भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

Botanical Survey of India

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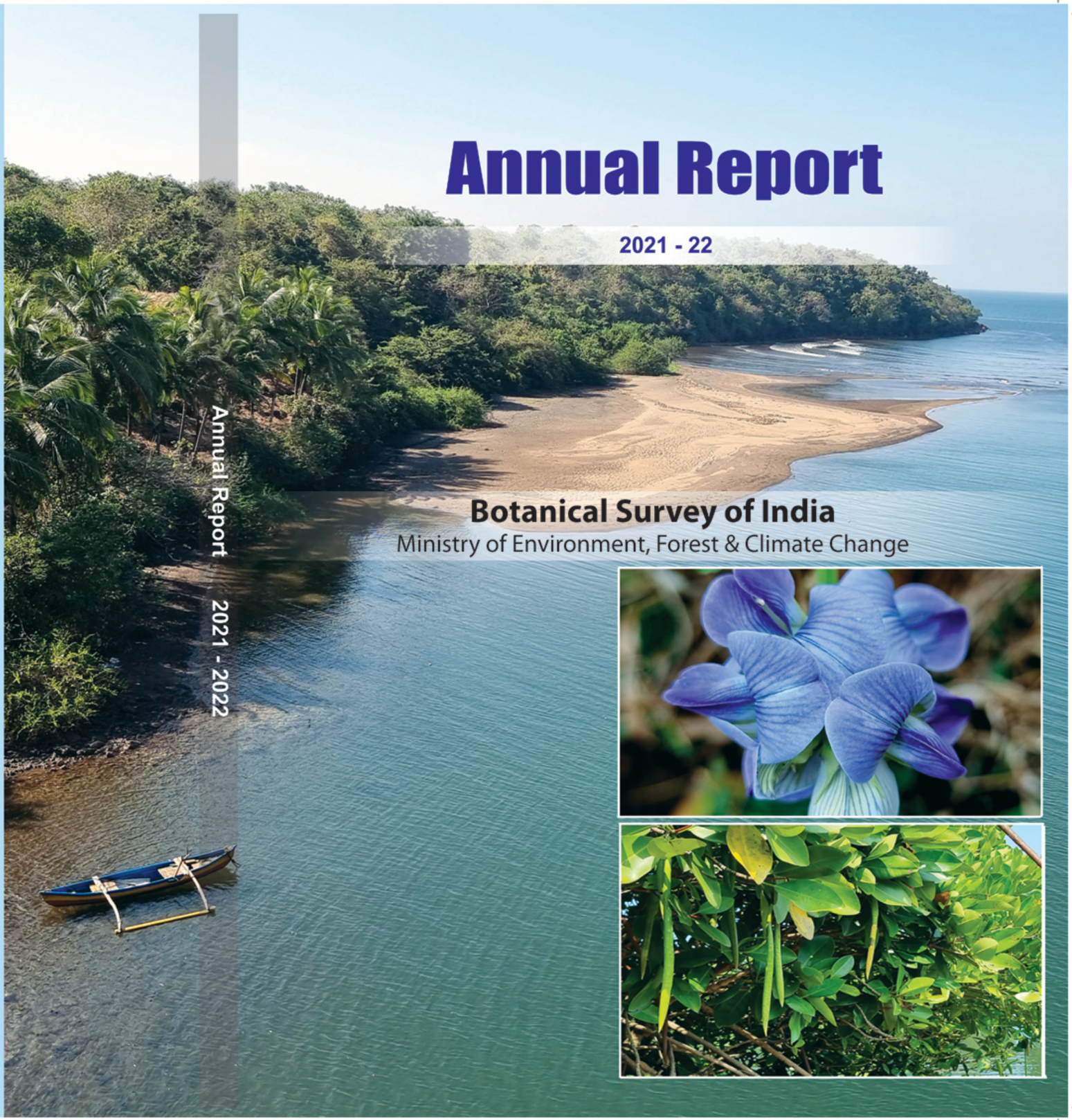

Annual Report

2021 - 22

Botanical Survey of India

Ministry of Environment, Forest & Climate Change

ANNUAL REPORT

2021-2022

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Ministry of Environment, Forest & Climate Change
Government of India

ANNUAL REPORT 2021-2022

Botanical Survey of India

Cover photo: Prashant K. Pusalkar

Acknowledgements
All Regional Centres of Botanical Survey of India

Published by
The Director
Botanical Survey of India
CGO Complex, 3rd MSO Building
Wing-F, 5th & 6th Floor
DF- Block, Sector-1, Salt Lake City
Kolkata-700 064 (West Bengal)
Website: http//bsi.gov.in

Printed at
Calcutta Repro Graphics
36/8B, Sahitya Parishad Street,Kolkata - 700006

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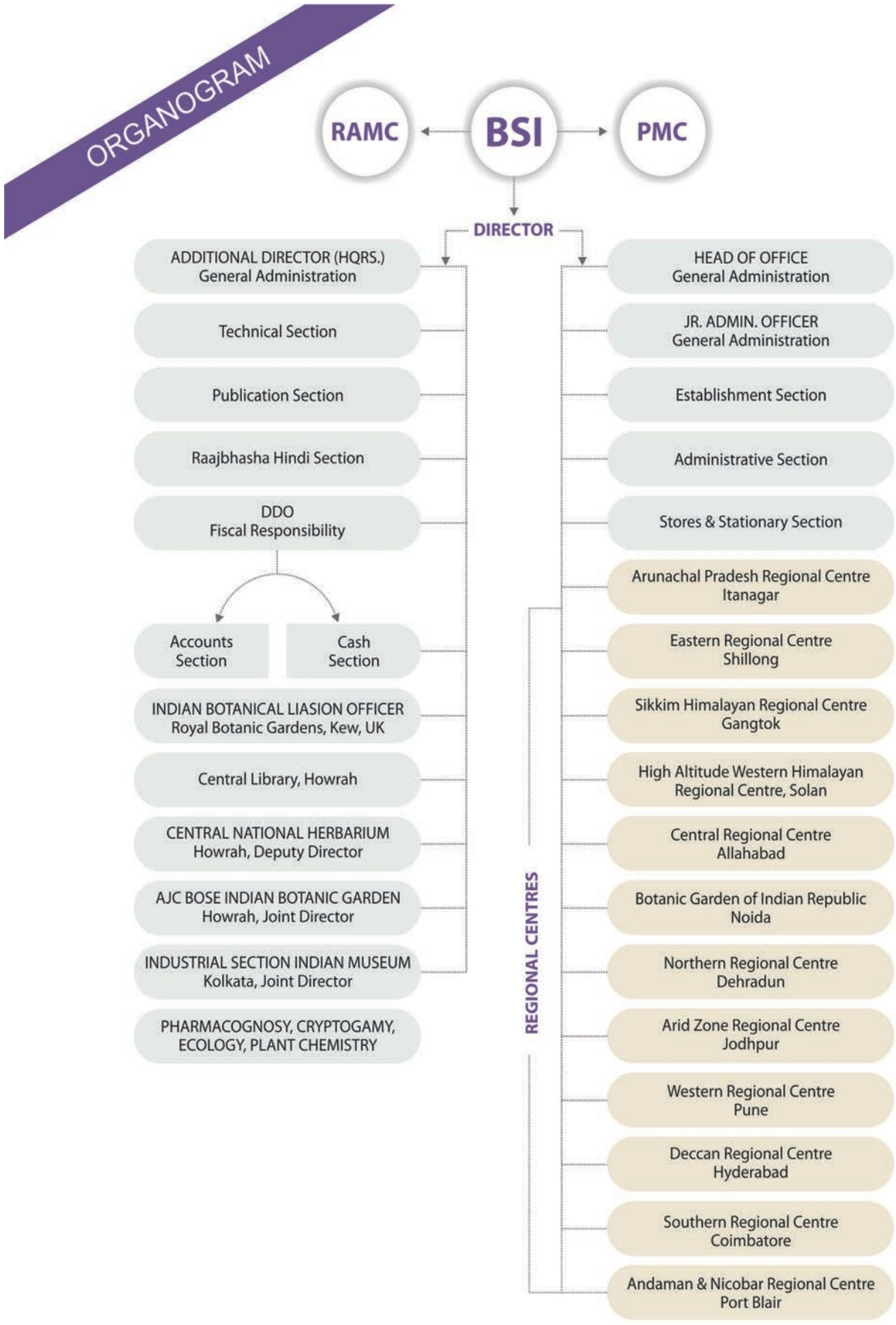
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Port Blair

FROM THE DIRECTOR'S DESK

A.A. Mao
Director, Botanical Survey of India

I am delighted to present the Annual Report of Botanical Survey of India for the year 2021-22. The report highlights the succinct description of all round achievements of the institute in the field of taxonomy, floristic research, biodiversity conservation, technological development, publication and many others.

During this year, scientists and staffs of BSI have carried out around 74 floristic expeditions (including several one day local tours) and 6 Herbarium Consultation tours under 64 Annual Action Plan projects to different phyto-geographic zones across India. These tours resulted in collection of a good number of plant specimens, of which most plant specimens have already been identified and preserved in the herbarium. Apart from floristic surveys, ethnobotanical and ecological studies, collection of live germplasm of rare, endangered, threatened, endemic and economically important plant species have also been done. Revisionary studies of Family Musaceae in Andaman & Nicobar Island, Pyrenulaceae and genus *Gastrochilus* D. Don, *Taraxacum* F.H. Wigg. were carried out. In ethnobotanical research extensive study was carried out in two tribes Tharu and Bhoxa of Uttarakhand. In this regard, ethnobotanically important plants were collected from Bhoxa villages and nearby forest areas of Udham Singh Nagar district, Uttarakhand. Currently BSI is engaged in survey, documentation and study of floristic diversity of 6 protected areas (2 National Park and 4 Wild Life Sanctuary) and 1 Ramsar Site. Not only angiosperms, BSI scientists are actively engaged in documentation of other plant groups such as Bryoflora of Jharkhand, Algal study of different area, Pteridophytes of India etc. In the field of mycology, study of Caterpillar fungi of Himalaya and Bambusicolous fungi of Goa are noteworthy. In keeping up with the recent trends, BSI is also focussing on molecular, phylogenetic and evolutionary studies. Importance was given in collection of RET plants and their ex-situ conservation in the experimental gardens of BSI. Apart from regular curatorial works, strength was also given in the herbarium digitization programme. This year a total of 244634 herbarium sheets were digitized.

During 2021-22, the scientists of BSI added 2 genus, 48 species, 2 varieties and 1 sub-species as new to science and 2 genus, 25 species, 1 variety and 1 sub-species as distributional novelties. Round the year perseverance of scientists of BSI is reflected through the publication of scientific articles in different national and international journals. This year BSI has achieved 301 research publications and 16 Hindi articles. The department published 17 books, 3 periodicals [Nelumbo (Vol 63, 2 issues and vol 64, 1 issue), Plant Discoveries 2021, Vanaspati Vani Vol 29] and Annual Report 2020-21.

BSI and its different regional centres have organized a number of outreach programmes, webinars, workshops, symposiums to disseminate knowledge and create awareness. Apart from this, scientists of BSI are active render of public services as reviewer of different journals, as supervisor of PhD and M.Sc. students, as different committee member, advisor etc.

This year BSI has celebrated 133rd Foundation day, on this occasion two days National webinar on 'Floristic Research in India, Contribution of BSI to the Nation: Present and Future' was organized on 13th and 14th February 2022. BSI also organized 10th RAMC meeting (Research Advisory and Monitoring Committee) at BGIR Noida from 20th and 21st September under chairmanship of Prof. A.K. Kaul. BSI and its all regional centres had organized Hindi Fortnight from 1st September to 15th September and Hindi Diwas on 14th September to promote Hindi as official language.

This year BSI has signed MoU with ICAR-NBPGR in order to exchange scientific research. BSI also released three websites for public reference viz. E-Archive website (https://archive.bsi.gov.in), E-Flora of India (8 volumes) and Plant checklist of India (https://efloraindia.bsi.gov.in).

A heartfelt congratulation to all my scientific and administrative colleagues for their much valued efforts, input, commitment and cooperation which ultimately reflects in the excellent performance and smooth running of the institute. I wish we continue to strive to fulfil our goals and maintain the eminence of this glorious institute.

(A. A. Mao)
Director

RESEARCH PROGRAMMES

भारतीय वनस्पति सर्वेक्षण

BOTANICAL SURVEY OF INDIA

AJC BOSE INDIAN BOTANIC GARDEN HOWRAH

PROJECT-1

Bryoflora of Jharkhand

Executing Scientist (s) : Dr. Devendra Singh
Date of initiation : 2018
Date of completion : 2022

OBJECTIVE: The main objective was to study Bryophyte diversity of the state of Jharkhand.

BACKGROUND: Field tour was undertaken in different areas of the state of Jharkhand during which specimens along with photographs of bryophytes were collected.

AREA AND LOCALITY: Jharkhand

SUMMARY & ACHIEVEMENTS: One field tour to Dalma Wildlife Sanctuary, Jharkhand was conducted and 66 specimens of Bryophytes were collected. 106 specimens of Bryophytes were collected from Jharkhand belonging to 16 families, 27 genera and 56 species. 27 species were illustrated/ microphotographed and described viz. *Anthoceros punctatus* L., *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., *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., *Funaria hygrometrica* Hedw., *Heteroscyphus hyalinus* (Steph.) Abha Srivast. & S.C. Srivast., *Hydrogonium gracilentum* (Mitt.) P.C. Chen, *Lejeunea devendrae* (Sushil K. Singh) P.K.Verma & K.K.Rawat, *Notothylas kashyapii* D.K.Singh, *Octoblepharrum albidum* Hedwig., *Plagiochasma appendiculatum* Lehm. & Lindenb., *Phaeoceros laevis* (L.) Prosk., *Riccia frostii* Austin, *Riccia huebeneriana* Lindenb.), *Riccia perssonii* Sultan Khan, *Riccia sorocarpa* Bisch., *Solenostoma tetragonum* (Lindenb.) R.M.Schust. ex Váňa & D.G. Long, *Targionia hypophylla* L.

PROJECT-2

Maintenance and development of Mangrove / Mangrove Associates in AJC Bose Indian Botanic Garden, Howrah.

Executing Scientist (s) : Dr. S.P. Panda, Dr. B.K. Singh & Sri Rahul Deb Barman
Date of initiation : 2021
Date to be completion : Ongoing

OBJECTIVE: The main objective was to maintain and develop Mangrove/Mangrove associates in AJC Bose Indian Botanic Garden, Howrah.

BACKGROUND: A thorough study of this species in India by assessing its morphological and ecological variations and examining the herbarium collections and literature in regional Centres of BSI and CAL is to be done for a re-assessment and re-validation study and as well as to clear the ambiguity on the species. Live plants, seeds, seedlings etc., of the variants are also to be collected, introduced and conserved in AJCBIBG for future reference and study.

AREA AND LOCALITY: The existing mangrove section along the river Hooghly in AJC Bose Indian Botanic Garden, Howrah.

SUMMARY & ACHIEVEMENTS: Growth and development of the existing mangrove and associated plants introduced along the garden riverfront were monitored and maintained by occasional de-weeding, removal of accumulated solid waste from the vicinity of the plant, providing support to tall and weak saplings, etc. It was observed that a good number of mangrove plant saplings had survived after the Amphan super

cyclone. It was found that *Heritiera fomes*, *Bruguiera gymnorrhiza*, *B. cylindrica*, *Excoecaria agallocha* etc. were responding better than other introduced species of mangroves. Saplings of *Rhizophora apiculata* were mostly damaged due to the overgrowth of weed species and insufficient tidal inundation. The growth rate was slow and it was quite natural in most of the mangrove species. Moreover, in this plantation zone, the water level was quite low with an insufficient range of salinity except during high tides in the rainy season and on the full moon and new moon days. Some of the saplings got damaged by the movement of pigs, fishing nets and solid debris floating in the tidal water. However, the main concern was the overgrowth of weeds especially *Derris trifoliata* and *Mikania micrantha* which were intermingling with the growing saplings. The unbranched, tall stem of species like *Rhizophora apiculata*, *Bruguiera gymnorrhiza* and *Bruguiera cylindrica* were prone to damage by excessive growth of weeds or any other physical injury. Around 80 seedlings/saplings of *Heritiera littoralis* Aiton and *H. macrophylla* Wall. ex Voigt. were collected from the natural regeneration in the garden and potted for ex-situ conservation. Germination trial was carried out from the seeds of *Kandelia candel* (L.) Druce & *Sonneratia alba* Sm. Quantitative assessment of mortality and survival rate of mangrove saplings can be estimated after the completion of de-weeding in this area.

PROJECT-3

Development and maintenance of aquatic plant section in AJCBIBG

Executing Scientist(s) : Dr. Devendra Singh, Dr. S.P. Panda, Dr. R. Saravanan & Ms. Titir Saha
Date of initiation : Ongoing
Date of completion : Ongoing

OBJECTIVE: The main objective of this project was to enrich the aquatic section with different species and cultivars of aquatic plants at the same time serving as an ex-situ conservatory of aquatic plant germplasm.

BACKGROUND: The aquatic plants being the primary provider of the aquatic ecosystem needs raised awareness and proper conservation which in turn would facilitate better management of the aquatic ecosystem.

AREA AND LOCALITY: AJCBIBG, Howrah

SUMMARY & ACHIEVEMENTS: Seeds of different cultivars of Lotus and Lilies including *Victoria cruziana* A.D. Orb. (Giant water lily), *Euryale ferox* Salisb., *Nelumbo nucifera* Gaertn., *Nelumbo lutea* (Willd.) Pers., *Ludwigia sedioides* (Humb. & Bonpl.), *H. Hara* and many other species of aquatic plants were collected and germinations were done successfully. Their growth and development were monitored regularly and efforts and care were taken for better development of the seedling into a full-fledged plant. Seeds of Lilies were collected from different AAP tours and put under germination and out of which maximum had germinated successfully and was made ready for transferring into the section of aquatic plants. During those tours live plants were also collected and kept alive in different lakes for afterward introduction in the aquatic plant section. Construction of Lily pool for growing Lotus and Lilies surrounded by small cemented tanks of 3.5 ft. diam. (20 nos.) were done. Growing other aquatic plants like *Aponogeton* sp., *Potamogeton* sp., *Najas* sp., *Wolffia* sp., *Nymphoides* sp. etc. for education, research and ex-situ conservation purposes was under progress and likely to be completed very soon. 20 water lily seedlings were collected from different sources and were made ready for introduction in the developing section of aquatic plants.

PROJECT-4

Curatorial work in the AJCBIBG

Executing Scientist (s) : Dr. Devendra Singh, Dr. S.P. Panda, Dr. R. Saravanan, Ms. Titir Saha, Dr. Arvind Parihar & Sri Arjun S.K.
Date of Initiation : Ongoing
Date of completion : Ongoing

OBJECTIVE: Introduction of plants in the garden for ex-situ conservation and collection of genetic resources for RET species.

BACKGROUND: Acharya Jagadish Chandra Bose Indian Botanical Garden (AJCBIBG) is located at Shivpur, Howrah. Commonly known as Calcutta Botanical Garden. Garden is spread across 109 hectare and exhibits a variety of rare plants and a total collection of more than 12,000 specimens.

AREA AND LOCALITY: AJCBIBG, Howrah

SUMMARY & ACHIEVEMENTS: Ex-Situ Conservation of various plant species by the collection of plant saplings and plantation in different divisions was done. 28 types of seeds of different endemic and economically important monocot and dicot plants were multiplied through seed germination. Plantation of different species (904 nos) was done in various divisions of the AJCBIBG namely Palmatum, Curator lawn, Charak Udyaan, Roystonea avenue, Palmyra avenue, near large palm house, lerum lake, Anderson avenue, Thompson avenue, Mahogany avenue, Div 1, 2, 4, 6, 19 & 22. Two *Cinchona* sp. saplings were collected from Prof. Dr. Stephen Cheriyil, Director & Managing Editor of CMRA (Centre for Multidisciplinary Research and Action) planted in pots in the Curatorial wing and were regularly taken care of. Later they were shifted to Plant Introduction Section for better care. Cuttings of 7 different varieties of *Bougainvillea* sp (Number of total cuttings-77) were transplanted in Glasshouse of Nursery-I under the supervision of Dr. R. Saravanan, Botanist, AJCBIBG. The names of the varieties are *Bougainvillea* 'Aruna', *Bougainvillea* 'Dr. P. V. Sane', *Bougainvillea* 'Poultoni Special', *Bougainvillea* 'Pixie Variegata', *Bougainvillea* 'Dr. H.B. Singh', *Bougainvillea* 'Splendens', *Bougainvillea* 'Spring Festival'. Development of a new Bougainvillea section near Rosarium is under process. Different cultivars (ca. 90) of Bougainvilleas have already been introduced. Proper labeling of palm species growing in the garden was taken on priority and completed successfully. Renovation of the Canna Section was done which was earlier in a bad shape. Under this program 60 beds in the Canna section were renovated and proper and timely manuring was done which resulted in better growth of the plants and also profuse flowering. Plants in all beds were replanted after the removal of the old roots, damaged rhizomes etc. The lawns in between the beds were maintained properly and thoroughly to make them attractive for the visitors. This section is now well flourished with 20 different colours of cannas. A new section for Gingers was developed with 38 species collected and introduced from different areas mostly from Andaman & Nicobar Islands and Shillong. Utmost care was taken to maintain and conserve these germplasm collections of gingers for the future. A new section exclusively dedicated to the germplasm collection as well as conservation of wild-growing Musa species was developed just back to the rosarium. This section housed 160 plants belonging to 08 species. The main target was to grow all Musa species which were growing scarily all over the garden in one place along with the collection and subsequent introduction of Musa species from all over the country. Cleaning of the various divisions, Palmatum, Bambusetum were completed which was badly damaged due to super cyclone 'Amphan'. Cleaning of AGCBIBG lakes were also done.

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORT BLAIR

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 : 2020

Date to be completion : 2022

OBJECTIVE: To document all the species of family Musaceae and preparation of consolidated account of the family along with their distribution status.

Musa Section at DEGCA

BACKGROUND: 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 *et al.* and *M. balbisiana* Colla var. *andamanica* Singh *et al.* from Andaman and Nicobar Islands. Systematics in the genus *Musa* has been believed as much complex and need a thorough investigation. 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 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 & ACHIEVEMENTS: Three field tours to the different geographical areas of Andaman and Nicobar Islands were conducted and 46 field numbers of specimens were collected along with the GPS details, examined, characterized morphologically and identified. 27 herbarium specimens of Genus *Musa* were examined and identified. All the identified/ determinavited specimens were incorporated into the herbarium (PBL). An overview of the diversity of Musaceae with their salient features, range of distribution, threats and conservation status was recorded in great detail. The genus Musa was reviewed for Andaman and Nicobar Islands in great detail for the first time based on a study of type specimens, live specimens, largely on field observations in type locality along with other authentic herbarium materials, relevant literature and molecular analyses (molecular data, DNA sequence data (ITS, trnL-F). The study recognized 06 species under the genus *Musa* of the family Musaceae in the Andaman and Nicobar and included four wild species namely *M. acuminata* Colla., *M. balbisiana* Colla., *M. indandamanensis* L. J. Singh, *M. paramjitiana* L. J. Singh, and two cultivated species i.e., *M. paradisiaca* L. and *M. textilis* Nees. The conservation status of wild *Musa* spp. in Andaman & Nicobar Islands, India were assessed and documented in detail for the first time. Wild germplasm of 03 species of *Musa* (*Musa acuminate*, *Musa balbisiana* and *Musa indandamanensis*) was collected and introduced in the Garden as a part of ex-situ conservation. Besides, the germplasm of 11 species of Rare & threatened and endemic plants were collected and introduced

into the garden. A wild banana conservatory section at Dhanikhari Experimental Garden cum Arboretum (DEGCA) was also established.

Musa indandamansis L.J. Singh

Musa indandamansis L.J. Singh

PROJECT – 2

Curatorial work at Botanic Garden (Multiplication and Nursery development of Bamboos, Palms, Zingibers, Endemic tree species) of Andaman & Nicobar Islands at Dhanikhari Exp. Garden cum Arboretum

Executing Scientist (s) : Dr. Chandan Singh Purohit & Dr. Vivek C.P.
Date of initiation : 2019
Date of completion : 2022

OBJECTIVE: Introduction of plants in the garden for ex-situ conservation and collection of genetic resources for RET species.

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

SUMMARY & ACHIEVEMENTS: A total of four field exploration tours were conducted in areas of North Andaman, Middle Andaman, South Andaman and Nicobar Islands between 2019 to 2022 and collected seedlings and seeds of selected 37 plant species belonging to Bamboos, Palms, Zingibers, and Endemic tree species of the Andaman and Nicobar Islands including IUCN Red Listed - Critically Endangered (CR) plant species-*Mimusops andamanensis* King & Gamble, Endangered (EN) plant species-*Bentinckia nicobarica* (Kurz) Becc., Vulnerable (VU) plant species-*Pterocarpus dalbergioides* Roxb. ex DC. and *Myristica andamanica* Hook.f., and Near Threatened (NT) plant species-*Mangifera andamanica* King and *Phoenix paludosa* Roxb and raised at Dhanikhari Botanical Garden. The growth behavioral pattern of 12 endemic tree species (height & number of leaves initiation/leaf fall) in relation to temperature, rainfall and humidity was also studied. Also, distribution maps of 20 endemic plant species were prepared and a Palmetum Section at Dhanikhari Experimental Garden cum Arboretum was developed.

Grewia calophylla Kurz seed sowing at nursery

PROJECT-3

Conservation Assessment, ENM studies including GIS mapping of Endemic trees of Andaman & Nicobar Islands (at least 50 trees species)

Executing Scientist(s) : Dr. Chandan Singh Purohit, Dr. Lal Ji Singh, Dr. Vivek C.P & Shri Bishnu Charan Dey
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: Mapping of 50 Endemic trees of Andaman & Nicobar Islands.

BACKGROUND: Andaman & Nicobar Islands support very luxuriant and rich vegetation due to tropical hot and humid climate with

abundant rains. Nature has provided these islands with a unique and varied flora and fauna in a total area of 8,249 Sq. Km, of which an area of 7,170.69 km2 are conserved as forests. Currently, the Andaman and Nicobar Islands are known to harbor 2650 species of plants (Pandey & Diwakar 2008). The degree of endemism in the Islands is estimated to be ca 10 % of the total flora (Singh *et al.*, 2014; Murugan *et al.*, 2016) i.e. 315 species belonging to 187 genera under 74 families. A total of 432 endemic taxa including three endemic genera (Nicobariodendron, Pseudodiplospora and Sphyranthera) within a small geographical area is a significant in terms of plant genetic diversity of the Islands.

The current project aims the conservation assessment and GIS mapping of endemic tree species of the islands.

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

SUMMARY & ACHIEVEMENTS: Two field tours were conducted so far to Middle Andaman from 07.12.2021 and 16.12.2021 and to Little Andaman from 17.03.2022 to 23.03.2022 and 1,372 seeds/seedlings/cuttings/bulbils etc. of the 40 plant species were collected during the field trips and introduced in the nursery of Botanical Garden. During the field survey, total 18 Endemic tree species i.e. *Bombax insigne* Wall., *Dillenia andamanica* C.E. Parkinson, *Diospyros marmorata* R. Parker, *Garcinia andamanica* King, *Goniothalamus macranthus* (Kurz) Boerl., *Grewia calophylla* Kurz ex Mast., Knema andamanica (Warb.) W.J. de Wilde, *Lagerstroemia hypoleuca* Kurz, *Magnolia andamanica* (King) D.C.S. Raju & M.P. Nayar; *Mesua manii* (King) Kosterm., *Mimusops andamanensis* King & Gamble, *Myristica andamanica* Hook.f., *Orophea katschallica* Kurz,, *Pandanus leram* Jones ex Voigt, *Psychotria pendula* Hook.f., *Pterocarpus dalbergioides* Roxb. ex DC., *Pubistylus andamanensis* Thoth., *Semecarpus kurzii* Engl. were located and recorded from the study area.

Bombax insigne Wall.

ARID ZONE REGIONAL CENTRE JODHPUR

PROJECT-1

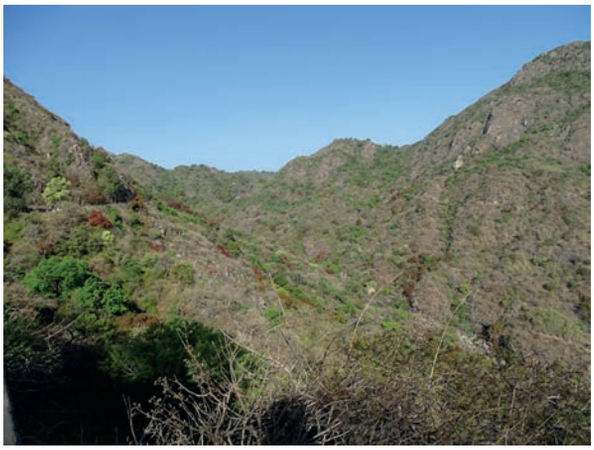
Flora of Mount Abu Wildlife Sanctuary, Rajasthan (India)

Executing Scientist (s) : Dr. Sanjay Mishra & Dr. S.L. Meena.

Date of initiation : 2021

Date of completion : 2023

OBJECTIVE: The main objective was to complete floristic study of the protected area which will eventually provide insights into the composition of the forest and form a basis for monitoring changes in the floristic diversity of Mount Abu WLS.



Panoramic views of Mixed Dry Deciduous forest of Mt. Abu WLS

Crateva adansonii subsp. odora (Buch.-Ham.) Jacobs

Vallaris solanacea (Roth) Kuntze

BACKGROUND: Mount Abu Wildlife Sanctuary spreads out into a plateau which is about 288 km² and altitude ranges from 300–1,722 m. Guru Shikhar is the highest peak in Rajasthan. It is very rich in floral bio-diversity starting from xenomorphic sub-tropical thorn forests in the foot hills to sub-tropical evergreen forests along PRIYEN water courses and valleys at higher altitudes.

AREA AND LOCALITY: 112.98 sq. km.

SUMMARY AND ACHIEVEMENT: Two botanical exploration tours to Mt. Abu Wildlife

Sanctuary were conducted from 29.12.2021 to 07.01.2022 (Q3-first tour) & 25.03.2022 to 04.04.2022 (Q4-second tour) and 433 field nos. comprising to 866 specimens were collected. Documentation of altitudinal range, latitude and longitude etc. of the explored area was done with GPS. 270 No. of species from the first tour were identified by comparing with the description available in literature and authenticated or by comparing Type specimen available in Indian as well as in foreign herbaria. Taxonomic description of 142 species were documented. Photographic documentation of the collected plants was done along with the landscape of the Sanctuary. More than 400 photographs of plants and landscape was taken. Seeds/seedlings of 42 species were collected from the forest and introduced in Desert Botanic Garden for *ex-situ* conservation.

Erythrina suberosa Roxb.

Firmiana colorata (Roxb.) R.Br.

PROJECT-2

Curatorial work at herbarium and digitization of herbarium specimens

Executing Scientist (s) : Dr. S.L. Meena, Dr. M.K. Singhadiya, Shri Ravi Prasad, Shri Ramesh Kumar & Shri Amit Kumar

Date of initiation : Ongoing

Date to be completion : Ongoing

OBJECTIVE: Digitization of herbarium specimens.

SUMMARY AND ACHIEVEMENT: As part of the digitization of herbarium specimens of BSJO, Metadata of 29189 herbarium specimens were prepared comprising all the major details of the herbarium sheet as per the standard format of BSI. 517 old unidentified specimens of herbarium were identified. 35 herbarium sheets of Type specimens were fully digitized.

PROJECT-3

Curatorial work at Botanic Garden of AZRC, Jodhpur

Executing Scientist (s) : Dr. S.L. Meena & Dr. Sanjay Mishra

Date of initiation : Ongoing

Date of completion : Ongoing

Gmelima arborea Roxb. ex Sm.

OBJECTIVE: The main objective of the project is the collection of RET and economically important species germplasm and their introduction in the

experimental garden for ex-situ Conservation and documentation of phenological data of plants growing in Desert Botanic Garden.

Asparagus racemosus Willd.

BACKGROUND: The experimental Botanic Garden (Desert Botanical Garden) of AZRC was established during 1994 with an area of c. 8 acres for the maintenance of arid germplasm, collection, growing and multiplication of rare / endemic/ endangered / threatened/ medicinal/ economically important and other plant species of North-western arid regions of India, with special focus on Rajasthan and Gujarat state. At present, about 300 species of vascular plants of various categories are conserved in the garden.

