parkeri*, *R. amblyommii*, *R. rhipicephali*, and the ancestral group (AG) - *R. bellii*. For this purpose, an anti-bat IgG was produced and used in the present study. Overall, 8.6% (39/451), 9.5% (34/358), 7.8% (28/358), 1.1% (4/358), and 0% (0/358) sera samples were reactive to *R. rickettsii*, *R. parkeri*, *R. amblyommii*, *R. rhipicephali*, and *R. bellii*, respectively. Endpoint titers of reactive sera varied from 64 to 256. From 20 bat species of 3 different families (Molossidae, Vespertilionidae, Phyllostomidae), 46 animals were shown to be reactive to at least one rickettsial antigen. Seropositivity per bat species varied from 0 to 33.3%. Most of the serologically positive sera reacted with two or more rickettsial antigens. Seropositivity for SFG rickettsial antigens in the absence of reactivity against *R. bellii* (AG species) suggests that bats of São Paulo aare infected by SFG rickettsiae. The possible role of soft ticks in serving as vectors of SFG rickettsiae to bats in São Paulo, associated to its public health risks, is discussed. This research was financially supported by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), grants 06/58210-7 and 06/60575-3.

Monday 23, Afternoon, Room 6

115 - Evolutionary mechanisms at the initial stage of speciation in two species of feather mites: stenoxenic *Proctophyllodes stylifer* and euryxenic *P. clavatus* (Analgoidea: Proctophyllodidae)

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Cophylogenetic analyses carried out so far reveal that the phylogenetic course of feather mite (Astigmata: Analgoidea, Pterolichoidea) evolution is mostly a result of cospeciation with their hosts. In the present study we analyse mechanisms behind diversification of two *Proctophyllodes* species differing in host range: stenoxenic *P. stylifer* from tits (*Parus* spp.) and euryxenic *P. clavatus* from several song bird families (Sylviidae, Certhiidae, Aegithalidae, and Cettiidae). Phylogenetic analyses based on molecular data (cytochrome oxidase subunit I) and discrete and continuous morphological characters revealed that the stenoxenic *P. stylifer* is internally divided into two clades: one associated with *Parus caeruleus* exlusively, and the second distributed on *Parus major*, *Pa. palustris*, and *Pa. montanus*. Mites from *Pa. caeruleus* are morphologically distinguishable from individuals of the other *P. stylifer* populations mainly by the shape of the aedeagus sheath. However, the genetic distance between two *P. stylifer* clades (2.8% K2P for COI sequences) does not allow determination of their systematic status; it is higher than the maximal value of intraspecific differences (<1.5%), but much lower than the lowest interspecific distance (>6.9%) observed for monoxenic *Proctophyllodes* species. The phylogenetic structure of *P. stylifer* populations coincides well with phylogenetic relationships observed in their hosts, which implies that codivergence is a key factor of *P. stylifer* evolution ($p<0.01$). Phylogenetic analyses of the euryxenic *Proctophyllodes clavatus* complex confirmed its division into *P. clavatus* s.s. and cryptic species *P. cetti* (distance = 9.6%). Similarly to *P. stylifer* from tits, both species are internally divided into two well-supported clades showing intermediate genetic differentiation (3.9% and 4.7%, respectively). Although all recovered clades in the *P. clavatus* complex are host specific, cophylogenetic analysis failed to reveal cospeciation as the main factor of the origin of host-parasite associations ($p>0.25$) and other events like sorting, duplication, and even horizontal transfer were most likely responsible for their current distribution among birds. Median-joining network analyses of *P. stylifer* recovered populations inhabiting *Pa. caeruleus* as a source for the remaining haplotypes and revealed numerous cases of gene flow. In case of *P. cetti*, populations inhabiting *Locustella luscinioides* and *Acrocephalus schoenobaenus* (Sylviidae) were the source of haplotypes for populations living on *Cettia cetti* (Cettiidae). For *P. clavatus* s.s., mites from *Sylvia borin* (Sylviidae) are dichotomously ancestral for population living on *S. nisoria* and mites inhabiting *Aegithalos caudatus* (Aegithalidae), *Certhia brachydactyla* (Certhiidae), and *S. communis*. Our results indicate that host biology can influence speciation of feather mites at its initial stage, e.g. host interspecific hybridisation or close bodily contact in breeding and feeding habitats enable gene flow among mite populations and can favor non-parallel cophylogenetic events.

Thursday 26, Morning, Room 1

116 - Goodbye Acari: molecular data support the diphyletic origin of mites

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Differences in morphology and life strategies between Actinotrichida and Anactinotrichida rise the question whether Acari derives from a single ancestor (monophyly hypothesis), or whether the mite body plan originated independently from two or more arachnid ancestors (polyphyly hypothesis). The concept that mites (including ticks) comprise a natural monophyletic taxon has found broader acceptance in recent years, as the issues have become less ambiguous. Simultaneous with the debate on origin of Acari emerged questions about their arachnid sister group. Frequently hooded tickspiders (Ricinulei) are postulated to be the sister-group of either a monophyletic Acari or of Anactinotrichida alone. Two hypotheses about the sister group of Actinotrichida respectively propose micro whip-scorpions (Palpigradi) or camel spiders (Solifugae). Another postulated candidate for the mite sister-group are the cyphophthalmid harvetsmen (Opiliones). Molecular phylogenetic analyses have proven the existence of two main evolutionary lineages, Anactinotrichida and Actinotrichida, but have not resolved unambiguously their reciprocal relationships: one analysis supported monophyly without indicating a sister-group (Klompen et al., 2007), and the second resolved the Ricinulei (Solifugae (Actinotrichida)) clade as the sister-group of the Pseudoscorpiones (Anactinotrichida) clade (Dabert et al., 2010). Our results, based on more expanded outgroup sampling (for nuclear 18S rDNA and mitochondrial COI) strongly support the diphyletic origin of mites. Likelihood analyses (ML, BI) of 18S rDNA reaffirmed Solifugae as the sister-group of Actinotrichida (83%, 1.00), with Ricinulei being basal to them (<50%, 0.77). The clade Ricinulei (Solifugae (Actinotrichida)) was the sister-group of Opiliones (weakly supported). The Anactinotrichida was reconstructed as the sister-group of Palpigradi, but this relationship was weakly supported. Consensus network analysis revealed a strong conflict in this node resulting from an alternative placement: Anactinotrichida as the sister group to Opiliones (Ricinulei (Solifugae (Actinotrichida))) clade, and Palpigradi as more basal. The close relationship of Solifugae and actinotrichid mites revealed by our analysis was also previously postulated by studies on ultrastructure of sperm cells and testis structure made by Alberti and coauthors. That Palpigradi are close relatives of Anactinotrichida (not Actinotrichida as previously proposed) is an unexpected result, with rather limited credibility.

Thursday 26, Afternoon, Room 5

117 - Tick innate immunity

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Ticks are blood-feeding parasites transmitting a large variety of pathogens to their vertebrate hosts. The vector competence of ticks is firmly linked with their innate immune system. Despite this, our knowledge of tick innate immunity is still scarce. In this presentation, data of humoral and cellular reactions of ticks will be presented. We have been studying two aspects of the immune system of *Rhipicephalus* (*Boophilus*) *microplus*, the most important ectoparasite of cattle in the southern hemisphere and the biological vector of babesiosis and anaplasmosis, causing huge losses to livestock: i. phagocytosis and production of reactive oxygen species by hemocytes after microbial challenge; and ii. antimicrobial peptides in hemolymph and midgut. The functional role of two hemolymph antimicrobial peptides, named microplusin and defensin, throughout an experimental infection with *Anaplasma* has been investigated by RNA interference (RNAi). In addition, we have characterized several antimicrobial peptides (hemocidins) from the tick midgut originated from the bovine hemoglobin digestion. Interestingly, we have established the contribution the two midgut proteinases in production of these hemocidins.

Together, our results suggest that both cellular and humoral reactions of *R.* (*B.*) *microplus* might be important for protection of the tick against pathogens and for controlling of symbiotic microorganism proliferation.

Monday 23, Afternoon, Room 3

118 - Control of *Tetranychus urticae* (Acari: Tetranychidae) with entomopathogenic fungi

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Tetranychus urticae is susceptible to many species of Ascomycetes, including *Lecanicillium lecanii*, *Hirsutella thompsonii*, *Beauveria bassiana*, *Metarhizium anisopliae*, *Isaria farinosa* and *I. fumosorosea*. Among these fungi, *B. bassiana* is the most commonly used pathogen against *T. urticae* in many crops in greenhouse and field conditions. In Brazil, *B. bassiana* is sprayed at high doses ($\geq 5 \times 10^{11}$ viable conidia/ha) to control this pest, especially on flowers, papaya and strawberry. Although there are a few *B. bassiana*-based products in the market registered for the control of *T. urticae* worldwide, the importance of this pathogen as mycoacaricide has gained importance lately. Conidia, blastospores and yeastlike cells are pathogenic to the pest and all life stages are susceptible to the fungus. Formulations based on emulsifiable vegetable oils are being developed to enhance fungal effectiveness and persistence in the field. *Neozygites floridana* (Entomophthorales) is the pathogen most commonly found naturally infecting *T. urticae*. Epizootics of *N. floridana* have been documented in several countries and field studies have demonstrated that this pathogen is an important control agent of spider mite populations, especially of *T. urticae*. Although *N. floridana* has been observed infecting at least 18 species from 8 genera of spider mites, each isolate is usually virulent against one or a few host species. Due to difficulties related to *in vitro* or *in vivo* mass production, *N. floridana* has never been used inundatively. Two control strategies for using this fungus is inoculative releases of low densities of fungus killed cadavers and conservation biological control, identifying factors which may limit the effectiveness of the fungus and modifying them or adopting strategies to enhance the natural enemies already present in the ecosystem. These fungal pathogens consist of feasible tools to be used both as stand-alone treatments and in integrated pest management, as a key role to circumvent the problem of resistance evolution of *T. urticae* to conventional chemical acaricides. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Tuesday 24, Afternoon, Auditorium - Poster

119 - Plant mites (Acari) from "Cariri Cearense", northeast Brazil

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Almost nothing is known about the diversity and seasonal occurrence of mites related to plants in the Cariri Cearense region; the basic knowledge is for planning handling proposals for species conservation. A study about plant mite diversity in Barbalha, Crato, Juazeiro do Norte and Missão Velha, northeastern Brazil was conducted from April thru December 2009. Two expeditions were realized, one in the dry season and the other in the rain season; samples of cultivated plants were taken along the roads, at preset stops programmed for each 9 to 10 km. Each sample consisted 1L of leaves. An amount of 381 samples were taken from 114 different plant species. More than 10,000 mites were collected. The family Phytoseiidae was the most abundant. Species from the genus *Euseius*, such as *Euseius alatus* De Leon, *Euseius citrifolius* Denmark & Muma, *Euseius concordis* (Chant), and *Euseius sibelius* (De Leon) were found. Species of Ascidae, Stigmaeidae, Tenuipalpidae and Tetranychidae were also collected.

Thursday 26, Afternoon, Auditorium - Poster

120 - Apoptosis induction in *Rhipicephalus* (*Boophilus*) *microplus* embryo cell line BME26 by inhibitors insulin signaling pathway

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This work describes events related to induction of apoptosis in embryonic tick cells BME26. In addition its role in metabolism, the insulin signaling pathway (ISP) also promotes cell survival in many organisms. Therefore, pharmacological inhibition of ISP is able to induce apoptosis in some cell types. Cells maintained without fetal calf serum for 72 hours, when compared with cells incubated in complete medium, showed a reduced number of citoplasmatic vesicles and uncommon alterations on their morphology as cytoplasm extensions. BME26 cells were incubated for 24 hours with H2O2 in dose manner concentrations. These cells showed higher resistance when compared with VERO cells (monkey kidney fibroblast cells). To induce apoptosis, cells were submitted to U.V. radiation exposure (between 10 to 15 minutes) and the results observed after 24 hours incubation. Many cells suffered necrosis when submitted to UV radiation during 20 minutes. Once established apoptosis, I could be compared if occurs the same by inhibiting the ISP through the use of selective inhibitors of two components of the ISP: PI3K (LY294002 and Wortmanin) and PKB (10-DEBC). Moreover, we analyzed the apoptotic effects in U.V. radiation exposed cells and ISP inhibitors incubated cells by microscopy, MTT viability, phosphatidyl-serine exposure and DNA fragmentation.

Wednesday 25, Afternoon, Auditorium - Poster

121 - Does forest fragmentation affect the diversity of plant-inhabiting mites?

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Fragmentation and total habitat loss are considered major threats to biodiversity. Studies of the effects of fragmentation on arthropods are important for the conservation of the biological diversity. Our aim was to test the extent at which forest fragmentation affects mite diversity. This study was conducted in four small (95-108 ha) and four large fragments (630-2190 ha) in northwest São Paulo State, Brazil. We selected 10 specimens of *Actinostemon communis* (Euphorbiaceae) and ten of *Trichilia casaretti* (Meliaceae); half of the specimens of each species were located at not more than 3 m from the margin of the patch (edge) and the remaining, at not less than 10 m from the edge (within fragments). Species richness was determined using first-order Jackknife rarefaction and compared using graphical analysis. The diversity, evenness and dominance of mite fauna were analyzed by the application of the indexes of Shannon-Wiener, Pielou and Simpson, respectively. We recorded 124 mite species belonging to 21 families. Tarsonemidae was the most specious family (34 species), followed by Phytoseiidae (31), Tetranychidae (9) and Tenuipalpidae (8). The community of mites recorded within large fragments had the highest species richness as well as the highest diversity (H'= 1.50) and evenness (e= 0.76), and lowest dominance (D= 0.05). At the edge of small fragments, we recorded the lowest diversity (H'= 0.45) and evenness (e= 0.24), and the highest dominance (D= 0.88). These data indicate that plants within fragments show a higher mite species richness and diversity in relation to those at the edge. The interior of fragments has higher diversity of microhabitats than the edge, supporting higher species richness. In the interior of both large (15 species) and small (12) fragments, we recorded the highest number of exclusive species in relation to the forest edges (large: 7; small: 4). Edges of fragments seem to correspond to a less suitable environment for most mites, probably because of higher light intensity, temperature and lower humidity; the same effect is also expected to affect mites inhabiting plants of the vegetation surrounding the forest patches. However, some species, mainly phytophagous and generalist mites, seem more adapted to live at the forest edge and attain high abundances, which can reduce the indexes of diversity and evenness. Therefore, the

fragmentation affects the structure of the community of mites associated to plants, resulting in lower species richness in changed environments and the dominance of one or a few species in the community. Our results corroborate the importance of conserving forest fragments for the maintenance of many mites that do not do well in deforested areas. This research was financially supported by FAPESP (2004/04820-3, 2006/55725-6 and 2006/57868-9) and CNPq (301372/2007-1).

Tuesday 24, Morning, Room 6

122 - Some statistics on the family Cunaxidae (Prostigmata: Acari)

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Prompted by the goals of “Species 2000”, a database for the family Cunaxidae was compiled from which some interesting statistics have been derived and will be discussed, viz. 1) the database; 2) number of taxa in the family; 3) number of contributing authors: 4) number of papers published on the family; 5) (zoo-) geographical concentration of contributors and; 6) number of original placements *vs* new combinations; 7) other phenomena.

Wednesday 25, Afternoon, Auditorium - Poster

123 - Effects of *Azadirachta indica* (neem) aqueous extract on the female reproductive system of *Rhipicephalus sanguineus* (Latreille, 1806) (Acari: Ixodidae)

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Many studies have been conducted with plants whose extracts have the potential to be used for pest control. One of these plants is *Azadirachta indica* (neem), whose main active ingredient is azadirachtin, a compound shown to have acaricide and insecticide activity. *Rhipicephalus sanguineus* (brown dog tick) is currently considered to be an "urban pest," because of its high levels of infestation and its ability to attack humans. In the present study partially and fully engorged *R. sanguineus* females were exposed to aqueous extracts of neem at concentrations of 10 and 20%, and to a control treatment. The results showed that differently from what was observed in the control, the pedicel cells of females exposed to neem at both concentrations lost their original shape. In the latter cases, the cytoplasm of the cells became fully vacuolated, especially near the germinal vesicle (oocyte nuclei) and in the oocyte pole, which is in contact with the cells of the pedicel. Oocytes in early stages of development (I and II) of ticks treated with both concentrations had irregular germinal vesicle, including the presence of two nucleoli as well as fragments of these. Oocytes in stages IV and V of exposed individuals showed full granular cytoplasm with bigger yolk granules when compared to the early stages. Chorion of mature oocytes was also altered, showing folds and deformations along their entire extension. The observed changes in cells of the reproductive system of *R. sanguineus*, especially in the oocytes, indicated that potential of neem as a new alternative method to control these ectoparasites. This research was financially supported by FAPESP 07/059020-0, 2008/53708-2 and CNPq.

Wednesday 25, Afternoon, Room 4

124 - Eriophyid mites (Acari: Prostigmata: Eriophyidae) from Turkey

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Knowledge of the Turkish eriophyoid fauna is fragmentary, while the diversity of this group should be high in Turkey, given the diverse ecological conditions in the country. Some of these species can most probably be pests of crops, whereas others can play important role in weed control. Therefore, a comprehensive survey of the eriophyoid mites of Turkey, especially on ornamental plants and weeds is needed. The author conducted regular mite surveys between 2005–2009

on ornamental trees and shrubs, along streets and in parks, gardens of estates, botanical gardens and private gardens, in various localities of Turkey. During this survey, 18 eriophyoid species belonging to the family Eriophyidae were identified. Four of these species were first records for the Turkish fauna.

Wednesday 25, Morning, Room 4

125 - Preliminary study on eriophyoid mites (Acari: Eriophyidae) infesting grasses in Turkey

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One hundred and one species of eriophyoid mites have been recorded in Turkey up to now, but only one of them on grasses (Poaceae). A faunistic survey of eriophyoid mites occurring on grasses in Turkey was carried out in spring and summer 2009. Mites were collected from eight grass species. They were mounted on slides for identification and also preserved in ATL buffer for DNA extraction, further amplification and sequencing. The following species have been found: *Abacarus hystrix* (Nalepa, 1896); *Abacarus longilobus* Skoracka, 2002; *Aceria tosichella* Keifer, 1969 (wheat curl mite); *Aculodes* n. sp.; and *Aceria* n. sp. The phylogenetic tree based on data from the cytochrome oxidase subunit I (COI) gene fragment from the mitochondrial genome presents relationships among taxa. *Aceria tosichella* has been recorded as the most common species infesting six grass species. Considering the economic significance of *A. tosichella* as a pest of wheat and the importance of Turkey in wheat production, this study should be continued including wheat and other cereals as potential hosts for the wheat curl mite in Turkey.

Thursday 26, Afternoon, Room 1

126 - The mitochondrial genomes of the predatory mites *Phytoseiulus persimilis* and *Metaseiulus occidentalis*: more similar than different?

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In 2007 the mitochondrial (mt) genome of the predatory mite *Metaseiulus* (*Galendromus*) *occidentalis* Nesbitt (Phytoseiidae: Typhlodrominae) was reported to be extraordinary large (24 961 bp), to lack *nad6* and *nad3* protein coding genes and to contain 22 tRNAs without T-arms. Wondering whether these idiosyncrasies were conserved in other closely related phytoseiid mites, we sequenced the complete mt genome of the Chilean predatory mite *Phytoseiulus persimilis* Athias-Henriot (Phytoseiidae: Amblyseiinae). In contrast to *M. occidentalis*, the *P. persimilis* genome is 16 199 bp in length, contains all 37 genes (including *nad6* and *nad3*) typically present in arthropod mt genomes and has 22 tRNAs with T-arms. In addition, *P. persimilis* has an extremely rearranged mt gene order compared to the ancestral arthropod mt gene order. Given the discrepancy between both phytoseiid genomes, we performed additional experiments on the *M. occidentalis* mt genome. Restriction digests and a southern blot revealed that the size of the *M. occidentalis* mt genome is probably smaller than previously reported. Moreover, we succeeded in amplifying *nad3* which is located between *nad4L* and *12S-rRNA*. Finally, we discovered that at least 15 of the 22 tRNAs could be folded into a canonical cloverleaf structure rather than the suggested structures lacking the T-arms.

Tuesday 24, Afternoon, Room 6

127 - On the anatomy and fine structure of the genital system of Veigaiidae (Acari: Gamasida)

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The genital system of gamasid mites shows considerable differences, which evidently are related to reproductive strategies. An obvious difference is the presence of so-called spermatodactyls in males of certain taxa, such as Dermanyssina, which is lacking in most other gamasids. Differences also occur in relation to sperm morphology (vacuolated sperm versus ribbon sperm and others). Such characters likely have the potential to give deeper insights into systematic relationships and events in the evolution of reproductive systems of Gamasida. However, the available information about these characters is still fragmentary, in particular with regard to internal structures. An interesting taxon in this respect is the Veigaiidae, which has apparently characteristics of Dermanyssina (e.g., spermatodactyls in the males, sperm access systems in the females) but of different morphology or position when compared to, e.g. Varroidae or Phytoseiidae, and are sometimes considered to be more closely related to Parasitina than to Dermanyssina. We summarize our recent observations, add new information on the female and male genital systems and discuss the results under evolutionary and systematical aspects.

Tuesday 24, Afternoon, Auditorium - Poster

128 - Environmental preferences of tydeid mites (Acariformes, Prostigmata, Tydeidae) in urban moss microhabitats

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The aim of this study was to detect quantitative relationships between mites and their habitat. The senior author collected 230 moss samples during June and November 2005 in five different locations in the city of Poznań (western Poland). In total, 676 specimens belonging to seven Tydeidae species were found, inhabiting eight moss species. The number of selected species of tydeid mites was reflected by local condition in analyzed microhabitat and location of given microhabitats. Environmental preference of mites in given microhabitat was tested by generalized estimating equations (GEE). According to the results, in the analyzed urban microhabitats, moss species composition was the main factor which affected the mite quantitative distribution. Furthermore, no effect of mite life-stage (adult, juvenile) or sex on their spatial preference was found in analyzed habitats.

Thursday 26, Afternoon, Auditorium - Poster

129 - *Ptilonyssus* Berlese & Trouessart, 1889 (Gamasina: Rhinonyssidae) from nasal cavities of species of *Oenanthe* (Aves: Passeriformes, Muscicapidae)

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Rhinonyssid mites of the genus *Ptilonyssus* are hematophagous specific endoparasites located in the nasal cavities of various passerines (Passeriformes). This kind of parasitism is very common in different families of birds in all parts of the world. In Russia passeriform, falconiform, coraciiform, apodiform and piciform host species are parasitized by *Ptilonyssus* species. This genus currently includes about 110 species, which have been recorded from birds of 20 passerine families. The aim of the present study is the investigation of the fauna of

rhinonyssid mites associated with passerines in Russia, in particular mites of the genus *Ptilonyssus*. Specimens used in the current study are derived from the large rhinonyssid mite collections of the Zoological Institute of the Russian Academy of Science (St. Petersburg) and the Okskii State Biosphere Reserve (Ryazan region). Seven species of passerines birds from four genera and three families were studied: *Oenanthe picata* (Blyth), *Oenanthe oenanthe* (L.), *Oenanthe pleschanka*, *Erithacus rubecula* (L.) (Oenanthe, Muscicapidae), *Motacilla flava* L., *Motacilla alba* L. (Motacilla, Motacillidae), *Silvia communis* Lath. (Sylvia, Sylviidae). 12 species of the genus *Ptilonyssus* have been found on these hosts. One new *Ptilonyssus* species was found in birds of genus *Oenanthe*.

Tuesday 24, Afternoon, Auditorium - Poster

130 - Diversity of mites on Vitaceae in the São Francisco River Valley, Brazil

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Grapevine, *Vitis vinifera* L., has is one of the main crops of "Vale do Rio São Francisco" in northeast Brazil, which accounts for 95% of the exportation of fresh grapes by the country. This crop is attacked by several pests, some of the most important of which are the mites *Tetranychus urticae* Koch and *Polyphagotarsonemus latus* (Banks). Little is known about mite diversity on grapevine in that region. This study aimed to document that diversity. Samples of grapevine leaves of the varieties Festival (09°12'43.9"S, 40°29'12.7"W) and Italia (09°23'2"S, 40°20'46.5"W) were collected monthly from September 2008 to August 2009. Additional samples were collected twice a year at 20 different locations for those as well as for the following varieties: Chena Black, Benitaka, Thompson Shiraz. In each survey, samples were taken from 12 plants for each variety. From each plant, a leaf was taken from each region (basal, middle and apical) of a branch taken from each part of the plant (basal, middle, and apical); thus, in total, 9 leaves were taken from each plant. Each leaf was placed in a separate bag for transport to the laboratory, where leaves were kept at 10°C for a maximum of seven days until processed. Immature (larvae and nymphs) and adult mites were counted under a stereoscope, collected, slide-mounted with Hoyer´s medium and identified. The analysis of the mite distribution on the plant was performed using the average of mites found per plant. The data were submitted to tests for normality and homogeneity of variance before analysis. A total of 24,726 mite specimens were found. Tetranychidae represented 69.1% of all mites sampled; *T. urticae* represented 57.7% and *Oligonychus mangiferus* (Rahman & Punjab) represented 42.3% of the mites of this family. Tarsonemidae accounted for 23%, being represented only by *P. latus*. Tenuipalpidae accounted for 1.7%, being represented only by *Brevipalpus phoenicis* (Geijskes). The Phytoseiidae totaled 6.5%; *Euseius citrifolius* Denmark & Muma and *Neoseiulus idaeus* Denmark & Muma corresponded to 79.0 and 10.2% of the phytoseiids collected. *Oligonychus mangiferus* was often associated with the Italia variety, while *T. urticae* and *P. latus* were associated with the Festival variety. *Neoseiulus idaeus* was found only in association with *T. urticae*, whereas *E. citrifolius* was found in greater numbers in association with *O. mangiferus*. No significant differences were observed between branches for either Tetranychidae, Phytoseiidae or Tarsonemidae, or between leaves for either Tetranychidae or Phytoseiidae; however, tarsonemids were more numerous on apical leaves.

Tuesday 24, Morning, Room 2

131 - *Raoiella indica* (Acari: Tenuipalpidae): a rapidly expanding generalist among specialist congeners

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The red palm mite, *Raoiella indica* (RPM), is a major invasive pest spreading aggressively throughout the Americas. The mite is originally

known as a pest of palms, but upon arriving to the neotropics, it has rapidly spread to numerous unrelated host plants. Unfortunately, very little has been known about the red palm mite or the genus *Raoiella*. Until this study, the mite was thought to be one of only three species known for the genus and knowledge of the origin of species, dispersal methods, and native predators, was completely lacking. Our research uses molecular data from several gene regions (COI, 16S, and 28S) to study the phylogenetic history and population genetics of the genus and species, respectively. Sequences of 27 populations from 15 different countries have been obtained and collections in Australia have discovered at least seven new species of *Raoiella*. Molecular results indicate that the most primitive RPM haplotypes tend to be in the Middle East and then has spread throughout the Old World and eventually into the Neotropics. Additionally, *R. indica* appears to be a host generalist whereas all other known species have only been found on a single type of plant host. The red palm mite is also the only species that is not restricted to a small geographic area.

Thursday 26, Afternoon, Auditorium - Poster

132 - Impact of natural epizootics of *Neozygites floridana* (Zygomycetes: Entomophthorales) on populations of the tomato red spider mite

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The tomato red spider mite, *Tetranychus evansi* (Acari: Tetranychidae), was recently introduced to Africa and Europe, where there is an increasing interest in using natural enemies to control this pest on solanaceous crops. Two promising candidates for the control of *T. evansi* were identified in South America, the fungal pathogen, *Neozygites floridana* and the predatory mite *Phytoseiulus longipes*. In this study, population dynamics of *T. evansi* and its natural enemies together with the influence of environmental conditions on these organisms were evaluated during four crop cycles in the field and in a protected environment on nightshade and tomato plants with and without application of chemical pesticides. *N. floridana* was the only natural enemy found associated with *T. evansi* in the four crop cycles under protected environment but only in the last crop cycle in the field. In the treatments where the fungus appeared, reduction of mite populations was drastic. *N. floridana* appeared in tomato plants even when the population density of *T. evansi* was relatively low (less than 10 mites/3.14 cm^2 of leaf area) and even at this population density, the fungus maintained infection rates higher than 50%. The application of pesticides directly affected the fungus by delaying epizootic initiation and contributing to lower infection rates than unsprayed treatments. Rainfall did not have an apparent impact on mite populations. These results indicate that the pathogenic fungus, *N. floridana* can play a significant role in the population dynamics of *T. evansi*, especially under protected environment, and has the potential to control this pest in classical biological control programs.

Thursday 26, Afternoon, Auditorium - Poster

133 - Molecular characterization of strains of the fungus *Neozygites floridana*, pathogenic to spider mites

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The fungus *Neozygites floridana* is important in population regulation of spider mites in different crops worldwide. When conditions are favorable, high relative humidity and mild temperatures, the fungus can cause infection levels higher than 90%. Because of taxonomic uncertainties in the family Neozygitaceae, most pathogens of this group associated with spider mites have been identified as *N. floridana*. Molecular techniques have been used to reveal intraspecific variation in Entomophthoralean genera such as *Pandora*, *Zoophthora*, *Entomophaga* but very few studies have been carried out with members of Neozygitaceae. The objective of this study was to evaluate the genetic variability of four isolates of *N. floridana* pathogenic to *Tetranychus urticae*, *T. evansi* and *Mononychellus planki*, through sequencing of the 18S ribosomal RNA regions. The sequences obtained were compared with *Neozygites* sequences available in the GenBank database. Maximum Parsimony analysis of partial sequences suggests the existence of a monophyletic group of

fungi pathogenic to spider mites (Order Prostigmata) separated from *N. parvispora*, pathogenic to thrips (Order Thysanoptera). The isolates originated from mites of the genus *Mononychellus*, *M. planki* and isolates of *M. tanajoa* from Brazil and Benin, were grouped together and the same was observed for isolates pathogenic to species of *Tetranychus*. Although morphologically similar, these fungi presented high divergence in the 18S rRNA region, suggesting that the 18S rRNA can be considered a useful tool for phylogenetic analysis of this group. However, additional studies are needed using a larger number of isolates and other molecular markers to elucidate whether *N. floridana* is a complex of species. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Wednesday 25, Afternoon, Auditorium - Poster

134 - Population dynamics of the red palm mite, *Raoiella indica* (Acari: Tenuipalpidae), in Florida, USA

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The red palm mite, *Raoiella indica* (Acari: Tenuipalpidae), was discovered in Palm Beach, Florida, USA at the end of 2007 in the southeastern portion of the peninsula. Since then, it has been found in other areas in the south and west of the state. All stages of the red palm mite and associated phytoseiid predators were sampled in coconuts in the areas of Palm Beach, Broward and Miami-Dade from January 2008 to March 2010. Red palm mites were found throughout the year, observing major peaks (i.e., average 4,000 mites/ pinna) in the area where the mite was first discovered and lower peaks in new invaded areas of the south. At all three sites the populations were the highest in the first four months after the initial infestation. A steady negative trend on population density has been observed since July 2008 until today, which could be related to the subtropical conditions of the state as well as the build-up of predators, such as *Amblyseius largoensis* (Acari: Phytoseiidae). A significant relationship was obtained between red palm mite density and predator increase ($P = 0.04$; $r^2 = 0.78$) in several areas infested with the mite. The effects of lower temperatures in the winter are discussed.

Thursday 26, Afternoon, Room 2

135 - The availability of alternative foods can influence the impact of pesticides on predatory mites

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Generalist predatory mites belonging to the family Phytoseiidae can persist in orchards and vineyards when tetranychid mites are scarce by feeding on pollen and other alternative foods (e.g., fungi, honeydew). Grass management can affect pollen availability on leaves with implications for phytoseiid persistence. Reducing grass mowing frequency in apple orchards can result in higher predatory mite numbers probably because of a higher pollen availability on leaves. On the other hand pesticide use can affect markedly phytoseiid abundance. A laboratory study was planned to demonstrate the role of pollen availability in mediating interactions between pesticides and the predatory mite *Kampimodromus aberrans*. The availability of fresh pollen reduced the impact of some pesticides on the predatory mite. Grape downy mildew (GDM) represents an alternative food source for a number of generalist predatory mites occurring in vineyards (e.g. *Amblyseius andersoni* and *Typhlodromus pyri*). We assessed the effect of GDM in mediating the effects of insecticides and fungicides on predatory mites in vineyards. In a first study the impact of different fungicides was evaluated in plots characterized by a variable incidence of GDM. Predatory mite abundance depended on the toxicological traits of fungicides (direct effects), but also on different GDM levels induced by fungicide applications (indirect effects). In a second study an insecticide was applied in treatments characterized by a gradient of GDM incidence. Insecticide application determined a reduction in predatory mites

population, but a post-treatment re-colonization was observed in plots with high GDM incidence. Implications of these results for IPM are discussed.

Monday 23, Afternoon, Room 3

136 - Comparative toxicities of pesticides on *Tetranychus urticae* and its predators *Phytoseiulus persimilis* and *Amblyseius andersoni*

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Phytoseiulus persimilis Athias-Henriot (Acari: Phytoseiidae) is a specialized predator of *Tetranychus urticae* Koch (Acari: Tetranychidae) extensively used in greenhouses. The performance of the predator can be altered by pesticides used to manage different pests. The knowledge of side-effects of pesticides on predatory and phytophagous mites is essential to prevent spider mites outbreaks. Here we present the results of toxicological studies on *P. persimilis* obtained using a laboratory method recently developed. In a second experiment, the toxicity of low risk insecticides was evaluated on *P. persimilis* and *T. urticae*. In these experiments, mites were treated by microimmersion and then reared in holding cells, on leaves previously treated with pesticides. An additional experiment was aimed at studying the effects of different routes of exposure to spinosad, *B. bassiana* and pyrethrins on *P. persimilis* and *T. urticae.* The impact of pesticides on predatory mites and their prey was mediated by the route of exposure. *Amblyseius andersoni* (Chant) is a generalist predatory mite able to keep *T. urticae* and *Panonychus ulmi* (Koch) populations at low levels on various crops. On apple, interactions between *A. andersoni* and their prey can be disrupted by pesticides. A laboratory study was carried out to evaluate the side effects of some neonicotinoid insecticides on the survival and the fecundity of *T. urticae* and *A. andersoni*. Trials were conducted with acetamiprid, imidacloprid, thiacloprid and thiamethoxam. A positive control (distilled water) and a negative control, i.e. etofenprox were also considered. *Tetranychus urticae* and *A. andersoni* were sprayed directly with pesticide solutions or exposed to pesticide residues. Some neonicotinoids slightly increased the fecundity of *T. urticae*. Tested pesticides proved to be harmless or slightly harmful to *A. andersoni* but sub lethal effects were sometimes noticed. Implications for IPM are discussed.

Thursday 26, Morning, Room 5

137 - The first report of two *Ornithodoros* tick species, the main vectors of relapsing fever from north of Iran, and a review of the disease situation

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Tick-borne relapsing fever is endemic in half a dozen north-western and central provinces of Iran and sporadically reported in another dozen provinces all along the north-westerly mountain range, Zagros. The disease has been reported from the mountainous areas of Sari Township, northern Iran for many years but attempts to recover its arthropod vectors have failed. In an intensive investigation to identify the vectors of relapsing fever in the region, the micro-niches of different villages with likelihood of presence of soft tick vectors of relapsing fever, including cracks and cervices of the mud walls of animal shelters, human dwellings as well as animal bodies were searched. *Ornithodoros tholozani*, one of the most important vectors of *Borrelia persica*, the causative agent of the tick-borne relapsing fever, was recovered from the cracks of the mud walls of an animal shelter. A second species *O. lahorensis* has also been reported for the first time from the region recovered from animal bodies in a village in a semi-desert environment. The biology and ecology of the species and their medical and public health implications are discussed in this paper.

Tuesday 24, Afternoon, Auditorium - Poster

138 - Repellence of alternative acaricides to adult females of *Tetranychus urticae* (Acari: Tetranychidae) on cotton

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This work evaluated the repellent effect of alternative acaricides to adult females of *Tetranychus urticae*. The oils of neem (Azadiractina at 1% - Quinabra™), physic nut (*Jatropha curcas* L), and castor bean (*Ricinus communis* L.), and the commercial formulation of neem, Azamax™ (Azadiractina A/B – 12 g/L) were tested. The mites have been reared under laboratory conditions since 2001 on potted plants of jack bean (*Canavalia ensiformis* D.C.) under greenhouse conditions. The experiments were carried out using arenas containing two leaf discs of 5cm diameter obtained from leaves of the median third of cotton plants. The leaf discs were treated with the LC_{99} of each tested product and distilled water as control to comparisons. Inside the arena the two leaf discs (treated and untreated) were connected using a glass slide of 18x18mm. On the glass slide 15 adult females of *T. urticae* from the stock colony reared on jack bean were released. Each product was tested individually with treated and untreated leaf discs treatments and 15 replications. The evaluation consisted of counting the number of mites on each leaf disc at one, three, six, 12, 24 and 48h-periods. The number of eggs laid on each leaf disc was recorded at the end of the 48h-period observations after releasing the females. The results were subjected to the analysis of frequency and test of chi-square for the honesty hypothesis of 50:50% choice using the statistical software SAS, version 8.02. The results showed that the castor bean oil did not affect the mite preference with equal number of mites on treated and untreated leaf discs across all evaluation periods. However, castor bean oil had significant effect on mite oviposition behavior with 100% (936 eggs) of the eggs on untreated leaf discs. Physic nut oil, Azamax™ and Azadiractina at 1% exhibited significant effect on mite preference from the first evaluation period (1h) through the end of the experiment (48h). Further, physic nut oil caused 96.9% reduction in oviposition on treated leaf discs, while Azamax™ and Azadiractina 1% caused 100%. These results characterize the acaricide potential of these natural as oviposition control for *T. urticae* in cotton.

Tuesday 24, Afternoon, Auditorium - Poster

139 - Toxicity of alternative acaricides to *Tetranychus urticae* (Acari: Tetranychidae) on cotton

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Brazil is one of the most important cotton producers in the world. Cotton plant in Brazil, however, and in the most producer areas in the world is infested by the two-spotted spider mite *Tetranychus urticae*. The objective of this work was to evaluate the toxicity of alternative acaricides to adult females of *T. urticae* on cotton variety BRS 8H. The mites were obtained from jack bean plants (*Canavalia ensiformis* D.C.) cultivated in plastic 5L-pots with sandy soil and humus under greenhouse conditions. The alternative acaricides selected were the commercial formulation of neem Azamax™ (Azadiractina A/B), soluble oils of neem *Azadirachta indica* A. Juss. (Azadiractina at 1% - Quinabra™), physic nuts (*Jatropha curcas* L.) and castor bean (*Ricinus communis* L). Leaf discs of cotton with 3.5cm diameter were dipped into distilled water or in the acaricides dilutions for five seconds. The leaf discs were let to rest for 30 minutes under room temperature to loose the excess of the solution and, afterwards, infested with 15 adult females of two-spotted spider mite. The material was maintained in a climatic chamber regulated at 25 ± 1 °C. The mortality was evaluated 48h post-treatment considering alive those mite with movements when touched using a camel hair brush. The experiment was carried out with five or six concentrations of each acaricide with four replications each and a control treatment. The lethal concentration (LC_{50}) was estimated for each acaricide using the Software POLO-PC. The

toxicity rate (TR) was also calculated for each acaricide using the formula: TR = greatest LC_{50} / tested LC_{50}. The commercial formulation of nim Azamax™ was the most toxic to *T. urticae* with the CL_{50} of 0.162 mg L^{-1}, followed by the oils from Azadiractina at 1% and physic nut with LC_{50} of 0.707 and 0.764 mg L^{-1}, respectively. Among the oils, castor bean oil was the less toxic with LC_{50} of 1.68 mg L^{-1}. Based on these LCs results, the TRs calculated were 2.20, 2.38 and 10.37 for physic nut, azadiractina at 1%, and Azamax™, respectively.

Thursday 26, Afternoon, Room 3

140 - *Raoiella indica* Hirst (Acari: Tenuipalpidae): first record and threat in Mexico

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The red palm mite, *Raoiella indica* Hirst, 1924, is a serious threat to coconut (*Cocos nucifera*) and other palms, as well as to *Musa* spp. (Musaceae), *Heliconia rostrata* (Heliconaceae), *Alpinia purpurata* (Zingiberaceae), *Eucalyptus* spp. (Myrtaceae), among others. This pest is widespread in Pakistan, Sri Lanka, Malaysia, Mauritius, Egypt, Sudan, Iran, Oman, Israel, Reunion Island, Saudi Arabia, United Arab Emirates and the Caribbean, Philippines. Reported in Martinique, and from there has spread to Dominica, Guadeloupe, St. Maarten, St. Lucia, Trinidad and Tobago, Puerto Rico, St. Thomas, U.S. Virgin Islands, Dominican Republic and Jamaica. In Mexico, it was first detected in Isla Mujeres, Cancun, Quintana Roo (southwestern Mexico), on October 19, 2009, probably present at low population levels. It was recently detected in Lazaro Cardenas, Benito Juarez, Solidaridad and Tulum counties, all in the State of Quintana Roo. It was collected attacking coconut plants. Collected material was sent to the Acarology Laboratory for identification. All states of development were found in the samples. Surveys were conducted in those sites, looking for the mite on other plant species (ornamental palms and banana). Different activities through the Mexican government (Sanidad Vegetal) were done to control the dispersal of the population.

Wednesday 25, Afternoon, Auditorium - Poster

141 - The status of *Steneotarsonemus spinki* (Smiley) (Prostigmata: Tarsonemidae) in Mexico, first record for the State of Veracruz

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Steneotarsonemus spinki (Smiley) has been recognized as an important pest in the last decades in different parts of the world. It is generally associated with different varieties of *Oriza sativa* L. causing severe damages, reducing yield by 30 to 90%. In 1997 this pest arrived in Cuba, and since then it spread to several other Latin American countries: Haiti and Dominican Republic (1998), Nicaragua (2003), Costa Rica and Panama (2004), Guatemala, Honduras, Colombia and Venezuela (2005) and Mexico (2006). In Mexico, this species was first collected in Palizada, Campeche. Since then, it has been collected in Balancan, El Carmen and Emiliano Zapata in 2007. In 2008, samples were taken in different rice producing States in the country and by the end of the season, *S. spinki* was found in the State of Veracruz. In this state, several samples were collected in Tierra Blanca, Tres Valles Tlalixcoyan, Cosamaloapan and Huimanguillo counties. Chlorosis and necrosis were observed in collected samples. In addition, empty panicles, which remained erect, were found; the grains were empty or partially full and spotted. Observations on development and behavior were done in the laboratory. Life cycle was completed in 25 days, sex ratio (female: male) was 1: 6. Not many natural enemies were found. The species was first found in the State of Campeche, spreading to Tabasco and then to Veracruz, moving to the northern part of the country basically. It is now known from 12 counties included in 3 Mexican states. Despite the efforts to prevent further spread, *S. spinki* seem potentially able to spread to a much wider area in the country.

Thursday 26, Afternoon, Auditorium - Poster

142 - GSK3β during *Rhipicephalus* (*Boophilus*) *microplus* embryogenesis: GSK3β RNAi effect and its involvement in apoptosis

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Glycogen Synthase kinase 3β plays an important role in protein synthesis, glucose metabolism, cell proliferation and differentiation, microtubule dynamics and cell motility through phosphorylation of many substrates. Any change in this multifunctioning protein can promote phenotypes such as altered formation or impairment of embryo development. Our group has characterized the GSK3β during embryogenesis of *R. microplus*. The RNA interference was used to analyze role of GSK3β during ovary formation and embryogenesis in partially engorged female ticks and this silencing affected both oviposition and hatching. Moreover, we conducted GSK3 silencing by RNAi in cell line BME26 that was approximately 62%. The GSK3 silencing affects glycogen concentration in culture tick cells. These data indicate that an enzyme can be involved in glycogen synthesis regulation, as described in other models. Moreover, recently studies showed GSK3β is a key enzyme in apoptotic signaling. Apoptosis induction was realized in cell culture by U.V. radiation exposure and 40% of cells entered in apoptosis after 24h of 10 min U.V. exposure. GSK3β silencing by RNAi was able to inhibit apoptosis induction by U.V. radiation exposure in culture cell line. These initial results suggest that GSK3 can be related in apoptosis signaling in tick embryo cells and its involvement needs to be clarified during embryogenesis.

Thursday 26, Afternoon, Auditorium - Poster

143 - Effects of extrafoliar exudates and cyanogenic potential of three cassava cultivars on life history parameters of *Thyphlodromalus aripo*, a predator of cassava green mite

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It is now widely known that many predatory arthropods utilize plant-based foods, allowing them to persist during periods when their main prey is scarce. Cassava (*Manihot esculenta*) exudates are known to have positive effects on the development and survival of phytoseiid predators. They are produced mainly along the leaf petiole and midrib of young leaves of cassava plants. The quality of cassava exudates was also found to vary with cassava cultivar. The predatory mite *Typhlodromalus aripo*, a very successful biological control agent of cassava green mite in Africa, is known to feed on cassava exudates as well as to feed directly on cassava leaves in the absence of any other food source. Cassava leaves are known to vary considerably in the levels of cyanogenic glucosides but it is not known if feeding on exudates and leaves of cassava with high levels of cyanogenic glucosides (or high cyanogenic potential – CNP) can have a negative effect on *T. aripo* biology. In this study, we compared – in laboratory experiments at 25 ± 1 ^{o}C, 70-90 RH and 12L:12D photoperiod - several life history parameters of *T. aripo* when feeding on exudates and/or leaf tissue of three cassava cultivars with different levels of CNP: (a) TME1 – low CNP; (b) TMS91934 – moderate CNP; and (c) TMS82/00661 – high CNP. Immature development duration was shorter (6.8 days) and immature survival was higher (68.2%) on exudates of TMS82/0066 than on exudates of TME1 (7.9 days, 53.8%) and TMS91934 (8.2 days, 56.8%). None of the exudates of the three cassava cultivars were suitable for *T. aripo* reproduction, but adult female survivorship on exudates varied with cultivar and was highest on TMS82/00662. The predatory mite did not complete immature development on leaf tissue of any of the three cultivars, but juvenile and female longevity was higher on leaf tissue of TME1 (low CNP) compared with the other cultivars. Exudates of the three cultivars were free of cyanogenic glucosides, but sugar concentration was two-fold higher in exudates of TMS82/00661 (high CNP) compared with the other two cultivars. Amino acid concentrations were similar in exudates of the three cultivars. The potential role of foliar cassava exudates in the persistence of *T. aripo* and the biological control of

cassava green mite are discussed.

Friday 27, Morning, Room 3

144 - Morphological variation and reproductive incompatibility among geographic populations of two phytoseiid mite species associated with the coconut mite in Africa and Brazil

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The coconut mite, *Aceria guerreronis* Keifer, is the most important arthropod pest of the coconut fruits. Numerous survey and records indicated that the abundance of *A. guerreronis* and its damage to the crop may be lower in certain areas of Brazil than in Africa and Sri Lanka. This might be because the natural enemies of coconut mites in Brazil are more efficient than those in Africa and Sri Lanka. Two natural enemies associated with the coconut mite in Brazil are the predatory mites *Neoseiulus paspalivorus* and *Neoseiulus baraki*. Predatory mites also identified as *N. paspalivorus* and *N. baraki* have been frequently found in Africa. Because of their higher efficiency, Brazilian populations of these species are being considered for use in classical biological control of the coconut mite in Africa and elsewhere. In this study we used cross-breeding experiments and morphometric analysis to assess the conspecificity of three populations of *N. paspalivorus*, one from Brazil and two from Africa – Benin and Ghana; and two populations of *N. baraki* - Brazil and Benin. Crossing experiment was conducted with a cohort of at least 100 eggs of each population, singly transferred to the rearing units and allowed to develop until adulthood. Mating of all possible combinations of recently molted females and males were considered and female fecundity was observed for 10 days. Univariate and multivariate analyses were performed on 32 morphological characters measured on females and males used in the crossing experiments. Inter-population crosses showed complete post-mating bidirectional reproductive incompatibility between the three populations of *N. paspalivorus*; however, strong inter-population discontinuities in morphometric characters were absent. It is therefore not yet clear if the three populations belong to one or different species. Reproductive isolation was also observed between the Benin and Brazil populations of *N. baraki*. Morphological comparisons also showed that the two populations exhibited differences in body size and seta length, with the Brazil specimens being large and having most of their setea longer than those of the Beninese specimens. Additional studies are underway to determine the role of endosymbionts in reproductive incompatibility between geographic populations of *N. paspalivorus* and *N. baraki*, and to determine their genetic differences by molecular techniques with the aim of clarifying their taxonomic relationships.

Monday 23, Afternoon, Room 5

145 - Some problems in the taxonomy of Raphignathoidea (Acari: Prostigmata)

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The superfamily Raphignathoidea currently consists of about 800 valid species in 57 genera of eleven families. The common problems of taxonomy in other groups also exist in this superfamily: a large number of species are still unknown and undescribed; named species were inaccurately described and specimens are missing or unavailable for further study; species of economic importance are often repeatedly described under different names, and so on. Here, from a practice development point of view, we review the history and discuss the development trends of the taxonomy of Raphignathoidea and propose our suggestion on the description and illustration of new taxa.

Monday 23, Afternoon, Room 5

146 - Describing Phytoseiidae mites (Acari: Mesostigmata): characters of value and the importance of intraspecific morphological variations

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The taxonomy and morphology of the family Phytoseiidae are relatively well known. Compared to other groups of mesostigmatid mites, some morphological features have more value in Phytoseiidae and some others less. The shape of female spermatheca is an example of important character, while variations of the tectum have no or less value in species determinations being consequently ignored in descriptions of new species. Specimens collected from a population always show some degree of intraspecific morphological variations. These variations should be recorded by describing, measuring and illustrating them. The main features with such variability are: the number of cheliceral teeth, presence of some dorsal setae, the length of dorsal shield setae and leg macrosetae, the shape of spermathecae, the shape of ventrianal shield, the number of preanal setae, presence of preanal pores, length of peritremes. In some cases, the perceived variation in the description of a species might be due to a wrong observation or poor illustration. Re-describing species based on strains of various geographic regions with sufficient specimens would increase our knowledge on intraspecific variations. Documenting the variations would facilitate correct species identification. In addition to the traditional method of describing species, molecular work would reveal any genetic differences based on the diagnostic morphological characters. Cross-breeding studies can also yield important supporting data.

Tuesday 24, Afternoon, Room 1

147 - Observations on mating behavior in *Hericia janehenleyi* and *Fusohericia lawrencei* (Sarcoptiformes: Astigmatina: Algophagidae), inhabitants of sap flux on trees

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Sap flux (= slime flux) on tree trunks is the result of a wound to the tree and subsequent bacterial infection, and forms a specialized habitat with unique inhabitants that include two genera in the astigmatid mite family Algophagidae. Direct observation under a dissecting microscope as well as phase contrast and scanning electron microscopy were used to investigate mating behavior in *Fusohericia lawrencei* and *Hericia janehenleyi*, both found in the eastern deciduous forest of the USA. Upon encountering a quiescent female tritonymph or a recently molted female, an *F. lawrencei* male mounts dorsally and clasps the female with legs I and IV. After copulation, the male rides about on the female's dorsum until her cuticle is completed sclerotized (3 or 4 days). At that time the female is no longer be receptive to males. The male's behavior is a form of post-copulatory mate-guarding that protects his sperm investment by preventing access to a receptive female by other males. The legs of male *H. janehenleyi* differ in many respects when compared to those of females and immature instars. They are much more robust, and when measured as a proportion of idiosomal length, they are significantly longer. Especially striking is the fact that coxae IV are located ventral to and mesiad of coxae III, thereby resulting in the articulation of legs IV directly below legs III. When encountering a female tritonymph, the male approaches from the rear, rotates legs IV so that they are directed forward, and uses them to 'scoop' her up and position her in the basket formed under his idiosoma. Males can move about, carrying the female in this "fork-lift" like manner. Males guard quiescent females until they ecdyse to adults, at which time mating takes place. Newly ecdysed females are receptive for only a short time, and males tend to abandon females once they have copulated. Successful pre-copulatory mate-guarding prevents other males from gaining access to a virgin female and thereby insures the guarding male's paternity of resultant offspring.

Thursday 26, Afternoon, Auditorium - Poster

148 - Andropolymorphism in *Eucheyletia* near *bishoppi* (Trombidiformes: Cheyletidae)

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Although andropolymorphism (= male polymorphism) is not common in mites, it has been observed in each of the major orders (Mesostigmata, Trombidiformes, and Sarcoptiformes). It is usually characterized by discrete morphological differences that separate males into two distinct forms. Polymorphism resulting from allometric growth, that is growth of one body part relative to another body part in which there is a change in relationships of proportions and/or shape, is quite rare. To my knowledge it has been reported for only one species of mite, *Eutogenes vicinus* (Cheyletidae), the males of which demonstrate allometric growth of the gnathosoma. The present paper describes allometric andropolymorphism in a second species of cheyletid mite, *Eucheyletia* near *bishoppi*, an inhabitant of nests of the mountain beaver (*Aplodontia rufa*) in Oregon, USA. In this species the ratio of pedipalpal length to idiosomal length for individual males ranges from 0.43 to 0.93, and the ratio of gnathosomal length to idiosomal length ranges from 0.65 to 1.23. The biological reason for this variation has not been determined.

Thursday 26, Afternoon, Auditorium - Poster

149 - Functional response of *Phytoseiulus macropilis* (Banks) (Phytoseiidae) under different *Tetranychus urticae* Koch (Tetranychidae) population density in laboratory

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We tested the functional response of *Phytoseiulus macropilis* (Banks, 1904) in the presence of different *Tetranychus urticae* Koch, 1836 (two-spotted spider mite - TSSM) population densities in laboratory, and we evaluated the curve that best fits the data obtained, based on the reduced x^2. The predators were obtained from 'Oso Grande' strawberry variety from Bom Princípio County, State of Rio Grande do Sul, Brazil. Circles of 2.5 cm in diameter were cut from strawberry leaflets and placed with adaxial surface down on distilled water in an open Petri dish of 3.5 cm x 1 cm. Fifteen visually healthy *P. macropilis* females were randomly taken and individualized in each of the arenas with different TSSM densities. The following densities were tested: 1, 2, 3, 5, 10, 20, 30, 35, 45, 55, 70 and 125 females. The tests were conducted in germination chamber with a light phase of 12 hours at 28±1ºC and a dark phase of 12 hours at 22±1ºC, at 80□5% relative humidity. In all tests with up to three prey, *P. macropilis* showed low rates of functional response, while higher rates were observed with higher prey densities. Strong positive correlations were observed between the increase in prey number and the daily consumption ($r = 0.84$ and $p = 0.0006$), and the daily consumption of prey and daily oviposition rate ($r = 0.92$ and $p < 0.0001$). Significant correlation was also observed between prey consumption and total oviposition ($r = 0.70$ and $p = 0.01$), and between the number prey offered and ovipositon rate ($r = 0.66$ and $p = 0.01$). A shorter oviposition period was observed when up to three prey were offered. The oviposition period and the increase of prey number offered were not statistically significant. Nevertheless, the longer the oviposition period, the higher was total oviposition ($r = 0.90$ and $p < 0.0001$). Curves representing the observed variation of each variable were constructed, based on the least square method.

Tuesday 24, Afternoon, Auditorium - Poster

150 - Faunistic analysis of mite species in four coffee production systems in Minas Gerais, Brazil

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Mites have always occurred naturally in coffee and have become important pests causing intensive damage in the production and quality of coffee crop. These pest mites are *Brevipalpus phoenicis* (Geijskes), *Oligonychus ilicis* (McGregor) and *Polyphagotarsonemus latus* (Banks) (Tenuipalpidae, Tetranychidae and Tarsonemidae). These species are controlled naturally by natural enemies, including predatory mites. The diversification of plants in the cultivated area is a strategy that allows the preservation and the increase of natural enemies, since these plants provide shelter and alternative food. The aim of the present research was to characterize the predominant species in four coffee cultivation systems using faunistic analysis. The systems studied were: organic, organic-mineral (SAT) and conventional in the municipality of Poço Fundo, and natural in the municipality of Machado. For each system studied 15 plants were sampled at random. From each plant, 20 leaves were collected, 10 on each side, in the middle third of the plant, totaling 300 leaves per system, with three evaluations. The leaves were placed in plastic bags and taken to the laboratory of Biology of the Federal Institute of Education, Science and Technology in Southern Minas, Machado. Then, the leaves were washed for the extraction of mites. After the preparation, the samples were transferred to glass vials, with 70% alcohol. Identification and quantification of the mites were done in the Laboratory of Acarology of the EPAMIG Sul de Minas/EcoCentro. The faunistic analysis was performed using the program ANAFAU. The conventional system showed a greater diversity, with10 different species, but in this system 102 specimens of pest mites were found, compared to 37 specimens in organic, 47 in natural and 3 in organic-mineral. Only 6 mite species were found in the organic-mineral system. *Brevipalpus phoenicis* was very dominant in the natural system and dominant in conventional and organic, and non-dominant in the organic-mineral. *Oligonychus ilicis* was very dominant in conventional and organic, non-dominant in organic-mineral system and was not observed in the natural system. The most common predatory mites were *Amblyseius herbicolus* (Chant) dominant in the conventional and natural, not dominant in the organic, and *Euseius citrifolius* Denmark & Muma, dominant in the conventional and non-dominant in the organic, and absent in other systems. The result indicates that the coffee cultivation system affects the population of pest mites and its predators. Best equilibrium between pest mite and predators was observed in the natural system.

Tuesday 24, Afternoon, Room 1

151 - Mechanisms of group cohesion in the two-spotted spider mite

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Group cohesion is crucial for species submitted to Allee effects, for which individual fitness is an increasing function of population size. An interesting acarine example of such species is the spider mite, *Tetranychus urticae*. This plant-feeding mite benefits from living in large groups, as the commonly spun web under which they live grants them protection against predators and unfavourable weather conditions. Furthermore, oviposition is stimulated in larger groups. Since group cohesion offers such benefits, it is worth to study the behavioural mechanisms that ensure it. This question was studied through laboratory experiments involving migration and aggregation of spider mites on bean plants. We tested and quantified two mechanisms underlying group cohesion: collective migration and the retentive effect of silk. Through mathematical modelling, we address the general question of the effects of such mechanisms on population dynamics. Our results show that the mechanisms by which group cohesion is achieved play a key role in the dynamics of the population.

Tuesday 24, Afternoon, Auditorium - Poster

152 - Phytoseiid mites (Mesostigmata: Phytoseiidae) from Madeira Island (Portugal)

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The Madeira archipelago, a Portuguese territory, is situated in the Atlantic Ocean and is comprised of two large and nine small islands, being Madeira the largest, with an area of about 740 km^2. All islands are of Tertiary volcanic origin and the vascular flora is exuberant and diverse, with about 1250 catalogued species, 10% of which are endemic. In 1969, Dr. Maria Manuela Carmona (Instituto Agronômico Nacional, Oeiras, Portugal) visited Madeira and reported five species of phytoseiid mites: *Amblyseius largoensis* (Muma), *Euseius hibisci* (Chant), *Iphiseius degenerans* (Berlese), *Typhlodromus pyri* Scheuten and *T. rhenanus* (Oudemans). In this work we present a preliminary list of phytoseiid species collected by F. Ferragut on native vegetation and cultivated plants in Madeira Island. A total of fifteen species were extracted from the plant material under a dissecting microscope; nine of them are new records for the archipelago and four of them are new species. *Neoseiulus idaeus* Denmark & Muma, *Kampimodromus aberrans* (Oudemans), *Euseius stipulatus* (Athias-Henriot), *E. scutalis* (Athias-Henriot), *Amblyseius herbicolus* (Chant), *Typhlodromus* (*Typhlodromus*) *phialatus* Athias-Henriot, *T.* (*Anthoseius*) *rhenanoides* Athias-Henriot, *T.* (*A.*) *microbullatus* van der Merwe and *Neoseiulella canariensis* Ferragut & Peña are reported for the first time for the island. *Neoseiulus* sp. n. was collected on the endemic *Echium candicans* (Boraginaceae) and it cannot be accommodate in any of the species groups defined by Chant & McMurtry, showing intermediate characteristics between the *desertus* and *peruanus* species group. *Typhlodromus* (*Typhlodromus*) sp. n. 1; *T.* (*T.*) sp. n. 2 and *T.* (*T.*) sp. n. 3 were collected on *Vaccinium padifolium* (Ericaceae), *Helichrysum obconicum* (Compositae) and *Castanea sativa* (Fagaceae), respectively. These species belong to the group characterized by females having four pairs of preanal setae, two pairs of sternal setae, four pairs of dorsal solenostomes, ventrianal shield without solenostomes and one macroseta [*T.* (*T.*) sp. n. 1] or three macrosetae [*T.* (*T.*) sp. n. 2 and *T.* (*T.*) sp. n. 3] on leg IV. Since the discovery of Madeira by the Portuguese, the original vegetation has undergone rapid and profound changes with the destruction of endemic flora, mainly by exploitation, agriculture and introduction of many aggressive plants, such as *Pinus*, *Eucaliptus* and *Acacia* species. Interestingly, most of new phytoseiid species were collected on endemic plants, except *Typhlodromus* (*Typhlodromus*) sp. n. 3; most of the remaining species have a wide geographical distribution and were found on introduced or cultivated plant species.

Tuesday 24, Afternoon, Auditorium - Poster

153 - *Tenuipalpus* Donnadieu (Tenuipalpidae) associated to Velloziaceae in the Chapada Diamantina, Bahia, Brazil

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The Chapada Diamantina is a mountainous region located in the State of Bahia, northeast Brazil. Its very varied vegetation includes extensive areas of *Campo Rupestre* and *Cerrado* ecosystems, rich in endemic taxa and with a diverse representation of plant families such as Velloziaceae (tree lilies), Eriocaulaceae (everlasting flowers), Melastomataceae, Orchidaceae and Bromeliaceae. One of the most characteristic families of *Campo Rupestre* is the Velloziaceae (Monocotyledones), restricted to South America, Africa, Madagascar and Arabian Peninsula, which comprises in the region about twenty species belonging to the genera *Vellozia* Vandelli, *Barbacenia* Vandelli and *Nanuza* L.B. Smith & Ayensu. During a survey conducted in January 2010 on natural vegetation, six new species of false spider mites belonging to the genus *Tenuipalpus* Donnadieu were found in association with several endemic Velloziaceae species. The mites were collected directly from the leaves under a dissecting microscope. *Tenuipalpus* n. sp. 1 was collected on *Nanuza plicata* (Martius) L.B. Smith & Ayensu; *Tenuipalpus* n. sp. 2 on *Vellozia hemisphaerica* Seubert and *V. punctulata* Seubert; *Tenuipalpus* n. sp. 3 on *Vellozia seubertiana* Goethart & Henrad and *V. furcata* L.B. Smith & Ayensu; *Tenuipalpus* n. sp. 4 on *Vellozia*

campanuloides Mello-Silva and *Barbacenia contasana* L.B. Smith & Ayensu; *Tenuipalpus* n. sp. 5 on *Vellozia caruncularis* Mart. ex Seub. in Mart. and *Tenuipalpus* n. sp. 6 on *Vellozia caudata* Mello-Silva. All the samples collected contained only one *Tenuipalpus* species even though plants from different species grew close each other. For this reason, we consider that some of these mites could be host specific in their feeding habits. *Tenuipalpus* n. sp. 1 belongs to the *anoplus* subgroup of the *caudatus* group, whereas the remaining five species belong to the *bakeri* subgroup of the *caudatus* group. All the species are illustrated and a tabular key to adult females and data on distribution patterns useful for species identification are provided. The genus *Tenuipalpus* is known in Brazil from 14 previously recorded species. The 6 new species included here suggest that this genus is the most diverse of the Tenuipalpidae in the country and there must be still many undescribed species on plant of the natural vegetation.

Tuesday 24, Morning, Room 6

154 - Phytoseiid mites (Mesostigmata: Phytoseiidae) from Dominican Republic: a taxonomical and biogeographical approach

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The Dominican Republic is located in the Caribbean basin just under the Tropic of Cancer. In its 48,700 km^2, the country shows a great variety of ecosystems and microclimates that harbor a rich fauna and flora, with significant numbers of endemic species. In spite of this fact plant mites have not received significant attention from taxonomists and, in particular, phytoseiid mites are still unknown. During an extensive survey on natural vegetation in different regions of the country, twenty-three phytoseiid species were collected, including two new species: *Phytoseius* sp. nov. on *Miconia* sp. (Melastomataceae) and *Typhloseiopsis* sp. nov. on *Cecropia peltata* (Cecropiaceae). The last species has female dorsal pattern 12A:7B with 19 pairs of setae and clearly shows the presence of *S2* on the dorsal shield both in males and females. According to this pattern the species keys the genus *Meyerius* van der Merwe; however, species now placed in this genus are morphologically very different and geographically restricted to southern Africa. For this reason, we consider this species to belong to *Typhloseiopsis* De Leon. To accommodate the new species a redefinition of the genus is proposed. Species composition in Dominican Republic was compared with the currently known phytoseiid species from neighboring countries. Dominican species complex shows greater affinities with species from nearby Puerto Rico and Jamaica (33 and 26% of coincident species, respectively), but also with faunas from distant countries as Guyana (24%), El Salvador (23.1%), Venezuela (19.5%), Trinidad & Tobago (19%), Honduras (18.6%) and Guatemala (16.7%). On the contrary, they are very different from that of Nicaragua (only 8.3% of coincidence), Mexico (8.8%), Costa Rica (8.9%) and Florida (9.5%). Despite our scarce present knowledge, a significant number of species occurring in Dominican Republic could have resulted of long distance dispersal from northern South America via the Isthmus of Panama, possibly aided by the presence of land bridges connecting Central America and the Greater Antilles in the past. Additional sampling of taxa will be needed to verify this simple and hypothesized scenario.

Thursday 26, Afternoon, Auditorium - Poster

155 - Field abamectin resistance, cross-resistance and synergism in *Tetranychus urticae* Koch (Acari: Tetranychidae) populations

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The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), is one of the most important pests in the world. In Brazil, it causes severe losses in several crops, including ornamental flowers. Abamectin is the acaricide mostly used nowadays for its control in the Pernambuco State,

but control failures are very common. Therefore, abamectin susceptibility tests were conducted, to check whether resistance was involved. In addition, it was evaluated the abamectin cross-resistance to milbemectin, diafentiuron, fenpyroximate and chlorfenapyr, as well as the potential involvement of enzymes in the detoxification of abamectin. Four field populations and a laboratory population were assessed. Synergists assays were performed with the most susceptible and resistant populations using PBO (piperonyl butoxide), TPP (triphenylphosphate), and DEM (diethyl maleate). The IRAC bioassay method #4 of the method series for susceptibility testing was used. In the synergist bioassays, mites were previously sprayed with each synergist in a Potter tower and, two hours later, exposed to acaricide treatments. Mortality was evaluated 48 hours after exposure and data submitted to probit analysis. The population from the Bonito was the most resistant to abamectin (RR = 295,963.6) followed by the Brejão (RR = 112,772.4). The highest synergism ratios referring to PBO, DEM, and TPP were 7.8-, 5.1-, and 2.1-fold, respectively, for the population of Petrolina, compared to the no synergized abamectin. The Petrolina population was considered a reference population for diafentiuron and the resistance ratios were 1.6, 618.8, and 1180.3 fold for the populations of Piracicaba, Brejão, and Bonito, respectively. The Piracicaba population was the reference for milbemectin, fenpiroximate and chlorfenapyr. For the milbemectin, the highest resistance ratio was 699.7-fold for the Brejão population followed by 651.1 and 9.9 for Bonito and Petrolina, respectively. Regarding fenpyroximate, the highest resistance ratio was 197.9 for the Brejão population followed by 147.9 and 3.9 for Bonito and Petrolina, respectively. The highest resistance ratio to chlorfenapyr was 3602.0 for Brejão population followed by 569.1 and 2.1 for Bonito and Petrolina, respectively. The results showed that the control failures in the field are associated with resistance. Among the synergists, PBO most increased the susceptibility of populations to abamectin, suggesting the involvement of monooxigenases-dependent cytochrome P-450 in abamectin resistance. Nevertheless, glutathione-S-transferases appear to be additional factors in such resistance. In regard to failures to other products, such as diafenthiuron in Pernambuco fields, the results suggest that they may be associated with their use in some of these areas. However, milbemectin has never been used in these areas before the collection, which suggests a cross-resistance with the related abamectin.

Wednesday 25, Afternoon, Room 1

156 - Domatia reduce larval cannibalism and intraguild predation in predatory mites

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Acarodomatia are small structures on the underside of leaves of many plant species, which are mainly inhabited by carnivorous and fungivorous mites. Domatia are thought to protect these mites against adverse environmental conditions and against predation. They are considered as an indirect plant defense; they provide shelter to predators and fungivores and these in turn protect the plants against herbivores and fungi. We studied the possible role of domatia of coffee (*Coffea arabica* L.) (Rubiaceae) and sweet pepper (*Capsicum annum* L.) (Solanaceae) in reducing cannibalism and intraguild predation in the mites inhabiting domatia. We measured cannibalism and intraguild predation of larvae by adults of the predatory mites *Iphiseiodes zuluagai* Denmark & Muma and *Amblyseius herbicolus* Chant on coffee leaf discs with domatia and of the predatory mite *Iphiseius degenerans* (Berl.) on sweet pepper leaf discs. For intraguild predation, we used larvae of the phytoseiids *Neoseiulus cucumeris* and *I. degenerans* as intraguild prey and adult females of the other species as intraguild predator on sweet pepper, and larvae and adult females of *A. herbicolus* and *I. zuluagai* on coffee. Domatia were closed with glue or left open. Cannibalism in all three species increased when domatia were closed. Intraguild predation was also significantly reduced on leaves with open domatia compared to leaves with closed domatia, despite the fact that intraguild predators could enter the domatia. This shows that domatia can protect young predatory mites against cannibalism and intraguild predation.

Wednesday 25, Afternoon, Auditorium - Poster

157 - Sample effort reduction of mites (Acari: Oribatida) in forest fragments in Alter do Chão, Pará, Brazil

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Oribatid mites have been cited in the scientific literature as indicators of soil quality because of their life cycle, their participation in soil resilience, and their high abundance and diversity. In Amazonian tropical forests, 90-120 species can reach an abundance of 15 thousands ind/m^2. Therefore, the high abundance and diversity together with the techniques necessary for identification, constrain the use of these animals in biodiversity studies in Amazon region, because the identification to species level is expensive and time-consuming. The sample effort reduction was recently tested in an Amazonian savanna with oribatid mites and despite the loss of information, the effort could be 50 or 75 percent reduced, representing a great economy for a project. Therefore, the possibility of effort reduction was never tested in forest fragments. We aim to evaluate the financial costs reduction, investigate the consequences in the ecological loss of information, and to collaborate to the establishment of a standardized protocol of mites surveys. The study site is a 16 X 16 km landscape surrounding the village of Alter do Chão, located on the right (eastern) bank of the Tapajós River, 35 km southwest of the city of Santarém, in the Brazilian Amazon (23º00'S, 54º57'W). We investigated 16 forest fragments of semi-deciduous forest embedded within patches of savanna vegetation, isolated for about 300 hundred years, varying in size, shape and degree of isolation. We established four parallel transects of 250 m-long, 50 m distant from each other, in each forest fragment. Fragments ranged in size from 2.4 to 361 ha. In 2001, soil cores (3.5 X 3.5 cm) that sampled approximately 12 cm^2 of area to a depth of 5 cm were taken, placing four consecutive samples in the same plastic container to form a compound subsample. Ten compound subsamples were taken for each plot and extracted by Berlese-Tullgren apparatus. To obtain successively smaller proportion of the subsamples, the content is poured into a funnel placed on the top of a plastic cup. Eight holes distributed around the bottom of the cup drains into a Petri dish divided in four quadrants. We reduce the initial volume to 50, 25, 12.5 and 6.25 percent, and the data will be analyzed to estimate the loss of taxonomical and ecological information in each dilution. Dissimilarity matrices will be generated using Bray-Curtis (abundance data) and Sørensen indices (presence/absence data). Mantel correlation between each reduced effort matrix and 100 percent sorting will be used as an index of how much information was retained. The effect of tree density, litter amount and size of the fragments will be analyzed using multiple regressions to estimate the loss of ecological information. We expect that the results of this investigation will indicate a great potential to reduce time and costs of future projects.

Monday 23, Afternoon, Room 5

158 - Eriophyoidea descriptions

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A wealth of information on procedures and techniques for morphological studies of Eriophyoidea have recently been summarized, revised and updated in de Lillo et al. (2009 – Exp.appl.Acarol. doi 10.1007/s10493-009-9311-x) and de Lillo & Skoracka (2009 - Exp.appl.Acarol. doi:10.1007/s10493-009-9297-4); more information in Amrine & Manson (1996, in Lindquist, Sabelis and Bruin, Eriophyoid Mites, their biology, natural enemies and control, Amsterdam, World Crop Pest 6:383-396) and Lindquist (1996, World Crop Pest 6:3-31). Additionally, it is recommended to observe live specimens to ascertain the direction of the scapular setae; in microscopic preparations the weight of the cover glass should be supported by fibers included in the mounting medium; details of the palpal antapical seta (dorsal palp genual seta) are to be referred to, whether they are straight, bent or branched; the relative position of the solenidion and empodium on tarsus of leg I, whether dorsad or

laterad, should be indicated and, regarding the immature, larvae and nymphs should be examined to search for easy characters which might discriminate them. To facilitate annotations, mainly measurements, an Eriophyoidea Description Form is presented.

Wednesday 25, Morning, Room 4

159 - Uncertainties in Eriophyoidea systematics

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Considering that only about 5%, at most 10%, of the species in this surprisingly diverse group have been named, it is argued that it is premature to investigate the phylogeny inside this superfamily, that is, it seems premature to jump too far in our assumptions. Host plants should be considered, but should not rule in eriophyoid classification; DNA (molecular) analyses have as many solutions as shortcomings – it is another tool that will help understanding these mites, but it is not a panacea. In our view we should wait until about 60% of the eriophyoids have been described and then develop a comprehensive, phylogenetically meaningful classification.

Tuesday 24, Afternoon, Auditorium - Poster

160 - Intercellular bridges in ovaries of astigmatic mites: their fine and molecular structure (Acari: Astigmata)

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Gametogenesis, including oogenesis, is characterized by incomplete cytokineses resulting in clonal groups of interconnected germ cells. In Astigmata, the ovaries have uniform structure: there is a large, multilobular (rarely multinucleate) central nutritive cell connected via permanent intercellular cytoplasmic bridges with surrounding oocytes at different stages of previtellogenesis. Such bridges are exceptional since they are either funnel-shaped and tightly filled with an electron-dense granular material (in all to date studied Astigmata species except Histiostomatidae: *Histiostoma feroniarum* and *Bonomoia opuntiae*), or practically two-dimensional, in the form of a very large aperture crossed with a thin electron-dense diaphragm (Histiostomatidae). In both cases, the dense material filling the bridges shows less dense "openings" or "channels", supposedly serving as routes for intercellular transport. To preliminarily determine the fine structure and molecular composition of both bridge types, we studied several species belonging to different groups of Astigmata by transmission electron microscopy, and two species, *Rhizoglyphus echinopus* and *H. feroniarum*, by fluorescence microscopy. The results on distribution of RNA, F-actin microfilaments, microtubules, different intermediate filaments and associated proteins, are shown and discussed.

Friday 27, Morning, Room 4

161 - Biodiversity of soil mites (Acari, Oribatida) in the Amazon Region

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To date, about 450 species of oribatid mites have been recorded in Amazonian surveys, with the majority being undescribed (~67%). In these mostly small-scale studies, various patterns of dominance and frequency of species or groups of species across habitats were detected. Trends also appeared in meso-spatial scale studies in Amazonia, such as those conducted in a dense upland rain forest reserve and a savanna forest. In this forest of 10,000 ha, 250 m-long plots were distributed over a 64 km^2 (6,400 ha) grid of trails, resulting in 72 plots with a distance of 1 km between them. A total of 161 taxa (adults) were recorded, including 82 known species (51%). This increased the number of named taxa in the reserve from 54 to 106 species. *Rostrozetes ovulum*, *Pergalumna passimpuctata*, *Xylobates capucinus capucinus*, *Spathulocepheus amazonicus*, *Monoschelobates parvus* were the most abundant

and frequent species. *Rostrozetes ovulum* represented 22% of all individuals, and was present in 89% of the plots. *Archegozetes longisetosus*, the second most abundant species, represented 6% of individuals, and was present in 32% of the plots. A total of 160 taxa was recorded in a mid-term survey (6 months) across a smaller spatial scale in soil and litter of a rain forest in Peru. Comparing the meso and the small-spatial scale surveys, the diversity in both forests appears similar, but the first survey also represented the natural variability of the forest, as wet up land forests in central Amazonia are not homogeneous, but have soil gradients linked to topographic variation, water retention, vegetation structure, and light penetration to the understory. A different scenario of species dominance was detected in another meso-spatial scale survey in 38 plots distributed over 256 km^2 (25,600 ha) of an Amazonian savanna. In each 250 m-long plot, four parallel transects were established at each 50 m. Five taxa contributed together to over 75% of the total abundance and each taxa occurred in at least 89% of the plots: *Neoppia schauenbergi*, *Symphauloppia* sp. A, *Microppia* sp., *Symphauloppia* sp. C, and *Cosmochthonius* sp.. *Rostrozetes ovulum* and *A. longisetosus* were detected in 20 (52%) and 8 (~21%) plots in the savanna, respectively, but their dominance was greatly reduced to less than 1% of all individuals. Moreover, some studies in Amazonia have shown that the composition of genera and species of higher taxa of Oribatida differs across habitats. More studies across medium and large spatial scales are needed to establish the use of these mites in detecting the natural variability in the environment, and also to distinguish this natural variability from anthropogenic impacts.

Wednesday 25, Afternoon, Room 2

162 - Reverse Immunogenomics for development of anti-tick vaccines

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Ticks exert selective pressure on their host's skin, the largest organ of vertebrates. However, little is known about cutaneous mechanisms to expel them. Bovines present contrasting, heritable levels of resistance to *Rhipicephalus microplus*, the cattle tick. In order to elucidate the mechanisms that result in these outcomes, we examined the global gene expression profile and the *in vivo* patterns of inflammation of cutaneous reactions to tick bites in indicine and taurine cattle, respectively, resistant and susceptible to ticks. We developed a strategy for high throughput discovery of candidate antigens for anti-tick vaccines using host infestation phenotypes and bioinformatics to disco genes coding for secreted proteins from tick salivary glands. Biopsies of skin were made from resistant and susceptible bovines that were naïve or infested with larvae or nymphs. Gene expression for individual samples was determined with Affymetrix chips. Data was normalized using RMA. Differentially expressed genes (DEGs) were obtained with custom packages (RankProd and LIMMA). Functional analysis was done using Metacore. Differential counts of infiltrating leukocytes were made by means of Giemsa staining. Lymphocytes were phenotyped with specific antibodies. cDNA libraries were constructed with mRNA from salivary glands of ticks feeding on susceptible or resistant bovines. Inserts of randomly selected clones were sequenced, analyzed with bioinformatics and the origin of the ESTs within contigs, whether from ticks fed on susceptible or resistant hosts, signal peptides and putative biological functions were determined. Genes of interest (GIs) that are candidates for vaccine antigens were pre-validated by verifying: 1) recognition of a recombinant protein by sera from immune resistant, but not susceptible bovines; 2) cross protection afforded by DNA vaccination with GIs of mice challenged with *R. sanguineus*; 3) the effect of iRNA with GIs on biological parameters of female ticks. The cutaneous transcriptional profile revealed that inflammation may be greater in resistant hosts because they express more message than susceptible bovines for chemokines for basophils, eosinophils and T and B lymphocytes; this result is reflected by significantly higher numbers of these cells recruited in the corresponding local inflammation. Other DEGs involved in extracellular matrix and tissue repair

suggest that resistant hosts have a more resilient skin to tick bites and respond more vigorously to wounding. The top scored maps produced by Metacore analysis indicate that production of odoriferous substances differs between phenotypes, a finding which has direct applications in semiochemical control. Finally, tick saliva may be classified as a xenobiotic and, accordingly, top networks were formed with DEGs that participate in responses to organic substances and xenobiotics. Of the candidate antigens, at least 70% were pre-validated confirming the usefulness of our platform for antigen discovery. This research was financially supported by the Brazilian CNPq and FAPESP.

Wednesday 25, Afternoon, Auditorium - Poster

163 - Preliminary study of oribatid mite communities in *Celtis tala* forest soils of Buenos Aires Province, Argentina

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Buenos Aires Province, in the middle-east of Argentina, is included in the biogeographic province of Pampas. Before agricultural exploitation, the natural vegetation of the area was characterized by grass, with some native forests in peripheral zones. These forests, named "talares", are dominated by a xeric tree, *Celtis tala*, in association with different plants as *Sambuco australis* and *Colletia paradoxa*. Talares were located in a narrow north-south strip of land from the paranaense bank to Tandilia hill system, growing on old seashell beds or mature hills. For centuries, these forests have been subjected to severe fragmentation process due to the use of land for agricultural and livestock practices. At present, a few forest patches of variable sizes remain embedded in a grassy matrix. The aim of this study was to identify the soil oribatid communities in *C. tala* patches of different sizes and the surrounding matrix, in three sites located in a north-south latitudinal gradient (Magdalena (Mg), Mar Chiquita (NR) and Mar del Plata (LP)), and to compare them. We expect the values of community variables: i) to be higher in forest patches than in grassy matrix; ii) to increase with the size of patches; iii) to decrease from north to south. Two patches of different sizes (G and Ch) and the surrounding grassland (B) were sampled by site. Variables compared were: species number, abundance, diversity and evenness. Richness (species number), Shannon diversity index and Pielou evenness index of oribatid community were estimated for each site and patch. We identified 71 species, distributed in 60 genera and 39 families. Richness by site was: 56, 33 and 34 to Mg, NR and LP, respectively. *Hemileius suramericanus* (Hammer) was the most abundant and ubiquitous species. Four species account for more than 50% of total specimens. Mite communities were more similar, in species composition, among patches than with the matrix in NR and LP, while in Mg the smallest patch was more similar to the matrix. At each site, variables did not show a common pattern. Richness: MgG>MgB>MgCh, NRG>NRCh>NRB, LPG>LPB>LPCh; diversity: MgG=MgCh=MgB, NRG=NRCh>NRB, LPG=LPCh=LPB; evenness: MgG=MgCh>MgB, (NRCh>NRG)=NRB, LPG=LPCh=LPB. The northernmost site (Mg) had 11 exclusive families; it also had the highest values of richness and diversity; evenness value was higher in LP. Effects of latitude and patch size are discussed.

Tuesday 24, Afternoon, Auditorium - Poster

164 - Phylogenetic identification of fourteen *Tetranychus* spider mites (Acari: Tetranychidae)

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Spider mites are very small and accurate identification of morphologically similar species is extremely difficult, because the number of diagnostic characters is limited and key traits for identification may vary intraspecifically. Most species of the spider mite genus *Tetranychus* in Japan show a particular morphological resemblance, the only character separating them being the diameter of the aedeagal knob. Because this genus contains many important pests in agriculture, the unambiguous identification of species is crucial for effective pest management and quarantine

procedures. DNA-based methods could form a welcome complement to the morphological methods. To this end, we first inferred the phylogenetic relationships within the genus *Tetranychus* using the internal transcribed spacer (ITS) region in nuclear ribosomal DNA and mitochondrial cytochrome *c* oxidase subunit I (COI) region. We determined sequences of the 14 known *Tetranychus* species in Japan, including the green and red forms of *T. urticae* that were counted as separate species. The ITS phylogeny supported monophyly in 9 of the 14 species. Three species – *T. kanzawai*, *T. parakanzawai* and *T. ezoensis* – composed a monophyletic clade. Two forms of *T. urticae* did not compose a monophyletic clade, but they had species-specific insertions. The COI phylogeny supported monophyly in 11 species, namely the monophyletic species in the ITS region plus *T. ezoensis* and green-form *T. urticae*. Red-form *T. urticae* consisted of a paraphyletic group, including green-form *T. urticae*. Thus, all *Tetranychus* species but two can clearly be separated using the COI region. The two species which could not be distinguished by DNA sequences, *T. kanzawai* and *T. parakanzawai*, seem to include one or two cryptic species, respectively.

Wednesday 25, Afternoon, Auditorium - Poster

165 - Dispersal strategies of *Aceria guerreronis* Keifer (Acari: Eriophyidae) on coconut

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The dispersal of mites may occur not only when they are transport by man on plant parts, but also as a direct action, either letting being carried by abiotic factors, walking, or attaching to carriers to be transported to other places. *Aceria guerreronis* Keifer has been considered a serious pest of coconut, by the damage it causes to developing fruits. Knowing its dispersal mechanisms is important to understand the process of infestation of new bunches as they are produced, or from plant to plant. Ultimately, this knowledge may provide relevant information for the establishment of strategies for the management of *A. guerreronis* and its natural enemies. Therefore, the objective of this work was to investigate the mechanisms of dispersal of *A. gerreronis* in coconut palms. The hypothesis that *A. guerreronis* could disperse by the wind, phoresy and walking was tested. The results showed that it walks to disperse at short distances between fruits of the same bunch or between bunches of the same plant, mostly at night. They also showed that *A. guerreronis* uses air currents to disperse at longer distances, and that phoresy on insects seems to occur only occasionally.

Wednesday 25, Afternoon, Room 4

166 - Eriophyoid fungal interaction: a win win situation

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A considerable number of plant feeding mites representing different families such as Acaridae, Siteroptidae, Tydeidae and Tarsonemidae interact with plant pathogenic fungi. While species within the Eriophyoidea appear to be the most common

phytophagous mites vectoring virus diseases, little is known of their role in fungal pathogen epidemiology. Interactions between herbivores and causal agents of diseases can be complex. Herbivores may facilitate fungal infection by vectoring pathogen spores and or by creating wound sites for fungal penetration. Causal agents of plant disease can manipulate plant defense mechanisms such that population development of their arthropod vectors will be enhanced substantially. In this talk we will present results from two studies on eriophyoid-fungal relationships. The first on *Aceria mangiferae* Sayed and the fungal pathogen *Fusarium mangiferae* Britz, Wingfield & Marasas in mango and the second on the cereal rust mite *Abacarus hystrix* (Nalepa) and rusts caused by *Puccinia* spp. Mango bud tissue colonized with *F. mangiferae*, and wheat and quackgrass leaves colonized with *Puccinia* spp., supported significantly higher populations of eriophyoid mites. Both mite species were observed bearing the spores of the respective pathogens on their body integument. *Aceria mangiferae* vectored the pathogen's spore into the bud, the sole port of entry for the fungal pathogen and the frequency and severity of fungal infection increased in the presence of *A. mangiferae*. While it appears that eriophyoids are playing a role in fungal epidemiology, further research is clearly needed to enhance our understanding of direct and indirect (plant mediated) interactions between plant pathogens and eriophyoid mites in different plant-pathogen systems.

Thursday 26, Afternoon, Auditorium - Poster

167 - Assessing the suitability of the Oriental red mite *Eutetranychus orientalis* (Tetranychidae) as prey for the predatory mite *Euseius stipulatus* (Phytoseiidae)

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The Oriental red mite, *Eutetranychus orientalis* (Acari: Tetranychidae), is an important pest of citrus but it has also been reported causing damage to grapevine, cotton, peaches and pears. It has a worldwide distribution, being found for the first time in southern Spain in 2001. Subsequently, it spread to the north, reaching the southern citrus crops of the Comunidad Valenciana, the main citrus producing region in Spain. In this area, the predominant phytoseiid mite is *Euseius stipulatus* (Acari: Phytoseiidae), which plays an important role in keeping the citrus red mite, *Panonychus citri*, under control. In order to verify the predatory potential of *E. stipulatus* on *E. orientalis*, developmental time, survivorship and oviposition rate of females on the first seven days of the reproductive period were studied under constant laboratory conditions (25 ± 1˚C, RH 65 ± 5%, photoperiod 16L: 8D h). Mites were kept individually in rearing units with a mixture of all developmental stages of prey *ad libitum*. Developmental time from egg to adult was 6.6 ± 0.7 days for females and 6.3 ± 0.9 for males, with an immature survival of 35%. Mortality was higher during larval period (52.3%), decreasing progressively for protonymphal (26.2%) and deutonymphal stages (21.5%). The percentage of fertile females was about 60%. There was considerable variation between individual females for both preoviposition period and fecundity rate. Preoviposition period (3.8 ± 1.39 days) was abnormally long and ranged from 2 to 6 days. Survivorship of adult females at the end of the seven days was 27%. Total fecundity was very low, reaching 1.1 ± 1.81 eggs/female, at a rate of 0.4 ± 0.30 eggs/female/day. Sex ratio of the offspring generation was 37.5% of females. During the trials we observed the presence of white coloration in the opisthosoma of many immature stages and adults, caused by large amounts of guanine crystals inside the excretory system which could affect the mite's performance. Some authors have related these symptoms to a deficient diet. These results show that *E. stipulatus* is able to complete its life cycle when feeding on *E. orientalis*, despite the high mortality, but its reproductive parameters are very low and the production of eggs almost null, indicating that this prey is not a suitable food for that predator. In the worst case scenario, the spread of the pest throughout the whole citrus production area may disrupt the implementation of IPM programs where *E. stipulatus* is a key natural enemy of citrus red mite.

Tuesday 24, Afternoon, Room 6

168 - Morphometrics and host specificity in Laelapine Mites (Acari: Laelapidae)

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The taxonomy of laelapine mites associated with neotropical small mammals has a solid, though conservative foundation. However, because of growing concern over habitat destruction and threats to biodiversity, a new emphasis has arisen about species delimitation, the methods by which species boundaries are determined and new species are discovered. Species are the fundamental units of analysis in conservation biology, but also in ecology, biogeography, and evolution. The failure to correctly diagnose the species boundaries of both mites and mammals continues to confound any effort to understand their coevolutionary history. The laelapine mite genera *Gigantolaelaps* and *Laelaps* are highly host specific in the Neotropics, occurring almost exclusively on sigmodontine rodents of the tribe Oryzomyini. We use traditional morphometric analyses to reveal that many nominal species of these mite genera that are thought to have polyxenous host associations are actually comprised of a complex of distinct morphological species, each exclusively associated with a single host species. To explore the relationship between host phylogeny and host ecology, we describe the morphological variation of polyxenous and pleioxenous *Gigantolaelaps* and *Laelaps* from two contrasting assemblages of small mammals: (1) five species of relatively unrelated (noncongeneric) sigmodontine rodents that share a common palustrine habitat, and (2) a group of rodents that are closely related phylogenetically, and seldom collected sympatrically. The future of systematic research with laelapine mites is certain to be highly productive, based on both traditional and modern approaches. The priority of this research should be the establishment of concordances in species boundaries based on molecular phylogenetic and classical taxonomic methods, based on morphological and host association characters.

Thursday 26, Morning, Room 6

169 - Low temperature and high humidity as a strategy for long-term storage of a predatory mite *Neoseiulus californicus* (Gamasida: Phytoseiidae)

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The survival rate of an indigenous Japanese strain of *Neoseiulus californicus* (McGregor) was investigated under 5°C and two relative humidity (RH) conditions (77% and 96%). Six life stages (egg, larva, protonymph, deutonymph, adult mated and un-mated females) were tested in a polypropylene vial (1.5 mL). The inside RH condition was controlled by providing a water-saturated filter paper. Generally, the mean and the median survival time (LT_{50}) were longer under 96% than those under 77%. The larval stage was an exception to this rule, as the survival rate under 77% was higher than that under 96%, probably due to hypersensitivity of larvae to high humidity. The mean and LT_{50} for adult mated females was longer than two months under 96%. This result can contribute for construction of an efficient storage system for *N. californicus*. The effect of RH on survival time of different life stages will be discussed.

Tuesday 24, Afternoon, Auditorium - Poster

170 - Parasitism by *Rhipicephalus* (*Boophilus*) *microplus* (Canestrini, 1887) in humans in the northern part of Parana State, Brazil

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Rhipicephalus (*Boophilus*) *microplus* is known in Brazil as the cattle tick. After reaching the host, it remains on it for 3-4 weeks, while developing from larva to adult (monoxenic). Parasitism of humans by this species is unusual in Brazil. In the Brazilian literature, there are only two reports of adult males of *R. microplus* parasitizing humans, one in the state of Rondonia and the other in the state of Rio Grande do Sul. During blood feeding, ticks cause spoliation by biting, inflammation, swelling and deformity of the skin at the site of attachment, and inoculate toxins and pathogenic microorganisms through the saliva. The objective of this study was to report a case of human parasitism by a female *R. microplus* and the damage caused at the site of tick attachment. A field collection of ticks was conducted on January 28th, 2010 in the region of Londrina, northern Parana State. While processing them in the laboratory, a tick was observed attached between the researcher's left hand fingers. It was removed and identified as an adult female of *R. microplus*. Immediately afterwards, a red spot containing blood was observed at the site of fixation. A week later, signs of inflammation (redness, mild swelling and little local discomfort) were seen at the attachment site. After another week, the lesion appeared crusty and yellowish. At the end of 17 days, total regression of the lesion was observed. This is the first report of a human parasitism by a mature specimen of *R. microplus* in the State of Parana.

Wednesday 25, Afternoon, Auditorium - Poster

171 - Tick-borne hemoparasites on free-living animals at Grande Sertão Veredas National Park – Preliminary report

A. Girotto[1], J.F. Soares[2], J.A. May Jr[2], T.F. Martins[2], O. Vidotto[1], M.B. Labruna[2] & E.A. Moraes Jr.[3]

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Grande Sertão Veredas National Park (GSVNP), located in the northwestern part of the State of Minas Gerais, Brazil, preserves an ecosystem typical of the Cerrado bioma (Brazilian savannah). Research on parasites of wildlife is crucial for sanitary studies of a population as well as for environmental quality, making it easier to understand host-parasite interactions. Ticks are vectors of pathogenic microorganisms, including viruses, bacteria and protozoa. In this context, the objective of this study was to investigate the presence of ticks and tick-borne hemoparasites in free-living Carnivore mammals from GSVNP. From July 2009 to March 2010, a puma (*Puma concolor*), an ocelot (*Leopardus pardalis*), two bush dogs (*Cerdocyon thous*) and four maned wolves (*Chrysocyon brachyurus*) were captured. After physical and chemical contention, ticks were collected from them, as well as blood in EDTA-tubes. In the laboratory, ticks were morphologically identified to species. Blood samples were individually subjected to DNA extraction and tested by polymerase chain reaction (PCR) for tick-borne agents. A total of 145 ticks were collected, represented by larvae (11), nymphs (57) and adults (77). Collected ticks were identified as *Amblyomma cajennense*, *Amblyomma triste*, *Amblyomma tigrinum*, *Amblyomma parvum* and *Rhipicephalus* (*Boophilus*) *microplus*. All but one of the captured animals hosted at least two tick species. In blood analyses, all samples amplified a fragment of 370-bp of the 18S rRNA gene of *Babesia* spp., and five of them amplified a 670-bp fragment of the 18S rRNA gene sequence of *Hepatozzon* spp.. A male bush dog and two female maned wolves were the negative animals for *Hepatozoon*. There was no PCR amplification for *Coxiella* spp. or pathogens of the Anaplasmataceae. DNA sequencing of the PCR products is in progress. Our preliminary data show that at least 5 tick species parasitize free-living Carnivore hosts at the GSVNP, and that these animals are infected by tick-borne protozoa. This research was financially supported by Fapesp and CNPq.

Tuesday 24, Morning, Room 3

172 - The effect of habitat disturbance and anthropogenic transportation on the evolution of acaricide resistance in the two-spotted spider mite *Tetranychus urticae* (Acari: Tetranychidae)

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Habitat destruction and anthropogenic transfer of organisms by human activities would influence the evolution of adaptive traits in the populations of organisms. Here I present two case studies for evolution of acaricide resistance in the two-spotted spider mite, *Tetranychus urticae*, concerning this issue. At first I examine the effect of variation in host plant characteristics on the development of acaricide resistance in the two-spotted spider mite (green form). This investigation examined the geographic variation in allozyme allele frequencies and in the degree of resistance to two new types of acaricide, pyridaben and fenpyroximate. From mortality tests at field-level concentrations of the acaricides, many populations collected from fruit trees and roses had a high frequency of resistant individuals for acaricides while almost all populations collected from herbaceous crops had low frequencies of resistant individuals. These results, combined with those from an allozyme study, indicate that patch size and persistence of host plants regulate the population structure of the mites, including gene flow between populations, and, by extension, the development of acaricide resistance. Next, I examine that the international trade of plants could cause biological invasion of the mite populations, with the consequent introduction of new acaricide resistance gene. I investigate mtDNA variations and the degree of resistance to a new type of acaricide, Fluacrypyrim, in two-spotted spider mite (red form) populations collected from various host plants in various sites. Some of the populations on carnation showed highly diverged DNA sequences and high resistance against the acaricide. It is considered that such populations were introduced from various countries on carnation seedlings. This result suggested the global genetic diversity of acaricide resistance. From these two studies, we can conclude that we must take both the local meta-population structures and global genetic divergence of mite populations into consideration to assess the risk of development of acaricide resistance.

Monday 23, Afternoon, Room 1

173 - The collapse of host-parasite co-evolutionary history caused by biological invasion

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Habitat destruction and anthropogenic transfer of organisms by human activities would cause collapse of co-evolutionary history between host and parasite, which would result in pandemic of parasites. To know the bio-diversity of parasites and trace their evolutionary history will be very important process for human to construct symbiotic relationships with parasites. We here would like to discuss the risk of collapse of co-evolutionary system caused by human activities, investigating phylogeny and ecology of parasitic mites attaching with bumblebees and stag beetles. The bumblebee tracheal mite *Locustacarus buchneri* is an endoparasitic mite specific to bumblebee species and distributed widely in the Eurasian Continent, North American Continent and those surrounding islands. We investigated mtDNA variations of both the parasitic mites and host bumblebees collected in Europe, China, Japan, Canada and USA, and revealed that the birthplaces of the parasite and host species are different; bumblebees originated in Eurasia and the parasitic mite originated in North America. It is considered that the mite host-switched from some original hosts to bumblebees since bumblebees expanded their distribution to the North America about 20 million years ago. The lucanid mite *Canestrinia spectunda* is a hitchhiker specific to the lucanid stag beetles and considered grazing mold on the surface of host beetles. We collected the stag beetles associated with the mites from various sites in the Asian area and investigated the mtDNA variation of them. It was revealed that the mite and lucanid stag beetles originated from same area and had co-speciated living more than 12 million years. Both the bumblebees and stag beetles have been artificially transported in large amounts between countries as agricultural pollinators and pet animals, respectively, so that it is feared that the long histories of co-evolution and co-speciation between the parasitic mites and host insects will be disturbed by introduction of the new hosts and parasites. Host-switches of invasive parasites without evolutionary process may cause unpredicted impacts on the native species. Thus, to trace the history of relationship between host and parasite

will make it possible to assess the ecological risks of anthropogenic transportation of organisms from the view point of introduction of parasites. For example, in the case of the chytrid fungus *Batrachochytrium dendrobatidis* which is an emerging disease of amphibians, it is expected to reveal the mechanism of the disease pandemic occurring especially in the Latin America and Oceania by reconstructing the co-cladogenosis between host and parasite. Although the strategies for conservation of biodiversity are discussed intently in the world recently, the importance of diversity in parasites and microorganisms attract little attention. We would like to emphasize the significance of parasite diversity.

