

Annual Action Plan 2020-21

Project Title: Ex-situ conservation of endemic, endangered and threatened plants of the region and recording of phenology of flowering / fruiting of species in garden.

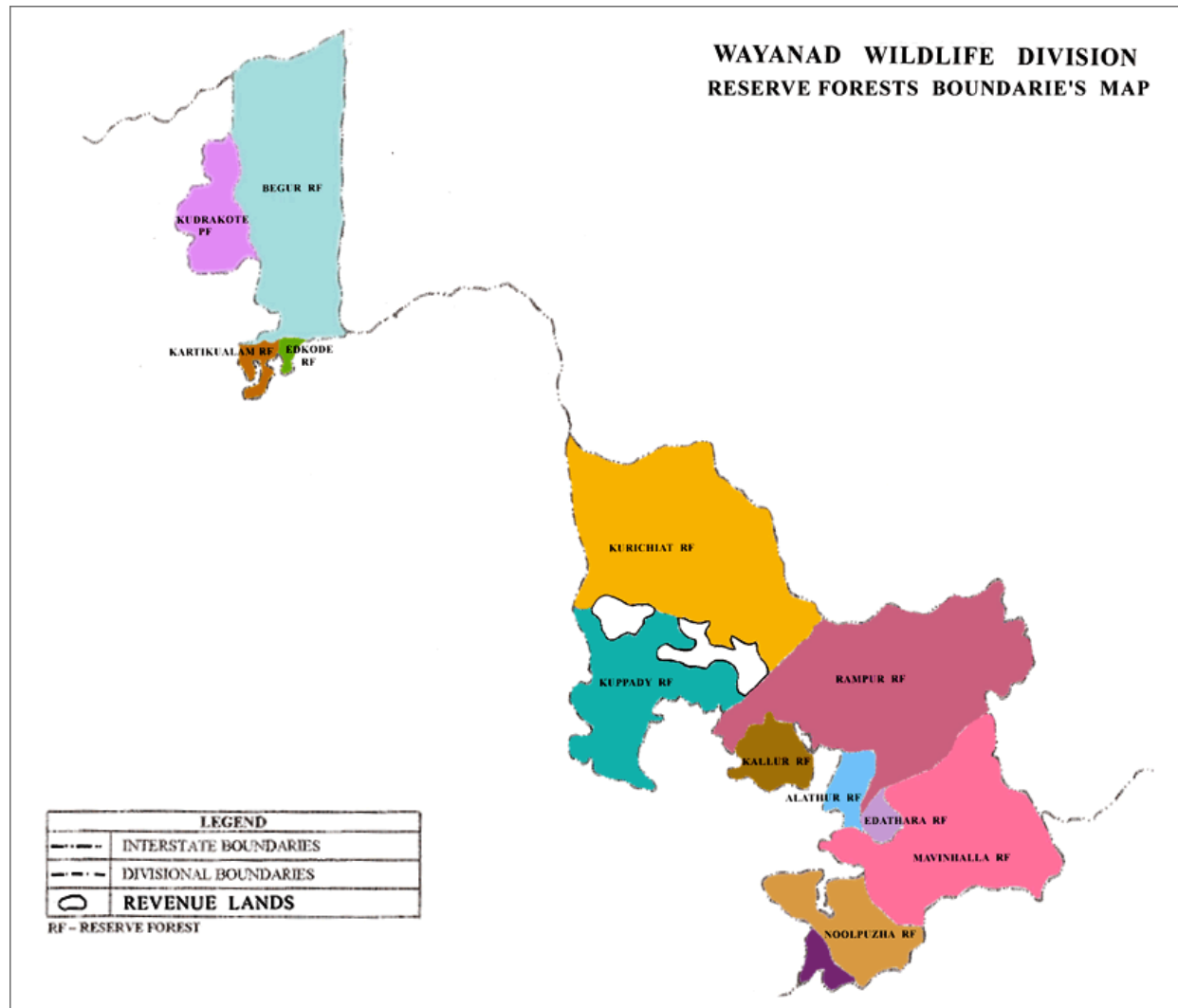
Executing officials: Dr. S. Kaliamoorthy, Scientist – E & Dr.T.S.Saravanan, Botanical Assistant