Anogeissus sericea Brandis var. *nummularia* King ex Duthie

SUMMARY AND ACHIEVEMENT: Day-to-day monitoring, management and developmental activities of the Desert Botanic garden were carried out and different theme-based sections were established in the garden. De-weeding, leveling, cleaning and beautification of 1.5 Acre area was done for the development of new sections. Fruits/ seeds of 06 Spp. (*Anogeissus sericea* Brandis *var. nummularia* King ex Duthie (50 nos.), *Commiphora wightii* (Arn.) Bhandari (50 nos.), *Senegalia senegal* (L.) Britton (50 nos.), *Dichrostachys cinerea* (L.) Wight & Arn. (30 nos.) and *Solanum virginianum* L. (50 nos.)) were collected for further multiplication. Nursery of 10 Spp. had been prepared; 20 Spp. (*Agave americana* L. (01 no.), *Agave angustifolia* Haw. (01 no.), *Albizia lebbeck* (L.) Benth. (01 no.), *Barleria acanthoides* Vahl (05 no.), *Boerhavia diffusa* L. (20 no.), *Caralluma edulis* (Edgew.) Benth. ex Hook.f. (01 no.), *Caralluma fimbriata* Wall. (01 no.), *Cassia fistula* L. (01 no.), *Cynanchum acidum* (Roxb.) Oken (05 no.), *Elaeocarpus ganitrus* Roxb. (01 no.), *Euphorbia caducifolia* Haines (01 no.), Fern (05 nos.), *Ipomoea pes-caprae* (L.) R. Br. (10 no.), *Mimosa pudica* L. (20 no.), *Moringa concanensis* Nimmo ex Dalzell & A. Gibson (05 no.), *Pedalium murex* L. (15 no.), *Phyllanthus amarus* Schumach. & Thonn. (20 nos.), *Plumbago zeylanica* L. (05 no.), *Ruellia longifolia* Rich. (05 no.) and *Senegalia senegal* (L.) Britton (01 no.)) were introduced in the Medicinal plant section; 08 Spp. (*Bothriochloa pertusa* (L.) *A. Camus*, *Cenchrus pennisetiformis* Steud., *Cymbopogon jwarancusa* (Jones) Schult., *Desmostachya bipinnata* (L.) Stapf., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult, Ochthochloa sp., *Oropetium thomaeum* (L.f.) Trin. and *Saccharum officinarum* L.) were introduced in the grass section and another 17 Spp. (*Anogeissus sericea* Brandis var. *nummularia* King ex Duthie (50 nos.), *Bauhinia racemosa* Vahl (20 nos.), *Bougainvillea* sp.- orange (50 nos.), *Bougainvillea* sp. - red (50 nos.), *Cadaba fruticosa* (L.) Druce (20 nos.), *Cascabela thevetia* (L.) Lippold (50 nos.), *Cassia fistula* L. (30 nos.), *Commiphora wightii* (Arn.) Bhandari (110 nos.), *Dolichandrone falcata* (Wall. ex DC.) Seem. (20 nos.), *Duranta erecta* L. (50 nos.), *Eriolaena hookeriana* Wight

& Arn. (30 nos.), *Euphorbia jodhpurensis* Blatt. & Hallb. (10 nos.), *Ficus carica* L. (50 nos.), *Mitragyna parvifolia* (Roxb.) Korth. (20 nos.), *Morus alba* L. (50 nos.), *Vitex negundo* L. (50 nos.), *Withania coagulans* (Stocks) Dunal (20 nos.)) were multiplied by cutting/ seed germination. A gymnosperm section had been developed in the garden. A new nursery had been established in the Botanic Garden. 751 plant saplings were distributed to different organizations/ the general public.

Millettia peguensis Ali

Caralluma fimbriata Wall.

ARUNACHAL PRADESH REGIONAL CENTRE ITANAGAR

PROJECT-1

Pteridophytic Flora of India, vol. 1
Executing Scientist(s) : Dr V. K. Rawat
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: The main objective was the description and illustration of pteridophytes and preparation of map though GIS.

Aleuritopteris formosana Hayata

BACKGROUND: Pteridophytes, the first group of spores-bearing vascular plants including ferns and fern allies, are adapted to a wide variety of habitats. As per the latest estimate India has about 1200 taxa under 130 genera belonging to 34 families. The pteridophyte hotspots in India are the Himalayas, Western Ghats, Eastern Ghats, Central India, and Andaman and the Nicobar Islands. Fern and fern allies can be seen in humid and shady places. The common types of forests that act as habitats for pteridophytes are tropical, subtropical and moist deciduous forests. Geographically ferns can be seen from sea level to the highest mountains. Fern and fern allies are highly sensitive to changes in their natural habitat, thus habitat destruction, anthropogenic influences, climate change, etc., are causing a fast decline in their population. Considering the constant anthropogenic pressure on their habitat, it is felt necessary to bring out the entire pteridophytic flora of the country in one comprehensive documentative form as "The Pteridophytic flora of India" which will be published in 4 Volumes. For the First Volume, the families Pteridaceae, Ophioglossaceae and Selaginellaceae have been allotted, which has to be completed by March 2023.

Onychium siliculosum (Desv.) C.Chr.

AREA AND LOCALITY: India

Adiantum phillippense L.

SUMMARY AND ACHIEVEMENTS: The project was started in 2021. During the previous year, 210 species under 23 genera from Pteridaceae, Selaginellaceae and Ophioglossaceae were described along with a proper citation, habit, habitat, distribution and taxonomical note. Microscopic studies were done of all 210 species to know the morpho-taxonomic status and proper identification. The details of described species under the genera are represented as follows- *Acrostichum* L. (2 spp.), *Actiniopteris* Link (1 sp.), *Adiantum* L. (26 spp.), *Aleuritopteris* Fee (19 spp.), *Anogramma* Link (2 spp.), *Ceratopteris* Brongn. (4 spp.), *Cerosora* (Baker) Domin (1 sp.), *Coniogranune* Fee (7 spp.), *Cryptogramma* R.Br. (2 spp.), *Doryopteris* J.Sm. (2 spp.), *Mickelopteris* Fraser-Jenk. (1 sp.), *Notholaena* R.Br. (7 spp.), *Oeosporangium* Vis. (14 spp.), *Onychium* Kaulf. (8 spp.), *Pellaea* Link (4 spp.), *Pityrogramma* Link (2 spp.), *Pteris* L. (64 spp.), *Syngramma* J. Sm. (1 sp.), *Taenitis* Willd. ex Schkuhr (2 spp.); *Selaginella* P. Beauv. (1 Genus: 21 spp.); *Ophioglossum* (3 Genus: 20 species). During this period 4 scientific papers were published and 2 new records for state and 1 new record from India were reported. In addition to the above, 21 live plants of fern species were conserved in the campus.

Coniogramme serrulata (Blume) Fee

PROJECT-2

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

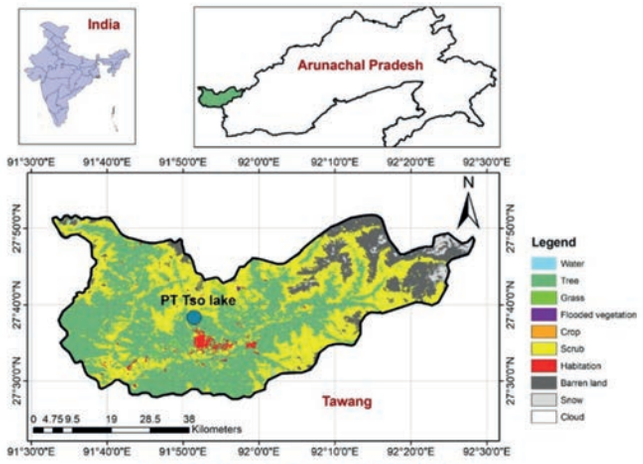
Executing Scientist(s) : Dr. M. R. Debta
Date of initiation : 2020
Date of completion : 2023

OBJECTIVE: To study phyto-taxonomy of selected High-Altitude Wetlands (HAWs) and its environs representing 5 districts of Arunachal Pradesh.

BACKGROUND: Arunachal Pradesh, a mountainous state of India spreading over 83,743 km2 area and well recognized for its diverse and affluent floral wealth, is an integral part of the Himalayas- a global biodiversity hotspot. The edaphic factors, diverse altitudinal and topographic terrain ranging from tropical grasslands to arctic-alpine or trans-Himalayan glacial moraines passing through the humid greater Himalayan ranges and variable forest ecosystems accommodate a lot of inland water bodies, marshy lands, broad riverine systems forming excellent biomes for the sustenance of varied life forms. Wetlands play a significant role in the functioning of terrestrial ecosystems. India is

a host of a great number of wetlands located throughout the country, a great majority of those are in the Himalayas. High Altitude Wetlands (HAWs) are water bodies found in upper temperate and alpine regions that are fed by glaciers or melting snow and change in their structure and blasts could affect millions. Most of these wetland complexes support a rich diversity of flora in the catchment areas which in turn are providing suitable habitat for rare and threatened high-altitude fauna like red panda (*Ailurus fulgens*), takin (*Budorcas taxicolor*), red goral (*Naemorhedus baileyi*), snow leopard (*Panthera uncia*), musk deer (*Moschus chrysogaster*) etc. However, these fragile HAWs are threatened by the changing climate and relentless anthropogenic pressure. Environmental variability in terms of climatic factors, geo-resources, and biotic interference regulate the spatial and temporal patterns of the vegetation of such an ecosystem. Therefore, it is of paramount importance to study and document the phyto-diversity of such high altitudes wetlands for enhanced research understanding as well as to regulate management priorities.

AREA AND LOCALITY: Penga Teng Tso lake, Tawang district; Thang Tsang wetland, West Kameng district.



Grid map of Tawang district showing PT Tso lake

SUMMARY AND ACHIEVEMENTS: 176 taxa were added to the earlier checklist and final taxonomic documentation of 123 taxa was prepared. One Field survey tour was conducted to two HAWs of Arunachal Pradesh during which 570 specimens were collected and 103 species were identified. One Herbarium Consultation tour was conducted to ASSAM, Shillong and exsiccatae of 101 taxa were prepared which were occurring in a high altitude wetland area near Sela top, Tawang but not exactly from the study areas. These taxa were noted considering they are supposed to occur in selected wetlands of this project since Sela top shares affinity in altitude, topographic terrain and eco-climatic zones with the others.

Cyananthus lobatus

Bistorta vivipara

Meconopsis aculeata

Gentiana elwesii

A checklist of 245 taxa was prepared from the high-altitude wetlands of Arunachal Pradesh based on herbarium and literature scrutiny. During the study, it was found that seldom any collector had gone to those areas for plant survey resulting in scanty herbarium and literature records. Grid maps were made using the ArcGIS software for two surveyed wetlands of West Kameng and Tawang districts. Ten photo plates were prepared to depict 80 species from these areas. Literary scrutiny and microscopic studies revealed a few taxonomically interesting specimens which are under further scientific investigation to bring out a contribution in the form of scientific novelty and new records.

PROJECT-3

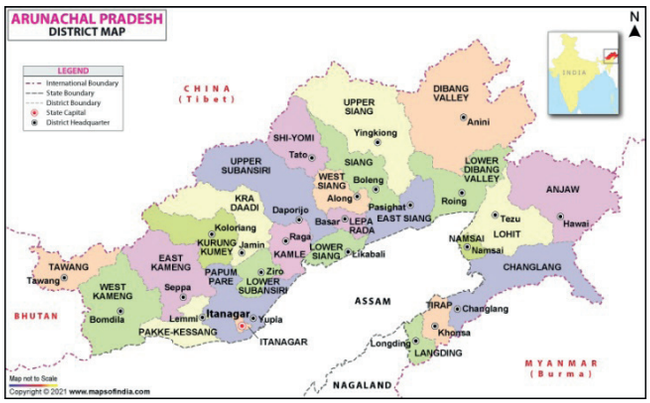
Enumeration of RET specimens of Arunachal Pradesh

Executing scientist (s) : Dr. K. Chowlu
Date of initiation : 2020
Date of completion : 2022

OBJECTIVE: Enumeration of RET species of Arunachal Pradesh.

BACKGROUND: Arunachal Pradesh is the largest state in Northeast India and every year many new species and new reports keep added so additions need to be compiled in a format and also their status needs to be recorded. So the RET status of the species in its present condition in the state should be known and properly compiled.

AREA AND LOCALITY: Arunachal Pradesh



SUMMARY AND ACHIEVEMENTS: The vegetation of Arunachal Pradesh falls under four broad climatic categories and can be classified into five broad forest types with a sixth type of secondary forest. These are tropical forests, subtropical forests, pine forests, temperate forests and alpine forests. In the degraded forest bamboo and other grasses is a common occurrence. For the annual action plan, all the possible literature available so far from

Arunachal Pradesh was consulted. Plants Extinct and Possibly/Presumed Extinct was Vanda coerulea (Orchidaceae) likewise all the possible list was prepared. Literature was studied and RET species of Arunachal Pradesh were compiled. 297 species were compiled under 182 genera. Out of 297 species, 75 were Critically Endangered, 106 were Endangered, 27 Vulnerable, 84 were Near Threatened and 5 were least concerned. From the tours conducted in different places of Arunachal Pradesh, one new sub-species was reported from Pakke Kesang and one rediscovery after 100 years got published from Anjaw district.

Lysionotus metuoensis Chowlu & G. Krishna

PROJECT-4

Curatorial work at Botanic Garden of BSI, APRC, Itanagar

Executing scientist (s) : Dr. R. Daimary
Date of initiation : 2021
Date of completion : Ongoing

OBJECTIVE: The primary objective of the project is to document all the live plant species available in the garden. Besides, phenological studies of the plants, regular maintenance of the garden is another objective of the project.

BACKGROUND: Botanical Survey of India, Arunachal Pradesh Regional Centre, Itanagar is having one botanical garden for ex-situ conservation of RET, endemic and economically important plant species of the state of Arunachal Pradesh. The state is known as biodiversity hotspot as regards to floristic diversity. Therefore, conservation of plant wealth of the state is necessary which will be a good resource for the scientists and researchers. The live plant species are collected by the scientists, research scholars from different parts of the state of Arunachal Pradesh during their field tours and conserved in the garden.

Globba racemosa Sm.

AREA AND LOCALITY: Arunachal Pradesh

ACHIEVEMENTS: 30 plant species available in botanical garden, BSI, APRC were identified and documented viz. *Ageratum conyzoides, Baliospermum calycinum, Begonia hatacoa, Begonia roxburghii, Bridelia assamica, Casearia vareca, Costuslacerus, Debregeasia dentata, Dendrobium aphyllum, Drymaria cordata, Elatostema lineaolatum, Houttynia cordata, Lagerstroemia speciosa, Lasia spinosa, Mesua ferrea, Phlogacanthus curviflorus, Phrynium pubinerve, Plantago erosa, Pothos scandens, Spilanthes paniculata, Oroxylum indicum, Rubia cordifolia, Saurauia punduana, Solanum khasianum, Spilanthes acmella, Stixis suaveolens, Terminalia arjuna, Thelypteris dentate, Tinospora cordifolia, Zanthoxylum rhetsa. Also 20 Live plant saplings were introduced at Botanic Garden, BSI, APRC viz. Pterocarpus santalinus, Azadirachta indica, Delonix regia, Cinnamomum verum, Mimusops elengi, Phyllanthus emblica, Magnolia champaca, Chukrasia tabularis, Aquilaria malaccensis, Dipterocarpus retusus, Swietenia mahagoni, Phoebe goalparensis, Polyalthia longifolia, Syzygiumcumini, Morus alba, Prunus pensylvanica, Citrus sinensis, Pyrus pyrifolia, Malus pumila, Citrus medica.*

BOTANIC GARDEN OF INDIAN REPUBLIC NOIDA

PROJECT-1

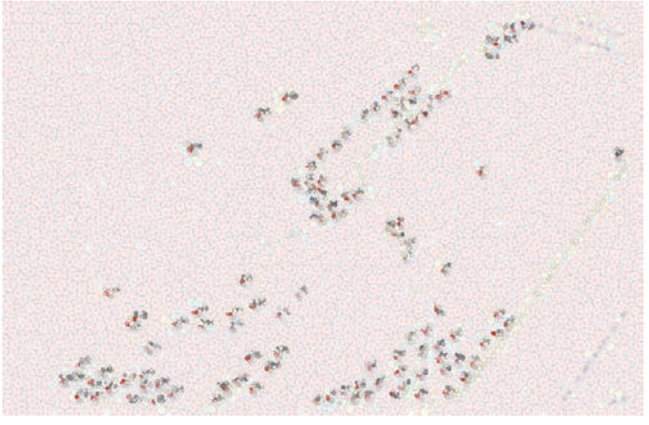
Mass Germination and Multiplication of Horticulture and Ornamental plant /Seasonal flowers in BGIR Noida

Executing Scientist (s) : Dr. Sandeep Kr. Chauhan
Date of initiation : 2021
Date to be completion : Ongoing

OBJECTIVE: The objectives of this project were as follows 1) to establish a Germplasm centre of Medicinal plants at BGIR, Noida for displays and awareness. 2) QR/Bar coding of the endemic plants in different plant Sections of BGIR Noida. 3) Collection of plants from the different Regional Centres of BSI, Botanic Gardens, Forest Dept and their introduction in BGIR Noida to eventually set up Seed bank, Tissue culture lab, plant conservatories and a Bio Composting /Vermicomposting unit. 4) The overall Maintenance and development of the different horticulture landscape sections were also done.

BACKGROUND: Plants were collected for introduction in BGIR and almost all introduced/ conserved plants were maintained with assistance of outsourced services and scientific staff by exercising de-weeding, mowing, hoeing, irrigation, etc.

ACHIEVEMENTS: About 300 Medicinal plant Germplasm centre was established in BGIR for display and awareness. Total 131 medicinal plant spp. maintained in the Ayur vatika section, and tagged with accepted names. All gabions were maintained and strengthened properly by addition of new seedling /saplings. Five species were introduced in Medicinal Section, *Alternanthera pungens* Kunth (Khaki), *Bacopa monnieri* (L.) Wettst. (Brahmi), *Cyanthillium cinereum* (L.) H. Rob (Sahadevi), *Sida cordata* (Burm.f.) Borss.Waalk. (Bhuinii) and *Solanum nigrum* L. (Makoi or Bhatkoia) by bringing them from different locations (aquatic and terrestrial areas) of BGIR.15 plant spp. (323 saplings) collected and introduced for strengthening of medicinal plant sections of BGIR i.e. : *Ipomoea indica, Ipomoea purpurea, Camellia japonica, Philodendron* (2 saplings), *Paphiopedilum insigne* (3 saplings), *Allamanda cathartica* (30 saplings), *Tarlmounia elliptica* (30 saplings), *Mansoaalliacea* (30 saplings), *Conocarpus* sp. (100 saplings), *Combretum indicum* (30 saplings), *Jasminum sambac* (30 saplings), *Jasminum auriculatum* (30 saplings), *Jasminum* sp. (Chameli 30 saplings), Sukh Shanti Plant (30 saplings), *Vanda tessalata* (5 saplings). QR/Bar coding of endemic plants in different plant Sections of BGIR Noida were done and all the plants have been digitized using DGPS & TOTAL STATION FOR GEO-COORDINATING TREES AND SHRUBS AT BGIR.



Also physical verification of the plants has been completed in all the sections. Different horticultural landscape section of BGIR Noida were developed and maintained. Throughout the year major focus was given on overall maintenance and development of all thematic sections especially the arboretum, 8 forest zones, economic plant species sections, medicinal plant sections and fruit section. Integrated Silvi-Horti intercultural practices such as integrated disease management, irrigation, weeding-hoeing /cleaning/ Training and

Pruning operation were performed time to time. Termites infestation was reduced to zero damage by application of drench irrigation and flood irrigation *vis a vis* application of Tricil. Efforts were centralized on reducing the weeds threshold to minimum by weedicide application time to time. New seed bank nursery was developed for conservation of plant propagules/seeds /stocks produced by seed bank lab. Leaf composting techniques were strengthened to enhance the soil organic content matter.

56 winter seasonal ornamental flowering varieties and 34 summer seasonal ornamental flowers were propagated through conventional methods. Hedges such as *Havelia, Tecoma, Bougeinvila*, *Duranta, Inermis, Barleria* were propagated in bulk and accordingly planted in entire road side network of BGIR. Ornamental plant nursery was established with annual production of about 4500 saplings of *Tecoma, Bouganvila, Ficus, Havelia, Duranata, Plumeria alba*. Plants were collected from different Regional Centres of BSI and Forest Departments and placed in respective zones and conservatories for conservation, acclimatization and growth :

Sr No	Number of plant species	Total no of plants	Centre collected
1	28	302	BSI Dehradun
2	47	1122	BSI Shillong
3	21	2021	BSI Jodhpur
4	12	3460	BSI Pune
5	5	24	BSI Hyderabad
6	28	592	BSI Coimbatore
6	31	260	BSI Arunachal Pradesh
7	18	2400	Forest Dept., Delhi
8	15	3000	Forest Dept., Noida
9	15	1500	Local Nurseries, Noida
	220	**13181**	

Xerophytic plants *viz. Crassula ovata* (Gollum), *Crassula ovata* (Crosbys compact), *Crassula ovata* (Obliqua), *Echeveria* Grus, *Echeveria Green* Prince, *Echeveria Green* Valvet, *Echeveria hookerii, Echeveria agavoides*, *Echeveria Blue* Star, *Echeveria elegance*, *Echeveria derenbergii*, *Anacampseros, Senecio* (Sting of pearls), *Senecio radicans* (Sting of bananas), *Pachyphytum, Sedeveria*, *Pachyveria*, *Sedum reflexum*, *Sedum clavatum*, *Sedum nussbaumerianum*, *Sedum linare*, *Sedum morganianum*, Painted lady, Donkey's tails, *Mesembryanthem oides*, Crested sunburst, Angel wing cactus, Josephs coat cactus, *Schlumbergera truncata* (White), *Schlumbergera truncate* (Red), *Portulaca riaafra* (White variegated), *Plectranthus prostrates* (Tangled heart plant) etc. were also collected. Cactus and succulents like *Epiphyllum oxypetalum* (20 Nos), *Epiphyllum anguliger* (25 Nos), Zade plant (50 Nos) were multiplied. Seed bank and Tissue culture lab were set up and Seed germination studies were also carried out.

Instruments like Seed inoculator, BOD, Shaker, Laminar Flows, Dual Chamber seed germinator, Seed cabinets (4 nos.) were purchased for seed storage and categorisation were made operational.

Seeds of *Sapindus muckorossi* (250 grams), *Ptereospermum chelonoides* (500 gms EPS), *Allium tuberosum* (MPS), *Terminalia bellirica* (2 kg EPS), *Aegle marmelos* (250 gm EPS), *Cissampelos pareira* (250 grams), *Eclipta prostrata* (25 grams), *Rauwolfia tetraphylla* (100 grams), *Psoralia corylifolia*, *Clitorea ternatea*, *Abrus precatorious* (100 grams), *Tectona grandis* (300 gm), *Oroxylum indicum* (200 gm), *Putranjiva roxburghii* (1.5 kg), *Cassia fistula* (500 gm), *Albizia lebbeck* (200 gm), *Terminalia chebula* (1.5 kg), *Terminalia elliptica* (1 kg), *Mimusops elengi* (200 gm), *Sapindus pinnata* (2 kg), *Mitragyna parvifolia* (100 gm) were collected.

Seed germination methodology was developed for 21 difficult to root spp. of endemic trees at BGIR. Seed germination studies were carried out for 41 endemic tree spp., and 21 medicinal plant spp namely *Spondious pinnata* 35/150 (seeds germinated/ Total seeds), *Tamarindous indica* 10/100, *Oroxylum indicum* 15/100, *Putranjiva roxuurghii* 50/250, *Pithosilobium dulse* 35/250, *Albezia libek* 20/200. *Jatropha* sp. 10/150, *Murrya konnexhi* 30/200, *Hardwickia binata* 20/250, *Desmodium oojeinense* (10/200). *Radermachera xylocarpus* (5/200), *Trachycarpus takil* (100/550), *Dalbergia latifolia* (24/250), *Swietenia macrophylla* (10/270).

Plant conservatories were set up and their management was taken care of with two conservatories for cactus and succulents plant. Seed bank net house conservatories were revamped with sprinklers. Bio Composting /Vermicomposting unit was set up using fruit based effective microorganisms (FEM) and 1000 qut. Vermicompost was prepared.

PROJECT-2

Establishment and enrichment of existing Forest Types and Proposed phytodiversity at BGIR Noida (zone 5,6,7,8) by introduction of plant spp., based on respective forest types and phytodiversity region.

Executing Scientist (s) : Dr. Priyanka Ashokrao Ingle
Date of initiation : 2021
Date of completion : Ongoing

OBJECTIVE: The major objectives of the project were to establish Thematic Botanic Garden sections in BGIR Noida aiming to conduct Precision Phenological Studies and preparation of Database of endemic trees, medicinal, fruit and endemic plants planted in BGIR Noida. This project included Mass scale germination and Multiplication of cactus and succulents in garden and also plant spp. collection from different parts of the BSI Regional Circles, Botanic Gardens, Forest Dept. to BGIR Noida to strengthen the BGIR Herbarium.

BACKGROUND: Introduction of Plants in the Garden. UP Forest Dept Gautam Budha Nagar provided some 2000 saplings of forest trees for BGIR NOIDA in June and July 2021.- 1120 plants planted in BGIR and 280 plants placed in conservatory and 600 plants given to RWA Noida .

ACHIEVEMENTS AND SUMMARY: The list of plants to be planted in zone 5, 6 and 7 and list of plants planted in zone 6 and 7 were prepared. The plants to be planted in zone 6 & 7 were sorted and the plantation of 561 saplings of 23 species were coordinated. The plants already planted in zone 1 & 7 were surveyed and documented. Scientist In-charged was assisted and the new zone wise plantation plan for eight forest types supposed to be developed in existing Woodland were designed. The list of endemic/Common plants to be planted in Broad Leaf Hill Forest other than the plants suggested by VYOM were prepared. Also the list of plants suggested by VYOM for plantation in Broad Leaf Hill Forest was checked.

CENTRAL BOTANICAL LABORATORY HOWRAH

PROJECT-1

FLORA OF TAMIL NADU (1-7 Vols.) Vol 7. Cyperaceae & Poaceae (2 Fam.) [152 genera & 652 spp.]

Executing Scientist (s) : Dr. C. Murugan, Dr. A. A. Kabeer & Dr. S. Arumugam
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to survey, study and document the family Cyperaceae and Poaceae of Tamil Nadu, India,

BACKGROUND: This project was initiated in 2015. During previous year, four field tours including 01 local tour were conducted to Valparai, Attakatti area, Meghamalai Wild Life Sanctuary, Mukurthi National Park, Namakkal and Salem districts during which a total of 152 field numbers were collected.

AREA AND LOCALITY: Tamil Nadu

SUMMARY AND ACHIEVEMENTS: A comprehensive checklist of the family Poaceae was prepared based on earlier literature and herbarium consultation. The checklist enumerates about 480 species, 04 subspecies and 08 varieties of grasses from the state of Tamil Nadu so far. The checklist provides the protologue citation of correct name of every taxon, basionym, synonyms, if any, along with relevant bibliographic references, diversity of every genus and the family, vernacular name (Tamil), state-wise and district-wise distribution of every taxon.

PROJECT-2

Wild edible plants of North-East region in India: Nutritional properties, genotoxicity, DNA damage preventive activity, HPLC studies for vitamin and phenolics content

Executing Scientist : Dr.Tapan Seal
Date of initiation : 2018
Date of completion : 2022

OBJECTIVE: The main obejective was to estimate chemical composition and nutritive value of wild edible plants of N.E. India.

AREA AND LOCALITY: North East Region

SUMMARY AND ACHIEVEMENTS: During this period anti-nutrient composition (Oxalate estimation, Phytate content, Saponin content, Tannin content and Cyanogenic glycosides) of 25 wild edible plants were studied. Using HPLC 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 50 wild edible plants were carried out along with Estimation of water-soluble vitamin (Vit C, Vit B1, Vit B2, Vit B3, Vit B5, Vit B6 and Vit B9) in 20 plant samples. Toxicity studies including Hemolytic toxicity, Hepatotoxicity of ten wild edible plants with genotoxicity studies of 20 wild edible plants and DNA damage preventive activity of 25 plants (which were rich in total phenolic content) were studied. The study revealed the lowest oxalate content in *Calamus erectus* (0.058%) and highest in *Budleja asiatica* (0.62%) with phytate content ranging between (*Teradium fraxinifolium* 0.15%-*Rubus ellipticus* 0.47%). siporin, tannin and cyanogenic glycosides estimated to be 0.05-0.32%, 0.16-1.52% and 0.00065-0.0084% respectively. The level of anti-nutrients in the investigated plants was found to be very low, within the permissible limit of WHO (oxalate: 0.75%; 1.5%, saponin: 2.6%; Tannin: 5%; Cyanogenic glycoside:

1%) and consumption of these plants as food may not cause any harmful effect on human beings. All the investigated plants were found to contain phenolic acids and flavonoids in varying amounts. The edible parts of *Diplazium laxifrons, Leucaena leucocephala* showed the significant presence of Gallic acid 6.35, 4.80 mg/gm dry extract respectively and for which they might be used as anti-carcinogenic, antimicrobial, anti-mutagenic, antiangiogenic and anti-inflammatory agents. It was found that a very high amount of protocatechuic acid in *Machilus edulis* and *Smilax zeylanica* (3.25 and 2.63 mg/gm Dry extract respectively) helps in the prevention and therapy of various oxidative stress related diseases such as neurodegenerative and hepatic diseases. HPLC analysis of the methanol extract of Smilax zeylanica showed a significant presence of p-coumaric acid (38.63 µg/mg dry extract) for which the plant might be responsible in reducing the formation of carcinogenic nitrosamines in the stomach. A very good amount of Vitamin C was detected in the leaves of *Cardamine hirsute* and *Sonchus oleraceus* (6.23 and 5.79 mg/100gm Dry plant materials DPM). These plants were found to contain an excellent amount of Vitamin B9. The Vitamin B1, B2, B3, B5 and B6 obtained in the investigated plants were very much comparable with common vegetables and fruits and the regular consumption of these vegetables would supply adequate vitamins necessary to regulate numerous body functions, nervous system, optimal maintenance of fat and also plays an important role as an antioxidant in vivo, both by preventing the adverse effect of reactive oxygen species (ROS), as well as by inhibiting lipid peroxidation. It was found that the percentage of viability of RBC and hepatocytes cell for all plant extracts at all concentrations (100-1000µg/ml) were very much comparable to the negative control (100.18%) whereas the percentage viability of both RBC and hepatocytes cell using H2O2 (Positive control) at a concentration 200µM were less than 50%. The outcome of the Genotoxicity study demonstrated that the Olive tail moment (OTM) of the aqueous concentrate of all investigated plants at a concentration 1000 µg/ml within the range 2.95- 4.89. The OTM value 1.79 was acquired utilizing negative control and positive control (mixture of whole blood, RPMI 1640 and 200 µM H2O2) showed OTM 21.38. The consequences of hemolytic poisonous quality, cytotoxicity and Geno toxicity of fluid concentrates of every single eatable plant uncovered that these are non-harmful at the cell and genomic level and safe to consume.

PROJECT-3

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

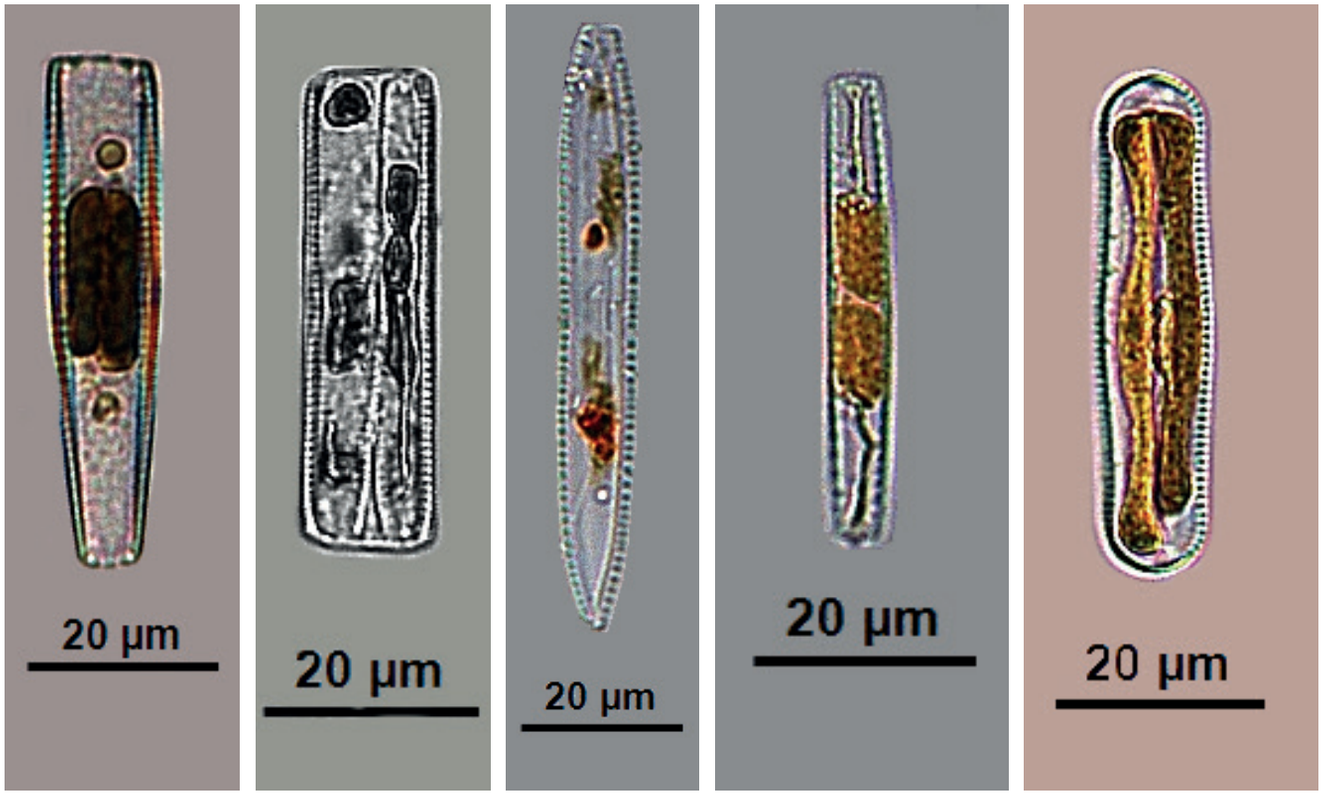
Executing Scientist : Dr Pratibha Gupta
Date of initiation : 2020
Date of completion : 2022

OBJECTIVE: The main objective of carrying out this work on Microalgae and monitoring of water quality of Sadir Lake of AJCBIBG, Howrah to study the periodicity, succession, distribution and analysis of Physico-chemical parameters to see the alteration in Micro-algal diversity and its abundance, qualitatively and quantitatively

AREA AND LOCALITY: Sadir Lake of AJC Bose Indian Botanic Garden

SUMMARY AND ACHIEVEMENTS: All the Lakes of AJCBIBG, Howrah were surveyed and found to be interconnected. It was observed that sewage / polluted water was entering from outside into Sadir Lake, AJCBIBG. So attempt had been made to study the Microalgae of Sadir Lake, AJCBIBG. Sadir lake is situated in Divisions number 04, 06 and 08 and third largest lake after King and Prain Lake and spread over 1.5588 hectares. During the survey in 12 field visits, 1015 field Photographs and 66 videos were taken. GPS readings were recorded from the sample collection areas. Total 120 numbers of water samples were collected for microscopic studies. All the samples were brought into the laboratory and preserved in formalin and properly maintained for identification. Water samples were analyzed 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 and 764 Photomicrographs were taken. Altogether

116 species of different classes-Cyanophyceae/ Cyanobacteria/Cyanoprokaryota, Coscinodiscophyceae, Chlorophyceae, Bacillariophyceae, Dinophyceae, Euglenophyceae, Mediophyceae and Trebouxiophyceae have been identified. Some of the species were observed in the samples repeatedly. Altogether 120 readings of water samples from Sadir Lake were recorded by Purely Sensor Based Multiparameter Water Proof Meter and 08 parameters viz. pH, ORP, EC, TDS, Salinity, DO, Pressure and Temperature were analyzed at a time. It was observed that initially, the DO reading of Sadir Lake was almost near to permissible limit then it started to decrease slightly below the permissible limit and then again improved slightly in the winter season, which may be because of the influx of quantity of sewage / polluted water entering from outside into the Sadir Lake and this area was almost completely covered with aquatic Macrophytes. Out of 116 species, 05 species namely *Nitzschia bacillariaeformis* Hustedt, *Nitzschia tropica* Hustedt.,*Pinnularia brandelii* Cleve, *Nitzschia thermaloides* Hustedt and *Gomphonema angustum* C. Agardh Hustedt were new record from India. Species observed in the samples like *Gomphonema angustum* C. Agardh, *Gomphonema minutum* (C.Agardh) C. Agardh, *Pinnularia subcapitata* W.Gregoryare water quality and pollution indicators. *Gomphonema parvulum* (Kütz.) Kütz, *Navicula cincta* (Ehrenb.) Ralfs, *Navicula veneta* Kütz., *Navicula viridula* var. *rostellate* (Kütz.) Cleve, *Nitzschia palea* (Kütz.) W.Smith, *Ulnaria ulna* (Nitzsch) Compère (*Synedra ulna* (Nitzsch) Ehrenb.) were pollution tolerant species. Most of the pollution tolerant species were dominantly observed in the samples. It was very interesting to note that *Oscillatoria sancta* Kütz. Ex Gomont, found in the samples contains antibiotic activity against many Bacterial and Fungal species which was already reported.