Thursday 26, Afternoon, Auditorium - Poster

174 - Artificial feeding of partially engorged female ticks with monoclonal antibodies against the gut of *Rhipicephalus microplus* and evaluation of its effects on parasite physiology

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The cattle tick *Rhipicephalus microplus* is an ectoparasite harmful to livestock, and vector of disease agents that affect the production of meat, milk and leather quality. The acaricides are the most widely used control method. The production of vaccines is studied as an alternative to control this tick, and in this context the identification of target proteins that can be used as vaccine immunogens. Monoclonal antibodies can be used to identify and characterize antigens that can trigger immune protection. Artificial feeding of partially engorged female of *R. microplus* through microcapillaries with monoclonal antibodies produced against antigens of the parasite is a practical alternative for preliminary testing of the effects of immunoglobulins in the physiology of the parasite. Clones producing monoclonal antibodies BrBm2, BrBm12 and BrBm32 against proteins from the gut of partially engorged female of *R. microplus* were used for production of ascites in mice BALB/c. The antibodies present in ascites were purified by affinity chromatography resin bound to protein G. For artificial feeding, the ticks were divided into groups (fed with blood with addition of the monoclonal antibodies or enzyme inhibitors only with blood or blood with addition of PBS). The results of artificial feeding showed that ticks weighing approximately 30 to 70 mg are capable of better nutrition through microcapillaries and often peak at more than double their initial weight after 24 hours of feeding. Females with weight over 70 mg showed a degree of mobility, even when fixed with double face tap, being able therefore to reject the microcapillary. Results showed that artificial feeding of ticks proved to be a viable technique for studying the effects of antibodies or drugs in the physiology of the parasite. However, the ticks fed monoclonal antibody BrBm2, BrBm12 or BrBm32 did not show a reduction in oviposition and hatching of larvae. New monoclonal antibodies against the gut and embryo of *R. microplus* will be tested in experiments of artificial feeding. This research was financially supported by CNPq, FAPERGS, CAPES, FAPERJ, INCT-EM and CAPES-PROCAD.

Tuesday 24, Afternoon, Auditorium - Poster

175 - Laboratory tests to determinate acaricidal activity of plant extracts against the mite *Oligonychus* (*Reckiella*) *zeae* (McGregor)

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The aim of this study was to test the acaricidal activity of different concentrations of ethanol extracts of creosote bush (*Larrea tridentata* DC), Mexican oregano (*Lippia graveolens* HBK), sweet marigold (*Tagetes lucida* CAV) and rosemary (*Rosmarinus officinalis* L) against the mite *Oligonychus zeae*. Plants were collected from natural habitats in the state of Durango, Mexico from March to June 2008. Ethanol extracts obtained from dry plant samples were diluted with distilled

water to 0.01, 0.1, 1, 2, 3, 4 and 5%. Laboratory bioassays with adult female mites were conducted on consecutive days by the leaf arena technique. Mite mortality was recorded at 24 h for the different treatments and corrected with the Abbot's formula to account for control mortality. Four replicates of each concentration of each extract were used. The mortality data were subjected to an analysis of variance (ANOVA) and Tukey's tests were performed to test for differences in percentage mortality of *O. zeae* between dilutions of ethanol extracts. Mite mortalities in different treatments were analyzed in a completely randomized design. Mites treated with 5% extracts of creosote bush, oregano, rosemary and sweet marigold had a mortality of 98% or more. Rosemary extracts at concentrations of 2, 3 and 4% caused mite mortality of 88%. Mexican oregano and sweet marigold extracts at 4% concentration caused a mite mortality of 72 and 82%, respectively. A 3% extract of creosote bush resulted in a mite mortality of 86%. Concentrations lower than 2% of the four extracts merely induced 10% mite mortality. The results of this research suggest the potential acaricidal activity of plant extracts, warranting further investigations so that they can be included in pest management programs of various crops infested by *O. zeae*. This research was financially supported by SAPPI-Instituto Politécnico Nacional for financial support for this project (20050288).

Thursday 26, Morning, Room 2

176 - Seasonal changes of spider mite (Tetranychidae) density and species composition on a weed and soybean

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Species identification of spider mites based on morphological characteristics is difficult because morphological differences may be subtle and are usually apparent only in male adults, which are hard to find. As an alternative method, we were able to discriminate females of each of the 13 known Japanese *Tetranychus* species using phosphoglucomutase (PGM) zymograms. During 3 years, we examined the species composition and seasonal density changes on kudzu vine (*Pueraria lobata* [Willd.]), a leguminous weed (1997-1999), and on soybean, *Glycine max* (L.) (1999-2001), using PGM zymograms. On kudzu vine, five spider mite species were sampled and *Tetranychus puearicola* Ehara & Gotoh was most abundant throughout the survey period (accounting for 75.6-96.9% of all females). Spider mite populations showed two types of seasonal fluctuation on kudzu vine: one was characterized by a single peak in September or October, and the other by two peaks, first in June, then in September. On soybean, six species were found and the most abundant species varied between years: *T. puearicola* (54.7%) in 1999, *T. parakanzawai* (72.6%) in 2000 and *T. kanzawai* (69.2%) in 2001. Such annual variation in dominant species is probably determined by the species that first invades the soybean fields, after the start of cultivation. Spider mite populations showed three types of seasonal fluctuation on soybean: the first was characterized by one peak in August, the second by two peaks (August, November), and the third by three peaks (June, August, October).

Thursday 26, Afternoon, Auditorium - Poster

177 - Mites associated with the Eared-dove (*Zenaida auriculata* Des Murs, 1847), in the region of Campinas, São Paulo State, Brazil

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Columbiformes are synanthropic birds of worldwide distribution. They are considered a pest in many regions, because of crops' destruction and disease transmission. *Zenaida auriculata* Des Murs, 1847 (Columbiformes: Columbidae) occurs from Antilhas to Tierra del Fuego, throughout most of Brazil. The mites associated with birds have different relationships with their hosts, ranging from accidental association to true parasitism (ecto- and endoparasitism). The data concerning mites associated with birds (nest, feather, quill, skin, aerial passages and subcutaneous mites) is poor; more study is needed on the subject of mites associated with birds, such as *Z. auriculata*, which occupies urban environments. This study aimed to

add information on the species of mites associated with *Z. auriculata* in the region of Campinas, SP [Campinas (22°49’11’’S, 47°4’12’’W, alt. 604m), Valinhos (22°58'14"S, 47°59'45"W, alt. 660m), Jaguariúna (22°42'20"S, 46°59'09"W, alt. 584m), Santa Bárbara D´Oeste (22°45'13"S, 47°24'49"W, alt. 565m)] and in Ourinhos (22°58'44"S, 49°52'14"O, alt. 483m). The Department of Animal Biology, Biology Institute, UNICAMP, receives corpses for analysis of mites. The birds were washed in 70%-alcohol solution and detergent, and agitated and filtered to collect the mites. After the filtration through filter paper, the mites were manually collected, maintained in lacto-phenol solution, for hydration and initial clarification for a few days. The mites were mounted on microscope slides with Hoyer´s medium. The identification was performed with the help of taxonomical keys of mite species and literature on the subject. A total of 34 samples were analyzed, and on three of them, there were no mites. As a result, we had representatives from the following suborders: Astigmata: Falculiferidae (*Falculifer isodontus* – 100% of samples, *Byersalges talpacoti* – 32,25% and *Pterophagus spilokyus* – 25,8%); Dermoglyphidae (*Dermoglyphus* sp. – 6,45%); Analgidae (*Diplaegidia columbigallinae* – 32,25%, and *Diplaegidia columbae* – 9,67%); Epidermoptidae (Epidermoptidae sp. – 3,22%); Pyroglyphidae (Pyroglyphydae sp. – 3,22%) and Hypodectidae (*Hypodectes propus* – 3,22%), Mesostigmata: Macronyssidae (*Ornithonyssus bursa* – 16,12%); Rhinonyssidae (*Tinaminyssus zenaidura* – 6,45%); Prostigmata: Cheyletiellidae (Cheyletiellidae sp. – 3,22%, *Ornithocheyletia* sp. – 6,45%) and Syringophilidae (*Peristerophila zenaidura* – 6,45%). The occurrence of *Hypodectes propus* (subcutaneous deutonymphs parasites) and *Byersalges talpacoti* are reported for the first time in the adult form of this host. 14 species of mites were found, distributed as follows: Astigmata 9, Prostigmata 3 e Mesostigmata 2. One species was in the respiratory system; four on the skin; one was hematophagous; two of quill mites; six were feather mites. Voucher specimens were deposited at a collection of Department of Animal Biology, Biology Institute, UNICAMP, in addition to photographs of nests, birds and mites (virtual collection).

Wednesday 25, Afternoon, Auditorium - Poster

178 - Effect of Cry1F Bt corn containing, event TC1507, on non-target arthropods that inhabit the soil

R. Gravena[1], S. Gravena[1], A.C. Santos[2], G. Kuhar[3], L.C.S. Amorim[1], S.R. Benvenga[1] & T.M. Bortolin[1]

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The objective was to evaluate the impact of transgenic corn hybrids containing the event TC1507 (Cry1F) on populations of non-target arthropods that inhabit the soil. The study was conducted in Itumbiara-MG and Toledo-PR. The treatments consisted of a Bt maize hybrid (Cry1F, event TC1507), the conventional hybrid without application of pesticides and conventional hybrid with insecticide applications. The insecticides used in the latter treatment were methomyl at 129 g ai/ha, lambda-cyhalothrin at 7.5 g ai/ha, and lufenuron at 15 g ai/ha; each was administered in a foliar application at V8; V11-V12; VT and V3-V4; V7-V8; V11-V12 stages of the crop to Itumbiara-MG and Toledo-PR respectively. Six soil samplings were conducted in each area during the season from V2 to R3 stages. The separation and quantification of arthropods was done through the method of Berlese-Tullgren and subsequent screening. The treatments did not differ considering the diversity and evenness indexes and multivariate analysis of principal components. The main order, in terms of abundance, was Oribatida (Acari), followed by Gamasida (Acari), Coleoptera (Insecta) and Hymenoptera (Insecta). The main arthropod morphospecies were termed as Microzetidae sp.1 (Oribatida), Scheloribatidae sp.1 (Oribatida), Galumnidae sp.1 (Oribatida), *Parasitus* sp. (Gamasida) and *Monomorium pharaonis* (Formicidae). Treatment with insecticides negatively affected the population of the ant *Monomorium pharaonis*. The transgenic maize expressing the Cry1F protein (event TC1507) did not cause significant impact on populations of soil arthropods.

Monday 23, Afternoon, Room 1

179 - The genomics of herbivore-plant interaction: whole genome sequence of *Tetranychus urticae* provides novel genomic tools for dissecting plant-pest relationship

V. Grbic[1], R. Clark[2], S. Rombauts[3], Y. van de Peer[3] & M. Grbic[1]

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In response to herbivore attack, plants have evolved a variety of mechanisms to deter herbivore feeding, which prevent the herbivores from jeopardizing the plant's health, reproduction, and ultimately survival. Understanding the fundamental mechanisms of plant resistance to pest and interactions between plant and herbivores represent the basis for breeding of pest-resistant crops. The current need for novel methods of pest control coincides with unprecedented advances in genomic analyses of crop plants that open novel avenues for biotechnology. In contrast, genomic resources for pest species, necessary for the development of new control strategies, are lagging behind. Thus, the current gap in knowledge about pest genetics, genomics and genomics of plant-pest interactions is a major obstacle for the detailed understanding of plant-pest relationship. The whole genome sequencing of the two spotted spider mite, *Tetranychus urticae* led by our group generated the first chelicerate whole genome and novel genomic resources in one of the major agricultural pests. *T. urticae* is a generalist herbivore and major agricultural pest that feeds on more then 1000 plant species (about 150 of which are of economic value). Conveniently, *T. urticae* develops on the model plant *Arabidopsis*, allowing utilization of the plethora of genomic tools available in this plant model species to dissect plant-pest interactions. We characterized the differential resistance among natural *Arabidopsis* accessions to spider mite damage and isolated *Arabidopsis* accessions resistant and susceptible to *T. urticae*. In addition, we profiled the transcriptome of naturally resistant and susceptible *Arabidopsis* accessions upon spider mite feeding using ATH1 *Arabidopsis* microarray. We isolated more that 500 genes induced by spider mite feeding in susceptible and resistant *Arabidopsis* ecotypes, including potential candidate genes for plant resistance to spider mites. In addition to plant response we analyzed the transcriptome of *T. urticae* feeding on resistant and susceptible plants using RNAseq technology. Mapping the transcripts to the *T. urticae* genome allowed us to determine genes and genetic pathways that are underlying herbivore response to susceptible and resistant hosts. Our screen for natural variation of plant resistance and herbivore transcriptome profiling represents the first systematic step toward uncovering elements of plant-pest interaction on the genomic level. This approach has a potential to isolate plant and pest genes for breeding/biotechnological modification of crop plants for resistance against major pest in agriculture.

Monday 23, Afternoon, Room 1

180 - The first chelicerate genome of a major agricultural pest, spider mite *Tetranychus urticae*, an emerging model for plant-herbivore interactions

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Chelicerates (scorpions, horseshoe crabs, spiders, mites and ticks) are the second largest group of terrestrial organisms after insects. The basal phylogenetic position of Chelicerates within the phylum Arthropoda makes this group essential for understanding the evolution of various arthropod lineages. Chelicerates contain economically important species including major agricultural pests (spider mites) and vectors of human diseases (ticks). While genomic resources in more modern arthropod groups such as insects and crustaceans are available there was so far no whole genome sequence of the

Chelicerate. The two-spotted spider mite (TSSP) *Tetranychus urticae* is a plant-feeding mite representing a major pest in agriculture world-wide. This polyphagous species feeds on over 1000 plant species including species known to produce toxic compounds. The TSSP is a major pest in greenhouse production, destroying tomatoes, peppers and cucumbers as well as annual and perennial crops such as maize, soy and deciduous fruits. Currently mites are controlled by pesticides but *T. urticae* is notorious for its ability to rapidly develop resistance to almost all chemicals used for its control and is considered 'the most resistant agricultural pest', based on total number of pesticides to which resistance has been determined. The whole genome sequencing and genome analysis of the *T. urticae* performed by our team revealed that TSSP has a tiny genome (75% *Drosophila* genome) that contrasts the gigantic genome of the related tick (2.7Gbp). Our work on the genome annotation reveals numerous changes of the TSSP hormonal milieu relative to insects, immune system, unusual Hox complex, patterning genes, proliferation of the detoxyfication genes (explaining enormous host range), methylation kit, RNAi machinery that is different from insects and sex-determination cascade. In addition to the genome annotation we performed extensive genome analysis including transcriptome profiling, micro RNA detection, DNA methylation patterns, transposone analysis and analysed experimentally plant response to mites and mite response to the plant hosts. This first Chelicerate whole genome sequence forms a major genomic resource in this group and will serve as a master genome for the future work in this important group of cosmopolitan agricultural pests.

Thursday 26, Morning, Room 5

181 - Search of *Rickettsia* spp. in the ticks *Amblyomma cajennense* and *Amblyomma dubitatum* in an endemic area for spotted fever in the Juiz de Fora County, Minas Gerais State, Brazil

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The present study evaluated the rickettsial infection in ticks *Amblyomma* spp. collected in April 2008, near the Paraíbuna River, Juiz de Fora County, Minas Gerais State, Brazil, an endemic area for Brazilian Spotted Fever (BSF). This location is surrounded by the Krambeck Forest, an Atlantic Forest remain in an urban area, where the constant presence of horses and capybaras with positive serology for *Rickettsia rickettsii*, and the recent occurrence of human cases of BSF (caused by *R. rickettsii*) occur. A total of 14 free-living adults ticks (10 *Amblyomma cajennense* and 4 *Amblyomma dubitatum*) and 289 parasitic life adults ticks (288 *A. cajennense* and 1 *A. dubitatum*) were tested individually by polymerase chain reaction (PCR) targeting a fragment of the rickettsial citrate synthase gene (gltA). No tick was shown to contain rickettsial DNA. These results support the idea that, not always, the relationship between rickettsia and their arthropod hosts is safe. The infection in the tick, for example, may be incomplete, aborting thus the transmission of rickettsia. It may still happen, even with infection rickettsia in the tick, reduced viability, fertility and even death of the arthropod after a few generations. This is contrary to the concept that the vector can be used, indefinitely, as a reservoir. The bacteria is also hereditarily transmitted between successive generations of a tick population, but only this mechanism is not enough to keep an active transmission to the host over time. There is laboratory evidence that *R. rickettsii* is pathogenic to tick vector.

Thursday 26, Afternoon, Auditorium - Poster

182 - Pollen as alternative food for *Neoseiulus californicus* (Acari: Phytoseiidae)

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The increase of plant diversity in agricultural systems can enhance the abundance of some natural enemies, by improving the availability of alternative food (nectar, pollen and honeydew) and shelter. Strawberry is an important crop in the orchards of

La Plata (Buenos Aires, Argentina). *Neoseiulus californicus* is a generalist predatory mite of spontaneous presence in strawberry crops and associated wild plants. It plays an important role in limiting the abundance of the main pest of this crop, *Tetranychus urticae* (Acari: Tetranychidae). Plant diversity could promote the persistence, in space and time, of this predator in the crops. The aim of this work was to determine whether pollen of strawberry and some wild plants constitute alternative foods to *N. californicus* in the orchards. Leaves and flowers of wild plants associated to strawberry crop were sampled monthly from April 2005 through March 2009. *N. californicus* and *T. urticae* presence was registered. Flowers of strawberry and the wild plants where the predator was observed were collected and pollen of each one was extracted. Eggs 24h old were put individually on strawberry discs, in a Petri dish. After eclosion, pollen of each plant was offered "*ad libitum*" to the nymphs. The control treatment was *N. californicus* fed with *T. urticae* eggs, nymphs and adults. The experimental conditions were 25 ºC, 60-70% RH and 14:10h L:D. Developmental time from egg to adult of *N. californicus* was registered in each treatment. Data were analyzed by ANOVA. The predator was registered in 13 out of 56 sampled plant species and it occurrred along with *T. urticae* on *Urtica dioica*, *Convolvulus arvensis*, *Dipsacus fullonum*, *Lamium amplexicaule*, *Morus alba* and *Picris echioides*. On *Sonchus oleraceus*, *Polygonum aviculare*, *Lolium multiflorum*, *Galega* sp., *Taraxacum officinale*, *Echinocloa crusgalli* and *Anoda cristata*, this predator could be feeding on pollen since its presence was coincident with the flowering of these plants and in the absence of *T. urticae*. The pollen of *U. dioica*, *S. oleraceus*, *L. multiflorum*, *P. echioides*, *E. crusgalli*, *P. aviculare*, *L. amplexicaule* was tested as food. The developmental time of *N. californicus* differed significantly among foods. Developmental time feeding on *S. oleraceous* pollen (6.96 ± 1.02d) was higher than on strawberry pollen (6.00 ± 0.98d), *U. dioica* pollen (5.71 ± 0.76) and on *T. urticae* (4.53 ± 0.79). *N. californicus* did not complete development, reaching only the protonymphal stage when feeding on pollen of *P. echioides*, *E. crusgalli* and *P. aviculare*. The results indicate that *N. californicus* can reach the adult stage but at lower developmental rate when feeding on pollen of some wild plants than when preying on *T. urticae*. These plants bloom in different seasons, so alternative food for the predator would be available throughout the year. While it is unknown whether the predator can reproduce with this food, its persistence in strawberry orchards would be favored.

Thursday 26, Afternoon, Auditorium - Poster

183 - Cloning and characterization of the gene of phosphoenolpyruvate carboxiquinase (PEPCK) of the tick *Rhipicephalus* (*Boophilus*) *microplus*

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The tick *Rhipicephalus* (*Boophilus*) *microplus* is an ectoparasite that causes economic losses in the extensive cattle production world-wide. The existing control methods can cause damage to animal and human health besides contributing for the selection of resistant parasites. Thus the development of a vaccine against this vector presents as a promising alternative control method and depends on the identification and characterization of molecules involved in the tick physiology. The embryogenesis of oviparous organisms occurs in the absence of exogenous nutrients, being dependent on the maternal reserve stored in the oocyte and also of the capacity of the embryo to mobilize energy through specific metabolic pathways. Phosphoenolpyruvate carboxykinase (PEPCK) is a key enzyme involved in the gluconeogenesis pathway in many organisms. It is responsible for the catalyses of oxaloacetate in phosphoenolpyruvate, being involved in metabolic pathways at the intersection of the glycolysis, gluconeogenesis and Krebs cycle. The objective of the present study was the cloning of the coding region and the analysis of the relative transcription of the gene of the PEPCK in different tissues. Primers were designed for PEPCK coding region and a product of 1908 pb was amplified in PCR and ligated into plasmid pGEM-T. *Escherichia coli* TOP 10 strain was transformed with the plasmid. Subsequently, the coding region was sub-cloned in

the pET5a expression vector and the identity of the clone was confirmed by PCR, hydrolysis with restriction enzymes and sequencing. The expression of recombinant protein is in progress. By qPCR, it was showed that the presence of the relative transcription of the gene of PEPCK in different organs of the tick being higher in the ovarian of the partially engorged females and in the fat body of engorged females. In the first days of the embryogenesis the relative transcription is high, following a decline in the third day and increasing again in the fifteenth day. In the larvae the relative transcription had a peak in the fifth day decreasing until the end of the larval development. These data suggest that the PEPCK is involved in the glucose balance during the embryonic development of *R. microplus*. Interestingly, a contig named 3947 was identified in a cDNA library of *R. microplus* presenting similarity with the PEPCK gene already characterized. This data suggest that the tick has two genes of PEPCK, important in the determination of tissue expression of each gene. Thereby, primers for the qPCR of the contig 3947 are being designed to the investigation of the relative transcription of this gene in different tissues of the *R. microplus*. This research was financially supported by CNPq, FAPERGS, CAPES, FAPERJ and INCT-EM.

Tuesday 24, Morning, Room 6

184 - Diversity, bio-ecology and management of mites infesting medicinal & aromatic plants in India

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In the present decade, the medicinal and aromatic plants (MAP) are receiving global attention due to their multifarious uses in diverse aspects like herbal drugs for human beings and veterinary animals, phytochemicals, phytopesticides, cosmetics, toiletries, food supplements and nutraceuticals, dyeing, colouring and flavouring agents, etc. Despite the manifold importance of MAP, not much study has been undertaken in the world in general and India in particular on mite pest complex of these plants though the MAP are often severely attacked by mites. The present paper deals with diversity of mites on MAP and their bio-ecological aspects. The study reveals the occurrence of 266 species of mites under 18 families and 75 genera belonging to 3 orders. Of these, 208 species under 65 genera and 7 families belong to phytophagous group (23 are important pests), 55 species under 17 genera and 10 families belong to predatory group (4 are important predators) and 3 species under as many genera and 2 families belong to fungivorous group. The phytophagous group includes Tetranychidae, Tenuipalpidae, Tarsonemidae, Eriophyidae, Nalepellidae and Rhyncaphytoptidae. The predatory group includes Phytoseiidae, Ascidae, Anystidae, Bdellidae, Cheyletidae, Erythraeidae, Eupodidae, Cunaxidae, Stigmaeidae and Tydeidae. The present communication, apart from documenting the diversity of mites of MAP, also includes observations on seasonal occurrence of these mites on 3 species of MAP viz., *Ocimum sanctum* L., *Withania somnifera* L. and *Raulvolfia serpentina* Benth ex Kurz, all very important medicinal herbs. The results of evaluation of some green pesticides like extracts of *Ocimum sanctum*, *Azadirachta indica*, *Pongamia pinnata*, *Vitex negundo*, etc. are also included. The presentation of this work was made possible by a grant provided by TWAS – The Academy of Sciences for the Developing World.

Thursday 26, Afternoon, Room 6

185 - Effects of encapsulated *Humulus lupulus* L. (Cannabaceae) extract to two-spotted spider mite, *Tetranychus urticae* (Acari: Tetranchidae)

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The project deals with selection and use of natural compounds, preferably from *H. lupulus* extract,

which are effective against agricultural pests in order to encapsulate them into a cyclodextrin matrix. The topic of the project fits well the modern guidelines of sustainable agriculture, which require development of technologies and methodologies of pest control as alternative to chemical pesticides. Sustainable methodologies using no-toxic biomatrices were developed to protect plant extracts effective against insect and arthropods. As result, plant extract is protected from oxidation and degradation; it is more handle, less lipophilic, more bioavailable than in net form. The new preparation biomatrix-plant extract allows the preparation of aqueous solutions for spray application. Literature data on chemical composition of *H. lupulus* extract showed many compounds, roughly belonging to two main families: xanthohumols (prenylated chalcone) and humulones or α-iso-acids (prenylated cyclobutenones). α-iso-acids are the major components of *H. lupulus* extract used in the project. The extract, a sticky brown oil, was analyzed by Nuclear Magnetic Resonance (^{1}H NMR) at 400MHz (Varian VXR 5000 spectrometer) in different denaturated solvents ($CDCl_3$, DMSO-d_6 and D_2O) to identify the most significant peaks and to correlate them to α-iso-acids isomers. Several attempts have been carried out to select the best conditions to prepare a homogeneous powdered encapsulated complex cyclodextrin-based. The higher insecticide activity of the total extract compared to different fractions was taken in account. The preparation of the complex cyclodextrin-based was carried out to achieve the total extract as a light yellow solid having a ratio 1:3 respect to □CD. The solid, less odourless, is easily handling and dosing. *H. lupulus* extract both in net form and in beta-cyclodextrin-complex was subjected to biological evaluation to test synergist and acaricidal effects. Effect of *H. lupulus* extract complexed in beta-cyclodextrin was evaluated in lab and greenhouse against *Tetranychus urticae* with *Humulus l.* extract in net form as control. Live mites were detected at 0, 12, 24 and 48 h after spraying an aqueous solution of *H. lupulus* extract complex at different concentrations. Test was carried out in 5 replicated assays. Further and more careful experiments carried out with half amount of extract complexed in beta-cyclodextrin manifested comparable activity (number of live mites) and release in 48 h compared to double amount of *H. lupulus* extract active in only 24h. Moreover, *H. lupulus* extract complexed in beta-cyclodextrin is easier handling and dosing than in net form and it forms aqueous solution for spray applications. In the experimental series no significant improvement was detected in *H. lupulus* extract complexed. Effects of complex have increased after 72h and 96h. This result indicated good complex stability.

Tuesday 24, Afternoon, Auditorium - Poster

186 - Mites of parks and ornamental gardens in Bucharest urban area

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In developed countries with high urbanization level, the conservation and creation of green areas represents an important mean to protect human beings and their environment. Recent climatic changes have allowed the multiplication and the development of several pest mites on plants of parks and ornamental gardens. These negatively affect the beauty of the plants and the grey of the buildings becomes infinite. The paper presents the mite species of woody and flower plants of urban areas, parks and ornamental gardens in northern Bucharest. It describes the frequency of occurrence, the host plants, the conditions favoring attacks, the impact of plant anesthetic and possibilities of control. Excessive drought and high temperatures in summer months have favored the development of phytophagous mites. Species found belong to the families Tetranychidae (*Tetranychus urticae* Koch, *Eotetranychus tiliarium* Hermann), Eriophyidae (*Eriophyes tiliae exilis* Nal., *Eriophyes tiliae rudis* Nal., *Eriophyes triradiatus* Nal.) and Tarsonemidae (*Polyphagotarsonemus latus* Banks). Attacked host plants are mainly *Tilia* species (*T. cordata*, *T. platyphyllos*, *T. tomentosa*, *T. americana*), *Salix* species (*S. babylonica*, *S. matsudana* 'Tortuosa'), *Rosa*, *Impatiens* etc. These pests uptake the cellular contents of plants; the leaves become yellow, dry and fall. The loss of leaves in the summer reduces the accumulation of substances that protect the plants from the effects of frost and drought, reducing their ornamental value. A new tetranychid pest, *Schizotetranychus celarius* Banks species, has been introduced to Romania, on *Phyllostachys aureosulcata*; attacked leaves show a distinctive symptom, visible on both sides of the leaf; feeding

site turns white-yellow and may look similar to variegation.

Tuesday 24, Afternoon, Auditorium - Poster

187 - Preliminary analysis of parasitic mites associated with *Mormoops megalophylla* (Chiroptera: Mormoopidae) from Apazapan, Veracruz, Mexico

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The ghost-faced bat, *Mormops megalophylla*, is a new world bat distributed from south Texas to Venezuela and Peru, including some Caribbean islands. It has been recorded from all Mexican states except for Baja California Norte. This species is gregarious, inhabiting caves with high humidity and constant temperature. Despite its wide distribution, knowledge about its associated fauna is still scarce and fragmented. The purpose of this work is to determine mite species associated with *M. megalophylla* and to analyze their ecological parameters at population and community levels. We collected a total of 80 bats from a hot cave, Cueva de los murciélagos, Apazapan, Veracruz (19°35'62"N and 96°69'93"W) from April to November, 2007. Mites were collected from their external surface, including the dorsal and ventral body, wings and tail membrane, ears, and nose. All specimens were fixed in 70% ethanol for taxonomic identification, and deposited in the collection J.B.M.-M., housed at the Laboratorio de Acarología, Facultad de Ciencias, UNAM, México D.F., México. We found 1561 parasites distributed in six families and 17 species: Spinturnicidae (*Cameronieta strandtmanni*), Argasidae (*Antricola coprophilus*, *A. mexicanus*), Myobiidae (*Eudusbabekia ecuadorensis*), Trombiculidae (*Microtrombicula boneti*, *Phalcophila antica*, *Phalcophila postica*, *Beamerella acutascuta* and five udeterminated species), Leeuwenhoekiidae (*Whartonia guerrerensis*, *Whartonia* sp., *Odontacarus* sp.), and Chirodiscidae (*Lawrenceocarpus planirostris*). Although the most abundant group was chirodicids, the trombiculids are the richest group, represented by several species. In contrast, the myobiids and argasids were the least abundant. The most prevalent species was *C. strandmanni*. This gregarious host species is represented in the cave studied by thousands of individuals; it is the most abundant bat species, followed by other mormoopid species inhabiting the cave such as *Pteronotus davyi*, *P. personatus* and *P. parnellii*. Overcrowding of bats promoting mite exchange and the stable environmental conditions in the cave must be referred to as important factors promoting acarine community structure. *Cameronieta strandtmanni* is the only species that has been previously recorded for the state of Veracruz; the remaining species represent new locality records.

Thursday 26, Afternoon, Auditorium - Poster

188 - *Tyrophagus putrescentiae* (Schrank) attacking *Telchin licus licus* (Drury) in a laboratory rearing

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The giant sugarcane borer, *Telchin licus licus* (Drury) (Lepidoptera: Castniidae), is one of the main pests of sugarcane in northeast Brazil. In a study to determine the natural enemies of this pest, immature specimens were collected from several sugarcane fields in Alagoas and Pernambuco States, both in northeast Brazil. They were taken to a laboratory and fed either sugarcane stems or an artificial diet recommended for rearing *Diatraea saccharalis* (Fabr.) (Lepidoptera: Crambidae). In periodic evaluations, white mites were observed feeding on pupae of *T. licus licus* obtained from those larvae. The mites were mounted in Hoyer's

medium on microscope slides and later identified as *Tyrophagus putrescentiae* (Schrank) (Astigmata: Acaridae). This cosmopolitan mite is an important contaminant of stored products in Brazil. It is essentially fungivore, but it can also feed on other substrates. It has been found infesting several stored products and in insect rearing and tissue culture facilities. It has also been reported feeding on soybean plants, as well as on mites and insects: *Apis cerana japonica* (Radoszkowski) (Hymenoptera: Apidae), *Diabrotica undecimpunctata howardi* Barber (Coleoptera: Chrysomelidae), *Lasioderma serricorne* (Fabricius) (Coleoptera: Anobiidae), *Aedes aegypti* (Linnaeus) and *A. albopictus* (Skuse) (Diptera: Culicidae). This is the first record of *T. putrescentiae* infesting the giant sugarcane borer. Further studies should be conducted to determine whether this behavior also occurs in the field and what is the impact of the mite on the population of that insect.

Tuesday 24, Afternoon, Room 2

189 - Genetic diversity of the Lyme borreliosis pathogen within endemic areas, emerging areas and cryptic transmission cycles in the Upper Midwestern United States

S.A. Hamer[1], G.J. Hickling[2], E.D. Walker[3] & J.I. Tsao[1,4]

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Borrelia burgdorferi is an obligate parasite that must live in either a tick or vertebrate host to persist. Consequently, its emergence across a landscape is intimately tied to the movement of its vectors and hosts. For 5 years we tracked the spatial and temporal dynamics of ticks and spirochetes in an invasion zone in lower Michigan: a counterintuitive finding was the detection of *B. burgdorferi* not only at sites that its principal vector *Ixodes scapularis* had invaded, but also at low levels in other tick species and in wildlife at sites where *I. scapularis* was not detected. To better understand this complex system of pathogen maintenance, we compared the genetic diversity and structure of *B. burgdorferi* sampled from cryptic sites and recently-endemic sites in Michigan, and from other sites in the Upper Midwest where Lyme disease has been endemic for more than 30 years. Data from the cryptic sites support our contention that *B. burgdorferi* is being maintained in the landscape, in the absence of *I. scapularis*, through transmission by other vector-competent tick species to wildlife hosts. Data from bird-associated ticks at a site where *I. scapularis* was not detected indicated that a high proportion of the local *B. burgdorferi* consisted of strains that were unique to that site. Some strains were shared with other sites, however, suggesting historical or current dispersal of *B. burgdorferi* between well-separated endemic and cryptic sites, most likely by infected avian hosts. At multi-state scale, analysis of *B. burgdorferi* sampled from questing adult *I. scapularis* from numerous sites across the Upper Midwest that had different *I. scapularis* colonization histories revealed similar levels of genetic diversity, rather than nested subsets, and an overall lack of geographic structure. These large-scale results suggest that the population biology of *B. burgdorferi* is not tied to the spread of *I. scapularis* and rather is enabled, in part, by highly mobile competent hosts and their cryptic competent vectors.

Tuesday 24, Morning, Room 2

190 - Invasion of the Lyme disease vector *Ixodes scapularis*: implications for *Borrelia burgdorferi* endemicity

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Lyme disease risk is increasing in the United States due in part to geographic expansion of populations of *Ixodes scapularis*, the principal vector of the disease agent *Borrelia burgdorferi*. A five-year

study was undertaken to track the spatial and temporal dynamics of an invading population of *I. scapularis* in lower Michigan. We employed mammal, bird and vegetation drag sampling at eight field sites established along coastal and inland transects originating in a zone of recent *I. scapularis* detection. We documented northward invasion of ticks along Michigan's west coast over the study period; this invasion was most evident in data from rodent-associated ticks. *B. burgdorferi* infection prevalences in drag-sampled *I. scapularis* from within the invasion zone were 9.3 and 36.6% in nymphs and adults, respectively. Low-prevalence *B. burgdorferi* infection was also detected, however, in other tick species and wildlife at inland sites where no *I. scapularis* were yet detected. *B. burgdorferi* was also present at northern coastal sites in years prior to the arrival of *I. scapularis*. Other *Borrelia* spirochetes, including *B. miyamotoi* and *B. andersonii*, were present at a low prevalence within invading ticks and local wildlife. These findings suggest that cryptic *Borrelia* spp. transmission by alternative vector-competent tick species is occurring in the absence of *I. scapularis*. Rapid invasion of blacklegged ticks – measurable within a 5-year time frame – into a landscape where cryptic transmission is already maintaining *Borrelia* spp. highlights the complex ecology of Lyme disease emergence in this region of the United States. These findings also have practical application, in that they confirm that wildlife sentinels can provide a valuable early warning of new foci of zoonotic disease emergence.

Friday 27, Morning, Room 3

191 - Coconut destiny after the invasion of *Aceria guerreronis* in India

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Aceria guerreronis has emerged as a common menace to most of the coconut plantations in India. The mite after its first invasion in the central part of Kerala during 1998 exhibited dramatic journeys to North and South regions, engrossing the major coconut cultivating regions of the state. Further, invasive march of the mite helped to conquer adjacent states like Tamil Nadu and Karnataka and Andhra Pradesh. Subsequently the mite succeeded in entering the neighboring islands of Lakshadweep and Sri Lanka exhibiting its severe pest status to the entire belt of the southern part of the Indian subcontinent. Such astonishing rate of spreading of the mite posed many problems, the magnitude of which was well exemplified in the socio-economic set-up of the people. Coconut provides one third of the agricultural income of the regions and more than 10 million people are dependent on this cash crop directly or indirectly through coconut based industries like coir, copra, oil, honey, furniture, handicrafts, beverages, soft drinks, bakery products and so on. The famous 'coconut lagoon ride' in Kerala, being a center of attraction to tourist, earns substantial income to the state. All the above human activities enhancing economic progress of the nation have come to a standstill within a decade after the introduction of the mite. A critical assessment of the various problems created by *A. guerreronis* in the agricultural economy of India would proclaim very many facts. Of these, the economic instability of the coconut farming community and the people employed in coconut based industries rank the highest order. Early settlement of *A. guerreronis* in developing nuts produced several kinds of cracks and crevices inducing heavy husk deformity in addition to severe nut fall. Damaged husk adheres firmly with the shell hindering normal development of the nut resulting pronounced size reduction. Firm adherence and crumbling of the husk eventually result in broken threads of low quality and quantity unacceptable to coir industry. Moreover, stunted and crumbled nuts require extra labour and expense in dehusking. Coconuts invaded by *A. guerreronis* contain far less quantity of juice and edible portions and hence register no market value. The most woeful aspect of mite impact relies on weight loss of copra and consequently of the reduction in the quantity of coconut oil produced. All the above points clearly indicate the alarming situation created by *A. guerreronis* in the agricultural economy of India. Efforts through private, scientific and government agencies though made to pacify the severity of mite attack, are not much encouraging and better results could be obtained. This definitely indicates the need for a Common International Forum to check coconut mite invasion and control on a common manifesto to save coconut plantations throughout the world. The paper further discusses the ways and means for combating the situation on a productive basis. The presentation of this work was made

possible by a grant provided by FACEPE – Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco.

Thursday 26, Morning, Room 3

192 - Oricultural farming practices and rearing of successful oribatid species

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Population of India has now crossed 1 billion people, with an annual growth rate of 2.3%. This increase is estimated to reach over 1,5 billion people by 2020 when there will be an annual requirement of 385 tonnes of food grains. In general, food grains produced through known farming practices in India depend to a greater extent on artificial fertilizers. This has created tremendous problems to the agroecosystem and also proved detrimental to life. Accordingly, a global need has been developed for alternate agricultural practices. In this context, it is all the more pertinent to consider the practical application of oribatid mites in organic farming, the need of the hour. These mites perform several indispensable roles in soil ecosystem of which biodegradation and soil productivity deserve special mention. Soil animals in general, devour a major portion of the litter accumulated, but degradation and subsequent absorption of the highly resistant cellulose material appear to be a difficult task. Except in few instances, most of the ingested plant materials is ejected without much change in nutritive value. Accordingly, major portion of the soil fauna, including mites, is known to be insignificant in terms of actual plant material degradation. However, oribatid mites have proved to be exceptional and instrumental in this respect. They act as important link in humification process by supplementing necessary enzyme complements required for degradation of simple to highly static elements with the help of a variety of gut microbes. These microbes apart from enzyme production may alter the gut condition in accordance with type of plant materials ingested to release required enzyme in time. Such remarkable efficiency of microbial colonies triggers degradation process uninterrupted, allowing the production of organic rich faecal pellets. Production of heaps of faecal pellets enriches nutrient status of the soil as evidenced in the present study. Such high efficiency of the microbes and ultimately of the oribatid mites scores them as better tools in agricultural production and hence the need for organic farming through 'oriculture'. This warrants the scope for exploitation of oribatid mites in organic farming practices and need for culturing of necessary species. Being small, rearing and maintenance of the required species of oribatids in large numbers appear to be mandatory. The paper further elaborates the cultural techniques of the species involved in the study and the relevance of 'Oricultural Technology' in modern agricultural practices. The presentation of this work was made possible by a grant provided by FACEPE – Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco.

Monday 23, Afternoon, Room 6

193 - Systematics and taxonomy of feather mites of the *Pterodectes* generic complex (Astigmatina: Proctophyllodidae: Pterodectinae): opening the black box

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The feather mite family Proctophyllodidae (Analgoidea) is one of the most diverse groups in the cohort Astigmatina, with over 400 species described. This family currently comprises the subfamilies Proctophyllodinae and Pterodectinae, the latter divided into two tribes (Rhamphocaulini and Pterodectini). Before the organization of several disparate forms into discrete genera, most pterodectines were treated as belonging to the heterogeneous genus *Pterodectes*. The genera within the *Pterodectes* group are subdivided into two complexes, the *Montesauria* and the *Pterodectes* generic complexes, the latter comprising six genera which present the male genital papillae situated anterior to the genital arch, and occurring mainly on New World passerines; these genera are: *Amerodectes* Valim & Hernandes, *Berladectes* Valim & Hernandes, *Cotingodectes*

Valim & Hernandes, *Metapterodectes* Mironov, *Pterodectes* Robin and *Tyrannidectes* Mironov. The present study provides an overview of the taxa under this vastly diverse group, in an attempt to start filling the gap in the knowledge of Neotropical pterodectines. These mites have colonized eleven host families of the three major lineages of Passeriformes: the Passerida (Cardinalidae, Emberizidae, Hirundinidae, Icteridae, Thraupidae, Troglodytidae, and Turdidae) host mites of the genera *Amerodectes*, *Metapterodectes* and *Pterodectes*; the Corvida (Corvidae) exhibit so far association with a sole species, *Tyrannidectes crassus*; the Tyrannida (Cotingidae, Furnariidae, and Tyrannidae) host pterodectines of the genera *Amerodectes*, *Tyrannidectes*, *Metapterodectes*, *Berladectes* and *Cotingodectes*. Current data suggest that species of *Amerodectes*, *Tyrannidectes* and *Metapterodectes* have been distributed rather erratically among the three major groups of passerines, probably as result of many cases of horizontal transferring. On the other hand, species of *Berladectes* and *Cotingodectes* were recorded only on South American birds of the Tyrannida (Tyrannidae and Cotingidae, respectively). It is likely that both genera were formed and evolved in the frame of their respective host families. Most of the Neotropical families and species of birds were not thoroughly investigated concerning their feather mite fauna, therefore we expect many more new taxa to be discovered on these birds. We only began to scratch the surface of this vastly underexplored diversity and up to this date, a still inexpressive number of known species withholds a clearer framework of the evolution and host-association of their species.

Thursday 26, Afternoon, Auditorium - Poster

194 - Determination and standardization of de conditions for mass rearing of *Phytoseiulus persimilis* (Parasitiformes: Phytoseiidae)

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One of the major pests of rose crops in Bogota's plateau is *Tetranychus urticae*, which causes reduction in plant growth and loss of flower buds. In Colombia, the excessive use of chemicals to control *T. urticae* has caused resistance to them. Moreover, this strategy produces damage to the environment and significantly affects the presence of natural enemies. Therefore, we have considered the use of other strategies such as the use of plant extracts, entomopathogenic fungi, cultural control and biological control. The use of predatory mites such as *Phytoseiulus persimilis* and *Neoseiulus* spp. is recommended. However, the implementation of this strategy in Colombia has been limited due to a deficit of availability of high volumes of predatory mites in the market; no mass production of these mites to satisfy the high volumes required in the field is presently available in Colombia. Therefore, it is vitally important to develop and standardize massive breeding processes that can supply the potential demand. For these reasons, this work was necessary to determine and standardize the conditions required to maintain the mass rearing of *Phytoseiulus persimilis*. The experiment was carried out in Cajicá (Cundinamarca). Under greenhouse conditions with a relative humidity of 70% and an average temperature of 18 ^{o}C, three plants were taken weekly from a group of bean plants (*Phaseolus vulgaris* var. Cerinza). The group of plants had been infested in the third week of their development with a population of approximately three *T. urticae* per square centimeter. In each plant, the population of *T. urticae* was observed to reach the highest value in the tenth week of development, with an average of 43,380 individuals per plant. After the seventh week of development, 25 *P. persimilis* were released per plant; the highest population of this predator was registered in the twelfth week, with an average of 156 specimens per plant. The counting of these populations was carried out weekly until the complete developmental cycle of the plant in week number fifteen. Temperature and relative humidity which can influence the development of the predatory mite on the plant was also recorded. It was observed that the obtained populations of the predatory mite could be enhanced by increasing both the number of *T. urticae* when the infestation takes place and the number of predatory mites that are released during the week number seven. This would allow reaching the predatory population more quickly.

Wednesday 25, Morning, Room 2

195 - Exploring the tick neurome: insights from the *Ixodes scapularis* (Acari: Ixodidae) genome

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The *Ixodes scapularis* (Lyme disease tick) genome project represents the first effort to sequence and assemble the genome of a tick. Researchers are using the *Ixodes* assembly to begin to characterize the genes and gene families of the "neurome" – defined here as the totality of genes, and their RNAs and protein products integral to the complex neurological networks of an organism. The products of many neurome genes are receptor proteins that function in various aspects of tick development and reproduction, and some are potential targets for intervention strategies. An overview of efforts by the broader tick research community to describe the genes of the *Ixodes* neurome will be provided. Work in our lab is directed at understanding an important family of neurome genes in arthropods – the G-protein coupled receptors (GPCRs). These membrane-bound receptors are signaling molecules which play essential roles in neurological processes. Tick GPCRs are of interest as targets for the development of new chemistries for tick control. Our work to characterize some of these receptors on a molecular and pharmacological level will be described. New sequencing technologies will create opportunities to extend such genome-wide studies to other economically important species of mites and ticks (Acari) in the near future. The tick research community has identified additional species of ticks which impact human health as "high priority" genome sequencing targets. The *Ixodes* genome assembly will be an important guide for comparative genomics within this lineage.

Monday 23, Afternoon, Room 1

196 - Management units of the predatory mite *Neoseiulus womersleyi* for conservation biological control in a tea field

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The predatory mite *Neoseiulus womersleyi* (Schicha) (Acari: Phytoseiidae) is an important natural enemy of the Kanzawa spider mite, *Tetranychus kanzawai* Kishida (Acari: Tetranychidae), in tea fields. Preservation of natural enemies by habitat management to reduce the need for acaricide sprays is thought to enhance the activity of *N. womersleyi*. To better conserve *N. womersleyi* in the field, however, it is essential to elucidate the population genetic structure of this predator. We analyzed population genetic structure of *N. womersleyi* in a tea field by using microsatellite DNA markers. Bayesian clustering analysis revealed that the population consisted of three genetic clusters. The kinship coefficients between individuals were also calculated within and among sites where the mites were collected. The coefficients did not differ significantly within a site as a function of the sampling dates, but the coefficients gradually decreased with increasing distance. Given the previously observed population dynamics of *N. womersleyi*, it appears that the area inhabited by a given cluster of the mite did not exceed 100 m. Therefore, the management unit for conservation of *N. womersleyi* should be this approximate scale.

Wednesday 25, Afternoon, Auditorium - Poster

197 - Effect of temperature on development and fecundity of the brown mite, *Bryobia rubrioculus* Scheuten (Acari: Tetranychidae), on sweet cherry

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The brown mite, *Bryobia rubrioculus* Scheuten, is one of the important pests on sweet cherry, black cherry and plum orchards of Hamedan, western region of Iran. Development and fecundity of this mite was studied on cherry at nine constant temperatures (15, 17.5, 20, 22.5, 25, 27.5, 30, 32.5 and 35 ºC), 60±5% RH and a photoperiod of 16:8 h (Light:Drak). The developmental time from egg to adult ranged from 43.36±0.63 days at 15 ºC to 14.54±0.37 days at 32.5 ºC. The average adult longevity of females was determined to be 14.02±0.88 days at 15 ºC to 6.46±0.67 days at 32.5 ºC. The highest and lowest mean number of eggs per female during adult life was 13.82±1.07 and 4.38±0.881 at 20 and 32.5 ºC, respectively. The results of this study can be used to predict *B. rubrioculus* development and population dynamics.

Wednesday 25, Afternoon, Auditorium - Poster

198 - Temperature-dependent demographic parameters of the brown mite, *Bryobia rubrioculus* (Scheuten) (Acari: Tetranychidae), under laboratory conditions

N. Honarparvar[1], M. Khanjani[1] & E.A. Ueckermann[2]

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The brown mite, *Bryobia rubrioculus* (Acari: Tetranychidae), is an important pest in cherry and plum orchards of Hamedan in western Iran. This study was conducted to assess demographic traits of *B. rubrioculus* at eight constant temperatures (15, 17.5, 20, 22.5, 25, 27.5, 30 and 32.5 ºC), 60±5% R.H. and photoperiod of 16:8 h. (Light:Dark), on sweet cherry (*Cerasus avium* L.). There were significant differences between demographic parameters at various temperatures. Net reproduction rate (R_o), generation time (T) and intrinsic rate of increase (r_m) ranged from 5.83±0.72, 42.79±0.83 and 0.041±0.003 at 15 ºC to 0.67±0.13, 24.15±0.41 and 0.025±0.002 at 32.5 ºC. The results revealed that maximum and minimum doubling time were 18.26±0.82 at 15 ºC and 10.67±0.39 at 20 ºC. The gross fertility ranged from 4.39±0.77 eggs at 32.5 ºC to 29.45±2.87 eggs at 15 ºC. The maximum survival rate (lx) was at 15 ºC and the minimum at 32.5 ºC. The results of this study showed that 20 ºC is optimal temperature for *B. rubrioculus* population growth.

Wednesday 25, Afternoon, Room 4

199 - The tomato russet rust mite *Aculops lycopersici* seriously damages tomato in China

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The tomato russet mite (TRM), *Aculops lycopersici* (Massee), invaded China in recent years and has caused serious damage in Shanghai, Yunnan and some other provinces in south and east China. The damage of this mite has been fully investigated. The effect of constant temperature and relative humidity on the development and reproduction of the TRM was investigated. The survival rates were highly affected by rearing temperature and relative humidity, the highest being 89.86% at 23 °C, and 87.1% at RH 53%. The developmental duration of TRM decreased with increasing temperature, and increased with increasing humidity. It was very short at high temperature and low humidity. Adult longevity decreased with increasing temperature, was 20.4 days at 26 °C, and increased with increasing humidity. Developmental thresholds of different stages were relatively high. That of egg, nymph and from egg to adult were 10.51, 9.02 and 9.15 °C, respectively. A total of 105.56 degree-days above a threshold of 9.15 °C were required to complete development from egg to adult emergence. Fecundity was highest at 26 °C and 53%RH with 44.3 eggs and 42.2 eggs per female, respectively. The highest intrinsic rate of natural increase was observed at 26 °C and 53%RH as 0.2645 and 0.2669, respectively. The results showed that the optimal temperature interval for its development is consider to be within 26°C~29 °C and the optimal humidity interval is within 53%RH~75%RH. There were significant

differences in population density of the mite on different tomato lines, those on YZ504, YZ507, YZ419 being the highest and those on YZ7, YZ618 and YZ619 being the lowest.

Tuesday 24, Afternoon, Auditorium - Poster

200 - Ticks (Acari: Ixodidae) parasitizing wild animals in semi-arid region of *Caatinga*, State of Pernambuco, northeast Brazil

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Ticks (Acari: Ixodidae) are obligate blood feeders that parasitize a wide variety of vertebrates. Knowledge of tick parasitism of wildlife is very useful to analyze the ecology and distribution of ticks, tick-borne diseases and their hosts in nature. In Brazil, information about ticks from *Caatinga* biome, the only totally present in the national territory, is scarce. The present study reports field data of ticks infesting free-living wild animals, including reptiles, rodents, xenarthra and carnivores, in semi-arid region of native *Caatinga* vegetation, in the municipalities of Cabrobó, Custódia, Floresta and Salgueiro, State of Pernambuco, northeast Brazil. During field work, from March 2009 to February 2010, a total of 69 ticks were collected from the following animals: *Boa constrictor* (Tropical American boa), *Euphractus sexcintus* (yellow armadillo), *Galea spixii* (Spix yellow-toothed cavy) and *Conepatus semistriatus* (striped hog-nosed skunk). The material was sent to the Laboratory of Parasitology, where adults were identified by current taxonomic keys. Some larvae and nymphs were incubated at 25±1°C, 95±5% RH to obtain the adults for identification. A total of 4 nymphs *Amblyomma* sp. and 1 adult *Amblyomma rotundatum* (female) were collected from *B. constrictor*; 6 adults *Amblyomma auricularium* (2 females; 2 males) from *E. sexcintus*; 3 larvae *Amblyomma* sp., 37 nymphs *Amblyomma* sp. and 8 nymphs *A. auricularium* from *G. spixii*; and 1 larva *Amblyomma* sp., 1 nymph *A. auricularium* and 8 adults *Amblyomma auricularium* (4 females, 4 males) from *C. semistriatus*. We report the first tick records in northeast Brazil on two species: *G. spixii* (nymphs) and *C. semistriatus* (nymph and adult). Previous host reports indicate adult *A. auricularium* to be almost restricted to armadillos (Dasypodidae), while immature stages have been reported on armadillos, marsupials, a murid rodent and domestic dogs. Despite the great importance, data of biology and ecology of ticks and their hosts in the region are scanty. The present study increases what is known about distribution of ticks and the parasitism of wildlife in the northeast region of Brazil.

Tuesday 24, Afternoon, Room 6

201 - Morphometric study of hard tick *Hyalomma anatolicum* male specimens from western Iran

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Species of hard ticks (Ixodoidea: Ixodidae) are efficient vectors of important pathogenic agents of both animals and human. Despite this notable effect, the taxonomic status and identification hard ticks of the genus *Hyalomma* have been debatable. *Hyalomma anatolicum* is one of these species; it is most abundant *Hyalomma* species in Iran. In spite of the great role of *H. anatolicum*, little research has been done on morphologic aspects of this species. There is no complete and comprehensive identification key for all Iranian *Hyalomma* species and the diagnostics are based on keys constructed for use in neighboring countries. The first step for the preparation of a good identification key is recognition of the morphologic characteristics of species in it's the areas where it is recognized to occur; correct identification will be possible when a sufficiently large number of specimens are examined. The present study aimed to perform the first step toward solving this problem on one of the most important *Hyalomma* species of Iranian fauna. This study is part of an extensive research conducted basically all over the Iranian territory.

Specimens of *H. anatolicum* were collected from five geographic regions of the Khuzestan and Lorestan provinces and morphometrically examined for valuable identification characteristics or traits to separate it from other closely related species. The studied parameters included seven quantitative, three qualitative and four comparative parameters, which were measured under stereomicroscope. The collected data were analyzed by SPSS software (Version-16.0) using ANOVA and T-test and the corresponding statistical tables were prepared. Afterwards, morphological variations in different geographic regions were drawn using a drawing tube connected to a light stereomicroscope. The result showed that all of the studied quantitative parameters in five regions had significance differences with each other. Also, among the comparative parameters, except lateral groove/scutumal length ratio, the other parameters were statistically meaningful. T-test analysis for qualitative parameters revealed the significance of some quantitative parameters in the two groups: group one (with qualitative parameter) and group two (without qualitative parameter). The interpretation of the results of this work showed the existence variation of morphologic parameter in *H. anatolicum* in five geographic regions and that only trait of the lateral groove/scutumal length ratio was stable. It is suggested that the amplitude and quantity of morphologic parameters of *H. anatolicum* should be considered for correct identification and key preparation of this species in further studies.

Wednesday 25, Afternoon, Auditorium - Poster

202 - Detection of *Anaplasma* species in ticks, domestic ruminants and at risk people in Iran

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A total of 101 ticks (54 *Rhipicephalus sanguineus*, one *R. sanguineus*, 39 *Ixodes ricinus*, 4 *Boophilus annulatus*, 2 *Haemaphysalis numidiana*, one *H. punctate*), blood samples of 87 domestic ruminants (65 sheep, 9 cattle and 4 goats) and blood samples of 40 shepherd were tested by nested PCR based on 16s rRNA gene for the presence of *Anaplasma* spp. and *Ehrlichia* spp. A 16s rRNA gene fragment of *Anaplasma* and *Ehrlichia* species was revealed in 50 ticks, 28 sheep, 2 cattle, one goat and 25 human. Sequencing results showed that 2 *R. sanguineu*s and 2 *I. ricinus* ticks, one human blood sample and 4 sheep blood samples were infected with *A. ovis*, and one *B. annulatus* and one sheep blood sample were infected with *A. bovis.* Moreover one sample of sheep was infected with *A. centrale.* This study is the first detection of *Anaplasma* species in Iranian ticks.

Thursday 26, Morning, Room 3

203 - The effect of fire on soil mites (Acari: Oribatida) in South African grasslands

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Fire is an important management tool in the conservation of grasslands in South Africa. In general, grasslands are burnt every one to four years in late winter, from July to September in controlled circumstances. Information on the impact of fire on biodiversity is required so that land managers can make decisions on a fire regime which will conserve biodiversity in grasslands. Despite the fact that soil fauna forms part of this biodiversity and plays an essential part in maintaining soil structure and nutrient cycling the effects of burning on soil fauna have not been studied in natural grasslands in South Africa. This is the first study to examine the responses of mite communities to fire disturbance in these grasslands. The study spanned over the first 15 months after burning. Mite species richness and abundance showed high variation between seasons. Species richness in the control plots peaked in early and late autumn and early spring, while abundance peaked in late autumn. The burnt/control factor did not have a such a great effect on abundance and species richness, but the general trend was higher abundance and species richness in the burnt plots compared to the control plots, from four months after burning. Overall, it seems likely that regular burning is favorable for mite populations and that managed burning in grasslands in South Africa will enhance soil mite diversity and in effect soil health.

Of the 60 species sampled, 15 could not be identified to species level. Most of these species are new species that needs to be described. There is currently insufficient taxonomic capacity in South Africa with lack of staff, students and research funding. Government and funding agencies must be made aware of the importance of classical taxonomy to have credible biology.

Tuesday 24, Morning, Room 2

204 - *Steneotarsonemus spinki*, field observations in 2007 and an update on the status in the United States

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The panicle rice mite (PRM), *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae), was found in breeding greenhouses (Arkansas, Louisiana, New York, and Texas) and a few rice fields (Louisiana and Texas) in the United States in the summer of 2007. Subsequently, in 2009, PRM was collected in greenhouses in northern California. This talk will summarize the areas infested, regulatory action initiated and survey efforts conducted in response to the initial reports. Currently, the PRM is listed as a reportable and actionable pest by the USDA-APHIS. The reason for this status is that it has been reported to cause from 5-90% crop losses in the Caribbean region. The PRM is not thought to have the ability to thrive in the temperate climate of the United States. Yet, southwest Louisiana has a sub-tropical climate with high temperatures and high humidity. The PRM thrives under both of these conditions. Furthermore, the PRM has been reported to cause economically significant losses when found in association with *Burkholderia glumae* (bacterial panicle blight) and *Sarocladium oryzae* (sheath rot) pathogens. Both of these pathogens are present in southwest Louisiana. A winter survey conducted from 2007 to 2008 found that mites were reduced to undetectable levels before fallow fields were planted in the spring. Mites have not been collected in commercial fields since the initial reports in 2007, but they have reinfested greenhouses.

Tuesday 24, Afternoon, Auditorium - Poster

205 - Some phytophagous mites associated with pomegranate, palm and citrus in southeast Iran

H. Izadi[1], A. Asadabadi[1], M. Khanjani[2] & A. Payandeh[3]

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During 2009-2010, mite faunal studies were conducted in pomegranate, palm and citrus orchards of Bam townships of southeast of Kerman Province, which resulted in collecting, mounting and identifying 8 species, 8 genera and 3 families. Mites were collected from soil and plants, mounted in Hoyer's medium and examined at 1000x under an Olympus BX50 phase-contrast microscope. All drawings were prepared with a camera lucida. Body length measurements represent the distance between the base of the gnathosoma and the end of the idiosoma, width was measured at the broadest point of the idiosoma, just anterior to legs III. Setae were measured from base to tip; distances between setae were measured between setal bases. Families, genera and species are listed below: Tetranychidae: *Tetranychus urticae* Koch, *Eutetranychus orientalis* (Klein), *Bryobia praetiosa* (Koch), *Panonychus citri* (McGregor), *Oligonychus afrasiaticus* (McGregor); Tenuipalpidae: *Tenuipalpus punicae* (Pritchard & Baker), *Dolichotetranychus* n. sp.; Acaridae: *Tyrophagus putrescentiae* (Schrank).

Tuesday 24, Afternoon, Auditorium - Poster

206 - Some predatory mites associated with pomegranate, palm and citrus from southeast of Iran

H. Izadi[1], A. Asadabadi[1], M. Khanjani[2] & A. Payandeh[3]

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During 2009-2010, a mite faunal study was conducted in pomegranate, palm and citrus orchards of Bam townships of southeast of Kerman province, which resulted in collecting, mounting and identifying 8 species, 8 genera and 5 families. Mites were collected from soil and mounted in Hoyer's medium and examined at 1000x under an Olympus BX50 phase-contrast microscope. All drawings were prepared with a camera lucida. Body length measurements represent the distance between the base of the gnathosoma and the end of the idiosoma, width was measured at the broadest point of the idiosoma, just before legs III. Setae were measured from the setal base to the tip of the setae; distances between setae were measured between setal bases. Families, genera and species are listed below: Cunaxidae: *Cunaxa capreolus* (Berlese); Stigmeidae: *Chylostigmaeus ferdowsii* (Khanjani, Raeisi & Izadi 2009), *Eustigmaeus segnis* (Koch), *Storchia robustus* (Berlese), *Stigmaeus elongates* (Berlese); Trombidiidae: *Allotrombium ovatum*; Phytoseiidae: *Neoseiulus zwoelferi* (Dosse); Tydeidae: *Tydeus caryae* (Khanjani & Ueckermann).

Thursday 26, Afternoon, Auditorium - Poster

207 - First record of *Quadraseta brasiliensis* (Brennan & Gettinger, 1989) (Trombiculidae: Trombiculinae: Schoengastiini) in *Euryoryzomys russatus* (Wagner, 1848)

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Many species of Trombiculidae (chiggers) were described in the past century. The last revision of the Neotropical and Nearctic chiggers was done in the 1980's. Eighty seven chigger genera were then reported for the West Hemisphere, including *Quadraseta*, described in 1970 and known to occur exclusively in the Neotropical region. In collections of wild rodents in the Atlantic Forest of the State of Paraná, southern Brazil, some specimens of trombiculid were found on *Euryoryzomys russatus* (Thomas). Part of those specimens was slide-mounted for morphological studies under light and confocal microcopy; they were identified as *Q. brasiliensis*. Some specimens were also prepared for molecular studies to compare its DNA sequence with those of other trombiculid species. Fourteen species are placed in *Quadraseta*, all ectoparasitic on mammals and birds: *Q. antillarum* [Curaçao, on *Sylvilagus floridanus* and Venezuela (Falcón, on *Marmosa robinsoni* and *S. floridanus*; Guaricó, on *M. robinsoni*, *Proechimys semispinosus* and *Zygodontomys brevicauda*; Bolivar, on *Z. brevicauda*)]; *Q. azulae* (Argentina – Buenos Aires, on mouse and opossum); *Q. flochi* (Colombia – La Flora, on *Thomasomys fuscatus*; Trinidad – Sangre Grande, Rios Grande Forest and Malajo Forest, on *Dendrocincla fuliginosa*, *Pitangus sulfuratus*, *Didelphis marsupialis*, *Akodon urichi*, *Heteromys anomalus*, *Nectomys squamipes*, *Oryzomys laticeps*, *Rattus rattus*, *Z. brevicauda* and "rat"; and Surinam – Uitkijk, on *Proechimys guyannensis*); *Q. macarenae* (Colombia – La Macarena, on *Oryzomys albigularis*); *Q. mackenziei* (Bolivia – San Joaquin, on *Callomys callosus* and *Proechimys guyannensis*); *Q. pazca* (Argentina – Buenos Aires, on *Mus* and *Rattus*); *Q. trapezoides* (Argentina – Buenos Aires, on fox); *Q. tachirensis* (Venezuela – Tachira, on *Akodon* sp. and *Akodon bogotensis*); *Q. mirandae* (Venezuela – Miranda, on *Oryzomys albigularis*); *Q. rotstieri* (Venezuela – Falcón, on *Proechimys guyannensis*); *Q. falconensis* (Venezuela – Falcón, on *S. floridanus*); *Q. akadonica* (Argentina – Neuquen Prov., on *Akodon longipilis* and *Auliscomys micropus*); *Q. brasiliensis* (Distrito Federal, on *Oryzomys capito*, *Marmosa agilis* and *Monodelphis americana*) and *Q. brennani* (Paraguay, on *Andalgalomys pearsoni* and *Akodon lasiurus*). Here we present the diagnosis of *Q. brasiliensis*: *Idiosoma*. A pair of humeral setae; dorsal idiosomal setae arranged 8-8-8-8-6-4-2. The SIF (Synthetic Identification Formula) is 4B-3-N-2/3111.0000. *Scutum.* sparsely punctuate; subrectangular, with sinuous anterior and posterior margins; 5 setae; sensilla subcapitate with few setules. Eyes 2/2. *Gnathosoma*. Cheliceral blade with tricuspid cap; papal tarsus with 4B (branched setae); palpal claw trifurcate. Palpal setal formula

B/B/BBB/4B. *Legs* 7-7-7; coxae unisetose; 3 genualae I, genuala II and III; tibiala III; subterminala and parasubterminala I. This is the first record of this species from Adrianópolis, Paraná, Brazil; this is also the first record of *E. russatus* as its host.

Tuesday 24, Afternoon, Auditorium - Poster

208 - Geometric-morphometric analysis of scutacarid mites (Heterostigmata, Pygmephoroidea)

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The analysis of shape has played an important role in a variety of biological studies for a long time. Traditionally, morphometry is done by measuring distances between particular points or in particular cases the angles between them. By doing so, the factor of size always has large impact and should be removed from raw data by size correction. Geometric morphometry (GM) is a tool for analyzing shape without influence of size, whereas the information for size still remains available. Instead of distances, shape coordinates are being determined and used for statistical analysis. Statistical results can be visualized as actual shapes or shape deformations. In mites, there are only few examples for the appliance of GM, presumably caused by difficulties in finding suitable landmarks. Landmarks have to be homologous anatomical loci that can be found repeatedly and reliably, and lie within the same plane. Because of the small size of mites, it is necessary to use microscopic slides for their investigation. Through the mounting procedure, specimens are often distorted and it is not easy to find corresponding points that remain stable even after a possible deformation of the whole animal. Members of the tarsonemid family Scutacaridae possess a flattened ventral side which is extremely seldom deformed in microscopic slides and therefore offers the required conditions for GM. In our study, we analyzed a variety of scutacarid species by using insertion points of ventral setae as well as particular ventral apodemata as landmarks. We demonstrate that the selected landmarks are suitable for GM as they show little variability. It is possible to separate genera and even species of the same genus, which are often difficult to differentiate by traditional methods because of a lack of distinct characters, by using GM.

Wednesday 25, Afternoon, Auditorium - Poster

209 - Composition and diversity of oribatid community (Acari: Oribatida) in litter of two plant coverages of the Otún Quimbaya Fauna and Flora Sanctuary (Risaralda-Colombia)

E. Jimeno[1,6], A. Sierra[2,6], J.O. Combita-Heredia[3,6], J.M. Vargas[4,6] & A. Sabogal[5,6]

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In this study we investigated the community of oribatid mites of litter found in an oakwood and a secondary early forest (BST 15-20 years) at the Otún Quimbaya FFS in two seasons: humid (February-April) and dry (June-July) 2005. Ten points per coverage were selected and a whole of 80 quadrants were examined. The samples were processed by Berlesse-Tullgren's technique. 148 samples were analyzed (77 in oakwood and 71 in BST), 9186 individuals were counted, grouped in 31 families and 51 morphospecies, 14 of which determined to genera. The most abundant families were Haplozetidae and Galumnidae and the most diverse Oppiidae. The coverage with major diversity was BST; no significant differences between seasons were found. The trade off of species, according to the index of similarity Chao-Jaccard, was 2.9% between coverages and 1.8% between seasons. Finally the community fit to the distribution model Log Normal. These results strengthen the previous findings in which the oribatid mites are one of the most numerous groups in the soil and litter, likewise show as the communities of oribatids seem not to have variations related directly to climate or coverages. Added to this, their generalistic feeding habit that

allows them to colonize different habitats. Likewise they reveal the possibility that the small percentage of difference could be due to a specific offer of resources of the micro-habitats.

Wednesday 25, Afternoon, Auditorium - Poster

210 - Composition and diversity of the community of litter mites (Arachnida: Acari) in two plant assemblages in the Otún Quimbaya Fauna and Flora Sanctuary (Risaralda-Colombia)

E. Jimeno[1,6], A. Sierra[2,6], J.M. Vargas[3,6], J.O. Combita-Heredia[4,6] & A. Sabogal[5,6]

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The community of litter mites in an oakwood and a secondary early forest (BST - 15-20 years) in the Otún Quimbaya FFS (Risaralda, Colombia) was studied in two seasons: humid and dry. Ten points were selected by coverage, in whole 80 quadrants. The samples were placed in funnels Berlese-Tullgren's. 148 samples were examined (77 in oakwood and 71 in BST). 15082 individuals were found grouped in 44 families, 111 morphospecies, 26 of which were identified to genera. The dominant group was Oribatida (31 families and 51 morphospecies), followed by Mesostigamata (8 families and 51 morphospecies), Prostigmata (4 families and 6 morphospecies) and Astigmata (one family and one morphospecies). The most abundant families were Haplozetidae and Galumnidae (Oribatida) and Uropodidae (Mesostigmata). The BST was the most diverse as the humid season. Using the index of similarity of Chao-Jaccard it was found a trade off of species of 10% between assemblages and of 1.3% between seasons. This behavior appears in other studies in which it is suggested that the combination of inner factors of every micro-habitat, as plant diversity and microclimate, influence the diversity and richness of mites more than the season. Finally, the community of mites adjusted to the distribution model Log Normal, showing that the community of mites in both coverages are in a condition of balance.

Wednesday 25, Afternoon, Room 2

211 - Humoral immune response of native cattle immunized with rBm86 (KU-VAC2) derived from Thai *Rhipicephalus microplus*

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Rhipicephalus (*Boophilus*) *microplus* ticks cause tremendous economic losses in Thailand. Current tick control methods rely on chemicals that result in environmental contamination, resistant ticks and high costs for animal owners. An anti-tick vaccine against *R. microplus*, targeting tick midgut, is commercially available, but these vaccines are more efficacious for homologous challenge with local tick strains. cDNA encoding Bm86 from *R. microplus* strains of Thailand was similarly developed to control ticks. The objective of this study was to assess the effects of immunization of Thai native cattle with Thai rBm86 (KU-VAC2) on experimental infestations with *R. microplus.* This study was conducted on the experimental farm at Chiang Mai University, and a private farm in Chiang Mai, Thailand. Eighteen adult females White Lamphun cattle with an age between 2 and 3 years were used. Animals were divided into control, adjuvant and immunized groups, each containing 6 animals. They were kept in an extensive grazing system and grazing was allowed at all times. Animals were immunized by intramuscular injection with a dose of 2 ml containing 200 µg/ml. As adjuvant, Montanide ISA 50V (Seppic, Paris, France) was used. The animals of the control and adjuvant groups were injected with the same amount of phosphate buffered saline and adjuvant alone, respectively. Animals were immunized three times at 3-weeks interval and received a single booster immunization six months after the first

immunization. Thai rBm86 was prepared with a yeast expression system. Animals were checked for their immune responses for 3 months. Vaccination resulted in significant differences of responses when compared to the control group ($P<0.05$). The antibody response in the vaccine group was five times higher than the control group and peaked after the third immunization. These results indicated that KU-VAC2 induced a protective immune response against *R. microplus*, which is expected to provide a safe nontoxic means of tick control. Further work is warranted to optimize the KU-VAC2 regimen, and to determine the efficacy of this antigen in combination with other vaccine candidate antigens.

Tuesday 24, Afternoon, Auditorium - Poster

212 - Diversity and population fluctuation of mites (Acari) on grapevine (*Vitis vinifera)* in two winery regions in the State of Rio Grande do Sul, Brazil

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In spite of the importance of grapevine in Rio Grande do Sul, little is known about the population fluctuation of mites considered important to this crop. Some Eriophyidae, Tarsonemidae and Tetranychidae mites are considered grape pests in that state. The objective of the present work is to understand the diversity and population fluctuation of mites on 'Cabernet Sauvignon' and 'Pinot Noir' grape varieties in two winery regions of that state, in Bento Gonçalves and Candiota, respectively, between October 2006 and September 2007. At each sampling date, a sample consisted of 3 leaves taken from each of 20 plants randomly distributed in each orchard. During the senescence period of the leaves, these were not collected, buds being collected in their place. Samples were also taken from the five most common non-cultivated plants in each area, for qualitative observations. Phytoseiidae was the family with the highest number of species (14), followed by Stigmaeidae (8) and Eriophyidae (7). *Calepitrimerus vitis* (Nalepa, 1905) was the main phytophagous species collected, having reached population outbreak in January in both regions. *Panonychus ulmi* (Koch, 1836) was observed between October and April in Bento Gonçalves, having reached its population peak in January. *Polyphagotaronemus latus* Banks, 1905 occurred in high levels in January, only on apical leaves. *Pronematus anconai* Baker, 1943 was present in all areas of this study. Its occurrence was correlated with the occurrence of *Cal. vitis*, *P. ulmi* and *P. latus* in Bento Gonçalves, and with *Colomerus vitis* (Pagenstecher, 1857) and *Tarsonemus* sp. in Candiota. *Neoseiulus californicus* (McGregor, 1954) was demonstrated to be associated with *Cal. vitis*, *P. ulmi* and *P. latus*, mainly on Pinot Noir grape variety in Bento Gonçalves. *Agistemus floridanus* Gonzales, 1965 was present only in Bento Gonçalves, associated with grapevine and non-cultivated plants; no clear relation was observed between it and the phytophagous species.

Wednesday 25, Morning, Room 6

213 - The use of soil mesofauna in ecotoxicological studies of platinum mine tailings storage facilities

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South Africa is one of the most important mining countries in the world, hosting the world's largest reserves of platinum group metals (PGMs). Even though mining is clearly an important activity in South Africa, contributing approximately US$ 7.4 billion annually to the country's gross domestic product (GDP), the costs to the environment are not insignificant. One of the most severe environmental aspects associated with mining is the storage of mineral waste on tailings storage facilities due to their impacts on air quality, ground water quality, aesthetics and land use. It is also unknown whether the environmental effects of tailings storage facilities increase or decrease over time. The aim of this study was to determine the ecotoxicity of platinum tailings storage facilities of different ages by means of soil mesofauna studies. Samples were obtained from three platinum tailings storage facilities of different ages of which two were already rehabilitated while the third was still operational at the time this study was performed. The latter was used as a negative control for the purpose of the study. Soil mesofauna were extracted

and identified in order to determine species richness, diversity, abundance and functional grouping. The soil mesofauna studies indicated the following trend in test sites 1, 2 and 3 from highest species diversity and species richness to lowest species diversity and species richness: Site 2 > Site 1 > Site 3. Since the aim of this study was to assess contaminants on the level of community structure and ecosystem functioning, species were divided into functional groups according to their feeding strategies. It included mycophagous, predatory, saprophagous and omnivorous, micro-algivorous and bacteriophagous as well as plant parasitic and herbivorous organisms. The most abundant functional group of individuals found on all the tailings storage facilities were the micro-algivorous and bacteriophagous group. The abundance of this functional group is an indication of the level of succession in this community being predominantly pioneer. The most abundant taxon found in the tailings materials was the Prostigmatic mites. Species diversity did not show a relationship with age of tailings storage facilities. Soil mesofauna studies conducted on platinum tailings storage facilities of different ages indicated that environmental effects may not be attributed to the age of tailings storage facilities. This was also the case in a parallel study utilizing earthworm bioassay studies, where it was found that environmental impacts of rehabilitated tailings storage facilities will increase with age, however these results are most likely to be an indication of the rehabilitation measures administered to the different tailings storage facilities.

Wednesday 25, Afternoon, Room 6

214 - Biological control of spider mites with the introduced *Neoseiulus californicus* in Korean apple orchard

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The spider mites *Tetranychus urticae* and *Panonychus ulmi* are important pests of apple in Korea. Intensive biological control trials with the native predatory mite *Neoseiulus womerseleyi* have not shown satisfactory results. We introduced a new phytoseiid mite, *Neoseiulus californicus*, to apple orchard, to evaluate whether it could keep the spider mite population in check and its possible interaction the native predatory mite. We found that introduction resulted in additive pressure when the structure of natural enemies is simple, but no additive effect when the structure of natural enemies is complex. Further discussions on the introduction of natural enemy to semi-permanent ecosystems, such as orchards, are discussed.

Wednesday 25, Morning, Room 6

215 - Structural change of mite community after mountain fire with perspective to climate change

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Mite community itself contributes to important regulation of soil food web in forest ecosystems. Wildfire is a dominant factor disturbing forest ecosystems. We assessed the impact of fire on the structural composition and relationship of major soil microarthropod groups, such as collembolans, oribatids and gamasids. We also assessed species composition of soil gamasid mites at mountain sites following fires with four different degrees of severity and at one control site, 5 years post-fire. As part of the results, 14 families, 28 genera and 54 species or species complexes were found. The abundance and richness were poor in severely burned sites, compared with the less damaged sites. The different species compositions, especially in the medium-burned site, require further ecological study to improve our understanding. Recent global climate change and subsequent fire regimes were discussed along with the structure and functioning of soil microarthropod complexes.

Thursday 26, Morning, Room 5

216 - A phylogenetic analysis of SERPIN gene in Thai cattle tick (*Rhipicephalus microplus*) salivary glands

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Serine proteases inhibitors (SERPIN) have been recognized by their immune regulatory mechanisms since they are capable of limiting immune activation by curtailing the enzymatic generation of stimulatory signals. Tick salivary gland (TSG) proteins have a potential role for application as novel tick control agents. SERPIN from TSG may be involved in facilitation of tick feeding and digestion of blood meal as well as pathogen transmission. Therefore, SERPIN is one of the most interesting candidate target antigens for tick vaccine development. However, the biodiversity of SERPIN genes in each region of Thailand is still questionable. In this study, we cloned SERPIN cDNA from salivary glands of semi-engorged females cattle ticks (*Rhipicephalus microplus*) collected from 10 representative provinces of Thailand by RT-PCR, analyzed their nucleotides and deduced amino acid sequences. Our results showed that the 10 serpin cDNA were 1,200 bp in length, which encodes a SERPIN protein of 399 amino acid residues that deduced amino acid was 96-98% identity. When compared phylogenic analysis to other SERPIN available in the GenBank database, Thai SERPIN sequences had less variation of amino acids in most positions of amino acid residues but there were more variations in different tick species than in other arthropods. Based on this result, SERPIN from all parts of Thailand were closely related. This supports the potential use of recombinant SERPIN as a candidate vaccine to immunize cattle against *R. microplus* in Thailand.

Wednesday 25, Morning, Room 1

217 - The chemical and molecular ecology of plant-mite interactions: variability in mite-traits that determine the efficiency of induced plant-defenses

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Herbivores, such as spider mites, induce plant defenses during feeding. However, these induced defenses are not always successful i.e. spider mites can suppress the induced response or can be resistant to the induced products. The ability to do one and/or the other differs between mite species, but also between individuals within populations of the same species. We are exploring the consequences of this variation for the ability of mite populations to adapt to novel host plants and to compete with other herbivores. We use a combination of chemical, molecular, and physiological tools in cultivated tomatoes, weeds and mites to characterize these traits and to manipulate them in order to test their ecological relevance. In this presentation we will provide an update on our recent advances.

Friday 27, Morning, Room 1

218 - Databasing the Ohio State University Acarology Collection: the good, the bad and the unexpected

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The Acarology Collection at Ohio State University is a medium sized collection (~ 64,000 slides, ~11,500 alcohol lots in incorporated collection). It was founded as a teaching collection and as a result emphasizes diversity rather than the specialization common to most research focused collections. As with many mite collections, older data management procedures were based on lots (collection events), rather than specimens. With financial support from the U.SA. National Science Foundation this system has been upgraded substantially switching to an on-line specimen based database. All specimens are barcoded, and where localities are known, these are georeferenced allowing instant generation of distribution maps. At present we have 46,000 specimens on-line, including nearly all Parasitiformes, and a large part of our holdings of

Prostigmata (slides and fluid). The plan is to have the entire collection on-line by the end of 2010. Searching can be on all Darwin Core fields, with output either as XML (for computer input) or human readable. The major challenge proved to be retroactive data capture. Data for many specimens was limited to various codes or numbers requiring major efforts in retrieving data. In addition, much of the locality information was incomplete or no longer valid, as were many species designations (mites or hosts). Even so, most data have been upgraded, and where possible, synonymy lists will be uploaded to help alleviate problems in this area for future projects. In the future we would like to expand this specific effort to an Acari nameserver.

Tuesday 24, Afternoon, Auditorium - Poster

219 - Diversity of predatory mites associated with agri-horticultural crops and weeds from Gangetic plains of West Bengal, India

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A study was conducted to explore the predatory mite fauna from different agri-horticultural crops and weeds in Gangetic plains of West Bengal during 2006-2008 to find out the most effective predatory mites that could be utilized in bio-control programmes. A total of 31 species belonging to 9 genera, 7 families and 2 orders were identified, along with their prey mites, period of occurrence and the host plants on which those were recorded. It was observed that 4 species, *viz*., the Phytoseiidae *Amblyseius longispinosus* and *A. largoensis*, the Stigmaeidae *Agistemus* sp. and the Anystidae *Walzia indiana* were the dominant species and proved to be effective for having good feeding potentiality. Hence, those can be considered as potential predators for suppressing the concerned prey mites and hence, need to be conserved. Among the others, phytoseiid mites as *A. multidentatus*, *A. ovalis*, *A. coccineae*, *A. fallacis* and the Cheyletidae *Cheletogenes ornatus* were relatively less abundant and their feeding potentiality under field condition was also in lower order. Therefore, their effectiveness as bio-control agents do not appear to be highly encouraging. The rest of the species were of rare occurrence.

Thursday 26, Morning, Room 2

220 - Impact of date of transplanting on the population dynamics of rice sheath mite, *Steneotarsonemus spinki* Smiley (Acari: Tarsonemidae), on rice cultivar IET-4786 under Gangetic plains of West Bengal, India

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The cultivation of rice is of immense importance to food security of Asia, where more than 90% of the global rice is produced and consumed. India is the largest rice growing country with the production of 91.50 million ton from 43.70 million ha and average productivity of 2.08 t/ha, where the state West Bengal is the rice producing bowl of the country covering an area of 6.18 million hectare with the annual production of 13.95 million tons and a productivity of 2.26 t/ha (Anonymous, 2006-07). During recent years, the rice sheath mite, *Steneotarsonemus spinki* Smiley was observed as one of the most destructive mite pests of rice in Bengal Basin during wet season. The mites infest and colonize in the sheath of the plant causing chaffy grain and brownish patches on the affected sites. Considering the importance of mite infestation, experiment was conducted to study the population dynamics of mite and impact of five different dates (at seven days interval D1-D5) of transplanting of rice cultivar IET-4786 on the mite intensity and crop yield, during July to November, 2007 in the district seed farm (located at $22^0 58' 52'' N$ latitude, $88^0 26' 30'' E$ longitude with an elevation of 9.75 m above Mean Sea Level) of Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal, India. No mite population was observed on leaf lamina but very scanty mite population was observed during 05.08.2007 in 1st,

2nd and 3rd date of transplanted (D1, D2 and D3) plots when no symptoms of damage were expressed. Thereafter, the mite population increased gradually, reaching the maximum level on 25.09.2007 on plants of the 1st, 2nd and 3rd dates of transplanting (DOT) and on 05.10.2007 on plants of the 4th & 5th DOT. The result revealed that peak incidence of mite occurred at the ripening stage of D1 and D2, but significantly higher number of mite population and 100% damage symptoms were observed in D4 and D5, at the panicle emerging to flowering stage. Poor yield were obtained from D5.

Thursday 26, Morning, Room 2

221 - Seasonal population development of spider mites (Acari: Tetranychidae) and their predators in sprayed and unsprayed apple orchards in Van, Turkey

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The aim of this study was to determine the seasonal population dynamics of spider mites (*Panonychus ulmi* (Koch), *Amphitetranychus viennensis* (Zacher), *Bryobia rubrioculus* (Scheuten) (Acari: Tetranychidae) and their natural enemies (*Kampimodromus aberrans* (Oudemans) (Acari: Phytoseiidae), *Zetzellia mali* (Ewing) (Acari: Stigmaeidae) and *Stethorus punctillum* Weise (Col.: Coccinellidae) on golden delicious and starking delicious apple cultivars in three apple orchards of Van, Turkey, during 2002-2003. Surveys were carried out weekly from May to November in sprayed and unsprayed apple orchards. The results of study indicated that the population densities of spider mites began to increase generally in early May, reached the maximum level from mid June to late August and preserved to late September in both years. During 2002, while the dominant species on both apple cultivars was *P. ulmi*, in 2003, it was *A. viennensis*. In this period, the population densities of *P. ulmi* and *A. viennensis* reached the maximum level of 318.1 and 427.2 mites/per leaf, respectively, in sprayed orchards. In unsprayed orchard, spider mites remained at very low levels certainly because of the presence of *K. aberrans* which was only one predator species on spider mites. On the other hand, in sprayed orchards, although *S. punctillum* and *Z. mali* were the most abundant predatory species on spider mites, they could not control the spider mites on both apple cultivar and years.

Tuesday 24, Afternoon, Auditorium - Poster

222 - The first record of *Alliphis halleri* (Acari: Mesostigmata: Eviphididae) from Iran

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Mites of the family Eviphididae are small to medium sized free-living Mesostigmata that are common in soil, decomposing organic matter such as vertebrate dung, carrion, sea debris and nests of mammals and birds and many of them are phoretic on arthropods associated with these substrates, especially scarab beetles. The Eviphididae, comprising over 120 species, belong to 17 genera. Some species, as *Alliphis halleri* (G. & R. Canestrini, 1881), are predators of harmful nematodes. The cosmopolitan eviphidid mites of the genus *Alliphis* Halbert, 1923 include about 28 named species worldwide. The most commonly cited species in the genus is *A. halleri*, which some authors consider to be a senior synonym of *A. siculus* (Oudemans, 1905). It has recently been determined that these are two distinct species. So far, only *A. siculus* has been reported from different regions of Iran. In an investigation on Eviphididae of Iran, the author collected and identified several specimens similar to these two species, but confirming that they should be *A. halleri*, not *A. siculus*. Also, some of the specimens which had previously been identified as *A. siculus* were re-examined and re-identified as *A. halleri*. This is the first report of *A. halleri* from Iran; it seems that previous records of *A. siculus* from that country actually correspond to misidentified specimens of *A. halleri*.

Thursday 26, Afternoon, Room 6

223 - Acetylcholinesterase point mutations in European strains of *Tetranychus urticae* (Acari: Tetranychidae) resistant to organophosphates

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The ability of spider mites to rapidly develop resistance to acaricides causes a major world-wide problem in their control. Characterizing the underlying mechanisms of resistance is required to design sensitive and reliable detection methods, an essential step in developing resistance management strategies. In *Tetranychus urticae* Koch, organophosphate (OP) and carbamate (CARB) resistance is most often caused by acetylcholinesterase insensitivity. By combining toxicological, biochemical and molecular data from three reference laboratory and three OP field collected resistant strains (OP strains), we characterized AChE1 mutations associated with resistance in *T. urticae*. The resistance ratios of the OP strains varied from 9 to 43 for pirimiphos-methyl, from 78 to 586 for chlorpyrifos, from 8 to 333 for methomyl and from 137 to 4164 for dimethoate. The insecticide concentration needed to inhibit 50% of the AChE1 activity was, in the OP strains, at least 2.7, 55, 58 and 31 times higher for the OP pirimiphos-methyl, chlorpyrifos oxon, paraoxon and omethoate respectively, and 87 times higher for the CARB carbaryl. By comparing the AChE1 sequences, four amino acid substitutions were detected in the OP strains: (1) F331W (*Torpedo* numbering) in all the three OP strains; (2) T280A found in the three OP strains but not in all clones; (3) G328A, found in two OP strains; (4) A201S found in only one OP strain. F331W, G328A and A201S, are possibly involved in resistance to OP and CARB insecticides. Among them, F331W is probably the most important and the most common in *T. urticae*. It can be easily detected by the diagnostic PCR-RFLP assay developed in this study.

Tuesday 24, Afternoon, Auditorium - Poster

224 - Geographic variation of a predatory mite, *Allothrombium pulvinum* Ewing (Acari: Prostigamata: Trombidiidae), revealed by geometric morphometric analysis

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Allothrombium pulvinum Ewing is a natural enemy of a variety of pest arthropods. Its larvae are ectoparasites of aphids, whereas the deutonymphs and adults are generalist predators of aphids, spider mites and various other small arthropods. Because of the potential of the species as a biological control agent, studies on the geographic patterns of morphological variation among natural populations can provide important information for using it in biological control programs. We analyzed the shape and size of Crista (a rod-like structure in the middle of the prodorsum) in 11 populations of adult individuals along *A. pulvinum* distribution range in Iran (five provinces spanning Northern Iran: Mazandaran, Guilan, Ardebil, East Azerbaijan and West Azerbaijan), using a Landmark-based geometric morphometrics method. This structure was selected because it provides highly homologous and reliable characters (Crista is strongly sclerotized structure and the exact location of the landmarks could be assessed more precisely). Twelve landmarks were selected on the Crista and multivariate analysis including principal component analysis, canonical variate analysis and multivariate analysis of variance were performed on partial warp scores and analysis of variance on centroid sizes. The relationship between geographic and morphological distances was also determined using Mantel test. Relationships between populations were investigated using the UPGMA method. The geometric morphometric analysis showed significant variation among pairs of geographic populations. *Allothrombium pulvinum* comprises at least two geographically distinct populations corresponding to North and North West of Iran. Furthermore, a significant correlation was found between geographic and morphological distances. Sexual dimorphism in the shape and size of Crista was also documented. The results were in agreement with previous genetic studies that revealed two geographically distinct populations. We conclude that geometric morphometrics provides a powerful way in exploring intra-specific variations and serves as an useful and novel way to visualize morphological variation in *A. pulvinum*. We recommend more extensive use of geometric

morphometric tools in the taxonomy of Acari. The method is nondestructive, quick and less costly than genetic analysis thus, allowing many individuals to be screened.

Wednesday 25, Morning, Room 3

225 - Effects of morphological leaf characters of some vegetables against the incidence of predatory mites of the genus *Apostigmaeus* (Stigmaeidae: Acari)

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Vegetables, being a major source of micronutrients, form the largest group of plants consumed by man (McCance & Holland, 1991). Summer vegetables are the most liked seasonal vegetables in Pakistan. The attack of insect and mite pests is the most important factor which causes significant loss to the yield. Bio-control agents are increasingly used in controlling different insect and mite pests because of resistance to chemicals and pesticide hazards to consumers, especially in vegetables. Predatory mites of genus *Apostigmaeus* play a pivotal role in controlling phytophagous mites and small soft bodied insects. Morphological plant characters influence the ability of predatory mites to suppress the population of different crop pests. Therefore, the present study was conducted to determine the role of morphological plant characters viz., leaf area, leaf hair density, thickness of leaf lamina and hair length of different vegetables such as tomato, bitter gourd, okra and brinjal against the incidence of predatory mites of the genus *Apostigmaeus* in the locality of the University of Agriculture, Faisalabad. The maximum population of the mite was observed on tomato (3.28 mites per leaf) which was followed by brinjal (2.41 mites per leaf), bitter gourd (2.03 mites per leaf) and okra (1.52 mites per leaf). Leaf area, leaf hairiness, thickness of leaf lamina and hair length had shown negative correlation with *Apostigmaeus* population.

Tuesday 24, Afternoon, Room 3

226 - The impact of varroa infection on beekeeping in Japan, with particular emphasis on the resistance of varroa to acaricides

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The varroa mite, *Varroa destructor*, is an external parasitic mite that attacks and weakens honey bees. The mite was originally found in the Asian honey bee, *Apis cerana*, but during the last 50 years, the mite has expanded its host to the European honey bee, *Apis mellifera*. When infested, honey bees are seriously damaged, since the mite sucks hemolymph. In addition, during the process of sucking, the mite spreads viruses to the bee and these viruses cause various kinds of diseases, which are generally known as "Varroais". A significant mite infestation will lead to the death of honey bee colonies, usually in the late autumn through early spring. Without periodic treatment, most honey bees will cease to exist within a few years. The mite however has been controlled by acaricides for many years, especially with the use of flubarinate. However, recently the resistance of varroa mites to acaricides has been reported in many countries. The varroa mite has a pronounced economic impact on the beekeeping industry, as it may play a central role with regard to colony losses, which are happening all over the world. Many methods have been tried for controlling the mite, but none of them is effective enough to take the place of existing acaricides. In Japan as well as in other countries, infestation of the varroa mite is one of the most significant problems in beekeeping. Apistan® (flubarinate) was the only registered acaricide to control the varroa mite, and it seems that the Japanese mite has also developed resistance against flubarinate. During the last two years, the shortage of honey bee colonies is a big problem facing Japan, as this means a lack of pollinator, which in turn is causing serious difficulties for Japanese horticulture. The mite is considered to be one of the main reasons for colony loss in Japan. In this symposium, we are going to introduce the general biology of the *Varroa destructor*. Then, we will present current research findings with regard to protection against the varroa mite. These will include: 1) A National survey showing acaricide resistance of the mite in Japan; 2) The effort to

search for new acaricides to control the varroa mite; 3) Recent advances in the molecular biology of the varroa mite.

Thursday 26, Morning, Room 4

227 - Virus/vector relationship of *Brevipalpus*-transmitted plant viruses

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The role of *Brevipalpus* mites as vectors for some plant viruses was initially observed in the citrus leprosis pathosystem and later also associated with the coffee ringspot, passion fruit green spot and orchid fleck diseases. More recently, a large number of cases of association of *Brevipalpus* transmitted or associated viruses were found mostly in ornamentals. Three species of *Brevipalpus* mites (*B. californicus*, *B. obovatus* and *B. phoenicis*) are known to vector these viruses. Ultrastructural cytopathology revealed that there are at least two different types of virus or viruslike agents transmitted/associated by *Brevipalpus* mites: (a) cytoplasmic, in which viral particles appear within endoplasmic reticulum cisternae and a prominent electron dense viroplasma is present in the cytoplasm; (b) nuclear, with short, rodlike particles present in the nucleus and cytoplasm and an electron lucent viroplasma in the nucleus. Citrus leprosis virus, cytoplasmic type (CiLV-C) is the prototype of this group. Its genome was entirely sequenced, having a genomic organization distinct from other known viruses, being the type species of a new proposed genus *Cilevirus*. Orchid fleck virus (OFV) is the representative of the nuclear type. Its genome is also completely sequenced with genomic organization similar to that of *Rhabdoviridae* family, but because it has a divided genome, a new genus *Dichorhabdovirus* has been proposed. An attempt to detect CiLV-C in the viruliferous *B. phoenicis* mite tissues was successful. Presumed virus particles were found between membranes of adjacent cells of the caeca, interstitial cells, muscle and prosomal gland complex. Immunolabeling experiments confirmed the viral nature of these particles. A model is being proposed to explain the localization of the CiLV-C in the mite tissue and the available data suggest that this virus only circulates, not replicating in the mite body. Examination of some nuclear type viruses as *Clerodendrum* chlorotic spot virus (ClCSV); Coffee ringspot virus (CoRSV), and Citrus leprosis virus, nuclear type (CiLV-N) vectored by *B. phoenicis* and OFV, by *B. californicus*) within the mite vector revealed consistently the same cytopathic pattern found in the infected plant tissues in cells of the prosomal gland and caeca, strongly suggesting that these viruses multiply in the mite cells. This information plays important role in the epidemiology and control of the viruses these mites transmit. This research was financially supported by FAPESP and CNPq.

Tuesday 24, Afternoon, Room 6

228 - Asimmetry in the number of solenidia in the tarsi of leg II in some *Brevipalpus* populations from Bella Vista, Argentina

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Brevipalpus californicus (Banks), *Brevipalpus phoenicis* (Geijskes) and *Brevipalpus obovatus* Donnadieu (Acari: Tenuipalpidae) are commonly found in South America. The most commonly used morphological characters to separate these closely related species are the number of setae on the lateral margin of the opisthosoma and the number of distal solenidia on tarsi II of females. While *B. californicus* has seven pairs of latero-opisthosomal setae (c_3, d_3, e_3, f_2, f_3, h_1 and h_2), the other two species have six (f_2 absent), and while *B. obovatus* has a single distal solenidion on tarsus II, the other two species are supposed to have two solenidia. Argentina was one of the countries where citrus leprosis (known locally as "lepra explosiva") was first described in South America, in the 1920's, and also where it was first demonstrated that *Brevipalpus* mites were involved in the disease transmission. The species was identified as

Tenuipalpus pseudocuneatus Blanchard, a synonym of *B. obovatus*. Further studies on the mite vector of citrus leprosis, found in most of the South and Central American countries as well as in Mexico, demonstrated consistently that the mite vector was *B. phoenicis*. To verify if only *B. obovatus* is present in the citrus grooves affected by leprosis in Argentina, *Brevipalpus* mites were collected from sweet orange plants (Valencia, Hamlin) in experimental and commercial orchards at Bella Vista, Corrientes, and fixed in 90% ethanol. Light (LM) and scanning electron microscopic (SEM) examinations were conducted to identify the species. Both *B. phoenicis* and *B. obovatus* were found in nearly similar numbers. However, unexpectedly, about ¼ of the individuals analyzed (18 of 62 examined in the LM and 23 of 98, in the SEM) were found to have one solenidion on the tarsus II of one side and two solenidia on tarsus II of the other side (either left or right). To verify whether this would also be common with other populations, SEM examinations were conducted with mites from a population of *B. phoenicis* maintained at "Centro APTA Citros Sylvio Moreira", and a population of the same species maintained at ESALQ; two populations of *B. obovatus* collected from *Solanum violaefolium*; and several populations of *B. chilensis* (belonging to *B. obovatus* group) collected in Chile. Asymmetric distribution of solenidia on the tarsus of leg II was found to be rare in those populations (usually less than 1%). Further studies are being conducted to verify whether the high level of variation in Argentina could be due to spurious crossings between *B. phoenicis* and *B. obovatus*. This research was financially supported by FAPESP and CNPq.