Date of initiation: Continuous Project

Date of completion: Continuous Project

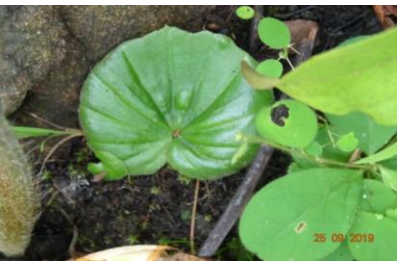


Objectives	Objective-wise brief Methodology
Plant exploration study visit (Quarter II & III) – Wyanad district, Kerala.	Two live plant exploration study visits are proposed that is in Quarter II (September 2020) and Quarter III (December 2020)
Recording of flowering & fruiting phenology of plant species present in NOEG, Yercaud.	<ol style="list-style-type: none"><li>1. Recording the flowering and fruiting phenology on each individual species through direct visual estimation until flowers and fruits completely fell off from each individual.<li>2. Additionally recording the number of individuals within each species of plant that were flowering and/or fruiting each month over the study period.





Liparis wightiana Thwaites



Nervilia crociformis
(Zoll. & Moritzi) Seidenf.



Pecteilis gigantea
(Sm.) Raf.



Eria exilis Hook. f.



E. filiformis (Wight) Rc



Liparis biloba Wight



Habenaria longicorniculata J. Graham

Deliverables	Summary of Achievements
<p>Ex-situ conservation of endemic, endangered and threatened plants of the region.</p>	<p>Due to pandemic situation and shortage of budget fund, two tours proposed to visit Wayanad district, Kerala could not be conducted.</p>
<p>Local plant exploration tours – Yercaud and surrounding areas. Conducted by Dr. S. Kaliamoorthy Scientist – E and Dr. T. S. Saravanan, Botanical Assistant</p>	<p>Local Tours conducted: Two Area of study: Manjakuttai, Yercaud Number of species collected & introduced: 18 species</p>

Local Tours conducted: Two

Area of study: Manjakuttai, Yercaud

Number of species collected & introduced: 18 species

- *Brachystelma saldanhae* S.J. Britto & P.V. Bruyns ,
- *Diplocentrum recurvum* Lindl.,
- *Drocera burmanii* Vahl,
- *Drocera peltata* Thunb.,
- *Habenaria glandilfloriformis* Blatt. & McCann.,
- *Habenaria heyneana* Lindl.,
- *Habenaria longicorniculata* J. Graham,
- *Habenaria longicornu* Lindl.,
- *Habenaria rariflora* A. Rich. ,
- *Impatiens balsamina* L. var. *balsamina*
- *Cassia mimosoides* L.
- *Ledebouria hyderabadensis* M.V. Ramana, Prasanna & Venu,
- *Ledebouria revoluta* (L.f.) Jessop,
- *Liparis wightiana* Thwaites,
- *Papilionanthe subulata* (Willd.) Garay,
- *Striga densiflora* (Benth.) Benth.
- *Utricularia* sp.,
- *Vanda testacea* (Lindl.) Rchb.f.,

Multiplication:

Endemic plants (Orchids): 13 species

- *Acampe praemorea* (Roxb.) Blatt. & McCann
- *Bulbophyllum fischeri* Seiden f.
- *Coelogyne fimbriata* Lindl.
- *Coelogyne pallens* Lindl.
- *Coelogyne pallens* Lindl.
- *Coelogyne stricta* (D.Don)Schltr.
- *Dendrobium amplum* Lindl.
- *Dendrobium chrysotoxum* Lindl.
- *Dendrobium fimbriatum* W.J. Hook
- *Epidendrum radicans* Pav. ex Lindl.
- *Eria psuedoclavicaulis* Blatt & McCann
- *Goodyera procera* (Ker Gawl.) Hook.
- *Liparis atropurpurea* Lindl.

