Annual Report

2020 - 21

Botanical Survey of India

CGO Complex, 3rd MSO Building, F - Wing, 5th & 6th Floor

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Website: http//bsi.gov.in

Botanical Survey of India

Ministry of Environment, Forest & Climate Change

Annual Report 2020-21

भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

Botanical Survey of India
Ministry of Environment, Forest & Climate Change

ANNUAL REPORT 2020 - 21

Botanical Survey of India

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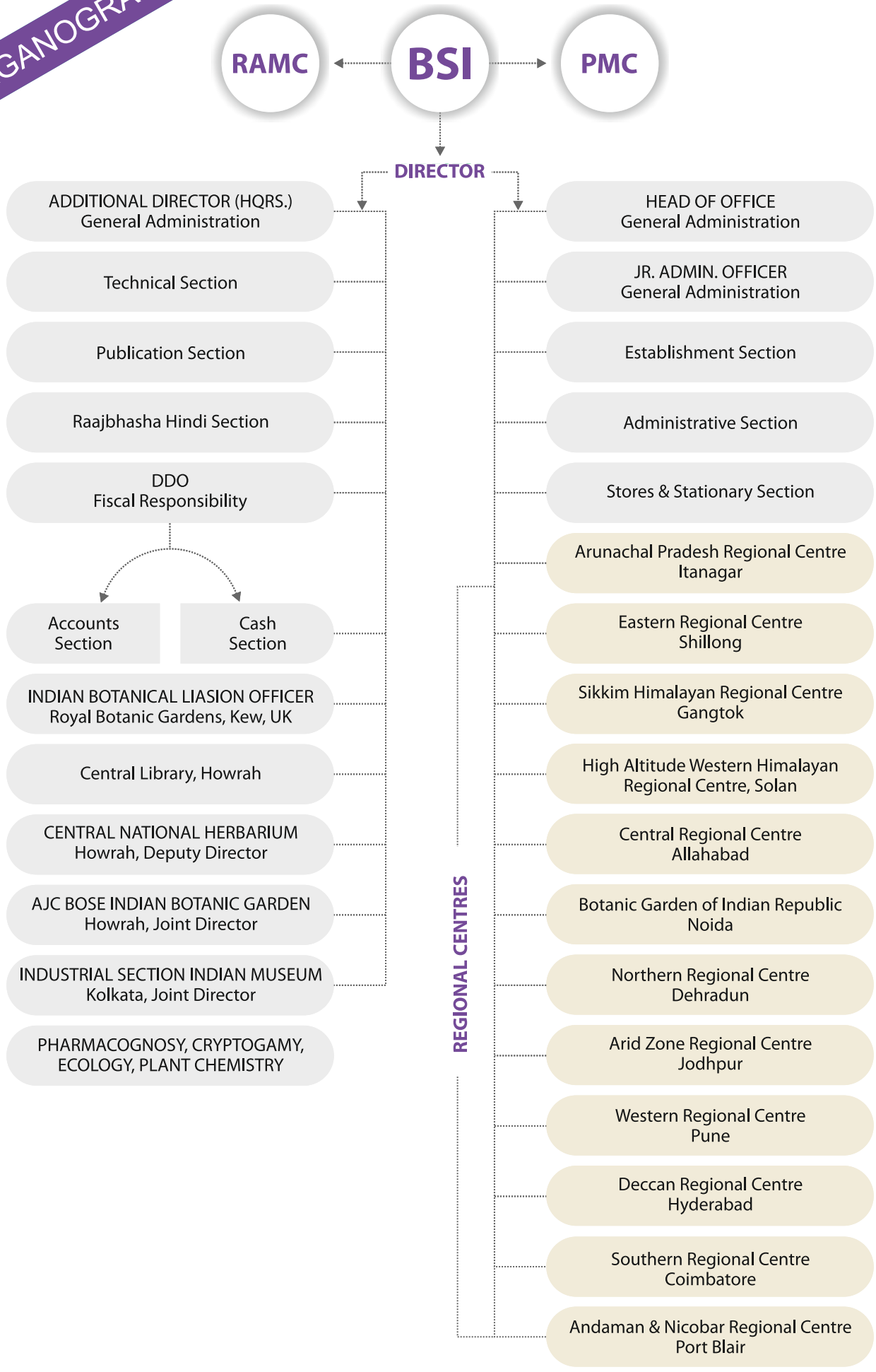
CONTENTS

ORGANOGRAM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Noida
Northern Regional Centre
Dehradun
Arid Zone Regional Centre
Jodhpur
Western Regional Centre
Pune
Deccan Regional Centre
Hyderabad
Southern Regional Centre
Coimbatore
Andaman & Nicobar Regional Centre
Port Blair

From the
DIRECTOR'S DESK

A.A. Mao
Director
Botanical Survey of India

It is a great pleasure and honours for me to present the Annual Report of Botanical Survey of India for the year 2020-21. The report emphasizes brief accounts of all-round achievements of the institute in the field of exploration, survey, research, technological development and outreach programmes.

During 2020-21, in spite of COVID-19 pandemic, the officials of this Institute carried out 24 field tours under 57 Annual Action Plan Projects, 18 Flora of India projects and for survey and exploration of plant diversity, traditional ethnobotanical knowledge of flowering and non-flowering plants, pharmacognosy of cycads and nutraceuticals studies of edible plant of NE India. Few local germplasm collection tours were undertaken to different regions under jurisdiction of regional Centres of BSI for collection of live plants, bulbs, seeds, rhizomes etc. of endemic, EET sp., RET plant species, ornamentals and orchids. In 2020-21, 06 tours in 07 protected areas and 01 tour in 01 wetland were carried out. During these field tours, a total of 6470 specimens including 171 fungal specimens were collected of which most were identified upto species level. During ethnobotanical tour among tribal areas of Bihar, 1159 field nos were collected with 1210 information.To study different specimens of allotted project, 07 herbarium consultation tours were conducted to different herbaria. During this period, under 'Flora of India' project, 10 volumes of Dicot and 04 volumes of monocot were completed by BSI officials and final Mss. were submitted. Rest of the volumes are under porocess and will be submitted soon. Revisionary studies of the families Musaceae, Pyrenulaceae and genus Gastrochilus was carried out.

During this period, the scientists of BSI published 52 new taxa and 22 new records for India.

SEM studies of seeds and epidermal features of 30 species of the families Acanthaceae and Solanaceae available at BSA herbarium, CRC, Allahabad and achenes of 02 species of the genus Ranunculus and 12 species of Thalictrum were carried out.

Besides, augmentation, maintenance of various herbaria, gardens and museum in BSI, dissemination of information relating to plant diversity is being continued. The Botanical Gardens of Botanical Survey of India were actively engaged in introduction, enrichment, conservation, propagation and multiplication of Rare, endangered and threatened plant species, medicinal plants, Zingibers, Rattans, Bamboos, Orchids, ornamental plants, ferns etc. A proto-type of GPS based navigation App for locating trees and shrubs of AJC Bose Indian Botanic garden, BSI, Howrah has been developed.

During 2020-21, 03 websites viz. https://bsi.gov.in, https://efloraindia.bsi.gov.in and https:// archive.bsi.gov.in were developed by BSI through which anybody can access eFlora of India [8 vols. (1, 2, 3, 4, 5, 12, 13, and 23) contains 8,813 records] & Plant Checklist of India, Algae of India Checklist databases (5,433 records) and 61,501 archieve materials (Textile design, Natural dyes, Botanical painting, Economic Botany and Type specimens). In Herbarium Digitization Programme, a total of 18561 sheets were digitized.

In this periods, for smooth functioning of research and developmental works, MoU was signed between Botanical Survey of India and five institutes.

This year Botanical Survey of India hosted several important events such as World Biodiversity Day (22nd May), World Environment Day (5th June), Himalayan day (9th September), International Yoga Day, Van mahotsab etc and organized 14 Webinars.

For outstandind contribution in the field of Plant taxonomy, Scientists of Botanical Survey of India were honoured with National Awards and recognitions by different professional societies and organizations.

I congratulate my scientific and administrative colleagues for their valuable cooperation and sincere efforts for enriching the work environment with team spirit, creativity and commitment. I am also thankful to all the staffs for fulfilling goals and targets of the Institution and maintaining the glory of Botanical Survey of India for carrying out taxonomic and floristic studies, survey, documentation and conservation of wild plant resources.

Jai Hind.

(A.A. Mao)
Director

ANNUAL RESEARCH PROGRAMME

ANNUAL ACTION PLAN PROJECT

AJC BOSE INDIAN BOTANIC GARDEN, HOWRAH

PROJECT-1

Wood rotting fungi of Valmiki National Park

Executing Scientist (s) : Dr. Manoj E. Hembrom
Date of Initiation : 2019
Date of Completion : 2021(November)

OBJECTIVE

Survey, collection, characterization, identification and documentation of wood rotting fungi of Valmiki National Park; preparation of detailed account of wood rotting fungi including their description, host range and specificity, preparation of key for easy identifying and notes; preparation of check-list and distributional map; preparation of macro–and microscopic illustrations of all recorded taxa under present investigation for easy identification and phylogenetic studies of selected taxa for their proper taxonomic placement.

BACKGROUND

The project was started in 2019. During previous year, one field trip *w.e.f.* 27. 09. 2019 to 05.10. 2019 was undertaken to Valmiki National Park and adjoining areas and surveyed c. 80 sq. Km. areas during which microscopic characterization, identification, illustration and description of 39 species belonging to 51 specimens/field nos. along with molecular phylogenetic studies were completed.

AREA AND LOCALITY

Valmiki National Park, Bihar; *c.* 335.6 sq.km.

SUMMARY AND ACHIEVEMENT

Due to situation of Covid 19 pandemic, no tours were possible for BSI officials but survey and collection, covering an area of *c.* 80 sq. km., falling under forest ranges of Chiutaha, Madanpur, Harnatand and Raghia areas of Valmiki National Park were conducted by local collaborators during which 150 sets of samples were collected randomly from different host trees including their representative's geo-coordinates of which eight species were identified and incorporated. Microscopy of Fifteen (15) samples was done along with their images and camera lucida drawings. Phylogenetic estimations of three species were undertaken.

PROJECT-2

Development of an Orchidarium in AJCBIBG through Collection, Introduction and EX-situ Conservation of the Orchids of Eastern Ghats of India

Executing Scientist (s):, Dr. S.P. Panda, Dr. R. Saravanan & Ms. Titir Saha
Date of Initiation: 2020

Date of Completion: 2022

OBJECTIVE

Developing a standard Orchidarium in AJCBIBG; conserving Orchids of Eastern Ghats in *ex-situ* method; preparation of a flowering calendar of the conserved species through phenological studies and imparting education and awareness among the people/ students visiting the Orchidarium.

BACKGROUND

This is a new project. It is universally accepted that the anthropogenic activities are one of the major causes for the destruction of biodiversity and extinction of number of valuable taxa which require an urgent need of the conservation. Analysis of statistical data on challenges of a changing earth establishing sharp increases of extinction rate of valuable taxa. The family Orchidaceae, one of the most diverse family among the angiosperms, with estimates 25,000 orchid species, have high proportion of threatened genera containing maximum amount of threatened species. According to the World Conservation Union, almost half of the extinct species are terrestrial herbaceous perennials. One third of the orchids belongs to this category, thus represent a life form class likely to experience a greater extinction risk, particularly under current climatic change scenarios. Dependency on multiple intrinsic factors limits the abundance and distribution of a particular orchid. Orchid capsules produce thousands of seeds and few of them germinate under natural conditions, due the lack of fully developed endosperm or inadequate food reserve. Under natural conditions, seeds of most terrestrial orchid species will germinate only in association with a compatible mycorrhizal fungus. Moreover, vegetative propagation of orchids is very slow and tedious process. Eastern Ghats due to its varied topographic conditions coupled with peculiar geographic locations harbour different kind of life forms out of which the orchids deserve special mention being the very rare and unique plants. The Eastern Ghats represent a high magnitude of orchid diversity dwelling in the remote forests of the states of Andhra Pradesh, Odisha and Tamil Nadu which are the best suited species for conserving *ex-situ* in West Bengal‘s climate. Due to habitat destruction as well as anthropogenic interferences the orchid biota are under severe threat. So collection and germplasm maintenance of these orchids in AJCBIBG will pave the way for conservation for posterity. It will also provide the species another chance to survive in the orchidarium of the AJCBIBG (Acharya Jagadish Chandra Bose Indian Botanic Garden), Botanical Survey of India, Howrah as well as revival of the orchidarium of the garden by enriching the orchid wealth of the garden which is very negligible or poorly represented at present. The *ex-situ* conservation of orchids in AJCBIBG will be very significant bearing in the prospect of future taxonomic works as well as for conservation of biodiversity in general and orchid diversity in particular prior to further genetic erosion of the species in the wild. The epiphytic orchids also like to grow on low light intensity, thus requires a specific greenhouse/poly house for production of healthy plants. It is also worth mentioning that the orchids require a specific temperature, light intensity, photoperiod for better growth and development. However, as the requirement varies from species to species, these need to be grown under specific controlled conditions. This project was taken as an immediate step of germplasm conservation of different orchids, growing in Eastern Ghats region along with hybrids and more importantly to establish an Orchidarium in AJCBIBG for both the visitors and researchers.

AREA AND LOCALITY

Eastern Ghats

SUMMARY AND ACHIEVEMENT

No tour was approved due to COVID-19 pandemic situation.

PROJECT-3

GIS Phyto-Mapping & Digitization of Shrubs and Trees in AJC Bose Indian Botanic Garden

Executing Scientist (s) : Dr. C.M. Sabapathy, Dr. B.K. Singh & Dr. Kanad das
Date of Initiation : 2015
Date of Completion : Ongoing

OBJECTIVE

Gathering information about the introduction of the Trees and Shrubs in the past and present from the researchers of BSI and from the Literatures/Catalogues as per availability; locating the Trees and Shrubs in the Garden; collection of fresh flowering and fruiting specimens, identifying. checking its present Nomenclature and making necessary corrections (if any); Mapping of the Identified trees in the software such as ARC GIS and other feasible software and creating a map database that helps user to access and identify the Shrubs and tree species in the AJCBIBG.

BACKGROUND

This project was initiated in 2015. During 2019-20, important trees were labelled along with scientific names, local names, distribution etc. by employing label writer in antique way. Re-fixing of Labels (Numbers) was done for the fast growing trees and maintenance of labels was monitored in regular intervals. The developed application was duly checked and made ready for further necessary actions.

AREA AND LOCALITY

AJC Bose Indian Botanic Garden, Howrah.

SUMMARY AND ACHIEVEMENT

480 trees (including all Palms) were labelled with names along with collection of geo-coordinates of all palm species. All the data were updated in the mobile App. Major impacts reported during this period is development of Botanical Survey of India mobile App which is a user-friendly digital platform for the users that gives a glimpse of the gardens under BSI and the protected areas of India. Under the AJC Bose Indian Botanic Garden users have a wide range of options full of interactive information, narration and navigation features for its different 'Plant Sections', 'Iconic Plants', 'Buildings & Monuments', 'Lakes', 'Garden Plants', etc. The App is also having Special features like 'Nearby Trees', 'Flowering Calendar', 'Quiz' that make this app interesting for users.

COMPLETED PROJECT

PROJECT-4

Exploration of Caterpillar fungi in Himalaya: Morpho-taxonomy, Molecular phylogeny, Chemical & nutraceutical properties

Executing Scientist (s) : Dr. Kanad Das, Dr. Manoj E. Hembrom & Sri Arvind Parihar

Date of Initiation : 2019
Date of Completion : 2021

OBJECTIVE

Survey, collection, characterization, identification and documentation of the species of highly exploited Caterpillar Fungi distributed in India and investigating the conspecificity amongst available fungal samples through morphology, molecular phylogeny, HPLC and nutraceutical properties.

BACKGROUND

The project was started in 2019. During previous year, two macrofungal survey tours *w.e.f.* 13.06.2017 to 27.06.2017 and 15.07.2019 to 24.07.2019 were undertaken to different parts of Uttarakhand namely, Baram, Kanar, Bahman, Tejam Khaaiar, towards Chippla Kedar of Kumaon Himalaya and Joshimath, Malari, towards Kuntibanar glacier, surroundings of Garhwal Himalaya and Lachung, Yumthang, Bichhuten, Dorji, Dombang, Jakthang, Khorathang, surrounding areas of alpine meadows and glacial moraines of North Sikkim respectively during which fruiting bodies of about 30 caterpillar fungi belonging to Ophiocordycipitaceae were collected from two major localities of Kumaon and Garhwal Himalaya and about 35 samples of alpine caterpillar fungi were collected from North Sikkim. Two genes (ITS, SSU) were isolated from the samples of Kumaon, Garwal, Sikkim and Arunachal Pradesh (provided by the Director, BSI) respectively. Based on the sequence data of these Indian materials several data-sets were prepared from sequence derived from GenBank and other literature. Different phylograms were prepared with the help of RAxML GUI. High Performance Liquid Chromatography (HPLC) analysis of specimens gathered from different parts of Himalaya was also performed to get further confirmation of identity.

AREA AND LOCALITY

Parts of Kumaon and Garhwal Himalaya (North-west Himalaya), Parts of North Sikkim (Eastern Himalaya); 130 sq. Km.

SUMMARY AND ACHIEVEMENT

LSU and SSU genes were isolated from samples collected in 2019 from Eastern to North-West Himalaya. These genes were amplified and sequenced. Datasets were prepared with the sequences of allied samples/species 2 and isolated genes. These sequences were aligned mostly with mafft alignment tool. Maximum likelihood analyses were conducted with the aligned sequences through raxml GUI 2.0 to get phylograms. SSU- and LSU-based phylograms were constructed separately to get the phylogenetic estimation. Compilation work with text, illustrations and phylograms was initiated. This study reported two species (*Russula lakhanpalii* A. Ghosh, K. Das & R.P. Bhatt and *Russula indocatillus* A. Ghosh, K. Das & R.P. Bhatt) as new to science.

PROJECT-5

Development of Musa section (*Ex-situ* conservation) in AJC Bose Indian Botanic Garden, Howrah

Executing Scientist (s) : Dr. S.S. Hameed, Dr.K. Saravanan & Mr. S.K. Arjun
Date of Initiation : 2020

Date of Completion **:** 2021

OBJECTIVE

Introducing and cultivating wild, endemic and exotic Musa and Callimusa varieties occurring in India through collection and exchange and develop a Musa section in AJCBIBG, Howrah.

BACKGROUND

This project is a new project. Musa is one of two or three genera in the family Musaceae; consists of bananas and plantains. Around 70 species of Musa are known, with broad variety of uses. Musa sectional systematics possesses a history dating back to 1887. Earlier classification was based on morphological traits such as Bananas with fleshy fruit; ornamental bananas with upright inflorescences and bracts were vibrantly coloured; and Bananas that were giant in size. During the course of time five sections in Musa came into existence like Eumusa, Rhodochlamys, Callimusa, Australimusa, and Ingentimusa which was later reduced into Musa and Callimusa based on genetic evidence and markers. In India more than 120 varieties of banana are being cultivated. This project was initiated to introduce all the endemic and wild Musa and Callimusa varieties.

AREA AND LOCALITY

A well-developed Musa section developed in AJCBIBG near to the Rosarium (adjacent to the Great Banyan Tree) becomes the integral part of Botanic Gardens in terms of conservation of germplasm as well as for educational purpose and curiosity. This would serve a long way in conserving wild and cultivated Musa varieties in AJCBIBG. The site is well demarcated and the land levelling has been made suitably. Hence, such sections would act as a gene pool of Musa‘s for future breeding programmes

SUMMARY AND ACHIEVEMENT

The germplasm of different Musa and Callimusa varieties and the germ plasms of the wild and cultivated varieties were obtained from the regional Centres of BSI where the particular species occurs. Further, different varieties of Musa growing in AJCBIBG were planted systematically at a place for developing the section. During this period, three endemic species *viz. Musa acuminata*, *Musa bulbisiana*, *Musa indandamanensis* were collected from Andaman & Nicobar Islands.

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORTBLAIR

PROJECT-1

Revision of the family Musaceae in Andaman and Nicobar Islands along with population assessment

Executing Scientist (s): Dr. Lal Ji Singh & Shri Gautam Anuj Ekka
Date of Initiation: April, 2020
Date of Completion: March, 2022

OBJECTIVE

Documentation of all the species of family *Musaceae* and preparation of consolidated account of the family along with their distribution status.

BACKGROUND

The family Musaceae is represented by a single genus, *Musa* L. from Andaman and Nicobar Islands, India. Earlier studies on the genus have accounted six taxa *viz.*, *M. acuminata* Colla, *M. balbisiana* Colla, *M. indandamanensis* L.J. Singh, *M. paramjithiana* L.J. Singh, *M. sabuana* K. Prasad & al. and *M. balbisiana* Colla var. *andamanica* Singh & al. from Andaman and Nicobar Islands. Many taxonomists believe that taxonomy of *Musa* L. is a complex and stated that *Musa* taxonomy, including the Rhodochlamys section, is still very obscure today just as it has been throughout its history despite several attempts at its clarification. Much of the diversity in the section is located in areas in continental Asia that have been and continue to be difficult, and sometimes even dangerous to travel and work in. For this reason, the present-day distribution, extent and status of many of the undescribed species are not clear despite some 200 years of study and still new species await description. Therefore, the family *Musaceae* needs an adequate review from these Islands.

The Andaman and Nicobar Islands represent an excellent population of *Musa* in protected areas in comparison to unreserved beach forests where they are sparsely scattered. Andaman and Nicobar Archipelago is one of the centre of hot spots of plant diversity in India and a landmass of 572 islands, isles, rocks and reefs with a total area of 8,249 km^2 and a coastline of 1,962 km. and lies between 6º45"–13º41"N and 92º12"–93º57"E, a region where the Musaceae have not been explored systematically because it has received little attention from taxonomists. The Musaceae taxonomy is complex because they usually have ephemeral flowers with a short flowering period. Therefore, the present study was proposed to examine thoroughly the morphological characters of all species of *Musa* found in the Andaman and Nicobar Islands.

AREA AND LOCALITY

Andaman and Nicobar Islands: *c.* 8249 sq. km.

SUMMARY AND ACHIEVEMENT

Two field tours were undertaken to different Islands such as Middle Andaman and Little Andaman during which 14 field number specimens along with were collected along with the GPS details,

examined, characterized morphologically and identified into 03 species *viz*. *Musa acuminate* Colla., *Musa balbisiana* Colla. & and *Musa indandamansis* L.J. Singh. The diversity of Musaceae with their salient features, range of distribution, threats and conservation status were recorded. All the identified/ determinavited specimens were incorporated into the herbarium (PBL). Wild germ plasm of 03 species of *Musa* (*Musa acuminate* Colla., *Musa balbisiana* Colla. & and *Musa indandamansis* L.J. Singh) was collected and introduced in the Garden as a part of ex-situ conservation. Besides, germplasm of 21 species of Rare & threatened and endemic plants was collected and introduced in garden. Molecular systematics of the genus *Musa* L. (Zingiberales: *Musaceae*) in Andaman and Nicobar Islands have been described for the first time. Population Assessment of *Musa paramjitiana* L.J. Singh (Musaceae): a critically endangered, endemic species in Andaman & Nicobar Islands, India have been described for the first time. This study recorded 04 species *viz. Rivina andamanensis* L. J. Singh & M. Chennakesavulu Naik, **(**Petiveriaceae) *Dendrophthoe gamblei* L.J. Singh, V. Ranjan, Rasingam and J. Swamy (Loranthaceae) *Luisia diglipurensis* Sanjay Mishra & Jalal (Orchidaceae) *Luisia jarawana* Sanjay Mishra & Jalal (Orchidaceae) as new to science and 08 species *viz*. *Crotalaria verrucosa* L. (Fabaceae), *Senna auriculata* (L.) Roxb. (Fabaceae), *Arthraxon hispidus* (Thunb.) Makino (Poaceae), *Desmodium heterocarpon* subsp. *ovalifolium* (Prain) H. Ohashi (Fabaceae), *Ammannia auriculata* Willd. (Lythraceae), *Chlorophytum vestitum* Baker (Asparagaceae), *Christisonia siamensis* Craib (Orobanchaceae), *Elatostema cuneatum* Wight (Urticaceae) as new to Andaman and Nicobar Islands.

Project- 2

Revision of the lichen family *Pyrenulaceae* in India

Executing Scientist (s): Dr. Jagadeesh Ram T.A.M.
Date of Initiation **:** April, 2017
Date of Completion **:** March 2022

OBJECTIVE
Revising the members of the family *Pyrenulaceae* in India.

BACKGROUND
The project was initiated in 2017. Literature survey was carried out and a total of 132 species were listed in 4 genera *viz*. *Anthracothecium*, *Lithothelium*, *Pyrenula* and *Pyrgillus*. During previous year, one field tour *w.e.f*. 09.03.2020 to 21.03.2020 was conducted to the Ernakulam, Idukki, Kollam, Kottayam and Thiruvananthapurm Districts of Kerala and Kanyakumari District of Tamil Nadu during which a total of 27 field nos. of family Pyrenulaceae were collected. A total of 152 specimens were examined and identified into 04 species of *Anthracothecium* and 24 species of *Pyrenula*.
AREA AND LOCALITY
India (Entire Country)

SUMMARY AND ACHIEVEMENT
A total of 200 specimens were examined and identified into 02 species of *Anthracothecium*, 02 species of *Lithothelium* and 22 species of *Pyrenula*. Taxonomic Descriptions of 13 species of *Pyrenula* were prepared. This study reported 07 species [*Pyrenula aggregataspistea* Aptroot & Cáceres, *Pyrenula ciliata* Aptroot**,** *Pyrenula cocoes* Müll. Arg., Pyrenula fulva (Kremph.) Müll. Arg. *Pyrenula*

rinodinospora Aptroot, *Pyrenula septicollaris* (Eschw.) R.C. Harris and *Pyrenula subglabrata* (Nyl.) Müll. Arg.] and 05 species [*Anthracothecium prasinum* (Eschw.) R.C. Harris Ajay, *Pyrenula subgregantula* Müll. Arg., *Pyrenula sublaevigata* (Patw. & Makhija) Upreti, *Pyrenula thailandica* Aptroot and *Pyrenula thelomorpha* Tuck] as new records for Andaman and Nicobar Islands.

Project-3

Ex-situ conservation of RET species (Bamboos, Palms, Zingibers, endemic tree species) of Andaman & Nicobar Islands at Dhanikhari Exp. Garden cum Arboretum and raise nursery

Executing Scientist (s): Dr. C. S. Purohit & Dr. Vivek C. P.
Date of Initiation : August, 2019
Date of Completion : March, 2022

OBJECTIVE
Documentation of RET plants belong to bamboos, palms, zingibers, and trees in the Andaman and Nicobar Islands, collection, introduction, multiplication and conservation of them in Dhanikhari Experimental Garden cum Arboretum and raising of nursery.

BACKGROUND
The project was initiated in 2019. During the previous year two field tours were conducted to Diglipur in North Andaman and Campbell Bay, Nicobar Islands during which total of 51 plant samples (Fld. Nos. 34101 to 34151) of EET species of Andaman and Nicobar Islands were collected along with GPS data and field photographs and processed for preparing the herbarium.

AREA AND LOCALITY
The Andaman and Nicobar Islands, c. 8249 sq.km.

SUMMARY AND ACHIEVEMENT
Three field tours *w.e.f.* 31.06.2020 to 02.07.2021, 05.12.2020 to 11.12.2020 and 11.02.2021 to 17.02.2021 were conducted to South Andaman, and Middle Andaman respectively during which *c.* 1961 seeds/seedlings/plantlets, 4234 live plants and 07 cuttings of 24 endemic and 07 threatened species were collected along with GPS coordinates of the localities and field photos of the plants. During this period, raised a total of 950 seedlings/sowed seeds of RET species in Garden and transplanted a total of 124 plants in different sections of the Garden. Some of the endemic/threatened plant species, collected from South and Middle Andaman Islands and introduced in Dhanikhari Experimental Garden cum Arboretum are: *Corypha umbraculifera* L.- 4 seedlings; *Phoenix paludosa* Roxb. - 5 plants; *Knema andamanica* (Warb.) W.J. De Wilde-766 seedlings, *Manilkara littoralis* (Kurz.) Dubbard-526 seedlings, *Pinanga andamanensis* Becc. -512 seedlings, *Pinanga manii* Becc.-150 seedlings & 900 seeds, *Pterocarpus dalbergioides* DC.-110 seedlings & 200 seeds; *Myristica andamanica* Hook.f.- 90 seedlings, *Grewia calophylla* Kurz ex Mast. -286 seeds, *Canarium denticulatum* Blume-35 seedlings, *Dipterocarpus griffithii* - 25 seedlings, *Magnolia andamanica* (King) D.C.S. Raju & M.P. Nayar-8 seedlings, *Carrisa andamanensis* L.J. Singh & Murugan-8 seedlings, *Schizostachyum andamanicum* M. Kumar & Remesh - 545 plantlets, *Amomum andamanicum* V.P. Thomas *et al*. - 500 plantlets, *Amomum maximum* Roxb.- 250 plantlets, *Zingiber pseudosquarrosum* L.J. Singh & P. Singh-50 plantlets, *Amomum aculeatum* Roxb.-37 plantlets, *Cyrtandra burtii* N.P. Balakrishnan-10 plantlets, *Psychotria andamanica* Kurz-10

plantlets, *Zingiber sp.*-2 plantlets, *Curcuma sp.*-4 plantlets, *Calamus andamanicus* Kurz.-2 plantlets, *Magnolia andamanica* (King) D.C.S. Raju & M.P. Nayar-35 seeds *Bulbophyllum spp.*-20 bulbs; *Dendrobium tenuicaule* Hook.f. - 5 bulbs; *Diospyros spp.*-100 seeds; *Diospyros kurzii* Hiern -10 seedlings; *Garcinia andamanica* King -50 seedlings; *Gigantochloa nigrociliata* (Buse) Kurz - 10 seedlings*; Goniothalamus spp.*-50 seeds; *Lagerstroemia hypoleuca* Kurz -20 fruits; *Myristica andamanica* Hook.f.- 34 seedlings; *Pteroceras muriculatum* (Rchb.f.) P.F. Hunt -2 plantlets; *Semecarpus kurzii* Engl. -60 seeds; *Rhopaloblaste angustata* (Kurz) Moore– 16 seedlings; *Strobilanthes spp.*-10 seedlings; *Terminalia manii* King -10 seedlings & 300 seeds; *Zingiber spp.*-5 plantlets; *Zingiber squarrosum* Roxb.-13 plantlets.

PROJECT -4

Executing Scientist (s): Dr. Lal Ji Singh and Shri Bishnu Charan Dey
Date of Initiation **:** April, 2018
Date of Completion **:** Ongoing

OBJECTIVE

Recording of flowering and fruiting of tree species of Andaman and Nicobar Islands.

BACKGROUND

The project was started in 2018. The Dhanikhari Experimental Garden cum Arboretum is spreaded over 30 hectare of land more than 1472 species. The knowledge of phenology of plants is critical for the successful management of forest genetic resources as well as conservation and regeneration of species. This project aims at to observe the phenology of all the tree species of the experimental garden.

AREA AND LOCALITY

Dhanikhari Experimental Garden Cum Arboretum (DEGCA), Nayashahar, 30 ha.

SUMMARY AND ACHIEVEMENT

Flowering and fruiting of 73 tree species were observed and recorded.

PROJECT-1

Ex-situ conservation of RET and economically important species of the Arid region in the experimental Garden of AZRC and documentation of phenological data on flowering & fruiting

Executing Scientist (s) : Shri Vinod Maina, Dr. Sanjay Mishra, Dr. M. K. Singhadiya, Dr. Ravi Prasad & P. Harikrishna

Date of Completion : Ongoing

OBJECTIVE

Collection of RET and Economically important species germplasm and introduction in the experimental garden for *ex-situ* Conservation; Documentation of phenological data of plants growing in Desert Botanic Garden.

BACKGROUND

The experimental Botanic Garden (Desert Botanical Garden) of this centre has been established during 1994 with an area of c. 8 acres. The main objective of the garden is maintenance of arid germplasm, collection, growing and multiplication of rare / endemic/ endangered / threatened/ medicinal/ economically importantand other plant species of North-western arid regions of India, with special focus on Rajasthan and Gujarat state of India. About 300 species of vascular plants and 04 gymnosperms of various categories are conserved in the garden.

AREA AND LOCALITY

Rajasthan & Gujarat.

SUMMARY AND ACHIEVEMENT

A total number of 16 rare and threatened, 33 medicinal& aromatic and 22 economically important, 11 ornamental, 15 grasses and some succulent plant species were collected along with 200 photographs and introduced in the Desert Botanical Garden. Some plant species were multiplied from cuttings, seeds, rhizomes, bulbs, tubers etc. 99 live plant saplings of different species (including EET) were distributed to different people and organizations free of cost for plantation and further multiplication. A new Grass section, Medicinal plant section and Succulent plant section was developed. Besides cleaning of medicinal & threatened species plot and rearrangements of the pots in NET house, lawn and hedge cutting and routine maintenance of garden has been undertaken. In connection with initiation for *ex-situ* conservation of Rare, Endangered and Economic (RET) important plants, saplings of 15 rare & threatened taxa, 32 taxa of medicinal and aromatic plants, 22 economically important taxa, 11 ornamental taxa including several seasonal ornamentals, 15 grasses and seeds of 38 taxa were collected. Multiplication of RET and other plants in nursery were done by seeds, cuttings and rhizomes/bulbs/tubers. Phenological data of existing plant species of Desert Botanic Garden was recorded thorough out the year and flowering in 09 taxa was observed for the first time after introduction.

ARUNACHAL PRADESH REGIONAL CENTRE, ITANAGAR

PROJECT-1

Family Pteridaceae of India & Polypodiaceae of India for the Pteridophytic Flora of India

Executing Scientist (s) : Dr. V. K. Rawat
Date of Initiation : 2020
Date to be completion : 2023

OBJECTIVE
Taxonomic Study of family Pteridaceae and Polypodiaceae for pteridophytic Flora of India

BACKGROUND
This is a new project. The family Pteridaceae and Polypodiaceae allotted under the Pteridophytic Flora of India. The family Pteridaceae is represented by 155 species within 19 genera and family Polypodiaceae is represented by 138 species under 21 genera from India.

AREA AND LOCALITY
India

SUMMARY AND ACHIEVEMENTS

Prepared manuscript for 19 genera and 155 taxa (excluding Pteris) from India along with detail description, keys and Citation. Some of which are *Acrostichum* L. (1 species), *Actiniopteris* Link (01 species), *Adiantum* L. (26 species), *Aleuritopteris* Fee (19 species), *Anogramma* Link (2 species), *Ceratopteris* Brongn. (04 species), *Cerosora* (Baker) Domin (01 species), *Coniogranune* Fee (07 species), *Cryptogramma* R.Br. (03 species), *Doryopteris* J. Sm. (02 species), *Mickelopteris* Fraser-Jenk. (02 species) , gen. nov. *Notholaena* R.Br. (07 species), *Oeosporangium* Vis. (14 species), *Onychium* Kaulf. (07 species), *Pellaea* Link (04 species) , *Pityrogramma* Link (02 species), *Pteris* L. (69 species), *Syngramma* J. Sm. , *Taenitis* Willd. ex Schkuhr (02 species). This study reported 05 new records for the state of Arunachal Pradesh

PROJECT-2

Pteridophytic Flora of Arunachal Pradesh (For Materials of the Flora of Arunachal Pradesh, Vol. 4.)

Executing Scientist (s): Dr. V. K. Rawat
Date of Initiation : April 2019
Date to be completion : March 2021

OBJECTIVE
Inclusion of all the Fern species reported from Arunachal Pradesh after the publication of _Flora of Arunachal Pradesh (Volume 1-3)‘.

BACKGROUND

This project was initiated in 2019. Arunachal Pradesh is the part of Eastern Himalaya region (one of the part of Hotspot). The state of Arunachal Pradesh is a part of Eastern Himalayan Ranges located between 26º 28‘ to 29º30, N latitudes and 91º 30‘ to 97º30‘ E longitudes. Arunachal Pradesh occupies the largest area (83.743 Sq. Km) in the northeastern region of India, and consists of mountainous ranges sloping to the plains of Assam. The diversity of topographical and climatic condition has favoured the growth of luxuriant forests, Entire Arunachal Pradesh consist of more than 654 species of ferns and Fern allies under 94 genera belonging to 32 families

AREA AND LOCALITY

Entire Arunachal Pradesh

SUMMARY AND ACHIEVEMENTS

Listing and documentation of 311 taxa under 41 genera belonging to 21 families along with proper citation, description and distribution for materials of Arunachal Pradesh some of which are Lycopodiaceae (3 genera/18 species) , Selaginellaceae (1/24), Equisetaceae (1/2), Psilotaceae (1/1), Ophioglossaceae (3/10), Marattiaceae (2/4), Osmundaceae (1/4), Plagiogyriaceae (1/4), Dipteridaceae (1/1), Glecheniaceae (2/6), Lygodiaceae (1/5), Marsileaceae (1/1), Cyatheaceae (1/8), Dicksoniaceae (1/1), Hymenophyllaceae (2/17), Dennstaedtiaceae (6/22), Lindsaeaceae (2/8), Pteridaceae (10/80), Vittariaceae (2/11), Aspleniaceae (1/35), Thelypteridaceae (1/49). During this study, 16 threatened fern species were reported.

PROJECT-3

Materials of the Flora of Arunachal Pradesh, Vol. 4.

Executing Scientist (s): Dr. M. R. Debta
Date of Initiation **:** April 2019
Date to be completion : March 2021

OBJECTIVE

Inclusion of all the species reported from Arunachal Pradesh after the publication of _Flora of Arunachal Pradesh (Volume 1-3)‘.

BACKGROUND

The materials for flora of Arunachal Pradesh have been published in 03 volumes till date. The last volume to this series was published in 1998. Since then many new discoveries and new reports have been made to the flora of this state in the last two decades by BSI scientists and those from other research institutions and academia. Therefore, the need is felt by BSI HQ to compile all those publications and put into one as an addition to the already available published flora.

AREA AND LOCALITY

Entire Arunachal Pradesh

SUMMARY AND ACHIEVEMENTS

Listed 250 taxa and documentation completed for 214 species, 03 subspecies and 15 varieties in the year 2020-21. The manuscript comprising a total of 349 species, 06 subspecies and 20 varieties under 238 genera belonging to 76 plant families was submitted to the Team leader for further compilation and final submission of the same to HQ, BSI.

PROJECT-4

Materials of the Flora of Arunachal Pradesh Vol. 4.

Executing Scientist (s): Dr.Umeshkumar L. Tiwari
Date of Initiation **:** October 2020
Date to be completion: March 2021

OBJECTIVE
Inclusion of all the species reported from Arunachal Pradesh after the publication of _Flora of Arunachal Pradesh (Volume 1-3)'.

BACKGROUND
The vegetation of Arunachal Pradesh falls under four broad climatic categories and can be classified in five broad forest types with a sixth type of secondary forests. These are tropical forests, sub-tropical forests, pine forests, temperate forests and alpine forests.

AREA AND LOCALITY
Entire Arunachal Pradesh.

SUMMARY AND ACHIEVEMENTS
Manuscript prepared for 42 families, 133 genera and 319 taxa recorded. A final list of 599 taxa, 262 genera belonging to 78 families was finalised. Overall 993 taxa belonging to 442 genera and 116 families were added to the Materials for the flora of Arunachal Pradesh.

PROJECT-5

Materials of the Flora of Arunachal Pradesh Vol. 4

Executing Scientist (s): Dr. K. Chowlu
Date of Initiation **:** April 2019
Date to be completion: March 2021

OBJECTIVE
Inclusion of all the species reported from Arunachal Pradesh after the publication of _Flora of Arunachal Pradesh (Volume 1-3)'.

BACKGROUND
After the publication of Materials of Arunachal Pradesh in 1998, many new discoveries and new reports to the state have made to the flora of Arunachal Pradesh by different scientists and researchers.

Therefore, it is very much needed to compile all those species published after 1998 and to put them into one available published flora. So all the species were compiled after 1998 by consulting all the different published literatures and compiled them as one report.

AREA AND LOCALITY

Entire Arunachal Pradesh

SUMMARY AND ACHIEVEMENTS

Two local tours were conducted to Sagali side and Itanagar side during which 19 species of orchids were collected of which 17 species were identified by consulting different literatures. A total 30 species of different genera, collected and made herbarium specimens, are *Eria arunachalensis* A.N. Rao, *Dendrobium aphyllum* (Roxb.) C.E.C. Fisch., *Vanda bicolor* Griff., *Bulbophyllum piluliferum* King & Pantl, *Dendrobium transparens* Wall. ex Lindl., *Dendrobium densiflorum* Lindl., *Ornithochilus difformis* (Wall. Ex Lindl.) Schltr., *Eulophia macrobulbon* (Parish & Rchb. F.) Hook. F., *Cymbidium bicolor* Lindl., *Aerides roseum* Loddiges ex Lindl. Ex Paxt., 11. *Gastrochilus calceolaris* (Buch.-Ham. Ex J.E. Sm.) D. Don, *Rhynchstylis retusa* Bl., *Eulophia promensis* Lindl., *Dendrobium chrysanthum* Wall. Ex Lindl., *Dendrobium chrysanthum* Wall. Ex Lindl., *Geodorum attenuatum* Grifft., *Peristylus constrictus* (Lindl.) Lindl. etc.

PROJECT-6

Enumeration of RET specimens of Arunachal Pradesh

Executing Scientist (s): Dr. K. Chowlu

Date of Initiation : November 2019

Date to be completion: March 2021

OBJECTIVE

Preparation of list of RET taxa available so far from Arunachal Pradesh

BACKGROUND

The vegetation of Arunachal Pradesh falls under four broad climatic categories and can be classified in five broad forest types with a sixty type of secondary forests. These are tropical forests, subtropical forest, pine forest, temperate forests and alpine forests. In the degraded forest bamboos and other grasses are of common occurrence.

AREA AND LOCALITY

Entire Arunachal Pradesh

SUMMARY AND ACHIEVEMENTS

Consulted all the possible species reported and available so far from Arunachal Pradesh. Plants Extinct and possibly/presumed Extinct is *Paphiopedilum wardii* Summerh. (Orchidaceae). Likewise the possible list of RET taxa is being preparing and it will be submitted in the final report.

PROJECT-7

Phyto-taxonomic studies in selected High Altitude Wetlands (HAWs) and its environs representing 5 districts of Arunachal Pradesh

Executing Scientist (s): Dr. M. R. Debta

Date of Initiation **:** August 2020

Date to be completion: March 2023

OBJECTIVE

Preparation of checklist of selected high altitude wetlands (HAWs) species along with their phytotaxonomic study.

BACKGROUND

The wetlands were selected after consultation with State Forest Department, scientists working earlier in BSI, Itanagar and by outreaching to local people. These were selected from Tawang, West Kameng, Upper Siang, Upper Dibang Valley and Lohit districts of Arunachal Pradesh.

AREA AND LOCALITY

05 districts of Arunachal Pradesh.

SUMMARY AND ACHIEVEMENTS

A checklist of 108 species was prepared along with preliminary description of 20 species based on literature and herbarium specimens. Relevant literatures were consulted and available herbarium specimens from ARUN and GBPNIHE, Itanagar were noted for further study.

BOTANIC GARDEN OF INDIAN REPUBLIC, NOIDA

PROJECT-1

Collection of plants for introduction in BGIR

Executing Scientist (s):
Target date of completion: Ongoing

SUMMARY AND ACHIEVEMENTS

BSI Regional Centres i.e. Northern Regional Centre, Dehradun; Central Regional Centre, Allahabad; Deccan Regional Centre, Hyderabad; Southern Regional Centre, Coimbatore; Andaman and Nicobar Regional Centre, Port Blair; Eastern Regional Centre, Shillong supplied saplings and seed to BGIR for introduction in the garden. Almost all introduced/conserved plants were maintained with assistance of outsourced services and scientific staffs by exercising de-weeding, mowing, hoeing, irrigation, etc. In connection with development and maintenance work, routine intercultural operations such as weeding, hoeing, watering, integrated insect pest and disease management operations were performed every month along with integrated Insect-Pest and disease management, Nutrient management etc. Some of the works were undertaken in Economic Plant Section, Medicinal Plant Section, Fruit Section, Periphery Woodland Area, Cactus and Succulent section and Aquatic Plant Section around the year. As and when required, new plant spp., were introduced in these sections. Plant labels were also placed wherever required. In ddition to this, pruning and de-weeding operations are being carried out around year. During this period, plant labels with brief descriptions were provided to all endemic trees planted in all eight forest types, Economic plant section, Medicinal Plant section and Fruit section, inventory list of all endemic plant species planted in various zones/sections in BGIR, about 20,000-22,000 hedge plants of *Hamelia patens* were planted for hedging and beautification. As per annual action programme for woodland development programme, 11 sp. were planted in Fruit section and 08 new species were introduced in EPS. Total plant species planted in proposed 09 forest types are as follow:

Whether common fruit bearing	
*	Used locally
✔	Common
NA	Not known
MU	MINOR USE(e.g using seeds)
	Not found any data
NO	No use of fruit

Table 1: List of existing species of Zone 2 and introduced

EXISTING

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	2	Manilkara hexandra	White or light yellow	December-January	March-April	150	*	12-25 m	growing	Yes
2	2	Terminalia arjuna	Pale yellow	April-May	October-November	170	✓	20-25 m	growing	Yes
3	2	Wrightia tinctoria	Light green yellowish	May-September	December-January	700	MU	3-15 m	growing	Yes
4	2	Syzygium cumini	white	March-April	May-july	220	*	10-30 m	growing	Yes
5	2	Ficus racemosa	Not seen	February-March	April-July	10	*	30 m	growing	Yes
6	2	Mangifera	Yellowish or reddish	March-April	June-July	10	✓	30 m	growing	Yes

		indica								
7	2	Schleichera oleosa	Greenish yellow	December-January	February-March	25	*	10-15 m	growing	Yes
8	2	Sterculia urens	Greenish yellow	October-January	February-June	10	*	15 m	growing	Yes
9	2	Artocarpus hirsutus	Yellowish green	November-January	July-September	50		35 m	growing	Yes
10	2	Lannea coromendelica	greenish	March-April	June-July	12	*	10-20 m	growing	Yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	2	Areca catechu	White, yellow	April-June	*	20 m	4-8 years	Partial
2	2	Ceiba pentandra	Creamy white or pale pink	February to June	*	45 m	4-5 years	Yes
3	2	Cycas revoluta (Gymnosperm)	-	Once every 3 to 4 years		6-7 m	more than 10 years	No
4	2	Dalbergia lanceolaria	Purplish white	May to June	NA	20 m	7-8 years	Yes
5	2	Dalbergia sissoo	Whitish to pink	March to May	NA	25 m	7-8 years	Yes
6	2	Ficus religiosa	red	January to June	NA	30 m	10 years	Yes
7	2	Manihot esculenta	Pale yellow cream/ tan	February to May	✓	3 m	crop plant	No
8	2	Mimusops elengi	cream	April	*	16 m	3-4 years	Yes
9	2	Saraca asoca	Gold/yellow sometimes pink or white	December to March	MU	7-10 m	6-8 years	Yes
10	2	Spondias	Greenish white	April to June	MU	10-15 m	5 years	Yes

		pinnata						
11	2	Syzygium cumini	white	March to April	*	10-30 m	5-7 years	Yes
12	2	Trachycarpus takil	Brown or tan		NO	10-15 m	10 years	No
13	2	Triphasia trifolia	white	December to April	*	3 m		Partial
14	2	Washingtonia robusta	cream	March to June	NA	25 m	5-8 years	yes
15	2	Zamia furfuracea (gymnosperm)	-	March- April	NO	1.3-2 m	10 years	No
15	2	Agathis robusta	purple	-	NA	50 m	8-10 years	yes
15	2	Cinnamomum zeylanicum	green	April-May	NA	10-15 m	4-5 years	Yes
15	2	Diospyros malabarica (Desr.) Kostel.	Ochre-yellow	May-June	MU	37 m	8-10 years	Yes
15	2	Elaeocarpus sp.	White, tinted purple	October		10-12 m	5 years	yes
15	2	Livistonia chinesis	Blue-black	February-April	NA	9-15 m	10 years	Partial
15	2	Saraca asoca (Roxb.) Willd.	Gold/yellow, sometimes pink or white	February -May	MU	9 m		yes

Table 2 List of existing species of Zone 2 and introduced

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow

1	2	Syzygium cumini	white	March-April	May-July	50	*	10-30 m	growing	Yes
2	2	Manilkara hexandra	White or light yellow	December-January	March-April	55	*	12-25 m	growing	Yes
3	2	Azadirachta indica	white	April-June	June-August	15	MU	15-20 m	growing	Yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	2	Alstonia scholaris	Greenish white or greyish color	October		40 m	8-10 years	yes
2	2	Azardirachta indica	white	February to March	MU	15-20 m	4-5 years	yes
3	2	Cymbidium aloifolium	Yellow with red stripes	March to June				
4	2	Lagerstroemia sp.	Pink, purple	August to October		20 m	3 years	yes
5	2	Manilkara hexandra	White or light yellow	August to December	*	12-25 m	5-8 years	Yes
6	2	Melia azedarach	Purple or lilac	September to November	*	15.2 m	5-6 years	Yes
7	2	Murraya koenigii	white		*	4-6 m	3-5 years	Partial
8	2	Neolamarckia cadamba	Red to orange	July to August	NA	45 m	5 years	Yes

9	2	Pithecellobium dulce	white	June to August	✓	10-15 m	2-3 years	Yes
10	2	Podocarpus neriifolius	yellow	March to mid April	MU	10-15 m	4 years	yes
11	2	Pterospermum acerifolium	white	March to June	NA	12-15 m	4-5 years	Yes
12	2	Putranjiva roxburghii	yellow	March to June	NA	20-22 m		Yes
13	2	Syzygium cumini	white	October	*	10-30 m	5-8 years	yes
14	2	Tabernaemontana	white	February to March	NA	1.5-1.8 m	2-3 years	Partial
15	2	Terminalia bellirica	Greenish yellow	March to June	MU	35 m	8-10 years	yes
16	2	Thevetia peruviana	yellow	August to October	MU	1.5-4 m	1-2 years	partial

Table 3 List of existing species of Zone 3 introduced

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	3	Albizia lebbeck	cream	April-July	September	75	NA	20-25 m	Growing	yes
2	3	Anogeissus latifolia	Pale green or yellow	May-July	December	77		35 m	Growing	yes
3	3	Bridelia retusa	Creamy white	May-August	July-September	57	MU	8 m	Growing	yes
4	3	Cassia fistula	yellow	April-July	August-October	20	MU	10-20 m	Growing	Yes

5	3	Senna sulfurea (=Cassia glauca	Bright yellow (drying orange or pinkish brown)	January-Februar y	April-May	10		5.4-6 m	Growi ng	yes
6	3	Dalbergia latifolia	white	January-Februar y	March-April	20	NA	20-40 m	Growi ng	yes
7	3	Grewia tiliaefolia	Bright pink	January	January-February	23	*	18 m	Growi ng	yes
8	3	Hardwickia binata	Pale yellowish green	July-August	September-February	75	NA	25-30 m	Growi ng	yes
9	3	Holoptelea integrifolia	Greenish - yellow to brownish	March-April	May-August	50	MU	25 m	Growi ng	yes
10	3	Kigelia africana	Dark red	April-May	January-February	3	NO	15-18 m	Growi ng	yes
11	3	Psidium guajava	white	April-June	July-October	20	✓	6-10 m	Growi ng	yes
12	3	Pterocarpus marsupium	yellow	July-Septem ber	April-June	5	MU	30 m	Growi ng	yes
13	3	Pterospermum acerifolium	white	March-July	July-August	25	NA	15-21 m	Growi ng	yes
14	3	Salvadora persica	Greenish yellow	January-April	July	3	*	6-7 m	Growi ng	yes

15	3	Schleichera oleosa	Greenish yellow	Februar y-March	August-September	34	*	10-15 m	Growi ng	yes
16	3	Sapindus mukorossi	white	May-June	November-January	5	MU	12-20 m	Growi ng	yes
17	3	Spathodea campanulata	Reddish orange or crimson (rarely yellow)	March-April	July-November	25	MU	7-12 m	Growi ng	yes
18	3	Syzygium cumini	white	May June	July-August	57	*	10-30 m	Growi ng	yes
19	3	Terminalia arjuna	Pale yellow	April-May	September-November	60	MU	20-25 m	Growi ng	yes
20	3	Terminalia bellirica	Greenish yellow	April-June	November-February	65	MU	35 m	Growi ng	yes
21	3	Terminalia chebula	Dull white to yellow	April-June	January-March	60	*	38 m	Growi ng	yes
22	3	Thespesia populnea	Yellow or orange	January-March	July-November	20	*	6-9 m	Growi ng	yes
23	3	Trewia nudiflora	Pale green	Februar y-March	July-November	30	NA	5 m	Growi ng	yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	3	Alstonia sp.	Greenish white or	October		40 m	8-10 years	yes

			greyish color					
2	3	Annona reticulata	Greenish yellow	May to June	*	7.5 m	3-4 years	partial
3	3	Anogeissus latifolia	Pale green or yellow	June to September		35 m	5-8 years	yes
4	3	Bottle Palm (Hyophorbe lagenicaulis)	White or cream	-		6 m	6-10 years	no
5	3	Caryota sp.(fishtail palm)	white			2.4-6 m	10-20 years	no
6	3	Cycas revoluta (Gymnosperm)	-	Once every 3 to 4 years	MU	6-7 m	more than 10 years	no
7	3	Garcinia cowa	Mostly pale yellow	December to September	*	15 m	10-12 years	yes
8	3	Lagerstroemia speciosa	Pink or purple	June to July	NA	20 m	3 years	yes
9	3	Lagerstroemia sp.	Pink or purple	August to October		20 m	3 years	yes
10	3	Mangifera indica	Yellowish or reddish	November to December	✓	3.7 m	5 or more years	yes
11	3	Manilkara hexandra	White or light yellow	August to December	*	12-25 m	5-8 years	yes

12	3	Melia azedarach	Purple or lilac	September to November	*	15.2 m	5-6 years	yes
13	3	Moringa oleifera	white	January		10-12 m	2-3 years	yes
14	3	Neolamarckia cadamba	Red to orange	June to August	MU	45 m	5 years	yes
15	3	Pithecellobium dulce	white	March to mid April	✓	10-15 m	2-3 years	yes
16	3	Podocarpus neriifolius	yellow	March to June	MU	10-15 m	4 years	yes
17	3	Pterospermum acerifolium	white	March to June	NA	12-15 m	5-7 years	yes
18	3	Salix alba	Gray green	February	NO	30 m	20 years	yes
19	3	Schefflera arboricola	White, pink or red	Once in a while (May to June)		2.5-3 m	10 years	partial
20	3	Syzygium cumini	white	March to April	*	10-30 m	5-8 years	yes
21	3	Tabernaemontana divaricata	white	March to June	NA	1.5-1.8 m	2-3 years	partial
22	3	Terminalia bellirica	Greenish yellow	April to May	MU		8-10 years	

23	3	Thevetia peruviana	yellow	Throughout the year	MU	1.5-4 m	2-3 years	yes
24	3	Triphasia trifolia	white	December to April	*	3 m	3-4 years	no
25	3	Washingtonia robusta	cream	March to June	NA	25 m	5-8 years	partial
25		Grewia asiatica L.	Yellow	March-June	*	8 m	4-6 years	yes
25		Lagerstroemia sp.	White to purple	August to October				yes
25		Madhuca longifolia var. latifolia (Roxb.) A.Chev	Creamy white	February-April	NO	20 m	10 years	yes
25		Manilkara hexandra	White or light yellow	August to December	*		5-8 years	
25		Sapindus laurifolius Balb. ex. DC.	Creamy white	December-March		6 m	9-10 years	
25		Terminalia chebula	Dull white to yellow	February -May	*		10-20 years	