Monday 23, Afternoon, Room 6

229 - Not gone with the wind: origin and diversification of hummingbird proctophyllodid mites (Acari: Proctophyllodidae) as evidenced by four nuclear genes

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With wingbeats ranging from 18 to 200 beats per second, hummingbirds offer seemingly inhospitable habitat for feather mites. Yet, hummingbirds harbor unique and diverse fauna of proctophyllodid feather mites adapted to live on or in the wing feathers. Other proctophyllodid mites are associated mostly with passerine birds. To infer the origin and relationships of proctophyllodids, we sequenced 4 nuclear genes (18S, 28S rDNA, EF1a, and HSP70, 11 kb aligned) for 144 taxa. Our phylogeny renders hummingbird mites as a monophyletic group being a sister taxon of the remaining Pterodectinae; the subfamilies Proctophyllodinae and Pterodectinae are sister groups. Thus, the previous proposal that hummingbird proctophyllodids are polyphyletic and 'Rhamphocaulinae' is a separate subfamily is not supported. We discuss whether the split between hummingbird and passerine mite lineages might represent the ancestral split between apodiform and passeriform birds and also test the hypothesis that living in extreme environments may influence speciation and ecological niche diversification.

Thursday 26, Morning, Room 1

230 - Placing Endeostigmata and Astigmata in the acariform tree of life using five nuclear genes

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There is no agreement in the position of two important lineages, Endeostigmata and Astigmata, in the mite tree of life. Previous analyses of DNA sequences and morphology offer conflicting hypotheses. We sequenced 5 nuclear genes (18S, 28S rDNA, EF1a, SRP54, and HSP70 (8.6 kb aligned) for 72 taxa, and conducted a phylogenetic analysis on a data set partitioned into structural RNA and protein sequences in the Maximum Likelihood framework. Our analysis shows that *Hybalicus* clusters with Prostigmata with a high bootstrap support. Most other endeostigmatid lineages cluster with oribatids, including Astigmata. These relationships almost exactly correspond to what was hypothesized based on a cladistic analysis of morphology by OConnor 25 years ago. In addition, the enigmatic deep soil mite *Paralycus*, previously placed in Prostigmata, Endeostigmata, or Astigmata was confidently inferred to be a part of protoplophorid oribatids. This is in agreement with the morphology based hypothesis of Norton et al.

(1983). Based on our tree, asexuality was an important and distinctive feature in the early evolution of acariform mites: some lineages (e. g., *Alicorhagia*) may have originated from an asexual ancestor and remained asexual for 400 million years, while some more recent lineages "re-evolved" sex. Astigmata, and *Paralycus* originated via paedomorphosis that lead to a significant shortening of their life-cycles and profoundly changed their morphologies.

Monday 23, Afternoon, Room 3

231 - Overwintering of *Neozygites floridana*, natural enemy of *Tetranychus urticae*, and the importance in conservational biological control

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Although most studies on conservation biological control of *Tetranychus urticae* focus on predators, the pathogenic fungus *Neozygites floridana*, is also an important natural enemy of this pest mite. Poor overwintering capacity of a pathogen through long unfavorable periods may significantly affect its efficacy and limit its potential use as a control agent. *T. urticae* is known to overwinter as hibernating females, and these may harbour *N. floridana*. The aim of this study was to investigate whether *N. floridana* could be found in hibernating *T. urticae* in Norway (min. ambient temp -15.3 ^{o}C), and if so, in what prevalence and what stage of its fungal life cycle. The occurrence of nymphs, males and hibernating or non-hibernating females of *T. urticae* throughout the winter (October 12, 2006 to February 19, 2007) was also investigated. The highest total number of *T. urticae*, including nymphs, males, non-hibernating and hibernating females, was observed at the first sampling date. At this date non-hibernating females were the most abundant. A sharp decrease in non-hibernating females, nymphs and males occurred from mid-October to mid-November, when the number of hibernating females also decreased, but not as fast. The relative abundance of hibernating females compared to non-hibernating females increased from 32.2% at the first collection (October 12) to 97.7% at the last collection (February 2). *N. floridana* was present as hyphal bodies in hibernating *T. urticae* females throughout the sampling period. The lowest percentages of hibernating females with *N. floridana* hyphal bodies were found at the first two sampling dates (5.5 and 0%, in October 12 and 19, respectively). Highest prevalence was observed on January 14 (54.4%). *N. floridana* resting spores (immature) were also found in hibernating females at some dates, but at lower prevalence than hyphal bodies and predominantly only until November 8. Prevalence of resting spores in hibernating females ranged from 2.5 to 13.8%. The study confirmed that *N. floridana* survived the winter as a semilatent hyphal body infection, protected inside hibernating females. The fungus is therefore ready to develop and sporulate as soon as climatic conditions permit, resulting in early season infection of the mite. An early-season introduction of *N. floridana* to control *T. urticae* in strawberries is important, since *T. urticae* is known to cause reductions in strawberry yield at much lower population levels in early season than in late season. For *N. floridana* to control *T. urticae* populations early in the spring, factors important for sporulation and dissemination of the fungus need to be favored. The use of pesticides, especially fungicides, might therefore be very important at this time of the year. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Thursday 26, Morning, Room 1

232 - Molecules, development and segments in basal Parasitiformes

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Ever since the pioneering work of Grandjean, Opilioacarida have been regarded as a possible bridge group between Acariformes and Parasitiformes. This idea is based on the obvious morphological differences between Opilioacarida and the two main lineages of Acari. This view has

recently been challenged by molecular analyses, suggesting Opilioacarida belongs within Parasitiformes, specifically within a lineage also including Holothyrida and Ixodida, but excluding Mesostigmata. Analyses including more taxa and more loci confirm this result, suggesting a significant conflict between morphology and molecules. Notably, some perceived differences among the parasitiform suborders may be invalid. A study of early postembryonic development in Opilioacarida (and Holothyrida) reveals patterns of sensilla on the idiosoma that are highly similar among all Parasitiformes. Moreover, all 4 suborders can be accommodated quite easily within a single scheme of segmentation: all Parasitiformes appear to have the same number of segments. The segmental distortions involved show strong similarity to pattern in Acariformes (and possibly other Arachnid groups). The analysis also allows some speculation on the nature of the nymphs in Mesostigmata.

Tuesday 24, Afternoon, Room 4

233 - Ticks and their relatives: higher order molecular systematics

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Tick systematics for most of its existence has proceeded with little or no consideration of the place of ticks within Arachnida, and specifically within the mite order Parasitiformes. This is a result of tradition, most tick systematists do not deal with mites and vice versa, and the obvious morphological, behavioral and life-history differences between Ixodida and other Parasitiformes. Molecular systematics has provided a relatively easy option for meaningful comparisons between ticks and mites, and over time a substantial literature on the subject has build up. Among the results: (1) Holothyrida is firmly established as the sistergroup to Ixodida, (2) Ixodidae and Argasidae are well supported monophyletic groups, (3) relationships among genera in Ixodidae are relatively well understood. Consequences of these results in terms of evolution of life history and evolution of morphology are still underexplored. Remaining issues are relationships in Argasidae and in Ixodinae, specifically as related to, respectively, bat associates and Australian endemics, and relationships within many of the large genera.

Monday 23, Afternoon, Room 3

234 - Can the use of *Phytoseiulus longipes* improve the biological control of two-spotted spider mite on greenhouse grown tomatoes?

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The predatory mite *Phytoseiulus persimilis* Athias-Henriot has been used for biological control of two-spotted spider mite (*Tetranychus urticae* Koch) on greenhouse grown tomatoes for many years. However, control is not always satisfactory. This is generally attributed to the glandular trichomes of tomatoes, which negatively affect the performance of *P. persimilis*. In recent years, populations of *Phytoseiulus longipes* Evans have been collected from tomato plants in South America. These populations performed well on *T. urticae* as well as *Tetranychus evansi* Baker & Pritchard in laboratory trials and might have the potential to improve spider mite control in greenhouses as they are adapted to tomato. Semi-field trials were conducted in greenhouses in two major greenhouse tomato production areas in Europe, the Netherlands and Spain to compare the performance of these two *Phytoseiulus* species in *T. urticae* control on tomatoes. The predatory mites were released on tomato plants that were infested with *T. urticae* in cages build within greenhouses. Two experiments were conducted in the Netherlands and one in Spain. The predatory mites were released at an approximate rate of one predator to ten spider mites. Spider mite and predatory mite populations were evaluated weekly over a period of 6-10 weeks by collecting leaflets from the plants and counting mites under the dissecting microscope. Both phytoseiid species significantly reduced the spider mite population compared to the untreated control in all three experiments but differences between the two phytoseiid species were not significant. The

number of cumulative spider mite days over the experimental period in the Netherlands was 7079±435 (control), 2016±447 (*P. longipes*) and 1100±215 (*P. persimilis*) in the first experiment, and 8993±717 (control), 2236±516 (*P. longipes*) and 3216±914 (*P. persimilis*) in the second experiment. In Spain the values were 2517±216 (control), 887±111 (*P. longipes*) and 565±90 (*P. persimilis*). The use of *P. longipes* does not improve biological control of *T. urticae* in tomato greenhouses compared to *P. persimilis*. The influence of temperature and humidity conditions in the greenhouses on the development of spider mite and predatory mite populations will be discussed.

Wednesday 25, Morning, Room 2

235 - Regulation of host wound healing cells by tick saliva

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To successfully complete feeding, ixodid ticks must subvert wound healing in the host. Two important cells involved in wound healing are fibroblasts and macrophages. Fibroblasts, found in the host's dermis, would normally migrate into the wound to initiate wound closure. Macrophages, commonly found in the tick feeding lesion area, would normally initiate the proliferative phase of wound healing. Here we report on the effects of salivary gland extract (SGx) and saliva from partially fed *Dermacentor variabilis* females on fibroblasts and a murine macrophage-like cell line (IC-21). Repair of injured fibroblast monolayers was delayed by SGx pretreatment and was not associated with reductions in cell number. In migration assays, SGx suppressed both basal- and platelet derived growth factor (PDGF)-stimulated fibroblast movement. Furthermore, SGx and saliva reduced PDGF-stimulated extracellular signal regulated kinase (ERK) activity. Thus, the delayed repair of monolayer injuries resulted from SGx inhibiting fibroblast migratory responses to chemotactic signals. SGx also suppressed injury- and growth factor-induced ERK activation in renal epithelial OK cells. Our data suggest that maintenance of the tick feeding lesion results, in part, from suppressing ERK signaling and fibroblast migration, events playing integral roles in the wound healing response. The effects of SGx on cells not involved in wound healing suggest that a constituent(s) in tick saliva has global effects on the ERK signaling pathway. In blind well assays, stimulated fibroblast migration is suppressed by PGE_2, an effect mimicked by tick saliva. Both the PGE_2 and saliva induced suppression of fibroblast migration are rescued by the PGE_2 antagonist AH 6809. In IC-21 cells, saliva increased both basal and PDGF stimulated migration. However, saliva did not affect PDGF stimulated ERK activity. Lipopolysaccharide stimulated interleukin-1 receptor associated kinase (IRAK) activity was unaffected by SGx, while zymosan-mediated IRAK activity increased when cells were pretreated with saliva. Saliva suppressed phagocytosis of zymosan particles by IC-21 cells. An RT^2 Profiler™ PCR Array revealed that saliva regulates gene expression in a manner consistent with an immune response skewed toward a Th2 reaction. These results suggest that *Dermacentor variabilis* has evolved a mechanism for regulating macrophage function which may contribute to the tick's ability to modulate immune function.

Tuesday 24, Afternoon, Room 6

236 - Discovery and description of nymphal stages of a heterozeronid mite (Acari: Mesostigmata: Heterozerconidae) from coastal forest litter in southeastern São Paulo State, Brazil

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Free-living mesostigmatic mites collected in coastal forest litter samples in southeastern Brazil were determined to be the nymphal stages of an unknown species of Heterozerconidae, a family whose adults are typically associated with millipedes (Diplopoda) and, less commonly, with squamate reptiles. This is only the second published record of immature heterozerconids and the first positive determination of field-collected heterozerconid nymphs for which the adult has yet to be identified. The protonymph and deutonymph are described, unique

morphological characters are discussed, and inferences are made as to the possible identity of the adult stage and its host.

Monday 23, Afternoon, Room 5

237 - Problems met with descriptions of new species or with genera revisions within the Phytoseiidae (Acari, Mesostigmata)

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The description of new species or the revision of a genus faces the problems of type loaning. In some occasions, collections have disappeared or have been lost (fires, inundations, etc.). This is the case of very important collections from specialists having described many species of Phytoseiidae. In many occasions, types are not lost but cannot be loaned because of the specific rules of the country in which types are deposited or because of the insecurity of postal services. In these cases, the only solution is to visit the country and to study types in the place, which is not always possible, costs a lot of money and is very time consuming. In some other cases, hopefully more rare, types declared to be deposited in one place are finally not in this place (despite the paper mentioning the deposit), or the types are deposited in the collection of the describer but he does not want to loan the types. As published descriptions are not always good enough to make a decision on the specific status of species examined: bad drawings, short and elliptic descriptions, not all information included in the descriptions, etc., there is a great need for standardising the rules concerning new species descriptions, especially for key-diagnostic characters. For this, the type material of the more related species must be observed, and thus solutions have to be found to make the access to types easier. One will agree on the facts that it is more than normal that laws and rules exist but it is not normal that the scientific heritage of humanity cannot be accessed freely and easily. One solution could be that in the future, type material be deposited in as many different natural history museums as possible. This will make access easier and reduce the chances of loosing all types in case the case of a disaster, if they are all deposited in a single museum. The International Code of Zoological Nomenclature should be changed in order to obligate taxonomists to do that. This matter should be further discussed. More generally, another problem when describing a new phytoseiid species is that the description is very often based on few specimens. The intra-specific variability, especially lengths (see Faraji's communication) is thus underestimated. This can lead to the use of non reliable diagnostic characters and sometimes to non relevant new species. Thus, there is a need for complete descriptions based on a great number of specimens conserved as type material. But there is also a need to take more into account re-descriptions and other specimens collected in other localities than type ones. Furthermore, new species are very often recorded one time from the type locality but are never or rarely recovered afterwards. This is a problem when molecular biology is applied to assist morphological diagnostic (i.e. cryptic species, weight of some morphological characters), as absolute alcohol preserved specimens are required. For this, in addition to microscopic type material (slides), it would be useful to conserve also and make available type alcohol preserved specimens for further DNA analyses.

Thursday 26, Afternoon, Room 1

238 - The concept of species and the morphological diagnostic of species within the family Phytoseiidae (Acari, Mesotigmata)

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The concept of species within the family Phytoseiidae is based on a series of morphological characters defined by several authors since the first description in 1839. As for all other taxonomic groups of mites with a microscopic size, there are only few morphological characters available. The description of a new species and then the process of identification are first of all based on characters of females. Sometimes, male and immature characters can also be taken into account but are rarely used

for identification as rarely reported in the descriptions. As a consequence, it is nearly impossible to identify male and immature when found without the females. The main feature used for species definition are the absence / presence of dorsal setae, their position, length and shape, that are associated to absence / presence of solenostomes and their nature on dorsal and ventral shields, chaetotaxy and shape of ventral shields, leg chaetotaxy and macroseta occurrence on some articles of the legs, lengths of chelicerae and absence / presence of teeth on each digit, the shape and dimensions of the spermatheca. All these characters must be included in a standard species description to make the species identification as reliable as possible and the comparison between species possible. However, species identification faces several problems. At first, in many papers, mostly in the past, only brief description and very bad drawings were published. Furthermore, the papers are somewhat difficult to retrieve, published in confidential journals, and in languages not easy to be understood by a large number of scientists. Lastly, another problem is that the weight of some characters to separate species is difficult to determine, especially because of the absence of studies on intra- and interspecific variations. For instance, for some species, the length of setae does not seem to accurately separate species such as it was proposed. All these elements can thus make uncertain the diagnostic decisions and has had probably a consequence on the high number of synonymies among the Phytoseiidae. When describing a new species, the observation of type material of species morphologically related is usually required. However, it is sometimes difficult to retrieve the lab / museum where the material type was deposited, thus difficult to loan the types and simply impossible in some countries. Lastly, the type material is sometimes in a so bad state that it is impossible to use. This paper clearly points out the need for additional morphological approaches, such as geometric morphometry, combined with molecular markers for species differentiation at all the life stages. All these additional characters will allow a more complete and accurate species description. Finally, this paper is a claim for a more integrative description of species of phytoseiid mites and thus, for the future development of a modern integrative taxonomy using all classical and new developments in taxonomy.

Tuesday 24, Morning, Room 4

239 - Current world tick fauna: Argasidae family

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The Argasidae tick family is currently composed by approximately 190 species. This number has increased significantly during recent years, especially in the Neotropical region, where eight new species were described during the last eight years. In contrast, very few research or progress has been achieved in other regions of the world. Since the beginning of the 20th century, there have been various proposals on the systematic of the family Argasidae. However, this issue continues to be a great problem, especially at genus level, with no consensus among taxonomists. Traditionally, major argasid genera proposed by American taxonomists were *Argas*, *Ornithodoros*, *Otobius*, *Antricola* and *Nothoaspis*. Russian and French taxonomists used to subdivide the genera *Ornithodoros* and *Argas* into several others, which were regarded as subgenera by Americans. More recently, a first phylogenetic study based on cladistic methods applied to morphological and biological characters, mostly on the larval stage, proposed the transfer of many *Ornithodoros* and *Argas* species, plus all *Antricola* and *Nothoaspis* species, to the genus *Carios*, which was resurrected from the subgenus level. While this classification has been used by some current taxonomists, others still use the classic American classification, and a few still use the Russian or French classifications. Since it is a consensus that the available literature is not sufficient to define which classification is the most appropriate, further morphological, biological, ecological, and especially genetic studies with type species of each genus is urgently needed for clarification of the generic status of the argasids. Regarding morphology, recent studies in the Neotropical region have shown that the adult stage of bat-associated argasids is so rich in derived characters, that they are poorly informative for generic classification; in this case, larval stage is much more informative. Finally, very little progress has been achieved with recent molecular-based

phylogentyic studies of argasids because the vast majority of available DNA sequences in Genbank are from New World ticks, with little information from other parts of the world. This research was financially supported by the Brazilian CNPq.

Wednesday 25, Afternoon, Auditorium - Poster

240 - Effect of trichomes in antibiosis of 12 native corn cultivars to *Tetranychus urticae* (Acari: Tetranychidae)

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Antibiosis of 12 native corn cultivars to *Tetranychus urticae* Koch, the twospotted spider mite, was determined. A colony of this mite was established in the laboratory with specimens collected corn plants at Laguna area in Coahuila, Mexico. Female mites were transferred from the colony to pieces of corn leaves (20 cm long). After 24 h, females were removed, but the eggs they laid were retained on the leaves. Post-embryonic stages then were reared to adulthood, transferring then groups of five one-day old mated females to each 1 cm^2 arena made of the third corn leaf on each native cultivar; each arena was maintained on a Petri dish lined with wet cotton wool and kept in a bioclimatic chamber at 25±2 °C, 60-70%RH and 12:12 photoperiod. Cultivars Bolita, Dulce and Tuxpeño showed higher degree of resistance to *T. urticae* as compared with Celaya, Reventador and Pepetilla. A negative relation was observed between female survivorship and daily oviposition rate in relation with trichome density on the leaves.

Wednesday 25, Afternoon, Auditorium - Poster

241 - Effect of *Megathyrsus maximus,* exotic grass, on soil mites in Mona Island Reserve

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Tropical dry forests are considered some of the most endangered biomes in the world, and have been particularly susceptible to human-induced grass introductions as these sites are often used for agricultural practices. Biological invasions can alter the ecosystem processes severely and lead to functional and compositional changes in the biota that may become permanent. Those effects can be reflected not only in the aboveground dynamics but have a marked influence in belowground fauna. Mites are very abundant in soils and can play a major role in the cycling of nutrients. They are represented by three major suborders: Oribatida, Mesostigmata and Prostigmata, which cover a variety of functional roles within the ecosystem. We are studying the association between the presence and absence of an invasive African grass, *Megatyrsus maximus*, and the mite community diversity in Mona Island Reserve, an isolated natural reserve west of Puerto Rico which exhibits a conglomerate sub tropical dry forests associations. We are testing the hypothesis that the presence of *M. maximus* decreases mite biodiversity and most likely Oribatida taxa, lowering the abundance of detritivorous mites. Prior studies suggest that species of Oribatida tend to be highly susceptible to environmental changes. Results suggested that grass invaded sites had lower mite abundance and species richness; however, Oribatida were lower in the grass invaded plot only at one site but not the other. Differences in abundance between grass invaded and non-invaded were also not as large for this site. Results suggest that although this exotic grass may have an effect on mite abundance and composition, other factors, not measured in this study, may also be important.

Tuesday 24, Afternoon, Room 1

242 - Aggregation behaviour and genetic diversity in *Tetranychus urticae*

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Spatial and temporal cohesion of aggregates can be explained by individual attraction to a same environmental stimulus or by mutual attraction between group members. Considering that leaves are not even surface, the distribution of *T. urticae* individuals over the host plant leaves should not be uniform. We studied the spatial distribution of 10 adult females when colonizing a new environment, in relation with the genetic proximity of individuals and the kind of substrate: biotic environment (leaf disc) or abiotic environment (glass discs). Leaf discs mimic natural environment offering a high quantity of food, whereas a glass disc is a homogeneous artificial substrate without food. By comparing the spatial distribution of mites on these two substrates, we can investigate the influence of food and leaves' irregularity on mites' aggregation. A red (Tunisia) and a green (Belgium) form of *T. urticae* were used to test the genetic compositions of the group (10 red individuals, 5 green + 5 red individuals or 10 green individuals). The aggregation level varied according to forms. It increased with time for the green and red groups. The aggregation dynamic of the mix group increased too but was intermediate between the two other forms which suggest that there is no spatial discrimination between the two forms, although they are genetically different. The aggregation level varies on different substrate: the green form was more aggregated than the red form on leaf discs whereas it was the opposite on glass discs. The aggregation dynamic of the mix group seems to follow the green one. The two forms present thus different strategies of spatial distribution in function of the genetic diversity level of the group.

Tuesday 24, Morning, Room 1

243 - Spatial and social organization of two mite species

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Social organization of arthropods relies on several interactions between individuals or between individuals and their environment. Several researches were carried out on this topic with social insects (Hymenoptera and Isoptera) but species characterized by a simpler social organization such as mites have been poorly studied. However, mites have necessary prerequisites to the emergence of social behaviours such as mutual conspecific attractions, spatial proximity and spatio-temporal overlap of generations. Our current work shows that cooperation in mites is not only limited to simple aggregative processes, but it surprisingly shows that mites also exhibit complex social behaviours such as recruitment and construction of common shelters. For instance, during migration, studies show that spider mites and dust mites show a tendency to choose the path that has previously been chosen by other mites. By means of theoretical and experimental studies, we show that this type of behaviour can be assimilated with trail laying and trail following, such as in ants. This results in collective migration and aggregates formations. Silk threads spinning by spider mites can be considered as a key element for their group life. Behavioural experiments provide evidences that mites construct a collective web, and use their silk to select their habitat and to communicate. In dust mites, social organization and communication are probably based on chemical information which triggers and control recruitment and aggregate formation. The evaluation of the mites' social degree requires thorough investigations.

Tuesday 24, Morning, Room 3

244 - Acaricide resistance management of the two-spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae) by incorporating modeling approach

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There are numerous reports on the occurrence of acaricide resistant strains of *Tetranychus urticae*. Thus, acaricide resistance has been considered one of the major factors that are responsible for the failure to control *T. urticae* in various crop and fruit tree systems. The analytical or simulation models, which typically explore the genetic, biological, and operational factors, are often used to predict how fast acaricide resistance is likely to develop in a *T. urticae* population, and thus could help develop strategies or tactics for delaying or reducing resistance. Effects of three selected acaricides (dicofol, milbemectin and bifenthrin) on life table parameters of *T. urticae* were experimentally determined. Only one developmental stage was treated by each acaricide at each LC_{50} for respective developmental stage. Tests were conducted through all developmental stages. The intrinsic rate (r) of untreated *T. urticae* was 0.202. The r value was highest in *T. urticae* which survived from eggs that were treated by dicofol or milbemectin, being 0.216 and 0.209, respectively, while it was significantly lower when adults were treated, being 0.139 and -0.034, respectively. Bifenthrin reduced the r value significantly when treated on any developmental stages, and was -0.076 when adults were treated. A stage structured matrix model of *T. urticae* was developed by incorporating survival, growth (transfer) and reproductive rates for each stage (egg, larva, protonymph, deutonymph, and adult). Then, demographic analysis was conducted to test the potential effects of different management tactics. The sensitivity analysis indicated that the survival rate was more sensitive than the growth rate, and especially the egg survival rate was most sensitive. The result suggests that the control to target both egg and adult stages appears to be preferable. Also, effects of susceptible allele introduction and acaricide treatment number on the resistance development were simulated by using a monogenic model system.

Tuesday 24, Morning, Room 3

245 - Molecular aspect of acaricide resistance of the two spotted spider mite

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We investigated the biochemical and molecular resistance mechanisms of the two-spotted spider mite (TSSM, *Tetranychus urticae* Koch) to three major acaricides including monocrotophos, fenpropathrin and abamectin with an emphasis on the target site insensitivity. As a primary step for resistance study, the UD strain was established as an absolutely susceptible reference strain that has a pure wildtype genetic background through susceptibility determination in conjunction with species identification. Cloning and extensive sequence comparison revealed that three point mutations (G228S, A391T and F439W) on the acetylcholinesterase (AChE), a single point mutation (L1024V) on the voltage sensitive sodium channel (VSSC) and a single point mutation (G323D) on the glutamate gated-chloride channel (GluCl) are associated with the resistance to monocrotophos, fenpropathrin and abamectin, respectively. Interestingly, extensive gene duplication of AChE gene (*Tuace*) was also involved in organophosphate (OP) resistance. Overexpression of AChE in OP-resistant field populations of TSSM was confirmed by Western blotting, suggesting that the OP resistance in TSSM appears to have evolved through a combination of mutation accumulation and extensive gene duplication. The enhanced detoxification enzyme activities mediated by carboxylesterase and cytochrome P450 monooxygenase were also associated with abamectin resistance as minor factors. Quantitative sequencing (QS) protocol, a population-based genotyping protocol, was developed to determine the allele frequencies of aforementioned point mutations conferring resistance, and employed for the prediction of the resistance-associated mutations in field-collected populations of TSSM. The three *Tuace* mutations

(G228S, A391T and F439W) were present in high frequencies. However, the L1022V mutation on the VSSC gene was found only in some regional populations and the G323D mutation on the GluCl gene was not found from field strains, suggesting the fenpropathrin and abamectin resistance is not yet widespread. Monitoring of acaricide resistance level by the QS method will contribute to the management of acaricide-resistant mite populations.

Thursday 26, Afternoon, Auditorium - Poster

246 - Does chaetotaxy determine the ability of *Phytoseiulus longipes* Evans (Acari: Phytoseiidae) to penetrate the webbing of *Tetranychus evansi* Baker & Pritchard (Acari: Tetranychidae)?

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The red spider mite, *Tetranychus evansi* Baker & Pritchard, is an important pest of solanaceous crops, especially tomato. This spider mite is well known by its high capacity to spin profuse and chaotically structured web over its host plants that acts as a defense mechanism against predatory mite. However, some predatory mites, as species of *Phytoseiulus*, are known to be well adapted to the web produced by their prey. It has been hypothesized that the ability of predatory mites to cope with the web produced by spider mites is related with their chaetotaxy. Here we study the chaetotaxy of two predatory mites, *Phytoseiulus longipes* Evans and *Phytoseiulus macropilis* (Banks), in order to understand how dorsal shield setae could help predatory mites to cope with the web of Tetranychidae mites. To access this, first we mounted specimens of both mite species on microscope slides, photographing the mites for the subsequent measurement of their dorsal shield setae. Later, we carried out a bioassay to study the effect of the web produced by *T. evansi* on the predation performance of both predatory mite species. Thus, we evaluated the predation and oviposition rates of the mites on discs with or without web. Considering that *P. macropilis* do not prey on *T. evansi* eggs we used tomato leaf discs with *Tetranychus urticae* Koch eggs but with the web produced by *T. evansi*. For *P. longipes*, we used discs with eggs and web of *T. evansi*. Predation and oviposition rate of *P. longipes* were not affected by *T. evansi* webbing ($F_{1,25}$=0.1213, P=0.7306 and $F_{1,25}$=0.9552, P=0.3378 respectively). The predation rate of *P. macropilis* was lower on discs with web of *T. evansi* than on discs without web (5.7±2.3 and 15.0±4.3 eggs per female, respectively) and the oviposition rate was similar on these treatments, but both results were statistically non-significantly ($F_{1,16}$=3.88, P=0.0664 and $F_{1,16}$=0.334, P=0.5633 respectively). On the chaetotaxy study, we could observe that only two setae were bigger on *P. longipes* than on *P. macropilis*: *j3* (82.31±1.49 µm on *P. longipes* and 33.76±4.40 µm on *P. macropilis*) and *z4* (90.88±2.02 µm on *P. longipes* and 49.54±3.13 µm on *P. macropilis*). It might be possible that these differences between their chaetotaxy enabled *P. longipes* a better capacity to deal with *T. evansi* webbing. In a future work we will intend to cut the setae *j3* and *z4* of *P. longipes* to test whether this structure are really the key factor that determines the ability of *P. longipes* this predatory mite to cope with *T. evansi* webbing. This research was financially supported by FAPEMIG and CNPq.

Wednesday 25, Afternoon, Room 6

247 - Small scale tests with predatory mites for control of the poultry red mite *Dermanyssus gallinae* (Acari: Dermanyssidae)

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Following a published assessment of predators controlling poultry red mites (*Dermanyssus gallinae*) in nests of the European starling, we carried out small-scale experiments in cages with 2 or 3 chickens to determine the impact of two species of predatory mites (*Androlaelaps casalis*,

Stratiolaelaps scimitus) on the dynamics of red mite populations. Three, replicated treatments, two with and one without predators, were carried out at three temperature regimes: 26 ºC, 30 ºC (day and night) and 25 ºC (day)-33 ºC (night). At the start c. 300 poultry red mites were released, whereas c. 1000 predators were introduced 12 days later at 26 ºC and (to reduce ultimate densities) 3 days later in all other experiments. After 6 weeks total population sizes were assessed. For the temperature regimes of 26 ºC and 25-33 ºC the predators reduced the poultry red mite population relative to the control experiments by a factor 3 and 30 for *S. scimitus* and by a factor of 18 and 55 for *A. casalis* respectively. For the temperature regime of 30ºC, less reduction was obtained (1.3 for *S. scimitus* and 5.6 for *A. casalis*) for reasons that may relate to the condition of the chickens (liquid state of the manure). Poultry red mite control was not negatively affected by high temperature and was always better with *A. casalis* than with *S. scimitus*. In none of the experiments predators managed to eradicate the population of poultry red mites. This may be due to a prey refuge effect since most predatory mites were found in and around the manure tray on the bottom of the cage, whereas most poultry red mites were found higher up in the cage (i.e. on the walls, the cover, the perch, the nest box and the food box). We discuss possibilities for reducing this refuge effect in order to improve red mite control in poultry houses.

Wednesday 25, Afternoon, Room 6

248 - Candidate predators for biological control of the poultry red mite *Dermanyssus gallinae* (Acari: Dermanyssidae)

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The red mite, *Dermanyssus gallinae*, is currently a significant pest in the poultry industry in Europe. Biological control by the introduction of predatory mites is one of the various options for controlling poultry red mites. Here, we present the first results of an attempt to identify potential predators by surveying the mite fauna of European starling (*Sturnus vulgaris*) nests, by assessing their ability to feed on poultry red mites and by testing for their inability to extract blood from bird hosts, i.e. newly hatched, young starlings and chicken. Two genuine predators of poultry red mites were revealed in this way: *Hypoaspis aculeifer* and *Androlaelaps casalis*. A review of the literature showed that some authors suspected the latter species to parasitize on the blood of birds and mammals, but they did not provide experimental evidence for these feeding habits and/or overlooked published evidence showing the reverse. We advocate careful analysis of the trophic structure of arthropods inhabiting bird nests as a basis for identifying candidate predators for control of poultry red mites.

Tuesday 24, Afternoon, Room 3

249 - Mechanisms of acaricide resistance and use of synergized formulations for the control of resistant populations of the cattle tick *Rhipicephalus microplus*

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Resistance to acaricides in the cattle fever tick *Rhipicephalus microplus* remains a major problem for the successful control of this economically important ectoparasite of cattle in many countries, including Mexico and Brazil. Resistance to coumaphos and other acaricides is also a major concern to the USDA's Cattle Fever Tick Eradication Program (CFTEP). During the past 10 years, research at the USDA-ARS Knipling-Bushland U.S. Livestock Insects Research Laboratory in Kerrville, Texas has focused on characterization of mechanisms of resistance to three major classes of acaricides (pyrethroid, organophosphate, and formamidine) and

development of new acaricide formulations to combat resistance. Using both the traditional and modified FAO larval packet tests, we measured the levels of resistance to various acaricides in tick samples collected from Mexico. Resistant tick colonies were established and maintained at the USDA-ARS Cattle Fever Tick Research Laboratory in Mission, Texas. The mechanisms of resistance were first studied using synergist bioassays to determine the involvement of metabolic enzymes, and then using molecular and biochemical techniques to identify and characterize resistant genes and the key metabolic enzymes involved in resistance. It has been determined that resistance to organophosphates is conferred by both insensitive AChE and the enhanced activity of *cyt*P450s, while a sodium channel mutation and a detoxifying esterase (*CzEst9*) are responsible for pyrethroid resistance. Although the mechanism of resistance to amitraz is still not fully understood, there is evidence suggesting that the gene(s) conferring resistance to amitraz may be closely linked to the ones contributing to pyrethroid resistance. To develop synergized acaricide formulations, the effectiveness of pyrethroid and amitraz mixtures was evaluated for the control of resistant *R. microplus* on cattle. Significant synergism was observed when amitraz was used as a synergist in pyrethroid toxicity bioassays under laboratory conditions. Results of the on-animal efficacy trials of pyrethroid and amitraz alone and mixtures of the two at different concentrations revealed a similar pattern of synergism. Adding amitraz to a pyrethroid formulation led to dramatic increases of percent reduction of both immature ticks and engorging female ticks. However, adding pyrethroid to an amitraz formulation did not increase control efficacy. Results from this study may lead to the adoption of new amitraz-synergized deltamethrin formulations for the control of pyrethroid-resistant *R. microplus*.

Thursday 26, Afternoon, Auditorium - Poster

250 - Efficacy of ELECTOR® against the Red Mite *Dermanyssus gallinae* in laboratory and field trials

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Dermanyssus gallinae is the economic most important ectoparasite in poultry houses. The insufficient efficacy of commercial products results from mistakes in handling or from resistance of the mites against active ingredients or substance groups. A new substance is Spinosad (Elector®, Elanco Animal Health). The efficacy against all mobile stages of the Red Mite with the Elector labelled rates in laboratory and field tests is demonstrated in this paper. In laboratory trials the efficacy of ELECTOR®, against all mobile stages of *D. gallinae* in the Mite Package Test in the concentrations 2000 ppm and 4000 ppm was observed. For the tests, fully engorged females were used. A clear efficacy could be observed in laboratory trials within the first 3 days and efficacy increased when mites were counted at 5 and 6 days post exposure. The trials showed efficacy against all mobile stages of *Dermanyssus gallinae* with both concentrations. The average mortality of nymphs after 6 day period was 92% with 2 mg/ml and 98% with 4 mg/ml. The average mortality rate of adults after 5 day period was 66% with 2 mg/ml and 93% with 4 mg/ml. The field trial was conducted in a farm with two separated identical barns. Both showed very strong infestation with mites. The development was in full reproduction. Sample collections were made once a week in alternate positions over a period of 56 days and 93 days, respectively. A total of 10 samples per stable were brought to the lab. Up to 1000 obviously seen mites, all were prepared with fine needles and embedded on slides in polyvinyl-lactophenol. Samples with obviously more than 1000 mites were absorbed in 100 ml 70% alcohol. 10% of the material was filtered and all mites and eggs prepared. All prepared material was counted and differentiated into larvae, nymphs and adults and into the sucking conditions engorged or not engorged. In house 1, treated with 2 mg/ml (2000 ppm), nearly 100 % mortality of mites could be observed until week 5 post treatment. Until week 7 the reduction was still 75%. In house 2, treated with 4 mg/ml (4000 ppm), the examination was made till day 93. A nearly 100% mortality could be observed until day 77 (week 11). Until day 84 (week 12) the mortality rate slowly came down to 57% and was finished at day 93, more than 13 weeks post treatment. The untreated control house maintained high red mite

infestations. Conclusions: The results show that ELECTOR® is effective against all mobile stages of the Red mite *Dermanyssus gallinae*. Laboratory trials were confirmed in a controlled field trial under commercial conditions with extremely high mite infestation with one Elector treatment.

Thursday 26, Afternoon, Auditorium - Poster

251 - Accessibility of *Neoseiulus baraki* Athias-Henriot (Acari: Phytoseiidae) and *Proctolaelaps bickleyi* Bram (Acari: Ascidae) under the perianth of *Cocos nucifera* L.

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The predatory mites most commonly associated with the coconut mite, *Aceria guerreronis* Keifer (Eriophyidae), under the perianth of coconuts in Brazil are species of *Neoseiulus* (Phytoseiidae) and *Proctolaelaps* (Ascidae). However, their role in controlling the pest has not been sufficiently studied. The objective of this study was to evaluate the limiting factors determining the time of access of the coconut mite and its predators to that restrict microhabitat. The study was conducted from December 2008 to August 2009 in Itamaracá, Pernambuco State, Brazil, where the main predatory mites found in that microhabitat are *Neoseiulus baraki* Athias-Henriot and *Proctolaelaps bickleyi* Bram. A total of 288 non-aborted and aborted fruits on dwarf green coconuts damaged by *A. guerreronis* were collected. All predators found under the perianth were collected, mounted in Hoyer´s medium and identified. Maximum heights of the idiosoma of *A. guerreronis* (at level of seta *d*) and of the predators found (at level of seta *s4*) as well as the minimum distance between the bract closest to the fruit and the surface of the latter (at the external edge of the bract) were determined. *Neoseiulus baraki* and *P. bickleyi* represented 85.2 and 97.2% of the predatory mites collected in non-aborted and aborted fruits, respectively. The average heights of *A. guerreronis*, *N. baraki* and *P. bickley* were 32, 51 and 77 μm, respectively. The average minimum distances between the edge of the closest bract and the surface of the fruits ranged between 24 and 68 μm for fruits of 1 to 5 months old bunches, respectively, being shorter for non infested fruits. The measurements suggested that: a) *A. guerreronis* can only have access to the area under the perianth on fruits slightly older than one month of age; b) *N. baraki* can have access to that area only approximately two months later; c) *P. bickleyi* has dimensions that make difficult their access to the perianth. Access to the perianth remains the key issue for biological control of *A. guerreronis*. Search for natural enemies with dimensions that allow them to penetrate the fruit perianth simultaneously or shortly after penetration of *A. guerreronis* should be intensified.

Tuesday 24, Afternoon, Auditorium - Poster

252 - Tarsonemid mites on *Cocos nucifera* L. (Arecaceae) from Oman with description of a new species of *Nasutitarsonemus* Beer & Nucifora (Acari: Tarsonemidae)

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Coconut is an important crop grown in the coastal plain of the Dhofar region, southeastern Oman, on the edge of the Arabian Peninsula desert. It holds a particular place in the landscaping of the region and is also of great interest for water, consumed to drink. One of the main pests of coconut in this region is the coconut mite (*Aceria guerreronis* Keifer). Surveys were conducted to understand the dynamics of that mite and its association with other arthropods. Samples of coconut fruits were collected in August and November in 2008, and February and May 2009. At each sampling date, 3 young (2-3 month) and 3 mid (4-6 month) aged fruits of coconut were collected from each of 5 trees in each of 30 fields in the Dhofar Region. In these surveys, the presence of tarsonemid mites was determined. *Steneotarsonemus furcatus* De Leon was the most commonly found tarsonemids on fruits as well as in growing tips of coconut seedlings, always at low levels. A few representatives of an

undescribed tarsonemid species were also found. That new species belong to genus *Nasutitarsonemus* and differ from the two described species of this genus by having dorsal setae, except *sc1* and *h*, smooth; *Nasutitarsonemus brontispae* and *Nasutitarsonemus alvuventris* have all dorsal setae serrate or pilose. Females of this new species further differ from the previously described species by having sejugal apodeme not continuous medially and by lacking poststernal apodeme; *N. brontispae* and *N. alvuventris* have sejugal apodeme continuous and poststernal apodeme present. All specimens (only females) of two others species of *Nasutitarsoenmus* were collected from beetle. Specimens of the new species here described were found on coconut fruits as well as in the growing tip of coconut seedlings. Although it was not possible to observe the feeding habits of this new species, the occurrence of males and females in a protected microhabitat (tight space between the bracts and the fruit surface, or between the bases of the younger leaves), in the absence of insects, suggests that it is not an insect parasite. The co-occurrence of this new species with *A. guerreronis* suggests that it could either prey on the latter or feed on the tender coconut tissues onto which it was found, though no damage to the fruits could be observed.

Wednesday 25, Afternoon, Auditorium - Poster

253 - The *in vivo* effect of *Annona muricata* L. (Annonaceae) extract on *Rhipicephalus microplus* (Acari: Ixodidae)

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The cattle tick, *Rhipicephalus microplus*, is the most important ectoparasite of Brazilian cattle ranching. Its control is primarily done with chemical products. The use of plant extracts to control ticks has been widely studied. The present work aims at evaluating the in vivo effect of *Annona muricata* seed organic extract on *R. microplus*. The study was conducted on a farm in the municipality of Viçosa, Alagoas, Brazil. Two groups of four Holstein cows were used. Cows of the control group were sprayed with distilled water and dimethylsulfoxide (1% concentration), whereas cows of the treated group were sprayed with extract of *A. muricata* seeds. After 24 hours, 120 engorged female mites were collected from the cows of each group and taken to the laboratory. The rate of conversion in eggs, egg weight, hatchability, mortality and product efficiency were evaluated. Differences in biological parameters were determined by Student's t-test ($P \leq 0.05$). Significant differences were observed between treatments. For the group treated with extract of *A. muricata* seeds, the rate of conversion in eggs was 33.66 ± 2.27, weight of each egg was 0.33 ± 0.20, hatchability was 58.33 ± 4.47 and the efficiency of the product was 53.62 ± 5.98. Rate of mortality was low (28.80 ± 0.08) when ticks were treated with extract of *A. muricata* seeds. Nevertheless, the extract can be an alternative to acaricides normally used to control *R. microplus*, because it interferes in the reproduction of *R. microplus*.

Wednesday 25, Afternoon, Auditorium - Poster

254 - Biological performance of *Polyphagotarsonemus latus* on genotypes of *Jatropha curcas*

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The broad mite, *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae), is a polyphagous mite that has been cited as one of the most important pests of physic nut in Brazil. However, there is no information available about broad mite development on the main genotypes of physic nut cultivated in this country. The aims of this research were to evaluate the biological parameters of *P. latus* and to determine the population growth through the estimation of the intrinsic rate of population increase (r_m) in laboratory and the instantaneous rate of population

increase (r_i) in the greenhouse, on five physic nut genotypes (Filomena, Bento, Oracília, Gonçalo and Paraguaçú). Assessments of the biological parameters were conducted in a laboratory, at 25±1 ^oC, 60±10% RH and 14 hours of photophase, on leaf discs with 3cm in diameter. Observations on the duration of life cycle, oviposition and longevity of *P. latus* were performed every 6 hours. The intrinsic rate of population increase (r_m) was calculated through the Jackknife method using the fecundity and survival rates of the females. The instantaneous rate of population increase (r_i) was conducted in the greenhouse on seedlings artificially infested with adult females of the *P. latus*. We also evaluated the injuries caused by the mite through a scale of grades. *P. latus* was able to complete its life cycle and to reproduce on all genotypes. The biological parameters and the fecundity of *P. latus* did not differ between genotypes. The intrinsic rate of population increase (r_m), the instantaneous rate of population increase (r_i) and the levels of injury caused by *P. latus* also did not differ between genotypes. The results contributed to understand the damaging potential of this mite to genotypes of *Jatropha* in Brazil, indicating that the mite deserves close attention on this plant species.

Tuesday 24, Afternoon, Auditorium - Poster

255 - Phytoseiid mites (Acari: Phyoseiidae) from citrus groves of different parts of the world

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According to FAO, citrus was present in 140 countries around the world in 2004. Several mite species of the families Diptilomiopidae, Eriophyidae, Tarsonemidae, Tenuipalpidae and Tetranychidae are known to damage citrus. Predatory mites are also commonly found on citrus and the family Phytoseiidae is well represented. The objective of this paper is to report the phytoseiid mites found on several important citrus producing countries around the world, collected mostly by the fourth author. Mites were collected from North America (USA), Central America and the Caribbean region (Dominican Republic, Honduras, Bahamas, Guatemala, Panama), South America (Brazil, Peru, Venezuela), Asia (China), Oceania (Australia), Mediterranean region (Morocco, Portugal, Spain) and Middle East (Israel). In total, 67 species were found: 12 *Euseius*, 11 *Amblyseius*, 7 *Proprioseiopsis*, 5 *Typhlodromus* (*Anthoseius*), 4 *Neoseiulus*, 4 *Typhlodromips*, 2 *Iphiseiodes*, 2 *Metaseiulus*, 2 *Phytoseius*, 2 *Typhlodromus* (*Typhlodromus*), 2 *Typhlodromalus* and one of each of *Amblydromalus*, *Chanteius*, *Galendromus*, *Iphiseius*, *Leonseius*, *Paraseiulus*, *Phytoscutus*, *Phytoseiulus*, *Proprioseiopsis*, *Scapulaseius*, *Typhlodromina* and *Typhloseiopsis*. Four of the species are new to science. *Amblyseius herbicolus* was the species most widespread; it was found in Central America, Caribbean, North America and Asia.

Thursday 26, Morning, Room 5

256 - Tick-borne emerging diseases under the perspective of the Brazilian biomes

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Various human activities have caused intense environmental change in all the Brazilian biomes, whether due to government policy development, cultural habits or even individual interests. These changes, the creation and/or the elimination of forest fragments, have considerably increased the risk of human exposure to various biological agents, including emerging pathogens of zoonotic potential that are carried by ticks, specially the events related to *Babesia*, *Borrelia*, *Ehrlichia* and *Rickettsia* organisms, their vectors and vertebrate hosts. In the scientific literature, we have many manuscripts about these biological agents and the related risk according to different epidemiological situations and ecosystems in Brazil. It was found that at least

one of the pathogens previously cited is of importance to public health and is transmitted by ticks in all Brazilian biomes, relating the findings of these organisms with domestic and wild vertebrate hosts, as well as their vectors, and the confirmation of human clinical cases. It appears that several areas of degraded or occupation in the different biomes and ecosystems are considered at risk for the occurrence of diseases transmitted by ticks, increased by human activities and the changes of animal habits due to urbanization. These activities facilitate the possibility of contact among the species and the installation of the natural cycle of these agents, their hosts and vectors in other places. In some cases the most susceptible areas to the transmission are clearly related to the proximity of watercourses, pastures, edges of forests and peridomestic environments. The Atlantic Forest, where there are still many epidemiological and ecological situations to be studied, is the biome in which we have more knowledge in all the considered aspects: arthropod vectors, their domestic and wild vertebrate hosts, and the report of confirmed and suspect human cases for all emerging zoonotic diseases reported in this study. Compared to other biomes, it can be said that still little is known about the situation and the local host-parasite relationships; findings described so far refer to a few localities; in addition, some refer to very old studies, conducted with inappropriate investigative technologies. Bearing in mind the human activities, especially those relating to development policies and the enormous lack of knowledge about agents pathogenic or not to humans, their vectors, their wild and domestic vertebrate hosts, it can be concluded that there is an urgent need for funding and implementation of projects in areas where taxonomists, ecologists and epidemiologists, among others, can work together. Wildlife biology surveys, ecology of vectors, hosts and associated pathogens, as well as advanced studies on molecular biology genomics and proteomics, and the development of prediction models through geo-referenced studies, among others, should be performed.

Tuesday 24, Afternoon, Auditorium - Poster

257 - New species of *Cheletonella* (Acari: Cheyletidae) with check list of cheyletid mites from middle Iraq

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Eight species of cheyletid mites (Prostigmata: Cheyletidae) new to Iraqi fauna were collected from stored grains, grass, and bats on several occasions over several years. Six of the eight species namely: *Acaropsis sollers*, *Cheyletus malaccensis*, *C. eruditus*, *C. aversor*, C. *trouessarti*, and *Lepidocheyla* sp. were collected from stored grains (wheat, barley and rice). The remaining two species, *Eutogenes* sp. and *Cheletonella* sp., were collected from Cogan grass around date-palm and bats respectively. *Cheletonella* sp. is described as new from 62 specimens collected from 27 bats (20 of *Pipistrellus kuhlii* and 7 of *Taphozous nudiventris*).

Thursday 26, Afternoon, Auditorium - Poster

258 - On the parasitism of Parasitengona on Parasitengona (Acari, Trombidiformes, Prostigmata)

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Data on host spectrum of Parasitengona mites, which are known as parasites at larval stage, are scattered in the literature. Larvae of Parasitengona terrestria are known to parasitize members of Arthropoda and Vertebrata, the only exception being the record pertaining to Mollusca. Very little is known about host preferences and mechanisms which influence the larval choice. Contemporary descriptions of species based on larval instar are frequently devoid of data on specific affiliation of the host. In many cases the host identification is limited to higher taxonomic ranks (e.g. order or family). Such a procedure hinders research and the progress in studies on the biology of the group. A recent survey of the data on the host spectrum shows that cases of parasitism of Parasitengona on Parasitengona are relatively rarely mentioned in the literature, whereas they are rather frequently

observed in both natural and laboratory conditions. The aim of this work is to summarize the hitherto data on larvae of Parasitengona which exploit members of the same taxa as hosts. The list of taxa, restricted to terrestrial Parasitengona, contains also new, hitherto unpublished records. A list of Parasitengona terrestria parasitizing members of the same taxon was prepared based on literature data and results of the most recent survey of alcohol-preserved material deposited at the Institute of Biology, Department of Systematics and Ecology of Invertebrates, Wrocław University of Environmental and Life Sciences, Poland. The material was mounted on microscopic slides in Swan's medium prior to identification carried out in light microscope Nikon Eclipse 50i. Larvae of nine species have been recorded to parasitize postlarval forms of 11 species assigned to the same group of mites. Of these records – seven apply to new, hitherto unpublished data. The members of the following families were found to enter the host (H) – parasite (P) relationship: H: Erythraeidae – P: Erythraeidae; H: Erythraeidae – P: Trombidiidae; H: Smarididae – P: Trombidiidae; H: Chyzeriidae – P: Chyzeriidae; H: Calyptostomatidae – P: Johnstonianidae; H: Trombidiidae – P: Johnstonianidae; Microtrombidiidae – P: Johnstonianidae. Most observations of parasitism of terrestrial Parasitengona mites on members of the same taxon pertain to Erythraeidae. Considering the existing knowledge of host spectrum of parasitic larvae identified to species level, Parasitengona terrestria should be regarded as alternative hosts for larvae representing the same cohort.

Thursday 26, Afternoon, Auditorium - Poster

259 - Myrmecofilous Parasitengona – accident or adaptation?

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Parasitic and predatory relations between Parasitengona terrestria (Acari: Trombidiformes) and ants (Hymenoptera: Formicidae) have been occasionally mentioned in the literature. Most of the discussed cases apply to species which in all likelihood should be regarded as feeding opportunists. Parasitizing larvae are usually found on more than one host species and the feeding spectrum of postlarval forms seems to go beyond one taxon recognized as prey. Very few cases point to the presence of highly specialized taxa within Parasitengona terrestria. Our aim is to summarize the hitherto data on trophic relations between terrestrial Parasitengona mites and ants. A list of Parasitengona terrestria displaying affinity to ants was prepared based on literature data and results of most recent field observations. A summary of literature records on trophic relations between Parasitengona terrestria (Erythraeidae, Calyptostomatidae, Trombidiidae, Microtrombidiidae) and Formicidae contains data on larvae of Parasitengona terrestria parasitic on Formicidae (six records) as well as data on postlarval forms of Parasitengona terrestria preying on Formicidae (three records). Another eight records reflect still questionable relations with Formicidae, due to the limited data provided in original publications. Here we present characteristics of two observed cases which may point to specific feeding adaptations of some representatives of Erythraeidae. Saboori et al. (2009) described *Makolia crimeaensis* Saboori, Khaustov and Hakimitabar, 2009 from larvae ectoparasitic on *Lasius* sp. Eight larvae originating from the same geographic area (Crimea) were examined in the present studies. Larvae collected together with the host *Tapinoma* cf. *erraticum* (Latreille, 1798), were found under stones, attached to the hosts body between the thorax and abdomen. The postlarval forms of *Erythraeus phalangoides* were observed to feed on ants assigned to *Lasius* sp.. Since *E. phalangoides* were observed also to use other food sources, both in the field and in the laboratory, the relations with the ant should be regarded as accidental.

Thursday 26, Afternoon, Auditorium - Poster

260 - "Quest for adults" – studies on chigger mites (Acari: Trombiculidae) of Poland

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Eighteen species of Trombiculidae have been hitherto recorded from Poland, whereas ca. 270 are known from Russia and the neighboring countries. Of the Polish fauna – only three species, i.e. *Hirsutiella zachvatkini* (Shluger, 1948), *Neotrombicula autumnalis* (Shaw, 1790) and *N. talmiensis* (Shluger, 1955), have been known from larvae and postlarval forms, whereas as many as 15 – exclusively from larvae. Such disproportion, resulting from the heteromorphic character of larvae in relation to active postlarval forms, first of all should be attributed to the greater attention paid to parasitic larvae, which, contrary to other Parasitengona terrestria, are associated with vertebrates, including humans. The present studies, constituting the first step in the research project on trombiculid fauna of Poland, aim at devising an effective method of laboratory rearing, which would allow to obtain postlarval forms from field-collected larvae and larvae from field-collected females. The latter, however, depends on the effects of the intense search for hitherto unknown habitats occupied by active postlarval forms. The project started at the beginning of 2009. Larvae of Trombiculidae were obtained from rodents caught in Sherman traps. Each host was examined for the presence of external parasites. A mass appearance of larvae was observed in rodents caught in wooded areas, whereas those collected in open habitats were not infested. In most cases larvae were attached to the inside of the ears, however in few cases aggregations of parasites were observed on the top of the head, between the ears. Litter and soil samples collected from the dens and migration paths of rodents did not contain the representatives of active postlarval forms. One species of Trombiculidae, *Neotrombicula inopinata* (Oudemans, 1909), was found in the material collected from *Myodes glareolus* (Mammalia, Rodentia, Cricetidae). The species has been hitherto known only from larvae. Several larvae, which were kept in rearing vials, developed into calyptostatic protonymphs and then – into active deutonymphs. The time between the detachment from the host and reaching the immobile phase, which was univocal with the onset of protonymph instar, varied between 8 and 23 days (n = 213, mean = 14.3), the time which elapsed between reaching the immobile phase and appearance of active deutonymphs ranged from 4 to 19 days (n = 79, mean = 13.5). This may indicate that also under natural conditions specimens reach the deutonymph stage already at the turn of summer and autumn, however the overwintering instar still remains unknown.

Wednesday 25, Afternoon, Room 6

261 - How to know how many *Neoseiulus longispinosus* (Phytoseiidae) are required to suppress *Tetranychus urticae* (Tetranychidae) on rose

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The two spotted spider mite, *Tetranychus urticae*, has become a serious pest of roses cultivated for cut flowers within polyhouses, near Bangalore. This spider mite has developed resistance to most of the acaricides used by floriculturists. Hence the cost of management of this spider mite has become enormous. *Neoseiulus longispinosus* has been found to be able to bring down the population of *T. urticae* when released at various predators: prey ratios like 1:400, 1:200, 1:100, 1:50 and 1:25, within a period related to the number released. Ratios of 1:50 and 1:25 have been found to be good since the population of the spider mite is reduced to almost nil between 20-30 days after release of the predators. French bean leaves on which the phytoseiids were multiplied have been used for releasing the predators. However, it was necessary to understand how the leaves (with predators) should be distributed in the polyhouse. The study was conducted in a floriculture unit near Bangalore. Three 20 x 1 m beds having rose plants infested with *T. urticae* were selected for the study. The predators were released at the centre of these beds, at 1:50 predator: prey ratio. Plants at 1, 3, 5, 7 and 9 m distance from the centre, on both sides, were sampled. Leaves from top, middle and bottom canopy of the plants were collected at weekly

intervals and populations of all stages of *T. urticae* and *N. longispinosus* were recorded. Since the predators were released only in the centre, when they were first noticed in a sample at a particular distance from the centre, they were considered to have migrated from the adjoining plants in the direction of the centre of the bed. The predator: prey ratios in these adjoining plants during the previous week were computed, using regression models, and the mean of such ratios from the thirty samples was estimated. Though the ratios for all stages of prey to all stages of the predator were computed, it was observed that ratios of total populations of both the prey and predator gave a better estimate. Results indicated that whenever the predator: prey ratio reaches 1:23 (mean) the predator tended to move away from the patch. Hence, when using *N. longispinosus* to manage *T. urticae*, on rose, the number released should be at a predator: prey ratio not higher than 1:23. If they are released at higher ratios they tend to disperse, increasing the cost of management.

Tuesday 24, Afternoon, Auditorium - Poster

262 - Acaricidal effect of plant extracts on the coffee pest mite *Oligonychus ilicis*

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In recent years, significant losses in quality and productivity of coffee, due to the attack of pest mites occurred. The most important species is the red coffee spider mite, *Oligonychus ilicis* (McGregor, 1917) (Acari: Tetranychidae), which attacks the upper leaf cells puncturing and extracting its contents, producing webs where dust and debris stick on, significantly reducing leaf photosynthetic capacity, resulting in decreased plant productivity. The control of this pest is more conventionally done using synthetic pesticides, which can cause disequilibrium in the agroecosystem and environmental pollution. The purpose of this study was to evaluate the effect of several extracts of natural plants on mortality of the mite *O. ilicis*. Potted coffee plants infested with red coffee spider mite in greenhouse in the EPAMIG Experimental Station of Lavras, Minas Gerais - Brazil and seven natural plant extracts: *Annona squamosa* L., *Chenopodium quinoa* Willd, *Annona muricata* L., *Azadirachtina indica* (leaf), *Azadirachtina indica* (oil), *Capsicum baccatum* L. and *Agave americana* L. were used. The extracts were obtained by drying the leaves of plants in a drying oven at 50°C for 48 hours. Soon after they were ground and placed in water for 24 hours for extraction the compounds. The dosages were 40 grams of ground leaves in 1000 ml of water resulting in a syrup with a concentration of 4%. Spraying was conducted with a manual sprayer in an amount of 250 ml of solution per treatment. Four evaluations have been made after applying, at 1, 5, 15 and 40 days. For each extract 10 leaves per plant with 5 replicates were collected for the evaluation of the mortality of mites, with a total sample of 50 leaves per extract. As the infestation was already intense, the number of live mites per leaf was quantified. The results were submitted to analysis of variance and means compared by the Scott-Knott, using statistical program SISVAR. All extracts used were efficient in comparison to control, however, the first evaluation, i.e. 1 day after application (24 hours), the extracts *A. indica* (leaf) and *A. muricata* showed similarity between them, being lower than the other extracts. The evaluations at 5 and 15 days after application had no significant difference between treatments. And after 40 days only the pepper extract (*C. baccatum*) was not different from control. These results show that plant extracts are promising for use in controlling mites, and other tests with plant extracts and selectivity to predators should be encouraged. This research was financially supported by Consórcio Café.

Thursday 26, Afternoon, Auditorium - Poster

263 - Field and greenhouse evaluation of spirodiclofen (Envidor) against spider mites (Acari: Tetranychidae) in Serbia

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Spider mite (Acari: Tetranychidae) resistance to acaricides has become a global phenomenon as a result of their exceptional intrinsic potential to evolve resistance, and human activities favoring that. A way of dealing with the resistance is to search for new compounds acting on novel biochemical and physiological targets. Spirodiclofen, an acaricide with a novel mode of action (inhibiton of lipid synthesis) has recently been commercialized and recommended as a compound that effectively controls mite populations resistant to other acaricides. The efficacy of the commercial product Envidor (containing 240 g/L spirodiclofen) against European red mite (*Panonychus ulmi*) on apple, and twospotted spider mite (*Tetranychus urticae*) on greenhouse cucumber was tested in Serbia from 2004 to 2008. Spirodiclofen efficacy was compared to the effectiveness of several other acaricides (bifenthrin, clofentezine, fenazaquin, fenpyroximate) that have been in use for some time. The acaricides were applied at their recommended applications rates. Control efficacy against *P. ulmi* was tested in a commercial apple orchard at Morović (N45°00.711′; E019°15.146′). Applied at the BBCH 09 growth stage against overwintering eggs, spirodiclofen achieved 89.1% and 86% efficacy in evaluations 12 DAT (=days after treatment) and 25 DAT. Similar effectiveness was demonstrated for fenpyroximate (91.3% and 84.4%, respectively), while clofentezine achieved a considerably lower efficacy (67.4% and 27.8%). In three trials involving the summer population of *P. ulmi* in three vegetation seasons, spirodiclofen achieved high and steady efficacy: 91% (15 DAT), 97.2% (30 DAT) and 98% (45 DAT) in the first season; 95.2% (14 DAT), 96.3% (29 DAT) and 95.7% (47 DAT) in the second season; and 97.4% (14 DAT), 95.6% (21 DAT) and 97% (38 DAT) in the third season. Highest clofentezine efficacy was 90.9% (30 DAT) in the first season, 77.4% (29 DAT) in the second and 68.1% (21 DAT) in the third. Bifenthrin achieved the highest efficacy in the first season, 78.2% (15 DAT), while it declined to 65.9% (14 DAT) in the second and was practically worthless in the third season. Such unsatisfactory efficacies of bifenthrin and clofentezine are probably the result of a resistance developing under high selection pressure of these compounds at Morović. The efficacy of fenpyroximate, tested in the second season, was high (97.4%) in evaluations 14 DAT and 29 DAT, but it was only 50.3% in evaluation 47 DAT. Efficacy in controlling *T. urticae* was tested in a commercial greenhouse in Padinska Skela (N44^{0}57.012'; E020^{0}25.741'). In evaluations 6 DAT and 10 DAT, spirodiclofen achieved 98.4% and 96.8% efficacy, while clofentezine effectiveness was 95.4% and 93.4%, and bifenthrin efficacy 96.5% and 98.8%, respectively. The results proved spirodiclofen (Envidor) to be effective in controlling the European red mite on apple and twospotted spider mite on cucumber, and a good alternative to older acaricides.

Thursday 26, Afternoon, Auditorium - Poster

264 - Spirotetramat toxicity to immatures and sublethal effects on fecundity of female adults of *Tetranychus urticae* Koch

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Spirotetramat, a tetramic acid derivative, has been recently introduced as a new product intended for controlling whiteflies, aphids and other sucking insect pests of agricultural crops. The insecticide has high acute toxicity to immatures, while significantly reducing the fecundity and fertility of female adults. Spirotetramat is a lipid biosynthesis inhibitor, similar to the tetronic acid derivative acaricides spirodiclofen and spiromesifen. Even though some suppressive side effects of spirotetramat have also been detected on spider mite populations in field trials targeted against insects, there are still no sufficient data on possible acaricidal properties of that compound. Acute toxicity of spirotetramat (commercial formulation Movento) to immatures and its sublethal effects on adult females of two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), were investigated in laboratory bioassays. The bioassays were conducted in four replicates in a climatically controlled room at 27±2°C, 50-80% RH and 16/8 L/D photoperiod. Acute toxicity of spirotetramat to immatures was tested by successive treatments of eggs, larvae, protonymphs and deutonymphs on bean leaf discs (30 mm in diameter) using Potter spray tower (3 ml of spray fluid, 1 bar air pressure), and mortality was

evaluated based on the number of mites reaching the adult stage. Concentration-mortality data were subjected to probit analysis and the following LC_{50} data were computed: 0.62 mg/L (eggs), 0.10 mg/L (larvae), 0.17 mg/L (protonymphs) and 0.15 mg/L (deutonymphs). Treated directly and in the same procedure as immatures, and exposed for several days to spirotetramat concentration of ≥2 mg/L upon leaf discs, adult females showed symptoms of poisoning similar to those caused by spirodiclofen and spiromesifen: swolleness, inability to lay eggs and their accumulation in the body, sticky remains on ovipositors. Sublethal effects of spirotetramat were determined after direct treatment of pre-ovipositing adult females on leaf discs using the concentrations of 2 mg/L, 20 mg/L and 200 mg/L. After 20 h of exposure on treated discs, females showing no visible symptoms of poisoning were transferred to untreated leaf discs and re-transferred to new discs at 48 h intervals during 10 days. Based on the number of eggs laid and survival rate of females, gross fecundity and net fecundity were calculated. At the end of the tenth day, the survival rate was 0.73 in untreated and 0.45, 0.27 and 0.05 in treated females. Compared with the control mites, gross fecundity was reduced by 9% (2 mg/L), 29% (20 mg/L) and 93% (200 mg/L), while net fecundity dropped 40% (2 mg/L), 67% (20 mg/L) and 98% (200 mg/L). The results indicate that spirotetramat has a similar effect on spider mites as the acaricides spirodiclofen and spiromesifen.

Wednesday 25, Afternoon, Auditorium - Poster

265 - Detection of bovine viral diarrhea virus in *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae) ticks fed on persistently infected cattle

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Bovine viral diarrhea virus (BVDV) is an agent that causes great economical losses to cattle breeding worldwide. Congenitally infected calves which born persistently infected (PI) by BVDV are main sources of infection to cattle. Transmission of BVDV by haematophagous arthropods has experimentally been proven, but BVDV transmission by ticks has never been investigated. Ticks can heavily infest cattle raised in tropical areas and *Rhipicephalus* (*Boophilus*) *microplus* is the most important between them. The aim of this study is to investigate the infection and transmission of BVDV by *R. microplus*. Three calves were used in the experiment: (i) a PI calf experimentally infested with ticks; (ii) a calf infested with the progeny from ticks fed on the PI calf; (iii) and a negative control calf. Reverse transcription-polymerase chain reaction (RT-PCR) was used to detect BVDV in ticks and calves sera. BVDV was detected in adult female ticks fed on the PI calf. Experimental infestation with larvae hatched from females infected with BVDV was not able to induce BVDV infection in a calf. Viral RNA was not detected in eggs and larvae hatched from female ticks infected with BVDV. The data indicates that BVDV is able to infect ticks which fed on PI cattle. Despite transovarial transmission to progeny seems unlikely, we cannot rule out a role for ticks in BVDV spread. It is important to note that contrarily to female ticks, male and larvae feed in a non-continuous way, and can parasite more than one bovine during their life cycle. Studies are in progress to determine if male ticks can be infected and transmit BDVD, and the viability of virus in different tick tissues. This research was financially supported by UFRGS, CNPq and CAPES.

Tuesday 24, Afternoon, Auditorium - Poster

266 - Host plant range of the Citrus Hindu Mite, *Schizotetranychus hindustanicus* (Hirst) (Tetranychidae), in Brazil

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The Citrus Hindu Mite (CHM), *Schizotetranychus hindustanicus* (Hirst), was originally described from citrus from South India, in 1924. For a long time, its presence had not been reported in any other continent or even in other countries. However, about 80 years after its description, the CHM was reported in Venezuela. A few years later, in

February 2008, it was found in the municipality of Boa Vista, State of Roraima, northern Brazil. Colonies of CHM were found infesting leaves and fruits of Tahiti lime, *Citrus latifolia* Tanaka, and lemon, *Citrus limon* (L.). Symptoms due to CHM infestation consisted of circular whitish spots uniformly distributed all over leaves and fruits; each circle is about with 1-3 mm in diameter. Sometimes the entire canopy was affected. Information on the host range of this invasive mite in Brazil is required to evaluate its potential for economic damage and also to guide the adoption of quarantine measures. This study aimed to know other citrus host plants for the CHM in Roraima, the only state in Brazil where this mite has been reported. Surveys were conducted in backyard and commercial orchards of the municipality of Boa Vista, from March 2009 to March 2010. Sampling of several citrus species/varieties presenting typical symptoms was conducted. Direct inspection of the suspect plant material was carried out under a dissecting binocular; mites collected were mounted in Hoyer´s medium for subsequent identification under a phase contrast microscope. The presence of *S. hindustanicus* was confirmed on all the suspect citrus species/ varieties: rangpur lime, *Citrus limonia* Osbeck; tangor murcott, *Citrus reticulata* Blanco x *Citrus sinensis* (L.) Osbeck; Valencia sweet-orange, *C. sinensis*; and Poncan mandarin, *C. reticulata*. In the checked orchards no other plant species presented CHM infestations. Future studies should evaluate the potential yield or quality losses caused by CHM infestations.

Tuesday 24, Afternoon, Auditorium - Poster

267 - Host plants of the Red Palm Mite, *Raoiella indica* Hirst (Tenuipalpidae), in Brazil

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The Red Palm Mite (RPM), *Raoiella indica* Hirst, an invasive mite in the Americas, was first found in Brazil in July 2009, in the State of Roraima, infesting coconut, *Cocos nucifera* L., and banana, *Musa* sp.. Phytosanitary measures have been adopted to prevent or delay RPM dissemination to other Brazilian States. Information on additional host plants of RPM in Brazil is required to guide the adoption of preventive control measures. The objective of this study was to determine other plants infested by the RPM in Roraima, the only State in the country where this mite has been detected. Surveys were conducted in urban areas of the municipality of Boa Vista, from September 2009 to March 2010. Leaves of potentially infested plants belonging to Arecaceae, Cannaceae and Heliconiaceae were collected and taken to a laboratory for examination under a stereomicroscope. Encountered mites were preserved in 70% alcohol for later mounting and identification under a phase contrast microscope. RPM was found on 15 plant species: Arecaceae - *Bactris gasipaes* Kunth, *Caryota urens* L., *Dypsis lutescens* H. Wendl., *Elaeis guineensis* N.J. Jacquin, *Euterpe oleracea* Mart., *E. precatoria* Mart., *Mauritia flexuosa* L., *Phoenix roebelenii* O'Brien, *Pritchardia pacifica* Seemann & H. Wendl., *Rhapis excelsa* (Thunberg) Henry ex. Rehder, *Veitchia merrillii* (Becc) H.E. Moore; Cannaceae - *Canna indica* L.; and Heliconiaceae - *Heliconia bihai* (L.) cv. Napi, *H. psittacorum* (L.) cv. Golden Torch and *Heliconia* sp. Very low infestation levels were observed on *C. indica*, *B. gasipaes*, *D. lutescens* and *E. guineensis*, suggesting that probably these are less favorable hosts for RPM than other plants. The presence of RPM on *M. flexuosa*, commonly known as "buriti", is of particular interest. This species is one of the common and outstanding components of the Amazon forest. The detection of RPM on these plants in the wild suggests the natural dissemination of this pest in the region. Further studies to compare the biotic potential of RPM on those hosts are warranted. Surveys to determine new hosts are still underway in the state of Roraima.

Wednesday 25, Afternoon, Room 2

268 - *In vitro* diagnosis of tick susceptibility to acaricides

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The importance of *in vitro* techniques in evaluating tick susceptibility to acaricides is mainly related to monitoring tick susceptibility in the field and the development of new active ingredients (a.i.) and formulations. Essentially, they are indicatives of situations found on farms and are the best choice for measurement of tick resistance under laboratory conditions. In some cases they should be complemented by *in vivo* tests. Only adult and larval stages are used for these kinds of tests, in which the Larval Packet Test (LPT), Larval Immersion Test (LIT) and Adult Immersion Test (AIT) are the most commonly implemented. According to an enquire done by FAO (Food and Agriculture Organization), the most used method in laboratories working with the diagnosis of resistance was the Adult Immersion Test (AIT), a bioassay applied to engorged female ticks. This test was described by Drummond et al. (1973) and was used to determine the relative effectiveness of new acaricides against a number of tick species. It is probably the most indicated way to provide quick supporting when tick control breaks down in the field. The Larval Packet Test is considered to be the most reliable, although it is limited by the length of time that it takes. In this test, tick larvae are exposed to chemically impregnated filter papers and their subsequent mortality is quantified after 24 hours. Results for this larval bioassay in *Rhipicephalus* (*Boophilus*) *microplus* takes about 6 weeks. This method remains the main choice for surveys and for definitive confirmation of a diagnosis of resistance. The Larval Immersion Test (Shaw, 1996) is a bioassay which also provides results in 6 weeks but is not so widely used for the diagnosis of resistance. Most of the discussions regarding acaricide resistance in ticks are based on techniques developed for the one-host tick *R.* (*B.*) *microplus*. The procedures, however, have been adapted and used successfully for other tick species, including 3-host ticks. The fact that there are several tests in use for the diagnosis of tick acaricide resistance indicates that none of them alone is enough to give a definitive answer to the problem, and complementary techniques are recommended.

Tuesday 24, Afternoon, Auditorium - Poster

269 - Nymphs of the genus *Amblyomma* (Acari: Ixodidae) of Brazil: descriptions, redescriptions, and identification key

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Together with the larval stage, the nymphal stage of ticks of the genus *Amblyomma* are the most aggressive ticks for humans entering areas inhabited by wildlife and some domestic animals in Brazil. However, due to the absence of morphological descriptions of the nymphal stage of most Brazilian *Amblyomma* species, plus the lack of an identification key, little or nothing is known about the life history of *Amblyomma* spp. nymphs in the country. In the present study, morphological description of the nymphal stage, illustrating important external characters through scanning electron microscopy, is provided for nymphs of 15 *Amblyomma* species that occur in Brazil, for which the nymphal stage had never been described: *A. aureolatum*, *A. auricularium*, *A. calcaratum*, *A. coelebs*, *A. fuscum*, *A. humerale*, *A. incisum*, *A. latepunctatum*, *A. naponense*, *A. nodosum*, *A. ovale*, *A. pacae*, *A. pseudoconcolor*, *A. scalpturatum*, *A. varium*. In addition, the nymphal stage of 12 *Amblyomma* species, which had been previously described, are redescribed: *A. brasiliense*, *A. cajennense*, *A. dissimile*, *A. dubitatum*, *A. longirostre*, *A. oblongoguttatum*, *A. parkeri*, *A. parvum*, *A. romitii*, *A. rotundatum*, *A. tigrinum*, *A. triste*. The descriptions and redescriptions totalized 27 species. Only 2 species (*A. geayi*, *A. goeldii*) out of the 29 *Amblyomma* species established in Brazil are not included in the present study. A dichotomous identification key is included to support taxonomic identification of the nymphal stage of 27 *Amblyomma* species established in Brazil. This research was financially supported by FAPESP.

Wednesday 25, Afternoon, Auditorium - Poster

270 - Biology of *Amblyomma fuscum* (Acari: Ixodidae) in the laboratory

T.F. Martins[1], J.F. Soares[1], J.S. Sampaio[2], H.S. Soares[1], A.H. Kubo[2], D.M. Barros-Battesti[2] & M.B.

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The tick *Amblyomma fuscum* is endemic to Brazil, with reports in the states of Pernambuco, Santa Catarina, Rio Grande do Sul and São Paulo. Initially, a laboratory colony of this species was established with engorged larvae and nymphs collected from opossums (*Didelphis aurita*) in Guaruja, State of São Paulo. The present study reports biological data of the first two lab generations of *A. fuscum*. For this purpose, free-living developmental stages and adult feeding on reptile hosts were observed in an incubator at 27°C and RH> 85%. Immature feeding was observed at room temperature, using two individual toads *Chaunus ictericus*, 6 wild mice *Calomys callosus*, 6 water rats *Nectomys squamipes*, and 3 opossums *D. aurita* for larval infestations. Nymphal infestations were performed on 2 *C. ictericus*, 6 *C. callosus*, 6 *N. squamipes*, and 3 *D. aurita*. Each of these hosts was infested with 3000 larvae or 55 nymphs approximately 25 days old. Two lizards *Tupinambis merianae* were each infested by eight pairs of adult ticks. Mean larval feeding period in days was 6.9 in *C. callosus* (range = 4-13), 6.7 in *N. squamipes* (4-13), 9.4 in *D. aurita* (4-14). No engorged larva was recovered from *C. ictericus*. The proportions of engorged larvae recovered per host species were: *C. callosus* – 2.3%, *N. squamipes* – 9.7%, *D. aurita* – 6.2%. Mean larval pre-molt periods in days (range in parentheses) were the following, according to the host species on which larvae fed: *C. callosus* – 14.9 (12-23), *N. squamipes* – 15.5 (13-23), *D. aurita* – 15.3 (12-23). Mean nymphal feeding period in days was 6.9 in *C. callosus* (4-13), 6.7 in *N. squamipes* (4-13), 9.4 in *D. aurita* (4-14). Nymphal recovery rates were 0.9% *C. callosus*, 32.7% in *N. squamipes*, and 23.9% in *D. aurita*. No engorged nymph was recovered from *C. ictericus*. Mean nymphal pre-molt periods to adult males and females were 21.9 (18-26) and 23.1 (19-28) days, respectively. Five engorged females were recovered from the two *T. merianae* (31.2% female recovery), which presented the following mean values: feeding period – 24 days (16-29), engorged weight – 1.89 g (1.58-2.04), pre-oviposition period – 9.2 days (7-12), egg mass weight – 0.99 g (0.85-1.04), egg incubation period – 51.4 days (47-55), Reproductive Efficiency Index (weight posture / female weight x 100) – 52.7 (51.0-55.1). Our results corroborate field data that indicate that small rodents and opossums are main hosts for *A. fuscum* immature stages, whereas reptiles are important hosts for the adult stage. This research was financially supported by FAPESP and CNPq.

Thursday 26, Afternoon, Auditorium - Poster

271 - Species boundaries and host associations of Laelapine mites (Acari: Laelapidae) associated with marsupials in the Carajas National Forest of Amazonian Brazil

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According to the literature, there are six species of laelapine mites that are clearly associated with marsupials in the Neotropics: *Androlaelaps hirsuta* Furman, 1971; *A. tuberans* Furman, 1972; *A. cuicensis* Gettinger; *A. ilhacardosoi* Gettinger & Martins-Hatano, *A. marioi* (Fonseca, 1964), *A. bergalloi* Gettinger, Martins-Hatano, Lareschi & Malcolm, 2005. On our survey of small mammals in the Carajas National Forest in Amazonian Para, we have registered the highest diversity of marsupials at a single locality in the New World. This taxonomic study will evaluate the adequacy of the literature to identify the laelapine mites distributed across a sympatric assemblage of marsupial hosts. Only two of the known species of laelapines have been described from Amazonian hosts. If all of our marsupials are infested with laelapines, and these mites are host specific, we would predict many new species. This study will measure host associations, and evaluate species boundaries in an attempt to understand how laelapid mites are distributed across a single community of marsupial hosts.

Thursday 26, Afternoon, Auditorium - Poster

272 - *Euseius citrifolius* and *Galendromus annectens* (Acari: Phytoseiidae) preying upon *Oligonychus santoantoniensis* (Acari: Tetranychidae) on *Lagerstroemia indica* L.

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Oligonychus santoantonensis Feres & Flechtmann was observed on the ornamental plant *Lagerstroemia indica* L. (Lythraceae), locally known as "reseda", in Ribeirão Preto, São Paulo State, Brazil. Mites of this species were found on the upper surface of the leaves. Symptom of attack is characterized as a darkening of the leaves. These mites have dark red color and are easily spotted moving on the leaves. Highest infestation levels corresponded to about 12 mites per leaf. This pest was first found in early July 2007. A week latter, high population levels of the predatory mites *Euseius citrifolius* Denmark & Muma (52%) and *Galendromus annectens* (DeLeon) (48%) (Phytoseiidae) were observed on the same plant. After two more weeks, the population of *O. santoantonensis* was reduced by 80%. The concurrent occurrence of those two predatory species suggest that they were not competing with each other, and that both can be used for the control of that phytopagous mite species. Furthermore, it is suggested that those predators should be tried as control agents of two other species of the same genus, *Olygonychus ilicis* (McGregor) and *O. yothersi* (McGregor), important pests in Brazil. This research was financially supported by CNPq.

Thursday 26, Afternoon, Room 3

273 - New occurrence of *Tetranychus roseus* Gutierrez, 1969 (Acari: Tetranychidae) in Brazil

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The phytophagous mite *Tetranychus roseus* was observed for the first time in Brazil, on March 26, 2007, by the senior author. It was found in high densities on *Licuala grandis* Wendland (Arecaceae), causing leaf yellowing and producing large amount of webbing. Adult mites and nymphs are pink with greenish spots, while larvae are yellowish green. Eggs, with round format and yellow-dark color, were preferably laid on the underside of leaves. The mite has been found also on other hosts, such as *Washingtonia filifera* (Linden) Wendl. (Arecaceae), *Rosa* sp., and *Dioscorea cayennensis* Lam. The species was described from *Medemia nobilis* (Hildebrandt & H. Wendl.) Drude (Arecaceae) in Madagascar and is considered a pest in that country. *Tetranychus roseus* probably has already been established in Brazil, because mites of this species were found on plant samples from several countries of São Paulo State, namely Piracicaba, Limeira and Bragança Paulista; very recently (May 6, 2010), it was found in Ribeirão Preto, São Paulo State (531 meters altitude, 21°10'30"S and 47°48'38"W), on *Chamaedorea elegans* Mart. (Arecaceae) that had been transported from Limeira-SP, according to information by landscape gardening shop owner. Special care is needed to prevent further dissemination of this mite, which is a generalist species with high potential to become severe pest of several crops. This research was financially supported by CNPq.

Wednesday 25, Afternoon, Auditorium - Poster

274 - Acaricidal effect of *Aloe vera* plant (Asphodelaceae) in the fight against cattle tick

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Rhipicephalus (*Boophilus*) *microplus* is a worldwide spread ectoparasite. In the parasitic phase, it is able to ingest 0.5 to 3.0 ml of blood. In Brazil, ticks cause losses estimated at over two billion dollars a year, mainly due to mortality of animals due to disease transmission, decreased weight gain, damage to leather, expenses with chemicals used for its control and decreased production of milk and meat. Currently, control of infestations in livestock is accomplished through the use of chemicals, which are most often liposoluble,

accumulating in the tissues of the host and representing a source of chemical contamination of meat and milk. Phytotherapy as infestation control represents a great alternative, because it may not only be a more economical means of control, but also prevent contamination of meat and milk, causes fewer problems with resistance by the parasites and does not harm the environment. In this study we tested the effectiveness of *Aloe vera* extracts for the cattle tick control. The extracts were obtained with different fractions of organic solvents, grinding each with 75 g of leaves of *Aloe vera* with 120 ml of the selected solvents (ethanol, acetone and/ or dichloromethane). The obtained products were filtered, concentrated on rotary evaporator at 60 rpm and at temperature below 60°C, and then kept at room temperature for 15 days, for complete evaporation of the solvents. After drying, 0.7 g of each extract was weighed in separate containers and dissolved in 10 ml of distilled water. The obtained solutions were used to conduct biological tests with ingurgitated females, according to the test of effectiveness described by Drumond (1973). The results of in vitro tests demonstrated that the extracts obtained with a mixture of ethanol and dichloromethane was the best for the control of cattle ticks, reaching 81.2% efficiency. Although not low, this level of efficiency is less than required by Brazilian regulation (95%). Further investigations are necessary to identify the compounds of *Aloe vera* plant, and more efficient extraction procedures, seeking a way to make possible the use of a plant product that does not harm the environment, the hosts to be protected and consumers.

Tuesday 24, Afternoon, Auditorium - Poster

275 - Phylogenetic relationships of three species groups in the genus *Oligonychus* (Acari: Tetranychidae) based on morphological and molecular data

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Eighteen species of the genus *Oligonychus* are known from Japan, consisting of three species groups: *clavatus*, *ununguis* and *pratensis*. These species groups can be distinguished by the number of tactile setae on tibia I: 7, 8 and 10 setae, respectively. In addition, the aedeagi of species belonging to the *clavatus* and *ununguis* species groups curve ventrally, whereas those of the *pratensis* group curve dorsally. The phylogenetic relationships of species of the genus *Oligonychus* were inferred using the mitochondrial cytochrome *c* oxidase subunit I (COI) region and the internal transcribed spacer 2 (ITS2) and 28S regions of ribosomal DNA (rDNA). We determined sequences of the 18 known *Oligonychus* species in Japan. The phylogenetic tree showed two clades with high bootstrap values, one clade consisting of the *clavatus* and *ununguis* species groups, the other of the *pratensis* group. This study shows that (1) inter-specific divergence detected in the COI region was at least 4% higher than intra-specific divergence, and this is enough to separate all Japanese *Oligonychus* species, and (2) phylogenetic trees of the *Oligonychus* species coincided with the morphological trait 'aedeagus shape', but not with 'number of tactile setae on tibia I'.

Thursday 26, Afternoon, Room 1

276 - Taxonomic concepts in the Phytoseiidae: the Chant-McMurtry system and its possible evolutionary significance

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The Chant-McMurtry system is based on 84 genera in 15 tribes. Some placements, such as *Eharius* in the Kampimodromini and *Paraamblyseius* in the Amblyseiini, are more problematic than others. We generally regard the most setose forms to be the most plesiomorphic. The most setose species in the Typhlodrominae are in the tribe Paraseiulini, with 22 pairs of dorsal setae, and all have *z6*. Most of the "archaic" (rare) setae found in the Amblyseiinae are completely suppressed in the Typhlodrominae. More highly derived tribes include the Typhloseiopsini, with displaced setae *z4*, and the Metaseiulini, with numerous adaptations at the genus level. The Phytoseiinae, probably derived

from the Typhlodrominae, seems to have no extant ancestral forms, all being highly derived with many suppressed setae. In the Amblyseiinae, we consider the Neoseiulini as the lineage from which all other tribes were derived. *Macrocaudus multisetatus* is the most setose, with 22 pairs of dorsal setae and the only one in the Amblyseiinae with 4 pairs of "preanal" setae on the ventrianal shield. Six of the 7 "archaic" setae, *J1*, *J3*, *J4*, *z6* (not considered archaic in the Typhlodrominae), *Z2*, *Z3* and *r5* occur in the tribe Neoseiulini. Postulated highly derived tribes include the Amblyseiini and Phytoseiulini, with very disparate setal lengths, and the Euseiini, with modified ventral shields. Determination of setal homologies can clarify taxonomic confusion. In the *Metaseiulus* species, it was shown that a seta inserted on the dorsal shield in some species and off the shield in others is the same seta, *R1*. These were considered different setae, resulting in erroneous decisions. Also, homologizing setae in various developmental stages confirmed that *Macrocaudus multisetatus* belonged to Amblyseiinae, not Typhlodrominae. There is evidence of convergence related to habitat, including *Phytoseius* and *Paraphytoseius* living on hairy leaves; *Galendromus*, *Phytoseiulus* and some *Neoseiulus* with long dorsal setae, living in heavily-webbed spider mite colonies; and *Gigagnathus*, *Paragigagnathus* and *Eharius*, with long hypostomes, apparently independently adapted to certain leaf surface conditions. Sometimes postulated synapomorphies outweigh differences in setal patterns. For example, it is proposed that *Galendromus pilosus*, even though lacking seta *z3*, has the other characters of typical *Galendromus*. Also, the *pusillus* species group is placed in *Amblyseius* rather than *Proprioseiopsis*, even though setae J2 are absent. Some groupings are very large, including the *rhenanus* group of *Typhlodromus*, the *cucumeris* group of *Neoseiulus*, the *andersoni* group of *Amblyseius* and the genus *Euseius* (in which we were unable to divide into species groups). Does this suggest profuse speciation or inadequacy of our system to break large species groups into smaller ones? Do we need more characters? Setal ratios are important in separating some tribes in the Amblyseiinae and have helped to better define such genera as *Typhlodromips* and *Amblyseius.* Molecular methods may add new elements for the grouping of phytoseiids.

Thursday 26, Afternoon, Auditorium - Poster

277 - Molecular phylogenetic study of marine halacarid mites (Acari: Prostigmata: Halacaridae)

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Halacarid mites are distributed widely throughout the world inhabiting variance habitats from pond of alpine belt to the bottom of the sea even at the depth of 7,000 m. Most of the halacarid mites can be found in intertidal and subtidal zones. The body length of a halacarid is approximately 0.5mm, thus Halacarid are defined meiobenthic organisms of coastal areas, completely adapted to permanent life in the sea. Halacarids are thought to occupy an important niche in the marine ecosystem because halacarids shows high biomass and species richness including more than 1,000 species. But there are little information of its taxonomy, ecology and phylogenetic evolution. Of course, there have ever been little molecular studies of halacarids. It is important for investigating evolution and phylogeny of such infinitesimal organisms to gain both morphology and molecular information. However, in the traditional method for extracting DNA from mite specimens individually, the morphological information must be spoiled because the whole body of specimens must be homogenized. In the present study, we tried to develop a new method for DNA extraction from marine haracarid mites individually, conserving external morphological characters, and inferred molecular phylogenetic relationship in the family Halacaridae from mtDNA and rDNA obtained by the new method. In addition, we investigated genetic variations of genus *Rhombognathus* (family: Halacaridae) population corrected from various sites. We attempted to assess the biodiversity of genus *Rhombognathus*.

Tuesday 24, Afternoon, Auditorium - Poster

278 - Cunaxidae predatory mites (Prostigmata) associated with garlic crops in México

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As part of the project "Integrated pests and diseases management on garlic crops in the State of Guanajuato", this work reports the predatory mites of the family Cunaxidae in garlic crops (at planting, plant growth and harvest periods). The objectives were to know the species of this family and to estimate their possible role as biological control agents in that agroecosystem. The study area was located in the municipalities of Celaya and Salamanca (Guanajuato State), where five plots were planted to garlic, three in the first and two in the second municipalities. Field work was conducted between August 2002 and July 2005. Rhizospheric samples of one kilogram (10 cm deep) were taken and placed in modified Berlese-Tulgren funnels for mite extraction during two weeks. A total of 103 cunaxids were extracted, belonging to 11 species of six genera. Most abundant species were *Neocunaxoides andrei* (23%) and *Cunaxa capreolus* (19%). Highest richness and diversity were observed in 2005, during plant development; lowest richness and diversity were observed during the planting period. *Dactyloscirus nicobarensis*, *Dactyloscirus* ca. *candylus* and *Coleoscirus breslauensis* were found at the three stages of the garlic crop, while *Dacty1loscirus humuli* and *Armascirus* sp. were found only during plant growth. Cunaxid density showed a temporal variation, being lowest at planting time, due to the treatments (fumigation and pesticides) before planting, and highest during the development of garlic plants, in the January and February. Cunaxid species increased over 100% from the beginning to the end of the garlic crop, so it is suggested that they play a very important role and are an essential link in the food webs in garlic soil agrosystems.

Wednesday 25, Afternoon, Auditorium - Poster

279 - Reinfestation of *Aceria guerreronis* Keifer (Acari: Eriophyidae) on coconut trees

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Aceria guerreronis Keifer is considered a major pest of coconut trees in the Americas, Africa and Asia. In spite of its economical importance, little is known about many aspects of the ecology of this species. This study aimed to evaluate the mechanisms involved in the infestation of new bunches under natural conditions and when all bunches are removed from a tree, and the time spent in this processes in both cases. We then studied the population dynamics of *A. guerreronis* using a scale of damage intensity. Damage intensity was evaluated under four different conditions, using a diagrammatic scale: (i) plants with all bunches removed; (ii) plants with the distal portion of the spikelets removed; (iii) plants bimonthly sprayed with Vertimec 18CE (Abamectin) (9g/ha); and (iv) control plants. For each treatment, two fruits from each of bunches 1-6 were randomly collected every month during four months. The removal of spikelet had no effect on the damage level of new bunches, but the occurrence of peak populations was delayed by about a month. Removal of all bunches did not affect the population level of the pest; in two months, population density reached the same level it had before bunch removal. The bimonthly application of Vertimec was efficient in maintaining the infestation of *A. guerreronis* at low levels. Based on the results of this study, the most probable forms of dispersal of *A. guerreronis* are discussed.

Wednesday 25, Afternoon, Auditorium - Poster

280 - Olfactory responses of predatory mites to *Aceria guerreronis* Keifer (Acari: Eriophyidae) infested coconut plant parts

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The coconut mite, *Aceria guerreronis*, is considered a major coconut pest in different parts of the world. It is widespread in most coconut growing regions of the Americas and Africa and has been established rapidly in some major producing countries in Asia. A promising control of this pest is the use of predatory mites. Among the predatory mites found in association with *A. guerreronis*, species of *Neoseiulus* (Phytoseiidae) and *Proctolaelaps* (Ascidae) seem to be the most effective natural enemies. In this study, we evaluate olfactory responses of the predators *Neoseiulus baraki* and *Proctolaelaps bickleyi* from plant parts infested by *A. guerreronis*. More specifically, we assessed the ability of the predators to identify and differentiate odors from parts of coconut plants infested or not by the eriophyid. The olfactory responses of both predators were investigated using an Y-tube olfactometer. The following tests were carried out offering to predators the choice of: (i) isolated parts (leaf, inflorescence or fruit) of infested coconut plant or air stream; (ii) isolated parts of non-infested or infested coconut plant; (iii) different parts earlier detected as more attractive. Further comparison was carried out for *P. bickelyi* using aborted and non aborted fruits infested by *A. guerreronis*. Both predators were able to distinguish between the infested plant parts (leaf, inflorescence and fruit) and the air stream. The predators preferred infested over non-infested plant parts. Among the parts of infested plants, the inflorescences provided the greatest attraction to the predators. However, *N. baraki* did not show preference between infested and non-infested inflorescences. *P. bickleyi* preferred aborted infested fruits over no aborted ones. The results suggest that *N. baraki* and *P. bickleyi* are able to locate and search for plants infested by *A. guerreronis*.

Wednesday 25, Afternoon, Auditorium - Poster

281 - Standardization of larvae immersion test for diagnosis of resistance of *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae) to amitraz

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The tick *Rhipicephalus* (*Boophilus*) *microplus* (Canestrini, 1887) is a hematophagous ectoparasite whose main hosts are cattle. Damage caused by this parasite refers to blood loss, damage to leather, transmission of causative agents of babesiosis and anaplasmosis, and the consequent causes in milk and meat production. Amitraz (formamidine group) has been used on cattle for over 30 years against ticks and has an important role in its control. Its application is feasible because its residues in meat are present for a short period of time, being rapidly degraded in the environment. Resistance of *R.* (*B.*) *microplus* to amitraz has been reported in many countries. In Brazil, there are already reports of resistance to amitraz. FAO (2004) proposes modified LPT (larvae package test) testing for diagnosing amitraz resistance. Data obtained in Brazil using LPT technique with amitraz have shown great variability, making the results less reliable. The LIT (larvae immersion test) technique presents itself as an alternative to obtain more homogeneous results. This study aimed to standardize LIT to amitraz with the sensitive strain Mozo, maintained in the laboratory since 1973 without contact with acaricides. In total, 9065 larvae were tested in seven replicates. Statistical analysis (PoloPC, Leora Software) resulted in LC50 and LC99 of 0.885 and 769.180, respectively. The results have immediate practical application in national and regional levels within an integrated pest management, resulting in an increase in livestock production quality and the health of the animals.

Wednesday 25, Afternoon, Auditorium - Poster

282 - Identification of pyrethroid resistance by a sodium channel mutation in population of *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae) collected from São Paulo State, Brazil

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae) is one of the major causes of

economic losses to producers in Neotropical regions. These ticks have rapidly developed acaricide resistance to several chemical classes in Brazil. The mechanism known as knockdown resistance (kdr) is a generic term for amino acid substitutions in the sodium channel associated with pyrethroid resistance. Point mutations to tick pyrethroid resistance results in an amino acid change from Phe to Ile in domain III of sodium channel. Our study investigated the presence of this mutation with nested-PCR assay developed to detect the genotype of individual tick larvae from fourteen farms of the São Paulo State, Brazil. Genomic DNA of the *Rhipicephalus* (*Boophilus*) *microplus* with the mutation in sodium channel has gotten through United States Department of Agriculture to be used as positive control. The majority of the population presented the characteristics of homozygous susceptible 73.2% (SS), 17.4% were heterozygotes resistant (RS) and 9.4% were homozygous resistant (RR). Correlation has not found between the presence of the sodium channel mutation and resistance to pyrethroid bioassay data because the samples are heterogenic with low resistance ratios.

Tuesday 24, Afternoon, Auditorium - Poster

283 - Spider mites (Tetranychidae) in Brazil – new hosts, localities and taxa

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The Tetranychidae Donnadieu, commonly known as spider mite family, contains a large number of strictly phytophagous mites and includes most of important pest mites. At the moment this family comprises 1257 species, being 185 reported from South America and 104 from Brazil. The increasing progress in learning about tetranychid mites in Brazil has been evidenced but most of information related to this group is concentrated in the southeastern region and/or usually refer to species associated to plants of economic importance. The expansion of new crops in some regions of the country, new agricultural areas and plant species in non-agricultural areas have been poorly exploited in relation to the occurrence of phytophagous mites in general, including the tetranychids. The aim of this study was to contribute to the taxonomic knowledge of spider mites in Brazil. A survey was performed in 15 states and in the Federal District, where 550 samples of 120 plant species were collected. Tetranychid mite infestations were confirmed on 207 samples and 20 species in the Tetranychinae and Bryobiinae subfamily were identified on 58 different hosts. New hosts for tetranychids in Brazil, South America or worldwide were reported for the following species: *Eutetranychus banksi* (McGregor); *Mononychellus tanajoa* (Bondar); *Oligonychus anonae* Paschoal; *O. mangiferus* (Rahman & Sapra); *Tetranychus bastosi* Tuttle, Baker & Sales; *T. evansi* Baker & Pritchard; *T. ludeni* Zacher; *T. mexicanus* (McGregor); *T. neocaledonicus* André; and *T. urticae* Koch. New localities in Brazil were reported for *Eotetranychus tremae* De Leon; *O. anonae*; *Panonychus ulmi* (Koch); and *T. gloveri* Baker & Pritchard. *Eotetranychus smithi* Pritchard & Baker is reported for the first time in Brazil, being collected on roses (*Rosa* sp.), in Rio Branco, Acre. Four new species of tetranychids were identified: two belonging to the genus *Oligonychus* Berlese, on grape (*Vitis vinifera* L.) and rose (*Rosa* sp.), from Pirapora and Três Marias municipalities, Minas Gerais, respectively; and two belonging to the genera *Monoceronychus* McGregor and *Schizotetranychus* Tragardh, both from weeping fingergrass (*Eustachys distichophylla* Lag. Nees), from Itaara and São Luiz Gonzaga municipalities, Rio Grande do Sul, respectively. Descriptions of the new taxa are in preparation.