Multiplication of rare plants: 23 species

- *Amomum hypoleucum* Thw.
- *Anemia schimperiana* Presl.
- *Angiopteris erecta* Desv.
- *Arachis villosa* Benth.
- *Curcumma caesai* Roxb.
- *Cyathea nilgirensis* Holttum
- *Davallia griffithiana* Hook.
- *Ensete superbum* Roxb.
- *Equisetum arvense* L.
- *Gnetum ula* Brongn.
- *Hardwickia binata* Roxb.
- *Impatiens yercaudensis* Bhaskar
- *Nageia wallichianus* (C.Presl) Kuntz.
- *Nepenthes khasiana* Hook.f.
- *Ophioglossum reticulatum* L.
- *Orthosiphon aristatus* (Blume)Miq.
- *Piper cubeba* L.f.
- *Psilotum nudum* P. Beauv.
- *Remusatia vivipara* (Roxb.) Schott
- *Sarcostemma intermedium* Decne
- *Schefflera venulosa* (Wight & Arn.) Harms
- *Sterculia populnifolia* Roxb.
- *Taxus baccata* L.

Experimental Garden section – Multiplication through seeds, separation of adventitious shoots (44 species)

- *Alpinia caerulea* (R.Br.) Benth
- *Asclepias curassavica* L.
- *Begonia heracleifolia* Champ & Schlech
- *Begonia malabarica* Lam.
- *Begonia manicata* Brongn.
- *Coreposis grandiflora* Nutt.ex Champ
- *Dietes iridioides* (L.) Sweet ex Klatt
- *Dorstenia indica* Wight
- *Episcia cupreata* (Hook.) Hanst.
- *Eryngium foetidum* L.
- *Hemerocallis fulva* (L.) L.
- *Impatiens balsamina* L.
- *Molineria capitulate* (Lour.) Herb.
- *Narine sarniensis* (L.) Herb.
- *Peperomia caperata* Yunck.
- *Plectranthus barbatus* Andrews
- *Ruta graveolens* L.
- *Salvia leucantha* Cav.
- *Spathiphyllum cannifolium* Dryand. ex Sims) Schott.
- *Zingiber neesatum* (J.Graham) Ramamoorthy

- *Agapanthes africanus* (L.) Hoffmanns.
- *Begonia X erythrophylla* Herincq
- *Begonia* 'China Doll' (Dillard)
- *Begonia bowerae* Ziesenh.
- *Begonia heracleifolia* Cham & Schltdl
- *Begonia malabarica* Lam.
- *Begonia pustulata* Liebm.
- *Calathea zebrina* (Sims) Lindl.
- *Calathea zebrine* Lindl.
- *Clivia miniata* Regel.
- *Ctenantha setose* (Roscoe) Eiechler
- *Cuphea platycendra* Hort.
- *Hedychium coronarium* J. Koenig
- *Heliconia indica* Lam.
- *Heliconia wagneriana* Petersen
- *Hymenocallis littoralis* (Jacq.) Salisb.
- *Ludwigia adscendens* (L.) H.Hara
- *Maranta lietzei* (E.Morren) C.H. Nelson, Sutherl., & Fern. Casas
- *Peperomia argyreia* (Hook.f.) E. Morren
- *Phaedranassa dubia* (Kunth) J.F.Macbr.
- *Sterlitzia reginae* Banks.
- *Zephyranthes candida* (Lindl.) Herb.
- *Zephyranthes rosea* Lindl.
- *Zingiber wightianum* Thwaites

Multiplication through cuttings: 17 plant species were multiplied

- *Agapanthes africanus* (L.) Hlf.
- *Dahlia excels* Benth.
- *Homalocladium platycladum* (F.Muell.) L.H.Bailey
- *Impatiens platypetala* Lindl.
- *Iresine herbstii* Hook..
- *Justicia carnea* Lindl.
- *Kalanchoe laxiflora* Baker
- *Vernonia shevaroyensis* Gamble
- *Pelargonium graveolens* L'Her.
- *Plectranthus scutellarioides* (L.) R.Br.
- *Plumeria alba*
- *Rhinacanthus nasutus* (L.) Kurz.
- *Rosa viridiflora* (Lavelle) C. K. Schneid.
- *Sauropus africans* Blume
- *Strobilanthus dyeriana* Mast.
- *Thunbergia coccinea* Wal
- *Trachelospermum jasminoides* (Lindl.) Lem

Recording of phenology of flowering / fruiting of species in garden.

