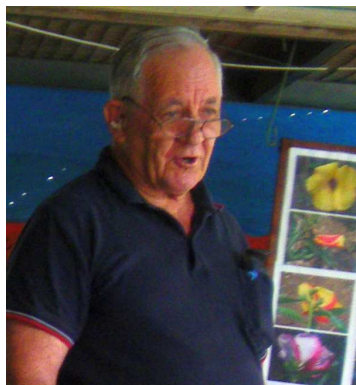


AUSTRALIAN NATIVE PLANT SOCIETY

HIBISCUS AND RELATED GENERA STUDY GROUP

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Geoff Harvey



Geoff Keena

HIBISCUS 'GEOFFS' HAZE'

EDITORIAL

The first edition of this Newsletter is dated June 2003. Here we are with this Issue, Number 30, dated December 2013. What happened in 2003? One source http://english.peopledaily.com.cn/200312/29/eng20031229_131479.shtml lists 10 events starting with the US space shuttle Columbia crashing and ending with a powerful earthquake rocking Iran, killing over 20,000 people. Other sources may list different events. Regardless of what is in any such list, some have succeeded, some have failed, some were one-offs and some have yet to reach their intended aim.

We are pleased and proud to include the launch of our first Newsletter in the list of successes and here present this Issue as an example of our on-going interest and work to bring before the people of Australia and the world the wonderful variety and beauty of these Australian plants to which we are devoted.

This has been possible because of the passion, curiosity, vision and determination of Geoff Harvey, Leader of the AUSTRALIAN NATIVE PLANT SOCIETY HIBISCUS AND RELATED GENERA STUDY GROUP. Geoff has been at the forefront of the many people who have devoted time, talent and resources to collecting, recording, exploring, breeding, propagating and sharing seed, cuttings, seedlings, expertise and knowledge and very importantly, making our much loved plants known and available so that others can join us in enjoying our Hibiscus and Related Genera now and into the future. Thank you to all who have had a part no matter how big or small, frequently or infrequently, in making the Study Group a success and the continuing production of the Newsletter possible.

We are sad to announce that after such a successful 10 years, that Geoff Harvey is relinquishing his role, due to ill health. We would like to thank him for his leadership and enthusiasm. As we look back over the last 10 years, we can see how much more we now know about Hibiscus and Related Genera than we did before Geoff undertook to form and lead this group.

Colleen and Geoff Keena, December 2013.

CONTENTS of HIBISCUS AND RELATED GENERA STUDY GROUP NEWSLETTER NO. 30:

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3. *Hibiscus heterophyllus* Glen Geddes form, by Geoff Harvey
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5. Pollination in Native Hibiscus by Colleen and Geoff Keena.

1. HIBISCUS 'GEOFFS' HAZE'

Colleen and Geoff Keena, Glamorgan Vale, Queensland.

It may appear that the apostrophe in the name of this hibiscus is in the wrong place. However, there is no mistake as this plant is named after two Geoffs. Both have both been associated with native hibiscus for a long time. Geoff Harvey has extensive experience with growing various hibiscus and for almost 40 years, Geoff Keena has shown an ability to notice native hibiscus that differ from the species and to create several gardens highlighting them.

This plant came up mid-way between a plant of *Hibiscus splendens*, below left, that has rose pink petals and green foliage and *Hibiscus divaricatus*. As shown in the following images, both parents have flowers that face down.

Hibiscus 'Geoffs' Haze' was selected partly because of its unusual growth and because of the profusion of large blooms that can be found from spring up until Christmas. The dark stems are an attractive feature. As the photos on the cover show, the petals of *Hibiscus* 'Geoffs' Haze' are light on the inside of the flower while the edge of the back of the petal is bright pink. This hibiscus prefers to be grown in full sun.