Thursday 26, Morning, Room 1

284 - A critical review of some closely related species of *Tetranychus sensu stricto* Tuttle & Baker (1968) (Prostigmata: Tetranychidae) in the public DNA sequences database

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Taxonomic misidentification of the specimens used to obtain DNA sequences is a growing problem reported for different groups of organisms, including mammals, birds, arthropods, fungi and bacteria, which threatens the utility of the deposited sequences in public DNA databases. Misidentifications and insufficient annotations in public DNA accessions not only has fallouts on the reliability of phylogenetic and ecological conclusions inferred from such sequences and causes obstacles to sequence-based species identification, but also affects plant protection and pest management. This paper provides evidence of misidentifications in molecular DNA public databases in phytophagous mites of the Tetranychidae family, belonging to the group *Tetranychus* (*Tetranychus*). We reviewed and analyzed 105 Genbank accessions matching ITS2 rDNA sequences and 137 *COI mt*DNA of 11 morphologically close species of *Tetranychus s. str*. as *T. cinnabarinus* (Boisduval), *T. ezoensis* Ehara, *T. kanzawai* Kishida, *T. neocaledonicus* André, *T. parakanzawai* Ehara, *T. phaselus* Ehara, *T. piercei* McGregor, *T. puerariсola* (Ehara & Gotoh), *T. truncatus* Ehara, *T. turkestani* Ugarov & Nikolski and *T. urticae* Koch. Because of similar body color of other *Tetranychus s. str*. that can be misidentified with most of the latter mentioned species, we also included to the dataset the sequences available in Genbank of the following red-colored species: *T. evansi* Baker & Pritchard, *T. gloveri* Banks, *T. ludeni* Zacher and *T. okinawanus* Ehara. Additionally, ITS2 and *COI* sequences of 18 new *T. urticae* samples from Brazil, France, Spain and Greece unambiguously identified by morphological criteria were generated in this study and included in the analyzed data. Among the deposited sequences in the Genbank, numerous cases of apparently mistaken identities were identified in the group *Tetranychus s. str*., especially between *T. urticae*, *T. cinnabarinus*, *T. kanzawai* and *T. truncatus*. This study uncovered that several taxonomically important DNA sequences publicly available are incorrectly named. It particularly sheds new light on the controversial taxonomic status of *T. cinnabarinus* and highlights the need to combine morphological and molecular approaches to guaranty reliability of accessions available in public databases.

Friday 27, Morning, Room 1

285 - Comprehensive searchable databases. An example with Spider Mites Web

A. Migeon & F. Dorkeld

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Classifying, counting, listing are some of the oldest human historical activities. First clay tablets were made by businessmen for accounting, not by poets! Classifying, understanding the “Systema Naturae” was also the purpose of Carl Linne. Next, came the book catalogues. Data basing the tree of life, or only some branches and leaves is becoming more and more common and our actual electronic databases carry on the same goal: organizing the knowledge of the life kingdom. Electronic databases are useful tools for pest managing but also for fundamental organism knowledge. They represent an unhoped-for chance to synthesize all the previous and rapidly developing knowledge. They allow and favour the rapid retrieve of dispersed information, regarding one taxon, with a typical record derived from paper records, but also and above all by allowing complex queries. Therefore output can easily lead to zoogeographical analysis, pest quarantine analysis but also host-plants (here for spider mites) and food web relations analysis. But, to be useful, these databases need two things. The first is valuable and verified data based information, implying a specialist certification. The second is an amount of available information to make profitable time spent for building the tools and entering data. Building such searchable database could be time consuming and temptation could be to keep them for oneself. But opening and distributing these works can be considered as positive and highlighting the team activities, representing an ethic feedback, data basing process being generally founded by publics grants. We present here Spider Mites Web an

example of such an open system aiming at providing a wide range of information on validated topic.

Wednesday 25, Afternoon, Room 2

286 - Past, present, and future of chemical acaricides

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There have been many different acaricides and acaricide formulations used throughout the history of tick control. Originally, various mixtures of crude oil, lard, sulfur, and kerosene were used for dipping livestock. This was followed by Beaumont crude oil. Arsenical dips were introduced in 1911 and used for 56 years in the United States. Organophosphate (OP) acaricides replaced arsenical dips in 1967, and are still used today. Amitraz was introduced to control OP-resistant ticks at the same time the pyrethroids were introduced in 1986, but its use was initially limited due to higher cost. The use of amitraz became more frequent after 1993 when pyrethroid resistance problems started to hinder tick control efforts. Macrocyclic lactones (ML), such as moxidectin and ivermectin, are known to possess broad spectrum activity against both internal and external parasites of host animals. The development of multiple resistance to OPs, pyrethroids, and amitraz prompted the search for alternative acaricides with different mode of action for tick control in Australia, Argentina, Brazil and Mexico. The first case of resistance to ML was reported from Brazil in 2001, and a more recent study in 2006 using the larval immersion test (LIT) confirmed the existence of 3.8-fold resistance to ivermectin in a tick strain from the state of Sao Paulo, Brazil. Fipronil, spinosad, and fluazuron are three new products available for tick control, but resistance and suboptimal control have made their use limited. Piperonyl butoxide (PBO) is the only synergist that has been used with pyrethroid acaricides to control pyrethroid-resistant ticks, and no synergist has been available for OPs. Several chemical compounds have recently been identified as having the potential to be used as synergists for OPs and amitraz, particularly coumaphos, to control OP-resistant ticks. Acaricide mixtures as a resistance management strategy have also been explored. Results of a recent study revealed synergism between permethrin and amitraz. Permethrin-amitraz mixtures have the potential to control tick populations resistant to pyrethroids, amitraz, or both. Anti-tick compounds synthesized by plants (especially from Brazil and Africa) fungi, and bacteria are being studied as potential new tick control products. Advances in genomics have led to the possibility for mining tick genomes for potential new acaricidal targets. These targets can be manipulated by either designing specific chemicals that have the ability to fit into specific receptors or breakdown gene products or, alternatively, with anti-tick vaccines developed to target these sites with antibodies created by the host.

Tuesday 24, Afternoon, Auditorium - Poster

287 - Population dynamics of phytophagous and predaceous mites on coffee plants (*Coffea arabica* L. cv. 'Mundo Novo'), in Atibaia Municipality, State of São Paulo, Brazil

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The objective of this research was to study the population dynamics of phytophagous and predaceous mites, as well as the interactions among these species on coffee plants. The study was carried out in a coffee (*Coffea arabica*) plantation, 'Mundo Novo' cultivar, in Atibaia municipality, State of São Paulo. Samples, constituted of 12 leaves and two branches per plant, were taken from ten randomly chosen plants. The collected mites were mounted in Hoyer's medium on microscope slides for later identification. A total of 3,606 mites were found, during this research, from which 1,963 mites were on leaf surfaces, 574 in domatia and 106 on branches. The most frequent species were *Oligonychus yothersi* (McGregor) with 907 specimens, corresponding to 25.2% of the total number of mites, *Brevipalpus phoenicis* (Geijskes) with 430 specimens, corresponding to 12%, *Iphiseiodes zuluagai* Denmark & Muma with 296 specimens, corresponding to 8.2%, and *Euseius concordis* (Chant) with 69 specimens,

corresponding to 1.9%. On leaf surfaces, the most frequent species were: *O. yothersi*, *B. phoenicis*, *I. zuluagai* and *E. concordis*. The tetranychid mite *O. yothersi* presented the highest incidence in September 2007. *B. phoenicis* presented low populations during the studied period. This species was found all year long, with small population peaks in June 2007 and February, June and September 2008. For *E. concordis*, the highest population densities were observed in January, March and November 2007 and September 2008. In domatia, few mite species were found, with predominance of *Lorryia* sp. (Tydeidae). On branches, the most frequent species was *B. phoenicis*. This research was financially supported by FAPESP.

Wednesday 25, Afternoon, Auditorium - Poster

288 - Edaphic mites of the families Ascidae and Phytoseiidae (Acari: Mesostigmata), in Atibaia municipality, State of São Paulo

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Mites of the families Ascidae and Phytoseiidae are commonly found in surveys of edaphic mite fauna. Mites of these families are considered predators of other mites, nematodes, and other small arthropods. The objective of this work was to identify the species of Ascidae and Phytoseiidae found in coffee agroecosystem, in Atibaia municipality, State of São Paulo. Samples of soil and leaf litter were collected monthly in 2008 and 2009. The method of Berlese-Tullgren was used for the extraction of mites. The collected mites were mounted in Hoyer's medium on microscope slides for later identification. A total of 3,087 specimens were found, from which 1,436 mites were of the family Ascidae and 1,651 mites of the family Phytoseiidae. The occurrence of mites of Ascidae, as well as Phytoseiidae, was predominantly in leaf litter (87.6%). Considering both families, 13 species were found, some of them are new species. In leaf litter, the most abundant species were *Asca* sp.1 and *Proctolaelaps diffissus* Karg (Ascidae) and *Amblyseius* sp. nov., *Amblyseius hexadens* Karg and *Chelaseius lativentris* Karg (Phytoseiidae). This species together represented 87.4% of all mites found in this substrate. In soil, *Protogamasellus mica* (Athias-Henriot) (Ascidae) was the most abundant species. Only this species represented 52% of all species found in this substrate. This research was financially supported by FAPESP.

Thursday 26, Afternoon, Auditorium - Poster

289 - Two new larval species of *Erythraeus* (*Zaracarus*) (Acari: Erythraeidae) from western Iran

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In order to collect neuropterans in the Hamedan Province of Iran, light traps were used in two different stations, as follows: Razan Shahanjarin (35°13′22″N, 49°10′16″E and altitude 1825 m a.s.l) and College of Agriculture, Bu-Ali Sina University, Hamedan (34°48′N, 48°28′E and altitude 1820 m a.s.l.). Both traps were utilized from mid July to late September 2009; they were emptied daily at 8 AM. The specimens collected were preserved in 70% alcohol, and later examined under a stereomicroscope to separate the mites from green lacewings and firebugs. The mites were then mounted on microscope slides in Hoyer's medium. Drawings were done by means of a Camera Lucida mounted on an Olympus BX51 compound microscope. The terminology follows Haitlinger (2003) and Goldarazena & Zhang (1998). Two new larval species of *Erythraeus* were found, namely: *E.* (*Zaracarus*) *soleimanii* Khanjani and Mirmoayedi et. al., from the green lacewing *Chrysoperla kolthoffi* (Navas), and *E.* (*Z.*) *hamedanicus* Khanjani and Mirmoayedi et. al., from the firebug *Pyrrhocoris apterus* L. (Hemiptera: Heteroptera: Pyrrhocoridae). A key to the world species is given. The holotypes are deposited in the Acari Collection of the Department of Plant Protection, Faculty of Agriculture, Bu Ali-Sina University, Hamedan, Iran and the paratype in the Arachnida Collection of ARC-Plant Protection Research Institute, Pretoria,

South Africa. Species of *Erythraeus* (*Zaracarus*) Southcott, 1995 are mostly ectoparasites of phytophagous insects such as aphids, flies and leaf hoppers (Southcott, 1995; Goldarazena & Zhang, 1998; Saboori, 2000) and rarely of entomophagous agents like green lacewing and firebugs.

Monday 23, Afternoon, Room 6

290 - Phylogeny and main evolutionary trends of the feather mite superfamily Analgoidea (Acari: Astigmata)

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The superfamily Analgoidea represents one of two major lineages of feather mites, the astigmatan mites that permanently inhabit birds and include both commensals and distinct ectoparasites. The analgoid feather mites have settled in a variety of microhabitats on the body of hosts, namely feathers with firm vanes, downy feathers, quill cavities, quill walls, feather follicles, respiratory passages, surface and external layers of skin. According to the current taxonomic concept, Analgoidea includes about 1620 species in 264 genera and 18 families. Phylogenetic relationships within the superfamily are not completely clear. Moreover, in the light of recent molecular-based investigations, the recent arrangement of higher psoroptidian families into the superfamilies Analgoidea and Sarcoptoidea appears to be disputable. A revised phylogenetic hypothesis at higher taxonomic levels (families and subfamilies) is proposed for Analgoidea by means of the cladistic analysis of external morphological characters. It is found out that Analgoidea with the traditional content of families appears paraphyletic, and some families (Epidermoptidae, Psoroptoididae) are closer to lineages from Sarcoptoidea in traditional sense. Based on implications of the obtained phylogenetic reconstruction for the specialization of analgoid families to particular microhabitats and their distribution among recent bird taxa, a preliminary hypothesis of the origin and subsequent evolution of these mites on avian hosts is proposed. Analgoidea originated from nest-inhabiting saprophagous ancestors that shifted to permanent living on birds. This apparently took place on the ancestors of Neornithes in the lower Cretaceous. The formation of major lineages of this superfamily was caused by the primary adaptation of the ancestral analgoid mites to particular types of microhabitats. The first divergence was the specialization of these mites to the skin and to the plumage. The inhabitants of the plumage have also diverged into the lineages specialized to the downy feathers and to the flight and body feathers with firm vanes. The penetration to such microhabitats as the cavities of quills, quill walls and feather follicles was realized by representatives of various lineages of the inhabitants of the plumage. These mites retain to various extents some morphological features of external inhabitants of the plumage.

Tuesday 24, Morning, Room 4

291 - Tick barcoding: viable option?

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The purpose of the Consortium for the Barcode of life (CBOL) is to obtain a complete molecular "catalogue of life". The main goal is to simplify identification of any kind of biological sample, but also to create a world DNA-sequence bank, objective that is getting more and more important every day, considering the rising rates in species extinction, and the need of quick and proper species identification of pathogenic organisms. Barcoding means identification of taxa using a simple molecular approach, consisting of a PCR and subsequent sequencing of the obtained product. Identification of tick samples based on morphology requires experience and a high level of knowledge of these arthropods, furthermore most discriminating morphological features are sometimes visible only in adult specimens, making species identification of immature stages not always possible, not to mention the importance of being able to quickly identify ticks obtained from patients that had not been properly preserved. The main

problem with barcoding is being able to correctly evaluate the capability of molecular markers to discriminate between different species. A molecular marker with high interspecific variability but high intraspecific identity needs to be used, in order to obtain a "gap" between different species. The genus *Amblyomma* comprises 131 species of hard ticks. Correct identification of all the species belonging to this genus of the family Ixodidae is often difficult, as indicated by the variation of the taxonomic keys for the denomination of certain species through the years. Here we present the testing of a barcoding approach on 560 samples from 69 species of the genus *Amblyomma*. As suggested by CBOL protocols, our PCR target was a fragment of 600 bp of the mitochondrial gene cytochrome c oxidase subunit 1 (COI). Amplification of this target in PCR was obtained with universal primers for diverse metazoan invertebrates LCO1490 and HCO2198. PCR was successful on all samples, allowing us to perform DNA sequencing and to obtain the desired 600bp DNA fragment for all 560 samples. The obtained sequence database was tested with a specific leave-one-out test in order to assess the presence of the "identity percentage gap" between intra- and inter-specific variations. The barcoding approach was coherent with the morphological identification of the samples in most cases, but a few situations of disagreement arose. Hypotheses to explain these cases of incongruence will be discussed, with a particular focus on the possible presence of cryptic species.

Tuesday 24, Afternoon, Auditorium - Poster

292 - Mite fauna in cassava varieties in Presidente Prudente, State of São Paulo, Brazil

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Some mite species of economic importance are associated with cassava cultivation around the world. The objective of the present study was to register the mite fauna from cassava varieties in order to emphasize ecology-based pest management. The field trial was conducted from February 2005 to December 2006 at APTA experimental station, located in Presidente Prudente municipality, state of São Paulo, Brazil (UTM 7545288,76 m N, 459930,31m S and 424,29 m). The cassava varieties (*Manihot esculenta* Crantz) ´IAC-12´, ´IAC-13´, ´IAC-14´, ´IAC-15´, ´IAC 576-70´, ´Roxinha´, ´Espeto´, ´Fécula Branca´ and ´Branca de Santa Catarina´ were planted at spacing of 1.2 m between rows and 1.0 between plants. At 15-days intervals 20 fully expanded leaves per plant from 40 plants were collected in each variety. A total of 1,345 mites were recovered from the cassava leaf samples, related to four families, five genera and seven mite species. *Mononychellus tanajoa* Bondar represented 76.3% of the mite specimens. The predators, *Euseius citrifolius* Denmark & Muma, *E. concordis* (Chant) and *Neoseiulus idaeus* Denmark & Muma were 13.6% of total mite specimens. *Brevipalpus phoenicis* (Geijskes), *Parapronematus acaciae* Baker, and *Tyrophagus* sp. represented 10.1% of the collections. The incidence of *M. tanajoa* in `Branca de Santa Catarina´ reached 53% of the mite diversity.

Thursday 26, Afternoon, Auditorium - Poster

293 - Feather mites of the endemic birds from Socorro Island, Revillagigedo Archipelago, Mexico

G. Montiel-Parra & T.M. Pérez

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The Mesoamerican forests are the third largest among the world's hotspots. These include as a third of the Mexican territory, including nearshore and offshore islands in both the Caribbean Sea and Pacific Ocean, which are important biologically due to the presence of endemic species and as nesting areas for seabirds. One of these hotspots is the Revillagigedo Archipelago, consisting of a group of

four volcanic oceanic islands in the Pacific. In increasing order of sizes, the islands are Roca Partida, Isla San Benedicto, Isla Clarión, and Isla Socorro. The latter, about 460 km south of Baja California, is the largest where the bird fauna includes eight endemic terrestrial bird taxa. The objective of the present study was to investigate the feather mites of the endemic birds from that island. A total of 29 species, 18 genera, 10 families, and 2 subfamilies of feather mites were identified from only six species of endemic birds: *Aratinga brevipes* (Psittaciformes: Psittacidae), *Columbina passerina socorroensis* (Columbiformes: Columbidae), *Mimodes graysoni* (Passeriformes: Mimidae), *Parula pitiayumi graysoni*, *Pipilo socorroensis* (Passeriformes: Parulidae) and *Thryomanes sissonii* (Passeriformes: Troglodytidae). Eighty five percent of the feather mites live in the surface of the feathers of birds and 15% in the interior of the quill of the primary and secondary flight feathers. *Aratinga brevi*pes host had the highest diversity, with ten species. *Mesalgoides polyplectrus* (Psoroptoididae) and *Aralichus nobilis* (Pterolichidae) were the most abundant species, both represented with all ontogenetic stage. We found eleven new species: six of the family Proctophyllodidae, two each of the families Analgidae and Pyroglyphidae, and one of the families Xolalgidae. The diversity of feather mites was analyzed in the four subspecies of *Aratinga holochlora* that are distributed in the continent, with 23 species from *A. h. holochlora*, 20 from *A. h. rubritorquis*, 15 from *A. h. strenua* and 11 from *A. h. brewsteri*. These were compared with the diversity of feather mites from *Aratinga brevipes* of Socorro. The results indicated that the parrots with wide distribution had the highest diversity. Conversely, the parrots with restricted distributions, as *A. brevipes* and *A. h. brewsteri*, had lower mite diversity, with 10 and 11 species, respectively.

Tuesday 24, Afternoon, Room 2

294 - Is global warming jeopardizing the biological control of invasive species? A case study in avocado agro-ecosystems from Spain

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Avocado fruit trees were introduced to southern Spain from Mesoamerica at the beginning of the 17th century by the Spaniard conquerors. Since then, avocado orchards have been exempt from important pests until the arrival, in 2004, of the persea mite, *Oligonychus perseae*, an exotic pest native from Central America. Biological control strategies tested against this invasive species focused on potentiating the populations of native phytoseiid mites through the addition of alternative food, i.e. pollen. Although the results were very promising in the 2007 campaign, the strategy did not work in the 2008 and 2009 campaigns. The inspection of a four-year (2006-2009) mite community dynamics combined with climatologic data, indicated that harsh summer environmental conditions were the most probable cause for the disruption of the biological control of this pest. Furthermore, the climatologic analysis of temperatures of our region along the last 45 years (1964-2008) revealed a significant warming trend for spring and summer maximum, minimum and average temperatures, especially from 1980 on, implying that harsh environmental conditions in summer and spring are likely to become frequent. We show here that the change in the environmental conditions, which are predicted by models of climate change, can deeply affect agricultural communities under biocontrol management, even more so when biocontrol is needed against invasive pest species originating from warm regions. The response to an increase of temperatures can be different for pests and natural enemies, and the magnitude and direction of this difference will determine the result of the biological control strategy. From a biological control point of view it is necessary to understand the relationship between the effect of warming on higher trophic levels and herbivore population outbreaks, an approach that has been considered only recently.

Thursday 26, Afternoon, Room 2

295 - Inducing apparent competition between pest and alternative food to improve biological control

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Agro-ecosystems are inhabited by several species that interact with each other. Often, these communities are not temporally stable. When applying biological control strategies, the species composition and community dynamics of agro-ecosystems should be known *a priori*. This is because adding new species or artificially increasing the density of one of them may alter the dynamics of the whole community, and lead to unexpected biological control results. In this work, we first identified the food web components of an avocado agro-ecosystem, and unravelled through field and lab experiments when species co-occur and how they interact with each other. We found that the structure of the avocado community shifted through time: in spring, the community was characterized by a "non-herbivore" prey (pollen) and an omnivorous predatory mite; in summer, the community was composed of an omnivore and a predator sharing an herbivore pest species as prey. We present here the results of field experiments carried out during 4 cropping seasons. Experiments were designed to lessen the potential intra-guild predation between predator and omnivore, and to induce apparent competition between alternative food and herbivore, mediated by the shared omnivore, via pollen application to the avocado trees. Results showed that adding pollen as alternative food source for the omnivore decreased pest populations, but not always, because the dynamics of the whole community was also strongly influenced by environmental factors.

Wednesday 25, Afternoon, Room 1

296 - Invasion success in communities with reciprocal intraguild predation depends on the stage structure of the resident population

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The probability of individuals being targeted as prey often decreases as they grow in size. Such size-dependent predation risk is very common in systems with intraguild predation (IGP), i.e. when predatory species interact through predation and competition. Theory on IGP predicts that community composition depends on productivity. When recently testing this using a terrestrial experimental system consisting of two phytoseiid mite species, *Iphiseius degenerans* as the IG-predator and *Neoseiulus cucumeris* as the IG-prey, and pollen (*Typha latifolia*) as the shared resource, we could not find the predicted community shift. Instead, we observed that IG-prey excluded IG-predators when the initial IG-prey/IG-predator ratio was high, whereas the opposite held when the initial ratio was low, which is also not predicted by theory. We therefore hypothesized that the existence of vulnerable and invulnerable stages in the two populations could be an important driver of the community composition. To test this, we first demonstrated that IG-prey adults indeed attacked IG-predator juveniles in the presence of the shared resource. Second, we show that the invasion capacity of IG-predators at high productivity levels indeed depended on the structure of resident IG-prey populations. Third, we further confirmed our hypothesis by mimicking successive invasion events of IG-predators into an established population of IG-prey at high productivity levels, which consistently failed. Our results show that the interplay between stage structure of populations and reciprocal intraguild predation is decisive at determining the species composition of communities with intraguild predation.

Thursday 26, Afternoon, Auditorium - Poster

297 - Mites associated with the ruddy ground-dove *Columbina talpacoti* (Temminck, 1810) in the region of Campinas, São Paulo State, Brazil

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We conducted a qualitative survey on the parasite mites of the ruddy ground-dove *Columbina talpacoti* (Temminck, 1810) (Columbiformes: Columbidae) in the region of Campinas, São Paulo

State (Campinas (22°49’11’’S, 47°4’12’’W, alt. 604m), Pedreira (22°40'56,49"S, 46°52'49,53"W, alt. 671m), Jaguariúna (22°42'20"S, 46°59'09"W, alt. 584m), Holambra (22°37'59"S, 47°03'20"W, alt. 600m), Paulínia (22°45'40"S, 47°09'15"W, alt. 590m), Itatiba (23°00'21"S, 46°50'20"W, alt. 750m) and Valinhos (22°58'14"S, 47°59'45"W, alt. 660m). This dove species is a common inhabitant of urban environment in Brazil, and is considered a pest in many regions. There is a competition for food among *C. talpacoti*, *Columba livia*, *Columba picazuro* and *Zenaida auriculata*. The mites associated with birds have different relationships with their hosts, ranging from accidental association to true parasitism (ecto- and endoparasitism). The Department of Animal Biology, Biology Institute, UNICAMP, receives corpses, feathers and nest for analysis. The corpses are washed with 70%-alcohol solution and detergent, and filtered for mite collection. The material was submitted to a process of clarification and hydration with lacto-phenol and mounted on microscope slides with Hoyer´s medium. A total of 43 corpses were examined and only two did not show any mite. The identification was performed with the help of a taxonomic key of mite species and literature on the subject. Mites pertaining to the following orders were identified: Astigmata: Falculiferidae (*Byersalges talpacoti* – 81,92%, *Byersalges phyllophorus* – 72,73%, *Falculifer* sp. – 2,27%), Dermoglyphidae (*Dermoglyphus* sp. – 13,64%), Analgidae (*Diplaegidia columbigallinae* – 75%, another species of *Diplaegidia columbae* – 65,91%) and Laminosioptidae (*Fainocoptes* sp. – 6,82%); Mesostigmata: Macronyssidae (O*rnythonyssus bursa* – 18,18%) and Prostigmata: Cheyletiellidae (*Ornitocheyletia columbigallinae* – 15,91%), Syringophilidae (*Castosyringophilus mucuya* – 4,55%) and *Harpirhynchidae* sp. – 18,18%. We redescribe the most frequent species and an identification key for all encountered species was developed. We discussed the frequency of species and the associations among them. There is a need for more information regarding the subject, in addition to earlier studies, in order to characterize the ectoparasitic fauna associated to the ruddy ground-dove in the region. Voucher specimens were deposited at a collection of Department of Animal Biology, Biology Institute, UNICAMP, in addition to photographs of nests, birds and mites (virtual collection).

Tuesday 24, Afternoon, Room 6

298 - First description of a *Neocypholaelaps* species (Mesostigmata: Ameroseiidae) from Brazil and a key to the world species of this genus

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Species of Ameroseiidae have been reported to feed on fungi and pollen. This family is represented by eight genera, of which *Ameroseius* Berlese and *Neocypholaelaps* Vitzthum are the largest. Sixteen ameroseiid species of the ameroseiid genera *Ameroseius* Berlese, *Hattena* Domrow and *Sertitympanum* Elsen & Whitaker Jr. have been reported from the Americas, but there is a single report of an unidentified *Neocypholaelaps* species in this continent. Mites of the latter genus have been reported mainly in Africa, Asia and Oceania. They are characterized mainly by having dorsal shield not rugose, undivided corniculi, cheliceral digits edentate or with a single subapical tooth and all legs with a pair of claws. Twenty species of *Neocypholaelaps* are known worldwide, from inflorescences, beehives, or phoretically associated with insects; there is a report of a possible case of damage caused by a species of this genus to coconut inflorescences in India. One of the main objectives of this work was to describe the single *Neocypholaelaps* species collected in the Americas, based on the morphology of adult females and males collected from inflorescences of *Geonoma* spp. (Arecaceae) in patches of Atlantic Forest at São Pedro (22º33’57’’S; 47º57’28”W) and Cananéia (24º53’45”S; 47º50’17”W), State of São Paulo, Brazil. They were mounted in Hoyer’s medium for examination under phase contrast microscopy. The new species is most similar to *N. stridulans* (Evans), *N. favus* Ishikawa, *N. varipilosa* Elsen and *N. apicola* Delfinado-Baker & Baker. A dichotomous key to help in the separation of the world species of *Neocypholaelaps* was also prepared in this work, based mostly on descriptions provided in the literature.

Tuesday 24, Afternoon, Auditorium - Poster

299 - A new Tenuipalpidae mite (Acari: Prostigmata) from *Phoenix dactylifera* (Arecaceae)

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Thirteen species are presently known in the genus *Phoenix* L. These species are native to different areas mostly in Africa and Asia. Although *P. canariensis* Chabaud, *P. loureirii* Kunth, *P. reclinata* Jacq, *P. roebelenii* O'Brien and *P. sylvestris* (L.) Roxb. are cultivated in relatively restrict areas, the "true" date palm, *P. dactylifera* L., is cultivated more widely. The latter is found mostly in the desert oases of northern Africa and western Asia, being also cultivated in Arizona and southern California. *Phoenix* spp. have been reported to be attacked by a variety of arthropods, including mites of the family Tenuipalpidae. The latter belong to the genera *Brevipalpus*, *Raoiella* and *Tenuipalpus*. Three *Tenuipalpus* species have been reported on *P. dactylifera* in western Asia and Pakistan, namely *T. eriophyoides* Baker, *T. pareriophyoides* Meyer & Gerson and *T. yarensis* Hasan, Bashir & Wakil. A new species of this genus was recently found in the Sultanate of Oman, always at very low population levels. This species is described in this work, based on adult females and males collected in Hasik, in the Dhoufar Region. It belongs to the *eriophyoides* species subgroup of the *caudatus* species group; this subgroup is characterized by having a pair of intercoxal setae at level of leg III (IC3a), 4 pairs of intercoxal setae at level of leg IV (IC4a1-4) and a pair of pores on the opisthosoma. It is distinguished from other species of this group mostly by the pattern of the dorsum of the idiosoma, sizes and shapes of idiosomal setae. In addition, in all the specimens of the new species examined in this study, only 7 IC4a setae are found; thus, the placement in the subgroup *eriophyoides* requires its redefinition, in relation to this character. A dichotomous key is provided to separate the *Tenuipalpus* species reported from date palms.

Wednesday 25, Afternoon, Auditorium - Poster

300 - Localization of 25 km^2 sampling grids inside a 100 km^2 of forest in Central Amazonia: does it matter for soil mite (Acari: Oribatida) distribution?

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Sampling oribatid mites in large areas using conventional methods is expensive, time-consuming, and this constrains their use on monitoring program. We investigated oribatid mites in a soil and vegetation gradients in Reserva Ducke, one of the most intensively studied sites in Amazon. In 2001/2002, a system of 9 N-S and 9 E-W trails was installed in the reserve. Following the RAPELD method, plots were distributed over a 64 km^2 grid of trails spaced 1 km apart, resulting in 72 plots (individual units) with a minimum distance of 1 km between them. Inside this large grid, the Program for Planned Biodiversity Research (PPBio) delimited a smaller grid of 25 km^2 with 30 plots, whose localization was defined by logistic and financial considerations. In 2002, 360 sub-samples of litter and soil were obtained in 72 plots of 250 m of length, and mites were extracted using a Berlese-Tullgren apparatus. To improve the cost-effectiveness of protocols, we evaluated if the localization of six alternative 25 km^2 grids inside the 100 km^2 of the reserve would affect conclusions about the abundance and diversity of the mites. We subdivided the 72-plot grid in six alternative grids of 30 plots, each of 25 km^2, taking in consideration the directions Northwest, Northeast, Southwest, Southeast, West (the PPBio grid), and South-Southeast in the reserve, respectively. We found 161 taxa in the 72-plot grid and more than 100 taxa in the alternative grids. The dissimilarity matrices were generated for each 30 plots grid based on the Bray–Curtis (abundance data) and Sørensen (presence absence data) indices. Mantel correlations were used for assessing relationships between the 15 pairs of matrices, assuming that values ≥ 0.7 indicate a satisfactory similarity of information from pairs of grids. Using abundance data of the mite community, correlations values varied from 0.41 to 0.63, indicating differences in information

depending on the position of the grid. Presence/absence data varied from 0.79 to 0.88 showing that species compositions were similar between grids. The localization of the 25 km^2 grids greatly affects information on the abundance but not the composition of species between grids. Multiple multivariate regressions captured the effects of clay percentage using data based in every grid. The most frequent species occurred in the majority of habitats in Reserva Ducke. If the standard PPBio grid was placed in another location of the reserve, only the lesser abundant species of oribatid mites would not have been sampled. The localization of the grid in the reserve is not a pre-requisite for the elaboration of a sampling protocol for oribatid mites. The smaller 25 km^2 grids can be used to obtain a satisfactory survey of the species with little loss of information.

Thursday 26, Afternoon, Auditorium - Poster

301 - Genetic analysis of different populations of *Rhipicephalus sanguineus* from Latin America, Spain, Italy and South Africa

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The *sanguineus* complex of the mite genus *Rhipicephalus* is composed by several species present almost only in the Old World. Just *Rhipicephalus sanguineus* is considered to occur in the New World. The species of this complex show high morphological similarity, and it is possible that more than one kind of this complex occurs in Latin America. A recent study reported significantly different genetic and biological parameters between a population of *R. sanguineus* from Brazil and another from Argentina, suggesting that the biosystematics status of *R. sanguineus* in South America must be reviewed. Furthermore, *R. sanguineus* has remarkable medical and veterinary importance in South America. This project aimed to perform a genetic analysis of 32 populations of *R. sanguineus*, 17 from Brazil (including 13 states), three from Chile, two from Venezuela, two from Colombia and one each of the following countries: Argentina, Uruguay, Italy, Spain, South Africa, Costa Rica, Panama, Mexico. A sample of *Rhipicephalus turanicus* from Spain and one from South Africa were also analyzed. Ticks from each population were genetically accessed using sequences of the 16S rDNA mitochondrial genes. The outcome of this work has shown the possibility of the existence of at least two distinct groups of ticks under the taxon *R. sanguineus* in Latin America, a group that may be originated from ticks of African origin and established in tropical and subtropical America, and other group that may have originated from European populations and established in southern, temperate South America.

Thursday 26, Afternoon, Auditorium - Poster

302 - Serosurvey for *Rickettsia* spp. in dogs from a non-endemic area for Brazilian spotted fever in Para State, Brazil

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This study assessed the seroprevalence of spotted fever group *Rickettsia* in 303 dogs in a non-endemic area for Brazilian spotted fever (BSF) in the city of Nazareth, State of Para, Brazil. Sera samples were tested by indirect immunofluorescence technique against six antigens of rickettsiae (*Rickettsia rickettsii*, *Rickettsia parkeri*, *Rickettsia amblyommii*, *Rickettsia rhipicephalii*, *Rickettsia felis* and *Rickettsia bellii*). Antibodies to *Rickettsia* were detected in 27 (8.9%) dogs. Nevertheless, none of the tested samples reached a title at least four folds higher for one antigen over the others. Therefore, it was not possible to detect a homologous reaction. This low seroprevalenve results may confirm the studied area as non-endemic for BSF, while dogs are shown as important sentinels for the presence of the bacteria *Rickettsia* in this area, where *Amblyomma cajennense* is the main tick parasitizing human beings.

Tuesday 24, Afternoon, Auditorium - Poster

303 - Acarofauna of vineyards associated with three production systems in the São Francisco River Valley, northeast Brazil

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Vineyards constitute a considerable part of irrigated fruit growing areas of the São Francisco Valley, Petrolina-PE and Juazeiro-BA. The production is mainly oriented to fresh consumption for exportation. Expansion of vineyards in this region has been accompanied by attacks of pests, including mites, which frequently reduces yield significantly. This aim of this research was to study the diversity of mites in three vineyard production systems: (i) certificate (following Integrated Fruit Production principles), (ii) semi-conventional (no control of insects and mites) and (iii) conventional (no monitoring for pest control). It was conducted in the county of Petrolina, Pernambuco, Brazil, from February 2008 to March 2010. Samples were taken twice a month at five locations (3 of 'Festival' variety and 2 of 'Brazil' variety) from 15 plants. Each sample consisted of 6 leaves per branch (2 apical, 2 middle and 2 basalleaves) of each of 3 branches per plant. The mites were counted and identified. In total, 31,836 mites were collected, 19,706 predators, 11,914 phytophagous and 116 of variable feeding habits. The family Phytoseiidade was the most numerous with 61.8% of the mites collected, followed by Tetranychidae (31.3%), Tenuipalpidae (3.1%), Tarsonemidae (3.1%) and Stigmaeidae (0.1%). Phytoseiids were most abundant on 'Brazil' variety, in the certificate system. The populations of tetranychids and tarsonemids were higher in the conventional system, in both varieties. However, on 'Festival' variety, the Tenuipalpidae population was most abundant in the semi-conventional system. The species found in the 3 production systems were *Euseius citrifolius* Denmark & Muma (Phytoseiidae), *Oligonychus* sp. (Tetranychidae) and *Polyphagotarsonemus latus* (Banks) (Tarsonemidae).

Thursday 26, Afternoon, Auditorium - Poster

304 - Gluconeogenesis in the tick *Rhipicephalus microplus*

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Ticks are obligate hematophagous and the blood meal is the only source of energy for its development. Despite the small amount of carbohydrates in blood, this arthropod accumulates glycogen in its tissues. Information on the conversion of the ingested protein to carbohydrate is almost nonexistent. To investigated glucose production in adult females of the hard tick *Rhipicephalus microplus* we selected enzymes potentially relevant to this process and studied the expression of its corresponding genes. As the genome of the cattle tick is unavailable we used bioinformatics tools to search for its coding sequences in EST databases that have information on *R. microplus*. When the coding sequence of a relevant gene was not found we used the genome information of *Ixodes scapularis*, the closest relative of the cattle tick that has its genome sequenced. This tick is the vector of the Lyme disease that is prevalent throughout USA. To access the expression profile of these genes, RNA was extracted from fat body, single strand cDNA was produced and used as template for RT-PCR. Six enzymes were expressed: three Transaminases, Phosphoenolpyruvate Carboxykinase, Pyruvate Kinase and Fructose-1,6-Bisphosphatase. Our results show that gluconeogenesis is an active metabolic pathway is ticks. The high expression of transaminases point to amino acids derived from blood protein as the carbon source for the process. This research was financially supported by CNPq, FAPERJ and INCTEM.

Tuesday 24, Afternoon, Auditorium - Poster

305 - Mite families on *Vitis vinifera* var. 'Merlot' at Sant'Ana do Livramento, Rio Grande do Sul, Brazil

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The State of Rio Grande do Sul is the largest grape producer in Brazil. Recently, vineyards have extended they range to the southwest of this state. Due to the low knowledge on the mite fauna in this region and the high economic importance of this taxonomic group in the vineyards in Brazil, especially at Rio Grande do Sul, an increase in the knowledge of this group can be considered highly necessary. In this context, the objective of this work is the increase of the knowledge of the diversity of vineyard plant-living mite community focusing on family taxonomic level. This study was conducted in crops of var. 'Merlot' at Vinícola Almadén Ltda., Santana do Livramento, Rio Grande do Sul. The studied vineyard corresponded to an area of 5.26 ha, with density of 2,525 plants/ ha spaced at 3.3 x 1.2 m. Samples were collected in February and March 2010. At each sampling date leaves of 30 randomly chosen plants were collected, one of upper (L1), one of the medium (L2) and one of the lower (L3) strata. Samples were placed in hermetic plastic bags and stored in a thermal box for transport to laboratory where they were kept under refrigeration until they were processed under binocular stereomicroscope. Mites found were stored in 70% ethanol and later mounted in Hoyer's medium for later identification under a compound microscope. Until now 241 individuals (82% phytophagous) were registered. Strata with larger number of specimens were L2 and L3; there were not significant differences in the abundance between strata (t test, $p = 0.173$). Four families were recognized, Tenuipalpidade (74.27%), Phytoseiidae (17.01%), Tarsonemidae (8.29%) and Cheyletidae (with an individual). Few mites were collected in February (34 mites); all specimens were phytophagous and were found only at the L3 stratum. A considerable increase in predator (42 mites) and phytophagous (165 mites) abundance occurred in March. The sudden increase from February to March could be due to the diminishing effect of a pesticide application conducted in January, which could have affected predatory and phytophagous species.

Monday 23, Afternoon, Room 6

306 - Life in a feather forest: applied studies on relationships between hens and *Ornithonyssus sylviarum*

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The northern fowl mite, *Ornithonyssus sylviarum*, is a key pest of poultry. It primarily inhabits the vent region of hens, where the protonymph and adult stages feed on blood. Abiotic factors probably influence habitat selection by the mite, and data will be presented for bioassays using experimental gradients of temperature, light and humidity. Mites become human nuisance pests, particularly when they are dense enough to be present on eggs, but they also cause economic damage. Mite damage is severe in first egg cycle (immunologically naïve) flocks, particularly as they are reaching peak egg production. This loss in egg production, feed utilization efficiency, hen weight gains, and sometimes egg size, is due to metabolic resources directed to mounting and maintaining the immune response. Mite densities are substantially reduced by this response over a 3-6 week period. Once infested, hens probably maintain low-moderate mite loads for very long time periods, with increases and decreases in mites cycling over periods of 5-7 weeks. Essentially all commercial hens are beak-trimmed to prevent cannibalism and reduce feed waste, but this greatly impairs their grooming ability. Ineffective grooming by beak-trimmed hosts results in mite densities of 1-2 orders of magnitude above numbers found on beak-intact hens. Besides the host's grooming activity, another common ectoparasite, the chicken body louse *Menacanthus stramineus*, also greatly reduces mite numbers, and lice actually will eliminate mites on many hosts

infested by both species. The nature of this interaction, and possible mechanisms involved, will be discussed. As animal welfare issues intensify in the developed world, development of docile hen strains holds tremendous promise to alleviate mite (and louse) damage and simultaneously reduce or eliminate the pesticides currently necessary for their suppression.

Thursday 26, Afternoon, Auditorium - Poster

307 - Evaluation of combined strategies for the management of *Tetranychus urticae* Koch (Acari: Tetranychidae) in a commercial rose crop

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In Colombia there are almost 7000 hectares of flower production. Floriculture generates employment for over 150,000 families. In this area, cut rose flowers are one of the main export products. However, their production is limited by the attack of pests among which stand out the spider mite *Tetranychus urticae* Koch. Control of this pest is done mainly by the use of chemicals, but other alternatives have been used in different countries with interesting results, for instance the use of cultural, ethological and biological control. For the last, it has been demonstrated in many countries that the phytoseiid mites *Phytoseiulus persimilis* and *Neoseiulus californicus* can diminish the spider mite densities in crops. Unfortunately these predatory mites are not widely used in Colombia; to promote their use, it is important to build strategies that ensure their success in the field. Thus, we tested in this project some strategies combining compatible agents as enthomopathogens and also the use of botanical extracts to improve the efficacy of the predatory mites. Six treatments were compared in a commercial rose crop under greenhouse conditions in the Bogotá Plateau (an area where 80% of the country flower production is located): 1) Predatory mites (*P. persimilis* and *N. californicus*), 2) An enthomopathogenic fungus (*Paecilomyces fumosoroseus*), 3) Garlic-chili plant extract, 4) Predatory mites + *P. fumosoroseus*, 5) Predatory mites + Garlic-chili extract 6) Garlic-chili extract + Predatory mites + *P. fumosoroseus* and 7) Traditional chemical control. For the release of predatory mites we used the functional response as a criterion, releasing between 14-27 predatory mites/plant; the *P. fumosoroseus* commercial product used contained 5 x 10^9 conidia/ml. There were three trials, each of them lasting five weeks. A trial consisted of all the treatments with two replicated plots (each including 180-210 plants in 24-m-long row). To measure the effect of treatments on the spider mite population, six leaves of four plants in each row were sampled weekly; we counted the number of spider mites on each leaflet using a 20x lens. We found that for a period of five weeks, two of the tested combinations could be recommended; there were pest density declines of 32-76% for the combination of *P. fumosoroseus* sprays with predatory mite releases after 72 hours, and of 56-73% for the combination of Garlic-chili plant extract with releases of predatory mites after 72 hours. Both strategies resulted in good levels of control (56-92%), compared with chemical control.

Tuesday 24, Afternoon, Auditorium - Poster

308 - Major mites associated with fungi in plant tissue culture laboratories in Costa Rica

P. Murillo & H. Aguilar

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Costa Rica has reached an important level in the production of plants cultivated *in vitro*. Plant tissue culture has had a deep impact in improving quality and quantity of several commercially important plant species. However, the microbial contamination in the explants cultivated *in vitro* has caused great losses in production, which can range from 3 to 55%. The main contaminants in plant tissue culture include viruses, bacteria, yeast, fungi, thrips and mites. Some mites are responsible for the observed contamination by microorganisms because they can carry fungal spores in their bodies. Contaminated vessels from tissue culture laboratories were studied to determine the main mites and fungi found under those conditions. Fungi were cultured on PDA medium at room temperature. Mites found in the vessels were

mounted in Hoyer´s medium on microscope slides, which were kept in an oven (40- 45 °C) for three days. The main mite species found were *Siteroptes reniformis* Krantz (Acari: Siteroptidae) and *Tyrophagus putrescentiae* (Schrank) (Acari: Acaridae). Four species of fungi have been identified as contaminants in laboratory tissue culture. Fungi associated with *T. putrescentiae* were identified as *Cladosporium* sp., *Penicillium* sp. and *Mucor* sp., whereas *S. reniformis* was found associated with *Nigrospora oryzae* (Berk.& Br.) Petch.

Thursday 26, Afternoon, Room 3

309 - *Tyrophagus putrescentiae* (Acari: Acaridae) damaging plants cultivated *in vitro*

P. Murillo & H. Aguilar

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Plant tissue culture has reached an important level in the production and export of *in vitro* plants worldwide. Nevertheless, microbial contamination including mites causes high losses in the production during the *in vitro* phase. *Tyrophagus putrescentiae* has been considered the major contaminant mite species in tissue culture laboratories, since it is able to carry fungi and bacteria on its body. In addition, it has been observed causing direct damage to plants cultivated *in vitro.* The population size at which *T. putrescentiae* is able to cause damage to anthurium plants (*Anthurium* sp.), cultivated under those circumstances was determined. Symptoms caused by the mite are described. Two anthurium varieties, 'ANMIRO' and 'ANWHGE', were cultivated in a Murashige and Skoog medium with 30 $g.l^{-1}$ of sucrose and 3 $g.l^{-1}$ of Phytagel during four weeks. The treatments for each variety were as follows: a) Absolute check (AC), b) Check + fungus inoculated in the cultured medium (CF), c) fungus on leaves + mites (FLM), d) fungus in medium + mites (FMM), and e) only mites (OM). Mite density within the vessels increased through time. The observed symptoms varied from holes on the foliar lamina up to complete plant deterioration. When there is an average population of about 62 mites per vessel, it would be expected to find 20% damaged crop. Fifty five days after the first evaluation, the highest amount of injury was observed in treatments FLM, FMM, and OM.

Tuesday 24, Afternoon, Auditorium - Poster

310 - Use of different SEM techniques in the study of *Tyrophagus putrescentiae* Schrank (Acari: Acaridae)

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Scanning Electron Microscopy (SEM) has commonly been used as a tool to complement observations under light microscope in the morphological description of mites. Unfortunately, in many cases several of the SEM techniques for soft-bodied mites, as *Tyrophagus* species, have not shown expected results. This investigation sought an efficient SEM procedure to observe and photograph the major morphological characters of *T. putrescentiae*, the most important tissue culture contaminant in Costa Rica. Six methods were used to process the samples. The evaluated treatments showed differences between them in relation to the preservation of the the structures of the specimens. Treatments using ethanol were the most viable option to process these mites. This technique allows a reduction both on time and processing costs. Advantages and disadvantages of each treatment are discussed.

Wednesday 25, Morning, Room 6

311 - Landscape distribution of oribatid mites (Acari, Oribatida) in Colchis National Park (Georgia, Caucasus)

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This investigation refers to the distribution of oribatid mites on different landscapes of Colchis National Park. Species composition and abundance were studied in: 1) Sand dunes, 2) *Juncus* mires, 3) Swampy alder (*Alnus barbata*) forests, 4) Humid alder forests and 5) Secondary meadows. Fourty-seven oribatid species were registered. Faunal diversity was not associated with number of specimens. The highest diversity index was registered for alder forests, whereas the lowest index was observed for dunes. In sand dunes, 10 species were found, 3 of which only at dune line. *Peloribates longipilosus*, a xerophilous species, showed the highest density (1267 ind/m^2), although density was lower in bogs (33 ind/m^2) and the mite was totally absent from the remaining landscapes. In *Juncus* mires, 32 species were registered, 16 of which only on this landscape, including bog specific *Zetomimus furcatus*, *Euzetes globosus* and *Punctoribates mansanoensis.* Twenty species were found in swampy alder forests, with predomination of *Steganacarus spinosus* (9433 ind/m^2) and *Nanhermannia nana* (8900 ind/m^2). These two species were found in lower densities in mires and secondary meadows as well. Seven species were exclusive to this landscape; ten species were registered in humid alder forests, where 2 typical inhabitants of humid forest soils appeared as exclusive species: *Metabelbella macerochaeta* and *Eremobelba geographica*. Oribatid fauna of this landscape was mainly similar to that of swamped forests. *Pergalumna minor* was found in high densities (900 ind/m^2), and was constantly present almost in every sample except dunes. Only five species were registered in secondary meadows, with *Protoribates lophotrichus* as the exclusive species. Faunal likeness between the landscapes shows high similarity between dune and mire oribatid communities, followed by swampy and humid alder forests and with isolation of fauna of secondary meadows. As the main factors of differences among the studied landscapes, vegetation cover and soil humidity are considered. The faunal changes show that the drainage works conducted in Colchis lowland in early XX century negatively influenced the vegetation and soil structure which was followed by impoverishment of soil fauna.

312 - Phenotypic differences between *Leipothrix dipsacivagus* Pet. et Rector and *L. knautiae* (Liro) (Acari: Prostigmata: Eriophyidae) populations inhabiting *Dipsacus* L. and *Knautia* L. (Dipsacaceae) plants

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Only three eriophyoid mite species of the genus *Leipothrix* Keifer are known to occur on dipsacaceous plants including hosts in the genera *Knautia* (L.), *Succisa* Haller, and *Dipsacus* L.. These three species are similar, but differ in few key characters. Description of eriophyoids includes over 250 character stases, most of them quantitative. Quantitative description of morphological variation between closely related species can provide basic information needed to improve the eriophyoid taxonomic system. Moreover, morphometric analysis can help in distinguishing intraspecific variation including host-adapted strains or even cryptic species. The purpose of this study was to investigate quantitative morphological traits of two *Leipothrix dipsacivagus* Pet. and Rector populations inhabiting *Dipsacus laciniatus* L. in Serbia and two *L. knautiae* (Liro) populations inhabiting *Knautia arvensis* L. and *K. dinarica* (Murb.) from North Russia and Serbia, respectively. MANOVA analysis revealed significant differences in 23 commonly used morphometric traits. Discriminant analysis identified 11 traits that were significantly different between the four populations under study. The length of dorsal shield, number of ventral annuli, distance between (*sc*) tubercles, length of first ventral *(d*) setae, length of (*2a*) setae, and distance between tubercles (*1b*) have the most distinct discriminative power based on the first canonical

function. This function clearly separated *L. dipsacivagus* from *L. knautiae.* The distance between (*sc*) tubercles, number of dorsal annuli, length of tibia of the leg II, length of body, length of (*3a*) setae, length of (*c2*) setae, and length of (*d*) setae have the most distinct discriminative power based on the second canonical function. This function made clear separations between three groups, viz. *L. knautiae* collected from *K. arvensis* in northern Russia, *L. knautiae* collected from *K. dinarica* in western Serbia, and *L. dipsacivagus* [The two *L. dipsacivagus* populations were not separated by the second canonical function]. Phenotypic differences among investigated taxa may originate from the existence of morphologically different species (*L. dipsacivagus* versus *L. knautiae*), and from the existence of different host and/or geographical races (*L. knautiae* from two host plants: *K. arvensis* and *K. dinarica* collected at two distant localities).

Thursday 26, Afternoon, Auditorium - Poster

313 - Host-parasite relationship between aquatic insects and water mites in the family Protziidae (Acari: Hydrachnellae)

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Water mites are distributed widely through ponds, lakes and mountain streams. The egg of water mites develops into adult through the stage of larva, protonymph, and deutonymph. In part of their life cycle, the larvae attach themselves to adult aquatic insects such as hemipterans, odonates, coleopterans, trichopterans, plecopterans and dipterans. Most of the information on host-parasite relationships comes from studies of lentic mites and insects, while relatively little is known about the relationships between lotic mites and insects. Protziidae is known to inhabit lotic water in mountain streams. The purpose of this study is to examine the host-parasite relationship between mite larvae of *Protozia* species and host insects. Aquatic insects were collected in streams in Japan from 2008 to 2009 by using light-trap and hand-sweeping. The following parasitic characteristics of mite larvae of *Protzia* species on aquatic insects were examined: 1) the preference for the host 2) the preference for the host sex, and 3) the preference for the attaching site on the host. The number of mites on each host insect was analyzed by the Mann-Whitney U-test. The parasitic rate between male and female hosts and the attaching sites on host insects were analyzed by the Chi-square test. As a result, mite larvae of *Protzia* species were associated with Trichoptera and Diptera. The number of mites on *Dolophilodes japonicus* (Trichoptera) and *Antocha* sp. (Diptera) are significantly different. In *Dolophilodes japonicus* and *Antocha* sp., the number of mites per an individual host species (i.e., abundance) was 3.78 and 1.43, respectively. It is considered that mite larvae of *Protzia* species prefer trichopteran to dipteran. Concerning the host sex, there was no significant difference in parasitic rate between male and female hosts. Comparing the number of mites between male and female hosts, the number of mites on the male is not significantly different from that on the female of *Antocha* sp.. However the number of mites on the male is significantly different from that on the female of *Dolophilodes japonicus*. Concerning the site preference, a clear preference for the specific body parts of the host insect was observed.

Wednesday 25, Morning, Room 6

314 - The computer database "Soil Fauna Databank" as a platform for information about recourses of acarofauna of the world

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In 1990, the international study programme, entitled "Invertebrate Fauna Databank", has been started as an initiative of the "Acarological Team" association of the Department of Animal Taxonomy and Ecology on Adam Mickiewicz University in Poznań (Poland). The aim of the programme was to gather and to make available to the specialists the materials and faunistic data of invertebrates. Since 2004, with the confines of the new-built Collegium Biologicum on the University, a new unit of the museum character – "Natural Collection" was created. The "Museum" is working on protecting, cataloguing and making the collection available to specialists of various mite groups. In the collection, among other things, type specimens of many mite groups have been gathered. The result of activities conducted so

far is the collection and the cataloguing of the computer database (Soil Fauna Databank) of more than 20 thousand soil samples from Poland and the whole world. Many monographies about various groups of invertebrates, mainly mites, have been written based on these materials. Recently, based on the literature, the electronic catalogue of Uropodina (Acari: Mesostigmata), have been created. There are drawings in this catalogue and SEM photographs of the whole species with its descriptions. This elaboration is a very helpful tool in the studies on taxonomy of Uropodina. Soil samples stored in one place and still collected in various countries and regions of the world could represent the basis for long lasting observations of changes in the communities of soil fauna, and moreover it could be "the germ" for monitoring studies of soil environment on a large scale. The "Collection" could also represent an important base of the type and comparative materials for taxonomic studies. It is also planned to make the Database available in the Internet, for use of specialists from around the world.

Thursday 26, Morning, Room 2

315 - Are the long-term fluctuations of the number and community structure of Uropodina (Acari: Mesostigmata) in Poland an effect of the climate changes and anthropogenic transformations of environment, or natural fluctuations?

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The most important contemporary environmental threats are deforestation and the problem of "global warming". Some scientists claim that the latter phenomenon is a natural process which occurs in the geological scale and that its convergence with intensive anthropopression is only accidental. Not much attention has been drawn into the study of the influence of climatic changes on soil fauna. The most important obstacle in the estimation of changes of the number and community structure of soil fauna was the lack of a point of reference to the past and determination of the output point for long lasting observations. The authors of this paper possess such historical data as well as meteorological and cartographical materials which shows the process of shrinkage of forest in Wielkopolska Province (Poland). The studies have been conducted in 20 forest complexes in central Wielkopolska. The "model" group was mites of the suborder Uropodina (Acari: Mesostigmata). More than 60% of the species from this group occurring in Poland are associated with soil and litter of various types of forests. Since XIV century, progressive deforestation and fragmentation of forests complexes have been observed in that province. The aim of the study was to estimate the influence of these changes on the communities of Uropodina. The community structure in each complex has been analyzed according to the following forest parameters: size, age, tree-stand composition and type of management (protected or a non-protected object). The importance of thickets and small forest islands as natural corridors for the dispersion of mites has been also assessed. The results show that the participation of typical forest species rises with an increase of forest area size. Biodiversity and abundance of species in the communities rise with both increasing degree of naturalness and age of a tree-stand. Thickets and plantations were not observed to play a role of ecological corridors for the forest species of Uropodina. The quantitative studies on structure of Uropodina communities, which have been conducted in 1978-1983 in the area of hornbeam nature reserves: "Jakubowo" and "Las gradowy on Mogilnica", and repeated (using the same methods and on the same areas) in 2005-2006 have shown significant differences in the species composition and two-fold reduction in the number of the mites. These results could be due to the effect of major differences between the weather of both periods. In the first period (1978-1983) it was very humid, whereas in the second (2005-2006) it was very dry with very hot summer. These differences in the community structure could have been also the consequence of progressive, harmful changes in soil environment, resulting from climatic and anthropogenic changes in the area.

Tuesday 24, Afternoon, Auditorium - Poster

316 - New species of *Hydrogamasus* (Mesostigmata: Ologamasidae) from Brazil and a key to the species of this genus

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Ologamasidae is a large and widely distributed group of predatory mites that inhabit soil, humus and compost. These mites are commonly found in southeastern Brazil, and for this reason some studies have been conducted to evaluate their potential as biological control agents of pest organisms. Ologamasids probably feed on collembolans, nematodes and other mites, according to the few biological conducted so far about those organisms. Forty-five genera are included in the Ologamasidae, including *Hydrogamasus* Berlese. This genus is comprised of four species, all described from seashores in Europe and Oceania. These species are characterized by having dorsal shield entire and fused to ventrianal shield, epistome with three extensions, two pairs of presternal shields and peritremal shield fused to exopodal shield IV. A new species of *Hydrogamasus* was recently found in soil and litter at Piracicaba, State of Sao Paulo, in southeast Brazil. This contrasts with previous reported of species of this genus, given that Piracicaba is located far away from the seashore. Females and males of this species are distinguished from other species by having the central extension of the epistome is distally serrated (smooth in other species), peritreme extending to level of coxa II (to level of coxa I in other species) and podosomal region of dorsal shield with 23 pairs of setae (20 pairs in other species). A key is provided to separate the species of this genus.

Wednesday 25, Morning, Room 2

317 - A population genomics view of plant/mite interactions

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A challenging problem in evolutionary biology is linking the evolution of phenotypes with underlying genetic changes. Most phenotypes are encoded by multiple genes that interact with each other as well as with the environment. In the case of spider mites, successful interactions between plants and mites almost certainly impact mite development and reproduction, and ultimately the evolution of the species. Toward understanding such interactions, tremendous steps have being recently made with the sequencing of the reference genome of a well studied spider mite, *Tetranychus urticae*. Concomitantly, rapid and inexpensive sequencing technologies, so-called second-generation sequencing methods, are available or will soon be available to make it possible to collect whole-genome resequencing data from multiple individuals from a population, at modest costs. With the ability to generate individual and population-level sequence resources, new genetic markers can quickly be identified across the genome (for example, single nucleotide polymorphisms, or SNPs, and small to large indels identified by aligning short reads to a reference sequence). These powerful tools ultimately will underlie a new approach to understand the genotype-phenotype connection, 'population genomics' and/or genome-wide association mapping (GWA), where a large number of molecular markers are scored in individuals from different environments or in bulk at the level of populations. Markers showing patterns of variation that associate with phenotypes can then be identified and characterized as potential targets of selection to underlie adaptation to the environment (for example, development and reproduction on a given plant host). To make this a reality, our groups are analyzing the high quality reference spider mite genome, as well as second-generation sequence data already generated for another mite population. We have already identified hundreds of thousands of SNP and small indels markers for use in genetic mapping studies. We show that genomic approaches have great promise for understanding the interaction of mites with their plant hosts.

Tuesday 24, Afternoon, Auditorium - Poster

318 - Presence of a tibial seta on leg II in a new eriophyoid mite - An atavistic character?

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Among plant feeding mites, the Eriophyoidea is the largest superfamily, currently with about 3700 valid taxa, yet considered to be a relatively poorly known group, with perhaps only 5-10% of the total number of anticipated species already described. Up to the present no eriophyoid species have been described with a tibial seta (*l'*) on the second pair of legs, such that its absence is considered typical or normal for all Eriophyoidea in the description of new taxa. Surprisingly, when preparing a description of a new species of the genus *Abacarus* Keifer from sugarcane, *Saccharum officinarum* L., from Costa Rica, collected by H. Aguilar and C. Sanabria, in 2008, the presence of this seta was clearly observed on leg II, just as it is usually present on the tibia of leg I. Type material comprised 31 females and 15 males, and the tibial seta on leg II was observed, in dorsal position, on all specimens which, due to the mounting position, allowed visualizing this segment. Although the presence of a tibial seta on leg II may be considered as a primitive (plesiomorphic) retention, its consistent absence among all the known early derivative taxa of Eriophyoidea (i.e., members of 18 genera in four subfamilies of Phytoptidae) does not support this hypothesis, especially in view of *Abacarus* being a relatively recently derived genus of the tribe Anthocoptini, in the subfamily Phyllocoptinae of the more derivative family Eriophyidae. Another possibility is that the presence of a tibial seta on leg II may be an atavistic character, i.e., a re-appearance of a previously suppressed seta, thus a character state reversal and derivative (apomorphic) condition. From now on we suggest that the absence of a tibial seta on leg II not be regarded as an assumed characteristic and the only possibility in eriophyoid leg chaetotaxy when describing a new taxon; and we wonder whether the occasional presence of this seta may have been overlooked in some previous descriptions. This attribute should also be considered in future phylogenetic studies of the group.

Wednesday 25, Morning, Room 4

319 - Molecular and morphometric tools in Eriophyoidea systematics

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Eriophyoidea systematics based exclusively on traditional morphology may present limitations. Because of the considerable reduction and simplification in the body plan of eriophyoid mites, the structures that can be used for its morphologically-based systematics are scarce compared to most of the other mites. Another limitation is the lack of useful characters specific to the adult male. An obvious significant cause of mistakes in eriophyoid systematics is the occurrence of deuterogyny, and as a consequence, many species may be junior synonyms of their correspondent deuytogyne/ protogyne. It is now widely accepted that the concomitant use of molecular tools and morphology can help to clarify the systematics of eriophyoid taxa in particular to solve misleading situations. As for other Acari, the Eriophyoidea has also benefit of the rapid development of molecular methods. DNA-based resources have started to be used in eriophyoids about 15 years ago, with the first publications dated from 1995. However the attempts are still scarce compared to other plant mite groups. This is a regrettable observation, because among the plant feeding mites, Eriophyoidea represent the most diverse and the second group economically important as crop pests. Although the palette of technical approaches used for this group is still limited important, advances have been done using DNA-based techniques. Morphometry has also proved to be an effective tool

to determine the intra- vs. interspecific variation in eriophyoid mites. Multivariate morphometric analysis allows detecting variation in quantitative characters useful to evaluate patterns of phenetic relationship. It also provides feedback information on expected characters variability within and between populations. Among morphometric methods the geometric morphometric has also been used in eriophyoid systematic to study geographic pattern of variation or to test synonym hypothesis. Shape variation may be interpreted as changes occurring during the evolutive history of a taxon. Geometric morphometric analysis allows the quantification and visualization of morphological variation within and between samples of organisms and provides information that may be used in order to obtain evidence of similarity among taxa/ populations. In this presentation we examine the main DNA and morphometric-based techniques that have been used to eriophyoid systematics. We discuss the results from the literature that have provided significant advances to address several essential questions on the eriophyoid systematics: e.g. to clarify suspected synonymies, to test hypothesis of cryptic species; to examine the occurrence of biotypes, especially in rapport to virus vectoring ability or host-plant associations, and to understand colonization patterns of invasive species. Challenges of new molecular and morphometric approaches are discussed.

Thursday 26, Afternoon, Room 4

320 - Current status and distribution of *Raoiella indica* (Acari: Tenuipalpidae) in Brazil

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The red palm mite, *Raoiella indica* Hirst, is a notable example of an invasive phytophagous mite to the New World. It was first found in the Caribbean in 2004, disseminating and extending its host range widely within a very short time. Its detection in Venezuela in early 2007 alerted Brazilian researchers about the risk of its entry in Brazil. The State of Roraima was considered as the most probable region where it could first be found in this country, because of its border with Venezuela, and because of the frequent trade of goods and movement of people between those countries. Surveys in this State were initiated in May 2007 and intensified in 2008 in three municipalities: Pacaraima (at the border with Venezuela), Boa Vista (the capital of Roraima, about 220 km south of the border with Venezuela) and Cantá (about 100 km southwest of the capital). The red palm mite was not found in those surveys. In July 2009, *R. indica* was found on coconut leaves in the urban area of Boa Vista; immediately subsequent samplings showed the mite to be spread over extensive areas of Boa Vista municipality and neighboring southern municipalities, infesting coconut, banana and other host plants. Probably, the dispersal of the red palm mite from Venezuela was not natural, but transported by man. An immediate impact of the introduction of *R. indica* in Brazil was social, due to the restriction of movement of bananas from Roraima, where it is widely grown by large and small farmers, to the State of Amazonas. Until now, the distribution of *R. indica* in Brazil is restricted to Roraima, north of the large Amazonian forest. While little can be done in terms of reducing the possible natural spread of the mite, given the common occurrence of palm trees in the natural vegetation, efforts have been dedicated to delay the dispersal by man to other parts of the country. Mitigation efforts should be put in place to allow the control of the pest. A biological control project has been initiated, to evaluate the role played by local predators and the possible introduction of exotic, prospective natural enemies.

Tuesday 24, Afternoon, Auditorium - Poster

321 - *Brevipalpus* mites of economic and quarantine importance – integrating morphology and molecular information to advance their systematics

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Brevipalpus mites are considered the most important pests within the Tenuipalpidae. The three main species, *B. californicus* (Banks), *B. obovatus* Donnadieu and *B. phoenicis* (Geijskes), have been incriminated as vectors of phytovirus. Dissemination of *Brevipalpus* mites associated to plant material and viruses represent an imminent threat to agriculture and ornamental industries. Systematics and phylogeny of *Brevipalpus* mites is of concern. The three mentioned species have been consistently confused and misidentified. The hypothesis that *B. phoenicis* represents a species complex has been analyzed. The quarantine species, *B. chilensis* Baker, is morphologically very close to *B. obovatus*, a species found worldwide, and taxonomists have discussed their possible synonymy. In order to advance with the understanding of *Brevipalpus* systematics, a phylogenetic analysis based on mitochondrial Cytochrome Oxidase I (COI) sequences and a detailed morphological study were conducted on *Brevipalpus* mites of the same populations. A total of 102 COI sequences of *Brevipalpus* mites from Brazil (65 sequences, 9 states; 11 hosts), Chile (33 sequences, 13 localities, 6 hosts) and the USA (4 sequences, 2 states, 2 hosts) were obtained. These data were analyzed together with other 41 sequences retrieved from GenBank from *Brevipalpus* originated from mites collected in Brazil (20, 3 states, 6 hosts); USA (16, 2 states, 6 hosts) and The Netherlands (6, 6 hosts). While a 430bp fragment was sequenced, the best alignment included 374 bp and was selected for further analysis which detected a total of 45 haplotypes. A *Cenopalpus pulcher* COI sequence was used as outgroup. About 30 specimens from the sequenced samples were mounted for morphological identification. Phylogenetic results support the present taxonomy of *B. obovatus* and *B. chilensis* as distinct taxa as well as the hypothesis of a species complex hidden in *B. phoenicis* phenotypes. Jointly, phylogenetic and morphological analyses support the presence of two *Brevipalpus* aff. *phoenicis* species among the studied populations: 1) from *Alnus subcordata* and *Ligustrum japonicum* from Colombo, Paraná, and *Ligustrum* sp. from Brasilia, DF, Brazil; 2) from coconut, Janaúba, Minas Gerais, Brazil. In addition to the genetic distance of these species with other *B. phoenicis* populations, the distinctive morphological character was the median dorsal ornamentation pattern. A detailed taxonomic study of these *aff.* species is under way, and includes immature stages and morphometric characters. Because their role as vector and pest of economic importance there is an urgent need to advance in *Brevipalpus* systematic; matching morphological and molecular information will be extremely helpful.

Wednesday 25, Morning, Room 4

322 - The Wheat Curl Mite *Aceria tosichella* in South America – occurrence areas and host plants

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The Wheat Curl Mite (WCM), *Aceria tosichella* Keifer, was known from the main wheat production areas in North America, Europe, Asia, Middle East and Oceania. Only recently the WCM and its associated virus were found in South America. The wheat streak mosaic (WSMV) virus was found for the first time in Argentina in 2002. Two years later, the WCM was also detected in that country in association with infected plants, in the Province of Buenos Aires. This information alerted to the threat that the pathosystem WCM/WSMV and the high plain virus represented to cereals in South America,

especially Argentina's neighboring countries with contiguous cereal production areas. In this study, the occurrence of the WCM in Brazil, Uruguay, Paraguay and other Argentina Provinces was evaluated through surveys of eriophyid mites on cultivated wheat, barley, oat and corn, as well as of common native or spontaneous grasses nearby the crop areas. Surveys in Brazil were conducted in the State of Rio Grande do Sul from October 2006 to March 2010, covering 42 municipalities. From March 2009 to March 2010, surveys were also conducted in the States of Paraná and Santa Catarina. In Brazil, up to now the WCM has only been found in 11 municipalities of the northwest and central regions of the State of Rio Grande do Sul, associated with 9 grasses - wheat, oat, barley, corn, *Lolium multiflorum*, *Bromus unioloides*, *Brachiaria plantaginea*, *Rhynchelytrum* sp. and *Chascolytrum* sp.. In Uruguay, surveys were conducted from February 2007 to November 2008, through most of the wheat producing area in 13 municipalities of 6 Departments (Colonia, Flores, Paysandú Rio Negro, San José, Soriano). The WCM was detected in the Departments of Colonia (4 municipalities), Rio Negro and Soriano (one municipality each), infesting wheat, *L. multiflorum* and *B. unioloides*. Surveys in Paraguay were conducted in August 2007, in 12 localities of four Departments (Coaguaçu, Maria Auxiliadora, Naranjal and Pirapó) on wheat and corn. The WCM was not found in Paraguay; however, complementary surveys should be conducted, for more reliable results on the status of this in that country. In Argentina surveys were conducted from 2006 to 2010, over all the wheat producing areas. In addition to Buenos Aires, the WCM was detected in the Provinces of Córdoba, Entre Ríos, La Pampa, Santiago del Estero, Santa Fe, Tucumán and Salta, infesting wheat, oat, corn, *Digitaria sanguinalis*, *Echinochloa crusgalli*, *Setaria* sp., *Panicum* sp, *Brachiaria* sp., *Sorghum halepense* and *Cynodon dactylon.*

Wednesday 25, Afternoon, Auditorium - Poster

323 - Season- and fruit age-dependent population dynamics of *Aceria guerreronis* and its associated predatory mite *Neoseiulus paspalivorus* on coconut in Benin

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The coconut mite *Aceria guerreronis* Keifer resides beneath the perianth of coconut fruits where it feeds on the tender meristematic tissue and causes substantial losses in coconut production in Africa and other countries where it occurs. Little knowledge is available, however, on its population dynamics. We followed the seasonal and fruit age-related population fluctuations of *A. guerreronis* and its predator *Neoseiulus paspalivorus* De Leon in four coconut plantations in Benin, West Africa, at monthly intervals over a one year period. Both percent fruit occupation and abundance of *A. guerreronis* varied among seasonal months, plantations and fruit age classes, but none of these factors had a consistent effect on *A. guerreronis* population abundance. Populations of *A. guerreronis* peaked twice - in the middle of the rainy season and at the end of the dry season. Percent fruit occupation and abundance of *N. paspalivorus* differed among plantations and fruit age classes. *Aceria guerreronis* and *N. paspalivorus* first appeared in the fruits at estimated fruit age of 0.9 and 1.2 months, respectively. Both mites reached their peak abundance (1512 and 2.3 per fruit for *A. guerreronis* and *N. paspalivorus* respectively) on 3 months-old fruits. Peak percent fruit occupation by *A. guerreronis* (~70%) occurred after 4.3 months, which was ~0.7 months earlier than that by *N. paspalivorus* (~22%). Obvious difficulties of the predators to access the area beneath the perianth on the very young fruits allows *A. guerreronis* a head-start in population build-up leading to strongly diverging population curves in relation to coconut fruit age. We conclude that protecting the very young fruits from *A. guerreronis* colonization is a key issue for developing successful control strategies.

Friday 27, Morning, Room 3

324 - Comparative biology of *Neoseiulus baraki* and *Neoseiulus paspalivorus*: interspecific interactions and predation efficiency

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The two phytoseiid mites *Neoseiulus baraki* and *N. paspalivorus* are the two most common phytoseiid predators beneath the coconut fruit bracts where they feed on the eriophyid mite *Aceria guerreronis*. That the two predators inhabit the same space and share a common prey on the coconut fruit may lead to direct and indirect interspecific interactions that can affect their co-occurrence, population abundance, and impact on the primary prey *A. guerreronis*. We conducted a series of laboratory experiments on cannibalism and interspecific predation by the two predator species with a range of *A. guerreronis* densities under coconut bracts. Both *N. baraki* and *N. paspalivorus* were cannibalistic in the absence of the extraguild prey *A. guerreronis*. In the presence of this prey, however, cannibalism by *N. baraki* decreased sharply but remained unchanged in *N. paspalivorus*, while oviposition rates by both species increased steeply. When the two predators were confined together and in the absence of *A. guerreronis*, *N. baraki* predation on interspecific larvae was 2.7 fold higher (19 larvae/day) than that of *N. paspalivorus* (7 larvae/day). Interspecific predation by *N. baraki* decreased only slightly in the presence of limited or abundant quantity of *A. guerreronis*, whereas interspecific predation by *N. paspalivorus* decreased sharply (20% and 14% that of *N. baraki* at low and high *A. guerreronis* abundance respectively). The number of *A. guerreronis* individuals consumed increased with initial prey density regardless of predator species, with *N. baraki* being always the more voracious predator; however, prey conversion efficiency by *N. paspalivorous* was considerably higher than by *N. baraki*. Three main conclusions can be drawn from these studies: (1) cannibalism by the two predator species is restricted largely to conditions when the preferred herbivorous prey is absent and is likely to play a negligible role in the dynamics of these predators; (2) asymmetric and strong intraguild predation by *N. baraki* on *N. paspalivorus* is expected to have substantial effects on the distribution and co-occurrence of the two species; and (3) *N. baraki* is a more voracious predator than *N. paspalivorus*, but less efficient in converting food to offspring. Implications of the biological characteristics of the two predatory mites for their role in the biological control *A. guerreronis* will be discussed.

Wednesday 25, Afternoon, Auditorium - Poster

325 - Spatial distribution and sampling of *Tetranychus turkestani* U. & N. on eggplant in Ahwaz

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Populations of *Tetranychus turkestani* U. & N. were sampled from young, mid-aged, and old leaves of eggplant in field conditions in Ahwaz, Iran. Most spider mites were found on the mid-aged leaves of eggplant. The mid-aged leaves contained 61% of the mite population. Linear regression of the number of mites sampled per plant against the number of mites on mid-aged leaves were determined as R^2=0.88. This portion is therefore a good site to sample spider mites on eggplant. On mid-aged leaves of blackbeauty variety, 47% of sampled individuals were eggs, 37% were young individuals, 0.07% adult females and 0.01 were adult males. Linear regression of the samples mean against various age groups gave R^2=0.844 for eggs, R^2=0.853 for immature, R^2=0.858 for adult females, R^2=0.576 for adult males and R^2=0.87 for both adult females and males. The number of eggs, immature, adult female and both adult female and male corresponded to the total population, and are suitable for precisely estimating the population. As the adults are more easily recognized, thus for making decision about pest management, we

recommend sampling of the adult population on the mid-aged leaves. All distribution index such as, the ratio of s/x^2, the value of Taylor power law (TPL) and the value of Iwao's patchiness regression (IPR) indicated a clumped dispersion of *T. turkestani* population on eggplant.

Wednesday 25, Afternoon, Auditorium - Poster

326 - Effect of temperature on development and reproductive parameters of *Tetranychus turkestani* U. & N. (Acari: Tetranychidae)

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Knowledge of relationship between temperature and mite developmental rates is useful in biological and ecological studies. The present study was undertaken to determine the effect of different temperatures (15, 20, 25, 30, 35, 40 ºC) on development and reproductive parameters of *Tetranychus turkestani* U. & N. The experiment was conducted in the laboratory under controlled conditions: 55±10 RH and 16L:8D photo period. The upper and lower thermal thresholds were estimated 12.4 and 41.6 ºC respectively. The total effective temperature for completing each generation (egg-to-egg period) was 360.74±16.09 degree-days. The degree-days were also determined for all growth stages (eggs, larvae, nymphs, adults and chrysalis) and different periods of adult females (pre oviposition, oviposition and post oviposition periods). The performance of one linear and 11 nonlinear developmental rate models (Logan – 6, Logan – 10, Sharp and DeMichele, Taylor, Lamb-1, Lamb-2, Hilbert and Logan, Briere – 1, Briere – 2, Lactine – 1 and Lactine – 2) were compared and criteria such as adjusted coefficient of determination (R^2), the residual sum of squares (SSR) and estimation of parameters with biological significance were used to provide complementary information on goodness – of fit and usefulness for predicting observations. The results indicated that the Lactine – 2 model (R^2 = 0.998, SSR = 0.0001 and x^2 = 0.0018) was the best. Upper (43.09 ºC) and lower developmental thresholds (6.05 ºC) and optimal temperature (36.5 ºC) of *T. turkestani* were estimated by this model.

Wednesday 25, Afternoon, Auditorium - Poster

327 - Population dynamics of strawberry spider mite, *Tetranychus turkestani* U. & N. (Acari: Tetranychidae), on aubergin

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Investigation concerning the influence of biotic and abiotic factors on the biology of *Tetranychus turkestani* U. & N. should be conduct to characterize the main factors responsible for changes in its population dynamics. For this reason, seasonal abundance of strawberry spider mite (SSM), *T. turkestani*, on four eggplant varieties, namely Blackbeauty, Ghasri, Esfahani and Inehrash, was studied weekly under field conditions in Shahid-Chamran University, Ahwaz, Iran, from May 2001 to October 2002. Spider mite infestation occurred throughout the season on the studied varieties. On all varieties, the highest population density was observed in June and July, in 2001 and 2002, respectively. Statistical analysis of SSM population abundance showed a significant effect of years on density of different life stages. As a consequence, the effect of sampling dates on population density of different spider mite stages assessed individually for each date and year. The results showed significant differences in population density in different sampling times for all varieties in two years. The trend of population changes correlated with various biotic and abiotic factors, namely population density of *Scolothrips longicornis* and *Phytoseius tropicalis*, daily maximum, average and minimum temperatures and

average relative humidity. Stepwise regression showed significant influence of maximum temperature and predators' population on population changes of two-spotted spider mite on the studied varieties during 2001 and 2002.

Friday 27, Morning, Room 4

328 - Effects of simulated climate change and grazing on rangeland soil microarthropods

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Canada contains 22,000,000 ha of land dedicated to range and forage production. To mitigate potential impacts of climate change on biodiversity and sustainable production of Canada's rangelands, it is essential to gain an understanding of links between temperature, precipitation, grazing and their effects on soil chemistry and biota. We have conducted a three year study at the Kinsella Research Ranch in central Alberta, Canada. Using a factorial design we tested effects of warming, two different precipitation and two defoliation (~grazing) regimes on carbon and nitrogen cycling, forage quality, plant assemblages, soil microbial activity and soil microarthropod assemblages. Alteration of precipitation had the strongest effect on soil microarthropods. Our data show contrasting patterns between the first (2007) and third (2009) year of the project. After 4 months of treatments, lowered precipitation increased abundances of mites and springtails. The third year showed the opposite effect with lower abundances in drought conditions, but higher abundances with added precipitation. However, at the family level, taxa show different responses to the treatments. Additionally, efficacies of rapid (Tullgren) and labour-intensive (kerosene flotation) extraction methods were compared. To date, 69 arthropod taxa have been identified, most of them mites (Arachnida: Acari). This includes 8 orders of macro-invertebrates, 3 families of Collembola, 2 families of Astigmata, 2 families of Endeostigmata, 15 families of Prostigmata (including 4 families of Heterostigmata) and 16 families of Oribatida (consisting of 25 genus- or species-level taxa). The microarthropod assemblage was numerically dominated by springtails and mites, the latter mainly consisting of prostigmatid mites.

Thursday 26, Afternoon, Auditorium - Poster

329 - *Ornithonyssus* spp. (Acari: Macronyssidae) from small land mammals in Brazil: morphology and molecular studies

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Based on chaetotaxy of the dorsal shield, the taxonomic status of many species of *Ornithonyssus* have been considered not valid, resulting in the synonymy of all Brazilian *Ornithonyssus* from small wild land mammals into one of the following four species: *O. bacoti*, *O. matogrosso*, *O. pereirai* and *O. wernecki*. Thus, knowledge on the *Ornithonyssus* genus in Brazil has been stagnated for more than 40 years. Because of the potential importance of the *Ornithonyssus* in pathogen transmission, we have revised all Brazilian species collected on small wild land mammals in Brazil by means of morphology and molecular studies. Types and material deposited at the Acari Collection of Instituto Butantan (IBSP) were examined; recently collected specimens were also identified. In addition an illustrated key to females of the currently valid Brazilian species of *Ornithonyssus* is included, based on optical and scanning electron microscopy. This research was financially supported by CNPq.

Tuesday 24, Afternoon, Auditorium - Poster

330 - Standardization of a method for monitoring populations of *Tetranychus urticae* (Acari: Tetranychidae) in a commercial rose crop

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In Colombia, mite control currently accounts for 35% of the cost of the total pest and disease control programs in rose cultivations. It is fundamental to design monitoring methods that allow an early pest detection and an accurately estimation of pest populations. As a result, wider management actions will be taken and a reduction of pesticide use and a restoration of natural enemy communities would be expected. According to these considerations, this work proposes a methodology that allows in a practical and reliable way to obtain density estimates of *T. urticae* for both traditional and bend-shoot production system. From the experimental crop with a bend-shoot production system, 81 squares were selected. From each square, three plants were randomly picked. Each plant was divided in three layers, and three leaves were randomly selected by layer within plant. In each leaf, the total population of the two-spotted mite was registered. On the other hand, from the crop with a traditional production system, 48 squares were chosen. From each square, one plant was picked and divided in three layers. Three leaves were randomly selected by layer within plant. In each leaf, all the stages of the pest were counted. A difference in the distribution of mites within the plant for both systems was found. In the traditional system, around 92% of the population was located in the lower layer of the plant and about 6% and 1% of the population was situated in the middle and high layer respectively. Whereas, in the bend-shoot system, the population were distributed as follows: 72% in the lower layer, 22% in the middle layer and 6% in the higher layer. It was also found that in the bend-shoot system, around 77% of the population was located in the four apical leaflets of a leaf. Meanwhile in the traditional system no difference was found about the distribution within the leaf. Taylor's power law was used to calculate sample sizes. Accordingly it is recommended that *T. urticae* population must be counted in the four apical leaflets (bend-shoot production system) or on all the leaflets (traditional production system) of a leaf taken from the lower layer of the plant. The number of plants and squares to sample changes according to the number of individuals by leaf.

Tuesday 24, Afternoon, Auditorium - Poster

331 - Action of permethrin (active ingredient of the Advantage® Max3, Bayer acaricide) on the salivary glands of *Rhipicephalus sanguineus* (Latreille, 1806) (Acari: Ixodidae) semi-engorged females

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Ticks are one of the most important groups of animals from the medical and veterinary points of view, once they cause damage to the host, especially by the transmission of pathogens. The Ixodidae's salivary glands are vital to the biological success of this group, as they produce substances necessary for ectoparasites fixing and feeding. Studies on the cytotoxic potential of chemicals in the salivary glands are an important tool, since data about the direct influence of acaricides in ticks' glandular system are rarely explored. This study examined, by morphological and histological techniques, the effects of permethrin in the cells of the *Rhipicephalus sanguineus*' salivary glands. For this purpose, semi-engorged females were subjected to 4 treatment groups (immersion tests) based on the LC50 of 2062 ppm: group I (control - distilled water), group II (206 ppm permethrin = 10% of LC50), group III (1031 ppm permethrin = 50% of LC50) and group IV (2062 ppm permethrin = LC50). The results showed that the salivary glands of the control group presented the acini I, II and III with typical spherical morphology and intact cells. In individuals subjected to 206 ppm permethrin, it was observed that most of the acini II suffered vacuolation and reduction of secretory granules. Some acini types I and III showed disorganization of acinar cells, however, most of them showed

morphology similar to the control group. In individuals exposed to 1031 ppm permethrin, changes were more prominent in comparison to other concentrations, since the glands were in advanced degeneration with disorganized acini, strongly vacuolated cells and apoptotic bodies, forming an amorphous mass. However, the salivary glands subjected to 2062 ppm permethrin showed acini intensely vacuolated and disorganized, which were classified as undetermined, once their identification was not possible in most of the cases. Thus, based on the data presented, it can be concluded that permethrin accelerates glandular degeneration, preventing the females to finish the feeding process, which reflects on the reproductive process, especially by reducing the egg-lay. This research was financially supported by FAPESP (Grants 2009/13859-4 / 07/59020-0)/ CNPQ.

Wednesday 25, Afternoon, Auditorium - Poster

332 - Oviposition rate as a tool for evaluating species of *Manihot* for resistance to cassava green mite (CGM), *Mononychellus tanajoa* (Acari: Tetranychidae)

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This paper reports results on development and oviposition rate of the cassava green mite (CGM), *Mononychellus tanajoa*, on wild *Manihot* genotypes and cultivars of *Manihot esculenta*, to identify genes for resistance to CGM in wild species of cassava as part of the project "Potential of utilization of cassava wild relatives as source of resistance to biotic and abiotic stresses". The following accessions: *Manihot peruviana* (PER-011V, PER-001V-02, PER-002V, PER-015V, PER-009V-06, PER-002-09, PER 005-01), *M. anomala* (ANO 059V-01, ANO 058V-01, ANO-050V-01, ANO-002-01), *M. flabellifolia* (FLA-030V, FLA 027V, FLA-005-06, FLA 005-09), *M. caerulescens* (CAE-BM-20, CAE-BM-021), *M. irwinii* (IRW-A027-07), *M. dichotoma* (DIC-602-06, DIC-001p08, DIC-587-03, DIC-602-01), *M. esculenta* (BGM 116, BGM 384), *M. glaziovii* (MAN-093V) and *Manihot* spp. (UFBA-096V). The study was carried out in a laboratory at Embrapa Mandioca e Frutos Tropicais, at 25±1 ^{o}C, 70±10%RH and 12: 12 h L:D. Development of immatures was evaluated daily on 24 accessions, while oviposition rate was evaluated for ten days on 26 accessions. The experimental design was completely randomized with 50 replicates per genotype. Data were subjected to analysis of variance and grouped using Scott-Knott test. Overall duration of the immature phase (egg to adult) of *M. tanajoa* was 11.4 ± 2.9 days, ranging from 10.0 to 14.0 days. Based on this parameter, the accessions were divided in four groups; accessions ANO-059V-01, CAE-BM-20, PER-011V and IRW-A027-07 had highest duration of the immature stage (13.1 to 14.0 days). Overall oviposition rate was 1.8 ± 1.3 eggs per female per day, ranging from 0.7 to 3.3 eggs per female per day. Based on this parameter, accessions were divided in five groups; accessions ANO-050V-01, ANO-058V-01, ANO-059V-01, PER-001V-02 and PER-015V had the lowest oviposition rates. The results suggest: a) the existence of sources of resistance at highest levels in wild genotypes; b) that oviposition rate can be used as a faster tool to select genotypes for breeding programs for resistance to CGM.

Thursday 26, Afternoon, Auditorium - Poster

333 - Relationship between GSK3β and PEPCK in bovine tick *Rhipicephalus* (*Boophilus*) *microplus*

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Phosphoenolpyruvate carboxykinase (PEPCK) is considered a key rate controlling enzyme in the gluconeogenesis pathway. Normally, insulin rapidly and substantially inhibits PEPCK gene transcription. The primary means of modulating PEPCK activity, which is proportional to the rate at which its gene is transcribed, is through hormonal control of PEPCK gene transcription. Some authors suggest a correlation between PEPCK and Glycogen Sinthase Kinase (GSK3β). GSK3β is an

enzyme that plays important roles in protein synthesis, cell proliferation, cell differentiation, and cell motility by phosphorylating initiation factors, transcription factors and glycogen synthesis. The inactivation of GSK3β leads to activation PEPCK through CREM/CREB (cyclic AMP response element). The transcriptional regulation of PEPCK gene has been extensively studied, but there are a few studies that elucidated the involvement with the GSK3β. In our studies we have evaluated the relationship between PEPCK and GSK3β in the embryonic cells and in partially and fully engorged *R. microplus* ticks. In previous results we showed the increase transcription PEPCK through iRNA to GSK3β. Now we are investigating the involvement of CREM in the PEPCK gene transcription in these cells. In this sense, we obtained CREM sequence from TIGR ESTs *R. microplus* bank and designed the specific primers to qPCR. Taken together our results suggest the involvement of GSK3 regulatory system in PEPCK gene transcription control in embryonic tick cells. This research was financially supported by CNPq, CAPES-PROCAD, INCT - Entomologia Molecular and FAPERJ.

Wednesday 25, Afternoon, Auditorium - Poster

334 - Symbiont investigation in mites of subterranean habitats

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Symbionts of arthropods are recognized for the crucial role in the ecology and evolution of their hosts. The *Cardinium* bacterium, a member of the phylum Bacteroidetes, has been implicated in a growing number of reproductive manipulations and other effects, and is estimated to infect at least 5-10% of all arthropods. In mites, this symbiont is able to induce cytoplasmic incompatibility, parthenogenesis and feminization, and enhanced fecundity. Subterranean organisms are performed as important group in peculiar fauna explored by speleobiologists, although little is known regarding their microbial diversity. In this study, we investigated the presence of symbionts in mite samples belonging of eleven families, collected in eleven Brazilian localities of different subterranean habitats. The presence of the symbiont was confirmed by PCR amplification and sequencing of 16S rDNA gene region. Four families of mites (Cheyletidae, Acaridae, Tarsonemidae, and Ascidae) were positive for the *Cardinium* symbiont, with 97 and 99% of sequence similarity. In three superfamilies (Uropodoidea, Eviphidoidea: Macrochelidae, Parasitoidea: Parasitidae) it was observed 16S rDNA fragment amplification for uncultured bacteria sequences, suggesting the presence of other symbionts. Here, we reported the first molecular survey of symbiont in mites of subterranean habitats, and provide new insights into the bacterial population of these atypical environments. This research was financially supported by FAPESP, CECAV/ ICMBio, CAPES, Conservação Internacional do Brasil, and CNPq (Proc. n° 477712/2006-1).

Thursday 26, Morning, Room 4

335 - Prevalence of the *Cardinium* symbiont and genetic variability of *Brevipalpus phoenicis* (Acari: Tenuipalpidae) populations from Brazil

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The presence of *Cardinium* symbiont has been reported and is associated with feminization in *Brevipalpus* mites and alterations of the reproduction of several other arthropod hosts. We report the prevalence of this endosymbiont and genetic variability of *B. phoenicis* populations from different plant hosts and geographic regions of Brazil. The presence of bacteria was confirmed by PCR amplification and transmission electron microscopy, and their variability was evaluated by analysis of the 16S rDNA and gyrB gene region. For *B. phoenicis* variability, we evaluated mitochondrial COI sequences. High similarity was observed between *Cardinium* from different mite populations, and interestingly, although the symbiont has been associated with the haploid

thelytoky, two mite populations were naturally aposymbiotic. COI sequences of *B. phoenicis* showed low intraspecific diversity between populations, however the largest distance was among symbiotic and aposymbiotic populations. In general, no correlation was observed between symbiont and mites of different host plants and geographical origins. This research was financially supported by FAPESP and CNPq.

Tuesday 24, Afternoon, Auditorium - Poster

336 - Ticks (Acari: Ixodida) on birds migrating over the Polish territory

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Geographical movements of ticks on a migratory host, known as natural transfer, occur in nature and are independent of human activity. The springtime returns to the nesting sites and the birds' autumnal migrations between the continents in search of food, living space, or changing environmental conditions create an opportunity for a variety of tick species to move short or long distances. Ticks frequently travel thousands of kilometres on their hosts, and extend the borders of their distribution area, which can be highly important epidemiologically. This research attempts to find out whether bird migrations across Poland are accompanied by transfer of ticks from distant tick populations. A total of 3950 bird specimens representing 56 species from the following families were examined: Accipitridae, Alcedinidae, Picidae, Alaudidae, Motacillidae, Troglodytidae, Prunellidae, Turdidae, Muscicapidae, Sylviidae, Regulidae, Remizidae, Paridae, Certhiidae, Laniidae, Sturnidae, Corvidae, Fringillidae and Emberizidae. Tick parasitisation was confirmed on 35 bird species. Overall tick prevalence was 14.3%, ranging from 11.1% in the spring to 19.8%in the autumn. The following species of ticks were confirmed to be migrating on travelling birds: *Ixodes* (*Pholeoixodes*) sp., *arboricola* Schulze & Schlottke, 1929, *Ixodes frontalis* (Panzer, 1798), *Ixodes eldaricus* Djaparidze, 1950, *Ixodes ricinus* (Linnaeus, 1758) and *Hyalomma marginatum* Koch, 1844. The probability of transfer of exotic ticks to Poland (Central Europe) by migrating birds is high, and the phenomenon may also be extremely important epidemiologically and epizootiologically. Ticks are reservoirs and vectors for numerous pathogens; in each case of transfer there is a risk of introducing these pathogens to native ticks, animals and people.

Thursday 26, Afternoon, Auditorium - Poster

337 - Compatibility of five different strategies for the control of *Tetranychus urticae* Koch (Acari: Tetranychidae) under experimental conditions

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Tetranychus urticae is one of the most important pests in rose crops, which is mainly controlled with chemicals. However, predatory mites, plant extracts and entomopathogenic fungi have also been used for its control. To ensure compatibility of these strategies the effect of entomopathogenic fungi (*Beauveria bassiana* and *Paecilomyces fumosoroseus*) and a chili - garlic extract on *Phytoseiulus persimilis* and *Neoseiulus californicus* females, which are predators of *T. urticae*, was evaluated. Under laboratory conditions, 20 treatments were evaluated per predator, three concentrations of the fungi (7,5 $x10^6$, 1,0 $x10^7$, 1.25 $x10^7$ conidia / ml), three concentrations of the extract (1.5, 2.0 and 2.5ml /L), combinations of these and two controls. Predators were sprayed directly and daily mortality and fertility recorded for 12 days. There was no difference on mortality between treatments ($p > 0.05$) for either predator, but there was a sublethal effect on fertility of *N. californicus* with the treatments, compared to the control. In an experimental crop of roses, 11 treatments were evaluated, in which we determined the effect of releasing the predators separately and together, and the order of application of the products tested in the laboratory to commercial concentration on *N. californicus*. The population size of *T. urticae* was recorded every 3 days, during 14 days. It was found that the most effective treatment for the phytophagous control was the release of *P. persimilis* by itself. It was also determined that a candidate strategy for an IPM for *T. urticae* can be the release of *N. californicus* followed by spraying of *P. fumosoroseus* and *B.*

bassiana in the commercial stratum of the plant. It is recommended to conduct this work in rose commercial crops.

Wednesday 25, Afternoon, Auditorium - Poster

338 - Windbreaks and hedgerows as hosts for citrus leprosies virus C

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Citrus leprosis, caused by citrus leprosis virus C (CiLV-C), is transmitted by the false spider mite *Brevipalpus phoenicis* (Acari: Tenuipalpidae). Leprosis is considered the main viral disease in sweet orange (*Citrus sinensis* L. Osbeck) groves in Brazil, where approximately US$ 80 million are spent yearly for the chemical control of its vector. The disease is present in several countries of South and Central America, and has reached Mexico. The virus does not invade its hosts systemically, thus the sources of inoculum are of utmost importance for the groves infection. At the moment, there are more than four hundred plant species known to be hosts of *B. phoenicis*, a polifagous and cosmopolitan mite. Besides *Citrus* spp., CiLV-C can infect other rutaceous and non rutaceous plants. Some of them are used as windbreaks or hedgerows in orchards and could play a role in the epidemiology of the disease. For this reason, the objective of this work was to evaluate the incidence and severity of citrus leprosis in orange plants cultivated near three different windbreak plant species infested with CiLV-C viruliferous mites. The experimental design was randomized blocks with 8 treatments and 4 replicates, totaling 32 plots. Each plot consisted of 12 plants spaced 1 meter apart, distributed in 4 rows and 3 columns. The plants in the central column were infested by viruliferous mites and the lateral plants were evaluated for the presence of mites (dispersal) and symptoms (viral transmission). The treatments were as follows: *M. arboreus*, *M. caesalpinaefolia* or *G. robusta* in the central position, with orange plants in the lateral positions; orange plants in the central position and *M. arboreus*, *G. robusta* or *M. caesalpinaefolia* in lateral positions; orange plants both in the central and lateral positions; and uninfested control, with orange plants in three positions, but without mite infestation. The latter treatment was planned to assess mite dispersal between plots and from outside the experimental field. Every plant received a total of 150 mites in two infestations (July and December). Neither mites nor leprosis symptoms were found in the plots that were not artificially infested, suggesting low mite dispersion between plots. The highest number of mites, incidence and severity of citrus leprosis was found in orange plants near the infested orange plants, following those near *M. arboreus* and *M. caesalpinaefolia*. Very low number of mites and disease incidence were found in orange plants near *G. robusta*. These results indicate that viruliferous mites can migrate from *M. arboreus* to citrus plants; therefore, the use of this hedgerow is not recommended in citrus orchards. The symptoms of leprosis were not conclusive in the alternative host plants; for that reason, another experiment is being conducted to verify leprosis symptoms in these plants.

Tuesday 24, Afternoon, Auditorium - Poster

339 - Salivary glands of female *Amblyomma cajennense* Fabricius, 1787 (Acari: Ixodidae) ticks fed on resistant rabbits

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Ticks have great economic and health importance since infested animals have reduced milk and meat production, and, besides that, they are expensive ectoparasites to control. While feeding, ticks can transmit to their hosts a large number of pathogens, including *Rickettsia rickettsii*, responsible for the "spotted fever" or "fever of the mountains." It is known that animals infested with ticks or artificially immunized with their salivary gland extracts develop resistance, which is related to a decrease in engorged female weight, in egg-laying by adults, in egg viability and, in some cases, in the capacity of pathogens transmission. The present study aimed to

examine morpho-histochemically the female salivary glands of semi and engorged *Amblyomma cajennense* fed on resistant rabbits. The results revealed that acinus I had no changes when compared to that of females fed on naive rabbits. The c cells of acinus II showed signs of early degeneration, which may result in feeding efficiency decrease. In acinus III d cells, activity time was longer. Such occurrence was associated with the time of female fixation, which increased in females fed on resistant hosts.