- Orchids: Flowering phenology was recorded for 118 species belongs to 48 genera; Fruiting phenology was recorded for 35 species belongs to 22 genera.**
- Other Angiosperms: Flowering phenology recorded for 110 species belongs to 84 genera; Fruiting phenology was recorded for 5 species belongs to 5 genera**



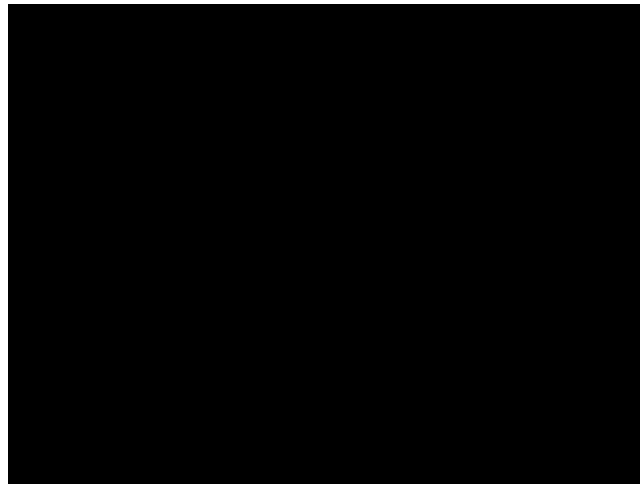
Hand Pollination of Orchids



Dendrobium aqueum Lindl.



Eria pseudoclavicaulis



- 250 saplings of *Bentinckia condapanna* Berry ex Roxb. (ARECACEAE), an endangered palm, were contributed to Kerala Forest Research Institute, Trissur, Kerala for conservation.
- 20 seedlings of *Bentinckia condapanna* Berry ex Roxb. (ARECACEAE), an endangered palm, was distributed to the Horticulture Research Station, Tamil Nadu Agriculture University, Yercaud on 16/09/2020 for plantation.
- 396 individuals in 100 species were contributed to BGIR, Noida, for introduction and conservation, on 18/12/2020.
- 205 individuals in 11 species were contributed to the Indian Institute of Management, Ministry of Education, Tiruchirappalli on 20/02/2021 for introduction and conservation in the campus.
- 262 individuals in 17 species were contributed to Indian Institute of Mangament, Ministry of Education, Tiruchirappalli on 05/03/2021 for introduction and conservation in the campus.

Ex-situ conservation of Endemic tree species of the region in NOEG, Yercaud

Executing officials: Dr. M.Y. Kamble, Sci. E &
Shri. B. S. Elango, Bot. Asst.

Quantifiable deliverables (targets) for 2020 – 2021

Multiplication and maintenance of existing collections.

Q2. Documentation of phenology.

Q3. One Field Tour, Conservation-cum-herbarium Consultation tour to Agasthyamalai Biosphere Reserve and TBGT Herbarium of Jawaharlal Nehru Tropical Botanical Garden and Research Institute, Palode, Thiruvananthapuram, Kerala.

Q4. Documentation of phenology.

Total tours: 1 Field-cum-Herbarium Consultation Tour

MULTIPLICATION OF EXISTING COLLECTIONS OF ENDEMIC TREE SPECIES:

Multiplied following endemic, endangered and threatened species in experimental garden through seeds or stem cuttings from existing germplasm as well as recently collected seeds from Agasthyamalai Biosphere Reserve, Western Ghats: 2489 nos.