The photos shown on the cover were taken in the garden (left) while the photos on the right were taken inside our house. The parent plant has rapidly outgrown any hibiscus around it, reaching a height and width of 3 to 4 metres. Its height means that the blooms, which face downwards, can be seen from underneath. The blooms face downwards as the stalk of each flower is curved in such a way that the flowers are held facing the ground. In the wind, this gives the impression of a profusion of dancing blooms.

While hibiscus that face upward are valued in some hibiscus, *Hibiscus diversifolius* is an example of a hibiscus where the pedicel or stalk supporting the bloom is recurved so that the flowers are held facing the ground. In *Hibiscus splendens*, immediately beneath the calyx, the pedicel is curved so that the flowers turn to one side. In the forms of *Hibiscus divaricatus* that we have, the flower faces the ground.



Peter Bevan of Pete's Hobby Nursery, Lowood, peteshobbynursery@iprimus.com.au struck some plants in spring of 2013 and these are being grown by both Geoff's. As well, Pete has *Hibiscus* 'Geoffs' Haze' in the Rail Trail planting outside Lowood and it is anticipated that this will be flowering there in time for Pete's Hobby Nursery Display Garden weekend this coming spring. Pete will have plants for sale at the SGAP Spring Sale.

As with any native hibiscus, plants should be tip-pruned regularly to form a compact bush and pruned by one third after flowering. Only fertilisers for native plants should be used. Australian hibiscus are hardy and fast growing with few pest problems. They are suitable for most soils and can make good tub plants. In frost prone areas, plants can be grown against a wall or in pots under eaves.

From spring to early summer, the last plant we have seen when leaving our house and garden is *Hibiscus* 'Geoffs' Haze'. The first plant that we notice upon returning is again *Hibiscus* 'Geoffs' Haze'. We think this beautiful plant is a fitting tribute to two Geoff's, both of whom have spent many years enjoying and promoting native hibiscus.

2. Breeding and Developing Australian Species: a Geneticist's Perspective - INTRODUCTION by Dr Dion Harrison, a paper presented to the ANSPA Conference, 2013.

Australia, and for that matter, Queensland, has an abundance of attractive native flowering plant species with significant potential for developing novel cultivars for ornamental horticulture applications (e.g. potted plants, landscape gardens, cut flowers). However, very few of these species have been domesticated, and / or are considerably underrepresented in the marketplace, both domestically and overseas. The reasons for this are many and wide-ranging and typically require significant investment in research and development in order to overcome many of the obstacles. Often the taxonomy is poorly understood. Correct identification of horticulturally 'interesting' species can be difficult and problematic, but it is very important for devising breeding strategies, plant labelling, PBR and plant patent applications, addressing implications for rare, threatened and endangered species, and also can lead to complications with transport and export (within Australia and overseas). Modern DNA sequencing methods are increasingly being used to resolve such taxonomic uncertainties. Another issue is the lack of detailed knowledge of the biology of most Australian plants. Knowledge of the seed biology, including germination requirements and processing are essential for breeding, and also for commercial production of seed propagated varieties. Often, there is only very limited cultural information available (i.e. requirements for propagation, growing on, and end-use in the garden center and garden landscape) to facilitate the successful commercial-scale production. Furthermore, many 'wild' selections adapt poorly to existing commercial production and distribution systems thereby requiring further breeding and selection to develop commercially acceptable varieties. In order to achieve this, it is essential to have a good understanding of the genetic diversity and breeding biology of the species, and often the genus. Breeding and selection activities also need to be market-led. Understanding the expectations and perceptions of all consumers in the value-chain (including propagators, growers, retailers, and end-point consumers) and access to marketing support is crucial for the successful development of 'novel' horticultural species. For example, whilst retailers and end-point consumers may be attracted to a pretty flower on an attractive plant in a pot, propagators and growers will primarily select crops with a good plant habit and structure, good disease resistance, and uniform and fast crop cycles in preference to traits such flower colour. Furthermore, retail and marketing will often prefer a product range rather than a one-off product, so this also needs to be considered when evaluating the market potential of a species and/or genus. Lastly, it's important to have access to the necessary expertise and key 'players' to be able to commercialise a new product successfully. After all this, it all comes down to market acceptance and acting on market feedback to continue to improve and develop the plants or make refinements to the production systems in order to meet the full commercial potential of a particular genus or species. This paper reports briefly on some of the research, development and commercialisation activities that I have been involved with or privy to in the horticultural development of the following Australian native plant genera: *Ptilotus*, *Phaius*, *Hibiscus* and *Alyogyne*.