Table 4 List of existing species of Zone 4 and introduced plants

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	4	Albizia lebbeck	cream	April-July	September-December	33	NA	20-25	growing	Yes
2	4	Anogeissus latifolia	Pale green or yellow	September-November	December-January	40		35 m	growing	Yes
3	4	Bridelia retusa	Creamy white	November-January	February-April	50	MU	8 m	growing	Yes

4	4	Cassia fistula	yellow	April-July	August-December	25	MU	10-20 m	growing	yes
5	4	Hardwickia binata	Pale yellowish green	July-August	September-January	80	NA	25-30 m	growing	yes
6	4	Holoptelea integrifolia	Greenish - yellow to brownish	January-February	April-May	56	MU	25 m	growing	yes
7	4	Terminalia bellirica	Greenish yellow	April-June	November-January	60	MU	35 m	growing	yes
8	4	Terminalia arjuna	Pale yellow	April-June	July-August	55	MU	20-25 m	growing	yes
9	4	Syzygium cumini	white	April-May	June- July	67	*	10-30 m	growing	yes
10	4	Dalbergia latifolia	white	December-February	March-April	20	NA	1.5-2 m	growing	yes
11	4	Grewia tiliaefolia	Bright pink	Decemeber-January	February	55	*	18 m	growing	yes
12	4	Kigelia africana	Dark red	March-May	June-July	3	NO	15-20 m	growing	yes
13	4	Pterocarpus marsupium	yellow	May	June	45	MU	30 m	growing	yes
14	4	Schleichera oleosa	Greenish yellow	March-April	May-June	25	*	10-15 m	growing	yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	4	Acacia catechu	yellow	June to August	NO	15 m	5-7 years	yes

2	4	Acalypha hispida	Bright red to deep pink	February to June	NO	1.5-3.7 m	4-6 years	no
3	4	Adenium obesum	Creamish-white with violet edges	July to September	NA	1.8-2.7 m	1-2 years	no
4	4	Aegle marmelos	Greenish white	January to May	*	13 m	4-5 years	yes
5	4	Albizia lebbeck	cream	February to April	NA	20-25	8-10 years	Yes
6	4	Albizia sps(BL)	cream	February to June		7-15 m	8-10 years	yes
7	4	Annona reticulata	Greenish yellow	May to June	*	7.5 m	3-4 years	yes
8	4	A indica	white	May to June	MU			
9	4	Anogeissus latifolia	Pale green or yellow	September to March		35 m	5-8 years	yes
10	4	Azadirachta indica	white	April to June	MU	15-20 m	4-5 years	yes
11	4	Barleria prionitis	Yellow or pale orange	August to March	NA	1.8 m	1 year	no
12	4	Bauhinia sp.	purple	January to June		6-12 m	2 years	yes
13	4	Bauhinia variegata	Pink or dark purple	January to April	MU	6-12 m	3-4 years	yes
14	4	Clerodendrum indicum	white	na	NA	1.5-3 m	2-3 years	no
15	4	Cassia fistula	yellow	May to July	MU		10 years	
16	4	Cassia glauca	yellow	May to June		5.4-6 m	8-10 years	yes
17	4	Jacaranda sps	Purple, white	January to March		20 m	2-14 years	yes
18	4	Mimusups sps	cream	June to July		25 m	3-4 years	yes
19	4	Cycas beddomei	-	Once every 3 to 4 years		3.5 m	more than 10 years	no

20	4	Dalbergia sissoo	Whitish to pink	March to May	NA	25 m	7-8 years	yes
21	4	Desmodium oojeinense	White or pink	February to May	NA	7-14 m	6-8 years	yes
22	4	Parkia sps	Bright red	March to May		10-15 m	5-7 years	yes
23	4	Ehretia laevis	white	January to April	MU	9 m	4-5 years	yes
24	4	Euphorbia sp.	Yellow, red also	March to June		.45 m	2-5 years	no
25	4	Ficus elastica	Not seen	March to May	NA	30 m	13 years	yes
26	4	Ficus panda	Not seen	March to May		2-30 m	5-7 years	yes
27	4	Gardenia turgida	White turning yellow with time	November to January		8 m	3-5 years	yes
28	4	Ginkgo biloba	yellow	April to May		50 m	20 years	yes
29	4	Haplophragma adenophyllum	Pale yellow	March to May		10-15 m	4-5 years	yes
30	4	Jacaranda mimosifolia	blue	Late May or early June	NA	20 m	2-14 years	yes
31	4	Jatropha gossypiifolia	Dark red	March to June	NA	2 m	2-3 years	no
32	4	Lagerstroemia speciosa	Pink or purple	June to July	NA	20 m	3 years	yes
33	4	Livistona chinensis (chinese fan palm)	Blue-black	-	NA	15 m	10 years	yes
34	4	Livistona decipiens (ribbon fan palm)	yellow	-	NA	9-10 m	10 years	yes
35	4	Madhuca indica	cream	March to May		20 m	10 years	yes
36	4	Manilkara hexandra	White or light yellow	August to December	*	12-25 m	5-8 years	yes
37	4	Melia azedarach	Purple or lilac	September to November	*	15.2 m	5-6 years	yes
38	4	Murraya koenigii	Cream,	July to August	*	2-5 m	3-5 years	yes

			white					
39	4	Murraya paniculata	white	-	MU	6 m	3-4 years	yes
40	4	Phyllanthus emblica	white	March to April	*	18 m	8-10 years	yes
41	4	Pithecellobium dulce	white	March to mid-April	✓	10-15 m	2-3 years	yes
42	4	Plumeria alba	White or creamish white	Throughout the year	NA	.9-6.1 m	1-3 years	yes
43	4	Pongamia pinnata	White, pink or lavender	April to June	NA	15-25 m	4-5 years	yes
44	4	Prosopis cineraria	Yellow or creamish white	February to May	MU	3-5 m	7-8 years	yes
45	4	Putranjiva roxburghii	yellow	March to May	NA	20-22 m		yes
46	4	Salix alba	Gray green	February	NO	30 m	20 years	yes
47	4	Santalum album	Purplish brown	March to April and September to October	MU	20 m	7-10 years	yes
48	4	Saraca asoca	Gold/yellow, sometimes pink or white	December to March	MU	7-10 m	6-8 years	yes
49	4	Schefflera arboricola	White, pink or red	Once in a while (May to June)		2.4-3 m	5 years	yes
50	4	Schleichera oleosa	Greenish yellow	March to June	*	10-15 m	5-8 years	yes
51	4	Spondias pinnata	Greenish white	April to June	MU	10-15 m	5 years	yes
52	4	Sterculia urens	Greenish yellow	January to April	*	15 m	5-7 years	yes
53	4	Tabernaemontana divaricata	white	March to June	NA	1.5-1.8 m	3-4 years	partial

54	4	Tamarindus indica	Yellow with red veins	January to April	✓	12-14 m	3-4 years	yes
55	4	Tecomella undulata	red to orangish red	December to February	MU	2-6 m	3-4 years	no
56	4	Terminalia arjuna	Pale yellow	May to June	MU		6 years	
57	4	Terminalia bellirica	Greenish yellow	April to May	MU		7-8 years	
58	4	Adansonia digitata L.	white	October-December	*	5-25 m	8-10 years	partial
59	4	Aegle marmelos (L.) Correa	Greenish white	May-June	*		4-5 years	
60	4	Annona squamosa L.	Greenish-yellow	April-August	✓	3-6 m	2-3 years	yes
61	4	Bauhinia tomentosa	yellow	November-December	MU	4 m	2 years	yes
62	4	Buchanania cochinchinensis (Lour.) M.R.Almeida	greenish	January- April		18 m	15-20 years	yes
63	4	Butea monosperma (Lam.) Taub.	Bright orange-red	February- April	NA	15 m	10-15 years	yes
64	4	Casuarina equisetifolia L.	red	February-June	NA	6-35 m	3-5 years	yes
65	4	Clerodendrum indicum (L.) Kuntze	white	January-May	NA	2.7 m		yes
66	4	Commiphora wightii (Arn.) Bhandari	Red to pink	November-July	NA	4 m	10 years	yes
67	4	Cordia macleodii Hook.f. & Thomson	white	April-June		9-12 m	12 years	yes
68	4	Desmodium oojeinense (Roxb.) H.Ohashi	Pink or light purple	December-February	NA	12 m		yes
69	4	Erythrrina suberosa		April-May	NA	12 m	8-10 years	yes

		Roxb.						
70	4	Ficus racemosa L.	Not seen	November-January	*	8 m	4-8 years	yes
71	4	Gardenia latifolia Aiton.	White turning yellow with time	April-July		30 m	10-15 years	yes
72	4	Haldina cordifolia (Roxb.) Ridsdale	Yellow often tinged with shade of pink	December-March	NA	40 m	5-8 years	yes
73	4	Hardwickia binata Roxb.	Pale yellowish green	August-september	NA	25-30 m	10-15 years	yes
74	4	Helicteres isora L.	Bright orange	April-December		1.5-3 m	6-7 years	yes
75	4	Indopiptadenia oudhensis	Greenish yellow	February-March		156-908m	5-8 years	yes
76	4	Lawsonia inermis L.	Yellow, red, white, Pink	April-July	NA	2-6 m	5 years	yes
77	4	Limonia acidissima L.	Cream/off-white, red, yellow/golden-yellow	March-May	*	9 m	8-10 years	yes
78	4	Manilkara hexandra (Roxb.) Dubard	White or light yellow	December-January	*			
79	4	Populus deltoids W.Bartram ex Marshall	Red, yellow	March-April		30-45 m	8 years	Yes
80	4	Pterocarpus marsupium Roxb.	yellow	November-January	MU	25 m	8-10 years	yes
81	4	Pterocarpus santalinus L.f.	yellow	February-May		8 m	3-5 years	yes

82	4	Prunus cerasoides	Pinkish white	October-November	MU	30 m	5-6 years	yes
83	4	Radermachera xylocarpa (Roxb.) ex K. Schum.	Red	March -April	NA	20 m	3-7 years	yes
84	4	Schleichera oleosa (Lour.) Merr.	Greenish yellow	March-April	*		5-8 years	
85	4	Shorea robusta Roxb. ex Gaertn.	white	January-March	MU	50 m		yes
86	4	Simarouba amara Aubl.	white	February- April	*	35 m	4-6 years	yes
87	4	Soymida febrifuga (Roxb.) A. Juss.	white	February- April	NA	25 m	5 years	yes
88	4	Strychnos nux-vomica L.	Pale green	March-May	MU	20 m	15-20 years	yes
89	4	Terminellia arjuna	Pale yellow	May-June	MU			
90	4	Terminelia elliptica	Dull yellow	April-May	NA	20 m	8 years	yes

Table 5 List of existing species of Zone 5 introduced

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	5	Wrightia tinctoria	Light green yellowish	August-October	November-December	45	MU	0.3-.75 m		no
1	5	Dalbergia sericea	Light pink	February-March	April	35		10 m		yes
1	5	Terminalia alata	Greenish yellow	March-May	June-August	66		32 m		yes
1	5	Terminalia bellirica	Greenish yellow	April-May	June	67	MU	30m		yes

1	5	Dalbergia sissoo	Whitish to pink	March-May	June-July	50	NA	25 m		yes
1	5	Albizia odoratissima	white	April-October	November-January	78	NA	15- 25 m		yes
1	5	Pithecolobium dulce	white	April-June	July-August	77	✓	10-15 m		yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	5	Aegle marmelos	Greenish white	June-September	*	8-10 m	4-5 years	yes
2	5	Melia dubia	Greenish white	January-December	*	0.6-0.7 m	2-3 years	no
3	5	Azadirachta indica	white	April-June	MU	15-20 m	4-5 years	yes
4	5	Bauhinia sp	pink	July to October		6-12 m	2 years	yes
5	5	Bauhinia variegata	Pink or dark purple	January-December	MU	6-12 m	2-3 years	yes
6	5	Euphorbia sp.	Yellow, red also	_		0.914 m	4-6 years	no
7	5	Ficus glomerata	Greenish white to purplish red	February-May	*	18 m	8-10 years	yes
8	5	Jatropha gossypiifolia	Dark red	January-December	NA	3 m	2-3 years	yes
9	5	Lagerstroemia parviflora	White to purple	Spring(March-May)	NA	30 m	2-3 years	yes
10	5	Lagerstroemia speciosa	Pink or purple	April-July	NA	20 m	3 years	yes

11	5	Pedilanthus tithymaloides	Bright white and pink	April-August	NO	2 m	5-7 years	yes
12	5	Portulacaria afra	pink	April-May		4.5 m		yes
13	5	Prosopis cineraria	Yellow or creamy white	August to January	MU	3-5 m	7-8 years	yes
14	5	Salvadora persica	Greenish yellow	February to June	*	6-7 m	3-7 years	yes
15	5	Tylophora indica	Greenish yellow outside and purplish within	October-December	NA	1.5- 2.5 m	5 years	yes
16	5	Cynanchum viminale (L.) L.	Yellow-green	August-May	MU	2 m	4 years	yes
17	5	Ephedra foliata	Pale yellow	-		0.3 m		no
18	5	Prosopis cineraria	Yellow or creamish white	August to January		3-5 m		yes
19	5	Senegalia catechu	Red	-	MU	15 m	5-7 years	yes
20	5	Senegalia visco	yellow	April-October	NA	6-12 m	3-4 years	yes

Table 6 List of existing species of Zone 6 introduced

Sl. No.	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Wheth provide shadow
1	6	Albizia lebbeck	cream	April-July	September	45	NA	18-30 m	growing	yes
2	6	Bridelia retusa	Creamy white	May-August	July-September	25	MU	10 m	growing	yes
3	6	Cassia fistula	yellow	April-July	October	3	MU	9-12 m	growing	yes

4	6	Gmelina arborea	Yellow tinged with brown	March-May	March-May yes	25	MU	3-30 m	growing	
5	6	Holoptelea integrifiloa	Greenish-yellow to brownish	May	May	44	MU	22 m	growing	yes
6	6	Mitragyna parvifolia	yellow	August-September	November-February	12	NO	12-15 m	growing	yes
7	6	Oroxylum indicum	Reddish purple outside and pale spinkish yellow within	June-July	November-February	55	*	18 m	growing	yes
8	6	Pterocarpus marsupium	yellow	July-September	April-June	5	MU	30 m	growing	yes
9	6	Schleichera oleosa	Greenish yellow	February-March	August-September	24	*	20 m	growing	yes
10	6	Spondius pinnata	Greenish white	May	June	34	MU	10-15 m	growing	yes
11	6	Sterculia urens	Greenish yellow	January-March	April-December	45	*	15-20 m	growing	yes
12	6	Terminalia arjuna	Pale yellow	April-May	September-November	66	MU	30 m	growing	yes
13	6	Terminalia bellirica	Greenish yellow	April-June	December-January	67	MU	30 m	growing	yes
14	6	Dalbergia latifolia	white	December-February	March-May	45	NO	20-40 m	growing	yes

S.NO	Zone	To be introduced species	Colour of flower	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow

1	6	Shorea robusta	white	October-January	MU	20-25 m	15 years	yes
2	6	Terminalia bellirica	Greenish yellow	October-January	MU	30 m	7-8 years	yes
3	6	Desmodium sps	Pink or light purple	April-May		10-12 m	6-8 years	yes
4	6	Robinia sps	White to pink or pinkish-red	January-March		12-30 m	10-15 years	yes
5	6	Dalbergia latifolia	white	December-February	NA	20-40 m	8-10 years	yes
6	6	Acacia auriculiformis	Light green yellowish	March-April	NA	12 m	5-6 years	yes
7	6	Phoenix sylvestris	white	January-December	MU	4-15 m	7-10 years	yes
8	6	Shorea robusta	white	October-January		20-25 m		yes
9	6	Terminalia bellirica	Greenish yellow	October-January	MU	30 m		yes

Table 7 List of existing species of Zone 7 and introduced (Subtropical Dry evergreen forest)

S.No	Zone	Name of the existing species	Colour of flower	Flowering season	Fruiting season	No. of trees already existing	Whether common fruit bearing	Approx. height of grown up tree	Approx time taken to grow	Whether provides shadow
1	7	Aegle marmelos	Greenish white	June-September	October-December	10	*	8-10 m	Growing	yes

2	7	Bauhinia purpurea	pink	September-December	January-March	22	MU	17 m	Growing	yes
3	7	Bridelia retusa	Creamy white	December-January	February-April	34	MU	10 m	Growing	yes
4	7	Ceiba pentandra	Pink, pale pink, pale yellow, white, creamy white	March	April	7	*	15 m	Growing	yes
5	7	Dalbergia latifolia	white	December-February	March-April	20	NO	20-40 m	Growing	yes
6	7	Gmelina arborea	Pale yellow to cream colored or pinkish-buff	February-April	May-July	29	MU	3-30 m	Growing	yes
7	7	Grewia optiva	Yellowish red	May-August	September-November	35	MU	13-15 m	Growing	yes
8	7	Haldina cordifolia	Yellow often tinged with shade of pink	June-July	October-November	44	NA	18-30 m	Growing	yes
9	7	Jatropha curcas	Dark or crimson red	March-July	August-November	25	MU	6 m	Growing	yes
10	7	Mitragyna parvifolia	yellow	July-August	September-October	10	NO	12 -16 m	Growing	yes
11	7	Schleichera oleosa	Greenish yellow	February-March	August-September	34	*	20 m	Growing	yes
12	7	Firmiana simplex (=Sterculia urens)	Greenish yellow	January-February	March-April	43	*	7.-10.6 m	Growing	yes
13	7	Terminalia arjuna	Pale yellow	April-May	September-November	67	MU	30 m	Growing	yes

14	7	Terminalia bellirica	Greenish yellow	April-June	December-January	66	MU	30 m	Growing	yes
15	7	Trewia nudiflora	Pale green	February-March	July-November	10	NA	5-10 m	Growing	yes

Sr. No.	Zones	Species to be introduced	Flower colour	Flowering season	Whether common fruit bearing	Approx. height of grown up tree	Approx. time taken to grow	Whether provides shadow

As part of Seed Bank development programme, seeds of total 45 species and 3120 plants were placed for germination some of which are: *Hardwickia binata* (102), *Caesalpina bundoc*(141), *Sterculia urens*(211), *Cassia tora* (121), *Melia arborea*(310), *Mitragyna parvifolia* (232), *Cassia fistula* (121), *Limonia acidissima*(72), *Bauhinia variegata*(21), *Bauhinia acuminata* (44), *Helicteres isora*(34), *Tectona grandis*(128), *Catharanthus roseus* (150), *Putranjiva roxburghii*(250), *Terminalia arjuna* (100), *Mimosa pudica*(50), *Albizia lebbeck*(50), *Abrus precatorius* (70), *Dalbergia lanceolata*(19), *Grewia nervosa*(12), *Albizia lebbeck* (10), *Mitragyna parvifolia* (54), *Acacia nilotica*(11) etc. To develop seed database, Data of 33 endemic trees were filled in data entry sheets. Seeds of 45 species were placed for seed germination As a result about 4315 plants were germinated and were growing in seed bank plant conservatories. Phenological study w.r.t flowering, fruiting, seed setting, seed harvest of 43 endemic tree species was carried round the year.

PROJECT-1

Ethnobotanical study of some tribal populated districts of Bihar, India

Executing Scientist (s): Dr. K.A.A. Kabeer, Sri A.C. Halder, Dr. R. Saravanan Dr. M. Mishra & Dr. P. A. Dhole

Date of Initiation : April 2018

Date to be completion: March, 2021

OBJECTIVE

Collection and consolidating the entire knowledge among tribal people regarding the plant- uses existing among tribal communities of the state through folklore survey and field works in some highly tribal populated areas and nearby forests of the state, collection and identification of plants and plant products used by the tribes for various purposes, documentation of traditional knowledge about plants and preparation of inventories of folklore plants, comparative study with already published literature to find out new or less known uses, live collection of rare and important ethnobotanical plants to develop small-scale ethnobotanical garden for *ex-situ* conservation point of view and survey of of countryside socio-religious fairs and festivals for collection of little or unknown ethnobotanical items /artefacts /handicrafts that may enrich the ethno-museum of C.B.L. and yield interesting information.

BACKGROUND

This project was started in 2018. Four field tours were conducted Aurangabad, Madanpur, Maharajganj, Arwal, Purnea, Banmankhi, Katihar and Barsoi Forest Divisions of Aurangabad, Nawada, Araria, Kishanganj, Purnea, Katihar, Gaya and Nalanda Districts and surveyed a total areas of 10,000 sq.km. during which a total of 535 field nos. were collected along with 962 ethnobotanical information with the help of medicine man (Baidya or older village people). A total of 176 plant specimens were identified, documented and 80 plant specimens have been mounted. Beside a total of 03 exhibits were collected for ethnobotanical museum.

AREA AND LOCALITY

14 districts of the state of Bihar *viz.* West Champaran, Araria, Kishangang, Purnea, Katihar, Banka, Jamur, Nawada, Nalanda, Gaya, Aurangabad, Arwal, Rohtas and Kaimur

SUMMARY AND ACHIEVEMENTS

Seven (07) ethnobotanical tours were undertaken in densely tribal populated regions of 13 districts of Bihar during which 1159 species were collected with 1210 ethnobotanical information gathered from medicine man and local villagers. Some dominant families are used for various purposes by the tribal people are Leguminosae (61), Malvaceae (29), Lamiaceae (25), Compositae (21), Apocynaceae (19), Poaceae (16), Euphorbiaceae (15), Rubiaceae (13), Moraceae (12), Solanaceae (11), Amaranthaceae (11), Combretaceae (10), Convolvulaceae (10). These plant species are used by the local tribes and other rural people for different purposes. It is analysed that 143 plant species are used for edible, Ethnomedicine (283), religious (24), veterinary (44), magico-belief (25), detergent (4), house hold articles (48), fodder (100), dye (10),

agricultural implements (10), toothbrush (21), sold in weekly market (25), gum (3), scorpion sting (11), snake bite (7), rope (23), biofencing (12), building / thatching materials (23), insect repellent ((9), fuels (33), timber (5), fish poison (8), fish catching instrument (2), oil (5), fragrance (2), country liquor (1) and miscellaneous (43) etc. As far as group wise utilization is concerned, it is analysed that 171 ethnobotanical information used for food, 596 for ethnomedicine, 47 for veterinary, 91 for fodder, 29 for fuel, 23 for rope, 4 for gum, 10 for dye, 05 for oil, 07 for insect repellent, 03 for snake repellent, 04 for detergent, 02 for beverage, 01 for condiments, 03 for fragrance, 08 for fish poison, 02 for fish catching instrument, 50 for household article, 15 for toothbrush, 10 for agricultural implement, 24 for building materials, 23 for magico-beliefs, 22 for religious, 08 for bio-fencing and 46 for other miscellaneous purposes collected during the study.

PROJECT-2

Chromosome count of Genus *Impatiens* of Sikkim/Darjeeling

Executing Scientist (s): Dr. (Mrs.) Monika Mishra
Date of Initiation **:** September 2018
Date to be completion: March 2021

OBJECTIVE

Study of Chromosome number of selected *Impatiens* species of Sikkim and Darjeeling Himalaya.

BACKGROUND

The project was initiated in 2018. Meiotic studies of nine *Impatiens* species (*Impatiens exilis* Hook.f., *Impatiens radiata* Hook.f., *Impatiens discolor* DC., *Impatiens spirifer* Hook. f. & Thomson, *Impatiens drepanophora* Hook.f., *Impatiens scabrida* Hook. f., *Impatiens racemosa* DC., *Impatiens sulcata* Wall. and *Impatiens pulchra* Hook. f. & Thomson were completed.

AREA AND LOCALITY

Sikkim and Darjeeling

SUMMARY AND ACHIEVEMENTS

A total of 14 species of *Impatiens* were investigated for chromosome count out of which chromosome number was reported for 09 species (*I. stenantha*, *I. falcifer*, *I. exilis*, *I. radiata*, *I. discolor*, *I. drepanophora*, *I. scabrida*, *I. racemosa* and *I. sulcata*) as in 05 species (*I. arguta*, *I. tripetala*, *I. gammae*, *I. pulchra* and *I. spirifer*) no dividing cells were noticed during the study. This investigation revealed a total of 04 haploid chromosome numbers i.e, n=7, 8, 9 and 10. Among these investigated species, chromosome number n=7 was noticed for 02 species (*I. falcifer* and *I. exilis*); while n=9 was reported in 05 species (*I. stenantha, I. radiata, I. drepanophora, I. racemosa, I. sulcata*). Chromosome number n=8 and n=10 were noticed in 01 species each (*I. scabrida* and *I. discolor* respectively). However, this study confirmed the previous report on chromosome number of these species, but some differences from previous reports have also been noticed. On the basis of compiled chromosome data from this study as well as previous reports, it is obvious that most of the presently investigated species, except *I. stenantha* (2n=18), *I. exilis* (2n=14, 28), *I. discolor* (2n=20), showed dysploid numerical chromosome variations viz., *I. falcifer* (2n=14, 16), *I. radiata* (2n=18, 20), *I. drepanophora* (2n=18, 20), *I. scabrida* (2n=12, 14, 16, 18, 20), *I. racemosa* (2n=18, 20) and *I. sulcata* (2n=16, 18, 20). *I. exilis* show polyploidy here. As observations in this study were made on meiosis

of Pollen Mother Cells (PMCs), therefore data on karyomorphology could not be generated but it is clearly noticeable that all the species observed with *n*=9, showed a bimodal karyotype (where one pair (one in gamete) of chromosomes is distinctly longer than other chromosomes).as reported by previous workers. Other species which observed with chromosome number *n*=7, 8 and 10, do not show such type of karyotype structure and all the chromosomes in those species were more or less the same size. During this investigation, course of meiotic behaviour was also studied in these *Impatiens* species. The detailed observations made on PMCs revealed that most of the species (except *I. exilis*) showed various meiotic aberrations, namely univalents, precocious separation, stickiness, laggards, bridges, unequal segregations, late disjunction of bivalents, unoriented anaphase, non-synchronization and micronuclei at different stages of cell division. Average pollen fertility in these species was found to be 92 - 99 %.

PROJECT-3

Micro-algae and monitoring of water quality of Sadir Lake of AJCBIBG" Howrah

Executing Scientist (s): Dr. Pratibha Gupta
Date of Initiation **:** September, 2020
Date to be completion: Ongoing

OBJECTIVE

Monitoring water quality of Sadir Lake of AJCBIBG, Howrah to study the periodicity, succession, distribution and analysis of Physico-chemical parameters and observing the alteration in Micro-algal diversity and its abundance both qualitatively and quantitatively.

BACKGROUND

As all the Lakes of AJCBIBG, Howrah was surveyed which are interconnected. It was observed that sewage / polluted water is entering from outside in to Sadir Lake. So attempt has been made to study the periodicity, succession, distribution and analysis of Physico-chemical parameters of Micro-algae of Sadir Lake to see the alteration in Micro-algal diversity and its abundance, qualitatively and quantitatively.

AREA AND LOCALITY

Sadir Lake, AJCBIBG

SUMMARY AND ACHIEVEMENTS

08 survey visits were conducted to the study site during which 79 samples were collected along with 841 field Photographs and 51 Videos of which 81 species were identified. GPS readings were recorded from the sample collected areas. All the samples were brought into the Laboratory and preserved in Formalin and properly maintained for identification. Water Samples were analysed under Leica DM 2500 sophisticated Research Microscope using Leica Qvin 3.2 Image Analysis Software and Leica Application Suit V4 Software with annotation for identification. Altogether 79 readings of water samples from Sadir Lake were recorded by Purely Sensor Based Multiparameter water Proof Meter and analysed 08 parameters *viz.* pH, ORP, EC, TDS, Salinity, DO, Pressure and Temperature at a time. It was observed that DO reading of Sadir Lake, initially was almost near to permissible limit, slightly starts decreasing below the permissible limit and then again slightly improved in winter season. Due to influx of quantity of sewage / polluted water from

outside into the Sadir Lake, this area was almost completely covered with aquatic Macrophytes. Most of the pollution tolerant species are dominantly observed in the samples.

PROJECT-4

Wild edible plants of North east region in India: Anti nutritional properties, genotoxicity, DNA damage preventive activity, HPLC studies for vitamin and phenolics content

Executing Scientist (s): Dr. Tapan Seal
Date of Initiation **:** April 2018
Date to be completion: March 2022

OBJECTIVE

Estimation of chemical composition and nutritive value of wild edible plants of N.E. India

BACKGROUND

This project was initiated in 2018. One tour was conducted to ERC, BSI to avail fluorescence microscopy and carry out Haemolytic toxicity, Hepatotoxicity and Genotoxicity studies of sixty plants. Anti-nutrient composition, Oxalate estimation, Phytate content, Saponin content, Tannin content and Cyanogenic glycosides of 65 wild edible plants were studied, quantitative estimation of Phenolic acids and flavonoids (Rutin, quercetin, kaempferol, apigenin, myricetin, gallic acid, catechin, ferulic acid, coumarin, naringin, p-hydroxybenzoic acid, protocatechuic acid, gentisic acid, vanillic acid, aesculin, caffeic acid, syringic acid, p-Coumaric acid, naringenin, salicylic acid, ellagic acid, luteolin, and sinapic acid) content were carried out in thirty wild edible plants using HPLC along with estimation of water soluble vitamin (Vit C, Vit B1, Vit B2, Vit B3, Vit B5, Vit B6 and Vit B9) in thirty plant samples.

AREA AND LOCALITY

N.E. India

SUMMARY AND ACHIEVEMENTS

Proximate composition: The antinutrient composition: Oxalate estimation, Phytate content, Saponin content, Tannin content and Cyanogenic glycosides of fourty wild edible plants were studied.

HPLC study : Quantitative estimation of Phenolic acids and flavonoids (Rutin, quercetin, kaempferol, apigenin, myricetin, gallic acid, catechin, ferulic acid, coumarin, naringin, p-hydroxybenzoic acid, protocatechuic acid, gentisic acid, vanillic acid, aesculin, caffeic acid, syringic acid, p-Coumaric acid, naringenin, salicylic acid, ellagic acid luteolin, and sinapic acid) content in fourty wild edible plants were carried out using HPLC.

Vitamin estimation: Estimation of water soluble vitamin (Vit C, Vit B1, Vit B2, Vit B3, Vit B5, Vit B6 and Vit B9) in sixty eight plant samples were carried out by HPLC.

Toxicity studies : Hemolytic toxicity, Hepatotoxicity studies of thirty wild edible plants and Genotoxicity studies of fourty wild edible plants were carried out.

CENTRAL NATIONAL HERBARIUM, HOWRAH

PROJECT-1

Algal Flora of Purbasthali Wetland, Bardhaman, West Bengal

Executing Scientist (s): Dr R.K. Gupta
Date of Initiation : April, 2020
Date to be completion: March, 2023

OBJECTIVE
Documentation of Algal diversity of Purbasthali Wetland, Bardhaman, West Bengal.

BACKGROUND
This is a new project.

AREA AND LOCALITY
Bardhaman, West Bengal

SUMMARY AND ACHIEVEMENTS
One field tour was conducted to Purbasthali wetland, West Bengal covering an area of 3.50 sq. km. during which 93 samples of algae were collected from various habitats of the wetland along with GPS. Limnological parameters were also recorded in the spot itself and through outside agency (Sources, Colour, Odour, Taste, Arsenic, pH, EC, TDS, Temperature, DO, Nitrate, Nitrite, Ammonia and Light intensity etc.). Total 95 algal samples were studied and identified of which 35 species were described. This study reflected dominance of the members of Euglenophyceae, Cyanophyceae, Chlorophyceae and Bacillariophyceae in the above mentioned Wetland.

PROJECT-2

Angiospermic Flora of Neora Valley National Park, Kalimpong, West Bengal

Executing Scientist (s): Dr. Vinay Ranjan, Dr Gopal Krishna & Dr Anant Kumar
Date of Initiation : April, 2016
Date to be completion: March, 2021

OBJECTIVE
The need for botanical exploration in Neora valley national park was due to following points: added 75 km area in the park; accumulation of recent discoveries; and gap of more than two decade in studies on the flora and vegetation. The objective of present study was to: explore, identify and document the floristic diversity of the entire park area including newly added area of NVNP; prepare upgraded angiospermic flora with colour plant photographs; depict the exact coordinates location of plant species and impart training in collection, preservation, herbarium making and identifying the plant elements.

BACKGROUND

Three field tours were conducted to the study areas during which 543 field numbers were collected in duplicate along with GPS data and 1747 photographs. All the collected specimens were processed and 343 field numbers were identified so far.

AREA AND LOCALITY

Neora Valley National Park, Kalimpong Dist., West Bengal, 26°52'3"- 27°7'3" N latitude and 88°45'-88°50' E longitude.

SUMMARY AND ACHIEVEMENTS

Ten field tours were undertaken since inception of the project during which 1826 field numbers were collected in triplicate. All the specimens were identified. Unfortunate due to COVID-19 pandemic, no tours were approved in 2020-21. This study reported two species *viz. Goodyera recurva* Lindl. & *Zeuxine gracilis* (Breda) Blume as new to the state of West Bengal.

PROJECT-3

Bryo-flora of Jharkhand

Executing Scientist (s): Dr. Devendra Singh
Date of Initiation **:** April, 2018
Date to be completion: March, 2022

OBJECTIVE

Extensive and intensive survey and collection of specimens from different areas of the Jharkhand. Taxonomic characterization of the species based on morphological, anatomical and ultrastructural parameters. Documentation of Bryoflora of Jharkhand in the form of the illustrated flora.

BACKGROUND

Two field tours were conducted to different study areas of the state of Jharkhand during which 199 specimens were collected of which a total of 107 specimens belonging to 47 species of bryophytes collected from Jharkhand were identified along with preparation of illustrations, microphotographs and description of 30 species belonging to 20 genera and 15 families. In addition, oil-bodies of 06 species were also studied from freshly collected specimens.

AREA AND LOCALITY

Jharkhand, 20°58'–25°18'N latitudes and 83°22'–87°56'E longitudes; *c.* 79,714 sq. km.

SUMMARY AND ACHIEVEMENTS

112 specimens belonging to 45 species were identified *viz*. *Anthoceros punctatus* L., *Anthoceros subtilis* Steph., *Asterella wallichiana* (Lehm. & Lindenb.) Pande, K.P. Srivast. & Sultan Khan ex Grolle, *Bartramia roylei* (Hook. f.) Müll. Hal., *Bryum coronatum* Schwaegr, *Bryum pseudotriquetrum* (Hedw.) Schwaegr, *Cyathodium aureonitens* (Griff.) Mitt., *Cyathodium cavernarum* Kunze ex Lehm., *Cyathodium denticulatum* Udar & S.C.Srivast., *Cololejeunea latilobula* (Herzog) Tixier, *Entodontopsis tavoyensis* (Hook.) W.R. Buck & Ireland, *Erpodium mangifereae* Müll. Hal., *Fissidens involutus* Wilson ex Mitt., *Fissidens cranulatus*

Mitt., *Fissidens sylvaticus* Griff., *Fossombronia himalayensis* Kashyap, *Funaria hygrometrica* Hedw., *Frullania ericoides* (Nees) Mont., *Heteroscyphus hyalinus* (Steph.) Abha Srivast. & S.C. Srivast., *Hydrogonium consanguineum* (Thwaites & Mitt.) Hilp., *Hyophila involuta* (Hook.) Jaeger, *Hyophila nymaniana* (M. Fleisch.) M. Menzel, *Hydrogonium gracilentum* (Mitt.) P.C. Chen, *Lejeunea aloba* Sande Lac., *Lejeunea devendrae* (Sushil K. Singh) P.K.Verma & K.K.Rawat, *Lopholejeunea sikkimensis* Steph., *Marchantia linearis* Lehm. & Lindenb., *Notothylas anaporata* Udar & D.K.Singh, *Notothylas kashyapii* D.K.Singh, *Octoblepharrum albidum* Hedwig., *Plagiochasma appendiculatum* Lehm. & Lindenb., *Plagiochasma intermedium* Lindenb. & Gottsche, *Physcomitrium eurystomum* Sendtn., *Reboulia hemisphaerica* (L.) Radd var. *hemisphaerica*, *Phaeoceros carolinianus* (Michx.) Prosk, *Phaeoceros laevis* (L.) Prosk., *Riccia billardierei* Mont. & Nees, *Riccia curtisii* (James ex Austin) Austin, *Riccia frostii* Austin, *Riccia glauca* L., *Riccia huebeneriana* Lindenb.), *Riccia perssonii* Sultan Khan, *Riccia sorocarpa* Bisch. var. *sorocarpa*, *Solenostoma tetragonum* (Lindenb.) R.M.Schust. ex Váňa & D.G. Long var. *tetragonum*, *Spruceanthus minutilobulus* (Udar & U.S.Awasthi) Sushil K. Singh, *Targionia hypophylla* L. of which 42 species were illustrated and described. This study recorded one species for the first time in Indian bryoflora, five species for the first from Central India and ten species recorded for the first time from the state of Jharkhand.

PROJECT-4

Revision of the genus *Gastrochilus* D. Don (Orchidaceae) in India

Executing Scientist (s): Dr. Avishek Bhattacharjee
Date of Initiation **:** April, 2018
Date to be completion: March, 2022

OBJECTIVE
Revisionary study of the genus *Gastrochilus* in India.

BACKGROUND
Two field tours were conducted to Uttarakhand and South India during which three species *viz*. *Gastrochilus acutifolius* (Lindl.) Kuntze, *G. inconspicuus* (Hook.f.) Kuntze and [*Gastrochilus flabelliformis* (Baltt. & McCann) C.J. Saldanha (earlier misidentified as *G. acaulis* (Lindl.) Kuntze] were collected. In addition one Herbarium Consultation Tour were undertaken to BSD, DD, MH and TBGT during which total 289 specimens of *Gastrochilus* (Orchidaceae). Description of 20 species were drafted.

AREA AND LOCALITY
Throughout India

SUMMARY AND ACHIEVEMENTS

Description and correct citation of 20 species [*Gastrochilus acaulis* (Lindl.) Kuntze, *G. affinis* (King & Pantl.) Schltr., *G. acutifolius*, *G. arunachalensis* A.N. Rao, *G. bellinus* (Rchb. f.) Kuntze, *G. calceolaris*, *G. dasypogon* (Sm.) Kuntze, *G. distichus, G. flabelliformis, G. garhwalensis* Z.H. Tsi, *G. inconspicuous, G. intermedius* (Griff. ex Lindl.) Kuntze, *G. linearifolius* Z.H. Tsi & Garay, *G. nilagiricus* Kuntze, *G. obliquus* (Lindl.) Kuntze, *G. platycalcaratus* (Rolfe) Schltr., *G. pseudodistichus* (King & Pantl.) Schltr., *G. rutilans*

Seidenf., *G. sessanicus* A.N. Rao, *G. sonamii* Lucksom] were finalised along with recorded distribution and phenology. A key to the species of the genus *Gastrochilus* was prepared for easy identification of the taxa. _Specimen examined‘ for *Gastrochilus acaulis, G. acutifolius,* G. *dasypogon*, *G. obliquus* and *G. pseudodistichus* was finalised. Typification related problem of 03 species *viz. Gastrochilus affinis*, *G.* bellinus *G. dasypogon* was resolved.

PROJECT-5

Liverworts and Hornworts Flora of Darjeeling District, West Bengal

Executing Scientist (s): Dr. Monalisa Dey
Date of Initiation : April, 2016
Date to be completion: March, 2021

OBJECTIVE

Documentation of the Liverworts and Hornworts of Darjeeling district of West Bengal along with taxonomic description, illustration, nomenclature, specimens examined, note on their habitat preferences and an identification key for easy identification of the taxa.

BACKGROUND

One field tour was conducted to various localities of Darjeeling District of West Bengal during which 98 field numbers of specimens were collected. 211 specimens belonging to 38 species collected before by self from Darjeeling District, West Bengal were identified. Camera lucida illustration and microphotography of 07 species were studied.

AREA AND LOCALITY

Darjeeling district, West Bengal, 26^{o} 27‘–27^{o} 13‘ N latitudes and 87^{o} 59‘–88^{o} 53‘ E longitudes; c. 3,149 sq. km.

SUMMARY AND ACHIEVEMENTS

214 specimens, collected in previous field trips, belonging to 56 species were identified. Some of which are *Acanthocoleus gilvus* (Gottsche) Kruijt, *Cololejeunea latilobula* (Herzog) Tixier, *Cololejeunea longiana* Grolle & Mizut., *Cololejeunea serrulata* Steph., *Cololejeunea trichomanis* (Gottsche) Steph., *Cheilolejeunea trapezia* (Nees) Kachroo & R.M.Schust., *Colura tenuicornis* (A.Evans) Steph., *Drepanolejeunea erecta* (Steph.) Mizut., *Drepanolejeunea fleischeri* (Steph.) Grolle & R.L.Zhu, *Drepanolejeunea herzogii* R.L.Zhu & M.L.So, *Lejeunea anisophylla* Mont., *Lejeunea curviloba* Steph., *Lejeunea flava* (Sw.) Nees, *Lejeunea obscura* Mitt., *Lejeunea tuberculosa* Steph., *Leptolejeunea balansae* Steph., *Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn., *Lopholejeunea subfusca* (Nees) Schiffn., *Microlejeunea punctiformis* (Taylor) Steph., *Ptychanthus striatus* (Lehm. & Lindenb.) Nees., *Spruceanthus semirepandus* (Nees) Verd. etc. Description of 40 species *viz. Acrolejeunea infuscata* (Mitt.) Jian Wang bis & Gradst., *Acrolejeunea recurvata* Mitt., *Bazzania himalayana* (Mitt.) Schiffn., *Bazzania ovistipula* (Steph.) Abeyw., *Bazzania tridens* (Reinw., Blume & Nees) Trevis., *Cheilolejeunea trapezia* (Nees) Kachroo & R.M.Schust., *Cololejeunea latilobula* (Herzog) Tixier, *Cololejeunea longiana* Grolle & Mizut., *Cololejeunea serrulata* Steph., *Cololejeunea trichomanis* (Gottsche) Steph., *Colura tenuicornis* (A.Evans)

Steph., *Drepanolejeunea angustifolia* (Mitt.) Grolle, *Drepanolejeunea erecta* (Steph.) Mizut., *Drepanolejeunea fleischeri* (Steph.) Grolle & R.L.Zhu, *Drepanolejeunea herzogii* R.L.Zhu & M.L.So, *Drepanolejeunea yunnanensis* (P.C.Chen) Grolle & R.L.Zhu, *Frullania muscicola* Steph., *Frullania retusa* Mitt., *Frullania nepalensis* (Spreng.) Lehm. & Lindenb., *Heteroscyphus bescherellei* (Steph.) S.Hatt., *Heteroscyphus coalitus* (Hook.) Schiffn., *Lejeunea anisophylla* Mont., *Lejeunea curviloba* Steph., *Lepidozia reptans* (L.) Dumort., *Leptolejeunea subdentata* Schiffn. ex Herzog, *Lopholejeunea subfusca* (Nees) Schiffn., *Marchantia emarginata* Reinw., Blume & Nees, *Marchantia linearis* Lehm. & Lindenb., *Metacalypogeia alternifolia* (Nees) Grolle, *Metzgeria consanguinea* Schiffn., *Microlejeunea punctiformis* (Taylor) Steph., *Plagiochila flexuosa* Mitt., *Plagiochila fruticosa* Mitt., *Plagiochila khasiana* Mitt., *Plagiochila nepalensis* Lindenb., *Plagiochila parvifolia* Lindenb., *Radula auriculata* Steph., *Radula obscura* Mitt., *Radula pocsii* K.Yamada, *Radula stenocalyx* Mont. was prepared. This study designated *Drepanolejeunea mawtmiana* as a new synonym of *Drepanolejeunea herzogii*.

PROJECT-6

Editing of Flora of Bihar Vol. 1 (Ranunculaceae-Mimosaceae)

Executing Scientist (s): Dr. Dr Vinay Ranjan, Dr Kumar Avinash Bharati and Dr Anand Kumar
Date of Initiation : April, 2020
Date to be completion: March, 2021

OBJECTIVE
Editing manuscripts from Ranunculaceae to Mimosaceae

BACKGROUND
This is a new project

AREA AND LOCALITY
NA

SUMMARY AND ACHIEVEMENTS

Editing of the Manuscript comprising of 521 taxa, 237 genera, 59 families and 106 cultivated taxa was completed.

PROJECT-7

Editing of Flora of Jharkhand Vol. 1 (Ranunculaceae-Mimosaceae)

Executing Scientist (s): Dr. Dr Vinay Ranjan, Dr Kumar Avinash Bharati and Dr Anand Kumar
Date of Initiation : April, 2020
Date to be completion: March, 2021

OBJECTIVE

Editing manuscripts from Ranunculaceae to Mimosaceae.

BACKGROUND

This is a new project

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

Editing of the Manuscript comprising of 524 taxa, 239 genera, 61 families and 106 cultivated taxa was completed.

CENTRAL REGIONAL CENTRE, ALLAHABAD

PROJECT-1

Morphological and cytological studies of selected plants from CRC, Garden, Allahabad

Executing Scientist (s): Dr. Ashutosh Kumar Verma
Date of Initiation : 2020
Date to be completion: 2021

OBJECTIVE

Morphological and phenological characterisation of selected taxa and assessing intra-specific cytotypic diversity of selected taxa.

BACKGROUND

This is a new project. Botanic gardens, repositories of living plant collections of different taxa, cumulatively conserve 6 million accessions of living plants, representing around 80000 taxa or about one fourth of estimated number of vascular plant species globally. Botanic gardens, not only serve as taxonomic and systematic research centres, but also play an important role as center for wild germplasm of economically important species, ecological data generation, study of plant physiology & plant growth tactics and study of plant animal interactions. Although botanic gardens have great potential to contribute in different streams of biological sciences but in true sense they remain unexplored as generally their activities are mainly confined to collection, introduction and maintenance of plant species. In order to overcome this lacunae there is need to follow _KNOW YOUR GERMPLASM' approach which provides better foundation to researchers for their research programmes, where inter and intraspecific morphological and genetic diversity of garden plants are assessed and various databases like morphometeric database, phenological database, chromosome count database etc. are generated to provide actual picture of botanic gardens with respect to germplasm collections. Botanic garden of the Botanical Survey of India, Central Regional Center (CRC), Allahabad, covering about 2.5 hectares area, harbours 638 species having medicinal, economically important, ornamentals rare and threatened plants belonging to 111 families. This project was proposed to study a total number of 51 species of angiosperms belonging to 37 genera under 20 families in morplo-cytological frame.

AREA AND LOCALITY

BSI, CRC, Garden, Allahabad

SUMMARY AND ACHIEVEMENTS

A total number of 51 species belonging to 37 genera under 20 families were analyzed in morphological and cytological frame *viz. Achyranthes aspera* L. (2n=28), *Allium tuberosum* Rottler ex Spreng.(2n=28), *Aloe vera* (L.) Burm. F. (2n=14), *Antigonon leptopus* Hook. & Arn. (2n=42), *Asparagus racemosus* Willd (2n=44), *Azadirachta indica A.* Juss. (2n=28), *Basella alba* L. (Green) (2n=44), *Bauhinia purpurea* L. (2n=28), *Bauhinia variegata* L. (2n=28), *Boerhavia diffusa* L. (2n=56), *Caesalpinia pulcherrima* (L.) Sw. (2n=28), *Cassia fistula* L. (2n=28), *Chlorophytum comosum* (Thunb.) Jacques (2n=28), *C. nepalense* (Lindl.) *Baker* (2n=26), *C. tuberosum* (Roxb.) Baker (2n=30), *Crotalaria spectabilis* Roth (2n=26), *Datura stramonium* L. (2n=24), *Delphinium ajacis* L.(2n=16), *Gymnema sylvestres* (Retz.) R. Br. ex Sm. (2n=22), Haworthiopsis limifolia (Marloth) G.D.Rowley (2n=28), *Helicteres isora* L. (2n=18), *Justicia simplex* D.

Don (2n=18), *Justicia adhatoda* L. (2n=34), *Lantana camara* L. (2n=44), *Lantana montevidensis* (Spreng.) Briq. (2n=48), *Ocimum basilicum* L. (2n=78), *Oroxylum indicum* (L.) Curz. (2n=28), *Papaver rhoeas* L. (2n=14), *Phlomoides superba* (Royle) Kamelin & Makhm (2n=22), *Physalis minima* L. (2n=48), *Pongamia pinnata* (L.) Pierre (2n=22), *Rauvolfia serpentina* (L.) Benth. ex Kurz (2n=22), *Rauvolfia tetraphylla* L. (2n=44,66), *Sansevieria cylindrica* Bojer ex Hook (2n=38), *Sansevieria trifasciata* Prain (2n=56), *Sansevieria zeylanica* (L.) Willd. (2n=40), *Santalum album L.* (2n=20), *Saraca asoca* (Roxb.) Willd.(2n=24), *Senna alata* (L.) Roxb. (2n=28), *Senna obtusifolia* (L.) H.S. Irwin & Barneby (2n=28), *Senna tora* L. (2n=28), *Senna sulfurea* (Collad.) H. S. Irwin & Barneby (2n=28), *Solanum diphyllum* L. (2n=24), *Solanum nigrum* L. (2n=24,72), *Solanum villosum* L. (2n=24,72), *Solanum virginianum* (2n=24), *Tamarindus indica* L. (2n=24), *Tinospora cordifolia* (Willd.) Miers ex Hook.f. & Thoms (2n=26), *Uraria picta* (Jacq.) DC. (2n=16), *Urena lobata* L. (2n=28) and *Withania somnifera* (L.) Dunal (2n=48). This study identified new cytotypes for 07 species of angiosperms.

PROJECT-2

Pteridophytic flora of India

Executing Scientist (s): Dr. Brijesh Kumar
Date of Initiation : 2020
Date to be completion: 2023

OBJECTIVE
Describing 75 species of pteridophytes for pteridophytic flora of India.

BACKGROUND
The Pteridophyte, the oldest land plants on earth, flourished so well in past and dominated the earth vegetation about 280-230 million years ago, presently do not form dominant vegetation anywhere in the world flora. They further grouped into two broad groups‘ fern-allies and ferns. Among these the ferns constitute a major element of the pteridophytic flora. In the present state, India harbours about 1300 species of pteridophytes which account for c. 2.5 percent of the total Indian flora. Present project was initiated to compile the descriptive account of Pteridophytes Flora of India.

AREA AND LOCALITY
India

SUMMARY AND ACHIEVEMENTS

Based on earlier published literatures, online resources (POWO, IPNI, TROPICOS) and available herbarium specimens, description of 75 species *viz. Botrychium daucifolium* Wall. ex Hook. & Grev., *B. lanuginosum* Wall. ex Hook. & Grev., *B. lunaria* (L.) Sw., *B. multifidum* (S.G.Gmel.) Rupr., *B. multifidum* subsp. *robustum* (Rupr. ex Milde) Clausen, *B. simplex* E.Hitchc., *B. ternatum* (Thunb.) Sw., *B. virginianum* (L.) Sw., *H. zeylanica* (L.) Hook., *Ophioglossum costatum* R.Br., *O. eliminatum* Khand. & Goswami, O. *gramineum* Willd., *O. lancifolium* C.Presl, *O. lusitanicum* L., *O. oleosum* Khand., *O. parvifolium* Grev. & Hook., *O. pendulum* L., *O. petiolatum* Hook., *O. polyphyllum* A.Braun ex Seub., *O. reticulatum* L., *O. rubellum* Welw. ex A.Braun [Family-Ophioglossaceae]; *Lepisorus amaurolepidus* (Sledge) B.K.Nayar & S.Kaur, *L. nudus* Ching, *L. clathratus* Ching, *L. jakonensis* (Blanf.) Ching, *L. loriformis* Ching, *L.*

macrosphaerus Ching, *L. mehrae* Fraser-Jenk., *L. scolopendrium* (Buch.-Ham. ex D.Don) Mehra & Bir, *L. sublinearis* Ching [Family-Polypodiaceae]. *Woodsia alpina* (Bilton) Gray, *W. andersonii* (Bedd.) Christ, *W. cycloloba* Hand.-Mazz., *W. elongata* Hook., *W. glabella* R.Br. ex Richardson, *W. hancockii* Baker, *W. lanosa* Hook., *W. rosthorniana* Diels., *Athyrium anisopterum* Christ, *A. atkinsonii* Bedd., *A. attenuatum* (C.B. Clarke) Tagawa, *A. cuspidatum* (Bedd.) M kato, *A. distans* (D.Don) T. Moore, *A. drepanopterum* (Kunaze) A. Braun ex Milde, *A. falcatum* Bedd., *A. fimbriatum* T. Moore, *A. flabellulatum* (C. B. Clarke) Tradieu, *A. foliolosum* T. Moore ex R. Sim, *A. himalaicum* Ching ex Mehra & Bir *A. davidii* (Franch.) Christ, *A. kumaonicum* Punetha, *A. mackinnoniorum* (C.Hope) C.Chr, *A. micropterum* Fraser-Jenk., *A. strigillosum* Moore, *A. nakanoi* Makino, *A. nephrodioides* (Baker) Christ, *A. parasnathens* (C. B.Clarke) Ching ex Bir, *A. pectinatum* (Wall. ex Mett.) C.Presl ex T.Moore, *A. praetermissum* Sledge, *A. punticaule* (Blume) T. Moore, *A. repens* (Ching) Fraser-Jenkins, *A. rupicola* (Edgew. ex C. Hope) C. Chr., *A. schimperi* Moug. ex Fée, *A. schimperi* subsp. *biserrulatum* (Christ) Fraser-Jenk., *A. setiferum* C.Chr., *A. strigillosum* (T.Moore ex E.J.Lowe) Salomon, *A. vermae* Fraser-Jenkins, *A. wallichianum* Ching, *Cystopteris dickieana* R.Sim, *C. fragilis* (L.) Bernh., *C. montana* (Lam.) Bernh., *Deparia boryana* (Willd.) M.Kato, *D. japonica* (Thunb.) M.Kato, *D. japonica* subsp. *petersenii* (Kunze) Fraser-Jenk. [Family- Woodsiaceae] was completed.

PROJECT-3

SEM studies of the species belonging to family Acanthacea and Solanaceae available at BSA

Executing Scientist (s): Dr. Nitisha Srivastava
Date of Initiation : September, 2018
Date to be completion: March, 2021

OBJECTIVE

Studies of seed surface and epidermal features of the species belonging to the family Acanthaceae available at BSA herbarium.

BACKGROUND

This project was initiated in 2018. In 2019-20, study of leaf epidermal morphology of both surfaces (abaxial and adaxial) was carried out for 17 species of the family Acanthaceae housed at BSA herbarium through Scanning Electron Microscopy. In the Annual Action Plan Projects of 2020-2021 a new family (Solanaceae) was added to the running project.

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

Epidermal details of 30 species *viz. Haplanthodes verticillatus* Nees, *Haplanthodes tentaculatus* Nees, *Ruellia prostrata* Poir., *Eranthemum purpurascens* Wight ex Nees, *Eranthemum roseum* (Vahl) R.Br., *Eranthemum pulchellum* Andrews , *Ruellia suffruticosa* Roxb., *Ruellia tuberosa* L., *Ruellia prostrata* Poir, *Justicia quinqueangularis* K.D.Koenig ex Roxb., *Justicia glauca* Rottler, *Justicia betonica* L.,

Justicia vahlii Roth, *Justicia japonica* Thunb., *Justicia glauca* Rottler, *Justicia gendarussa* Burm.f., *Justicia glabra* K.D.Koenig ex Roxb., *Datura metal* L., *Datura innoxia* Mill., *Datura stramonium* L., *Withania somnifera* L. (Dunal), *Petunia axillaris* (Lam.) Britton, Sterns & Poggenb., *Petunia hybrid* Vilm., *Physalis minima* L., *Physalis peruviana* L., *Cestrum nocturnum* L., *Cestrum diurnum* L., *Nicotiana rustica* L., *Nicotiana tabacum* L., *Nicotiana plumbaginifolia* Viv. Comparative accounts of epidermal studies of 60 species were worked out and final manuscript writing is under process.