A B C D E

Microalgae of Sadir lake: A: *Gomphonema angustum* C.Agardh, B: *Nitzschia bacillariaeformis* Hustedt, C: *Nitzschia thermaloides* Hustedt, D: *Nitzschia tropica* Hustedt, E: *Pinnularia brandelii* Cleve

CENTRAL NATIONAL HERBARIUM HOWRAH

PROJECT-1

Algal Flora of Purbasthali Wetland, East Bardhaman, West Bengal

Executing scientist(s) : Dr. R.K. Gupta
Date of initiation : 2020
Date of completion : 2023

OBJECTIVE: To document Algal diversity of Purbasthali Wetland, Bardhaman, West Bengal.

AREA AND LOCALITY: 180.3 km^2

ACHIEVEMENTS: Two field tours were conducted and 103 samples along with field data were collected. 84 species were identified and description was prepared which was dominated by blue green algae. Several limnological parameters viz. pH value, total dissolved solids, electrical, conductivity, nitrate, nitrite, ammonia, total phosphate, dissolved oxygen, COD, BOD and arsenic were recorded.

PROJECT-2

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

Executing scientist(s) : Dr Kanad Das
Date of initiation : 2019
Date of completion : 2021

OBJECTIVE: The main objective was to inventorize the occurrence of caterpillar fungi especially the taxon ophiocordyceps sinensis in India, if occur, either same species found in all the Himalayan states in India or lookalikes are also exploited in the name of *O. sinensis*, identification of other lookalikes along with two or multigene phylogeny, High Performance Liquid Chromatography (HPLC) analysis and study of nutraceutical properties.

BACKGROUND: Himalayan Caterpillar fungi especially the genus Ophiocordyceps and its allies are highly prized and most exploited among all the members of mycobiota since long back. *Ophiocordyceps sinensis*, the most demanding one has long history of being used in Chinese Traditional Medicine. Because of its diversified medicinal properties, demand for *O. sinensis* has significantly increased in recent years. Subsequently, to meet the demand of fruiting bodies, the entire alpine Himalayan stretch is under huge pressure of exploitation. In the Himalayan stretch it is collected from Nepal, Bhutan and India (especially Uttaranchal, Sikkim, Himachal Pradesh and Arunachal Pradesh). It is distributed in grass- and shrub-lands that receive a minimum of 350 mm. average annual precipitation. It is found at an altitude of 3000–5000 meters above sea level. It is worth mentioning that several species of these caterpillar fungi are lookalikes i.e. morphologically similar. This is a new project.

AREA AND LOCALITY: Season for the Caterpillar fungi in Himalaya is May to June every year (snow melting period). In 2021 – 2022 during May – June, severe Covid 19 surge (2nd wave) was going on everywhere in India. Respective forest departments stopped issuing forest permits for the researcher from different states as the partial lockdown situation was going on everywhere. Facing this problem, we also didn't manage to undertake exploration for the collection of Caterpillar fungi. However, in the month of July, 2021 we managed to procure some samples from few villagers in Tawang district of Arunachal Pradesh. Samples were well preserved and studied.

ACHIEVEMENTS: Morphological (macro- and micromorphological) workout was completed with the collected samples. Micromorphological photography was completed and respective illustrations were prepared. Nutraceutical potential from the collected samples was assessed. Multiple phylogenetic analyses (nrSSU-based, nrLSU-based, Combined SSU-LSU) were conducted with the sequences derived from materials collected from different parts of Himalaya. Maximum likelihood and Bayesian analyses were conducted. Finally

combined phylogenetic tree was prepared. The outcome proved to be nothing but *Ophiocordyceps sinensis* (Ophiocordycipitaceae), the most valuable Caterpillar fungus. Final technical report was submitted on 7 April, 2022.

PROJECT-3

Marine Macro Algae Flora of India

Executing scientist(s) : Dr M. Palanisamy & Dr S.K. Yadav
Date of initiation : 2019
Date of completion : 2022

OBJECTIVE: The main objectives were as follows 1) Preparation of checklist of marine macro algae in India 2) Survey and documentation of the marine algae of the unexplored areas along with photography of all the marine algae found in the Indian coast 3)Identification and preparation of Taxonomic keys 4)The compilation of data in the form of Marine Macro Algal Flora of India

BACKGROUND: This is a new project.

AREA AND LOCALITY: Throughout India

ACHIEVEMENTS: During the years 2021-2022 description was written for 615 (Green 100 + Brown 173 + Red 342=615) species of marine macro algae and final manuscript of Marine Macro Algae Flora of India was prepared and submitted to HOO, CNH, Howrah on 31/03/2022 to forward the same to Director, BSI, Kolkata. One book chapter and ten papers were published. 145 literatures pertaining to marine macro algae were collected.

PROJECT-4

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

Executing scientist(s) : Dr. Avishek Bhattacharjee
Date of Initiation : 2018
Date of completion : 2021 (extended up to 2022)

OBJECTIVE: The main objective was to complete revisionary account of the genus Gastrochilus in India.

BACKGROUND: The project was initiated in 2018. In 2018-19, herbarium consultation tour was conducted in West District of Sikkim and Darjeeling district of West Bengal during which specimens were studied and taxonomic account of species was prepared.

AREA AND LOCALITY: Throughout India.

ACHIEVEMENTS: Herbarium-cum-field tour was conducted in different parts of West Kameng district of Arunachal Pradesh w.e.f. 10.11.21 to 21.11.21. Taxonomic account of the genus with 18 species and 1 variety (excluding variety proper) was completed. The final report (softcopy) was submitted to BSI Hqrs on 4.4.2022. *Gastrochilus yei* J.W. Li & X.H. Jin was reported as new record for India while *Gastrochilus sessanicus* A.N. Rao was reported as new record for China and *Gastrochilus affinis* (King & Pantl.) Schltr. was reported as new record for Western Himalaya. *Gastrochilus changjiangensis* Q. Liu & M.Z. Huang was excluded from India. Five names, *Gastrochilus carnosus* Z.H. Tsi, *Gastrochilus corymbosus* A.P. Das & S. Chanda, *Gastrochilus garhwalensis* Z.H. Tsi, *Gastrochilus minimus* J.W. Li, D.P. Ye & X.H. Jin, *Gastrochilus nepalensis* Raskoti were published as synonym nova. *Gastrochilus minimus* which was treated under *G. sessanicus* even before its valid publication, was actually validly published after October, 2021. Besides, the name *Gastrochilus pseudodistichus* (King & Pantl.) Schltr. was typified. Four papers were published from the Project.

PROJECT-5

Digitization of all the species belonging to the family Balsaminaceae and updation of Family Balsaminaceae in e-flora of India

Executing scientist(s) : Dr Kumar Avinash Bharati and Dr Anand Kumar
Date of initiation : 2021
Date of completion : 2022

OBJECTIVE: The main objective was Digitalization of all the species belonging to the family Balsaminaceae and updation of Family Balsaminaceae in e-flora of India.

AREA AND LOCALITY: NA

ACHIEVEMENTS: All specimens were sorted out from general herbarium collections and the specimens were taken to Digital herbarium. Barcodes were assigned for each specimen and

pasted on the herbarium sheets. 3812 barcodes were assigned to Balsaminaceae specimens indicating that there were a total of 3812 specimens housed at CAL. Each specimens were scanned in TIFF (600 dpi) with the help of scanner EPSON 11000XL. The scanned TIFF images were edited and converted in two format JPEG (600 dpi) and JPEG (300 dpi) with the help of Adobe Photoshop. Metadata of all specimens (3812 specimens) belonging to Balsaminaceae at CAL were prepared in Excel sheet. The names of the species were updated using IPNI and localities were updated using Google. It was found that out of 3812 specimens, a total of 3246 specimens belong to India while the remaining 566 specimens belong to other countries. The family Balsaminaceae had been updated online in e-Flora of India. The final report was submitted to Hqrs. on 21st March, 2022 in softcopy and 24th March, 2022 in hardcopy.

PROJECT-6

Plant diversity in Sacred Grooves of South Bengal

Executing scientist(s) : Dr Kumar Avinash Bharati
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: The study aimed at the identification of collected specimens from the sacred groves of South Bengal and preparation of the manuscript.

AREA AND LOCALITY: A total of 72 sacred grooves are covered located in the district of Paschim Medinipur, Jhargram, Bankura and Purulia.

ACHIEVEMENTS: One field tour was completed, during exploration 72 sacred grooves were covered and 86 species were identified. GPS readings of all the sacred grooves were taken and enclosed in the report. Collection numbers 99001 to 99096 were collected in duplicates. However, the specimens were collected adjacent to the sacred grooves because collections in the sacred grooves are not allowed, hence, specimens of many species were not collected.

PROJECT-7

Flora of Eagle Nest Wild Life Sanctuary and its adjacent regions, West Kameng District Arunachal Pradesh

Executing scientist(s) : Sri Sanjay Kumar and Dr. S. S. Dash
Date of initiatio : 2018
Date of completion : 2022 (extended up to March, 2023)

OBJECTIVE: The main objective was to undertake extensive field survey, collection and floristic assessment of the Eagle Nest WLS.

ACHIEVEMENTS: In 2021–2022 due to the severe Covid 19 surge, respective forest departments stopped issuing forest permits for the researcher from different states as the partial lockdown situation was going on everywhere. Facing this problem, executing scientists also didn't manage to undertake exploration tours. Herbarium material of the second exploration tour (10.07.2019 to 03.08.2019) was processed per standard Herbarium procedure. The identification of earlier collection was being carried out and simultaneously identification and description of c. 70 plant species were completed. Some of the identified species were *Rubus andersonii* Hook.f. (Rosaceae), *Rubus lasiostylus* Focke (Rosaceae), *Rubus wardii* Merr. *Rubus buergeri* Miq., *Cautleya gracilis* (Sm.) Dandy (Zingiberaceae), *Cautleya spicata* (Sm.) Baker (Zingiberaceae), *Impatiens radiata* Hook.f. (Balsaminacae), *Asystasiella neesiana* (Wall.) Lindau (Acanthaceae), *Rubus inopertus* (Focke) Focke (Rosaceae), *Rubus cooperi* D.G.Long; *Rubus calycinus* Wall. ex D.Don (Rosaceae), *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. The third Plant Exploration field tour was conducted w.e.f. 16.02.22 to 1.03.2022 and 103 field numbers in triplet, 309 specimens were collected and 650 photographs and more than 15 short video clips were recorded. During the field exploration first sample of *Sapria himalayana* Griff. was collected from West Kameng for Central National Herbarium along with 6 live orchid species, 1 species of *Paris polyphylla* Sm. (Melanthiaceae) for ex-situ conservation at Orchidarium, CNH and Botanic Garden, Howrah.

CENTRAL REGIONAL CENTRE ALLAHABAD

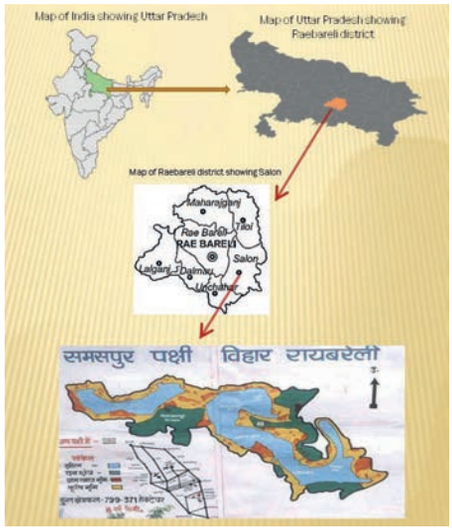
PROJECT -1

Floristic diversity of Samaspur Ramser Site, Raebareli, Uttar Pradesh

Executing scientist (s) : Dr. Arti Garg & Dr. Nitisha Srivastava
Date of initiation : 2021
Date of completion : 2022

OBJECTIVE: The main objective was to undertake extensive field survey and floristic assessment of the Samaspur Ramsar Site, UP.

BACKGROUND: The Samaspur Ramsar site, Raebareli, earlier known as Samaspur Bird Sanctuary was declared as Ramsar Site on 2nd Dec, 2019. It is a perennial lowland marsh which is typical of the Indo-Gangetic Plains. There are six connected lakes with a central lake of c. 8 Sq km expanse which is recurrently filled up during rains and floods. The Ramsar site is a natural abode of more than 75,000 birds of residents and migratory nature including some threatened species such as the endangered Egyptian vulture (*Neophron percnopterus*) and Pallas's fish eagle (*Haliaeetus leucoryphus*), and more than 1% of the South Asian population of the vulnerable common pochard (*Aythya ferina*).




View of lake at Samaspur Ramser Site


Butea monosperma


Scrub forest


Nymphaea rubra


Marsilea quadrifolia


Azolla pinnata


Callistemon citrinus


Datura metel


Abutilon indicum

AREA AND LOCALITY: Samaspur Ramser Site, Raebareli

SUMMARY AND ACHIEVEMENTS: A total of 02 field tours were conducted in which 445 specimens were collected and 430 photographs were taken. From the collection (177 field nos.), 157 field nos. were identified. Floristic diversity studies revealed the occurrence of more than 125 species including both terrestrial and aquatic plants.

PROJECT-2

Flora of Kuno National Park, M.P.

Executing scientist (s) : Dr. A.K. Verma
Date of initiation : 2021
Date of completion : 2023

BACKGROUND: Kuno National Park comes under Kuno wildlife Division of Sheopur district of Madhya Pradesh and situated between latitude 250 30' 50.03" N to 260 05 ' 23.19" N and longitude

Tiktoli Gate Kuno National Park

Kuno River

Firmiana simplex (L.) W. Wight

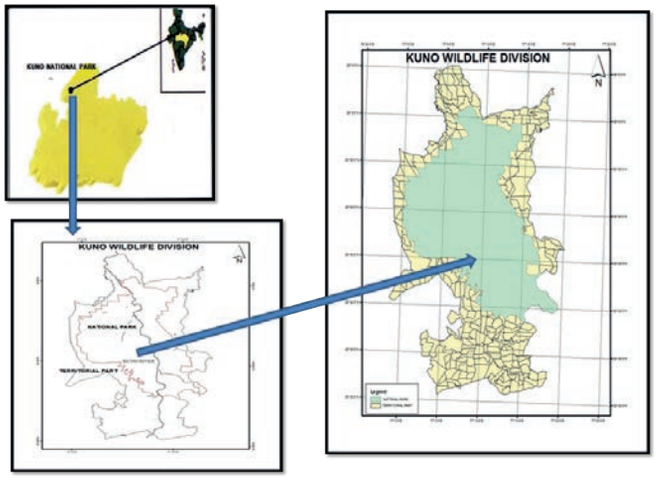
Echinops echinatus Roxb.

Diospyros melanoxylon Roxb.

Trichosanthes cucumeriana L.

760 58' 37.45" E to 770 20' 07.98" E. This national park started out as sanctuary of about 348 km2 in 1981. In December 2018 the state government changed the status of the wildlife sanctuary to National Park and enlarged the protected area about 400 km2. Now it covers around 748 km2. Kuno river forming the life line of the national park. Biogeographically most of area of the park falls under the Kathiawar-Gir dry deciduous forest eco-region and the forest types found in this area include the Northern tropical dry deciduous forest, Southern tropical dry deciduous forest, Dry Savannah forest & grassland, tropical riverine forests. In recent past this national park also identified as site for reintroduction of Asiatic Lions. Till date comprehensive floristic account of Kuno National Park is not available, considering these facts present project work was undertaken.

AREA AND LOCALITY: During the period of report 02 field tours were conducted and all ranges of national park covered.



Map as per Kuno National Park

SUMMARY AND ACHIEVEMENTS: During the period two field tours were conducted and all ranges of aforesaid national park were covered and information on vegetation type, forest type, dominating vegetation type etc. were explored. A total of 800 specimens were collected along with 350 photographs. From the collection (298 field nos.), 160 field nos. comprising of 160 species were identified.

PROJECT-3

Pteridophytic flora of India

Executing scientist (s) : Dr. Brijesh Kumar
Date of initiation : 2020
Date of completion : 2023

AREA AND LOCALITY: India

SUMMARY AND ACHIEVEMENTS: This project was initiated to prepare a detailed descriptive account of Indian Pteridophytes. Under which the description of 75 species were completed in the last year (2020-2021). During the year 2021-22, the description of 71 species were also completed with updated nomenclature based on earlier published literature, online resources (POWO, IPNI, TROPICOS) and available herbarium specimens. Besides, two herbarium consultation tours to herbaria viz., DD, BSD, PAN, PUN, LWG, and CAL were conducted and 851 specimens were studied and c.1000 were photographed.

Diplazium proliferum (Lam.) Thouars

Athyrium wallichianum Ching

PROJECT-4

Curatorial work and maintenance of the RET and economically important species in the experimental garden of BSI, CRC, Allahabad.

Executing scientist(s) : Dr. Arti Garg, Dr. Brijesh Kumar, Dr. A. K. Verma, Dr. Saurabh Sachan
Date of initiation : Ongoing
Date of completion : Ongoing

OBJECTIVE: The project aims to prepare a revised list of tree species by exploring the c. 2.50 hectares area of CRC campus through field survey and developing the meta-data for each tree species (including botanical name, family name, common name, vernacular name, key morphological features and economic uses). A digital QR code will be created for all the tree species to achieve user-friendly identification. The major outcome of the work is that even non-experts can identify tress species easily at any given time. This project will lead a way to disseminate the taxonomic knowledge of tree species to students, research scholars, scientists, and to all plant enthusiastic using existing technology.

BACKGROUND: Trees are invaluable resources of tropical biodiversity which helps in maintaining a balanced ecosystem and to mitigate climate change. However, accurate identification of tree species are challenging due to factors like tree height, non-availability of reproductive characters, overlapping key characters, and less expertise in the field of plant taxonomy. Rapid identification of trees species is pre-requisite to understand the ecological relationships and to execute conservation and management practices. The work is focused on establishing Quick Response (QR) code based identification method for tree species housed in the Experimental garden of Botanical Survey of India, Central Regional Centre, Prayagraj.

ACHIEVEMENTS AND SUMMARY: Maintenance of garden had been carried out regularly which includes maintenance of RET and economically important species. Indroduction of some RET species were done viz. *Pterocarpus santalinus* Buch.-ham. ex Wall. (Red Chandan, Endangered), *Santalum album* L. (Malyaji Chandan, Vulnerable), *Sarcostemma acidum* (Roxb.) Voigt (Somvalli), *Dalbergia latifolia* Roxb. (Kala Shisham, Vulnerable), *Careya arborea* Roxb. (Kumbhi), *Cordia dichotoma* G. Forst. (Lasoda), *Croton tiglium* L. (Jamalghota). 11 plants were conserved for introduction in the BSI, CRC garden namely *Rhododendron simsii* Planch. (Azalea) -3 samples, *Brassica oleracea* L. (ornamental cabbage) -2, *Nymphea rubra* Roxb. ex Andrews -1, *Primula* sp. -3, *Mangifera indica* L. -1 (Thailand variety: fruiting throughout the year), *Cinnamomum verum* -1 sample, *Cinnamomum tamala* -1, *Pimenta dioica* -1, *Ranunculus asiaticus* -2, *Hibiscus rosa sinensis* -1, *Manilkara zapota* -1, *Bambusa tuldoides* -2, *Euphorbia pulchirrhima* -2, *Dracaena reflexa* -2 and *Dracaena marginata* -2.

DECCAN REGIONAL CENTRE HYDERABAD

PROJECT-1

Flora of Manjeera Wildlife Sanctuary, Telangana, India

Executing scientist (s) : Dr. L. Rasingam
Date of initiation : 2019
Date of completion : 2022

OBJECTIVE: The main objective was to document the floral diversity of the Manjeera Wildlife Sanctuary, Telangana State.

Strobilanthes urens

BACKGROUND: Manjeera Wildlife Sanctuary is a fresh water ecosystem with an area of 20 sq km located in Sangareddy District of Telangana, India (17°57′52″N 78°02′22″E). The man-made reservoir was notified as wildlife sanctuary on 20th May 1978 to conserve marsh crocodiles, fresh water terrapins and other water birds. It is located 50 km northwest of Hyderabad and drinking water source for the twin cities. The riverine ecosystem has many small islets viz., Puttigadda, Bapangadda, Sangamadda, Karnamgadda, which harbour good vegetation and the extensive marshy fringes and act as nesting sites for water birds. Although Manjeera Wildlife Sanctuary is an important biodiversity area in the Telangana state 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.

Paracalyx scariosus

AREA AND LOCALITY: Two field tours from 19th to 23rd September 2021 and 14th to 17th March 2022 have been carried out in the Manjeera Wildlife Sanctuary. During the tours the following areas viz. Manjeera Barrage, Policegadda, Singur lower, Minpur, Nizampet, Pulkal, Bapanigadda, Pottipally, Mubarakpur, Puddigadda *etc.* were covered and 132 field numbers were collected.

ACHIEVEMENTS AND SUMMARY: Since inception of the project, a total of five field tours (26th to 31st August 2019; 11th to 15th December 2019; 23rd to 26th February 2021; 19th to 23rd September 2021; 14th to 17th March 2022) were undertaken to the study area and 481 field numbers were collected. All the field numbers were identified to 368 taxa belonging to 255 genera and 71 families. A herbarium consultation tour was also undertaken to Central National Herbarium, Howrah from 15th to 21st February 2020 and plant families namely Poaceae, Asclepiadaceae and Scrophulariaceae were consulted. Citations and descriptions were prepared for all the 368 taxa along with field information. The field label details were recorded in

the Excel sheet for the preparation of digital herbarium labels. One research article was published reporting two species viz. *Abutilon bidentatum* Hochst. ex A.Rich. (Malavaceae) and *Mimulus strictus* Benth. (Phrymaceae) as additions to the flora of South India from Manjeera Wildlife Sanctuary. Final technical report was prepared and submitted to the directorate.

Luffa echinata

PROJECT-2

Flora of Kinnerasani Wildlife Sanctuary, Telangana

Executing scientist (s) : Dr. J. Swamy
Date of initiation : 2019
Date of completion : 2022

OBJECTIVE: The main objective was to document the floral diversity of the Kinnerasani Wildlife Sanctuary, Telangana State.

Sida sivar

BACKGROUND: Kinnerasani Wildlife Sanctuary is located in the Eastern Ghats of Telangana state. The sanctuary is named after the river Kinnerasani, which is a tributary of river Godavari. The sanctuary covers 635.41 km2 of area and this terrain serves as the homeland for various animals, birds, reptiles and plants, hence it was declared as wildlife sanctuary in 1977 under the provisions of Section of Wildlife (P) Act 1972.

Adenosma indiana

AREA AND LOCALITY: 635.41 km2 area of Kinnerasani Wildlife Sanctuary, Telangana.

ACHIEVEMENTS AND SUMMARY: The project was initiated in 2019 and completed in 2022. During the period (2019-2021), seven (7) field tours were undertaken and about 1200 field numbers were collected and identified. The final report was prepared and submitted to directorate in April 2022. Floristic investigation of the sanctuary revealed that the floral diversity of the sanctuary is represented by a total of the 721 taxa belonging to

443 genera and 100 families with 3 sub species and 3 varieties occurring in the study area. A new discovery (*Amorphophallus konkanensis* Hett., S.R.Yadav & K.S.Patil var. *kinnerasaniensis* J. Swamy & Rasingam) to science, 15 generic records and 50 species records were added to the flora of Telangana state, Eastern Ghats and peninsular India and also more than 600 species were added to the flora of Bhadradri Kothagudem district. *Sporobolus tetragonus* Bor (Poaceae: Chloridoideae) was rediscovered after laps of fifty years of its last collection from Corbett National Park, Uttarakhand and reported as an addition to the flora of South India. Nineteen research papers were published and 8 were communicated.

Sporobolus tetragonus

PROJECT-3

Grasses of Telangana state

Executing scientist (s) : Dr. Nagaraju Siddabathula
Date of initiation : 2017
Date of completion : 2022

OBJECTIVE: The objective of the project was to review the significance of the grasses,to undertake regular periodic botanical explorations, collect the grasses to assess the grass diversity of the areas and to prepare good illustrations, photographs and to build diagnostic keys based on field observations.

BACKGROUND: Systematic studies of the erstwhile Hyderabad state came from two principal sources, the State Forest Department and the Department of Botany, Osmania University, Hyderabad. Before independence Telangana region was in Hyderabad State. The study of the flora of Hyderabad State dates back to the 19th century when Walker (1849) and Bradley (1849) published their pioneer works, which included agricultural, medicinal and other economically important species of Daulatabad and Warangal districts of the State. Campbell in 1898 included a list of forest plants of Hyderabad state in his Glimpses of the Nizams Dominions. During the same period Bisco, a Forest officer listed 128 chief timber yielding and other economically important plants of the state. Patridge (1911) published a book entitled "Forest Flora of Hyderabad State". He described 450 species belonging to 69 families and provided keys to taxa, information on local names and economic importance of plants. The book was later revised by Khan (1953), who added some more information on the vegetation and described 567 wild and cultivated species. Sayeeduddin (1935, 1938, 1941a, b, 1954) published a series of papers on the flora of Hyderabad State and reported a total of 370 species. Suxena (1947) listed 115 grasses from Hyderabad State. Other works on the flora of Telangana region include Santapau (1954), Sebastine & Henry (1966), etc.

Botanical explorations were revived with the reorganisation of Botanical Survey of India in 1954. Collections were made and interesting results were published. K. Subramanyam, K.M. Sebastine, G.V. Subba Rao, N.P. Balakrishnan, and K. Thothathri are some of the important contributors from Botanical Survey of India to the flora of Telangana. Sebastine & al. (1960) enumerated 268 species from Medak district. Sebastine & Henry (1966) studied the flora of Pakhal and surrounding regions of Narasampet taluk in Warangal district and reported 254 species of 198 genera belonging to 70 families. Thothathri (1964) studied Nagarjunakonda and surroundings and recorded 251 species. Subba Rao & Kumari (1967) published a short account of 434 species from Kodimial, Manthani and Raikal of Kharimnagar district. Kapoor & Kapoor (1973) enumerated an additional 66 species from Kharimnagar district. Rao (2012) reported 734

species of flowering plants in University of Hyderabad campus.

AREA AND LOCALITY: Telangana

ACHIEVEMENTS AND SUMMARY: This work records the occurrence of 260 species of grasses in the state; these include 7 infraspecific taxa (1 subspecies and 6 varieties). On analysis, it is seen that the 268 taxa of grasses in Telangana are have spread to 6 subfamilies, 14 tribes and 93 genera.

PROJECT-4

Digitization and Development of Database of Herbarium specimens

Executing scientist (s) : Dr. Ravi Kiran Arigela
Date of initiation : 2021
Date of completion : Ongoing

OBJECTIVE: The main objective of the project was Digitalization and development of database of Herbarium specimens.

BACKGROUND: The project was initiated under annual action plan of BSI. The objective of the project is to prepare the digital database of Herbarium and maintainance of virtual herbarium.

ACHIEVEMENTS AND SUMMARY: During the period, a total of 719 and 203 new genus and species covers as well as the labels have been prepared respectively. Seven thousand six hundred and twelve (7612) specimens have been segregated from the general herbarium for the digitization purpose. One thousand six hundred (1600) herbarium sheets have been digitized and 3290 specimens were reincorporated in the general herbarium.

PROJECT-5

Development of Museum of DRC

Executing scientist (s) : Dr. G. Swarnalatha
Date of initiation : November 2021
Date of completion : Ongoing

OBJECTIVE: The objective was the development and maintenance of the Museum.

BACKGROUND: For the development of the BSI-DRC Museum, one wooden display cabinet and five customized display boards were procured. LED lights were installed in one display unit. Fluid preservatives of museum specimens were changed wherever required. Thematic rearrangement of Museum specimens was completed in one display unit. New labels were prepared wherever necessary. 16 new specimens were added to the museum and the damaged specimens discarded

ACHIEVEMENTS AND SUMMARY: One wooden display cabinet with 12 show cases were procured. Out of 12 showcases, specimens were mounted on three show cases. Five customized display boards were also procured and specimens were mounted on them with LED lightings. Thematic rearrangement of Museum specimens was completed for one display unit. New labels were prepared wherever necessary. Fluid preservatives of museum specimens were changed wherever required and 16 new specimens were added to the museum.

EASTERN REGIONAL CENTRE SHILLONG

PROJECT-1

Flora of Nagaland

Executing scientist (s) : Dr. N. Odyuo, Dr. Chaya Deori, Dr. David Lalsama Baite Dr. S.R. Talukdar (Under guidance of Dr. A. A. Mao)
Date of initiation : 2016
Date of completion : 2022

OBJECTIVE: The main objective was to document the floral diversity of Nagaland

View of Doyang Reservoir (Nagaland)

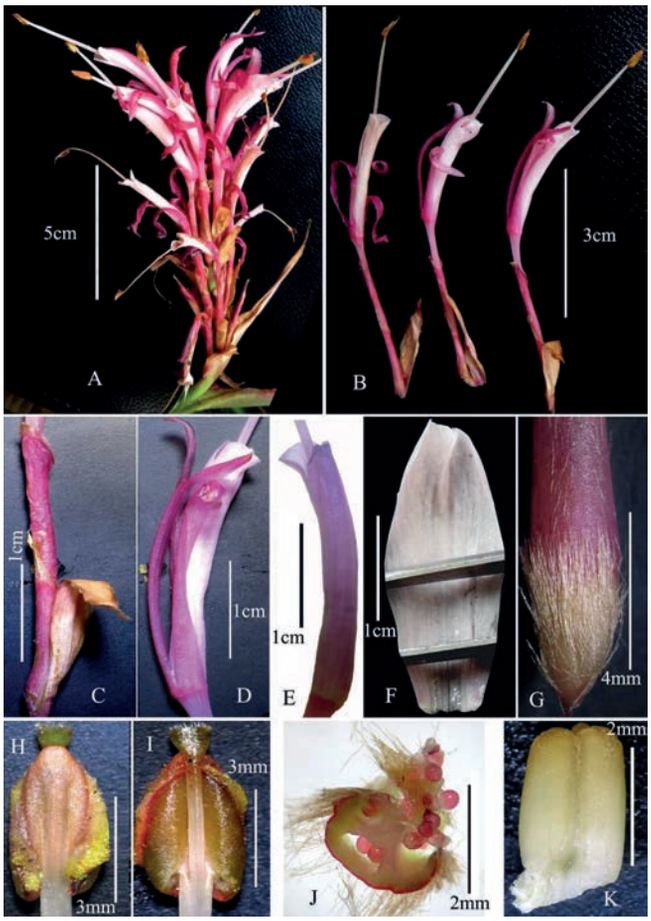
BACKGROUND: The present state of Nagaland includes former Naga Hills district of Assam and Tuensang district of North-East Frontier Agency (NEFA). Nagaland lies in the extreme north eastern part of India, covering an area of 16,579 sq. km., between 25°6'-27°4'N and 93°20'-95°15' E. The state is bounded by Assam in the west and north-west and flanked by Tirap district of Arunachal Pradesh, in the north-east. The southern boundary is marked by the state of Manipur, on the east by International boundary between India and Myanmar. The soil of Nagaland can be grouped mainly under Enlfisol, Entisol, Enceptisols and Ultisols (Source: nagaland.nic.in/soil DIPR-Basic Facts 2011 RTI Manual (nlsic.gov.in).The forests cover of the state is 12,489 km^2, which is 75.33% of the state's geographical area. In term of forest canopy density classes, the state has 1279 km^2 under very dense forest, 4587 km^2 under moderately dense forest and 6623 km under open forest (FSI: 2017). The vegetation and forests of Nagaland based field study and surveys can be discussed under the following types: a) Sub-alpine meadows, b)Tropical evergreen and Semi-Evergreen forest, c) Tropical deciduous forest, d) Temperate forest, e) Subtropical pine forest, f) Mixed Bamboo forest.

AREA AND LOCALITY: Nagaland; c. 16,579 sq. km.