3. *Hibiscus heterophyllus* Glen Geddes form also known as Glen Geddes Serpentine Endemic by Geoff Harvey

Question From Ann McHugh SGAP Rockhampton Branch.

"I am trying to find information on the *Hibiscus heterophyllus* Glen Geddes form. I have a lot of photos of *Hibiscus* from Canoona but am not sure about the different form. We have a tour of Canoona for the upcoming conference and I would like to be sure what it looks like and where it is to show our visitors".

Answer from Geoff Harvey -

Names and Location – In the past "Glen Geddes" was a railway siding 54 km north of Rockhampton, situated beside the Bruce Highway. At present the railway siding no longer exists, but a good Glen Geddes rest area (Canoona) is located at the same site on the opposite side of the Bruce Highway – (approx 23.03S;150.16E) The rail and highway run parallel at this point.

The name Canoona refers back to the first North Australian gold rush of 1858 involving an estimated 15,000 people. The Canoona Pastoral Station covered a large area between Yaamba and Marlborough. This area lies within the Port Curtis Pastoral District and is sub-coastal just to the north of the Tropic of Capricorn. It is part of the Livingstone Shire, with the *Hibiscus* under question confined to the serpentine derived soils. A report by Amy Cooper of the Industrial Land Management Programme, Centre for Land and Water Resource Management Central Queensland University, Rockhampton, Queensland produced a report titled "The Serpentine Ecosystem in the Livingstone Shire", being a Report to the Livingstone Remnant Vegetation Study. This report can be viewed on the Internet and is dated 2002. The report lists 18 endemic serpentine plant species as well as an additional 3 possible endemics. Amongst these endemic plants, appears *Hibiscus* species (Glen Geddes P.I. Forster PIF 9409) Paul Forster is a well known botanist at the Brisbane Herbarium who had collected widely in Northern Queensland.

Why My Interest in the Glen Geddes *Hibiscus*? This began with the entry on page 156 of Keith A.W. Williams's book titled "Native Plants Queensland". The full quote is as follows –

"Glen Geddes Sorrel. An interesting natural hybrid plus or minus 2m high but frequently plants are seen that may be a little shorter. The plants have distinctly red coloured stems; especially on the older and mature parts of the plant. It is a plant of slightly spreading habit but the stems tend to be more or less erect or ascending. The plant is of open appearance and grows in sunny situations. Occasional plants grow amongst the trees of the very open sunny hardwood forest. The habitat is well grassed and there are other shrubs, particularly low Acacias, growing in the area. This species is known at present from a limited area. The plants grow at the bottom of low hillsides where the soil is dark grey clay loam heavily impregnated with stone and gravel. There is a liberal surfacing of this mixed aggregate. The plant has been brought into cultivation and it is successful. The leaf has a tendency to become somewhat larger and often is lobed."

Please note that the location is 23.03S; 150.16E being the "Glen Geddes" rest site and the flowering time is August. Mr. Williams is recognising the plants as natural hybrids from *H. splendens* X *H. heterophyllus*, whereas the probable cross was the Serpentine Endemic X an introduced *H. heterophyllus*.