Wednesday 25, Afternoon, Auditorium – Poster

340 - Seasonality of two species of phytophagous mite (Acari: Eriophyidae, Tenuipalpidae) associated with three clones of rubber tree (*Hevea brasiliensis* Muel Arg., Euphorbiaceae) in the State of Bahia, Brazil

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Bahia State is the third larger latex producer in Brazil. *Calacarus heveae* Feres, 1992 and *Tenuipalpus heveae* Baker, 1945 (Tenuipalpidae) are the main mite species damaging rubber tree in the southeastern and mid-western regions of Brazil. Nothing has been reported on those mites in Bahia. Knowledge about seasonality of pest mites can give valuable data for the establishment of integrated management programs. The aim of this work was to determine the seasonality of those mites on clones MDF180 and FX3864 in a rubber tree crop of "Plantações Michelin da Bahia" in Igrapiúna, Bahia. Samplings were carried out monthly from May 2008 to April 2009, in two areas planted to the former and three planted to the latter clone. From each area, seven leaves from each of fifteen trees were sampled at each sampling date. All mites found were recorded and mounted on microscopy slides in Hoyer´s medium, except *Calacarus heveae*, just counted on the leaflets. Data were analysed by ANOVA to compare abundance of *C. heveae* and *T. heveae* between areas and clones. Multiple regression analysis was used to verify the possible influence of climatic parameters on mite populations. For both mite species, infestation level was significantly higher on plants of clone FX3864 ($F=14.453$; $p<0.001$). Critical period of mite infestation was observed to be in the first semester. *Calacarus heveae* population increased exponentially from January to April 2009, reaching almost density of 800 mites/ leaflet on clone FX3864, and less than 70 mites/ leaflet on clone MDF180. On the other hand, the population level of *Tenuipalpus heveae* reached a maximum of just nine mites/ leaflet. Peak infestation occurred after the rainiest month, with high temperature and relative humidity. A strong positive correlation was observed between the abundance of these phytophagous mites, rainfall and duration of sun line period ($R^2=0.942$; $p<0.001$).

Wednesday 25, Afternoon, Auditorium - Poster

341 - The influence of the Atlantic Rainforest in the distribution of phytophagous and predatory mites associated with rubber tree (*Hevea brasiliensis* Muel Arg., Euphorbiaceae) in the State of Bahia, Brazil

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Some phytophagous mites are among the most important pests of rubber tree in Brazil, injuring leaves and reducing latex production. *Calacarus heveae* Feres, 1992 and *Tenuipalpus heveae* Baker, 1945 are reported as the main mite pests of this crop. Their control is done just with the use of chemicals. Previous works have reported that vegetation neighboring rubber tree plantations influences the composition of the mite fauna and its distribution in rubber tree crops. The aim of this study was to verify whether fragments of Atlantic rainforest influence the abundance of the mite fauna on rubber trees. This study was developed in "Plantações Michelin da Bahia", in Igrapiúna, Bahia, on two rubber tree clones. Samplings were carried out monthly from May 2008 to April 2009, in two rubber tree plantations surrounded by native vegetation, two plantations with a traditional rubber tree system, and one plantation with native

vegetation bordering the crop. Each sample consisted of seven leaves taken from each of fifteen trees in each area. The total number of mites found on both leaf surfaces was registered. Data were analyzed by ANOVA to compare abundance of *C. heveae, T. heveae* and predators between plantations and between clones. The results suggest that rubber tree areas surrounded and bordered by native vegetation had lower population density of phytophagous mites (F=7.626; p=0.001); however, no differences were observed between plantations for predator population (F=2.241; p=0.113); phytophagous mites were less abundant on clone MDF 180 than on clone FX 3864 (F=60.462; P= 0.001). *Calacarus heveae* was the most abundant specie in all studied areas, followed by *T. heveae* and species of the genus *Lorryia* (Cooreman, 1958). Phytoseiidae was the most common family of predatory mites in all plantations, but the species found differed between plantations. *Leonseius regularis* (De Leon, 1965) was the most common phytoseiid on rubber trees close to native vegetation, whereas *Euseius alatus* De Leon was the most common in traditional rubber tree system. Other two most common species also positively influenced by the native vegetation, *Cunaxatricha tarsospinosa* (Castro & Den Heyer, 2008) (Cunaxidae) and *Agistemus* sp. (Stigmaeidae), were three times more abundant in the areas close to native vegetation than in areas far from the forests.

Thursday 26, Afternoon, Room 4

342 - *Raoiella*: more than meets the eye

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The chaetotaxy of the palpi, coxae and tibiae of the legs, the length and type of dorsal setae, as well as idiosomal cuticular patterns have been used diagnostically for the genus *Raoiella*. These characters were interpreted from slide mounted specimens using light/ phase contrast microscopy. However, the body shape, cuticular patterns, variation in chaetotaxy of the palpi and characteristics of the dorsal setae are often unclear or difficult to see. The use of confocal laser scanning microscopy (CLSM) and low temperature scanning electron microscopy (LT-SEM) has led to the discovery of novel characters useful at the species level, and has also enabled the re-interpretation of some previously mentioned characters. For example, the round body reported in some species is an artefact of the slide mounting process, the position and number of setae on the dorsum of the immature stages and adults has been misinterpreted, and the presence of a dorsal plate has been overlooked through the use of conventional light microscopy. The CLSM has helped identify the presence of plates and the LT-SEM has allowed us to see minute details of the stylet tip, segmentation of the palpi, solenidia, cuticular sculpturing, shape and length of dorsal setae, tubercles, and the nature of the empodial complex. In addition, it has enhanced our understanding of the feeding behaviour and host plant associations within the genus.

Monday 23, Afternoon, Room 6

343 - Phylogenetic relationships of the Sarcoptoidea (Acari: Astigmata) parasitic on mammals: evidence for polyphyly of the group

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The superfamily Sarcoptoidea comprises 12 families of astigmatid mites that are permanent parasites of mammals. We used approximately 5.1kb of sequence data from 3 genes (28S, 18S rDNA and EF-1a) to test the monophyly of the Sarcoptoidea and that of the Psoroptidia, a group of astigmatid mites that includes most of the permanent parasites of vertebrates and the house

dust mites and relatives. Sixty seven taxa representing 8 of the 12 sarcoptoid families, 14 families of bird-associated Psoroptidia: Analgoidea and Pterolichoidea were sequenced as well as 131 taxa representing 16 non-psoroptidid astigmatid families and one oribatid outgroup. Reconstructions of the phylogeny using maximum parsimony and Bayesian analyses confirm the monophyly of the Psoroptidia, but the Sarcoptoidea appear polyphyletic. Both analyses suggest the families Psoroptidae and Sarcoptoidea are more closely related to lineages restricted to birds than to other mammal parasites. The remaining families of fur mites and nasal endoparasites of mammals may form a monophyletic group. These results suggest multiple colonization events from bird hosts to mammal hosts during the evolution of the Psoroptidia.

Monday 23, Afternoon, Room 4

344 - Ecology of ticks infesting wild birds in Brazil

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Wild birds are important to public health because they carry various zoonotic pathogens, either as a reservoir hosts or by dispersing infected arthropod vectors such as ticks. Approximately 1,670 bird species are reported occurring in Brazil, nevertheless, despite such high diversity, the ixodid tick fauna parasitizing birds is poorly studied and there is scarce information about the role of this host-parasite relationship in the maintenance and spread of pathogen agents in nature. In Brazil wild birds were found to be important hosts of *Ixodes auritulus, Ixodes paranaensis, Amblyomma longirostre, Amblyomma aureolatum, Amblyomma calcaratum, Amblyomma nodosum, Amblyomma humerale, Amblyomma geayi*, and *Amblyomma parkeri*. However, *Ixodes fuscipes, Amblyomma cajennense, Amblyomma tigrinum, Amblyomma pseudoconcolor, Amblyomma brasiliense, Amblyomma ovale, Amblyomma coelebs, Amblyomma naponense, Haemaphysalis juxtakochi*, and *Rhipicephalus sanguineus* were also occasionally found on birds. The prevalence of ticks on birds and the composition of tick species infesting birds varies between different geographical regions. These differences depend on the type of vegetation and the ecology and behavior of the hosts. Birds that inhabit different strata in the forest have different levels of ticks infestations; arboreal passerine birds seem to be the most important hosts of *A. longirostre, A. geayi* and *A. parkeri*, whereas ground-feeding passerine birds seem to be the most important for *A. calcaratum, A. nodosum, A. humerale* and *A. aureolatum*. In the preserved humid Atlantic Forest in the states of São Paulo and Bahia, and in the Amazon Rainforest in northern Brazil (state of Pará), the most common tick species found on birds is *A. longirostre*. In dried regions of the Atlantic Forest (the Seasonal Semideciduous Atlantic Forest of the interior of the state of the São Paulo), the predominant species is *A. nodosum* where in forest remnants smaller than 100 ha increases significantly its prevalence and abundance on birds. In the State of Paraná, southern Brazil, cave birds were shown to be important host of all life stages of *Ixodes paranaensis*, and synantropic birds from city parks were shown to be hosts of *Ixodes auritulus*. Among pathogens infecting ticks found on birds 15.4, 56.7 and 100% immature forms of *A. longirostre* from the state of Bahia, Pará and São Paulo respectively, and 57.1% of *A. geayi* from Pará were found infected by *Rickettsia amblyommii*, bacterium with unknown pathogenicity. In the interior of the state of São Paulo, 23.6% and 5.7% nymphs of *A. nodosum* were found to be infected by the pathogenic bacterium *R. parkeri* and the non-pathogenic *R. bellii*, respectively. Altogether, wild birds play an important role in life-histories of various Brazilian tick species. The role of birds in maintaining *Rickettsia* in nature is not clear. However, the infection of various ticks found on birds suggests that further researches must be conducted regarding the potential of these rickettsiae as a source for emerging diseases.

Wednesday 25, Afternoon, Auditorium - Poster

345 - Rickettsial infection in ticks *Amblyomma parvitarsum* Neumann, 1901 from Argentina

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Bacteria of the genus *Rickettsia* are obligate intracellular parasites that are widely distributed around the world, being maintained in nature by arthropod populations, which are frequently their vectors to humans. They can cause serious diseases. In Argentina, human infection by Spotted Fever Group rickettsia was first proved through serological assay in the 1990s. Thereafter, several *Rickettsia* species have been found infecting *Amblyomma* ticks, and to cause human diseases of moderate to high importance. The present study reports for the first time the presence of a *Rickettsia* in *Amblyomma parvitarsum*, based on 45 adult specimens (32 females, 13 males) collected in March 2009 at San Guillermo, San Juan Province, Argentina. Ticks were individually submitted to DNA extraction and tested by PCR, targeting three rickettsial genes: *gltA*, *ompA*, and *ompB*. Twenty-nine (21 females, 8 males) ticks (64.4%) were found infected by rickettsia, based on positive results by the three PCR assays. BLAST analyses showed that the nucleotide sequences obtained from the PCR products were closest to *Rickettsia* sp. strain Atlantic rainforest, a novel rickettsial strain pathogenic for humans in Brazil; they, shared 99.8%, 99.6% and 99.1% similarities with the partial sequences of the *gltA*, *ompA* and *ompB* genes, respectively. This rickettsial strain obtained from *A. parvitarsum* was designated as *Rickettsia* sp. strain P. Phylogenetic analyses inferred from the three rickettsial genes showed that strain P grouped in a monophyletic group with *Rickettsia* sp. Atlantic rainforest, *Rickettsia africae* strain S, *Rickettsia sibirica mongolotimone*, *Rickettsia sibirica sibirica*, and the strains of *Rickettsia parkeri*, namely Maculatum, Cooperi, and NOD. The pathogenicity of strain P to animals or humans is unknown. However, in recent years an increasing number of new tick-borne *Rickettsia* species or strains have been observed in that region. These were initially considered non pathogenic to humans, but recent works have suggested the opposite. Since strain P is phylogenetically closely related to pathogenic *Rickettsia* species (*R. parkeri*, *R. africae*, *R. sibirica*), it is a novel potentially pathogenic rickettsial strain in Argentina.

Tuesday 24, Morning, Room 1

346 - How does a parasitic mite behave as a bodyguard of its host?

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Some bees and wasps that host mites have peculiar pocket-like structures called acarinaria, external invaginations to facilitate mite transportation. These have long been considered as morphological adaptations to securely transfer beneficial mites into nests although there was no evidence to support this hypothesis. We demonstrated that the parasitic mite *Ensliniella parasitica*, which uses acarinaria, increases the reproductive success of its host wasp *Allodynerus delphinalis* by protecting it from parasitoid wasps. In an arena simulating a wasp cell, every time the parasitoid *Melittobia acasta* accessed a prepupa, adult mites attacked it, continuously clinging to it and possibly piercing the intersegmental membrane of the parasitoid with their chelicerae. Subsequent mortality of the parasitoid depended on the number of attacking mites: an average of six mites led to a 70% chance of mortality, and ten mites led to 100% mortality. Because frequency of mite attack increased with mite numbers in a cell, we suggest that the attack is carried on stimulated by a physical contact between them by accident. Both females and males seemed attack the parasitoid similarly. In this way, parent mites protect the food source (juvenile wasps) for themselves and ultimately for their offspring. We propose that wasps evolved acarinaria to maintain this protective guarding behavior.

Thursday 26, Afternoon, Auditorium - Poster

347 - An unintentionally introduced mite associated with a bamboo nesting carpenter bee through international trade

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The recent rapid increase in international trade has brought us not only lots of benefit but undesirable by-products such as invasive alien species. These days under the quarantine systems, most pest organisms have been blocked but many, particularly those whose biological and ecological characteristics are unknown could freely move through the barrier. In 2006, adults and nests of an exotic bamboo nesting carpenter bee, *Xylocopa tranquebarorum*, were collected for the first time in the central Japan. Like most other carpenter bees, it was associated with a species-specific mite, which was morphologically similar to *Sennertia alfkeni* associated with the native *X. appendiculata circumvolans*. Thus, we investigate the *X. tranquebarorum* mite from the invasive species aspect. While in the continental Asian region *X. tranquebarorum* is associated with *S. horrida*, in Taiwan the bee is associated with another mite, *S. potanini*. The mite found on the exotic *X. tranquebarrorum* was separated from the Japanese mite *S. alfkeni*. Based on these results, together with the recent shift of bamboo exporting countries to Japan from Taiwan to mainland China, we concluded that the mite was originally associated with *X. tranquebarorum* and introduced with the bee from Asia except Taiwan. Both deutonymphs and feeding stages of the exotic mite were morphologically very similar to those of *S. alfkani*, though more derived. Life history traits of the mite were similar to those of *S. alfkeni*. For instance, without the associated bee the mite was not able to complete its life cycle after the deutonymph. Therefore, we suggest that the mite could not be a house dust mite, but that genetic contamination with the Japanese mite and/or host switch from *X. tranquebarorum* to *X. appendiculata circumvolans* within Japan is highly suspected.

Monday 23, Afternoon, Room 1

348 - Molecular diagnostic within a Phytoseiidae species, *Typhlodromus* (*Typhlodromus*) *exhilaratus* Ragusa (Acari: Mesostigmata), at different life stages

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Several species of Phytoseiidae are well known for their ability to control mite pests in many crops in the world. However, biological control success greatly depends on the accurate identification of the predatory mites involved. Yet, species diagnostic in the family Phytoseiidae is difficult and sometimes ambiguous. Up to now, species diagnostic is essentially based on the morphological characters of females. Thus, when samples only contain immature stages and males, accurate morphological diagnostic is poorly supported. Molecular tools could be of great help for species identification whatever the stage concerned, as is argued by barcoding defensers. In this study, the reliability of the molecular diagnostic at precoce and male stages was studied using two mitochondrial DNA fragments (12srRNA and mtCYTB) for the phytoseiid *Typhlodromus* (*Typhlodromus*) *exhilaratus*, known to control mite pests in grapevines in southern Europe. The first key point was to extract sufficient DNA quantity from a single specimen, whatever the life stage considered: egg, larva, protonymph, deutonymph and adults (males and females). Despite a lower PCR quality for egg specimens, DNA has been amplified for both DNA fragments studied, for all the life stages considered. Furthermore, DNA sequences obtained were similar for all the stages tested. The conclusion of this study would thus be that the use of these molecular markers could facilitate species diagnostic, but the conditions to succeed is to have a sufficient DNA species library to assign the DNA sequence obtained to the correct species.

Tuesday 24, Afternoon, Auditorium - Poster

349 - Molecular and morphological variation within the species *Neoseiulus californicus* McGregor (Acari: Phytoseiidae): consequences for diagnostic and biological control

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Neoseiulus californicus (McGregor) is an important biological control agent used worldwide to control pest mites in many crops. The accurate diagnostic of this species is thus required to ensure a successful biological control. The aim of this study was to determine how molecular markers could provide an accurate and easy diagnostic tool of this species. Morphological and molecular (12S rRNA ,Cytb mtDNA and ITS) analyses were carried out on seven populations collected from all over the world and on some species. Significant differences between the seven populations were observed for almost all the morphological characters considered (33 characters among 42). However these differences were very small and the standard errors within each population very low, except for a few characters. The genetic distances between the specimens of *N. californicus* and other species belonging to the same genus were high and no overlap was observed, sustaining the reliability of such an approach to help in species diagnostic. Furthermore, genetic distance within populations was very low and overlap between intra and inter populations distances was observed, except for two populations collected in France (Marsillargues and Midi-Pyrénées). Genetic distances between these two latter populations and the other ones were actually high and no overlap between intra and inter populational distances were observed. These results raise questions on the status of these two populations, as no morphological differences with the other populations were observed. Are they two cryptic species or two populations of the same species? Discussion on the taxonomic status of the species *N. californicus*, taking into account all the redescription of this species, is developed. However, to clearly conclude, cross breedings would be required.

Tuesday 24, Morning, Room 1

350 - Do quiescent deutonymph females guarded by a male attract additional males in spider mites?

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In some taxa, females choose their mates indirectly by using male combat. In the Kanzawa spider mite, *Tetranychus kanzawai* (Acari: Tetranychidae), adult males guard quiescent deutonymph females, which is considered as a male mating strategy. Although it has already been mentioned in the literature that quiescent female *Tetranychus urticae* already attended by a male commonly attract additional males, there is no data to prove it. In a dual choice experiment, more *T. kanzawai* males first approached females already guarded by a conspecific male than approached solitary females. Thus, I examined which factors attracted males during precopulatory mate guarding. Males were not attracted to males not in a mate-guarding position. In contrast, the presence of a non-breeding individual, a deutonymph male or female, in a mate-guarding position did attract conspecific males. These results suggest that the presence of any conspecific individual in a mate-guarding position stimulates quiescent deutonymph females to attract males. Guarded quiescent deutonymph females also attracted the attention of the predatory mite, *Neoseiulus womersleyi* (Acari: Phytoseiidae), but solitary females did not. This implied that guarded females would be probably in more danger than solitary females. However, *T. kanzawai* males were not attracted to guarded quiescent deutonymph females that had been previously exposed to *N. womersleyi*. Thus, *T. kanzawai* quiescent deutonymph females appeared to attract males in response to their environment. When more than one male attempts to guard one female, male combat often occurs. Consequently, a male that won the combat gets to guard the female. Therefore, I hypothesized that *T. kanzawai* females choose their mates indirectly by using male combat during precopulatory mate guarding.

Thursday 26, Afternoon, Auditorium - Poster

351 - Production of recombinant Vitellin-Degrading Cysteine Endopeptidase: a candidate antigen for an anti-tick vaccine

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus*

is an ectoparasite of economic importance for cattle production due to injuries caused to host skin, blood spoliation, and indirectly as a vector of *Babesia bovis*, *Babesia bigemina* and *Anaplasma marginale*. Understanding tick physiology is an important step towards its control. The enzyme studied in this work, Vitellin-Degrading Cysteine Endopeptidase (VTDCE), is a peptidase active during embryogenesis, being the major enzyme responsible for vitellin degradation in *R. microplus* eggs. Previously, it was shown that the native protein induces a partial protective immune response. However, due to the difficulties to obtain the native form, the production of a recombinant protein (rVTDCE) is an alternative to conduct further studies. The present work aims to improve the expression and purification of the recombinant protein and to verify the immunogenicity of rVTDCE in rabbit and cattle. For the production of rVTDCE *Escherichia coli* BL21 (DE3) STAR was transformed with plasmid pET-32a containing the VTDCE ORF. Bacteria were induced with IPTG for protein expression and subjected to sonication and centrifugation to separate it in soluble and insoluble fraction. rVTDCE was purified by affinity Ni^{2+}-Sepharose chromatography from soluble fraction. In order to solubilize the inclusion bodies, two denaturant agents (guanidine hydrochloride and urea) were tested. We verify that the rVTDCE solubilization with guanidine hydrochloride was more efficient and conserved the antigenic properties necessary for vaccination tests. The rVTDCE was used for rabbit and cattle immunization showing that the recombinant protein is immunogenic for both species. These polyclonal sera were used in western blot and confirmed the cross-reactivity between rVTDCE and native protein. These features are very important to produce an anti-tick vaccine for cattle. To solve the relationship between protein function and protein structure the characterization of the amino acids involved in catalytic site of the enzyme is essential. With this objective, the labeling of this enzyme with an irreversible inhibitor and the analysis of tryptic peptides by mass spectrometry in LC-MS/MS system is under progress. This research was financially supported by CNPq, CAPES, CAPES-PROCAD, FAPERGS, FAPERJ and INCT-EM.

Wednesday 25, Afternoon, Auditorium - Poster

352 - Biology of *Amblyomma parvum* Aragão, 1908 (Acari: Ixodidae) using different hosts in laboratory conditions

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Ticks are obligatory hematophagous ectoparasites and are thus infectious disease vectors for both humans and animals. To understand the epidemiology of tick-borne infectious diseases it is essential to know the life cycle of ticks. *Amblyomma parvum* is a Neotropical tick and its life cycle is poorly understood. In this work the biology of *A. parvum* is described when fed on several potential and domestic hosts (chicken, dog, rabbit, horse, guinea pig, cattle and goat). The complete life cycle of the tick varied from 97 to 102 days. Highest engorgement weight of larvae was obtained of ticks fed on horses and nymphs on guinea pigs. Highest larval yield were obtained from guinea pigs and that of nymphs from horses. Mean molting rate varied from 58.4% in goats to 100% in dogs. Engorged female and egg mass weights, yield and conversion of female weight to eggs rates were superior in dog ticks and lowest in goat ticks. The highest egg hatching rate was seen in ticks from dogs (100%) and the lowest in ticks from cattle (48.3%). Overall it was seen that dogs were the best host for adult *A. parvum* ticks, and guinea pigs for immatures. Horses were also shown to be a good host for all tick stages. It can thus be affirmed that *A. parvum* is a host generalist tick, and its distribution is probably much more restricted by environmental requirements than by hosts.

Friday 27, Morning, Room 3

353 - Stakeholders analysis of coconut production and perception on coconut mite-damage and other coconut constraints in Tanzania

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This report presents the findings from baseline survey carried out in five coconut growing districts of Tanzania in 2009. Secondary data show that land under coconuts cultivation in 2008/9 was estimated at 310,000 ha in Tanzania making it the largest producer of coconut in sub-Saharan Africa. This assessed stakeholder perceptions of the performance of coconut value chain including losses due to coconut mite and other constraints, opportunities for production and marketing improvement in Tanzania. A wide range of information on coconut production, farming system, processing and marketing was collected. Purposive and random sampling techniques were used to select 200 coconut farmers while 40 traders were randomly selected for the study. On average a household owned 2.6 ha of coconut farm usually mixed with other crops. The study also revealed that on average farming household owned about 400 palms with average productivity of 56 nuts per palm per year. The use of pesticides for controlling insects and mites in coconut production was not common among farmers. However, weeds as other pests in some of the coconut fields were controlled through intercropping coconuts tree with other crops, ring weeding, slashing and mulching. National aggregate coconut production grew minimally at 0.03% per year from 20 metric tons in 2002 to 21 metric tons in 2009. However, further analysis showed that coconut production at the household level had declined by about 52% since 2007 largely due to attack by coconut mite, lethal yellowing and drought while in many coconuts producing areas of Tanzania, a significant proportion of the trees stopped producing nuts (senile). The contribution of coconut stands at about 56% of the total cash income in the household equal to 300U$D per year. While actual income from coconut declined, its share in the total income increased as follows; 50% in 2007, 55% in 2008 and 66% in 2009.This increase was due to decline in production of other crops caused by drought. Expansion of both domestic and regional markets for coconut products such copra, oil, coir and timber presents better opportunities for investment in the coconut sub-sector. Value addition activities including processing and marketing coconut products are uncoordinated and informal. Government involvement in the coconut value chain is very limited. Coconut as the "orphan child" has resounding evidence in the lack of sustained roadmap for industry growth. While other cash crops receive policy attention through regulatory bodies to oversee their developments, coconut in Tanzania is a neglected crop despite its large contribution to the farmers' livelihood. Along with research efforts to minimize production constraints such as lack of high yielding coconut varieties, diseases and pests, it is also important to establish coconut board to promote the development of the sub-sector.

Thursday 26, Morning, Room 3

354 - Oribatid mites (Acari: Oribatida) in cocoa plantations of the State of Bahia, northeast Brazil

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The shaded cocoa plantations in southern Bahia, Brazil, provide a forest-like structure with high humidity, microclimatic stability and thick layer of litter that affects arthropod diversity positively. Although many species of oribatid mites are exclusively arboreal, they are among the more abundant and diverse arthropods in the upper layer of soil and litter, being important components of food chains involved in the process of recycling organic matter. Approximately 10,000 Oribatida species are known worldwide and approximately 480 in Brazil, but specific records in the state of Bahia are still not available. The present work presents the first faunistic survey of oribatid mites in the State, based on specimens collected from samples of vegetal parts and soil-litter interface in cocoa plantations of eleven localities of the municipalities of Camamu, Ilhéus, Itabuna, Ituberá, Taperoá, Uruçuca and Valença. Adult mites were identified and quantified. Results related to edaphic oribatid mites were submitted to a faunistic analysis, through the calculation of abundance,

constancy, diversity, dominance and frequency indexes. One-hundred-twenty-eight morphologically distinct species were determined in seventy-two genera and forty-one families. Forty-one species were nominally identified, representing the first records of Oribatida in Bahia. *Allozetes lacandonicus* Mahunka & Palacios-Vargas and *Charassobates tuberosus* Balogh & Mahunka were registered for the first time in Brazil. Only 4.5% of the specimens, pertaining to fourteen species, were found exclusively on vegetal parts. A high diversity of edaphic oribatid mites was detected through the faunistic indexes, with *Trachyoribates ovulum* Berlese, *Scheloribates praeincisus* (Berlese), *Protoribates praeoccupatus* Pérez-íñigo & Baggio, *Pergalumna australis* (Pérez-Íñigo & Baggio) and *Eohypochthonius becki* Balogh & Mahunka being the more representative species in the cocoa plantations of southern Bahia.

Tuesday 24, Afternoon, Auditorium - Poster

355 - Two unusual new species of Tarsonemidae (Acari: Prostigmata) from natural vegetation in Brazil

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The Neotropical Region is recognized as a place with great biodiversity. However, knowledge of mite diversity in this region is still restrict, especially for the Tarsonemidae. During the last ten years an effort has been dedicated to know the species of this family in Brazil. Finding new species in this region is not surprising, mainly in areas covered by natural vegetation. Sometimes, the new species found show some unusual characters. In the State of São Paulo, Brazil, a program named BIOTA (funded by FAPESP) is in progress, to map the biological richness of this state. As part of this program, surveys in natural vegetation are considered a priority; in those surveys many new mite species have been found, including tarsonemids. Two new species of *Tarsonemus* have been recently found; they were defined as new because of the following characteristics: *Tarsonemus* sp nov. 1 – leg one with a distinct line of fusion between tibia and tarsus; wide tegula, approximately three times wider than trochanter IV; setae *d* and *f* approximately with the same length and twice longer than setae *e* and *h*; setae *h* twice longer than setae *c1*. *Tarsonemus* sp nov. 2 - wide tegula, approximately three times wider than trochanter IV, setae *e*, *f* and *h* approximately with the same lengths and twice longer than setae *d*; setae 3b serrate; setae *pl*" of tarsus II spine-like, robust and distant from omega. Both species share some unusual characteristics for the genus (broad tegula and plates *EF* and *H* with long setae). Additionally, the line of fusion between tibia and tarsus I observed in *Tarsonemus* sp. nov. 1 is not observed in any other species of genus and must be a plesiomorphic character. These findings indicate that the determination of meaningful tarsonemid phyllogenetic relationships still demands extensive basic taxonomic research, especially in the neotropics. This research was financially supported by FAPESP.

Thursday 26, Afternoon, Auditorium - Poster

356 - Hexythiazox effect mixed with acaricides on *Brevipalpus phoenicis* (Geijskes, 1939) (Acari: Tenuipalpidae) in citrus crop

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The citrus leprosis control is mainly done by the mite vector *Brevipalpus phoenicis* extermination through acaricide spray. To evaluate the efficiency of hexythiazox mixed with acaricides on *B. phoenicis* an essay was designed. The experiment was carried out in a citrus orchard (variety 'Pera') located in Taiúva-SP, from April to September of 2000. The experimental design was randomized blocks with 6 treatments and 4 replications, each plot consisted by three trees in a row. It was established the following treatments (all in mL or g c.p./100 L of water): (1) hexythiazox WP of 1.5, (2) hexythiazox WP of 3, (3) hexythiazox WP of 1.5 + abamectin 18 CE of 15; (4) hexythiazox WP of 1.5 + fenbutatin oxide of 40, (5) hexythiazox WP of 1.5 + dinocap EC of 50, (6) hexythiazox WP of 1.5 + cyhexatin WP of 25, (7) hexythiazox WP of 1.5 + chorfenapyr CS of 31.25, (8) hexythiazox WP 1.5 +

propargite EC of 50, (9) hexythiazox WP of 1.5 + dicofol EC of 200; (10) MD 311 (experimental product) of 50 mL and (11) control. The products were sprayed with a tractor-mounted sprayer with handy spears, using 15 liters solution per tree. Surveys of the mite populations were made before and 8, 15, 37, 63, 105 and 141 days after the application. Ten fruits were collected per survey, at random, in the central part of the plot, from the interior canopy and wrapped in paper bags. The fruits were brought to the laboratory to remove mites with a sweeping machine to quantify them under a stereomicroscope. The data were analised through F test and means were compared by Tukey test. The mixtures efficiency was calculated by Schneider-Orelli formula. It was found that the hexythiazox mixed with fenbutatin oxide, dinocap, cyhexatin, chorfenapyr and propargite were the treatments that presented highest efficiencies on the *B. phoenicis* control. These mixtures resulted in percentages of 100% efficiency at 8 days after application (DAA), and remained up to 141 DAA. Hexythiazox + abamectin and hexythiazox + dicofol showed a lower shock effect on mite, getting an efficiency of 75.0 and 75.9%, respectively, at 8 DAA. There was a re-infestation in the hexythiazox + dicofol treatment at 105 days after application. Using the experimental product MD 311 a lower effect on the mite population was observed, obtaining a maximum efficiency of 80.5% at 37 DAA.

Thrsday 26, Morning, Room 2

357 - Predatory mites associated with the coconut mite, *Aceria guerreronis* Keifer (Prostigmata: Eriophyidae), in the State of São Paulo, Brazil

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The coconut mite, *Aceria guerreronis*, is one of the main pests of this crop in several countries. Colonies of this mite are found beneath the bracts of young fruits, where the mite feeds on the meristematic tissues, often causing premature fruit drop. The objective of this study is to determine the levels of occurrence of the coconut mite and associated predators in the State of São Paulo. Samples were collected between July and December 2009 from two coconut fields in each of the following municipalities: Cedral, Mirandópolis Riolândia and Tupã (northwest region), and Peruíbe (on the east coast). Samples were taken from 5 plants of each field; each sample consisted of 10 young fruits (5 to 10cm in length), 30 leaflets and five spikelets, taken from each plant; in addition, 10 fallen fruits were collected from each field, when present. The coconut mite was found in at least one field of each municipality, but the overall proportion of infested fruits was only approximately 8.4%. In the State of São Paulo, this mite had been reported only from the coastal municipality of Ilha Bela. On fruits standing on plants, 67% of the predators collected belonged to the Ascidae; 84% of these were species of *Proctolaelaps*. All mites collected from fallen fruits belonged to that same family; 52% of those were species of *Lasioseius*, while the remaining were species of *Proctolaelaps*. On leaflets, 71% of the predators collected belonged to the Phytoseiidae; 41, 28 and 24% of these were species of *Iphiseiodes*, *Euseius* and *Amblyseius*, respectively. On the inflorescences, 56% of the predators were phytoseiids and 40% ascids. Most phytoseiids belonged to *Euseius* (37%) and *Amblyseius* (31%), whereas most ascids belonged to *Proctolaelaps* (64%). *Neoseiulus baraki* and *Neoseiulus paspalivorus*, commonly found in several countries and also in northeastern Brazil, were not found in this study. The results indicated a low incidence of coconut mite in the State of São Paulo, and a diversity of associated predatory mites, especially ascids and phytoseiids, which could play a role in maintaining the population of coconut mite at low level.

Tuesday 24, Afternoon, Auditorium - Poster

358 - Mite diversity on Rosaceae in the São Francisco Valley, northeast Brazil

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The Rosaceae include about 100 genera and more

than 2,000 species spread throughout the world. Among the fruit trees of this family, apple, pear, peach and plum are highlighted by the potential production and increasing consumption in Brazil. One alternative is the diversification of crops in different irrigation poles of the Brazilian semi arid region. The installation of a plant collection of temperate climate fruits in the region of São Francisco Valley, aiming at the adaptation of these species for commercial cultivation in that region has been challenging to overcome issues such as climatic differences and consequently pest monitoring and control. The study here described was conducted at the Experimental Station (Bebedouro) of Embrapa Semi-Árido and referred to evaluations conducted on apple ('Eva' and 'Condessa' varieties), pear (Ally and 'princesinha' varieties), peach and plum (varieties 'Rubenal', 'Irati', 'Fla 79-3' and 'Fla 87-7'), between July 2008 and March 2010. Sampling of mites was performed weekly on 10 plants at random, collecting 3 leaves per plant (basal, middle and apical of the canopy of the plant). The leaves were placed in paper bags and taken to the Entomology Laboratory of Embrapa Semi-Árido and kept under refrigeration. Then, the leaves were observed under a 40X stereo-microscope, for arthropod counting. The mites were collected and send to the Acaralogy Laboratory at the Universidade Federal Rural de Pernambuco for identification. Mites of the families Tetranychidae, Tarsonemidade, Phytoseiidae and Tydeidae (Proenematinae) were present on all crops studied. Tenuipalpidae and Stigmaeidae were not recorded on plum and peach. The species were identified as *Tetranychus urticae* Koch (apple and pear), *Tetranychus* sp. (peach and plum), *Eutetranychus* sp. (peach), *Euseius citrifolius* Denmark & Muma (plum variety Rubenal), *Euseius concordis* (Chant) (plum variety Irati) and *Amblyseius tamatavensis* Blommers (pear variety Ally).

Tuesday 24, Afternoon, Auditorium - Poster

359 - Occurrence of mites on persimmon trees in the semi-arid region of northeast Brazil

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The cultivation of persimmon is gaining importance in Brazil, in areas traditionally cultivated as well as in new areas, increasing available products for the national and the international markets. Recently, this crop was introduced in Petrolina-PE, in the Experimental Station of Embrapa Semi-Árido (Bebedouro), for evaluation of agronomic performance. As one of the barriers to its cultivation refers to phytossanitary management, this study aimed to investigate the mite fauna on persimmon in semi arid conditions. From July 2008 to March 2010, samples consisting of three leaves per each of 10 plants were collected and taken to the laboratory to count, collect and mount the mites. After sorting, duplicates were sent to the Acaralogy Laboratory of the Universidade Federal Rural de Pernambuco – UFRPE for identification. Phytophagous mites belonged to the families Tetranychidae, Tarsonemidae and Tenuipalpidade were found. Among the predatory mites individuals of the Phytoseiidae and Stigmaeidae were observed. Mites of the family Tydeidae were also found. The most numerous species found were identified as *Brevipalpus phoenicis* (Geijskes) (Tenuipalpidae) and *Euseius citrifolius* Denmark & Mum (Phytoseiidae).

Thursday 26, Afternoon, Auditorium - Poster

360 - Occurrence of the mite *Orthogalumna terebrantis* (Acari: Oribatida) on *Eichhornia crassipes* in Apipucos Dam, Recife-PE, Brazil

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Macrophyte plants are very important in maintaining the balance of aquatic environments, contributing to physical and chemical changes and microbiological processes for nutrient removal. These plants are an alternative in many effluent treatment systems, as sewage, in aquaculture, and

post-treatment of agro-industrial effluents. The species *Eichhornia crassipes*, known as baroness, has a considerable ecological importance recognized through its filtrating properties, reducing the proliferation of bacteria, pathogenic virus and other microorganisms that consume oxygen from the aquatic environment, being considered as biological cleaner. However, due to its rapid proliferation, high population densities of *E. crassipes* may impair the navigability of rivers and cause problems in hydroelectric reservoirs. Oribatid mites are arthropods that exploit different feeding habits, comprising more than 9000 species represented by 172 families. In Apipucos Dam, Recife, PE, *E. crassipes* has been badly damaged by the mite *Orthogalumna terebrantis* (Acari: Oribatida). Females produce holes of about 0.1 mm on leaf surface, mainly on younger leaves, where they lay their eggs. Larvae and nymphs feed intensively inside galleries constructed by them. Adults emerge through holes of about 0.3 mm, causing weight loss and drying of the plants. Previous studies have indicated that this species has great potential to be used in biological control of *E. crassipes* due to the following features: (i) it is a monophagous species; (ii) it has an sclerotized body, reducing its dehidration and predation by other organisms; (iii) it has high reproductive capacity and may produce 13 generations per year; (iv) it can feed alternatively on algae.

Thursday 26, Afternoon, Auditorium - Poster

361 - Sources of lipids in oocytes of *Amblyomma triste* (Koch, 1844) (Acari: Ixodidae) during vitellogenesis process

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Ticks are arthropods of great medical and veterinary importance, since they transmit several pathogens to their host (Rey, 2001). The aim of the present study is to provide the first data regarding the origin of lipids in the oocytes of *Amblyomma triste*, through the use of ultrastructural cytochemical techniques. Ovaries of this mite were fixed in 2.5% glutaraldehyde in 0.1 M cacodylate buffer, washed once in the same buffer and once in 0.1 M imidazole buffer, post-fixed in 2% osmium tetroxide in 0.1 M imidazole buffer, followed by acetone dehydration, and then included in Epon resin. The ultrathin sections obtained were observed through transmission electron microscope (Philips 100), without undergoing the contrast process. The ovary of the tick *A. triste* is classified as panoistic, which is characterized by the presence of oocytes without nurse and follicular cells. The present study has demonstrated that the oocytes in all developmental stages (I – IV) are attached to the ovary through a pedicel, a cellular structure that synthesizes and provides elements for the oocytes during vitellogenesis. The lipids are synthesized and/or incorporated by oocytes in all stages; they are freely distributed or they form complexes with other elements. The present study clearly shows that cells of the ovary wall do not produce nor transport lipids into oocytes during the vitellogenic process. The exogenous sources responsible for providing lipids to oocytes in this tick species are the pedicel cells and the haemolymph. This research was financially supported by FAPESP - proc. 05/59208-3 and CNPq – 09-59020-0.

Tuesday 24, Afternoon, Room 3

362 - Acaricide resistance management in Brazilian citrus

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The Brazilian citrus industry is responsible for more than 30% of world citrus production. Among major problems that affect citrus production in Brazil, the citrus leprosis mite, *Brevipalpus phoenicis* (Geijskes), is one of the most serious pests because it transmits citrus leprosis virus. Approximately US$80 million are spent per year on acaricides in Brazilian citrus groves, to control mainly *B. phoenicis* and the citrus rust mite, *Phyllocoptruta oleivora* (Ashm.). Because of constant selection pressure with acaricides and some biological characteristics of *B. phoenicis* (thelytoky and

limited dispersal), the evolution of resistance is of great concern in Integrated Pest Management (IPM) programs. Thus, the major objective of this research was to collect basic information for implementing an acaricide resistance management program in Brazilian citrus. For this purpose, bioassay procedures were defined for characterizing the baseline susceptibility of *B. phoenicis* to major acaricides recommended in citrus groves, including new molecules such as spirodiclofen and ethoxazol. Resistance has already been detected and characterized to dicofol (≈60-fold), propargite (≈10-fold), cyhexatin (≈10-fold), sulfur (>100-fold) and hexythiazox (> 10,000-fold). Diagnostic or discriminating concentrations of different acaricides were defined for monitoring resistance. Cross-resistance relationships among acaricides were established to define the best acaricide rotation or mixture scheme for managing resistance. Studies on dynamics of the resistance were conducted under laboratory and field conditions to evaluate the stability of the resistance in the absence of selection pressure. The rate of reset to susceptibility in the absence of selection pressure varied from field to field. Several challenges in the implementation of an acaricide resistance management were faced in Brazilian citrus, such as the need of basic research and educational program, as well as the involvement of the citrus growers, industries, chemical companies and consultants.

Tuesday 24, Morning, Room 4

363 - Revision of the genus *Ixodes* (Ixodidae) in the Neotropical Region

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Ixodes Latreille is represented by 242 species worldwide. Among then, 45 are known to occur in the Neotropical region, 38 of which are endemic. Some species can parasitize mammals and birds in their different stages of development, while others have greater host specificity, depending on the biological stage. No dichotomous key is presently available for the adults of the *Ixodes* species. Many descriptions have been done long ago, and they are not adequate to determine the identity of the respective species. There are few studies on the *Ixodes* of the Neotropical region, mainly for those from Central America, often known from a few specimens or only from the types. In early 1990s, genetic markers emerged as important tools in tick systematics. Morphological studies, knowledge of the geographical distribution and of the host range of each species and the availability of illustrated keys are important to assist in the correct identification of *Ixodes*. In addition molecular biology could also complement morphological studies. Furthermore, there is a need to examine the largest number of collections, types and all deposited material, to find the mistakes in the identifications and new records of locality. After revising many collections, it was observed that one species from Central America could be synonymy and another from the same region is misidentified. Besides, the DNA sequences of *I. pararicinus* from Uruguay and *I. aragaoi* from Brazil are very similar, indicating they are the same species, but different from that of Argentina. In addition, there are new records of localities of at least 3 species: *I. andinus* and *I. downsi* to Colombia and *I. bequaerti* to Panama. Regarding pathogen transmission, many species of *Ixodes* are vectors of microorganisms that cause diseases in humans and animals. However, there is little information about the presence of pathogens in neotropical ticks. The species belonging to the "*Ixodes ricinus*" complex have been widely studied, mainly by their role as vectors of *Borrelia burgdorferi* (sensu lato), responsible for Lyme disease in the Northern Hemisphere. This complex includes 18 species worldwide, of which *I. affinis*, *I. aragaoi*, *I. minor* and *I. pararicinus* occur in the Neotropics. Immature *I. aragaoi* have been found parasitizing wild small rodents, while adults have been reported on deer and other mammals, in an area with human cases of a Lyme-similar disease in Brazil, but nothing is known about its role in *Borrelia* transmission. *Ixodes loricatus*, does not belong to that complex, but it has been found naturally infected with spirochetes in the same area, as well as with *Rickettsia belli* in the southeastern Brazil. This research was financially supported by FAPESP.

Tuesday 24, Afternoon, Auditorium - Poster

364 - First record of *Ixodes schulzei* (Acari: Ixodidae) in the State of Paraná, Brazil

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The genus *Ixodes* Latreille, 1796 is currently represented by approximately 242 species, 8 of which have been reported from Brazil. All species of this genus are restricted to wild hosts, primarily mammals, but at least two are exclusive bird parasites. *Ixodes schulzei* Aragão & Fonseca, 1951 is an endemic tick to Brazil, where it has been reported from the states of Rondônia (northern), Minas Gerais, Rio de Janeiro, São Paulo (southeastern) and Santa Catarina (southern). It has been found almost exclusively in association with the water rat, *Nectomys squamipes* (Brandt). Previous laboratory studies of life cycle, suggest that *I. schulzei* could be parthenogenetic, because only female ticks have been obtained from engorged nymphs. The immature stages and the female of *I. schulzei* were recently described and redescribed, respectively. The objective of the present study is to report for the first time the presence of *I. schulzei* in the State of Paraná and to report a new host for this species. Two larvae and one nymph were collected on *Akodon montensis* (Thomas), in João Surá, municipality of Adrianópolis, State of Paraná, southern Brazil. The single nymph collected in the field was dead. The larvae were taken to the laboratory, where they and the corresponding subsequent nymphs were fed on *N. squamipes* and maintained in an incubator at 27 °C and 95%RH. The engorged nymphs molted to females of *I. schulzei*, which were fed and then taken back to incubator for egg laying. After that occurred, both were deposited in the Acari Collection of "Instituto Butantan" (log number IBSP 10.336). Females were identified with the use of illustrated keys. Studies about life cycle of this species are in progress. The present scientific communication amplifies the known distribution of *I. schulzei* and confirms a new host (*A. montensis*) for that tick species.

Tuesday 24, Morning, Room 3

365 - An approach to acaricide-resistance developments from perspectives of genetic linkages and population structures in spider mites

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Since the 1990s, many populations of the two-spotted spider mite, *Tetranychus urticae* Koch, and the European red mite, *Panonychus ulmi* (Koch), have developed global resistance against many new acaricides. Recent problems with acaricide resistance may be characterized by the development of complex- and/or multi-resistance to acaricides in distinct classes. Moreover, the acaricides involved cross-resistance and the inheritance of resistance are not necessarily common to localities. This suggests that each selection process possibly leads to a different type of resistance mechanism, depending on the location and past selection history, and may yield different cross-resistance patterns. Pesticide-resistance development is an example of microevolution in arthropod pests. Population genetics, which is affected by many factors including biological and ecological traits of arthropod pests, properties of pesticides, and pesticide application patterns, underlies the evolution. We address genetic mechanisms during the process of acaricide resistance evolution through genetic linkage between resistance genes and population structure. With regard to the genetic linkage, Uesugi et al. (2002) demonstrated the genetic linkage between etoxazole- and chlorfenapyr-resistance genes in a Japanese *T. urticae* population. We analyzed genetic linkage between hexythiazox- and etoxazole-resistance loci by crossing experiments. Consequently, we found that etoxazole resistance was largely controlled by a single major autosomal locus in Japanese *T. urticae* populations while hexythiazox resistance was controlled by more than one locus, and one hexythiazox-resistance locus was tightly or completely linked to the etoxazole-resistance locus. This suggests that one of the hexythiazox-resistance genes was also located near to the chlorfenapyr-resistance gene on the same chromosome. Such

linkages among resistance genes to the acaricides that belong to the different classes may possibly cause the hitchhiking effects (apparent cross resistance, Uesugi et al. 2002) through intense selection by successive acaricide applications. We tried to construct genetic linkage maps of microsatellite loci in *T. urticae* and mapped etoxazole-resistance gene. Such maps will contribute to the efficiency in the linkage analysis among resistance genes. Population structure should largely affect the development rate and also the spatial distribution of acaricide-resistance genes. Therefore, we also analyzed a fine- and large-scale gene flow of *T. urticae* in greenhouse roses and apple orchards, respectively, using microsatellite markers. The results suggest completely different gene flow in *T. urticae* populations between the two habitats; limited gene flow in the glasshouse and successful migration in the orchard.

Thursday 26, Morning, Room 3

366 - Nondestructive DNA extraction protocol for oribatid mites (Acari)

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Oribatid mites are classified into one kind of soil mesofauna. Approximately 170 families, 1,200 genera and 10,000 species and subspecies are described in the world, and they are the largest mite taxon (Subias, 2004). Recently, genetic information is commonly introduced to reorganize different taxa of oribatid mites (e.g. Sylvia et al., 2008). Up to the present, most genetic analysis of oribatid mites are carried out by grinding specimens to reach a high yield DNA. This process, however, has an inconvenience, as the specimen used for genetic study analysis cannot be used for morphological study. In a study on lice, Cruickshank et al. (2001) developed a technique to extract DNA without grinding the entire body. The aim of this study was to examine the applicability of that technique to oribatid mites, extracting DNA from the exoskeleton without grinding the specimen. We chose three oribatid mite species because of differences in their exoskeletons. We conducted three types of treatments: 1) retaining the whole body structure, 2) completely smashing the mite, 3) smashing only the notogaster. We used DNeasy Tissue Kit (Qiagen). We followed the standard protocol, but incubated the sample in Proteinase K for 48 hours. We amplified 28S LSU D3 region about 300 bp (e.g. Maraun et al., 2004), then determined the sequence. Important morphological traits are remained after the extraction process. We obtained sufficient quality of DNA to perform genetic analysis by this method (Cruickshank et al. 2001). This was most likely possible because DNA readily dissolves from the legs, pores, and other relatively soft body parts of the oribatid mites by processing in Proteinase K for a long time. The small body size (Brachychthonidae; body size 160 μm - 200 μm) might also have assisted the ready dissolution of DNA. One potential problem is when muscular tissue melts, making a cavity inside the body of the oribatid mite. Microscopic observation becomes difficult when the specimen is hollow inside. Therefore, extra care might be required when preparing a specimen for a type species.

Tuesday 24, Afternoon, Auditorium - Poster

367 - Seazonality of plant-living mites in *Vitis labrusca* L. at Caxias do Sul, Rio Grande do Sul, Brazil

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The “Serra Gaúcha” is the main grape producing region of Brazil, where 54% of the grape produced in the country is cultivated. However, in the last years, grape production has been heavily affected by phytophagous mites, which have been causing heavy damages and considerable reduction in profitability. For this reason, this work has been designed to gather preliminary knowledge to recognizing the structure of phytophagous mites populations and their potential predators in *V.*

labrusca var. Isabel vineyards. Samples have been taken fortnightly since January 2009 at "Centro de Pesqusa Agroindustrial", of "Fundação Estadual de Pesquisa Agropecuária do Rio Grande do Sul" (FEPAGRO), in Caxias do Sul, Brazil. At each sampling date, leaves of 30 randomly chosen plants were collected, one from the upper (L1), one from the medium (L2) and one of thelower (L3) strata. Samples were placed in hermetic plastic bags and stored in a thermal box for transport to laboratory, where they were kept under refrigeration until processed under a binocular stereomicroscope. Mites found were placed in 70% ethanol and later mounted in Hoyer's medium for subsequent identification under a compound microscope. Until now, a total of 1066 mites (64,36% phytophagous and 35,64% predators) were registered, based on the data of 20 sampling dates, from January 2009 to February 2010. The available data suggests a seasonal abundance distribution with 792 individuals registered in the first sampling period (January to June 2009) and 274 individuals registered in the second sampling period (September 2009 to February 2010). In the first sampling period, phytophagous mites corresponded to a total of 434 individuals while predators corresponded to 358 individuals, with the highest phytophagous abundance registered in March 2009 (151 mites). In the second sampling period, phytophagous mites were represented by 252 individuals while predators were represented by 22 individuals; in the same period the highest phytophagous mite abundance was registered in February 2010, with 249 individuals. The available data for predatory mites in February 2009 indicates that this group appears to be available at samples only from the second fortnight of the same month; the same seasonal pattern seems to have occurred in February 2010; only 22 individuals were sampled from the second fortnight of this month. Mites collected in the second sampling period (September 2009 to June 2010) are still being process. When the work is completed, we will analyze the possible effects of the cropping system, biotic and abiotic factors on mite populations.

Wednesday 25, Afternoon, Room 4

368 - Eriophyoid mites from Araucariaceae of ancient lineage

S.K. Ozman-Sullivan

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Araucariaceae is an ancient family of conifers which had maximum diversity in the Jurassic and Cretaceous periods, when it was found almost worldwide. Today there are 41 known species in the genera *Agathis*, *Araucaria* and *Wollemia* in the southern hemisphere. The highest diversity is in New Caledonia, with other species in Australia, New Zealand, Malaysia, Argentina and Chile. *Agathis robusta*, *Araucaria bidwillii*, *Araucaria cunninghamii* and *Wollemia nobilis* are Australian representatives of the family. Only one eriophyid species, *Pentasetacus araucariae*, which forms galls on upper and lower surface of leaves of *Araucaria araucana*, has been recorded from Araucariaceae. Six new species belonging to Calacarini, Eriophyini and Phyllocoptini were found in this study. Two of them were found on *A. robusta*. One of them is vagrant and the second species is found between the scales of new buds. Two new species, one vagrant on the needles and the other in the tip buds, were found on *A. cunninghamii*. Two new vagrant species were also found on *A. bidwillii*. All the vagrant species were rare. The species living in the buds caused drying at the tip of the shoots. *Wollemia nobilis* shoot specimens collected during spring, summer and autumn from their native location were checked but no eriophyoids were found.

Thursday 26, Morning, Room 5

369 - Seasonal densities of dust mites in the houses of allergic asthma patients in Samsun, Turkey

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The most important allergens in house dust are house dust mites which cause diseases such as allergic asthma, rhinitis, dermatitis, urticaria and angiodema. The temperate climate and high humidity of Turkey's Black Sea region provide ideal conditions for house dust mites. The aim of

this study from 2007-2009 was to determine the seasonal densities of dust mites in the houses of allergic asthma patients in Samsun. Dust samples were taken from 5 allergic asthma patients' houses monthly by using a vacuum cleaner on the bed and carpet near the patient's bed for 2 minutes per m^2. Fifteen gram subsamples of the dust and debris were taken and mites were collected by using the Berlese funnel extraction method, identified and counted. A total of fifteen species were found in this study. *Dermatophagoides pteronyssinus* (Trouessart) was the most common species, followed by *Tyrophagous putrescentiae* (Schrank). While *D. pteronyssinus* had a maximum population density in September in both years, the density of *T. putrescentiae* was at its highest in October 2007 and November 2008. The remaining mites also had highest population densities at different times in both years. Only one individual of each of *Pyemotes* sp., *Histiostoma* sp. and *Bryobia* sp. was found.

Thursday 26, Afternoon, Room 2

370 - Pollen provisioning enhances *Euseius* populations and improves biological control in avocado and citrus

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Euseius species have been considered specialized pollen feeders, because their population fluctuations are often associated with pollen abundance. We propose that these predators have the potential to control pests when pollen is abundant. In the present study we evaluated this hypothesis in avocado and citrus for the control of persea mite, *Oligonychus perseae* Tuttle, Baker and Abbatiello and citrus rust mite (CRM), *Phyllocoptruta oleivora* (Ash.), respectively, using *Euseius scutalis* (Athias-Henriot). We conducted experiments at two spatial scales: on seedlings in a climate chamber and in the orchard. In the seedling trials, pollen was provisioned with a prototype pollen applicator while it was windborne from patches of Rhodes grass (*Chloris gayana*) in the field trials. In the avocado seedling trial, *E. scutalis* left pollen-free plants and allowed *O. perseae* populations to persist. On the pollen-provisioned plants in contrast, *E. scutalis* populations increased to high levels and persea populations dropped to zero. In the citrus seedling experiments, pollen applications similarly affected *E. scutalis* and *Amblyseius swirskii* Athias-Henriot populations (the latter being the dominant phytoseiid on citrus in the Israeli coastal plain) but only *E. scutalis* succeeded in controlling CRM. In the avocado field trial, now in its second year, natural populations of *E. scutalis* populations on trees next to the Rhodes grass patches were significantly higher and persea populations lower than those on trees five rows away. In citrus, four months post release, *E. scutalis* establishment was recorded adjacent to the Rhodes grass patches, albeit still at low population levels. Our future research will focus on enhancing populations of *E. scutalis* for CRM control with windborne pollen provisioning cover crops. Whether local populations of less effective phytoseiids such as *A. swirskii* will prevent the establishment of *E. scutalis* is now being addressed in lab and field experiments.

Thursday 26, Afternoon, Auditorium - Poster

371 - Cloning of cystatin genes from *Rhipicephalus* (*Boophilus*) *microplus*

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The tick *Rhipicephalus* (*Boophilus*) *microplus* causes important losses to livestock production. A vaccine has been considered one of the most promising methods for the control of this parasite. The success of this strategy is dependent on the cloning of the genes and characterization of the role

of tick molecules in the arthropod physiology. Protease inhibitors, including cystatins, are present in tick salivary glands. Cystatins are natural tight binding reversible inhibitors of papain-like cysteine proteases and have been found in various non-vertebrate organisms. In nematode parasites, it was demonstrated that cystatins play a role in evasion of the host defense system and in modulation of the immune response. Although members of the cystatin family are present in ectoparasites, including ticks, little is known of their specificity or function. Recent studies showed that cystatins are important for the feeding success of the ticks *Haemaphysalis longicornis*, *Amblyomma americanum* and *Ixodes scapularis*; however, the target enzymes and the mechanism of action remain still unknown. The production of the recombinant cystatins will provide an opportunity to investigate protein functions and possible use for tick control. The objective of the present study was the cloning of *R. microplus* cystatin genes. Analysis in TIGR *R. microplus* EST database detected DNA sequences with high similarity for tick cystatins. Primers designed for cystatins coding region were used to amplify cDNAs from salivary glands or ovary of *R. microplus* populations from Brazil and Uruguay. The cystatins coding regions were obtained and ligated into plasmid vector pGEM-T. *Escherichia coli* TOP 10 bacteria were transformed with the plasmids and products were confirmed by PCR, digestion with restriction enzymes and DNA sequencing. The cDNAs encoding cystatins with 129, 130, 140 and 158 amino acids were obtained. The amino acid sequences contained a highly conserved amino acid sequence (QxVxG) present in various cystatins. Other conserved regions found include a glycine in the N-terminal region and a PW motif in the second hairpin loop in the C-terminal region. In addition, the putative amino acid sequences contain 4 cysteine residues in the C-terminus; these residues are responsible to form two disulfide bonds in family 2 cystatins. Analyses of DNA sequences of the two cystatin genes from Brazilian and Uruguayan ticks showed mutations when compared to sequences present in TIGR database. The sub-cloning and expression for production of recombinant cystatins are in progress. This research was financially supported by CNPq, CAPES, FAPERGS, FAPERJ and INCT-EM.

Wednesday 25, Afternoon, Auditorium - Poster

372 - Economic thresholds for *Tetranychus urticae* (Acari: Tetranychidae) on *Citrus clementina*

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Tetranychus urticae is one of the key pests of citrus in Spain, especially in clementine mandarins. The effects of different mite populations on clemetine fruit quality and quantity was assessed for three consecutive years in 24 clementine trees individually isolated in mesh cages. Trees were visited at weekly intervals and different measurements were taken: number of leaf-flushes, number of symptomatic (= chlorotic) leaves per m^2, number of adult females per symptomatic leaf, per random leaf and, when available, per fruit. Phytoseiids were also counted on all these sampling substrates. At the end of the season the production of each individual tree was harvested and weighed and mite damage (scarring on the fruit) for each tree characterized based on 6 different categories (damage index, DI, from 0 to 5, for no damage to scar covering more than 50% of fruit skin, respectively). No relationship between mite infestation and production was found. However, when DI-values were plotted against the different mite measurements taken, strong relationships were found. Cummulatted symptomatic leaf-counts taken in August and September satisfactorily predicted DI at harvest. Neither phytoseiid mite nor leaf flush counts affect mite damage and therefore were not included when establishing the Economic Injury Level, which resulted in 15 cummulated symptomatic leaves during the aforementioned period.

Wednesday 25, Afternoon, Auditorium - Poster

373 - Effect of windbreaks of arboreal legumes on mite population on coffee

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Alternative methods of pest control are important tools in minimizing the impact of pesticides, especially in food production. The availability of certain plant species in the surroundings of coffee plantations may promote favorable conditions to increase the number of natural enemies of coffee pests, and consequently to reduce pest problems. Two mite species stand out among coffee pests, *Brevipalpus phoenicis* (Geijskes) (Tenuipalpidae) and *Oligonychus ilicis* (McGregor) (Tetranychidae). Several species of predatory mites of the family Phytoseiidae are naturally associated with these pests. The objective of this study was to evaluate the influence of windbreaks consisting of arboreal legumes in the population of pest and predatory mites on coffee plants. The study was conducted in the municipality of São Sebastião do Paraíso, Minas Gerais, Brazil, at EPAMIG Experimental Farm, between 2003 and 2007. The experiment consisted of five treatments and three replicates. Each treatment consisted of a control (no windbreak) or one of the following legumes used as windbreak for plots of coffee plants: pigeon pea (*Cajanus cajan* Millsp.) bracatinga (*Mimosa scrabrella* Benth), leucaena [*Leucaena leucocephala* (Lam.) De Wit] and acacia (*Acacia mangium* Willd). The windbreak consisted of parallel lines of trees. Each plot of coffee plants had five rows of 60 coffee plants each. Samples of coffee leaves were collected twice a year, once in the dry and once in the rainy season; each sample consisted of 60 leaves per plot. Mites were removed from the leaves by washing and mounted on slides in Hoyer's medium, for quantification and identified. We found 18 species of 11 mite families. Faunistic analysis (ANAFAU) showed that *B. phoenicis* and *O. ilicis* were dominant and very abundant in the control treatment and in the treatments corresponding to pigeon pea and leucaena windbreaks. However, in the treatments corresponding to acacia and bracatinga windbreaks, *B. phoenicis* was super dominant and super abundant. *O. ilicis* was super dominant in treatment corresponding to acacia windbreak and dominant in the other treatments. In all treatments *B. phoenicis* was more numerous (total 917) than *O. ilicis* (total 245). The predatory mite *Euseius citrifolius* Denmark & Muma (Phytoseiidae) was the most numerous; it was dominant in the control treatment and in the treatments corresponding to pigeon pea, leucaena and bracatinga, and super dominant in the treatment corresponding to acacia. Arboreal legumes did not affect the number of pest mites or of predatory mites, especially of *E. citrifolius*, on coffee plants. This research was financially supported by FAPEMIG, Consórcio Café and INCT do Café/CNPq-FAPEMIG.

Thursday 26, Afternoon, Room 4

374 - Alternatives for the chemical control of the red palm mite, *Raoiella indica* (Acari: Tenuipalpidae) on palms and bananas

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Several insecticides were tested for efficacy against the red palm mite on potted coconut palms and banana kept inside of a greenhouse in Rio Piedras, Puerto Rico and on field grown coconut palms in Broward County, Florida. Mite populations were recorded before infestation and regularly every week after treatment for approximately 3-4 weeks after treatment. In Florida, all treatments (Pylon, Sanmite, Shuttle, Tetrasan, Thiolux, Ultiflora, Avid + oil and Avid + Silwet) were statistically low in mite density compared to the untreated control for 42 days after spray. Avid treatments, which were applied twice, were statistically lower than the control 28 days after the second spray. In general, Sanmite and Avid + Glacial had the lowest mite densities throughout the experiment. During the second test, 28 days after treatment, all Tetrasan treatments and sulfur had the lowest density compared to the control. In Puerto Rico, the

acaricides, Ultiflora, Tetrasan, Floramite, Shuttle, Kelthane and Forbid were significantly different from the untreated control. Seven pesticides, SorbiShield, SucraShield, Floramite, Hexygon, Shuttle 15 SC, Oberon and Tetrasan were applied to bananas planted in one five-gallon pot. Trials were conducted 4 times. During the first trial, Tetrasan (Etotaxole) reduced mite densities up to 14 d after application, while during the second trial Shuttle (Acequinocyl) provided control 14 d after treatment. The mixture of Sorbishield plus Oberon and Sorbishield alone and Sorbishield + Shuttle provided satisfactory control 3 through 12 d after treatment.

Thursday 26, Afternoon, Auditorium - Poster

375 - Data from spermiogenesis and sperm cell structures support a close relationship between the genera *Thalassarachna* and *Halacarus* (Halacaridae)

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Halacaridae includes some genera of relatively large, free-leaving marine predacious mites. Representatives belonging to three of these genera had their spermatogenesis, sperm cell morphology and companying secretions newly described: *Halacarus actenos* Trouessart, 1889, *Agaue panopae* (Lohmann, 1893), and *Halacaropsis hirsuta* (Trouessart, 1884). All three species share the presence of a complete acrosomal complex, a plesiomorphy, and similar nuclear condensation process, which begins close to the nuclear envelope and progresses centripetally. This is shared by *Thalassarachna*, *Halacarellus*, *Arhodeoporus* and *Copidognathus* (Halacaridae), but contrasts with the pattern found in the halacarid *Rhombognathus* and most Actinotrichida, in which chromatin condensation progresses uniformly throughout the nucleus. We regard the centripetal progress of nuclear condensation as an apomorphy uniting most Halacaridae with the exception of *Rhombognathus*. Most Acariformes sperm cells have plasmalemma modifications, probably related to sperm cell capacitation inside female. In the studied species, *Agaue* and *Halacaropsis* species present only simple and empty pleats of the cell membrane. In *Halacarus*, however, additionally to the tubules from the membrane, the basal portions of the mature sperm cells present a ring-like cistern filled with dark material similar to that occurring in *Thalassarachna*. The most remarkable feature uniting *Thalassarachna* and *Halacarus*, however, is the lost track between the acrosomal vesicle and chromatin body during spermatogenesis. This gives rise to sperm cells clearly differentiated in two morphologically and functionally specialized halves, the apical half containing the acrosomal vesicle and the basal half containing the chromatin body and the ring-like plasmalemma enfolding with electron-dense material. Except for *Halacarellus*, without an acrosomal complex, other halacarid mites studied so far have a conventional acrosomal complex with the acrosomal vesicle keeping close contact with the chromatin body. A phylogenetic study of Halacaridae genera is lacking and a close relationship between *Halacarus* and *Thalassarachna* has never been suggested before. Although conclusions based upon a single aspect must be confronted with the characters from other sources (external morphology, molecular data), our provisional hypothesis is that *Halacarus* and *Thalassarachna* are sister groups.

Thursday 26, Afternoon, Auditorium - Poster

376 - Spermatology of *Arhodeoporus gracilipes* Trouessart, 1889 supports the inclusion of *Arhodeoporus* in the Copidognathinae (Halacaridae, Acariformes)

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Sub-familiar classification of Halacaridae is still in

flux and new data are in need for replacing the current raw similarity classification for other based in common ancestry. One of the main problems is the composition of Halacarinae, a heterogeneous group of genera set together because of the absence of clear apomorphies, rather than by shared apomorphies. The Copidognathinae Bartsch, 1983, which comprises the diverse genera *Copidognathus* (more than 359 described species, approximately one-third of all Halacaridae species), *Acarothrix*, *Copidognathides*, *Werthela* and *Phacacarus*, was defined by at least one clear synapomorphy, the presence of a single nymph during ontogeny. Another possible apomorphy is the presence of at most a pair of subgenital setae on the genital lids. Some similar looking genera, such as *Arhodeoporus*, *Camactognathus* and *Winlundia* were not included in Copidognathinae, but rather kept in Halacarinae. Ultrastructural observations on spermiogenesis, sperm cell and accompanying secretions of *Arhodeoporus gracilipes*, an *Acarothrix* species, and previous information on *Copidognathus* spermatology supported the inclusion of *Arhodeoporus* in the Copidognathinae. Both groups share identical spermiogenesis. Initial spermatids have electron-dense cytoplasm with scattered small mitochondria, and nuclei with patches of heterochromatin. The cytoplasm and nuclei of these cells undergo an intense swelling. The second spermatids are large and electron-translucid cells, with mitochondria in row along the remains of the endoplasmatic reticulum. In the following stage, most of the cytoplasmatic structures and mitochondria disappear or undergone deep transformations. Nuclei and cells elongate and chromatin starts to condense near the nuclear envelop. An acrosomal complex appears at the tip of nucleus. The acrosomal filament is thick and crosses the length of the nucleus. Plasmalemmal invaginations at cell surface give rise to tubules filled with an electron-dense material. As a final step in spermiogenesis, cytoplasm of the last spermatids undergoes a moderate condensation and the carioteca disappears. Mature sperm cells were found in a matrix of "simple" and "complex" corpuscles, consisting in flattened, spindle-shaped secreted bodies. Rather than sperm aggregates, spermatozoa were contained in a single droplet inside the *Vas Deferens* on a large mass of secretion structured as heaps of elongated bodies. As clear synapomorphies shared by Copidognathinae and *Arhodeoporus*, acrosomal vesicle is small, being narrower than the chromatin body, and the latter has an eccentric placement. This discovery is very useful in allowing polarizing the in-group Copidognathinae character states, allowing straightforward selection of an out-group for more than one-third of Halacaridae species.

Thursday 26, Morning, Room 3

377 - Assembling foodwebs from temperate mosses: can oribatid chelicerae help?

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Determination of the diet of free-living mites has traditionally been hampered by their small size. More recently, stable isotope analyses have been used successfully to detect feeding guilds within a group previously thought to be composed of food generalists with little niche differentiation: oribatid mites. Elucidation of species' position in the foodweb is relevant to studies of soil microarthropod communities and it is of particular use in the study of the moss-microarthropod microecosystem, a system which is increasingly being used as an experimental model to test core questions in ecology. The moss microarthropod fauna is dominated in abundance and diversity by oribatid mites. Here, stable isotope studies of oribatid mites are expanded and isotope signatures of species are compared with the morphology of their chelicerae. Preliminary results of a field experiment where moss communities were subjected to habitat fragmentation and climate change are also presented, with a focus on the incorporation of foodweb data to enhance the understanding of the system.

Thursday 26, Afternoon, Room 6

378 - Efficacy of ecofriendly compounds against Red Palm Mite (*Raoiella indica*) on coconut seedlings in the Sultanate of Oman

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The Red Palm Mite, *Raoiella indica*, is a pest of the Old World described from India attacking leaves of coconut trees. Its greatest economic importance is reported on coconuts, banana and some ornamental palms. The symptoms are apparent on the lower leaves, which turn yellowish. At high infestation levels, it can kill the seedlings. An experiment was conducted at Dhofar Research Station in March-April 2010, to test the effect of ecofriendly compounds against this pest on 3 to 5 months old coconut seedlings. The test consisted of five treatments: Coconut oil + Soap at 1.5 + 1%, 3 + 1% and 4.5 + 1%; Fenpyroximate 0.2% and Control. Six seedlings were used per treatment, each seedling considered a replicate. Assessments were conducted on a leaflet of each seedling. Plants were sprayed twice, the second time three weeks after the first, using a hand sprayer at rate of 800 L/ha. Mite densities (all stages considered) were evaluated immediately before spraying as well as 5, 10, 15 and 20 days after spraying. Only the highest concentration of coconut oil was effective and significantly different ($P < 0.05$) from other treatments in all evaluations. Considerable variation in number of mites may be observed when coverage is not adequate. Nozzles must be adapted for bottom up application, for better coverage of the lower leaf surface. For large-scale treatments, the use of appropriate equipments is of major importance, for the use of oil to be economically advantage. The presentation of this work was made possible by a grant provided by FACEPE – Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco.

Thursday 26, Afternoon, Auditorium - Poster

379 - Biology of an Omani population of *Neoseiulus paspalivorus*, a predator of the coconut mite, *Aceria guerreronis* (Acari: Phytoseiidae, Eriophyidae)

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The coconut mite, *Aceria guerreronis*, is a major pest of coconut in the Salalah region, southern Oman. The main natural enemies associated with this pest in this region are the predatory mites *Neoseiulus paspalivorus* and *Cydnoseius negevi*, both Phytoseiidae. While *C. negevi* has only been collected on coconut in Oman, *N. paspalivorus* has been reported from several countries in Africa, America and Asia. Biological studies are important to evaluate the performance of a predator as control agent of a pest. Some studies have been conducted on the biology of *N. paspalivorus* from different countries in Africa, America and Asia. The objective of this study was to determine biological parameters of an Omani population of this predator when offered *A. guerreronis* and coconut pollen as food sources. The study was conducted in the Biological Control Laboratory of the Salalah Agricultural Research Station at 25±1 °C, 80±10% RH and 12 h D:L. Mites were reared on experimental arenas. The study was initiated with 45 eggs of the predator on each food source. Predators were examined every 8h in the immature phase and daily in the adult phase. They were able to develop and oviposit on both food sources, but survivorship of juveniles was considerably higher on *A. guerreronis* than on coconut pollen (88 and 38%) and the biological cycle (egg to adult) was slightly shorter on the former than on the latter (5.5 and 6.1 days). Integration of these parameters with higher fecundity of the predator on *A. guerreronis* than on coconut pollen (32.6 and 3.8 eggs) resulted in highly different intrinsic rates of population increase (r_m= 0.180 and 0.019 female/ female/ day) on those respective food sources. These results are compatible with the fact that *N. paspalivorus* has been found exclusively under the bracts of coconut, where *A. guerreronis* resides and where pollen grains are not readily available. The results are also similar to results of previous studies conducted with populations of other regions of the world. The presentation of this work was made possible by a grant provided by FACEPE – Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco.

Thursday 26, Afternoon, Room 6

380 - Survey of *Rhipicephalus microplus* resistance to ivermectin at cattle farms with history of macrocyclic lactones use in Yucatan, Mexico

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Engorged females of *Rhipicephalus microplus* were collected from 40 cattle farms in Yucatan, Mexico to evaluate ivermectin resistance. Larval progeny of each tick sample was produced in laboratory to be evaluated using the larval immersion test in order to determine mortality. Concentration-mortality data were subjected to probit analysis to estimate lethal concentrations (LC). Resistance ratio (RR) of each tick sample was calculated by dividing its calculated LC by the LC of an ivermectin-susceptible strain. Field populations of *R. microplus* showed various levels of resistance to ivermectin; the top three resistant populations were Chen-Pato (RR_{50} = 10.23, RR_{99}= 179.6), San Diego (RR_{50}= 7.37, RR_{99}= 115.3) and San Fernando (RR_{50}= 7.09, RR_{99}= 50.22). These can be considered low levels of resistance. However, the intensive use of macrocyclic lactones to control both endo- and ectoparasites in the region will likely lead to a more serious resistance problem that may cause control failure in the future. This research was financially supported by Fomix-Conacyt, Mexico (YUC-2008-C06-108773).

Wednesday 25, Afternoon, Auditorium - Poster

381 - Effects of *Eotetranychus lewisi* (Acari: Tetranychidae) density on photosynthesis and chlorophyll in peach leaves

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The Lewis spider mite, *Eotetranychus lewisi* (McGregor), is one of the most important pests in peach, *Prunus persica* (L.) (Batsch), orchards in North-Central Mexico. In early autumn 2003, a glasshouse experiment was carried out to assess the influence of foliar damage by the Lewis mite on peach trees. Two year old 'diamante mejorado' peach trees were infested with three different densities of mites per leaf: (A) 10-20, (B) 21-40, (C) 41-80; a mite-free control was added. Net photosynthesis (Pn) was quantified weekly using an infrared gas analyzer (LI 6200). Chlorophyll was measured by means of a chlorophyll meter (Spad 502). Mite populations were maintained near the initial induced densities with non-chemical control. At the end of the experiment, cumulative mite-days per leaf (CMD) were 153, 1313, 2844 and 4771 in control and groups (A), (B) and (C), respectively. When compared to the control, these cumulative mite-days caused reductions of 32.9, 42.1 and 53.5% in total chlorophyll content (TCHL) in (A), (B) and (C) groups respectively, as well as reductions of 23.9, 39.1 and 48.3%, in net photosynthesis (Pn) for groups (A), (B) and (C), respectively. Linear correlations were observed for reduction of net photosynthesis and chlorophyll content respect to CMD. The results here reported correspond to Project 20031821 SAPPI-Instituto Politécnico Nacional, México.

Thursday 26, Afternoon, Auditorium - Poster

382 - Use of PCR-Multiplex technique for prey detection in citrus mites

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Tetranychus urticae Koch and *Panonychus citri* (McGregor) (Acari: Tetranychidae) are the most important tetranychid mites affecting citrus orchards in the Valencian Community (eastern Spain). An outstanding group of natural enemies associated to

this mites are phytoseiids and specifically in our region, *Euseius stipulatus* (Athias-Henriot), *Phytoseiulus persimilis* Athias-Henriot, *Neoseiulus californicus* (McGregor), *Amblyseius barkeri* (Hughes) and *Typhlodromus phialatus* Athias-Henriot (Acari: Phytoseiidae). These species can prey on both *T. urticae* and *P. citri*, but their individual contribution in the field to control these phytophagous mites is not fairly known. Besides, these phytoseiids can also prey on each other. Predation can be measured by analysing the phytoseiid gut content through molecular techniques. DNA obtained from each individual phytoseiid mite gut is scarce, in such a way that DNA becomes a limiting factor. Because of this limitation, we have selected the PCR-multiplex technique for multiple prey detection in a single PCR reaction. PCR-Multiplex has been optimized considering two tetranychid preys (*T. urticae* and *P. citri*) and five phytoseiids (*E. stipulatus*, *P. persimilis*, *N. californicus*, *T. phialatus* and *A. barkeri*). Until now, satisfactory results have been obtained in the detection of *T. urticae* DNA, at different digestion times (between 0 and 24 h), in the gut content of *E. stipulatus*, *N. californicus*, *P. persimilis* and *A. barkeri*. The use of this molecular technique in field samples will increase the knowledge of mite trophic relationships and therefore could contribute to improve biological control.

Wednesday 25, Afternoon, Auditorium - Poster

383 - Mesostigmatid mites (Acari: Mesostigmata) from Pedregal de San Ángel Ecological Reserve, Distrito Federal, Mexico

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The soil is a very complex ecosystem where many physical, chemical and biological processes affect the organisms living in that habitat. Mesostigmatid mites are important edaphic fauna playing different roles in the soil; some are predators of springtails, nematodes and other invertebrates; others are phytophagous or mycophagous. The named Pedregal de San Ángel Ecological Reserve (REPSA by its Spanish abbreviation) is located at Southeast of Mexico City (19º14' - 19º25' N - 99º08' - 99º15' W), inside the area of the central *campus* of the Universidad Nacional Autónoma de México (UNAM). That is an important area with many endemic species of flora and fauna of Mexico Valley. We estimated the diversity and abundance of mesostigmatid mites in two areas into the REPSA. One site was named "open" (O), due to less dense vegetation and the consequent easy access to visitors; the other was named "close" (C), due to denser vegetation and the consequent limited access to visitors. In each site, 156 soil samples were taken through one year, from March 2008 to March 2009, for a total of 312 samples during the study. The mesostigmatids from the samples were extracted, isolated, and quantified. The higher abundance was recorded in the "O" site. Higher species richness was also found in that site, where the most abundant families were Uropodidae, Ascidae, Laelapidae and Rhodacaridae; the last three families are comprised of species with predatory habits, preying on springtails, nematodes, small insects and immature forms of Oribatid mites. In contrast, the urpodids are considered as bacteriophagous or micophagous, some species feeding on organic matter. In site "C", the most abundant families were the same as in the previous site, and also Macrochelidae, which usually inhabits organic substrates with large amount of litter; these mites are predators on nematodes, springtails and eggs and larvae of microarthropods. Thus most mesostigmatids families in REPSA are predators, their abundance is related with the resource availability, represented by the presence of their preys. In both sites higher abundance and diversity were recorded in the rainy season. This study was supported by PAPIIT-IN208508 project, founding by Dirección General de Asuntos del Personal Académico, UNAM. Dr. José G. Palacios-Vargas gave us invaluable suggestions.

Thursday 26, Morning, Room 1

384 - The European Scutoverticidae (Acari: Oribatida): a combined approach of molecular genetics and various morphological investigations reveals paraphyly of the genus *Scutovertex*

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The genus *Scutovertex* is highly heterogeneous and the members are supposed to show high intraspecific morphological variability resulting in a difficult classification of some specimens. Indeed the taxonomy of this entity is uncertain at least in part and certain representatives show problematic positions within the genus. A multivariate analysis of 16 continuous morphological variables of different Austrian and European populations of *Scutovertex minutus*, *S. sculptus* and *S. arenocolus* was performed to test intraspecific variation. The analysis of the geographic distant populations of each species showed a complete overlap in the graphs, whereas the species tested against each other were clearly separated. These results demonstrate stable morphological characters within the *Scutovertex* species and contradict the formerly supposed high intraspecific variability. To clarify the phylogenetic relationships among 11 species of the family Scutoverticidae an investigation of nucleotide sequences of one mitochondrial (COI) and two nuclear (28S rDNA, *ef-1α*) genes, as well as 79 morphological characters was performed. Both molecular genetic and morphological data revealed a paraphyletic genus *Scutovertex*, with *S. pictus* probably representing a distinct genus. Moreover a detailed morphological analysis of the juveniles of selected members of the Scutoverticidae demonstrated homogeneous characters within *Scutovertex* whereas modified lateral setae on tibia I seem to be specific for the immatures of this group. *Scutovertex pictus* deviates in this and certain other important characteristics of the juveniles of this genus, as for example in a different shape of sensilla and a differing placement of respiratory organs on the legs. These results also confirmed the paraphyletic placement of *S. pictus* within *Scutovertex*. The combined approach of adult and juvenile morphology as well as molecular genetics showed consistent results and provided detailed and informative insights into the relationships of the family Scutoverticidae.

Wednesday 25, Morning, Room 2

385 - Analysis of the tick kinin receptor function through structure-activity relationships of kinin peptidomimetics, and RNAi and immunohistochemistry in females of *Rhipicephalus microplus* (Acari: Ixodidae)

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Arthropod kinins (insect kinins) are multifunctional neuropeptides that regulate diuresis in many species of insects. They share the evolutionarily conserved C-terminal pentapeptide motif Phe-X^1-X^2-Trp-Gly-NH_2, where X^1 = His, Asn, Ser, or Tyr and X^2 = Ser, Pro, or Ala. Compounds with similar biological activity could be exploited for the control of arthropod pest populations such as the southern cattle tick *Rhipicephalus microplus*. Insect kinins, however, are susceptible to fast enzymatic degradation by endogenous peptidases that severely limit their use as tools for pest control or for endocrinological studies. To enhance resistance to peptidases, analogs of the insect kinins incorporating bulky α,α-disubstituted amino acids in positions adjacent to both primary and secondary peptidase hydrolysis sites were synthesized. Several of these analogs are highly stable to hydrolysis by degradative enzymes angiotensin coverting enzyme, neprilysin and leucine aminopeptidase. Six analogs were evaluated by calcium bioluminescence assay on the recombinant tick receptor expressed in CHO-K1 cells and four either matched or exceeded the potency of the control kinin peptide agonist (*Gen. Comp. Endocrinol. 162: 122-128*). The physiological role of kinins in ticks has not been yet elucidated. We previously showed kinin-like

immunoreactivity in tick synganglion. Although two neurons of the cheliceral ganglion only exhibited leucokinin immunoreactivity, in four neurons and nearly the total network of arborizations immunoreactivity co-localizes with that of periviscerokinin (*Biochem. Biophys. Res. Comm.338:1860-1864*). Here we investigated kinin receptor immunoreactivity in various tissues with a polyclonal anti-peptide antibody developed in calves against receptor fragments conjugated to keyhole limpet hemocyanin. We also silenced the receptor in female ticks through RNAi and evaluated the silencing effect through photography, female weight and survivorship in comparison to two sets of negative controls.

Wednesday 25, Afternoon, Auditorium - Poster

386 - A note on the life cycle of *Amblyomma nodosum* (Neumann, 1899) (Acari: Ixodidae) under laboratory condition

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Ticks are important ectoparasites, feeding on the blood of animals and humans. They cause lesions in the skin of their hosts and they are notable vectors of infectious agents. The knowledge on Neotropical tick biology or ecology is scarce, because most species typically have two or three-hosts during their cycles, and the hosts are wild animals. In Brazil, most tick species parasitic on wild animals belong to the genus *Amblyomma*, and the hosts of immatures and adults belong to different animal categories. Some aspects of the life cycle of ticks can only be reveled if they are reared under laboratory conditions. *Amblyomma nodosum* is a typical tick of South and Central America. In Brazil, *A. nodosum* was registered in the States of Rio de Janeiro, Minas Gerais, São Paulo, Goiás, Mato Grosso, Mato Grosso do Sul, Paraná and Rio Grande do Sul. The list of hosts of *A. nodosum* includes Xenarthra mammals and birds for adults and immatures, respectively. The observations reported in this abstract refer to the offspring of an engorged female of *A. nodosum* collected from an anteater seized by IBAMA-Screening Center for Wild Animals in Seropédica, Rio de Janeiro, Brazil. The female and its offspring were maintained in controlled laboratory condition (27 ± 1 ºC and 80 ± 5% RH). The female laid an egg mass of 593.10 mg, whose viability was around 90%. Unfed larvae (400 mg) and nymphs (200 mg), with 20 to 30 days, were allowed to feed on the ears of two rabbits (New Zealand x California), using the technique of cloth bag. The rabbits had no previous contact with ticks or acaricide products. For the larva, durations of pre-parasitic period on both animals were 5.8 and 7.2 days, while durations of the parasitic period were 3.38 and 7.62 days; durations of pre-ecdysis and ecdysis periods ranged from 21 to 23 and 4 to 12 days, respectively. Larval viability was nearly 50%. For the nymph, durations of different phases were: 9.69 to 11.81 for pre-parasitic, 3.38 to 7.62 for parasitic, 25 to 32 days for pre-ecdysis and 4 to 8 days for ecdysis. Nymphal viability was nearly 50%. Totals of 792 larvae (= 448.4 mg), 14 nymphs (89.7 mg) and 7 adults, including 2 females and 5 males, were recovered. A female and a male died and the second generation started with one female and 4 males. In the second generation, some adjustments were done to allow the successful establishment of a colony.

Monday 23, Afternoon, Room 4

387 - Ecology of Brazilian spotted fever

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Brazilian Spotted Fever (BSF) is the most severe tick-borne-disease in Brazil. It is caused by infection with bacterial organism *Rickettsia rickettsii*. In the last 10 years, approximately 40-120 cases of BSF have been reported annually. The disease epidemiology is strongly associated with the life cycle and ecology of the two known tick vectors: *Amblyomma cajennense*, a natural inhabitant of the Brazilian Savannahs and disturbed rainforest sites, and *Amblyomma aureolatum*, a strict inhabitant of the Atlantic Rainforest. *Amblyomma cajennense* presents a life cycle that lasts a year and it is regulated by behavioral diapauses of unfed larvae. Succinctly, the adult season starts on late spring and females feed and lay eggs during the summer. Remarkably, even larvae

hatching in early summer do not seek for hosts; they wait motionless on the vegetation sheltered ground. On the ensuing fall, when the temperature and the moisture become favorable, all larvae thereupon start climbing up the vegetation questing for hosts, what delivers an enormous tick burden to the environment and might become a threat for human beings. However, epidemiology of BSF reports a different picture, with few cases during the fall and a massive number of cases during the winter, when the larval season has already finished and the nymphal season has begun. This may show that despite the fact that larvae exist in extremely larger number, nymphs may show a higher rickettsial infection rate and a higher transmission rate. No vertebrate is known as a natural reservoir for *R. rickettsii*. Instead, mathematical frameworks show that vertebrates play an essential role in horizontal amplification of the bacterium, acting as a bridge between infected and uninfected ticks. Among the natural hosts of *A. cajennense*, capybaras have been shown susceptible to infection by *R. rickettsii* and an important source of infection to uninfected born ticks, but just for a short period of time of about two weeks. On the other hand, the transmission of BSF by *A. aureolatum* has a different scenario, where dogs carry infected ticks from the inner rainforest fragments into human habitations; additionally, in this case, instead of nymphs, adult ticks attack and transmit BSF to humans. Birds and hystricognathi rodents are the main natural vertebrate hosts for immature *A. aureolatum*. The dynamic of the vertebrate host population may regulate the dynamics of the rickettsial infection rates in the tick population borne on a balance between susceptible and immune animals, where a disequilibrium towards susceptibility, such as an irregular increase in the number of newborns, may start an outbreak that would increase the tick infection rate and therefore the risk to humans. In Brazil, the ecology and interaction of the vertebrate keystone species in the natural history of *R. rickettsii* are an important research foci for the forthcoming years.

Wednesday 25, Afternoon, Auditorium - Poster

388 - A new ivermectin detoxification pathway in *Rhipicephalus* (*Boophilus*) *microplus*

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Acaricide resistance is a major problem hindering the control of the tropical cattle tick, *Rhipicephalus* (*Boophilus*) *microplus*, in several areas around world where cattle production suffers severe economic losses due to tick infestation. The macrocyclic lactone (ML) ivermectin (IVM) is widely used for treatment of endo- and ecto-parasites. However, resistance to IVM has been reported in a considerable number of parasites, including cattle tick. From molecular, biochemical and pharmacokinetic studies, the role of ATP-binding cassette (ABC) transporter in MLs resistance has become evident in nematodes as *Haemonchus contortus* and *Onchocerca volvulous*. ABC transporters are integral membrane proteins that actively transport diverse types of amphiphilic xenobiotics, including drugs such as the MLs, across the cellular membranes, protecting the organisms against these compounds. Here, we aim to investigate the participation of ABC transporters in *R.* (*B.*) *microplus* IVM-resistance. IVM toxicity was assessed by the larval packet test (LPT) in seven IVM-resistant field populations from São Paulo and Rio Grande do Sul states (Brazil), using as reference two susceptible strains. Mortality was determined in larvae previously exposed to ciclosporin or MK571, inhibitors of the ABC transporters of subfamilies B and C, respectively. In five populations, the IVM toxicity was significantly higher ($p < 0.05$) in ciclosporin or MK571 exposed larvae, when compared to not inhibitor-exposed larvae. However, in the susceptible tick populations, IVM toxicity was not changed in inhibitor-exposed as compared to non inhibitor-exposed larvae. To investigate the molecular mechanism involved with the increased IVM detoxification, we have analyzed the mRNA transcription levels of three tick ABC transporters by real-time reverse-transcription PCR. The transcription levels of ABC-B1 and ABC-C1, belonging to subfamilies B and C respectively, were higher in larvae exposed to IVM compared to non IVM exposed larvae. However, the transcription level of ABC-D1, of subfamily D, was not altered. These results suggest that ABC transporters are involved in IVM detoxification and that ABC-B1 and ABC-C1 might be the central molecules involved in this process. ABC transporter-mediated detoxification might be a new tick resistance

mechanism. Therefore, the understanding of this process will help the development of new molecular methods for the detection of acaricide resistance and improvement of strategies for the tick control. This research was financially supported by CAPES, CNPq, PRONEX, INCT-EM and FAPERJ.

Monday 23, Afternoon, Room 3

389 - Feasibility of the use of phytoseiid mites in biological control programs of *Tetranychus urticae* in Brazil

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Phytoseiid mites are considered the most important natural enemies of *Tetranychus urticae*, two-spotted spider mite (TSSM), around the world. Recently, the interest of Brazilian producers for the applied use of biological control agents, such as predatory mites, has increased. The adoption of this strategy can be explained due the requirement of consumers for clean food, produced under rational use of pesticides or even totally free of pesticide residues. Other reasons have driven the use of applied biological control such as the high levels of arthropods pesticide resistance. Programs based on inundative releases of predatory mites to control TSSM have been conducted in several crops in Brazil, such as ornamentals, vegetables and fruits. The main species used are the generalist predator *Neoseiulus californicus* and the specialist *Phytoseiulus macropilis*. It is recommended that the first species be released when infestation is still low (< 5 mobile forms of TSSM/leaf). On the other hand, *P. macropilis* has been shown satisfactory results even at high pest population. PROMIP is a Brazilian company that has been producing and supplying *N. californicus* and *P. macropilis* to control TSSM in several crops, since 2006. The company recommends the use of both species together or separately, depending upon pest infestation level at the time of release. When initial infestation is high, the company recommended first the introduction of *P. macropilis* in "hot spots", followed by the release of generalist predator *N. californcius* after the reduction of infestation, to keep TSSM population under control. The use of resistant strains of predatory mite has been a feasible strategy, mainly when the beneficial mites are introduced in conventional systems, where the use of pesticides to control insects and diseases is a common practice. The company distributes these natural enemies using plastic bottles and the method for release has been considered by growers to be easy, comfortable, convenient and fast.

Wednesday 25, Afternoon, Auditorium - Poster

390 - Integrated production: an open door to biological control of *Tetranychus urticae* in Brazilian strawberry fields

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Spider mites are considered primary pests in strawberry crops. Among them, *Tetranychus urticae* (Acari: Tetranychidae), two-spotted spider mite (TSSM), is the most important species. Currently, the main strategy employed to manage this pest mite, in this crop is the use of pesticide spraying. However the exclusive use of chemical control has led to a series of problems such as high levels of pesticide residues on fruits and the selection of pesticide resistance strains under field conditions, resulting in failure of the control program. Programs based on the use of alternative strategies, such as applied biological control, integrated with others tools can reduce these problems and implement the management of TSSM in strawberry. The objective of this study was to evaluate the effectiveness of the release of the generalist predator *Neoseiulus californicus* (Acari: Phytoseiidae) to control TSSM in strawberry. The experiment was carried out in a commercial strawberry field (conducted under low tunnels), located in Venda Nova do Imigrante, State of Espirito Santo. Two strawberry beds with an area of 50 m^2 each were set aside. In one bed, the control of the TSSM was performed under "conventional system", based on the use of pesticides registered for use on strawberry (treatment 1). In the other, the control of TSSM was done by releasing the predatory mite *N. californicus* (treatment 2); predator introductions were done when the infestation was around 20 mobile forms of TSSM per leaflet, using a rate of 25 mobile forms of the predator/ m^2. The release was done immediately after the first sampling (day 0). The population

density of *T. urticae* and *N. californicus* were estimated by counting the numbers of mobile forms of both mites on 25 leaflets taken randomly from each bed (conventional and biological control). Samplings were conducted every week during a period of approximately 50 days. Mite counting was done with a pocket stereomicroscope at 10× magnification. In the first treatment, four acaricide sprayings were done; the pesticides used were abamectin (twice), milbemectin and propargite. In the biological control treatment, reduction of the infestation of TSSM was first noticed just 21 days after the introduction of *N. californicus*. Afterward the predator was able to keep the population of TSSM under control. The delayed effect of the predatory mite on the reduction of the TSSM infestation probably occurred because this natural enemy was introduced when the level of infestation was high. These results showed that the use of *N. californicus* is an effective tool for biological control of TSSM in strawberry in Brazil. However introduction of the predator needs to be done on the first hot spots (initial infestation of the pest).

Wednesday 25, Afternoon, Auditorium - Poster

391 - *Tetranychus urticae* – important pest in soja culture, in Romania

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Soybean is considered an important crop in Romania, occupying about 120,000 ha annually, with a widespread distribution over the country. One of the limiting production factors of this crop is the attack of *Tetranychus urticae* Koch. Present throughout the country, pest densities reach very high level, hundreds of individuals/leaf, especially in the plains of southern, central and eastern part of the country (the Romanian Plain, Transylvania Plateau and Moldavia), producing considerable annual crop losses. Research has shown that in Romania this mite overwinters in the adult stage in the soil, under lumps of earth or under plant debris, and in cracks of tree bark. Six generations of *T. urticae* occurs annually. For soybean, generations III and IV are of economic importance. The emergence and development of these generations coincide with the end of vegetative growth phase and throughout the reproductive phase of soybean plants. Principles and methods for damage evaluation are presented. Current technology to protect soybean crops from pest attack requires the application of two chemical treatments and contributes to savings of approximately a third of the crop yield. The warning to start the control measure is the emergence of mobile mites of the third and fourth generations. Biological tests have shown the suitability of the following acaricides to be used in the control: Envidor (0.3 l / ha), Memento (0.5 l / ha), Nissorun 10 WP (0.4 kg / ha), Ortus 5 SC (0.5 l / ha), Seizer 10 EC (0.2 l / ha) and Surveyor (0.8 l / ha).

Thursday 26, Afternoon, Auditorium - Poster

392 - Mites associated with nests of *Acromyrmex lundi* (Hymenoptera: Formicidae: Attini) in Buenos Aires, Argentina

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Despite the many studies concerning myrmecophilous mites, there are relatively few concerning mites in the nest of the ants of the tribe Attini. These ants are particularly suitable for these studies because their nest has a variety of microhabitats that are used by many myrmecophilous organisms (e.g. Coleoptera). We present some results of an ongoing investigation concerning the presence of mites in the nests of *Acromyrmex lundi* (Guerin 1830) in the province of Buenos Aires, Argentina, in the biogeographic province of Pampas. The mites were extracted using Berlese funnels from samples from 20 localities. All four main groups of soil mites are represented: Prostigmata, Astigmata, Oribatida and Mesostigmata. The collected taxa are presented by means of tables by species vs. locality, tree species in which the nest is located and microhabitats (fungus chamber or debris) in which the mite

species was found. Some findings result in new citations for the Neotropics, as the genera *Scatoglyphus* (Astigmata) and *Gemmazetes* (Oribatida), both considered Holartics. Also, new associations between ants and mites are reported.

Thursday 26, Afternoon, Auditorium - Poster

393 - *Cheletoides uncinatus* (Heller, 1880) found as a parasite of peacok (*Pavo cristatus* L), in Holambra, São Paulo and Poços de Caldas, Minas Gerais, Brazil (Acari: Prostigmata: Cheyletidae and Aves: Galliformes: Phasianidae)

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The mites included in the Cheyletidae family are important predators, occurring in most habitats. The majority of species are of free life habits, but Cheyletosomatini tribe includes the genus *Cheletoides* Oudemans, 1899, an assemblage of species which are extraordinarily specialized, living in quills of bird feathers, as predators to quill mites encountered in these hosts. We have examined a peacock specimen (*Pavo cristatus* L), found dead on the road (probably run over) in Holambra, São Paulo, Brazil (22º37'55"S, 47º03'36"O, Alt. 600m). In the quills of wing and tail feathers we observed several specimens of mites that we identified as *Cheletoides uncinatus* (Heller, 1880). However, no other mite could be positively identified as its prey. The examination of the wing feathers of a second specimen, derived from Poços de Caldas, Minas Gerais, Brazil (21º47'16"S, 46º33'41"O, Alt. 1260m), revealed the presence, in the quills, of the same cheyletid, and also numerous exuviae of larvae, nymphae and adults belonging to an unidentified species of a syringicolous Phthiraptera - possibly the prey of the cheyletids. A review in the related scientific literature indicates that the possible preys for this species would be other kinds of quill mites. One must observe, however, that this acari species has been observed only by Heller in 1880 (the specie's author) and by Oudemans, in 1899 and in 1904 (the genus' author). All others who have mentioned this taxon have done so without checking new material. The peacock has been introduced in the whole world as an ornamental bird, including in Brazil. This finding, therefore, represents the reencounter of *C. uncinatus*, 130 years after its original description, even though it occurs in a very common and widespread animal.