View of Lakhuti vegetation (Nagaland)

ACHIEVEMENTS AND SUMMARY: From April 2021 to March 2022, three field tours were undertaken to Doyang, Wokha Districts, Nagaland for 22 days and a total of 194 field numbers were collected along with photographs of different plants, landscapes, forest types, vegetation etc. During this period 55 taxa were identified and 216 species were documented with proper citation and description along with the preparation of key for 101 taxa. Flora of Nagaland Vol. I was finalized which consisted of 768 taxa, 371 genera & 84 families from Ranunculaceae to Asteraceae. Detailed examination of the collected specimen and study of the introduced live plants in the Garden from the present project had resulted in the publication of 01

Generic records for India viz. *Stadiochilus burmanicus* R.M. Sm. and one new species of *Aspidistra mokukchungensis* (accepted) and one new record to India *Aspidistra yingjiangensis* (accepted).



Stadiochilus burmanicus R.M. Sm.

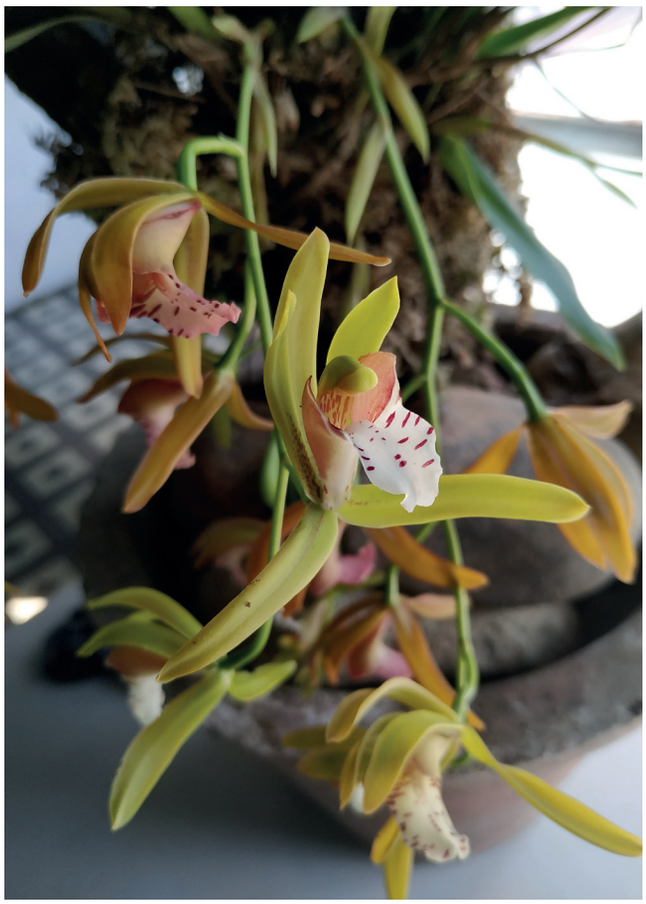
PROJECT-2

Micropropagation of EET plants of Northeast India

Executing scientist (s) : Dr. Deepu Vijayan
Date of initiation : 2020
Date of completion : Ongoing

OBJECTIVE: To standardize the protocol, mass multiplication of EET plants of Northeast India namely Eriodes barbata (Lindl.) Rolfe, Pholidota katakiana Phukan and Micropera rostrata (Roxb.) N.P. Balakr. Maintenance of in vitro raised plants of Armodorum senapatianum and Cymbidum tigrinum in plant tissue culture, garden and polyhouse.

BACKGROUND: The project was initiated in 2015. During the previous years, protocol development, statistical analysis and micropropagation of Armodorum senapatianum, Rhododendron coxianum and Cymbidium tigrinum were completed.Some new in-vitro seed germination was successfulfor Ilex khasiana andArmodorum senapatianum.

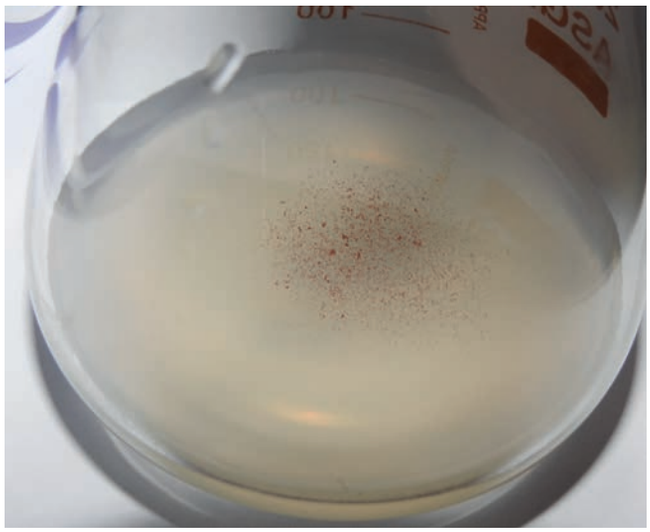


Cymbidium tigrinum C.S.P.Parish ex Hook.

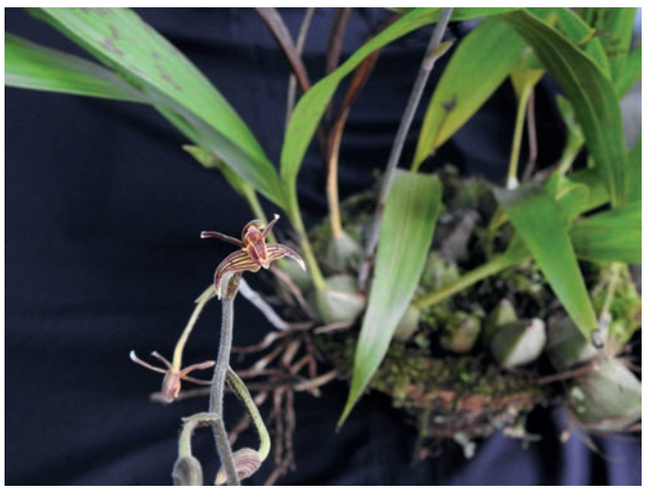
Cymbidium tigrinum C.S.P.Parish ex Hook. plant hardening

AREA AND LOCALITY: North East India

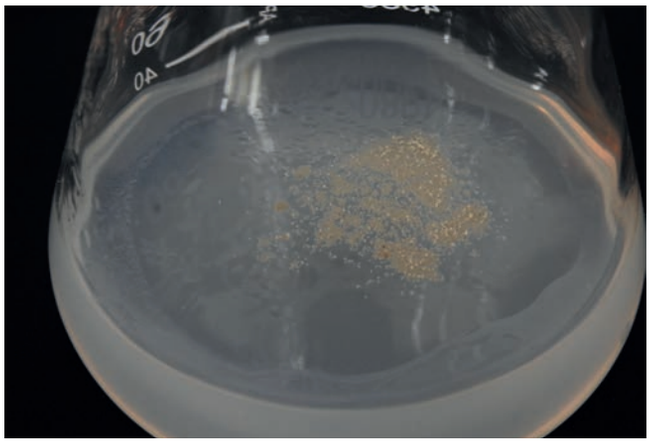
Micropera rostrata



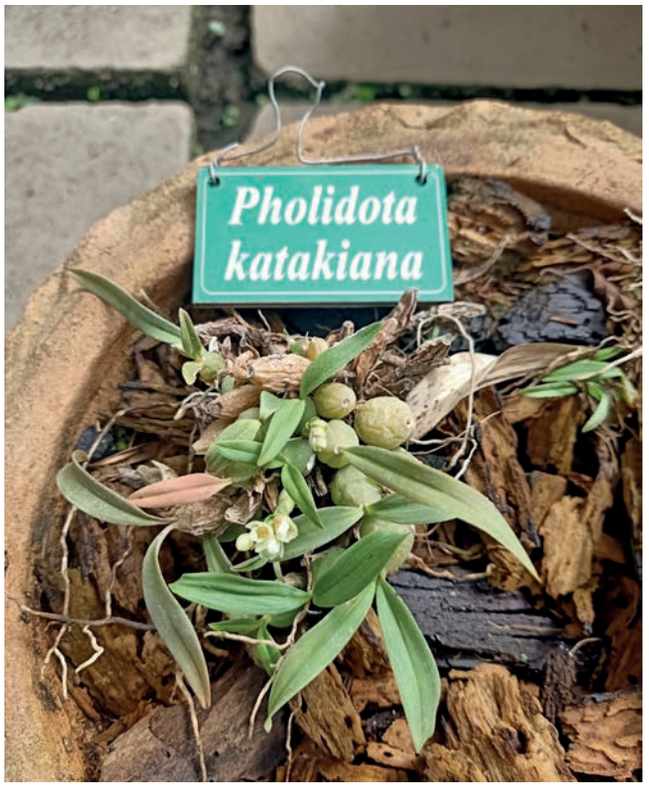
(seeds inoculate in MS medium)



Eriodes barbata (Lindl.) Rolfe



(MS basal medium)



Pholidota katakiana Phukan

P. katakiana Phukan culture (in ms medium + 10 % Banana)

Cymbidium whiteae King & Pantl.

ACHIEVEMENTS AND SUMMARY: In vitro raised plants of Armodorum senapatianum and Cymbidum tigrinum were maintained in plant tissue culture, garden and polyhouse. In vitro raised seedlings of Cymbidium tigrinum (100 Nos) were transferred for hardening. Eriodes barbata splitting were planted in individual pots for multiplication. Surface sterilization using 70% ethanol and inoculation of Eriodes barbata seeds was done in MS Medium. Maintenance, documentation and pollination were carried out for Pholidata katakiana and Subculturing was done in MS Medium and MS Medium supplemented with 10% Banana. Surface sterilization using 70% ethanol and inoculation of Micropera rostrata seeds in MS Medium and MS Medium supplemented with 10% Banana was done. Surface sterilization and inoculation of Vanda coerulea seeds in MS Medium, MS Medium supplemented with 0.2% Activated charcoal and MS Medium supplemented with 10% Banana was done.

PROJECT- 3

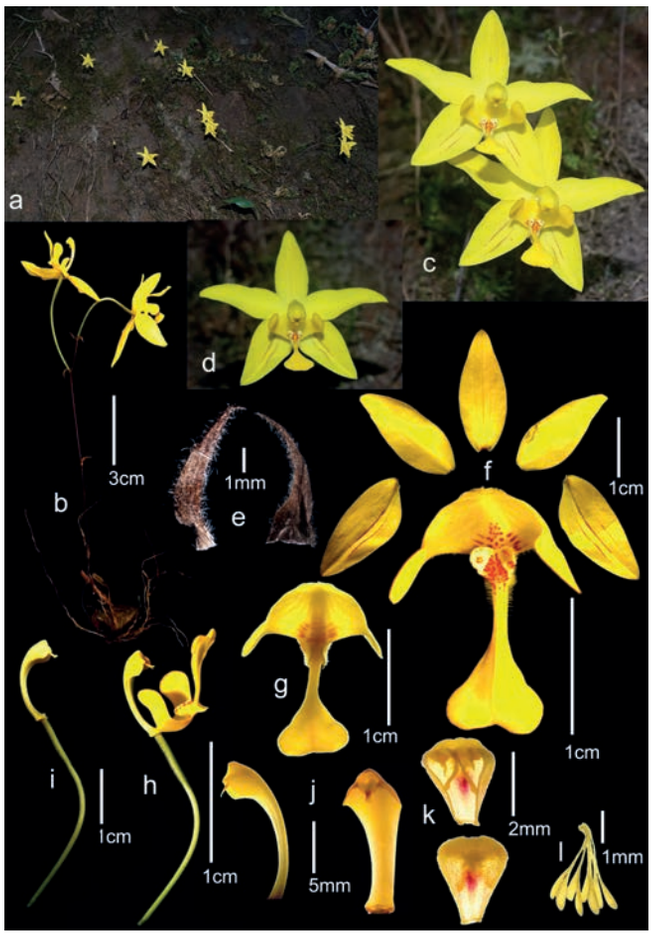
Editing of Herbaceous Flora of Meghalaya Vol. 1 & 2

Executing Scientist (s) : Dr. Chaya Deori
Date of initiation : 2020
Date of completion : 2022

OBJECTIVE: The main objective was editing of manuscript of herbaceous flora of Meghalaya, Vol. 1, which has already been reviewed by publication section, BSI, Kolkata.

AREA AND LOCALITY: Meghalaya

ACHIEVEMENTS AND SUMMARY: Herbaceous flora of Meghalaya volume 1 & 2 comprising of 2,522 taxa was finalized. Keys of families, newly added genera and species were prepared. One new record to India *Spathoglottis affinis* de Vriese (orchidaceae) from Meghalaya, one new addition *Calanthe davidii* Franch. (Orchidaceae) and Recollection of Impatiens angustiflora (Balsaminaceae) were published.



Spathoglottis affinis de Vriese (Orchidaceae)

Calanthe davidii Franch.(Orchidaceae)

PROJECT- 4

Flora of Manipur Vol. II

Executing Scientist(s) : Shri B.B.T. Tham, Shri L.R. Meitei & Shri Harminder Singh
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

BACKGROUND: This project started in 2021 and the team has been collecting and documenting the plant spdecimens of the target families from the different areas of Manipur.

AREA AND LOCALITY: Under taken 1 field tour to Manipur covering Jiribam, Tamenglong, Noney, Bishnupur, Imphal West and Ukhrul districts of the state.

ACHIEVEMENTS AND SUMMARY: One field tour was conducted to Manipur w.e.f. 22.03.2022 to 31.03.2022, covering Jiribam, Tamenglong, Noney, Bishnupur, Imphal West and Ukhrul districts of the state. During the field tour 98 Field nos. (144001–144098) were collected. A total of 89 live plants belonging to 36 species have also been collected. Library Study of relevant Flora, Journals etc. concerning the floristic wealth of Manipur were carried out. Herbarium consultation was done in ASSAM herbarium of the Regional Centre and a list of total of 143 plant species was prepared.

Grassland habitat at Keibul Lamjao National Park

Sub tropical forest Tamenglong

Chisocheton cumingianus (C.DC.) Harms

Ficus racemosa L.

PROJECT- 5

Curatorial works and maintenance of the Experimental Botanic garden, BSI, ERC, Barapani & ex situ conservation and multiplication of rare, endangered, threatened, endemic and economically important plants of North East India.

Executing Scientist(s) : Shri B.B.T. Tham & Shri L.R. Meitei

Date of initiation : Ongoing

Date of completion : Ongoing

OBJECTIVE: The main objectives were as follows 1) ex-situ conservation and multiplication of endemic, rare, threatened and economically important plants of North-East India at EBG, Barapani. 2) 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.

Improvised Rock Flower beds prepared in EBG

Seedling of *Psychotria nervosa* Sw. raised from seeds obtained from plant growing in the garden

AREA AND LOCALITY: 1(one) field tour to Manipur was carried out and also 4(four) one day local tours were conducted to different nearby localities viz. Ritiang, Umsning, Syadriat, Umsning, Umtasor forest and Ryngkangkhla, Umtham all located in Ri-bhoi District of Meghalaya.

ACHIEVEMENTS AND SUMMARY: During the period 2021-2022 one field tour to Manipur w.e.f. 22.03.2022 to 31.03.2022 and four one day local tours were conducted in which a total of 315 plant saplings/seedlings and 18 cuttings belonging to 121 species were collected. A Total of 929 saplings/seedlings/rhizomes and 28 cuttings belonging to 178 species were planted and conserved in EBG, Barapani. Out of the above 178 species, 48 species were RET and 58 were economically important species. Phenological data was observed and recorded for 176 plant species. About 2693 saplings/seedlings were raised from 18 species by seed germination and stem cutting method. A new Orchid plant section was developped in upper portion of EBG and 112 nos. of terrestrial orchids belonging to 15 species were planted in this section. 19 new flower beds were prepared in the front portion of upper garden of EBG for beautification and ornamental plants were planted there. A total of 3898 saplings/seedlings to different organizations and individuals for plantation were distributed. Also 73 plant saplings/seedlings belonging to 16 species in EBG were planted during Van Mahotsav Celebration on 06/07/2021 and 07/07/2021. 30 boards/nameplates were prepared and tagged for some plant species which have no name plates assigned to them before. Interacted and guided 170 visitors who visited the botanic Garden during the period.

Seeds of *Elaeocarpus serratus* L.

Preparing a *Vanilla borneens* Rolfe Collected for germination cutting for Plantation using Moss as a base.

PROJECT-6

Curatorial works at herbarium of ERC, Shillong (ASSAM)

Executing Scientist(s) : Mrs. Nandita Sarma, Miss. Kankana Chakraborty, Mr. Vijayand, Miss. Debala Tudu

Date of initiation : 2021

Date of completion : Ongoing

OBJECTIVES: Regular maintenance of herbarium, preparation of database and incorporation of metadata of all herbarium specimens and digitization of herbarium specimens of ASSAM.

BACKGROUND: The Herbarium of Eastern Regional Centre of BSI (Acronym: ASSAM) is largest Herbarium in North-east India.Total Number of Angiosperm available in ASSAM-1, 14,522 (Dicot- 88925 and Monocot-25597). Total number of Pteridophytes available in ASSAM - 8,414, Total number of Gymnosperm available in

ASSAM- 576; Type specimens available in ASSAM-779. This herbarium has many valued historical collections of Gustav Mann, U.N. Kanjilal, P.C. Kanjilal, N.L. Bor, C.E.C. Fischer, Kingdon Ward etc. This herbarium also has some collection from neighbouring countries like Bhutan, Bangladesh, Myanmar, Nepal etc.

AREA AND LOCALITY: ASSAM herbarium, ERC.

SUMMARY & ACHIEVEMENTS: During the entire tenure of the project, a total of 94533 specimens were enlisted as metadata which was approximately 76.55% of total herbarium specimens. Total number of angiosperm enlisted as metadata were 87,797 {Dicot- 78,237 (88%) and Monocot- 9,560 (38%)} while total number of Pteridophytes enlisted as metadata were 6,160 (74%)} and that of gymnosperms were 576 (100%)}. Total Metadata with Barcode applied to them were 15,720 while 78,813 metadata were without barcodes. Total 34312 Barcodes were applied. Total number of Scanned Type Specimens-779. In addition to that cleaning, changing of genus cover, species cover of herbarium sheets were done whenever needed.

Barcodes pasted on the Herbarium sheets

Metadata prepared Scanning of Type sheets

Scanning of Herbarium sheets

Scanning of type sheets

Genus folders changed

Incorporation of Herbarium sheets

HEADQUARTERS
KOLKATA

PROJECT-1

Flora of Kerala Vol. 2

Executing Scientist(s) : C. Murugan
Date of initiation : 2019
Date of completion : 2022

OBJECTIVES: The main objective was to study the plants and complete the floristic assessment of the state.

SUMMARY AND ACHIEVEMENTS: During this period 520 specimens from M S Swaminathan Research Foundation was consulted. Three botanical explorations in different parts of Kerala were conducted and 138 field numbers were vouched and 141 species under 45 genera and 16 families (Apocynaceae, Asclepiadaceae, Symplocaceae & Gentianaceae) were documented.

PROJECT-2

Flora of Kerala Vol. 3

Executing Scientist(s) : Shri P. Murugan under the guidance of Dr. C. Murugan
Date of initiation : 2020
Date of completion : 2022

OBJECTIVE: Survey and Documentation of Flora of Kerala Vol. 3. Compilation of Flora of Kerala Vol. 3. Updating of manuscript.

AREA AND LOCALITY: Kerala State.

Youngia nilgiriensis Babc.

Senecio lawsonii Gamble

SUMMARY AND ACHIEVEMENTS: Description of 25 families was completed. Key preparation was being carried out. New Discoveries, new records made during this project- 1. *Dendrobium gopalanii* Sulaiman & Murugan-Orchidaceae; 2. *Eugenia pachakumachiana* Arumugam & Murugan-Myrtaceae; 3. *Grewia lakshminarasimhanii* Arumugam, Murugan, R. Manikandan & W. Arisdason -Tiliaceae.

PROJECT-3

Flora of Kerala Vol. 4

Executing Scientist(s) : Shri Basil Paul under the guidance of Dr. C. Murugan & Dr. Sujana, K.A.
Date of initiation : 2020
Date of completion : 2022

OBJECTIVES: The main objective was to document the flora of Kerala for the Flora of Kerala, Vol. 4 (Gamopetale Part – II) according to the format of previous volumes.

SUMMARY & ACHIEVEMENTS : A total of 114 taxa belonging to Acanthaceae, Bignoniaceae, Gesneriaceae and Lamiaceae were described. Manuscripts were updated for Convolvulaceae, Lentibulariaceae, Scrophulariaceae and Verbenaceae. Identification keys were prepared for Avicenniaceae, Bignoniaceae, Boraginaceae, Gesneriaceae, Orobanchaceae, Pedaliaceae, Plantaginaceae, Solanaceae and Symphorematacеae.

PROJECT-4

Flora of Tamil Nadu Vol. 3: Rubiaceae – Gentiancaeae

Executing Scientist(s) : Dr. C. Murugan, Dr. M. Murugesanand Dr. S. Arumugam
Date of initiation : 2021
Date of completion : 2024

OBJECTIVES: The main objective was to study the plants and complete the floristic assessment of the state.

BACKGROUND: Under this project taxa belonging to Families: Rubiaceae – Gentiancaeae, 26 family 275 genera & 871 Spp. were studied, identified and documented.

AREA AND LOCALITY: Nilgiri Biosphere Reserve and Anamalai Tiger Reserve.

SUMMARY AND ACHIEVEMENTS: All the species of allotted 26 families were scrutinized based on available literature, herbarium specimens of various herbaria (MH, CAL), virtual herbaria (K, E, GH, RAW, UC, US, NY, BM, G, P, L), from various online sources, websites, books, journals, revisions and monographs. Complete checklist for 871 taxa belonging to families from Rubiaceae to Gentianaceae was prepred. 7 local field tours to various parts of Nilgiri Biosphere Reserve and Anamalai Tiger Reserve was conducted and various vegetation types/habitats and plants were photographed. Detailed descriptions of the following 241 species under 32 genera were completed along with details, viz. accepted name and nomenclatural citations, distribution, status and phenological details as per the given format, based on consultation of herbarium specimens and relevant literature. This inchude 18 species of *Pavetta*, 18 species of *Ixora*, 7 species of *Tarenna*, 10 species of *Neanotis*, 13 species of *Lasianthus*, 4 species of *Canthium*, 15 species of *Psychotria*, 27 species of *Hedyotis* and 18 species of *Ophiorrhiza* (RUBIACEAE); 2 species of *Cissamplelopsis*, 2 species of *Helichrysum*, 1 species of *Gymnanthemum*, 2 species of *Monosis*, 2 species of *Gynura*, 1 species of *Synedrella*, 3 species of *Kleinia*, 5 species of *Anaphalis*, 8 species of *Senecio* (ASTERACEAE); 15 species of *Symplocos* (SYMPLOCACEAE); 3 species of *Canscora*, 8 species of *Swertia* and 2 species of *Gentiana*, 9 species of *Exacum* (GENTIANACEAE); 4 species of *Rauvolfia*, 1 species of *Baeolepis*, 3 species of *Sarcostemma*, 12 species of *Ceropegia*, and 3 species of *Gymnema* (APOCYNACEAE); 1 species of *Asyneuma*, 1 species of *Isotoma*, 5 species of *Campanula*, 3 species of *Wahlenbergia* (CAMPANULACEAE); 8 species of *Lobelia* (LOBELIACEAE); 1 species of *Sphenoclea* (SPHENOCLEACEAE); 4 species of *Vaccinium* (VACCINIACEAE). During this period herbarium metadata has been prepared as per the prescribed format for 10271 herbarium sheets that are deposited in Madras Herbarium (MH), belonging to the following families, *viz.*, Campanulaceae, Ebenaceae, Epacridaceae, Ericaceae, Monotropaceae, Myrsinaceae, Plumbaginaceae, Primulaceae, Sapotaceae, Sphenocleaceae, Theophrastaceae, Vacciniaceae, Symplocaceae (734 herbarium sheets), Gentianaceae (1255 herbarium sheets) and Apocynaceae (2169 sheets).

7 local field exploration tours to various parts of Nilgiri Biosphere Reserve and Anamalai Tiger Reserve was conducted to take photographs as well as to collect endemic plant species in connection with Flora of Tamil Nadu. From these field tours, 396 field numbers was vouched.

PROJECT-5

Wild useful/edible plants of Arunachal Pradesh

Executing Scientist(s) : Dr. Umeshkumar L. Tiwari, Dr. S.S. Dash, Dr. K. Chowlu, and Dr. Ranjit Daimary
Date of initiation : 2021
Date of completion : 2023

OBJECTIVES: To study and prepare a pictorial guide to the wild edible plants of Arunachal Pradesh.

BACKGROUND: World over, tribal population still stores a vast knowledge on utilization of local plants as food material and other specific uses. They are mainly dependent on forests, which provide them food plants and other day to day use material for their existence. This biological wealth is essentially important to their life and tradition systems. Wild edible plants not only supplement to the food quantity but also make significant contribution to the community's nutrition.

AREA AND LOCALITY: Arunachal Pradesh state.

SUMMARY AND ACHIEVEMENTS: Two field tours were conducted. One field tour was conducted by Dr. Chawlu to Anjaw, Lohit, Namsai and Changlang districts from Nov-Dec 2021 and information of 78 plant species and 100 voucher specimens were collected. Second field tour was conducted by Dr. SS Dash and Dr. UL Tiwari to East kameng, Papumpare and West Kameng Districts in the month of March-April 2022 and information of 136 plant species were collected. 178 field numbers were collected and plants were identified and submitted to ARUN herbarium at Itanagar. In the present study, about 132 wild edible plant species have been recorded. People were mostly found to consume fruits and leaves however, other plant parts like barks, flowers, tubers, stem, etc. were also utilized infrequently. Some of the species like *Gynura cusimbua, Houttuynia cordata, Phlogacanthus* sp, *Paederia scandens, Plantago major, Solanum nigrum, Spilanthes acmella, Zanthoxylum armatum*, etc. used as vegetables wild vegetables. Wild edible plant species play a major part in supplementing other foods, especially in rural communities. Species like Bamboos, *Diplazium esculantum, Docynia indica, Rubus* sp., *Elaeagnus* sp., *Ficus* sp., *Houttuynia cordata, Musa* sp., *Prunus persica, Solanum nigrum, Zizyphus mauritiana* and *Syzygium cuminii* are collected from the wild for consumption and for sale to supplement their income. Different varieties of mushroom are also collected, used and sold in the market abundantly. Some of the locally preferred species like *Castanopsis, Ficus cunia, Mangifera sylvatica, Plantago major, Spondias axillaris* etc. are not sold in the local markets due to the easy accessibility and availability of the species from the forest. Some of the fruits collected during the study which were sold in the local vendors were *Actinidia deliciosa, Baccaurea ramiflora, Phyllantus emblica, Dillenia indica, Docynia indica, Elaeocarpus floribundus, Dysoxylum excelsum, Spondias pinnata* and *Zizyphus mauritiana.*

Manihot esculenta Crantz

Family: Euphorbiaceae

Fl. & Fr.: April-June.

Parts used: Underground root

Local name: Nai gudung(singpho), Pan khan (wangcho)

Used: Tuberous root is boiled and taken.

Shrubs, 1–4 m. Roots thickened. Stems erect, terete when young. Leaves persistent; stipules lanceolate, entire; blade basally attached, usually 3–10-lobed, sometimes unlobed, lobes without secondary lobes. Inflorescence axillary.

Common in villages along houses; in cultivation.

Elaeocarpus floribundus Blume

Family: Elaeocarpaceae

Fl. & Fr.: June-September.

Local name: Muokho waa (Khampti tribe)

Mokho si(singpho)

Uses: Taken raw as fruits. Fruits were processed

and preserved into pickles and were consumed as make appetizer by the locals.

Trees 15-25 m tall. Leaves simple, alternate, spiral; lamina boradly ovate or elliptic-ovate, cuneate or rounded at base, bluntly acuminate at apex. Inflorescences in axillary racemes; flowers white. Drupes ca. 2.5-4 cm long, light green, oblong-pyriform, rounded at both end, fleshy; spindle shaped, vertically 3-grooved, rugulose.

Common in riverine forest along Kameng river.

PROJECT-6

Plants of Kolkata

Executing Scientist(s) : Dr. S.S. Dash, Dr. R.K. Chakraborty, Dr. A.A. Mao, Dr. Umeshkumar L. Tiwari and Ms. Sinchita Biswas.
Date of initiation : 2021
Date of completion : 2023

OBJECTIVES: Prepare a checklist of Plants and pictorial guide to plants of Kolkata.

BACKGROUND: The Calcutta Corporation came into existence in 1727 and the tree planting on the roadsides was initiated may be on that time with certain areas kept aside for parks and gardens. In the course of more than a century and a quarter there was tremendous boost to the construction, development and management of buildings, churches, parks, gardens and office premises, etc. The management and functions of Calcutta Corporation were reoriented in several stages in the years 1794, 1847. 1852, 1863, 1875 and 1883. A new civic body under the name of Calcutta Improve¬ment Trust (CIT) came into existence in 1911. The population of the city also continued to increase mainly due to better means of livelihood. Calcutta became the seat of the Central and State Government offices and main centre of business and trade for whole of eastern India. With increasing trade in jute, paper and other enterprises, it became the centre of mass employment for a variety of people, the professional, trader, skilled, unskilled and the self-employed. In a city crowded with buildings and increasing population and pollution, the available open spaces must receive due care and attention. There are more than 200 parks, gardens, children's play grounds, squares, garden plots and roadside gardens Azad Hind Bag, Bengal Gymkhana Ground, College Square, Deshapriya Park, Deshbandhu Park, Hagi Md. Mohassin Square, Jatindra Mohan Park (Taia Park), Marcus Square, Northern Park, National Congress Park (Park Circus Maidan). Rabindra Kanan, Raja Subodh Maliick Square, Shaheed Bhagat Singh Udyan (Minlu Square), Watgunj Square Bidhan Sishu Udyan, and Woodburn Park. These Park contains many interesting ornamental trees and shrubs, play grounds for children, gymnasium, swimming pool and maintains a good children's library. The parks and gardens serve as the most frequented spot by the aged for walk and rest, and a common place of play and pass time for the children. They are mostly visited by housewives for relaxation after the days toil. Their cool, beautiful surroundings refresh the minds and generate natural aesthetic sense amongst the public.

AREA AND LOCALITY: Kolkata.

SUMMARY AND ACHIEVEMENTS: Plant checklist was prepared and 120 species were photographed. Description for 42 species was completed.

Spathodea campanulata P.Beauv.

Family: Bignoniaceae

Bengali Name: Rudrapalash;

English Name: African tulip tree, fountain tree, scarlet bell flower;

Hindi Name: Rugtoora.

Fl. & Fr.: February-October.

Native of tropical Africa.

A tall, erect, evergreen tree, 12-20.0 m or more high with short and slender branches. Leaves large, compound, odd pinnate, having 4-8 pairs of leaflets and a terminal one, oval, pointed. Flowers borne in clusters on top branches, large, showy; corolla enclosed by a spathe or boat-shaped calyx filled with liquid which splits on one side exposing the petals; corolla tulip-shaped, tube short and narrow, expanding into a five lobed bell, deeply corrugated, brilliant crimson with yellow frilled edge. Fruits smooth, woody, oblong, boat-shaped capsules, pointed at both ends.

Common in corporation garden, planted along roadside.

Albizia lebbek **(L.)** Benth.

Acacia febbeck Willd.; ***Mimosa febbeck*** L.

Family: Mimosaceae

Bengali Name: Shirosh

English Name: Fry wood tree, Parrot tree.

Hindi Name: Siris.

Fl. & Fr.: April-June.

Native of tropical Asia.

A large, deciduous tree with spreading branches and attractive foliage, generally 10-20 m high with brownish-grey, rough and irregularly cracked bark. Leaves alternate, bipinnate with 4-8 pinnae, each with 10-16 or more, small, obliquely-oblong, obtuse leaflets, pale green with velvety surface. Flowers in axillary globose heads, white or greenish-white with innumerable Jong, white stamens, sweetly scented.

Common in corporation garden, planted along roadside.

PROJECT-7

Marine Macro Algal Flora of West Bengal coast, India

Executing Scientist(s) : Dr. S.K. Yadav & Shri K. Majumdar
Date of initiation : 2019
Date of completion : 2022

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

BACKGROUND: The Marine Macro Algal Flora of the West Bengal coastline is unexplored / under explored. Therefore, a thorough study and field exploration is required for proper documentation of the marine macro algae of the study area.

AREA AND LOCALITY: West Bengal Coastal areas, including Sundarban Biosphere Reserve.

Map showing seaweeds collection sites in West Bengal coast

SUMMARY & ACHIEVEMENT/OUTCOME: A field tour to the West Bengal coastal areas, including Sundarban Biosphere Reserves (SBR) w.e.f. 22nd to 31st December, 2021 (10 days) was conducted and 16 coastal areas such as Udaypur, Dheusagar, Mohana, Shankarpur, Mandarmoni, Junput, Tajpur, Old Digha, New Digha, Namkhana, Ganga Sagar dwip, Bokkhali, surrounding Islands of Sundarban BR– Amlamethi, Jhorkhali and Canning region of the Sundarban was surveyed. During the survey, 50 field nos. of seaweeds were vouched and GPS and coastal nature of all the localities were recorded. All the collected seaweed samples were duly processed and preserved in dry forms (herbarium sheets) and few delicate specimens in wet forms (preserved in containers in 4% formalin solution). 92 field nos. (including previous collections) of seaweed specimens were identified and taxonomic description of 21 taxa of seaweeds, comprising of 12 Chlorophyceae and 9 Rhodophyceae were completed. All the preserved samples were properly labelled and deposited into the Cryptogamic Section, CNH (CAL).

Mangroves supporting seaweeds vegetation in Sundarban BR

Collection of seaweeds growing on Mangroves in Sundarban BR

PROJECT-8

Red Listing of Indian endemics as per IUCN criteria: Family Ranunculaceae

Executing Scientist(s) : D.K. Agrawala, Debasmita Dutta Pramanik, J.S. Jalal, S.S. Dash
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: Evaluation of threat status of Indian endemics belonging to the family Ranunculaceae and spatial representation of the endemic on the global atlas.