Hibiscus species that occur near "Glen Geddes" include the yellow flowered *Hibiscus divaricatus* that is common southwards from Yaamba to near Childers, northwards from Marlborough and inland near the chrysoprase mine. *Hibiscus splendens* has been seen along Atkinson Road that runs north/south parallel to the Bruce Highway on the western side separated by the "Lake Learmouth State Forest". The site is on the edge of the serpentine country adjoining old alluvial terraces from the nearby Fitzroy River. Most of the plants grow in a thicket about 25 m in from the road verge on the eastern side. They probably originated from the alluvial river habitat. The more upright form of *H. heterophyllus* was probably introduced by travellers discarding plant material at the rest area and one such plant was seen near the railway on 24th May, 2008. The other *Hibiscus* species that would be cross compatible with the above mentioned "*Hibiscus* species Furcaria section" is *H. meraukensis* that is recorded from the coastal strip to the east of the study area. We have found no indication that it occurs near Glen Geddes.

40 to 50 years ago my Study Companion, David Hockings saw *Hibiscus* of many colours at and near Glen Geddes and this occurrence has been well recorded by botanists. Today these upright hybrids have disappeared probably as they are unable to endure permanently on the serpentine soils. The species from outside the serpentine country were probably introduced by road construction machinery and road-base material. Presently the only *Hibiscus* observed on the serpentine soils is the pure Glen Geddes species or form as identified by the botanist Paul Forster, or hybrids that have mostly reverted to the 'Serpentine endemic'. David Hockings found a fine semi-upright hybrid that he collected and grew for a number of years. It had a handsome pink flower with a frilly petal edge, red stems and mostly lobed leaves. Colleen Keena and myself also grew this form and though much admired was found to be short lived under cultivation (see image below).

Visits to Glen Geddes:

My First Trip to Glen Geddes – 18th and 19th Sept. 2002. Quotes from field notes. 'All plants seen at the time were near the commencement of the flowering season with immature seed capsules. A road known as Raspberry Creek Rd. heads east from near the rest area and branches into Nickel Road. This is a newly made road through semi-open hardwood forest with occasionally quite dense scrub on the serpentine soils.

Growing from the imported road construction material at the road verge were several plants of a *H. heterophyllus* to 2.5 m in height with handsome lobed leaves. The somewhat distorted pink flowers did not open until after 11 am and were deemed to be unsuitable for horticultural purposes. The end of Nickel road had a locked gate beyond which a considerable area of bushland had been cleared for grazing purposes and an auction sign was in place. As a general observation no Hibiscus are found where cattle graze and the opening up of this land could greatly reduce the habitat in which the 'Serpentine Endemic' is found.

Glen Geddes visit 3/3/2005 – A short stop whilst passing through. All Hibiscus were in full bloom. A 'Serpentine Endemic' was noted 3 km south of Marlborough on a grassy bank to the western side of the highway.

Glen Geddes visit 23rd and 24th May 2008 – A walk into the scrub 2.5 km from the turn/off from Raspberry Road into Nickel Road located the 'Serpentine Endemic' growing in an eroded gully 200 m in from the right hand side. There was no indication of any natural hybridisation having taken place. The plants were very stunted with pale pink flowers. 24th5/2008 - Drove into Atkinson Road (also known as Woodville Rd.) and noted typical 'Serpentine Endemics' .5 to 2 km from the turn-off. Flower colours varied from medium pink to pale pink and white. Further along the road at 3.7 km a good stand of *H. splendens* was found with abundant prickles and long epicalyx in two rows double the normal number. Some hybrids were seen near the road verge 5 km from the turn/off, with *H. splendens* obviously one of the parents. A subsequent visit by Study Group member, Greg MacDonald from Mackay located a yellow bloomed hybrid much further into the road and close to Marlborough where *H. divaricatus* is found. Flowering was good at this time including the 'Endemics' on the Highway near Glen Geddes.

Glen Geddes Visit 5th April 2009 – Glen Geddes Hibiscus recorded at Lat 23.06S; Long. 15.16E in Atkinson Rd.

Description of Glen Geddes Plants. – Low spreading bush of a stunted appearance. Generally less than 1 meter in height. Main stems are often prostrate or ascending to be supported by other vegetation. It was found to always be in flower during my visits with a colour range from white to pale and darker pink. Flowers remain open until late afternoon. New leaf growth is lobed becoming entire with a distinctly wider centre further along the stem. Flowering takes place at the end of the main stems or from short upright branchlets arising from the main stem nodes. Distinguishing characteristics include red stems, sometimes frilly petal edges, colour breaks from the petal blotch and the stunted growth.