Thursday 26, Afternoon, Auditorium - Poster

394 - Mutum-de-Penacho, *Crax fasciolatus* Spix, 1835 (Aves: Craciformes: Cracidae), a new host for *Paralgopsis* sp. (Acari: Analgoidea: Pyroglyphidae: Paralgopsinae) in the Brazilian State of Pará

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The monogeneric subfamily, Paralgopsinae Fain, 1988, includes, amongst the Pyroglyphidae, shaft parasites considered as exclusively associated to parrots (Aves: Psittaciformes: Psittacidae), since its two described species had been recorded only from the neotropical parrots genera *Ara*, *Aratinga*, *Amazona* and *Phyrrhura*. We examined the flight feather quills of one "Mutum-de-Penacho" specimen (*Crax fasciolatus* Spix, 1835), derived from Fazenda Fartura, Santana do Araguaia (09º44'20"S; 50º11'26"O; alt. 1049m), state of Pará, Brazil. Several mite specimens were collected and identified as belonging to the genus *Paralgopsis* Gaud & Mouchet, 1959, but don't correspond to the descriptions of any of the known species for this group [*P. ctenodontus* Gaud, 1968, from Brazil and *P. paradoxus* (Trouessart, 1899), from Colombia]. This finding increases the records of hosts of Paralgopsinae. We report the occurrence of this quill mite in Craciformes, family Cracidae, as new hosts, which indicates that the relationship host/parasite between this Acari group and birds is probably ancient.

Thursday 26, Afternoon, Auditorium - Poster

395 - Quill mites from the domestic hen (*Gallus gallus* L.): first occurrence in Brazil of *Gaudoglyphus minor* (Nörner, 1882), *Dermoglyphus elongatus* (Robin & Mégnin, 1877) e *Paralges pachycnemis* Trouessart & Mégnin, 1874 (Acari: Gaudoglyphidae e Dermoglyphidae)

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Quill inhabiting mites (syringicolous mites) of the feathers of birds in the Phasianidae family (Aves: Galliformes), belong to the two suborders of Acari: Protigmata and Astigmata. Amongst the Prostigmata, only Syringophilidae includes parasitic representatives (species of genera *Picobia* and *Syringophilus*), and Cheyletidae includes specialized predators in subfamily Cheletostomatinae. In the Astigmata group, some families include parasites, as Analgoidea (Dermoglyphidae, Gaudoglyphidae) and Pterolichoidea (Ascouracaridae). The Phasianidae family includes, apart from the domestic hen, turkeys, pheasants, guineafowl and quail. The domestic hen, cosmopolitan due to its domestication, has been associated to seven species of quill mites described in the world: *Syringophilus bipectinatus* (Heller, 1880) and *Picobia polonica* Skoracki, Magowski & Dabert, 2002 (Syringophilidae), *Dermoglyphus elongatus* (Robin & Mégnin, 1877) and *Dermoglyphus columbae* Sugimoto, 1941 (Dermoglyphidae), *Gaudoglyphus minor* (Nörner, 1882) (Gaudoglyphidae), *Gallilichus hiregoudari* D' Souza & Jagannath, 1982 (Ascouracaridae) and *Fainocoptes galli* (Laminosioptidae). In Brazil, only the following species have been recorded: *S. bipectinatus*, *Dermoglyphus* sp. and *G. hiregoudari*, and also *Speleognathopsis galli* Cooremann, 1954 (cheyletid predator of quill parasites). We examined several individuals of both sexes of the domestic hen in the cities of Campinas (Lat. 22º44'20"S; Long. 47º01'15"O; Alt 582m), and Jaguariuna (22º44'05"S, 46º58'59"O, Alt. 601m), state of São Paulo. The following species have been found in the quills of wing and tail feathers of the birds: *S. bipectinatus*, *D. elongatus* (first confirmation of this species occurring in Brazil), and also, for the first time in Brazil, in this host, *G. minor* and *Paralges pachycnemis* Trouessart & Mégnin, 1874, both described here in greater detail.

Thursday 26, Afternoon, Auditorium - Poster

396 - *Speleognathopsis galli* Cooremann, 1954 (Prostigmata: Trombidiformes: Ereynetidae: Spaleognathinae), parasite of *Gallus gallus domesticus* L. in Jaguariúna, São Paulo, Brazil

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The Ereynetidae family comprises species of free living life mites, including two subfamilies that live in the nasal passages of terrestrial vertebrates. The Speleognathinae are exclusive parasites of mammals and birds and feed from on blood and mucus of the respiratory airways of its hosts. The genus *Speleognathopsis* includes a number of parasite species from mammals and birds, with *S. galli* Cooremann, 1954, described in some regions of the world as associated to the domestic hen (*Gallus gallus domesticus* L.). In Brazil, this species has been reported only once, in 1981, from Rio de Janeiro. We have examined two female individuals of domestic hens derived from Jaguariúna (22º44'05"S, 46º58'59"O, Alt. 610m), São Paulo, Brazil, accidently poisoned with a formicide. The necropsy revealed the presence of several forms of Trombidiformes mites, Ereynetidae, in the mucus of the trachea and turbinates, which we identified as *Speleognathopsis galli* Cooremann, 1954. We thus report the occurrence of this rarely observed mite in Brazil.

Thursday 26, Afternoon, Room 3

397 - Impact of nut-infesting eriophyid mite, *Aceria guerreronis* Keifer, on the out-turn and quality of coconut fiber

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Studies were conducted to assess the impact of the nut-infesting eriophyid mite, *Aceria guerreronis* Keifer, on coconut fiber out-turn, nut parameters and fiber quality. For every one point increase in damage grade, a significant reduction was encountered in the mean fiber out-turn of both white and brown fibers. An out-turn of 60.1 kg of white fiber and 59.2 kg of brown fiber was obtained from 1,000 nuts with severe infestation (grade 5) as against a yield of 100.5 and 99.4 kg of white and

brown fiber, respectively, from 1,000 uninfested nuts (grade 1). Economic returns derived from the sale of coconut fiber or related end-products were also drastically affected due to the infestation by *A. guerreronis.* Nut parameters, namely whole nut weight, husk weight, nut weight without husk, water content and kernel weight fell significantly with increase in nut damage grade. Tensile strength of 15.7 kg, fiber length of 10.8 cm and fiber diameter of 0.4 mm were recorded in the fibers extracted from severely damaged nuts resulting in poor quality of the fiber.

Friday 27, Morning, Room 4

398 - Rainforest-restoration success as judged by assemblages of soil- and litter-dwelling mites (Arachnida: Acari)

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Decline in rainforest cover in many areas of Australia is being countered by various forms of forest reestablishment, including ecological-restoration plantings, timber plantations, and unmanaged regrowth. We used assemblages of soil and litter-dwelling mites to determine which style most closely captures the assemblage structure of intact rainforest at 84 tropical and subtropical sites in eastern Australia. Site-types surveyed were pasture (the typical 'pre-restoration' state), unmanaged regrowth, monoculture forestry, multi-species forestry, ecological restoration and intact rainforest. Re-established forest was 5-20 years old. Mites were extracted from soil/litter samples and were identified to family or to finer levels (excluding Oribatida). For two diverse but taxonomically difficult superfamilies characteristic of rainforest, Uropodoidea and Trombidioidea, identification was to morphotaxon. Presence/absence data were analyzed in several ways. First, we used our data to create a list of 'indicator taxa' for pasture and rainforest, and determined the abundance of these indicators for each of the reforestation types. We also calculated morphotaxon richness for uropodoids and trombidioids and compared them among site-types. In both cases, ecological restoration sites were most similar to rainforest. We then used ordination and ANOSIM to compare mite assemblages among site-types. Although mites were able to distinguish clearly between rainforest and pasture sites, they did not identify any reforestation-type that was consistently similar to rainforest. They did, however, indicate that monoculture forestry and multi-species forestry plantations were often not readily distinguishable from pasture. We conclude with a brief discussion of the utility of mites in rapid bioassessment programs.

Thursday 26, Afternoon, Auditorium - Poster

399 - Finding of *Megniniella* sp. mites (Astigmata: Analgidae) on pelicans *(Pelecanus occidentalis*) in Mazatlan, Sinaloa, Mexico

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In the present paper, the finding of Analgidae mites (Astigmata) on pelicans is communicated. Birds for examination were made available through a bird conservation and restoration project, whose aim is to care for ill birds that are sent to Mazatlán Aquarius, in Sinaloa State, Mexico. A total of 20 females and 12 males of an ectoparasitic mite were taken from the feathers of two young pelicans; the mites were isolated and transferred to liquid of Kono, before mounting them in Hoyer´s medium for identification. Using the key of Gaud & Atyeo (1998), the mites were determined as belonging to the Analgidae, subfamily Megnininae, genus *Megniniella*. The species could not be determined. Mites of this genus have been found on other birds. The importance of this communication lies on the fact that this is the first time that mites of this genus are found on pelicans. Further samples of these

mites from the same site may allow the determination as to whether it is a new species or a species already described.

Tuesday 24, Afternoon, Auditorium - Poster

400 - First report on the presence of mites isolated from cultures of nematophagous fungi

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The objective of the present communication is to report the isolation of mites from cultures of nematophagous fungi. Mites (Acari) correspond to an ample group of arthropods whose feeding habits are very diverse; some can be mycophagous, others feed on plant cell contents, others are hematophagous on birds and mammals, predators of other mites, omnivorous, etc. In the development of an investigation on nematophagous fungi, cultures of *Dudugtonia flagrans*, *Arthrobotrys oligospora* and other species were established in disposable Petri dishes. The cultures were maintained under flow bell, using sterilized agar as substrate. To each fungus culture, larvae III of *Haemonchus contortus* nematode were added. This nematode constitutes a serious problem for cattle raising, by causing anemia. In a total of 150 culture boxes, the following mite species were found: *Tyrophagus putrescentiae* and *Sancassania berlesei* (both Astigmata, Acaridae) and *Lasioseius penicilliger* (Mesostigmata, Ascidae). The latter turned out to be very effective to feed on the fungi as well as on nematode larvae. Therefore, colonies of this mite have been established, to further evaluate its ability to feed on larvae of that nematode, and also the potential of the former as biocontrol agents of the latter.

Thursday 26, Afternoon, Room 1

401 - Taxonomic concepts in the Phytoseiidae: the idea of genus according to Athias-Henriot

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The need of deepening systematic studies in the Phytoseiidae family became evident after the Second World War, because of the very vague description and drawings of the species described by the first acarologists, and the increasing economic interest of the species belonging to this family in applied biological control programs against infestations by phytophagous mites in agricultural crops. Many scientists started to work on Phytoseiidae classification and one of them was the French Athias-Henriot. In her first work, she tackled the question of supraspecific grouping in this family from an evolutionistic point of view, and suggested a system for numbering dorsal shield setae, that could be applied both in hypotrichous and holotrichous forms. She also looked for other characters, such as the ratios of the distance between the insertion of some setae on dorsal and sternal shields, the presence of macrosetae on legs, the ratio of length/width of the ventrianal shield etc. After the use of spermatheca for taxonomic purpose by Dosse (1957, 1958), she adopted also this character to define genera, without giving it a particular weight. Meanwhile, she also studied other gamasids, and in 1966 considered the insemination apparatus as the main character for distinguishing superfamilies. It should be mentioned that she distinguished the Phytoseiidae, inside the Laelapoidea, mainly for the dorsal hypotrichy and for the genera inside the subfamily Phytoseiinae, according to the presence (*Typhlodromus* and relative lineages) or absence (*Amblyseius* and relative lineages) of the setae *s3* [*z3* in Rowell et al., (1978) system]. In 1967, she adopted the Lindquist and Evans (1965) chaetotactic nomenclature system in the description of new *Amblyseius* from South America. In the same year she advanced the hypothesis that the insemination apparatus should clarify the phylogenetic kinships better, as, due to its internal position, it is less intensely subject to hereditary modifications in comparison to the external parts of the body that are in direct contact with the environment. One year later, Athias-Henriot published an exhaustive study on the insemination apparatus of Laelapoidea stating the taxonomic importance of this structure. She also studied adenotaxy and sigillotaxy in order to find characters defining natural lineages. In 1975, she studied the dorsal organotaxy of Amblyseiini in

order to define characters to be used in describing the species. Two years later she redefined the genus *Cydnodromus* emphasizing both the importance of the insemination apparatus and the evolution of the solenostome gv3. In describing the new genera *Dictyonotus* and *Pegodromus*, in 1978 and 1981 respectively, Athias-Henriot considered the insemination apparatus and the other characters as having the same weight. In 1983, Ragusa and Athias-Henriot redescribed the genus *Neoseiulus*, considering the insemination apparatus as the main character for the genus definition, associated to a series of other (related) characters.

Wednesday 25, Afternoon, Room 6

402 - A green technology – Using phytoseiid predators to manage spider mite pests

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Neoseiulus longispinosus (Acari: Phytoseiidae) were released in a polyhouse to control *Tetranycus urticae* (Acari: Tetranychidae) which was damaging rose plants. The chlorophyll content of the leaves of the plants onto which the predators had been released and of the plants of the adjoining plots, where the predators had not been released, was monitored for seven weeks after predator release. Though the grower was spraying acaricides in the adjoining plots and was satisfied with the control of *T. urticae* achieved, the plants appeared less healthy than the plants in plots where predators were released. The chlorophyll content of leaves of plants onto which the predators had been released at 1:25 ratio was 31.4% higher than the chlorophyll content of leaves of plants in plots where acaricides were used to manage *T. urticae*. Further, the annual cost of management of *T. urticae* was Rs. 74,908.00 per hectare using *Neoseiulus longispinosus* as compared to Rs. 160,607.00 per hectare using acaricides.

Wednesday 25, Morning, Room 3

403 - Integrated management of coconut eriophyid mite, *Aceria guerreronis*, in Tamil Nadu, India – A case study

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An outbreak of eriophyid mite, *Aceria guerreronis* Keifer (Acari: Eriophyidae), was first reported in India in 1998. The ill effects caused by the use of chemicals required the search for alternative, ecofriendly methods. Earlier studies revealed the importance of K in pest management. Integrated Management (IM) package was validated against *A. guerreronis* by conducting eighteen demonstration trials between 2004 and 2007. IM package includes application of inorganic (Nitrogen, Phosphorus, Potash and micronutrients), organic nutrients (decomposed farm yard manure + neem cake), basin cultivation of sunnhemp and spraying of botanicals during summer months. The impact of IM package was compared with Farmers Practice (FP). The results revealed that more than 76 per cent reduction in mite population was recorded in gardens treated with IM after three years. No significant reduction in predatory mite population was recorded in IM treated trees. The percentage green nut damage in IM treated trees reduced from 57.2 in 2004 to 13 per cent in 2007. In addition, IM treated gardens recorded lower Mean Grade Index (MGI) (1.61) with higher nut yield (206 nuts/tree/year) and copra content (16 – 20 kg/ 100 nuts) as compared to higher MGI (2.80), lower nut yield and copra content in FP gardens. The benefit/ cost ratio was high in IM treated gardens when compared to FP gardens. Considering the habitat of coconut, regular application of nutrients along with spot application of botanicals will sustain and enhance the production of nuts, besides minimizing mite damage significantly.

Thursday 26, Afternoon, Auditorium - Poster

404 - Geometric morphometric analysis of Mexican species of *Arrenurus* (*Megaluracarus*) Viets, 1911 (Acari: Hydracarina: Arrenuridae)

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One of the most highly diverse genus of water mites is *Arrenurus*. At least 300 species have been included in the subgenus *Megaluracarus* of this genus, of which male´s cauda is one of the distinctive characters; measurements of this morphological feature have provided the taxonomic basis for the group. Our research applies for the first time a geometric morphometrics approach to describe and compare the morphology of the idiosoma of the species of this group. We explored patterns of variation of the shape of the male of eleven Mexican species of subgenus of this group, to provide information for taxonomic, phylogenetic or ecological inferences. Digitized images of the dorsum of 130 *Megaluracarus* specimens were obtained under scanning electronic microscopy. Landmark configurations were registered with 10 homologous anatomical loci or landmarks (LM), two on both edges of the idiosoma, two at the union of the dorsal and ventral plates and six on the dorsal plate setae, excluding the cauda. We also registered the idiosoma outline. We used MakeFan (IMP) software to define 58 mathematically equivalent semilandmarks (SLM) which were confined in a curve with SemiLand (IMP). All "x, y" coordinates of LM and SLM were digitized using TPSDig2.12. We performed a Procrustes superimposition with all the 130 coordinate configurations, using CoordGen (IMP). Partial warps as shape variables were extracted and variance was examined by Principal components analysis (PCA) and Canonical variate analysis, using PCAGen and CVAGen (IMP). In both analyses, patterns of size-free shape variation of eleven Mexican species of *Arrenurus* (*Megaluracarus*) revealed at least six general forms. The taxonomic utility of these six shapes of the morphology of idiosoma remains to be explored with more species to be added to the morphometric analyses. Our study shows the utility of a geometric morphometric approach to reveal useful characters for the taxonomy of water mites.

Wednesday 25, Morning, Room 3

405 - Management strategy of *Raoiella indica* Hirst in Cuba, based on biology, host plants, seasonal occurrence and use of acaricide

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Raoiella indica is a bright red mite that attacks many important plant species, mainly palm and banana species. Significant infestations have been found damaging *Musa* species in Cuba, where it can become a key pest because of the greater economical importance of bananas compared to coconuts. To establish the real potential of this mite as a pest, the following activities were performed: a) a survey to find out its range of host plants in the country; b) its development and reproduction parameters were studied on coconut and banana leaves as host plants; c) its seasonal variation on *Musa* sp. and the associated predatory mites; d) a mathematic model was built to represent the observed seasonal variation on *Musa* sp.. In addition, the miticide effect of Mitigan (Dicofol 18% emulsifiable concentrate, EC) and the line 13 of *Bacillus thuringiensis* on females and eggs were evaluated. Twenty one plant species were found as host, of which 13 were Arecaceae, five were Musaceae and one was Strelitziaceae and one was Zingiberaceae. *Mycrocycas calocoma* and *Cycas* sp. are reported as new host plants for this mite. Eggs hatched after an average of 8.5 and 8.1 days on coconut and banana, respectively. The larvae developed to protonymphs in 8.7-8.8 days. Deutonymphs developed to adults in 6.6-9.2 days. The whole period from egg to adult lasted 31.4±3.31 days on coconut and 33.4±4.76 on banana leaves. Female oviposition period, longevity and total oviposition were higher on coconut than on banana. The red palm mite population showed an exponential increase, reaching a peak in the dry season. *Amblyseius largoensis* Muma was the only predator species recorded in association with the red palm mite. In general, there was a correspondence between prey and predator population trends; a forecasting model helped to conceptualize how the various processes affected mite population. The

acaricide Mitigan showed the best control of *R. indica*. Data obtained in the study made possible the design of a management strategy for *R. indica* in Cuba, but until now, the best recommendation is to maintain the surveillance system.

Friday 27, Morning, Room 2

406 - Characterization of human and animal parasitism by the re-emerging tick *Ornithodoros brasiliensis* (Acari: Argasidae)

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Ornithodoros spp. are hematophagous parasites of humans and animals, being considered a public health issue in several countries. These ticks are vectors of pathogens, and also can induce a non-infectious toxic syndrome directly associated to their bite. *Ornithodoros brasiliensis* is a nidicolous tick, only found in southern Brazil mountain region. Recently, cases of *O. brasiliensis* parasitism were reported again in this region, more than 50 years after the last report. Here we describe a preliminary epidemiologic characterization of *O. brasiliensis* parasitism. We also describe the clinical findings of a dog bitten by *O. brasiliensis*, as far as we are aware the first case of a non-paralytic tick toxicosis in Brazil. Farms located in the municipalities of São Francisco de Paula and Jaquirana, state of Rio Grande do Sul, endemic regions for *O. brasiliensis*, were randomly selected. In these farms, searches for *O. brasiliensis* were performed, and the inhabitants were interviewed in order to identify risk factors and to obtain information about retrospective cases of *O. brasiliensis* bite. Four *O. brasiliensis* nests (containing ticks in all developmental stages) were found in sand of house basements or farm sheds. Data indicate that *O. brasiliensis* feeds on humans, dog, chicken, rat, long-nosed armadillo (*Dasypus hybridus*), and hog-nosed skunk (*Conepatus chinga*). The retrospective analysis of human cases allowed the identification of 11 people bitten in the last 4 years. Also, five people noticed that they were bitten in the last 4-10 years, and six people were bitten more than 10 years ago. All bitten people reported the following symptoms: transient skin rash, intense pruritus, edema and erythema, slow-healing lesion. Additionally, a part of bitten people showed local pain, blisters, marked limb edema, transient fever, malaise, headache, and slight dyspnea. Despite some bitten people needed medical attention, the local medical authorities had rare or nil information on this tick. Thus, the most part of bitten people were treated for allergy. Also, we assisted a case of a dog bitten by five *O. brasiliensis* ticks. This animal presented clinical and laboratory findings compatible with a tick toxicose syndrome, such as diffuse skin rash, apathy, pyrexia, anemia, and CPK increase. No tick borne pathogens were found in bitten dog's blood. Specimens of *O. brasiliensis* collected in field were feed on rats and mice in laboratory. The tick bite induced extensive lesions, fever and local tissue necrosis in laboratory animals. The re-emergence of human and animal parasitism by *O. brasiliensis*, the toxic effects related to its bite and the poor knowledge about this tick may place this parasite as an emerging public health concern in Southern Brazil. This research was financially supported by CNPq, CAPES and INCT-Entomologia Molecular.

Wednesday 25, Afternoon, Auditorium - Poster

407 - Weight gain and blood parameters alterations induced by *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae) tick on cattle under field conditions

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus* is a one-host tick, considered most harmful bovine parasite. This tick is widely distributed between 32°N and 35°S, which includes important cattle breeding zones, such as Latin America and Oceania. It is well-known that *R. microplus* causes great

economic losses, directly through bovine blood loss, and indirectly, via transmission of tick-borne pathogens, such as *Babesia* spp. and *Anaplasma marginale*. Nevertheless, there is insufficient information about the impact of tick infestation in host health under field conditions. The aim of this work is to determine the effects of a low tick infestation, in field conditions, in cattle weight gain and some blood parameters. To address these issues, 40 bovines (*Bos taurus taurus*, Devon and Red Angus breeds), were maintained in field conditions in the municipality of São Gabriel, southern Brazil for 126 days, between the months of August and December (late winter and spring). These animals were divided in two groups: (i) bovines treated three times with ivermectin (200 µg/kg); and (ii) no treated bovines. Adult ticks were periodically counted on left side of the bovine body. The bovine weight was registered at day 0 and 126. Blood samples were collected from all bovines at days 0, 42, 84 and 126. During this experiment, tick count was always under 100 ticks per bovine, even in non-treated animals, characterizing a low parasite load. As expected, treated bovines showed a significant lower tick count than treated cattle. Ivermectin-treated animals presented a better weight gain compared with non-treated bovines. Additionally, the non-treated bovines showed lower hematocrit, leukocyte count, serum fructosamine, and phosphorus serum content. These results indicated a systemic effect of tick parasitism in infested bovines, leading to productivity losses. This research was financially supported by CNPq, CAPES and INCT-Entomologia Molecular.

Tuesday 24, Afternoon, Auditorium - Poster

408 - A new species of *Aculops* Keifer (Acari: Prostigmata: Eriophyidae) on *Dipsacus laciniatus* L. (Dipsacaceae)

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Investigations have been conducted in Europe in the last decade in order to find potential agents for biological control of invasive teasels in North America. During surveys conducted in Serbia in May 2007, the new eriophyid mite species *Aculops* n. sp. (Acari: Prostigmata: Eriophyidae) was collected from *Dipsacus laciniatus* L. (Dipsacaceae). In this presentation the new species is described and illustrated. Differential diagnosis is provided in comparison with *Aculops salixis* Xue, Song and Hong, 2007. This is the first eriophyoid mite species in the genus *Aculops* described from plant species of the family Dipsacaceae. Subsequent surveys for this new species at the original collection site and in the surrounding region have been unsuccessful and it is presumed that this species is relatively rare, at least in northern Serbia.

Thursday 26, Afternoon, Auditorium - Poster

409 - Comparative biological aspects and growth rate of *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae) and *Amblyseius largoensis* (Muma) (Acari: Phytoseiidae)

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The cassava green mite *Mononychellus tanajoa* is an important pest of cassava *Manihot esculenta* Crantz (Euphorbiaceae) in the Northeastern state of Maranhão, Brazil. Predatory mites of the family Phytoseiidae are the main natural enemies of pest mites and are naturally found inhabiting cassava plants. We compared some biological aspects and the growth rate of *M. tanajoa* and its main natural enemy in the study region, the predatory mite *Amblyseius largoensis*. All experiments were conducted in the laboratory on leaf discs (2.5 cm diameter) made from cassava leaves. Predatory mites were fed with all developmental stages of *M. tanajoa*. The incubation period was 4.76 ± 0.01 (means ± SE) for *M. tanajoa* and 1.78 ± 0.80 days for *A. largoensis*. The developmental stages of larvae, protochrysalid, protonymph, deutochrysalid, deutonymph and teliochrysalid for *M. tanajoa* were 1.03 ± 0.02, 0.85 ± 0.02, 0.96 ± 0.02, 0.75 ± 0.01, 1.00 ± 0.02 and 0.99 ± 0.02 days while the periods of larvae, protonymph and deutonymph for *A. largoensis* were 0.62 ± 0.03, 0.72 ± 0.04 and 0.77 ± 0.05 days. The period from egg to adult for *M. tanajoa* and *A. largoensis* were 10.21 ± 0.11 and

4.74 ± 0.14 days, respectively. The instantaneous rate of increase (ri) of *M. tanajoa* was higher (0.42) than that of the predatory mite *A. largoensis* (0.38). The laboratory results suggest that the predatory mite *A. largoensis* may help to regulate populations of *M. tanajoa* in the field.

Tuesday 24, Afternoon, Auditorium - Poster

410 - A new genus and a new species in the Diptilomiopidae (Eriophyoidea) from yellow mombin, *Spondias mombim* L. (Anacardiaceae), from northeast Brazil

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The yellow mombin, *Spondias mombin* L. (Anacardiaceae), is a common fruit tree cultivated in Northeastern Brazil, where it is known as "cajá-mirim". The yellow mombin is native of the tropical Americas and of natural occurrence in the lowland moist forests of the Amazon in South America, as well as southern Mexico, Central America and the Caribbean. In Brazil it is largely distributed in the north and northeast States. Yellow mombin's fruits are commonly used to prepare juice, ice cream and jelly. So far, no eriophyoid mite has been described or reported from *S. mombin*. However, four species have been described from plants of the *Spondias* genus, all in Asia (India and Thailand), from *S. mangifera* Willd., *S. bipinnata* Airy-Shaw & Forman and *S. cytherea* Sonn., belonging to *Diptilomiopus* Nalepa, *Tegolophus Keifer* and *Vasates* Shimer genera, respectively. The objective of the present study was report the occurrence of a new Diptilomiopidae genus and a new species found on the *S. mombin*, in the State of Pernambuco, northeast Brazil. In the laboratory, twenty-one mites were collected from yellow mombin leaf by direct examination under a microscope stereoscope, mounted in slides using Berlese modified medium and studied under a phase-contrast microscope. These vagrant Eriophyidae specimes were found on the lower leaf surface and exhibited yellowish color in life. Specimens were identified as belonging to a new genus and a new species in the family Diptilomopidae. The new genus is close to *Sakthirhynchus* Umapathy & Mohanasundaram, 1999; *Chakrabartiella* Amrine & Stasny, 1994; and *Hyborhinus* Mohanasundaram, 1986 genera of Rhyncaphytoptinae, in the absence of coxal seta I (*1b*). However it differs from these genera especially in the leg and prodorsal shield chaetotaxy. It differs from *Sakthirhynchus* in the presence genual seta (*l''*) and tibial seta (*l'*) on leg I and prodorsal shield tubercles, all missing in *Sakthirhynchus*; from *Chakrabartiella* in the absence of genual seta (*l''*) on leg II and of scapular setae (*sc*), both present in *Chakrabartiella*; and from *Hyborhinus* in the absence of femoral seta (*bv*) on legs I and II; genual seta (*l''*) on leg II and of scapular seta (*sc*), all present in *Hyborhinus*. Description of the new taxon is in preparation.

Tuesday 24, Afternoon, Auditorium - Poster

411 - A new species of *Dichopelmus* (Eriophyidae) from the Surinam cherry, *Eugenia uniflora* L. (Myrtaceae) from Brazil

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The Surinam cherry, *Eugenia uniflora L.* (Myrtaceae), is a native tree fruit in Brazil and is largely disseminated throughout the country where it is commonly known as "pitanga". This fruit tree grows to 10 meters tall; young leaves are reddish and become green when mature. Fruits are consumed *in natura* or used to prepare juice, ice cream, jelly, liqueur and wine. Four eriophyoid mites have been reported from the Surinam cherry: *Aculops eugeniae* Keifer, 1977 from Florida, USA; *Aculus pitangae* Boczek & Davis, 1984; *Calacarus*

kleithria Flechtmann, 2003; and *Diptilostatus nudipalpus* Flechtmann, 2003, the last three species from southeastern Brazil. The objective of the present study was report the occurrence of a new Eriophyidae species associated with *E. uniflora*, in the State of Pernambuco, Brazil. Specimens were collected in the germplasm collection of the Department of Agronomy, Universidade Federal Rural de Pernambuco, in Recife, Brazil (8°01'L and 34º56'W). These vagrant Eriophyidae specimens were found on the lower leaf surface and exhibited yellowish color in life. Twenty mites were mounted in slides using Berlese modified medium and studied under a phase-contrast microscope. Specimens were identified as Phyllocoptinae belonging to the genus *Dichopelmus* Keifer, 1959. The new species is similar *D. notus* Keifer, 1959 and *D. flechtmanni* Huang, 2001 in the short scapular seta (*sc*) (reaching only the first dorsal annulus in *D. notus* and the second in *D. flechtmanni*) and in the 4-rayed divided empodium. However the new species differs from the mentioned species for the completely smooth prodorsal shield (almost smooth in *D. notus* but presenting longitudinal furrows and rough in *D. flechtmanni*); in the presence of elongated microtubercles in the median region of the dorsal annuli (absent in *D. notus*; sparse, not elongated and not restrict to the median region in *D. flechtmanni*); and in the epigynum ornamentation: basal half area smooth and the distal half with a row of longitudinal lines (in *D. notus* the epigynum longitudinal lines extend over the distal half occupying almost the entire coverflap and in *D. flechtmanni* the epigynum presents two rows of longitudinal lines and the basal area is not smooth). Description of the new species is in preparation.

Thursday 26, Afternoon, Auditorium - Poster

412 - Does food supplementation favor *Amblyseius herbicolus* (Chant, 1959) (Acari: Phytoseiidae) to control *Oligonychus ilicis* (McGregor) (Acari Tetranychidae) on coffee?

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The red spider mite, *Oligonychus ilicis* (McGregor) (Acari: Tetranychidae), is an important pest of coffee plants for reducing the photosynthesis area of the leaves and consequently the yield. Many mites of the family Phytoseiidae are known as efficient predators of this pest. *Amblyseius herbicolus* (Chant, 1959) (Acari: Phytoseiidae) is a generalist predator, feeding on spider mites and pollen and is easily found on coffee plants. To test if *A. herbicolus* can control a small population of the red spider mite, we carried out an experiment in a local scale. Coffee leaf discs (3 cm in diameter) were kept floating on water in a plastic cup (50 mL). Four treatments were performed, as follow: (1) thirty adult females of *O. ilicis* with one adult female *A. herbicolus*; (2) thirty adult females of *O. ilicis* with one adult female of *A. herbicolus* and a small amount of cattail pollen; (3) thirty adult females of *O. ilicis*; and (4) one adult female of *A. herbicolus* with a small amount of cattail pollen. Thirty replicates were performed for each treatment and each replicate consisted by one leaf disc. The mites were kept on the leaf discs during the period of nine days. In the presence of prey and pollen as food sources, the predator could increase its survival during the whole period of the experiment ($p < 0.0001$). Moreover, there is no effect of the treatments on the oviposition rate of the predator ($p = 0.3379$). When the *O. ilicis* faced the presence of pollen on the leaf discs its oviposition rate presented a significant increased ($p < 0.0001$) and its eggs hatched earlier ($p < 0.0001$). The results suggested that the presence of pollen as a complementary food source for the predators could only contributed for a longer survival of the predator, but in contrast increased the oviposition rate and reduced the incubation period of the eggs of *O. ilicis*. Future experiments with a more large temporal scale will be done to study the efficiency of *A. herbicolus* and food supplementation on control of *O. ilicis*. This research was financially supported by FAPEMIG.

Thursday 26, Afternoon, Auditorium - Poster

413 - Selectivity of the insecticide Rynaxypyr for three species of phytoseiid mites relevant to coffee and citrus in Brazil

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Among the predaceous mites, the Phytoseiidae are the most important and studied. The phytophagous mites *Brevipalpus phoenicis* (Geijskes) (Tenuipalpidae) and *Oligonychus ilicis* (McGregor) (Tetranychidae) are frequently found on coffee (*Coffea* spp.) in association with the phytoseiids *Iphiseiodes zuluagai* Denmark & Muma, *Euseius alatus* DeLeon, *Amblyseius herbicolus* (Chant), *Amblyseius compositus* Denmark & Muma and *Euseius citrifolius* Denmark & Muma (Acari: Phytoseiidae). On citrus (*Citrus* spp.), the phytoseiid species frequently associated with the pest mites, particularly *B. phoenicis*, are *I. zuluagai*, *E. alatus*, *A. herbicolus*, *A. compositus*, *E. citrifolius*, and *Euseius concordis* (Chant). The purpose of this research was to study the effects of the product Rynaxypyr (Premio 20 SC, DuPont) on three phytoseiid species relevant to coffee and citrus, following standard laboratory procedures. The method used was residual spraying on a glass surface, recommended standard for laboratory testing of adverse effects on predaceous mites. The products were sprayed in a Potter tower, with a deposit of spray of about 1.7 mg/cm^2. Glass cover slips (20 x 20 mm) floating in water in a 5-cm Petri dish in diameter and 2-cm in depth, uncovered, were used as a surface for application of the products, and as a support for the mites. After application of the product, the slides were placed to dry under ambient conditions for one hour, and then placed in on the surface of the water, in the center of the dish; the water served for the mites to drink and to prevent them from escaping. A small amount of castor bean pollen was placed in the center of the cover slip, to serve as food for the surviving phytoseiids. Five mated female phytoseiids were taken from stock colonies and transferred onto each cover slip in dose-response study design, with 7 treatments and 6 replicates, using a completely randomized experimental design. Each test lasted 8 days, with a daily count of the live females and eggs laid. The product Rynaxypyr, in all tested dosages (15, 30, 50, 100 and 500 mg a.i./liter of water) was selective for the tested phytoseiid species, *A. herbicolus*, *I. zuluagai* and *E. citrifolius*, being classified as not harmful, comparable to the agrochemical hexythiazox (Savey 500 WP) equivalent to a harmless standard of selectivity in laboratory. Overall, the treatments resulted in low mortality rates and negligible impact on reproduction. Rynaxypyr is therefore a complement to programs of integrated pest management, to preserve the populations of predatory mites in crops of coffee and citrus, among others, in Brazil. This research was financially supported by DuPont Brazil.

Thursday 26, Afternoon, Auditorium - Poster

414 - Resistance of the predatory mite *Phytoseiulus macropilis* Banks (Acari: Phytoseiidae) to dimethoate

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The use of predatory mites resistant to acaricides is a strategy that could be applied to improve biological control of phytophagous mites. The predatory mite *Phytoseiulus macropilis* Banks (Phytoseiidae) is a natural enemy of pest mites on strawberry crops in Brazil. Two predatory mite populations were evaluated, both from strawberry fields of Barbacena, State of Minas Gerais. The first was maintained for three years on bean plants, *Phaseulus vulgaris*, in a greenhouse, before the evaluations. The second, collected about three year after the first population, was maintained for a short period on *Canavalia ensiformis* leaves under laboratory conditions before the evaluation. Both populations were fed with *Tetranychus urticae*. Predators were treated with 2.5 ml solution of Nortox 500 CE (a.i. dimethoate) at the following concentrations: 0, 0.155, 0.31, 0.155, 7.5, 600 and 1250 mg a.i./L. The mortality curves for each population were calculated. From theses curves the lethal concentration for 50% of the population (LC_{50}) was estimated and the differential selectivity index (DSI_{50}) was calculated. The LC_{50} of the predators from strawberry fields and for those kept in the greenhouse were 10.51 mg a.i./mL and 1.17 mg a.i./mL, respectively. The DSI_{50} (differential selectivity index) showed that predatory mite population from strawberry field was 9.4 times more resistant to dimethoate than those reared in the greenhouse for three years. Further studies are

needed in order to evaluate the use of resistant predatory mite population in biological control of pest mites in strawberry fields. This research was financially supported by FAPEMIG.

Tuesday 24, Afternoon, Auditorium - Poster

415 - Phytoseiid mites (Acari: Phytoseiidae) of the Brazilian Cerrado vegetation

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Mites of the family Phytoseiidae are important predators, several of which have been demonstrate to be able to maintain potential pest mites below the economic damage level. Those mites are still poorly known in the Brazilian Cerrado, the second largest biome in Brazil and which undergoes severe devastation. Losses with such devastation are irrecoverable, as endemic species, including mites dependent upon such vegetation may go extinct. The aim of this work was to record phytoseiid species on plants of this vegetation. Twelve visually most abundant plant species (including arboreal, shrubby and herbaceous plants) were examined, from each of ten fragments from the states of Goiás, Mato Grosso do Sul and Minas Gerais (18°51'S / 52°35'W; 18°15'S / 52°44'W; 17°51'S / 51°45'W; 17°49'S / 51°41'W; 17°40'S / 51°02'W; 17°24'S / 49°45'W; 18°31'S / 48°54'W; 15°38'S / 47°44'W; 15°59'S / 46°41'W; 16°17'S / 47°27'W). Each sample consisted of leaves, branches, flowers and fruits (the latter, when present). Each sample was rinsed with 30% alcohol to extract mites; the liquid was then passed through a filter (25µm opening), and the material retained on the filter was transferred to vials with 67% alcohol. The mites were then mounted in Hoyer´s medium for identification. In total, 24 phytoseiid species of 13 genera were found: *Amblyseius aerialis*, *Amblyseius neochiapensis*, *Euseius citrifolius*, *Euseius plaudus*, *Euseius sibelius*, *Galendromus annectens*, cf. *Graminaseius* sp., *Iphiseiodes zuluagai*, *Metaseiulus ferlai*, *Neoparaphytoseius sooretamus*, *Neoseiulus anonymus*, *Neoseiulus benjamini*, *Neoseiulus idaeus*, *Neoseiulus melinis*, *Neoseiulus tunus*, *Phytoseius guianensis*, *Phytoseius intermedius*, *Phytoseius nahuatlensis*, *Proprioseiopsis dominigos*, *Proprioseiopsis ovatus*, *Ricoseius loxocheles*, *Typhlodromalus aripo*, *Typhlodromalus peregrinus* and *Typhlodromus neobakeri*. This result evidences predominance of Amblyseiinae sub-family over the others as it represented 76% of the species found, as observed in previous surveys conducted in the Neotropical Region. Also important is the fact that many of species found has also been reported from the Atlantic Forest. That suggests that devastation of those regions, reducing it to fragments, and agricultural exploitation of those corresponding devastated areas has lead to homogenization of the species composition of those regions.

Tuesday 24, Afternoon, Auditorium - Poster

416 - Similarity between mite communities of *Jatropha curcas* L. and the associated spontaneous plants

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Jatropha curcas L. (Euphorbiaceae) has been calling the attention of agriculturists because of the potential of its fruits for production of biodiesel. However, for being a new crop, still in need of adequate selection, further studies are required in order to determine the best management of the pests affecting it. An option would be the use of spontaneous plants to enhance the action of natural enemies, and/ or to extinguish the plants that might function as reservoirs for the pests. High infestations of pest mites like *Polyphagotarsonemus latus* and *Tetranychus bastosi* have been observed on *J. curcas*. Several authors have reported the importance of spontaneous vegetation in other crops as reservoirs of important natural enemies of pest organisms attacking the crop. The objective of this study was to evaluate and compare the mite fauna *J.*

curcas and in the associated spontaneous vegetation. The study was conducted in two sites: in two fields in each of two sites, namely Jales-SP and Itapagipe-MG (20º12'S/50º32'W and 20º13'S/50º30'W; 19º53'S/49º33'W and 19º49'S/49º19'W). In each area, 10 specimens of *J. curcas* were marked for monthly samplings during one year. Spontaneous plants, visually most abundant in each field, were also sampled in the same period. In total, 20 species of spontaneous plants were sampled in the four collection areas. On *J. curcas*, 21 mite species were found in Itapagipe-MG and 20 in Jales-SP. About 60% of the species found on *J. curcas* were also found on the spontaneous vegetation; these were *Amblyseius neochiapensis*, *Asca* sp., *Brevipalpus obovatus*, *Czenspinskia* sp., *Euseius citrifolius*, *Euseius concordis*, *Galendromus annectens*, *Iphiseiodes zuluagai*, *Lorryia formosa*, *Oulenzia* sp., *Polyphagotarsonemus latus*, *Pronematus* sp., *Proprioseiopsis* sp., *Tarsonemus* sp. and *Typhlodromalus aripo*. Taking into account only the Phytoseiidae mite species in both collection sites, similarity between *J. curcas* and spontaneous plants was 71%. Of the phytoseiids found concurrently on *J. curcas* and spontaneous plants, *E. citrifolius*, *E. concordis* and *T. aripo* were the most prominent, observed in all the areas and in large numbers. The occurrence of *T. aripo* is noteworthy, given its importance as an efficient biological control agent in other crops. *Euseius citrifolius* and *E. concordis* are generalist species, which have preference for pollen, although they can also act as predators. Phytophagous mites occurring concurrently on *J. curcas* and spontaneous plants were found in lower levels in the latter; therefore those plants do not seem to be used as important reservoirs of those mites in those sites. Conversely, considerable numbers of predators were found on the spontaneous plants, suggesting that they could serve as important reservoirs of predatory mites.

Thursday 26, Afternoon, Auditorium - Poster

417 - Role of *Blattisocius keegani* Fox as a biological control agent on two date mites in Egypt

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Mites are among the most important pests of stored products in many parts of the world. This study was conducted on mite populations associated with stored dried dates of the Gazally variety in Alexandria, Egypt. Ten mite species belonging to seven families were collected and recorded. The most common species belongs to the Acaridae (27.69%), followed by species of Ascidae (19.7%), Glycyphagidae (15.49%), Carpoglyphidae (13.1%) and Cheyletidae (11.21%). The most dominant species were *Tyrophagus putrescentiae*, *Blomia freemani*, *Blattisocius keegani*, *Carpoglyphus lactis* and *Cheyletus malaccensis*, with averages of 30.2 ± 2.3, 21.7 ± 2.1, 18.5 ± 1.8, 18.3 ± 1.9 and 15.7 ± 2.2 mites/kg of dates, respectively. The effect of the predatory mite *B. keegani* as biological control agent of *T. putrescentiae* and *B. freemani* on dried dates was evaluated. The daily mean numbers of prey consumed were 2.65 ± 0.18 and 1.83 ± 0.06, while the total mean numbers of prey consumed were 40.7 ± 1.68 and 35.9 ± 1.1 per female predator. Mean total longevities were 15.3 ± 0.83 and 19.7 ± 0.81 days on those respective prey species. Statistical analyses showed significant differences between means.

Tuesday 24, Afternoon, Auditorium - Poster

418 - Acaricidal activity of essential oil of *Ocotea limae* Vattimo from Pernambuco against *Tetranychus urticae* (Acari: Tetranychidae)

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The problem of two-spotted spider mite, *Tetranychus urticae* Koch, is due to the great adaptability to the numerous crops followed by high temperature environments. Control strategies with the use of acaricides have become the main tactic to minimize the damage caused to crops of economic interest. However, indiscriminate use of conventional acaricides has promoted adverse effects of these products, such as toxicity to applicators, environmental pollution and residues in food. Our research group is developing studies of alternative pest control, highlighting the use of

aromatic herbs belonging to the biome of Pernambuco. Among the products with biological activity recognized are species belonging to the genus *Ocotea*, which is included in the family Lauraceae. Species of this genus are recognized by the production of essential oil. This is the case of the species *Ocotea limae* Vattimo that grows spontaneously in fragments of the Atlantic Forest in Pernambuco. Due to their high volatility, essential oils have been investigated for their potential as a fumigant alternative to conventional acaricides. This study aims to evaluate the fumigant action of essential oil of *O. limae* on the two-spotted spider mite (*T. urticae*). Bioassays were conducted under laboratory conditions of 26±1°C, 65±10% RH and 12h photophase. Petri dishes (9 cm in diameter) with three leaf disks of *Canavalia ensiformis* (L.) (2.5 cm in diameter) containing ten adult female two-spotter spider mite, laid out on disks of dampened filter paper, were placed in fumigation chambers with a capacity of 2.5L. The essential oil of *O. limae* and eugenol (positive control) were applied in concentrations ranging from $6.4x10^{-5}$ to 4.0µL/L air. The parameters: mortality and oviposition were evaluated after 24 hours of exposure. The data were submitted to ANOVA and means compared by Tukey test ($P<0.05$). The LC50 estimates were obtained by Probit analysis. It was observed that at the concentration of 4.0µL/L air *O. limae* oil promoted 97.7% of mortality of mites. Significant reduction in the posture of *T. urticae* was observed for *O. limae* oil at concentration of 0.4µL/L air. Value of LC50 estimated of *O. limae* oil was 1.01µL/L air. These results, although preliminary, suggest that *O. limae* oil is promising for the control of *T. urticae* because of its toxicity associated with a reduction of the oviposition. However, further studies should be conducted to optimize the potential of this oil under field conditions and evaluate cost-effective for use in integrated management of the two-spotted spider mite.

Wednesday 25, Afternoon, Auditorium - Poster

419 - Preliminary study of artificial feeding of *Rhipicephalus sanguineus* (Acari: Ixodidae) through the capillary tube technique

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Rhipicephalus sanguineus, known as the brown dog tick, is a common ectoparasite of domestic dogs that can be found almost worldwide. It is a three-host tick, each active developmental stage (larva, nymph and adult) feeding only once and molting away from the host. Once engorgement is complete, the female detaches from the host to oviposite about 4,000 eggs in the environment, dieing after ovoposition. *R. sanguineus* ticks are known vectors of the pathogens *Babesia canis* and *Ehrlichia canis*, the etiological agents of canine babesiosis and canine monocytic ehrlichiosis, respectively. Ticks are second only to mosquitoes as vectors of human diseases. Nowadays, the most common acaricide used for tick control are fipronil, amitraz, carbaryl, pyrethroids and macrocyclic lactones. Nevertheless, the long-term use and misuse of acaricides is a problem that may result in environment pollution and acaricide resistance in tick populations. The present study aimed to adjust the artificial feeding technique through capillaries for *R. sanguineus*. Three groups (A, B and C) of 25 semi-engorged female ticks were formed. Each group was previously allowed to feed on rabbits for 4, 5 and 6 days, respectively, and then fed with citrated canine blood using capillary tubes twice a day for a period of 3 days. Ticks from all three groups were capable of feeding, but group B females (after 5 days of feeding on rabbits) increased their weight more than the other two groups; i.e., mean weight gain: A-0.74 mg, B-4.4 mg, C-1.8mg. No female of the studied groups completed the engorgement by *in vitro* feeding. In addition, a few females from the three groups did not show any increase in their weight. Thus, further bioassays must be conducted to certificate the correct time of exposition of the females to rabbits before artificial feeding. This information can contribute to the study of new potential acaricides.

Wednesday 25, Afternoon, Auditorium - Poster

420 - Disturbance of fire on soil mites in a *Nothofagus pumilio* forest from Patagonia, Argentina

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Fire is a phenomenon of great ecological impact, promoting profound changes in the scenery and in communities. In Patagonia, and particularly in the Andinean-Patagonic forests (*Nothofagus* spp.), fire has been a constant problem. The relationship between vegetation and soil micro arthropods and as well as between the disruption of forests and its consequence on these organism have been studied. However, the disturbance produced by fire and its impact on the soil micro arthropods have not been studied in Argentina. Thus, in Argentina how edafic conditions are changed, which mite orders are most affected and how re-colonization process of these environments take place are unknown. This research is intended to study the abundance and diversity of soil micro arthropods of a *Nothofagus pumilio* (lenga) forest in Patagonia, a large region of southern Argentina. Samples were collected in two seasons (summer and autumn 2009), from a site burned about one year before and from a control, unburned site. At each sampling date, 5 samples of 1000 cc of litter and soil were collected from each site and placed in Berlese funnels for mite extraction (using a bulb of 25 W). After a week, the extracted mites were separated under a magnifying glass, counted and identified to order. Chemical analysis of the soil was conducted (pH 1:1; % MO; % CO; % total N; C/N; P disp. mg kg-1; S-SO4- mg kg-1; CIC eq/100g; Ca meq/100g; Mg meq/100g; K meq/100g; Na meq/100g.) and water content was determined. Preliminary results showed that the mite orders found at both sites were Oribatida, Mesostigmata, Prostigmata and Astigmata. In the control site, the most abundant mites were Oribatida, followed by Mesostigmata. The opposite was observed in the site burned the year before. Different proportions of each group were observed in different seasons; in both sites, the non-Uropodina Mesostigmata and Prostigmata were most abundant in the summer whereas Oribatida and Uropodina were most abundant in the Autumn. One first conclusion is that mites show a slow ability to recover their average abundance after the site is burned. No appropriate local bioindicator from fire disturbance could be determined.

Thursday 26, Afternoon, Room 4

421 - Dispersion indices and sampling plans for the red palm mite (Acari: Tenuipalpidae) on coconut

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The red palm mite (*Raoiella indica*), an invasive pest of coconuts and ornamental palms in the old world, entered the Western Hemisphere in 2004, spreading rapidly through the Caribbean and into Florida. Developing effective sampling methods may aid in the timely detection of the pest in a new area and allow measures to be put in place to slow the spread of the pest as other mitigation strategies such as biological control become available. Studies were conducted to provide and compare intra tree dispersion of red palm mite on coconut using Taylor's power law in 3 different geographical areas recently invaded by the mite and to provide an insight on the effects intra plant distribution, time of collection, number of individuals present in the samples and level of mite infestation. At early stages of the mite's infestation the populations were highly clumped and concentrated in the lower strata of the palm. As populations increased, the distribution of mites remained clumped but they exploited other strata. The number of samples that will need to be collected when the required precision is 0.10 and *R. indica*'s densities are between 0.01mites /cm^2 to 0.10 mites /cm^2 are 247samples to 103 samples respectively. However, when a mean of 1 mite /cm^2 is found, the required samples will be 43. If the sampling objective is to detect the presence of *R. indica* at very low densities, in order verify the presence or absence of the pest in an area where it is not confirmed, the number of samples that need to be collected could be very large and the amount of labor to process these samples could be even higher. Under these circumstances, it might be better to sample based on

the symptoms of mite attack. We discuss the use of a presence/absence model as a more realistic way for sample for areas where infestation is incipient or an area that is high risk for infestation.

Thursday 26, Afternoon, Room 4

422 - *Raoiella indica*: facing it

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Biological invasions are a major threat to natural ecosystems and agricultural crop production. With globalization, the increase in trade and movement of people, the frequency of species invasions has substantially grown in the last 3 decades. Polyphagous pest species targeting hosts with wide distribution have and can spread quickly and cause tremendous losses. The recent invasion of *Raoiella indica* (Acari: Tenuipalpidae) raises major concerns about the need for increased cooperative research initiatives in the Americas and the Caribbean. *Raoiella indica* feed on many palm species, especially *Cocos nucifera*, *Musa* spp. and many other ornamental plants. Efforts to reduce its invasion rate and mitigate losses have been put in place with two recently established working groups/networks. 1) DGroups (Development through Dialogue, FAO) established a discussion group where the Caribbean Plant Health Directors taskforce can meet online and formally discuss palm pests including the recent invasion of red palm mite (RPM); 2) Additionally, after the initial RPM detection in Puerto Rico (2006), a multi-agency task-force was established to address U.S. management efforts (mainland and insular) for this new invasive pest. This multi-agency taskforce is charged with, the development of proper sampling techniques, a pest status taxonomic revision, characterization of the dynamics of the pest and its natural enemies (arthropods and microorganisms), in addition to a thorough description of its host range, the search and identification of natural enemies (classic biological control) for potential introduction, its chemical control, identification of any plant host resistance that might exist, and general pest management and training. These working groups/networks have been very successful in organizing the critical information on RPM. They also continue to emphasize the importance of prevention and preparedness when dealing with invasive species and that a proactive approach is the best means for management of invasive species.

Tuesday 24, Afternoon, Room 3

423 - Current status of acaricide and ivermectin resistance of *Rhipicephalus microplus* in Mexico

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The "southern cattle tick" *Rhipicephalus microplus* is responsible for considerable losses in cattle production due to disease transmission (*Babesia* and *Anaplasma*), blood loss, and the cost of control and treatment of transmitted diseases. Chemicals, including organophosphates (OP), synthetic pyrethroids (SP), amitraz (Am) and macrocyclic lactones (MLs) play a major role in controlling *Rhipicephalus*. The intensive use of these chemicals has led to the development of resistant tick populations in tropical and subtropical countries. In Mexico, *R. microplus* has developed resistance to all main classes of acaricides in past decades because of the intensive use of chemical acaricides. In Mexico, resistance to OP and SP acaricides first developed in the 1980s and 1990s, respectively. Am was introduced along with SP to control OP-resistant ticks in 1986. Initially, Am was not widely used, because of its higher cost, but its use became more prevalent and intensive after SP resistance was discovered in 1993. The first case of Am and

fipronil resistance in *R. microplus* in Mexico was confirmed in 2001 and 2008, respectively. From 2004 to 2009, our research group studied 217 field populations of *R. microplus* and determined the prevalence of farms with resistance to SP, OP and Am in the southern Mexico. We found that SP resistance was one of the most serious problems in the Mexican tropics (from 66% to 96% of the farms showed resistance to SP) and a mutation in the sodium channel gene of *R. microplus* was associated with this class of resistance. Presently, many tick populations are resistant to multiple classes of acaricides in Mexico. In the last 8-10 years, MLs (ivermectin, doramectin and moxidectin) have been used to control both gastrointestinal nematodes and cattle ticks in Mexico. Due to the increasing ML treatments to control parasites, resistance of *R. microplus* to ivermectin has been recently reported in Yucatan, Mexico. The findings of *R. microplus* resistant to all three major classes of acaricides and ivermectin underscore the seriousness of the resistance situation and the importance of having a resistance management strategy in the country. This research was financially supported by Fomix-Conacyt, Mexico (YUC-2008-C06-108773).

Thursday 26, Afternoon, Room 6

424 - Development of a new, biological insect and tick repellent as effective as deet

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TMOF is a decapeptide produce by the ovary of adult mosquitoes, released into the hemolymph, and which regulates proteases in the digestive system. We have been interested in using TMOF as a model system to study the use of polymer chemistry to stablize peptides in the insect digestive system and hemolymph and to enhance hemolymph accumulation of peptides moving across the insect cuticle and gut. Interestingly, these mimics were similar in structure to the methyl ketone, undecanone, found in the trichomes of wild tomato plants. Undecanone in these plants elicits resistance to hebivory. Testing showed that undecanone was a tick and mosquito repellent. Because of the known toxicology profile of undecanone including it use as a food additive, it was formulated into the commercial repellent, BioUD, containing 7.75% undecanone. BioUD was shown in arm and cage studies as well as in practical field studies in the US and Canada using human subjects to be as effective or more effective than Deet. In laboratory and field studies, the same was found for ticks. Detailed comparative studies of BioUD with Deet and other commercial repellents currently on the market will be presented, along with work on the mode of action of BioUD and the development of next generation compounds even more effective than BioUD. BioUD has been approved by the EPA without restrictions for use on human skin and clothing, does not affect plastics like Deet, and is non-flammable (unlike many Deet products). It is also a good example of the unanticipated but pratical impact of basic research. The technology is license by the company Scotts and is now commercially available throughout the US.

Wednesday 25, Morning, Room 2

425 - Hormonal regulation of reproduction in acarines: ticks versus insects

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Our knowledge of the regulation of female reproduction in arthropods is mostly about the regulation of storage proteins. For many years, it was thought that ticks and mites were like insects and regulated vitellogenin (Vg) synthesis with juvenile hormone (JH). It was also proposed that two peptides in ticks, EF alpha and EF beta, were transferred to the female genital tract during mating, and these pheromones initiated blood feeding to

repletion and vitellogenesis. Our studies were unsuccessful in showing that ticks could synthesize the common insects JHs in both the hard tick, *Dermacentor variabilis* (*Dv*), and the soft tick, *Ornithodoros parkeri* (*Op*). In addition, JH activity could not be detected in any life stage of *Dv*, using the *Galleria* bioassay, and JH could not be found in hemolymph during the time of reproduction by selective ion EI GC MS in both *Dv* and *Op*. The most predominant carrier (hemolymph storage) protein (CP), the yolk protein (Vg) and the Vg receptor have been sequenced for the first time from ticks by our laboratories. CP and Vg from *Dv* were unique within the Arthropoda because of their ability to sequester heme, hypothesized to be critical for the evolution of hematophagy in ticks. We have shown that ecdysteroids and not JH regulate the synthesis of the Vg messages, synthesis and release of Vg protein into the hemolymph, and normal egg production in *Dv*. Separate 454 transcriptomes were developed for the first time from any tick species for the synganglion (and associated neurosecretory organs) (approx. 20,000 contigs were assembled), and Agilent microarrays were constructed to the former. Fourteen putative neuropeptides and five neuropeptide receptors were described from the synganglion transcriptome among many other messages. Also, the putative pathway from acetoacetyl-CoA thiolase to farnesyl diphosphate synthase but not the JH branch was found exclusive to the synganglion. Microarray analysis of gene expression in the synganglion related to blood feeding and reproduction will be described for the first time. Studies of tick synganglion/reproductive organ transcriptomes and global gene expression offer opportunities for identifying regulatory systems important in tick development and possible targets for novel methods of tick control. We will also be presenting the first 454 transcriptomes to the ovary and to the female genital track of *Dv* and the first 454 and Illumina transcriptomes to the synganlion of the deer tick, *Ixodes scapularis*. This research was financially supported by NSF (#0723692) and the NC Agricultural Experiment Station.

Tuesday 24, Afternoon, Auditorium - Poster

426 - Cytotoxic effects of permethrin in reproductive system of *Rhipicephalus sanguineus* (Latreille, 1806) (Acari: Ixodidae) semi-engorged females

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Female reproductive system of Ixodidae is considered to be of vital importance for biological success of the group since it is constituted by essential structures for the perpetuation of the species. Due to the wide use of the permethrin (active ingredient of the Advantage® Max3, Bayer) in tick control and the scarce data in the literature about the action of this acaricide in the reproductive system of the females' ticks, the present study aimed to investigate, through morpho-histological techniques, the toxic effects of permethrin on oocytes of *Rhipicephalus sanguineus* semi-engorged females. These were subjected to four treatments based in the LC_{50} of 2062 ppm of permethrin: group I (control - distilled water), group II (206 ppm), group III (1031 ppm) and group IV (2062 ppm). Results demonstrated that in the control group the oocytes were unaltered. In females exposed to 206 ppm, some oocytes I became more elongated and with some vacuoles in the cytoplasm. These data show that the acaricide, even at low concentrations, would be able to cause changes in the germinative cells. At 1031 ppm, oocytes I assumed an irregular pear shape and presented larger and more numerous vacuoles in the cytoplasm, suggesting that this concentration of permethrin cause more damage in the tick reproductive system. However, in females subjected to 2062 ppm, oocytes I were no longer observed, indicating that at this concentration, major changes would occur in germinative cells, leading to autophagic cell death. Oocytes II and III exposed to 1031 and 2062 ppm showed great cell changes, such as extensive cytoplasm vacuolation and reduction of yolk granules, suggesting that the action of permethrin is intensified in higher concentrations. This work also showed that few altered oocytes IV and V were found at the concentration of 206 ppm. However, at concentrations of 1031 ppm and 2062 ppm, a high number of altered oocytes was observed, especially in the latter concentration, in which the number and size of cytoplasmic vacuoles was intensified signaling a need of the cell to recycle cytoplasmic portions damaged by the action

of permethrin (as damaged organelles) or to degrade the whole cell. Based on these data, it is concluded that lower concentrations of permethrin than the commercially sold (about 300,000 ppm) would be enough to induced changes in germinative cells, making them non viable. These results would help to reduce the damages caused to hosts, to environment, as well as to non-target organisms, such as humans, which during the application of acaricides for the control of *R. sanguineus* would be indirectly in contact with these chemicals. This research was financially supported by FAPESP (Grants n° 07/57809-5 and n° 07-59020-0) and CNPq (Grant n° 308733/2006-1).

Wednesday 25, Afternoon, Auditorium - Poster

427 - Importance of mite species in different agroecosystems and their control in Romania

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The present status of mite species in different agroecosistems in Romania is presented. Four species are polyphagous (of which *Tetranychus urticae* and *Polyphagotarsonemus latus* Banks are the most important); 4 are found on small grains, but they have no practical importance; 3 are found on ornamental plants. Mites are very important in orchards: 2 are polyphagous and 13 are found on in orchards; only 2 out of 5 species identified in grape vine plantations require chemical treatments, mites being the second pest problem in this ecosystem. The broad mite is not susceptible to some insecticides, but homologated acaricides have been effective in the control of mites. Pesticides should be carefully applied so they do not interfere with natural enemies that offer biological control of the pest complex. Reduction of chemical residues on different crops has been a goal all over the world; this is accomplished by reducing the amount of pesticides used as well as by the use of new, safer active ingredient. This trend has also been observed in Romania; in that country, the number of acaricides varied from 12 in 1972-1979 to 5 in 1980-1989, 10 in 1990-1996, 4 in 1997-2004 and 6 in 2010, based on 5 active ingredients. Only Envidor 240 SC (spirodiclofen 240 g/l) was registered in 2005. According to the data provided by ALCEDO Company, the market of pesticides in Romania varied from 110 million Euros in 2003 to 140 million in 2008 and 180-200 million euros (forecast for 2012). Peak consumption occurred in 1991 (over 200 million euros). Market structure in 2006 (typical structure) was: fungicides - 36.5%; insecticides-acaricides - 20.4%; herbicides - 37.5% seed treatment - 4.9% other - 0.7%; in 2007 (year of drought), it was: fungicides - 20.6%; insecticides-acaricides - 28.7%; herbicides - 44.0% seed treatment - 5.9% other - 0.8%. In the last few years, the number of acaricides approved in the EU dropped by 70% and the number of available acaricide families in EU decreased to less than 1/3 of what it was. Causes of the decreasing number of acaricides or active ingredients were the disappearance of active ingredients due to toxicological or environmental reasons, high-cost of registration, etc. As an example, acaricides of Nihon Nohyaku Company are no longer permitted in Romania, although they are still approved for use in EU. Biological control has not been proven satisfactory for commercial crops in Romania. EU and Romanian policies are discussed.

Thursday 26, Afternoon, Room 6

428 - Evaluation of Abamectin 1.8 EC and Profenofos 50 EC against the eriophyid mite *Aceria guerreronis* on coconut

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The eriophyid mite *Aceria guerreronis* Keifer was first described by Keifer from Mexico in 1965. Since then, it has been reported from various parts of the world causing extensive damage to coconut. Profenofos and abamectin were evaluated for their efficacy against *A. guerreronis*. The LC_{50} values of profenofos and abamectin were 0.114 and 0.032 ppm, respectively. LT_{50} values were 2.39 and 2.07 h for 0.50 and 1.0 ppm of profenofos and 6.62, 4.28 and 2.04 h for 0.05, 0.1 and 0.2 ppm of abamectin, respectively. Abamectin 0.0144% effected population reduction of 99.59 and 80.60 per cent under laboratory condition. Spot application of abamectin (0.0144%) was found to be more effective in reducing the mite population (75.91 to 66.64%) over control, with low nut damage grade.

Abamectin 0.0144% was moderately toxic to predatory mites. No detectable amount of residues was found in coconut water and kernel up to 60 days after two rounds of spray. Abamectin was found to be more effective than profenofos but, the effectiveness lasted for only three weeks. The increase in mite population after a lapse of 21 days may be due to the overlapping generations, which necessitates repeated applications.

Wednesday 25, Afternoon, Auditorium - Poster

429 - Effect of relative humidity on the seasonal fluctuation of *Eupalopsellus hamedaniensis* Khanjani *et al.* (Acari: Eupalopsellidae) in cherry orchards in Hamedan Province of Iran

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Predatory mites play an important ecological role in terrestrial ecosystems and are increasingly being used in management for biocontrol of pest mites, thrips and nematodes. One of the important predatory mites in cherry orchards in the Hamedan Province of Iran is *Eupalopsellus hamedaniensis* Khanjani et al.. In this research, the effect of relative humidity on the seasonal fluctuation of *E. hamedaniensis* was studied. Sampling was conducted weekly from September 2008 to late November 2009 in an untreated cherry (*Prunus cerasus*) orchard located at 48°28'31.0"N, 34°47'24.3"E and 1913 m altitude above sea level. In the selected orchard, pesticides had not been used in the past 20 years. At each sampling date, 15 branches were taken randomly from 10 different trees (5 from each of three canopy level: bottom, mid and upper). These were transported to the laboratory where they were shaken above a white tray; the organisms falling onto the tray were then brushed into the a Petri dish, which was then examined under a stereomicroscope to collect the mites. This study showed that *E. hamedaniensis* was a dominant species. The predator first appeared in mid July, when relative humidity was around 30.9%; it was found on the trees until early December, when relative humidity was 81.6%. Peak population levels were observed from mid September (with 38.17% RH) to early October (with 34.07% RH). The results indicated that *E. hamedaniensis* plays a major role in the control of the brown mite, *Bryobia rubrioculus* (Scheuten), particularly by preying upon the immatures stages, from eggs to the protonymph, and that it could be used as a control agent in IPM programs.

Wednesday 25, Afternoon, Auditorium - Poster

430 - Effects of temperature on seasonal fluctuations of *Eupalopsellus hamedaniensis* Khanjani *et al.* (Acari: Eupalopsellidae) in orchards of the Hamedan Province of Iran

E. Rostami[1], H. Abassipour[1], M. Khanjani[2] & A. Askarianzadeh[1]

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Arthropods have different roles in fruit orchards of Hamedan province, west of Iran; some are phytophgous and others are are in predators or parasites. The brown mite, *Bryobia rubrioculus* (Scheuten), is an important pest, while *Eupalopsellus hamedaniensis* Khanjani et al. is a dominant and the most important predator of eggs, larvae and protonymphs of the brown mite. Nothing is known about the biology of that predator. In this research, effect of temperature on seasonal fluctuations of *E. hamedaniensis* was studied from September 2008 to late November 2009 in orchards. The geographical position of the orchards was recorded with a GPS. The study was conducted in an untreated and organic fruit orchard; every week 15 flushed (30-40 cm length) of 10 trees were examined and numbers of immature and adults of *E. hamedaniensis* were recorded. The results indicated that *E. hamedaniensis* population appears usually in mid July (at 23.9±3 °C) and is active on the trees until early December (at 9.3±3 °C). Peak population levels were observed from mid September (at 20.8±1 °C) to early October (at 18.2±1 °C). Temperatures of 18 °C had an adverse effect on population increase. The results suggested that *E. hamedaniensis* can have a significant effect on *B. rubrioculus* between 18 and 21 °C in fruit orchards, significantly reducing its population level.

Tuesday 24, Afternoon, Auditorium - Poster

431 - Faunistic study of fruit tree mites in Hamedan Province, west of Iran

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During 2008-2009, a faunistic survey of mites of fruit trees was conducted in the Hamedan Province of Iran. Different samples were taken from soil, fruit trees and weeds. After clearing the mites in lactophenol, mites were mounted on slides for identification. The species found were: BDELLIDAE: *Bdella* sp., *Spinibdella cronini* (Baker & Balock), *Cyta* sp.; EUPALOPSELLIDAE: *Eupalopsellus hamedaniensis* Khanjani et al.; STIGMAEIDAE: *Stigmaeus pilatus* Kuznetsov, *S. elongatus* Berlese, *Ledermuelleriopsis zahiri* Khanjani & Ueckermann; CALIGONELLIDAE: *Neognathus terrestris* (Summers & Schlinger), *Caligonella humilis* (Koch), *Molothrognathus azizi* Khanjani & Ueckermann; CUNAXIDAE: *Cunaxa* sp, *Cunaxa capreola* (Berlese), *Pulaeus martini* Den Heyer; CHEYLETIDAE: *Acaropsella kulagini* (Rohdendorf); ANYSTIDAE: *Anystis baccarum* (Linn); PSEUDOCHEYLIDAE: *Anoplocheylus malayeriensis* Ueckermann & Khanjani; PACHYLAELAPIDAE: *Pachchylaelaps karawaiewi* Berlese, *Pachylaelaps siculus* Berlese; VEIGAEIDAE: *Veigaia nemorensis* (Kock); RAPHIGNATHIDAE: *Raphignathus hecmatanaensis* Khanjani & Ueckermann, *Raphignathus collegiatus* Atyeo et al., *Raphignathus protaspus* Khanjani & Ueckermann.

Tuesday 24, Afternoon, Room 2

432 - Environmental impact of international exchange of beneficial agents to control invasive mite pests

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The dispersion of live specimens of one country to another or from one region to another within a same country, by the transport of material or by natural factors, can pose risks. Other than the possibility of being pests, these specimens may also carry undesirable organisms. In this scenario, quarantine laboratories play an important role in protection of plants, because they aim to reduce the likelihood of unwanted organisms (hyperparasites, pathogens, pests, mites, nematodes, weeds and other pests) entering a given country. These laboratories can promote the so-called classical biological control of pests. While in these, natural enemies should be identified and cleaned of contaminants before they are released for studies in regular biology laboratories or for direct field releases. Classical biological control of pests involves the action of collecting natural enemies in their native ecosystems, or in other ecosystems, introducing them in the new environment envisioning their establishment and adequate pest control. Its use requires continuous responsible and safe exchange of natural enemies between countries, as well as in situ conservation of species of native natural enemies in their different habitats. Ensuring the safety of the introduction of biological control agents in a new ecosystem is very important. Nowadays, the "Costa Lima" Brazilian National Quarantine Laboratory, at Embrapa Environment, Jaguariúna, State of São Paulo, Brazil, is participating in projects to introduce predatory mites to control *Aceria tosichella* Keifer on wheat and *Raoiella indica* Hirst in palm trees in the south and northern regions, respectively. The trend in the use of biological pest control is to increase considerably, given the international demands for the use of agricultural practices less harmful to the environment.

Wednesday 25, Afternoon, Room 1

433 - Multiple predators, intraguild interactions and biological control of a single spider mite species

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To test whether biological control of spider mites is promoted by the use of multiple instead of a single predator species, experiments have been published that employed either an additive design (initial density of each predator is kept constant) or a replacement design (initial density of all predators together is kept constant). The variable under test is usually some measure of pest abundance. We will argue that such tests are not always adequate to infer positive or negative effects among multiple predator species and their impact on the pest. Instead, there is a need for experiments elucidating predator-predator interactions and their impact on the pest at a mechanistic level, using a series of experiments ranging in focus from the individual level to the population level, from the laboratory to the field, from short-term to long-term and from small scale to large scale. To illustrate this, two experiments will be discussed, the first based on a replacement design and the second on an additive design: (1) Combined releases of *Phytoseiulus persimilis* and *Neoseiulus californicus* for control of spider mites on strawberries in Turkey, and (2) Predator removal with respect to established populations of *Typhlodromalus aripo* and *Amblydromalus* (*Typhlodromalus*) *manihoti*, which are supposed to control green mites on cassava in Africa. These examples show that microhabitat specialization of the predators in the field reduces negative effects of intraguild predation among predator species and promotes their synergistic effect on pest suppression.

Wednesday 25, Morning, Room 3

434 - Response of two-spotted spider mite, *Tetranychus urticae* Koch, on 14 accessions/ cultivars of *Lycopersicon*

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Fourteen accessions/ cultivars from different species of *Lycopersicon* were studied for resistance to two-spotted spider mite (TSSM), *Tetranychus urticae* Koch, in laboratory and greenhouse conditions. The studied germplasms were 4 varieties (Sankranthi, Nandi, Vybhav and Pusa ruby) and one accession (NDTVR-73) of *L. esculentum*, 2 accessions of *L. pimpinellifolium* (LA 0373 and LA 2533), 2 of *L. peruvianum* (LA 643 and LA 2152), 3 of *L. hirsutum* (LA 1740, LA 1777 and LA 2860) and 2 of *L. pennellii* (LA 2580 and LA 2963). *In vitro* studies were carried out using thumbtack and leaf disk bioassays. *L. hirsutum* and *L. pennellii* accessions supported more number of mites on the tack, whereas on the other species, all mites moved on to the leaf after 2 h. The highest number of eggs (5.15 eggs/♀/d) was recorded on *L. pimpinellifolium* 'LA 2533' and the lowest (0 egg/♀/d) was on *L. hirsutum* and *L. pennellii* accessions. Mite mortality was high and damage score was low on leaf disks of *L. pennellii* and *L. hirsutum* accessions, whereas the lowest mortality and highest plant damage were observed on *L. esculentum* varieties (Nandi and Sankranthi). Developmental time of the mite was longest (8.61 days) on leaf disks of *L. esculentum* 'NDTVR-73' and shortest (7.18 days) on *L. pimpinellifolium* 'LA 2533'. Under greenhouse conditions the mite did not established on *L. hirsutum* and *L. pennellii* accessions. Among the other accessions/cultivars, 'Nandi' and 'Sankranthi' supported the highest, whereas 'NDTVR-73' supported the lowest mite population and plant damage. The highest and lowest density of type VI glandular trichomes recorded on *L. esculentum* 'NDTVR-73' (67.33/mm²) and *L. pennellii* 'LA 2963' (0.79 /mm²), respectively. There was no relationship between density of type VI trichomes and resistance to the mite. Type IV glandular trichomes observed only on the foliages of *L. hirsutum* and *L. pennellii*. Relation between density of type IV glandular trichomes and resistance to the mite was strongly positive.

Wednesday 25, Afternoon, Auditorium - Poster

435 - Effect of different almond cultivars on biological parameters of two-spotted spider mite, *Tetranychus urticae* Koch

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Resistance of 10 almond cultivars to two-spotted spider mite (TSSM) was studied in lab and greenhouse conditions during 2008-2009. The cultivars were: Nonpareil, Feraduel, Shahrood6, Shahrood13, Shahrood21, Sefid, Mamaei, Rabie, Azar and Shokofeh. All cultivars were grafted on Gf677 rootstock and maintained in greenhouse conditions. An initial experiment to determine mite oviposition and plant damage was conducted under laboratory conditions. For that purpose, six young leaves of each cultivar were collected; each was used to prepare an arena (2.5 X 1.2 cm) which was placed on absorbent cotton wad in a plastic Petri dish and infested with 5 adult female mites (3-5 days in age). The arenas were kept in an incubator at 27±0.5 °C, 50±5% RH and 14 L: 10 D photoperiod. After 72 h, mite oviposition, mortality and leaf damage (0-6 scale) were measured. The highest and the lowest oviposition rates were observed on Mamaei and on Shahrood21, respectively. The highest mite mortality was observed on Shahrood13 and the lower level of leaf damage was observed on Shahrood21 and Shahrood13 cultivars. In the second experiment, also conducted in a laboratory, 30 leaf arenas of each cultivar were prepared (as mentioned above); then, a larva was introduced to each arena and the biological parameters of the mite were determined until the death of last female. Results indicated that there are significant differences among the studied cultivars. The highest (88%) survivorship of immature was observed on Azar, whereas the lowest was observed on Shokofeh (47%) and Shahrood21 (50%). The longest (5.27 days) immature period was observed on Shahrood21. The shortest adult period observed on Shahrood21 (5.15 days) and Shokofe (5.2 days), whereas the longest (10.45 days), was observed on Mamaei. The highest fecundity (57.6 eggs/ female) was observed on Mamaei, whereas, the lowest was observed on Shokofe (15.1 eggs/ female) and Shahrood21 (31 eggs/ female). Greenhouse study was done based on a Complementary Randomized Design (CRD), with 6 replicates. Three adult female mites were transferred onto each replicate (plant). After three weeks, mite population density (number of eggs, nymphs and adults) was estimated. Nonpareil and Shahrood6 cultivars supported the highest, whereas, Shokofeh and Shahrood21 supported the lowest mite density. According to the results, Mamaei and Nonpareil are highly susceptible, whereas Shokofe and Shahrood21 are tolerant to TSSM.

Wednesday 25, Afternoon, Auditorium - Poster

436 - The effect of temperature on life history parameters of the almond spider mite (Acari: Tetranychidae)

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The effect of nine constant temperatures (12.5, 15, 17.5, 20, 25, 27.5, 30, 33, 36 °C) on important biological parameters (immature development time, female longevity, oviposition rate, oviposition period, and the mean number of egg per female per day) and also demographic parameters (net reproductive rate, mean generation time, intrinsic rate of increase and finite rate of increase) of almond spider mite were conducted in the laboratory under controlled conditions: 50 ± 5 RH and 12L : 12D. The upper thermal threshold was estimated to be 39°C. The highest and lowest juvenile development time were recorded as 22.68 and 3.07 days at 13 and 30°C, respectively. According to maximum intrinsic rate of increase, minimum mortality percent and higher fecundity at 27.5°C, it can be assumed that this was the optimum temperature for population development of the almond spider mite. The increase in mortality rate at 30°C indicated the proximity of the upper thermal threshold. In the experiment conducted at 36°C, eggs developed to adult but oviposition did not occur. No significant trend was found in daily fecundity rate among nine temperatures. Total number of eggs laid per female was significantly different among temperatures. The use of Logan et al.'s model allowed the description of the influence of temperature on the population growth. The values of Logan et. al.'s model parameters, estimated by least–squares regression techniques, are p_1= 0.175, p_2= 0.0701 and p_3= 0.01. According to our results, the temperature range within which

almond spider mite can develop is broad, from 12.5°C to more than 36°C. Altogether, this phytophagus mite has a high potential for population growth with regard to the temperature range within which it can develop and the high rates of increase ratios between 12.5°C and 33°C. Further investigation concerning the influence of other biotic and abiotic factors on the biology of almond spider mite should be conducted to characterize the main factors responsible for changes in population dynamics.

Friday 27, Morning, Room 2

437 - Epidemiology of tick infestation on cattle and buffaloes of Lower Punjab, Pakistan

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Tick (Acari: Ixodidae) infestation is still a serious nuisance to livestock and the dairy industry of Pakistan. The current paper reports the prevalence and associated risk factors for bovine tick infestation in the districts of Layyah and Muzaffargarh of Lower Punjab, Pakistan. A questionnaire based survey was conducted to identify and to quantify variation in the prevalence of bovine tick infestation with respect to host (age, species, sex, and breed) and environmental (geographical area and climate) determinants. Multiple stage cluster random sampling was used and 3500 cattle and buffaloes from the two districts were selected. Prevalence of bovine tick infestation was significantly higher (OR=1.95; $p<0.05$) in cattle (1076/1475; 72.9%) than in buffaloes (957/2025; 47.3%). *Hyalomma anatolicum anatolicum* was the major tick species (1173/3500; 33.5%), followed by *Rhipicephalus sanguineus* (456/3500; 13%). The highest monthly prevalence in both districts was found in July. Ticks were not found in Layyah from November to March and in Muzaffargarh from December to March. The average number of ticks was proportional to the prevalence of infestation. Also, tick infestation in a 7 x 7cm^2 dewlap of the animal was proportional to that of the rest of the body. Prevalence of tick infestation was associated ($p<0.05$) with district, host species and breed. In cattle, prevalence of tick infestation was associated ($p<0.05$) with age and sex of host. The results of this study provide better understanding of disease epidemiology in the studied districts, which will help the planning of control strategies.

Wednesday 25, Afternoon, Auditorium - Poster

438 - Evaluation of biological aspects of partially engorged females of *Rhipicephalus sanguineus* (Acari: Ixodidae) fed artificially through capillary tubes

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Artificial feeding of ticks is a low cost technique, allowing the study of biological aspects of vector and its relationship with pathogens. The objectives of this work were to check weight gain and influence of artificial feeding technique through capillary tubes, and the biological aspects of non-parasitic phase of partially engorged *Rhipicephalus sanguineus* females. On the seventh day of feeding, partially engorged female ticks were collected from the skin of the rabbit host (*Orictolagus cuniculus*) and divided in four groups of homogeneous weight, each composed of twelve females. Each group was exposed to artificial feeding for periods of 6, 12, 24 and 36 hours. The control group was obtained through natural tick detachment after complete engorgement. For the artificial feeding, females were fixed in trays with double sided tape. Capillary tubes containing citrated canine blood were placed on the mouthparts of the ticks. After feeding, the females were weighed to check blood intake and placed in Petri dishes for monitoring biological aspects, at 27 ± 1 °C and 80% RH. ANOVA and Tukey test were used for quantitative variables. In addition, the nonparametric Kruskal-Wallis was applied for qualitative variables, both with a significance level of 5%. Average weights were 3.03±5.50, 14.62±8.19, 15.71±10.41 and 29.71±22.46 for groups fed artificially for 6, 12, 24

and 36 hours, respectively. Gradual increase in weight gain as a function of feeding time occurred, but complete engorgement when compared to the control group was not observed. When comparing the average weight gain of groups fed artificially in groups, groups corresponding to 6 and 12 hours differed significantly from the group corresponding to 36 hours. The total weight of the egg masses and the percentage of hatching larvae of females fed for 6, 12, 24 and 36 hours and the control group were 21.31±5.69, 27.33±6.37, 30.88±7.44, 40.21±17.41 and 108.84±26.08, and 69.17±35.79, 62.50±40.93, 55.83±42.31, 54.17±44.41 and 90.83±2.89, respectively. Regarding total weight of posture, only the groups fed for 6 and 36 hours differed significantly between themselves, and all differed from the control group. Regarding percentage of hatching, no statistical differences were observed between the groups fed artificially and the control group. Artificial feeding of *R. sanguineus* showed better results after 24 hours of exposure to capillary tubes. Based on these results, an *in vitro* study of transmission and interaction ticks/pathogens for *Borrelia* spp. by using blood from patients with Lyme-like Disease (Baggio-Yoshinari Syndrome) is in progress. This research was financially supported by FAPESP –No. 2007/57749-2 and to CNPq academic career scholarship to D.M.B.B. and A.H.F., and CAPES Ms. Degree fellowship to R.K.S..

Tuesday 24, Morning, Room 1

439 - Is preference for the lower leaf surface associated with avoidance of solar ultraviolet radiation in spider mites?

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The spatial distribution of the twospotted spider mite *Tetranychus urticae* Koch is biased towards the lower leaf surface as compared to the upper leaf surface on their host plants. Solar ultraviolet radiation (UVR) as well as artificial ultraviolet-B (UV-B; wavelength 280-315nm) irradiation cause severe deleterious effects on *T. urticae* in all developmental stages and reduce fecundity (Ohtsuka and Osakabe, 2009). Plants accumulate phenolic compounds which absorb UVR through epidermis and protect sensitive targets in mesophyll cells, resulting in significantly lower UVR at the lower leaf surface compared to the upper leaf surface. Therefore, *T. urticae* may be able to avoid the deleterious effects of solar UVR on lower leaf surface, leading to the hypothesis that *T. urticae* remains on lower leaf surfaces in consequence of behavioural adaptation to solar UVR. We tested whether the preference of *T. urticae* for lower leaf surface is associated with their perception and avoidance of solar UVR. For solar UVR manipulation, we used UV-opaque films and a sheet which reflected both visual lights and UV components. As a result, we found that solar UVR accelerated the movement of *T. urticae* adult females on the upper leaf surface of their host plants to the lower leaf surface. Reversely, when the lower leaf surface was irradiated with the reflected solar UVR and solar UVR on the upper leaf surface was attenuated, adult females moved from that surface to the upper surface. Monochromatic UVR tests revealed that UVR at 280 and 300 nm wavelength (UV-B) exerted complete lethal effect on eggs, while 320-360 nm wavelength (UV-A) was harmless. In contrast, adult females did not avoid 280, 300, and 360 nm wavelength but avoided 320 and 340 nm. The deleterious effects of solar UVR on the egg hatchability were serious through spring to autumn. In the late autumn, the lethal effect of solar UVR on eggs was reduced but still remained significantly. The overall impact of solar UVR on performance of *T. urticae* and the fact that irradiation of solar UVR on the lower leaf surface overcame the preference of this mite to the lower leaf surface suggest that solar UV radiation may be one of the prime factors determining the spatial distribution of this mite. Moreover, our findings suggest that *T. urticae* exploit shorter components of UV-A (harmless) as the information to avoid deleterious effects of the components of solar UVR, i.e. UV-B radiation. From these, we presume that the preference to lower leaf surfaces is a consequence of adaptation to solar UV-B.

Wednesday 25, Afternoon, Auditorium - Poster

440 - Seasonal fluctuation and population density of mites, vectors of *Citrus Leprosis Virus* C, and their predators in citrus orchards in Campeche, Yucatan and Quintana Roo, Mexico

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The citrus leprosis disease, caused by *Citrus Leprosis Virus C* (CiLV-C), is considered one the most important viral diseases of sweet citrus varieties in different countries of South America. Transmission of CiLV-C has been associated with three species of *Brevipalpus*, namely *B. phoenicis*, *B. californicus* and *B. obovatus*. These species are present in Mexico, but CiLV-C has been found only in two states, Tabasco and Chiapas, leading to a major effort to protect other citrus regions of the country, where CiLV-C has not been reported. The main disease management strategy is to reduce population density of those mites. However, there is a lack of information about their ecology in Mexico. Therefore, the aim of this investigation is to know how the populations of these three species of *Brevipalpus* fluctuate throughout the year in citrus mixed orchards, and which mites may prey on *Brevipalpus* spp. This investigation started on February 2010 and will continue until February 2011, in three southeast regions of Mexico (Campeche, Yucatan and Quintana Roo). Samples of leaves, fruits, branches and buds are taken every six weeks in a 10x10 tree array census. The complete results of this investigation will provide more accurate sampling strategies for regulation purposes, which eventually will help to use efficiently current control strategies such as chemical and biological. Results obtained so far are presented, and their implication on CiLV-C occurrence is discussed.

Wednesday 25, Afternoon, Auditorium - Poster

441 - *Metarhizium anisopliae* action *in vivo* to control *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae)

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus* occurs worldwide. Nowadays, tick infestation in domestic animals has been controlled with the use of chemical acaricides. The present work aims at evaluating the in vivo effect of the fungus *Metarhizium anisopliae* on *R. microplus*. The study was conducted on a farm in the municipality of Viçosa, Alagoas, Brazil. Two groups of four Holstein cows were used. Cows of the control group were sprayed with distilled water and dimethylsulfoxide (1% concentration), whereas cows of the treated group were sprayed with a suspension of spores of Fitossan 4 isolate of *M. anisopliae* (10^8 conidia/ml). After 24 hours, 120 engorged female mites were collected from the cows of each group and taken to the laboratory. The rate of conversion in eggs, egg weight, hatchability, mortality and product efficiency were evaluated. Differences in biological parameters were determined by Student's t-test ($P \leq 0.05$). Significant differences were observed between treatments. Tick mortality of treated cows reached 36.6% in the first days after sparying; in addition, reproduction was also reduced. Rate of conversion in eggs was 32.3±1.99; weight of each egg was 0.33±0.20; hatchability was 58.3±4.47; and efficiency of the product was 53.6±5.98. These results indicate that Fitossan 4 isolate of *M. anisopliae* can be an alternative to the control of *R. microplus*.

Tuesday 24, Afternoon, Auditorium - Poster

442 - New records of *Ixodes amarali* Fonseca, 1935 (Acari: Ixodidae) in northern Brazil

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Parasitology, Butantan Institute, Av. Vital Brasil 1500, 05503-900 São Paulo, SP, Brazil.

Ixodes amarali Fonseca, 1935 is a tick species endemic to Brazil, where it has been reported in the northeastern, midwestern, and southeastern regions. All active stages of this species parasitize small rodents and marsupials. From September 2007 to October 2009, we collected ticks on rodents and marsupials in the central western, northern and southeastern regions of Brazil. The material was sent to the laboratory where adult females were identified by current taxonomic keys, and the larvae and nymphs were identified by comparison with material deposited in the Acari Collection of "Instituto Butantan". All ticks were identified as *Ixodes amarali* Fonseca, 1935 from the following hosts and localities: Sate of Goiás – 1 larva on *Gracilinanus agilis* (agile gracile opossum), Abadiânia municipality; State of Pará – 1 female on *Monodelphis brevicaudata* (northern red-sided opossum), and 1 larva and 1 nymph on a Cricetidae rodent, in Carajás National Forest, Paraoapebas municipality; Sate of Minas Gerais – 3 nymphs on *Oligoryzomys* sp. (bush rat), Canaã municipality; 18 larvae and 2 nymphs on *Monodelphis kunsi* (pygmy short-tailed opossum), Pompéu municipality; 28 larvae, 6 nymphs and 3 females on *Monodelphis domestica* (gray short-tailed opossum), Ecological Station of Pirapitinga, Morada Nova de Minas municipality; 1 female on *M. domestica*, State Park of Rola-Moça Ridge, Belo Horizonte municipality; 1 female on *M. domestica*, Diamantina municipality. The present scientific communication increases the known distribution and host-records of *I. amarali*, recording for the first time the presence of this tick species in the northern region of Brazil.

Thursday 26, Afternoon, Auditorium - Poster

443 - Efficiency of the predatory mites *Iphiseiodes zuluagai* and *Euseius concordis* in controlling *Polyphagotarsonemus latus* and *Tetranychus bastosi* on *Jatropha curcas* plants in Brazil

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One of the most promising plant species for biofuel production in Brazil is the physic nut, *Jatropha curcas*. Major phytosanitary problems include the attack of two pest mite species, the broad mite, *Polyphagotarsonemus latus*, and the spider mite *Tetranychus bastosi*. Owed to pesticide usage-related problems, there is an increasing demand for sustainable environment-friendly control methods such as biological control. In this study, we evaluated the suitability of the predatory mites *Iphiseiodes zuluagai* and *Euseius concordis* in controlling *P. latus* and *T. bastosi* on *J. curcas*. The number of *T. bastosi* killed by *I. zuluagai* was lower than the number of *P. latus* consumed. *E. concordis* preyed upon both *T. bastosi* and *P. latus* but the number of prey killed was always lower in comparison with *I. zuluagai*. However, *P. latus* and *T. bastosi* are suitable for the development of *I. zuluagai* and *E. concordis*, as oviposition of both predators did not differ in relation to prey species. The preference of *I. zuluagai* for leaves infested by either *P. latus* or *T. bastosi*, combined with the higher values for predation obtained by this predatory mite when fed on *P. latus*, compared to that values obtained by *E. concordis*, suggests that *I. zuluagai* can be more efficient than *E. concordis* in reducing populations of *P. latus* and *T. bastosi* under field conditions. Furthermore, we report here on the first record of predatory mites associated with *P. latus* and *T. bastosi* on native *J. curcas* plants in Brazil. In conclusion, we emphasize the crucial importance of predatory mites as natural biological control agents of mite pests on *J. curcas* in small farms.

Tuesday 24, Morning, Room 3

444 - Acaricide resistance management for *Tetranychus urticae* in Brazil

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The two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae), is an important agricultural pest with global distribution. Its phytophagous nature, high reproductive potential and short life cycle facilitate rapid resistance development to acaricides, often after few applications. Studies have been carried out on acaricide resistance in *T. urticae* in Brazil aiming at defining strategies for resistance management. Resistance has been detected to several acaricides, such as abamectin, milbemectin, fenpyroximate and chlorfenapyr. High resistance frequencies (> 70%) have been observed on ornamental plants (chrysanthemum, gerbera, roses) and strawberry; for some acaricides (e.g. chlorfenapyr) high resistance frequencies have also been detected on cotton and papaya. Conversely, many populations have been observed to be susceptible to diafenthiuron, spiromesifen and etoxazole, with resistance frequencies lower than 5%. Positive cross-resistance between abamectin and milbemectin was observed evaluating 25 field populations from different crops. Abamectin and milbemectin resistance have shown to be unstable in the absence of selection pressure. The frequency of milbemectin resistance decreased from 75 to 14.5%, while the percentage of abamectin resistant mites decreased from 57 to 9.1%, in 7 months, under laboratory conditions. Studies comparing milbemectin resistant and susceptible strains of *T. urticae* indicated a fitness cost associated with the resistance, including a reduction in oviposition rate of the resistant strain. Studies on genetics of fenpyroximate resistance indicated that it is controlled by a major, incompletely dominant factor. Frequencies of fenpyroximate resistance declined significantly in the absence of selection pressure, but the rate of decline was lower than that observed for abamectin and milbemectin. One of the strategies to prolong acaricide efficacy in the field is the rotation of chemicals that do not show positive cross-resistance. This strategy is probably very interesting for abamectin and milbemectin, considering the instability of resistance. Experiments carried out in commercial strawberry fields have shown that the use of predaceous mites (e.g. *Neoseiulus californicus*) in association with selective acaricides is also a promising strategy for the management of acaricide resistance in *T. urticae*, enabling a drastic reduction in the frequency of acaricide applications, with a consequent reduction in the acaricide selection pressure. This research was financially supported by the Brazilian FAPESP, CNPq, IRAC-BR.

Thursday 26, Afternoon, Auditorium - Poster

445 - Monitoring of acaricide resistance in *Tetranychus urticae* Koch (Acari: Tetranychidae) in several crops in Brazil

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The two-spotted spider mite, *Tetranychus urticae*, is an important agricultural pest, affecting crops by direct feeding, reducing the photosynthetic activity and causing leaf abscission in severe infestations. Its high reproductive potential and short life cycle facilitate rapid development of resistance to many acaricides, often after a few applications. The objective of this study was to detect the resistance of *T. urticae* to eight acaricides and to evaluate the resistance frequency in commercial fields of several crops in Brazil. Discriminating or diagnostic concentrations (in mg of active ingredient per liter) were used for monitoring *T. urticae* resistance to the following acaricides: abamectin (4.79), milbemectin (5.5), fenpyroximate (46.3), chlorfenapyr (37.4), diafenthiuron (150), propargite (40.3), spiromesifen (6.96) and etoxazole (5.5). Fifteen mite populations were collected from commercial fields of different crops (raspberry, cotton, bean, papaya, strawberry, grape, chrysanthemum), in several municipalities of the States of São Paulo (Campinas, Holambra, Jales, Campos do Jordão, Monte Alegre do Sul, Jales), Mato Grosso (Primavera do Leste), Goiás (Cristalina) and Bahia (Mucuri, Nova Viçosa) in Brazil. Bean-leaf-disc arenas were infested with adult female of *T. urticae* and submitted to acaricide spraying at the diagnostic concentration of each chemical, using a Potter spray tower. At least 240 mites were used for each population and acaricide. In the case of spiromesifen and etoxazole, the bioassays were carried out using *T. urticae* eggs. The percentages of survival were registered at 48 and 72 hours after treatment, for the tests in adult females (abamectin, milbemectin, fenpyroximate, chlorfenapyr, diafenthiuron, propargite); and for 7 days (daily evaluations of egg hatching) for tests in eggs (spiromesifen, etoxazole). The results showed

significant differences between populations in their responses to the acaricides. In the case of abamectin, milbemectin and fenpyroximate, the highest resistance frequencies (42 to 91%) were observed for strawberry and chrysanthemum, especially in the State of São Paulo. For chlorfenapyr, the highest resistance frequency was observed for cotton (71%) from Cristalina. For propargite, the most resistant population was collected from chrysanthemum in Holambra, with 65% of resistant mites. Other populations presented frequencies of resistance propargite lower than 15%. Most populations were susceptible to diafenthiuron, spiromesifen and etoxazole, with frequencies of resistance lower than 5%. This research was financially supported by FAPESP.

Tuesday 24, Morning, Room 1

446 - Variation in nest sanitation behavior among social spider mites of genus *Stigmaeopsis*

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Waste management is an important adaptation in nest-building and group-living animals, because poor sanitation can reduce living space inside nests and facilitate disease infection among nest mates (Lee 1994; Hamner & Parrish 1997). Such behavior has been found in many social insects and arachnids, from communal to eusocial (e.g. Wilson 1975; Hölldobler & Wilson 1990; Choe & Crespi 1997). It has been also found in several spider mites and mesostigmatid mites, and is considered to be closely associated with the evolution of mite sociality (Treat 1975; Saito 1983, 1995, 1997, 2010; Donze & Guerin 1994). Spider mites of the genus *Stigmaeopsis* (Acari: Tetranychidae) show obvious waste management behaviors. They construct tunnel-like woven nests with no specific structure except for two entrances on the leaf undersurface of host plants, live within the nests in groups, and deposit fecal piles at particular sites (Saito 1983, 1995). *Stigmaeopsis takahashii* and *S. saharai* establish two defecation sites per nest, one per entrance, by a simple rule: defecate just outside the entrance (Sato & Saito 2006). On the other hand, *S. miscanthi* and *S. longus* tend to establish one defecation site per nest by two simple rules: in the absence of feces (e.g., just after nest establishment), defecate near the nest entrance (like *S. takahashii* and *S. saharai*); subsequently, defecate on established fecal piles (Sato et al. 2003; Sato & Saito 2006). These mites recognize fecal piles from volatile chemical cues diffused from the piles (Sato et al. 2003; Sato & Saito 2006), but the two species show some differences in response to chemical cues (Sato & Saito 2008). This prompts the questions of why there are differences in waste management behavior among species within the genus and why the response of *S. miscanthi* to the volatile chemical cues is different from that of *S. longus*. To answer these questions we looked at species differences in the method of nest expansion in relation to nest size and group size, and at the groups' host plant history. We discuss the evolution of waste management behavior in this genus, comparing ecology and evolutional history among species.

Tuesday 24, Morning, Room 1

447 - How early learning affects the foraging behavior of predatory mites

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Learning, change in behavior after experience, is a ubiquitous phenomenon in both vertebrate and invertebrate animals. Learning may affect every major life activity and allows behavioral optimization in variable environments. In arthropods, learning in the context of foraging is particularly well documented for adult insects with a taxonomic bias on flies, bees and parasitoid hymenopterans. In contrast, relatively little is

known about learning by true predators and juvenile individuals. True predators such as phytoseiid mites typically feed throughout life using the same feeding mode and have a less intimate relation to individual food items than parasitoids. These characteristics, ease of rearing and usability in manipulative experiments make phytoseiid mites perfectly suited animals to scrutinize the consequences of juvenile learning for later life. Here, we give a synopsis of recent studies demonstrating how experience with a given prey in the early stages of life may change foraging behavior and enhance fitness-related life history traits of adult phytoseiid mites. The first example deals with adaptive learning in the specialist spider mite predator *Phytoseiulus persimilis*. Adult females that had fed on an alternative prey, conspecific individuals, during juvenile development, attacked this prey sooner than naïve females did, optimized their daily predation rates and had enhanced survival prospects. The second example shows that adult females of *Neoseiulus californicus*, a generalist predator with a ranked preference for spider mites, have shorter attack latencies and higher predation rates on the alternative prey, western flower thrips, after imprinting on this prey in the early stages of development. The third example highlights that the effects of experience with thrips and/or spider mites by juvenile *Amblyseius swirskii*, a broad generalist predator without known prey preference, on adult foraging behavior and oviposition greatly depend on the point in time and sequence of experiences with these prey species during ontogeny.