BACKGROUND: The family Ranunculaceae is represented in India by 293 taxa under 31 genera of which 42 taxa are reported as endemic to the country. The family is well known for having highly explored medicial plants like Aconites, Thalictrum, Caltha etc., but no comprehensive work has been done on the threat assessment in Indian context. Therefore, assessment of the endemic species under the family Ranunculaceae has been proposed for red list assessment as per IUCN guidelines.

AREA AND LOCALITY: Entire India

SUMMARY AND ACHIEVEMENT: Relevant books viz. The Indian Plant Red Data Book-1 (Jain & Sastry, 1984), The Red Data Books of Indian Plants -2 (Nayar & sastry, 1988), Flora of India – Vol. 1(M.A. Rau in Sharma & al., 1993), Endemic Plants of India (Singh & al., 2015), Flowering Plants of India-An annotated Checklist [Mao & dash (ed.), 2020] and all available pertinent literatures were consulted. Total 42 endemic taxa from previous works were listed. Type materials of the endemic taxa from different National herbaria (CAL, MH, BSD, DD, KFRI, ASSAM, ARUN) were listed and studied. Data sheet of 25 taxa belonging to the genera *Aconitum* (08 taxa), *Anemone* (03 taxa), *Caltha* (01 taxa) and *Clematis* (13 taxa) (Name of the taxon with author name, synonym, citation, taxonomic status, key diagnostic features, phenology, habitat, distribution and specimen examined) has been prepared as per IUCN guidelines. All the data have been compiled from literature and herbarium data. The distribution data of 25 taxa have incorporated in excel sheet and latitude-longitude data procured from Google earth.

HIGH ALTITUDE WESTERN HIMALAYA 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 : 2022

OBJECTIVE: The main objective was 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: Documentation and compilation of floristic diversity of the campus 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.

Site of the Study, Dr. Y.S. Parmar University, Nauni, Solan (Source: Goggle Map)

AREA AND LOCALITY: Dr. Y.S. Parmar University Campus, Nauni, Solan (H.P.). The campus of the Dr. Y.S. Parmar University is situated at Nauni, lies between 31º. 2777 N Latitude and 76º.94373 E Longitudes in Solan district, about 12 Km from Solan on Solan to Ramgarh Road, at an altitude of 1300m. It has around 5.5 Km^2 area including forest area, villages *viz.* Kalaghat, Pandha, Khaltu, Khad along with river streams and ravine areas.

SUMMARY AND ACHIEVEMENTS: The manuscript/project report as per Annual Action Plan, 2021-2022 had been submitted to Director, BSI, Hqrs., Kolkata. It was found that the floristic account of Dr. Yashwant Singh Parmar University of Horticulture and Forestry Campus, Nauni was mainly concerned with flowering plants and covers 113 families (Dicot- 96 and Monocot-17), 400 genera and 623 species (Dicot-548 and Monocot-75), including infra-specific taxa and also some cultivated species among the angiosperms. The proportion of the dicots and monocots was 7.3:1.

The vegetation of Dr. Y.S. Parmar University had also been categorized as per the revised survey of the forest types of India by Champion and Seth (1962). The diverse geographical features of Dr. Y.S. Parmar University and its habitats along with its resident flora supported a very rich floristic composition. The following major types of forests were found mostly in the Northern parts of the campus and recorded during survey work (Champion & Seth, 1968).

1. Subtropical mixed forests: Such type of vegetation was found near Kalaghat and Pandha villages in the Northern parts of the campus. Tree species that were commonly seen in the Kalghat forest area were *Aegle marmelos, Bauhinia purpurea, Bombax ceiba, Cassia fistula, Cocculus laurifolius, Falconeria insignis, Ficus benghalensis, Ficus palmata, Kydia calycina, Mallotus philippensis, Myrica esculenta, Neolitsea cuipala, Ougeinia oojeinensis, Pyrus pashia Quercus leucotrichophora, Rhamnus triquetra, Toona ciliata, Wendlandia heynei* etc. and their associates.

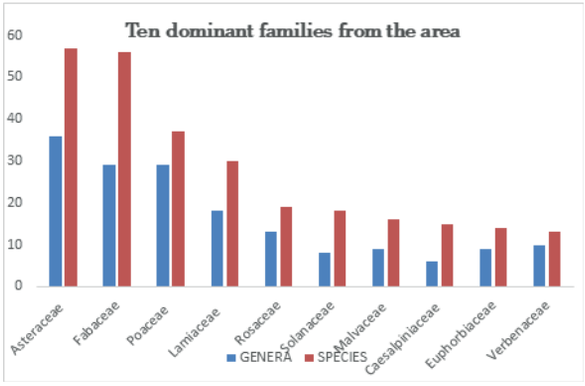
1a. Riverine forest areas: Such type of vegetation was found in the catchment area of

Khaltu and Khad rivers. Major species were *Acacia nilotica, Albizia chinensis, Cassia fistula, Colebrookea oppositifolia, Ehretia laevis, Ficus palmata* etc. and their associates.

1b. Dry open slopes: *Berabris asiática, Campylotropis eriocarpa, Carissa carandas, Cissampelos pareira, Clematis gouriana, Desmodium spp., Dioscorea bulbifera, Hypericum oblongifolium, Indigofera cassioides, Woodfordia fruiticosa* etc.

2. Sub-tropical Pine forests: *Pinus roxburghii* and his associates.

In general, forest vegetation and flora of the campus were found to be economically important. Various timber-yielding species like *Dalbergia sissoo, Falconeria insignis, Kydia calycina, Lannea coromandelica, Mallotus philippensis, Neolitsea cuipala, Pinus roxburghii, Ougeinia oojeinensis, Quercus leucotrichophora, Toona ciliata, Wendlandia heynei* etc. were found in the forest area. Other edible, medicinal herbs, Dye, Fibre and Oil yielding species were also found in that region.During survey work, it was observed that at many places on forest margins, introduced plant species and common weeds were encroaching the habitat of indigenous species *viz. Aleurites fordii, Ageratina adenophora, Ageratum conyzoides, Alternanthera pungens, Berbena brasiliensis, Bidens pilosa, Bischofia javanica, Bolusanthus speciosus, Conyza bonariensis, Cuscuta reflexa, Cynara scolymus, Jasminum mesnyi, Lantana camara, L. montevidensis, Nicotiana tabacum, Parthinium hysterophorus, Paulownia tomentosa, Solidago canadensis, Salvia* spp, *Xanthium strumarium* etc. Many wild, naturalized and cultivated flowering plant species of the campus were found to have a great potential for their exploitation as ornamental. Some of them found in the study area were *Bombax ceiba* (red flowers), *Brugmansia arborea, Butea monosperma* (bright red flowers), *Cassia siamea, Cassia fistula* (beautiful pendulous yellow flowers), *Callistemon viminalis, Cestrum parqui, Combretum indicum, Cullen corylifolium, Crassula multicava, Erythrina* spp. (red Coral Tree), *Euonymus japonicus, Fumaria parviflora, Galphimia gracilis, Gomphrena pulchella, Ipomoea quamoclit, Jasminum* spp. (white and yellow scented flowers), *Lagerstroemia speciosa, Lobularia maritima, Malva pusilla, Manosa alliaca, Mirabilis jalapa* (red flowers), *Ougenia oojensis* (pink flowers), *Pentas lanceolata, Podranea ricasoliana, Pseudoacacia robinia, Rosa* spp. (white and pink flowers), *Russelia equisetiformis, Ruta graveolens, Santlum album, Sapium sebiferum, Senna siamea, Smallanthus sonchifolius, Solanum americanum, Strelitzia reginae, Thunbergia coccinea, Trachycarpus fortune, Tradescantia pallida, Tradescantia sillamontana, Tropaeolum majus, Uraria hamosa, Veronica filliformis, Viola canescens, Woodfordia fruiticosa* (red flowers), *Zephyranthes minuta*, some species of orchids (*Habenaria, Herminium*) and Zingibers (*Hedychium, Alpinia*); species of *Albegia, Cassia, Ficus, Duhaldea, Mimosa, Clematis, Ranunculus, Hedera, Asparagus* etc. Many species of flowering plants were found to be depleting and their population was becoming threatened due to over-exploitation or loss of habitat in the whole of Himachal Pradesh. The economically important species particularly the medicinal and ornamental species were found to be facing a great threat due to the pressure of various biotic and abiotic factors. The present survey observed such species, which were under threat and conserved in Botanical garden. Some of them were highly medicinal *viz. Abutilon indicum, Aconitum heterophyllum, Ajuga bracteosa, Andrographis paniculata, Artimisia annua, Atropa belladonna, Bacopa monnieri, Barlaeria priponitis, Berbaris aristata, Berbaris lycium, Bergenia stracheyi, Celastrus paniculatus, Centella asiatica, Dactylorhiza hatagirea, Dioscorea deltoidea, Eclipta alba, Leucas lanata, Ocimum spp., Plantago ovata, Piper longum, Podophyllum hexandrum, Pogostemon benghalensis, Rheum moorcroftianum, Saussurea costus, Valeriana jatamansi, Sapium insigne, Smilax aspera, Stephania glabra, Terminalia* spp., *Tinospora glabra, Withania somnifera* etc.



Graphic representation of the dominant families.

INDUSTRIAL SECTION INDIAN MUSEUM KOLKATA

PROJECT-1

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

Exexuting Scientist (s) : Dr. S. Datta, Dr. K. Pagag, and Dr M. Bhaumik.
Date of initiation : 2020
Date to be completion : 2022

BACKGROUND: The Industrial Section, Indian Museum was established on 1st April, 1887, situated at 1, Sudder Street Kolkata (became a part of Botanical Survey of India since January, 1911). The Botanical Gallery (ca 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. A comprehensive catalogue of the exhibits of this gallery is therefore essential.

SUMMARY AND ACHIEVEMENTS: 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. The collections are not only important in understanding the uses of the plant world but also provide an insight of the further exploration in the field of economic botany. There have been several collections outside India from Afghanistan, Burma and Bangladesh which is important in understanding the different uses of the plants across the country.

A catalogue of exhibits of Gum & Resin section was being prepared with 2546 specimens enlisted.

NORTHERN REGIONAL CENTRE DEHRADUN

PROJECT-1

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

Executing Scientist (s) : Dr. Giriraj Singh Panwar & Dr. Bhavana Joshi
Date of initiation : 2021
Date to be completion : 2023

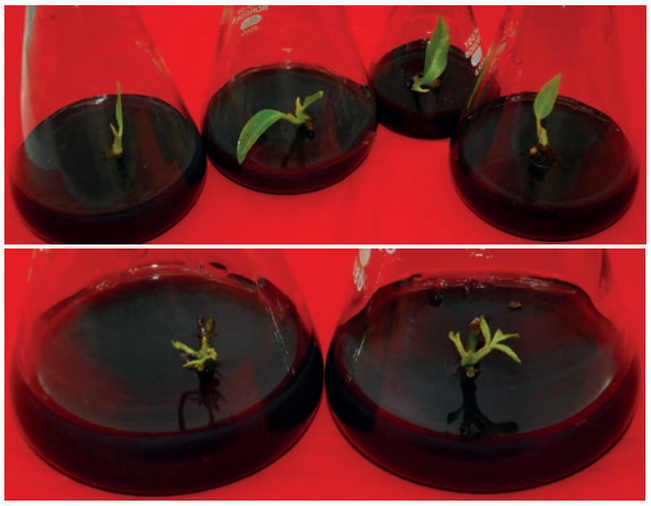
OBJECTIVE: The main objectives were as follows 1) collection of explants/plant propagules from the wild population. 2) Standardization of micropropagation protocol for the selected species by direct and indirect organogenesis methods using different explants such as shoot tip, nodal segment, axillary bud, young leaves and other meristematic tissues. 3) Hardening of plantlets in the green house/ net house and shifting of acclimatized plants to the open environment as well as field.

BACKGROUND: 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 3,27,200 KM2 (Dhar & Samant, 1993), which is about 62% of Indian Himalayan Region and about 10% of total area of India.

AREA AND LOCALITY: North-West Himalaya.

SUMMARY AND ACHIEVEMENTS: Micropropagation protocol was standardized for the *Mezotropis pellita* (Prain) Sanjappa (Leguminosae). Bud break was observed in the nodal segment of explants of *Magnolia kisopa* (Buch. -Ham. ex DC.) Figlar (Magnoliaceae). Bud break was also observed in the nodal segment of explants of *Zanthoxylum armatum* DC. (Rutaceae).

Micropropagation of *Mezotropis pellita*: (a) germination of seeds, (b) axenic shoot tip explants inoculated into shoot induction medium. (c) development of multiple shoots, (d-f) development of roots, (g & h) hardening and acclimatization of plantlets to the open environment.



Direct organogenesis in *Magnolia kisopa* and *Zanthoxylum armatum* by using nodal segment explants.

PROJECT-2

Ethnobotanical study of Tharu and Bhoxa tribe of Uttarakhand, India

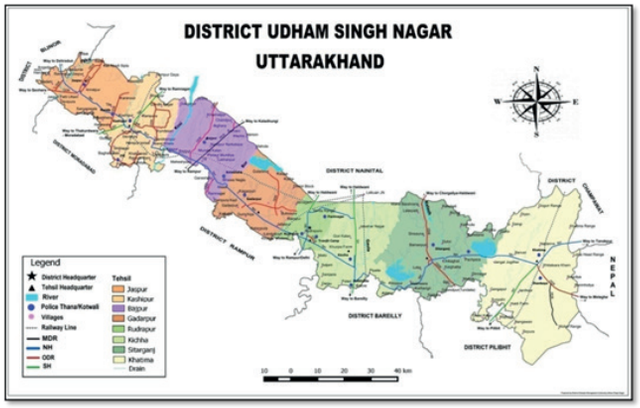
Executing Scientist (s) : Dr. Harish Singh

Date of initiation : 2020
Date to be completion : 2023

OBJECTIVE: The main objectives were as follows 1) Folklore survey and field work in the Tharu, Bhoxa and indigenous populated areas and nearby forests of the state. 2) Collection and identification of plants and plant products used by them for various purposes. 3) Documentation of traditional knowledge about utilization of plants and preparation of inventories of folklore plants. 4) Germplasm collection of rare and important ethnobotanical plants to develop small-scale ethnobotanical garden for ex-situ conservation point of view. 5) 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: Bhoxa villages and nearby forest areas of Udham Singh Nagar district (approx. 260 Km^2).



A survey team in Chunakhan Forest (Uttarakhand)

SUMMARY AND ACHIEVEMENTS: During 2021-22, 200 field numbers (in duplicate) were collected with 270 field numbers with ethnobotanical uses for various purposes (Medicine – 129, Edible – 45, Fodder – 24, Dye-02, Veterinary – 04, House Hold Articles – 07, oil-01, Religious – 15, Magico-belief – 02, Fish Poison – 01, Broom – 04, Fiber/ Rope – 04, Mat – 02, Basketry – 05, Bio-fencing -02, Fuel – 05, Hut-Thatching -05, Detergent – 02, Plates & Bowls– 02, Miscellaneous – 08). Also 08 live plants and seeds of 04 plants were collected for introduction in the Garden and 07 plant parts for the Museum. More than 500 good-quality digital photographs/ videos were recorded. GPS data of 08 localities of the surveyed area were noted. 167 plant specimens (26 of Dehradun and 141 of Udham Singh Nagar districts) were identified and verified from Herbarium (BSD). A total of 257 ethnobotanical information was computerized in Excel sheet and documented on herbarium sheets/reports after they were properly dried, poisoned, labeled and mounted.

A total of 168 ethnobotanical data were collected from already published literature for comparative study. 14 additional references were also collected pertaining to Ethnobotany of Uttarakhand from different sources. During 2020-21, 1545 sq. km areas of Dehradun district was surveyed among Bhoxa tribe and Udham Singh Nagar district among Tharu tribe and 276 field numbers were collected with 366 ethnobotanical uses.

Bhoxa boys collecting leaves of Tectona grandis L.f. for making plate

A medineman at Chhoi village (Uttarakhand)

PROJECT-3

Taxonomic revision of genus *Taraxacum* F.H.Wigg. in India

Executing Scientist (s) : Dr. Sameer Patil and Dr. S.K. Singh

Date of initiation : 2020

Date to be completion : 2023

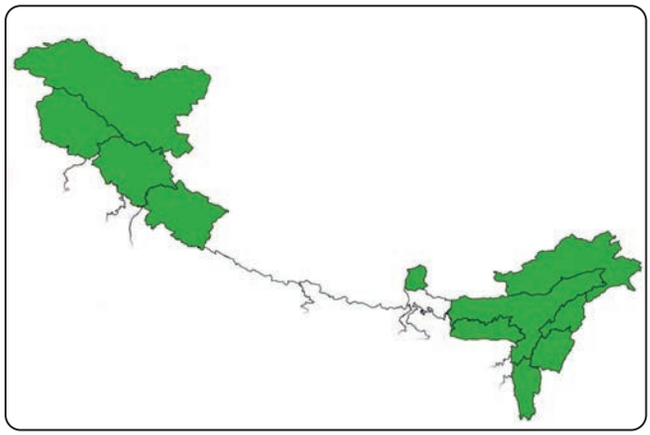
OBJECTIVE: The main objectives were as follows 1) to define and classify species of genus Taraxacum in India. (ii) To describe the species on the basis of morphological characters and provide a taxonomic key for identification (iii) To perform SEM study of capsules of Taraxacum species in India.

Taraxacum succedens

BACKGROUND: To define and classify c. 83 species of genus *Taraxacum* in India. (ii) To describe the species on the basis of morphological characters and provide a taxonomic key for identification (iii) To perform SEM study of capsules of Taraxacum species in India.

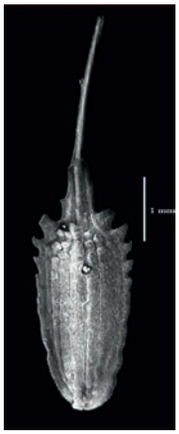
Taraxacum lahulense full bloom at Chandratal

AREA AND LOCALITY: Jammu & Kashmir, Ladakh & Himachal Pradesh, Sikkim & Northeast India.



SUMMARY AND ACHIEVEMENTS: One field tour was conducted to Ladakh & Himachal Pradesh for 17 days (31 July to 16 August 2021). 354 specimens of 89 spp. of *Taraxacum* were collected, mostly from cold desert habitat. Achene samples of 63 spp. were collected for SEM study and achene gene pool of *Taraxacum* of India was prepared. Samples of 37 spp. for cytological study were also collected while 96 nos. of achene samples were collected for Scanning Electron Microscopic study of *Taraxacum* spp. from field tours and also procured from duplicates of various herbaria during 2021-22. Herbarium consultation tours were conducted to DD, PUN, PAN, IHBT & Jammu University for 15 days (14 to 18 December 2021 & 31 March to 9 April 2022) resulting in consultation of 810 herbarium specimens of *Taraxacum* mostly of Western Himalayas. The identity of 506 herbarium specimens housed in various herbaria were determined and corrected. Herbarium data for ecological and GIS mapping of various *Taraxacum* sections of Western Himalayas were noted. Also achene samples from 120 duplicate herbarium specimens of different herbaria were collected for SEM analysis. 55 specimens of *Taraxacum* collected from field tours were identified. 10 species of Taraxacum were determined and corrected based on field specimen and achene study. Growth and phenology of *Taraxacum* spp. collected from cold desert habitat were monitored and introduced in BSI, NRC, greenhouse. Ecological Niche Modelling maps of *Taraxacum* species of Western Himalayas were prepared to determine the exact probable distribution of each species. Computational analysis of achenes of various species of Taraxacum was conducted and a character comparison table was prepared for morphology-based phylogenetic analysis.

Taraxacum officinale



Taraxacum officinale (Achene)

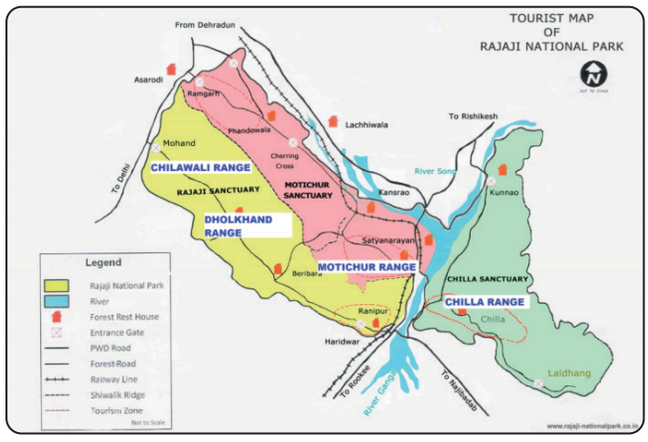
PROJECT-4

Assessment of Plant diversity in Rajaji National Park, Uttarakhand.

Executing Scientist (s) : Dr. Puneet Kumar, Dr. S.K. Singh, Dr. P.K. Deroliya & Poulami Ghosh
Date of initiation : 2021
Date to be completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the Rajaji National Park, Uttarakhand

BACKGROUND: This project aimed at the processing, identification and documentation of plants collected from the Rajaji National Park, Uttarakhand.



A view of mixed forest and grassland vegetation in the Rajaji National Park

AREA AND LOCALITY: Chilla Range, Motichur Range, Chillawali and Dholkhand Range

A view of mixed forest and grassland vegetation in the Rajaji National Park

SUMMARY AND ACHIEVEMENTS: During the period, three field tours were conducted in Qtr. 3 and Qtr. 4 to four ranges (Chilla Range, Motichur Range, Chillawali, and Dholkhand Range) of the National Park. A total of 328 field numbers, comprising about 984 plant specimens, were collected during the collection tours. Out of these, 162 field numbers were identified, belonging to 68 families under 127 genera and 142 species. Of these identified plant species, 23 were new additions to the already existing list of plants in the National Park. Besides, on the basis of BSD herbarium consultation, 36 species were also reported as new additions to the flora of the National Park. Literature pertaining to the flora of the National Park was consulted and 44 references were collected. A list of all the species (including 806 spp.) was prepared which were reported from the park in previously published literature.

Enydra fluctuans Lour.

Ougeinia oojeinensis (Roxb.) Hochr.

Urtica urens L.

PROJECT-5

Backlog clearance of unidentified herbarium sheets at BSD

Executing Scientist (s) : Dr. S.K. Singh, Poulami Ghosh, Subhasmit Bhattacharyya and Latika Sagarwal

Date of Initiation : 2021

Date to be completion : Still going on and has been proposed to carry forward for the next year 2022- 2023

OBJECTIVE: The main motive of this project was Identification, fumigation & incorporation of the previously unidentified sheets into the BSD Herbarium, Dehradun.

SUMMARY AND ACHIEVEMENTS: 269 no. of plant specimens belonging to 189 genera from 73 families were identified. As per the instructions from Headquarters, herbarium digitization work was undertaken which included retrieving 3,723

no.s of metadata from different floras [Grasses of Jammu & Kashmir (BSI, unpublished), Flora of Pin Valley, Flora of Cold desert vol-02 & vol-04, Flora of Jammu & Kashmir, vol-02, vol-04, Flora of Sultanpur National Park, Flora of Himachal & Flora of Nandhour]. Metadata entry of 58,046 plant specimens along with barcode entry of 6,010 sheets was completed.

PROJECT-6

Curatorial works and maintenance of the garden of NRC, Dehradun

Executing Scientist(s) : Dr. S.K. Singh, Dr. Ramesh Kumar, Dr. Puneet Kumar & Dr. P.K. Deroliya
Date of Initiation :
Date to be completion : Ongoing

OBJECTIVE: The objective was the regular maintenance of the Garden.

BACKGROUND: This project aims at regular maintenance and conservation of the of endemic threatened and economic plant species in the garden of NRC and regularly documenting their phenological data.

Valeriana jatamansi

SUMMARY AND ACHIEVEMENTS: During this period, seven one day tours were conducted to different areas of Uttarakhand. During these tours 64 species of threatened and economically important plants were collected *viz.*, *Asplenium laciniatum* D. Don, *Betula alnoides* Buch. -Ham. ex D. Don, *Begonia* sp., *Bulbophyllum caryophyllum* J.J. Sm., *Canna* sp., *Cardiocrinum giganteum* (Wall.) Makino, *Carpinus* L., *Cautleya spicata* (Sm.) Baker, *Cautleya gracilis* (Sm.) Dandy, *Coelogyne* Lindl., *Crepidium acuminatum* (D. Don) Szlach., *Cyathea albosetacea* (Bedd.) Copel., *Daphniphyllum himalense* (Benth.) Müll.Arg., *Davallia* Sm., *Leucostegia* C. Presl., *Dendrobium* sp., *Didymocarpus* Wall., *Drynaria* sp., *Gentiana kurroo* Royle, *Gaultheria nummularioides* D.Don, *Ficus roxburghii* Wall. ex Steud., *Gloriosa superb* L., *Habenaria marginata* Colebr., *Hedychium ellipticum* Buch. -Ham. ex Sm., *Crotalaria mysorensis* Roth., *Zeuxine struteumatica* (L.) Schltr., *Tamarix dioica* Roxb. ex Roth., *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda, *Roscoea purpurea* Sm., *Ipomoea purpurea* (L.) Roth; *Androsace lanuginosa* Wall., *Eulaliopsis binata* (Retz.) C.E.Hubb.; *Valeriana jatamansi* Jones ex Roxb., *Verbascum thapsus* L.; *Gerbera gossypina* (Royle) Beauverd; *Swertia paniculata* Wall.; *Erigeron emodi* I.M. Turner; *Wikstroemia canescens* Wall. ex Meisn.; *Isodon lophanthoides* (Buch. -Ham. ex D. Don) H. Hara; *Abies spectabilis* (D. Don) Mirb.; *Adiantum venustum* D. Don; *Crepidium acuminatum* (D. Don) Szlach.; *Parnassia nubicola* Wall.; *Parochetus communis* D. Don; *Picea smithiana* Boiss.; *Primula denticulata* Sm.; *Satyrium nepalense* D. Don; *Swertia ciliata* Royle ex D. Don; *Swertia paniculata* Wall.; *Rhodiola sinuata* (Royle ex Edgew.) S.H. Fu; *Androsace lanuginosa* Wall.; *Halenia elliptica* D. Don; *Ajuga* sp., *Desmodium* sp., *Rhodiola* sp., *Pedicularis* sp.; *Trigonella* sp.; *Cheilanthes* sp.; *Thelypteris* sp, *Asparagus* sp. *Habenaria* sp, *Hypericum* sp.; Dahlia sp. (wild four variant yellow, orange, white, Red).In addition, previously introduced and conserved species in the Botanic Garden were multiplied through cuttings and raised from seed sowing viz. *Withania somnifera* (L.) Dunal – 15 seedlings; *Prosopis cineraria* (L.) Druce – 30 seedlings; *Jatropha curcas* L. – 50 seedlings; *Tabeubia rosea* (Bertol.) Bertero ex A.DC.; *Elaeocarpus serratus* Benth. = 200 Nos; *Pongamia pinnata* (L.) Merr. = 300 Nos; *Artocarpus lacucha* Roxb. = 200 Nos; *Saraca asoca* (Roxb.) W.J.de Wilde = 2 Nos; *Quercus* sp. = 100 Nos. *Gardenia gummifera* L.f. – 08 cuttings; *Chrysanthemum* L. cuttings – 150 cuttings; *Duranta* L. cuttings – several; *Hibiscus rosa*-sinensis L. – 30 cuttings; *Plectranthus amboinicus* (Lour.) Spreng – 15 cuttings. *Hibiscus rosa*-sinensis cuttings – 15; *Duranta* cuttings – several; *Elaeocarpus serratus* – seedlings; *Terminalia*

arjuna – seedlings; *Terminalia bellerica* – seedlings; *Terminalia chebula* – seedlings; *Pongamia pinnata* – seedlings; *Cinnamomum zeylanica* – seedlings; *Nyctanthes arbor*-tristis – seedlings; *Saraca asoca* – seedlings; *Quercus* sp. – seedlings; *Bougainvillea* Comm. ex Juss.; *Commiphora caudata* (Wight & Arn.) Engl.; *Ficus carica* L.; *Lawsonia inermis* L.; *Chrysanthemum* and *Camellia* sp., *Nelumbo nucifera* Gaertn. – 03 seedlings (Germinated from seeds); *Catharanthus* sp. – 0 7 saplings (04 different colors); *Gardenia jasminoides* J. Ellis, – 02 saplings; *Agave geminiflora* (Tagl.) Ker. - Gawl. – 03 saplings; *Neoregelia* sp.(red) – 03 saplings; *Coleus* sp. – 04 saplings (04 different colors); *Nolina recurvata* (Lem.) Hemsl. – 02 saplings; *Dahelia* – 02 saplings. Plantation: *Cordyline terminalis* (L.) Kunth– 04 saplings; *Calthea ornata* (Lindl.) Korn. – 04 saplings; *Potentilla* sp. – 03 saplings; *Anthurium* sp. – 04 saplings; *Nymphaea* sp. – 01 sapling, *Chrysanthemum* cuttings – 200; *Neoregelia* (green) – 23 saplings in the garden.Phenological data for species conserved in the Botanic Garden was also noted for 168 species including Herb (66 spp.), Shrub/undershrub (34/3 spp.), Tree (56 spp.), Climber (7 spp.), Aquatic herb (2 spp.) and fruiting in 86 species including Herb (9 spp.), Shrub (14 spp.), Tree (63 spp.) during this period.

Crepidium acuminatum

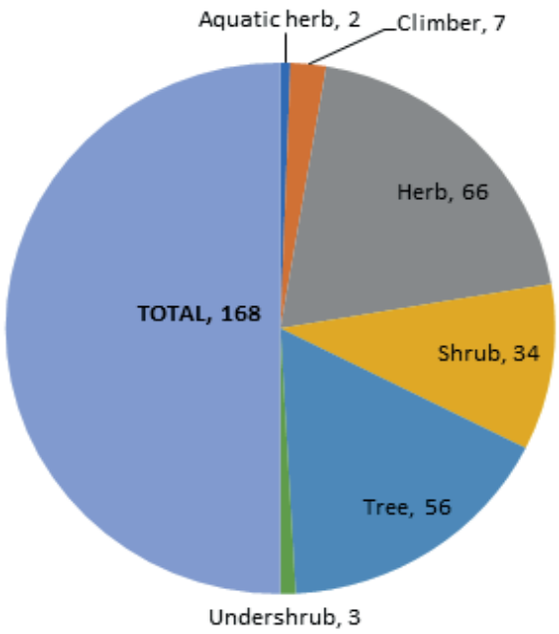


Fig 1. Flowering data

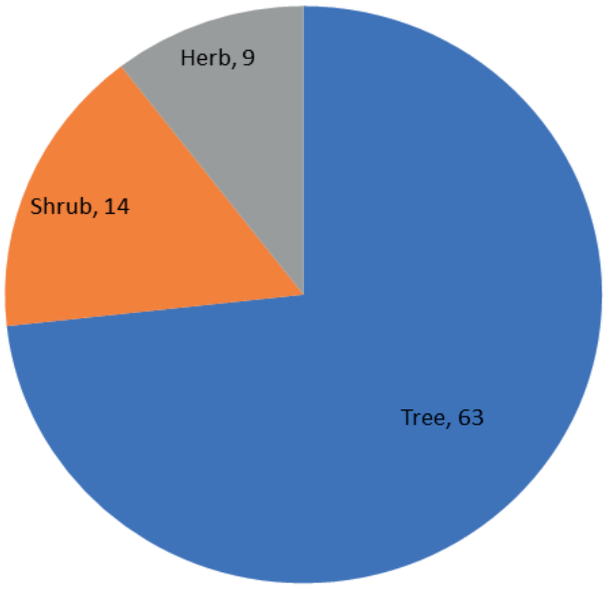


Fig 2. Fruiting data

Besides, maintenance including deweeding, hoeing, manuring, insecticide treatment etc. of rosary, charak udhyan, annual beds, medicinal plant section, net houses, fern house, poly house, nympheaea ponds and pots were also done.

PROJECT-7

Development of Medicinal plant Garden

Executing Scientist (s) : Dr. Harish Singh
Date of initiation : 2021

Date of completion : 2023

OBJECTIVE: The objective was the development of the medicinal plant garden.

BACKGROUND: The project was designed to collect medicinal plants from different areas and their plantation in the garden. The progress and agricultural operation to be recorded.

AREA AND LOCALITY: Nearby areas of Dehradun

SUMMARY AND ACHIEVEMENTS: During 2021-22, a medicinal plant nursery with 110 nursery beds along with path of 75 x 180 feet area was prepared including it's planning/ designing. Lists of 63 easily available medicinal plant species were prepared and 53 species of medicinal plants were planted. Also around 100 saplings of medicinal plants were planted on 'Himalayan Day programme' on 09-09-21. 08 live plants and seeds of 04 plants from Udham Singh Nagar district were collected and planted. Centre for Aromatic Plants (CAP) Sailakui, Dehradun was contacted for arrangement of saplings of aromatic plants and their progress was observed and recorded in regular intervals.

PROJECT-8

Pteridophytic flora of India

Executing Scientist (s) : Dr. B.S. Kholia, / Team of BSI Pteridologists
Date of initiation : 2020
Date of completion : 2023

OBJECTIVE: The objective of this project was revision and flora writing of selected families of Indian Pteridophytes

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 (Fraser Jenkins *et al.*, 2016). 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 vegetation pattern in India rank only next to the flowering plants. The project Pteridophytic flora of India was allotted in August 2020. From 2022-2023 Herbarium specimens housed at BSI was studied. 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.

SUMMARY AND ACHIEVEMENTS: Description of 80 species was completed. In addition, 613 samples were identified and the label information of 483 herbarium sheets was filled. The key of Lycopodiaceae and Dennstaedtiaceae were prepared. Two herbarium tours were (Calicut and Assam) undertaken and consultation and identification of 150 herbarium sheets were done.