PROJECT-1

Flora of Manjeera Wildlife Sanctuary, Telangana

Executing Scientist (s): Dr. L. Rasingam
Date of Initiation : April, 2019
Date to be completion: March, 2022

OBJECTIVE
Documentation of the floral diversity of the Manjeera Wildlife Sanctuary, Telangana state.

BACKGROUND
This project was initiated in 2019. The Manjeera Wildlife Sanctuary is an important biodiversity area in the Telangana state but no complete floristic account for the area is available except few sporadic collections from the surrounding areas. Hence, the project was initiated in the year 2019 to list out all the floral elements. During 2019-20, Two plant explorations tours were undertaken to Bapangadda, Peddagaddu, Puddigadda, Policegadda, Nizampurgadda, Mubarakpur, Nizampur, Kolukoor, Pottipalli, Yettigaddasangam, Singur dam, Gangojipet and Gongulur of Manjeera Wildlife Sanctuary during which a total of 291 field numbers were collected among which 70 field numbers were identified up to species level. In addition one Herbarium Consultation Tour was conducted to CAL, Howrah during which specimens of Poaceae and Lauraceae were consulted.

AREA AND LOCALITY
Sangareddy district, Telangana

SUMMARY AND ACHIEVEMENTS
One field tour *w.e.f.* 23.02.2021 to 26.02.2021 was conducted to Manjeera Wildlife Sanctuary, Telangana during which 58 field numbers were collected. 113 field numbers collected from previous tours were identified into 101 species.

PROJECT – 2

Grasses of Telangana State, India

Executing Scientist (s): Dr. Nagaraju Siddabathula

Date of Initiation : April, 2019
Date to be completion: March, 2022

OBJECTIVE
Documentation of the grass diversity of the Telangana state.

BACKGROUND

This project was started in 2019. Four field tours were conducted to different regions of the state during which about 190 field nos. were collected and identified. A total of 107 descriptions were drafted.

AREA AND LOCALITY

Telangana State

SUMMARY AND ACHIEVEMENTS

One field tour *w.e.f.* 23.03.2021 to 01.04.2021 was conducted to Warangal District, Telangana State during which 103 field numbers were collected of which 53 species were identified along with draft description for 105 species.

PROJECT – 3

Flora of Kinnerasani Wild Life Sanctuary, Telangana

Executing Scientist (s): Dr. J. Swamy

Date of Initiation : April, 2019

Date to be completion: March, 2022

OBJECTIVE

Documentation of the floral diversity of the vascular plants of the Sanctuary and highlighting the plant wealth of the protected area along with threats and conservation measures.

BACKGROUND

This project was initiated in 2019. During 2019-20, four field tours were conducted to the study area during which 420 field numbers were collected of which 120 field numbers were identified.

AREA AND LOCALITY

Bhadradi –Kothagudem districts, Telangana State; c. 635.41 sq. km.

SUMMARY AND ACHIEVEMENTS

Two field tours *w.e.f.* 11.11.2020 to 23.11.2020 and 17.03.2021 to 01.04.2021 were undertaken to Kinnerasani Wild Life Sanctuary (KWLS) during which 334 field numbers were collected of which 219 field numbers were identified into 191 species. Descriptions for 16 species were completed.

PROJECT – 4

Revamping of BSID Herbarium, Updation, Incorporation & Digitization

Executing Scientist (s): Dr. Mudadla Sankararao & Dr. A. Ravikiran

Date of Initiation : August, 2020

Date to be completion: March, 2021

OBJECTIVE

Revamping the herbarium by updating the species and genus covers by computer generated label and digitization.

BACKGROUND

This is a new project. BSI DRC Herbarium is holding nearly 20000 specimens of whicn about 17200 specimens were scanned till date. Among 17200 total scanned images, 1450 scanned specimens were converted from TIFF to JPG during 2019–2020. The scanned images of about 946 specimens were copied and saved in 45 DVDs as back up. Revamping of BSID is in progress and the new project has been assigned for the year 2020-2021.

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

In connection with the on-going herbarium digitization project, specimens: incorporated-888, mounted- 99, remounted-1030; prepared new species covers-983, new genus covers-183 and specimen‘s reincorporated-2108 herbarium sheets, from Ranunculaceae to Poaceae families at BSID. In addition, 4000 herbarium sheets were Segregated and arranged as per field number along with 7000 duplicates specimens. Further, one hundred seventy seven (177) Herbarium specimens of Pteridophytes housed at BSID herbarium were rearranged properly according to Bentham & Hooker‘s classification system as well as list of the taxa of these families with currently accepted names and other relevant data was prepared. A total 40 new genus and 68 species folders with printed labels were prepared (with currently accepted names, synonyms (if any).

PROJECT-1

Flora of Nagaland

Executing Scientist (s) : Dr. A.A. Mao, Dr. N. Odyuo, Dr. D.L. Biate, Dr. D.K. Roy & Mr. R. Lytan
Date of Initiation : April, 2016
Date to be completion : March, 2021 (extension sought till March 2025)

OBJECTIVE

Documentation of floral diversity of the state of Nagaland.

BACKGROUND

The project was initiated in 2016. During previous year, two field tours were conducted to Phek, Wokha and Mokokchung districts of Nagaland during which 631 field numbers were collected of which total 172 taxa were identified. Description of 148 species were completed along with proper citation, phenology and distribution. A total of 397 live plants were collected for introduction in the Experimental Garden of Botanical Survey of India, ERC.

AREA AND LOCALITY

Nagaland; c. 16579 sq. Km.

SUMMARY AND ACHIEVEMENTS

One field tour *w.e.f.* 21.10.2020 to 01.11.2020 was undertaken to Doyang, Wokha Districts, Nagaland during which a total of 160 specimens were collected along with field photographs of different plants, landscapes, forest types, vegetation etc. Total 225 species were documented with proper citation and description along with key of 411 number of taxa. A total of 6 species of *Strobilanthes* sp. with complete sheets collected from Nagaland were incorporated into the herbarium. Final Mss. for Vol. I comprising of 661 species, 10 subspecies and 5 varieties under 299 genera and 75 families under finalization to be submitted by August 2021. This study reported 02 new species viz. *Peliosanthes nagalandensis* N. Odyuo, D.K. Roy, N. Tanaka and A.A. Mao; *Peliosanthes tobuensis* N. Odyuo, D.K. Roy, R. Lytan, N. Tanaka and A.A. Mao and One new generic record to India viz. *Stadiochilus burmanicus* R.M. Sm.

PROJECT-2

Micropropagation of EET Plants of North East India Phase-II

Executing Scientist (s) : Dr. Deepu Vijayan
Date of Initiation : April, 2015
Date to be completion : Ongoing

OBJECTIVE

Standardization of the protocol, mass multiplication of EET plants of Northeast India namely *Eriodes barbata* (Lindl.) Rolfe, *Pholidota katakiana* Phukan & `*Micropera rostrata* (Roxb.) N.P. Balakr. Regular subculturing of *in vitro* raised cultures of *Cymbidium tigrinum* and *Armodorum senapatianum* and hardening of lab to land plants to be continued.

BACKGROUND

This project was started in 2015. Plant genomic DNA was isolated from *Cymbidium tigrinum* and *Armodorum senapatianum* for molecular taxonomic work. Approx. 50 seedlings of *Rhododendron coxianum*, earlier transplanted from lab to land to the garden of Botanical Survey of India Shillong, were acclimatized and growing healthy; *In-vitro* seed germination of *Ilex khasiana* was successful and 20 seedlings were transferred from lab to land. *In-vitro* seed germination of *Paphiopedilum hirsutissimum* collected from Khonghampat, Orchidarium, Manipur are set and was under observation.

AREA AND LOCALITY

North East India

SUMMARY AND ACHIEVEMENTS

Inoculation of *Micropera rostrata* and *Eriodes barbata* in MS Medium was done. Initiation of *in vitro* cultures of *Eriodes barbata* in MS Medium. Initiation of *in vitro* cultures of *Micropera rostrata* in MS Medium. Subculturing and maintenance of *Armodorum senapatianum* and *Cymbidum tigrinum.* Maintenance of *in vitro* raised plants of *Armodorum senapatianum* and *Cymbidum tigrinum* in plant tissue culture, garden and polyhouse.

PROJECT-3

Botanical illustration, art, flower painting, and "plant portraits" of selected EET plants of India

Executing Scientist (s) : Ms. L. Ibemhal Chanu
Date of Initiation : August, 2020
Date to be completion : March, 2022

OBJECTIVE

Botanical painting with accuracy of scale and colour with natural stone colour, honey-based colour on hot press white colour paper.

BACKGROUND

This is a new project. Selection of plants parts, photography, develop idea of the composition, rough sketches generated for 10 plants viz. *Aristolochia platanifolia* (Klotzsch) Duch., *Aristolochia saccata* Wall., *Armodorum senapatianum* Phukan & A.A.Mao, *Bulbophylum rothchilsdianum, Ceropegia anshariana.*, *Cymbidium tigrinum* C.S.P.Parish ex Hook., *Ilex khasiana* Purkay, *Nepenthes khasiana* Hook.f., *Paphiopedilum fairrieanum* (Lindl.) Stein & *Vanda coerulea* Griff. ex Lindl. along with SEM study for better vision of microscopic hairs, textures.

AREA AND LOCALITY

Plants are selected from BSI, ERC, Shillong.

SUMMARY AND ACHIEVEMENTS

The methodology adopted is an infusion of Taxonomy and Indian Miniature Painting techniques in botanical illustration. Composition of *Aristolochia platanifolia* (Klotzsch) Duch**,** *Armodorum senapatianum* Phukan & A.A.Mao, *Bulbophylum rothchilsdianum, Ceropegia anshariana, Cymbidium tigrinum* C.S.P.Parish ex Hook., *Paphiopedilum fairrieanum* (Lindl.) Stein and *Vanda coerulea* Griff. ex Lindl. were completed. Line drawing of 09 plants completed. Wash and layering of *A. senapatianum*, *B.rothchilsdianum,C. anshariana, C. tigrinum*, *P. fairrieanum*, *V. coerulea*, A flowering plant of *C. anshariana* and *C. tigrinum* (with netted vennation of roots), with a flower split across showing the pollen track, a flowering twig of *A. senapatianum*, *P. fairrieanum.* Primary color differentiation with properties of pigments are completed for 09 plants. SEM study for 09 plants completed. Photography for pictures of the plant for composition of painting of 09 plants are taken.

PROJECT-4

Herbaceous Flora of Meghalaya

Executing Scientist (s) **:** Dr. Chaya Deori
Date of Initiation **:** December, 2020
Date to be completion **:** March, 2021 (request for extension up to September 2021)

OBJECTIVE

Editing of manuscript of Herbaceous flora of Meghalaya, Vol. 1, which has already been reviewed by publication section, BSI, Kolkata.

BACKGROUND

It was compiled and submitted in 2010 by me along with our ex-scientists of ERC, Shillong. Herbaceous flora Volume-1- comprised of 678 taxa and 340 genera under 88 families Ranunculaceae-Leeaceae-28 families by B. K. Das; Fabaceae-Primulaceae-26 families by Chaya Deori & R. Shanpru; Apocyanaceae-Ceratophylaceae-34 families by Chaya Deori; Herbaceous Flora Volume-II-comprised of 950 taxa and 300 genera under 27 families: Hydrocharitaceae-Poaceae-27 families by Chaya Deori & Namita Dam.

AREA AND LOCALITY

Meghalaya

SUMMARY AND ACHIEVEMENTS

The updating of nomenclature of each species was done following Tropicos, IPNI, World flora online. More than 300 photographs were selected and the remaining was under process. Correction of 800 taxa was completed and 309 taxa remaining. Preparation of keys of families, newly added genera and species remaining. Alphabetical arrangement of photographs, Index to Botanical names, correction of introductory portion remaining.

PROJECT-5

Ex-situ conservation and multiplication of endemic, rare, threatened and economically important plants of North-East India at Experimental Botanic Garden, BSI, ERC, Barapani

Executing Scientist (s) : Shri B.B.T. Tham & Shri L.R. Meitei
Date to be completion : Ongoing

OBJECTIVE

Ex-situ conservation and multiplication of endemic, rare, threatened and economically important plants of North-East India at EBG, Barapani. To record phenological data of flowering and fruiting for the plants available in the garden.

BACKGROUND

The main target is collection of live plants, specifically endemic, rare, threatened and economically important ones available in the North-Eastern Region for *ex-situ* conservation and multiplication purpose in Experimental Botanic Garden, BSI, ERC, Barapani. The existing Experimental Botanic Garden is located ca. 22 km away from Shillong near Umiam Lake at Umiam, Ribhoi District with an area of *ca* 25 acres at an altitude *ca* 1000m (3000 ft.). This Garden is very ideal for growing and conserving the diverse flora of this region as the prevalent conditions both climatic and edaphic of the area is highly suitable and viable for such an exercise. In the process, introduction/acclimatisation and paying considerable attention towards maintenance of germplasm collection growing and multiplication of endemic, rare, endangered, threatened plant wealth of North-East India in order to save them from extinction is the main priority. About 1500 species of vascular plants, 13 gymnosperms, 75 pteridophytes and 53 bryophytes of North-East India are conserved here. Many of them are rare, endemic and economically important plant species of this region. To enrich the flora of the garden with particular reference to EET and other economically important plants, field tours will be conducted in various parts of NE India on a regular basis for collection and introduction of EET plants in the garden.

AREA AND LOCALITY

Entire Northeast India

SUMMARY AND ACHIEVEMENTS

Two local field trips on 06.10.2020 and 09.10.2020 to 11.10.2020 were conducted to Mawphlang area, East Khasi Hills, Meghalaya and Shella area of East Khasi hills, Meghalaya during which a total of 30 live plant species were collected. A total of 09 EET plant species, 26 economically important plant, 9 *Impatiens* species, 67 plant seedlings/saplings were planted in EBG, Barapani. 323 cuttings of *Azalea* sp. and *Nepenthes khasiana* were made for multiplication purpose. Seeds of 08 species were collected, processed and stored; 05 species were sown in germination beds; 12 plant species were transplanted from germination beds to jute sapling bags for proper growth. phenological data of flowering and fruiting of 185 species in EBG were recorded. 04 plant species *viz*., *Aglaonema hookerianum* Schott, *Alangium chinense* (Lour.) Harms, *Chonemorpha fragrans* (Moon) Alston and *Ixora pseudoacuminata* Deb & Rout. were identified in EBG, Barapani which were not identified earlier.

HEADQUARTER, BSI

PROJECT-1

Flora of Eagle Nest WLS and its adjacent regions, West Kameng Dist., Arunachal Pradesh

Executing Scientist(s) : Shri Sanjay Kumar & Dr. S.S. Dash
Date of Initiation : April, 2018
Date of completion : March, 2022 (extended to 2023)

OBJECTIVE: Floristic Survey in Eagle nest Wild life Sanctuary and documentation of the flora occurring within the boundary of the sanctuary and its adjacent regions. Preparation of a pictorial guide of the sanctuary and its adjacent region.

BACKGROUND
This project was initiated in 2028. One exploration tour was undertaken to the study site during which 208 field numbers were collected in triplets along with more than 3000 photographs and GPS codinates. All collected specimens are well processed, dried and poisoned as per slandered herbarium procedure.

AREA AND LOCALITY: Eagle Nest Wild Life Sanctuary and its adjacent Region, West Kameng, Arunachal Pradesh, c. 518 sq. km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Herbarium material of second exploration (10.07.2019 to 03.08.2019) were processed per standard Herbarium procedure. The identification of earlier collection was going on and simultaneously description of 53 plant species ie. *Lygodium flexuosum* (Linn.) Sw.; *Lepisorus nudus* (Hooker) Ching, *Pteris wallichiana* J. Agardh, *Abies densa* Griffith, *Magnolia campbellii* Hook.f. & Thom., *Magnolia champaca* (Linn.) Baill. ex Pierre, Cautleya gracilis (Sm.) Dandy,*Rhododendron anthopogon* D. Don; *Rhododendron campanulatum* D.Don, *Rhododendron keysii* Nuttall etc., was completed.

PROJECT-2

Marine Macro Algal Flora of West Bengal coast, India

Executing Scientist(s) : Dr. S.K. Yadav & Shri K. Majumdar
Date of Initiation : April 2019
Date of completion : March 2021

OBJECTIVE:
Exploration of Marine Macro Algal Flora of West Bengal coast

BACKGROUND:
This project was initiated in 2019. During 2019-20, one field tour was conducted to the coastal areas of the state of West Bengal during which 50 field numbers of marine macro algal samples were collected in duplicate / triplicate. All the relevant field details such as habit, habitats, nature of the locality and its GPS

position (using Garmin 12 channel XL), vegetation patterns etc. were recorded and photographed using digital camera. All the collected samples were processed properly and preserved in both wet form (in containers) and in dry form *i.e.* herbarium sheets. Of the collected 50 field numbers, 42 F.N. were identified along with description of 05 species.

AREA AND LOCALITY

West Bengal Coastal areas, including Sundarban Biosphere Reserve.

SUMMARY & ACHIEVEMENT/OUTCOME:

During the period, 50 field numbers of marine macro algae (seaweed) specimens were studied and identified. All the identified herbarium sheets were properly labelled and deposited in to the Central National Herbarium (CAL), Howrah. Besides, collected and referred 48 references pertaining to the marine macro algal taxonomy and diversity of the India coast. Completed taxonomic description and nomenclature updation of 09 species of seaweeds namely *Ulva clathrata* (Roth) C. Agardh; *U. compressa* L.; *U. lactuca* L.; *U. flexuosa* Wulfen; *U. linza* L.; *U. prolifera* O.F. Muell. (Family: Ulvaceae); *Chaetomorpha aerea* (Dillwyn) Kuetz. (Family: Cladophoraceae); *Catenella caespitosa* (With.) L. Irvine and *C. nipae* Zanardini (Family: Caulacanthaceae). Based on the present study and review of literature, prepared a preliminary checklist of the marine algae of the West Bengal coastline.

HIGH ALTITUDE WESTERN HIMALAYAN REGIONAL CENTRE, SOLAN

PROJECT-1

Floristic diversity of Dr. Y.S. Parmar University Campus, Nauni, Solan, Himachal Pradesh

Executing Scientist(s) : Dr. Kumar Ambrish & Dr. Kuldip S. Dogra
Date of Initiation : 2020
Date of completion : 2021

OBJECTIVE:

Documentation of the floristic diversity of Dr. Y.S. Parmar University Campus, Nauni, Solan, Himachal Pradesh in pictorial form which includes Botanical and local name of species, brief description, flowering and fruiting period, its medicinal or economic uses if any along with digital photographs.

BACKGROUND:

This is a new project. The campus of the Dr. Y.S. Parmar University, situated at Nauni, Solan Dist., about 12 Km from Solan on Solan to Rajgarh Road, at an altitude of 1300 m., covering about 5.5 sq. km. area, has a rich floristic diversity of angiosperms, gymnosperms, ferns which includes indigenous as well as alien plant species. The main aim of the university is education and research in the horticulture and forestry aspects and to up lift the livelihood of locals through research and technology transfer using local resources in Himachal Pradesh. After signing the MoU with this University, Botanical Survey of India now exclusively working on the development of infrastructure of this centre and on other research activities like plant exploration and their conservation. In view of the lack of data on the floristic diversity of the Dr. Y.S. Parmar University, Nauni, Solan, this project was proposed for documentation and compilation of the floristic diversity of the University campus, which has also being desired by the Hon'ble V.C. of the University. As per previous literature, a total of 576 plant species occurring in the campus of this university which includes wild (*ca.* 444) as well as cultivate species (*ca.* 132). The wild plants belong to 109 families of the flowering plants. Out of these families the most dominant families are Poaceae, Asteraceae, Fabaceae, Lamiaceae, Rosaceae and Solanceae. This document will be very helpful to the faculties, researchers and students of UHF Nauni who are engaged in applied aspects of plant research and resource conservation.

AREA AND LOCALITY

Dr. Y.S. Parmar University, Solan district, *c.* 5.5 sq. km. area.

SUMMARY & ACHIEVEMENT/OUTCOME:

115 species were listed from the published literature. 03 field tours were undertaken to the UHF, Nauni Campus covering an area of 1.5 sq. km. during which 69 species were collected of which 65 species were identified *viz. Clematis gouriana* Roxb., *Clematis grata* wall., *Clematis paniculata* Thumb., *Ranunculus arvensis* L., *Ranunculus laetus* wall, *Ranunculus hirtellus* Royle, *Thalictrum foliolosum* DC., *Michelia champaca* L., *Cissampelos pareira* L., *Cocculus laurifolius* DC., *Berberis lycium* Royle, *Argemone mexicana* L., *Papaver dubium* L., *Fumaria parviflora* Lam., *Capsella bursa- pastoris* Medic., *Erysimum hieracifolium* L., *Lepidium ruderale* L., *Nasturtium officinale* R.Br, *Raphanus sativum* L., *Sisymbrium sophia* L., *Sisymbrium thalianum* J. Gay & Monn, *Crataeva nurvala* Buch-Ham. *Viola serpens* wall. *Viola tricolor* L., *Flacoutia indica* (Burm. f.) Merr., *Xylosma longifolia* Clos, *Populus deltoides* Marshall, *Salix alba* L., *Polygala abyssinica* R.Br. ex. Fresen., *Polygala Chinensis* L., *Polygala triphylla* Buch-Ham. ex. D.Don., *Silene conoidea* L., *Stellaria media* L., *Stellaria bulbosa* wulf., *Hypericum oblongifolim* Choisy.,

Abelmoschus moschatus (L.) Medic., *Abelmoschus fliculnius* (L.) Wt. &Arm., *Achania grandiflora* L., *Hibiscus rosa-sinensis* L., *Malva pusilla* Sm., *Malva rotundifolia* L., *Malva verticillata* L., *Malvastrum coromandelianum* (L.) Garcke , *Sida rhombifolia* L., *Sida acuta* Burm.f., *Bombax ceiba* L., *Ceiba speciosa* (A.St.-Hil.) Ravenna, *Pterospermum acerifolium* (L.) Willd., *Pterygota alata* (Roxb.) R. Br., *Grewia asiatica* L., *Grewia optiva* J.R. Drumm. Ex. Burrett, *Triumfetta annua* L., *Triumfetta pilosa* Roth, *Reinwardtia indica* Dumort., *Geranium divaricatum* Ehrh. Beitr., *Geranium ocellatum* Camb., *Oxalis corniculata* L., *Impatiens balsamina* L., *Citrus aurantifolia* (Christmann & Panz.) Swingle, *Citrus aurantium* L., *Citrus jambhiri* Lushington, *Citrus reticulata* Blanco, *Murraya koenigii* (L.) Spreng., *Zanthoxylum armatum* DC., *Melia azedarach* L. and *Euonymus pendulus* Wall. The campus is a home of many herbaceous plant species which have a quit useful medicinal and economic value. The alien plant species are also predominantly introduced in the campus of the University for horticulture and forestry purposes which are now rapidly spreading in the campus and surrounding areas of the Nauni University. This study reported a number of alien plant species reported from the campus which includes *Chorisia speciosa, Paulownia tomentosa, Jasminum mesnyi, Solidago Canadensis, Salvia coccinea, Verbena brasiliensis, Nicotiana tabacum* etc.

INDUSTRIAL SECTION INDIAN MUSEUM, KOLKATA

PROJECT-1

Collection of Algae specimens deposited at ISIM

Executing Scientist(s) : Dr. K. Pagag, Dr. S. Datta and M. Bhaumik
Date of Initiation : April, 2020
Date of completion : March, 2021

OBJECTIVE:
Development of repository of algal specimens and providing a source of authentic identification that can be used for further taxonomic study of algae in India.

BACKGROUND:

This is a new project. Botanical collections are crucial tool in the field of biodiversity studies, environment impact assessment and genetics as well as taxonomic researches. They provide the base for identification as well as evaluation of species conservation status. The National Centre for Seaweed Herbarium at Marine Algal Research Station (MARS) at Mandapam, Tamil Nadu is an internationally acclaimed centre with about 5,000 specimens of more than 280 seaweed species and the only internationally recognized centre having a diverse collection of seaweeds from across the country, predominantly from Tamil Nadu and Gujarat, and designated as a reference repository at the national level. Thus there is a need for development of more herbaria of marine algae of India and providing a source of authentic identification that can be used to further the taxonomic study of algae in India and research information can communicate to the public, government and Industry. The herbarium of Industrial Section Indian Museum, Botanical Survey of India (BSIS) currently house 5081 marine algae specimens belonging to c. 56 families and c. 112 genera. The specimens are from different coastal areas of India with a large collection from different islands of Andaman and Nicobar archipelago. The collections were all made by Dr. K.S. Srinivasan during the period of 1944 to 1955. Few collections were made by an anonymous collector during the period of 1914 to 1917 as a part of study economic plants for British India. There is also a minor representation of marine algae from California by Elmer Yale Dawson and Queensland, Australia by A.B. Cribb, as a part of marine algae herbarium of BSIS.

AREA AND LOCALITY
NA

SUMMARY & ACHIEVEMENT/OUTCOME

During preparation of database, all specimens were cleaned, dusted and loose or unmounted specimens were mounted on herbarium sheets where it is necessary. All specimens were studied, detail metadata were prepared along with updated nomenclature with the help of www.algaebase.org. This database consists of the label data of all collections. The data include the scientific name, collection date, collector‘s name and

collection number (where ever present) and place of collection. A database of c. 5081 sheets was prepared, 500 loose sheets were mounted. Final Report was submitted to HQRS in hardbound and softcopy. A dedicated almirah procured and all specimens kept in the almirah. The family, genera and taxa were arranged alphabetically as per hierarchy.

PROJECT-2

Documentation of exhibits and materials of Botanical gallery in Industrial Section Indian Museum

Executing Scientist(s) : Dr. S. Datta, Dr. K. Pagag & Dr M. Bhaumik
Date of Initiation : April, 2020
Date of completion : March, 2022

OBJECTIVE:
Cataloguing of different exhibits of Botanical Gallery

BACKGROUND:

The Botanical Gallery of the Industrial Section, Indian Museum, covering an area of *c.* 10,000 sq. ft. area in 2nd floor of the Museum, has permanent exhibit display in 8 thematic Bays displaying Indian timbers, Food products, Medicinal produces, Vegetable fibers, Oil and oilseeds, Dyes and Tans and finally Gums and Resin at east end. The Gallery provides information on both wild and cultivated economical plants commonly used in India. The Botanical Gallery houses different artifacts that date back to 1890 collected by different collectors working under the Reporter of Economic Products. This project was proposed to prepare a comprehensive catalogue of the exhibits of this gallery.

AREA AND LOCALITY
NA

SUMMARY & ACHIEVEMENT/OUTCOME:

A detail record of each exhibit is being prepared with its collection details. Few collections by eminent collectors like Sir G. Watt and D. Hooper were also recorded who have played a significant role in the layout of the botanical museum present today. A catalogue of exhibits of Gum & Resin section was being prepared with 739 specimens enlisted. The most important collection is a Gutta-percha sample which was exhibited in Calcutta exhibition in 1883-84. The catalogue of Oil & Oil seeds section was being prepared (with 650 specimens listed), for fibre section (*c*. 200 specimens are listed). Fibre samples of *Pandanas furcatus* (Exb. No. 32023), *Furcraea foetida* and *Fucraea* sp. were identified which were exhibited at the Calcutta International Exhibition.

NORTHERN REGIONAL CENTRE, DEHRADUN

PROJECT-1

(A)Pictorial Flora of Pteridophytes of Uttarakhand

Executing Scientist(s) : Dr. B.S. Kholia
Date of Initiation : 2018
Date of completion : 2021

OBJECTIVE:
Preparing a pictorial guide of Pteridophytic flora of Uttarakhand.

BACKGROUND:
This project was initiated in 2018.

AREA AND LOCALITY
Uttarakhand

SUMMARY & ACHIEVEMENT/OUTCOME
Identified 168 plant species and completed label writing of 260 herbarium sheets in all respect. The work will useful for common people, foresters, students, researchers policy makers and other stake holders towards better understanding of the Uttarakhand Pteridophytes as well as making policies for conservation.

(B) Pteridophytic Flora of India

Executing Scientist(s) : Dr. B.S. Kholia
Date of Initiation : 2020
Date of completion : 2023

OBJECTIVE:
Revision and flora writing of selected families of Indian Pteridophytes

BACKGROUND:
Pteridophytes are the second highest group of vascular plant in India and are represented by *c.* 1200 taxa. They are distributed from seal level to snow line in alpine Himalayas. A comprehensive account of Pteridophytes was written during British period by Col. R. H. Beddome - a British surgeon and Army officer. His illustrative work was published in between 1856-1893. After this significant work, several regional and state floras, and more recently a comprehensive checklist of Indian Pteridophytes was published (Fraser-Jenkins & al., 2017-2020). But at present there is no modern detailed descriptive account avialable for the Indian Pteridophytes. In view of the aforesaid reason and to fill the gap of knowledge the present work was taken up by the BSI. This is a new project.

AREA AND LOCALITY
India

SUMMARY & ACHIEVEMENT/OUTCOME
Description of *c.* 30 species was completed towards the Pteridophytic flora of India. 1479 Herbarium sheets of Pteridophytes were incorporated in BSD herbarium. This study reported 07 species viz., *Huperzia pinifolia* Trevis., *Ophioglossum gomezianum* Welw. ex A.Braun, *Dennstaedtia smithii* (Hook.) T.Moore,

Arthromeris nigropaleacea S.G. Lu, *Lepisorus tricholepis* K.H.Shing &Y.X.Lin, *Dennstaedtia smithii* (Hook.) T.Moore, *Katoella yunnanensis* (Christ) Fraser-Jenk. & Kholia as a New Record for India based on misidentification of earlier researchers. During this study, 02 Epitype, 19 Lectotype and one Neotype were designated and 6 new combinations were published.

PROJECT-2

Taxonomic Revision of genus *Taraxacum* in India

Executing Scientist(s) : Dr. Sameer Patil and Dr. S.K. Singh
Date of Initiation : 2020
Date of completion : 2023

OBJECTIVE:

To define and classify *c.* 83 species of genus *Taraxacum* in India; to describe the species on the basis of morphological characters and provide a taxonomic key for identification and to perform SEM study of capsules of *Taraxacum* species in India.

BACKGROUND:

The genus *Taraxacum* F.A. Wigg., with its large geographical range covers most of the extra-tropical Northern Hemisphere (and scattered in temperate regions of Southern Hemisphere), its enormous sectional diversity and about 3500 published species names (approximately 2500 species), and various combinations of reproduction systems, represents a challenge for plant biologists and taxonomists. The European *Taraxacum* sections, at least in the northern two thirds of Europe, are known to a considerable extent, and many species were studied also from the viewpoint of their mode of reproduction, ploidy level, variation and distribution patterns. In Asia, on the contrary, there are many regions where even the basic taxonomic exploration remains in its infancy. It should be emphasized that the West Himalaya is a territory harboring a substantial part of the sectional diversity of dandelions. There are about 60 sections recognized in *Taraxacum*, and twenty one are recorded in the West Himalaya (Kirschner & al. 2020). The project was taken to be the first to evaluate the *Taraxacum* taxonomy in rich areas of alpine Himalayas. Tentative estimation of species of *Taraxacum* in Indian Himalayas is *c.* 100 species. This is a new project.

SUMMARY & ACHIEVEMENT/OUTCOME

The protologues of all Himalayan species of *Taraxacum* were procured for morphological analysis. Distribution and phenological data of each species were collected for preparing GIS maps for each species. For SEM studies, achenes were collected from duplicate specimens. A table for the genus *Taraxacum* with distinguishable characters was prepared. During this period, GIS and RS based distribution mapping were prepared and altitudinal variation pattern through ENM of *Taraxacum* species in Western Himalayas was analysed. SEM study of seven species of *Taraxacum* achenes was completed.

PROJECT-3

Scanning Electron Microscope (SEM) Study of Achenes of the genus *Ranunculus* L. and *Thalictrum* Tourn. ex L. in N. W. Himalaya

Executing Scientist(s) : Dr. Purushottam Kumar Deroliya and Dr. S.K. Singh

Date of Initiation : 2020
Date of completion : 2021

OBJECTIVE:

To carried out ectodermal study of Achenes of the available taxa in BSD; **m**icro-photographing of the ultra-structure observed under SEM and analyzing the ultra-structure with reference to taxonomical acceptance of the primitive and complex taxa.

BACKGROUND:

The family Ranunculaceae is best regarded as a group of ornamental plants and many of the species are of medicinal value. The species of Ranunculaceae are distributed nearly all over the world and represented by 56 genera and 2100 species (Mabberley, 2017), including 19 monotypic genera (Tamura, 1993). About 28 genera and 192 species are distributed in various part of India, with preponderance in Himalayan regions. Two genera, namely *Ranunculus* L. and *Thalictrum* Tourn. ex L. are taken up in the present study which are represented by 65 species (44 taxa of Ranunculus + 21 species of Thalictrum) in India (Rau, 1993; Srivastava, 2010) and majority of them (40 taxa) are represented in western Himalaya. While doing the floristic works for different states in jurisdiction of Northern regional centre of BSI, it has been observed that opinions on species and infraspecific delimitation and their taxonomic treatment varies and inconsistent among the various workers. These inconsistencies are much prevalent particularly in genera *Ranunculus* and *Thalictrum*. These taxonomical aspects of the species needed detailed intensive study supported by SEM as the anomalies might be due to lack of comprehensive and detailed micro morpho-structural studies. Achene is treated as _An indehiscent pericarpium, or fruit, with a pericarp contiguous to the seed‘. Fruit (Achene) structure in Ranunculaceae is an important taxonomic parameter for the diagnosis both at generic level and species level often referred as Achenes and are very small. Due to small nature, they are difficult to observe the ornamentation through necked eyes. The microstructures borne by them are not clearly distinguishable through stereo zoom microscope. Thus, it is imperative to study this microstructure under Scanning Electron Microscope to provide additional taxonomic details of this primitive group of plant. This is a new project.

AREA AND LOCALITY

North-West Himalaya comprising the area of two states *viz*., Himachal Pradesh, Uttarakhand and two union territories *viz*., Jammu & Kashmir, Ladakh, lies in the northern part of India. It is ringed by Pakistan to the West, China to the North, China and Nepal to the East and covers an area of *c.* 3,27,200 sq. Km. (Dhar & Samant, 1993), which is about 62% of Indian Himalayan Region and about 10% of total area of India.

SUMMARY & ACHIEVEMENT/OUTCOME

During this period, 15 species were identified and 49 specimens were reincorporated in BSD herbarium. A list of fourty taxa (37 species and 3 varieties) of the genus *Ranunculus* and 20 species of *Thalictrum*, reported from North-Western Himalayas in published literature, was prepared among which only 17 taxa of the genus *Ranunculus* and 12 species of the genus *Thalictrum* were available in BSD for procuring achenes. About 390 specimens of genus Ranunculus were scrutinized to select the appropriate samples of achenes of different species. Fifteen species of *Ranunculus* L. documented in respect of micro-morphological characters along with micro-photographing of the ultra-structure of achenes observed under the SEM : 1. *Ranunculus adoxifolius* Hand.-Mazz. [U.C. Bhattacharyya 52094; M.V. Viswanathan 54797; K. Chandra Sekar 103763], 2. *R. arvensis* L. [N.C. Nair 21825; 22038; B.P. Uniyal 80226; R.R. Rao & S. Kumar 81667; A.K. Goel 63819; N.P. Singh 25453], 3. *R. brotherusii* Freyn. [H.J. Chowdhery & B.P. Uniyal 86045; P.K.

Hajra 74080], 4. *R. diffusus* DC. [U.C. Bhattacharyya 40434; Bipin Balodi 88872; J.N. Vohra 54379; T.A. Rao 7449; B.M. Wadhwa 57784; C.L. Malhotra 72594; B.P. Uniyal & M.S. Pundir 96923], 5. *R. distans* Wall. ex D. Don [J.P. Sharma 32591; U.C. Bhattacharyya 40367, 15002; Rajnikant & Kapil 131417; M. Sanjappa 110749; C.L. Malhotra 72581], 6. *R. hirtellus* Royle [N.C. Nair 16976; U.C. Bhattacharyya 45289; T.A. Rao 7703; P.K. Pusalkar 104270], 7. *R. hyperboreus* Rottb. [M.A. Rau 50224; P.K. Pusalkar 102260], 8. *R. lobatus* Jacquem. ex Cambess. [P.K. Pusalkar 103348], 9. *R. longicaulis* Ledeb. ex A. Spreng. [M.V. Viswanathan 54798; H.J. Chowdhery & B.P. Uniyal 85993], 10. *R. munroanus* J.R. Drumm. ex Dunn [H.J. Chowdhery & B.P. Uniyal 85921], 11. *R. muricatus* L. [O.P. Misra 45838; B.P. Uniyal 88594; R.R. Rao & S. Kumar 83559; B.P. Uniyal 93502, 79249], 12. *R. natans* C.A. Mey. [U.C. Bhattacharyya 51967, 45327], 13. *R. palmatifidus* H. Riedl. [K. Chandra Sekar 103650; B.P. Uniyal & Bipin Balodi 93962], 14. *R. pulchellus* C.A. Mey. [M.V. Viswanathan 54738; B.M. Wadhwa 59933], 15. *R. sceleratus* L. [B.P. Uniyal 80373; R.R. Rao & S. Kumar 83549; N.C. Nair 21990; U.C. Bhattacharyya 21125]. A total of 2065 SEM micro-photographs were taken.

PROJECT-4

Cytological studies in some selected chromosomally lesser-known/unknown plants and Liverworts from Botanic Garden of BSI, NRC, Dehradun, and adjoining areas.

Executing Scientist(s) : Dr. Puneet Kumar and Dr. S. K. Singh
Date of Initiation : 2020
Date of completion : 2021

OBJECTIVE:

Collection of material for cytological studies. To determine the original chromosome number through male meiosis/mitosis. Study of meiotic behaviour and pollen fertility for each species and detail cytological analysis of aberrant genotypes/Morph-variants (if found).

BACKGROUND:

Chromosomes have been recognized as vital characters for a very long time. Many biosystematic studies have over the years included cytological observations. Chromosomal data of living organisms effectively forms an independent data set for phylogenetic analysis and has probably been most useful in the investigation of groups of closely related and morphologically similar organisms. The interpretation, characterization and identification of a cell's complete chromosome set are the initial stages in the process of using chromosomal characters for systematics. Regardless of being the simplest karyotype parameter, the chromosome number offers some distinct magnetism to cytotaxonomists. It is the fastest, economical, and easiest approach to acquire any significant data about the genome of a species. The chromosome number is the best identified and unique cytotaxonomic data for almost all families and maximum plant genera. Chromosome counting produces reliable and highly reproducible data. Like other karyotype features, it is not influenced by external conditions, developmental phases, age, etc. Alternatively, an odd or unexpected somatic chromosome number usually means meiotic problems or sterility. A careful study of the chromosome number variation associated with a well-established phylogenetic tree can be a powerful tool for understanding the mechanisms of karyotype evolution, and to resolve the ambiguity of the complex taxonomic groups/ species. This is a new project.

AREA AND LOCALITY

Botanic Garden of BSI, NRC, Dehradun, and adjoining areas.

SUMMARY & ACHIEVEMENT/OUTCOME

20 species were collected for cytologically studies of which 18 species ((*Gentiana kurroo* Royle; *Cheilocostus speciosus* (J.König) C. Specht; *Costus pictus* D.Don and *Withania somnifera* (L.) Dunal., *Roscoea alpina* Royle (two floral variants purple and white) and *Roscoea purpurea* Sm; *Agrimonia eupatoria* L. (Rosaceae); *Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn; *Catamixis baccharoides* Thomson; *Hedychium flavum* Roxb.; *Ipomoea nil* (Linn.) Roth; *Kaempferia parviflora* Wall.ex Baker; *Nervilia crociformis* (Zoll. & Moritzi) Seidenf.; *Ophioglossum reticulatum* L.; *Pogostemon pumilus* (Graham); Press; *Rhynchoglossum notonianum* (Wall.) B.L. Burtt; *Stephania glabra* (Roxb.) Miers; *Rhus punjabensis*) were identified and meiotic/mitotic studies were done for eleven species. Herbarium processing of all the cytologically studied voucher specimens is under progress. Of 11 species studied cytologically, desirable stages for counting the chromosome number were observed in eleven species (*Agrimonia* eupatoria, $2n=4x=56$; *Gentiana kurroo,* $2n=2x=26$; *Withania somnifera*, $2n=4x=48$; *Boenninghausenia albiflora*, $2n=2x=20$; *Hedychium flavum*, $2n=2x=34$; *Ipomoea nil*, $2n=2x=30$; *Kaempferia parviflora*, $2n=2x=22$; *Nervilia crociformis,* $2n=4x=$c 40; *Ophioglossum reticulatum*, $2n=21x=$c 1260; *Pogostemon pumilus,* $2n=2x=32$; *Rhynchoglossum notonianum,* $2n=2x=20$; *Stephania glabra,* $2n=2x=26$; *Lilium polyphyllum* D. Don ex Royle ($2n=2x=24$)). Among studied species, chromosome counts for two species namely, *Catamixis baccharoides* and *Pogostemon pumilus* were reported for the first time at worldwide level and first chromosome counts are also recorded from India in three species.

PROJECT-5

Ethnobotanical study of Tharu and Bhoxa tribe of Uttarakhand, India

Executing Scientist(s) : Dr. Harish Singh
Date of Initiation : 2020
Date of completion : 2023

OBJECTIVE:

Folklore survey and field work in the Tharu, Bhoxa and indigenous populated areas and nearby forests of the state.Collection and identification of plants and plant products used by them for various purposes.Documentation of traditional knowledge about utilization of plants and preparation of inventories of folklore plants.Germplasm collection of rare and important ethnobotanical plants to develop small-scale ethnobotanical garden for *ex-situ* conservation point of view.Survey of countryside socio-religious fairs and festivals for collection of little or unknown ethnobotanical specimens/ items /artifacts /handicrafts that may enrich the ethno-museum of BSI, NRC, Dehradun.

BACKGROUND:

Uttarakhand is an ideal State from ethnobotanical point of view, as rich in floristic as well as in ethnic diversity with varied climate zone. The State is inhabited by 5 tribal groups namely Tharu, Bhoxa, Bhotia, Jaunsari, and Raji. Only Bhoxa and Tharu tribe are residing in sub-Himalayan tract (*Terai, Bhabar* and plain area) of Uttarakhand. Through scrutiny of literature, it is found, more than 400 research papers/ articles/ books have been already published on various aspects of Ethnobotany of Himalayan region of Uttarakhand but only few papers have been published on Ethnobotany of Tharu, Bhoxa and indigenous people of *Terai,*

Bhabar and plain area of Uttarakhand. Hence, it was proposed to collect all the traditional knowledge on utilization of plants from the Tharu, Bhoxa and indigenous people of sub-Himalayan tract (Udham Singh Nagar, Dehradun and Pauri districts) of Uttarakhand before their complete extinction through extensive field survey as well as from literature survey.

AREA AND LOCALITY

Uttarakhand

SUMMARY & ACHIEVEMENT/OUTCOME

Four local field tours on 20.09.2020, 12.10.20, 23.12.20 and 08.03.21-14.03.21 were conducted in Dehradun Dist. and Udham Singh Nagar Dist. among Bhoxa tribe during which 556 field numbers with 366 ethnobotanical uses were collected. Among the collected specimens 97 species were identified and 87 species were incorporated in BSD herbarium, *viz. Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm. *Senna tora* (L.) Roxb. *Bauhinia semla* Wonderlin, *Calliandra haematocephala* Hassk, *Justicia adhatoda* L., *Glycosmis pentaphylla* (retz.) DC., *Solanun mauritianum* Scop., *Clerodendrum infortunatum* L., *Murraya koenigii* (L.) Spreng., *Litsea glutinosa* Lour.C.B. Robins., *Sida acuta* Burm.f., *Solanum violaceum* Ortega, *Solanum viarum* L., *Datura metel* L., *Senna tora* (L.) Roxb., *Senna* occidentalis (L.) Link, *Cissampelos pareira* L., *Achyranthes aspara* L., *Rubus niveus* Thunb. ,*Baliospermum solanifolium* (Burm.) Suresh, *Curculigo orchioides* Gaertn., *Mallotus philippensis* (Lam.) Muell.Arg., *Plumbago zeylanica* L., *Ehretia laevis* Roxb., *Ageratum conyzoides* (L.) L., *Flacourtia jangomas* (Lour.) Raeush., *Dioscorea belophylla* (Prain) Voigt ex Haines, *Carissa carandas* L., *Drimia indica* (Roxb.) Jessop, *Lantana camara* L., *Flemingia chapper* Benth., *Porana paniculata* Roxb., *Ardisia solanacea* (Poir.) Roxb., *Naringi crenulata* (Roxb.) Nicolson, *Abrus pulchellus* Thwaites, *Asparagus racemosus* Willd., *Syzygium cumini* (L.) Skeels, *Holoptelia integrifolia* Planch, *Shorea robusta* Gaertn., *Holarrhena pubescens* Wall. *ex* G.Don, *Terminalia chebula* Retz., *Colebrookea oppositifolia* Sm., *Dendrocalamus strictus* (Roxb.) Nees, *Ficus racemosa* L., *Urtica dioica* L., *Ricinus communis* L., *Morus alba* L., *Bauhinia variegata* L., *Rumex nepalensis* Spreng., *Vallaris solanacea* (Roth) Kuntze Till now, *c.* 1545 sq. km. areas were surveyed.

PROJECT-6

Ex-situ conservation of endemic threatened and economic plant species in the associated garden of NRC and documentation of monthly data on flowering and fruiting

Executing Scientist(s) : Dr. S.K. Singh, Dr. Puneet Kumar & Dr. Purushottam Kumar Deroliya

Date of completion : Ongoing

OBJECTIVE:

Collection, introduction and subsequent maintainace of endemic, threatened and economic plant species in the Boranic Gardens, NRC.

SUMMARY & ACHIEVEMENT/OUTCOME

04 one day field tours were conducted to Mussoorie and adjoining areas, Asan barrage, Karwapani swamp, Gopeshwar and Nakraunda swamp on 10.07.2020, 01.08.2020, 25.02.2021 and 16.9.2020 respectively during which *Incarvillea emodi*, and some RET sp. *viz. Cymbidium iridifolium*; *Cymbidium iridioides* ;

Dendrobium monticola; *Dendrobium crepidatum* Lindl. & Paxton; *Dendrobium christyanum*; *Dactylorhiza hatagirea* ; *Coelogyne cristata*; *Bulbophyllum umbellatum*; *Bulbophyllum cardiophyllum* ; *Oreorchis indica*; *Zeuxine flava* ; *Cyathea spinulosa*; *Potentilla anserina*, *Acorus calamus*; *Bacopa monnieri*; *Calamus tenuis*; *Equisetum ramosissimum*;*Talinum fruticosum* and *Talinum portulacifolium* were collected and introduced in Botancal garden. In addition some other plants namely *Eria alba*; *Rhododendron* 02 sp.; *Eiria* sp; *Celtis australis*; *Skimmia anquetilia* ; *Madhuca butyracea*; *Selaginella* sp. were collected for the purpose of introduction in garden. Besides, *Vallisineria spiralis*, *Azolla pinnata* ; *Marsdenia roylei, Potamogeton crispus* were also collected during germplasm collection tour. In addition, the existing collection are also maintained in the Botanic Garden under *ex situ* conservation. About 900 plants 25 species of endemic, threatened and economic plant species propagated in the garden were sent to BGIR Noida. Phenological data: October [Fl 27; FR 19], November [Fl 21; FR 27], December [Fl 10; FR 19], Januray [Fl 18; FR 28], February [Fl 21; FR 27], March [Fl 40; FR 24] were recorded around the year.

PROJECT-7

In vitro mass multiplication and propagation and rehabilitation in natural habitat of useful and threatened species of North-West Himalaya.

Executing Scientist(s) **:** Dr. Giriraj Panwar & Dr. Bhavana Joshi

Date of Initiation **:** 2020
Date of completion **:** 2023

OBJECTIVE:

Collection of explants/plant propagules (seed, live plants or plant parts) from the wild population.Standardization of micropropagation protocol for the selected species by direct and indirect organogenesis methods using different explants such as shoot tip, nodal segment, axillary bud, young leaves and other meristematic tissues.Hardening of plantlets in the green house/net house and shifting of acclimatized plants to the open environment as well as field.

BACKGROUND:

The North-Western Himalaya encompasses a wide ecological breadth from subtropical broad leaf forests to alpine grasslands. The region is spread over four Indian states *viz.* Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Ladakh (Union Territory). This wide ecological breadth is a result of combined effect of the range it covers from low-lying hills to high Himalayan mountain with altitudinal range 29°–36° N, 74°–81° E and moisture regime from cold deserts to rain forests. It covers about 10% of the geographical area, 20% of the forest cover and 40% of the endemic species of the Indian subcontinent. The North-West Himalaya of India is one of the biodiversity hotspots and constitutes nearly 5000 species of angiosperms of which ca. 24% are endemic to the region. It represents nearly 105 species of threatened plant from its different bio-geographical zones. Most of the plant species of this area are of immense economic importance and are being used by the local people for their several requirements since long back. Many of the plant species are being used for the cure of several ailments. Due to their medicinal and other economic importance, these plants are rapidly being depleted from their natural habitat. Most of the plant species of the North-West Himalayas are facing the acute threat and few of them are in the verge of extinction. The economical and medicinal importance of floral diversity of the region has long been mentioned in ancient

Hindu texts and has been a subject of curiosity for botanists over the centuries. Rare, Endemic and Threatened plants (RET) are an integral component of the local flora and vegetation, and the disappearance of these species can lead to loss of biodiversity. Therefore, effective *ex-situ* conservation strategyis essential to ensure their successful propagation and perpetuation. Thus, these three threatened species were selected for their ex-situ propagation through tissue culture technology.

AREA AND LOCALITY

NA

SUMMARY & ACHIEVEMENT/OUTCOME

Micropropagation protocols were standardized for the endemic and endangered species *viz.Eulophia dabia*, *Nepenthes khasiana* and *Rhynchostylis retusa*. All the three species were successfully established to the open environment and saplings of *E. dabia* were also provided to the forest Department of Uttarakhand. Seeds of *Zanthoxylum armatum*, *Cyathea spinulosa*, *Trachycarpus takil* and *Mezotropis pellita* were collected from the wild and experimental botanical Garden, inoculated onto basal MS medium for the in vitro germination. Seeds of *Zanthoxylum armatum* and *Mezotropis pellita* were also sown in soil for the ex-vitro germination. Shoot tip and nodal segment explants of *Malaxix acuminata*, *Dendrobium crepidatum*, *Magnolia kisopa* and *Zanthoxylum armatum* were inoculated into MS medium supplemented with different concentration of plant growth regulators.

SIKKIM HIMALAYAN REGIONAL CENTRE, GANGTOK

ROUTINE PROJECT-1

Updating the BSHC Herbarium and its Digitization

Executing Scientist(s) : All the scientific staffs
Date of completion : Ongoing

SUMMARY OF WORK DONE

Scanning and metadata entry for 1605 sheets were done from Barcode BSHC 00025988 to BSHC00027592.

SOUTHERN REGIONAL CENTRE, COIMBATORE

PROJECT-1

Flora of Kanniyakumari Wildlife Sanctuary, Tamil Nadu

Executing Scientist(s) : Dr. Sujana K. A. & Mr. R.G. Vadhyar
Date of Initiation : 2016
Date of completion : 2021

OBJECTIVE:

To carry out studies on flowering plant diversity of Kanyakumari Wildlife Sanctuary, Tamil Nadu with special focus on endemic and threatened plants.

BACKGROUND:

Kanniyakumari is one of the smallest districts in Tamil Nadu and has very high proportion of its landscape under tree cover (70%). The reserve forests and protected areas are owned and managed by the forest department and they constitute about 31 % of geographical area. Kanniyakumari Wildlife sanctuary with adjacent areas of Kalakkad Mundanthurai Tiger Reserve and Neyyar Wildlife Sanctuary of Kerala State constitutes the southernmost tips of Western Ghats. Kanniyakumari Wildlife Sanctuary is floristically one of the richest areas in our country. The natural vegetation of this region represents varied biomes ranging from southern thorn forests, dry deciduous, moist deciduous, semi evergreen forests to ever green hill sholas with grassy downs. The tract is exceedingly rich in wildlife harbouring a variety of animals. The vegetation and flora of Kanniyakumari sanctuary are exceptional because of extraordinary variety of species occurring within a small area.

AREA AND LOCALITY

The Kanniyakumari forest division located between $70^{0}10'$-$77^{0}35'$ East longitudes $08^{00}5'$-$08^{0}35'$North latitudes was declared as Kanniyakumari Wildlife Sanctuary during 2002, covering an area of 45777.57 ha. Later in 2007, Kani tribal settlements, approach road to settlements and area leased out to Arasu Rubber Corporation were excluded from the sanctuary and an area of 40239.55 hectares was declared as Kanniyakumari Wildlife Sanctuary.

SUMMARY & ACHIEVEMENT/OUTCOME

One field tour was conducted to the study area on 21.09.2020. Processed 460 specimens collected in previous field tours of which 151 specimens were identified and reported. This study reported 01 species new to science (*Memecylon nervosum* Vadhyar, J.H.F. Benj. & Sujana) and 02 new distributional records (*Meistera fulviceps* (Thwaites) Skornick. & M.F.Newman, *Polyalthia longipedicellata* (Alister et al.) Shailajakumari et al.) for Tamil Nadu.

PROJECT-2

Assessment of Plant diversity in Cauvery North Wildlife Sanctuary; Tamil Nadu

Executing Scientist(s) : Dr. R. Manikandan & Smt. Mehala Devi

Date of Initiation : 2017
Date of completion : 2021

OBJECTIVE:
Documentation of the floral diversity of the Cauvery North Wildlife Sanctuary; to categorize the threat status for the threatened and endemic plants from the study area; Herbarium consultation to different herbaria and Study of plant resources and their utilization practices by local communities living in and around the Sanctuary.

BACKGROUND:
The Cauvery North Wildlife Sanctuary was recently established in the year of 2014, covers an areas of 504.33 sq. km. It is situated in the Hosur and Dharmapuri Forest Divisions of the two districts namely Krishnagiri and Dharmapuri, in the state of Tamil Nadu. The elevation varies from 200 m to 1390m and the annual rainfall around 800 mm from the Hosur Plateau into the river. Though there are sporadic works on floristic account from the adjoining areas of the sanctuary, no details floristic account of the Sanctuary is carried out till now. Therefore the present work has been undertaken.

AREA AND LOCALITY
Cauvery North Wildlife Sanctuary, Tamil Nadu, 504.33 sq. km.

SUMMARY & ACHIEVEMENT/OUTCOME

Herbarium consultation was conducted to THE RAPINAT HERBARIUM, St. Joseph's College (Autonomous), Tiruchirapalli, Tamil Nadu from 04.01.2021 to 13.01.2021 during which 400 specimens were consulted from the study area. Approx. 396 sq.km. area was surveyed till now and 200 field numbers were identified from earlier collections from CNWLS. Label writing for almost all specimens were completed and pasted on mounted specimens. During this study, *Strobilanthes carnatica* Carine, J.M. Alexander & Scotland (Acanthaceae) was collected from the type locality after 40 years. A list of 70 endemic species was collected from the study area.