Note – This Hibiscus may be more vigorous if grown in good soil or potting mix. One plant grown from seed collected in Atkinson Rd. is still alive on my son's property at Hervey Bay. It is the size of a power pole to about 5 m in height and produces masses of pink flowers during spring and early summer. It is possibly a mutation, displays extreme hybrid vigour or has undergone a doubling of the chromosome number.

Taxonomy – Specimens have been examined by botanists at the Brisbane Herbarium with the conclusion at the time that they were all hybrids – references can be found if required. The name or recognition of Hibiscus Serpentine Endemic has come into recent use. My tentative conclusion is that it is a variety or sub-species of *Hibiscus heterophyllus*. Further studies and re-examination of the correct material should be considered.

Visits to Glen Geddes – The Glen Geddes Hibiscus is of particular interest to me, however the location is 8 hours drive from the Sunshine Coast. It is an ongoing study and if I am able to make further trips I would hope to meet up with SGAP members from Rockhampton. Of particular interest is the nearby populations that occur outside the Serpentine country.

Contacts –Quite some time ago the then secretary of SGAP Rockhampton, Dawn Pound provided me with the following contacts that may help with the Glen Geddes Hibiscus – Neil and Dianna Hoy hoynd@optusnet.com.au ; Dr. Phillip Esdale pesdale@npme.net.au ; and John Birks birksp3@bigpond.com

I have been out of action due to health problems and haven't as yet followed up with these contacts.



Flower of plant found by David Hockings and grown by Colleen Keena and Geoff Harvey. Unfortunately it can be short-lived. See above.

HIBISCUS BURTONII IMAGES WERE TAKEN BY MARTIN BENNETT, AUGUST 2013

Martin Bennett is a Lead Field Ecologist whose work means he is able to see a variety of locations in Queensland. Photos that Martin has previously sent Peter Bevan and myself include a large white-flowered form of *Hibiscus meraukensis* from Curtis Island, a gold form of *Hibiscus divaricatus* from Gladstone and a vivid yellow form of *Hibiscus heterophyllus* from Flagstone. His most recent photos are of *Hibiscus burtonii*.

Martin writes:

This Hibiscus grew to 60cm high, and had a single stem for half its height where it then began to multiple branch, leaves were green and were covered in white hairs, stems were covered in gold hairs, an occasional 1cm pale mauve flower was seen.

It was recorded from a Quilpie Council borrow pit 10k north east of Eromanga at Mt Bellalie. It was a very hot 32 degree day and there was a strong hot wind blowing, the shire has been drought declared for some time. I saw *Hibiscus sturtii* there also, it was a rounded shrub 40cm across multi stemmed and about 30cm high, nothing like the one or two stems around Kogan/Miles area, mind you the leaves and flowers are huge there compared to the ones at Eromanga which were tiny.

The borrow pits are typically on land zone 7, red gravelly ridge country, this is the harshest of the soils out here from a moisture and nutrient point of view . These ridges have Mulga, and or Gidgee dominant canopy species, and some emergent Mountain Yapunyah, Gum-top bloodwood and Moreton Bay ash, mid-storey of Leopard tree, Boonaree, various Eremophila, Senna species in the shrub layer, ground layer comprised mainly of Chenopods, Sida, Hibiscus, Euphorbia, Centipeda, Alternanthera, Sarcostemma, Dysphania and Asteraceae species.



This photo shows Mt Bellalie in the background of the borrow pit.
The soil is clearly visible.