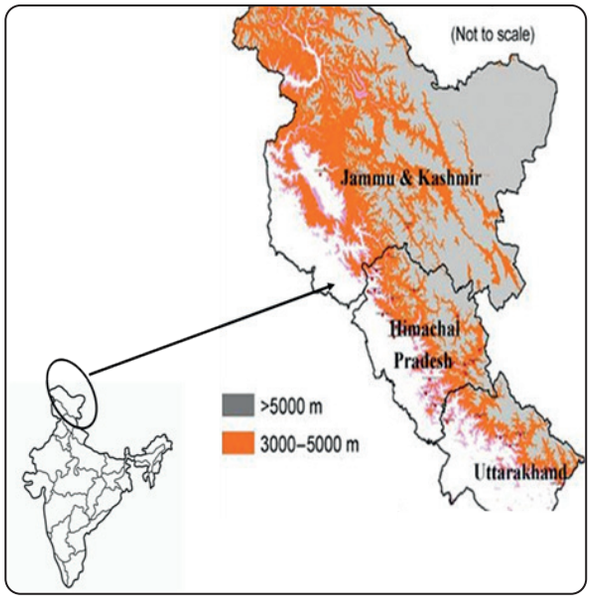
PROJECT-9

Grass Flora of Western Himalaya

Executing Scientist (s) : Dr. Manish K. Kandwal
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plantgrass s and complete the grass flora for the Western Himalayas.

BACKGROUND: This project was initiated with the goal of Processing, identification and documentation of the collected specimens from the exploration tours to different areas like Jammu and Kashmir and Ladakh, Himachal Pradesh and Uttarakhand.



Map of Western Himalayas

AREA AND LOCALITY: Four local tours were conducted in Dehradun and adjacent areas the area includes Narander nagar, Rishikesh, Chakarata and Rajaji National Park.

SUMMARY AND ACHIEVEMENTS: 104 specimens were collected and 87 species were studied/ identified from preserved BSD herbarium. 200 herbarium sheet form Western Himalaya which include all parts of western Himalaya were listed from BSD herbarium and library consultation was done for preparation of checklist of the grasses of Western Himalaya. Thysanolaena maxima (Roxb.) Kuntze was collected from Chakarata and Rajaji national park respectively for introduction in the BSI, NRC Garden.

Neyraudia arundinecea (L.) Henrard.

Pogonatherum panecium (Lam.) Hack.

Imperata cyllindrica (L.) P. Beauv.

Microstegium falconeri (Hook.f.) Clayton

Field photographs of species collected during local collection tours

SIKKIM HIMALAYAN REGIONAL CENTRE GANGTOK

PROJECT-1

Curatorial works and maintenamce of Germplasm of Rhododendron L. (Ericaceae) and Impatients Riv ex L. (Balsaminaceae) in EBG, BSI-SHRC.

Executing Scientist(s) : Rajib Gogoi & J.H. Franklin Benjamin
Date of initiation : Ongoing
Date of completion : Ongoing

OBJECTIVE: The major objective of this project was collection and maintenance of Rhododendron L. (Ericaceae) and Impatiens Riv ex L. (Balsaminaceae) in Experimental Botanic Gardens, Gangtok.

AREA AND LOCALITY: Sikkim

SUMMARY & ACHIEVEMENTS: Regular maintenance and monitoring of the germplasm was carried out and 13 species were introduced namely *Impatiens cathcartii* Hook.f., *I. bakthangensis* Chhetri, Sherpa & Gogoi, *I. jurpia* Buch.-Ham., *I. stenantha* Hook.f., *I. drepannophora* Hook.f., *I. pulchra* Hook.f. & Thomson. (Balsaminaceae), *Rhododendron arboreum* Sm., *R. maddenii* Hook.f., *R. dalhousieae* Hook.f., *R. formosum* Wall., *R. grande* Wight, *R. griffithianum* Wight, *Rhododendron wattii* Cowan (Ericaceae). 40 Saplings of *Prinus cerasoides* D.Don, 3 saplings of *Malus sylvestris* (L.) Mill., 7 saplings of *Luculia gratissima* (Wall.) Sweet (Rubiaceae) was planted, also *Magnolia doltsopa*, *Impatiens cathcartii*, *Phoenix rupicola*, *Zingiber clarkii*, *Alstomeria* spp. and 20 planting material of Yacon were supplied to BSI-ERC, Shillong. Planting material of Yacon (*Smallanthus sonchifolius* (Poepp.) H.Rob. (Asteraceae) was distributed to five villages in Sikkim & Darjeeling Hills.

PROJECT-2

Wild edible plants of Sikkim and Darjeeling Himalaya

Executing Scientist(s) : Rajib Gogoi & J.H. Franklin Benjamin
Date of initiation : 2021
Date of completion : 2023

OBJECTIVE: This project proposed to list down WEPs of Sikkim Himalayas (all districts in Sikkim and 2 district in W.B.- Darjeeling & Kalimpong).

BACKGROUND: Wild Edible Plants (WEP) play major role in meeting the nutritional requirement (vitamins, carbohydrates, proteins, fibers and minerals) of the tribal and forest dependent and rural population. They provide in particular vitamins A and C, zinc, iron, calcium, iodine, thiamine, riboflavin, niacin, and folacin. They are the main source to select alternative source of food plant/medicine etc. WEP play important role in food security and nutritional balance especially for women, children, and the poor, who heavily rely on them.

AREA AND LOCALITY: South & West Sikkim

SUMMARY & ACHIEVEMENTS: Literature and herbarium were referenced for Wild Edible Plants (WEPs) of the geographical region. About 200 species of WEPs recorded from literature were listed out with the parameters like Plant name, Family, Local name, Use and Parts used. One field tour to South and West Sikkim was conducted for 14 days between 21/03/2022 to 03/04/ 2022. 46 villages, 5 haats and 3 protected areas were surveyed for WEPs. 80 taxa of WEPs were photographically documented and 65 field numbers were collected. Museum enrichment was done by collecting flower, fruit and seed based WEPs in liquid preservatives and also unique ethnobotanical artifacts like sitting mats weaved out of various grasses, and sample traditional fermented liquids like wine (Rhododendron, Ginger, Large Cardamom, Banana, Fragaria, etc.) for display in the museum for creating awareness to the visitors. Literature and herbarium were referenced for Wild Edible Plants (WEPs) of the geographical region.

SOUTHERN REGIONAL CENTRE COIMBATORE

PROJECT- 1

Flora of Tamil Nadu (Volume 1: Ranunculaceae – Connaraceae)

Executing Scientist(s) : Dr. W. Arisdason and Dr. M. Anantha Lakshmi
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

BACKGROUND: Under this project taxa belonging to Families: Ranunculaceae – Connaraceae were studied, identified and documented.

AREA AND LOCALITY: One botanical exploration tour was conducted to Hosur Forest Division, Krishnagiri District and Kolli Hills, Namakkal District.

SUMMARY & ACHIEVEMENTS: Previously a comprehensive checklist of 51 flowering plant families (Ranunculaceae – Connaraceae) that included about 940 species, 09 subspecies and 31 varieties belonging to 329 genera was prepared. The detailed taxonomic accounts of 13 families, altogether representing 89 taxa [86 species (including 06 cultivated) and 03 varieties] belonging to 20 genera was prepared. Habit sketches (flowering-/fruiting-twig) of *Clematis munroiana* Wight, *C. theobromina* Dunn and *C. wightiana* Wall. were prepared based on herbarium.

During 2021-22, a joint four-day botanical exploration tour was conducted along with the team members of Volume 5 of Flora of Tamil Nadu to Hosur Forest Division, Krishnagiri District and Kolli Hills, Namakkal District from 15.02.2022 to 18.02.2022 and about 160 plant specimens were collected. Furthermore, different vegetation types, habitats and plants either with flowers or fruits were photographed. The taxonomic account of 15 families, altogether representing 90 taxa [87 species (including 06 cultivated) and 03 varieties belonging to 21 genera were prepared. The representative herbarium specimens of all 15 families were consulted at Madras Herbarium (MH) while preparing the taxonomic treatment of the respective family. The 160 specimens that were collected during the aforementioned botanical exploration tours were provisionally identified either in the field or in the lab. The voucher specimens making was being carried out simultaneously, however, the identity of voucher specimens of 40 species was further confirmed by scrutiny of pertinent literature and comparing with authenticated specimens housed at MH. Metadata for 2216 herbarium specimens, housed at Madras Herbarium were prepared.

PROJECT-2

Flora of Tamil Nadu (Volume 2: Fabaceae -- Sambucaceae)

Executing Scientist(s) : Dr. Sujana, K.A and Dr. Rakesh G. Vadhyar
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

SUMMARY & ACHIEVEMENTS: Literature survey was carried out and different literature was consulted, representative specimens of allotted families were deposited at MH. A checklist of 1346 taxa under 35 families was prepared. Manuscript of description was prepared for 191 taxa: Chrysobalanaceae (3 taxa), Parnassiaceae (2 taxa), Hydrangeaceae (3 taxa), Droseraceae (3 taxa), Datiscaceae (1 taxon), Trapaceae (2 taxa), Turneraceae (2 taxa), Caricaceae (2 taxa), Sonneratiaceae (1 taxon), Punicaceae (1 taxon),

Alangiaceae (2 taxa), Cornaceae (3 taxa), Caprifoliaceae (12 taxa), Aizoaceae (7 taxa), Molluginaceae (8 taxa), Melastomataceae (39 taxa), Myrtaceae (58 taxa), Combretaceae (10 taxa), Rosaceae (12 taxa) and Lythraceae (20 taxa).

PROJECT-3

Flora of Tamil Nadu (Volume 4: Menyanthaceae to Plantaginaceae) (19 families with about 240 genera and 880 spp.)

Executing Scientist(s) : Dr. V. Sampath Kumar, Ms. Lydia M. Thomas & Ms. Rini Vijayan
Date of initiation : 2021
Date of Completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

BACKGROUND: A checklist is being prepared for the different families by referring various floras. Citations are made for the species and infraspecific taxa for the families Gesneriaceae (30 taxa), Lentibulariaceae (19 taxa), Orobanchaceae (8 taxa), Solanaceae (104 taxa) and Verbenaceae (50 taxa). The family Gesneriaceae has been completed in all aspects including key to the genera and species. While the descriptions and artificial keys are being prepared for the other families.

SUMMARY & ACHIEVEMENTS: Checklist was prepared for different families by referring various Flora. Citations were made for the species and infraspecific taxa for the families Menyanthaceae (3 spp.), Boraginaceae (37 taxa, incl. 1 subsp.), Convolvulaceae (105 taxa, incl. 2 subsp.), Plantaginaceae (6 taxa, incl. 1 subsp.), Symphrometaceae (3 spp.) and Verbenaceae (68 taxa, incl. 3 vars.). Descriptions were also prepared for 50 taxa belonging to the last 3 families. Herbarium metadata was prepared for 3,666 herbarium sheets belonging to families, such as Myoporaceae (6), Selaginaceae (3), and Verbenaceae (3657) by one of the team members, Ms, Lydia M. Thomas. Besides, the herbarium database was prepared for 15,176 sheets belonging to the families, Hydroleaceae (105), Polemoniaceae (3), Boraginaceae (2532), Convolvulaceae (3951), Solanaceae (3175), Scrophulariaceae (3742), Gesneriaceae (674), Lentibulariaceae (792) and Orobanchaceae (202).

PROJECT-4

Flora of Tamil Nadu (Volume 5: Nyctaginaceae to Ceratophyllaceae)

Executing Scientist(s) : Dr. R. Manikandan, Ms. Mehala Devi, R. & Shri Soumitra Bera
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

AREA AND LOCALITY: One botanical exploration tour for four days was conducted to Hosur Forest Division, Krishnagiri District and Kolli Hills, Namakkal District.

SUMMARY & ACHIEVEMENTS: All the species under the allotted 33 families were scrutinized based on available books, journals, revisions and monographs, and also herbarium specimens available in MH. Complete checklists for 850 taxa under allotted families were prepared from Nyctaginaceae to Ceratophyllaceae for Flora of Tamil Nadu, Vol. 5. A four-day field tour was also conducted to various parts of Kolli hills and Hosur Forest Division and 160 field numbers were vouched and photographed showing vegeatation, habit, flowering and fruiting twigs. Detailed descriptions for the following 51 taxa under 4 genera were completed for the families Moraceae (04 genera and 50 taxa) and Chloranthaceae (01 genus and 01 species) along with details, *viz.*, correct name and nomenclatural citations, distribution, status and phenological details as per the given format for Flora of Tamil Nadu based on herbarium specimens, relevant literature. A joint four-day botanical exploration tour was conducted along with the team members of Volume 5 of Flora of Tamil Nadu to Hosur Forest Division, Krishnagiri District and Kolli Hills, Namakkal District from 15.02.2022 to

18.02.2022, and about 160 plant specimenswere collected. Furthermore, different vegetation types, habitats and plants either with flowers or fruits were photographed. Herbarium Metadata was prepared as per the prescribed format for 6580 herbarium sheets that were deposited in Madras Herbarium (MH). The 160 specimens that were collected during the aforementioned botanical exploration tour were provisionally identified either in the field or in the lab. The voucher specimens making was being carried out simultaneously, however, the identity of voucher specimens of 40 species was further confirmed by scrutiny of pertinent literature and comparing the specimens with authenticated specimens housed at MH.

PROJECT-5

Flora of Tamil Nadu (Volume 6: Hydrocharitaceae to Eriocaulaceae)

Executing Scientist(s) : Dr. M.U. Sharief, Dr. S.S. Hameed, Dr. W. Arisdason & Dr. Ravichandran
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

AREA AND LOCALITY: Anamalai Tiger Reserve, Tamil Nadu, ca 500 km2.

SUMMARY & ACHIEVEMENTS: A checklist of 33 families was prepared *viz.* Hydrocharitaceae, Burmanniaceae, Orchidaceae, Zingiberaceae, Marantaceae, Cannaceae, Musaceae, Asparagaceae, Hypoxidaceae, Amaryllidaceae, Dioscariaceae, Stemonaceae, Smilacaceae, Colchicaceae, Asphodelaceae, Liliaceae, Pontederiaceae, Xyridaceae, Commelinaceae, Juncaceae, Arecaceae, Pandanaceae, Typhaceae, Araceae, Triuridaceae, Alismataceae, Aponogetonaceae, Potamogetonaceae, Cymodoceaceae, Flagellariaceae, Iridaceae, Eriocaulaceae and Ruppiaceae, represented by 171 genera and 552 species. Detailed description was prepared for Hydrocharitaceae, Burmanniaceae, Cannaceae and Marantaceae altogether representing 37 taxa. A total of 60 plant specimens were collected, including voucher specimens of 30 species through field tours; the specimens were mounted and labelled. About 150 field photographs of endemic species were taken. Description was prepared for 37 taxa belong to Hydrocharitaceae, Burmanniaceae, Cannaceae and Marantaceae.

PROJECT-6

Flora of Tamil Nadu (Volume 7: Cypereaceae and Poaceae)

Executing Scientist(s) : Dr. C. Murugan, Dr. A.A. Kabeer & Dr. S. Arumugam
Date of initiation : 2021
Date of completion : 2024

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

BACKGROUND: The project was initiated in 2021 with an outlook to publish the Flora of Tamil Nadu, Volume 07 (Cyperaceae and Poaceae) has been assigned to Dr. C. Murugan, Sci-E (HQ, BSI); Dr. A.A. Kabeer, Sci-E (CBL, BSI) &Dr. S. Arumugam, Bot. Asst. (SRC, BSI) to make a complete updated descriptive documentation of these families. Herbarium specimens deposited at MH and CAL were studied. The existing past and present literatures were reviewed to restore the taxonomic complex within species/generic group. The team standardized and updated nomenclature of each taxa using worldwide online database.

SUMMARY & ACHIEVEMENTS: Literature pertinent to Volume 7 from various Floras, revisions and articles published in different journals were collected. Metadata was prepared from Madras Herbarium. Checklist was prepared for the Family Cyperaceae comprising about 243 species with description for 20 taxa under the genera *Actinoscirpus* (1 species), *Bulbostylis* (7 taxa)and *Carex* (12 species). Checklist of Poaceae was also prepared (c 136 genera and 447 species under 19 tribes).

PROJECT-7

Revision of the lichen family Pyrenulaceae in India

Executing Scientist(s) : Dr. T.A.M. Jagadeesh Ram
Date of initiation : 2017
Date of completion : 2023

OBJECTIVE: To revise 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*. One Herbarium consultation tour was undertaken to Botanical Survey of India, Eastern Regional Centre, Shillong in 2017. A total of 204 specimens in 9 species of *Anthracothecium* Hampe and 32 species of *Pyrenula* Ach. were consulted. Field tours to the states of Arunachal Pradesh, Kerala, Meghalaya and Tamil Nadu were undertaken in 2018, 2019 and 2020 and collected 177 Field Numbers. A total of 240 specimens including recent and previously preserved collections in PBL were examined and identified into 6 species of *Anthracothecium* and 54 species of *Pyrenula*.

SUMMARY & ACHIEVEMENTS: One herbarium consultation tour was undertaken to BSI, CRC, Allahabad and National Botanical Research Institute (NBRI), Lucknow from 07.03.2022 to 18.03.2022. A total of 69 specimens were consulted at NBRI; 128 specimens and 260 specimens of Pyrenulaceae were loaned from Eastern Regional Centre, Shillong (ASSAM) and Central Regional Centre, Allahabad (BSA), for further study. A total of 156 specimens were identified into 2 species of *Anthracothecium*, 3 species of *Lithothelium* and 31 species of *Pyrenula*. Taxonomic description of 41 species of *Pyrenula* was finalized, and the bibliographic citations and distribution details of 38 species of *Pyrenula* was prepared. A total of 112 species: *Anthracothecium* (4 spp.), *Lithothelium* (9 spp.), *Melanothecopsis* (1 sp.), *Pyrenula* (93 spp.), *Pyrgillus* (4 spp.) and *Sulcopyrenula* (1 sp.) were recognized under *Pyrenulaceae*.

PROJECT-8

Ex-situ Conservation of Endemic, Endangered and Threatened Plants of region and recording of phenology of flowering/fruiting of species in garden

Executing Scientist(s) : Dr. S. Kaliamoorthy & Dr. T.S. Saravanan
Date of initiation : Continuous Project
Date of completion : Continuous Project

OBJECTIVES: One field tour was conducted to Wayanad District, Kerala from 05.01.2022 to 12.01.2022, and 57 species belonging to 38 genera and 12 families were collected and geocoordinates of place of collections were also recorded. Besides five local tours were also conducted in Yercaud and 32 species belong to 22 genera and 14 families were collected and introduced.

Osbeckia parvifolia Arn.

SUMMARY & ACHIEVEMENTS: Six field visits including five local field visits were conducted in Yercaud. Number of photographs were taken and identified during the tour (A CD with properly labelled photographs to be submitted). Around 100 photographs were taken, 57 photographs of plant species were recorded with identification. The 32 rare, endangered and threatened orchid species were collected and introduced in the botanic garden. A total of 32 species belonging to 22 genera and 14 families were collected and introduced in the NOEG, Yercaud for ex-situ conservation, which include four species of *Habenaria* (Orchidaceae), and 28 species belonging to 21 genera and 13 other

flowering plant families. Phenological study of orchids were carried out (Flowering phenology was recorded for 102 species belong to 47 genera and fruiting phenology was recorded for 36 species belong to 24 genera).With reference to other angiosperms , flowering phenology was recorded for 283 species belong to 194 genera, and fruiting phenology was recorded for 99 species belong to 76 genera. It needs to be highlighted that during the live plant collection tour, the rare and threatened plant species, namely *Ipsea malabarica* (Rchb.f.) Hook.f. and *Liparis biloba* Wight were collected and introduced in the garden for multiplication using conventional vegetative propagation method. Two new epiphytic species of *Impatiens* L. (Balsaminaceae) from the southern Western Ghats were described and got accepted for publication in Phytotaxa. *Molineria capitulata* (Hypoxidaceae) was published as a new record for Tamil Nadu while *Heterotis* Benth. (Melastomataceae) was published as a new generic record for Tamil Nadu. Rare, Endangered and economically important plants were collected and details of conservation initiations were recorded.

PROJECT: 9

Flora of Kerala Vol. 5

Executing Scientist(s) : Dr. M.U. Sharief (Dr. G.V.S. Murthy)
Date of initiation : 2020
Date of completion : 2022

OBJECTIVE: The main objective was to study the plants and complete the floristic assessment of the state.

SUMMARY & ACHIEVEMENTS:Finalisation of the entire manuscript was being carried out.

PROJECT: 10

Flora of Kerala Vol. 6 (Moncots – Part I)

Executing Scientist(s) : Shri M. Sulaiman & Dr. M. Murugesan
Date of initiation : 2018
Date of completion : 2022

OBJECTIVE: The objective of this project was to prepare and update the taxonomic account of 38 families based on herbarium specimens and available literature. To reconstruct the bracketed keys to the species and infra-specific taxa, wherever necessary, especially when new reports are included or changed in nomenclature and taxonomic status. Also to prepare fresh bracketed keys for few families for which manuscripts are not available. To provide up-to-date nomenclature of every taxon with standardized bibliographic citations. To update and standardize the nomenclature of every taxon. To provide authentic and up-to-date information on the occurrence and distribution of every taxon. To submit the updated and refined taxonomic account of the allotted families.

Pholidota imbricata Hook. (Habit)

Pholidota imbricata Hook. (Fruits)

SUMMARY & ACHIEVEMENTS :During the period, from 01.04.2021 to 31.03.2022, description of 141 species belonging to 45 genera and 16 families were prepared along with key to genera and species. A total of 520 herbarium sheets housed in the herbarium of M.S. Swaminathan Research

Foundation, Wayanad, Kerala were consulted, also three plant exploration tours (for over 22 days) were conducted in different parts of Kerala and 148 flowering plant species were documented. During this period, 1 new species was described and 8 nomenclatural issues were resolved. Description for 191 species belonging to 52 genera and 19 families was prepared along with keys for Flora of Kerala. A new species, Dendrobium gopalanii M. Sulaiman & Murugan was described.

Dendrobium anamalayanum Chandrab., V. Chandras. & N.C. Nair

Aerides ringens (Lindl.) C.E.C. Fisch.

WESTERN REGIONAL CENTRE PUNE

PROJECT-1

Pteridophyte flora of India

Executing Scientist(s) : Dr A. Benniamin, Dr. Jesubalan
Date of initiation : 2020
Date of completion : 2023

OBJECTIVE: The objective was to describe 75 species of pteridophytes for Pteridophytic Flora of India.

BACKGROUND: Pteridophytes form a conspicuous element of vegetation as an 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 the topography, variable climatic conditions and geographical positions. However, there are about 1107 species belonging to 35 families and 130 genera in India (Fraser Jenkins *et al.*, 2016). 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 the terrestrial vegetation along forest margins, roadsides and forest floors, the contribution of ferns and fern-allies to the vegetation pattern in India rank only next to the flowering plants. The project Pteridophytic flora of India was allotted in August 2020. During the period 2021-2022, the Herbarium specimens housed at BSI were studied. A critical review of past and present literature was done to restore the taxonomic complex among species. Standardization and nomenclatural updates were carried out using the standard worldwide online database.

AREA AND LOCALITY: India

SUMMARY AND ACHIEVEMENTS: Description was prepared for 98 species for the family Dryopteridaceae *viz. Arachniodes amabilis, Arachniodes assamica, Arachniodes carvifolia, Arachniodes chinensis, Arachniodes coniifolia, Angiopteris crassipes. Angiopteris helferiana, Angiopteris evecta, Marattia fraxinea, Christensenia aesculifolia, Plagiogyria adnata, Plagiogyria euphlebia, Plagiogyria glauca, Plagiogyria pycnophylla, Arachniodes amabilis, Arachniodes assamica, Arachniodes carvifolia, Arachniodes chinensis, Arachniodes coniifolia, Arachniodes cornucervi, Arachniodes henryi, Arachniodes miqueliana, Arachniodes palmipes, Arachniodes rhomboidea, Arachniodes simulans, Arachniodes sledge, Arachniodes spectabilis, Arachniodes superba, Ctenitis mannii, Ctenitis subglandulosa, Dryopsis apiciflora, Dryopsis arunachalensis, Dryopsis clarkei, Dryopsis ferruginea, Dryopsis heterolaena, Dryopsis apiciflora, Dryopsis arunachalensis, Dryopsis clarkei, Dryopsis ferruginea, Dryopsis heterolaena, Dryopteris cutodentata, Dryopteris alpestris, Dryopteris assamensis, Dryopteris atrata, Dryopteris barbigera, Dryopteris carolihopei, Dryopteris cochleata, Dryopteris conjugata, Dryopteris chrysocoma, Dryopteris costalisora, Dryopteris fructuosa, Dryopteris gamblei, Dryopteris hasseltii, Dryopteris juxtaposita, Dryopteris khasyana, Dryopteris komarovii, Dryopteris lepidopoda, Dryopteris marginata, Dryopteris meghalica, Dryopteris namegatae, Dryopteris nobilis, Dryopteris panda, Dryopteris pulvinulifera, Dryopteris redactapinnata, Dryopteris rubrobrunnea, Dryopteris scottii, Dryopteris serratodentata, Dryopteris sikkimensis, Dryopteris sparsa* subsp. *sparsa, Dryopteris sparsa* subsp. *rectipinnula, Dryopteris sparsa* subsp. *viridescens, Dryopteris splendens, Dryopteris stenolepis, Dryopteris subimpressa, Dryopteris ublacera, Dryopteris subtriangularis, Dryopteris vidyae, Dryopteris wallichiana, Dryopteris wallichiana* subsp. *Himalaica, Dryopteris wallichiana* subsp. *nepalensis, Dryopteris woodsiisora, Dryopteris xanthomelas, Dryopteris yoroii,*

Oleandra musifolia, Oleandra pistilaris, Oleandra undulata, Oleandra wallichi, Bolbitis asplenifolia, Bolbitis appendiculata, Bolbitis semicordata, Bolbitis feeiana and *Bolbitis subcrenoides* for the Pteridophytes flora of India. Key to the genus *Bolbitis* was prepared for the Pteridophytes flora of India. Distribution map was prepared for 300 species through QGIS software for the Pteridophytic flora of India.

PROJECT-2

Phyto Data-Base of Konkan

Executing Scientist(s) : Dr. Prashant K. Pusalkar
Date of initiation : 2020
Date of completion : 2023

OBJECTIVE: The objective was 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: 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: South Konkan (Ratnagiri and Sindhudurg districts, Maharashtra)

SUMMARY AND ACHIEVEMENTS: Documentation of 1932 species of 87 flowering plant families were completed. 2 floristic survey tours were carried out in Q3 and Q4 to South Konkan regions and habitats covering coastal belt (sandy, muddy and rocky beaches), estuarine banks, lakes, mangrove (coastal and inland) forests, coastal & inland fort-associated flora and hill forests and laterite plateaus (Sadas) were surveyed. 317 specimens were collected and 105 species were identified.

PROJECT-3

Bambusicolous fungi of Goa

Executing Scientist(s) : Dr. Rashmi Dubey
Date of initiation : 2020
Date of completion : 2024

OBJECTIVE: The main objective were 1) To explore the diversity of Bambusicolous fungi of Goa and its adjoining areas; 2) Morphological identification of the bambusicolous fungal species along with Scanning Electron Microscopic studies; 3) Isolation and molecular characterisation of Bambusicolous fungal species associated with different parts of Bamboo (leaves, culms, branches, sheathes, lowers, rhizomes, and roots); 4) To evaluate the validity of bambusicolous fungal taxa and clarify their phylogenetic relationships by Multigene sequencing; Cataloguing, preservation and maintenance of fungal germplasm.

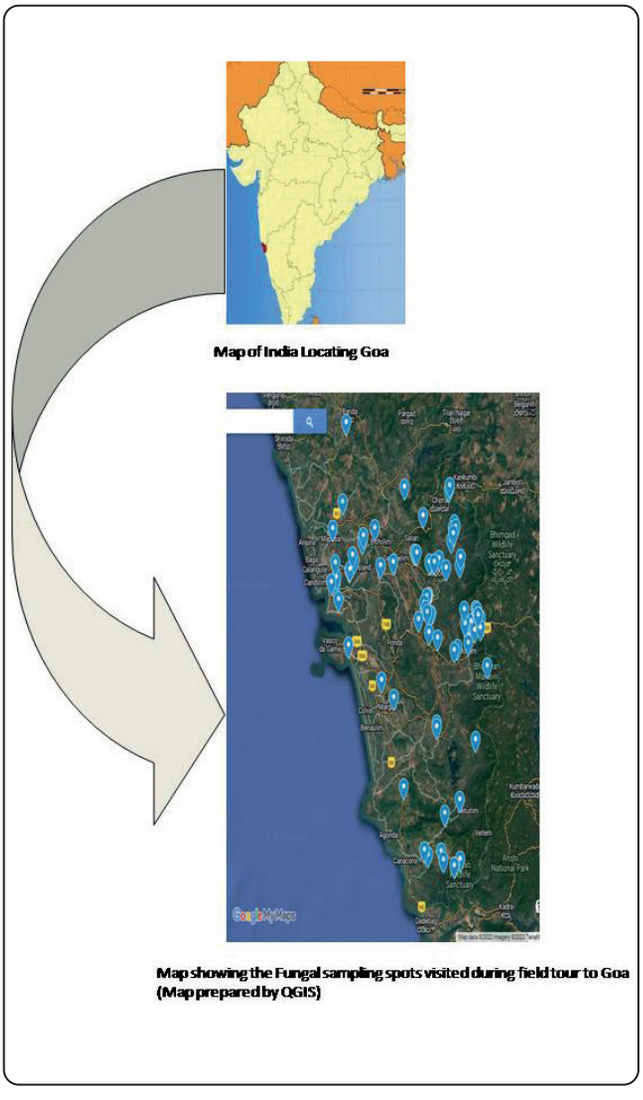
BACKGROUND: India is the second richest country in bamboo genetic resources after China and is likely to support an equally diverse mycota. But India's knowledge of bamboo fungi is still at the cataloguing stage. Bambusicolous fungi records are indexed, but the bamboo species hosting bambusicolous fungi 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 limit surveillance and impedes insights on bamboo pathology. Therefore, this work was undertaken for a comprehensive understanding of complex of Bambusicolous Fungi.

Objectives of the work were to conduct the Morpho-molecular characterisation of Bambusicolous fungal species associated with different parts of Bamboo. For implementation of this work, standard methodology was adopted as: Survey and collection of samples, laboratory processing for morpho and molecular studies (DNA extraction, PCR amplification, DNA sequencing) and Phylogenetic analyses.

AREA AND LOCALITY: During 2021-22, one field tour was conducted to Goa from 24.2.2022 - 3.2.2022 and an area of 500 sq. km ca. were covered. All six wildlife sanctuaries and one National park (Mollem National Park), various nurseries, Gardens and Road side were visited in this tour to have ideas about bambusicolous fungi growing in these protected areas as well as unprotected areas. The areas of North Goa having Madei WLS, Bondla WLS and Mollem NP had some patches of Bamboo growing in wild conditions which were visited. Some patches were also visited in South Goa *viz*. Netravali WLS and Cotigao WLS. Bamboos have very little natural toxicity and, therefore are easily prone to fungi and insect attacks. During the exploration, it was also observed that the forests of Goa provide a congenial environment for the growth of epiphytic and parasitic fungal species on Bamboos owing to the humid climate and heavy rainfall. A huge infection of Sooty molds, Rust, Leaf blight, Leaf spots, Powdery mildew and Tar spots were frequently recorded in those areas. It was also observed that in the forests of Goa the Bamboos had grown vegetative for a species-specific period and had undergone flowering and dying within three years. So most bamboo plants were found in vegetative conditions having 2-3 m in height.

SUMMARY AND ACHIEVEMENTS: 1 field

tour was conducted to protected areas of Goa from 24.2.2022 - 3.2.2022. More than 300 samples including dead and live culms, fallen leaves, fresh leaves, Leaf sheath and inflorescence were collected and more than 400 photographs were taken during this tour, which includes the photographs of fungi infecting parts of Bamboo along with the vegetation of the surveyed area. In lab conditions, 264 Bambusicolous fungal sections were cross-checked and 1249 slides were prepared and 591 photomicrographs were captured. A total of 131 fungal spp were identified while a total of 102 fungal isolates were grown on semisynthetic media and cultures of 103 spp. were maintained and revived regularly. The nomenclature of all documented fungi was updated using worldwide myco online databases such as Mycobank and Index fungorum, 2022. Description of 74 spp. fungal species were completed and accessioned. The Molecular Protocols for the identification of fungi were standardized. Molecular studies were conducted for 24 fungal specimens for nuclear ribosomal gene ITS with ITS4 & ITS5 markers. Multigene analysis of DNA sequences was conducted for three nuclear ribosomal genes ITS (primers -ITS 4 & ITS 5) LSU (primers -LR0R and LR7) and TEF 1 α gene (primers- Ef 1 and Ef 2). Out of 24 fungal species, molecular phylogenetic relationship was studied for 19 specimens, *viz. Aplosporella bambusicola* sp.nov Rashmi Dubey; *Nodulisporium indicum* S.M. Reddy & Bilgrami 1972; *Gymnopilus ochraceus* Høil. 1998, (Aspergillus jensenii Jurjević, S.W. Peterson & B.W. Horn 2012, *Nodulisporium indicum* S.M. Reddy & Bilgrami 1972, *Dothiorella longicollis* Pavlic, T.I. Burgess & M.J. Wingf.; *Achaetomium globosum* J.N. Rai & J.P. Tewari 1964; *Dothiorella longicollis* Pavlic, T.I. Burgess & M.J. Wingf. 2008 (PPS 12); *Astrocystis bambusicola* R.H. Perera & K.D. Hyde 2017 (PPS 13); *Ceriporiopsis semisupina* C.L. Zhao, B.K. Cui & Y.C. Dai 2014; *Trichoderma afarasin* P. Chaverri & F.B. Rocha 2015; *Nigrospora zimmermanii* Crous 2017; *Punctulariopsis subglobispora* (Hallenb. & Hjortstam) Ghob.-Nejh. 2010; *Dothiorella longicollis* Pavlic, T.I. Burgess & M.J. Wingf. 2008; *Raffaelea sulcati* A. Funk, 1970A. Funk, 1970; *Hypoxylon lignic*. One new species *Aplosporella bambusicola* sp. nov. Rashmi Dubey 2022 was established and two new distributional novelties to India, *Nigrospora zimmermanii* Jayasiri *et al.*, 2019 (unpublished) and *Trichoderma afarasin* P. Chaverri & F.B. Rocha, 2015(unpublished) were recorded. Metadata for all fungi of AAP projects were completed and 496 fungal species were digitized by preparing photo plates with labels and barcodes. New modern techniques for projects were incorporated *viz.* digitization of micro fungal herbarium, multigene analysis of DNA sequences and statistical analysis for studying the diversity of fungi.