PROJECT-3

Marine Macro Algal Flora of India

Executing Scientist(s) : Dr. M. Palanisamy & Dr. S.K. Yadav

Date of Initiation : 2019
Date of completion : 2022

OBJECTIVE:
Survey and documentation of the marine algae of the unexplored areas; photography of all the marine algae found in the Indian coast; Consultation of literature and herbarium specimens housed in various herbaria in India; Identification and preparation of Taxonomic keys; The compilation of data in the form of Marine Macro Algal Flora of India

BACKGROUND:

India (8°–37° N and 68°–97° E), is one of the seventeen mega diversity countries (www.conservation.org) and the 7th largest country in the world with 2.4% of the global geographical area. The country has a coastline of ca 7,516.16 km and an Exclusive Economic Zone (EEZ) of around 2.5 million km^2. The Indian coastline has a massive network of beaches, backwaters, estuaries, creeks, cliffs, lagoons, mangroves and coral reefs, which supports a large number of marine flora and fauna. The coastline includes 97 major estuaries, 34 major lagoons, 31 mangroves areas, 5 coral reefs and 31 Marine Protected Areas. The pattern of distribution and diversity of seaweeds in various maritime states in India varies greatly. Tamil Nadu coast shows the highest number of seaweeds with 426 species (Anon.,1978), followed by Maharashtra coast with 240 species (Sonali, 2010); Gujarat coast with 198 species (Jha & al., 2009); Kerala coast with 147 species (Palanisamy and Yadav, 2016), Lakshadweep islands with 82 species (Anon., 1979) and Andaman & Nicobar islands with 80 species (Muthuvelan & al., 2001); Karnataka with 108 taxa, comprising 36 species of Chlorophyceae, 30 species of Phaeophyceae and 42 Rhodophyceae members (Palanisamy & Yadav, 2017); Diu island with 70 species (Mantri & Subba Rao, 2005); Andhra Pradesh with 65 species (Anon, 1984); West Bengal with 14 species (Mukhopadhyay & Pal, 2002); Odisha with 21 species (Rath & Adhikary,2006).

In order to improve our knowledge on seaweed resources of the country, several checklists and consolidated reports have been published by various phycologists. Dixit (1965, 1968) published a list of 411 species of seaweeds from the Indian coasts including the coasts of Pakistan and Sri Lanka. Srinivasan (1969, 1973) published two volumes on the *Icons of Marine Indian Algae*, describing about 50 species of seaweeds from the Indian coast. Krishnamurthy & Joshi in 1970 published *A Checklist of Indian Marine Algae* that included records from Pakistan and Sri Lanka and listed 520 taxa of seaweeds. Subsequently, Untawale & al. (1983) published a list of marine algae of India in the form of memiography and recorded 624 species of seaweeds. Duraiswamy (1990) published a detailed taxonomic account of a green seaweed genus *Caulerpa* in India. Silva & al. (1996) published *The Catalogue of the Benthic Marine Algae of the Indian Ocean*, which is considered a monumental work for the Indian seaweeds. Desikachary & al., (1990, 1998) published the *Rhodophyta* (red seaweeds) of India in two volumes. Sahoo & al. (2001), based on the available literature, published a checklist on the *Seaweeds of Indian Coast* and recorded 770 species including 184 species of Chlorophyceae, 166 species of Phaeophyceae and 420 species of Rhodophyceae. Oza & Zaidi (2001) from Central Salt and Marine Chemicals Research Institute (CMFRI), Bhavnagarpublished*A Revised Checklist of Indian Marine Algae* which included 844 seaweed species including forma and varieties from throughout the Indian coasts. Recently, a revised monograph on brown seaweeds *i.e.Phaeophyceae of India and Neighbourhood* (Volume I & II) have been published by Krishnamurthy & Baluswami (2010) and Krishnamurthy & Ezhili (2013) respectively. More recently, the Botanical Survey of India, Kolkata (Rao & Gupta, 2015) has published an updated checklist on the Indian marine algae, containing a report of 865 taxa of seaweeds which included 212 taxa of Chlorophyceae, 211 taxa of Phaeophyceae and 434 taxa of Rhodophyceae.

However, many of the maritime states have not been explored intensively. Also, the taxonomical problems and nomenclature issue were not considered and have to be updated. Hence, there is a necessity of intensive field exploration in the unexplored or less explored coastal states so that we can bring an updated national seaweed flora. Considering the above facts, the present taxonomic studies on the *Marine macro algal flora of India* has been taken into account

AREA AND LOCALITY

India (8°–37° N and 68°–97° E) is a peninsular country with *ca* 7500 km long coastline, spread into 9 coastal states and 4 UTs. It is one of the seventeen mega diversity countries and the 7th largest country in the world with 2.4% of the global geographical area. The country has a coastline of ca 7,500 km and an Exclusive Economic Zone (EEZ) of around 2.5 million km^2. It is naturally endowed with diverse patterns of habitats like beaches, backwaters, estuaries, creeks, cliffs, lagoons, mangroves and coral reefs, which support a large number of marine flora and fauna.

The Indian coasts consist in nearly of 43% of their total length of sandy beaches, in 11% of rocky with headlands, platforms and cliffs, and in 46% of mud flats and marshy wetlands (ICMAM, 2009). In terms of marine environment, Indian coastline stretches about 5700 km covering 9 states on mainland and about 7500 km including islands and union territories (Oza & Zaidi, 2001) with a very wide range of coastal ecosystems such as estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs (Venkataraman, 1939).

The coastline of India shows wide range of variability in its topography, geographical position and provides the great habitats for the enormous diversity of marine macro algae.

SUMMARY & ACHIEVEMENT/OUTCOME

112 Nos. specimens were labelled and identified from previous collection from Gujarat coast (collected during 10.03.2020 – 21.03.2020). Totally, 77 taxa of 22 families under 15 orders were recognized. Among them, Rhodophyceae is the predominant class with 38 taxa followed by Chlorophyceae with 21 taxa and Phaeophyceae represents 18 taxa. Dictyotaceae is the primary family encompasses of 9 taxa, and Ulvaceae, Gracilariaceae, Halymeniaceae, Caulerpaceae, Sargassaceae typify with 5 taxa. Valoniaceae is the trivial family with only one taxon.

PROJECT-4

Ex situ conservation of endemic endangered and threatened Plts. Of the region and recording of phenology of flowering / fruiting of species in garden

Executing Scientist(s) **:** Dr. S. Kaliamoorthy & Dr. T. S. Saravanan
Date of completion **:** Ongoing

OBJECTIVE:

Ex situ conservation of endemic endangered and threatened Plts. Of the region including ewcording phenological data.

BACKGROUND:

Wayanad district lies with a hilly terrain on the southern Western Ghats and located in the northeast part of Kerala at a distance of about 76 km from the seashores of Kozhikode. The area lies between North latitude 11° 26‘ to 12° 00‘ and East longitude 75° 75‘ to 76° 56‘. The altitude varies from 700- 2100 metres above MSL. It is bounded on the east by Nilgiris and Mysore district of Tamil Nadu and Karnataka respectively, on the north by Coorg district of Karnataka, on the south by Malappuram district and on the west by Kozhikode and Kannur districts of Kerala. To the west and south are the low lands of Malabar, to the east rise the Nilgiri hills, to the northeast lies the Mysore plateau, while to the northwest the chain of Ghats

stretches away in to the Coorg. Annual rain fall ranges from 3000 to 4000 mm. Wayanad recorded the mean maximum and minimum temperature for the last five years were 29°C and 18°C respectively with a relative humidity up to 95 per cent during the southwest monsoon period. Total area under forests in Wayanad is 787 sq. km. The forest area in the district is administratively divided into Wayanad Wildlife Sanctuary (Sulthan Bathery, Muthanga, Kurichiad and Tholpetty Ranges 344.44 km2) and other reserve forests. The reserve forest of the district is under two administrative divisions namely Wayanad north (214.29 km2) and Wayanad south divisions (325.339 km2). North division constitutes Mananthavady, Periya and Begur ranges, which is dominated by evergreen and moist deciduous forests. South division forms Kalpetta, Meppady and Chedeleth ranges, which is also dominated by evergreen and moist deciduous forests.

The natural flora of this area is that of the evergreen and moist deciduous forests consisting of a mixture of evergreen and deciduous elements. Some of the dominant trees of this region are *Artocarpus hirsutus*, *Albizia odoratissima*, *Pterocarpus marsupium*, *Gmelina arborea*, *Acrocarpus fraxinifolius*, *Mallotus tetracoccus* and *Terminalia crenulata*. Epiphytic orchids common in these plantations are *Rhynchostylis retusa*, *Aerides ringens* and *Cleisostoma tenuifolium*. High humidity, shade and sheltered condition provide ideal habitat for epiphytic as well as terrestrial orchids, ferns, mosses and herbaceous flowering plants. Orchidaceae, form the largest family in India and take the second position in the order of dominance in Wayanad district; whereas in Kerala and Western Ghats their position is third and fourth respectively. The family Orchidaceae is represented by 165 species belonging to 68 genera. Of these, 59 species belonging to 29 genera are terrestrial in habit, while 106 species in 39 genera are epiphytic.

AREA AND LOCALITY

Wayanad district, Kerala

SUMMARY & ACHIEVEMENT/OUTCOME

One local tour to Manjakuttai, Yercaud was conducted for collection of live plants during which 18 species were collected and introduced in garden *viz. Papilionanthe subulata* (Willd.) Garay – 3 plants; *Vanda testacea* (Lindl.) Rchb.f.– 2 plants; *Diplocentrum recurvum* Lindl. – 2 plants; *Habenaria glandilfloriformis* Blatt. & McCann.- 4 plants; *Habenaria rariflora* A. Rich. – 2 plants; *Brachystelma saldanhae* S.J. Britto & P.V. Bruyns – 6 plants; *L*edebouria *revoluta* (L.f.) Jessop – 3 plants and *Ledebouria hyderabadensis* M.V. Ramana, Prasanna & Venu – 5 plants. In addition, multiplication of endemic plants, orchids (*Goodyera procera* (Ker Gawl.) Hook. – 11 Plants, *Coelogyne pallens* Lindl. - 2 Plants, *Coelogyne fimbriata* Lindl.– 2 Plants, *Eria psuedoclavicaulis* Blatt & Maccann – 12 Plant), Ornamental Plants (Orchids) (*Acampe praemorsa* (Roxb.) Blatt&Macaan – 3 Plants, *Epidendrum radicans* Pav. ex Lindl. – 35 Plants), RET species (*Amomum hypoleucum* Thw. – 7 Plants, *Angiopteris erecta* Desv. – 3 Plants, *Arachis villosa* Benth. – 7 Plant, *Cyathea nilgirensis* Holttum - 3 Plants, *Davallia griffithiana* Hook. – 2 Plants etc), seedlings of *Alpinia caerulea* (R.Br.) Benth - 3 Plants, *Dorstenia indica* Wight– *6* Plants, *Asclepias curassavica* L.– 5 Plants, *Hemerocallis fulva* (L.) L. – 2 Plants, *Zingiber neesanum* (J.Graham) Ramamoorthy –5 Plants etc.), cuttings of *Homalocladium platycladum* (F.Muell.) L.H.Bailey – 4 Nos, *Impatiens platypetala* Lindl.– 5 No, *Kalanchoe laxiflora* Baker – *8 Nos*, *Monosis shevaroyensis* (Gamble) H. Rob. and Skavarla – 20 Nos. etc., was done in Experimental garden. During 2020-21, Flowering & fruiting phenology were recorded for 104 species belongs to 43 genera of Orchids and for 79 species belongs to 65 genera of angiosperm were recorded.

PROJECT-5

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

Executing Scientist(s) : Dr. M.Y. Kamble & Shri B.S. Elango
Date of completion : Ongoing

OBJECTIVE:
Multiplication and maintenance of existing collections; documentation of phenology; plantation of of multiplied saplings of endemic tree species in the Arboretum and Garden and distribution of of saplings of endemic species to Botanical Gardens, Research Organizations and Forest Departments, for reintroduction and ex-situ conservation.

BACKGROUND:
The Agasthyamalai Biosphere Reserve is located in two states; Kerala and Tamil Nadu. This Biosphere has a total area of 3500 sq km; 1828 sq km is in Kerala and 1672 sq km is in Tamil Nadu. The Agasthyamalai region is partly located on the southern part of the Western Ghats. It contains moist forests and tropical forests. Parts of Agasthyamalai are classified as a mid-elevation tropical wet evergreen rainforest and other areas are subtropical climatic regimes. One of the regions in Agasthyamalai is the Kalakad-Mudanthurai Tiger Reserve and it is located right in the Agasthyamalai Hills. In the rainforest there are three different seasons throughout the year. Agasthyamalai Biosphere Reserve became part of World Network of Biosphere Reserves in 2016. The area lying between 77°5‘ and 77°40 E longitude and 8°50‘ N latitude, falls within the hilly tracts of the Kollam and Thiruvananthapuram districts of Kerala, and Tirunelveli-Kattabomman and Kanniyakumari districts of Tamil Nadu. This Biosphere has a forest cover of about 2000 sq.km., with altitudes ranging from 67 to 1868 m. It is composed of Neyyar, Peppara and Shendurney Wildlife Sanctuaries and their adjoining areas of Achencoil, Thenmala, Konni, Punalur, Thiruvananthapuram Divisions and Agasthyavanam Special Division in Kerala and areas of KalakkadMundanthurai Tiger Reserve in Tamil Nadu. The area represents diverse ecosystems with almost all types of vegetation known to occur such as the southern tropical thorn forests, southern tropical moist deciduous forests, tropical semi-evergreen forests, southern tropical wet evergreen (rain) forests, subtropical montane forests and grassy swards at high altitudes. The AgasthymalaBiosphere Reserve harbours approximately 2000 species of flowering plants which include ca100 endemic and 50 rare and endangered species.

AREA AND LOCALITY
Agasthyamala Biosphere Reserve (SWG)

SUMMARY & ACHIEVEMENT/OUTCOME

During 2020-21, 714 no. of endemic, endangered and threatened species were multiplied in experimental garden through seeds or stem cuttings from existing germplasm as well as previously collected seeds from Agasthyamalai Biosphere Reserve, Western Ghats.
ENDEMIC TREES: 580 nos. of seedlings

Through seeds: 490 nos.
Through stem cuttings: 90 nos.

ENDEMIC SHRUBS: 120 nos.

Through seeds: 01no.

THREATENED LIANA: 14 nos.

Through seeds: 14 nos.

Regarding maintenance of endemic tree species in the garden, saplings of 39 species (*Syzygium palodense* Shareef, E.S.S. Kumar & Shaju (MYRTACEAE); Vulnerable, *Syzygium mundagam* (Bourd.) Chithra (MYRTACEAE); Vulnerable, *Xanthophyllum arnottianum* Wight (XANTHOPHYLLACEAE); Vulnerable, *Tabernaemontana gamblei*Subram. & Henry (APOCYNACEAE); Endangered etc.) developed in the germination trays/beds through seeds or stem cuttings and transferred in earthen pots, nursery bags; maintaining in glass house, shady areas, etc in experimental garden. 270 endemic species (*Arenga wightii* Griff. (ARECACEAE); Vulnerable – 5 nos., *Bentinckia condappana* Berry ex Roxb.; Endangered – 55 nos., *Cinnamomum malabatrum* (Burm.f.) J. Presl. (LAURACEAE) – 1 no., *Cynometra travancorica* Bedd.; (FABACEAE); Endangered– 2 no., *Garcinia talbotii* Raizada ex Santapau (CLUSIACEAE); Least Concern – 10 nos., *Holigarna arnottiana* Hook. f. (ANACARDIACEAE); Least Concern– 5 nos. etc.) were planted in Arboretum and garden premises and 01 indigenous tree (*Mesua ferrea* L. (CLUSIACEAE) – 2 nos.) was also planted. Saplings of Endemic, Endangered and Threatened species multiplied in the garden were distributed to other botanical gardens, research organizations and State Forest Departments for reintroduction in forest areas and plantation in their gardens and ex-situ conservation. In 20-21, 51 Endemic, Endangered and Threatened species are maintaining in the garden Saplings 270 nos. under 24 nos. of Endemic species has been planted and more than 30 endemic tree species are being maintained in newly developed Arboretum and experimental garden.

PROJECT-6

Flora of Kerala Volume 3

Executing Scientist(s) **:** Dr. Shri P. Murugan & Dr. C. Murugan
Date of Initiation **:** 2020
Date of completion **:** 2022

OBJECTIVE:

Survey and documentation of the plant diversity; identification of endemic taxa and threatened taxa according to IUCN criteria and Documentation of plant resources and their utilization practices by local tribal communities living in and around the areas and their traditional conservation.

BACKGROUND:

In view of complete the Flora of Kerala, Director, Botanical Survey of India, Kolkata instructed at the Head of Office meeting held at the Central National Herbarium, Kolkata during May, 2018 (03-05-2018 to 04-05-2018). Hence, four students allotted to the Botanical Survey of India, Coimbatore to complete the target of Flora of Kerala Vol 3-7.

AREA AND LOCALITY

Kerala State lies along the Southern West coast of India between 8° 18′ and 12° 48′ N latitude and 74° 52′ and 77° 22′ E longitude. It is bounded by Karnataka in the North, Tamil Nadu in the South and East and the Arabian Sea in the West.

SUMMARY & ACHIEVEMENT/OUTCOME

One herbarium (MH!) was consulted and documented 87 genera and 27 spp.

Volume-4

Executing Scientist(s) **:** Shri Basil Paul & Dr. Sujana K. A. (under the supervision of Dr. M. U. Sharief)

SUMMARY & ACHIEVEMENT/OUTCOME

A total of 87 taxa belongs to 4 families [Acanthaceae (16), Lamiaceae (54), Pedaliaceae (5) and Solanaceae (12)] were documented along with nomenclature update and description of 87 species.

Volume 6

Executing Scientist(s) **:** Shri M. Sulaiman & Dr. M. Murugesan

SUMMARY & ACHIEVEMENT/OUTCOME

A total of 106 taxa belongs to Orchidaceae were documented.

WESTERN REGIONAL CENTRE, PUNE

PROJECT-1

Pteridophyte Flora of India

Executing Scientist(s) : Dr. A. Benniamin
Date of Initiation : August 2020
Date of completion : March, 2023

OBJECTIVE:
Study of Pteridophytic flora of India

BACKGROUND:
Pteridophytes form a conspicuous element of vegetation as intermediate between the lower cryptogams and higher vascular plants with long geological history on the planet. There are about 12,000 species recorded globally. India has a rich and varied Pteridophytic flora due to the varied nature of topography, variable climatic conditions and its geographical positions. However, there are about 1107 species belonging to 35 families and 130 genera in India. The vascular flora of our country in general has about 15,000 species and as a constituent of Indian flora of vascular plants, the ferns and fern-allies form only five percent part as far as the number of species is concerned. But, due to their abundance in individuals as well as their conspicuousness in epiphytic vegetation and in the terrestrial vegetation along forest margins, roadsides and forest floors, the contribution of ferns and fern-allies to the vegetational pattern in India rank only next to the flowering plants. The project Pteridophytic flora of India was allotted in August 2020. During the period studied the Herbarium specimens housed at MH. Critical review of existing past and present literature to restore the taxonomic complex among species. Standardizing and updating of nomenclature using standard worldwide online database.

AREA AND LOCALITY
India

SUMMARY & ACHIEVEMENT/OUTCOME:
Under Pteridophytic flora of India Vol 1 (Selaginellaceae ,Asplenicaeae , Woodsiaceae, Marattiaceae, Osmundaceae, Plagiogyraceae, Oleandraceae, Dryopteridaceae) Project, a total of 103 species belonging to 10 genera completed for the Pteridophytic flora of India. A detailed description along with key was prepared.

PROJECT-2

Phyto Data-Base of Konkan, Maharashtra

Executing Scientist(s) : Dr. Prashant K. Pusalkar
Date of Initiation : September, 2020
Date of completion : March, 2023

OBJECTIVE:

Preparation of complete Phyto Data-Base of Konkan region, covering diverse phyto-documentation aspects ranging from general phyto-diversity documentation to threats and status analysis of the flora, including documentation of unique and vulnerable conservation-dependent habitats/ ecosystems.

BACKGROUND:

This is a new project. The green Konkan coast, with diverse phyto-resources distributed in varied zones ranging from foot hills of Western Ghats to coastal Laterite plateaus (*Sada*‘) and further from coastal sand dunes to mangrove forests and adjoining marine ecoststem, is unique and one of the richest phyto-diversity zones of the country. However, unlike the adjoining Western Ghat region, the phyto-diversity documentation of this coastal green belt is scattered and without consolidated compiled database. The project initiated in 2020 with the aim to form complete phyto-diversity data-basing of species-rich Konkan coast, as baseline data for green resource status and diversity assessment, management, and conservation.

AREA AND LOCALITY

Konkan region, Maharashtra.

SUMMARY & ACHIEVEMENT/OUTCOME:

Initiated preparation of Konkan Phyto Data-Base with documentation of phyto-diversity from scientific literature and Herbarium specimen study along with compilation of phyto-research references. Completed identity confirmation and data documentation (487 species under 32 flowering plant families - under different categories such as Arboreal diversity, Climber diversity, Special and Unique Plant groups, Endemics and Conservation-dependent Species) with nomenclature updation, distribution and status documentation.

PROJECT-3

Bambusicolous fungi of Goa

Executing Scientist(s) : Dr. Rashmi Dubey
Date of Initiation : April, 2020
Date of completion : March, 2024

OBJECTIVE

Exploration of the diversity of Bambusicolous fungi of Goa and its adjoining areas; morphological identification of the bambusicolous fungal species along with Scanning Electron Microscopic studies; Isolation and molecular characterisation of Bambusicolous fungal species associated with different parts of Bamboo (leaves, culms, branches, sheathes, lowers, rhizomes, and roots); evaluating the validity of bambusicolous fungal taxa and clarifying their phylogenetic relationships by Multigene sequencing; cataloguing, preservation and maintenance of fungal germplasm.

BACKGROUND:

This is a new project. India is the second richest country in bamboo genetic resources after China and is likely to support an equally diverse mycota. But India‘s knowledge of bamboo fungi is still at the cataloguing stage. Bambusicolous fungi records are indexed, but the bamboo species hosting bambusicolous fungi are often not reported, secondly most bamboo species are in the wild and not domesticated for phytopathological scrutiny, and the complex lifestyle of bamboo species which encompasses fast growth, giant height, often growing in difficult terrain limits surveillance and impedes insights on bamboo

pathology. Thus these works will an opportunity for a comprehensive understanding of complex of Bambusicolous Fungi. Standard methodology will be adopted as: Survey and collection of samples, laboratory processing for morpho and molecular studies (DNA extraction, PCR amplification, DNA sequencing) and Phylogenetic analyses for conducting the studies.

AREA AND LOCALITY

Goa, c. 3,702 sq. km. area

SUMMARY & ACHIEVEMENT/OUTCOME:

Few samples were collected while attending other tours and started works for AAP Project. A total of 21 samples were collected and 24 fungal sp. were identified, which are as follows: *Acrodictys bambusicola* M.B.Ellis (Pezizomycotina)- Dead Bamboo, Dr. Salim Ali Bird Sanctuary,Goa; *Beltraniellaspiralis*Piroz. & S.D. Patil, 1966 (Beltraniaceae)-Dead Bamboo, Mhadei WLS, Goa; *Corynesporaca ssiicola* (Berk. & M.A. Curtis) C.T. Wei 1950-Corynesporacaceae- Leaf; *Chaetosphaerulina lignicola* (Tubeufiaceae) on Bamboo stem, Mhadei WLS, Goa; *Diatrypeloranthi* Tend. 1971 (Diatrypaceae) -Bamboo stem, Mhadei WLS, Goa; *Exserohilum elongatum* Hern. -Restr. &Crous 2018-(Pleosporaceae)-Dead Bamboo; *Kamalomyces bambusicola* Y.Z. Lu & K.D. Hyde 2017-(Dothideomycetes)-Dead bamboo stem- Dr. Salim Ali Bird Sanctuary,Goa; *Monodictys putredinis* (Wallr.) S. Hughes Dead bamboo stem, Dr. Salim Ali Bird Sanctuary,Goa; *Paradictyoarthriniumdiffractum* Matsush. 1996 (*Paradictyoarthriniaceae*) -Dead Bamboo, Mhadei WLS, Goa; *Pithomycesellisii* V.G. Rao & Chary 1972-(Didymellaceae)- Dead bamboo stem, Mhadei WLS, Goa, Dr. Salim Ali Bird Sanctuary,Goa; *Sporidesmiumehrenbergii* M.B. Ellis 1958-Amorphothecaceae- Dead bamboo stem; *Sporidesmium* sp. 1-Dothideomycetes-Dry Bamboo stem, Dr. Salim Ali Bird Sanctuary, Goa; *Aspergillus flavus* Link. 1890 *(Aspergillaceae),* on leaf of Bamboo, Dr. Salim Ali Bird Sanctuary, Goa; *Fusarium chlamydosporumWollenw. & Reinking, (1925), Nectriaceae* ,on leaf of Bamboo, Mhadei WLS, Goa;*Fusariumincarnatum*(Desm.) Sacc.,(1886), *Nectriaceae,* on leaf of Bamboo, Dr. Salim Ali Bird WLS, Goa; *Fusariumproliferatum* (Matsush.)Nirenberg ex Gerlach & Nirenberg (1982)*, Nectriaceae,* on leaf of Bamboo, Dr. Salim Ali Bird Sanctuary, Goa; *Lasiodiplodia theobromae (Pat.) Griffon &Maubl., (1909),* (*Botryosphaeriaceae)* on leaf of Bamboo, Dr. Salim Ali Bird WLS, Goa; *Trichoderma asperellum*(1999), (Hypocreaceae),on leaf of Bamboo Mhadei WLS, Goa; *Hypocreales* sp. on leaf of Bamboo, Dr. Salim Ali Bird Sanctuary, Goa; *Phomaherbarum Westend. 1852* (Didymellaceae), on leaf of Bamboo, Dr. Salim Ali Bird Sanctuary, Goa; *Nigrosporasphaerica*(Sacc.) E.W. Mason, (1927) (Sordariomyceteson leaf of Bamboo, Mhadei WLS, Goa; *Trichoderma asperellum*(1999) (Hypocreaceae),on leaf of Bamboo, Mhadei WLS, Goa.

PROJECT-4

Flora of Lakshdweep Islands

Executing Scientist(s) **:** Dr. Priyanka Ingle
Date of Initiation **:** September, 2020
Date of completion **:** March, 2021

OBJECTIVE:

BACKGROUND:

This is a new project. The Lakshadweep archipelago, consists of 36 islands, 12 atolls, 03 reefs and 05 submerged sand banks in the Arabian Sea, have a total geographic area of about 32.62 sq. km. of which only 10 islands are inhabited. These islands are similar in floristic composition due to prevalence of similar type of soil, climate and rainfall. Lakshadweep harbours c. 358 angiosperms represented by 79 families, 265 genera and 5 pteridophytes. The low species diversity in the islands may be due to the calcareous nature of soil. Also the main source of water is rain, which sieves down quickly due to the high porosity of the soil. Hence, plants with roots long enough to reach water can only survive. The lagoon side or western side of islands is dominated by littoral species like *Ipomoea pes-caprae* (L.) R. Br.,*Launaeasar mentosa* (Willd.) Sch. Bip. ex Kuntze, *Pemphis acidula* J.R. Forst., *Scaevola taccada* (Gaertn.) Roxb., *Spinifex littoreus* (Burm.f.) Merr., *Suriana maritima* L. and *Volkameriai nermis*L. while eastern shore is dominated by *Cordia subcordata* Lam. and *Guettarda speciosa* L. The middle portion of the islands is dominated by coconut trees. Other species include *Artocarpu saltilis* (Parkinson ex F.A. Zorn) Fosberg, *Colubrina asiatica* (L.) Brongn., *Dodonaea viscosa* Jacq., *Hernandia nymphaeifolia* (C. Presl) Kubitzki, *Hibiscus tiliaceus* L., *Morinda citrifolia* L., *Pisonia grandis* R. Br., *Tacca leontopetaloides* (L.) Kuntze and *Thespesia populnea* Sol. ex Corrêa.

AREA AND LOCALITY

Lakshadweep archipelago, latitudes 8° N to 12° 30‘ N and longitudes 71° E to 74° E

SUMMARY & ACHIEVEMENT/OUTCOME

Nomenclature of 358 taxa was standardised using global databases along with updated citations. Generic and species keys were prepared wherever required. Studied herbarium specimens available at BSI, prepared data and included approximately 300 specimens examined on the basis of available data from CAL, MH, etc. This work resulted in the updated Flora of Lakshadweep Islands which includes 358 angiospermic taxa (including infraspecific taxa) represented by 79 families, 268 genera and 05 pteridophytic taxa.

PROJECT-5

Checklist of the Flowering Plants of Goa

Executing Scientist(s) : Dr. C.R. Jadhav & Dr. P.K. Pusalkar
Date of Initiation : September, 2020
Date of completion : March, 2021

OBJECTIVE

Preparation of checklist of vegetation of Goa

BACKGROUND:

This is a new project. Goa, a state on the southwestern Coast of India within the region known as ‗Konkan‘, is separated from Deccan highlands by the Western Ghats and covering an area of 3702 sq. km with 131 km long coast line which is more or less dentate with creeks, inlets and river deltas. Its maximum length is 105 sq. km. and the width is 60 km. Vegetation of Goa can be broadly classified into four types: Estuarine vegetation of Mangroves along swampy river banks; Strand and creek vegetation along coastal belt; Plateau

vegetation along undulating terrain and foot hills and Semi-evergreen and evergreen vegetation along the upper Ghats. Keeping in mind the need of National Data Base on Plants of India, this project was proposed.

AREA AND LOCALITY

Area is 3702 Sq. km. It is situated between the latitudes 14°53′54″ N and 15°40′00″ N and longitudes 73°40′33″ E and 74°20′13″ E.

SUMMARY & ACHIEVEMENT/OUTCOME

About 800 species/ taxa (of Dicotyledons) species were listed along with their Families, synonyms, localities and phonological data from Flora of Goa, Diu, Daman, Dadra and Nagarhaveli(Vol.1 & 2) by Rolla Sheshagiri Rao, 1985. These names were checked and updated with global database. A list of about 800 species /taxa was prepared along with their latest accepted names, Families, localities and phonological data for preparation of National Data Base on plants.

PROJECT

FLORA OF INDIA

Flora of India Vol. 8 (*c.* 523 taxa)

Executing Scientist(s) : Dr. S.S. Dash (Team Leader) & Dr. Debasmita Dutta Pramanick
Date of Initiation : 2019
Date of completion : 2021

OBJECTIVE
Updating nomenclature and documentation of 36 genera, 441 species and 80 infraspecific taxa of the families Rosaceae, Chrysobalanaceae & Neuradaceae in India.

BACKGROUND
This project was initiated in 2019. During 2019-20, One Herbarium consultation tour was conducted to DD & BSD during which a total 1364 no. of specimens were studied and reconfirmed identity of 12 specimens at DD. Updated nomenclature and description of 120 taxa along with proper citation, basionym, relevant synonyms, phenology, distribution, uses, chromosome nos. and taxonomic notes. A checklist comprising of 36 genera and 523 taxa was prepared for ‗Checklist of Flora of India'.

AREA AND LOCALITY
India

SUMMARY & ACHIEVEMENT/OUTCOME:
Volume 8 comprising of 36 genera, 441 species and 80 infraspecific taxa of the families Rosaceae, Chrysobalanaceae & Neuradaceae in India was completed in the ‗Flora of India' format with current nomenclature according to ICN and author citations according to Brummitt and Powel's ―Author of Plant Names", abbreviations of Periodicals confirmed with BPH and for Books with TL-2. Final Manuscript was submitted.

Flora of India, Vol. 10

Executing Scientist(s) : Late Dr. B.K. Sinha & Dr. S.S. Dash (Team Leader)
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Mss. has been submitted and is under editing stage.

Flora of India, vol. 11

Executing Scientist(s) : Dr. C. Murugan (Team Leader), Dr. W. Arisdason, Dr. M. Murugesan & Dr. K.A. Sujana
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. is not submitted.

Flora of India, vol. 14

Executing Scientist(s) : Dr. M. Gangopadhyay & Dr. Arti Garg
Date of Initiation : 2018
Date of completion : 2021

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, vol. 15

Executing Scientist(s) : Dr. A.A. Mao, Dr. S.S. Dash, Dr. U.K. Tiwari & Dr. V.K. Mastakar
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, vol. 16

Executing Scientist(s) : Dr. Dr. S.S. Dash, Dr. A.A. Mao, Dr. Arti Garg, Dr. U.K. L. Tiwari, Dr. Sanjay Mishra, Dr. Anand Kumar, Dr. A. Pramanik & Dr. Riju Palika Roy

Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, Vol. 17

Executing Scientist(s) : Dr. J. Jayanthi
Date of Initiation : 2018
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, Vol. 18

Executing Scientist(s) :Dr. S.L. Meena, Dr. Sanjay Mishra & Dr. P. Hari Krishna
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has not submitted.

Flora of India, Vol. 19

Executing Scientist(s) :Dr. Arti Garg, Dr. O.N. Maurya, Dr. A.N. Shukla, Dr. Ashutosh Verma, Dr. Manas Ranjan Debta & Dr. anand Kumar
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, Vol. 20

Executing Scientist(s) : Late Dr. P. Lakshminarasimhan, Dr. K. Karthigeyan, Dr. W. Arisdason & Dr. Gopal Krishna
Date of Initiation : 2018
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, Vol. 21

Executing Scientist(s) : Dr. V. Sampath Kumar, Dr. Gopal Krishna & Dr. Anant Kumar
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has not submitted.

Flora of India, Vol. 22

Executing Scientist(s) : Dr. Manas Bhaumik, Dr. Debasmita Dutta Pramanick, Dr. Sankar Rao Mudadla, Dr. Geeta Chowdhury, Dr. Sudeshna Dutta & Mr. K. Sharma
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has been submitted.

Flora of India, Vol. 24

Executing Scientist(s) : Dr. Prashant K. Pusalkar & Dr. Priyanka Ingle
Date of Initiation : September, 2018
Date of completion : March, 2021

SUMMARY & ACHIEVEMENT/OUTCOME:

Final Mss. has been submitted.

Flora of India Vol. 25 (*c.* 85 genera & 725 species) & Vol. 26 (*c.* 83 genera, 579 species)

Executing Scientist(s) : Dr. D.K. Agrawala, Dr. J.S. Jalal, Dr. Chaya Deori & Dr. Avishek Bhattacharjee
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss. has not been submitted.

Flora of India Vol. 27 (*c.* 592 species)

Executing Scientist(s) : Dr. Rajib Gogoi, Dr. J.H. Franklin Benjamin, Dr. B. K. Singh & Dr. Mahua Pal
Date of Initiation : 2019
Date of completion : 2020 (December)

SUMMARY & ACHIEVEMENT/OUTCOME:
Final Mss has been submitted.

Flora of India Vol. 28 (*c.* 277 taxa)

Executing Scientist(s) : Dr. M.U. Sharief, Dr. S.S. Hameed, Dr. Rajib Gogoi, Dr. Vinay Ranjan, Dr. Anant Kumar, Dr. B.K. Singh & Dr. M. Murugesan
Date of Initiation : 2020
Date of completion : 2021 (September)

SUMMARY & ACHIEVEMENT/OUTCOME
Final Mss. has been submitted.

Flora of India Vol. 29

Executing Scientist(s) : Dr. V.P. Prasad
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME
Final Mss. has not submitted

Flora of India Vol. 30

Executing Scientist(s) : Dr. Pushpa Kumari
Date of Initiation : 2019
Date of completion : 2020

SUMMARY & ACHIEVEMENT/OUTCOME
Final Mss. has been submitted.

Flora of India Vol. 31 & 32

Executing Scientist(s) : Dr. P.V. Prasanna, Dr. K.A.A. Kabeer, Dr. Manish Khandwal, Dr. C.S. Purohit, Dr. Sangita Dey, Dr. K. Prasad, Dr. C.P. Vivek, Mr. S. Nagaraju, Dr. S. Arumugam, Dr. J. Swamy, Dr. P. Singh, Dr. S.K. Srivastava, Dr. S.R. Yadav, Dr. Alok Chorghe & Dr. K.V.C. Gosavi
Date of Initiation : 2019
Date of completion : 2020 (for Vol. 31)/ 2021 (for vol. 32)

SUMMARY & ACHIEVEMENT/OUTCOME
Final Mss of Vol. 31 has been submitted/ Final mss. of Vol. 32 is has not submitted.

PLANT DISCOVERIES 2020

India, the land of diversity, possesses a wide range of variation in the topography from snowcapped mountains and cold deserts of the mighty Himalayas; Gangetic plains; Deccan plateau; hot and arid region of the Thar Desert; the peninsula; guarding coastal lines with mangroves; Islands grouped amidst the ocean. It shares its territory in four global biodiversity hot spots – The Western Ghats; The Himalayas; Indo-Burma; and the Sundaland. Eventually it has given rise to a mesmerizingly diverse plant wealth with more than 50000 species comprising the phanerogams, cryptogams and microbes. Many are yet to be identified and described.

The latest estimate of plant diversity in India stands at 54733 taxa including 21849 angiosperms, 82 gymnosperms,1310 pteridophytes, 2791 bryophytes, 2961 lichens, 15504 fungi, 8979 algae and 1257 microbes. These represent approximately 14 percent of the total recorded plant species in the world. The groupwise current number of taxa known from India and their percentage contribution to the known Indian plants has been presented in the following table.

Group	No. of taxa in India	Percentage of plant diversity in India
Virus/Bacteria	1257	2.29
Algae	8979	16.4
Fungi	15504	28.33
Lichens	2961	5.41
Bryophytes	2791	5.11
Pteridophytes	1310	2.39
Gymnosperms	82	0.15
Angiosperms	21849	39.92
Total	**54733**	**100**

During the year 2020, scientists of BSI and other organizations have discovered 1 family, 05 genera, 249 species, 12 infraspecific taxa as new to Indian flora. Of these 202 taxa are new to science and 65 are new distribution record from India. 45% of novelties published in various National and International journals are of seed plants, 21% fungi, 8% Algae, 16% Lichen and 7% microbes while 2% are bryophytes and 1% Pteridophytes. This year one new monogeneric family *Hanguanaceae* has been recorded for the first time from India. Among plants groups seed plant contributed the maximum discoveries of which dicotyledons contributes 66% and monocotyledons 34%.

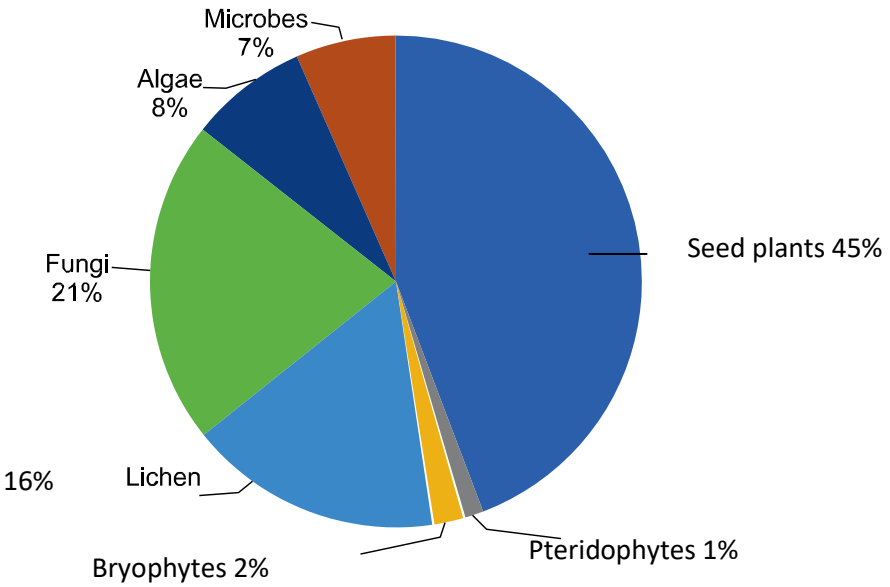

Figure 1. Percentage of contribution of different Plant groups during 2020

22% of total discoveries were made from Western Ghats during the year 2020 followed by Western Himalaya (15%), Eastern Himalaya (14%) and North East Ranges (12%). The West coast contributes 10% while East Coast contributes (9%) in total discoveries; Eastern Ghats and South Deccan contributes 4% of each while Central Highland and North Deccan (3%) of each. Minimum contribution has been made from East Deccan (2%) and Western Plains and North Deccan 1% each. The Northern Plains which is not represented in chart has only 1 new algae species *Westiellopsis akinetica* discovered from Varanasi, Uttar Pradesh. The hotspot regions such as Western Ghats, North Eastern Regions have contributed 48% of total discoveries. In state wise analysis, maximum discoveries were made from Kerala with more than 40 taxa, followed by Maharashtra and Arunachal Pradesh.

NEW SPECIES

Aloe trinervis C.S. Purohit, R.N. Kulloli & Suresh Kumar, J. Asia-Pacific Biodivers. 13: 329. 2020 (Aloaceae).
The species has been discovered and described based on the collection made from Bikaner district, near Shivbari-Jorbhir, Rajasthan, India.

Argyreia lakshminarasimhanii S. Shalini, Sujana, Arisdason & D. Maity, Rheedea 30(4): 444. 2020 (Convolvulaceae).

The species has been discovered and described based on the collection made from foothill of Megamalai, on the Ghat road, Theni district, Tamil Nadu of India at 999 m altitude.

Boeica arunachalensis D. Borah, R. Kr. Singh, M. Taram & A.P. Das, Indian Forester 146(9): 871. 2020 (Gesneriaceae).

The species has been discovered and described based on the collection made from Nirjuli, Papum Pare district of Arunachal Pradesh, India at 166m altitude.

Brachystelma telanganense Rasingam & J. Swamy, Rheedea 30(3): 379. 2020 (Apocynaceae).

The species has been discovered and described based on the materials introduced from Mallayalodhi, Mahbubnagar district of Telangana state, India, cultivated in the experimental garden of Botanical Survey of India, Deccan Regional Centre, Hyderabad.

Capparis danielii Murugan, R. Manik., S.P. Nithya, B. Karthik & Arisdason, Phytotaxa 472(3): 284. 2020 (Capparaceae).

The species has been discovered and described based on the collection made near Gulf of Mannar Biosphere Reserve, Muruganandapuram, Tirunelveli district of Tamil Nadu, India.

Chloris telanganae Nagaraju, Prasanna, Y.V. Rao & S.B. Padal, Phytotaxa 434(2): 195. 2020 (Poaceae).

The species has been discovered and described based on the collection made from Prof. Jayashankar Telangana State Agricultural University, Rajendranagar, Ranga Reddy district of Telangana, India at 538 m altitude.

Dendrobium nageswarayanum Chowlu, Natl. Acad. Sci. Lett., 2020. https://doi.org/10.1007/s40009-020-00919-x (Orchidaceae).
The species has been discovered and described based on the collection made from Koloriang Hill, Kurung Kumey district of Arunachal Pradesh, India at 823 m altitude.

Dendrophthoe gamblei L.J. Singh, V. Ranjan, Rasingam & J. Swamy, J. Asia-Pacific Biodiv. 13: 489. 2020 (Loranthaceae).
The species has been discovered and described based on the collection made from Yarlampalli, Anantapur district of Andhra Pradesh, India.

Dipcadi coimbatorensis V. Ravich., R. Kr. Singh & Murugan, Kew Bull. 75(1): 16-1. 2020 (Asparagaceae).
The species has been discovered and described based on the collection made from rocky hill-top of Seengapathy beat of Bolambatty forest range, Nilgiri Biosphere Reserve, Coimbatore district of Tamil Nadu, India at 700 m altitude.

Eugenia bolampattiana V. Ravich., Murug. & Murugan, Gard. Bull. Singapore 72(1): 118. 2020 (Myrtaceae).
The species has been discovered and described based on the collection made from Bolambatty hills, above Kovai Courtallum, Coimbatore district of Tamil Nadu, India at 758 m altitude.

Eugenia sphaerocarpa Vadhyar, Sujana, J.H.F. Benj. & Murthy, Phytotaxa 442(2): 122. 2020 (Myrtaceae).
The species has been discovered and described based on the collection made from Malabar Wildlife Sanctuary, Kakkayam, Ambalapara, Kozhikode district of Kerala, India at 768 m altitude.

Goniothalamus sericeus Sujana & Vadhyar, Taiwania 65(2): 176. 2020 (Annonaceae).

The species has been discovered and described based on the collection made from Kanyakumari Wildlife Sanctuary, Balmore Forest Beat, Muthukuzhivayal, Kanyakumari district of Tamil Nadu, India at 1194 m altitude.

Habenaria rangatensis M.C. Naik & K. Prasad, Phytotaxa 442(1): 027. 2020 (Orchidaceae).
The species has been discovered and described based on the collection made from Rangat hills, Middle Andamans, of Andaman & Nicobar Islands, India at 51 m altitude.

Impatiens bakthangensis Chhetri, Sherpa & Gogoi, Nordic J. Bot. e02872.2020 (Balsaminaceae).
The species has been discovered and described based on the collection made from Bakthang falls, Gangtok, East Sikkim district of Sikkim, India at 1700 m altitude.

Iseilema kunhikannanii K.C. Mohan, Y. Mahesh & K. Prasad, Phytotaxa 434(1): 113. 2020 (Poaceae).
The species has been discovered and described based on the collection made from Bundi forest division, Near Garrada village, Bundi district of Rajasthan, India at 452 m altitude.

Lepidagathis rajasekharae K. Prasad & A.M. Reddy, Phytotaxa 470(1): 112. 2020 (Acanthaceae).
The species has been discovered and described based on the collection made from Seshachalam hills, way to Mogalipenta from Talakona top, Kadapa district of Andhra Pradesh, India.

Luisia diglipurensis Sanjay Mishra & Jalal, Phytotaxa 453(3): 255. 2020 (Orchidaceae).
The species has been discovered and described based on the collection made from Diglipur, Shyam Nagar, on roadside mango trees, North Andaman of Andaman & Nicobar Islands, India at 7 m altitude.

Luisia jarawana Sanjay Mishra & Jalal, Phytotaxa 453(3): 260. 2020 (Orchidaceae).
The species has been discovered and described based on the collection made on the way to Sagwan nallah, on *Bombax insigne* Kurz, Middle Andaman of Andaman & Nicobar Islands, India at 16 m altitude.

Memecylon nervosum Vadhyar, J.H.F. Benj. & Sujana, Edinburgh J. Bot. 77(3): 403. 2020 (Melastomataceae).
The species has been discovered and described based on the collection made from Panagudi forest section, beyond Sengamal Estate, Kanyakumari Wildlife Sanctuary, Kanyakumari district, of Tamil Nadu, India at 785 m altitude.

Pedicularis khoiyangii D. Borah & R.Kr. Singh, Phytotaxa 430(4): 288. 2020 (Orobanchaceae).
The species has been discovered and described based on the collection made from Sela pass, Tawang district of Arunachal Pradesh, India at 4200 m altitude.

Pedicularis raghvendrae Arti Garg & R.Kr. Singh, Phytotaxa 452(1): 111. 2020 (Orobanchaceae).
The species has been discovered and described based on the collection made from Bansoi, North Sikkim district of Sikkim, India at 2200 m altitude.

Peliosanthes ashihoana D.K. Roy, N. Odyuo & N. Tanaka, Taiwania 65(4): 493. 2020 (Asparagaceae).
The species has been discovered and described based on the collection made from experimental garden of Eastern Regional Centre, Shillong, East Khasi Hill district of Meghalaya, India.

Peliosanthes bipiniana D.K. Roy, N. Odyuo & N. Tanaka, Taiwania 65(4): 496. 2020 (Asparagaceae).
The species has been discovered and described based on the collection made from experimental garden of Eastern Regional Centre, Shillong, East Khasi Hill district of Meghalaya, India.

Peliosanthes nagalandensis N. Odyuo, D.K. Roy, N. Tanaka & A.A. Mao, Phytotaxa 456(3): 286. 2020 (Asparagaceae).
The species has been discovered and described based on the collection made from experimental garden of Eastern Regional Centre, Shillong, East Khasi Hill district of Meghalaya, India.

Peliosanthes tobuensis N. Odyuo, D.K. Roy, R. Lytan, N. Tanaka & A.A. Mao, Phytotaxa 456(3): 290. 2020 (Asparagaceae).
The species has been discovered and described based on the collection made from experimental garden of Eastern Regional Centre, Shillong, East Khasi Hill district of Meghalaya, India.

Pseuderanthemum arunachalense D. Borah, R.Kr. Singh & Taram, Indian Forester 146(7): 660. 2020 (Acanthaceae).
The species has been discovered and described based on the collection made from Nirjuli, Papum Pare district of Arunachal Pradesh, India at 165 m altitude.

Rivina andamanensis L. J. Singh & M. Chennakesavulu Naik, J. Asia-Pacific Biodiv. 13: 484. 2020 (Petiveriaceae).
This new species has been discovered and described based on the collection made from Kalsi forest, Middle Andaman, Andaman and Nicobar Islands, India at 12 m altitude.

Spathoglottis arunachalensis J. Tsering & K. Prasad, Phytotaxa 432(3): 289. 2020 (Orchidaceae).

This new species has been discovered and described based on the collection made from Sessa Orchid Sanctuary, West Kameng district of Arunachal Pradesh, India at 1235 m altitude.

Stereochilus arunachalensis Chowlu & A.N. Rao, Phytotaxa 433(2): 177. 2020 (Orchidaceae).
This new species has been discovered and described based on the collection made from Hunli, Lower Dibang Valley district of Arunachal Pradesh, India.

Strobilanthes lakshminarasimhanii Sameer Patil, Nelumbo 62(2): 113. 2020 (Acanthaceae).
This new species has been discovered and described based on the collection made from Mandalpatti-Hamiyalla forest path, Pushpagiri Wildlife Sanctuary, Kodagu district of Karnataka, India at 1149 m altitude.

NEW SUB SPECIES

Arisaema barnesii *subsp.* sheshanagae Sameer Patil, J. Jap. Bot. 95(6): 333. 2020 (Araceae).
This new sub species has been discovered and described based on the collection made from Mandalpatti, Pushpagiri Wildlife Sanctuary, Kodagu district of Karnataka, India at 1147 m altitude.

LICHEN

Caloplaca rajasthanica S. Y. Kondr., Upreti & G. P. Sinha, Acta Bot. Hung. 62: 340. 2020 (Teloschistaceae).
This new species has been discovered and described based on the collections made from Honeymoon Point, W. L. Forest, Mt Abu, Rajasthan, India, at 1142±10 m altitude.

Cratiria rubrum R. Ngangom, Nayaka & R. Gogoi, Plant Science Today 7: 585. 2020 (Caliciaceae).
This new species has been discovered and described based on the collections made from Komorakata Reserve Forest, Hojai, Nagaon district, Assam, at 68 m altitude.

Diorygma isidiatum Swarnal., Archieve for Lichenology 26: 2. 2021 (Graphidaceae).
This new species has been discovered and described based on the collections made from an islet in the Kameng river, Bhalukpong, Sonitpur district, Assam, India, at 146 m altitude.

ALGAE

Actinotaenium himalayanum Chettri, Das & Sudipta K. Das, Natl. Acad. Sci. Lett., doi.org/10.1007/s40009-020-00925-z, 2020.
This new species has been discovered and described based on the collection made from a concrete wall from Nandok, East Sikkim, Sikkim, India.

Gomphonema adhikarii C. Radhakrishnan, S. K. Das et B. Karthick, Fottea, 20 (2): 130. 2020.
This new species has been discovered and described based on the collection made from a small road side pool from the alpine region of Arunachal Pradesh, Eastern Himalaya, India.

Pinnularia sikkimensis S. K. Das, C. Radhakrishnan, M. Kulikovskiy, J. Glushchenko, P. Kociolek & B. Karthick, Phytotaxa 447 (3): 165/ 2020.
This new species has been discovered and described based on the collection made from South Sikkim district of Sikkim, India, at 686 m altitude

Ecballocystopsis dichotoma Hu & Bi var. anandii Das, Gupta & Adhikary, Nordic J. Bot., P. 4, e02609, doi: 10.1111/njb.02609. 2020.
This new algal variety has been discovered and described based on the collection made from moist granite rock, in Lower Ghaghri fall, Latehar, Jharkhand, India.

FUNGI

NEW GENUS

Lonavalomyces Dubey, J. New Biol. Rep. 9(3): 317. 2020.

This new genus has been discovered and described based on the collection isolated from the fallen bamboo stems collected from Lonavala, Pune district, Maharashtra, India.

NEW SPECIES

Conlarium indicum R. Dubey & S. Manikpuri, CREAM 11(1): 115. 2021 (Conlariaceae).

This new species has been discovered and described based on the collection made from decaying Bamboo from Sawantwadi, Sindhudurg district, Maharashtra, India.

Gomphidius pseudoglutinosus K. Das, Hembrom, A. Parihar & Vizzini, Cr yptogamie Mycol. 41(4): 78. 2020 (Gomphidiaceae).

This new species has been discovered and described based on the collection made from Dombang valley, North district of Sikkim, India at 2920 m altitude.

Hymenochaete boddingii Hembrom, A. Parihar, K. Das & A. Ghosh, Cr yptogamie Mycol. 41(4): 83. 2020 (Hymenochaetaceae).

This new species has been discovered and described based on the collection made from Rajmahal hills, Borio-block, from Sahibaganj-Borio road to Gowaibhita and surroundings, on the buried root and fallen litters of *Madhuca longifolia* (J. Koenig ex L.) J. F. Macbr. tree in *Shorea robusta* Gaertn. dominated forest, Sahibganj district of Jharkhand, India at 152 m altitude.

Lactarius brunneoaurantiacus K. Das & I. Bera, Nordic J. Bot. e02940. 2020 (Russulaceae).

This new species has been discovered and described based on the collection made from Tugla valley, East district, Sikkim, India, at
3846 m altitude.

Lactarius indoscrobiculatus K. Das & I. Bera, Nordic J. Bot. e02940. 2020 (Russulaceae).

This new species has been discovered and described based on the collection made from Kyongnosla, East district, Sikkim, India, at 3411 m altitude.

Lonavalomyces indicus Dubey, J. New Biol. Rep. 9(3): 318. 2020.

This new species has been discovered and described based on the collection made from fallen Bamboo stem, collected from Lonavala, Maharashtra, India.

Mycoenterolobium borivaliense Rashmi Dubey & Amit D. Pandey, J. New Biol. Rep. 9(3): 313. 2020.

This new species has been discovered and described based on the collection made from decaying bark, from Kanheri Caves, Tulsi range, Sanjay Gandhi National Park, Mumbai, Maharashtra, India.

Ramaria thindii K. Das, Hembrom, A. Parihar & A. Ghosh, Cryptogamie Mycol. 41(4): 88. 2020 (Gomphaceae).

This new species has been discovered and described based on the collection made from Memeinchu, East district of Sikkim, India at 3539 m altitude.

Russula ashihoi K. Das, A. Ghosh, Buyck & Hembrom, Nordic J. Bot. e02962. 2020 (Russulaceae).
This new species has been discovered and described based on the collection made from Gnathang, East district, Sikkim, India.

Russula baniyakundensis A. Ghosh, K. Das & D. Chakr., Phytotaxa 483(3): 249. 2020 (Russulaceae).
This new species has been discovered and described based on the collection made from Baniyakund, Rudraprayag district, Uttarakhand, India, at 2636 m altitude.

Russula indonigra A. Ghosh, K. Das, Buyck & Hembrom, Nordic Journal of Botany e02962. 2020 (Russulaceae).
This new species has been discovered and described based on the collection made from Jakhdhar, Rudraprayag district, Uttarakhand, India, at 1565 m altitude.