Thursday 26, Afternoon, Auditorium - Poster

448 - Expression and purification of two fragments of glycogen syntase kinase from *Rhipicephalus microplus*

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The tick *Rhipicephalus microplus* is an important ectoparasite that causes substantial economic damage to livestock production. Acaricides are used in the conventional tick control. However, studies using vaccination strategies have shown to be a promising control method. Our research group has characterized proteins evolved in tick embryo development, like glycogen sintase kinase (GSK). GSK is serin/threonin kinase involved on glycogen synthesis, the major form of glucose storage in animal cells. Previous results showed that treatment of adult tick with a specific inhibitor of GSK (alterpaullone) causes significant reduction in the number and viability of the eggs. Therefore, the study of *R. microplus* GSK could contribute to the development of a new vaccine for immune protection against the tick. In order to study this enzyme at the molecular level, we cloned and expressed two DNA fragments encoding the N- and C- terminal regions of GSK. Specific primers were designed and used in PCR to clone the two GSK fragments. The amplicons were digested with restriction enzymes and ligated in expression vector. The cloning was confirmed for cleavage with restriction enzymes, PCR and DNA sequencing. *Escherichia coli* BL21(DE3) RIL were transformed with the plasmid N-GSK-pAE and *E. coli* BL21(DE3) RP were transformed with the plasmid C-GSK-pAE for expression of recombinant proteins. Optimal production was achieved by testing different growth temperatures, period of cultivation and IPTG concentrations. The expressions were analyzed by SDS-PAGE 12% and the presence of the recombinant proteins were confirmed by Western blot, using monoclonal antibody anti-histidine. The purification of the N-GSK protein fragment has been done by Ni^{2+} affinity chromatography. The immunizations of rabbits and bovines are in progress to assess the capacity of the rGSK to induce an immune response. Also, the sera could be used to test the capacity of antibodies to interfere in the embriogenesis of the tick. This research was financially supported by CNPq, FAPERGS, CAPES, FAPERJ and INCT-EM.

Thursday 26, Afternoon, Auditorium - Poster

449 - Combined use of entomopathogenic fungi and sublethal dosages of acaricides as new biocontrol strategy?

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Ticks are major pests of livestock and humans and serve as vectors of pathogens in several diseases. Their control is currently based on the use of synthetic acaricides but biological control strategies are in demand because of toxicological as well as environmental concerns and increasing problems with tick resistances. Entomopathogenic fungi (EF) are one group of promising biocontrol agents. The susceptibility of different tick species to EF can be high but nevertheless there is still need for research to improve EF efficacy because great variability among strains has been reported. One strategy to improve efficacy is to combine the fungi with low dosages of pesticides either to enhance directly EF virulence, to change tick behaviour in order to increase the chances of contamination or to depress the immune response of ticks. But it is unclear if these combinations will have a synergistic, additive, antagonistic or intermediate character. We investigated the use of acaricides, i.e. Fipronil and Amitraz, to depress the immune response of ticks with the aim to maximise the pathogenicity of EF. We chose larvae and engorged females of the cattle tick *Rhipicephalus microplus* (Canestrini) for our in vitro tests with two strains of *Metarhizium anisopliae* var. *anisopliae* (Metsch.) Sorokin. (Hypocreales: Clavicipitaceae). Engorged females were dipped in the different EF and acaricide solutions and afterwards kept in Petri dishes for 14 days. The mortality was recorded daily and the amount of laid eggs was evaluated at the end of the experiment. Larvae were incubated on treated filter paper for 21 days and mortality was recorded twice a week. We could observe an increasing mortality rate of ticks in some of the combined treatments of EF and low dosages of pesticides compared to the mortality in the individual treatments, indicating at least additive effects. Results are discussed in the context of improved tick control strategies.

Wednesday 25, Morning, Room 3

450 - Effect of acaricides on two strains of the entomopathogenic fungi *Metarhizium anisopliae* var. *anisopliae* in vitro

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Entomopathogenic fungi (EF) are widely used as biological control agents against a broad range of insect and arachnid pests. But the control efficacy is variable due to unfavourable and fluctuating environmental conditions but also to intrinsic factors. One strategy to enhance EF efficacy is to combine the fungi with low dosages of pesticides. These sublethal dosages of chemicals can increase control efficiency of EF but only if they do not affect the viability, development and virulence of the EF. Adverse effects could be inhibition of germination and/ or vegetative growth, as well as conidiogenesis and sporulation, or genetic mutations. The present study investigated the effect of different concentrations of Fipronil, Permethrin, Imidacloprid, NeemAzal and Amitraz, selected as potential candidates for combined applications, on two strains of the EF *Metarhizium anisopliae* var. *anisopliae* (Metsch.) Sorokin (Hypocreales: Clavicipitaceae) in vitro. EF was inoculated on a medium supplemented with five different concentrations (0.32 to 200 ppm) of the above mentioned pesticides. Germination rate, vegetative growth and sporulation were evaluated. Results showed, according to a sporulation and vegetative growth compatibility classification, that most pesticides were classified as compatible with both tested EF strains. Only Fipronil in higher dose rates of 40 and 200 ppm could be classified as moderately toxic to one EF (strain 7). Furthermore only higher concentrations of the pesticides caused slight inhibition of spore germination and a reduction in colony size. At maximum sporulation was reduced about 50% by 40 or 200 ppm Fipronil or Amitraz. Therefore it is likely to use most of the tested pesticides in combination with both strains of *M. anisopliae* for an IPM approach. Studies on the effect of these combinations on target organisms are in progress.

Thursday 26, Afternoon, Auditorium - Poster

451 - A comparative proteomic analysis of partially and fully engorged *Rhipicephalus* (*Boophilus*) *microplus* female salivary glands

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Rhipicephalus (*Boophilus*) *microplus* is a one-host tick that causes high losses in livestock production in tropical and subtropical areas. As all hematophagous parasites, it must counter attack haemostatic, immune and inflammatory host responses to achieve a blood meal. Studying tick salivary glands is critical to improve the understanding of their role during tick feeding and in pathogen transmission, as well as to propose key molecules as antigen candidates for an anti-tick vaccine. This work applies a comparative proteomic approach in order to identify proteins in *R.* (*B.*) *microplus* partially and fully engorged female salivary glands. Partially and fully engorged female tick salivary glands were dissected in PBS at 4°C, and had their protein content extracted in Tris 40 mM pH 8.0. This preparation was desalted and concentrated with ReadyPrep 2D Cleanup Kit (Bio-Rad). Both samples were separated in 1-D gel electrophoresis. After running, gels were cut in 0.5-0.5 cm pieces and digested using modified trypsin. Hydrolysis products were analyzed by LC-MS-MS. Also, tick salivary glands were separated by 2-D gel electrophoresis (first dimension: 7 cm IPG strips linear pH range 3-10; second dimension: SDS-PAGE 12% gels). The 2-D gels were analyzed using the PDQuest 2D gel analysis software (Bio-Rad). The LC MS-MS analysis of proteins separated by 1-D electrophoresis identified several proteins with different molecular and biological functions, as calreticulin, Hsp90 heat shock protein, glutathione S-transferase, triosephosphate isomerase, paramiosyn and Na+/K+ ATPase, besides other cellular structural components. The 2-D gel electrophoresis analysis showed differences between the numbers of proteins identified in salivary glands from fully and partially engorged females. In this analysis, 121 protein spots were detected from fully engorged female salivary glands and 152 from partially engorged female. The next step of this work is to identify these proteins by LC MS-MS analysis.

Thursday 26, Afternoon, Room 5

452 - A physiological and biochemical view of tick embryogenesis

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The processes of vitellogenesis and embryogenesis have been studied in various organisms, particularly in mosquitoes, cockroaches, flies and ticks. Although the roles of 20-hydroxyecdysone (20E) and juvenile hormone have been well characterized for vitellogenesis in insects, we know much less about the hormonal control of vitellogenesis in ticks. Initially, it was hypothesized that juvenile hormone was involved in tick vitellogenin-synthesis. However, more critical studies uncovered no evidence for the occurrence of juvenile hormone or juvenile hormone-like molecules in tick species. Current research shows that in ticks, it appears that ecdysteroids, and not juvenile hormone, regulate the expression of the vitellogenin gene and the synthesis and release of vitellogenin protein into the hemolymph. In general, tick vitellogenin carbohydrate, lipid and amino acid composition is similar to that of insect vitellogenin. After secreted into the hemolymph, vitellogenin is uptaken by oocytes through a receptor-mediated endocytosys. Moreover, there are different strategies to control vitellogenin synthesis and uptake by ovary in ixodide ticks. Once in the oocytes, vitellogenin is partially processed in the endosomal compartment and then stored as vitellin, the main reserve protein for embryo development. It occurs in specialized organelles called yolk granules. Embryo development depends on the availability of yolk material stored into oocytes. Clearly, characterization of molecules involved in vitellogenesis and embryo development contributes

to a better understanding of tick parasite physiology. During embryogenesis, acidic enzymes are responsible for nutrients availability for embryo nutrition. The Vitellin-Degrading Cysteine Endopeptidase (VTDCE), Boophilus Yolk Pro-Cathepsin (BYC), Tick Heme Binding Aspartic Proteinase (THAP) and Larvae Cysteine Endopeptidase (RmLCE) are enzymes involved in vitellin hydrolysis in *Rhipicephalus microplus* eggs and larvae. Egg enzymes usually are produced by gut and fat body and transported through the hemolymph to be internalized into oocytes, playing their role in tick embryo nutrition. Significant advancement has been made in recent years on the understanding of tick reproductive process. Several putative targets for new tick control strategies have been characterized. Indeed, enzymes have been tested in native or recombinant forms as immunogens to a multiantigenic anti-tick vaccine. As VTDCE, BYC, THAP and RmLCE are involved in important physiological process, the study of their potential as targets for an anti-tick vaccine is an attractive research topic.

Thursday 26, Afternoon, Auditorium - Poster

453 - Cloning and molecular characterization of kynurenine aminotransferase from the cattle tick *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae)

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Infestations by the tick *Rhipicephalus* (*Boophilus*) *microplus* represent a great economic problem to the cattle production. An environmentally friendly alternative method to control tick infestations would be the use of vaccines. Kynurenine aminotransferase (KAT) is an enzyme involved in tryptophan catabolism, being responsible for catalyzing the transamination of kynurenine to kynurenic acid, and 3-hydroxykynurenine to xanthurenic acid. The metabolites originated in this pathway have been shown to be involved in many biological processes in mosquitoes and tick species. Since KAT was demonstrated to be more expressed during the parasite blood-feeding course, it is possible to suppose that this enzyme could have an important role during tick feeding. Phylogenetic analysis showed that *R. microplus* KAT protein sequence is in the same clade of the *Haemaphysalis longicornis* and *Ornithodoros moubata* tick sequences, and it has similarity with the KAT sequences of *Aedes aegipty* and *Drosophila melanogaster*. Also, the tick protein sequence has various differences when compared with *Bos taurus* KAT sequence. In *silico* antigenic analysis demonstrated the protein has many immunogenic regions. These observations are essential to develop a vaccine against the parasite. In this context, the aim of this study was to clone the KAT coding region of *R. microplus* and to characterize the recombinant protein. To accomplish this, a nucleotide sequence with high similarity to the KAT of the tick *H. longicornis* was identified in a public cDNA data bank (TIGR) and used to project primers flanking de coding region of KAT gene of *R. microplus.* RNA extracted from gut of *R. microplus* females was used for cDNA production. The specific-primer amplicon obtained by PCR was inserted in the cloning vector pGEM-T Easy, and this construction was used to transform *Escherichia coli* TOP 10 strain. The DNA sequence of KAT in the recombinant plasmid was confirmed by restriction enzyme analysis and sequencing. Subsequently, for protein expression the amplicon was subcloned in the vector pET-5a with insertion of a histidine tail, and *E. coli* BL21 (DE3) strain was transformed. Expression of the recombinant protein is under progress. In future steps, immunological and biochemical characterization of recombinant *Rm*KAT will be developed. This research was financially supported by CNPq, INCT-EM, FAPERGS and CAPES.

Thursday 26, Afternoon, Room 3

454 - *Tetranychus urticae* Koch a new threat to medicinal plants in India

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India is quite rich in indigenous medicinal plants

growing luxuriously over wide areas with different climatic conditions. In the present context of "back to nature" in health care, it is very relevant that these valuable plants should not only be preserved but their conservation should also be encouraged. The phytophagous mite *Tetranychus urticae* has been reported to cause serious damage and pose a threat to medicinal agro-ecosystems. A faunistic survey in semi arid region of Rajasthan indicated that in all 20 plants species of 6 families have been recorded to be infested mainly by this species but also by three other species. The infestation was most severe in case of *Withania somnifera* as compared to other medicinal plant species. *Tetranychus urticae* has been a dominant species and recorded throughout the year.

Tuesday 24, Afternoon, Room 6

455 - Comparative and functional morphology of the mouthparts of larvae of Parasitengona (Acariformes)

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Larval morphology is an important source for evolutionary information because larvae may reproduce generalized morphology of the stock phyletic lines in every group of organisms, including acariform mites. Nevertheless, larval forms in Acariformes and particularly in Parasitengona are still poorly investigated. To fill this gap in our knowledge, the anatomy and ultrastructural organization of the mouthparts of larvae of the soil-inhabiting mites *Neotrombicula pomeranzevi* (Schluger, 1948) and *Hirsutiella zachvatkini* (Schluger, 1948) (Trombiculidae), parasites of vertebrates, as well as of *Platytrombidium fasciatum* (Koch, 1836) and *Camerotrombidium pexatum* (Koch, 1837) (Microtrombidiidae) and the water mites *Piona carnea* (Koch, 1836) (Pionidae) and *Hydrodroma despiciens* (Muller, 1776) (Hydrodromidae), parasites of arthropods, were studied for the first time using whole-mount preparations, semi-thin sections and TEM and SEM methods. In these groups, the organization of the gnathosoma differs significantly in general architecture and in details, reflecting evolutionary trends as well as peculiar functional specialization and adaptations of those mites. In trombiculid larvae, the mouthparts reveal the most generalized plesiomorphic organization. The basal cheliceral segments are short, free and totally separated from each other. The lateral hypostomal lips form temporary sucker, and the pharynx is totally jointed to the gnathocoxal plate. In microtrombidiid larvae, the gnathosoma is covered by the arched dorsal shield, the chelicerae are comparatively long and separated, and the apical hypostomal lips form permanent apomorphic sucker provided with an internal armature. Conversely, in water mite larvae, the chelicerae may be partially (*P. carnea*) or totally (*H. despiciens*) free and fused (*P. carnea*) or separated (*H. despiciens*). The apical hypostomal lips are flexible and organized freely, the pharynx is separated from the gnathocoxal plate, and the epistome is poorly developed. In general, water mite larvae show significant variation and many particular adaptations in organization of the mouthparts. They are thought to be the most derived group in comparison with microtrombidiids and especially trombiculids. This study is supported by a grant N 09-04-00390-a from the Russian Foundation for Fundamental Research.

Thursday 26, Morning, Room 3

456 - Occurrence of *Hydrozetes parisiensis* (Oribatida: Hydrozetidae) on water glasses in Lake Biwa, morphology and gene sequence

S. Shimano[1], T. Sato[1], G. Kuriki[2] & Y. Kusuoka[3]

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The ydrozetid mites are usually recorded in *Sphagnum* bogs in Japan. We investigated an ancient freshwater lake, the 4-million-year-old Lake Biwa in Japan. At first, by motorboat sampling in the south part of Lake Biwa, *Hydrozetes parisiensis* was collected from water glasses within one meter from the water surface (the depth of lake: six meters at this point). Second, in some sampling points of the southern half of the lake, the same species was collected from water glasses. In this report, we present the first record of *H. parisiensis* from Japan and gene sequence based on Japanese specimens. This research was financially supported by the Lake

Biwa Museum, Comprehensive Research Project 06–02 (Y. Kusuoka & S. Shimano).

Friday 27, Morning, Room 4

457 - Aoki's bioindicator and its modern value

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Among the over 20 people currently studying oribatid mites in Japan, most of them are pupils of Dr. Aoki. Over 650 named oribatid species are currently known in Japan, of which 300 were newly described by Dr. Aoki. Although generally considered an oribatid taxonomist, Dr. Aoki developed a method for using oribatid mites as biological indicators. Unfortunately, his proposed method was only reported in Japanese. Here we present his approach and evaluate its value. Although there are other publications treating oribatid mites as bioindicators (e.g. Caruso *et al*., 2007), in this report, we focus on the "Japanese" perspective. Aoki (1983) proposed the "MGP analysis" for using oribatid communities as bioindicators (in Japanese, with English summary). "MGP" referred to the three major taxonomic groups: the group M (Macropylina), the group G (Gymnonota), and the group P (Poronota). He took into account the relative dominance in the number of species (MGP-analysis I) and the number of individuals (MGP-analysis II) for each of these groups (MGP). He found that groups M, G and P tend to predominate in moors, forests and urban plantations while none of the groups predominate in grasslands. Actually, he thought that the differences were due to levels of tolerance to desiccation, with the "lower forms" of oribatids showing poor tolerance to dry environments, mainly caused by human disturbance. In many studies examining environmental changes in Japan, the MGP-analyses (I and/or II) were used and their results supported the hypothesis that human disturbance is the main factor driving the composition of oribatid mites. Aoki (1978, 1989) developed a system for scoring the genera of oribatids. However, the system did not work well for genera, and he used it instead at the species level. Aoki (1994) gave a score (integrals from 1 to 5) to a total of one hundred species, each showing a clear and distinct response to environmental changes. This "100 oribatid species" system was developed for the warm-temperate zone of Japan. Harada & Aoki (1997) evaluated it across some vegetation types. For instance, in Nematology, families were assigned to categories (1 to 5) relating to cp groups (colonizer-persister), and to feeding habit groups and functional groups. For oribatid mites, life history traits, soil depth, and feeding habit should be considered. We will discuss some ecological aspects of oribatids as bioindicators. Aoki (2000) had studied oribatids in moss cushions growing on city constructions – the ultimate human-disturbed environment. We will describe his challenge to find the "hometown" of some oribatid species he found there. Recently, Aoki (2009) reviewed the biogeography of oribatids in the Ryukyu archipelago. We will also discuss about the potential use of oribatid mites as biogeographical markers of soil faunas.

Thursday 26, Afternoon, Room 2

458 - Intra- and extra-guild predation between *Amblyseius swirskii* and *Neoseiulus cucumeris* and western flower thrips – which is the preferred food source?

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The relationships between the predatory mites *Amblyseius swirskii* Athias-Henriot and *Neoseiulus cucumeris* (Oudemans) (Acari: Phytoseiidae), and their prey, western flower thrips *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae), were investigated to determine the effects of predation on intra-guild or extra-guild prey and predator preference. Life history characteristics of both predatory mite species were determined when

fed eggs and larvae of the other predator species, and compared to data obtained when the predators were fed thrips larvae. In addition, choice tests were conducted to determine if the predators had a preference for different prey or if they were indiscriminate predators. *Amblyseius swirskii* appears to be an important intra-guild predator of *N. cucumeris* juveniles because of a high predation rate and a preference for *N. cucumeris* juveniles over thrips. *Neoseiulus cucumeris* is also an intra-guild predator of *A. swirskii* juveniles; however, it has a lower predation rate than *A. swirskii*. Contrary to intra-guild predation theory, intra-guild prey was an equally good or better food source than thrips (extra-guild prey) for both predators. Feeding preference for intra-guild prey was likely in part due to the defensive behaviour exhibited by thrips larvae when attacked. Immature mite stages especially had problems capturing and feeding on first instar thrips. Laboratory trials showed that the presence of adult conspecific mites with immature mites increased the survival percentage of predatory mites from larvae to adult and decreased development time. The results of this study indicate a high potential for negative interactions between *A. swirskii* and *N. cucumeris* when used together in biological control of thrips and is supported by observations in the field where *A. swirskii* has been observed to eliminate *N. cucumeris* when both predatory mites occur together.

Wednesday 25, Afternoon, Auditorium - Poster

459 - Community of gamasid mites (Acari: Mesostigmata) of the Otún-Quimbaya Fauna and Flora Sanctuary (Risaralda-Colombia)

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Mesostigmata, is a group of predominantly predatory mites that reflect in their community composition variations concerning the vegetable structure and environmental factors. The aim of this study was to describe the composition and diversity of mites of this group in two vegetation types, Oakwood (Plantation) and secondary early forest (BST 15-20 years), at the Otún Quimbaya FFS. Samplings were conducted in two climatic seasons (February / April – humid and June / July - dry). The samples were processed in Berlese-Tullgren funnels. 148 samples were analyzed (77 in Oakwood and 71 in BTS), 3045 individuals were counted, belonging to 18 families grouped in 40 morphospecies (40 BTS and 26 for Oakwood), 8 of which were identified to genus and 3 to species. The vegetation with major abundance was BST (2288 individuals: 1042 humid and 1246 for dry), versus the Oakwood (757: 329 humid and 428 dry). The most abundant family was Uropodidae. The period and vegetation type with highest diversity were dry and BST. The index of similarity Chao-Jaccard showed a species trade between periods of 2.8 % and between vegetation type of 17.7 %. The results show that the differences obtained between the communities could be because of variations in the structure, composition and thickness of the litter, as well as the regime of humidity of the micro-habitats. Finally, making an ecological approximation, the Oakwood seemed to present a typical behavior of plantation, which can possibly be due to a higher homogeneity in the litter than observed in the BST.

Tuesday 24, Afternoon, Auditorium - Poster

460 - *Neogamasellevans* Loots & Ryke (Mesostigmata: Ologamasidae) of the State of São Paulo, Brazil and descriptions of new species

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Mites of the family Ologamasidae seem to be some of the most abundant and frequent Mesostigmata in soils of natural habitats and agricultural land in Brazil, especially those of the genus *Neogamasellevans* Loots and Ryke. However, little is known about these mites. An effort has been

dedicated to identify the species of *Neogamasellevans* collected in the State of São Paulo, to describe some of the new species found and to prepare taxonomic keys for the species examined. The specimens examined are deposited in the mite reference collection of "Departamento de Entomologia e Acarologia, Escola Superior de Agricultura Luiz de Queiroz", Piracicaba, State of São Paulo, Brazil. For this work, a phase contrast microscope provided with a measuring scale and a drawing tube was used. The mites were identified to genera and species by comparing their morphological characteristics with the original descriptions and redescriptions of each group. A total of 13 species of *Neogamasellevans* were identified, 12 of which new to science; *Neogamasellevans preendopodalis* Loots e Ryke is the sole described species collected in this work. The new species are being described. A dichotomous key has been prepared to separate all of the species of this genus, including the new species described in this work.

Friday 27, Morning, Room 3

461 - The search for natural enemies of the coconut mite (*Aceria guerreronis* Keifer) in Latin America

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Knowledge on predators of the coconut mite, *Aceria guerreronis* Keifer (Acari: Eriophyidae), has been reviewed by Moraes & Zacarias (2002). A detailed assessment of the effectiveness of these predators was initiated in 2004, with the aim to introduce them as biocontrol agents of the coconut mite to other continents. This evaluation was carried out in northeast (several states) and northern Brazil (State of Para) (Lawson et al., 2008), a region considered to be the area of origin of the pest. As a follow-up, a new study started in 2008, with the aim to evaluate the natural enemies found in other coconut-growing areas in the American continent, especially those climatically most similar to areas in Africa and Asia where the coconut mite is a pest. Surveys were conducted in the following states: Roraima and Rondonia (Brazil); Arauca, Antioquia, Cordoba and Sucre (Colombia); Campeche, Guerrero, Quintana Roo and Tabasco (Mexico); and Falcón and Sucre (Venezuela). Taking together the results from all studies conducted since 2004, we report that the coconut mite was found in some of the sites sampled in northern Brazil and in most of the sites sampled in northeast Brazil and the other American countries, usually at high densities. The coconut mite was found on the coconut fruits but never on coconut leaves, where *Raoiella indica* Hirst (Acari: Tenuipalpidae) was the most abundant phytophagous mite, especially in Venezuela. The most abundant predatory mite found on fruits was *Neoseiulus paspalivorus* (DeLeon) (Acari: Phytoseiidae), followed by *Proctolaelaps bickleyi* Bram (Acari: Ascidae), whereas on leaves the most abundant predatory mite was *Amblyseius largoensis* (Muma) (Acari: Phytoseiidae). Another predator, *Neoseiulus baraki* (Athias-Henriot), was abundant on fruits in parts of northeast Brazil, but was rare in other visited parts of Latin America. Phytoseiids and ascids seem to be commonly found in association with the coconut mite in northeast Brazil, Colombia and Venezuela, but not in Mexico and parts of northern Brazil. On leaves, the phytoseiids seem to be very common in every country where they have been searched for. The coconut mite seems to be widespread on coconut palms the American continent, often causing considerable damage despite the presence and abundance of predatory mites. Apparently, these predators cannot prevent damage by the coconut mite, but it remains to be determined whether damage would be higher in case the predators were absent.

Wednesday 25, Afternoon, Auditorium - Poster

462 - Effect of antiparasitic compounds on the reproductive efficiency of *Rhipicephalus* (*Boophilus*) *microplus* field strains, in Descalvado, Brazil

I.C. Silva[1], L.M. Souza[1,2], M.A.A. Belo[1,2] & V.E. Soares[1,2]

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The resistance of *Rhipicephalus* (*Boophilus*) *microplus* has been largely related to the incorrect use of acaricides, since many drugs have been administered indiscriminately, under various forms and dosages, resulting in antiparasitic inefficacy, economic losses, as well as poisoning of human and animals. With different pharmacodinamics and pharmacokinetics, the commercial acaracides can often act on the reproductive capacity of ticks, impairing different physiology mechanisms, helping to control the tick population in the environment. In this context, the present study aimed to evaluate in vitro the efficacy of commercial acaricides on the *R.* (*B.*) *microplus* female reproductive efficiency. Samples of ticks were collected from naturally infested cattle from seven farms in Descalvado County, São Paulo State, Brazil, to be processed in the Laboratory of Veterinary Parasitology (UNICASTELO). Homogeneous females tick groups were separated for body weight to the pharmacological challenge with five acaricides, establishing the experimental treatments as follows: T1= Control (submitted to distilled water), T2 = Cypermethrin 5% + Dichlorvos 45% + Piperonyl Butoxide, T3 = Cypermethrin 15% + Clorpiriphos 25% +Citronellal 1%, T4 = Cypermethrin 15% T5 = Deltamethrin 25% T6 = Amitraz 12.5%. The engorged female ticks were immersed for 10 minutes in diluted solutions as prescribed by their manufacturers. After drying them on paper towel to remove excess of drugs, they were placed in Petri dishes and stored in a climatic chamber with controlled temperature, humidity and photoperiod. Eighteen days post-treatment, the egg masses were collected, weighed and placed in sterile plastic syringes and later identified to obtain the reproductive efficiency index (REI = weight of egg mass / initial weight of females x 100). The results of this study show that the average of initial female weight was 2.173 g with a variation range from 2.336 to 2.078. The observed conversion of body weight into eggs was 46.61% for T1, followed by 34.98% (T5), 34.21% (T3), 23.87% (T4), 10% (T6) and 2.27% (T2). Therefore, the comparative effectiveness drug study on the tick reproduction showed that the association containing the pyrethroid's synergist, piperonyl butoxide, (T2) and the treatment with amitraz (T6), resulted in greater inhibition on the reproductive efficiency of *R.* (*B.*) *microplus* female strains from Descalvado, Brazil.

Wednesday 25, Afternoon, Auditorium - Poster

463 - Efficacy of commercial acaricides on *Rhipicephalus* (*Boophilus*) *microplus* female posture

I.C. Silva[1], L.M. Souza[1,2], M.A.A. Belo[1,2] & V.E. Soares[1,2]

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Rhipicephalus (*Boophilus*) *microplus* has a worldwide distribution in the tropical and subtropical region, and occurs in 95% of the Brazilian territory. Regarding the economic losses caused by this tick, it has been estimated to reach around one billion dollars per year, resulting from depletion on milk production, increased mortality, reducing reproductive performance and gain weight, as well as, to impair the leather quality, costs with tick control and hemoparasitosis treatment. Several studies focusing on the *R.* (*B.*) *microplus* biology and reproduction have been conducted in Brazil, especially in the south and southeast regions. This study aimed to evaluate the efficacy of commercial acaricides on the tick female posture. In this context, samples of ticks were collected from naturally infested cattle from seven farms in Descalvado County, São Paulo State, Brazil, to be processed in the Laboratory of Veterinary Parasitology (UNICASTELO). Homogeneous female tick groups were separated for body weight to the pharmacological challenge with five acaricides, establishing the experimental treatments as follows: T1= Control (distilled water), T2 = Cypermethrin 5% + Dichlorvos 45% + Piperonyl Butoxide, T3 = Cypermethrin 15% + Clorpiriphos 25% +Citronellal 1%, T4 = Cypermethrin 15% T5 = Deltamethrin 25% and T6 = Amitraz 12.5%. The engorged female ticks were immersed for 10 minutes in diluted solutions as prescribed by their manufacturers. After drying them on paper towel to remove excess of drugs, they were fixed in Petri dishes and stored in a climatic chamber with

controlled temperature, humidity and photoperiod. At 18 days post-treatment, the postures were evaluated through the macroscopic characteristics for all groups, which are then classified into complete postures (CP), partial postures (PP), viable postures (VP) and absent postures (AP). Considering the previously established standardization, in this study it was observed that the control group T1 (distilled water) exhibited 97.1% of CP, followed by 65.0% and 63.0% in T5 and T4 treatments, respectively. Moreover, there was a significant lack of engorged female tick postures in the T3 (75.1%), T2 (70.1%) and T6 (53.4%) groups. These results demonstrated that *R.* (*B.*) *microplus* engorged females from Brazilian Descalvado's strains, submitted to treatments containing organophosphates, T2 (Dichlorvos) and T3 (Clorpiriphos), showed significant reduction in egg laying, revealing the organophosphate's pharmacological effectiveness through the parasite acetylcholinesterase inhibition, impairing the reproductive physiology of this specific ixodidae.

Wednesday 25, Afternoon, Auditorium - Poster

464 - Larval hatchability from egg masses of *Rhipicephalus* (*Boophilus*) *microplus* treated with different acaricides

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus* is a parasite of great economic impact on the Brazilian cattle production, with its control predominantly performed with chemicals that can be harmful to animals. The erroneous and indiscriminate use of these compounds result on the reduction of their effectiveness. The aim of this study was to evaluate the percentage of larvae hatchability in egg masses of *R.* (*B.*) *microplus* exposed to several chemicals. Samples of ticks were collected from naturally infested cattle from seven farms in Descalvado County, São Paulo State, Brazil, to be processed in the Laboratory of Veterinary Parasitology (UNICASTELO). Homogeneous females tick groups were separated for body weight to test the pharmacological challenge with five acaricides, establishing the experimental treatments as follows: T1= Control (submitted to distilled water), T2 = Cypermethrin 5% + Dichlorvos 45% + Piperonyl Butoxide, T3 = Cypermethrin 15% + Clorpiriphos 25% +Citronellal 1%, T4 = Cypermethrin 15%, T5 = Deltamethrin 25% and T6 = Amitraz 12.5%. The engorged female ticks were immersed for 10 minutes in diluted solutions as prescribed by their manufacturers. After drying them on paper towel to remove excess of drugs, they were fixed in Petri dishes and kept in a climatic chamber with controlled temperature, humidity and photoperiod. At the end of tick's posture the eggs were weighed and stored in 20 ml syringes. After 20 days of incubation, the visual larvae hatchability was evaluated under a stereomicroscope. The results observed in this study confirm the high pharmacology activity of deltamethrin treatment (T5), reducing approximately 66.6% the hatch, followed by the treatment with the compound containing the synergistic effect of piperonyl butoxide (T2) that presented 64, 4% of hatch reduction, and the amitraz activity, with 63.6%. These findings become more significant, especially when they were compared to the control group, treated with distilled water, which showed about 96% hatch. These results demonstrated, however, the effect of pyrethroids and amitraz on ticks eggs, revealing the importance of these drugs in the sanitary control against *R.* (*B.*) *microplus* infestation, principally, to restrain their biological cycle in animal facilities.

Tuesday 24, Afternoon, Auditorium - Poster

465 - Predatory mites associated with native plants in São Luís, Maranhão State, Brazil

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Mite diversity studies in forest patches may reveal natural enemies that can be used in biological control programmes. Native plants may act as a reservoir of natural enemies through the provision of shelter and alternative food such as nectar and pollen. The objective of this work was to evaluate the diversity of predatory mites on native plants in a

forest remnant located in São Luís, Maranhão, Brazil. The following plant species were selected: *Symphonia globulifera* L. (Clusiaceae), *Carapa guianensis* A. (Meliaceae), *Himatanthus articulatus* M. (Apocynaceae), and *Cecropia hololeuca* M. (Urticaceae). We collected branches with leaves and surveyed them for mites using the methodology described by Zacarias et al. (2004). Specimens were mounted in Hoyer's medium (Flechtmann, 1985) and identified using dicotomic keys and a review by Lofego (2004). Faunistic analyses were carried out using the programme ANAFAU (Moraes et al., 2003). Mite surveys were conducted over a period of 9 months (from August 2008 to April 2009). We identified 437 mites belonging to 9 families: Ascidae, Cheyletidae, Cunaxidae, Phytoseiidae, Stigmaeidae, Tenuipalpidae Tetranychidae, Tarsonemidae, and Tydeidae. Faunistic analyses revealed that the family Phytoseiidae was dominant, very abundant, very frequent and constant. Phytoseiid mites are considered the main natural enemies of pest mites. Among the Phytoseiidae, *Amblyseius* sp.1 and *Iphiseiodes zuluagai* (Denmark & Muma, 1972) were dominant, very abundant and very frequent while *Phytoseius* sp. was considered overdominant, overabundant, overfrequent and constant. *Amblyseius aerialis* (Muma, 1955), *Amblyseius herbicolus* (Chant, 1959), *Euseius concordis* (Chant, 1959), *Neoseiulus* sp., *Iphiseiodes* sp., and *Typhlodromips* sp. were also found inhabiting native plants. We conclude that forest remnants of São Luís harbour a rich community of mites including predatory mites which might be used in future biological control programmes.

Thursday 26, Afternoon, Auditorium - Poster

466 - Movement and oviposition behaviors of *Brevipalpus phoenicis* (Acari: Tenuipalpidae) on citrus leaves exposed and non-exposed to *Euseius concordis* (Acari: Phytoseiidae)

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The mite *Brevipalpus phoenicis*, vector of citrus leprosis virus (CiLV), is considered one of the main pests of citrus in Brazil. Mites of the family Phytoseiidae are the most important natural enemies of this pest. The objective of this research was to evaluate the influence of the predaceous phytoseiid *Euseius concordis* on the movement and oviposition behaviors of *B. phoenicis* on citrus leaves. For the experiment of *B. phoenicis* movement behavior, citrus leaf arenas were divided in two equal parts placing a moistened cotton stripe across the center of the arena. On one half of each arena, 4 adult females of *E. concordis* and approximately 40 *B. phoenicis* mites (all stages) were placed. On the other half, no mite was placed. After 24 h, all live mites (*E. concordis* and *B. phoenicis*, including eggs) were removed from the arenas, leaving only the remains of the killed specimens of *B. phoenicis*. The middle cotton stripe was then removed and 20 *B. phoenicis* adult females were placed on the central part each arena. The numbers of *B. phoenicis* mites on the exposed and non-exposed parts of each arena were registered 0, 5, 10, 20, 30, 45 min, and 1, 2, 3, 4, 5, 6, 24 and 48 h later. The experiment was replicated 50 times. For the experiment of oviposition, similar procedure was adopted, but the arena was not divided, being the entire citrus leaf arena exposed to the predators. In this experiment, 25 arenas were exposed to *E. concordis* and 25 arenas were not exposed to the predator. The number of eggs laid by *B. phoenicis* was registered 6, 12, 24, 48 and 72 h after removing the predators. The experiments were carried out at 25 ± 2ºC. In the experiment of movement behavior, significant differences in the distribution of mites on areas exposed and non-exposed to *E. concordis* were observed between 30 minutes and 48 h after removing the predators. The highest contrast was observed in the evaluation at 4 h, for which the number of *B. phoenicis* mites on non exposed areas was 1.73 times higher than on areas previously exposed to *E. concordis*. In the experiment of oviposition, significant differences in the number of *B. phoenicis* eggs on arenas exposed and non exposed to the phytoseiid mite were observed between 24 and 72 h after removing the predators. The highest contrast was observed at 24 h, with a number of eggs 43% higher on arenas non-exposed to the predator. This research was financially supported by FAPESP.

Tuesday 24, Afternoon, Auditorium - Poster

467 - Occurrence of phytophagous and predatory mites in citrus plantations of São Luís, Maranhão State, Brazil

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Pest mites may inflict severe losses to many cultures including citrus in Brazil. The most important pest mites attacking citrus in Brazil are the citrus rust mite *Phyllocoptruta oleivora* (Acari: Eryophyidae) and the flat mite *Brevipalpus phoenicis* (Acari: Tenuipalpidae). Predatory mites such as those of the family Phytoseiidae are key natural enemies of pest mites and are naturally found inhabiting citrus plantations. We evaluated the acarofauna of *Citrus latifolia* Tan, *C. sinensis* L., and *C. reticulata* Blanco plants monthly over the entire year of 2008. Mite extraction from leaves was conducted according to Zacarias et al. (2004). Specimens were mounted in Hoyer's medium (Flechtmann, 1985) and subsequently identified using dicotomic keys and a review by Lofego (2004). Faunistic analyses were conducted using the programme ANAFAU (Moraes et al., 2003). We identified 410 specimens belonging to 8 families: Phytoseiidae, Cunaxidae, Cheyletidae, Stigmaeidae, Tenuipalpidae, Tetranychidae, Tarsonemidae and Tydeidae. Among the phytoseiid mites *Amblyseius aeralis* was very frequent according to faunistic analyses. The predatory mites *A. aerialis*, *A. largoensis*, and *Iphiseiodes zuluagai* presented the highest number of specimens. *Amblyseius acalyphus* and *Neoseiulus idaeus* occurred only sporadically. In conclusion, predatory mites found in citrus plantations should be conserved in order to contribute to the biological control of pest mites.

Thursday 26, Afternoon, Auditorium - Poster

468 - Influence of physiological insecticides used in the control of coffee leaf-miner on the mite *Oligonychus ilicis*

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Oligonychus ilicis (McGregor, 1917) (Acari: Tetranychidae) is one of the main phytophagous pest-mites of coffee plants. They live on the upper surface of the leaves, puncturing the epidermis and mesophyll cells to absorb and feed on the extravasated cellular content. In consequence, the leaves loose their natural shine and become than, causing heavy reduction in plant's photosynthesis potential and reduced growth on new plants. *Leucoptera coffeella* (Guérin-Mèneville & Perrotet, 1842) (Lepidoptera: Lyonetiidae), the coffee leaf-miner, is considered the most important pest of crop and occurs in all coffee producing regions in Brazil. Its damage results in intense plant defoliation and reducing the coffee yield and plant longevity. The chemical control is the method more conventionally used for these pests. *O. ilicis* and *L. coffeella* usually occur in the coffee plantations in the same season, usually in the dry weather, so the coffee producer could use an insecticide to control both pests. This would reduce the application costs and the intensive use of insecticides and acaricides, causing less impact to the environment. The objective of the present work was to evaluate the influence of different physiological insecticides, applied to control *L. coffeella*, on the population of *O. ilicis*. The following insecticides were used: novaluron (Rimon 100 EC - 300ml/hectare), novaluron (Rimon Supra 100 SC - 300ml/hectare), flufenoxuron (Cascade - 600ml/hectare), lufenuron (Match 50 CE - 600 ml/hectare), the standard spirodiclofen (Envidor 240 SC - 300 ml/hectare) and control (water). Spraying was conducted using a Potter tower at a pressure of 15 lb/pol^2; each leaf received 1.5±0.5 mg/cm^2. The leaves were placed on a sponge constantly moistened with distilled water and a thin layer of hydrophilic cotton was placed around the leaves. The leaves were divided in two parts with cotton, allowing the use of two plates per treatment (four replications), and to each part five females were transferred with a brush. The number of viable eggs was submitted to analysis of variance and means compared by Scott-Knott test. The leaves used were free of agrochemicals. The mite mortality and the number of viable eggs were evaluated daily for 10 days. For *O. ilicis* only one physiological insecticide showed efficiency (flufenoxuron 75% of mortality) and the standard (spirodiclofen) showed efficiency of 89%. The spirodiclofen showed no viable eggs and flufenoxuron an average of viable eggs of 35, or 27% of reduction in the number of viable eggs average when compared to the control (130 viable eggs). The results indicate that the physiological insecticide flufenoxuron is an alternative for use in

the control of *O. ilicis* and *L. coffeella*; therefore field tests are necessary to confirm these results for the mite control.

Thursday 26, Morning, Room 5

469 - *Rickettsia* infection in hard ticks (Acari: Ixodidae) from Paulicéia municipality, São Paulo State, Brazil

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This study was conducted in Paulicéia municipality, São Paulo State, where *Amblyomma triste* ticks was recently found to be infected by the emerging pathogen *Rickettsia parkeri*. Cattle farms and sugar cane plantations characterize the municipality, but remnants of the Atlantic Forest can also be found along the Paraná River. Ticks were collected in September 2009 by dragging with white flannel over the vegetation in 10 equidistant areas of the municipality. Overall, 536 larvae, 590 nymphs, and 44 adults, all free-living, were collected. The tick *Amblyomma cajennense* comprised 98.0% (43/44) of the adults. A single adult of *Amblyomma coelebs* [2.0% (1/44)] was also collected. Similarly, *A. cajennense* comprised 99.0% (586/590) of the nymphs, whereas only 1.0% (4/590) of the nymphs were *A. coelebs*. DNA sequencing of polymerase chain reaction (PCR) products of a fragment of the 16S mitochondrial gene was applied to identify larval species. Until now, 22.3% (120/536) of the larvae have been identified as *A. cajennense*, with 99 to 100% of identity to corresponding *A. cajennense* 16S sequences in GenBank (accession number FJ424404). For the detection of rickettsial infection of ticks, samples were tested by PCR targeting a fragment of the rickettsial citrate synthase gene (*gltA*). Overall, two *A. cajennense* adults, 2 *A. coelebs* nymphs, and 1 *Amblyomma* larval pool (not identified to species) contained rickettsial DNA. The 2 *A. coelebs* nymphs were also PCR positive for the rickettsial *ompA* gene, which is specific for the spotted fever group (SFG). DNA sequencing of these PCR products is in progress. These results will be compared to the already determined anti-SFG *Rickettsia* antibody titers of domestic and wild animals in the study area, in order to establish factors associated to *Rickettsia* infection.

Tuesday 24, Afternoon, Room 1

470 - Glandular trichome 'forests' on tomato leaves act as a predation refuge for tomato russet mites

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We studied the spread of tomato russet mites (*Aculops lycopersici*) on tomato leaflets (*Lycopersicon esculentum* cv Castlemart) in presence and in absence of the predatory mite *Amblyseius swirskii*. Experiments lasted 5 days starting from mite introduction onto the leaf, and were performed on detached leaflets divided in three sectors: midvein, lateral veins (vascular bundle visible at 40x magnification) and areas between veins. Per leaf, the trichomes were classified according to type (glandular, non-glandular) and density, whereas the russet mites were classified according to density in each leaf sector, side of the leaf and activity status (moving or resting). Moreover, predation and oviposition by the predators were recorded. The tomato russet mites first colonized the morphological upper surface and, mainly, the midvein, but within two days they distributed themselves all over the leaf surface. However, in the presence of the predatory mite *A. swirskii*, the russet mites tended to aggregate in areas with higher trichome density where predation risk is lower. The predatory mites laid their eggs on the long non-glandular trichomes, yet their search for russet mites was more or less random and the number of predation events registered was negatively related to the trichome density. We conclude that tomato russet mites actively seek refuge in the 'forest' of glandular trichomes.

Thursday 26, Morning, Room 6

471 - Laboratory evaluation of the effects of *Beauveria bassiana* (strain ATCC 74040) on *Eotetranychus carpini* and *Kampimodromus aberrans*

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The study was conducted to determine the effects of the entomopathogenic fungus *Beauveria bassiana* (Bals.) Vuill. (strain ATCC 74040) (Naturalis®), mainly indicated to be applied against leafhoppers on grapevine. The susceptibility of the phytophagous mite *Eotetranychus carpini* (Oud.) (Tetranychidae) and of the predatory mite *Kampimodromus aberrans* (Oud.) (Phytoseiidae) to treatment with the fungus was evaluated under laboratory conditions at 25°C, 75% RH and 16L: 8D photoperiod and water as control, on detached vine leaf system. To evaluate the effect of the fungus on mortality and fecundity of the two mite species, adult females of different age and eggs were exposed to the it. On the females, the effect of toxicity was evaluated for 12 days. The highest toxic effect was on *E. carpini*; 67.4% of the treated specimens died within 4 days after treatment, while no significant phytoseiid mortality was recorded. The mortality rate of the tetranychid considerably decreased over the following days. On tetranychid eggs, the fungus caused high reduction in hatchability; about 76% of eggs died, while in the untreated this figure was about 16%. The pathogenic effect of *B. bassiana* on fecundity was evaluated only on the tetranychid; within 10 days after treatment, a reduction of eggs laid of about 50% was registered. In laboratory, *B. bassiana* was found to be toxic to *E. carpini* while very low pathogenic effects were detected on the phytoseiid *K. aberrans*. The different responses between the 2 species should be integrated with data obtained in field or semi-field studies, by evaluating the effect of repeated applications on the behaviour of this predator and its ability to recognize treated leaves.

Thursday 26, Afternoon, Room 3

472 - Emerging pest scenario of important mite pests in North India

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The results generated through All India Network Project on Agricultural Acarology and Network Project on Insect Biosystematics since 1987 are described in the present paper. *Tetranychus ludeni* was identified as alarming problem during 1987, many outbreaks were recorded on cowpea (*Vigna ungiculata*), an important summer vegetable of the region, from 1988 to 1990. Major reason of outbreaks was caused by insecticides. Out of 100 selected farmers, none used any acaricide to control the mite pest. Since then, many farmers have left cultivation of cowpea. Problem is still persisting though the area of cultivation has been reduced. In okra, particularly grown during summer months, is having serious problem of *Tetranychus urticae* and *Tetranychus macfarlanei*. Summer egg plant (brinjal, *Solanum melongena*) is having regular problem of *Tetranychus urticae* and *T. macfarlanei*. The eriophyid mite *(Aceria lycopersici*) has emerged as important pest causing damage and consuming upper portion of leaves in the last 5-6 years. The high temperatures favour the mite infestation. The symptom of injury is indicated by russeting like deformations in the plant. *Panonychus ulmi* has emerged as serious problem on apple in Himachal Pradesh. The expanding cultivation of apple has also expanded the severe infestation of this mite. *Petrobia latens* population is increasing year by year in dry land cultivation of Rajasthan. This mite has attained serious pest status on wheat and coriander like aphids. The *Larvacarus transitans* is emerging as serious pest of 'Ber' (*Zyzhipus mauritiana*) in Rajasthan area. The paper also highlights the coconut eriophyid mite (*Aceria guerreronis*) problem which has paralyzed the coconut production in peninsular India a decade back but now the problem is not alarming. The symptoms of injuries of different mites on cowpea and okra are discussed in the present paper. The reason attributed for increasing trend in mite infestation is due to unilateral and continuous use of

pesticides like synthetic pyrethroids, which devastate the predatory mite fauna. The serious emerging trend of *Polyphagotarsonemus latus* on chilli is being continuously recorded since there is a growth of chilli acreage in the area. The availability of acaricides in market favoured the control of this pest. The hundred farmers selected to know about plant protection measures adopted in chilly revealed the use of acaricides on 100 per cent basis. During the last 5 years, the paddy crop is getting infestation of *Stenotarsonemus spinki*, which is being continuously recorded in this region.

Wednesday 25, Afternoon, Room 4

473 - Host specificity of *Aceria* species: the evidence from ecological, experimental and molecular data

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Host specificity is a fundamental trait of herbivore species as it defines their resource base and reflects past evolutionary interactions between the herbivore and plant lineages. Thus, measuring host specificity is one of the major purposes of researching plant-herbivore interactions and of understanding the evolution of host specialization. Eriophyoid mites are a significant component of the herbivore fauna, and many species are of great importance as plant pests or agents in biological control of weeds. However, there are still many questions and gaps regarding host specificity of numerous eriophyoid species. Using ecological, experimental and molecular data we aimed to assess the host specificity of some *Aceria* species feeding on monocots: *Aceria tulipae* (Keifer), *A. aculiformia* Sukhareva, *A. eximia* Sukhareva, *A. calamagrostis* Sukhareva, *A. erectii* Skoracka, *A. flexuosae* Skoracka, *A. glomerivagrans* Skoracka, with special attention to *A. tosichella* Keifer. Quantitative ecological data were obtained during long-term field studies (1998-2009) in central Europe. These data were used to estimate parameters of infestation and host specificity indexes which revealed the differences in the degree of utilization of different hosts by mite species, helped to detect accidental hosts, and showed how sampling effort may influence the estimates of host range. Experimental data obtained by evaluation of fitness (survival and reproduction) of mite species on different hosts provided information about mites' physiological host ranges, which in some cases were not consistent with ecological ones. The analysis of the cytochrome oxidase subunit I (COI) gene fragment from the mitochondrial genome helped to interpret ecological and experimental results. It showed both among- and within-host genetic differentiation within *A. tosichella* suggesting existence of host races or even cryptic species. We conclude that interpretation of results obtained from each of the data sets (ecological, experimental or molecular) separately could lead to incorrect outcomes. Thus, we recommend application of all these approaches (quantitative field surveys, laboratory testing, and molecular genetics) for obtaining reliable information on host specificity of herbivores.

Wednesday 25, Morning, Room 4

474 - Morphological and genetic variation in the wheat curl mite, *Aceria tosichella* (Eriophyidae)

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The wheat curl mite, *Aceria tosichella* Keifer, is an eriophyoid mite associated with a large number of grass species (including many cereals) worldwide. Due to the serious direct damages caused by this mite and its ability to transmit the *Wheat streak mosaic virus* (WSMV), the *High Plain virus* (HPV), and other plant disease agents, the wheat curl mite is responsible for significant crop losses in many production areas. Considering the potential of *A. tosichella* to utilize a wide range of grass hosts and to disseminate throughout the world, phenotypic variation among populations under different environmental conditions can be expected. Phenotypic variation may be genetically based or it might result from the influence of environmental factors and possible interactions between the two. In this study, based on morphological and DNA data, we aim to assess the level of differentiation between populations of *A. tosichella* originating from different hosts and continents. The study included populations of *A. tosichella* from Poland, Argentina, Brazil, and Australia that were collected from the following hosts: *Arrhenantherum elatius*, *Bromus inermis*, *Elymus repens*, *Festuca arundinacea*, *Hordeum leporinum*, *H. murinum*, *Triticum aestivum*. Populations of *Aceria tulipae* (Keifer), collected from *Allium sativum* and *A. cepa* in Poland, served as the nearest out-group. The morphometic analyses (cluster analysis, PCA, DFA) included 39 quantitative traits, and molecular analysis was based on mitochondrial cytochrome oxidase subunit I (COI) sequence data. Both morphological and genetic results revealed noteworthy differences between the populations studied. The sequence divergence among different clades was at the level corresponding to different species. Both data sets showed that *A. tosichella* infesting *T. aestivum* in Brazil, Argentina and Poland formed the most distinct group. This suggests that populations associated with wild grasses are different from those attacking wheat. Populations infesting *Hordeum* spp. in Poland and Australia formed a genetically distinct clade, suggesting that there is some host-dependent genetic variation within the taxon. Our results support previous indications that the wheat curl mite may represent a species complex.

Wednesday 25, Morning, Room 1

475 - The stochastic demography of two coexisting male morphs of *Rhizoglyphus robini* (Astigmata)

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Stochastic demography has great potential to increase understanding of links between genes, phenotype, demography, and dynamics in stochastic environments. Using data from life table experiments, we show that the long-run stochastic growth rates of the two genetic male morphs of the bulb mite (*Rhizoglyphus robini*) are equivalent across different stochastic environments. The fitness equivalence of the two morphs suggests that stabilising mechanisms, such as density- or frequency dependence, required to maintain their coexistence, are weak. These results illustrate the power of experimental stochastic demography to understand problems like the coexistence and maintenance of genetic polymorphisms in stochastic environments. Prospects on how experimental evolutionary studies using this approach can increase insights into the interplay between trait selection and the demographic structure of populations in varying environments are discussed. Such insights are important since environmental regimes (natural and those imposed by experimenters), or feedback between individuals and environmental conditions, may lead to selection on phenotypic traits - especially in species that have short generation times.

Wednesday 25, Afternoon, Room 4

476 - Effectiveness of eriophyid mites for biological control of weeds

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Eriophyid mites are thought to have a high potential

for use as classical biological control agents of weeds. However, in the past 20 years few species have been authorized for introduction, and few have significantly reduced the target plant's population. Natural enemies, resistant plant genotypes, and adverse abiotic conditions may all reduce the ability of eriophyid mites to control weeds. Furthermore, host specificity experiments conducted under laboratory conditions sometimes indicate a wider host range than that observed in the field, which results in failure to obtain approval for release. We need to know more about the natural behavior, life history and evolutionary stability of eriophyid mites. This is critical for designing and interpreting experiments to measure host plant specificity and potential impact on target and nontarget plants, which must be known before they can be released.

Tuesday 24, Afternoon, Auditorium - Poster

477 - Occurrence of *Amblyomma* ticks (Acari: Ixodidae) on free-living wild mammals in Santarém, State of Pará, Eastern Brazilian Amazon

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Ticks that parasitize domestic animals are the most studied; consequently, the species that parasitize wildlife are still poorly known, especially in relation to its taxonomy, biology, ecology, geographical distribution, usual hosts, and vector capacity of pathogens. From August to October 2009, *Amblyomma* ticks were collected from free-living wild mammals, roadkilled in Santarém, Pará state, Brazil. Ticks were identified using current taxonomic keys for adults and nymphs. *Amblyomma* larvae could not be identified to species level due to lack of sufficient literature for such purpose. The following tick-host parasitic associations were found: 2 nymphs of *Amblyomma pacae* on a common opossum (*Didelphis marsupialis*); 3 nymphs of *Amblyomma naponense* and 1 nymph of *Amblyomma humerale* on 4 spotted pacas (*Cuniculus paca*); five larvae of *Amblyomma* spp and 20 nymphs of *A. humerale* on six nine-banded armadillos (*Dasypus novemcinctus*); 5 males and 2 females of *Amblyomma nodosum*, 8 males and 1 female of *Amblyomma calcaratum*, 9 males and 2 females of *Amblyomma goeldii*, and 3 nymphs of *A. humerale* on four collared anteaters (*Tamandua tetradactyla*); 1 male and 2 females of *A. naponense* on a collared peccary (*Pecari tajacu*). According to the literature, there has only one host-record for the immature stage of *A. pacae*, being on *D. marsupialis* in the state of Rondônia, Western Brazilian Amazon. Our present records constitutes the first report of nymphs of *A. naponense* on *C. paca* and the first record of nymphs of *A. humerale* parasitizing *C. paca*, *D. novemcinctus* and *T. tetradactyla* in Brazil. This study registers for the first time the occurrence of *A. pacae* and *A. nodosum* in the State of Pará, Brazil. This research was financially supported by FAPESP and CNPq.

Tuesday 24, Afternoon, Auditorium - Poster

478 - Occurrence of ticks on wild animals in northeastern Brazil

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Ticks are arthropod ectoparasites of the Arachnida class, parasitizing terrestrial vertebrates, namely amphibians, reptiles, birds and mammals world widely. They are important for public health and animal for transmitting infectious agents and to cause injuries to their hosts during blood feeding. During the months of December 2007 and January 2010 ticks from wild animals were collected in northeastern Brazil. Ticks were collected from a cane toad (*Rhinella jimi*) and an six-banded armadillo (*Euphractus sexcinctus*) in Paulo Afonso, State of Bahia; an oncilla (*Leopardus tigrinus*) in the city of Pau dos Ferros, State of Rio Grande do Norte, 16 Brazilian guinea pigs (*Cavia aperea*) in Mossoró, State of Rio Grande do Norte, and

Fortaleza, State of Ceará. Ticks were identified using current taxonomic keys for adults and nymphs. In total, 25 adult ticks, 1 nymph, and 26 larvae were collected, as follows: *Amblyomma rotundatum* (3 females from a *R. jimi*); *Amblyomma auricularium* (8 males and 1 female from *E. sexcinctus*); *Rhipicephalus sanguineus* (4 males, 9 females from a captive *L. tigrinus*); *Ornithodoros* sp. (26 larvae from *C. aperea* in Mossoró); *Amblyomma parvum* (1 nymph from *C. aperea* in Fortaleza). This constitutes the first report of *R. sanguineus* parasitizing *L. tigrinus* in Brazil. The tick *R. sanguineus* has been reported on other wild carnivores in captivity in Brazil, namely crab-eating fox (*Cerdocyon thous*), hoary fox (*Pseudalopex vetulus*), maned wolf (*Chrysocyon brachyurus*), and margay (*Leopardus wiedii*). The present report of *R. sanguineus* in *L. tigrinus* reinforces previous findings that this species of tick use captive wild carnivores as hosts. The present study reports for the first time the occurrence of *A. auricularium* in Bahia, Brazil. This research was financially supported by FAPESP and CNPq.

Wednesday 25, Afternoon, Auditorium - Poster

479 - Deleterious effect of the bacterium *Rickettsia rickettsii* on engorged females of the tick *Ambyomma cajennense* (Fabricius, 1787) (Acari: Ixodidae)

J.F. Soares, H.S. Soares, T.F. Martins, F.A. Nieri-Bastos & M.B. Labruna

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Brazilian spotted fever (BSF), caused by *Rickettsia rickettsii*, is an illness with high lethality in human beings. The tick *Amblyomma cajennense* is considered the main vector of this rickettsiosis in South America. In this paper, we performed experimental infection of an *A. cajennense* colony with *R. rickettsii* and evaluated possible harmful effects of the rickettsial infection on the tick biological parameters. For this purpose, guinea pigs experimentally infected with *R. rickettsii* were infested with uninfected larvae and nymphs. In parallel, uninfected control ticks were allowed to feed on uninfected guinea pigs. After larval feeding and molting, the resultant nymphs were infested on uninfected guinea pigs. Afterwards, adult ticks were infested on uninfected rabbits. In parallel, some adults of the uninfected control group were infested on *R. rickettsii*-experimentally infected rabbits. After adult infestations, engorged females were recovered from rabbits and evaluated for the following reproductive parameters: engorgement weight, preoviposition period, egg mass weight, egg incubation period, percentage of eclosion, and reproductive efficiency index. Our methods allowed us to compare four experimental groups of ticks, namely GL, GN, and GA (first exposed to *R. rickettsii* during larval, nymphal, and adult feeding, respectively), and CG (uninfected control group). Female biological parameters were compared between groups by analysis of variance and the averages have been compared by the Tukey test ($P \leq 0,05$). Analyses revealed that the CG engorged females had significantly higher engorged weight than GL and GN females. CG egg weight was also higher than those of three infected groups. Finally, GN eggs had percentage of eclosion significantly lower than CG eggs. The remaining parameters did not differ significantly between groups. This work indicates that as a whole, *R. rickettsii*-infected *A. cajennense* ticks shows lower fitness than uninfected ticks, possibly due to damaging effects of *R. rickettsii* on *A. cajennense*, as demonstrated for other tick vector of *R. rickettsii* in the United States. This research was financially supported by FAPESP

Wednesday 25, Afternoon, Auditorium - Poster

480 - Biology of *Ixodes schulzei* Aragão & Fonseca, 1951 (Acari: Ixodidae) in the laboratory

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The tick *Ixodes schulzei* is endemic to Brazil, where it feeds primarily on small rodents. Since the male of *I. schulzei* remains unknown, it has been suspected that it reproduces by parthenogenesis. From an *I. schulzei* engorged female collected on a *Nectomys squamipes* in the city of Araçariguama,

State of São Paulo, Brazil, a laboratory colony has been established and used for biological studies. Tick free-living phases were maintained in an incubator at 27°C and relative humidity >85%. During two tick generations in the laboratory, 16 rodents of the species *Calomys callosus* and 6 *N. squamipes* were each infested with 10-500 larvae. Thereafter, 6 *C. callosus* and 6 *N. squamipes* were each infested with 40-100 nymphs. For adult ticks, 6 *N. squamipes* were each infested with 5 to 10 females. Grouping data from the two lab generations, larval mean feeding period was 8.6±1.7 days on *C. callosus* and 8.8±2.4 days on *N. squamipes*. The proportion of larvae that successfully fed (feeding success) on *C. callosus* (50.9%) was significantly higher ($P<0.05$) than on *N. squamipes* (18.5%). Nymphal mean feeding period was 8.9±1.6 days on *C. callosus* and 8.6±1.8 days on *N. squamipes*, with feeding success higher ($P<0.05$) on *C. callosus* (22.9%) than on *N. squamipes* (15.7%). Mean larval and nymphal premolt periods were 11.6±1.8 and 23.3±2.3 days, respectively. Female feeding success was 36%, with the following mean biological parameters. Feeding period: 9.1±1.2 days; engorged female weight: 0.2048g; preoviposition period: 9.4±1.5 days; egg mass weight per female: 0.1092g; egg incubation period: 42.6±2.5 days; Reproductive Efficiency Index: 52.7; egg % hatching: 74.5. Since all engorged nymphs molted solely to females, which successfully fed and reproduced without males, it is confirmed that *I. schulzei* is an obligatory parthenogenetic species. This research was financially supported by FAPESP and CNPq.

Wednesday 25, Afternoon, Auditorium - Poster

481 - Survey of tick-borne hemoparasites on wild animals in Cumari, State of Goiás, Brazil

J.F. Soares[1], A. Girotto[2], J.A. May Jr.[1], F.G. Lemos[3], F.C. Azevedo[4], O. Vidotto[2] & M.B. Labruna[1]

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The region of Cumari, State of Goiás, Brazil, is characterized by the presence of a Savanna-like biome. In the Savannah biome, home of many endangered wildlife, the study of potential pathogens of animals will allow to estimate the corresponding risks to which the latter are exposed. Thus, the objective of this study was to verify the presence and identify tick-borne hemoparasites in wild animals of Cumari. The following free-living animals were captured in Cumari between November 2009 and March 2010: two males and two females of hoary foxes (*Pseudalopex vetulus*), and two males and one female of crab-eating fox (*Cerdocyon thous*). Blood samples were collected in individual tubes containing EDTA. The material was sent to the laboratory, and subjected to PCR (polymerase chain reaction) targeting hemoparasite DNA. The blood of animals of each species showed to contain DNA of *Babesia* sp.; 2 *C. thous* (the same *Babesia*-positive animals) and all 4 *P. vetulus* contained DNA of *Hepatozoon* sp. There was no PCR amplification of DNA of *Coxiella* sp. or pathogens of the Anaplasmataceae family. DNA sequencing of the PCR products is in progress for proper identification of the tick-borne protozoa infecting wild carnivores in Cumari. This research was financially supported by FAPESP and CNPq.

Tuesday 24, Afternoon, Room 1

482 - Influence of temperature on the post-embryonic development and distribution of the coconut mite, *Aceria guerreronis*

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The coconut mite, *Aceria gurerreronis*, has invaded and paralyzed most of the coconut plantations in the southern regions of India. Several reasons have been attributed for the wide distribution of the mite; availability of fresh nuts throughout the year and optimum temperature in most part of the year appear to be the predominant factors. In order to formulate effective control strategies, influence of temperature on the life stages and total duration of the mite need to be analysed critically. Adult females collected from fresh nuts of 1 to 2 months were transferred to culture bowls specially prepared for this purpose. These culture bowls provided sufficient exposed areas of meristamatic tissue for

ready availability of the food for the mite as well as free areas for selection of ovipositional site. Post-embryonic development of the mite was studied under laboratory conditions at 27 ± 1°C and RH of 80%. Eggs were small, measuring 65.8 □m long, white, round to oval in shape and were detected from the third day onwards. A single female laid a maximum of 12 eggs per day. Prior to hatching, a small projection appeared on the animal pole where a longitudinal slit appeared through which the mite emerged out. The process of hatching took 30 minutes to complete. The vermiform first nymph was transparent and sluggish, measuring 75-105□m long. It started feeding soon after hatching. The active period of the first nymph lasted 2.3 days and subsequently it entered into the first quiescent period of one day. It molted into the second active stage, which measured 157.5 to 196□m. The second nymphal stage lasted 2.4 days and then it entered into the second quiescent period of 1.3 days. This was followed by the emergence of the adult. Thus an average of 10.5 days was necessary for the completion of the life cycle of the mite from egg to adult stage. However, when post-embryonic development was studied under a higher temperature of 29 ± 1°C, maintaining other conditions as same, the mite could complete its life cycle within a period of about 9 days. This indicates shorter duration of life cycle for the mite with higher temperature. Probably this would have been one of the reasons for the high mite population build up in nature during summer season and consequently its distribution to wider areas of coconut plantations in Kerala.

Wednesday 25, Morning, Room 2

483 - Transcriptome of male tick accessory gland/testis and possible role in regulating female reproduction in the ixodid tick *Dermacentor variabilis*

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A previous study reported evidence that the male engorgement factor (EF) responsible for engorgement in *Amblyomma hebraeum* consisted of two proteins, EFα and EFβ. Both were required to stimulate female engorgement. No evidence of EFβ was found in *Dermacentor variabilis* fed males but a transcript similar to EFα was identified. The absence of a signal peptide suggested that it was not a secreted protein. However, when suspensions made from extracts of concentrated fed male reproductive organs and from mated female seminal receptacles were separately injected into fed virgin females, up to 50% commenced rapid engorgement, vitellogenesis and oviposition versus none in controls. Purification of the extract abolished the female response. Collectively, these findings suggested that EF in *D. variabilis* is a non-secreted membrane-bound protein. To further investigate the male role, we created a transcriptome of the fed male accessory gland and testes/vas deferens to identify molecules important in reproductive activity and the male EF. Pyrosequencing of RNA from these organs was done with a 454 GS-FLX sequencer (Roche). The resulting 563,093 raw reads were assembled into 12,804 contigs. A total of 3,951 contigs were found with e-values ≥ e-10 (30.9%). Functional assignments were made using BLAST (nr) homologies in the NCBI, ACARI, and SwissProt databases. Using GO designations (level III), a total of 8,634 contigs could be assigned to 30 categories including reproduction, immunity, biological/cellular adhesion, protein digestion and protease inhibitors. In a similar effort to understand the role of female in reproduction regulation, we created a transcriptome of mixed stages for the female synganglia. Among the noteworthy findings was evidence of a G-protein coupled receptor similar to the SPR in *Drosophila*. Studies to silence this gene in the females failed to disrupt the post-mating effect but produced engorged females with a body weight twice the non-injected females. The protein composition of freshly deposited spermatophores was compared to the predicted proteins in the male transcriptome. Proteins were identified by tryptic digestion/LC/mass spectrometry. Many of the predicted proteins (68%) in the male transcriptome were found in the spermatophore, further supporting their functional assignments. Among the proteins found were several similar to proteins recognized as components of the seminal fluids of insects, including proteins implicated in stimulating female reproductive activity. No evidence of EFα and EFβ was found in the spermatophore. Further analysis of

the tissue-specific male reproductive transcriptome and protein composition of the male organs and spermatophore provides an opportunity to examine the global expression of transcripts and proteins in these structures and compare the molecules found with those reported to function in reproduction in other invertebrates.

Wednesday 25, Morning, Room 1

484 - Broad mites and whiteflies: partners or rivals?

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In ecological systems, plants are often attacked by multiple herbivores. These could interact by competing over plant resources, cooperate in exploiting the host, or be indifferent to each other. The situation is further complicated by plant responses that create a dynamic "arena" for herbivore interactions. The present study addresses the interaction between two herbivores, whiteflies (*Bemisia tabaci*, WF) and broad mites (*Polyphagotarsonemus latus*, BM), on a common host plant - tomato. Broad mites exhibit a specific phoretic association with whiteflies for transportation between hosts. This mode of movement is energy saving for broad mites, but carrying an extra load could be costly to whiteflies. Even though both are herbivorous, they differ in their feeding mode and elicit different responses in the host. They could therefore be rivals, competing for the plant resources, or partners collaborating in overcoming plant defenses. We explored the interaction between the two herbivores and the plant at the ecological and molecular level, by comparing herbivores performance and plant responses in simultaneous and sequential infestations. We studied their host selection behavior and portrayed the plant response to BM and WF by transcript profiling. Our results indicate that whiteflies negatively affect the development of broad mite population on the tomato plant. Some negative effect of broad mites on whiteflies was also observed. Moreover, plants infested by both herbivores appeared to survive better than those infested by broad mites alone. In choice experiments, whiteflies preferred to settle on BM uninfected plants. Plant responses are currently being analyzed using high-throughput sequencing. The evolutionary, ecological and epidemiological relevance of the broad mite-whitefly association will be discussed.

Friday 27, Morning, Room 2

485 - Occurrence of human parasitism by genus *Ornithodoros*

C.E. Souza[1], L.H.T. Marquezi[1], C.S. Franco[1], P.H. Koyanagui[2], S.M.P. Sampaio[2] & A.H. da Fonseca[3]

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Considering the important role of ticks as vectors and reservoirs of disease and the lack of major species of ticks that parasitize humans and scope of Brazilian spotted fever (BSF), the state of São Paulo proposes a system of surveillance of ticks through spontaneous. These notifications are intended initially known species of ticks with a high parasitization for humans and the municipalities with the highest rate the infestation. For both the population should be encouraged to report the occurrence of ticks and the Basic Health Unit (BHU) fill the notification form. The genus *Ornithodoros* comprises about 100 species in the world, with 47 occurring in the neotropics and 37 are endemic. The *Ornithodoros* are vectors of Borrelia that cause recurrent fevers in different parts of the world and are also incriminated as potencial vectors and reservoirs of *Rickettsia rickettsii*, the causative agent of spotted fever in humans in the Americas. The objective of this study is to report the occurrence of three cases of human parasitism by the genus *Ornithodoros* the period 2005 to 2008. Usually these species feed on animals of the order *Chiroptera*. The first notification was received from Mococa. Fishermen reported that they were attacked in the sands of the river in the municipality of São Joaquim-MT. They look samples and sent to the BHU, which were identified as *Ornithodoros rostratus*. The second letter was Ribeirão dos Indios, Brazil, where residents of the building were

damaged by *Ornithodoros rostratus* who had been sheltering in a heap of sand from a sand port unidentified. The third service is the *Ornithodoros mimon*, coming from municipality of São Simão-SP. The residence is located in a neighborhood of small farms surrounded by a residual gallery forest and residents, the ticks were in the bathroom had some cracks between the walls and ceiling of wood. Ticks were located in the lining that contained large quantities of dry leaves and the remains of rodents and marsupials. The resident also reported the presence of bats. These ticks were attacking the neighbors in the room next door bathroom cited. The people attacked by this tick complained of a painful bite that left bruises and itching for a period of 15 days. Given these reports, it is necessary to have a surveillance system ticks medical important to better understand the different species that parasitize more human.

Tuesday 24, Afternoon, Auditorium - Poster

486 - A survey of ticks (Acari: Ixodidae) from capybaras (*Hydrochaeris hydrochaeris*) in the Campinas region, São Paulo State – Brazil

C.E. Souza[1], F.C. Uchoa[1], C.S. Franco[1], M.M. Holcman[2], A. Pinter[2] & A.H. da Fonseca[3]

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Brazilian Spotted Fever (BSF) is an acute febrile zoonotic disease whose etiologic agent is *Rickettsia rickettsii*, an obligatory intracellular bacterium. This rickettsial infection is transmitted by ticks, which are more than simple vectors, since also act as reservoirs of this bacteria, transmitting the infection vertically, trans-ovarially. In Brazil, its main vector species is *Amblyomma cajennense*. In the region of Campinas the more commonly transmission sites pointed out in the epidemiological investigation forms are riparian gallery forests belonging to the hydrographic basins of the Piracicaba, Jaguari, Atibaia, Camanducaia rivers and/or in public parks. In these areas populations of capybaras are abundant along the entire length of these rivers. Results of recent studies have shown that 20 to 25% of ticks fed on *R. rickettsii* infected capybaras became infected by the bacterium by horizontal transmission, that is, the capybaras act as an amplifying host of *R. rickettsii* in *A. cajennense* ticks in Brazil. The objective of this study was to determine the species of ticks that parasitize capybaras in the region of Campinas-SP to better understand the epidemiology of BSF. Two hundred and forty capybaras were captured in the region of Campinas in the following municipalities: Campinas (Lagoa Taquaral - 48; Lago do Café - 35 e Parque Ecológico de Barão Geraldo - 12), Monte Alegre do Sul (Faz. Exp. do Instituto Agronômico de Campinas – IAC - 60), Cordeirópolis (Lago União - 15), Paulínia (Parque Brasil - 8), Pirassununga (Campus da USP - 21), Valinhos (Parque público CLT - 28), Jaguariúna (Faz. Duas Marias - 8; Haras Jaguariúna - 5). After capture the animals were anesthetized, weighed, tagged and inspected for the presence of ticks, being released in the same place. The ticks were identified based on the taxonomic key of Aragão, Fonseca (1961). The stages of larvae and nymphs were identified to genus. 96,25% of the examined animals were parasitized by ticks; 6456 ticks were collected: 25,64% were *A. cajennense*; 37,90% *Amblyomma dubitatum*; 27,28% nymphs of *Amblyomma* ssp.; 9,19% larvae of *Amblyomma* ssp. The average number of ticks per host was 27,95. Our data indicate that these animals play an important role in the epidemiology of BSF in the studied region, serving as amplifying hosts of *Rickettsia rickettsii* and increase the population density of *A. cajennense.*

Thursday 26, Morning, Room 5

487 - Detection of antibodies to *Rickettsia* spotted fever group and survey of fauna of ticks on *Didelphis* in some municipalities in the State of São Paulo – Brazil

C.E. Souza[1], S.S.L. Souza[1], F.C. Uchoa[1], C.S. Franco[1], M.M. Holcman[2], A. Pinter[2], E. Seitz[3] & A.H. da Fonseca[4]

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The tick-borne diseases constitute a public health problem of great importance worlwide. Some wild animals represent an important role as amplifier host of *Rickettsia rickettsii*, contributing to

maintenance and dissemination of this agent in nature, when during rickettsemia, they infect ticks that feed on them. In order to investigate the prevalence of antibodies against *Rickettsia* and study the fauna of ticks that parasitize the opossum and using live-traps, a total of 1120 opossums were captured in gallery forests and peridomiciles in the following municipalities: Campinas 56; Pedreira 27; Jaguariúna 8; Valinhos 2; Piracicaba 11; Vargem Grande do Sul 1; Monte Alegre do Sul 6; Caçapava 1. The captured animals were sedated and a blood sample was collected and centrifuged to obtain serum. The ticks collected were identified using taxonomic keys. The sera were processed by the technique of indirect immunofluorescence assay (IFA) against the first antigen *R. rickettsii* sera and reagents IFA with titers ≥1/64 were tested at most 2 antigens *R. parkeri* and *R. bellii*. The blades used in these tests were provided by Dr. Marcelo B. Labruna (University of São Paulo). The prevalence of *R. rickettsii* was 37,5% for opossum. Of the respondents 8,9% opossums *Didelphis aurita* and 56,7% *Didelphis albiventris* were parasitized by ticks. Adults and young opossums of the species *D. aurita* showed higher positivity and a higher proportion of parasitism (P≤0,05;test x^2). Of the ticks collected 722 were larvae of *Amblyomma* ssp.; 252 nymphs of *Amblyomma* ssp.; 14 *Ixodes loricatus*; 1 *Amblyomma dubitatum* and 1 *Amblyomma cajennense*. In an animal from Jaguariúna (Faz. Sta Julia), 134 engorged nymphs were collected under laboratory conditions (27 ºC and 80% humidity); these moulted to *Amblyomma cajennense*. Adult *Ixodes loricatus* were collected only in two municipalities: Caçapava a male on a *D. aurita*; Monte Alegre do Sul ten females from two *D. albiventris*. The species of ticks collected coincide with those described in the literature, and the predominance of immature *Amblyomma* ssp. varying depending on season, and low specificity of this kind, especially in parasitized small animals. From these data it is concluded that *Didelphis* ssp. are participating in the epidemiological chain of Brazilian spotted fever as a possible amplifier host for *Rickettsiia rickettsii* in nature, due to the increase in the number of infected ticks thus enabling the transmission to humans.

Tuesday 24, Afternoon, Auditorium - Poster

488 - Ectoparasites of *Crotalus durissus* (rattlesnake) in northern Brazil, a case report

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Snakes of the genus *Crotalus* have terrestrial habits. They are very robust animals whose main feature is the presence of a shaker, or rattle, at the extreme of the tail. *Crotalus durissus* is found in western Brazil and also in certain areas of the Brazilian states of Rondonia, Amazonas and Para (in the latter state, in Humaita open fields, Sierra Pipe and Santarem). The objective of this study is to report the presence of ectoparasites of *C. durissus* next to Santarem International Airport, State of Para. Injured rattlesnakes were captured in the airport area but died soon after; they were then sent to the Microscopy Laboratory of FIT (Faculdades Integradas de Tapajos), where the ectoparasites were detected. These were collected in vials with 70% alcohol for later processing and identification; the snake was preserved and deposited in the scientific collection of LPHA (Linha de Pesquisa Herpetologica da Amazonia, at FIT). Three adult male ticks were collected and identified as *Amblyomma dissimile* (Ixodidae), according to the keys provided by Aragão et al. (1961) and Guimarães et al. (2001). There are few reports on snake ectoparasites from the Santarem region. Further studies on snake ectoparasites in the Amazon region are warranted.

Tuesday 24, Afternoon, Auditorium - Poster

489 - Parasitism of *Boa constrictor* by *Amblyomma dissimille* Koch in the region of Santarem, in the State of Pará, Brazil

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The municipality of Santarém is located in the western part of the Brazilian State of Pará, along the Tapajos River, in the Amazon basin. Climate in this municipality is characterized as semi-arid tropical. A large part of its territory consists of floodplain and lowlands, where different species of snakes are commonly found, including *Boa constrictor*. The objective of this work was to report the parasitism of *B. constrictor* by the tick *Amblyomma dissimile* (Ixodidae) in Santarém. These ectoparasites were collected from a snake collected at km 15 of Everaldo Martins highway and from five snakes hosted at the local zoo (ZOOFIT); two of the latter snakes were collected at the ground of the zoo, two in the urban area of Santarém and one next to km 15 of Everaldo Martins highway. The ticks were collected in 70% alcohol and sent to FIT (Faculdades Integradas do Tapajós) where they were identified to species using the keys of Aragão et al. (1961) and Guimarães et al. (2001). In total, 229 ticks (128 males, 68 adult females and 33 nymphs) were collected, all identified as *Amblyomma dissimille*. On average, 38.2 ticks were found on each snake. Species of *Amblyomma* have been reported to parasitize amphibians, reptiles and mammals. Thus, the determination of the diversity and the hosts of those organisms are relevant, given their potential importance as parasites and as vectors of pathogens, to a wide diversity of vertebrates, including man and domesticated animals.

Tuesday 24, Afternoon, Auditorium - Poster

490 - Pattern of occurrence of *Aceria guerreronis* Keifer (Acari: Eriophyidae) and other mites associated to coconut fruits in Una-BA, Brazil

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Aceria guerreronis Keifer is an important coconut pest in the Americas, Africa and Asia, occurring in high population levels in the northeastern region of Brazil. Because of the inefficacy of chemical acaricides in the control of the pest, predatory mites have been considered as biological control agents. The objective of this work was to evaluate the pattern of occurrence and population dynamics of *A. guerreronis*, their associated predators and other mites present, in a field with hybrid coconut trees in the municipality of Una-BA. Twenty monthly samples of fruits were taken in the period of July/08 to January/10. Each month, five fruits, about 4-months old, from twenty randomly selected plants were collected, independently of the presence of damages caused by *A. guerreronis*. The position of the bunches in relation to the cardinal points was determined. All the mites present in the fruits were identified and counted. A total of 2,129,563 mites were collected, 99.9% being *A. guerreronis*. Other phytophagous species registered were *Steneotarsonemus furcatus* De Leon and *Tarsonemus* spp.; although occurring in low levels, *Bdella ueckermanni* was the most abundant and frequent predator in this study. The higher population levels of *A. guerreronis* were recorded in fruits presenting 32 and 48% of damaged areas. There was no relation between the position of the bunches referring to the cardinal points and the direction of predominant winds in the incidence of *A. guerreronis*. There was a positive correlation between the population densities of *A. guerreronis* and higher temperatures, lower relative humidity and lower accumulated precipitation.

Thursday 26, Afternoon, Auditorium - Poster

491 - Biological control of two-spotted spider mite in roses with the predatory mite *Neoseiulus californicus*

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The rose, *Rosa* spp., is a plant of Asian origin, and its distribution around the world came from Asia to Europe and the Americas. It develops well in Brazil and is cultivated in many regions. The culture of flowers is one of the segments of agriculture more profitable per unit area, and its profits are generally three times that of fruit and ten times that of grain

production; there is also a rapid return of the investments. In the 1500 ha planted with cut flowers in Brazil, the cultivation of roses represents almost 30%. After the state of São Paulo, the state of Minas Gerais is the second largest producer of flowers. Monitoring identified the two spotted spider mite, *Tetranychus urticae* Koch, 1936 (Tetranychidae) as one of the biggest problems in the culture of rose, along with thrips (Thripidae) and aphids (Aphididae), traditionally requiring the use of many pesticide applications per year. The chemical control method is conventionally used, however, presents serious problems such as pest resistance to most of the products used. Biological control, besides not causing damage to the applicator and the environment, does not require waiting period between application and harvest. Phytoseiidae mites can be used to control pest mites in greenhouse. The objective of this study was to evaluate the biological control of two-spotted spider mite in roses under protected cultivation systems with releases of the predatory mite *Neoseiulus californicus* (McGregor, 1954) (Phytoseiidae). The two-spotted spider mite *T. urticae* was reared on jack-bean (*Canavalia ensiformis* L.) in greenhouse and also in the laboratory. The predatory mite *N. californicus* was reared only in the laboratory on leaves of jack-bean infested by two-spotted spider mite. Two experiments were conducted in greenhouse with eight treatments, three replications of one rose plant, *Rosa alba* L., in a wooden cage covered with "voil", in a randomized block design. In all treatments 20 females of two-spotted spider mite/plant were introduced for infestation. After nine days, the predators were released ranging from 0 to 14 mites / plant leaves with signs of infestation of the pest mites. In one of the experiments there was a second release after 15 days of the first. For the evaluation six leaves of each plant were collected, two of each of its parts (top, middle and basal of plants). The assessment was for a month, once every week. The leaves collected were taken to the laboratory for the number of mites alive count, with the help of stereoscopic microscope. The results showed, in both experiments, that with the increased the number of predatory mites, in four weeks, there was a mortality of the pest mites from 70 to 80%. This research was financially supported by FAPEMIG.

Thursday 26, Morning, Room 6

492 - Comprehending the potential of non-host-specific acarophilic fungal species in the control of *Tetranychus urticae*

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The two-spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae), qualifies as the most economically important phytophagous mite with the widest host range in India and elsewhere. All-season collections of diseased individuals and/or populations of *T. urticae* on a range of horticultural crops, mainly vegetables, in Bangalore, India, yielded both entomophthoralean and hyphomycetous fungal genera since 2001. Their grouping into acaropathogens, non-specific entomopathogens and opportunistic or minor pathogens indicated the dominance of the last two categories. However, among the most aggressive and decimating natural pathogens, except for *Neozygites floridana*, the others were infrequent. Since inundative application of *N. floridana* as a mycoacaricide has not reached a conclusive phase as yet, other non-host-specific fungal species from various acaro- and entomo-sources were tried and tested against *T. urticae* under laboratory and greenhouse conditions on 12 vegetable plant species. After culling out inferior fungi through initial screening, 32 acarophilic fungal species were taken to further studies. At this stage, at least three categories of potential pathogens of *T. urticae* have been identified: (a) readily pathogenic (7 species), (b) pathogenic after repeated passaging (11 species), and (c) adjuvant-aided pathogenic (14 species). Fungal species derived from mite hosts brought about better mortality (laboratory: 58-92%; greenhouse: 45-78%) than those from insect hosts (laboratory: 37-78%; greenhouse: 26-65%).

Tuesday 24, Afternoon, Auditorium - Poster

493 - Toxicity of *Vitex* spp. (Lamiaceae) to two spotted spider mite, *Tetranychus urticae*

N. Srinivasa, G.V. Manjunatha Reddy & B. Mallik

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Injudicious use of acaricides has lead to large scale environmental disturbances, a major one being acaricide resistance in major phytophagous mite species, *Tetranychus urticae*. Investigations on the acaricidal activity of botanical preparations have been conducted in India and other countries, with the major intension of reducing our reliance on synthetics compounds and as an alternative. Three different species of *Vitex*, Lamiaceae, were evaluated for their acaricidal activity against *T. urticae*, using aqueous and methanol extracts of leaves and bark. Maximum repellence was observed with aqueous leaf extracts was 26%, while aqueous bark extracts accounted for a maximum repellence of 53%. Methanol extracts from leaf and bark caused 30% and 66% repellence of adults within 24 hours. Maximum adult mortality observed with aqueous leaf, aqueous bark, methanol leaf and methanol bark extracts of *Vitex* spp. was 51%, 50%, 62% and 78%, respectively. Aqueous bark extracts affected egg laying of two spotted spider mite with a maximum deterrent index of 47, with around 50% reduction in female longevity as well as in oviposition period. Comparatively, methanol bark extracts were more deterrent for egg laying (deterrent index of 64) and also oviposition period was reduced by more than 60%. Among the different *Vitex* species studied, *Vitex altissima* was found more acaricidal.

Thursday 26, Afternoon, Room 6

494 - Resistance to dicofol in two spotted spider mite, *Tetranychus urticae*, infesting tomato

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Frequent failures in the control of two spotted spider mite, *Tetranychus urticae*, infesting tomato have been experienced by growers in the traditional tomato growing districts of Kolar in the Karnataka State of the Indian subcontinent. As a result, farmers of this region often resort to newer acaricidal molecules like fenazaquin, abamectin etc., in place of conventional acaricides, as dicofol. Investigations were carried out to ascertain the level of resistance to dicofol in *T. urticae* populations occurring on tomato during 2007-08. As a basic requirement for acaricide resistance studies, base line values for the susceptibility of *T. urticae* to dicofol were determined in the laboratory, following leaf dip bioassay technique. Originally, *T. urticae* population collected from the field on tomato was maintained in the laboratory for several generations without exposing them to any acaricide, including dicofol. This population was assayed for its susceptibility to dicofol in the 5^{th}, 15^{th}, 25^{th} and 38^{th} generations in the laboratory. LC_{50} values of dicofol in the corresponding generations were, 183.2, 0.7, 0.5 and 0.1 ppm. The decreasing trend in the LC_{50} values over different generations indicated progressive susceptibility of *T. urticae* in the laboratory in 38 generations. The base line value for the susceptibility of *T. urticae* to dicofol was considered 0.1ppm; this value was used for quantifying the level of resistance of field populations sampled from Vadagur village at different intervals between June 2007 and January 2008. LC_{50} values of dicofol for *T. urticae* populations sampled during 3^{rd} week of June 2007, 1^{st} week of September 2007, 1^{st} week of December 2007 and last week of January 2008 were 50, 365.5, 649.1 and 604.6 ppm, which correspond to the resistance ratios of 500, 3655, 6491 and 6046. This clearly indicated increase in the intensity of resistance to dicofol during tomato growing season between June 2007 and January 2008. Very high level of resistance *i.e.*, 500 – 6491 folds resulted in frequent control failures observed with dicofol application in this tomato growing region. Similar trend in dicofol resistance was evident from Chintamani, another area of tomato cultivation in the same district of Kolar, which recorded 532 to 3266 folds of resistance during September-October 2007. Newer molecules like fenazaquin (125 g ai/ha), propargite (570 g ai/ha), chlorfenapyr (75 g ai/ha) and fenpyroximate (30 g ai/ha) were found more promising against dicofol resistance *T. urticae* population occurring on tomato in Kolar District.

Thursday 26, Afternoon, Auditorium - Poster

495 - Biology of *Leipothrix dipsacivagus* (Petanovic & Rector, 2007) (Acari: Prostigmata: Eriophyidae) – A promising candidate for biological control of *Dipsacus* spp.

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The eriophyid mite *Leipothrix dipsacivagus* has been recorded from Serbia and Bulgaria on *Dipsacus laciniatus* and from France on *D. fullonum*. Host-specificity tests have shown that it can develop and reproduce only on *Dipsacus* spp., which indicates that it could be regarded as potential biocontrol agent against invasive teasels in North America. The objective of the present study was to study key aspects of the biology of *L. dipsacivagus*. The mites for the stock colony were collected from *D. laciniatus* in Klokotnitsa, Bulgaria and reared on rosettes of *D. laciniatus* under laboratory conditions. The experiments were designed with two variants – using fertilized and unfertilized females. The parthenogenesis of this mite is arrhenotokous. Unfertilized females produced males only, while the offspring of fertilized females consisted of both sexes. The duration of the egg stage from unfertilized females was 6.32 ± 0.85 days. The egg stage from fertilized females was 5.80 ± 0.63 days for male offspring and 6.90 ± 1.14 days for female offspring. The development time for active immature instars (larva and nymph) hatching in the variant with unfertilized females was 3.98 ± 0.57 days, and hatching in the variant with fertilized females – 3.43 ± 0.96 (males) and 5.33 ± 1.56 days (females) respectively. The life cycle (egg to adult) was 10.39 ± 1.16 days for progeny of unfertilized females. An average of 9.56 ± 1.01 days for males and 11.44 ± 1,39 days for females were the development times from egg to adults for progeny of fertilized females. Fecundity of fertilized and unfertilized females was also established. The total egg production per female was averagely 18.28 ± 5.60 eggs, and the daily egg production was about 1.56 ± 0.60 eggs per female. Adult longevity for males and females was averagely 9.30 ± 2.00 and 15.91 ± 4.30 days, respectively. The results suggest that *L. dipsacivagus* could be successfully mass produced in a laboratory for possible use as a biological control agent against invasive teasels.

Tuesday 24, Morning, Room 1

496 - The influence of familiarity on grouping behavior of the predatory mite *Phytoseiulus persimilis* (Acari: Phytoseiidae)

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Numerous animals across various taxa are able to discriminate between familiar and unfamiliar conspecific individuals. Group-living animals often use this ability to preferentially associate with familiar individuals. One explanation for the latter phenomenon is provided by limited attention theory, which predicts that focusing on a given task has costs with respect to the attention paid to other tasks. Assuming that familiar members within a group require less attention than unfamiliar ones, grouping with familiar individuals may increase efficiency in other tasks such as mating, oviposition, foraging and anti-predation, and ultimately increase fitness. Until now, limited attention theory has been exclusively tested in vertebrates. Here, we hypothesized that the plant-inhabiting predatory mite *Phytoseiulus persimilis*, which is able to discriminate between familiar and unfamiliar conspecific individuals, preferentially associates with familiar individuals. We tested this assumption using bean leaf arenas in (1) heterogeneous groups of familiar and unfamiliar gravid females deriving from one (pure) or two (mixed) populations, and (2) heterogeneous groups of familiar and unfamiliar juvenile individuals (protonymphs and larvae) all deriving from the same population. We found that the likelihood of two neighboring individuals being familiar was significantly higher in both pure and mixed groups of gravid females and juvenile groups. Moreover, within mixed female groups and within juvenile groups the distances between familiar neighbors were significantly lower than those between unfamiliar neighbors. We discuss the

potential adaptive value of these behaviors in light of limited attention theory.

Wednesday 25, Morning, Room 4

497 - Deutogyne female of eriophyoid mites (Acari, Eriophyoidea): specific morphological form, diapausing stage, or both?

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Since H. Keifer's (1939) description of the life cycle of *Tegonotus aesculifoliae* the terms "protogyne female" (PF) and "deutogyne female" (DF) have become widely used. DF is considered to be morphologically distinguished from PD and is a diapausing wintering stage which starts reproducing in the spring only. Since new information about DF in different species was revealed, the term became used more widely, e.g. it was applied to wintering females morphologically undistinguished from PF or to the reproducing females that had no diapause. According to Oldfield (1996), morphological differences between PF and DF are of adaptive character and consist of reduction in the number of opisthosomal annuli and of elements of the prodorsal shield design and in disappearance of microtubercules on opisthosomal annuli. These differences between DF and PF are most common to subfamily Eriophyinae. But the same characters distinguish subfamilies Eriophyinae and Phyllocoptinae, i.e. hidden-live and vagrant forms of eriophyids. In this paper we analyzed published data on morphology of 41 species of mites (16 from Eriophyinae, 18 from Phyllocoptinae and 7 from Diptilomiopidae) living on deciduous trees of Europe and Northern America and having diapausing DF. Principal Component Analysis by 9 morphological characters was undertaken and two main factors were revealed. When put on the factor plot most of the analyzed species formed three groups of points corresponding to three suprageneric taxa with some species left out of the groups. We joined the points PF and DF belonging to one species and obtained 41 vectors. Morphological changes between PF and DF of the most mites species from subfamily Eriophyinae were of the similar direction. In subfamily Phyllocoptinae and family Diptilomiopidae we were not able to distinguish any general trend. Following this we formed new variables based on the differences between the values of characters of PF and DF for every species and considered a correlation matrix of these new variables. Correlation analysis showed coherent increase in the lengths of prodorsal shield, gnathosoma and legs and decrease in the number of dorsal annuli which are typical for transformation from hidden-living towards vagrant habitus. The most distinct coherence was within subfamily Eriophyinae. Previously we formulated the hypothesis that the main tendency in the evolution of eriophyoid mites was in the repeated transition from hidden-living to free-living mode of life and back, which was connected with adaptation to new ecological niches on host-plants (Bagnjuk, Sukhareva, Shevchenko, 1998). Probably these transitions were under the influence of global climate changes. In such case DF as a special form might reflect the steps of the evolution of the mites. Thus DF of eriophyines with less annuli and microtubercules could serve as the evidence of their vagrant ancestors and equal-ringed DF of phyllocoptines could be the evidence of their hidden-living ancestors.

Tuesday 24, Afternoon, Room 1

498 - Why *Tetranychus urticae* prefers the underside of leaves: kinetic responses to UV-B and visible light

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Ultraviolet-B radiation (UV-B) is known to induce lethal damage in many organisms. Since leaves absorb and reflect both UV-B and visible light but transmit a part of the latter, the underside, which is the main habitat of the two-spotted spider mite (*Tetranychus urticae*), is considered to be a less harmful environment with visible light. This may explain why *T. urticae* prefers to inhabit the

underside of leaves, and suggests the possibility that UV-B could act as a repellent and visible light as an attractant. To verify this possibility, we investigated the orientation behavior of *T. urticae* on a micro-locomotion compensator (MLC). The MLC system kept a test mite freely walking on a glass plate (60 x 60 cm) in a constant position by sliding the plate horizontally, and recorded traces of the mite in the PC-programmed virtual field, in which a checkered pattern of light and dark patches (patch size: 3 x 3 cm) was created. If the mite enters the light patch, it will be irradiated with non-directional light stimuli by light-emitting diodes located just above the mite's position. The results showed that when the non-diapausing female entered the patch of UV-B (310 nm) at 0.2 W/m^2, it made an abrupt turn and returned from the light to dark patch immediately. On the contrary, when the mite left the patch of white light composed of visible wavelengths at 2.0 W/m^2, it made an abrupt turn and returned from the dark to light patch immediately. From these results, the excess proportion index (EPI) was calculated to assess the frequency of stays (i.e., preference) in light patches. The EPI ranged from –1 (repulsion) to +1 (attraction) and indicated no preference at 0. The EPIs in the UV-B and visible light treatments showed negative and positive values respectively and were significantly different from those (≈ 0) in the control where all patches were dark. These data clearly show that the non-diapausing females avoid UV-B and are attracted to visible light by a photokinetic mechanism, suggesting that they employ the distribution of either or both UV-B and visible light as a reliable criterion for selecting the underside of leaves. Further experiments on the action spectrum for photokinetic attraction/repellent responses of both non-diapausing and diapausing females are now under way to find an effective wavelength which may lead to the construction of a suitable lighting system for controlling mite behavior.

Wednesday 25, Afternoon, Auditorium - Poster

499 - A space-saving system for testing the photoperiodic response of insects and mites, and its use in diapause experiments for *Tetranychus urticae*

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In insects and mites, their development, reproduction and diapause are often controlled by photoperiod. It is traditionally necessary to prepare a large system with light sources (e.g., fluorescent lamps), timing devices and incubators corresponding to the number of treatments in order to observe the effects of different photoperiodic conditions simultaneously. Such systems are costly, take up space, and are not suitable for observing small creatures such as insects and mites. We therefore developed a novel space-saving system consisting of a laptop computer, a light controller with microprocessors, aluminum bottles (300 mL) each with a white light-emitting diode (LED, power consumption: 72 mW) and a small incubator (126 L). In this system, the light (L) and dark (D) cycle, light intensity, night interruption timing, intensity (I) and period (T) can be controlled in each bottle separately. Using this system, photoperiodic induction of diapause in the two-spotted spider mite (*Tetranychus urticae*) was examined at an air temperature of 18°C and an L/D cycle of 8/16 h including night interruptions with different I and T at the middle of D. The results suggested a significant correlation (P<0.0001) between a dose of night interruption (I x T) and diapause incidence; diapause incidence decreased as the dose increased. The median effective dose (ED_{50}) for 50% diapause incidence was 36.4 J/m^2 (= 154 µmol/m^2) when calculating wavelengths below 600 nm that *T. urticae* could sense. Since the single LED generated little heat, the difference in air temperature inside the bottle between L and D periods was within 0.1°C. These results showed that our system could control a specific temperature condition inside the bottle without any unwanted noise, and that the factor which might disturb diapause induction of *T. urticae* in the field could be identified by manipulating the photoperiodic condition. Further experiments on spectral sensitivity in the photoperiodism are now under investigation to find an effective wavelength which may have a low ED_{50} value for the diapause disturbance. This would lead

to the innovation of a suitable lighting system for physical control of *T. urticae*.