PROJECT-4

Supplement to the Flora of Maharashtra

Executing Scientist(s) : Dr. M.Y. Kamble
Date of initiation : 2021
Date of completion : 2022

OBJECTIVE: Compilation of species as supplemented to the existing Flora of Maharashtra.

BACKGROUND: Flora of Maharashtra was published in 03 volumes in the years 1996, 2000 & 2001. Since then, a number of taxa had been added to the flora of the state as discoveries and new records in the last two decades by scientists and researchers of the Botanical Survey of India and those from other research institutions and academicians. Therefore, it was felt by the Botanical Survey of India to compile all those publications and put them into one as a Supplement to the Flora of Maharashtra.

AREA AND LOCALITY: Not Applicable

SUMMARY AND ACHIEVEMENTS: Documentation of species as a supplement to the existing Flora of Maharashtra was being carried out. A tentative list of taxa as new to science, described from the state or new distributional novelties to state Flora was prepared. So far 250 taxa were listed as additions to the State flora. Literature for more than 200 taxa was collected. Descriptions for about 90 taxa were completed along with citation, distribution, phenology of flowering & fruiting, ecological note, etc. Documentation of updated data for Threatened plants of Maharashtra had been initiated.

PROJECT-5

Curatorial works and maintenance of the Herbarium of BSI, Pune

Executing Scientist(s) : Dr. A. Banniamin
Date of initiation :
Date of completion :

OBJECTIVE: The objective was the regular maintenance of the Herbarium.

SUMMARY AND ACHIEVEMENTS : During the year Digitization of Herbarium of 1, 48,000 specimens Metadata has prepared and 47,967 Photographs of Herbarium have taken with the assistance from Scientific staffs of WRC, Pune and Students from Universities and Colleges from Pune.

PROJECT FLORA OF INDIA

भारतीय वनस्पति सर्वेक्षण

BOTANICAL SURVEY OF INDIA

Flora of India Vol. 27

Family Zingiberaceae (c.238 taxa)

Executing Scientist (s) : Dr. S. K. Singh, Dr. Ramesh Kumar, and Dr. Sameer Patil & Dr. Sachin Sharma
Date of initiation : 2020
Date of completion : 2021

SUMMARY AND ACHIEVEMENTS

The project (c.238 taxa) was completed, and report was submitted to Director BSI for publication.

Flora of India Vol. 19

Family Scrophulariaceae, Orobanchaceae and Lentibulariaceae (c. 570 taxa)

Executing Scientist(s) : Dr. Arti Garg
Date of initiation : 2019
Date of completion : 2021

SUMMARY AND ACHIEVEMENTS

All work of families Scrophulariaceae, Orobanchaceae and Lentibulariaceae with 464 taxa under 73 Genera, 412 species, 30 subspecies and 22 varieties were Compiled, edited and submitted. Besides that, 99 photographs and 41 line drawings with legends, Bibliography and Taxonomic keys of all 73 genera of the volume were also prepared and submitted. A contribution in description of 101 taxa of *Pedicularis* L. and *Digitalis* L. was also made.

Flora of India Vol. 27

Asparagaceae

Executing Scientist(s) : Dr. Rajib Gogoi & Dr. B.K. Singh
Date of initiation : 2019
Date of completion : 2020

SUMMARY AND ACHIEVEMENTS

580 type/herbarium images of 90 taxa were collected along with protologue/references of 80 taxa. 75 references on chromosome number of 59 taxa were collected and incorporated in the manuscript of Asparagaceae. 10 references on uses of 09 nos. of taxa were collected and incorporated in the manuscript of Asparagaceae. 35 taxa were described and 4 specific key of Asparagaceae were edited after the first revision of manuscript.

Flora of India Vol. 6

Fabaceae, PART I (Circidoideae, Dialioideae, Detarioideae, Caesalpinioideae (including Mimosoids) and Faboideae (Genistoids)

Executing Scientist(s) : Dr. Prashant K. Pusalkar
Date of initiation : 2020
Date of completion : 2023

SUMMARY AND ACHIEVEMENTS

Executing scientists coordinated with Dr. M. Sanjappa and classification, nomenclature, description, keys, distribution, phenology was compiled and updated. Flora India, Volume 6 (Fabaceae – Part I) comprising General Information, Key to the Groups, and taxonomic treatment of the Subfamily Circidoideae, Subfamily Dialioideae, Subfamily Detarioideae, Subfamily Caesalpinioideae (including Mimosoids) & Subfamily Faboideae (Genistoids) were checked, finalized and formatted. 3 subfamilies, 3 tribes, 2 clads and 13 genera were Revised/updated. The volume was completed and submitted for the editing.

Flora of India Vol. 24

(Urticaceae-Ceratophyllaceae)

Executing Scientist(s) : Dr. Prashant K. Pusalkar
Date of initiation : 2019
Date of completion : 2020

SUMMARY AND ACHIEVEMENTS

Post-editing updating, corrections/data incorporation, checking and final page-maker formatting of the Flora of India, Volume 24 comprising 12 families, namely Urticaceae, Moraceae, Cannabaceae, Ulmaceae, Platanaceae, Juglandaceae, Myricaceae, Casuarinaceae, Fagaceae, Betulaceae, Salicaceae and Ceratophyllaceae were attended. Illustrations and colour photo plates of the volume were finalized and submitted. The finalized volume was submitted to technical & publication section, BSI for publication.

Flora of India (Editorial Committee)

Executing Officials: Dr. A.A. Mao, Director; Dr. S.S. Dash, Tech. Sec. Incharge, Dr. J. Jayanthi, Scientist E; Dr. J.S. Jalal, Scientist E; Dr. D.K. Agrawala, Scientist E; Dr. U.L. Tiwari, Scientist C and Dr. G. Krishna, Botanist Assistant.

1. Flora of India, Volume 14:

Manuscript of family Rubiaceae consisting of 108 genera and 587 species, 13 subspecies, 45 varieties, 7 cultivated/ hybrid species and 27 doubtful species was reviewed to make it uniform as per Flora of India format. After the manuscript were gone through critically and following the current concept of genera it is now reduced to 101 genera, 584 species, 3 subspecies and 43 varieties that are found in India, 15 genera and 21 species are cultivated/ hybrid. Each and every genus and tribe was checked to make it uniform as per format. All names were checked meticulously and standardized as per standard taxonomic literature. Corrections were incorporated for species and infraspecific taxon. In the species descriptions, inconsistencies in measurements were checked and revised there were lots of changes in the measurements, and standard description format was followed. In most cases, taxonomic characters were found twice in the description and these were rectified. Distribution of genus in World was not uniform and the distribution of species in India were lacking uniformity, missing many state names. Based on available literature and collections all the information was added. More than 300 taxa were lacking the ecological information. Ecological information based on the available literature was added.

2. Flora of India, Volume 15

This volume was thoroughly reviewed for consistency in formatting, content, gaps in information etc. This volume comprises of 12 families such as Stylidiaceae, Goodeniaceae, Campanulaceae, Sphenocleaceae, Ericaceae, Clethraceae, Pyrolaceae, Monotropaceae, Epacridaceae, Diapensiaceae, Plumbaginaceae, Primulaceae containing 41 genera and 500 species. Critically editing and proof checking was carried out for all species dealt in this volume. Key to the families, genera and species were checked. Description of families, genera and species were checked. Details such as flowering & fruiting, distribution, habitat & ecology details were checked. Endemic status was checked. State wise distribution in India and world distribution were checked. All the information on missing species such as *Goodenia koninsbergeri, Stylidium darwinii* was marked in the manuscript along with references. All the comments, observations and corrections were marked in track change mode and communicated to the team leader for further course of action.

3. Flora of India, Volume 16:

This manuscript was critically gone through in both hard copy and soft copy for editing and proof check. This volume comprises of 8 families such as Myrsinaceae, Sapotaceae, Ebenaceae, Styracaceae, Symplocaceae, Oleaceae, Salvadoraceae, Apocynaceae containing 69 genera and 389 species. Key to the families, genera and species were checked. Description of families, genera and species were checked. Details such as flowering & fruiting, distribution, habitat & ecology details were checked. Endemic status was checked. State wise distribution in India and world distribution were checked. Author citation was checked. Vernacular names and specific notes, uses were also checked. Following are the observations made in the manuscript. Several species in Myrsinaceae family that were not included in the manuscript were pointed out and these species were included at appropriate places.

Suggestions were given for improvement of taxonomic descriptions of species dealt in the manuscript with the existing literature, for the species which is known only by literature or limited herbarium records. Taxonomic ambiguities in species treatment were also noticed. Under Symplocaceae family, the missing species were pointed out and added. Genus's description, distribution details and key to species were found missing in some genera and were pointed out. Under Apocynaceae family, missing species were pointed out in the manuscript. In addition, all the literature pertaining to these missing species were provided in the manuscript for incorporation. Punctuations were not found to be used at appropriate places, and all these were corrected. For several species author citation was not found in correct format. Consistency was not followed in description in many places and those were attended. Inconsistencies were found in the measurements in the species description and those were pointed out as well as rectified. Endemic status of species was not mentioned in many places. State wise distribution was found incomplete in several places. In many places missing classical taxonomic literature were included. Ecology detail was not found in the majority of the species and were noted. Consistency in author citation and standard format was also checked. Important revisionary work which was found missing in the citation were included. Under Oleaceae family, missing species were included in the manuscript. Relevant literature was provided along with detail for incorporation. All the comments, observations and corrections were marked in track change mode and communicated to the team leader for further course of action.

4. Flora of India, Volume 17

As the team leader of this volume and author of families Asclepiadaceae and Gentianaceae updated this volume with the newly published taxa. This volume comprises of 5 families such as Asclepiadaceae, Loganiaceae, Buddlejaceae, Gentianaceae and Menyanthaceae containing 114 genera and 641 species. Literature consultation was carried out continuously for updation of the manuscript with new records and newly described taxa and other recent taxonomic changes, In Asclepiadaceae family, newly described species were added and subsequently the key to species of respective genus were updated. The herbarium image of *Caralluma* from Pretoria National Herbarium (PRE), Sanbi was acquired for studies. In addition to this more photographs were also collected from different researchers for inclusion in the manuscript. Under Gentianaceae family, new species, distributional records published recently were added in the manuscript and the key to species and infraspecific key were updated. All the descriptions of newly added species were scrutinized as per flora of India format and arranged as per sequence. The nomenclature of all species were Updated and relevant citations were added. Flowering & Fruiting details were checked and updated. Habitat details of all species were prepared and incorporated under each species. Distribution details within India/World were prepared and incorporated under each species. Literature for uses of species were scrutinized and added. Photographs from own collections were Identified and sorted out. The manuscript was updated upto March 2022. Photographs from different resource persons were collected and sorted out. The updated volume along with photographs was submitted for composing. The Menyanthaceae family was updated with additional species and the key to species was also updated.

5. Flora of India, Volume 22

In the preliminary editing following observations were made such as the standard abbreviation of authors and books was not correct in many places, general consistency in the text as per flora of India format, descriptions with common generic characters were repeated in the generic and species descriptions and many cases species habitat/ ecology information was missing. All these comments were sent to the team leader for incorporation. After receiving the incorporated text, again nomenclatural changes were done. In the genus *Boerhavia* two species were added e.g. *Boerhavia coccinea* and *B. procumbens*. Accordingly,

the key to the species was also revised. All the legends of illustrations and photo plates were checked and modified as per flora of India format.

6. Flora of India, Volume 28

This volume comprises of families such as Arecaceae, Xyridaceae, Typhaceae, and Pandanaceae. The Arecaceae manuscript and comments provided for revising the family were reviewed as per Flora of India format. Author citations were checked. Suggestions were given to include major classical and latest regional floras/ taxonomic accounts, vernacular names, improving the descriptions of the species, references etc. Many of the important literature pertaining to Rattans/ Calamus were found missing, which has been included in the manuscript. Many taxa were found missing in the manuscript. List of cultivated species was not provided in the manuscript. All the observations were communicated to the author for revision of the manuscript. The families Typhaceae comprising of 2 genera and 11 species and Xyridaceae comprising of 1 genus and 6 species were gone through for consistency in formatting and corrections were incorporated in the manuscript. The revised manuscript of family Pandanaceae was gone through and comments were sent to authors for further revision of manuscript. Corrections were incorporated for following the format of Flora of India. Incomplete citations were pointed out. Incomplete distribution, world distribution and endemic details were pointed out. Corrections in vernacular names were pointed out. The manuscript along with observations was communicated to authors for further course of action.

7. Flora of India, Volume 30 subfamily- Bambusoideae

This volume contains 151 species and 6 varieties. All the species were checked as per the flora of India format. Author citations were corrected wherever required. The unnecessary text part was deleted and made this volume as per the flora of India requirement. Flowering & fruiting, habitat and distribution part were corrected for the majority of species.

8. Flora of India, Volume 31

The manuscript comprising of Poaceae family first volume was reviewed. Family, genus and species description were checked for consistency, punctuations, spelling errors etc. Key to genera and species were checked. All the corrections were marked in track change mode. The corrections were communicated to the team leader.

9. Flora of India, Volume 32

Around 50 species were checked for this volume. General comments were made to improvise this volume. Technical errors were pointed out in the manuscript. Author citation was corrected for standard abbreviation of authors and edited books.

NEW DISCOVERIES

भारतीय वनस्पति सर्वेक्षण

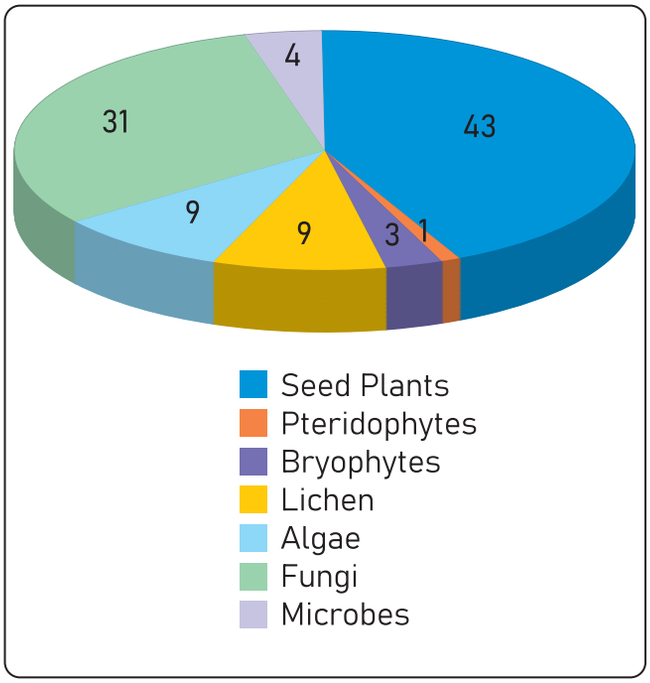
BOTANICAL SURVEY OF INDIA

PLANT DISCOVERIES 2021

Current estimation of plant diversity in India stands at 55048 taxa including 21984 angiosperms, 82 gymnosperms, 1314 pteridophytes, 2800 bryophytes, 2989 lichens, 15602 fungi, 9008 algae and 1269 microbes. This represents approximately ..... Percent of total recorded plant species in the world. The Group wise 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	1269	2.31
Algae	9008	16.36
Fungi	15602	28.34
Lichens	2989	5.43
Bryophytes	2800	5.09
Pteridophytes	1314	2.39
Gymnosperms	82	0.15
Angiosperms	21984	39.94
Total	**55048**	**100**

During the year 2021, Scientists of BSI and other organizations have discovered 14 genera, 298 species, 17 infraspecific taxa as new to Indian flora. Of these 204 taxa are new to science and 125 taxa are new distributional record from India. 43% of novelties published in various National and International journals are of seed plants, 31% fungi, 9% each of algae and lichen, 4% microbes while 3% bryophytes and remaining 1% pteridophytes. Among Plant Groups seed plants contributed the maximum discoveries of which dicotyledons contribute 61% and monocotyledons 39%.



Percentage of contribution of different Plant groups during 2021

23% and 21% of total discoveries were made from Western Ghats and Western Himalayas respectively during the year 2021 followed by Eastern Himalayas (11%). East Coast and West Coast contribute 10% each. This is followed by Eastern Ghats (8%), North East Ranges and Eastern Plains with 5% contribution each. North Deccan contributes 3% while South Deccan contributes 2%. Central Highland, East Deccan, Northern Plains and Western plains contribute minimum with 1% each of total discoveries. The hotspot regions such as Western Ghats, North Eastern Regions have contributed 28% of total discoveries. In state wise analysis, maximum discoveries were made from Kerala with 51 taxa followed by Maharashtra and Arunachal Pradesh.

NEW TO SCIENCE

SEED PLANTS
NEW GENUS

Septemeranthus L.J. Singh, *Feddes Repertorium*. **132**(3): 2. 2021 (Loranthaceae)

This new genus has been discovered and described based on type species *Septemeranthus nicobaricus* L.J. Singh distributed in Kopen Heat, Great Nicobar, Andaman & Nicobar Islands.

NEW SPECIES

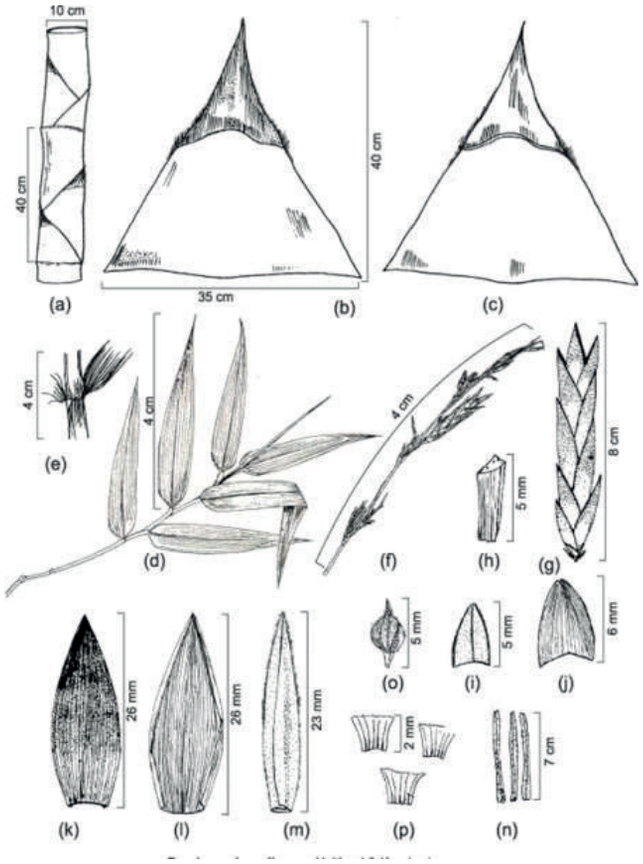
Aglaonema manabendrae D.K. Roy, N. Odyuo, R. Lytan & A.A. Mao, *NeBIO*, **12**(1): 1. 2021(Araceae)

This new species has been discovered and described based on the collection made from cultivated plants in the Garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya.

Artabotrys sericeus Sujana & Vadhyar, Gard. Bull. Singapore 73(2): 462. 2021(Annonaceae)

This new species has been discovered and described based on the collection made from Swamikuchimalai, Kanyakumari Wildlife Sanctuary, Kanyakumari District, Tamil Nadu at 770 m altitude.

Bambusa daporijoeana Naithani and Kandwal, Indian Forester, **147**(7): 687. 2021 (Poaceae)



This species has been discovered and described based on herbarium specimen collected from West Siang and upper Subansiri districts of Arunachal Pradesh.

Begonia ahooensis P.L.Sherpa, Aditya Pradhan & Arun Chettri, *Phytotaxa*, **502**(3): 289. 2021 (Begoniaceae)

This species has been discovered and described based on collection made from Ahoo-Yangtam, East District, Sikkim at 895 m altitude.

Ceropegia ansariana Murug. & A.A. Mao, *Taiwania* **66**(2): 122. 2021 (Apocynaceae)

This species has been discovered and described based on collection made from Blue Mountain

Forest areas, Champhai District, Mizoarm at 1250 m altitude.

Corynandra telanganensis J. Swamy & Rasingam, Ann. Bot. Fennici 58: 1. 2021 (Cleomaceae)

This species has been discovered and described based on samples collected from Rajendra Nagar Mandal, Rangareddy District, Telangana at 551 m altitude.

Cremanthodium indicum D.Borah, R.Kr.Singh & Thungon, Biodiversitas 22(3):1272. 2021 (Asteraceae)

This species has been discovered and described based on collection made from Penga-Teng Tso Lake, Tawang District, Arunachal Pradesh at 4100 m altitude.

Crotalaria lamelliformis P. Sivaramakrishna, P. Yugandhar & L.J. Singh, Phytotaxa 490 (1): 70. 2021(Fabaceae)

This new species has been discovered and described based on the collection made Near Sadasivakona, Chittoor District, Andhra Pradesh.

Cyanotis deccanensis P. Yugandhar, P. Sivaramakrishna, N. Savithramma & L.J. Singh, Nordic J. Bot. e03324. 2021 (Commelinaceae)

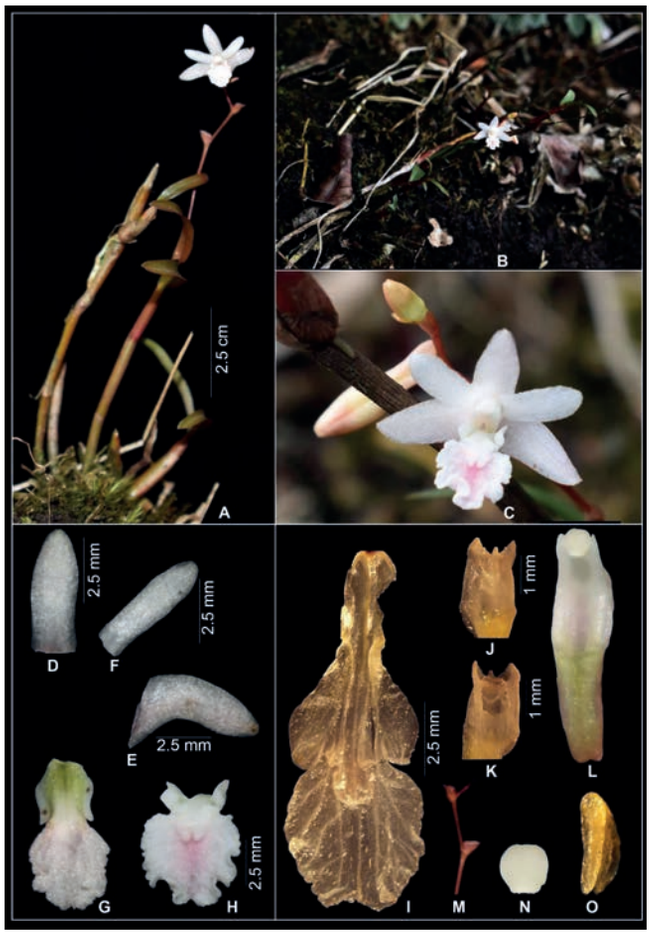
This new species has been discovered and described based on the collection made from Nissankadurgam hills, Chittoor District, Andhra Pradesh.

Cyperus nicobaricus V.P. Prasad, Nelumbo 63(1): 256. 2021 (Cyperaceae)

While studying the specimens of Cyperaceae in different Indian herbaria, authors came across this new species from Regional Herbarium, Botanical Survey of India, Andaman and Nicobar Regional Centre, (PBL), collected from Little Nicobar Island, Andaman and Nicobar Islands.

Dendrobium gopalanii M. Sulaiman & Murugan, Taiwania 66(4): 557. 2021(Orchidaceae)

This new species has been discovered and described based on the collection made from Agasthyarkoodam, Agasthyamala Biosphere Reserve, Thiruvananthapuram, Kerala.



Dendrobium gopalanii

Dendrophthoe laljii P. Sivaramakrishna, P. Yugandhar & G.A. Ekka, J. Asia-Pacific Biodivers. 14: 454. 2021 (Loranthaceae)

This new species has been discovered and described based on the collection made from Pilpillow, Nancowry group of Islands, Andaman & Nicobar Islands, India.

Dentella cylindrica M.C. Naik & L.J. Singh, Indian J. Forestry 43(4): 308. 2020 (Rubiaceae)

This new species has been discovered and described based on the collection made from forested area of DAM, Little Andaman, Andaman and Nicobar Islands.

Elaeocarpus gadgilii A.M. Maya, V.Suresh & K.M.P.Kumar, Phytotaxa 489 (1): 88. 2021 (Elaeocarpaceae)

This species has been discovered and described based on collection made from Mattumala, Nelliyampathy, Palakkad District, Kerala.

Glycosmis albicarpa Sujana & Vadhyar, Nordic J. Bot, doi: 10.1111/njb.03501. 2022 (Rutaceae)

This species has been discovered and described based on collection made from Kunnimuthicholai, Kanyakumari wildlife sanctuary, Tamil Nadu at 633 m altitude.

Glyphochloa shrirangii K. Prasad, S. Nagaraju & Chorghe, Nordic J. Bot. e03103. 2021 (Poaceae)

This species has been discovered and described based on collection made from lateritic plateaus of Pune, Maharashtra at 700 m altitude.

Henckelia dasii Taram, D.Borah, R.Kr.Singh & Tag, Feddes Repertorium 132: 1. 2021(Gesneriaceae)

This new species has been discovered and described based on the collection made from Ziro Valley, Lower Subansiri district, Arunachal Pradesh.

Henckelia lallanii Taram, D.Borah, Tag & R.Kr.Singh, Feddes Repertorium 132: 2. 2021(Gesneriaceae)

This new species has been discovered and described based on the collection made from Potin, Lower Subansiri district, Arunachal Pradesh.

Hiptage laxiflora Sujana & Vadhyar, Ann. Bot. Fennici 58: 28. 2021 (Malpighiaceae)

This new species has been discovered and described based on the collection made from Kuthirapanjan, Sivagamipuram, Kanyakumari wildlife sanctuary, Thiruneveli, Tamil Nadu.

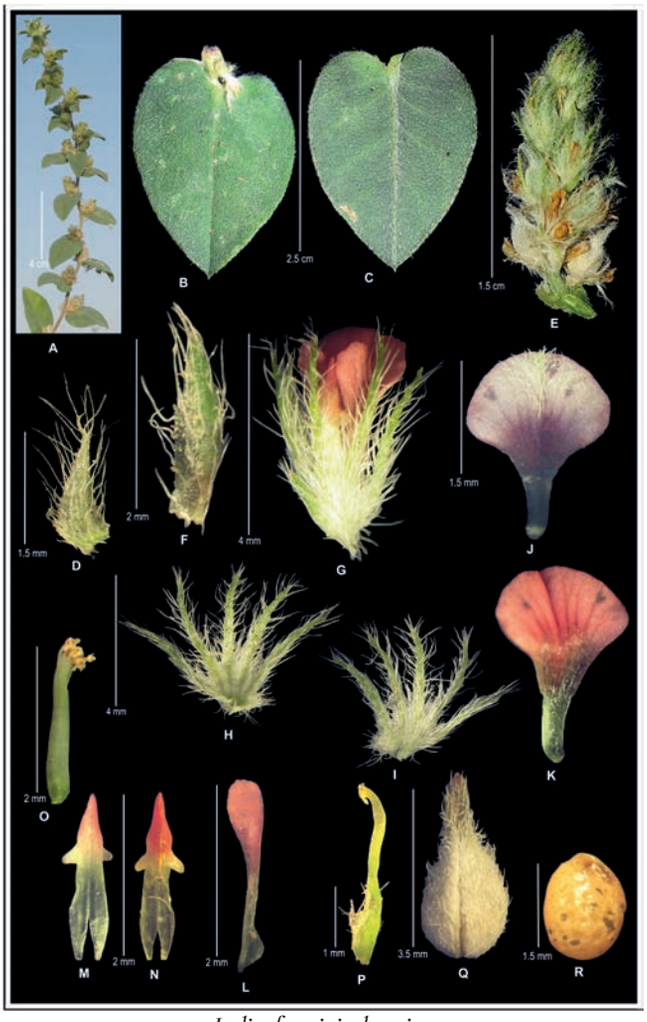
Impatiens pasighatensis D. Borah, R. Kr. Singh & Taram, Indian Forester, 148 (2): 233-235, 2022 (Balsaminaceae)

This new species has been discovered and described based on the collection made from Sirki, Pasighat, East Siang district, Arunachal Pradesh at 390 m altitude.

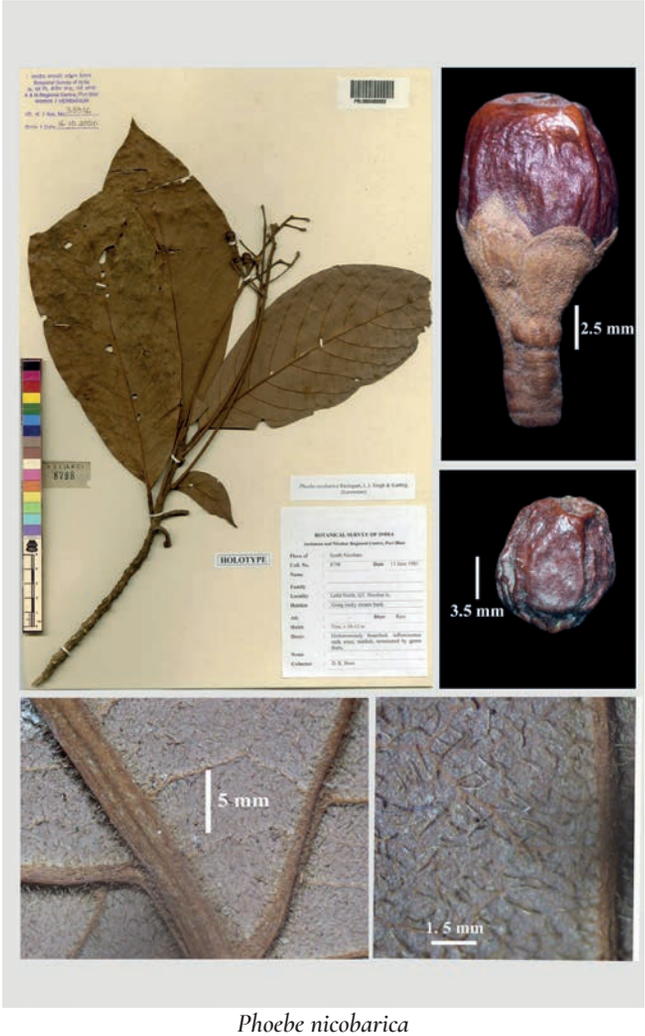
Indigofera jaisalmerica C.S. Purohit et R.N. Kulloli, J. Asia-Pacific Biodivers. 14: 628. 2021 (Fabaceae)

This new species has been discovered and described based on the collection made from Brahamsar Dham, Jaisalmer, Rajasthan at 157.5 m altitude.

Lophopogon prasannae K. Prasad, Nagaraju, A. Naray., A.M. Reddy, Sankara Rao & B.R.P. Rao,



Indigofera jaisalmerica



Phoebe nicobarica

Phytotaxa 500 (3): 235. 2021 (Poaceae)

This species has been discovered and described based on collection made from Nigidi forest, Ananthapuramu district, Andhra Pradesh at 458 m altitude.

Odisha bonaccordensis K. Prasad, Jalal & Agrawala, Nelumbo 63 (2): 6. 2021(Orchidaceae)

This new species has been discovered and described based on the collection made on way to Agasthyakudam from Bonaccord, Agasthyamala Biosphere Reserve, Thiruvananthapuram district, Kerala at 641 m altitude.

Pancratium venkaiahii R.Prameela, J.Prak.Rao, S.B.Padal & M.Sankara Rao, J. Threatened Taxa 14(3):20801 (Amaryllidaceae)

This new species has been discovered and described based on the collection made from Ginjeru Village, Vizianagaram District, Andhra Pradesh at 75 m altitude.

Phoebe nicobarica Rasingam, L.J. Singh & Karthig, Rheedea 31(2): 53. 2021 (Lauraceae)

While working on the flora of Little Andaman Island, the senior author came across the species collected by D.K. Hore from Laful north of Great Nicobar Island at the herbarium of the Botanical Survey of India, Andaman & Nicobar Regional Centre (PBL), Port Blair.

Pyrostria laljii M.C. Naik, Arriola & M. Bheemalingappa, Ann. Bot. Fennici 57: 336. 2020. (Rubiaceae)

This new species has been discovered and described based on the collection made from Wandoor Forest, South Andaman Island, Andaman & Nicobar Islands.

Sauromatum arunachalense U.L. Tiwari, R. Maity & S.S. Dash, Nelumbo 63(1): 3. 2021 (Araceae)

This species has been discovered and described based on collection made from Papum Pare district of Arunachal Pradesh at 272 m altitude.

Septemeranthus nicobaricus L.J. Singh, Feddes Repertorium 132: 2. 2021 (Loranthaceae)

This new species has been discovered and described based on the collection from Kopen Heat, Great Nicobar, Andaman & Nicobar Islands.