Russula lakhanpalii A. Ghosh, K. Das & R.P. Bhatt, Nova Hedwigia 111(1-2): 118. 2020 (Russulaceae).
This new species has been discovered and described based on the collection made from Teka, Pauri Garhwal, Uttarakhand, India, at 1946 m altitude.

Russula indocatillus A. Ghosh, K. Das & R.P. Bhatt, Nova Hedwigia 111(1-2): 124. 2020 (Russulaceae).
This new species has been discovered and described based on the collection made from Chopta-Baniyakund, Rudraprayag district, Uttarakhand, India, at 2634 m altitude.

NEW DISTRIBUTIONAL RECORDS

SEED PLANTS

SPECIES RECORD

Anthoxanthum monticola (Bigelow) Veldkamp (Poaceae).
This species has been reported for the first time from India based on the collection made from Tawang district of Arunachal Pradesh, India.

Apocopis collinus Balansa (Urticaceae).
This species has been reported for the first time from India based on the collection made from Teressa Island, Andaman & Nicobar Islands, India.

Stereochilus erinaceus (Rchb.f.) Garay (Orchidaceae).
This species has been reported for the first time from India based on the collection made from Sessa-Tipi, West Kameng district of Arunachal Pradesh, India.

Tripogonella minima (A. Rich.) P.M. Peterson & Romasch (Poaceae).
This species has been reported for the first time from India based on the collection made from Chegunta, Medak district of Telangana, India.

VARIETAL RECORD

Meconopsis merakensis Tosh. Yoshida, Yangzom & D.G. Long *var.* merakensis (Papaveraceae).
This variety has been reported for the first time from India based on the collection made from Nagula Tso, Tawang district of Arunachal Pradesh, India.

BRYOPHYTES

Dinckleria singularis (Schiffn.) M. A. M. Renner, Schäf.-Verw. & Heinrichs, (Marchantiophyta: Plagiochilaceae).

This species has been reported for the first time from India based on the collection made from Zupuk to Damingla forests, West Siang district of Arunachal Pradesh, India at 3500m altitude.

LICHENS

Bacidia pycnidiata Czarnota & Coppins (Ramalinaceae).
This species has been reported for the first time from India based on the collection made from Ouguri hills, Tezpur, Assam.

Chapsa farinosa Lücking & Sipman (Graphidaceae).
This species has been reported for the first time from India based on the collection made from Quinamol, Ta Rivana, Goa.

Diorygma sticticum Sutjar., Kalb & Lücking (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Cotigao Wildlife Sanctuary, Goa.

Fissurina albocinerea (Vain.) Staiger (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Cotigao Wildlife Sanctuary, Goa.

Graphis bungartzii A.B. Peña, Lücking, Herrera-Camp. & R. Miranda (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Miranda, Panigaon, Sonitpur district, Assam, at 75 m altitude.

Graphis discarpa A.W. Archer (Graphidaceae).

This species has been reported for the first time from India based on the collection made from IISER Kolkata Campus, Mohunpur, West Medinipur district, West Bengal.

Graphis nigririmis (Nyl.) Müll. Arg. (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Kolli hills, Namakkal district, Tamil Nadu, at 800 m altitude.

Malmidea nigromarginata (Malme) Lücking & Breuss (Malmidiaceae).

This species has been reported for the first time from India based on the collection made from Nagaon district, Assam, India.

Ocellularia alba (Fée) Müll. Arg. (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Cotigao Wildlife Sanctuary, Goa, India.

Phaeographis pseudostromatica Seavey & J. Seavey (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Arimora, Sonitpur district, Assam, India.

Porina malmei P.M. McCarthy, Biblioth (Pertusariaceae).

This species has been reported for the first time from India based on the collection made from Tezpur, Assam, India.

Porina nuculastrum (Müll. Arg.) R.C. Harris (Pertusariaceae).

This species has been reported for the first time from India based on the collection made from Nagaon district, Assam, India.

Pyrenula laetior Müll. Arg. (Pyrenulaceae).

This species has been reported for the first time from India based on the collection made from Nagaon district, Assam, India.

Pyrenula wrightii (Müll. Arg.) R.C. Harris (Pyrenulaceae).

This species has been reported for the first time from India based on the collection made from Nagaon district, Assam, India.

Sarcographa verrucosa (Vain.) Zahlbr. (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Choibari, Sonitpur district, Assam, India.

Thelotrema crassisporum Mangold (Graphidaceae).

This species has been reported for the first time from India based on the collection made from Cotigao Wildlife Sanctuary, Goa, India.

EX-SITU CONSERVATION

The preamble of Article 9 of the Convention on Biological Diversity (CBD) stresses the need of establishing Botanic Gardens as a complementary approach to *in-situ* conservation (i.e. conserving plant / animal species in their natural habitat) practices to conserve threatened plant taxa of the country of their origin and to adopt appropriate measures to ward off their extinction. In order to commensurate with the directives of CBD, Botanical Survey of India, the leading Taxonomy research organization under Ministry of Environment, Forest and Climate Change (MoEF & CC), being the custodian of the floral wealth of the country (even well before CBD came into existence) BSI has initiated works in the same lane and has set up several well networked major and minor Botanic Gardens throughout the country exclusively to conserves its vast, endemic and threatened flora. In some centres, storage of seeds, conserving pollen, storage of plant shoots in low temperature (*in vitro* preservation) as well as tissue culture methods is being employed to this effect.

Botanic Gardens under control of Botanical Survey of India are:

Sr. No.	Name of the Gardens/*ex-situ* conservatory	Focal area	No. of species conserved	Regional Centres jurisdiction
1.	Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah, W.B. (erstwhile Indian Botanic Garden, Howrah), c. 273 acre	A national repository of plants. Conserves economically important plant species of India and all over world.	*c.* 1400 species	Howrah
2.	Experimental Botanic Garden, Andaman & Nicobar Island Regional Centre, Dhanikhari, c. 70 acres	Endemic and threatened plants of Andaman & Nicobar Islands	*c.* 250 species	Portblair
3.	Experimental Botanic Garden, Arid Zone Regional Centre, Jodhpur, c. 12 acres	Endemic and threatened plants of Rajasthan and Gujarat and Cactus collection	*c.* 185 species	Jodhpur
4.	Experimental Botanic Garden, Arunachal Pradesh Regional Centre, Sankie View	Endemic and threatened plants of Arunachal Pradesh	*c.* 200 species	Itanagar
5.	Botanic Garden of Indian Republic (BGIR), Noida, U.P. c. 163.79 acres	An under construction garden showcasing wide variety of regional flora from 23 states	*c.* 900 species	Noida
6.	Experimental Botanic Garden, Central Regional Centre,	Endemic and threatened plants of Uttar Pradesh and Madhya	*c.* 600	Allahabad

	Allahabad, c. 07 acres	Pradesh; wild rose and its cultivars	species	
7.	Barapani Experimental Garden, Barapani & National Orchidarium, Eastern Regional Centre, Shillong, Meghalaya, c. 25 acres	Orchids, Nepenthes, Insectivorous plants, Medicinal plants, endemic, threatened plants of North east India including well equipped tissue culture laboratory for micro propagation and storage of germ plasm	*c.*750 species	Shillong
8.	Experimental Botanic Garden and National Orchidarium, Yercaud, Southern Regional Centre, Coimbatore, c. 40 acres	Endemic orchids of Western & Eastern Ghats, Endemic plants of Western Ghats and others along with well-equipped Tissue culture laboratory	*c.* 1200 species	Coimbatore
9.	Experimental Botanic Garden, Western Regional Centre, Mundhwa, Pune, c. 38 acres	Endemic and threatened plants of Maharashtra, Goa and Karnataka; Pteridophytes, Gymnosperms	*c.* 500 species	Pune
10.	Experimental Botanic Garden, Sikkim Himalayan Regional Centre, Gangtok	Endemic and threatened plants of Sikkim Himalaya, Orchids and Gymnosperms	*c.* 200 species	Gangtok
11.	Experimental Botanic Garden, Northern Regional Centre, Dehradun, *c*. 05 acres	Endemic and threatened plants of Uttarakhand and Uttar Pradesh	*c.* 350 species	Dehradun

(A) *EX-SITU* CONSERVATION OF RARE/THREATENED/ENDEMIC PLANTS:

Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah, West Bengal :

As a part of Garden management & maintenance activities, a committee was formed to survey and assess the post Amphan damages in terms of both qualitative and quantitative losses of trees and shrubs. More than 1000 trees belonging to 195 species were damaged. Restoration of around 50 plants fallen during Amphan *viz. Adansonia digitata*, *Cycas zeylanica*, *Triplaris americana*, *Intsia bijuga, Goniothalamus wynaadensis*, etc. were done. _The Great Banyan Tree' was also damaged by this devastating supercyclone. Approx. 41 nos. prop roots were completely uprooted and approx. 30 nos. branches were broken or partially or completely damaged. Out of 41 nos. uprooted prop roots, 10 prop roots were restored successfully by pouring extra soil and covering the bases of partly uprooted/exposed prop roots in 3 places after applying fungicide at the exposed portion. New supports made up of Bamboo were provided in 3 places for lifting up the drooping branches up to a suitable height. Approx. 85 no. aerial roots were encaged in _Bamboo cage' for training them as _prop roots' of which 15 nos. are at 15-20 ft. height, 34 nos. of aerial roots touched the ground as _new prop roots'. Approx. 47 nos. encaged aerial roots were repaired in terms of refixing and replacing of bamboo cages fitted to them as per necessity. Old bamboo support was repaired and replaced in 30 places and new support was provided in 13 places. Succulent Mound with 19 succulent plant species, Cactus Mound with 22 different Cacti, Hedge plantation along the Ganges with 20 different plant species were developed. Introduced climbing roses along with other rare Indian breed as well as foreign breeds in Rosarium. In Charak Udyan, most of the Amphan damaged trees were restored. Plantation drive of 10 medicinal plant species *viz*. *Vernonia amygdalina*, *Ocimum basilicum*, *Pandanus amaryllifolius*, *Syzygium aromaticum*, *Aloe vera*, *Hibiscus fragrance*, etc. was continued along with de-weeding and regular cleaning; pruning of overgrown canopies, etc. Potting of *Cycas beddomei* Dyer, *Cycas clivicola* K. D. Hill, *Cycas indica* A. Lindstr.& K.D.Hill, *Cycas sphaerica* Roxb., *Dioon edule* Lindl., *Zamia angustifolia* Jacq., *Zamia inermis* Vovides, J.D.Rees & Vázq.Torres, *Zamia fischeri* Miq.ex Lam., *Zamia loddigesii* Miq., *Zamia pumila* L., *Zamia standleyi* Schutzman, *Zamia variegata* Warsz., brought from NBRI, were processed for hardening and further introduction in Cycad section. 16 seedlings of *Cycas* sp. viz.: *Cycas indica* (05), *Cycas beddomei* (06) and *Cycas sphaerica* (05) were maintained for introduction in Cycas section. Multiplication of both *Victoria amazonica* & *V. cruziana* from seeds (about 2000 seedlings) and necessary population were well maintained at different lakes of AJCBIBG that served as a good attraction to visiting public. Seedlings were provided to various Govt. agencies/Institutes and Universities on request for conservation. During this period, 40 species of RET & E and other endemic plants were multiplied for *ex-situ* conservation. Renovation of plant multiplication house was done in which cuttings of Jasminum sp., Bougainvillea sp. (20), Hibiscus sp., Codium sp., Bignonia sp. and Ephedra sp. were planted. Development of Musa section was done by introduction of 06 suckers of 03 species *viz*.: *Musa indandmanica*, *Musa bulbisina* and *Musa acuminta* received from BSI, ANC, Port Blair along with reincarnation of Canna section. Cuttings / saplings of *Alstonia* sp. (100), Euphorbia sp. (50) and *Hibiscus* sp. (100) made ready for further uses. Multiplication of *Mesua ferrea* (Indian rose chestnut-56 seeds), Helianthus sp., *Calendula* sp., *Impatiens* sp., *Baccharoides anthemintica*, *Helichrysum* sp. *Cosmos* sp., *Uraria picta*, *Althea* sp., *Dehalia*. *Papaver* spp., *Daisy* sp., *Dianthus* sp., *Dimorphotheca* sp., *Ipomoea* sp., *Allyssum* sp., *Verbena* sp., *Mesembrynthemum* sp., etc. were done through seed collection and germination. Regarding multiplication of RET/Endemic and economically important plants, harvested seeds of double coconut (*Lodoicea maldivica*)

were successfully placed for germination (after a month-long effort of preparation of wooden pots by Dr. A.A. Mao, Director BSI on a specially designed huge wooden pots with suitable media at the corner of curator lawn adjacent to CPWD office. The pots were adequately guarded with bamboo fencing. Germination processes were continuously monitored along with maintaining humidity, soil temperature, moisture etc.

Experimental Botanic Garden, Andaman & Nicobal Island Regional Centre, Dhanikhari, Port Blair

As part of *ex-situ* conservation of EET plants of Andaman and Nicobar Islands, several species are being collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. Some of the plant species are: *Musa acuminate* Colla., *Musa balbisiana* Colla. & and *Musa indandamansis* L.J. Singh, *Knema andamanica* (Warb.) W.J. De Wilde, *Manilkara littoralis* (Kurz.) Dubbard, *Pinanga andamanensis* Becc., *Pinanga manii* Becc., *Pterocarpus dalbergioides* DC., *Myristica andamanica* Hook.f., *Grewia calophylla* Kurz ex Mast., *Canarium denticulatum* Blume, *Dipterocarpus griffithii* Miq., *Magnolia andamanica* (King) D.C.S. Raju & M.P. Nayar, *Carrisa andamanensis* L.J. Singh & Murugan, *Schizostachyum andamanicum* M. Kumar & Remesh, *Amomum andamanicum* V.P. Thomas *et al*., *Amomum maximum* Roxb., *Zingiber pseudosquarrosum* L.J. Singh & P. Singh, *Amomum aculeatum* Roxb., *Cyrtandra burtii* N.P. Balakrishnan, *Psychotria andamanica* Kurz, *Tropidia curculigoides* Lindl., *Zingiber sp.*, *Curcuma sp.*, *Calamus andamanicus* Kurz, *Borassus flabellifer* L., *Pinanga manii* Becc., *Grewia calophylla* Kurz ex Mast., *Magnolia andamanica* (King) D.C.S. Raju & M.P. Nayar.

Experimental Botanic Garden, Arunachal Pradesh Regional Centre, Sankie View

As part of *ex-situ* conservation of RET & EET plants of Arunachal Pradesh, a new project ‗Ex Situ conservation of RET and economically Important Plants of Arunachal Pradesh and Botanical garden of APRC, Itanagar)' was initiated.

Experimental Botanic Garden, Arid Zone Regional Centre, Jodhpur

As part of *ex-situ* conservation project, a total number of 16 rare and threatened, 33 medicinal & aromatic and 22 economically important, 11 ornamental, 15 grasses and some succulent plant species were collected and introduced in the Desert Botanical Garden. Some plant species were multiplied from cuttings, seeds, rhizomes, bulbs, tubers etc. About 99 live plant saplings of different species (including EET) were distributed to different people and organizations free of cost for plantation and further multiplication. A new Grass section, Medicinal plant section and Succulent plant section was developed. Seeds of different species were also collected. Beside routine maintenance of garden and cleaning of medicinal & threatened species plot, rearrangements of the pots in NET house and lawn was undertaken. In connection with initiation of *Ex-situ* conservation of Rare, Endangered and Economic important plants in Experimental Botanic Garden of Arid Zone Regional Centre, saplings of 16 rare & Threatened taxa, 32 medicinal & aromatic taxa, 22 economically important taxa, 11 ornamental taxa including 15 seasonal ornamental taxa, 15 grasses, seeds of 38 taxa were collected and conserved. A new Grass section is being developed in the garden. Multiplication of Rare, Threatened, Medicinal and other plants done by seeds of *Desmodium gangeticum (*L.) DC. (50 nos.), *Asparagus racemosus* Willd. (45 nos)*, Plumbago zeylanica* L. (20 nos.)*, Mimosa pudica*L. (10 nos.), *Dolichandrone falcata* (Wall. ex DC.) Seem. (40 nos.), *Tecomella undulate* (Sm.) Seem.(50 nos.), *Syzygium cumini* (L.) Skeels (100 nos.), and *Azadirachta indica*A. Juss (100 nos.), *Moringa concanensis* Nimmo (250 nos.), *Sapindus laurifolious* (300nos.), *Withania coagulans* (Stocks) Dunal (100nos), *Acacia senegal* (L.) Willd (50 nos), *Pterygota alata* (Roxb.) R.Br. (50nos), *Peltophorum* sp. (45 nos), *Moringa oleifera* Lam. (50

nos), *Bombax ceiba* L.(25 nos), *Aegle marmelos* (L.) Corrêa (30 nos) *Mimusops elengi* L.(20 nos), *Spilanthes acmella*(L.) L. (50 nos.).,*Syzygium heyneanum* (Duthie) Gamble (60 nos.) , *Commiphora wightii* (Arn.) Bhandari (20 nos.), *Citrus limon* (L.) Osbeck (20 nos), *Momordica balsamina* L. (2 nos), *Hibiscus micranthus* L.f. (16 nos), *Capparis divaricata* Lam (20 nos); cuttings of *Commiphora stocksiana* (Engl.) Engl., *Barleria prionitis*L. var.*dicantha* Blatt &Hallb (5 nos.), *Vitex trifolia* L. (50 nos.), *Justicia adhatoda* L. (100 nos.), *Tinospora cordifolia* (Willd.) Miers (250 nos.), *Bambusa vulgaris* Schrad. (Tiger bamboo) (2 nos.) and *Ficus carica* L. (20 nos.)., Rose sp.(100 nos), *Psidium guajava* L. (50 nos), *Murraya koenigii* (L.) Spreng. (20 nos), *Portulaca* L. (25 nos), *Commiphora agallocha* Engl. (10 nos), *Vitex negundo* L. (30 nos), *Cissus quadrangularis* L.(10 nos), *Bryophyllum pinnatum* (Lam.) Oken (5 nos), *Bougainvillea glabra* Choisy (30 nos), *Sarcostemma* sp. (20 nos), Golden hedge (50 nos), *Cascabela thevetia* (L.) Lippold (50 nos), *Tabernaemontana divaricata* (L.) R.Br. ex Roem. &Schult. (25 nos)., *Nerium indicum* Mill. (25 nos), *Morus alba* L. (14 nos); Rhizome/Bulb/tuber of *Chlorophytum tuberosum*(Roxb.) Baker(50 nos.) ,*Aloe barbadensis*Mill.(10 nos), *Dioscorea alata* L.(3 nos), *Saccharum officinarum (1 no)*. Phenological data of existing plant species of Desert Botanic Garden was recorded thorough out the year including 09 species for first time. The mortality-survival ratio of the introduced taxa are as follows. Mortality rate of 83 Threatened, medicinal, ornamental and economically important plants was monitored throughout the season which is as follows: *Moringa concanensi s* Nimmo. (10.5%), *Salvadora oleoides* Decne. (8.24%), *Bauhinia racemosa* Lam. (71.7%), *Prosopis cineraria* (L.) Druce (62.78%), *Syzygium cumini*(L.) Skeels (8.66%), *Sesbania grandiflora* (L.) Pers. (35.55%), *Albizia lebbeck* (L.) Benth. (54.59%), *Erythrina variegata* L. (00.00%), *Tecomella undulata* (Sm.) Seem. (96.6%), *Bauhinia variegata* L. (97.5%), *Phoenix dactylifera* L. (27.69%), *Tabernaemontana divaricata* (L.) R.Br. ex Roem. &Schult. (50 %), *Cascabela thevetia* (L.) Lippold (80%), *Golden hedge* (00.00%), *Aloe barbadensis* Mill. (00.00%), Cactii (20%), *Sarcostemma* sp.(00.00%), *Bougainvillea glabra* Choisy (20%), *Syzygium heyneanum* (Duthie) Gamble (00.00%), *Cassia rumphi* (55.29%), *Dolichandrone falcata* Seem. (30%), *Bryophyllum pinnatum* (Lam.) Oken (80%), *Cordia gharaf* Ehrenb. ex Asch. (64.28%), *Guazuma ulmifolia* Lam. (85.80%), *Pongamia pinnata* (L.) Pierre (24.16%), *Commiphora wightii* (Arn.) Bhandari (82.66%), *Tamarindus indica* L. (54.06%), *Gmelina arborea* Roxb. (50.38%), *Cassia fistula* L. (48.5%), *Sapindus laurifolious* Gaertn. (14.52%), *Acacia senegal* (L.) Willd. (26.5%), *Withania coagulans* (Stocks) Dunal (58.28%), *Pterygota alata* (Roxb.) R.Br. (94%), *Ceiba pentandra* (L.) Gaertn. (75.92%), *Asparagus racemosus* Willd. (00.00%), *Peltophorum* sp. (80%), *Balanites aegyptiaca* (L.) Delile (30%), *Tinospora cordifolia* (Willd.) Miers (00.00%), *Moringa oleifera* Lam. (1%), *Ficus religiosa* L. (15%), *Cissus quadrangularis* L. (00.00%), *Bombax ceiba* L. (96%), *Vitex negundo* L.(80%), *Ceropegia* pots (00.00%), *Chlorophytum tubrosum* Santapau & R.R.Fern. (00.00%), *Ficus* sp.(00.00%), *Commiphora agallocha* Engl. (90%), *Cocculus* sp. (45%), *Solanum trilobatum* L. (45), *Solanum torvum* Sw.(65%), *Azadirachta indica* A. Juss. (00.00%), *Aegle marmelos* (L.) Corrêa (28.7%), *Manilkara hexandra* (Roxb.) Dubard (96.4%), *Dichrostachys* sp. (93%), *Nyctanthes* L. (97.43%), *Adenanthera pavonine* L. (00.00%), *Terminalia chebula* Retz.(00.00), *Mimosa hamata*Willd. (00.00), *Cullen plicatum* (Delile) C.H.Stirt. (96.5%), *Murraya koenigii* (L.) Spreng. (67.34%), *Psidium guajava*L.(00.00%), *Mangifera indica* L.(00.00%), *Mimusops elengi* L.(00.00 %), *Spilanthes acmella*(L.) L. *Spilanthes acmella*(L.) L.(00.00 %), *Uraria picta*(Jacq.) DC.(00.00%), *Atriplex sp.* (00.00%), *Santalum album* L. (45%), *Rose cutting* (00.00%), *Carpentaria acuminata* (H.Wendl. &Drude) Becc. (100%), *Caryota mitis* Lour. (100%), *Adonidia merrillii*(Becc.) Becc. (100%), *Mallotus philippensis*(Lam.) Müll. Arg. (100%), *Swietenia mahogani*L.(100%), *Mesua ferrea* L.(100%), *Tabebuia chrysantha*(Jacq.) G.Nicholson (100%), *Citrus limon* (L.) Osbeck (30%), *Nyctanthes arbor-tristis* L. (97.43%), *Momordica balsamina* L.(00.00%), *Hibiscus micranthus* L.f. (18.75%), *Capparis divaricata* Lam. (95%).

Botanic Garden of Indian Republic (BGIR), Noida

As part of *ex-situ* conservation, "Collection of plants for introduction in BGIR" was taken as project. During 2020-21, BSI Regional Centres i.e. Northern Regional Centre, Dehradun; Central Regional Centre, Allahabad; Deccan Regional Centre, Hyderabad; Southern Regional Centre, Coimbatore; Andaman and Nicobar Regional Centre, Port Blair; Eastern Regional Centre, Shillong supplied saplings and seeds to BGIR. The details are as under: 1. BSI, CRC Allahabad: Provided 150 Central Indian species – Plantation done in respective areas; 2. BSI, NRC Dehradun: Provided 55 species of endemic as well as common plants of Uttarakhand.- Plantation done in respective area; 3. BSI, SRC Coimbatore: Provided 200 saplings of 87 species of endemic and common ornamental vascular plants from Western Ghats which were placed in conservatory for acclimatization; 4. BSI, DRC Hyderabad: provided Species of endemic Cycas from Eastern Ghats along with endemic plants which were kept in Conservatory for acclimatization; 5. BSI, A & N Port Blair: Provided 20 rare species of endemic taxa (Cryptogams & phanerogams)- 90 % Mortality was reported; 6. BSI, Shillong : provided 40 saplings of 12 sps . - 50 % Mortality was reported; 7. BSI, WRC, Pune: Provided 120 saplings of 30 species of endemic vascular plants from Western Ghats; 8. UP Forest Dept Gautam Budha Nagar- provided some 2000 saplings of forest trees of which 1120 plants were planted in BGIR, 280 plants were kept in conservatory and 600 plants were given to RWA Noida. In 2020-21, plantation was continued in different sections and forest types. As part of seed bank development programme, seeds of 45 species were placed for seed germination and approx.. 4315 plants were germinated which were growing in seed bank plant conservatories. In addition routine cleaning, deweeding, pest and insect management were being continued for smooth functioning of the garden works.

Experimental Botanic Garden, Central Regional Centre, Allahabad

In connection with *ex-situ* conservation of RET and economically important species in the experimental garden of BSI CRC, Allahabad, an AAP project was taken in 2020. During this period, two field tours were conducted to Rewa, and Ayodhya, M.P. during which germplasm of *Acacia catechu* (L.f.) Willd., *Careya arborea* Roxb., *Commiphora wightii* (Arn.) Bhandari, *Cordia macleodii* Hook.f. & Thomson, *Gymnema sylvestre* (Retz.) R.Br. ex Sm., *Plumbago zeylanica* L., *Prosopis cineraria* (L.) Druce, *Radermachera xylocarpa* (Roxb.) Roxb. ex K.Schum., *Sarcostemma brevistigma* Wight & Arn. Were collected for introduction at garden of BSI, CRC, Allahabad. Beside an endemic plant *Alectra parasitica* A.Rich. subsp. *chitrakutensis* (M.A.Rau) K.K. Khanna & An. Kumar and medicinal plant *Gloriosa superba* L. from Gerua locality of Banda district were collected and introduced in CRC garden. During garden Inspection tour to Banda University of Agriculture and Technology, Banda, 25 saplings of *Bougainvillea* sp. and one Cactus sp. brought for introduction in CRC Garden. As a part of development of garden, Fern cum NET house of CRC Garden was renovated along with Green India Map in CRC campus. Regarding multiplication programme, 100 plant saplings of *Saraca asoca* were multiplied in CRC experimental garden. Distributed 120 plant saplings of Saraca asoca during Flower Show at Company Garden, Allahabad; gifted about 1000 plant saplings to company garden for plantation programme and 300 seeds of *Saraca asoca* to Prof. N.B. Singh, Dept. of Botany, University of Allahabad for multiplication purpose.

Barapani Experimental Garden, Barapani & National Orchidarium, Eastern Regional Centre, Shillong, Meghalaya

The garden serves as a repository of Endemic, endangered, threatened and economic plant resources of Northeast India and also creates awareness of the importance of its conservation. During April 2020-March 2021, two local germplasm collection tours were conducted to Mawphlang area, East Khasi Hills, Meghalaya and Shella area of East Khasi hills, Meghalaya during which 53 plant species were collected and planted in EBG, Barapani (Umiam) and conserved viz. *Actinidia callosa* (3 nos.), *Aquilaria malaccensis* (3 nos.), *Areca catechu* (6 nos.), *Artocarpus lakoocha* (1 no.), *Begonia hatacoa* (1 no.), *Begonia* sp. (4 nos.), *Boesenbergia* sp. (9 nos.), *Bruceamollis* (5 nos.), *Bryophyllum pinnatum* (3 nos.), *Castanea dentata* (3 nos.), *Castanopsis indica* (1 no.), *Cephalotaxus griffithii* (5 nos.), *Cheilocostus speciosus* (6 nos.), *Cycas revoluta* (7 nos.), *Dioscorea* sp. (1 no.), *Diospyros* sp. (6 nos.), *Garcinia pedunculata* (2 nos.), *Elaeagnus* sp. (9 nos.), *Equisetum* sp. (3 nos.), *Eriosema chinensis* (2 nos.), *Euphorbia antiquorum* (5 cuttings), *Globba* sp. (5 nos.), *Gnetum gnemon* (5 nos.), *Hedychium rubrum* (2 nos.), *Hedychium* sp. (5 nos.), *Holmskioldia sanguinea* (1 no.), *Impatiens angustiflora* (4 nos.), *Impatiens arguta*(4 nos.), *Impatiens bracteata* (3 nos.), *Impatiens chinense* (2 nos.), *Impatiens jurpia*(5 nos.), *Impatiens porrecta*(4 nos.), *Impatiens pulchra* (3 nos.), *Impatiens tripetala* (5 nos.), *Impatiens* sp. (7 nos.), *Impatiens* sp. (8 nos.), *Impatiens* sp. (3 nos.), *Ledebouria*sp.(8 nos.), Liliaceae sp. (6 nos.), *Lycopodium* sp. (1 no.), *Magnolia champaca* (5 nos.) *Musa* sp. (5 nos.), *Osbeckia* sp. (6 nos.), *Phlogacanthus thyrsiflorus* (20 nos.), *Podocarpus neriifolius*(5 nos.), *Pyruspashia* (14 cuttings), *Rauvolfia verticillata* (2 nos.), *Sonerila maculata* (4 nos.), Unidentified sp. (2 nos.), Unidentified sp. (2 nos.), Unidentified sp. (1 no.),*Zingiber* sp. (1 no.)and *Zizyphus mauritiana* (2 nos.).

Experimental Botanic Garden and National Orchidarium, Yercaud, Southern Regional Centre, Coimbatore

In connection with *ex-situ* conservation project, two AAP projects were proposed :

1. **_*ex situ* conservation of endemic endangered and threatened Plts. Of the region and recording of phenology of flowering / fruiting of species in garden**‘: 01 local field tours was conducted to Manjakuttai, Yercaud during which 18 species [*Papilionanthe subulata* (Willd.) Garay (3 plants), *Vanda testacea* (Lindl.) Rchb.f. (2 plants), *Diplocentrum recurvum* Lindl. (2 plants), *Habenaria glandilfloriformis* Blatt. & McCann. (4 plants), *Habenaria rariflora* A. Rich. (2 plants), *Brachystelma saldanhae* S.J. Britto & P.V. Bruyns (6 plants), *Ledebouria revoluta* (L.f.) Jessop (3 plants) and *Ledebouria hyderabadensis* M.V. Ramana, Prasanna & Venu (5 plants)] were collected and introduced in garden. A total no. of 64 plant species including Orchids and rare & endangered plants were multiplied by seedlings, planlets, cuttings etc. During this period, flowering & fruiting phenology for 104 species belongs to 43 orchid genera and 79 species belongs to 65 other Angiosperm genera were recorded. Saplings of 03 species *viz*. *Monosis shevaroyensis* (Gamble) H. Rob. and Skavarla (1 plant), *Garcinia talbotii* Raizada ex Santapau (10 plants) and *Bentinckia condappana* Berry ex Roxb. (Endangered) (20 plants), developed in NO&EG, Yercaud,were distributed to the Forest Department, Salem for plantation in the reserve forest areas of Yercaud.

2. _Ex situ conservation of Endemic tree species of the region in NOEG, Yercaud’: During 2020-21, total 714 nos. of endemic, endangered and threatened species were multiplied in experimental garden through seeds or stem cuttings from existing germplasm as well as previously collected seeds from Agasthyamalai Biosphere Reserve, Western Ghats. Details of species multiplied are:

ENDEMIC TREES: 580 nos. of seedlings

(Through seeds: 490 nos.)

06 RET species [*Arenga wightii* Griff. (ARECACEAE); Vulnerable (16 nos.), *Bentinckia condapanna* Berry ex Roxb. (ARECACEAE); Endangered (270 nos.), *Garcinia gummi-gutta*(L.) Robs. (CLUSIACEAE); Least concern (43 nos.), *Garcinia imberti* Bourd. (CLUSIACEAE); Endangered (117 nos.), *Goniothalamus wightii* Hook.f. & Thomson (ANNONACEAE); Endangered (27 nos.); *Ixora brachiata* Roxb. (RUBIACEAE); Least concern (17 nos.)]

(Through stem cuttings: 90 nos.)

01 Vulnerable species [*Euphorbia vajravelui* Binojk. & N.P. Balakr. (EUPHORBIACEAE); Vulnerable (90 nos.)]

ENDEMIC SHRUBS: 120 nos.

(Through seeds)

01 species [*Crotalaria longipes* Wight & Arn. (FABACEAE); Endangered (120 nos.)]

THREATENED LIANA: 14 nos.

(Through seeds)

01 species [*Gnetum ula* Brongn (Least Concern) (14 nos.)]

In connection with maintenance of endemic tree species in garden, Saplings of 39 species developed in the germination trays/beds through seeds or stem cuttings and transferred in earthen pots, nursery bags are being maintained in glass house, shady areas, etc in experimental garden. Approx. 270 endemic tree species including one indigenous species (*Mesua ferrea* L. (Clusiaceae) was planted and being maintained in Arboretum and garden premises. Saplings of 20 nos. of *Bentinckia condapanna* Berry ex Roxb. (Arecaceae) was distributed to Horticultural Research Station, Tamil Nadu Agriculture University, Yercaud. flowering and fruiting phenology of tree species growing in NOEG Yercaud were documented. 51 nos. of Endemic, Endangered and Threatened species are being maintained in the garden of which 03 are critically endangered (*Abutilon ranadei* Woodrow & Stapf (Malvaceae); *Nothopegia castaneifolia* (Roth) Ding Hou (Anacardiaceae); *Syzygium travancoricum* Gamble (Myrtaceae); 12 are endangered *Bentinckiacondapanna*Berry ex Roxb.,*Bentinckia nicobarica* (Kurz) Becc. (Arecaceae); *Crotalaria longipes* Wight & Arn. (Fabaceae); *Dipterocarpus indicus* Bedd. (Dipterocarpaceae); *Garcinia imberti* Bourd. (Clusiaceae); *Gluta travancorica* Bedd. (Anacardiaceae); *Goniothalamus wightii* Hook.f. & Thomson (Annonaceae); *Hopea parviflora* Bedd (Dipterocarpaceae); *Humboldtia vahliana*Wight (Fabaceae); *Monosis travancorica* (Hook.f.) H. Rob. & Skvarla (Asteraceae); *Syzygium stocksii* (Duthie) Gamble (Myrtaceae); *Tabernaemontana gamblei*Subram. & Henry (Apocynaceae); 13 are vulnerable (*Arenga wightii* Griff. (Arecaceae); *Calophyllum apetalum* Willd. (Clusiaceae); *Cullenia exarillata* A. Robyns (Bombacaceae); *Euphorbia vajravelui*Binojk. & N.P. Balakr. (Euphorbiaceae); *Garcinia indica* (Thouars) Choisy; *Garcinia rubro-echinata* Kosterm.; *Garcinia travancorica* Bedd. (Clusiaceae); *Kingiodendron pinnatum* (Roxb. ex DC.) Harms (Fabaceae); *Pinanga dicksonii* (Roxb.) Blume (Arecaceae); *Pterospermum reticulatum* Wight

& Arn. (Sterculiaceae); *Syzygium mundagam* (Bourd.) Chithra; *Syzygium palodense* Shareef, E.S.S. Kumar & Shaju (Myrtaceae); *Xanthophyllum arnottianum* Wight (Xanthophyllaceae), 04 near threatened (*Baccaurea courtallensis* (Wight) Muell.-Arg. (Euphorbiaceae); *Cyathea nilgirensis* Holttum (Cyatheaceae); *Humboldtia decurrens* Bed. ex Oliv. (Leguminosae–Caesalpinioideae); *Sageraea laurina* Dalzell (Annonaceae), 10 Least concern (*Artocarpus hirsutus* Lam. (Moraceae); *Garcinia gummi-gutta*(L.) Robs.; *Garcinia talbotii* Raizada ex Santapau (Clusiaceae);*Holigarna arnottiana* Hook. f.; *Holigarna grahmii* (Wight) Kurz (Anacardiaceae); *Hydnocarpus pentandrus* (Buch.-Ham.) Oken (FlacourtiaceaE); *Ixora brachiata* Roxb. (Rubiaceae); *Knema attenuata* (Hook.f. & Th.) Warb. (Myristicaceae); *Palaquium ellipticum* (Dalz.) Baill. (Sapotaceae); *Vateria indica* L. (Dipterocarpaceae) and 09 Not Evaluated (*Actinodaphne bourdillonii* Gamble (Lauraceae);*Alstonia venenata* R.Br. (Apocynaceae); *Barleria acuminata* Nees (Acanthaceae); *Barleria grandiflora* Dalzell; *Barleria involucrata* Nees var. *elata* (Dalzell) C.B. Clarke; *Cinnamomum malabatrum* (Burm.f.) J. Presl. (Lauraceae); *Hardwickia binata* Roxb. (Fabaceae); *Vernonia shevaroyensis* Gamble (Asteraceae); *Thunbergia mysorensis* (Wight) T. Anderson (Acanthaceae).

Experimental Botanic Garden, Western Regional Centre, Mundhwa, Pune

Ex Situ Conservation of four species namely *Cyathea spinulosa, Anogramma leptophylla* and *Botrychium lanuginosum* and *Elaphoglossum stigmatolepis* were conserved through spore culture and introduced in to Green house of Botanical Garden of BSI,WRC,Pune. In this period, Endemic, conservation-dependent medicinal and economic plants, orchids, Aquatic plants, bulbous and rhizomatous plants, Aroids, climbers were collected for introduction and conservation in different Sections of WRC Botanic garden such as ‗speciation spectrum-Genus diversification', Aquatic Section, Bulbous Section, Aroidarium and Climber conservatory.

Experimental Botanic Garden, Sikkim Himalayan Regional Centre, Gangtok

As part of *ex-situ* conservation programme, one day local tour was undertaken for collecting germplasm of endemic and threatened plants of the region during which 21 plants [*Anisadenia saxatilis* Wall. ex Meissn (Linaceae), *Elatostema dissectum* Wedd. (Urticaceae), *Elatostema hookerianum* Wedd. (Urticaceae), *Elatostema lineolatum* Wight (Urticaceae), *Gaultheria nummularioides* D. Don (Ericaceae), *Impatiens pradhanii* H.Hara (Balsaminaceae), *Leycesteria gracilis* (Kurz) Airy Shaw (Caprifoliaceae), *Loxostigma griffithii* (Wight) C.B.Clarke (Gesneriaceae), *Mazus dentatus* Wall. ex Benth. (Scrophulariaceae), *Rhododendron camelliiflorum* Hook.f. (Ericaceae), *Rhododendron dalhousieae* Hook.f. (Ericaceae), *Rhododendron triflorum* Hook.f. (Ericaceae), *Rubus wardii* Merr. (Rosaceae), *Strobilanthes helicta* T.Anderson (Acanthaceae) etc] were collected for introduction and *ex-situ* conservation in experimental garden of BSI, SHRC. During this period, a total of 59 species were planted in the Garden *viz.* A. *Ginkgo biloba* L. (Ginkgoaceae), *Trachycarpus fortunei* (Hook.) H.Wendl. (Arecaceae), *Paris polyphylla* Sm. (Liliaceae), *Agapetes serpens* (Wight) Sleumer (Ericaceae), *Rohdea nepalensis* (Raf.) N.Tanaka (Crassulaceae), *Aeschynanthus gracilis* C.S.P.Parish ex C.B.Clarke (Gesneraiaceae), *Viola pilosa* Blume(Violaceae), *Elatostema nasutum* Hook.f. (Erticaceae), *Wallichia oblongifolia* Griff. (Arecaceae), *Hypericum uralum* Buch.-Ham. ex D.Don (Hypericaceae), *Impatiens cathcartii* Hook.f. (Balsaminaceae), *Lyonia ovalifolia* (Wall.) Drude (Ericaceae), *Rhododendron griffithianum* Wight (Ericaceae), *Rhododendron maddenii* Hook.f. (Ericaceae), *Rhododendron grande* Wight (Ericaceae), *Prunus cerasoides* Buch.-Ham. ex D.Don (Rosaceae), *Musa thomsonii* (King ex Baker) A.M.Cowan & Cowan (Musaceae), *Rhododendron triflorum* Hook.f. (Ericaceae), *Magnolia globosa* Hook.f. & Thomson (Magnoliaceae), *Begonia megaptera*

D.Don (BEGONIACEAE), *Citrus medica* L. Rutaceae), *Clerodendrum colebrookeanum* Walp. (Verbenaceae), *Daphne sureil* W.W.Sm. & Cave (Thymelaeaceae), *Elatostema integrifolium* (D.Don) Wedd. (Urticaceae), *Elatostema* spp. (Urticaceae), *Elatostema* spp. (Urticaceae), *Elatostema* spp. (Urticaceae), *Impatiens decipiens* Hook.f. (Balsaminaceae), *Impatiens jurpia* Buch.-Ham. (Balsaminaceae), *Piper pedicellatum* C.DC. **(**Piperaceae), *Luculia gratissima* (Wall.) Sweet. (Rubiaceae), *Begonia palmata* D.Don, *Primula boothii* W.G.Craib (Primulaceae), *Cinchona* spp. (Rubiaceae), *Zingiber clarkii* King (Zingiberaceae), **Strobilanthes maculata** (Wall.) Nees., *Impatiens puberula* DC. (Balsaminace), *Impatiens discolor* Wall. (Balsamiaceae). In addition, two nursery beds were raised with the shoot cuttings of *Cephalotaxus griffithii* Hook.f., *Camellia japonica* L., *Rhododendron griffithianum* Wight, *Rhododendron maddenii*Hook.f., *Rhododendron grande* Wight &*Prunus cerasoides* Buch.-Ham. ex D.Don. 10 spp. Of Orchids were rescued from the tree cutting sites due to smart city project in Gangtok and planted in BSI, Garden.

Experimental Botanic Garden, Northern Regional Centre, Dehradun

As part of *ex-situ* conservation of endemic threatened and economic plant species in the associated garden of NRC, an AAP Project was proposed in 2020. Four one day collection tours were conducted to Mussoorie and adjoining areas, Asan barrage and Karwapani swamp, Gopeshwar and Nakraunda swamp during which *Vallisineria spirallis* L.; *Azolla pinnata* R. Br.; *Marsdenia roylei* Wight, *Potamogeton crispus* L., *Cymbidium iridifolium* Roxb.; *Cymbidium iridioides* D.Don; *Dendrobium monticola* P. F. Hunt & Summerh.;*Dendrobium crepidatum* Lindl. & Paxton; *Dendrobium christyanum* Rchb.f.; *Dactylorhiza hatagirea* (D.Don) Soó; *Coelogyne cristata* Lindl.; *Bulbophyllum umbellatum* Lindl.; *Bulbophyllum cardiophyllum* J. J. Verm.; *Oreorchis indica* (Lindl.) Hook.f.; *Zeuxine flava* (Wall. ex Lindl.) Trimen; *Cyathea spinulosa* Wall.ex Hook.; *Potentilla anserina* L.,*Acorus calamus* L.; *Bacopa monnieri* (L.) Wettst; *Calamus tenuis* Roxb; *Equisetum ramosissimum* Desf.;*Talinum fruticosum* (L.) Juss. and *Talinum portulacifolium* (Forssk.) Aschers.ex Schweinf. Were collected and introduced in Botancal garden. In addition of this collection, some other plants introduced in the Botanical Garden are: *Eria alba* Lindl.; *Rhododendron* 02 sp.; *Eiria* sp; *Celtis australis* L.; *Skimmia anquetilia* N. P. Taylor & Airy Shaw; *Madhuca butyracea* (Roxb.) J.F.Macbr.; *Selaginella* sp. Existing collection of RET plants in the Botanic Garden under *ex situ* conservation is being maintained. About 900 plants 25 species of endemic, threatened and economic plant specie snamely,*Indopiptadenia oudhensis* (Brandis) Brenan; *Prunus cerasoides* D. Don; *Musa velutina* H. Wendl. & Drude; *Quercus leucotrichophora* A. Camus ex Bahadur; *Sophora mollis* (Royle) Baker.;*Terminellia arjuna* (Roxb.) Wight & Arn.; *Acer oblongum* Wall.ex DC.; *Livistonia chinensis* R.Br.; *Artabotyrs hexapetala* (L. f.) Bhandari; *Tetrapana papyrifera* (Hook.) K.Koch; *Agathis robusta* (C. Moore ex F. Muell.) F.M. Bailey; *Tinospora sinensis* (Lour.) Merr.;*Cinnamomum camphora* (L.) J. Presl; *Terminellia chebula* (Retz.) Gaertn.; *Chlorophytum cosmosum* (Thunb.) Jacques; Piper sp.; *Vitis vinifera* L.; *Musa rubra* Wall. ex Kurz; *Mentha piperita* L.; *Bauhinia tomentosa* L.; *Ephedra foliate* Boiss. ex C.A.Mey.; *Terminellia elliptica* Willdenow; *Cymmbopogon flexuosus* (Nees ex Steud.) J.F. Watson; *Dioscorea alata* L.; *Stevia rebaudiana* (Bertoni) Bertoni; *Cinnamomum zelanicum* Blume propagated in the garden were sent to BGIR Noida About 200 plants of endemic, threatened and economic plant species namely, *Terminalia elliptica* Willd.;*Cinnamomum camphora* (L.) J.Presl; *Elaeocarpus lacunosus* Wall.ex Kurz; *Indopiptadenia oudhensis* (Brandis) Brenan propagated in the garden were distributed to local people on the occasion of Ozone Day, 16.09.2020. Regular recording of the phenological data of all the plant species was continued.

B. *IN-VITRO* / MICROPROPAGATION OF RET PLANTS:

Eastern Regional Centre, Shillong:

As a part of *ex-situ* conservation project, micro propagation experiments were carried out for selected RET taxa of NE India: Protocol development, statistical analysis and micropropagation of *Armodorum senapatianum, Rhododendron coxianum* and *Cymbidium tigrinum* were already completed. Some new *in-vitro* seed germination was successful for *Ilex khasiana* and *Armodorum senapatianum*. *In vitro* cultures of *Eriodes barbata* and *Micropera rostrata* was initiated by inoculation of *Micropera rostrata* and *Eriodes barbata* in MS Medium. Subculturing of *Eroides barbata*, *Cymbidum tigrinum* and *Armodorum senapatianum* was maintained in MS Medium. Splitting of *Eriodes barbata* plants were planted in individual pots for multiplication. Maintenance of *in vitro* raised plants of *Armodorum senapatianum* and *Cymbidum tigrinum* in plant tissue culture, garden and polyhouse is being continued.

Northern Regional Centre, Dehradun:

To ensure successful propagation and perpetuation of endemic and RET species of Western Himalaya, three (03) threatened species were selected for their *ex-situ* propagation through tissue culture technology. Micropropagation protocols were standardized for the endemic and endangered species *viz. Eulophia dabia*, *Nepenthes khasiana* and *Rhynchostylis retusa*. All the three species were successfully established to the open environment and saplings of *E. dabia* were also provided to the forest Department of Uttarakhand. Seeds of *Zanthoxylum armatum*, *Cyathea spinulosa*, *Trachycarpus takil* and *Mezotropis pellita* were collected from the wild and experimental botanical Garden and were inoculated onto basal MS medium for the in vitro germination. Seeds of *Zanthoxylum armatum* and *Mezotropis pellita* were also sown in soil for the ex-vitro germination. Shoot tip and nodal segment explants of *Malaxix acuminata*, *Dendrobium crepidatum*, *Magnolia kisopa* and *Zanthoxylum armatum* were inoculated into MS medium supplemented with different concentration of plant growth regulators.

Southern Regional Centre, Coimbatore

During 2020-21, the protocols for the *Micropropagation of Crotalaria longipes* Wight & Arn. was standardized. The in vitro developed plantlets were assessed for their genetic integrity using ISSR markers.

PUBLICATIONS

PAPERS PUBLISHED:

1. ARIGELA, R.K., PARAMESH, L. AND R.K. SINGH 2020. Ipomoea parasitica (Kunth) G. Don, a new record to the flora of Telangana State, India and typification of the name Convolvulus parasiticus Kunth. Indian Forester 146(48): 775–777.
2. BABBAR, DEEPAKSHI,DAMINI SHARMA, KUSUM UPADHYAY MAYANK D. DWIVEDI AND SANDEEP CHAUHAN 2020 Reassessment of threat status of Allium carolinianum Redouté (Amaryllidaceae) Pleone 14(2): 331-359.
3. BANDYOPADHYAY S., A. BHATTACHARJEE AND M.N. MITTA 2020. Marketing of achievements through fake awards – A ‗novel' trend in modern academic and research systems. Ann. Pl. Sci. 9 (12): 4103–4104.
4. BENNIAMIN, A. AND M. SHUNMUGA SUNDARI.2020. Diversity and distribution of the genus Arachniodes Blume (Dryopteridaceae) in North-East India, Pleione13 (2) 236 – 246.
5. BENNIAMIN, A. M. SHUNMUGA SUNDARI, C. BAGATH SINGH AND D. JESUBALAN 2020. Spore germination and early gametophyte development of an endemic fern Elaphoglossum beddomei Sledge. Indian fern J. 37: 244-249.
6. BENNIAMIN, M. SHUNMUGA SUNDARI, V.K. RAWAT 2019.Polystichum tangmaeinse (Dryopteridaceae) – A threatened fern from Arunachal Pradesh. Bull. Of Arunachal Forest Research 34(1-2): 11-17.
7. BERA, I., K. DAS, AND A. GHOSH 2020. Morphological description and phylogenetic estimation of Lactarius abieticola (Russulaceae), a new record for Indian mycobiota. Nelumbo 62(2): 124 -130.
8. BHANDARI, A., H. SINGH, A. SRIVASTAVA, PUNEET KUMAR, G.S. PANWAR AND A.A. MAO 2021. In-vitro propagation and cytological analysis of Sophora mollis Royle: an endangered medicinal shrub. J. of Genetic Engineering and Biotechnology. 19(40). https://doi.org/10.1186/s43141-021-00140-3.
9. BHARATI, K.A. 2018. Traditional uses of some plants in the surrounding villages of Baraila Lake Salim Ali Jubba Sahani Bird Sanctuary, Bihar. Ethnobotany 30: 40–48.
10. BHATTACHARJEE, A. AND S. BANDYOPADHYAY 2020. Jaideep Mazumdar: a passionate, silent researcher who left treasures behind. Phytotaxa: 470 (1): 117–120.
11. BHATTACHARJEE, A., G. KRISHNA AND S. BANDYOPADHYAY 2020. (025) Proposal to clarify that a circumscription applies to a taxon, not to a name. Taxon 69(6): 1379.
12. BHATTACHARJEE, A., G. KRISHNA AND S. BANDYOPADHYAY 2020. (043) Proposal to amend the definition of ―diagnosis" in Article 38.2. Taxon 69(6): 1388.
13. BHATTACHARJEE, A., M. DEY AND S. BANDYOPADHYAY 2020. (034–035) Proposals to amend Article 9.6 and Example 6. Taxon 69(6): 1384.
14. BHATTACHARJEE, A., R. BHADRA AND S. BANDYOPADHYAY 2020. (050) Proposal to amend the definition of ―synonym" in the Glossary. Taxon 69(6): 1393.
15. BHATTACHARJEE, A., S. BANDYOPADHYAY AND D. MAITY 2020. (029) Proposal to add a new Example after Article 9.1. Taxon 69(6): 1382.
16. BHATTACHARJEE, A., S. BANDYOPADHYAY AND M.N. MITTA 2020. Soft copy of unpublished Ph.D. theses in the internet – A serious concern. Harvest 5(2): 87.
17. BHATTACHARJEE, A., S. DEY AND S. BANDYOPADHYAY 2020. (012) Proposal to modify Article 9.12. Taxon 69(3): 630.
18. BHATTACHARJEE, A., S. DEY AND S. BANDYOPADHYAY 2020. (044) Proposal to amend Recommendation 40A.1. Taxon 69(6): 1389.
19. BHATTACHARJEE, B., P. LAKSHMINARASIMHAN, S.K. MUKHERJEE, S. KALIAMOORTHY AND A. BHATTACHARJEE 2020. Notes on the identity of Vernonia shevaroyensis (Asteraceae) and its neotypification. Nelumbo 62 (2): 148–153.
20. BIATE, D.L. AND D.K. AGRAWALA 2020. Rediscovery of Epilobium trichophyllum Hausskn: A rare and endemic plant from Sikkim Himalaya, India. Journal of Threatened Taxa 12(4): 15518 – 15521.
21. BISWA, S.,A. LOKHO AND P. LAKSHMINARASIMHAN 2020. Ethnobotanical study of Birhore Tribe in Koderma Wildlife Sancturay Jharkhand, India. Advances Pl. Sci. 33: 139–152.
22. BISWAS, TUHIN KANTI , SHRABANA CHAKRABARTI, BISWAJIT AUDDY, TANMOY MONDAL, SRIKANTA PANDIT, TAPAN SEAL 2020. Pterocarpus santalinus: A Wonder Gift of Nature. Evidence Based Validation of Traditional Medicines, 935-964.
23. BORAH, D., R. K. SINGH, AND A. GARG 2020. New records of four Pedicularis species (Orobanchaceae)

for the Flora of Arunachal Pradesh state, India, and two new synonyms for P. pantlingii.NeBIO: 11(3): 180–186.