ENDEMIC TREES: 2050 nos. of seedlings

Through seeds (1765 nos.)

Alstonia venenata R. Br. (APOCYNACEAE); Not – 1050 nos.

Arenga wightii Griff. (ARECACEAE); Vulnerable – 16 nos.

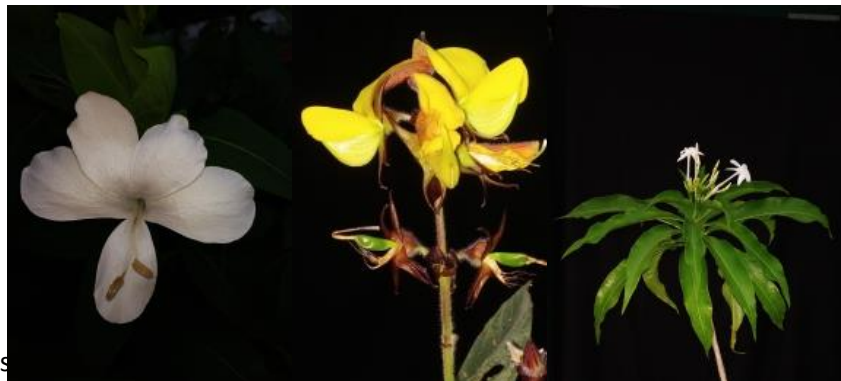
Bentinckia condapanna Berry ex Roxb. (ARECACEAE); Endangered – 410 nos.

Garcinia gummi-gutta (L.) Robs. (CLUSIACEAE); Least concern – 53 nos.

Garcinia imberti Bourd. (CLUSIACEAE); Endangered – 192 nos.

Goniothalamus wightii Hook.f. & Thomson (ANNONACEAE); Endangered – 27 nos.

Ixora brachiata Roxb. (RUBIACEAE); Least concern – 17 nos.



Through stem cuttings (270 nos.)

Euphorbia vajravelui Binojk. & N.P. Balakr. (EUPHORBIACEAE); Vulnerable – 270 nos.

Through offsets (15 nos.)

Cyathea nilgirensis Holttum (CYATHEACEAE); Vulnerable – 15 nos.

0.56 cm

ENDEMIC SHRUBS: 395 nos.

Through seeds

Crotalaria longipes Wight & Arn. (FABACEAE); Endangered – 165 nos.

Through stem cuttings

Barleria acuminata Nees (ACANTHACEAE) – 110 nos.

Barleria grandiflora Dalzell – 120 nos.



THREATENED LIANA: 44 nos.

Through seeds

Gnetum ula Brongn (Least Concern) – 44 nos.



MAINTENANCE OF ENDEMIC TREE SPECIES IN THE GARDEN:

Saplings of following species developed in the germination trays/beds through seeds or stem cuttings and transferred in earthen pots, nursery bags; maintaining under glass house, shaded areas, etc in experimental garden.