Monday 23, Afternoon, Room 4

500 - Aspects of tick ecology in natural and anthropized environment of Brazil

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Ticks are ectoparasitic vectors of some of the major infectious animal diseases in Brazil. These ectoparasites are even more recognized as pests of humans. For example, awareness of mild to highly lethal tick-borne human rickettsioses is increasing in the country. Considering the tight and several times species-characteristic relationship between ticks and environment, tick-borne diseases have a clear ecological background. At the same time Brazil is a country with continental dimensions with several biomes and its landscape is undergoing profound modifications. Such modifications undoubtedly influence tick populations. Thus tick ecology-related information has to be taken from totally modified environment (urban), environment with mixed original as well as anthropic elements (rural), preserved natural areas and, last but not least, small fragments of natural areas. Current tick fauna of Brazil is estimated at 61 species, most of which belonging to the *Amblyomma* genus. Knowledge about these ticks is overall scanty. Nonetheless, some general features about tick ecology are known. Urban and rural environment are dominated by domestic animal ticks some of which might represent surrogate host-parasite relationships, as is the case of *Amblyomma cajennnese* on horses. These environments also maintain the non-Neotropical exogenous ticks and which already established in the country. This is the case of the brown dog-tick *Rhipicephalus sanguineus* and the cattle tick *Rhipicephalus* (*Boophilus*) *microplus*. Rural areas many times do also have Neotropical ticks favored by or resilient to the altered/mixed environment and hosts necessary for their life cycle. This is the case of *Amblyomma nodosum*, an anteater tick, *Ixodes loricatus*, a tick from opossums, or *Amblyomma ovale* and *Amblyomma parvum*, both carnivore ticks. Natural areas have the original tick fauna and may be a barrier to exogenous ticks. They also keep tick species unable to survive elsewhere. The Atlantic Rainforest, for example, precludes the establishment of the Brazilian savannah tick, *Amblyomma cajennense*, while maintaining high populations of *Amblyomma incisum*, a tick species unable to survive in dry environment outside humid forests. A particularly important feature is presented by the very small natural areas, often close to or even within urban areas. In such environments there is a tendency for decreased biodiversity, increased density of generalist hosts and unbalanced host-parasite relationships. Increasing populations of capybaras in small gallery forests or in forest fragments by lakes or dams are associated with unbearably high environmental infestations of both *Amblyomma cajennennse* and *Amblyomma dubitatum* ticks. Humans and domestic animals at such sites are exposed to tick-bites and tick-borne diseases such as Rocky Mountain spotted fever. Thus, tick ecology should be in research agenda for the sake of both animal and public health. This research was financially supported by the Brazilian CNPq.

Friday 27, Morning, Room 2

501 - Species and seasonal distribution of ticks in Serra da Canastra, a natural reserve of the Brazilian savannah in Minas Gerais, Brazil

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Brazil's tropical savannah, the Cerrado biome, is considered a biodiversity hot spot. Information about ticks from the Cerrado biome is overall scarce. In this report ticks species and aspects of seasonal distribution of free-living ticks from a natural reserve of 71,525 hectares from this biome, the Serra da Canastra National Park in Minas Gerais State, Brazil is presented. Ticks were collected with CO_2 traps and cloth dragging every season for two consecutive years (2008 and 2009) at seven

locations representing different phytophysiognomies of the Cerrado. Ticks from domestic animals from the region were also sampled and ticks biting researchers involved in the study annotated. Overall 1,158 free living ticks from seven different species were found. From these 63.7% were *Amblyomma cajennense*, 13.4% *Amblyomma dubitatum*, 9.5% *Amblyomma brasiliense*, 0.4% *Amblyomma ovale*, 0.3% *Amblyomma nodosum*, 0.1% *Haemaphysalis leporispalustris*, 0.1% *Ixodes schulzei* and 12.6% retained as *Amblyomma* spp. nymphs or larvae. Adults of *A. cajennense* peaked in summer whereas nymphs in winter of both years. Larvae of this tick species were found solely in autumn of the first year and winter of the second. *Amblyomma* spp. nymphs peaked in spring of 2008 and winter of 2009 whereas *Amblyomma* spp. larva clusters peaked in winter of both years. A distinct seasonal distribution could not be found for other tick species. Ticks were overwhelmingly found in forestall phytophysiognomies. A surprising feature of the study was the lack of *Amblyomma tigrinum* among host-seeking ticks, a species that is routinely recovered from manned-wolves of the park. Dogs (n= 84) were found to be routinely infested with *Rhipicephalus sanguineus*, *A. cajennense*, *A. ovale* and *Rhipicephalus* (*Boophilus*) *microplus* but only one *A. tigrinum* was found on one dog. Bovines (n= 17) harbored *R.* (*B.*) *microplus* and *A. cajennense* ticks and horses (n=16) *Dermacentor nitens* and *A. cajennense* ticks. From three domestic pigs 26 adult *A. cajennense* ticks were recovered. The only examined cat was infested with one *A. cajennense* and four *Amblyomma* spp. larvae. From two inspected henneries no tick was found in one and high infestation with *Argas miniatus* ticks was recorded in the other. Nine adults and one nymph of *A. cajennense* as well as five *Amblyomma* spp. nymph human bites were recorded during the study period. Results confirmed earlier reports on the overwhelming prevalence of *A. cajennense* ticks in the Cerrado biome of Brazil. *A. tigrinum* tick species known to exist in the park is supposed to be found in very low densities or at specific sites that were not sampled. This research was financially supported by CNPq.

Wednesday 25, Morning, Room 1

502 - Response of predatory mites to a herbivore-induced plant volatile: genetic variation for context-dependent behaviour

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Plants infested with herbivores release specific volatile compounds known to recruit natural enemies. The response of natural enemies to these volatiles may be either learned or genetically determined. We asked whether there is genetic variation in the response of the predatory mite *Phytoseiulus persimilis* to methyl salicylate (MeSa). MeSa is a volatile compound consistently produced by plants being attacked by the two-spotted spider mite, prey of *P. persimilis*. We predicted that predators express genetically determined responses during long-distance migration where previously learned associations may have less value. Additionally, we asked whether these responses depend on odours from uninfested plants as a background to MeSa. To infer a genetic basis, we analyzed the variation in response to MeSa among iso-female lines of *P. persimilis*, using choice-tests that involved either (1) MeSa presented as a single compound or (2) MeSa with background-odour from uninfested lima bean plants. These tests were conducted with starved and satiated predators, i.e. two physiological states, one that approximates migration and another that mimics local patch exploration. We found variation among iso-female lines in the responses to MeSa, thus showing genetic variation for this behaviour. The variation was more pronounced in the starved predators, indicating that *P. persimilis* relies on innate preferences when migrating. Background volatiles of uninfested plants changed the predators' responses to MeSa in a manner that depended on physiological state and iso-female line. Thus, it is possible to select for context-dependent behavioural responses of natural enemies to plant volatiles.

Thursday 26, Afternoon, Room 4

503 - Ecology of *Raoiella indica* and its natural enemies in Kerala, India

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Since its introduction into the New World, *Raoiella indica* (the red palm mite, RPM) has been reported on a variety of different host plants from the monocotyledon orders Arecales and Zingiberales. From the literature, the host range reported prior to that was limited to *Cocos nucifera* (Coconut), *Areca catechu* (Arecanut or betelnut palm), *Phoenix dactylifera* (Date palm) and *Dictyosperma album* (Hurricane palm). The apparent host range expansion may be due to numerous factors. Firstly, the host range may be as wide in the Old World, but remains unreported as the new hosts are not economically important as the above species. Alternatively, in the New World RPM may be benefitting from being released from co-evolved natural enemies associated with it in the Old World. The apparent new association with bananas is of particular interest as this remains unreported as a host in the Old World in refereed journals. A series of field surveys were carried out in Kerala, India between December 2008-April 2010 investigating the host range and preference of RPM. Temporal surveys on areca and coconut revealed that populations built up to significantly higher densities on areca than coconut when populations were at their peak, with evidence that females migrate down the stem of areca when densities were high. It is hypothesised that this behaviour may be related to over-seasoning behaviour during the monsoon, as mites migrate inside the sheath of fronds on the stem. Surveys were also carried out to assess population levels on local banana varieties, on bananas varieties reported as multigenerational hosts in the Caribbean and on palm varieties reported as host in the Caribbean. No evidence that local banana varieties grown in Kerala are hosts of RPM was found during surveys, even when grown on heavily infested plots intercropped with coconut seedlings. Laboratory studies are currently assessing the ability of local and New World varieties of banana to act as a host for RPM.

Tuesday 24, Afternoon, Auditorium - Poster

504 - Tick fauna in the Khorasan Janoubi Province, Iran

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The Iranian Province of Khorasan Janoubi is located in the border with Afghanistan. The main activity of the people living in the rural areas of this province are cattle breeding and farming. Due to the common transmission of Crimean-Congo Hemorrhagic Fever (CCHF) in this region, a faunistic study was carried out in the summer and the autumn of 2009. A total of 299 ticks were collected from 86 animals. Ticks of the families Ixodidae (hard ticks) and Argasidae (soft ticks) were identified. The main hosts were cow, goat, sheep and poultry. Collected hard ticks belong to the genera *Dermacentor*, *Hyalomma* and *Rhipicephalus*. Those genera contained 86, 13.5 and 0.5% of the hard tick specimens. The main species of hard tick were *Dermacentor marginatus*, *D. nivous*, *Hyaloma asiaticum*, *H. marginatum*, *H. detritum*, *H. dremodarii* and *Rhipicephalus sangineus*. Collected soft ticks were *Ornithodoros lahorensis* (79%) and *Argas persicus* (21%). Understanding the population and species of ticks will provide a clue for control of CCHF in the region.

Tuesday 24, Afternoon, Room 3

505 - Genetic factors potentially reducing fitness cost of organophosphate-insensitive acetylcholinesterase(s) in *Rhipicephalus* (*Boophilus*) *microplus* (Acari: Ixodidae)

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Acaricidal activity of organophosphate (OP) and carbamate acaricides is believed to result from inhibition of acetylcholinesterase (AChE). Previous studies in *Rhipicephalus* (*Boophilus*) *microplus* demonstrated the presence of three presumptive AChE genes (*BmAChE*s). Biochemical

characterization of recombinant BmAChE proteins expressed in the baculovirus system demonstrated that each of the three *R. microplus* rBmAChEs have enzymatic properties consistent with identification as functional acetylcholinesterases. Complementary DNAs (cDNAs) for each of the three *BmAChE*s were cloned and sequenced from individual adult tick synganglia excised from an OP-resistant strain. The data revealed the presence of multiple sequences within an individual tick for each of the *BmAChE*s, suggesting alternative mRNA splicing or expression of multiple alleles for each of the *BmAChE* genes. Quantitative real-time PCR provided evidence of elevated relative copy number for each of the *BmAChE* genes, and direct sequencing of genomic DNA provided evidence of structural *BmAChE* gene diversity with respect to presence or absence of introns, as well as presence or absence of sequence polymorphisms. Baculovirus expression of rBmAChE1 and rBmAChE3 proteins containing some of the predicted amino acid sequence polymorphisms resulted in production of OP-insensitive AChE, demonstrating the presence of mutations resulting in reduced OP-inhibition for at least two of the three BmAChEs. RNA interference was utilized to silence expression of the *BmAChE* genes in adult ticks *in vivo*, resulting in tick mortality if all three *BmAChEs* were silenced simultaneously, but not if any two of the three were silenced, suggesting that the BmAChE proteins functionally complement one another *in vivo*. It is proposed that deleterious effects of *BmAChE* mutations are mitigated by gene duplication and maintenance of allelic diversity, including both OP-sensitive and OP-insensitive alleles.

Thursday 26, Morning, Room 2

506 - Mechanisms explaining the population dynamics of the cassava green mite, *Mononychelus tanajoa* (Bondar) (Acari: Tetranychidae)

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Smallholder agriculture dominates the producing landscape of the northeastern Brazilian state of Maranhão. Slash and burn practices are still used by the majority of smallholders to cultivate several crops including cassava, *Manihot esculenta* Crantz (Euphorbiaceae). The cassava green mite *Mononychellus tanajoa* is a key pest of cassava in some countries and may be kept in check by naturally occurring predatory mites of the family Phytoseiidae. In addition to predatory mites, environmental variables may also contribute to regulate pest mite populations in the field. We evaluated the population dynamics of both *M. tanajoa* and the most common predatory mite found in the study region, *Amblyseius largoensis* Muma (Acari: Phytoseiidae), over the cultivation cycle (11 months) of cassava in four study sites located around the city of Miranda do Norte, Maranhão state, Brazil. In addition, we determined the relative importance of the abiotic environmental variables (rainfall, temperature and relative humidity) to the abundance of *M. tanajoa*. The abundance of *M. tanajoa* increased whereas the abundance of *A. largoensis* remained constant throughout time. Hierarchical partitioning analyses revealed that most of the variance for the abundance of *M. tanajoa* was explained by rainfall and relative humidity followed by *A. largoensis* abundance and temperature. We conclude that although the predatory mite *A. largoensis* contributed to regulate the cassava green mite populations the main mechanisms explaining *M. tanajoa* abundance were abiotic environmental variables.

Tuesday 24, Afternoon, Auditorium - Poster

507 - Comparison of two techniques for collection of free-living ticks in the Amazonian forest

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In the present study, we performed a comparative analysis of the following two methods for collection

of ticks in animal trails in a park of primary Amazon forest in the State of Rondônia, Brazil: (i) Dragging – this method is based on passing a $1m^2$-white flannel on the vegetation, checking the flannel for the presence of ticks every 5-10 meters. (ii) Visual search – this method consists of looking for questing ticks on the tip of vegetation leaves along animal trails in the forest. For comparisons, 10 consecutive visits at seven-day intervals were performed, from 16 August to 18 October 2007. In each visit, the same 1,000 m of animal trails was sampled by one of the two methods, which were applied at alternated weeks, so that each of the two methods were performed 5 times in the same trail. Each collected tick was identified to species (adults) or to genus (immatures) by using hand lenses, and immediately released at the same collection site. A total of 103 adult ticks encompassing four *Amblyomma* species (*Amblyomma scalpturatum*, *Amblyomma oblongoguttatum*, *Amblyomma latepunctatum*, *Amblyomma naponense*) were collected by the visual search method, while only 44 adult ticks encompassing three *Amblyomma* species were collected by dragging. On the other hand, dragging was more efficient for immature ticks, since no larva or nymph was collected by visual search whereas 18 nymphs and 7 larvae were collected by dragging. By visual search, adult ticks were observed either on the upper surface leaf surface (abaxial) or on the lower leaf surface (adaxial). In the later case, visual detection of the tick was more difficult because it relied on the detection of the distal portion of tick legs holding on the abaxial edge of the leaf. At any case, finding a tick questing on the vegetation inside a forest could have been a very difficult task if one searched randomly at any vegetation leaf, with no criterion. However, to optimize tick collection, the investigator had to pretend he was a passing animal walking slowly on the trail; then he selected only those leaves facing the trail, that is, those that would normally be in direct contact with a passing host. We demonstrated that the visual search method is suitable for collecting adult ticks in the Amazon forest; however, field studies should include a second method such as dragging in order to maximize collection of questing larvae, nymphs and adults.

Wednesday 25, Morning, Room 1

508 - Inbreeding depression and purging in a haplodiploid: gender-related effects in two-spotted spider mites

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Inbreeding reduces fitness less in haplodiploid species than in diploid species, because the haploidy of males exposes recessive deleterious alleles that are otherwise protected from selection in heterozygous individuals. However, genes only expressed in females will not face this exposure. This leads to two predictions for haplodiploids: (1) the negative effect of inbreeding is larger for life-history traits controlled by genes with female-limited expression and (2) purging of deleterious alleles during episodes of inbreeding is stronger in these traits. Inbred lines of the two-spotted spider mite mite *Tetranychus urticae* were created by mother-son mating for three generations. Maturity rate, juvenile survival, oviposition rate and longevity were compared between inbred and outbred lines. Purging through inbreeding was investigated by comparing the intensity of inbreeding depression in outbred lines with a history of either inbreeding or outbreeding. Negative effects of inbreeding and evidence for purging through inbreeding were found for the female trait oviposition rate, but not for juvenile survival or longevity. Both male and female maturity rate were negatively affected by inbreeding, which is most likely due to a maternal effect because inbred offspring of outbred mothers was not affected. Hence, negative inbreeding effects and purging through inbreeding occurred and depended on gender.

Wednesday 25, Morning, Room 1

509 - The maintenance of genetic variation for oviposition rate in two-spotted spider mites: inferences from artificial selection

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Despite the directional selection acting on life-history traits, substantial amounts of standing variation for these traits have frequently been found. This variation may result from balancing selection (e.g. through genetic trade-offs) or from mutation-selection balance. These mechanisms affect allele frequencies in different ways. Under balancing selection alleles are maintained at intermediate frequencies, whereas under mutation-selection balance variation is generated by deleterious mutations and removed by directional selection, which leads to asymmetry in the distribution of allele frequencies. To investigate the importance of these two mechanisms in maintaining heritable variation in oviposition rate of the two-spotted spider mite, we analyzed the response to artificial selection. In three replicate experiments we selected for higher and lower oviposition rate, compared to control lines. A response to selection only occurred in the downward direction. Selection for lower oviposition rate did not lead to an increase in any other component of fitness, but led to a decline in female juvenile survival. The results suggest standing variation for oviposition rate in this population consists largely of deleterious alleles, as in a mutation-selection balance. Consequently, the standing variation for this trait does not appear to be indicative of its adaptive potential.

Friday 27, Morning, Room 1

510 - Databases and Phytoseiidae

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The family Phytoseiidae contains 2,230 valid species. Some of them are well known for their predatory abilities and their efficiency for controlling pests especially tetranychid mites in many crops worldwide. Therefore, increasing scientific knowledge on these mites is expected to develop more sustainable, healthier and safer agriculture. Even thought 4,875 publications (between 1978 and 2008) deal with the Phytoseiidae, only some species are used in biological control; certainly because information is scattered in many publications, written in different languages and edited in journals often not easy to retrieve. Except for two world paper catalogues (1986 and 2004), no synthesis actually exists. Furthermore, none of these two catalogues have complete data. One book concerns the preys associated to species of Phytoseiidae all around the world; however as the two former catalogues, it is a paper version and it has to be updated. Yet, research in taxonomy requires reliable and complete information to ensure a reliable diagnostic, carry out biogeographic and phylogenetic analyses, define biodiversity conservation strategies, study biodiversity distribution and impact of climatic changes on biodiversity, etc. The compilation of such information contributes clearly to the development of a modern and integrative taxonomy. An “easy” way to compile this information and to make it rapidly available for many users is the development of databases, including several features such as recent nomenclature changes, date, location of descriptions; the name of the descriptor; records (locations, dates, host plants, publication references). We present in this communication the database already built for the family Phytoseiidae and its usefulness in taxonomy, macro-ecology studies and crop protection applications. Furthermore, we will also present the main perspectives of development and sharing activities among the taxonomists we would like to develop in the future.

Thursday 26, Afternoon, Room 1

511 - Barcoding of life and Phytoseiidae

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Phytoseiidae is a mite family widespread all around the world, including more than 2,000 species. Many of them are considered as major predators of phytophagous mites in various crops worldwide. Their accurate identification is thus of first interest in biological control and sustainable crop production, but it involves several difficulties such as the low number of characters available due to

their small size, the reliability of some characters to distinguish between species and the immature stages identification. For instance, great variation in idiosomal seta lengths, that are often considered as key diagnostic characters, is reported in a same species. As a consequence, we can think that a large number of species have been described more than once and that cryptic species could exist. Molecular markers could clearly assist species diagnostic, through the recently developed barcoding approaches. This communication aims to present this approach, to review its advantages and drawbacks and to show some applied examples of this method within the Phytoseiidae. Two genes, one mitocondrial (12S rRNA) and one nuclear (ITS) markers, were used. This approach allowed an accurate discrimination between all the Phytoseiidae species considered. Furthermore, diagnostic at precoce life stages was possible. It has also been applied to ascertain the diagnostic of a new species. However, even if mt DNA well performed for species discrimination, in some cases high intraspecific distances were observed, questioning the existence of one or more species. For this, multi-loci barcoding, using mt and nuclear genes, seems to be a key condition for the success of such a method. We also observe that a common threshold allowing the delineation between intra- and interspecific distances for all the family, is not possible as this threshold varies between the sub-families Amblyseiinae and Typhlodrominae for a same gene. Lastly, the success of barcoding approach is completely dependant of a good and accurate classical morphological diagnostic and on a database containing the sequences of all the Phytoseiidae mite species. For this, a world consortium of Phytoseiidae mite taxonomists would be a mean for this database construction and use, working on integrative taxonomy including morphological, molecular and ecological data for assessing a reliable diagnostic.

Thursday 26, Afternoon, Auditorium - Poster

512 - Selectivity of plant extracts to the predaceous mite *Amblyseius herbicolus* (Chant) (Acari: Phytoseiidae)

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The red coffee spider mite, *Oligonychus ilicis* (McGregor) (Tetranychidae), is considered one of the main phytophagous pest-mite of coffee plants, capable of causing major reduction in plant photosynthesis, negatively affecting plant growth and yield. Some Phytoseiidae mites, including *Amblyseius herbicolus* (Chant) are important population regulators of phytophagous mites in coffee agroecosystem. Thus, for the full success of the integrated pest mite management, it is necessary that applied pesticides do not affect the predatory mites. This shows the importance of the selectivity studies, taking into account biological control as a component of integrated pest management programs. The use of plant extracts with acaricide property represents an alternative to pest control, especially when the use of agrochemicals is not allowed, as in organic crops. The objective of the present work was to evaluate the effect of plant extracts on *A. herbicolus* in coffee plantations. Tests were performed with 5 extracts obtained from plant parts that were dried, pounded and placed in water for 24 hours for extraction. The treatments used were: check, oil of *Azadirachta indica* L., and leaves of *Annona squamosa* L., *Capsicum baccatum*, *Azadirachta indica* L. and *Agave americana* L. at a concentration of 4%. The residual contact bioassay of sprayed glass surface (cover slip 2x2 cm) was used. Spraying was conducted using a Potter tower at a pressure of 15 lb/pol^2. Each cover slip received 1.5±0.5 mg of extract/cm^2. One hour after spraying, 5 females were transferred to each cover slip. Total adverse effect (E%) was calculated taking into account the mortality in the treatment (corrected for mortality in the check treatment) and the effect in reproduction. The numbers of live females and of viable eggs were counted daily for eight consecutive days; dead mites were also removed daily. Tests were replicated six times. The values found for effect for each extract were classified in toxicity classes from 1 to 4, according IOBC/WPRS. All extracts were selective to the predator; one (*A. americana*) was classified as slightly noxious (class 2); the remaining was classified as innocuous (class 1). While extract of *A. americana* stimulated reproduction of the predator (Er = 1.8), others did not affect the reproduction (Er with values close to 1: *A. indica* oil 1.1, *A. squamosa* 1.2, *C. baccatum* 1.1 and *A. indica* leaves 1.2) Those levels of selectivity suggest that the use of those extracts in integrated pest management

programs on coffee plantation pose no major impact on the population of *A. largoensis*. This research was financially supported by "Consórcio Café".

Tuesday 24, Afternoon, Auditorium - Poster

513 - Evaluation of plant extracts in the control of *Oligonychus ilicis* (McGregor) and *Tetranychus urticae* Koch (Acari: Tetranychidae)

M.A. de Toledo, P.R. Reis, G.C. Souza-Pimentel, H.B. Andrade, E.C. Silveira & P.P. Marafeli

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The coffee red spider mite, *Oligonychus ilicis* (McGregor) (Tetranychidae), is considered one of the main pest mites of coffee plants. The two-spotted spider mite, *Tetranychus urticae* Koch (Tetranychidae), is a major pest on several different crops. Pesticide application is the most conventional method used to control these mites. However, the intensive and quite often inadequate use of pesticides can select for resistant populations and cause serious damage to the growers and to the environment. Thus, the use of less toxic products, as plant extracts, represent an alternative for pest control, especially when the use of agrochemicals is not allowed, as in organic crops. The objective of the present work was to evaluate the topical and residual effect of plant extracts on *O. ilicis* on coffee (*Coffea* arabica L.) leaves, and on *T. urticae* on jackbean (*Canavalia ensiformes* L.) leaves; the latter were free from agrochemicals. Tests were performed with 17 extracts obtained by drying the leaves, pounding and placing them in water for 24 hours for extraction. The plants were collected in the southern region of Minas Gerais, Brazil. The treatments used were: check, *Albizia polycephala* L., *Mentha sativa* L, *Aloe vera* L., *Helianthus annuus* L., *Thymus vulgaris* L., *Pneumus boldus* L., *Persea americana* M., *Ruta graveolens* L., *Ricinus communis* L., *Dieffenbachia picta* S., *Annona squamosa* L., *Allium sativum* L., *Atemoia* sp., *Equisetum giganteum* L., *Caryophylus aromaticus* L., *Laurus nobilis* L, and *Foeniculum vulgare* M. (at 15% concentration). Spraying was conducted using a Potter tower, at a pressure of 15 lb/pol^2, with a deposit of spray of 1.5±0.5 mg of extract /cm^2. Immediately after the leaves dried, they were placed on a sponge constantly dampened with distilled water; a thin band of hydrophilic cotton was placed around the leaves to prevent mites from escaping. Each leaf was divided in four quarters with a narrow band of hydrophilic cotton; for each mite species, 5 gravid females were transferred into each quarter of a leaf; each quarter of a leaf was considered a replicate for a given treatment. Mite mortality was evaluated 72 hours after application. For *O. ilicis*, eleven extracts showed mortality efficiency above 60%: *A. polycephala* (100%), *M. sativa* (94%), *A. vera* (88%), *H. annuus* (88%), *T. vulgares* (88%), *P. boldus* (81%), *P. americana* (81%), *R. graveolens* (69%), *R. communis* (63%), *D. picta* (63%), *F. vulgare* (63%). For *T. urticae*, only two extracts caused at least 60% mortality: *R. communis* (80%) and *A. vera* (60%). Thus, the latter species showed to be more resistant to the extracts than *O. ilicis*, perhaps because of its more common exposure to chemical pesticides on different crops. Additional tests are warranted to further investigate the feasibility of the use of those extracts to control those pest species. This research was financially supported by "Consórcio Café".

Tuesday 24, Afternoon, Auditorium - Poster

514 - Ticks on birds in a small forest fragment of Cerrado in Uberlândia, Minas Gerais, Brazil

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Information on bird ticks from the Brazilian savannah, the Cerrado, the second largest biome of the country, is scanty. In this article we report the tick species, parasite prevalence and infestation intensity of birds from a small forest fragment within the Cerrado of Minas Gerais State, in the municipality of Uberlândia. On the whole, 162 birds from 26 species were captured. Only six birds of five species were not Passeriformes and had no

ticks. One adult tick, 296 larvae and 67 nymphs were found on passerine birds. Of these, it was possible to identify 31 larvae and 27 nymphs of *Amblyomma longirostre*, 17 nymphs of *Amblyomma nodosum*, a larva of *Amblyomma cajennense* and an adult male of *Rhipicephalus sanguineus*. All other ticks were retained as *Amblyomma* sp. larvae (n= 264) or nymphs (n= 26). Overall tick infestation intensity and prevalence were 4.3% and 52% respectively; considering only Passeriformes, infestation intensity and prevalence were 4.3% and 54%, respectively. Of the bird species represented by more than 5 individuals, highest infestation prevalence was observed on *Eucometis penicillata* (83%), *Saltator maximus* (80%), *Leptopogon amaurocephalus* (75%) and *Basileuterus leucophrys* (63%). Sampling of host-seeking ticks on the ground within the forest for a two year period yielded only five *Amblyomma* sp. nymphs and one *A. nodosum* adult male, whereas searching for ticks on domestic animals (cattle, horses and dogs) yielded only *Boophilus microplus* ticks. Although identification was possible for only 27% of the bird ticks, there seemed to be no correlation between environmental and domestic animal versus bird infestation. It can be supposed that bird encounter for infestation occurs above ground or at sites not sampled in this work.

Wednesday 25, Afternoon, Auditorium - Poster

515 - Development of *Tetranychus urticae* (Acari*:* Tetranychidae) population on cucumber plants treated with two biostimulators and growth of mite infested plants

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The experiments were conducted under glasshouse and laboratory conditions. Two varieties of cucumber plants, Iwa and Aramis, were treated with two biostimulators, Asahi and Siapton, to check the influence on the susceptibility of plants to spider mites *Tetranychus urticae*. Treatments were repeated 3 times during experiment, starting from the 3 leaf plant stage. Few days later the plants were inoculated with spider mites (10 females per plant). The development of spider mite populations and level of plant injuries were monitored on three groups of plants of every variety: control (untreated plant), plants treated with Asahi, plants treated with Siapton. The fecundity of *T. urticae* females was also studied, under laboratory conditions, on the leaves taken from all groups of plants. The samples of the leaves were also collected for analyses on the content of some primary and secondary metabolites to check possible changes in food quality for spider mites after treatment with biostimulators. It was found that on the plants treated with biostimulators a lower spider mite population was developing, as compared to control. The more visible effect was observed after spraying of plants with Siapton. Some differences between cucumber cultivars were also observed. Six weeks after inoculation of plants with *T. urticae*, the population of this mite on cv Aramis treated with Siapton was 4 times lower than on untreated plants. Fecundity of *T. urticae* was about 12 -30% lower on the leaves treated with both biostimulators as compared to untreated plants. Treatment of cucumber plants with tested biostimulators could probably change the quality of food for the mites. The growth of mite infested plants was much more intensive after spraying with both biostimulators. Better effect of growth stimulation was observed in the case of cv Aramis as compared to Iwa.

Wednesday 25, Afternoon, Room 6

516 - The invasive persea mite, *Oligonychus perseae* (Tetranychidae), in Canary Islands: conservative or augmentative biological control?

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The persea mite (PM), *Oligonychus perseae* Tuttle, Baker & Abbatiello, is an important pest of avocado in dry Mediterranean environments of Mexico, California and Israel. It has recently spread to the western Mediterranean countries, arriving in southern Spain in 2004 and in Canary Islands in 2006. In Canary Islands it causes intense leaf drop, increasing the risk of fruit sunburn. Predatory mites

are abundant on avocado leaves being *Euseius stipulatus* (Athias-Henriot), *Euseius scutalis* (Athias-Henriot) and *Neoseiulus californicus* (McGregor) the dominant species. Their populations show a positive response to increases in PM, but apparently they are unable to prevent these seasonal peaks because of the high densities of the pest. In order to increase predator activity, augmentative releases of *N. californicus* were evaluated in two commercial avocado orchards. The first trial was done in an orchard located in the northern cooler side of Tenerife Island, whereas the second was conducted in an orchard on the southern, warmer and dryer slope of the island. Densities of PM and predatory mites were monitored for 26 weeks on trees that were treated either with two or three releases of *N. californicus* at a rate of 2000 individuals per tree. Control trees were not inoculated with predators. Releases were initiated when 30% of leaves were occupied by PM. Ten leaves were randomly picked fortnightly from experimental trees and checked under a dissecting microscope. In the orchard located in the north, early and late releases of *N. californicus* failed to reduce PM populations below levels observed in the controls. No significant effect of releases either on average density of PM or on infestation levels on treated trees was observed. Prey-predator ratios were not significantly affected by the treatments. The high PM density between June-August, resulting in ratios ranging from 33 to 301 mobile forms per predator, was unfavorable for a reduction of PM populations. Only during March-May and September prey-predator ratios reached values around 10:1-15:1, which should provide a successful control. Recovery of *N. californicus* on treated trees was insignificant and the dominant predatory mite was *E. stipulatus* both in treated and untreated trees and in trials under early and late release schedule. Similar results were obtained in the orchard located in southern Tenerife, except that the dominant phytoseiid mite was *E. scutalis*, better adapted to warm and arid environments than *E. stipulatus*. These data suggest that *N. californicus* was unable to establish and increase on avocados, despite the high number of predators released. To promote and improve biological control, current research is focused on developing methods for conservation/augmentation of *E. stipulatus*.

Thursday 26, Morning, Room 6

517 - The occurrence of two pest mites and three groups of biocontrol agents in organic and conventional strawberry fields

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Organic fields are often assumed to have fewer pests and more benefiials than conventionally managed fields. We monitored 12 Norwegian strawberry fields, 6 organic and 6 conventional fields, by sampling leaves twice a year in 2002 and 2003. Young folded leaflets were visually inspected for eggs and adult females of strawberry mite (*Phytonemus pallidus fragariae*), and mature leaves were used for extraction of mobile stages of two-spotted spider mite (*Tetranychus urticae*). The spider mites were examined for infection of the mite-pathogenic fungus *Neozygites floridana*. Predatory mites (Phytoseiidae) were recorded on both leaf types, and the females mounted and identified. We also sampled leaves from selected plants in the boundary vegetation of most fields to look for sources of *T. urticae*, phytoseiids and *N. floridana*. Soil was sampled from each field, to study the natural occurrence of entomopathogenic nematodes. All samples were taken 0-13 metres from the border vegetation. Both pest mites tended to be more abundant in conventional than in organic fields, while the number of phytoseiid mites was very low in both growing systems. Nevertheless, three phytoseiid species were recorded for the first time in Norway: *Amblyseius rademacheri* Dosse, *Neoseiulus kodryensis* (Kolodochka) and *Neoseiulus reductus* (Wainstein). *N. floridana* infection found in *T. urticae* females varied from 0-19%, and was higher in 2002 than in 2003. The fungus was recorded at least once in all 12 fields, and there was no consistent difference between the two growing systems. In 2002 there was a significant negative correlation between % *T. urticae* with *N. floridana* hyphal bodies found in the first sampling and the number of *T. urticae* present in the second sampling about 4 weeks later.

Beneficial nematodes (mostly *Steinernema*) tended to occur in more of the organic than of the conventional soil samples. To sum up, both pests (*T. urticae* and *P. pallidus*) and one of the beneficial groups (entomopathogenic nematodes) seemed to conform to the expected difference between organic and conventional fields. There are many possible mechanisms related to the differences in pesticide and fertilization regimes that could lead to such a pattern. For the two remaining beneficials (*N. floridana* and Phytoseiidae) we could not find a consistent correlation between abundance and growing system. This research was partially financed by Norwegian Foundation for Research Levy on Agricultural Products/ Agricultural Agreement Research Funds, Proj. 190407/110.

Thursday 26, Afternoon, Auditorium - Poster

518 - The acaricidal effect of the essential oil of *Ageratum conyzoides* L. (Asteraceae) against the poultry red mite, *Dermanyssus gallinae* (Acari, Dermanyssidae)

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Dermanyssus gallinae, the poultry red mite or chicken mite, is the most important haematophagous poultry ectoparasite in Brazil. Heavy infestations cause anemia, decrease egg production, and some in cases even death if the parasite cannot be controlled. Essential oils have been shown to be effective in arthropod control in agriculture. *Ageratum conyzoides* L. (Asteraceae), commonly known in Brazil as 'Mentrasto', is a medicinal plant with several properties. It is native to tropical America and now spread to various tropical and subtropical parts of the world. *A. conyzoides* was collected in Ibiuna County, SP, Brazil. Fresh leaves were cut into small pieces and placed in a distillation Clevenger apparatus for 2 h. The hydrolyte was extracted with hexane and evaporated at room temperature and the resulting oil was stored in dark glass bottles in a freezer until it was used by GC/MS analysis in a Shimadzu QP-5000 equipped and bioassayed. Females of *D. gallinae*, starved for three days, were obtained from a stock colony of the Laboratory of Parasitology. Filter papers were impregnated with 200 µL of brute oil and at 50% in five replicates, with 20 females each. Tests and control tubes were kept at 27ºC and 80% UR. The mortality in tests groups after 24 hours of exposure were 100% and in the control group 100% of mites were alive. The analysis by GC/MS showed that its main components are precocene II (46.35%), precocene I (42.78%), cumarine (5.01%) and trans-caryophyllene (3.02%). The results showed a potentially high efficiency of this product on the control of this parasite.

Tuesday 24, Afternoon, Room 6

519 - *Tetranychus urticae* and *T. cinnabarinus* synonymous or not?

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The validity of *Tetranychus urticae* Koch (green form) and *T. cinnabarinus* (Boisduval) (carmine form) (Tetranychidae) as two separate species has been questioned by many authors. In 1955 both names were synonymised under *T. telarius* (Linn.). In 1956 they were revived again and separated on the shape of the lobes of the dorsal striae, however, *T. telarius*, was still the name used for the green form. The shape of the lobes and colour to distinguish between these two species were questioned by some authors but considered valid by others. In 1979, *T. cinnabarinus* was synonymised with *T. urticae* mainly because of the incomplete reproductive isolation between them. SEM studies conducted in 1981 showed significant differences in the density of lobes on the dorsal striae per 10 µm, averaging 6.44 for *T. urticae* and 7.47 for *T.*

cinnabarinus. This and the shape of the lobes were considered enough proof to separate these two species, though the aedeagus and other diagnostic characters of the male and female were similar in both species. However, dorsal lobe density may vary between specimens and with the climatic conditions experienced by the mites. Moreover, crossbreeding studies conducted in 1963, 1977 and 1979 between these two species showed variations in the shape of the lobes. A comprehensive study was initiated recently to address this issue. It focused on the dorsal striae lobe's shape and density using SEM. As we obtained hybrids from crosses between two populations of the green and the carmine forms, lobes variations in the progeny of crosses were also studied.

Thursday 26, Afternoon, Auditorium - Poster

520 - A study of myrmecophilous mites: factors affecting mite diversity in ant nests

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Ants (Formicidae) have long been an insect group of great interest to the scientific world, whether for their ecological roles, feeding strategies, or social behaviors. They form complex colonies, harboring resources that can potentially be exploited by other arthropods. Kin-recognition is the key to the ants' survival and is necessary for protection of the colony's resources, but myrmecophiles (organisms living in association with ants) are able to overcome these defenses, and apparently have cracked the ants' code. Although myrmecophily has been studied in detail for some groups of arthropods (primarily Coleoptera), mites (Acari), among the most frequent of ant guests, remain largely unstudied. Previous work on acarine associates has focused primarily on descriptions and has provided little ecological information. This study is a pioneering effort to provide a more robust list of the often overlooked inhabitants of ant nests focusing on Ohio, a state that has yet to be mentioned in any myrmecophilous mite study. A general survey of common Ohio ants was conducted from April to September 2008 and 2009. Mites were individually removed from workers, reproductive castes, food resources, and debris in 271 colonies. Mite collections totaled 147 species on 30 species of ants and approximately 65 species of mites in the nests themselves. Mites consisted primarily of representatives of the Cohort Astigmata (Histiostomatidae and Acaridae), the Cohort Heterostigmatina (Scutacaridae and Microdispidae), and suborder Mesostigmata (Laelapidae, Antennophoridae, and Uropodina). Many mite species were host specific and attachment site specific. Statistical analyses showed the number of associated mite species per colony to be determined by several factors including, ant subfamily, habitat, nest substrate, colony size, and ant size. An unusually large number of mite species were found to be associated with the ant genus *Lasius*. This is likely the result of a nest founding strategy (social parasitism) exhibited by some species of this genus which causes parasitic ant species to encounter and share more mites than non parasitic species in the same genus. Results show significantly greater mite diversity in colonies when 1) the ant subfamily is Formicinae (even after removal of *Lasius*), 2) the colony is in the woods, 3) the nest substrate is wood, 4) the colony is populous, 5) the ants are large, and 6) the ant species establishes its nest parasitically.

Wednesday 25, Afternoon, Room 1

521 - Order of invasion affects the spatial distribution of reciprocal intraguild predators

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When intraguild predation is reciprocal, hence, two predator species kill and feed on each other, theory predicts that well-mixed populations of the two species can not coexist. At low levels of the shared resource, only the best competitor exists, whereas if the level of the common resource is high, the first species to arrive on a patch can reach high numbers, which prevents the invasion of the second species through intraguild predation. The order of invasion may therefore be of high importance in systems

with reciprocal intraguild predation with high levels of productivity, with the species arriving first excluding the other species. However, natural systems are not well-mixed and usually have a patchy structure, which gives individuals the possibility to choose patches without the other predator, thus reducing opportunities for intraguild predation. Such avoidance behaviour can cause spatial segregation between predator species, which, in turn, may weaken the intraguild interaction strength and facilitate their co-occurrence in patchy systems. Using a simple set-up, we studied the spatial distribution of two reciprocal intraguild predators when either of them was given priority on a patch with food. We released females of two predatory mite species sequentially and found that both species avoided patches on which the other species was resident. This resulted in partial spatial segregation of the species and thus a lower chance for the two species to encounter each other. Such behaviour reinforces segregation, because heterospecifics avoid patches with established populations of the other species. This may facilitate coexistence of two intraguild predators that would exclude each other in well-mixed populations.

Tuesday 24, Afternoon, Room 1

522 - Effects of *Aculops lycopersici* on trichome density and establishment of predatory mites (Acari: Phytoseiidae) on tomatoes

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The tomato russet mite, *Aculops lycopersici* (Massee), the greenhouse whitefly, *Trialeurodes vaporariorum* (Westwood), the sweetpotato whitefly, *Bemisia tabaci* (Gennadius), and the two-spotted spider mite, *Tetranychus urticae* Koch, are world-wide pests on tomatoes. Whiteflies and spider mites can be very well controlled with phytoseiid predatory mites in greenhouse crops such as sweet pepper, cucumbers and eggplants. However, in tomato crops phytoseiid predatory mites are less effective as biological control agents than on other plants because tomato plants have glandular trichomes which negatively affect their performance. In this study the generalist phytoseiid predatory mites *Amblydromalus limonicus* (Garman & McGregor) and *Amblyseius swirskii* (Athias-Henriot) were evaluated as potential biological control agents of *T. vaporariorum* and *A. lycopersici* on tomato plants. In laboratory experiments, both predators showed high oviposition rates when feeding on eggs of *T. vaporariorum* and on all stages of *A. lycopersici* as prey on tomato leaf disks. When the predatory mites were released on tomato plants infested with *T. vaporariorum* and with plant pollen as an additional food source, both predatory mite species did not establish on the plants. When the predatory mites were released on tomato plants infested with a high density of *A. lycopersici*, then *A. swirskii* and *A. limonicus* established successfully on the plants and the population of both predatory mites increased rapidly within a few weeks. However, when *A. limonicus* was released in high numbers on tomato plants with a low infestation of *A. lycopersici*, the predators were not able to control the pest. Close observation of tomato plants infested with low and with high densities of *A. lycopersici* showed that the density of trichomes is much lower on plants which are heavily infested. This could improve the movement and searching ability of predatory mites. The perspectives of predatory mites as potential biological control agents of *A. lycopersici* will be discussed.

Tuesday 24, Afternoon, Room 1

523 - Recognition of odours of plants infested with prey by *Amblyseius swirskii*

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As a defensive method against herbivore pests, many plants can release volatiles to attract predators. This allows predators to localize infested plants, and can result in very specific relationships between the species involved. However, little is known about these interactions in a more complex system with multiple prey species. The predatory mite *Amblyseius swirskii* has proven to be successful in biological control of various pests on greenhouse crops. Interestingly, *A. swirskii* show increased population growth, achieves higher

densities, resulting in increased control when both thrips and whitefly prey are present. The blind mite uses olfactory cues from infested plants to find their prey. Considering the fitness benefits of a mixed diet for *A. swirskii*, it is hypothesized that these predatory mites will prefer a mixed diet over a single prey. We determined whether *A. swirskii* can recognize and distinguish between plants infested with specific pest compositions, based on olfactory cues. In a Y-tube olfactometer and in greenhouse release-recapture experiments, predatory mites were offered a series of choices between volatiles emanating from cucumber plants infected with combinations of thrips and whitefly. *A. swirskii* recognition based on plant odours was found to be more specific than previously thought. The preferences give some insight into the indirect effects between prey that share a host plant and a predator population.

Thursday 26, Afternoon, Room 2

524 - *Amblyseius swirskii* disperses differently in greenhouses with two pests versus one pest species present

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The whitefly *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae) and the thrips *Franklineilla occidentalis* (Thysanoptera: Thripidae) are two important pests of crops such as cucumber and tomato in greenhouses in Western Europe. The generalist predatory mite *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) is a relatively new enemy used for control of whitefly and thrips in greenhouse crops. Recent experiments have shown that control of the whitefly by this predatory mite was better in the presence of thrips than without thrips, but there was no effect of the presence of whiteflies on thrips densities at the end of the crop season. The densities of predators were up to 15 times higher in presence of both pests than in the single-pest treatments. Laboratory experiments with *A. swirskii* suggest that this is caused by higher juvenile survival and developmental rate on a mixed diet. Hence, better control may be achieved through a positive effect of mixed diets on predator population growth. However, the use of one species of predator as control agent against several pests simultaneously can also lead to temporal and spatial escape of the pests early in the crop season because an increase in the numbers of one prey species may arrest the predators at certain plants, thus creating temporary refuges for the other pest on other plants. This is especially the case with *A. swirskii* because they are slower dispersers than thrips and whitefly. We therefore conducted a large-scale greenhouse experiment to investigate whether the use of a single natural enemy species for biological control of two pests can lead to a spatial escape of thrips from control. Initially, we found significantly higher numbers of thrips larvae in greenhouse compartments where both pests were present compared to compartments where only thrips was present, especially on plants that were some distance away from the point of release of the predators. Thrips escaped predation because the predators dispersed slower in compartments with two pests present. After six weeks, this effect was overruled by the higher total number of predators in greenhouses with two prey species. The average yield of cucumbers did not differ between compartments with or without a second pest present. Hence, successful biological control was achieved, despite the spatial escape of thrips.

Thursday 26, Afternoon, Room 6

525 - An overview of cytochrome b point mutations conferring resistance to bifenazate and acequinocyl in field strains of spider mites (Acari: Tetranychidae)

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The family of spider mites (Acari: Tetranychidae) includes important phytophagous mite species such as the two-spotted spider mite, *Tetranychus urticae* Koch, and the citrus red mite, *Panonychus citri* McGregor. One of the major problems in the

chemical control of spider mites is their ability to develop resistance to many important acaricides in a very short term. Resistance of *T. urticae* to bifenazate, a carbazate acaricide, was previously linked with mutations in the mitochondrial cytochrome b Q_o pocket, suggesting bifenazate acts as a Q_o inhibitor. Screening of 20 field strains of *T. urticae* that had been exposed to bifenazate for several seasons revealed the presence of several cytochrome b mutations. Consequently, resistance levels were investigated in bifenazate susceptible and resistant strains bearing distinct mutations in the cd1- and ef-helix aligning the Q_o pocket. Since some of these mutations were recently shown to cause cross-resistance to the known acaricidal Q_o inhibitor acequinocyl, cross-resistance to acequinocyl was investigated to establish a correlation between cytochrome b genotype and acequinocyl resistance. Most recently, bifenazate resistant *P. citri* strains were detected in the field and preliminary investigations into the toxicology and genetics will be presented.

Tuesday 24, Afternoon, Auditorium - Poster

526 - Potential geographic distribution of mites of the family Ixodidae in the State of Michoacán, Mexico

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Mites are the most diverse group of arachnids. Some mite species have become pests, threatening several economic sectors and public health. Michoacán is essentially an agricultural and animal husbandry state, which makes it necessary to acquire appropriate knowledge about the present distribution of ticks, thus allowing for designing adequate pest control strategies. Ticks are mostly parasites of wild animals establishing a host-parasite relationship leading to an innocuous infestation; however, when human or domestic animals are fortuitously infested, the parasite may cause severe problems. The objective of the present work was to predict the distribution of mites in the state of Michoacán as a first step to the goal of arriving to the level of geographic differentiation required for the design of ecological pest control strategies. Based on the known distribution of the hosts, the possible spatial location of ticks in Mexico was inferred by means of Geographic Information System applications. Results indicate the potential presence in the state of Michoacán of at least 31 species of Ixodidae. The resulting species richness map indicates some species have highly restricted distribution while others are amply localized throughout the state due to their greater ecological plasticity. The areas showing a lesser incidence of mites have less than five species and those with higher presence, over 18. However, the authors consider that these results are biased by the intensity of host sampling and that there is a manifest need for considerably increasing the number of collections of both hosts and ticks, besides of needed field verification of the presence-absence of tick species.

Thursday 26, Afternoon, Room 4

527 - Current status and distribution of *Raoiella indica* in Venezuela

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The Red Palm Mite (RPM), *Raoiella indica* Hirst, is probably Asian in origin, but since 2004 it is distributed in the Caribbean area, where it has become a serious threat to coconut and banana producers. In 2007, *R. indica* was found for the first time in Sucre State, in northeastern Venezuela. Since the Red Palm Mite was officially reported in Venezuela, the Instituto Nacional de Salud Agrícola

Integral (INSAI) in cooperation with the Universidad Centroccidental Lisandro Alvarado (UCLA) have carried out surveys to determine distribution of *R. indica* and its natural enemies. Nowadays the RPM is widely distributed along the whole coastal line on coconut trees, but it is also associated to several host plant species, mainly Musaceae, Zingiberaceae and Strelitziaceae. Also some field experiments consisting in application of botanical pesticides as alternative control strategy to maintain pest population levels under economic threshold have been tested in Falcón State, the main coconut producer area in Venezuela, however, no conclusive results have been obtained. Currently, Venezuelan government and educational institutions efforts are being devoted to established a classical biological program. For this purposes searching for Phytoseid mites in the probable origin areas, i.e., Reunion Island are planned to test their efficacy to decline pest population levels. If the RPM has begun to disperse to Bolívar and Amazona States in southern Venezuela was not yet determined, although existence of natural populations of several native palm species, especially *Mauritia flexuosa* seems to support this hypothesis.

Tuesday 24, Afternoon, Auditorium - Poster

528 - Distribution of *Raoiella indica* Hirst (Acari: Tenuipalpidae) in Venezuela

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The red palm mite (RPM), *Raoiella indica* Hirst, is an invasive pest in the Caribbean region and in South America. It is currently considered a serious threat to palms and bananas in producing areas. In 2007, this pest mite was reported in the State of Sucre, northern Venezuela. To determine the current distribution of *R. indica* in Venezuela, surveys were carried out from October 2008 to October 2009 in banana (*Musa* spp.), coconut (*Cocos nucifera* L.), ornamental plants and on weeds growing in association with those crops. Samplings were conducted in some of the main municipalities in northwestern (Anzoategui, Monagas, Nueva Esparta and Sucre), central (Aragua, Carabobo) and northeastern (Falcón and Zulia) Venezuela. Higher population levels were registered both in commercial coconut farms in Falcón, Monagas and Sucre, and on coconut plants growing along coastal line in Aragua, Carabobo and Nueva Esparta. Also, high population levels were found in small banana farms in Falcón. The RPM was also found on *Roystonea regia* (Kunth) O.F. Cook (Arecaeaae) and *Strelitzia* sp. (Strelitziaceae), used as ornamentals in the State of Zulia, in low population levels. The occurrence of RPM on weeds could be sporadic, as no immatures were observed on those plants. Since first reported in Venezuela in 2007, the RPM has spread to extensive areas in the northern part of the country. Given the recent report of this pest mite in northern Brazil in 2009, additional samplings in southern Venezuela should be carried out, to confirm its presence on native palm species occurring naturally in this area.

Wednesday 25, Afternoon, Auditorium - Poster

529 - Prostigmata (Acarida: Acariformes: Prostigmata) from soil of a coffee growing farm in Huatulco, Oaxaca, Mexico

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The mountain area south of Oaxaca is covered with Tropical Deciduous Forest, which is a natural stock of soil and natural resources. Since the nineteen century, coffee crops were introduced as a rustic agroecosystem structure, trying to maintain the original forest conditions in order to reach the highest production and to maximize soil conservation. The coffee farm "El Nueve" is one

example of this agroecosystem structure, common in the south of Oaxaca. On that farm, coffee plants (*Coffea arabica* var. *typica* L.) are grown in this type of Tropical Deciduous Forest remnants which includes the following three soil types: Phaeozem skeletico (Plot 1), Umbrisol ferralico (Plot 2) and Phaeozem calcarico epileptico (Plot 3). We studied the different mite compositions according to season (dry and wet) and the soil types in that farm. Each soil sample covered an area of 95 cm^2 and was taken at depth of 10 cm. Thirty samples were taken in the dry and 16 in the wet seasons. Data referring to mite abundance in the dry season were recently published. Twenty two mite families of the Order Prosigmata were found: Alycidae, Anystidae, Bdellidae, Camerobiidae, Cheyletidae, Cunaxidae, Ereynetidae, Erythraeidae, Eupodidae, Lordalichidae, Microdispidae, Nanorchestidae, Pyemotidae, Rhagidiidae, Smaridiidae, Sphaerolichidae, Scutacaridae, Stygmaeidae, Tarsonemidae, Terpnacaridae, Trombididae, Tydeidae. Of these, Cunaxidae and Eupodidae had the highest densities (83.2 and 37.9 specimens/ m^2, respectively). In the wet season, the same families were found, except for Anystidae, Camerobiidae, Sphaerolichidae and Terpnacaridae. In addition, mites of the following groups were found in the wet but not in the dry season: Alicorhagidae, Labidostomatidae, Trombiculidae (larvae) and Opilioacarida. Densities of Eupodidae increased, whereas densities of Tydeidae decreased. Differences in mite family composition between soil types and between seasons will be discussed.

Wednesday 25, Afternoon, Auditorium - Poster

530 - Oribatid mites from Cozumel, Quintana Roo, Mexico

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The Island of Cozumel is located in the Caribbean Sea, between the Yucatan Peninsula and Cuba. At least 8 different ecosystems can be identified on that island: Medium high tropical forest, 4 types of palm trees, Mangrove forests, Coastal dunes with some halophyte plants and Petenes, which are unique in the Yucatan Peninsula. A study was conducted to identify the edaphic mites on this island, employing the usual methodology for soil fauna. Litter samples (20 x 20 cm) were taken and processed in Berlese funnels. On coastal dunes, pit-fall traps were installed, remaining in the field during three days. The content of the traps was filtered using a very fine mesh, and the organisms were washed with alcohol and conserved in it. For the taxonomic study, the organisms were mounted on microscopic slides in Hoyer´s medium. All samples were collected in 3 surveys, conducted in the spring, summer and autumn of 2009-2010. Although soil mites were virtually unknown on the island, we identified in this study 150 species of 85 families, mainly of Mesostigmata, Notostigmata, Prostigmata, Oribatida and some Astigmata. On the island, San Gervasio is not only a very important archaeological site of the Mayan culture, but also one of the sites with high medium tropical forest, with some Mahogany trees (*Swietenia macrophylla*), Ramón (*Brosimum alicastrum*), Cedro (*Cedrela odorata*) and other trees that were widely used by the Mayans. This was the site in which we found the highest number of species as well as of microhabitats occupied by them. We expect that the number of species collected will increase with further surveys to be conducted later this year. Precise identification of those mites is underway. Of particular interest is the new record of *Caribeacarus* sp. (Opilioacaridae: Parasitiformes) on the island.

Wednesday 25, Morning, Room 6

531 - Feeding habits and preference of habitats of Opilioacaridae in Mexico, Central America and Madagascar

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The Opilioacaridae (Acari: Parasitiformes) are more diverse than previously expected. More than 39 species are known in this family, distributed in a wide range of ecosystems and living in very different types of microhabitats in almost all continents. In this study we present the result of observations on feeding habits of more than 350 mites of this family from South America (Mexico, Cuba, Dominican Republic, Panama, Venezuela and Brazil) and from Madagascar, including females, males and all immature stages. In the 90% of the specimens dissected and mounted in Hoyer´s medium, it was possible the presence of food particles. Considering the worldwide distribution of Opilioacaridae and the high diversity of microhabitats they occupy, the diversity of food ingested does not seem to be wide, consisting of pollen grains, whole mite bodies (mainly Prostigmata and Astigmata), parts of Collembola (scales, mouthparts, legs and other parts of the body), Nematoda (only in adult females and males), spores and microscopic algae. Some juveniles, especially those recently molted had plenty of food, suggesting that they were really hungry. On the contrary, moulting juveniles had almost no food in their guts; occasionally, a single pellet consisting of perfectly packed food remain was observed, ready to be expelled. Gut content suggest low specificity of those mites, which ingest a variety of resources as they are available through the season. As to habitats occupied, opilioacarids were found in semi-desert areas, under shrubs or rocks, in tropical forest, coastal dunes, low flooded forest, pine-oak forest, moss on decaying trunks or moss on living trees, spring waters and moss on the walls of "cenotes" with water falls. In Mexico they have been collected in every state along the Atlantic and the Pacific Oceans. *Caribeacarus* sp. is also reported for the first time in the Cozumel Island, in the Caribbean Sea. Opioacarids were also found in a wide range of habitats in Madagascar, from spiny forests at the sea level to the rain forest on the high mountains, also on moss and under rocks.

Tuesday 24, Afternoon, Auditorium - Poster

532 - Toxicity of lime sulphur to *Polyphagotarsonemus latus* and to its hosts, *Capsicum frutescens* and *Jatropha curcas*

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The broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae), is a polyphagous pest that attacks several important crops worldwide. In Brazil, it is considered a key pest of chili pepper and of physic nut, among other crops. For these crops, there are no acaricides registered. Lime sulphur, a combination of lime and elemental sulphur with water, may represent an alternative to control broad mite. In order to provide technical information about the use of this product, we first estimated the lethal concentration (LC) and the instantaneous rate of increase (r_i) of *P. latus* exposed to different lime sulphur concentrations. Second, we carried out field and semi-field experiments to evaluate the phytotoxicity of different concentrations of lime sulphur to chili pepper and to physic nut plants. Lime sulphur LC_{95} was equal to 1.24% and the concentrations that restrained mite population growth ($r_i = 0$) was 1%. In the field, chili pepper plants sprayed with lime sulphur concentrations of 0.5 to 2.5% did not show toxicity symptoms. However, in a semi-field experiment, leaves of physic nut plants sprayed with those same concentrations showed symptoms of toxicity; at 0.5%, damage was light, corresponding to small burned areas. At higher concentrations, damage was more extensive, corresponding to burnt edges and tips of the leaves. Lime sulphur may represent a viable alternative to control *P. latus* on chili pepper, but toxicity limits its potential use in physic nut crop.

Tuesday 24, Afternoon, Room 1

533 - Effect of host plants on growth and reproduction of the broad mite, *Polyphagotarsonemus latus* (Banks)

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Polyphagotarsonemus latus (Banks) or broad mite is one of the important pests of several crops worldwide. This study aimed to investigate the effect of the host plants on growth and reproduction of this mite species. Young leaves of mulberry, basil, and physic nut were used as host substrates. Each broad mite was reared on a leaf disc placed on hydrogel and allowed to complete its development. Observations were conducted every 4.8 hours until all mites reached adulthood, and then every day until all adults died. Mulberry leaf was the best host plant to promote broad mite growth and reproduction, while basil, and physic nut young leaves prolonged broad mite development and caused less reproduction. Adding male to female arena after they reached adulthood resulted in higher female: male sex ratio of their offspring. The life histories of broad mite on each host plant are discussed.

Wednesday 25, Afternoon, Room 6

534 - Effect of prey and pollen on the population of *Amblyseius cinctus* Corpuz & Rimando

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Amblyseius cinctus is one of the potential predatory mites in Thailand for controlling broad mite, *Polyphagotarsonemus latus* (Banks), on chili and other host plants. Alternative food sources for *A. cinctus* were investigated under laboratory condition for mass-rearing purpose. A mulberry leaf was placed onto a moist sponge in a plastic box under 12:12 dark: light condition. Ten gravid females and 5 mature males of *A. cinctus* were released onto each arena. Two types of prey mites (broad mite and mulberry red mite, *Tetranychus truncatus*Ehara) and 2 types of pollen sources (cattail and palm pollens) and their combinations were provided to *A. cinctus* as food sources. After 10 days of continuous feeding on different food supplies, *A. cinctus* reproduced continuously and their population sizes (all stages) increased in all treatments, ranging from 1.07 up to 9.13 folds. Providing only broad mite, mulberry red mite or no mites (pollens alone) did not cause any difference in their population growth within 10 days (48.56 *A. cinctus* per arena on average). However, adding either cattail pollen or palm pollen to tested arena could increase the population size of *A. cinctus* after 10 days compared with no pollen. *A. cinctus* populations in treatments with palm pollen, cattail pollen and no pollen (prey mites alone) were 55.56, 50.78 and 34.75 per arena after 10 days, respectively. Thus, both types of pollens could be used to enhance the population growth of *A. cinctus* under laboratory condition. Broad mite with pollen could enhance growth rate of *A. cinctus* as compared to mulberry red mite with pollens. However, rearing *A. cinctus* on mulberry leaves with broad mite is considerably time-consuming. Thus, mulberry red mites and available pollens should be used to maintain *A. cinctus* colony. Broad mite should be added later when high numbers of *A. cinctus* are needed. The results of food combination for *A. cinctus* population and their distribution on rearing arena will also be discussed.

Wednesday 25, Afternoon, Room 6

535 - Effectiveness of *Amblyseius cinctus* Corpuz & Rimando and conventional practices on broad mite control in a chili field: a case study

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A 0.02 hectare of chili field (*Capsicum frutescens* Linn.) was infested naturally with broad mites (*Polyphagotarsonemus latus*) in June 2009. Both conventional practices and *Amblyseius cinctus* were applied in June-August 2009 to determine the effectiveness of *A. cinctus* in addition to the conventional practices for broad mite control. A total of 24 plots were set in the broad mite infested field. Two levels of predator addition (none and

addition) and four levels of the conventional practices (none, fertilizer, fungicide and pesticide) and their combinations were applied weekly to plots. Plant damage levels and growth were determined once a week. Numbers of broad mites and predators per shoot were counted and measured monthly. The fruits were harvested at the end of July and August. The improvement of growth and production of chili plants subjected to each condition were discussed.

Thursday 26, Afternoon, Auditorium - Poster

536 - Role of the angiotensin converting enzyme on tick reproduction

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Angiotensin converting enzyme is a carboxydipeptidase that removes dipeptides from some oligopeptides. In vertebrates, this enzyme is involved in the control of blood pressure and fertility. EST sequences from *Rhipicephalus microplus* matching ACEs were found in GenBank and clusterized into four contigs. 3D models of two of these sequences were built and differences in shape and surface electrostatic potential detected, suggesting that these enzymes have different physiological substrates. We have previously shown that enalapril-maleate inhibited egg laying in 69% but did not inhibit ovary development. To access the expression profile of these genes, RT-PCR was performed using cDNA of several tissues as template. In vitelogenic females the expression of these genes was different among tissues but in pre-vitelogenic females the expression of all genes was observed in all tissues tested, supporting the idea that the isoforms of this enzyme have distinguish physiological roles throughout tick life cycle. To identify possible neuropeptides eventually produced by ACE-like proteins and involved in ovarian duct contraction, the hemolymph of control and of injected ticks were compared. Peptides having MW below 3kDa were analyzed by mass spectrometry and a change in their profile was detected. The proteins with MW above 3kDa will be analyzed by electrophoresis. Our results support a possible role for an ACE-like protein in the reproduction of *R. microplus*. This research was financially supported by CNPq, IPPF, FAPERJ, INCTEM and CAPES.

Wednesday 25, Afternoon, Room 6

537 - More mine-damaged leaves, more phytoseiids

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Studies in apple and grapefruit orchards showed that abandoned leaf mines of two microlepidopterans species allow microplane organisms to augment and provide refuge to arthropods. *Phyllonorycter blancardella* (Gracillariidae) produces tentiform mines in apples, whereas *Phyllocnistis citrella* (Gracillariidae) causes mines that deform leaves and rolls the edges of leaves in citrus trees. This report is based reviewing original data from studies conducted in apples orchards in eastern Ontario between 1993 and 1995; and in grapefruit orchards in central Florida and in south Texas in 2001 and 2010, respectively. Among the arthropod species, the relative abundance of predatory phytoseiid mites was greater on leaves damaged by leafminers compared with leaves that did not have mines, for both apple and grapefruit trees.

Wednesday 25, Afternoon, Room 6

538 - Experiences with *Neoseiulus fallacis* (Acari: Phytoseiidae) in apple orchards of eastern Ontario (Canada) and North Carolina (USA)

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The phytoseiid mite *Neoseiulus fallacis* (Garman) is a well distributed predatory mite in many areas of

North America. Here, the authors are going to discuss their experience working with this predator under laboratory and field conditions. The abundance, phenology, behavior, release for spider mite control and insecticide resistance of *N. fallacis* are the topics to be treated in this article.

Tuesday 24, Morning, Room 1

539 - When a predator becomes a prey: threat-sensitive predator species recognition by prey in an acarine guild

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Frequently prey is faced with multiple predator species, which differ in their predation risk for prey. Since any anti-predation behaviour is traded-off against other fitness related activities, prey should be able to discriminate among high risk and low risk predator species and adjust their anti-predation behaviour accordingly. Such threat-sensitive responses are well documented in classical prey-predator interactions, but not in predator-predator interactions. The members of phytoseiid mite guilds are ideal study organisms to evaluate potential threat-sensitive responses of intraguild (IG) prey to species-specific IG predation risk. The predatory mites *Phytoseiulus persimilis*, *Neoseiulus californicus* and *Amblyseius andersoni* constitute a natural guild sharing spider mites in Sicily and elsewhere in the world. The small and little mobile larvae of *P. persimilis* are more likely and more often preyed upon by the high risk IG predator *A. andersoni* than by the low risk IG predator *N. californicus*. First, we measured survival and videotaped the behaviour of single *P. persimilis* larvae held on leaf discs in the presence of only cues or physical presence of a high or low risk IG predator female and predator absence. 66% and 21% of the larvae were killed within 60 minutes in the presence of the high and low risk IG predator. Preliminary analyses indicate that the total distance covered by IG prey larvae was shorter in the presence (cues or physical) of the high risk IG predator than in predator absence whereas it was longer in the presence (cues or physical) of the low risk IG predator as compared to the control. Thus, it seems that IG prey larvae are threat-sensitive but respond in opposite directions relative to predator absence. In any case, anti-predation behaviours by larvae were rather inefficient. Second, we assessed oviposition site selection of naïve and experienced IG prey females in choice experiments using bean leaves with or without cues of the high risk or low risk IG predator. IG predation risk triggered a threat-sensitive response in experienced females, which deposited nearly all eggs in the predator free prey patches. We conclude that threat-sensitive oviposition behaviour by experienced IG prey females is a more efficient strategy to reduce the IG predation risk of offspring than direct anti-predation behaviours by the larvae themselves. To the best of our knowledge, our study is the first experimental documentation of learned threat-sensitive species recognition and anti-predation response in a predator guild.

Thursday 26, Morning, Room 4

540 - The usual *Brevipalpus* suspects and their taxonomy (Acari: Tenuipalpidae)

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The genus *Brevipalpus* has over 280 species worldwide and includes some of the most important agricultural pests. Many species within the genus have been consistently confused and misidentified over the years. The present study provides a discussion of the characters and character states used to separate *Brevipalpus* species. Low-temperature scanning electron microscopy and traditional light microscopy techniques were used to illustrate the morphological differences between six common pest species (*B. phoenicis*, *B. californicus*, *B. obovatus*, *B. lewisi*, *B. chilensis* and *B. trinidadensis*). Morphology of the prodorsum, opisthosoma, and leg chaetotaxy of all six species was examined and compared.

Tuesday 24, Afternoon, Room 6

541 - Coxalae pattern of the sand-mites with proposed two new families: Apoloniidae stat. n. and Sauracarellidae stat. n. (Actinedida: Trombiculoidea)

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In 1947, Wharton placed all the sand-mites (= chiggers) into the family Trombiculidae (Ewing, 1929) with four subfamilies, Trombiculinae, Leeuwenhoekiinae, Walchiinae and Apoloniinae, without accepting Womersley's familial separation of Leeuwenhoekiidae in 1945. In 1952, Womersley defined Trombiculidae with two subfamilies only, Trombiculinae and Gahrliepiinae (=Walchiinae), and included the Apoloniinae into Leeuwenhoekiidae. A third family, Walchiidae (Ewing, 1946) (=Gahrliepiinae Womersley, 1952), has been elevated by Wen in 1999. In the present study, the larval pedocoxala and gnathocoxala patterns were shown to be the important characters to distinguish the Leeuwenhoekiidae from Trombiculidae and Walchiidae, as well as from Apoloniinae and Sauracarellini. In the leeuwenhoekiid larvae except all legs are 6 segmented (fSP = 6.6.6), the pedocoxala pattern is fcx = 2.1.1 accompanied by the sternals fst = 0.2, moreover, the gnathocoxalae are eccentrically inserted. While in the rest groups of the sand-mites fSP = 7.7.7 or 7.6.6., fcx = 1.1/n.1/n accompnying fst = 2.2 and gnathocoxalae in marginal or submarginal insertions. The Apoloniinae differs from rest groups of the sand-mites by providing only one pedogenualae σ^1 but laking both σ^2, σ^3. The conclusion is that the Apoloniinae and the Sauracarellini could be elevated to the family levels, Apoloniidae stat. n. and Sauracarellidae stat.n., bringing the total number of sand-mite families to five. The diagnosis of each are: (1) Leeuwenhoekiidae Womersley, 1945 — scutum wider than long, with two anteromedian setae, with or without anteromedian projection (AM = 2, A = 1 or AM = 2, A = 0), sensillae flagilliform, fSP = 6.6.6, fcx = 2.1.1, fst = 0.2, pedogenual microseta κ^2 present, gnathocoxalae (gx) eccentrically inserted, multisetosous larvae. Type genus: *Leeuwenhoekia* Oudemans, 1911; (2) Sauracarellidae (Vercammen-Grandjean & Kolebinova, 1968) stat. n. — scutum wider than long with rear margin protruded, both paired anteromedian setae and anteromedian projection present (AM = 2, A = +), sensilla clavate, fSP = 7.7.7, fcx = 1.1.1, fst = 2.2, genual microseta κ^2 present, gx marginally or submarginally located. Type genus: *Sauracarella* Lawrence, 1949; (3) Apoloniidae (Wharton, 1947) stat. n. — peniscutum cordate, either with one anteromedian seta and an anteromedian projection (AM = 1, A = 1), or two anteromedian setae without anteromedian projection (AM = 2, A = 0) , or with both (AM = 2, A = 1), sensilla short and thick filamentous, fSP = 7.7.7, fcx = 1.1/2.1/n, fst = 2.2, κ^2 wanting, gx marginal or submarginal in location, multisetosous. Type genus: *Apolonia* Torres & Braga, 1939; (4) Trombiculidae Ewing, 1944 — scutum wider than long, with only one anteromedian seta, without anteromedian projection (AM = 1, A = 0), sensilla flagilliform or clavate, fSP = 7.7.7, fcx = 1.1.1, fst = 2.2, κ^2 wanting, gx marginally or submarginally located. Type genus: *Trombicula* Berlese, 1905; (5) Walchiidae (Ewing) Wen 1999 — scutum longer than wide, both anteromedian seta and anteromedian projection lacking (AM = 0, A = 0), sensillae clavate, fSP = 7.6.6, fcx = 1.1.1 fst = 2.2, and lacking κ^2 and pedotibiala φ^3, gx marginally or submarginally inserted. Type genus: *Walchia* Ewing, 1931.

Tuesday 24, Afternoon, Auditorium - Poster

542 - Mitochondria-rich cells in astigmatic mites (Acari: Astigmata)

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Mitochondria are well-characterized intracellular organelles usually aggregated in locations characterized by high energy consumption. Light microscopic and transmission electron microscopic observations of the internal anatomy of feather mites *Diplaegidia columbae* (Buchholz, 1870) (Analgoidea, Analgidae) and *Falculifer rostratus* (Buchholz, 1869) (Pterolichoidea, Falculiferidae) revealed in the anterior half of the bodies distinctive cells filled with an elaborate network of supposedly ER-derived membranes forming double-membrane

lamellae and associated with very numerous, large mitochondria. The mitochondria have densely packed, parallel cristae and are enveloped individually or in small groups by the lamellae, to form together a well organized mitochondrial-lamellar complex. The function of the complex and the cells is not clear at present, although their involvement in heat generation is considered.

Tuesday 24, Morning, Room 6

543 - Determination of predatory mite species distribution in green land areas of İstanbul

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This research was carried out to determine the natural enemies of harmful mites on deciduous trees, conifer and shrubs in recreation areas of İstanbul Province, Turkey, in 2006-2008. A total 1200 samples collected from 51 plant species were infested by mites. As a result of surveys, 37 predator mite species were identified belonging to 20 different families. This article focuses on the Phytoseiidae which were the most commonly detected (5.9% of the total count). Most frequently identified predator species inlcude *Amblyseius andersoni* (Chant), *Neoseiulus riparius* Koldochka, *Thyplodromus tiliae* Oudemans, *Typhlodromus athiasae* Porath and Swirski, *Euseius finlandicus* (Oudemans), *Paraseiulus triporus* Chant and Yoshida-Shaul, *Typhlodromus* (*Typhlodromus*) *cotoneastri* Wainstein, *Typhlodromus* (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan, *Phytoseius plumifer* (Canestrini and Fanzago), *Typhlodromus* (*Anthoseius*) *recki* (Wainstein) (Acari: Phytoseiidae). *A. andersoni* was found with *Tydeus californicus* (Acari: Tydeidae) on *Carpinus betilus. T. athiase* was the most abundant phytoseiid species collected.

Thursday 26, Morning, Room 3

544 - Determinants of oribatid mite (Acari: Oribatida) communities spatial heterogeneity

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Driving forces determining soil fauna spatial diversity patterns and trends are still poorly known. Recent developments in spatial soil ecology demonstrated that these trends may differ in case of different spatial resolution and geographic coverage of the research. The aim of my study was to evaluate the degree of impact of various ecological and biogeographic factors on distribution of oribatid mite diversity in space. Oribatid mites (Acari: Oribatida) is one of the relatively well-studied groups of soil mesofauna forming a considerable part of soil biodiversity. We noticed that in the majority of studies on oribatid diversity and biogeography the importance of such parameters as spatial resolution (geometric or ecological size of the data unit) and geographic coverage (location of the study area within one or more landscape units of a certain level) is normally underestimated. However our own research on oribatid diversity in different parts of Europe suggests the expert importance of these factors for receiving unbiased results. The example of oribatid communities studied by me in three remote plots in Southern Schwarzwald (Southern Germany) shows that landscape heterogeneity may be much more important in determining oribatid species richness than forest type or management scheme applied. Too closely located sampling sites would not allow discovering that. Comparing diversity of oribatid mites from different forest patches in the Netherlands showed that the descriptive value of geologic age for explaining of the existing oribatid diversity patterns increases if resolution of the study decreases from the individual soil sample to the landscape type (R^2 was gradually increasing from 0.34 to 0.91). Interesting patterns are revealed when we increase geographic coverage of the studies. For example on the North-South transect going from Sweden to Italy forest type may play a modulating role in explanation of oribatid richness. Spruce forests in Western Europe tend to bear more species than beech ones even in the geographically and climatically uniform places. Also oribatid species richness North-Eastern – South-Western trend revealed in European Russia is partially explained by the internal landscape diversity of natural zones at this territory. If we focused just at the landscape

resolution level the trend would not be significant, but over 30% of the variance would be explained if we reduced resolution to the ecoregion level. We can conclude that the response of oribatid mite communities species richness at the given resolution scale and geographic coverage level is the highest for those factors which demonstrate highest variance between research units at the same combination of resolution and geographic coverage. This finding will help in the future to solve a considerable share of basic biogeographic problems for oribatid mites.

Friday 27, Morning, Room 4

545 - Oribatid mites as indicators of habitat changes in space and time

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Soil fauna is one of the most conservative and at the same time dynamic component of terrestrial ecosystems subject to changes induced by natural or anthropogenic factors. Oribatid mites (Acari: Oribatida) is one of the relatively well-studied group of soil mesofauna forming a considerable part of soil biodiversity. They have been extensively used as a model group for all kinds of bioindicator research to test impacts of different substances and impacts on soil biota. Our studies in different natural zones and landscapes of Northern Eurasia, including forests and grasslands, showed that there is a three-level response of oribatid communities to habitat disturbances and subsequent recovery. First level, at the shorter perspective, is associated with recovery of abundance and numeric diversity, second, at the mid-term time scale, with shifts in functional and ecological community structure, and third, related to longer periods of time, (ca 50-100 years) – adjustment of the faunistic composition to natural or seminatural situations. The degree of disturbance may also be indicated by the degree of alteration of the faunistic and functional "core" of the community. The deeper the disturbance, the more functional and structural differences in the oribatid communities will be observed. Oribatids may also indicate and be relicts of the former and long ago drastically altered ecosystems for example in urban or forest soils currently covered with grasslands. There is a striking example of oribatid mite community in the Polish Tatra mountains showing that the level of the upper timber line 50-100 years ago can be easily reconstructed by studying modern oribatid communities and their faunistic composition. At the deforested areas typically forest oribatid species can be detected. At the broader time scale the modern range and especially arrangement of refugia of the species *Nothrus palustis* corresponds to the range of oak in Northern Eurasia six to seven thousand years ago during the Atlantic climatic optimum time. Spatial aspects of oribatid community response to habitat changes are less frequently addressed. However both structure and numeric diversity of oribatid communities may indicate current and past climatic and historic gradients in modern landscapes. Internal landscape diversity plays an important modulating role in revealing these trends and should be analyzed separately. Impact of these complex interactions in space and time on oribatid community diversity and structure could be considered as an important frontier in oribatid bioindicator research.

Tuesday 24, Afternoon, Auditorium - Poster

546 - Clarifying the identity of *Amblyseius swirskii* and *Amblyseius rykei* (Acari: Phytoseiidae): are they two distinct species or two populations of one species?

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The generalist predator *Amblyseius swirskii* is an efficient natural enemy of small insects and phytophagous mites, particularly thrips and spider mites. This phytoseiid species was considered for a long time as a subtropical species and *A. rykei* as a sub-Saharan African species. A recent revision of phytoseiid species of the subtribe Amblyseiina from sub-Saharan Africa (Zannou et al., 2007) determined that the two species are identical and

synonymized them. To confirm or invalidate that morphological study, we crossed Benin population of *A. rykei* and Israel population of *A. swirskii* through two generations and back-crossed their hybrids to their parents. We also conducted biological studies on these two species on maize (*Zea mays*) and typha (*Typha* sp.) pollens. All females of homogamic and heterogamic crosses produced viable progeny, fertile F1 and viable F2. All the laid eggs hatched and sex ratio was female-biased for all crosses. Biological studies showed that life parameters of these two species were not significantly different when fed with maize or typha pollens. These results indicate that *A. rykei* and *A. swirkii* are probably conspecific, and thus may be a single species as concluded by Zannou et al. (2007). Additional biological and/or molecular studies with several natural populations including populations from type locality of both species will be conducted in the future to confirm or (in much less likely scenario) refute our conclusions.

Friday 27, Morning, Room 3

547 - Mite diversity in coconut habitat in West and East Africa

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Evaluation of side effects is necessary in all classical biological control programs. This necessitates adequate knowledge of the diversity of arthropods and plants associated to the target pest or crop before the introduction of the exotic natural enemies in a target region. Several surveys were conducted in coconut orchards in Benin and Tanzania from 2004 to 2010 to determine mite diversity in coconut (*Cocos nucifera* L.) habitats in both countries in preparation to the introduction of exotic predatory mites to control the eriophyid mite *Aceria guerreronis* in these countries. During these surveys, mites were collected from leaves, flowers, and surface and beneath bracts of coconut fruits. Mites were also collected from the five most common plants found in the plantations. Twenty and 15 families of mites were recorded in coconut habitats in Benin and Tanzania, respectively. Of the phytophagous mites, *Aceria guerreronis* was the most common (more than 90% of the total number of mites found beneath bracts) mite pest encountered beneath bracts in Benin and Tanzania. This pest mite was found in all surveyed coconut plantations in both countries and was only encountered beneath bracts of nuts, where it was sometimes associated with very low densities of *Steneotarsonemus furcatus*. *Raoiella indica* was the most common (more than 70% of the total number of pest mites recorded on coconut leaves) and one of the most important mite pests (in term of damage) recorded on coconut leaves in both countries. Phytoseiids were the most common (about 80%) predators recorded. On coconut tree, *Neoseiulus baraki* (2-13% in Benin, 23-41% in Tanzania), *N. neobaraki* (0-2% in Benin, 37-59% in Tanzania) and *N. paspalivorus* (84-98% in Benin, 15-18% in Tanzania) were the most common predators found in association with *A. guerreronis* beneath bract of nuts. *Amblyseius largoensis* was the most abundant (more than 25%) on leaflets and nut surfaces not covered by bracts. On non-Arecaceae plants, the Phytoseiidae was mostly represented by *Phytoseius amba* followed by *Paraphytoseius horrifer* or *A. largoensis*. Among the other mites, *Neocypholaelaps* sp. of the family Ameroseiidae was the most common and was mostly found on coconut flowers and nut surface. Densities of *A. guerreronis* and its predators (phytoseiids) showed seasonal variability. The abundance of *N. paspalivorus*, *N. baraki* and *N. neobaraki* beneath bracts is largely due to their smaller size relative to other predatory mite species encountered in coconut habitat. Potential factors affecting distribution and relative abundance of these three species of predatory mites in West and East Africa will be discussed.

Thursday 26, Morning, Room 6

548 - Effects of the entomopathogenic fungus *Isaria fumosorosea* CCM 8367 on the predatory mite *Typhlodromus pyri*

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Strain CCM 8367 of the entomopathogenic fungus *Isaria fumosorosea* (Wize) Brown and Smith (Ascomycota: Hypocreales) is a perspective biocontrol agent against horse chestnut leaf-miner, *Cameraria ohridella* Deschka & Dimic (Lepidoptera). This invasive pest attacks *Aesculus hippocastanum* L., an important ornamental tree in Europe. Besides aesthetic damage, the injury inflicted to the leaves by *C. ohridella* larval feeding can result in weakening of infested trees and reduction of their growth. *I. fumosorosea* strain 8367, deposited in the Czech Collection of Microorganisms in Brno, showed high insecticidal activity against *C. ohridella* pupae and eggs. Although some specificity of this strain can be expected, the effects on beneficial organisms inhabiting horse chestnut trees should be known before the fungus is implemented in biological control of *C. ohridella*. *Typhodromus pyri* Scheuten is a phytoseiid mite (Acari: Phytoseiidae) frequently found in areas on various tree species, including *A. hippocastanum*. In the present paper we studied the effects of *I. fumosorosea* 8367 on this predatory mite using laboratory bioassays. Adult females of *T. pyri* were immersed for 30-60 seconds into the suspension of conidiospores at concentration 5×10^7 spores/ml with agent Tween while control was immersed into distilled water with Tween only. Predatory mites (70 per treatment) were kept on plastic arenas and fed with pine pollen. The mortality as well as fecundity were evaluated 72 and 144 h after fungus application. In a choice experiment, individual *T. pyri* female was released onto microscope cover glass with one half treated with *I. fumosorosea* (1500 conidiospores/mm^2) and the movement of the mite was recorded using video tracking system EthoVision for 10 minutes. The experiments were carried out in a climatized cabinet at 25˚C and 18L:6D photoperiod. The results revealed that 72 and 144 hours after the treatment the mortality of *T. pyri* females was respectively 1.4 and 5.7% in the control, and 14.3 and 37.1% in *I. fumosorosea* treated females. The differences were statistically significant. Choice experiments showed that there was no significant difference between time *T. pyri* spent in fungus treated and untreated zone. We can conclude that although *I. fumosorosea* CCM 8367 has a negative effect on the survival of *T. pyri*, this mite does not seem to avoid areas with *I. fumosorosea*. This research was financially supported by the Ministry of Education, Youth and Sports (grant No. 2B06005).

Monday 23, Afternoon, Room 5

549 - New dimensions in taxonomic descriptions: opportunities and challenges in the cybertaxonomic era

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Describing world's species remains a fundamental quest of biology, especially when over 90% of the world's species are still waiting to be discovered, named and described in this age of biodiversity crisis. For mites, this fundamental task is especially challenging because the Acari is one of the most diverse yet poorly known groups. In this paper I will discuss the opportunities that cyber infrastructure and technology can offer to facilitate virtually every aspect of taxonomic research. In particular, I will elaborate on new dimensions in digital taxonomic descriptions and publications.

Thursday 26, Afternoon, Auditorium - Poster

550 - Scanning electron microscopy observation of invasive parts and receptor in *Semanotus bifasciatus* (Coleoptera: Cerambycidae) after infested by *Pyemotes zhonghuajia* (Acari: Pyemotidae)

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After being infested by *Pyemotes zhonghuajia*, the third larval instar and the pupa of *Semanous bifasciatus* were observed under scanning electron microscopy. The results showed that the number and the distribution of receptor were variable on different parts of the third larval instar and of the pupa. It was also observed that the extent of damage caused by *P. zhonghuajia* was distinct in different parts of the host. Up to a certain degree, the

parasitic mite was selective in the beginning. After finding a suitable region to parasitize, it always injected a toxin into the host larva, paralyzing it. The pyemotes always choose the segmacoria from the second segment to the sixth of the larva of *S. bifasciatus* to parasitize, however, in the case of the pupa, the pyemotes choose the intersegmental membrane to parasitize, sometimes they never parasitize the pupa. The epidermis where there were some receptors always protruded, so it was difficult for the *P. zhonghuajia* to parasitize. The relationship between the beginning invasive parts and the distribution of receptors are discussed in the paper.

Wednesday 25, Morning, Room 2

551 - Identification and function of neuroendocrine networks in ticks

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Ticks are vectors of numerous pathogens (e.g. arboviruses, *Rickettsia*, *Anaplasma*, *Ehrlichia*, *Coxiella*, *Borrelia*, *Babesia*) causing serious diseases in animals and humans. These pathogens are usually stored in the salivary glands and/or the gut, and transmitted into the vertebrate bloodstream during feeding of the tick. The salivary glands and gut receive elaborate innervations from the brain (synganglion), but very little is known about regulatory mechanisms controlling the activity of these organs and associated transmission of pathogens. Therefore, we used neuropeptide antibodies, DNA probes, biochemical analysis, molecular cloning and bioinformatics to identify possible regulatory molecules and structures controlling activity of these organs. Immunohistochemical staining with antibodies to 23 insect neuropeptides revealed a very complex peptidergic network of neurons with putative neuromodulatory or neuroendocrine functions. Neuromodulatory neurons arborize within the synganglion, whereas neuroendocrine neurons project their axons on surface of the periganglionic sheath, lateral organs, salivary glands or gut. Several prominent neuroendocrine neurons innervating the salivary glands have been described in detail and their peptidergic content has been identified using biochemical and molecular approaches. Decrease of immunohistochemical staining from axons and axon terminals on salivary ducts and acini suggests that these neurons may control secretion of bioactive proteins from salivary glands during feeding. Further studies revealed peptidergic endocrine cells in the lateral organs and gut, as well as in segmentally distributed pedal endocrine cells. These novel paired cells in each pedal segment may represent homologues of the insect Inka cells crucial for activation of the ecdysis sequence. Bioinformatics and molecular biology has been used to identify genes encoding neuropeptides and their receptors in the genome of the tick *Ixodes scapularis*. Phylogenetic analysis grouped the tick neuropeptides and their receptors with GPCRs of insects and crustaceans. We show that ticks contain very complex peptidergic neuroendocrine systems producing a large number of neuropeptides. Various neuropeptides or peptide hormones are released at specific time to control development, feeding and reproduction of these ectoparasites.

Wednesday 25, Afternoon, Room 2

552 - New perspectives on synthetic anti-tick vaccines

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The tick *Rhipicephalus* (*Boophilus*) *microplus* is one of the most important ectoparasites and cause more damage and harm the livestock industry worldwide. FAO data estimate that the damage caused by this parasite is around U.S. $ 7 billion dollars annually. Its control is basically done by the use of acaricides, that besides losing their efficacy because the acquisition of resistance by the parasites, often present a serious environmental problem characterized by the contamination of the soil and water as well as by the possible presence of residues in meat, milk and dairy products. New technologies are being studied to improvement the control, specially the identification of new target

antigens for use in vaccine development. Some vaccines used in the past, based in full proteins Bm86 and Bm95, did not have good commercial success for many reasons, including the low action in some populations of the parasite. The new technologies of subunit vaccines, exploited to develop anti-tick vaccines, are those drawn from antigenic and immunogenic defined epitopes, and chemically synthesized or produced by genetically modified organisms. The first reference to the use of this technology for tick control was done by Patarroyo and colleagues in 2002. It was designed from the original sequence of a Bm86 vaccine candidate called SBm7462®. This vaccine yielded protection of up to 81% in a controlled study. Starting with all the knowledge acquired for the construction of peptides immunologically defined today we have the option of using the information available for the construction and synthesis of genes for production of recombinant peptides specific for use in vaccines. The great advantage of this technology is the low cost of production of peptides for both stages of preclinical studies and for clinical studies. Through devices used in the construction of genes it is possible to obtain extremely pure peptides, and with a huge competitive advantage over chemical synthesis, which is to obtain peptides and / or small proteins with tertiary conformations, mimicking in practice, the immunogenic conformation of a native protein. Another advantage over peptides produced synthetically is the possibility of insertion sites of N - glicosilation, which when expressed in eukaryotic organisms, eg. the yeast Pichia pastoris, leading to the incorporation of Man8GlcNAc2 act positively on the presentation and processing of antigens by APC cells, enhancing the immune response desired. Experiments using this new technology are being conducted at the Laboratory of Biology and Control of Vectors and hematozoa / Federal University of Viçosa, Minas Gerais, Brazil, and have shown good results with an efficiency of 67% in stall test.

Monday 23, Afternoon, Room 4

553 - High resolution predictive mapping of *Rhipicephalus microplus* and *R. annulatus* in south Texas after vaccination with the anti-tick vaccine Gavac

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The Cattle Fever Tick Eradication Program (CFTEP) has successfully prevented the permanent re-introduction of the cattle fever tick (CFT) into the U.S since 1943. Eradication is maintained through continuous systematic inspection of cattle within the quarantine zone for ticks. The detection of one tick initiates biweekly acaricide dips of all cattle every 7-14 days. Because the current CFT eradication strategy is based primarily on the use of acaricides the integrity of the CFTEP is vulnerable to the development of acaricide resistance in the CFT. Conventional anti-tick vaccines based on the tick gut antigen Bm86 exist commercially (TickGARD™ and Gavac®) and could serve as an alternative to the use of acaricides to eradicate ticks, but their level of efficacy against *R. microplus* is too low for eradication if used alone. Therefore, the current anti-tick vaccine technology would need to be used as part of an integrated eradication program to be beneficial. Using Gavac® with ticks found in Cuba and Northern Mexico, control of *R. microplus* ranges from 60-80%. However, for reasons that remain to be fully understood, Gavac® is more efficacious against *R. annulatus*. Recent experiments achieved 99.6 and 100.0% control of *R. annulatus* infested cattle in two different studies (Canales et al. 2009; Almazan et al. 2010). Interestingly, vaccination in combination with macrocylic lactone (ML) treatment has been shown to be synergistic (Willadsen, personal communication). This is an indication that anti-tick vaccination could be useful in an integrated eradication program. In order to investigate the potential benefit of anti-tick vaccines within south Texas, the effect of tick vaccination on habitat suitability was modeled based on technology developed previously for the prediction of habitat suitability along the Rio Grande/Rio Bravo Valley. Estrada-Pena et al. (2006) used high-resolution satellite imagery to map habitat suitability for both

R. annulatus and *R. microplus* over an area covering parts of southeastern Texas and northeastern Mexico. Results from the computation were compared to actual data on tick outbreaks at the Texas–Mexico border and it was able to predict with high accuracy areas of high habitat quality and correlate this with actual numbers of outbreak ticks found in Texas. Presently, we used the model, updated with current climate and cattle abundance data, to predict habitat suitability along south Texas border counties assuming all cattle were vaccinated with Gavac® and including control levels previously reported from recent literature. The results of this analysis are discussed.

Thursday 26, Afternoon, Auditorium - Poster

554 - Anti-hemostatic and cytotoxic activies of crude saliva of *Amblyomma cajennense* (Fabricius, 1787) (Acari: Ixodidae)

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Ticks are blood-feeding arthropods that secrete anticoagulant molecules through their saliva to maintain the fluidity of blood during its feeding. Proteins isolated from the saliva of hematophagous animals are useful tolls to understand many pathophysiological processes (blood clotting, platelet aggregation, cell death, etc). Tick saliva possesses protein toxins having numerous biological activities. Some of these proteins have been showed to have considerable cytototoxic effect against many types of cancer cells. In this study, the crude saliva obtained from the *Amblyomma cajennense* tick was shown to contain several biological effects such as protease inhibitors including Factor Xa, Thrombin as well as platelet aggregation inhibitors and also features of cytotoxic activity against cancer cells. The profile of the saliva's proteins by anion exchange chromatography in a FPLC system was analyzed and seven protein fractions (pools- PI at PVII) were eluted; these were investigated on coagulation and fibrinolysis factors and platelet aggregation. The P-III and P-VI were able to inhibit the FXa amidolytic activity; the P-V inhibited the platelet aggregation induced by collagen, while thrombin inhibition was found on P-VII. The crude saliva was tested for cytotoxicity activity on the MTT assay, Flow Cytometry and Fluorescence Microscopy on two human tumor cell lines Sk Mel-28 (melanoma cells) and Mia paCa-2 (pancreas adenocarcinoma cells). Interestingly, cytotoxic effects were not observed on human fibroblasts, used as a control. Thus, these studies open perspectives for the characterization of new molecules involved in both processes in the haemostatic system. This research was financially supported by FAPESP.

Thursday 26, Morning, Room 4

555 - Cause and consequence of haploid females in *Brevipalpus* mites

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A group of closely related *Brevipalpus* mites is characterized by a unique feature: they are the only known animal species with haploid females. This situation is caused by an infection with intracellular *Cardinium* bacteria. These bacteria feminize haploid males, thereby ensuring that they can be vertically transmitted to the next generation. A molecular phylogeny based on CO1 shows that *Brevipalpus* mites can be divided into a limited number of clades, representing the most abundant species. Three species are indeed infected and feminized by *Cardinium* symbionts. In a fourth species the feminization appeared to be a genetic trait of the mite itself, since no *Cardinium* is present. A consequence of the haploid individuals becoming female is that reproduction is asexual. Although asexual reproduction is expected to result in low levels of genetic variation, we found a large number of clones in each species. One way that genetic variation could be generated is through occasional sex. This appeared unlikely because no sexual populations have been found and although males can be found at low frequency in the field, mating experiments with these males failed to produce hybrid offspring. However, recently, *Brevipalpus chilensis* populations have been reported to contain large numbers of males suggesting that this species reproduces sexually. Comparing mitochondrial and nuclear genetic markers showed that two species have reproduced strictly clonally for quite some time. In the other

two species evidence was found for sexual reproduction in the relatively recent past. Incongruencies between the mitochondrial phylogeny of the host and bacterial phylogeny suggest that there may be occasional sexual reproduction or horizontal transfer of *Cardinium*. Implications of these findings for the origin of new clonal genotypes and host plant adaptation will be discussed.

Wednesday 25, Morning, Room 3

556 - Compatibility of *Beauveria bassiana* (Balsamo) Vuillemin (Hypomycetes: Moniliales) with diatomaceous earth against *Tyrophagus fatimii* (Astigmata: Acaridae) on stored wheat

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Stored grain mites are the most resistant pests and their control by conventional methods using higher doses of chemicals not only produce hazardous effect in commodity but also develop resistance. In the present study, the insecticidal efficacy of *Beauveria bassiana* (Balsamo) Vuillemin (Hypomycetes: Moniliales) was tested either alone or in combination with diatomaceous earth against *Tyrophagus fatimii* (Astigmata: Acaridae) in the laboratory. The dose rates of SilicoSec were 1g and 1.5g/ kg of wheat while the rates of *B. bassiana* were 3.2 x 10^7, 3.2 x 10^8 and 3.2 x 10^9 conidia/ kg of wheat. Mortality was assessed after 5, 10, and 15 days at 20 and 25^{o}C and 50 and 60% relative humidity. It was observed that at the higher temperature and lower relative humidity the diatomaceous earth was highly effective against *T. fatimii*; however, *B. bassiana* gave highest mean mortality (55.71%) at the lower temperature and higher relative humidity at the highest dose rate after 15 days of exposure interval. The combined effect of both diatomaceous earth and *B. bassiana* gave 83.33% mite mortality at 25^{o}C and 60% relative humidity when tested at their highest levels of dose rates. The results clearly indicate that even the low dose rates of diatomaceous earth can enhance the efficacy of *B. bassiana* and that temperature and relative humidity may play great role in their efficacy against *T. fatimii*.

Thursday 26, Afternoon, Auditorium - Poster

557 - Biological notes on the coccinellid *Stethorus*, predators of spider mites (Acari: Tetranychidae) in Mexico

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The genus *Stethorus* (Coleoptera: Coccinellidae) includes beetles that are widely distributed in Mexico as predators of mites, mainly spider mites (Acari: Tetranychidae). There is essentially no information in Mexico on the distribution and ecology of *Stethorus* spp., their behavior, and their consumption of prey. The objectives of this investigation were: 1) observations on their distribution in some localities of Mexico, 2) laboratory observations on behavior (predation, mating, and reproduction) of *Stethorus* spp., for specimens collected in semidesert areas of Nuevo León, northeastern Mexico, and 3) determination of the duration of all life cycle phases of those species. *Stethorus* species were found on papaya plants in Monterrey, Nuevo León, El Mante, Tamaulipas, and Villaflores, Chiapas in summer-fall 2009, in all cases associated with tetranychid prey. *Stethorus* were also observed on ornamental sotol (*Dasylirion* sp.), feeding on tetranychids (*Petrobia mexicana*?) in Saltillo, state of Coahuila, and on oak trees (*Quercus* sp.), feeding on unknown prey, in General Terán, Nuevo León, in May 2010; in the latter case, first-instar scale insects and eriophyid (Acari: Eryophidae) galls were very abundant on leaves, but we could not confirm that the beetles were feeding on these potential preys. For predation observations, a pair of adult *Stethorus* collected from papaya was isolated in a Petri dish. Adults were also released on bean and papaya plants higher than 30 cm in the laboratory. For oviposition, we isolated 5 *Stethorus* in plastic containers. All insects were fed *Tetranychus urticae*. *Stethorus* were observed at all localities mentioned, on papaya, indicating a widespread association of this plant, the mite pest and the predator. The populations of *T.*

urticae on papaya leaves appear to be related to the absence or presence of *Stethorus*. These insects are very voracious. Individual consumption of adult predators was approximately 20 adults and 13 eggs of *T. urticae* in 24 h. A total of 102 eggs were obtained (mean= 40.8); from these emerged 31 larvae, 5 pupae, and 3 adults. Egg-to-adult development lasted 21 days; field-collected adults lived at least one additional month in the laboratory. Released insects stayed for at least three days on the same plant in the laboratory. Because of their voracity, the maintenance of these insects in the laboratory is difficult, as it requires a large and continuous supply of spider mites. Further observations are required; however, the best strategy for their use in applied biological control in field crops and orchards might be habitat conservation and the management of naturally existing populations.

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