24. BORAH, D., R. K. SINGH, AND A. GARG 2020. Rediscovery of Pedicularis denudata (Orobanchaceae), a little known, rare herb, after 135 years from India. Phytotaxa 461(2): 136–138.
25. C.BAGATH SINGH, A. BENNIAMIN AND D.JESUBALAN 2020. Range Externsion of Three South Peninsula Indian fern to Karnataka State. Indian Fern J. 37: 130-138.
26. C.S. PUROHIT AND RAMESH KUMAR 2019. Range Extension and the Recollection of Rhododendron cephalanthum (Ericaceae) in India. J. American Rhododendron Society 179 – 180.
27. CHAKRABARTY, T. AND G. KRISHNA 2020. An overlooked new variety of Tritaxis glabella from India with a note on the consequent new synonyms of Croton lawianus (Euphorbiaceae). Pl. Sci. Today 7(3): 302–307.
28. CHAKRABARTY, T. AND G. KRISHNA 2020. Typification of Adelia resinosa, the basionym of Mallotusresinosus (Euphorbiaceae), and its three new synonyms from India. Phytotaxa 446(2): 121–127.
29. CHAKRABARTY, T. AND G. KRISHNA 2020. Typification of eight accepted names and two synonyms in Indian Euphorbiaceae. Nelumbo 62(2): 161–172.
30. CHAKRABARTY, T., G. KRISHNA AND ANAND KUMAR 2020. (038) Proposal to add a new Example to Article 9.17. Taxon 69(6): 1385–1386.
31. CHAKRABARTY, T., S. PANDAY AND ANAND KUMAR 2020. Reinstatement of two varieties of Trigonostemon viridissimus and seven superfluous lectotypifications in Indo-Burmese Trigonostemon (Euphorbiaceae). J. Asia-Pacific Biodivers. 13: 766–770.
32. CHANDORE A.N., AUTI S.G., GOSAVI, K.V.C., S.M. SHENDAGE, AND M.Y. KAMBLE 2020. Eleocharis equisetina C. Presl (Cyperaceae) An extended distribution to Andaman & Nicobar Islands and notes on its identity. Indian Forester 146(3): 261-262.
33. CHAUDHURI, S. 2021. An overview of subtribes Boivinellinae Pilg. and Anthephorinae Benth. in India. Int. J. Adv. Res. Biol. Sci. 8(3): 80–88.
34. CHAUDHURY, SAGARI, HABIBUR RAHAMAN, HARISH SINGH, K CHAUDHURI AND TAPAN SEAL 2020. Nutritional and medicinal importance of Dioscorea glabra R. Baron, a potent wild edible plant consumed by the Lodha tribal community of West Bengal, India, Current Nutrition and Food Science16(3), 284-295.
35. CHOWLU, K., A. N. RAO AND C.DEORI 2020. Synopsis of Eulophia R. Br. (Orchidaceae) in Manipur (India) with a new distributional record to the state. Pleione. 14(2): 361-366.
36. DAS, K., A. GHOSH, B. BUYCK AND M.E. HEMBROM 2020. Two new species of Russula subgenus Compactae from Indian Himalaya based on morphology and molecular phylogenetic inferences. Nordic Journal of Botany 38(11): 1–11.
37. DAS, K., A., GHOSH, BUYCK, B. AND M.E. HEMBROM2020. Two new species of Russula subgenus Compactae from Indian Himalaya based on morphology and molecular phylogenetic inferences. Nordic Journal of Botany doi: 10.1111/njb.02962
38. DAS, K., I. BERA, AND A. GHOSH 2020. Lactarius brunneoaurantiacus sp. nov. andL. indoscrobiculatus sp. nov. from India. Nordic Journal of Botany doi: 10.1111/njb.02940.
39. DAS, S. AND K. KARTHIGEYAN 2020. Notes on the lectotype of Tetrapogon roxburghianus (Poaceae: Chloridoideae: Cynodonteae). Phytotaxa 464(3): 249 – 251.
40. DAS, S.K. AND D. SINGH 2020. Epiphytic algae on the Bryophytes of Larsemann Hills, East Antarctica. Natl. Acad. Sci. Lett.https://doi.org/10.1007/s40009-020-00947-7.
41. DAS, S.K., D.S. RAWAT, R.K. GUPTA AND S.P. ADHIKARI 2020. A Taxonomic appraisal on the rare green algal genus Ecballocystopsis M.O.P. Iyengar (Chlorellales; Trebouxiophyceae): morphological and numerical approach. Nord. J. Bot. 38: 1–8.
42. DATTA, S. AND T. SEAL 2020. Effect of solvent extraction in antioxidant activity and RP-HPLC based study of phenolic acids and flavonoids in Cayratia trioloia (L.) Domin. Journal ofPharmacognosy and Phytochemistry 9(6): 896-900.
43. DATTA,SUDESHNA AND TAPAN SEAL 2020. Effect of solvent extraction in antioxidant activity and RP- HPLC based study of phenolic acids and flavonoids and Cayratia trifolia (L.) Domin. Journal of Pharmacognosy and Phytochemistry 9(6): 896-900.
44. DEORI, C. 2020. Obituary, Tynjuh Mawbor Hynniewta. Nelumbo 62(1): 107-110.
45. DEY S.M., GOGOI, R.AND SUBIR BANDYOPADHYAY 2019. Report of Cheniellaquinnanensis subsp. quinnanensis and C.quinnanensis subsp. gandhiana from two more localities in NE India (Leguminosae: Cercidoideae), ENVISNewsletter 24(2): 4-5.
46. DUBEY,RASHMI 2020. Lonavalomyces - A New Anamorphic Ascomycetes Genus reported from Lonavala, Western Ghats of India. Journal on New Biological Reports. 9(3) 316 – 320.

47. DUBEY,RASHMI AND AMIT D. PANDEY 2020. Mycoenterolobium borivaliensis sp. nov. (Pleosporomycetidae, Dothideomycetes) from reported from India. Journal on New Biological Reports: 9(3) 312 – 315.
48. DUBEY,RASHMI AND S.MANIKPURI 2021. Conlariumindicum: A novel fungus from Western Ghats of India. Journal of Fungal Biology 11(1): 112-118.
49. DUTTA PRAMANICK, DEBASMITA 2021. Foliar architectural pattern of some members of the family Nyctaginaceae in India with special emphasis on their taxonomic significances. *eJournal of Applied Forest Ecology* 9(1): 29-44.
49. DWIVEDI, M.D., S. CHAUHAN, A. SRIVASTAVA, PRAGYA SOURABH, S. MISHRA, J. THAKUR AND A.N. SHUKLA2020. Systematic position and habitat distribution modeling for reintroduction of critically endangered medicinal plant Pittosporum eriocarpum Royle (Pittosporaceae). Pleione. 14(1): 109-120.
50. FRASER-JENKINS, C.R., B.S. KHOLIA AND D.R. KANDEL 2020. Recent Changes and Corrections in the Taxonomy of Indian Pteridophytes: Part 2. Indian J. For. 43(1):58-86.
51. FRASER-JENKINS, C.R., B.S. KHOLIA, AND D. R. KANDEL 2020. Recent Corrections and Changes to Indian Pteridophytes, part 1. Indian J. For. 42 (4): 309–316.
52. GARG, A. AND TIWARI, A.P. 2020. Floristic account of the Van Vihar National Park in Bhopal, Madhya Pradesh, India. Indian J. For. 42(4): 323-336.
53. GARG, A., PATRUT, R.T., PATRUT, A., WOODBORNE, S. AND RAKOSY, L. 2021. Radiocarbon dating and status of theoldest extant Ceylon iron wood (Manilkara hexandra) in the riverine Ramsar site of India. Current Science. 120 (3):562 – 566. (Research communications)
54. GARG, A., R. KR. SINGH, AND B.S. KHOLIA 2020. Pedicularis raghvendrae (Orobanchaceae), a new species from Sikkim Himalaya, India. Phytotaxa. 452 (1): 110–115.
55. GHOSH, A. K., R.P. DAS, BHATT AND M.E. HEMBROM 2020. Two new species of the genus Russula from western Himalaya with morphological details and phylogenetic estimations. Nova Hedwigia 111(1-2): 115–130.
56. GHOSH, A., DAS, K. AND , D.CHAKRABORTY 2021. Morphology and molecular approach reveal a new species of the genus Russula subsect. Lepidinae (Russulaceae) from India. Phytotaxa 483(3): 244–254.
57. GNANASEKARAN, G., W. ARISDASON AND Y. DENG 2020. An overview on the validation of the name Andrographis longipedunculata (Acanthaceae). Phytotaxa 433(1): 75–76.
58. GOGOI, R.2020.Methodology of study of Impatiens (Balsaminaceae): A Morphological approach, Plant systematics and ethnobotany: methods and practices 85-97.
59. GOGOI, R. AND N. SHERPA 2020. Taxonomic identity of Impatiens cathcartii Hook.f. &I. serratifolia Hook.f. with notes on typification of both names. Bio. Res. Con. 59(2):1-8, DOI: 10.2478/biorc-2020-0008.
60. GOGOI, R.,N. SHERPA AND G. CHHETRI 2020. Impatiens bakthangensis sp. nov. (Balsaminaceae): a new species from Sikkim, India, Nordic J Botany,doi: 10.1111/njb.02872.
61. GOGOI, R., N. SHERPA, B.B.T. THAM, C. DEORI, AND S. TALUKDAR 2020. Recollection of Impatiens angustiflora (Balsaminaceae) and notes on its lectotypification. Nelumbo 62(2):154-160, DOI: 10.20324/nelumbo/v62/2020/156894.
62. GOGOI, R., N. SHERPA, B.B.T. TNAM, C. DEORI AND S.R. TALUKDAR 2020. Recollection of Impatiens angustiflora (Balsaminaceae) and notes on its lectotypification. Nelumbo 62(2): 154-160.
63. GOGOI, R., N., SHERPA, M. MURUGESAN, AND L. R. MEITEI 2020. Rediscovery of Impatiens cothurnoides C.E.C. Fisch., taxonomic identity, lectotypification and notes on its distribution, Botany Letters. https://doi.org/10.1080/23818107.2020.1856715.
64. GOGOI, R., SHERPA, N. AND S. BORAH 2020, Taxonomic revision of Impatiens laxiflora Edgew. (Balsaminaceae) and its allied species in India, Nepal, Bhutan & China. Botany Letters. DOI: 10.1080/23818107.2020.1857834.
65. GUPTA, PRATIBHA2020. Corona has to be run away from India. Curr. Cri., P 4.
66. GUPTA, PRATIBHA 2020. Don't be afraid of corona. Curr. Cri., P 4.
67. GUPTA, PRATIBHA2020. Epiphytic algal diversity on mango tree of Acharya Jagdish Chandra Bose Indian Botanic Garden, Howrah. Anusandhan 8(1): 60 – 64.
68. HARIKRISHNA, P., J. SWAMY, VINOD MAINA AND RAMESH KUMAR (2019). Ocimum filamentosum Forssk. (Lamiaceae): A new distributional record for the flora of Rajasthan, India. Indian J. For. 42 (4): 337-338.
69. IBANEZ, T., G.KEPPEL, C. BAIDER, BIRKINSHAW, C., FLORENS, F. B. V., LAIDLAW, M., MENKES, C., PARTHASARATHY, N., RAJKUMAR, M., RATOVOSON, F., RASINGAM, L., REZA, L., AIBA, S., WEBB, E.L., ZANG, R. AND BIRNBAUM, P. 2020. Tropical cyclones and island area shape species abundance distributions of local tree communities, Oikos doi: 10.1111/oik.07501

70. INGLE, P., S. BHOSLE AND P. LAKSHMINARASIMHAN 2020. Indian traditional food, food habits and customs in combating pandemics: You are what you eat. Journal of Economic and Taxonomic Botany 44(1-4): 5–7.
71. JALAL, J.S., I. DATT RAI, A. BHATTACHARJEE AND G. SINGH 2020. New distributional record of Gastrochilus affinis (Orchidaceae) from Western Himalaya with notes on a new synonym and typification. Nelumbo 62 (1): 12–15.
72. JHA, VIDYANATH., RAMESH KUMAR JHA, AND BASANT KUMAR SINGH 2020. Forest Products Preferred for Use in Human Endeavours - A Case Study of Darbhanga District in North Bihar (India). e Journal of Applied Forest Ecology (eJAFE), 8(1): 11-19.
73. JOSHI, P., V. K. RAWAT, BRIJESH KUMAR, HIMANSHU DWIVEDI 2019. Taxonomic studies of genus Goniophlebium and Selliguea of District Tehri Garhwal, Indian Central Himalaya. Bull. of Arunachal Forest ResearchVol 34 (1&2): 1-10.
74. JOSHI, P., V.K. RAWAT, B.KUMAR, H. DWIVEDI 2019. Taxonomic studies of genus Goniophlebium and Selliguea of district Tehri garhwal, Indian Central Himalaya. Bull. ArunachalForest Res., 34 (1 &2), 1–10.
75. K. MITTAL, P. INGLE AND R. DANGI 2020. Trigonella glabra (Leguminosae): A new addition to Trigonella genetic resources in India. Journal of Economic and Taxonomic Botany 44(1-4): 62– 66.
76. KAMBLE, M.Y. AND C.P. VIVEK. 2020. Grasses of six Wildlife Sanctuaries in North Andaman Islands, India. Journal of Non-Timber Forest Products 26(4): 167–174.
77. KANDWAL,M.K., SANDEEP TAMBE AND G. S. RAWAT 2020. Anthoxanthum monticola (Bigelow) Veldkamp [Poaceae]: A new record for India, Pleione 14(2): 249 - 253.
78. KANWAL K.S., U.L. TIWARI, M.S. LODHI AND R.S. RAWAL (2020). Meconopsis merakensis var. merakensis (Papaveraceae), a new record for India. Rheedea 30(3): 391–395.
79. KARTHIGEYAN, K., W. ARISDASON AND L. RASINGAM 2020. Lectotypification of Justicia anfractuosa (Acanthaceae), an Endemic and Rare Species from Northeast India. J. Jap. Bot. 95(1): 39–40.
80. KHANNA, K.K., A.P. TIWARI, AND A.N. SHUKLA 2020. Six taxa of angiosperms as new distributional records for Chhattisgarh, India. J. New Biolo. Report. 220-222.
81. KHOLIA, B.S. 2019. Know your Botanist. Prof S. S. Bir in ENVIS under ENVIS News letter 24(2): 11.
82. KHOLIA,B.S., C. R. FRASER-JENKINS, N. PUNETHA AND S. K. SINGH 2021. On the occurrence of Oeosporangium tenuifolium (Burm.f.) Fraser- Jenk. & Pariyar in the Western Himalaya, Uttarakhand, India. Indian Journal of Forestry 43(2): 166-168.
83. KRISHNA CHOWLU, A. NAGESWARA AND CHAYA DEORI 2020. Synopsis of Eulophia R.Br. (Orchidaceae) in Manipur (India) with a new distributional record to the state Pleione 14 (2): 361-366.
84. KRISHNA CHOWLU, A. NAGESWARA RAO AND R. MAITY 2020. Two additions to the orchid flora of Manipur, India. Richardiana 4 (9): 139-146.
85. KRISHNA CHOWLU, A. NAGESWARA RAO, MANAS R. DEBTA AND V. K. RAWAT. Eulophia promensis (Orchidaceae)-An addition to the flora of Manipur, India. Richardiana 4 (12): 232-237. 2020.
86. KRISHNA, G., A. BHATTACHARJEE AND K. KARTHIGEYAN 2021. Hoya edeni (Apocynaceae: Asclepiadoideae): Notes on its overlooked first drawing, original material at CAL and etymology. Nelumbo 62(2): 192 – 196.
87. KRISHNA, G., A. BHATTACHARJEE AND S. BANDYOPADHYAY 2020. (039) Proposal to add a new paragraph to Recommendation 9A. Taxon 69(6): 1386.
88. KRISHNA, G., A. BHATTACHARJEE AND S. BANDYOPADHYAY 2020. (047) Proposal to add a new paragraph with a new Example to Recommendation 50D. Taxon 69(6): 1390.
89. KRISHNA, G., A. BHATTACHARJEE, S. BANDYOPADHYAY AND M. SANJAPPA 2020. (021) Proposal to amend Recommendation 46C.2. Taxon 69(3): 636.
90. KRISHNA, G., A. BHATTACHARJEE, W. ARISDASON AND S. BANDYOPADHYAY 2020. (042) Proposal to add a new Example under Article 36.1. Taxon 69(6): 1388.
91. KULLOLI R.N., C.S. PUROHIT, V. MAINA AND B. KARI. 2020. Recollection of Critical Endangered Plant Ceropegia odorata Nimmo ex J. Graham (Asclepiadaceae) after 128 years from Mount Abu wildlife sanctuary, Rajasthan, India. Journal of New Biological Reports 9(3): 277 – 280.
92. KULLOLI, R.N. AND C.S. PUROHIT 2020. Habenariagibsonii var. foetida (Orchidaceae): An addition to the flora of Rajasthan. Species 21(67): 202–207.
93. KULLOLI, R.N., C.S. PUROHIT AND S. KUMAR 2020. Aloe trinervis. The IUCN Red List of Threatened Species.
94. KULLOLI, R.N., C.S. PUROHIT, RAMESH KUMAR AND VINOD MAINA 2019. Notes on the occurrence of Anticharis glandulosa Ascj. Var. caerulea Blatt. & Hallb. ex Santapau (Scrophulariaceae) – a rare endemic plant of Indian Desert. Phytotaxonomy 18: 65 – 68.
95. KUMAR R., C.S., PUROHIT, R.N. KULLOLI AND V. MAINA 2019. Begonia picta Smith (Begoniaceae) – new record for Rajasthan from Mount Abu Wildlife Sanctuary. The Begonian 86: 214 – 217.

96. KUMAR S., C.S. PUROHIT AND R.N. KULLOLI 2020. Aloe trinervis sp. nov. A new succulent species from Indian Desert (Asphodelaceae). Journal of Asia Pacific Biodiversity 13(2): 325 – 330. https://doi.org/10.1016/j.japb.2020.03.001.
97. KUMAR SAMPATH, K., S. ARUMUGAM AND V.K. MASTAKAR 2020. Lectotypification of Albizia lathamii (Leguminosae: Mimosoideae). Phytotaxa 446 (4): 260–264.
98. KUMAR, ANAND 2020. A contribution to the ethnomedicinal plants of Gautam Buddha Wildlife Sanctuary, Bihar & Jharkhand. Int. J. Adv. Res. Bio. Sci. 7(11): 108–115.
99. KUMAR, ANAND 2020. A preliminary report on the Flora of Eco-Sensitive Zones of Gautam Buddha Wildlife Sanctuary, Bihar & Jharkhand. Int. J. Adv. Res. Bio. Sci. 7(11): 83–88.
100. KUMAR, ANAND 2020. New combinations in the genus Machilus (Lauraceae). Int. J. Adv. Res. Bio. Sci. 7(12): 29–31.
101. KUMAR, ANAND 2020. Notes on the lectotypification of three names in genus Fimbristylis Family Cyperaceae. J. Bombay Nat. Hist. Soc. 117:
102. KUMAR, ANAND 2020. Notes on the typification of five names in Lauraceae. ThaiForest Bull., Bot. 48(2): 142–144.
103. KUMAR, ANAND 2020. Second-step lectotypification of six names of Litsea (Lauraceae). Phytotaxa 460(3): 214–224.
104. KUMAR, ANAND 2021. On the nomenclatural type of Sohmaea barbaticaulis (Fabaceae). Phytotaxa 482(2): 215–218.
105. KUMAR, ANAND AND K.A. BHARATI 2020. Second-step lectotypification of Fimbristylis alboviridis (Cyperaceae). Phytotaxa 442(1): 41–42.
106. KUMAR, ANAND AND O.N. MAURYA 2020. Lectotypification of Boschniakia himalaica, the basionym of Xylanche himalaica (Orobanchaceae). Rheedea 30(3): 404–406.
107. KUMAR, ANAND AND O.N. MAURYA 2020. Nomenclature notes on type materials of six names in Linderniaceae. Botany Letters 167: 378–387.
108. KUMAR, ANAND AND O.N. MAURYA 2020. Typification of two accepted names and one synonym in the genus Nepeta L. Adansonia, sér. 3, 42(11): 219–225.
109. KUMAR, ANAND, G. KRISHNA AND T. CHAKRABARTY 2020. Two New Synonyms in Indian Cryptocarya (Lauraceae). Nelumbo 62(2): 173–177.
110. KUMAR, ANAND, O.N. MAURYA AND S. BANDYOPADHYAY 2020. (017) Proposal to add a new Example after Article 11.4. Taxon. 69(3): 633.
111. KUMAR, ANAND, P.P. GHOSHAL AND K.A. BHARATI 2020. Notes on the type specimens of names in Aconitum (Ranunculaceae) at Central National Herbarium (CAL). Phytotaxa 475(4): 209–238.
112. KUMAR, ANAND, S. SACHAN, T. SHIL AND O.N. MAURYA 2020. An annotated checklist of the vascular plants of the Udaipur Wildlife Sanctuary, West Champaran, Bihar, India. Trop. Pl. Res. 7(1): 209–228.
113. KUMAR, ANAND, T. CHAKRABARTY,S. BANDYOPADHYAY AND A.BHATTACHARJEE 2020. Notes on nomenclature and typification of Heteropogon fischerianus and H. contortus var. distichus (Poaceae). Rheedea 30(3): 388–390.
114. KUMAR, ANANT 2020. An account on Endemic Taxa of Indian Subcontinent collected from Buxa Tiger Reserve, Alipurduar, West Bengal. Int. J. Adv. Res. Biol. Sci. 7(11): 96–99.
115. KUMAR, ANANT AND V. RANJAN 2020. Life Forms and Biological Spectrum of the Flora of Gorumara National Park, West Bengal, India. Int. J. Adv. Res. Biol. Sci. 7(11): 131–134.
116. KUMAR, ANANT AND V. RANJAN 2020. Wild edible plants of Gorumara National Park, Jalpaiguri, West Bengal. Int. J. Adv. Res. Biol. Sci. 7(12): 1–5.
117. KUMAR, ANANT AND W. ARISDASON 2020. Aquarius cordifolius (L.) Christenh. & Byng (Alismataceae), an invasive alien species: its introduction, colonization and plausible threats in India. Curr. Sci. 118(4): 524–525.
118. KUMAR, PUNEET.,H. SINGH AND J.S. JALAL 2020. A note on Corallorhiza trifida Chatel.: A lesser known partial myco-heterotrophic orchid from Himachal Pradesh, Western Himalaya, India. Indian Forester. 146(6): 565-566.
119. KUMAR, S., C.S. PUROHIT ANDR.N. KULLOLI 2020. Aloe trinervis sp. nov.: A new species from the Indian Desert. Journal of Asia-Pacific Biodiversity. 13. 10.1016/j.japb.2020.03.001.
120. LAHIRI, R., JYOTSHANA, A.K. VERMA, K. SHANKERAND R.K. LAL 2020. Diallel analysis of seven promising genotypes of opium poppy for assessment of their combining ability and efficacy in future genetic improvement programmes. Environmental and Experimental Biology (2020). 18: 161–168.
121. LAKSHMINARASIMHAN, P., N. ODYUO, C. DEORI, D. VIJAYAN, D. L. BIATE, ANDK. N. GANDHI 2020. –A report on the fourth Botanical Nomenclature course organized bythe Botanical Survey of India at Shillong". Harvard Papers in Botany 25(1): 75-78.
122. LAKSHMINARASIMHAN, P., N. ODYUO, C. DEORI,D. VIJAYAN, D. L. BIATE AND K. N. GANDHI.

2020. A Report on the Fourth Botanical Nomenclature Course Organized by the Botanical Survey of India at Shillong. J. Jpn. Bot. 95(5): 315–317.

123. LAL JI SINGH, VINAY RANJAN, RASINGAM, L. AND J. SWAMY 2020. A new species of genus Dendrophthoe Mart. (Lorantheae-Loranthaceae) from the Peninsular India, Journal of Asia-Pacific Biodiversity, 13(3): 487-493. https://doi.org/10.1016/j.japb.2020.03.017
124. LODH, P., V. SAMPATH KUMAR, S.K. MUKHERJEEAND S.N. SINHA 2020. Salvia roborwoskii Maxim. — an addition to flora of Western Himalaya, India. NeBio 11(3): 189–191.
125. M. SHUNMUGA SUNDARI, A. BENNIAMIN AND V. IRUDAYARAJ 2020. Chromosome Study on an Endangered Oak Leaf Fern Tectaria zeilanica (Houtt) Sledge (Dryopteridaceae) from South India. International Journal of Plant Biology & Research, 8(1): 1115 (2020).
126. MAHESH, Y., L. RASINGAM AND M.V. RAMANA 2020. Habenaria reniformis (D. Don) Hook.f. (Orchidaceae) - A New Distributional Record for Andhra Pradesh, Nelumbo 62(1): 57-59.
127. MAHESHWARI, M. UMA AND K. KARTHIGEYAN 2021. On the occurrence and distribution of the narrowly endemic Andaman Lantern Flower Ceropegia andamanica (Apocynaceae: Ceropegieae). Journal of Threatened Taxa 13(1): 17597 – 17600.
128. MAJUMDAR S. AND M. DEY 2021. Drepanolejeunea mawtmiana, a new synonym of Drepanolejeunea herzogii (Lejeuneaceae: Marchantiophyta) with a note on the diversity of the genus Drepanolejeunea in India. J. Bryol. DOI: 10.1080/03736687.2020.1864893.
129. MANE S.S., RATH C., SUSMITHA B., GAUR S.K., RATNA J.G.V., SRIKANTH N., TRIPATHI A.K. AND M.Y. KAMBLE (2020). Ethnomedicinal Knowledge among Nicobarese Tribes of Car Nicobar Island of Andaman and Nicobar Islands, India. Journal of Drug Research in Ayurvedic Sciences 5(1):13–24.
130. MASTAKAR, V.K. 2020. Five new additions to the Angiospermic Forest Flora of Chota Nagpur Plateau, Jharkhand state, India. Int. J. Adv. Res. Biol. Sci. 7(12): 63–68.
131. MAZUMDAR, J., S. BANDYOPADHYAY AND A. BHATTACHARJEE 2020. (013) Proposal to amend Article 9.20. Taxon 69(3): 631
132. MEHALA DEVI, R., S.P. NITHYA, R. MANIKANDAN, W. ARISDASON AND C. MURUGAN 2021.Leafless Goglet Plant. ENVIS Newsletter.25(1): 5–6.
133. MISHRA, S., J.S. JALAL, C.P. VIVEK, G.A. EKKA, D.K. AGRAWALA AND L.J. SINGH 2020. A note on the occurrence of Luisia unguiculata (Orchidaceae) in Andaman & Nicobar Islands, India. Nelumbo 62(1): 50 – 53.
134. MISHRA, S., J.S. JALAL, C.P. VIVEK, AND L.J. SINGH 2020. Two new species of Luisia (Vandeae, Orchidaceae) from the Andaman and Nicoba Islands, India. Phytotaxa 453 (3): 255–264.
135. MISHRA, S., S. PANDA AND S.S. JENA 2019. Notes on Cirrhopetalum panigrahianum (S. MISRA) S. MISRA: an endemic orchid from Odisha, India. J. Econ. Tax. Bot. 43 (1-4): 42-44.
136. MURUGAN, C., R. MANIKANDAN, S.P. NITHYA, B. KARTHIK AND W. ARISDASON 2020. Capparis danielii (Capparaceae), a new species from the Gulf of Mannar Biosphere Reserve, India. Phytotaxa 472(3): 283–291.
137. MURUGAN, P., M. SULAIMAN AND BASIL PAUL. 2020. Tarenna flava Alston (Rubiaceae): A New Record for Kerala from Agasthyamalai Biosphere Reserve, Western Ghats, India. Indian Forester 146(8): 780-781.
138. MURUGAN, P., V. RAVICHANDRAN AND C. MURUGAN 2020. Rediscovery of Ophiorrhiza incarnata C.E.C.Fisch. (Rubiaceae) after lapse of 83 Years from the Western Ghats, India" to Journal of Threatened Taxa, 23.03.2020.
139. NAGARAJU, S., P. V. PRASANNA, AND Y. V. RAO 2019. Two Tripogon species as additions to the Grass flora of Telangana State, India. Journal of Economic and Taxonomic Botany 43 (1-4): 52-55.
140. NAIK, M. C. AND L.J. SINGH 2020. Two legume species additions to the flora of Andman & Nicobar Islands, India. Abrahamia 5(1): 1-4.
141. NAIK, M.C. AND L.J. SINGH 2020. Desmodium heterocarpon subsp. Ovalifolium addition to the flora of India from South Andaman Islands, India. Species 22(69), 80-83.
142. NAIK, M.C., L.J. SINGH AND K.N. GANESHAISH 2020. Floristic Diversity and Analysis of South Andaman Islands (South Andaman District), Andaman and Nicobar Islands, India. Species 21(68): 343-409.
143. NAIK, M.C., L.J. SINGH, G.A. EKKA AND C.P. VIVEK 2020. Addition of four species to the flora of Andaman Islands, India. Journal of Threatened Taxa 13 (2): 17843-17846.
144. NOLTIE, H.J., ANAND KUMAR, K.A. BHARATI, A. BHATTACHARJEE AND G. KRISHNA 2021. The specimens of William Roxburgh in the Central National Herbarium (CAL) at the AJC Bose Indian Botanic Garden, Kolkata. Curr. Sci. 120(6): 997–1006.
145. ODYUO, N., D.K. ROY, R. LYTAN, N. TANAKA AND A.A. MAO 2020. Peliosanthes nagalandensis and P.tobuensis (Asparagaceae: Nolinoideae) - two new species from North-Eastern India. Phytotaxa 456(3): 285-295.

146. P. A. DHOLE 2021. Wild edible plants with its socio-economic importance used by tribes of Gaya District, Bihar. Int. J. Adv. Res. Biol. Sci. 8(1): 51-58.
147. PÁEZ, V. DE LOS A., A. R. ANDRADA, PUNEET KUMAR, M. S. CARO 2021. Cytomixis in Angiosperms from Northwestern Argentina. Botany Letters, Published online: https://doi.org/10.1080/23818107.2021.1903994.
148. PAGAG, K AND S.K. BORTHAKUR 2020. Macrophytes of the wetlands of Lakhimpur district, Assam. International J. of Bot. and Res. 10(2): 65-72. Doi: 10.24247ijbrdec20208
149. PAGAG, K., D. VIJAYAN AND A.A. MAO 2020. Phytochemical studies of leaves and roots (In vitro) of endemic orchid Arachnis senapatiana (Phukan & A. A. Mao) Kocyan & Schuiteman. Journal of Pharmacognosy and Phytochemistry 9(6): 1465-1467.
150. PANDA, S. P., D. BEHERA, S. BISWA, M. U. SHARIEF, B. T. PANDA and H. N. SUBUDHI 2021. Schoenorchis gemmata (Lindl.) J.J. Smith: Anaddition to the Orchidaceous flora of Eastern Ghats, India. J. Pharmacogn. Phtochem. 10 (1): 2801-2803.
151. PANDA, S. P., H. K. SAHOO, R. SARAVANAN, D. BEHERA, M. U. SHARIEF AND H. N. SUBUDHI 2020. Some Less Known medicinal herbs of Kandhamal District of Odisha. J. Pharmacogn. Phtochem. SP6: 424-428.
152. PANDA, S.P., D. BEHERA, S. BISWA, M.U. SHARIEF AND H.N. SUBUDHI 2021. Schoenorchis gemmata (Lindl.) J.J. Smith: An addition to the Orchidaceous flora of Eastern Ghats of India. J. Pharmacogn. Phytochemistry 10(1): 2801–2803.
153. PANWAR, G. S. AND BHAVANA JOSHI. 2020. Micropropagation of Tricholepis roylei Hook.f.-a point endemic species of the Western Himalaya. J. of Genetic Engineering and Biotechnology. 18(40). 1-8. https://doi.org/10.1186/s43141-020-00051-9
154. PATHAK, M. AND K.A. BHARATI 2020. Mapping Ethnobotany research in India. Ethnobotany Research and Applications 20:1-12.
155. PATIL, SAMEER 2020. A neglected taxon of Arisaema (Araceae) from Western Ghats, India. Journal of Japanese Botany 95(6): 332–335.
156. PATIL, SAMEER 2020. A step towards conserving Anoectochilus elatus: a South Indian Jewel Orchid. NeBIO 11(2): 67–70.
157. PATIL, SAMEER 2020. Ceropegia ciliata: increasing extent irrespective of diminishing Shola landscapes. NeBIO 11(3): 192–194.
158. PATIL, SAMEER 2020. Nomenclature notes and lectotypification in the monotypic genus Getonia (Combretaceae). Rheedea 30(3): 400–403.
159. PATIL, SAMEER 2020. Strobilanthes lakshminarasimhanii (Acanthaceae): A new species from Kodagu, Karnataka. Nelumbo 62(2): 113–116.
160. PEDDI H.K., J. SWAMY, V. MAINA AND R. KUMAR 2020. OcimumfilamentosumForssk. (Lamiaceae): A new distributional record for Rajasthan, India. Indian Journal of Forestry 42(4): 337-338.
161. PRAMEELA, R. J. SWAMY AND J. PRAKASH RAO 2020. Notes on distribution of Xanthosoma sagittifolium (L.) Schott (Araceae) in Peninsular India. Journal of Indian Botanical Society 100 (1&2): 87-90.
162. PRAMEELA, R., M. VENKAIAH, J. SWAMY, AND J. PRAKASARAO 2020. Amaryllids of Andhra Pradesh, India. Tropical Plant Research 7(3): 594-603.
163. PRASAD, R., K.L. MEENA AND M.K. SINGHADIYA 2021. Veronica polita Fr. (Plantaginaceae) - an addition to the Flora of Western India from Sariska Tiger Reserve, Rajasthan. Indian Forester 147(2): 205–206.DOI: 10.36808/if/2021/v147i2/153126
164. PUROHIT, C. S. 2020. Dalechampia &Micrococoa Two generic addition for flora of Aravalli range, India with Status of Family – Euphorbiaceae of Todgarh-Raoli wild life sanctuary, Rajasthan, India. J New Biol.Rep.9 (2):209– 219.
165. PUROHIT, C.S. 2020. Ipomoea sagittifolia Brum. f.- Addition for Flora of Rajasthan and Status of family Convolvulaceae in Todgarh-Raoli Wildlife Sanctuary, Rajasthan. Int. J. Sci. Res. Sci. Technol. 7(3): 49 – 65.
166. PUROHIT, C.S. 2020. New population records of an Endemic plant- Melhania magnifolia Blatt. & Hallb. from Todgarh-Raoli wildlife sanctuary, Rajasthan. Species 21(68): 306-315.
167. PUROHIT, C.S. 2020. Seven families addition under class Polypetalae for flora of Todgahr-Raoli wildlife sanctuary, Rajasthan. Indian Journal of Arid Horticulture 1(2): 91 – 95.
168. PUROHIT, C.S. AND R. KUMAR 2020. A review on genus Calligonum L. (Polygonaceae) from India and report Calligonum crinituman addition for Flora of India. Journal of Asia Pacific Biodiversity 13(2): 319 – 324. https://doi.org/10.1016/j.japb.2020.03.002.
169. PUROHIT, C.S., K. JAIN AND MERUSIKHA 2020. Cucumis sativus forma hardwickii – New Record for Rajasthan with status of family Cucurbitaceae of Todgarh-Raoli wildlife sanctuary, Rajasthan. Species 21(68): 410 – 423.

170. PUROHIT, C.S., M. SINGH AND A. BHARTI 2020. New addition of two IUCN Red Listed bird species of Order: Gruiformes for Todgarh-Raoli Wildlife Sanctuary, Rajasthan, India. International Journal of Zoology Studies 5(4): 28 – 29.
171. PUROHIT, C.S.,M. SINGH, P. SINGH AND A. BHARTI 2020. Asian Pied Sterling: A new addition to Avian diversity of Todgarh-Raoli wildlife sanctuary, Rajasthan, India. Journal of New Biological Reports 9(2): 259 – 261.
172. PUROHIT, C.S., R.N. KULLOLI, R. KUMAR, V. MAINA AND B. KARI 2020. A little known orchid Habenaria longicorniculata (Orchidaceae) from Mount Abu wildlife sanctuary, Rajasthan and its IUCN status. Journal on New Biological Reports 9(3) 299 – 305.
173. PUROHIT, C.S., RAMESH KUMAR 2020. A review on genus Calligonum from India and report Calligonum crinituman addition for Flora of India. J. Asia-Pacific Biodiversity 13(2): 319 – 324.
174. RANJAN, V., G. KRISHNA, A. BHATTACHARJEE AND ANANT KUMAR 2020. Addition of two ground orchids in flora of West Bengal (India). Richardiana 4: 147–156.
175. RASINGAM, L. AND J. SWAMY 2020. Brachystelma telanganense (Apocynaceae: Asclepiadoideae-Ceropegieae) - a new species from Telangana, India. Rheedea 30(3):379-382.
176. RASINGAM, L. AND K. KARTHIGEYAN 2020. Ziziphus ridleyana, a new name for Ziziphus macrophylla Ridl. (Rhamnaceae), Phytotaxa 454 (1): 071–072.
177. RASINGAM, L. AND K. KARTHIGEYAN 2021. Two new names in the family Lauraceae. Phytotaxa 491(2): 191–192.
178. RATHER, S.A., W SHU, M.D. DWIVEDI, C. ZHAOYANG 2021 Molecular phylogeny and systematic evaluation of the Caragana opulens species complex (Fabaceae, Papilionoideae) based on the molecular and morphological dataPhytotaxa 478 (2), 179-200.
179. RATHI, R.S., K.C. BHATT, A. PANDEY, U.L. TIWARI, K. PRADHEEP, N.S. PANWAR AND S.P. AHLAWAT 2020. Tubocapsicum anomalum (Franch. & Sav.) Makino: A New Record to the Flora of Arunachal Pradesh, India. Indian Journal of Plant Genetic Resources 33(1): 115–118.
180. REWICZ, A., ADAMOWSKI, W., S.BORAH, AND R. GOGOI 2020. New Data on Seed Coat Micromorphology of Several Impatiens spp. from Northeast India., Acta Societatis Botanicorum Poloniae 89(3):89312, DOI: 10.5586/asbp.89312.
181. ROSSI, W., K. DAS, M.E. HEMBROM, S. SANTAMARIA, A. PARIHAR, A. GHOSH, T.W. HENKEL, V. HOFSTETTER, E. RANDRIANJOHANY, A. VIZZINI, X.H. WANG AND B. BUYCK 2020. Fungal Biodiversity Profile 91–100.Cryptogamie Mycologie 41(4): 69–107.
182. ROY, D. K. AND B.K. SINGH 2019. Notes on taxonomic recognition and recollection of Tupistra nutans (Asparagaceae). Bulletin of Arunachal Forest Research. 34(1&2):25–28.
183. SACHAN, S., A. KUMAR, P.P. GHOSHAL AND K.A. BHARATI 2020. Checklist and Key to the Asteraceae of Bihar, India. Int. J. Adv. Res. Biol. Sci. 7(4): 1–25.
184. SAILU, G. AND J. SWAMY 2020. Avifaunal Diversity of Pocharam Wildlife Sanctuary, Medak. Pitta 17 (12): 8-15.
185. SARAVANAN, R., D. KANNAN, S. P. PANDA AND S. DATTA 2020. Traditionally used wild edible plants of Kuldiha Wildlife Sanctuary (KWLS), Odisha, India. J. Pharmacogn. Phtochem. SP6: 482-488.
186. SARVANAN. R., KANNAN, D., PANDA, S.P., S. DATTA 2020. Traditionally used wild edibles plants of Kluldiha Wildlife Sanctuary, Odisha, India. Journal of Pharmacognosy & Phytochemistry 6: 482-488.
187. SAWMLIANA, M., G. KRISHNA AND T. CHAKRABARTY 2020. Notes on re-collection of Phyllanthus tetrandrus (Phyllanthaceae) from Mizoram, India. Nelumbo 62(1): 46–49.
188. SEAL, TAPAN 2020. "Effect of boiling and microwave cooking on nutritional, anti-nutritional and toxicity of wild edible plants of North-Eastern region in India" International Journal of Pharmacy and Pharmaceutical Sciences 12 (11): 61-70.
189. SEAL,TAPAN 2020. "Nutritive scenario of wild consumable plants of Meghalaya state in India together with heavy metals, anti-nutritional, vitamin and toxicity studies." Research Journal of Pharmacognosy and Phytochemistry 12(3): 123-134.
190. SEAL,TAPAN, K. SUNITA 2021. Comparative study of Ethno medicinal plants used by the tribals of Bhadradri Kothagudem district of Telangana and Siddharthnagar district of Eastern Uttar Pradesh. International Journal of Botany Studies, 6(1), 611-615.
191. SEAL, TAPAN, KAUSIK CHAUDHURI, AND BASUNDHARA PILLAI 2020. Evaluation of antioxidant activities, toxicity studies and its DNA damage protective effect of various solvent extracts of Litsea cubeba fruits. Heliyon, 6, e03637.
192. SEAL, TAPAN, KAUSIK CHAUDHURI, AND BASUNDHARA PILLAI 2020. Wild Edible Plants of Meghalaya State in India: Nutritional, Minerals, Anti-nutritional, Vitamin content and Toxicity Studies. Pharmacognosy Magazine, 16: 142-151.
193. SENGUPTA S. AND RASHMI DUBEY 2021. Taxol producing fungi: a critical review in experimental

aspects. J. Mycopathol.Res. 59 (1): 1-9.
194. SHARIEF,M.U. AND S.P. PANDA 2020. Folklore artefacts of aboriginal Shompen tribe in Great Nicobar Island, India. Genet. Resour. Crop Evol. DOI 10.1007/s 10722-020-01027.
195. SHARMA, R., K.S. DOGRA AND K. AMBRISH 2020. Traditional Knowledge of Medicinal Plants used in the rural areas of Solan District, Himachal Pradesh. Journal of Non-Timber Forest Products, 27(2): 104-112.
196. SINGH C.BAGATH AND A. BENNIAMIN 2021. Assessment of threat status of Cyrtomium micropterum (Kunze) Ching (Dryopteridaceae) in India using IUCN Regional guidelines.Journal of Threatened Taxa 13(1): 17554–17560.
197. SINGH S.K., T. PÓCS, D. SINGH AND S. KUMAR 2020. A synopsis of Colura (Dumort.) Dumort. (Marchantiophyta: Lejeuneaceae) in India. Cryptog. Bryolog. 41 (10): 111–129.
198. SINGH, L.J. AND M.C. NAIK 2020. Rivina andamanensis (Petiveriaceae): a new species from Andaman and Nicobar Islands, India. Journal of Asia-Pacific Biodiversity 13: 482- 486.
199. SINGH, L.J., V. RANJAN, L. RASINGAM AND J. SWAMY 2020. A new species of genus Dendrophthoe Mart. (Lorantheae-Loranthaceae) from the Peninsular India. Journal of Asia-Pacific Biodiversity 13: 487–493.
200. SINGH, D.K., S. MAJUMDAR, D. SINGH AND E.A.M. NOVOA 2020. Ramudaria – A New Name for Udaria (Lophocoleaceae, Marchantiophyta). Indian J. Forest. 43 (2): 190–191.
201. SINGH, H., J. SINGH., PUNEET KUMAR., V.K. SINGHAL, B.S. KHOLIA AND L. M. TEWARI 2020. Chromosome count, male meiotic behaviour and pollen fertility analysis in Agropyron thomsoniiHook.f. and Elymus nutans Griseb. (Triticeae: Poaceae) from Western Himalaya, India. Caryologia. 73(2): 89-98.
202. SINGH, H., M. MISHRA AND P. A. DHOLE 2020. Ethnomedicinal uses of plants from Kaimur and Rohtas districts of Bihar, India. Ethnobotany 30:10-21.
203. SINGH, H., M.MISHRA AND P. A. DHOLE 2019. Abutilon pannosum (G. Forst.) Schlet. (Malvaceae)- A New Adition to the Flora of Bihar, India. Indian J. Forestry 42(4): 105-106.
204. SINGH, H., M. MISHRA AND P. A. DHOLE 2020. Ethnomedicinal Plants Used by the Tribal Communities of West Champaran District of Bihar, India Pla. Sci. 3(4):38-44.
205. SINGH, H., M. MISHRA AND P. A. DHOLE 2020. Ethnomedicinal uses of plants from Kaimur and Rohtas districts of Bihar, India. Ethnobotany 30: 10-21.
206. SINGH, H., M. MISHRA AND P.A. DHOLE 2020. Ethnomedicinal Plants used by the tribal communities of West Champaran District of Bihar, India. Plantae Scientia. 3 (4): 38-44.
207. SINGH, L.J, GAUTAM ANUJ EKKA, SANJAY MISHRA, C.P. VIVEK, V. SHIVA SHANKAR, M.C. NAIK AND FOUZIYA SALEEM 2020. Habitat status of Musa paramjitiana L.J. Singh (Musaceae): a critically endangered, endemic species in Andaman & Nicobar Islands, India. Pleione 14(1): 121–127.
208. SINGH, L.J., M.D. DWIVEDI, S. KASANA, M.C. NAIK, G.A. EKKA, A.K. PANDEY 2020. Molecular systematics of the genus Musa L.(Zingiberales: Musaceae) in Andaman and Nicobar Islands, Biologia 75 (11): 1825-1843.
209. SINGH, L.J., MAYANK D. DWIVEDI, SHRUTI KASANA, MUDAVATH C. NAIK, GAUTAM A. EKKA AND ARUN K. PANDEY 2020. Molecular systematics of the genus Musa L. (Zingiberales: Musaceae) in Andaman and Nicobar Islands. Biologia75: 1825–1843.
210. SINGH, M., J.S. JALAL, D.K. AGRAWALA AND H. NEGI 2020. Liparis pygmaea (Malaxideae, Orchidaceae), a new distributional record from Western Himalaya, India with notes on typification. Richardiana 4: 126 – 133.
211. SINGH, R. K. AND ARTI GARG 2020. Amritdhara Sacred Grove - an unparalleledConservatory of Endemic, Endangered and Medicinal plants of Chhattisgarh. Indian Forester. 146 (12): 1183-1184.
212. SINGH, R.K., R.K. ARIGELA AND K.A. SUJANA2020. Taxonomy and Typification of Endemic Climbing Shrub Strophanthus wightianus Wall. ex Wight of Southern Western Ghats, India. Indian Forester 146 (5): 469–471.
213. SINGH, R.K., R.K. ARIGELA, D. BORAH AND M. TARAM 2020. Henckelia collegii-sancti-thomasii (Gesneriaceae), a new synonym of narrow endemic species H. hookeri of Northeast India. NeBIO 11(3): 205–207.
214. SINGHADIYA, M.K. AND R. PRASAD 2020. Additions to the Flora of Sariska Tiger Reserve, Rajasthan. Ind. J. Pure App. Biosci. 8(6): 173–180.
215. SONI, A. K. AND V. K. RAWAT 2020. Lindsaea heterophylla (Lindsaeaceae) A New Record for The Eastern Himalaya, Pteridogeographical Region of India. Indian Fern Journal. 37: 293-298.
216. SONI, A. K. AND V. K. RAWAT 2020.A New subspecies Record for the Pteridophytic Flora of Arunachal Pradesh, India: Hypodematium crenatum(Forssk.) Kuhn subsp. crenatum (Dryopteridaceae). Indian Fern Journal. 37: 288-292.
217. SONI, A. K., M. R. DEBTA AND V. K. RAWAT 2020. An Overview of Family Pteridaceaein North East India. Indian Fern Journal. 37: 277-287.
218. SONI, ASHISH K., MANAS R. DEBTA AND VINNET K. RAWAT 2020. An overview of family Pteridaceae in North East India. Indian Fern. J. 37: 277-287.

219. SRIVASTAVA, NITISHA 2020. Role of epidermal micromorphology in delimitation of taxa in genus Andrographis (Acanthaceae) in India. Tropical Plant Research, 7(2): 491–495.
220. SUJANA, K.A. AND R.G. VADHYAR 2019. Notes on distribution, conservation and pollen morphology of an endemic and threatened wild ginger. Journal of Non-timber forest Products 26(2): 89–91.
221. SUJANA, K.A. AND R.G. VADHYAR 2020. Ginger herb Meistera fulviceps: a new distribution record for Tamil Nadu. Plantasia #18, In: Zoo's Print 35(4): 15–17.
222. SUJANA, K.A. AND R.G. VADHYAR 2020. Polyalthia longipedicellata (Annonaceae): An addition to the flora of Tamil Nadu. Indian Forester 146 (8):778-779.
223. SWAMY, J. 2020. Pancratium zeylanicum L. (Amaryllidaceae): An Addition to the Flora of Telangana, India. Indian Forester146 (5): 459-460.
224. SWAMY, J. 2020. Tripogonella minima (Poaceae: Chloridoideae: Cynodonteae: Tripogoninae), a new record for Asia from Peninsular India. Rheedea 30(3):396-399.
225. SWAMY, J. AND L. RASINGAM 2020. A new variety of Amorphophallus konkanensis (Araceae) from Telangana, India. Nelumbo 62 (1): 4-11.
226. SWAMY, J. AND L. RASINGAM 2020. Notes on the distribution of Tephrosia noctiflora Bojer ex Baker (Leguminosae) in Andhra Pradesh. Plantasia #20, In: Zoo's Print 35(5): 113–116.
227. SWAMY, J. AND L. RASINGAM 2021. Corynandra telanganensis (Cleomaceae), a new species from India. Ann. Bot. Fennici 58: 79–82.
228. SWAMY, J. AND P.V. RAMANA 2020. Rhynchosia nummularia (L.) DC. (Fabaceae): An Addition to the Flora of Andhra Pradesh, India. Indian Forester 146 (4): 361-362.
229. SWAMY, J. AND S. NAGARAJU 2019. Schonefeldia gracilis (Poaceae: Chloridoideae): An addition to the flora of Telangana, India. Journal of Economic and Taxonomic Botany 43 (1-4): 56-57.
230. SWAMY, J., L. RASINGAM, S. NAGARAJU AND P.R. MANE 2020. A new species of Dillenia(Angiosperms: Dilleniaceae) from the Eastern Ghats of Andhra Pradesh, India. Journal of Threatened Taxa 12(11): 16636–16640.
231. SWAMY, J., NAGARAJU, S., POOJA, R. MANE AND T.J. SHAIKH 2021. Bothiochloa insculpta (Hochst. ex.A. Rich.) A. Camus (Poaceae): A new record for the flora of Telangana, India. Indian Forester 147 (1):89-90.
232. THAKUR, J., M. D. DWIVEDI, N. SINGH, P.L. UNIYAL, S. GOEL AND A.K. PANDEY 2021. Applicability of Start Codon Targeted (SCoT) and Inter Simple Sequence Repeat (ISSR) markers in assessing genetic diversity in Crepidium acuminatum (D. Don) Szlach.Journal of Applied Research on Medicinal and Aromatic Plants 23, 100310.
233. TIWARI, A.P., A. GARG ANDA.N. SHUKLA 2021. *Blumea sonbhadrensis*, a new synonym of *Erigeron sublyratus* (Asteraceae). Phytotaxa 480 (3): 291–296.
234. TIWARI, A.P., A.N. SHUKLA, K.K. KHANNA AND R.L.S. SIKARWAR 2020. Lectotypification of *Alysicarpus gracilis* (Papilionoideae: Leguminosae). Phytotaxa 449(2): 200-202.
235. TIWARI, MOHIT KUMAR AND PRATIBHA GUPTA 2020. In vitro study on effect of antitubercular drugs on Mycobacterium lucknowense sp. nov. isolated from Indian frog Rana tigerina. Anusandhan 8(1): 48 - 52.
236. TIWARI, U.L. & V.K. RAWAT 2019. (pub. 2020). Some addition to the flora of Arunachal Pradesh and India. Bulletin of Arunachal Forest Research 34(1&2): 29–33.
237. TIWARI, U.L. AND V.K. RAWAT 2019. Some addition to the flora of Arunachal Pradesh and India. Bull. Of Arunachal Forest Research. Vol 34 (1&2): 29-33.
238. UPADHYAY, A., GOGOI, R. AND P.K. MITRA 2021. Ethnobotany of the genus Elatostema JR Forster & G. Forster. Ethnobotany Research and Applications 21: 1-24.
239. VADHYAR, R.G., J.H.F. BENJAMIN AND K.A. SUJANA 2020. Memecylon nervosum (Melastomataceae), A new Species from South India. Edinburgh Journal of Botany 77(3): 403–411.
240. VADHYAR, R.G., K.A. SUJANA, J.H. FRANKLIN BENJAMIN AND G.V.S. MURTHY 2020. Eugenia sphaerocarpa (Myrtaceae), a new species from Western Ghats of Kerala, India. Phytotaxa 442(2): 121-127.
241. VIVEK, C.P., S. MISHRA, G. A. EKKA AND L. J. SINGH 2020. Arthraxon hispidus (Poaceae): A new record for Andaman and Nicobar Islands, India. J. Econ. Taxon. Bot. 43 (1-4): 58-59.
242. WISITRASSAMEEWONG, K., M.S. PARK, H. LEE, A. GHOSH, K. DAS, B. BUYCK, B.P. LOONEY, M. CABON, S. ADAMČÍK, C. KIM, C.S. KIM AND Y.M. LIM 2020. Taxonomic revision of *Russula* subsection Amoeninae from South Korea. Mycokeys 75: 1–29.
243. YADAV, P.B.S. AND R.K. ARIGELA 2020. A partially leucistic Indian Peafowl Pavo cristatus from Tamil Nadu, India. Indian BIRDS 16(3): 94–95.
244. YADAV, S. K. AND M. PALANISAMY 2020. Eleven New Additions to Marine Macro Algal Flora of Karnataka Coast, India Nelumbo Vol 62 (1): 90-102.

245. YADAV, S.K. 2020. Medicinal prospective of seaweed resources in India: A review. J. Pharmacogn. Phytochem. 2020; 9(6):1384-1390.
246. YADAV, S.K. AND K. MAJUMDAR 2020. A preliminary study on the marine macro algal flora of West Bengal coast, India. Int. J. Adv. Res. Biol. Sci. 7(12): 75-81.
247. YADAV, S.K. AND K. MAJUMDAR 2020. Mangrove associated seaweeds in Sundarban Biosphere Reserve, West Bengal, India. Int. J. Adv. Res. Biol. Sci. 7(12): 53-62.
248. YADAV, S.K. AND M. PALANISAMY 2020. Eleven new additions to marine macro algal flora of Karnataka coast, India. Nelumbo. 62 (1): 90-102.
249. YADAV, S.K., K. MAJUMDAR AND S.L. MEENA 2020. Seaweeds on Mangroves: An amazing habitat in the Sundarban Biosphere Reserve, West Bengal, India. NeBio 11 (3): 201-204.
250. YADAV, S.K., M. PALANISAMY AND G.V.S. MURTHY 2020. Seaweed resources of Kerala coast and its economic potential. Madras Agric. J. 107 (spl. vol.): 126-130.

BOOK CHAPTERS:

1. BASU, P, R.K. GUPTA AND S.K. DAS 2020. Freshwater Algae. In: CHANDRA, K., C. RAHUNATHAN AND A.A. MAO (eds.), Biodiversity profile of East Kolkata Wetlands. Zoological Survey of India and East Kolkata Wetlands Management Authority, Department of Environment, Govt. of West Bengal. pp. 266-281.
2. BEHERA, D., S.P. PANDA AND D. PARIDA 2020. Orchids of Satkosia Tiger Reserve of Odisha and its Medicinal Application in Proc. International virtual conference on —thnomedicine-challenges and opportunities in global healthcare scenario" Organized by Narasingh Choudhury Autonomous College, Jajpur, Odisha and Federal technical university, Nigeria on 25th and 26th July 2020. Pp. 108-118.
3. BHARATI, K.A. 2021. Floristic Diversity of eco-sensitive zone of Baraila lake Salim Ali Jubba Sahni Bird Sanctuary, Vaishali district, Bihar. In: SINGH, L.J. AND V. RANJAN (eds.), New Vistas in Indian Flora. Vol. II. Bishen Singh Mahendra Pal Singh, Dehradun, India. pp. 249–269.
4. BHATTACHARJEE, A. 2020. Basic concept on orchids and their identification. In: Maity, D. (ed.), Plant Systematics and Ethnobotany: Methods and Practices. Department of Botany, University of Calcutta, pp. 45–58.
5. BHAUMIK, M. (2019). _Plantaginaceae' in Fl. West Bengal vol. 4. P. Lakshminarasimhan et al (eds) pp. 360-361. BSI. Kolkata.
6. DAS, K., D. CHAKRABORTY, A. GHOSH, M.E. HEMBROM, A. PARIHAR AND I. BERA 2020. Demystifying 102 Indian Mushrooms. ENVIS Resource Partner on Biodiversity &BSI, Kolkata. 45pp.
7. DEORI, C. 2020. Diversity, Conservation and Sustainable utilization of Orchid Flora of Northeast India. The herbal Wealth of North East India. Edited by Bapan Banik and Manas Bhowmik, EBH Publisher, India. Chapter 1. Pp.1-8.
9. DUTTA PRAMANICK, DEBASMITA & L.K. GHORA 2020. Nyctaginacese in Fl. West Bengal vol. 4. P. Lakshminarasimhan et al (eds), BSI, Kolkata.
10. GUPTA, PRATIBHA2020. Role of various Algae and herbs in prophylactic and therapeutic treatment of COVID - 19 infection. International (Web) conference on Environment and Society (ICES 2020) 9: 105.
11. GUPTA, R.K., P. BASU AND S.K. DAS 2020. How to know fresh water algae of India; an annotated key for identification of important genera. In: Maity, D. (ed.) Plant Systematics and Ethnobotany; methods and practices. The proceeding of the 3rd and 4th National workshop under taxonomy training centre, AICOPTAX, MoEF & CC, Govt. of India, Department of Botany, University of Calcutta. pp. 131–190.
12. HEMBROM, M.E. 2020 Macro-fungi In: Chandra K, Raghunathan C, Mao AA (Eds) Biodiversity Profile of East Kolkata Wetlands. Jointly published by the Director, Zool. Surv. India, Kolkata and East Kolkata Wetlands Management Authority, Department of Environment, Govt. of West Bengal. 260–265.
13. KARTHIGEYAN, K. 2020. Island Flora: Diversity and Endemism in the Flora of Andaman & Nicobar Islands - an Overview. In: MAITY, D. (ed.), Plant systematics and ethnobotany: methods and practices (The Proceedings of the 3 and 4 National Workshops under Taxonomy Training Centre, AICOPTAX, MoEF & CC) Govt. of India. Department of Botany, University of Calcutta. pp. 59 – 84.
14. KARTHIGEYAN, K., B. K. SINGH, A. K. BHARATI AND O.N. MAURYA 2021. Invasive Alien Plants. In: CHANDRA, K., C. RAHUNATHAN AND A.A. MAO (eds.), Biodiversity profile of East Kolkata Wetlands. Zoological Survey of India and East Kolkata Wetlands Management Authority, Department of Environment, Govt. of West Bengal. pp. 318 – 326.
15. KARTHIGEYAN, K., O.N. MAURYA, B. K. SINGH AND K.A. BHARATI 2021. Floral Diversity. In: CHANDRA, K., C. RAHUNATHAN AND A.A. MAO (eds.), Biodiversity profile of East Kolkata Wetlands. Zoological Survey of India and East Kolkata Wetlands Management Authority, Department of Environment, Govt. of West Bengal. pp. 298 – 317.