Actinodaphne bourdillonii Gamble (LAURACEAE); Not Evaluated
Alstonia venenata R. Br. (APOCYNACEAE); Not Evaluated
Arenga wightii Griff. (ARECACEAE); Vulnerable
Artocarpus hirsutus Lam. (MORACEAE); Least Concern
Baccaurea courtallensis (Wight) Muell.-Arg. (EUPHORBIACEAE); Near Threatened
Bentinckia condapanna Berry ex Roxb. (ARECACEAE); Endangered
Bentinckia nicobarica (Kurz) Becc. (ARECACEAE); Endangered
Calophyllum apetalum Willd. (CLUSIACEAE); Vulnerable
Cinnamomum malabattrum (Burm.f.) J. Presl. (LAURACEAE); Not Evaluated
Cullenia exarillata A. Robyns (BOMBACACEAE); Vulnerable
Dipterocarpus indicus Bedd. (DIPTEROCARPACEAE); Endangered
Garcinia gummi-gutta (L.) Robs. (CLUSIACEAE); Least Concern
Garcinia imberti Bourd.; Endangered
Garcinia indica (Thouars) Choisy; Vulnerable
Garcinia talbotii Raizada ex Santapau; Least Concern
Gluta travancorica Bedd. (ANACARDIACEAE); Endangered
Goniothalamus wightii Hook.f. & Thomson (ANNONACEAE) Endangered
Hardwickia binata Roxb. (FABACEAE); Not Evaluated
Holigarna arnottiana Hook. f. (ANACARDIACEAE); Least Concern
Holigarna grahamii (Wight) Kurz; Least Concern
Hopea parviflora Bedd. (DIPTEROCARPACEAE); Near Threatened
Humboldtia decurrens Bed. ex Oliv. (FABACEAE); Near Threatened
Hydnocarpus pentandrus (Buch.-Ham.) Oken (FLACOURTIACEAE); Least Concern
Ixora brachiata Roxb. (RUBIACEAE); Least Concern
Kingiodendron pinnatum (Roxb. ex DC.) Harms (FABACEAE); Endangered
Knema attenuata (Hook.f. & Th.) Warb. (MYRISTICACEAE); Least Concern
Monosis travancorica (Hook.f.) H. Rob. & Skvarla; Endangered
Palaquium ellipticum (Dalz.) Baill. (SAPOTACEAE); Least Concern
Pinanga dicksonii (Roxb.) Blume (ARECACEAE); Vulnerable
Pterospermum reticulatum Wight & Arn. (STERCULIACEAE); Vulnerable
Sageraea laurina Dalzell (ANNONACEAE); Near Threatened
Syzygium mundagam (Bourd.) Chithra (MYRTACEAE); Vulnerable
Syzygium palodense Shareef, E.S.S. Kumar & Shaju (MYRTACEAE); Vulnerable
Syzygium stocksii (Duthie) Gamble (MYRTACEAE); Not Evaluated
Syzygium travancoricum Gamble (MYRTACEAE); Critically endangered
Tabernaemontana gamblei Subram. & Henry (APOCYNACEAE); Endangered
Vateria indica L. (DIPTEROCARPACEAE); Critically endangered
Vernonia shevaroyensis Gamble (ASTERACEAE); Not Evaluated
Xanthophyllum arnottianum Wight (XANTHOPHYLLACEAE); Vulnerable



Plantation of Endemic tree species in Arboretum and garden premises: Following species has been planted and being maintained: 376 NOS.

Arenga wightii Griff. (ARECACEAE); Vulnerable – 10 nos.
Bentinckia condappana Berry ex Roxb.; Endangered – 85 nos.
Bentinckia nicobarica (Kurz) Becc. (ARECACEAE); Endangered – 9 nos.
Cinnamomum malabatrum (Burm.f.) J. Presl. (LAURACEAE) – 1 no.
Cynometra travancorica Bedd.; (FABACEAE); Endangered – 2 no.
Crotalaria longipes Wight & Arn.; Endangered – 155 nos.
Euphorbia vajravelui Binojk. & N.P. Balakr. (Vulnerable) – 10 nos.
Garcinia gummi-gutta (L.) Robs.; Least Concern – 10 nos.
Garcinia imberti Bourd.; Endangered – 6 nos.
Garcinia indica (Thouars) Choisy; Vulnerable – 9 nos.
Garcinia talbotii Raizada ex Santapau (CLUSIACEAE); Least Concern – 14 nos.
Gluta travancorica Bedd. (ANACARDIACEAE); Endangered – 16 nos.
Holigarna arnottiana Hook. f. (ANACARDIACEAE); Least Concern – 7 nos.
Hopea parviflora Bedd. (DIPTEROCARPACEAE); Near Threatened – 9 nos.
Kingiodendron pinnatum (Roxb. ex DC.) Harms (FABACEAE); Endangered – 6 nos.
Knema attenuata (Hook.f. & Th.) Warb. (MYRISTICACEAE); Least Concern – 4 nos.
Monosis travancorica (Hook.f.) H. Rob. & Skvarla (ASTERACEAE); Endangered – 4 nos.
Palaquium ellipticum (Dalz.) Baill. (SAPOTACEAE); Least Concern – 2 nos.
Syzygium mundagam (Bourd.) Chithra (MYRTACEAE); Vulnerable – 4 nos.
Syzygium palodense Shareef, E.S.S. Kumar & Shaju (MYRTACEAE); Vulnerable – 2 nos.
Syzygium travancoricum Gamble (MYRTACEAE); Critically endangered – 4 nos.
Syzygium stocksii (Duthie) Gamble; Endangered – 2 nos.
Tabernaemontana gamblei Subram. & Henry (APOCYNACEAE); Endangered – 3 nos.
Xanthophyllum arnottianum Wight (XANTHOPHYLLACEAE); Vulnerable – 2 nos.