HIBISCUS BURTONII, MARTIN BENNETT, AUGUST 2013



5. POLLINATION AND POLLINATION SYNDROMES

TEXT: Colleen Keena

PHOTOS: Geoff Keena

INTRODUCTION

The topic of pollination in native hibiscus has interested me for over 30 years. At the time of my initial interest, we lived on the outer edge of Brisbane where natural stands of white flowering *Hibiscus heterophyllus* occurred a short distance away. We started growing white *Hibiscus heterophyllus* and added a gold flowering *Hibiscus divaricatus* some time later (final image). Then we noticed that the previously all white stand of *Hibiscus heterophyllus* now had plants with lemon flowers. This interest in pollination has continued as we have seen hibiscus blooms with huge numbers of tiny insects clustered around the centre of the bloom (images below).

Pollination is described as an essential process in sexual reproduction: the movement of pollen between plants, in addition to the dispersal of seeds, affects the genetic variation of populations. Restriction in pollen movement reduces genetic variation within populations, while increases in genetic variation are achieved by out-crossing (P1:63). The lemon flowers mentioned above demonstrated how easily out-crossing can occur in native hibiscus.

POLLINATION SYNDROMES

As I started to read around the topic of pollination, I began to read about 'Pollination Syndromes'. Various references describe 'Pollination Syndromes' as characteristics or traits of flowers pollinated by different vectors. In the table reproduced below (W 1), the traits are colour, nectar guides, odour, nectar, pollen and flower shape. The vectors are: bat, bee, beetle, bird, butterfly, fly, moth and wind. Other references differ slightly but all that I have seen describe flower characteristics or traits that may appeal to a particular type of pollinator. It is then often suggested that the characteristics can be used to predict the type of pollinator that will aid the flower in successful reproduction.

Pollinator Syndrome Traits Table

	Pollinator							
Trait	Bats	Bees	Beetles	Birds	Butterflies	Flies	Moths	Wind
Color	Dull white, green or purple	Bright white, yellow, blue, or UV	Dull white or green	Scarlet, orange, red or white	Bright, including red and purple	Pale and dull to dark brown or purple; flecked with translucent patches	Pale and dull red, purple, pink or white	Dull green, brown, or colorless; petals absent or reduced
Nectar guides	Absent	Present	Absent	Absent	Present	Absent	Absent	Absent
Odor	Strong musty; emitted at night	Fresh, mild, pleasant	None to strongly fruity or fetid	None	Faint but fresh	Putrid	Strong sweet; emitted at night	None
Nectar	Abundant; somewhat hidden	Usually present	Sometimes present; not hidden	Ample; deeply hidden	Ample; deeply hidden	Usually absent	Ample; deeply hidden	None
Pollen	Ample	Limited; often sticky and scented	Ample	Modest	Limited	Modest in amount	Limited	Abundant; small, smooth, and not sticky
Flower Shape	Regular; bowl shaped – closed during day	Shallow; have landing platform; tubular, erect	Large bowl-like, Magnolia	Large funnel like; cups, strong perch support	Narrow tube with spur; wide landing pad	Shallow; funnel like or complex and trap-like	Regular; tubular without a lip	Regular: small and stigmas exerted

Pollinator traits or characteristics have been described in various references. For example, nectar guides (W2) help a bee quickly locate the flower's centre through a region of low ultraviolet reflectance near the centre of each petal. This pattern is invisible to humans because our visual spectrum does not extend into the ultraviolet. Bees, however, can detect ultraviolet light. This adaptation benefits the flower with more efficient pollination and the bee through rapid collection of nectar. References such as W2 show the flower recorded on "normal" film and on ultraviolet-sensitive film.

Characteristics can be divided into visual cues and olfactory cues (W3), with some pollinators more olfactory than visual and with some which use both senses. It is noted that flowers have evolved fragrances and this results in efficient pollinator attraction. Butterflies and birds are described as not very olfactory, rather they are much more visual in behaviour. In contrast, bees are attracted to certain scents, particularly those described as sweet or spicy. Moths and bats are very olfactory and not too visual in orientation and bat-pollinated flowers usually produce strong fruity or musky scents while moth-pollinated flowers produce very heady sweet fragrances.