16. KHOLIA, B.S.2021. Pteridophyta in M. Sharma, Vascular Flora of Punjab and Chandigarh vol. III. (Monocotyledonae, Gymnospermae & Pteridophyta). Bishen Singh Mahendra Pal Singh Dehradun.pp.1875-1906.
17. KUMAR, B., P. JOSHI, H. DWIVEDI AND V.K. RAWAT 2021. An Analysis of pteridophytic flora of Jammu and Kashmir State. In L. J. Singh & V. Ranjan (Eds.) New Vistas in Indian Flora. Bishen Singh Mahendra Pal Singh, Dehradun pp. 215-232.
18. KUMAR, PUNEET., H. SINGH AND A. KUMAR 2020. Traditional knowledge of medicinal and threatened plants used by the local inhabitants dwelling in and around Sechu-Tuan Nalla: a high altitude wildlife sanctuary in Himachal Pradesh, northwest Himalaya. pp 329-333. In: Proceedings of International Biodiversity Congress (IBC 2018) held at Forest Research Institute, Dehradun, India, 4-6 October, 2018.
19. MALICK, K. C. AND M. BHAUMIK 2019. ‗Scrophulariaceae' in Fl. West Bengal vol. 4. P. Lakshminarasimhan & al (eds) pp. 96-136. BSI. Kolkata.
18. MANAS R. DEBTA AND K. AMBRISH. 2021. Vegetation and Floristic Analysis in Col. Sher Jung National Park, Sirmaur district, Himachal Pradesh. In L.J. Singh & V. Ranjan (eds.), New Vistas in Indian Flora 2: 613-638.
20. MANDAL, S.K. & M. BHAUMIK 2019. ‗Lentibulariaceae' in Fl. West Bengal vol. 4. P. Lakshminarasimhan & al (eds) pp. 140-147. BSI. Kolkata.
21. MANISH KUMAR KANDWAL AND M. VIJAY Grass Feeding Habits of Migratory Waterbirds at Asan Conservation Reserve, Dehradun, Uttarakhand 2021, New Vistas in Indian Flora (Vol. II) : pp. 803-808 ISBN: 978-81-946147-1-5
22. MANISH KUMAR KANDWAL.The Diversity of Grasses in Uttarakhand, India New Vistas in Indian Flora (Vol. II) : pp. 667-682 ISBN: 978-81-946147-1-5.
23. MEENA, S.L., S. MISHRA, H.K. PEDDI AND V. MAINA 2019. An Outline of Angiospermic Diversity of Gujarat State, India. New Vistas in Indian Flora (Vol. II): pp. 541-564 (Eds. L. J. Singh & V. Ranjan).

Booklets published:

1. HAJONG, S., G.D. HARISH AND D. L. BIATE 2021. Compiled and published booklet ―Effective conservation of medicinal & aromatic plants at ICAR-NBPGR RS, Shillong" Published by ICAR-National Bureau of Plant Genetic Resources, Regional Station Shillong.

2. HAJONG, S., G.D. HARISH AND D. L. BIATE 2021. Compiled and published booklet ―Community Seed Banks-Effective and low cost method for conservation of traditional crop varieties" Published by ICAR-National Bureau of Plant Genetic Resources, Regional Station Shillong.

Hindi Articles:

1. प ुर ो0हत, स ी. एस., आर. क ु मार एव ं व ी. मैना 2020। भारत ीय म0eथल मA व ानeप0तक प ादपj hवhवधत ा एव adल ु ‡भ क ा स ंरÆण।अ0भनवभ ारत 177-182 ।

2. न0िदत ा शम ा[, क ा ंगक ान पग ाग एव ं स ु र ेUg क ु म ार शम ा[, 2020. असम क े ल ोग‚ ‡व ार ा xचच ा क‚ द ेखभाल और सद ्य ाकरण क े 0लए प ौध‚ का प ार ंपारक उपय ोग. वनeप0तव ाण ी।

Abstract

Books published by BSI:

RANJAN, V. AND ANANT KUMAR 2020. Flora of Gorumara National Park (ed. PAUL, T.K.), Botanical Survey of India, Kolkata. pp. 127.

GUPTA, R.K. AND SUDIPTA KUMAR DAS 2020. Algae of India vol.4: A Checklist of Indian Diatoms, Botanical Survey of India, Kolkata. pp.327.

MAURYA, O.N., ANAND KUMAR AND SAURABH SACHAN 2021. The Flora of the Udaipur Wildlife Sanctuary, West Champaran, Bihar, India, Botanical Survey of India, Kolkata. pp. 111.

KAMBLE, M.Y. 2020. Flora of North Andaman Islands (In reference to six Wildlife Sanctuaries), Botanical Survey of India, Kolkata. pp. 142.

PALANISWAMY, M., S.K. YADAV AND G.V.S. MURTHY 2020. Seaweeds of Kerala Coast, India, Botanical Survey of India, Kolkata. pp. 200.

SINGH, K.P., A.A. ANSARI, KK. KHANNA, G.P. SINHA, B.K. SHUKLA, ANAND KUMAR, U.S. VAISH, A.N. SHUKLA AND V.K. MADHUKAR 2020. Flora of Uttar Pradesh (Araliaceae-Ceratophyllaceae) (ed. SINHA, G.P. AND A.N. SHUKLA), Botanical Survey of India, Kolkata. pp. 517.

SEMINAR/SYMPOSIUM/TRAINING/WORKSHOP ORGANIZED BY BOTANICAL SURVEY OF INDIA

Topic: Himalayan Mountain Biodiversity Threats & Solutions

Date: 10.12.2020
Speakers: Prof. (Dr.) P. K. Goswami, Dr. A.A. Khuroo, Dr. Santhosh K. Shah, Dr. Chandan Tamuly, Dr. R.S. Rawal, Dr. Rajesh Joshi, Dr. S.S. Dash, Dr. D.K. Agrawala, Dr. Tapan Seal
Organized by: SHRC, GANGTOK

Topic: Alien Plant Invasion in India: Status & Consequences

Date: 17.12.2020
Speaker: Prof. R.K. Kohli, Vice-Chancellor, Amity University of Punjab
Organized by: HAWHRC, SOLAN

Topic: International code of Nomenclature (ICN) for Plants

Date: 06.01.2021
Speaker: Dr. Kanchi N. Gandhi, Senior Nomenclatural Registrar, Harvard University Herbaria, U.S.A.
Organized by: DRC, HYEDARABAD

Topic: Science in Białowieża Forest

Date: 08.01.2021
Speaker: Prof. (Dr) Bogdan Jaroszeewicz, Professor & Director of the Białowieża Geobotanical Station, University of Warsaw
Organized by: SHRC, GANGTOK

Topic: Diversity of Bryophytes in India with special reference to Western Himalaya

Date: 15.01.2021
Speaker: Dr. D.K. Singh, Former Scientist-G, Botanical Survey of India
Organized by: HAWHRC, SOLAN

Topic: Evolutionary play of Invasive species in a changing Himalayan theatre

Date: 22.01.2021
Speaker: Dr. Manzoor A Shah, Department of Botany, University of Kashmir, Srinagar
Organized by: HAWHRC, SOLAN

Topic: 'Green walk'- Plant resources as AID for prevention of covid 19

Date: 27.01.2021
Speaker: Fr. Dr. S. Ignacimuthu, S.J. Director of Xavier Research Foundation, St. Xavier's College

Organized by: SRC, COIMBATORE

Topic: 'Green walk'- Wetlands: Potential importance and Conservation need under Climate Change Scenario"

Date: 02.02.2021
Speaker: Dr. N. Parthasarathy Professor Department of Ecology & Environmental Sciences, Pondichery University Puducherry UT
Organized by: SRC, COIMBATORE

Topic: Plant Systematics: Insights from Morphology and Molecules

Date: 17.02.2021
Speaker: Dr. Arun K. Pandey Vice-Chancellor Mansarovar Global University
Organized by: HAWHRC, SOLAN

Topic: 'Green Walk'- "Plant Taxonomy and Floristics in the Anthropocene Epoch"

Date: 19.02.2021
Speaker: Dr. Syd Ramdhani Senior Lecturer cum-curator, Ward Herbarium, School of Life Sciences, University of Kwazulu Natal, Durban, South Africa
Organized by: SRC, COIMBATORE

Topic: Role of Botanical Survey of India in Taxonomic Research in India

Date: 22.02.2021
Speaker: Dr. M. Sanjappa Ex Director, Botanical Survey of India
Organized by: HAWHRC, SOLAN

Topic: "Exploration of La Amistad National Park (Costa Rica/Panama)"

Date: 23.02.2021
Speaker: Alex Monro, Research Leader at the Royal Botanic Garden Kew
Organized by: SHRC, GANGTOK

Topic: Revising the Generic Limits of Coleus and Plectranthus (Lamiaceae, Tribe Ocimeae)

Date: 12.03.2021
Speaker: Dr. Alan Paton, Royal Botanic Gardens, Kew, U.K.
Organized by: CNH, HOWRAH

Topic: 'Green Walk-4: Management of Water Resources with Emphasis of Mangrove Ecosystem'

Date: 22.03.2021
Speaker: Dr. Deiva Oswin Stanley, Former Director, Eco Balance Consultancy, Gujarat
Organized by: SRC, COIMBATORE

SEMINAR/SYMPOSIUM/CONFERENCE ATTENDED BY BSI OFFICIALS

Dr.Pratibha Gupta, Scientist E

Attended Global Web Conference, Pandemic Covid 19: Glocal Impact on Environment and Sustainable Development from 05.06.2020 to 06.06.2020 organised by Internal Quality Assurance Cell (IQAC), Pryagraj and Glocal Environment & Social Association (GESA), New Delhi.

Attended Webinar on Relevance of yoga in Combating COVID -19 Pandemic on 21.06.2020 (Sunday) at 09.00 A.M. on the occasion of celebration of 6th International Yoga Day organised by Department of Science & Technology, Science and Technology of Yoga and Meditation (Satyam).

Attended webinar on ―Climate Variability & Change-Challenges for Disaster Risk Reduction in India" on 20.08.2020 at 3.00 P.M. organised and conducted by Indian Institute of Public Administration (IIPA), New Delhi.

Attended one day National Webinar on Role of Indigenous Traditional Knowledge and Herbal Drugs in Combating Against Pandemic COVID-19 held on 11.09.2020 organised by Department of Botany and Internal Quality Assurance Cell, Maulana Azad College 8, Rafi Ahmed Kidwai Rd, Taltala, Kolkata, West Bengal.

Attended National Webinar on ―Role of Mathematical Modelling in the prospective of COVID - 19 Pandemic" on 26.09.2020 (Saturday) at 11.00 A.M. organised by B.S.N.V. P.G. College, Lucknow.

Attended one day National Webinar on the occasion of International habitat Day on 05.10.2020 on the topic ―Plant Diversity of Cold desert of Western Himalaya and its Conservation strategies organised by BSI, Higher Altitude Western Himalayan Regional Centre, U.H.F. Nauni Campus, Solan (H.P.)".

Attended one day Webinar on Women Empowerment and Gender Justice in India on 08.10.2020 at 10.30 A.M. organised by Women Grievance and Welfare Cell, Dr Ram Manohar LohiaAwadh University, Faizabad University, U. P.

Attended National Webinar on Role of Botanical Survey of India in Biodiversity Conservation on 14.10.2020 at 11.00 A.M.organized by BSI, Deccan Regional Centre, Hyderabad.

Attended Webinar on COVID - 19 Awareness in Festive Season on 17.10.2020 (Saturday) at 07.00 P.M. organized by People's Association for Science and Environment.

Attended one day National Webinar on ―Micropopogation of Threatened Plant Species and Conservation in India" on 30.10.2020 at 11.30 A.M. organised by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Nauni Campus, Solan (H.P.) The speaker of the said Webinar was Dr A. A. Mao, Director BSI.

Attended Webinar on Harmful effects of burning agriculture residue (Parali) and Municipal solid waste organised by Christ Church College, Kanpur in association with U.P. Pollution Control Board, Kanpur WASH Solutions Lucknow and Swajal Shakti Samadhan, Banda on 27.11.2020.

Attended Webinar-cum Brain-Storming Session on ―Himalayan Mountain Biodiversity – Threats and Solutions" on the theme : Mountain Biodiversity on the occasion of International Mountain Day, 2020 organized by Sikkim Himalayan Regional Centre, Gangtok on 10.12.2020.

Attended one day Webinar on Plant Diversity of the Western Ghats, India on the occasion of 65th

Foundation Day of BSI, Western Regional Centre, Pune organized by Western Regional Centre, Pune on 12.12.2020.

Attended National Webinar Series, Lecture - 3 on Alien Plant Invasion in India : Status and Consequences organized by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Nauni Campus, Solan (H.P.) on 17.12.2020.

Attended 2nd International (Web) Conference on Environment and Society (ICES 2020) : Socio-economic and Environmental Issues : Challenges and Future Prospects in Current Pandemic Situation jointly organised by Glocal Environment & Social Association (GESA) New Delhi, National Environmental Science Academy (NESA), New Delhi, India and Asian Biological Research Foundation (ABRF), Prayagraj (U.P.), India from 26.12.2020 to 28.12.2020.

Attended Webinar on International Code of Nomenclature (ICN) for Plants jointly organised by Botanical Survey of India, Deccan Regional Centre, Hyderabad and Department of Botany, Andhra University, Visakhapatnam on 06.01.2021 at 11.00 A.M.

Attended Green Talk: Webinar Series in 2021 first talk on Science in Bialowieze Forest – Bialowieze Forest in Science on 08.01.2021 at 2.30 P.M. Talk delivered by Prof. (Dr.) Bogdan Jaroszeewicz, Professor & Director, BialowiezeGeobotanical Station, University of Warsaw organised by Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok.

Attended Webinar on "Green Walk"- Plant Resources as Aid for prevention of COVID - 19, organised by Botanical Survey of India, Southern Regional Centre, Coimbatore on 27-01-2021 at 14.30 PM.

Attended Webinar on Green walk - ―Wetlands: Potential importance and Conservation need under Climate Change Scenario" organised by Botanical Survey of India, Southern Regional Centre, Coimbatore at 11.00 PM.

Attended webinar on Plant Taxonomy and Floristics in the Anthropocene Epoch organised by BSI, SRC, Coimbatore on 19-02-2021 at 2.30 P.M.

Attended National Webinar on Plant Diversity and Climate in the past :Palynological Evidences in Sedimentary Archives organised by Department of Botany, Brahmanand College, Kanpur on 16.02.2021 at 4.30 PM.

Attended Webinar ―Green Walk: Plant Taxonomy and Floristic in the Anthropocene Epoch" by Dr. Syd Ramdhani Senior lecturer cum-Curator, Ward Herbarium, School of Life Sciences, University of Kwazulu Natal, Durban, South Africa organized by BSI, SRC, COIMBATORE on 19.02.2021 at on 19-02-2021 at 2. 30 P.M.
Attended National Webinar on ―Role of Botanical Survey of India in Taxonomic Research in India" organised by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Nauni Campus, Solan (H. P.) on 22.02.2021 at 11.30 AM talk delivered by Dr. M. Sanjappa, Ex Director, BSI.

Attended Green Talk – 2 Webinar on ―Exploration of La Amistad National Park (Costa Rica/ Panama)" by Alex Monro, Research Leader at Royal Botanic Garden Kew, RBG organised by Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok at 02.30 PM.

Attended Webinar on "Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae)" talk delivered by Dr Alan Paton, Royal Botanic Gardens, Kew, U.K." organized at BSI, CNH on 12.03.2021.

Attended Webinar on Management of Water Resources with Emphasis on Mangrove Ecosystem organised by BSI Southern Regional Centre, Coimbatore, India on 22.03.2021 at 3.00 P.M. organised

on the occasion of International Water Day.

Delivered invited Lecture on the topic entitled –Corona Virus Problem and Solution and its Impact on Environment" on 06.06.2020 in session IV, Global Web Conference Pandemic COVID-19: Global Impact on Environment and Sustainable Development (PESD2020) in Webinar.

Delivered Lecture on the topic entitled –Role of various Algae and herbs in prophylactic and therapeutic treatment of COVID - 19 infection" on 28.12.2020 in International (Web) conference on Environment and Society (NESA), New Delhi, India and Asian Biological Research Foundation (ABRF), Prayagraj (U.P.), India.

Dr. Lal Ji Singh, Scientist-E

Attended the International Webiner on –*The importance of Historical Ecology for interpreting processes of evolution in plants of Ocenic Islands*" organised by the Department of Life Science, Mansarovar Global University, Bhopal on 11.09.2020.

Attended the Webinar on –*Sustaining all lives on Earth: Forest and Wildlife Conservation in Andaman and Nicobar Islands*" organized by the Department of Environment and Forests, Andaman and Nicobar Administration, Port Blair on 26.09.2020.

Attended National Webinar on –*NISARG Bharat: Enhancing Peoples' Participation in the e-PBR Framework*" organized by National Mission on Biodiversity and Human Well-being Biodiversity Conversations: India's opportunities and challenges on 09.10.2020.

Attended National Webinar on –*Role of Botanical Survey of India in Biodiversity Conservation*" organized by BSI, Deccan Regional Centre, Hyderabad on 14.10.2020.

Attended two days' workshop through Webinar on –*Coastal and Marine Biodiversity of Islands Ecosystem*" at ZSI, ANRC, Port Blair on 07.01.2021 and 08.01.2021.

Delivered an invited lecture through Webinar on –*Overview of Floral Diversity of Andaman and Nicobar Islands*" for two days' workshop on –*Coastal and Marine Biodiversity of Islands Ecosystem*" at ZSI, ANRC, Port Blair on 07.01.2021.

Attended Webinar series 27.01.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Fr. Dr. S. Ignacimuthu, S.J. from St. Xavier College, Palayamkottai, on topic entitled *'Plant Resources as aid for prevention of COVID-19*'.

Attended Webinar series on 02.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Prof. N. Parthasarathy from Pondicherry University, on topic, *'Wetlands: Potential Importance and Conservation need under climate change scenario*'.

Attended National Webinar Series, Lecture-6 on 17.02.2021 organised by BSI, HAWHRC, Solan and lecture delivered by Dr.Arun K. Pandey, Vice-Chancellor, Mansarover Global University, Bhopal on topic *'Plant Systematics: Insights from Morphology and Molecules*'.

Attended Webinar series on 19.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Dr. Syd Ramdhani, Senior Lecture and Curator of the Ward Herbarium from University of Kwazulu Natal Durban, South Africa, on topic *'Plant taxonomy and floristics in the Anthropocene Epoch'*.

Attended Webiner on topic entitled –*Role of Botanical Survey of India in Taxonomic Research in India*" by Dr. M. Sanjappa, Former Director, BSI, on 22.02.2021 organised by BSI, HAWHRC, Solan.

Attended Green Talk-2, Webinar series on 23.02.2021 organized by BSI, Sikkim Himalayan Regional Centre, Gangtok and lecture delivered by Alex Monro, Royal Botanic Garden, Kew on topic entitled *Exploration of La Amistad National Park (Costa Rica/ Panama)*.

Attended Webinar on topic entitled –*Revising the Generic Limits of Coleus and Plectranthus*(Lamiaceae, tribe Ocimeae)" by Dr. Alan Paton, Royal Botanic Garden, Kew, U.K. on 12.03.2021 organised by Central National Herbarium, BSI, Howrah.

Dr. Rajib Gogoi, Scientist E

Participated as panellist on a Webinar organised by GB Pant Institute of Himalayan Environment, Pangthang on the eve of International Biodiversity Day on 22.05.2020 and put forwarded views on the subject —Rold of Biodiversity to combat Pandemic".

Delivered a talk on –Biodiversity of NE India" on National Webinar organized by Department of Botany, Bodoland University, Kokrajahar, Assam on 4th June 2020.

Delivered a talk on –Balsams of Eastern Himalaya" on National Webinar organized by Department of Botany, Goalpara College, Assam on 11.07.2020.

Delivered a talk on –Himalayan Biodiversity: a plant Hunter's experience" on National Webinar organized by Department of Botany, Guwahati College, Assam on 13.07.2020.

Delivered a talk on –Biodiversity of NE India" on National Webinar organized by Department of Botany, Digboi College, Assam on 20.07.2020.

Delivered valedictory talk on 16.08.2020 in an International Webinar on the subject –Himalayan Biodiversity" organized by Shree Aayappa College of Wemen, Coimbatore, Tamilnadu& Maharishi Dayanand University, Rohtak, Haryana.

Delivered a talk on –Wild Edible plants of NE India" on an International Webinar organized by AJCB College, Department of Botany, Kolkata on 19.08.2020, Assam on 13.07.2020.

Delivered a talk on –Phytodiversity of NE India" on an National Webinar organized by Bagnan College, Department of Botany, Howrah, West Bengal on 20.09.2020.

Delivered a webinar talk on –Botanical exploration & techniques of herbarium preparation & preservation'' in National Webinar in Botany Department, Assam University-Diphu Campus on 30.12.2020.

Dr. Sandeep Chauhan, Sci. E

Delivered on role of soil microorganism in enhancing the soil productivity at Dept. of Agriculture sciences, Amity University, Noida on 12th Dec., 2020.

Invited: Dept of Biotechnology, GautamBudha University, Noida, Amity Institute of Agriculture.

Attended 3days online course on DNA, Taxonomy and Phylogeny held by Institute of Science and Technology, Chennai (21st -23rd May 2020).

Attended three days online workshop on In-Silico PCR analysis held by Late Shri Vishnu Waman Thakur Charitable Trust, Virar (26th-28th June 2020).

Attended Ayuryog Expo Webinar XV: Himalayan medicinal plants: challenges and opportunities on June 8th2020.

Attended webinar on International Webinar on Biodiversity and Environmental Health in Shivaji College, University of Delhi held on 20th May, 2020.

Attended webinar on "PLANT BIOLOGY: A JOURNEY FROM EARTH TO SPACE" organized by the Department of Botany, Ramjas College, University of Delhi, on 22nd- 23rd May, 2020.

Attended webinar on "Corona kesathbhi, Corona kebaadbhi" organized by the collaboration of ArogyaBharati, MansarovarAyurvedic Medical College, Bhopal and Sri Sai Institute of Ayurvedic Research and Medicine Bhopal (M.P.) on 26th May 2020.

Attended A webinar on –Botanical Secrets for Wellness: Clued From Nature‘s Signature” organized by the Phytomics: The Botanical society of Bhaskaracharya College of AppliedSciences (University of Delhi), held on 16th May 2020.

Attended webinar on –Evolution of science seen from historical perspective” Conducted by the Department of Botany, Deshbandhu College under the aegis of IQAC on 12th& 13th May 2020.

Aattended a National webinar on –Nutrition and Immunity- Simplified and Applied” organized by the Department of Food Technology, Bhaskaracharya College of Applied Sciences, University of Delhi on May 19, 2020.

Attended webinar on –Molecular Taxonomy and DNA barcoding: Concepts, Methods and Applications organized R.D. & S.H. National College and S.W.A. Science College, Mumbai on 20th May, 2020.

Attended National webinar on Biodiversity Conservation” (NWBC 2020) organized by Daulat Ram College under the aegis of Internal Quality Assurance cell (IQAC) on 8th June 2020.

Attended webinar titled –Biodiversity: Bio- indicators, Monitoring and Ecosystem Health” on 5th June.

Attended National webinar on –Entrepreneurship Aspects on Biodiversity Conservation and indigenous healing practices of Northeast India” organized by Kalindi college, University of Delhi, held on June 2 2020.

Attended webinar on –Overview and Opportunities in the field of LC-MS/MC- based bio analysis” by Mansarovar Global University on 30th May 2020.

Attended webinar on –New opportunities in Medicinal Plants Sector for Farmers and Entrepreneurs" organised by department of life sciences, Mansarovar Global University held on 24th May 2020.

Attended E-conference on climate change, environmental health and sustainable development goals in post COVID-19 world organised by Guru Gobind Singh Indraprastha University, Delhi on 2nd -5th June 2020.

Attended webinar on –Environmental Impact Assessment techniques" by T-GIS online platform, Gujarat on 23rd May 2020.

Attended a three day webinar on –Developing tools for sustainable crop development" by Durham University from 27th -29th May 2020.

Attended a National webinar on –Data analysis and statistical computing" organised by Dr. BhimraoAmbedkar University, Agra on 27th May 2020.

Attended webinar on –Pattern of Biodiversity across the Indian Himalaya" by Amity University on 27th May 2020.

Attended a virtual event on Environment day [5th June 2020] focusing on –Redefining our common future: Safe and Secure".

Attended webinar on –SOLID WASTE UTILIZATION FOR SOIL HEALTH SUSTENANCE: CURRENT PERSPECTIVES" by Dr. Satya Sundar Bhattacharya Assistant Professor, Department of Environmental Science, Tezpur University, Assam on 28th June 2020.

Attended webinar on –MICROBIOME - PERCEPTIONS AND PERSPECTIVES" by Biotecnika Info Labs Pvt. Ltd on 27 June 2020.

Attended a webinar on 24th June 2020 titled –Biological diversity act" by National Biodiversity Authority (NBA-UNDP).

Dr. Kumar Ambrish, Scientist- E and Dr. K.S. Dogra, Scientist- D

Attended the webinar on Himalayan Mountain Biodiversity Threats and Solutions on 10.12.2020 organized by BSI, SHRC, Gangtok on celebration of International Mountain Day, 2020.

Attended the webinar on Plant Diversity of the Western Ghats, India on 12.12.2020 organized by BSI, WRC, Pune on celebration of 65th foundation day of WRC, Pune.

Attended the webinar on the Green talk on the topic Science in Bialowieza Forest- Bialowieza Forest in Science on 08.01.2021 organized by BSI, SHRC, Gangtok.

Attended the webinar on Green walk on the topic Plant Resources as Aid for Prevention of COVID-19 on 27.01.2021 organized by BSI, SRC, Coimbatore.

Attended the brainstorming session on Plant Bio-resources (including Agri and Horti resources) under the proposed —Himalayan Bio-resources Mission" organized by DBT New Delhi on 27.01.2021.

Attended online the 131st Botanical Survey of India Foundation day on 13.02.2021 organized by Hqrs. Kolkata.

Attended online the ceremony of Signing MoU between Botanical Survey of India, Kolkata and ICFRE, Dehradun on 15.02.2021.

Attended the webinar on Green Talk on the topic –*Exploration of La Amistad National Park (Costa Rica/ Panama)*" on 23.02.2021 organised by SHRC, Gangtok. The talk given by Dr. Alan Patron from Royal Botanic Gardens, Kew, U.K.

Attended the Webinar on Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae) on 12.03.2021 organized by BSI, CNH, Kolkata. The talk given by Dr. Alan Patron from Royal Botanic Gardens, Kew, U.K.

Attended the webinar on Hindi Workshop on 18.03.2021 organized by BSI, CBL, Kolkata.

Dr. K. Karthigeyan, Scientist-E

Delivered a lecture on the ‗Role of Herbarium in Plant Identification" during the taxonomy workshop organized by ATREE on 15.12.2020.

Delivered lecture on ‗Diversity and Conservation of Mangroves in Sundarban Biosphere Reserve, India in the National Webinar on Biosphere Reserves of India: identification, Conservation and Management organized by Govt. MadhavSadashivraoGolvalkar College, Rewa, M.P on 17th March, 2021.

Delivered a lecture on Herbarium methodology in the workshop organized by CNH in collaboration with Bethune College Kolkata on 24th December 2020.

Dr.Arti Garg, Sci-E

Delivered **online keynote webinar lecture on 'Role of Palynology in taxonomy' in workshop at BSIP on 22.3.21;** invited lecture on Palynological Techniques on 29th May, 2020 for Dept. of Botany, Bundelkhand University, Jhansi.

Attended a webinar from 4 to 6 November 2020 on Dr. E.K. Janaki Ammal Memorial lecture series on Plant taxonomy and Ethnobotany in India-Future and Challenges organized by NMNH New Delhi, Attended a webinar-cum-Brainstorming on ‗Himalayan Mountain Biodiversity – Threats & Solutions' organised by Botanical Survey of India, SHRC, Gangtok on International Mountain Day 10.12.2020,

Attended a webinar on ‗Plant Diversity of the Western Ghats, India' organized by Botanical Survey of India, Western Regional Centre, Pune on 12.12. 2020,

Attended a webinar Lecture-3 on ‗Alien Plant Invasion in India: Status and Consequences' organised by Botanical Survey of India, HAWRC, Solan on 17.12.2020 at 11:30 am to 01:00PM.

Dr. N. Odyuo, Scientist-E

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya and acted as co-chair in a technical session.

Attended 10 (te) webinars organised by BSI and other institutions.

Shri Vinod Maina, Scientist-E

Attended the Green Talk webinar ‗Lecture on -Exploration of La Anistad National Park by Dr. Alex Monro, Royal Botanical Garden, Kew' organised by BSI, SHRC, Gangtok on 23.02.2021 (2:15 pm to 5:15 pm).

Dr. Chaya Deori, Scientist-E

Presented a Paper as Poster on ―Diversity, conservation and sustainable utilization of orchid flora of community forests of west and south–west khasi hills districts of Meghalaya, India" during the National Conference cum Workshop (hybrid mode) on ―Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show held at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya from March 5-7. 2021.

Acted as co-chair in a technical session of the National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya

Attended 13 (thirteen) webinars organised by BSI and other institutions.

Dr.Jagadeesh Ram, T.A.M., Scientist-E

Attended National Webinar on ―*NISARG Bharat: Enhancing Peoples' Participation in the e-PBR Framework*" organized by National Mission on Biodiversity and Human Well-being Biodiversity Conversations: India's opportunities and challenges on 09.10.2020.

Attended Webinar series 27.01.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Fr. Dr. S. Ignacimuthu, S.J. from St. Xavier College, Palayamkottai, on topic entitled ‗*Plant Resources as aid for prevention of COVID-19*'.

Attended Webinar series on 02.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Prof. N. Parthasarathy from Pondicherry University, on topic, ‗*Wetlands: Potential Importance and Conservation need under climate change scenario*'.

Attended National Webinar Series, Lecture-6 on 17.02.2021 organised by BSI, HAWHRC, Solan and lecture delivered by Dr.Arun K. Pandey, Vice-Chancellor, Mansarover Global University, Bhopal on topic ‗*Plant Systematics: Insights from Morphology and Molecules*'.

Attended Webinar series on 19.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Dr. Syd Ramdhani, Senior Lecture and Curator of the Ward Herbarium from University of Kwazulu Natal Durban, South Africa, on topic entitled ‗*Plant taxonomy and floristics in the Anthropocene Epoch'*.

Attended Webiner on topic entitled ―*Role of Botanical Survey of India in Taxonomic Research in India*" by Dr. M. Sanjappa, Former Director, BSI, on 22.02.2021 organised by BSI, HAWHRC, Solan.

Attended Webinar on topic entitled "*Revising the Generic Limits of Coleus and Plectranthus*(Lamiaceae, tribe Ocimeae)" by Dr. Alan Paton, Royal Botanic Garden, Kew, U.K. on 12.03.2021 organised by Central National Herbarium, BSI, Howrah.

Dr.Vineet Kumar Rawat, Scientist-E

Attended webinar on "Himalayan Mountain Biodiversity–Threats & Solutions" on 10th December 2020.

Attended webinar on "Alien Plant invasion in India: status and consequences" by Prof. R.K. Kohli on 17th December 2020.

Attended webinar on "Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe-Ocimeae)" by Dr Alan Paton, RBG, Kew on 12th March 2021.

Attended webinar on "Exploration of La Amistad National Park (Costa Rica / Panama)" by Dr Alex Monro, RBG, Kew on 23rd February 2021.

Dr. L. Rasingam, Scientist E

Delivered a lecture on "An overview of Deccan Regional Centre, Hyderabad at the "National Webinar on Role of Botanical Survey of India in Biodiversity Conservation" on 14th October 2020 organized by BSI, DRC, Hyderabad.

Delivered a lecture on "The recent advances in Plant Taxonomy in the two days online workshop jointly organised Botanical Survey of India, Deccan Regional Centre and St. Ann's Women College, Mehdipatnam on 25th November 2020.

Delivered a key note address on 'Recent Trends in Plant Taxonomy' in 'National Webinar on Emerging aspects of Taxonomy and Biodiversity' organised jointly by Botanical Survey of India, Deccan Regional Centre, Hyderabad and Government City College, Hyderabad on 3rd February 2021.

Attended the National Webinar on "Discovery and Genetic Characterization of India's Biodiversity: Strategies for addressing the Linnaean shortfall in India" on 6th October 2020 jointly organized by the National Biodiversity Authority and the Biodiversity Collaborative.

Attended the 30th Annual conference of Indian Association for Angiosperm Taxonomy (IAAT) and Webinar on 4th and 5th December 2020.

Attended the Webinar-cum-Brainstorming on 'Himalayan Mountain Biodiversity–Threats & Solutions' organized by Botanical Survey of India, SHRC, Gangtok on 10th December 2020.

Attended the National Webinar on Plant Diversity of the Western Ghats, India organized by Botanical Survey of India, WRC, Pune on 12th December 2020.

Attend the online webinar titled "Green walk- Plant resources as aid for preservation of COVID-19" on 27th January 2021 organised by BSI, Southern Regional Centre.

Dr.DeepuVijayan, Scientist-C

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya

Attended 5(five) webinars organised by BSI and other institutions.

Dr. David Lalsama Biate, Scientist 'C'

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya

Attended 4(four) webinars organised by Botanical Survey of India and other institutions

Dr.Sankararao Mudadla, Scientist C

Delivered a talk on Virtual Herbarium at BJR Government Degree College, Narayanaguda on 04.03.2021.

Delivered a talk on Floristic diversity of Seshachalam Biosphere Reserve at in a National Webinar organised by Govt. M.S. Golwalkar College Rewa in Madhya Pradesh on 16.03.2021.

Attended a National webinar on New opportunities in the Medicinal Plant sector for farmers and entrepreneurs' organised by Mansarovar Global University Madhya Pradesh on 24.05.2020.

Attended a National webinar on ‗Biodiversity & Conservation' organised by Daulat Ram College Delhi University on 08.06.2020.

Attended a National webinar on Biodiversity conservation during Covid-19' organised Andhra Loyola College Vijayawada, Andhra Pradesh on 13.06.2020.

Attended a National webinar on Recent Biotechnological Tools for Crop Improvement' organised by Advanced Post Graduate Centre, Acharya N.G. Ranga Agricultural University, Lam, Guntur (A.P.), India in Association with Institutional Development Plan (IDP) under NAHEP. On 24.06.2020.

Attended a National webinar on ‗Herbs & Drug interaction' organized by the VIVA College of Arts, Science & Commerce College Mumbai on 06.07.2020.

Attended a National webinar on ‗Biodiversity conservation its management' organised by Govt. Girls' P.G. College, Ujjain (M.P.) from 14.07.2020 - 15.07.2020.

Attended a National webinar on ‗Need of R&D for scientific validation of Traditional Herbal Medicines' organized by Department of Botany, Arignar Anna Govt Arts and Science College, Karaikal, Puducherry on 18-08-2020.

Attended a National webinar on ‗Modern History of Botany in India & Role of Botanical Survey of India'.organized by the Department of Botany, Basirhat College, North 24 Pargnas, West Bengal on 29.08.2020.

Attended a National webinar on ‗Improvisations in Growing plants (IGP-2020), organized by Gujarat University Ahmadabad, Gujarat' on 11.09.2020.

Attended a National webinar on ‗Herbs for Healthcare' organized by the Department of Botany, Maulana Azad College, Kolkata on 11.09.2020.

Attended a National webinar on ‗Emerging Aspects of Taxonomy and Biodiversity' organized by Department of Botany, Government City College (A), Hyderabad, in association with Botanical Survey of India, Deccan Regional Centre, Hyderabad on 03.02.2021.

Attended the National level one week online short term course on ‗Plant Taxonomy' organized Department of Botany, Nizam College, Osmania University from 03.08.2020-08.08.2020

Attended the Faculty development programme on ‗plants for food and health care' at Yogi Vemana University, Kadapa from 12.08.2020 to 14 .08.2020.

Dr.Kumar Avinash Bharati, Scientist-C

Attended workshop titled ―Science Leadership Workshop" organized by the Central university of Punjab, Bathinda and sponsored by INSA (Indian National Science Academy), New Delhi from June 22–28, 2020.

Attended webinar on 10.12.2020, topic: ―The Himalayan Mountain Biodiversity: Threats and solutions".

Attended webinar on 4th & 5th December 2020: Annual Conference of Indian Association for Angiosperm Taxonomy

Attended webinar on 06.01.2021, topic: ―International Code of Nomenclature (ICN) for plants" by Dr K. Gandhi, Harvard University, USA.

Attended webinar on 10.12.2021, topic: Himalayan Mountain Biodiversity Threats & Solutions

Attended webinar on 23.02.2021, topic: ―Exploration of La Amistad National Park (Costa Rica/Panama" by Alex Monro, Royal Botanic Garden, Kew

Attended webinar on 12.03.2021, topic: ―Revising the Generic Limits of Coleus and Plectranthus (Lamiaceae, Tribe Ocimeae)" by Dr Alan Paton, Royal Botanic Gardens, Kew.

Delivered talk on ―Floristic diversity of Baraila Lake Salim Ali Jubba Sahni Bird Sanctuary, Bihar" in a webinar organized by Department of Science, Vivek College, Bijnor, Uttar Pradesh on 15th July 2020.

Delivered talk on ―Introduction to Ethnobotany & Status of Research in India" in a webinar organized by Shri MathuradasMohata College of Science, Nagpur on 22nd January 2021.

Dr Manas R. Debta, Scientist-C

Attended webinar on ―Himalayan Mountain Biodiversity–Threats & Solutions" on 10th December 2020.

Attended webinar on ―Alien Plant invasion in India: status and consequences" by Prof. R.K. Kohli on 17th December 2020.

Attended webinar on ―Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe-Ocimeae)" by Dr Alan Paton, RBG, Kew on 12th March 2021.

Attended webinar on ―Exploration of La Amistad National Park (Costa Rica / Panama)" by Dr Alex Monro, RBG, Kew on 23rd February 2021.

Dr. Krishna Chowlu, Scientist-C

Attended Green talk by Alex Monro, RBG Kew, London, webinar organized by Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok on 23.02.2021.
Attended webinar on Wetlands Potential importance & Conservation need under Climatic scenario organized by Botanical Survey of India, Southern Regional Centre, Coimbatore on 02.02.2021.

Dr Monalisa Dey, Scientist-C

Participated as a resource person in the Virtual Workshop on Herbarium Techniques organised by The Department of Botany, Bethune College, Kolkata in Collaboration with Central National Herbarium & ENVIS Resource Partner on Biodiversity of Botanical Survey of India on 23rd December, 2020 and gave lecture as well as practical demonstration on Collection and Herbarium Methodology of Bryophytes.

Dr Debasmita Dutta Pramanick, Scientist-C

Attended webinar -cum-Brainstorming session on ‗Himalayan Mountain Biodiversity-Threats and Solutions' organised by BSI, SHRC, Gangtok, on 10.12.2020.

Attended National Webinar series Lecture:3 Alien plant invasion in India: Status and Consequences organised by BSI, HAWHRC, Solan, on 17.12.2020.

Attended webinar on ‗International Code of Nomenclature (ICN) for Plants' organised by BSI, DRC, Hyderabad, on 06.01.2021.

Attended webinar on ‗Science in Bialowieza' organised by BSI, SHRC, Gangtok, on 08.01.2021.

Attended webinar on National Webinar series Lecture:4 Diversity of Bryopytes in India with special reference to Western Himalaya, organised by BSI, HAWHRC, Solan, on 15.01.2021.

Attended webinar on National Webinar series Lecture:5 Evolutionary play of Invasive species in a changing Himalayan theatre, organised by BSI, HAWHRC, Solan, on 22.01.2021.

Attended webinar on ‗Green Walk': Plant resources as an aid for prevention of COVID -19 organised by SRC, Coimbatore, on 27.01.2021.

Attended webinar on ‗Green Walk' -Wetlands: Potential importance and conservation need under climate change scenario, organised by SRC, Coimbatore, on 02.02.2021.

Attended National Webinar series Lecture: 6 Plant systematics: Insights from morphology and molecules, organised by BSI, HAWHRC, Solan, on 17.02.2021.

Attended webinar on ‗Green Walk' -Plant taxonomy and floristics in the Anthropocene Epoch' , organised by SRC, Coimbatore, on 19.02.2021.

Attended National Webinar series Lecture:7 Role of Botanical Survey of India in Taxonomic research in India, organised by BSI, HAWHRC, Solan, on 22.02.2021.

Attended webinar on ‗Exploration of La Amistad National Park (Costa Rica/ Panama)', organised by BSI, SHRC, Gangtok, on 23.02.2021.

Attended webinar on ‗Revising the generic limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae)', organised by CNH, Howrah, on 12.03. 2021.

Attended webinar on ‗Green Walk' 4-Management of water resources with emphasis on Mangrove ecosystem', organised by SRC, Coimbatore, on 22.03.2021.

Dr. A.N. Shukla, Scientist-C

Delivered an invited Facebook Live lecture on "Plant Diversity" on 17.05.2020 organized by Bharat Utthan Nyas, Kanpur.

Delivered an invited lecture on Herbarium Techniques on 29th May, 2020 for Ph.D. course work organized by Dept. of Botany, Bundelkhand University, Jhansi.

Delivered an invited lecture on "Biodiversity" in Global web conference on Pandemic Covid-19: Glocal Impact on Environment and sustainable Development (PSED 2020) June 6th 2020, organized by DDU Govt. P.G. College, Saidabad, Prayagraj.

Delivered invited on "Role of Botanical Survey of India in Conservation of plant species" in Webinar organized by Govt. P.G. College, Raigarh, M.P. on 13.01.2021.

Delivered invited on "Plant Diversity and conservation" in National Webinar organized by Govt. P.G.CollegeTeonthar, Rewa, M.P. on 01.02.2021.

Delivered invited on "Floristic diversity and vegetation types of Chhattisgarh" in National Webinar organized by Govt. MadhavSadashivraoGolvalkar College, Rewa, M.P. on 18.02.2021.

Delivered invited on "Conservation of plant species" in Webinar organized by Govt. Aranya Bharti P.G. College, Baihar, M.P. on 22.02.2021.

Attended webinar on "New opportunity in Medicinal Plants Sector for Farmers and Entrepreneurs" on 24th May 2020, organized by Dept. of Life Sciences, Mansarovar Global University.

Attended National webinar on Medicinal and Aromatic plants for Boosting Immunity in the era of COVID-19, on May 29, 2020, organized by Dept. of Botany DDU Gorakhpur University.

Attended national webinar on "Bharat me Covid-19: Vaigyanik Sandesh aur Hindi kiSabdawali" on 3-5 June 2020 (3-6 PM) organized by Christ Church College Kanpur.

Attended a National webinar on "Time for Nature" organized by Forest Research Centre for Eco-Rehabilitation Prayagraj, on 5th June 2020.

Attended National webinar on "Environment and Forest Management in post Covid Pandemic era on 19th June 2020, organized by Forest Research Centre for Eco-Rehabilitation Prayagraj.

Attended "Pockets of Hope - Series" Webinar on Nanda Devi Biosphere Reserve organized by UNESCO New Delhi; Ministry of Environment, Forest & Climate Change, Government of India; Surabhi Foundation; National Biodiversity Authority of India; WWF-India; and TERI on 19th June, 2020.

Attended webinar on "Covid-19 on research progress in Life Sciences: Mitigation of losses and way forward" on 5th July 2020, organized by Dept. of Life Sciences, Mansarovar Global University.

Delivered a lecture on Biodiversity in Webinar organized by Govt. Girls P.G. College, sidhi, M.P. on 29 July 2020.

Attended a webinar from 4 to 6 November 2020 on Dr. E.K. Janaki Ammal Memorial lecture series on Plant taxonomy and Ethnobotany in India-Future and Challenges organized by NMNH New Delhi.

Attended Webinar-cum-Brainstorming on ‗Himalayan Mountain Biodiversity – Threats & Solutions' organised by Botanical Survey of India, SHRC, Gangtok on International Mountain Day 10.12.2020 from 14:30 – 17:45.

Attended Webinar on ‗Plant Diversity of the Western Ghats, India' organized by Botanical Survey of India, Western Regional Centre, Pune on 12.12. 2020 from 10:30am – 1:30pm.

Attended Webinar Lecture-3 on ‗Alien Plant Invasion in India: Status and Consequences' organised by Botanical Survey of India, HAWRC, Solan on 17.12.2020 at 11:30 am to 01:00PM.

Attended Webinar on "Webinar on International Code of Nomenclature (ICN) for Plants" organized by Botanical Survey of India, Deccan Regional Centre, Hyderabad on 06.01. 2021.

Dr. S.P. Panda, Scientist C

Delivered a talk on Role of AJCBIBG in Ex-situ Conservation of Plants on NationalWebinar on "Conserving Diversity of Plants for Present and Future Generation" organised byDepartment of Botany, SG College, Jajpur, Odisha on 21st December,2020.

Delivered a talk on AJCBIBG: At a Glance in a National webinar on Botanic Gardens and biodiversity of India- Identification, Conservation and Management organised byGovt. MadhavSadashivraoGolvalkar College, Rewa, MP on 17.02.21.

Dr.Chandan Singh Purohit, Scientist- C

Attended Webinar on "Ensuring water security" organized by Kerala State Council for Technology and Environment in association with ICAR-CIFT & NIT held on 08.05.2020.

Attended Webinar on "Evolution of Science seen from Histrocial perspective" organized by Department of Botany, Deshbandhu College, University of Delhi held on 12.05.2020 & 13.05.2020.

Attended Webinar on "Natural Fragrance- Chemistry, Recent Development and Research Avenue" organized by NATUCARE INDIA held on 16.05.2020.

Attended Webinar on "Fundamentals of microscopy and histochemical analysis for standardization of crude drugs" organized by NATUCARE INDIA held on 17.05.2020.

Attended Webinar on "Molecular Taxonomy and DNA Barcoding: Concepts Methods and Application" organized by R.D & S.H. National College and S.W.A. Science College, Mumbai held on 20.05.2020.

Attended Webinar on "*Grasses – Introduction, Economical and Ecological Importance*" in a Series of Webinar on ‗Spectrum of Conservation' organized by OikoEssenceEdutours LLP on 24.05.2020, Mumbai, India.

Delivered an invited lecture in Webinar on "*Ex-situ conservation of Threatened Angiosperm plants*" organized by NATUCARE INDIA held on 24.05.2020, Mumbai, India.

Attended Webinar on –*Costa Rica: A Biodiversity Hotspot*" in a Series of Webinar on ‗Spectrum of Conservation' organized by R.D. & S.H. National College and S.W.A. Science College on 25.05.2020, Mumbai, India.

Attended Webinar on –*Insect Plant Interaction*" in a Series of Webinar on ‗Spectrum of Conservation' organized by OikoEssenceEdutours LLP on 28.05.2020, Mumbai, India.

Delivered an invited lecture on –*Phytodiversity of Alpine Sanctuary – Shingba Rhododendron Wildlife Sanctuary*" in a Series of Webinar on ‗Spectrum of Conservation' organized by OikoEssenceEdutours LLP on 30.05.2020, Mumbai, India.

Attended International Webinar on –Global Environmental Challenges, Biodiversity, Principles of Guru Jambheshwar Ji and Remedies" organized by JNVU, Jodhpur and JambhaniSahitya Academy, Bikaner on 03.06.2020 to 05.06.2020, Bikaner, Rajasthan.

Attended –Conservation on Medicinal Plants, Enhancing Nutrition and Developing Immunity against Disease" organized by TERI, IHC, New Delhi on 04.06.2020.

Attended Online National Conference on Environment – An intelligent Recycling organized by Govt. College for Girls Sector 14, Gurugram on 05.06.2020 to 06.06.2020.

Presented a research paper entitled –*Conservation of threatened and endemic species of Thar Desert, Rajasthan and their Present Status*" in Online National Conference on Environment – An intelligent Recycling organized by Govt. College for Girls Sector 14, Gurugram on 05.06.2020 to 06.06.2020.

Attended Webinar series in 2021 on 08.01.2021 organized by BSI, SJRC, Gangtok and lecture delivered by Prof. Bogdan Jaroszeewicz from Poland, on topic entitled ‗Science in Biolowieza Forest – Biolowieza forest in Science'.

Delivered invited lecture entitled –*Conservation of Threatened Desert Plants*" on 16.01.2021, organized by Govt. Dungar College Bikaner under Gyan Ganga Programme.

Attended Webinar series 27.01.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Fr. Dr. S. Ignacimuthu, S.J. from St. Xavier College, Palayamkottai, on topic entitled ‗*Plant Resources as aid for prevention of COVID-19*'.

Attended Webinar series on 02.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Prof. N. Parthasarathy from Pondicherry University, on topic, ‗*Wetlands: Potential Importance and Conservation need under climate change scenario*'.

Attended Webinar series on 19.02.2021 organized by BSI, SRC, Coimbatore and lecture delivered by Dr. Syd Ramdhani, Senior Lecture and Curator of the Ward Herbarium from University of Kwazulu Natal Durban, South Africa, on topic entitled ‗*Plant taxonomy and floristics in the Anthropocene Epoch'*.

Attended Webinar on topic entitled –*Role of Botanical Survey of India in Taxonomic Research in India*" by Dr. M. Sanjappa, Former Director, BSI, on 22.02.2021 organised by BSI, HAWHRC, Solan.

Dr. Sanjay Mishra, Scientist-C

Delivered a lecture on ―Role of Botanical Survey of India in Conservation" to the visiting trainee Forest Guards of Arid Forest Research Centre, Jodhpur on 19.02.2021.

Attended Webinar Lecture on ―INTERNATIONAL CODE OF NOMENCLATURE (ICN) FOR PLANTS" by Dr.Kanchi N. Gandhi, Senior Nomenclatural Registrar, Harvard University Herbaria, USA on 06.01.2021, organised by Botanical Survey of India, Deccan Regional Centre, Hyderabad in association with Department Of Botany, Andhra University, Visakhapatnam, India.

Attended one day National Webinar organized by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Nauni Campus, Solan (H.P.) on ―Alien Plant Invasion in India: Status and Consequences". Date: October 17.12.2020 Time: 11:30 A.M. to 01:00 P.M.

Attended one day National Webinar on ―Micropropogation of threatened plant species and conservation in India" organized by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Nauni campus, Solan (H.P.) on 30.10.2020.

Attended the International webinar on ‗The importance of historical ecology for interpreting process of evolution in plants of oceanic islands' organised by Dept. of Life Sciences, Mansarovar Global University, Bhopal on 11.09.2020.

Dr. A.K. Verma, Scientist-C

Delivered an invited lecture on ‗Use of Hindi in official & personal correspondences-I' in Hindi karyasala organized by BSI, CRC, Allahabad.

Delivered an invited lecture on ‗Ozone depletion and its impact on life forms' at BSI, CRC, Allahabad.

Delivered an invited lecture on ‗Cytology and its implications in plant taxonomy' at Govt. TRS College, Rewa.

Attended webinar on ―Breeding of Oilseeds: A Challenge for Self- Sufficiency" organized by Bihar Agricultural University, Sabour, Bhagalpur, Bihar.

Attended Webinar-cum-Brainstorming on ‗Himalayan Mountain Biodiversity – Threats & Solutions' organized by BSI, SHRC, Gangtok.

Attended Webinar on ‗Plant Diversity of the Western Ghats, India' organized by BSI, WRC, Pune.

Attended Webinar on ‗Alien Plant Invasion in India: Status and Consequences' organized by BSI, HAWRC, Solan

Attended a webinar lecture on ‗Evolutionary play of invasive species in a changing Himalyantheater organized by BSI, HAWRC, Solan.

Attended Webinar on ―International Code of Nomenclature (ICN) for Plants" organized by BSI, DRC, Hyderabad.

Dr. M.K. Singhadiya, Botanist

Attended the National webinars on ‗Role of BSI in Taxonomic research in India', organised by BSI, HAWHRC, Solan on 22.02.2021 and he also attended workshop on ‗ Forestry research sustainable

Forest management and livelihood‘ organised by Himalayan Forest Research Institute, Shimla on 17.03.20121.

Attended a National webinar on ―Green walk -Plant Resource as AID for prevention of Covid-19” and ―Green walk -Plant Taxonomy and Floristics in the Anthropocene Epoch” both organised by Botanical Survey of India, SRC, Coimbatore on 27.01.2021 & 19.02.2021 respectively.

Attended a National webinar on ―Science in Bialowieza Forest-Bialowieza Forest in Science” organised by Botanical Survey of India, SHRC, Gangtok on 08.01.2021.

Attended a National webinar on Plant Diversity of the Western Ghats, India, Organised by Botanical Survey of India,WRC, Pune on 12.12.2020, Time: 10:30 A.M. to 01:30 P.M.

Attended National Webinar on ―Redefining Gardening from Hobby to Enterprise: series 2” [Topic 1: Garden types and its benefits; Topic 2: Gardening: A Wonderful hobby and a promising career option] organized by Daulat Ram College, University of Delhi on 11.11.2020.

Attended two National webinars viz. ―Plant Diversity of Cold Desert of Western Himalaya and its Conservation Strategies” organized by Botanical Survey of India, High Altitude Western Himalaya Regional Centre, Solan (H.P.) on 05.10.2020 and webinar on ―NBARG Bharat: Enhancing peoples participation in the e-PBR framework” organized by Botanical Survey of India, Zoological Survey of India & CSIR on 09.10.2020.

Mr P.P. Ghoshal, Botanist

Attended webinar on ‗Webinar-cum-Brainstorming on ‗Himalayan Mountain Biodiversity – Threats & Solutions‘‘ organized by BSI Sikkim Himalayan Regional Centre Gangtok on10.12.2020.

Attended webinar on ―Plant Diversity in India” by Dept. of Botany, Bagnan College in Collaboration with IQAC, Bagnan College on 20/09/2020.

Attended webinar on ‗Role of Botanical Survey of India in Biodiversity Conservation‘ organized by BSI DRC Hyderabad on14.10.2020.

Dr Mahua Pal, Botanist

Attended a National level Webinar on ―Plant Diversity in India” arranged by Bagnan College on 20.9.2020.

Attended 30-th Annual conference of Indian Association for Angiosperm Taxonomy & Webinar on 4.12.2020 & 5.12.2020.

Attended Webinar on International Code of Nomenclature (ICN) for Plants jointly organised by Botanical Survey of India, Deccan Regional Centre, Hyderabad and Dept. of Botany, Andhra university, Visakhapatnam on 6.1.21.

Attended Webinar on ―Revising the Generic Limits of Coleus and Plectranthus (Lamiaceae, Tribe Ocimeae)” arranged by Central National Herbarium, Botanical Survey of India on 12.3.21.