Indigenous tree planted: 1 no.

Mesua ferrea L. (CLUSIACEAE) – 2 nos.



- **Dr. S. Kaliamoorthy**, Scientist – E & In-charge attended the meeting of Town Official Language Implementation Committee (TOLIC), Salem arranged by Salem Division, Southern Railway through video conferencing in Google meet on 03/09/2020.
- **Dr. S. Kaliamoorthy**, Scientist – E organized Hindi Pakhwada Celebration from 01/09/2020 to 15/09/2020 and Hindi diwas on 14/09/2020 in the Office. Valedictory function of Hindi Pakhwada was organized on 16/09/2020. Dr. M. U. Sharief, Scientist – E & HoO and Dr. Sujana, Scientist – D & Hindi Officer attended the function and prizes were distributed to the participants.
- **Dr. S. Kaliamoorthy**, Scientist – E organized World Ozone Day Celebration on 16/09/2020 at NOEG, BSI, SRC, Yercaud. Dr. V. A. Sathyamurthy, Professor & Head, Horticultural Research Station, TNAU, Yercaud was the Chief Guest, Dr. M. U. Sharief, Scientist – E & HoO spoke on the importance of Ozone layer.
- **Dr. S. Kaliamoorthy**, played a role as an organizing secretary for the Green Walk webinar lecture series, organized by the Botanical Survey of India, Southern Regional Centre, Coimbatore, with the lecture title “Plant Taxonomy and Floristics in the Anthropogenic Epoch” presented by Dr. Syd Ramdhani, Senior Lecturer cum Curator, School of Life Sciences, University of Kwazulu-natal, Durban, South Africa organized by on 19.02.2021.
- **Dr. S. Kaliamoorthy** worked as organizing committee member in the online webinar entitled “Green Walk–Plant resources as aid to prevention of Covid-19”, organized by Botanical Survey of India, Southern Regional Centre, Coimbatore on 27.01.2021. Resource person: Fr. Dr. S. Ignacimuthu, S.J., Xavier’s College, Palayamkottai, Tamilnadu.
- **Dr. S. Kaliamoorthy** worked as organizing committee member in the Green walk online webinar series organized by Botanical Survey of India, Southern Regional Centre, Coimbatore on 02.02.2021. Title “Wetlands: Potential Importance and conservation need under climate change scenario”. Resource person: Dr. N. Parthasarathy, Department of Ecology and Environmental Sciences, Pondicherry University, Pondicherry.
- **Dr. S. Kaliamoorthy** worked as organizing committee member in the Green walk online webinar series organized by Botanical Survey of India, Southern Regional Centre, Coimbatore on 22/03/2021. Title: Management of water resources with emphasis on Mangrove Ecosystem. Resource person: Dr. Deiva Oswin Stanley, Integrated Ecosystems Management Specialist & Mangrove Ecologist, Vadodara, Gujarat.
- **Dr. S. Kaliamoorthy**, attended a National Webinar Series, Lecture – 4 on 15/01/2021, organized by the BSI, HAWHRC, Nauni Campus, Solan (H.P.) and received a e-certificate.

Title of the Project: *Ex-situ* Conservation and Propagation of Indigenous, Threatened and Endemic Plants through Improvement of Infrastructure Facilities in National Orchidarium & Experimental Garden (NOEG) (Lead Garden Proposal).