POLLINATION IN HIBISCUS SPLENDENS AND HIBISCUS HETEROPHYLLUS

References from USA indicate that hibiscus flowers are mostly pollinated by hummingbirds and the flowers are colours of red, orange, pink and white which birds like. This is not true of hibiscus in Australia. Here birds are not the main pollinators and some colours of our native hibiscus differ.

While there is evidence of wind pollination in species such as grasses, many flowers have evolved to use a 'smart' vector, namely animals. These vectors have sensory organs to locate flowers, locomotion to get to the flowers and intelligence to remember that they can depend on a reward if repeated visits are made. In order to use an animal pollination vector, a flower needs to attract the animal for the first visit. Then the pollinator needs to be rewarded. It can then visit similar flowers, thus carrying pollen from plant to plant. Rewards can be nectar, pollen, behaviour or some combination of these (W3).

Geoff Williams and Paul Adam in 'The flowering of Australia's Rainforest: A Plant and Pollination Miscellany', 2010, provide specific information on pollination relating to two of our native hibiscus that are rainforest species: *Hibiscus heterophyllus* and *Hibiscus splendens*. This is particularly helpful as, has been noted, USA references indicate both a different trait - colour and a different vector - birds in relation to pollination of hibiscus. This demonstrates that flower pollination syndromes, inferred from floral features, may be unreliable predictors of effective pollinators. Williams and Adam (page 111) provide an interesting example of the risk of predicting pollinating vectors based on flower colour. They note that *Brachychiton acerifolius* is not pollinated by birds as suggested by its red flowers but by bees which cannot see red. They conclude that while there are observations of flower morphology resulting in incorrect inferences of pollination mode, that broad correlations between flower structure and pollination vectors have permitted the recognition of serviceable pollination syndromes. They warn that characterisation of a particular plant species as representative of a single pollination syndrome can obscure, at least occasionally, wider plant-pollinator relationships.

Williams and Adam note that in *Hibiscus splendens* and *Hibiscus heterophyllus*, the pollinators are small beetles, usually Nitidulidae. *Hibiscus splendens* and *Hibiscus heterophyllus* possess highly sculptured pollen and it has been suggested that this indicates specialised adaptation for carriage and / or collection by insects. Pollination in these hibiscus is by related flower visitors or by single or very closely related species.

They write of the role of predators, noting that many animals, e.g. Assassin Bugs, Wasps, Spiders and Insectivorous birds also frequent flowers and wait patiently in ambush and so predators of pollinators may themselves perform pollination. The most commonly recorded reward for these pollinators is nectar. While nectar is mostly sugar and very high-energy food, it is also a source of protein, vitamins and minerals. Pollinators that feed on pollen end up depositing at least a few pollen grains on the stigma. We have seen Sedge Frogs visiting hibiscus flowers (final three images).



Insects clustered in native hibiscus blooms; closeup of the same insects; *Apis mellifera* on a hibiscus in cultivation

It should be noted that Williams and Adam are writing of Rainforest. On page 80 they state that the introduction of exotic flower visitors, e.g. *Apis mellifera*, the honey bee, or removal of plants to areas of cultivation or remnant vegetation within cultivation zones, gardens or regions removed from the natural range may obscure pollination. It should be noted that Williams and Adam are writing of Rainforest. On page 80 they state that the introduction of exotic flower visitors, e.g. *Apis mellifera*, the honey bee, or removal of plants to areas of cultivation or remnant vegetation within cultivation zones, gardens or regions removed from the natural range may obscure pollination modes and pollinator relationships (see third image above). They continue that while visitors may function as pollinating agents, in many cases they are probably acting unwittingly and pollination is incidental. They note (page 112) that *Apis mellifera* bees are a potential threat to native bees and to the reproductive ecology of flowering rainforest plants but that the full impact of their presence remains uncertain.