Dr Anand Kumar, Botanist

Demonstrated as resource person on process of Digitization of herbarium specimens on 23.12.2020 on ‗Virtual Workshop on Herbarium Techniques‘ jointly organized by the Department of Botany, Bethune College, Kolkata in collaboration with Central National Herbarium & ENVIS Resource Partner on Biodiversity, Botanical Survey of India, Howrah.

Attended Webinar on ―International Code of Nomenclature (ICN) for plants" by Dr K.N. Gandhi, Harvard University, USA on 06.01.2021 organized Botanical Survey of India, Deccan Regional Centre, Hyderabad; "Science in Białowieża Forest - Białowieża Forest in science" by Prof. (Dr) Bogdan Jaroszeewicz organized by Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok.

Attended National Webinar-cum-Brainstorming session on ‗Himalayan Mountain Biodiversity– Threats & Solutions' organized by Botanical Survey of India, SHRC, Gangtok on Dec 10, 2020.

Dr.Brijesh Kumar, Botanist

Attended Webinar on "Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae)" ―organised by Central National Herbarium, Howrah on 12.03.2021.
Attended Webinar on "Role of Botanical Survey of India in Taxonomic Research in India" ―organised by BSI, HAWHRC, Solan on 22.02.2021.

Attended Webinar on ―Plant Systematics insights from morphology and molecules" organized by Botanical Survey of India, HAWHRC, Solan on 17.02.2021.

Attended webinar on, ―Diversity of Bryophytes in India with special reference to Western Himlaya" organized by Botanical Survey of India, HAWHRC, Solan on 15.01. 2021.

Attended The Green Talk: Webinar Series in 2021 on "Science in Bialowieza Forest-Bialowieza Forest in Science" organized by Botanical Survey of India, SHRC, Gangtok on 08.01. 2021.

Attended Webinar on ―International Code of Nomenclature (ICN) for Plants" organized by Botanical Survey of India, DRC, Hyderabad on 06.01. 2021.

Attended Webinar Lecture-3 on ‗Alien Plant Invasion in India: Status and Consequences' organised by Botanical Survey of India, HAWRC, Solan on 17.12.2020 at 11:30 am to 01:00PM

Attended Webinar on ‗Plant Diversity of the Western Ghats, India ' organized by Botanical Survey of India, Western Regional Centre, Pune on 12.12. 2020 from 10:30am – 1:30pm.

Attended Webinar-cum-Brainstorming on ‗Himalayan Mountain Biodiversity – Threats & Solutions' organised by Botanical Survey of India, SHRC, Gangtok on International Mountain Day 10.12.2020 from 14:30 – 17:45.

Attended a webinar on topic, ―Diversity and distribution of Pteridophytes in India" organized by Department of Botany, Holy Cross College (Autonomous), Tiruchirappalli on 06.08.2020.

Dr. G. Swarnalatha, Botanist

Delivered a lecture on the topic entitled ―An Introduction to the Lichenized Fungi" in a two days national level e-workshop on Recent Trends in Plant Taxonomy organized by St. Ann's College for Womens, Hyderabad in collaboration with Botanical Survey of India, DRC on 25th & 26th November 2020.

Attended webinar on International Code of Nomenclature (ICN) for Plants held on 06.01.2021 organized by Botanical Survey of India, DRC in association with Andhra University, Visakhapatnam.

Shri B.B.T. Tham, Botanist

Attended the National Conference cum Workshop on ―Interdisciplinary approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid show at BSI, ERC, Shillongw.e.f. March 5-7, 2021

Mis.L. IbemhalChanu, Botanist

Attended and participated in the National Conference cum Workshop on ―Interdisciplinary approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid show at BSI, ERC, Shillongw.e.f. March 5-7, 2021.

Dr. B.K. Singh, Bot. Asstt.

Delivered talk on ―Role of Botanic Garden in Plant Conservation with SpecialReference to AJC Bose Indian Botanic Garden" as Lead Speaker in 2-days National Webinarentitled ―LIFE IN THE UNIVERSE AND DIVERSITY" organized by Department of Botany in collaboration with IQAC, Ranaghat College on 15th and 16th July, 2020.

Delivered talk on ―AJC Bose Indian Botanic Garden &ex-situ conservation: A Post Amphan Review" in the State Level Webinar on ―Urban and Mangrove Plantation: A Post12Amphan Introspection" organized by Department of Botany in collaboration with IQAC, Charuchandra College, Kolkata on 28th July, 2020.

Delivered talk on ―A virtual journey to Botanic Garden" in a 4-days Online Lecture Series on ―Virtual Journey through Botanical World" organized by Department of Botany in collaboration with IQAC, THK Jain College, Kolkata on 13th August, 2020.

Delivered talk on ―Role of Botanic Garden in Plant Conservation" in the NationalLevel Webinar on ―Biodiversity of India and its Conservation" organized by Department ofBotany in collaboration with IQAC, Bagnan College, Howrah on 20th September, 2020.

Delivered talk on Medicinal Plant Identification in a 1day workshop at HerbalGarden organized by Institute of Post Graduate Ayurvedic Education & Research at Shyamadas Vaidya Shastra Pith, Dept. of Health & F.W., Govt. of West Bengal on 12.02.2021.

Delivered talk on Nokrek Biosphere Reserve, Meghalaya A Session of TheWebinar on ―Biosphere Reserves of India- Identification, Conservation and Management"Organised by Govt. M.S. Golwalkar College, Rewa (M.P.) on 19th March, 2021.

Shri Ravi Prasad, Bot. Asstt.

Delivered a lecture on ―**Herbarium Techniques**" in a UGC sponsored programme ―Gyan Ganga-State level training-cum-workshop under subject specific short-term program-Initiative for Teaching-Learning Excellence in Botany and New Dimensions of Advance Studies in Botany, jointly organised by ‗Directorate of College Education Rajasthan, Jaipur' and ‗Government College Bundi, Rajasthan' on 16.02.2021.

Attended the 43rd All India Botanical conference of Indian Botanical Society, held at NBRI, Lucknow in virtual mode during 19th-21st March, 2021.

Attended 3 days (4–6 Nov., 2020) National Webinar on ―DrE. K. JanakiAmmal Memorial Lecture series on ‗Ethnobotany in India- Future and Challenges' organised by National Museum of Natural History, New Delhi in collaboration with University of Trans Disciplinary Health Sciences & Technology, Bengaluru.

Dr. P. Hari Krishna, Bot. Asstt.

Attended two National webinars viz. ―Role of Botanical Survey of India in Biodiversity Conservation" held on 14th Oct., 2020 organised by Botanical Survey of India, Deccan Regional Centre, Hyderabad and Webinar on ―Biodiversity and Wildlife Conservation" held on 9th October, 2020 organized by Raj Rishi Govt College, Alwar.

Dr Anant Kumar, Botanical Asstt.

Imparted a virtual training regarding herbarium methodology and techniquesto students and teachers of Bethune College, Kolkata on 23rd December, 2020 (Wednesday) conducted by Central National Herbarium & ENVIS Resource Partner with the Department of Botany, Bethune College, Kolkata.

Dr ShyamBiswa, Botanical Asstt.

Delivered a demonstration on practical session as resource person on Herbarium Methodology to undergraduate students and other faculty members, on ‗Virtual Workshop on Herbarium Techniques' on 23.12.2020 jointly organised by the the Department of Botany, Bethune College, Kolkata in Collaboration with Central National Herbarium & ENVIS Resource Partner on Biodiversity, Botanical Survey of India, Howrah.

Attended Webinar on ―Alien Plant invasion in India, Status and Consequence" on 17th December 2020 organized by BSI Solan Circle (HAWHRC).

Attended Webinar on ―International Code of Nomenclature (ICN) for Plants" by Dr. K. N. Gandhi on 06th January 2021 organized by BSI, DRC, Hyderabad.

Dr Vijay Kumar Mastakar, Botanical Asstt.

Attended National Webinar On RELEVANCE OF ETHNOBOTANY IN CONTEMPORARY SOCIO – ECONOMIC CONDITIONS 14th August, 2020 Organized by S.K. Jain Institute of Ethnobiology School of Studies in Botany Jiwaji University, Gwalior (M.P.).

Attended National Webinar On ―Frontiers of Biodiversity Conservation and Herbal Research" Organized by: Chaman Lal Mahavidhyalya, Landhaura, Haridwar (UK) (Department of Zoology & Botany) In collaboration with Botanical Survey of India, Kolkata (Ministry of Environment, Forest & Climate Change, India) National Webinar On ―Frontiers of Biodiversity Conservation and Herbal Research" 9th August 2020.

Attended webinar on the title ‗'Restoring Biodiversity for Environmental Sustainability'' organized by National Museum of Natural History, Ministry of Environment, Forest and Climate Change, New Delhi on 28th August, 2020.

Attended webinar on Alien Plant Invasion in India: Status and Consequences on 17th December, 2020. Govt. of India Ministry of Environment, Forest and Climate Change Botanical Survey of India High Altitude Western Himalayan Regional Centre, Nauni Campus, Solan (H.P.) National Webinar Series Lecture- 3 on 17th December, 2020.

Attended webinar on ―Evolution of science seen from historical perspective" Conducted by the Department of Botany, Deshbandhu College, University of Delhi under the aegis of IQAC on 12th & 13th May 2020.

Dr.Nitishas Srivastava, Bot. Asstt.

Attended a webinar on "International Code of Nomenclature (ICN) for Plants" organized by Botanical Survey of India, Deccan Regional Centre, Hyderabad on 06.01. 2021.

Attended the Green Talk: Webinar Series in 2021 on "Science in Bialowieza Forest-Bialowieza Forest in Science" organized by Botanical Survey of India, SHRC, Gangtok on 08.01. 2021.

Attended Webinar Lecture-3 on ‗Alien Plant Invasion in India: Status and Consequences' organised by Botanical Survey of India, HAWRC, Solan on 17.12.2020 at 11:30 am to 01:00PM.

Attended a national webinar series, Lecture-7, on "Role of Botanical Survey of India in Taxonomic Research in India" organized by Botanical Survey of India, High Altitude Western Himalayan Regional Centre, Solan (H.P.) on 22/02/2021.

Attended Webinar on "Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae)" ―organised by Central National Herbarium, Howrah on

Attended Prof. R. Misra Memorial Lecture on ―Impact of urbanization on vegetation covers using fuzzy technique on satellite images" delivered by Prof.Anupam Pandey, Geography Department, University of Allahabad, organized by ICREF, Prayagraj on 02/03/ 2021.

Ms. Sinjini Mukherjee, Bot. Asstt.
Attended a webinar on International Code of Nomenclature (ICN) for Plants on 06.01.2021.

Attended a webinar on Green Talk: Webinar series in 2021, first talk on Science in Bialowieza Forest – Bialowieza Forest in Science on 08.01.2021.

Attended a National Webiner Series Lecture-7 on Role of Botanical Survey of India in Taxonomic Research in India on 22.02.2021 from 11:30 am to 01:00 pm.

Attended a webinar Impact of Urbanization on Vegetation Covers using Fuzzy Technique on Satellite Images by Prof.Anupam Pandey, Geography Department, University of Allahabad organized by ICFRE on 02/03/2021.

Dr. S. Nagaraju, Bot Asstt.

Attended a National Webinar on Biosphere reserves of India: Identification, Conservation and Management held at Govt. MadhavSadasivraoGolvalkar College, Rewa (M.P) on 16.03.2021.

Attended a webinar on Revising the Generic Limits of *Coleus* and *Plectranthus* (Lamiaceae, Tribe Ocimeae- Dr.Alen Paton Kew, and U.K) held at CNH, BSI, Howrah on 12.03.2021.

Dr. J. Swamy, Bot Asstt.

Organized ―Two Day National Level E-Workshop on Recent Trends in Plant Taxonomy" in collaboration with St. Ann's College for Women, Mehidipatnam, Hyderabad and Botanical Survey of India, Deccan Regional Centre, Hyderabad on 25 & 26. November 2020 and delivered two lectures on the topics entitled Herbarium methodology and its role in plant taxonomy and conservation and endemic and threatened plants of Andhra Pradesh and Telangana and IUCN classification.

Organized a National Webinar on ―Emerging Aspects of Taxonomy and Biodiversity" in collaboration with Government City College, Osmania University, Hyderabad and delivered a lecture on ―Endemism with special reference to Telangana" on 03.02.2021.

Delivered a lecture on Taxonomic tools: herbarium, floras, botanical keys & GPS and participated in the National level One Week Online Short Term Course on ―Plant Taxonomy" held during 3rd to 8th August, 2020 organized by Department of Botany, Nizam College, Osmania University, Hyderbad, Telangana.

Delivered a lecture on Virtual Exploration, Identification of Plants and Herbarium Methodology in the National level Webinar on ―Frontiers in Biological Sciences" held during 24th to 25th September, 2020, organized by Department of Botany, Telangana Social Welfare Residential Degree College for Women, Mahendrahills, Hyderabad, Telangana.

Delivered a lecture on Herbarium role in conservation in the National level Webinar on ―Role of Botanical Survey of India in Biodiversity Conservation" held on 14th October, 2020, organized by Botanical Survey of India, Deccan Regional Centre, Hyderabad, Telangana.

Delivered lecture on Herbarium methodology with special reference to digital/virtual herbaria and also demonstrated herbarium methodology in one day Workshop cum Training on Herbarium Techniques and awareness on Virtual and Digital Herbaria jointly organized Department of Botany, BJR Degree College, Narayanaguda, Hyderbad and Botanical Survey of India, Deccan Regional Centre, Hyderabad on 04th March 2021.

Attended National webinar on Techniques in Molecular Biology: A Virtual Laboratory Insight organized by Department of Genetica& Biotechnology, University College for women, Koti, Hyderabad on 12th August 2020.

Attended one day National Conference on Plants and Environment. Organised by Department of Botany, Telangana University, Nizamabad, Telangana on 23. 11.2020.

Attended International Webinar organized by Plantgenomia on Genome Editing to Enhance Multiple Disease Resistance in Crop Plants on 20th December 2020.

Attended webinar on International Code of Nomenclature (ICN) for Plants organized by Botanical Survey of India, DRC in association with Andhra University, Visakhapatnam which was held on 06th January 2021.

Attended webinar on "Green Walk"- Plant Resources as Aid for prevention of Covid - 19, organized by Botanical Survey of India, Southern Regional Centre, Coimbatore on 27th January 2021.

Dr. Satya RanjanTalukdar, Bot. Asstt.

Presented a Paper as Poster on ―Diversity, conservation and sustainable utilization of orchid flora of community forests of west and south–west khasi hills districts of Meghalaya, India" during the National Conference cum Workshop (hybrid mode) on ―Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show held at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya from March 5-7. 2021.

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya.

Attended 16(Sixteen) webinars organised by Botanical Survey of India and other institutions.

Smt. NanditaSarma, Botanical Assistant

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya.

Attended 20(twenty) webinars organised by Botanical Survey of India and other institutions.

Shri Harminder Singh, Botanical Assistant

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya.

Attended 12(twelve) webinars organised by Botanical Survey of India and other institutions.

Shri Vijay, Botanical Assistant

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya.

Attended 9(nine) webinars organised by Botanical Survey of India and other institutions.

Miss Kankana Chakraborty, Botanical Assistant

Attended National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show held on 5th to 7th March, 2021, at Botanical Survey of India, ERC, Shillong- 793003, Meghalaya.

Attended 8(eight) webinars organised by Botanical Survey of India and other institutions.

ACTIVITIES OF RESEARCH FELLOW

1. Taxonomic revision of the subtribes Eleusininae Dumort., Aleuropodinae P.M. Peterson & al., Perotidinae P.M.Peterson & al. and Gymnopogoninae P.M. Peterson & al. (Poaceae: Chloridoideae: Cynodonteae) in India by Shrabasti Das, SPF & Dr. K. Karthigeyan, Scientist- E.

The main objectives of the study are taxonomic revision of the subtribes - Eleusininae Dumort., Aleuropodinae P.M. Peterson & al., Perotidinae P.M.Peterson & al. and Gymnopogoninae P.M. Peterson & al. (Poaceae) in India with reference to correct identity and updated nomenclature and to characterize the macromorphology and micro-morphological characters under SEM and find out an evolutionary line according to taxonomic characters. As per the current estimate, 15 genus and 46 species are belonging to the subtribe Eleusininae Dumort., 5 genus and 11 species are belonging to the subtribe Aleuropodinae P.M. Peterson, 2 genus and 4 species are belonging to the subtribe Perotidinae P.M.Peterson & al., 2 genus and 2 species are belonging to the subtribe Gymnopogoninae P.M. Peterson & al.. in India. About 300 photographs of 15 collected species or plant parts were taken during field tours; voucher specimens for all the collected materials were prepared. Detailed description, illustration and nomenclatural notes of 25 taxa were completed towards the preparation of the final report. In addition to this, SEM of caryopsis will be carried out. The study so far yielded one publication on the lectotypification of *Tetrapogon roxburghianus.*

2. Revision of the subtribes- Boivinellinae Pilg. and Anthephorinae Benth. (Poaceae) by Shreya Chaudhuri, SRF & Dr. Vinay Ranjan, Scientist-E

The main objective of the Revision of the subtribes- Boivinellinae Pilg.and Anthephorinae Benth. (Poaceae) is to prepare an up-to-date checklist of all the species belonging to the ewo subtribes. Also, a detailed taxonomic description of all the taxa will be prepared based on the type material, herbarium study, fresh collection, protologues and literature. According to the current estimate there are about 9 genera and 49 species belonging to the two subtribes. Till now, illustration from the herbarium specimens of 7 genera consisting 24 species are completed that belong to the subtribe Boivinellinae also detailed description of 7 species are prepared. Also photographs of the spikelet from herbarium specimen and also from fresh collection are being taken from which photo plates will be prepared. Specimen examined for *Echinochloa colonum* (L.)Link, is being prepared from the herbarium specimen

3. Ex-situ conservation of Rare Endangered Threatened, Endemic & Economic plants of Rajasthan and Gujarat under ABG scheme.
Name of candidate: Deepshikha Soni
Date of Initiation of the Project: 6th June 2019 Date of completion of the Project: 6th June 2022

The major objective of the project is to conserve Rare, Endangered, Threatened, Endemic & Economic plants of Rajasthan and Gujarat and develop the Desert Botanical Garden, BSI, AZRC, Jodhpur.The major work during the period under report include visiting different field sites, recording and analysis of field data's (e.g. RET plants, Medicinal plants, Economically important plants, Grasses section, Succulent section) tagging of plants, regular monitoring of plants growth, looking after manuring, watering, repotting, removal of weeds

and pest control in nurseries. Collected plant saplings of different wild as well as cultivated species and provided services in development of different plant sections in Botanical garden of BSI, AZRC. Additionally, consulted library and studied the concerned literatures. Visited some of the local botanical gardens and nurseries of Central Arid Zone Research Institute & Arid Forest Research Institute, Jodhpur.

Achievements/Outcomes during 2020-2021: Collected data on of Rare, Endangered, Threatened, Endemic & Economic plants of Rajasthan and Gujarat. Tagged the plants of office premises. Consultation of herbarium (BSJO) of the office. Collected seeds of different plant species for raising seedlings, sown seeds of different plants species for raising seedlings in the polybags. Documented nursery plants. Captured growth data of the RET plants. Prepared list of Medicinal & economic plant section of Botanical Garden. Grown different species of plant by grafting, cutting method etc. Transferred 340 saplings of *Asparagus racemosus* Willd.from mother beds to polybags

4. Flora of Nagaland by Rikertre Lytan, JRF and Dr. Nripemo Odyuo Scientist-E & HoO.

During this year, Descriptions were made for 255 species and Key preparation for 411taxa. Processed and mounted of one type specimen of *Aglaonema* sp. Morphological studies and dissection were done for *Zingiber pherimaense* Biseshwori & Bipin; *Chlorophytum assamicum*D. Borah & A.P.Das; *Pentasacme caudata* Wall.;*Tupistra khasiana* D.K.Roy, A.A.Mao & Aver.Preparation of Herbarium Meta data (ASSAM) were done for260 sheets80 from family Liliaceae and 180 from family Cyperaceae. Data compilation were donefor Rare, Endangered and Threatened species of Nagaland and Manipur state wise. One field tour was undertakento Doyang, Wokha Districts, Nagaland for 12 days from 21st October to 1st November 2020 and a total of 160 specimens were collected. Three Local field tours within the State of Meghalaya were undertaken for collection of *Gaultheria fragrantissima* Wall. seeds and live specimen of some orchid species. During this tenure one new species of *Peliosanthes* has been published and two species are under communicated (one new species of *Aglaonema* sp and one species of *Stadiochilus* sp a new generic record to India). Attended seven webinar ―International Code of nomenclature for Plants" jointly organized by BSI, Deccan Regional Centre, Hyderabad and Dept. of Botany, Andhra University, Visakhapatnam on 06th.01.2021; ―Science in Bialoweza Forest" organized by BSI, Sikkim Himalayan Regional Centre, Gangtok on 08th.01.2021; ―Evolutionary play of invasive species in a changing Himalayan theater" organized by BSI, HAWHRC, Solan on 22nd.02.2021; ―Documenting the diversity of La Amistad National Park Panama-Costa Rica" organized by BSI, Sikkim Himalayan Regional Centre, Gangtok on 23th.02.2021.―Green Talk-Plant Resources as Aid for Prevention of Covid-19" organized by Southern Regional Centre, Coimbatore on 27th .02.2021. ―Recent Trends in Biological Sciences' organized by Department of Botany, St. Joseph's College (Autonomous), Devagiri, Kozhikode, Kerala during 02-06 March 2021. ―Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid show" organized by The Orchid Society of India (TOSI), Department of Botany, Punjab University, Chandigarh & Botanical Survey Of India, Kolkata, on 5th& 6th . 03.2021.

5. Phytochemical screening, proximate composition, nutritional analysis and mineral element status of selected wild edible fruits of northeast India by Larima Sten, JRF and Dr. Deepu Vijayan, Scientist-C

During the period from April 2020- March 2021, tour was conducted to Sohrarim, Laitmawsiang, Pynursla, Pdengchakap, Mawtyngar, Pynursla, Laitmawsiang, Experimental Botanical garden, Barapani, Shillong, and Sohparu for the collections of wild edible fruits. Plant samples was processed by washing, drying, cutting, grinding and taking photographs. Solvent extraction was performed using Soxhlet apparatus and Rotary evaporator. Hot water extraction was prepared for qualitative phytochemical analysis and cold extraction was also carried out for some fruits. Qualiltative phytochemical screening of *Anodendron paniculatum* (leaves and fruits). Estimation of protein by Bradford method, total moisture Content for *Antidesma bunius* (fruits), *Tetrastigma dubium* (fruits and seeds) and *Tetrastigma planicule* (fruits and seeds), total phenolic content for *Quercus semiserrata* (fruit) and *Prunus jenkinsi* (fruit) was carried out. Estimation of total saponin content for *Vaccinium griffithianum* (fruit), *Syzygium megacarpum* (fruit, exocarp), *Quercus semisarrata* (fruit), *Prunus jenkinsii* (fruit), *Anodendron paniculatum* (fruit), *Citrus latipes* (mature fruit, immature fruit, mature fruit cover), *Hodgsonia heteroclita* (exocarp), *Aphananthe cuspidata* (fruit), *Calamus erectus* (fruit and fruit peel), *Debregeasia longifolia* (fruit, leaves), *Cayratia japonica* (fruit), *Ficus auriculata* (fruit), *Artocarpus lakoocha* (fruit, flower) and *Meyna spinosa* (fruit). DPPH and ABTS radical scavenging activity of *Quercus semiserrata* (fruit), *Vaccinium griffithianum* (fruit), *Syzygium megacarpum* (fruit and exocarp), *Citrus latipes* (mature fruit, mature fruit peel), *Debregeasia longifolia* (fruit), *Aphananthe cuspidata* (fruit), *Anodendron paniculatum* (fruit, leaves) and *Prunus jenkinsii* (fruit). Reducing Power Assay (RPA) for *Quercus semiserrata* (fruit), *Syzygium megacarpum* (fruit), *Aphananthe cuspidata* (fruit), *Citrus latipes* (immature fruit), *Cayratia japonica* (fruit), *Vaccinium griffithianum* (fruit), *Prunus jenkinsii* (fruit), *Calamus erectus* (fruit peel) and *Citrus latipes* (mature fruit). Estimation of carotenoids for *Anodendron paniculatum* (fruit and leave), *Cayratia japonica* (fruit), *Calamus erectus* (fruit and fruit peel), *Prunus jenkinsii* (fruit), *Syzygium megacarpum* (fruit), *Aphananthe cuspidata* (fruit), *Quercus semiserrata* (fruit), *Vaccinium griffithianum* (fruit), *Viburnum feotidum* (fruit) and *Antidesma bunius* (fruits). Determination of niacin content for *Viburnum feotidum* (fruits) and *Antidesma bunius* (fruits). Thin Layer Chromatographic analysis (TLC) of gallic acid, *Syzygium megacarpum* (fruits and exocarp), *Quercus semiserrata* (fruit), *Prunus jenkinsii* (fruit), *Vaccinium griffithianum* (fruit), *Calamus erectus* (fruit), *Hodgsonia heteroclita* (seed cover), *Meyna spinosa* (fruit) and *Citrus latipes* (immature fruit, mature fruit peel) for methanolic extract. Ultra High Performance Liquid Chromatographic (UHPLC) analysis of phenolics, flavonoids and vitamins standards and eight fruit samples. Attending National Conference cum Workshop on Interdisciplinary approaches to taxonomy, conservation, and economic utilization of Floriculturally and Medicinally Important Orchids and Orchid Show organized by The Orchid Society of India (TOSI), Department of Botany Punjab University and BSI, Kolkata, West Bengal jointly with NEHU from 5^{th}-7^{th} March, 2021.

6. Taxonomic revision and phylogenetic study of Zingiberaceae with special reference to endemic and endangered species of North East India by Suparna Debnath, JRF and Dr. Deepu Vijayan, Scientist- C

During April 2020-March 2021, 5 field tours were conducted to different areas of Meghalaya such as Jarain, Amlarem, Pdengchakap, Barapani Experimental Garden, BSI, Pynursla, Umtyngngar, Laitlyngkot and Mawphlang during which different plants of the family Zingiberaceae were collected. As a part of molecular phylogeny isolated genomic DNA and agarose gel [0.8% (w/v)] electrophoresis in 1x TBE buffer, along with Lambda DNA to check quality and quantity of 17 Zingiberaous plants. PCR standardisation using nuclear (ITS) and chloroplast (matK, rbcL, trnH-psbA, trnC-ycf6), trnF-ndhJ, trnL intron) markers

were carried out in the genomic DNA of different Zingiberous plants. Received good quality DNA sequences for 2 primer pairs (rbcL, c & d) of *Hedychium chingmeianum, Zingiber bipinianum, Zingiber kangleipakense* and *Zingiber pherimaense.*DNA sequence were used to construct phylogenetic tree using four phylogenetic tree construction methods: neighbor-joining (NJ) method, the maximum parsimony method (MP) method, the maximum likelihood (ML) method, and the Bayesian inference (BI) method. Dissected and taken photographs and measurements of plant parts of 10 species of the family Zingiberaceae. Prepared photoplates for 8 species of Zingiberaceae (*Curcuma amada, Globba saltatoria, Hedychium coronarium, Hemiorchis pantlingii*, *Zingiber bipinianum, Bosenbergia longiflora, Cautleya gracillis and Caulokaempferia secunda*) using Adobe Photoshop 7.0. During this period several miscellaneous works have been done such as, prepared abstract of the paper- Phylogenetic reconstruction of newly discovered species of the genus *Zingiber* (Zingiberaceae) from Northeast India based on chloroplast sequence data for the National seminar on Plant Taxonomy and Traditional Knowledge in the Himalayan and Northeast India and Annual Conference of East Himalayan Society for Spermatophyte Taxonomy, organized by Rajiv Gandhi University, Arunachal Pradesh from 24th-25th April, 2021; herbarium label information was recorded for 286 sheets from the family Zingiberaceae for metadata of the herbarium specimens of Assam for Flora of India Project; recorded RET species of Assam and Mizoram under the reference regarding ―Intimation of Endemic & Endangered (RET) species" Arunachal Pradesh and other states of N.E.R. of India; hands on training for molecular taxonomy and DNA barcoding was given to Ms. Vaishali (internship student) from 28th January- 5th February, 2021 under the supervision of Dr. D. Vijayan, Scientist-C and supervisor, BSI, ERC; attended National Conference cum Workshop (Hybrid mode) on Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid show from March 5-7, 2021 organized by The Orchid Society of India, Chandigarh and Botanical Survey of India, Kolkata.

7. Taxonomic studies of *Ficus* L. of Northeast India by Sreyoshee Sensarma, SRF and Dr. Chaya Deori, Scientist E

During this year, Citations have been made. 5 tours and one small one day field tour is completed(2 herbarium and 3 field tours). Collected 36 specimens among which 20 specimen have been identified.Have described 31 spp. Submitted 30 descriptions of *Ficus* spp. In the Flora of India Project Made 7 photo plates and 7 illustrations. Have consulted almost 760 protologues, downloaded them and also collected 25 types. Have typed the references. Made the Checklist of *Ficus* L. of North-east India. Made a Google Earth Map of Surveyed areas of Mizoram. Dissected 12 spp. of *Ficus* Attended seven webinar ―International Code of nomenclature for Plants" jointly organized by BSI, Deccan Regional Centre, Hyderabad and Dept. of Botany, Andhra University, Visakhapatnam on 06th.01.2021; ―Science in Bialoweza Forest" organized by BSI, Sikkim Himalayan Regional Centre, Gangtok on 08th.01.2021; ―Evolutionary play of invasive species in a changing Himalayan theater" organized by BSI, HAWHRC, Solan on 22nd.02.2021; ―Documenting the diversity of La Amistad National Park Panama-Costa Rica" organized by BSI, Sikkim Himalayan Regional Centre, Gangtok on 23th.02.2021.―Green Talk-Plant Resources as Aid for Prevention of Covid-19" organized by Southern Regional Centre, Coimbatore on 27th .02.2021. ―Recent Trends in Biological Sciences' organized by Department of Botany, St. Joseph's College (Autonomous), Devagiri, Kozhikode, Kerala during 02-06 March 2021. ―Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid show" organized by The

Orchid Society of India (TOSI), Department of Botany, Punjab University, Chandigarh & Botanical Survey Of India, Kolkata, on 5th& 6th of March, 2021.

8. Micropropagation of some selected endemic and threatened plants of Northeast India byMs. Dawanri Marwein, JRF & Dr. Deepu Vijayan, Scientist C.

During the period from April 2020 – March 2021, *In vitro* propagation protocol and genetic fidelity analysis of *Rhododendron formosum* Wall. have been standardized and manuscript is under preparation. Standardization of surface sterilization protocol, *in vitro* and *ex vivo* seed germination experiments, multiple shoot induction and rooting experiments of *Rhododendron inaequale* Hutch.and*Adinandra griffithii* Dyer. have been carried out. Culture initiation and shoot multiplication of *Pyrenaria barringtoniifolia* Seem. and*Rhododendron iteophyllum* Hutch. have been carried out. Regular subculturing and rooting of *Rhododendron wattii*Cowan.,*Pyrenaria khasiana* R.N.Paul. *Cymbidium tigrinum* and *Cymbidium whiteae* have been carried out. Seed germination experiments of*Calanthe masuca, Coelogyne corymbosa, Coelogyneviscosa, Pholidota katakiana* and *Micropera rostrata*have been carried out. *In vitro* raised plants of *Rhododendron formosum*Wall., *Pyrenaria khasiana*R.N.Paul., *Rhododendron inaequale* Hutch., *Rhododendron wattii* Cowan. and*Adinandra griffithii* Dyer. were transferred for hardening. Regular watering and maintenance of the seeds and seedlings of *Pyrenaria camelliflora* Kurz., *Pyrenaria khasiana* R.N.Paul., *Rhododendron formosum* Wall., *Rhododendron inaequale* Hutch.and *Adinandra griffithii* Dyer. in the polyhouse and in the garden of BSI, ERC, Shillong.Seedlings of *Rhododendron inaequale* Hutch. were reintroduced in the garden of BSI, ERC, Shillong. Seedlings of *Pyrenaria khasiana* R.N.Paul.were reintroduced in the garden of BSI, Experimental Garden, Barapani. Two local tours were conducted to different forest areas of Meghalaya for the collection of plant samples. Data compilation were done for Rare, Endangered and Threatened species of Meghalaya and Tripura. Attended 7 webinars and participated in the Two-day Online Workshop on Data Analysis using SPSS.

9. Floristic Studies on Papikonda National Park, Andhra Pradesh by Y. Mahesh, JPF & Dr. L. Rasingam, Scientist – D

Conducted three field tours during the year (April 2020 to March 2021) and covered 360 km² areas in 14 beats under four forest ranges. A total of 450 field numbers have been collected and captured photographs for maximum species. Among the 450 field numbers 200 field numbers are identified and prepared description for 58 species. Published 02 research papers and communicated 04 research papers.

10. Flora of Kerala Vol. 3:

Name of the Executing officials: Shri P. Murugan, SRF & Dr. C. Murugan, Scientist _E'
Duration of the project:June, 2018 to July, 2022
During this period (April, 2020 to September, 2020), Senior Research Fellow, consulted one herbarium (MH!) and documented 87 genera and 27 spp.

11. Flora of Kerala Vol. 4:

Executing Scientist: Shri Basil Paul, SRF &Dr. Sujana K. A., Scientist, Scientist _D' under the supervision of Dr. M. U. Sharief, Scientist E, HoO.

Duration of the Project: 01.04.2020 – 31.03.2022

Achievements

A total of 87 taxa belongs to 4 families were documented.

12. Flora of Kerala, Volume – 6:
Executing Scientist (s): Shri M. Sulaiman, SRF & Dr. M. Murugesan, Scientist _C‘
Duration of the project: April, 2020–March, 2022
Achievements

A total of 106 taxa belongs to Orchidaceae were documented.

FUNDED/COLLABORATIVE PROJECTS

Restoration of Mangroves in Sundarban through Afforestation, Integrated Mangrove-Shrimp Farming, Income Generation and Community Participation (2017-2020)" Dr K. Karthigeyan, Scientist- E (PI)

Funded by _Nature Environment and Wildlife Society (NEWS), completed all the field surveys and submitted a detailed final report to the Director, Botanical Survey of India for onward submission.

Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species, Dr. D.K. Agrawala, Scientist-E (PI), Dr.Rijupalika Roy (Research Associate), Shri Aazhivaendhan; MsShreyasi Nayak; Shri Sayak Chakraborty; Shri Shuvadip Sarkar; Ms. Sanchayita Sengupta (SPF) and Ms Oindrila Chakraborty (JPF)

Funded by National Mission on Himalayan Studies (NMHS) under Himalayan Research Fellowship Scheme

Abstract communicated entitled _Taxonomic studies on the genus *Acanthephippium* Blume (Orchidaceae) in India' for National Conference cum Workshop on –Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya during March 5-7, 2021. The students attended the 6th Himalayan Researchers Consortium (HRC)-2021 held through Online Webinar Mode during 2–3 February 2021 and Presented the work progress under the project –Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species" of the allotment: Tribe Vandeae- Sub-tribe: Aeridinae. Abstract communicated entitled _Taxonomic studies on the genus StereochilusLindl. (Orchidaceae) in India' for National Conference cum Workshop on –Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya during March 5-7, 2021.Communicated a paper on: Stereochiluserinaceus (Rchb.f.) Garay (Orchidaceae) – A new distributional record for India with notes on its relationships and threat status assessment.Communicated a paper on: *Stereochiluserinaceus* (Rchb.f.) Garay (Orchidaceae) – A new distributional record for India with notes on its relationships and threat status assessment.Communicated abstract for poster on –Species with confusing identity within the genus *Phalaenopsis* Blume (Orchidaceae) in India" to be presented in National Conference cum Workshop on –Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya on March 5-7, 2021Abstract communicated entitled _Notes on the Bulbophyllumodoratissimum complex in India' for National Conference cum Workshop on –Interdisciplinary Approaches to Taxonomy, Conservation and Economic Utilization of Floriculturally and Medicinally Important Orchids" and Orchid Show at Botanical Survey of India (BSI), Eastern Regional Centre, Woodlands, Laitumkhrah, Shillong, Meghalaya during March 5-7, 2021.Morphological characteristics finalized for 4 genera with their respective species i.e*Arachnis* Blume (3spp.), *Ascocentrum*Schltr. (2spp.), *Biermannia*King &Pantl.(4 spp.), *Chilochista*Lindl.is completed.Attended the Webinar on Science in Bialowieża Forest – Bialowieża Forest in science on 08.01.2021 organized by BSI, SHRC.Communicated

manuscript on vertical farming of orchids communicated in journal house.Attended 30th Annual conference of Indian Association for Angiosperm Taxonomy and Webinar (4th and 5th December 2020).Attended Webinar cum Brainstorming on ―Himalayan Mountain Diversity- Threats and Solutions" on 10.12.2020 at BSI, SHRC.

***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), was sanctioned vide letter numberF. No. 10/28/2014-CS (BG) dated 24/07/2015**

Micropropagation of Target plants (Micropropagation protocols for 3 plants were achieved): *Monosis shevaroyensis* (Gamble) H. Rob. and Skavarla – multiplied through micropropagation using nodal and leaf explants; *Crotalaria shevaroyensis* Gamble - multiplied through micropropagation using nodal and leaf explants; *Canarium strictum* Roxb - multiplied through micropropagation using nodal explants.

The following orchid species were multiplied through asymbiotic seed germination method: *Xenikophytonsmeeanum* (Rchb.f.) Garay; *Aerides crispa* Lindl.;*Dendrobium aqueum* Lindl.; *Bulbophyllum fuscopurpureum* Wight; *Dendrobium aqueum* Lindl.; *Eria pseudoclavicaulis* Blatt.

Vegetative Propagation of Target Plants using seeds: *Crotalaria shevaroyensis* Gamble; *Bentinckia condapana* Berry ex Roxb.;*Canarium strictum* Roxb

Vermiculture: Well decomposed vermicompost was prepared using earthworms available in the natural forest areas. Leaf liters 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.

Study of Diversity of Marine Macro Algae of Andhra Pradesh, India" under AICOPTAX scheme." sponsored by MoEF & CC, New Delhi, Dr. M. Palanisamy, Sc. – 'E'(PI),2016-2019

The present study reveals that, 134 taxa of seaweeds were reported from the coastline of Andhra Pradesh. Among them, one taxon new addition to India, 25 taxa were new distributional additions to the state flora of Andhra Pradesh. The prospects, commercial and economic values of the 58 taxa of the marine macro algae from Andhra Pradesh were inventoried. The taxonomical description of 70 species was prepared in the prescribed format of BSI, Kolkata also, the population studies on seaweeds from Andhra Pradesh were detailed.

Reinvestigation on Flora of Gulf of Mannar Biosphere Reserve after Tsunami, Dr. C. Murugan, Scientist- 'E' (PI), Dr. R. Manikandan, Scientist-'E' (Co-PI) and Ms. Nithya, S.P., JPF (2018-2021)

During this period, 212 species were identified.

HERBARIUM INFORMATION (2020-21)

Sr. No.	Herbarium maintenance	APRC	AZRC	BGIR	CNH	DRC	ERC	ISIM	SHRC	TOTAL
1.	No. of specimens mounted/remounted/labelled/changing, pressing, processing for mounting	878	00/00/150	–	463/7237	04/00/00	1707/295/00/1157	170/00/00/00	644/00	**3866/7532/150//1157**
2.	No. of herbarium sheets stiched/restiched/cleaned/poisoned/repoisoned/ fumigated/dusted	1634/00/00/649/00/8507	225/00/00/00	–	707/00/9216/2510/25896	–	1810/3502/418/224/82/5541	00/00/00/1730/00/1765	1273/00/00/2590/	**5649/3502/9634 7703/25978/15813**
3.	No. of herbarium sheets accessioned/reaccessioned/ scanning of accession registers	825	5691	–	–	–	600	–	87	**7203**
4.	No. of old specimens/new specimens incorporated/ reincorporated/Scanning of type sheets		5813	–	8239	04/2500	741/370/00/36	00/145/00/00/00	48	**14797/3063/00/36**
5.	No. of specimens sent on loan		00	–	–	–	04	–	31	**35**
6.	No. of loaned/gifted specimens received/returned/exchanged		00	–	33/31/1662	–	1345/00/00	–		**1378/31/1662**
7.	No. of specimens identified (inhouse)/ for visitors/data field up of backlog specimens		100/38	–	559	–	84/00/88	–	00/12	**184/609/88**
8.	No. of genus/species covers changed/ new genus/species cover prepared/ No. of Type specimens folders made/listing and counting:		209/347	–	2105/4455	225/800	2826/742/00/100/50/30	108/00/00		**5473/6344/00/100/100/50/30**
9.	No. of specimens seggregated		00	–	13860	–	–	–		**13860**
10.	Documentation of existing herbarium sheets at herbaria/entry in excel sheet/ field data written		1160	1561	40486/4068	–	882/00	–		**44089**

HERBARIUM DIGITIZATION (2020-21)

REGIONAL CENTRES	BGIR	CNH	DRC	ERC	SHRC	**TOTAL**
	1500	14,980	310	166	1605	18561

AWARDS AND HONOURS

Dr. Chaya Deori: Received USHA VIJ memorial award for the year 2021 for her outstanding contribution towards orchid Art and science by the Orchid Society of India (TOSI) during the National Conference cum Workshop on Interdisciplinary Approaches to Taxonomy, Conservation, and Economic Utilization of Floriculturally and Medicinally Important Orchids and Orchid Show, organized by TOSI (Journal of Orchid Society of India), Chandigarh in collaboration with Botanical Survey of India and NEHU, Shillong held from 5th to 7th March 2021, ERC, Shillong- 793003, Meghalaya.

Dr. Chandan Singh Purohit:

Received Second Position in e-oral presentation competition in National Conference on Environment – An intelligent Recycling organized by Govt. College for Girls Sector 14, Gurugram on 05.06.2020 to 06.06.2020

Received Third Position in National level e-poster competition jointly organized by Durgapur Govt. College and Durgapur Wildlife Information & Nature Guide Society (WINGS) during 05.06.2020 to 10.06.2020.

SERVICE RENDERED

A. PUBLIC SERVICE RENDERED

Academic expert services:

Review of paper: As a potential reviewer, BSI scientists reviewed 64 manuscripts for Journal of Advanced Plant Sciences, Rheedea, Taiwania, Phytokeys, Journal Of Advanced Plant Sciences, Phytotaxa, Nelumbo, Feddes Repertorium, Journal of botanical taxonomy and geobotany, Nordic J. Botany, Systematic Botany, Cryptogamy Mycologie, Journal of Bioresources, Journal of Threatened Taxa, Phytotaxonomy, BSI ENVIS-Newsletter, Journal of Biochemistry and Biophysics, Phytotheraphy Research etc.

Evaluation of PhD thesis/viva voce: BSI scientists evaluated 04 Ph.D. thesis from different Universities and Institutes; also acted as external subject expert member of RAC for Ph.D. programme at FRI (D) University centre, AFARI, Jodhpur

Expert Services: Queries on plant ecology, distribution, nomenclature, conservation of RET plants, old Botanical paintings, history of Botanical Garden were attended by BSI officials. Scientific assistanes were also provided to the students, research scholars and scientists visited herbaria of different regional centres of BSI including Central National Herbarium. During Ph.D. Course work classes organised for Ph.D. students of AFRI, Jodhpur, scientists of AZRC, BSI, delivered lectures on different topics. BSI orchid expert demonstrated process of orchid identification and description to the researchers as and when required.

Identification and authentication of plant samples: BSI officials of different Regional Centres identified *c.* 1236 pecimens of Angiosperms, Pteridophytes, Gymnosperms, Bryophytes etc. received from different Institutes, Colleges and Universities.

Visitors attended: BSI officials attended about 200 visitors including scientists, VIPs, dignitaries, professors, academicians, researchers and students all over India and abroad. Due to COVID-19 pandemic, AJCBIBG was closed for common people most parts of the year.

Plantation programmes: In the eve of different programmes celebrated in BSI, *c.* 3010 saplings of EET, medicinal and aromatic species (*Cerbera odollam* Gaertn., *Costus pictus* D.Don, *Knema andamanica* (Warb.) W.J. de Wilde, *Piper longum* L., *Semecarpus kurzii* Engl., *Alpinia calcarata* (Haw.) Roscoe, *Alpinia luteocarpa* Elmer, *Amomum aculeatum* Roxb., *Amomum andamanicum* V.P. Thomas & al., *Amomum maximum* Roxb., *Curcuma zedoaria* (Christm.) Roscoe, *Etlingera fenzlii* (Kurz) Škornick. & M. Sabu etc. were distributed to different Institutes, Universities, Colleges, students and common people. Fruits with viable seeds of 355 species (*Musa bulbisiana* Colla, *Hedychium coronarium* J. König, *Musa acuminata* Colla, *Musa bulbisiana* Colla, *Musa indandamanensis* L.J. Singh *Zingiber squarrosum* Roxb., *Zingiber zerumbet* (L.) Roscoe ex Sm. etc.) were also distributed to AJC Bose Indian Botanic Garden, Howrah.

Technical services: As per demand of researchers from National and foreign Institutes, a total of 53 Type-images of *Habenaria trifurcata*, *Ziziphus kunstleri*, *Phlogacanthus*

pulcherrimus, *Ophiorrhiza pykarensis*, *Magnolia maingayi*, *Melocalamus compactiflorus*, *Glyptopetalum quadrangulare*, *Salacia grandiflora*, *Bixagrewia nicobarica*, *Arundinella intricata*, 09 type-images belonging to the family Musaceae, *Trichosanthes listeri*, *Phyllanthus nephradenius*, *Typhonium listeri, Barclaya motleyi* var. *kunstleri*, *Bentinckia nicobarica, Cryptocarya ferrarsi* var. *macrocarpa* and specimen-image (1) of *Cryptocarya* ferrarsi, specimen-images of *Gymnema* sylvestre, *Trisepalum kingie,* Holotype-image of *Chandrasekhariana keralensis*, *Hedyotis gamblei*, 02 Roxburg's drawings (*Sida cuneifolia* and *Elaeocarpus ganitrus*), 03 specimen-images (general herbarium) of Orchidaceae, 66 Wallich's specimen-images of *Impatiens* sp., Six hundred thirty five (635) packets of loaned specimens of bryophytes etc were sent through Technical section, BSI. In addition, queries on some loaned specimens of bryophyets (of Dr. Patrick Sweeney, Senior Collections Manager, Yale University Herbarium (YU), on type specimen of *Tephrosia travancorica* (Fabaceae)(of Dr. Anoop P. Balan, Malabar Botanical Garden & Institute for Plant Sciences, Kozhikode), on the type specimen of *Stereospermum tetragonum* var. *angustifoilum* (of Dr. Shrikant Ingalhalikar, Pune), on specimens of *Synotis borii* (Raizada) R. Mathur belonging to the collections *N. L. Bor* 17280, *C. B. Clarke* 41921 and *C. B. Clarke* 42637 (of Dr. Tang Ming, Royal Botanical Gardens, Richmond), on Roxburgh's drawing (of Dr. K. N. Nair, Senior Principal Scientist & Professor, CSIR-National Botanical Research Institute, Lucknow), on type-specimens of *Senecio mishmi* C. B. Clarke (of Dr. Tang Ming, Royal Botanical Gardens, Richmond), on availability of type-specimen of *Solenanthus tchitounyi* (of Dr. Sina Khalvati, Bu-Ali Sina University, Iran). In addition to this, technical guidance was provided to researchers and students regarding Herbarium process and methodology. Compiled various data required for RTI, RET plants, publications for BSI website, replied to Lok Sabha queries on various aspects of conservation of threatened species in CRC garden, GSDP participants, status of *Boswellia serrata* in Madjhya Pradesh and Chhattisgarh etc.

IT services:

Websites developed

https://bsi.gov.in

A new official website of Botanical Survey of India was prepared and launched on 30th July 2020. It has been hosted on NIC cloud services –Meghraj".

https://efloraindia.bsi.gov.in

The eFlora of India & Plant Checklist of India application has been hosted on the cloud named –Baadal" (MHRD & IIT Delhi) on 30th March 2021. Online Plant Checklist of India databases comprising 2.5 lakhs botanical names (21,558 taxa belonging to 275 families and 2744 genera, 1404 cultivated taxa and a total of 1907 infra-specific taxa (including 1518 varieties, 337 subspecies and 52 forma) was completed; E-Flora of India, 8 vols. (1, 2, 3, 4, 5, 12, 13, and 23) contains 8,813 records; Algae of India Checklist databases contain 5,433 records.

https:// archive.bsi.gov.in

E-archive of BSI has been hosted on the NIC cloud on 23rd March 2021. A total of 61,501 images and associated information are available on the website as follows: Textile design

(1,704), Natural dyes (6171), Botanical Paintings(5812), Economic Botany (20017) and Type specimens (27797).

Evaluation of project:

Dr. N. Odyuo visited Nagaland *w.e.f.* 21st to 23rd October, 2020 for evaluation of the project entitled _Ex-situ Conservation of Economical, Endemic and Threatened plants species in the Botanical Garden of Modern College, Piphema Campus, Kohima, Nagaland.

Miscellaneous services:

BSI Officials acted as judges of Flower show, quiz competition, poetry competition, drawing competitions arranged by different colleges, Universities, institutes and delivered lectures on popular topics to the participants.

B. REVENUE

Revenue earned through sale of BSI Publication: Rs. 152699/-

Revenue earned through miscellaneous services: Rs. 67316/-

EVENTS AND ACTIVITIES

MEMORANDUM OF UNDERSTANDING

A Memorandum of Understanding (MoU) was signed between ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi and Botanical Survey of India, Kolkata to establish a long-term relationship for purposes of strengthening their complementary research on management of plant genetic resources and institutional development on 03.03.2021.

A Memorandum of Understanding (MoU) was signed between Indian Council of Forestry Research and Education, (ICFRE), Dehradun and Botanical Survey of India (BSI), Kolkata for academic, educational and research cooperation on 15.02.2021.

A Memorandum of Understanding (MoU) was signed with Directorate of Cinchona and Other Medicinal Plants, Mungpoo, West Bengal on 4th February, 2021 for publication of a book.

A Memorandum of Understanding (MoU) was signed between Botanical Survey of India, Kolkata and Sikkim University, Gangtok to undertake the activities as mutual interests and for research collaboration between both the Institutes on 11.01.2021.

A Memorandum of Understanding (MoU) was signed between Institute of Bioresources and Sustainable Development (IBSD), Imphal and Botanical Survey of India, Kolkata for scientific and research cooperation on 20.11.2020.

EVENTS, CELEBRATIONS AND ACTIVITIES

International Biological Diversity Day:

All the regional centres of Botanical Survey of India celebrated ‗International Biological Diversity Day' on 22.05.2020 by plantation programme, raising cuttings of *Taxus baccata* L., *Cephalotaxus griffithii* Hook.f., *Camellia japonica* L., organising online drawing competition and online poetry writing competition.

World Environment Day:

Different Regional Centres of BSI celebrated World Environment Day on 5th June, 2020 wherein all the scientists and staffs actively participated in plantation programme, distribution of saplings and different competitions arranged.

International Day of Yoga:

All the regional centres of BSI organised International Day of Yoga on 21.06.2020 wherein trainers were invited to guide the staffs.

World Ozone Day:

Different regional centres of BSI organised World Ozone Day on 16th September 2020 during which online slogan writing and virtual drawing competitions were arranged for the school students.

International Mountain Day:

Celebrated International Mountain Day by organising webinar on the topic ‗Himalayan Mountain Biodiversity Threats and solutions on 10.12.2020. In this platform, Dr. R.S. Rawal, Director, GB Pant National Institute of Himalayan Environment (NIHE), Prof. (Dr.) P.K. Goswami, Director, NEIAH (Ministry of AYUSH), Dr. A.A. Khuroo, Biodiversity & Taxonomy Lab, Botany Dept., University of Kashmir, Dr. S.S. Dash, Head, Technical Section, BSI, Dr. Santosh K. Shah, Senior scientist, BSIP, Lucknow, Dr. Chandan Tamuly, Head, CSIR-NEIST, Dr. Rajesh Joshi, Regional Head, GB Pant National Institute of Himalayan Environment (NIHE), Dr, D.K. Agrawala, Senior scientist, BSI, SHRC and Dr. Tapan Seal, Senior scientist, Plant Chemistry Unit, BSI delivered lectures on different aspects of Himalayan biodiversity. The webinar was inaugurated by Dr. Rajib Gogoi, Head, SHRC, BSI, Gangtok. Dr. A.A. Mao, Director, BSI delivered an introductory presentation on the topic ‗Himalayan Biodiversity Inventorization Utilization and Conservation-special emphasis to Eastern Himalaya'.

World Wildlife Day:

Organized the photography competition (in collaboration of ENVIS RP and AJCBIBG) on the occasion of World Wildlife Day on 3rd March, 2021.

Foundation Day Programme:

All the staffs of BSI, AZRC, Jodhpur attended the live session 132nd Foundation Day celebration of Botanical Survey of India on 13.02.2021.

All the staffs of BSI celebrated 132nd Foundation Day of Botanical Survey of India on 13th February, 2021 in Central National Herbarium, Howrah.

Hindi pakhwara:

Different regional centres including Headquarter of Botanical Survey of India celebrated Hindi pakhwara by arranging different competitions as extempore, essay writing, quiz, noting-drafting, translation etc. on 1st-15th September, 2020. To popularize rajbhasa Hindi among staffs of BSI, all the participants were felicitated on valedictory programme.

Miscellaneous:

Observed ‗Vigilance Awareness Week' from 27th October to 3rd November, 2020.

Organized the Fit India Freedom Run (run/ walk/ cycling) at different offices of BSI on 29th and 30th September, 2020 in which all the staffs (including outsourcing staffs) and scholars participated.

Organized the Fit India Plog (Running and Pick Litter) on 2nd October, 2020.

To commemorate the 151st Birth Anniversary of Mahatma Gandhi, ‗Swachh Bharat Abhiyan' was observed on October 2, 2020 during which Cleanliness drive was carried out in all the Offices of BSI.

All the offices of Botanical Survey of India organized 74th Independence Day Flag Hoisting on 15.08.2020.

BUDGET ESTIMATE
2020-21

Grant No. 25
3435- Ecology & Environment (Major Head)
01-Survey (Botanical) (Sub-Major Head)
01.001-Direction & Administration (Minor Head)
04-Attached/ Subordinate Offices (Sub Head)
04.01-Botanical Survey of India (Detailed Head)
Object Head

FY 2020-2021	REVISED BUDGET 2020-2021	Exp. Upto 1/4/2020 to 31/3/2021	Balance as per actual exp.	Percentage %
1- Salaries	450778000	450445355	332645	100
2 -Wages	25000	24590	410	98
3 - Overtime Allowances	20000	19131	869	96
5 - Rewards	0	0	0	#DIV/0!
6 - Medical Expenditure	3370000	3156975	213025	94
11 - Domestic Travel Expenses	1500000	1444806	55194	96
12 - Foreign Travel Expenses	0	0	0	-
13 - Office Expenses	42800000	42035222	764778	98
14 - Rents, Rates &Taxes	5500000	5459383	40617	99
16 - Publication	800000	797774	2226	100
20 - Other Administrative Expenses	110000	107796	2204	98
21 - Supplies & Materials	360000	357800	2200	99
26 - Advertising and Publicity	0	0	0	-
27 - Minor Works	34725000	34724399	601	100
28 - Professional Services	225000	224631	369	100
30 - Oth. Cont. Services	64976000	64657000	319000	100
31 - Grant-in-aid	568000	568050	-50	100
34 - Scholarship & Stipend	14500000	14325249	174751	99
Total - PLAN	**620257000**	**618348161**	**1908839**	100