Principal Investigator: Dr. S. KALIAMOORTHY, Scientist – E

✓ **Micropropagation protocols** for 3 plants viz., 1. *Vernonia shevaroyensis* Gamble, 2. *Crotalaria shevaroyensis* Gamble, *Canarium strictum* Roxb were standardized.

✓ **The following orchid species were multiplied through asymbiotic seed germination method.** 1. *Xenikophyton smeeanum* (Rchb.f.) Garay, 2. *Aerides crispa* Lindl. 3. *Dendrobium aqueum* Lindl., 4. *Bulbophyllum fuscopurpureum* Wight, 5. *Dendrobium aqueum* Lindl. 6. *Eria pseudoclavicaulis* Blatt.

✓ **Vegetative Propagation** using seeds was achieved with 1. *Crotalaria shevaroyensis* Gamble, 2. *Bentinckia condapana* Berry ex Roxb., 3. *Canarium strictum* Roxb.

✓ **Vermiculture:** Well decomposed vermicompost was prepared using earthworms available in the natural forest areas. Leaf litter available from the garden premises were used for preparing vermicompost. The vermicompost prepared was effectively used for the vegetative propagation experiments using stem of threatened plants and other ornamentals.

Publications:

1. **Kaliamoorthy, S.** Hariharan, S. and Balaji, VK. (2021) Micropropagation and clonal fidelity assessment of acclimatized plantlets of *Crotalaria longipes* Wight & Arn. using ISSR markers. *Vegetos* (Springer). <https://doi.org/10.1007/s42535-021-00203-3>.

Research Articles:

Kaliamoorthy, S. Hariharan, S. and Balaji, VK. (2021) Micropropagation and clonal fidelity assessment of acclimatized plantlets of *Crotalaria longipes* Wight & Arn. using ISSR markers. *Vegetos* (Springer).

<https://doi.org/10.1007/s42535-021-00203-3>.

Bandana Bhattacharjee, P. Lakshminarasimhan, Siobhan Mukherjee, **S. Kaliamoorthy** and Avishek Bhattacharjee (2020) Notes on the identity of *Vernonia shevaroyensis* (Asteraceae) and its neotypification. *Nelumbo* Vol. 62 (2): 148 – 153.

T. S. Saravanan, **S. Kaliamoorthy**, M. Y. Kamble and M. U. Sharief. Extended distribution of *Impatiens scapiflora* (Balsaminaceae) to the flora of Eastern Ghats. Accepted for publication in the “Journal of Threatened Taxa”.

T. S. Saravanan and **S. Kaliamoorthy**. *Impatiens macrocarpa* Hook. f. (Balsaminaceae): An addition to the flora of Tamil Nadu, India. Accepted for publication in the “Indian Forester”.

Book Chapter published:

Kamble M.Y. and **S. Kaliamoorthy**. 2020. “Endemic Trees of South India” in L.J. Singh & V. Ranjan (eds.), “*New Vistas in Indian Flora*” Chapter 22. Bishen Singh Mahendra Pal Singh, Dehradun. 403-417. ISBN No. 9788194332350.

Kaliamoorthy S. and M.Y. Kamble. 2020. “Orchids of South India”. in L.J. Singh & V. Ranjan (eds.), “*New Vistas in Indian Flora*” Chapter 33. Bishen Singh Mahendra Pal Singh, Dehradun. 639-666. ISBN No. 9788194614715.

Communicated:

Kaliamoorthy, S. Hariharan, S. Micropropagation of *Vernonia shevaroyensis* Gamble – an endemic and endangered plant species of India. Communicated to Plant Cell Tissue & Organ Culture (PCTOC).

Under Preparation:

Enumeration of the flora of National Orchidarium & Experimental Garden, BSI, SRC, Yercaud is under preparation jointly by Dr. M.U. Sharief, Dr. S. Kaliamoorthy and Dr. M. Y. Kamble.