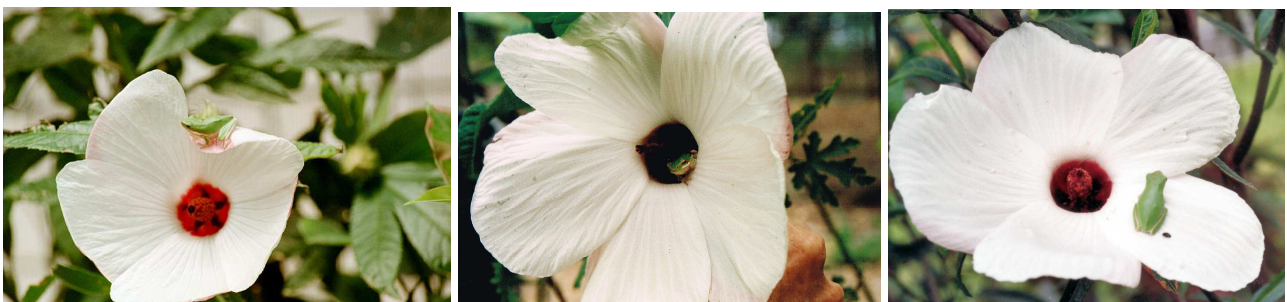
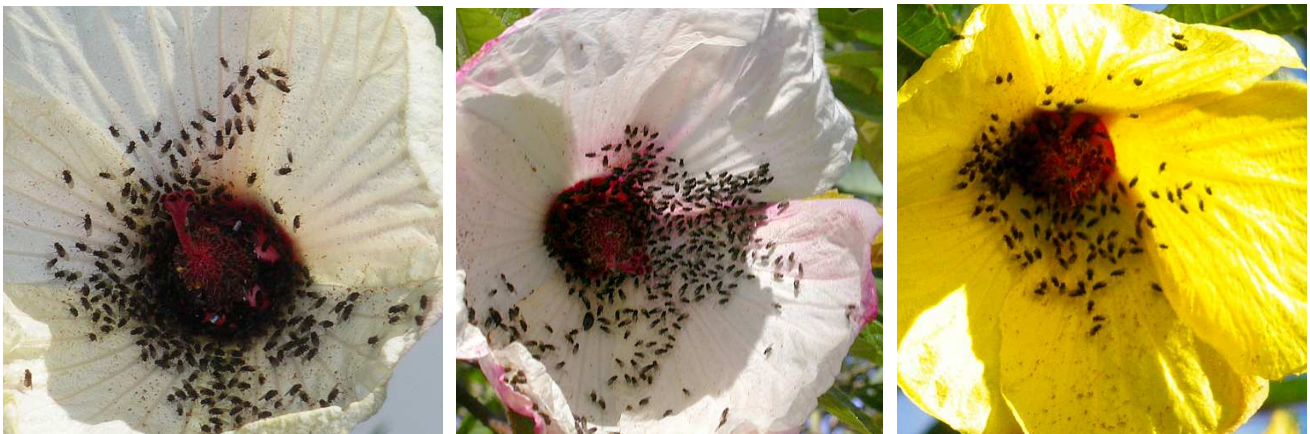
Williams and Adam note that *Hibiscus splendens* is one of a number of predominantly pioneer or edge rainforest species that exhibit relatively high levels of selfing. They describe *Hibiscus splendens* (page 63) as a specialist species, pollinated by one or a small number of pollinators and note that its ability to self-pollinate may have important consequences for the maintenance of populations in the absence of their particular pollinators. They continue that selfing may result in a decline in offspring quality but may permit the local survival of species in fragmented stands where individual populations are severely reduced.

I find the information about selfing important as members of the Study Group have seen pockets of *Hibiscus splendens* that are being reduced in size, as well as locations where only a solitary plant remains.

CONCLUSION

While caution is suggested by some in relation to pollination syndromes, others argue that pollination syndromes provide great utility in understanding the mechanisms of floral diversification.

We are fortunate that information is available on pollination within their rainforest habitat of two of our native hibiscus, *Hibiscus splendens* and *Hibiscus heterophyllus*.



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