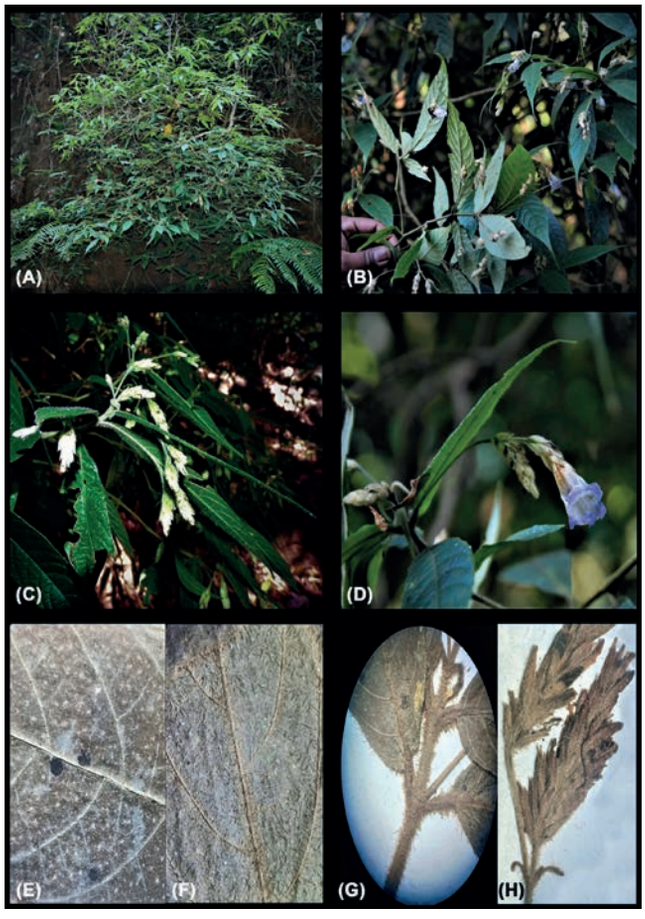
Staurogyne arunachalensis R. Kr. Singh, D. Borah & Yama, Ann. Bot. Fennici 59 :47-51.2022 (Acanthaceae)

This new species has been discovered and described based on the collection made from Kimin, Papum Pare District, Arunachal Pradesh, India at 115 m altitude.

Striga todgarhica C.S. Purohit, Journal on New Biological Reports 10 (2): 89–94 (Orobanchaceae)

This new species has been discovered and described based on the collection from Todgarh-Raoli Wildlife Sanctuary, Jojawar Range, Uperli Babhan Rajasthan, India.

Strobilanthes pushpagiriensis Sameer Patil, Nordic J. Bot. e03053. 2021 (Acanthaceae)



This new species has been discovered and described based on the collection made from Vanachal-Kadamakkal forest path, Pushpagiri Wildlife Sanctuary, Kodagu, Karnataka at an elevation of 1036.2 m.

NEW VARIETIES

Dichanthium caricosum (L.) A. Camus var. bilobum Y. Mahesh, Rasingam & J. Swamy, Indian J. Forestry 43(2), 134. 2020 (Poaceae)

This new variety has been discovered and described based on the collection made from Kondamodalu Beat, Gokavaram Range, Papikonda National Park, East Godavari District, Andhra Pradesh at 439 m altitude.

Murdannia triquetra var. ***ahuchawlense*** Kangkan Pagag & Sashin Kumar Borthakur, Phytotaxa 525 (2): 163. 2021 (Commelinaceae)

This new variety has been discovered and described based on the collection made from North Lakhimpur, Ahuchawl Gaon, Assam

NEW SUBSPECIES

Lysionotus metuoensis subsp. ***arunachalensis*** K. Chowlu & G. Krishna, J. Jpn. Bot. 97(2): 99–104. 2022. (Gesneriaceae)

This new subsp. has been discovered and described based on the collection made from Pakke-Kessang district of Arunachal Pradesh.

BRYOPHYTES

Plagiochila dampaensis Sushil K. Singh & K. K. Rawat, Ann. For., 28(1&2):2.2020(Plagiochilaceae)

This new species has been discovered and described based on the collection made from Phuldungsei range, Dampa Tiger Reserve, Mamit, Mizoram at 1731 m altitude.

Plagiochila mizoramensis Sushil K. Singh & K. K. Rawat, Ann. For., 28(1&2):3.2020(Plagiochilaceae)

This new species has been discovered and described based on the collection made from Tawi Wildlife Sanctuary, Aizawl, Mizoram at 1731 m altitude.

Riccia keralensis Manju, Chandini, Sushil, K.Singh & K. P. Rajesh, The Bryologist, 124 (3):377.2021 (Ricciaceae)

This new species has been discovered and described based on the collection made from the damp soil in overlapping patches in pure population, Ramanattukara, Kozhikode ditrict, Kerala at 15 m altitude.

Saccogyna darjeelingensis M. Dey & S. Majumdar, Curr. Sci. 123 (2) :145 (Marchantiophyta)

This new species has been discovered and described based on the collection made from Darjeeling district, West Bengal.

FUNGI

NEW GENUS

Biligiriella S. Sengupta Chatterjee & Rashmi Dubey, J. Mycopathol. Res. 59(3): 319. 2021.

This new genus has been discovered and described based on type species Biligiriella indica S. Sengupta Chatterjee & Rashmi Dubey collected from dried leaves of palm from Biligiri Rangaswamy Temple Wildlife Sanctuary, Karnataka.

NEW SPECIES

Achroiostachys bambusicola Dubey, Species, 2021, 22(70), 319. 2021. (Stachybotryaceae)

This new species has been discovered and described based on the collection made from the leaves of Bambusa bambos (L.) Voss from Tansa Wildlife Sanctuary, Thane District, Maharashtra.

Biligiriella indica S. Sengupta Chatterjee and Rashmi Dubey, J. Mycopathol. Res. 59(3): 320.2021.

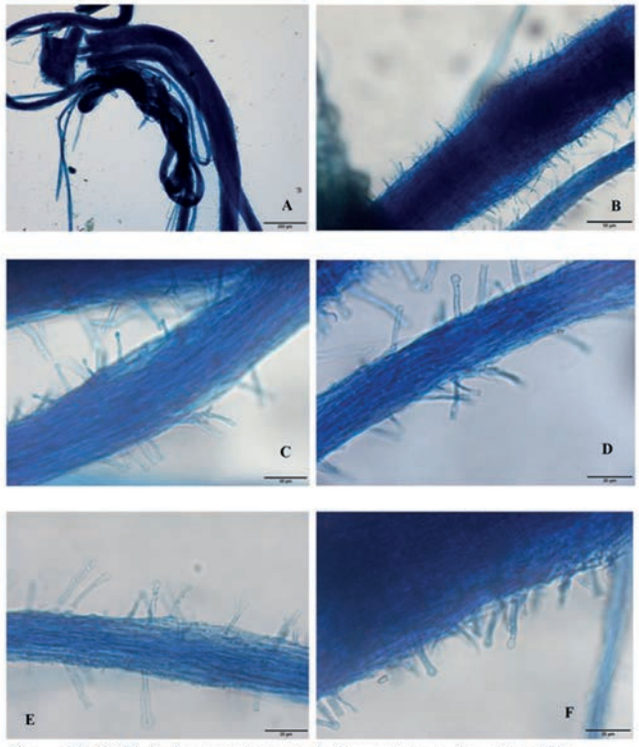


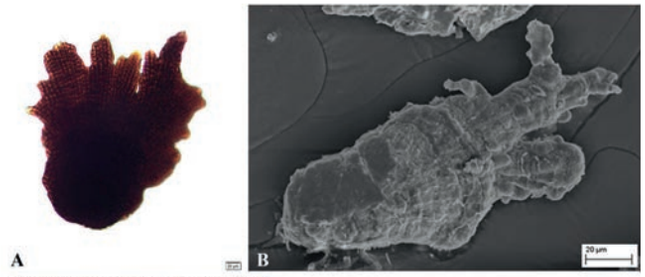
Fig. – *Biligiriella indica* gen. et sp. nov. A: Synnemata growing as thread like projections on the substratum. B: Acapitate synnemata composed of numerous loosely aggregated whitish cream, smooth, parallel hyphae C–F: Aseptate solitary conidia attached to the monoblastic phialides. Bars: A 200 µm; B 50 µm; C–F 20 µm.

This new species has been discovered and described based on the collection made from dried leaves of palm from Biligiri Rangaswamy Temple Wildlife Sanctuary, Karnataka.

Chroogomphus himalayanus K. Das, Hembrom, A. Parihar & Vizzini, Phytotaxa 528 (2): 86.2021 (Gomphidiaceae)

This new species has been discovered and described based on the collection made on the soil among mosses, under the trees of Abies, Firing Range Forest, Gnathang, East-district, Sikkim at 3640 m altitude.

Dictyosporium matherense Rashmi Dubey, Asian J. Forestry 6 (1): 1-8, 2022. (Dictyosporiaceae)



***Dictyosporium matherense* Rashmi Dubey 2022**
Dubey R. 2022. *Dictyosporium matherense* sp. nov.: A new-fangled cheirosporous fungal species described from the W Ghats of India. Asian Journal of Forestry, 6(1): 1-8.

This new species has been discovered and described based on the collection made on dry stem litter from Matheran, Maharashtra.

Elotespora mumbaiensis Rashmi Dubey, Phytotaxa 529 (1): 176. 2021.

This new species has been discovered and described based on the collection made from dead twig litter from Yeoor range, Sanjay Gandhi National Park, Mumbai, Maharashtra.

Heteroconium tulsiense Rashmi Dubey & Amit d. Pandey, Phytotaxa 536 (2) https://doi.org/10.11646/phytotaxa.536.2.8 (Antennulariellaceae)

This new species has been discovered and described based on the collection made from Tiger Reserve areas (Tulsi Range), Sanjay Gandhi National Park, Mumbai, Maharashtra.

Janetia heterospora Rashmi Dubey, J. Mycopathol. Res. 59(3): 256. 2021.

This new species has been discovered and described based on the collection made from wooden branch, Sawantwadi, Maharashtra.

Lactifluus kanadii I. Bera, A. Ghosh, Nuytinck & Verbeken, Persoonia 46: 477.2021 (Russulaceae)

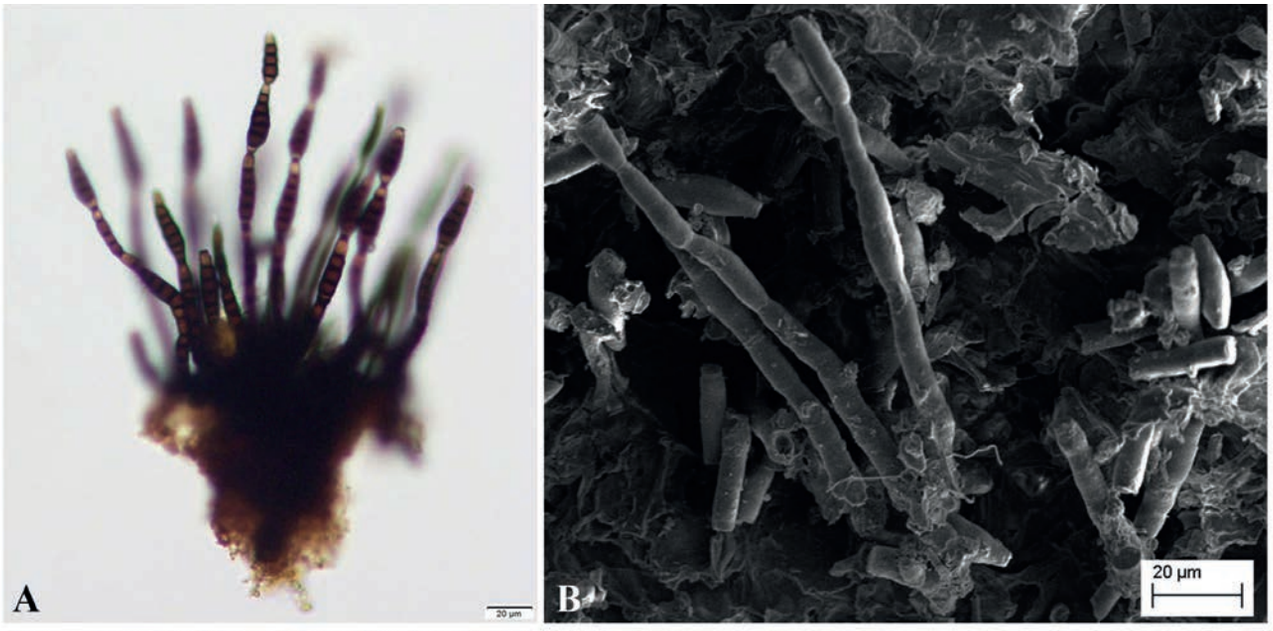
This new species has been discovered and described based on the collection made from Bebar Thanka, Dirang, West Kameng district, Arunachal Pradesh at 1982 m altitude.

Phaeolus sharmae Hembrom, A. Parihar, K. Das & A. Ghosh, Cryptog. Mycol. 43(2): 38. 2022 (Laetiporaceae)

This new species has been discovered and described based on the collection made from Yumthang valley, Shingba Rhododendron sanctuary, North district, Sikkim.

Russula adwanitekae A. Ghosh, K. Das & Buyck, Eur. J. Taxon. 782: 161.2021 (Russulaceae)

This new species has been discovered and described based on the collection made from



***Heteroconium tulsiense* Rashmi Dubey & AD Pandey 2022**
Dubey R, Pandey AD. 2022. *Heteroconium tulsiense* (Antennulariellaceae): a novel microfungus from Sanjay Gandhi National Park, Maharashtra, India. Phytotaxa, 536(2): 190-196.

Adwani-Teka forests, Pauri Garhwal, Uttarakhand at 1989 m altitude.

Russula purpureozonata K. Das, A. Ghosh & Buyck, Eur. J. Taxon.782: 164.2021 (Russulaceae)

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

Russula xerampelinoides K. Das, I. Bera, A. Ghosh & Buyck, Cryptog. Mycol. 42(5): 81.2021 (Russulaceae)

This new species has been discovered and described based on the collection made from Yumthang valley, North district, Sikkim, India at 3644 m altitude.

Vuilleminia tropica Hembrom, A. Ghosh, A. Parihar & K. Das, Cryptog. Mycol. 43(2): 54.2022 (Vuilleminiaceae)

This new species has been discovered and described based on the collection made from Rajmahal hills, Sahibganj district, Brindaban Panchayat, Joshkuti, Jharkhand.

NEW DISTRIBUTIONAL RECORDS

SEED PLANTS
GENERIC RECORDS

Rehderodendron Hu (Styracaceae)

This genus earlier known from SE Asia has been reported for the first time from India based on the collection made from Chiyang Tajo block, East Kameng district of Arunachal Pradesh.

Stadiochilus R. M. Sm. (Zingiberaceae)

This genus earlier known from Myanmar (Kachin State) has been reported for the first time from India based on the collection made from Woashu Village, Tuengsang district, Nagaland.

SPECIES RECORDS

Anadendrum latifolium Hook.f. (Araceae)

This species earlier known from China, Indo-China, Indonesia, Malaysia and Philippines has been reported for the first time from India based on the collection made from Katchal Island of Andaman & Nicobar Islands.

Eriochloa meyeriana (Nees) Pilg. (Poaceae)

This species earlier known from Africa, Asia and Australia has been reported for the first time from India based on the collection made from Acharya Jagadish Chandra Bose Indian Botanic Garden, Shibpur, Howrah, West Bengal.

Fagopyrum urophyllum (Bureau & Franch.) H.Gross (Polygonaceae)

This species earlier known from south and central China has been reported for the first time from India based on the collection made from Namchi, South district, Sikkim.

Gastrochilus yei J.W. Li & X.H. Jin (Orchidaceae)

This species earlier known from China has been reported for the first time from India based on the collection made on the way from Lachung to Katao, North Sikkim District of Sikkim.

Neopicrorhiza minima R.R. Mill (Plantaginaceae)

This species earlier known from Bhutan (Trongsa and Bumthang districts) has been reported for the first time from India based on the collection made near Kyo-tso lake, Tawang district, Arunachal Pradesh at 3820 m altitude.

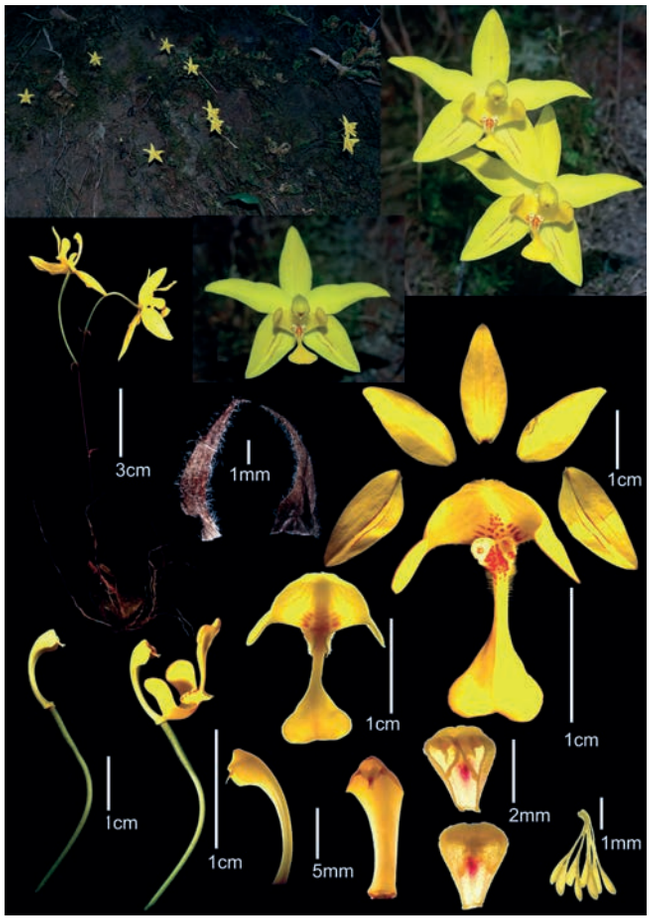
Rehderodendron microcarpum K.M. Feng ex T.L. Ming (Styracaceae)

This species earlier known from SE Asia and predominantly from south China, Myanmar, Vietnam has been reported for the first time from India based on the collection made from Chiyang Tajo block, East Kameng district of Arunachal Pradesh.

Spathoglottis affinis de Vriese (Orchidaceae)

This species earlier known from Bangladesh, Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam has been reported for the first time from India based on the collection made from West Jaintia Hills, near Kudengthymmai Village, Sui

Synkew Living Root Bridge, Meghalaya.



Stadiochilus burmanicus R. M. Sm. (Zingiberaceae)

This species earlier known from Myanmar (Kachin State) has been reported for the first time from India based on the collection made from Woashu Village, Tuengsang district, Nagaland.

Veronica plebeia R. Br (Plantaginaceae)

This species earlier known from Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia) has been reported for the first time from India based on the collection made from Marlimund lake, Niligiri, Tamil Nadu.

SUB-SPECIES RECORD

Desmodium heterocarpon L. DC. subsp. ovalifolium (Prain) H. Ohashi (Fabaceae)

This sub species earlier known from Tropical Southeast Asia, China, Sri Lanka, Myanmar, Thailand, Malaysia, Philippines, Indonesia and Pacific Island has been reported for the first time from India based on the collection made from Shoal Bay, Mount Harriet, Write Myo, South Andaman, Andaman and Nicobar Islands.

VARIETAL RECORD

Cephalanthera erecta (Thunb.) Blume var. oblanceolata N. Pearce & P.J. Cribb (Orchidaceae)

This variety earlier known from Bhutan has been reported for the first time from India based on the collection made near Gharsari Mandal, Chamoli, Uttarakhand.

PTERIDOPHYTES

Dryopteris lunanensis (Christ) C. Chr. (Dryopteridaceae)

This species earlier known from Bhutan, China, Tibet, Japan has been reported for the first time from India based on the collection made from Dibang Wildlife Sanctuary, Dibang Valley District, Arunachal Pradesh at an altitude of 1900 m.

LICHEN

Arthonia cyanea Müll. Arg. (Arthoniaceae)

This species earlier known from Central and South America and Philippines has been reported for the first time from India based on collections made from the Parlob island, Middle Andaman, Andaman and Nicobar Islands.

Arthonia mira R. Sant. (Arthoniaceae)

This species earlier known from Central and South America, South Africa, and Thailand has been reported for the first time from India based on collections made from the Nayadera Limestone caves, Baratang Island, South Andaman, Andaman and Nicobar Islands.

Byssoloma discordans (Vain.) Zahlbr. (Pilocarpaceae)

This species earlier known from Central and South America, Indonesia, Jamaica, Madagascar and Thailand has been reported for the first time from India based on collections made from Mount

Harriet National Park, South Andaman Islands, Andaman and Nicobar Islands.

Enterographa bartlettii Sérus. (Roccellaceae)

This species earlier known from New Zealand has been reported for the first time from India based on collections made from the Parlob island, Middle Andaman, Andaman and Nicobar Islands.

Herpothallon queenslandicum (Elix) Elix (Arthoniaceae)

This species earlier known from Australia has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Malmidea tratiana Kalb & Mongk. (Malmideaceae)

This species earlier known from Thailand has been reported for the first time from India based on collections made from the R. M. Point Forest, Rutland Island, Andaman Islands, Andaman and Nicobar Islands.

Opegrapha heliabravoa Herrera-Campos & Lücking (Roccellaceae)

This species earlier known from Mexico has been reported for the first time from India based on collections made from the Parlob island, Middle Andaman, Andaman and Nicobar Islands.

Strigula macrocarpa Vain. (Strigulaceae)

This species earlier known from Central and South America, Nigeria, the Philippines and Uganda has been reported for the first time from India based on collections made from the R. M. Point Forest, Rutland Island, Andaman Islands, Andaman and Nicobar Islands.

ALGAE

Cloniophora plumosa (Kuetz.) Bourr

This species erstwhile known from Bangladesh, Europe, Hawaii, Japan has been reported for the first time from India based on the collection made from the Kumarasamy Lake, Coimbatore, Tamil Nadu.

FUNGI

Didymocrea leucaenae Jayasiri, E.B.G. Jones & K.D. Hyde

The fungal species earlier known from Thailand has been reported for the first time from India based on collection made from decaying bark of unidentified plant from Amboli Ghat, Sindhudurg District, Maharashtra.

Favolus roseus Lloyd

The fungal species has been reported for the first time from India based on the collection made from Marath-wada, Taluka Kannad, Puranwadi, Aurangabad district, Maharashtra at 116 m altitude.

Lactarius abieticola X.H. Wang

The fungal species has been reported for the first time from India based on collection made from Yumthang, Sikkim at 3619 m altitude and from Ani Gompa, Tawang district, Arunachal Pradesh.

Lactarius ambiguus X.H. Wang

The fungal species has been reported for the first time from India based on collection made from Chug, West Kameng district, Arunachal Pradesh at 1761 m altitude.

Lactarius hirtipes J.Z. Ying

The fungal species has been reported for the first time from India based on collection made from Sergaon, West Kameng district, Arunachal Pradesh at 2408 m altitude.

Lactarius kesiyae Verbeken & K.D. Hyde

The fungal species has been reported for the first time from India based on collection made from Dirang, Namchu, West Kameng district, Arunachal Pradesh at 1968 m altitude.

EX-SITU CONSERVATION

भारतीय वनस्पति सर्वेक्षण

BOTANICAL SURVEY OF INDIA

Ex-situ Conservation

Botanical Survey of India, a primier organization under Ministry of Environment, Forest and Climate Change is custodian of 11 botanic gardens covering different geographical regions of India. Through this gardens BSI practices ex-situ conservation of different rare, endangered, threatened and economically important plants which require conservation. All the gardens have been designed for collection, introduction, multiplication and maintenance of germplasms of orchids, bamboos, medicinal plants, palms, ferns, legumes, wild edible plants, insectivorous plants, gymnosperms and RET plants. Since their inception, all these gardens are doing excellent works in the field of ex-situ conservation, biodiversity conservation, education and awareness.

Botanic Gardens under control of Botanical Survey of India are:

Sl. No.	Name of Garden	Regional Centre jurisdiction	Focal Area
1	AJC Bose Indian Botanic Garden, Howrah	Howrah	Medicinal plants
2	Andaman & Nicobar Regional Centre, BSI, Experimental Garden, Dhanikhari	Port Blair	Medicinal plants
3	Arid Zone Regional Centre, Jodhpur: Experimental Garden, Jodhpur	Jodhpur	Arid plants
4	Arunachal Pradesh Regional Centre, Itanagar: Experimental Garden, Sankie View	Itanagar	Indigenous species of Arunachal Pradesh
5	Botanic Garden of Indian Republic, Experimental Garden, Noida	Noida	Arboreta, Woodland and Botanic Garden Education
6	Central Regional Centre, Experimental Garden, Allahabad	Allahabad	Wild Rose and its cultivars
7	Eastern Regional Centre, Shillong: Experimental Garden, Barapani	Shillong	Zingiberaceae, Orchids
8	National Orchidarium and Experimental Garden, Yercaud	Coimbatore	Orchids
9	National Gymnosperm collection cum Botanic Garden, Pauri	Dehradun	Gymnosperms
10	Sikkim Himalaya Regional Centre, Experimental Garden, Gangtok	Gangtok	Orchids ,Gymnosperms
11	Western Regional Centre, Pune, Experimental Garden, Mundhwa	Pune	Pteridophytes, Gymnosperms

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

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

As part of ex-situ conservation of EET plants of Andaman and Nicobar Islands, several species were collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. Some of the plant species were: *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.

Barapani Experimental Botanic Garden, 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 2021-March 2022, as paer of ex-situ conservation project, the following 178 plant species were collected and planted at EBG, Barapani (Umiam) and conserved *viz. Acanthaceae* sp. (2 nos.), *Acanthaceae* sp. (3 nos.), *Acanthephippium striatu*m (6 nos.), *Acanthus leucostachyus* (4 nos.), *Acanthus leucostachyus* (6 nos.), *Acer laevigatum* (5 nos.), *Adinandra griffithii* (5 nos.), *Aerides* sp. (1 no.), *Aeschynanthus* sp. (2 nos.), *Agapetes* sp. (1 no.), *Aglaia perviridis* (5 nos.), *Agrostophyllum brevipes* (5 nos.), *Alnusnepalensis* (5 nos.), *Alpinianigra*(2 nos.), *Alpinia* sp. (3 nos.), *Alpinia* sp. (7 nos.), *Alpinia* sp. (9 nos.), *Amomum* sp. (5 nos.), *Angiopterisevecta*(2 nos.), *Angiopteris* sp. (1 no.), *Anoectochilusroxburghii* (2 nos.), *Aphananthecuspidata* (5 nos.), *Araceae* sp. (1 no.), *Araceae* sp. (1 no.), *Areca* sp. (2 nos.), *Areca* sp. (6 nos.), *Arundina graminifolia* (13 nos.), *Asystasia* sp. (2 nos.), *Averrhoacarambola* (4 nos.), *Bamboo* sp. (20 nos.), *Bauhinia* sp. (3 cuttings), *Begonia roxburghii* (2 nos.), *Begonia* sp. (2 nos.), *Begonia* sp. (3 nos.), *Boesenbergia* sp. (7 nos.), *Boesenbergia* sp. (7 nos.), *Bryophyllum pinnatum* (3 nos.), *Bulbophyllum pteroglossum* (5 nos.), *Bulbophyllum* sp. (4 nos.), *Bulbophyllum* sp. (3 nos.), *Bulbophyllum* sp. (5 nos.), *Burseraserrata* (1 no.), *Calamus* sp. (1 no.), *Calantheclamata*(6 nos.), *Calanthesylvatica* (6 nos.), *Camellia* sp. (2 nos., 4 cuttings), *Carica papaya* (10 nos.), *Carica papaya* (15 nos.), *Celtistetrandra* (2 nos.), *Cephalantheropsis obcordata*(6 nos.), *Cephalotaxusmannii* (7 nos.), *Cinnamomumbejolghota* (2 nos.), *Coelogynesuaveolens*(8 nos.),*Coelogyneviscosa* (1 no.), *Colocasia* sp. (2 nos.), *Commelina* sp. (2 nos.), *Coniogramme no.* (1 no.), *Crepidiumcalo phyllum* (9 nos.), *Crepidium* sp. (15 nos.), *Cyathea* sp. (3 nos.), *Cycaspectinata* (2 nos.), *Cymbidium aloifolium* (5 nos.), *Cymbidium* sp. (2 nos.), *Daphne* sp. (2 nos.), Dendrobiumdensiflorum (3 nos.), *Dendrobiumchrysotoxum* (1 no.), *Dendrobiumsulcatum* (2 nos.), *Dendrobium* sp. (5 nos.), *Dendrobium* sp. (3 nos.), *Dendrobium* sp. (4 nos.), *Dendrobium* sp. (7 nos.), *Dendrodiumchrysanthum* (8 nos.), *Dipteriswallichii* (7 nos.), *Docyniaindica* (7 nos.), *Dracaena* sp. (9 nos.), *Epipogiumroseum* (18 nos.), *Equisetum* sp. (4 nos.), *Eriapaniculata* (7 nos.), *Eriatomentosa* (8 nos.), *Etlingeralinguiformis* (1 no.), *Etlingera* sp. (8 nos.), *Fern* sp. (1 no.), *Fern* sp. (1 no.), *Fern* sp. (2 nos.), *Fern* sp. (2 nos.), *Flemingiastrobilifera* (1 no.), *Garciniacowa* (2 nos.), *Garcinia* sp. (3 nos.), *Garcinia xanthochymus* (4 nos.), *Geodorum recurvum*(14 nos.), *Geodorum* sp. (21 nos.), *Geodorum* sp. (6 nos.), *Gnaphalium* sp. (3 nos.), *Gnetumgnemon* (2 nos.), *Goodyeraprocera* (14 nos.), *Goodyeraprocera* (5 nos.), *Gynocardiaodorata* (5 nos.), *Hedychiumcoronarium* (1 no.), *Hedychium* sp. (2 nos.), *Hedychium* sp. (2 nos.), *Hodgsoniaheteroclita* (3 nos.),

Hodgsonia sp. (14 seedlings), *Homalomena* sp. (1 no.),*Hoveniadulcis* (2 nos.), *Hoya* sp. (3 nos.), *Ilex khasiana* (11 nos.), *Illigerakhasiana* (4 nos.), *Impatiens sashinborthakurii*(7 nos.), *Impatiens* sp. (3 nos.), *Impatiens* sp. (2 nos.),*Impatiens* sp. (3 nos.), *Impatiens* sp. (4 nos.), *Impatiens* sp. (4 nos.), *Liliaceae* (1 no.), *Liparis* sp. (5 nos.), *Liparis viridiflora* (5 nos.), *Ludwigiaadscendens* (6 nos.), *Mangifera* sp. (6 nos.), *Melastoma* sp. (1 no.), *Mesua* sp. (7 nos.), *Micropera* sp. (2 nos.), *Musa markkui* (10 nos.), *Musa* sp. (1 no.), *Musa* sp. (1 no.), *Musa* sp. (5 nos.), *Musa* sp. (6 nos.), *Musa* sp. (7 nos.), *Myricaesculenta* (3 no.), *Nelumbonucifera* (4 nos.), *Nephelaphyllum* sp. (1 no.), *Nymphaeanouchali* (4 nos.),*Oenanthejavanica* (1 no.), *Ophiorrhiza* sp. (3 nos.), *Orchid* sp. (1 no.), *Orchid* sp. (1 no.), *Orchid* sp. (1 no.), *Orchid* sp. (2 nos.), *Orchid* sp. (8 nos.), *Pandanus* sp. (1 no.), *Paphiopedilum insigne* (12 nos.), *Paphiopedilum venustum* (2 nos.), *Parkiatimoriana* (2 nos.), *Peliosanthes* sp. (2 nos.), *Peristylis* sp. (4 nos.), *Phaiusmishmensis* (5 nos.), *Phaiustankervilleae* (8 nos.), *Phlogacanthuscurviflorus* (2 nos.), *Phlogacanthus* sp. (1 no.), *Phlogacanthus thyrsiformis* (2 plants and 14 cuttings), *Pholidotaarticulata* (3 nos.), *Pholidotaconvallariae*(3 nos.), *Pholidotaimbricata* (1 no.), *Pholidota* sp. (2 nos.), *Pithecellobiumdulce* (2 nos.), *Pothoschinensis* (1 no.), *Prunuscerasoides* (1 no.), *Pyrenariakhasianavar lakhimpurense*(15 nos.), *Rhaphidophora* sp. (6 nos.), *Rubiaceae* sp. (2 nos.), *Rubiaceae* sp. (3 nos.), *Saccandraglabra* (120 plants), *Scutellaria* sp. (3 nos.), *Selaginella* sp. (4 nos.), Sterculia sp. (1 no.), *Strobilanthes* sp. (3 nos.), *Syzygium* sp. (4 nos.), *Tacca* sp. (5 nos.), *Tainia* sp. (7 nos.), *Tainia* sp. (6 nos.), *Thunia* sp. (1 no.), *Thuniaalba* (3 nos.), *Tupistra* sp. (3 nos.), *Unidentified* sp. (1 no.), *Unidentified* sp. (2 nos.), *Unidentified* sp. (2 nos.), *Vanda* sp. (4 nos.), *Vitaceae* sp. (2 cuttings), *Vitis* sp. (5 cuttings), *Zeuxine* sp. (2 nos.), *Zingiber* sp. (3 nos.), *Zingiber* sp. (5 nos.), *Zingiber* sp. (52 rhizomes), *Zingiberaceae* sp. (4 nos.) and *Zingiberaceae* sp. (3 nos.).

Experimental Botanic Garden, Sikkim Himalayan Regional Centre, Gangtok

As part of ex-situ conservation project, during 2021-22, plants (9 taxa) were collected during the tour to Marchak-Singtam, East Sikkim via., Kabi, North Sikkim. The following plants were collected for plantation in the garden-*Aralia armata*(Wall. ex G.Don) Seem. [Araliaceae]; *Asplenium phyllitidis* D.Don [Aspleniaceae]; *Canna indica* L. [Cannaceae]; *Castanopsis indica* (Roxb. ex Lindl.) A.DC. [Fagaceae]; *Colocasia* sp. [Araceae]; *Dieffenbachia* sp. [Araceae]; *Ficus* sp. [Moraceae]; *Murraya koenigii* (L.) Spreng. [Rutaceae]; *Phlogacanthus thyrsiformis* (Roxb. ex Hardw.) Mabb. [Acanthaceae]

Experimental Botanic Garden, Arunachal Pradesh Regional Centre, Sankie View

As part of ex-situ conservation project, during 2021-22, following RET plant species were introduced in the botanical garden of BSI, APRC namely *Pterocarpous santalinus* L.f., *Aquilaria malaccensis* Lam. In addition with *Azadirachta indica, Delonix regia, Cinnamomum verum, Mimusops elengi, Phyllanthus emblica, Magnolia champaca, Chukrasia tabularis, Dipterocarpus retusus, Swietenia mahagoni, Phoebe goalparensis, Polyalthia longifolia, Syzygium cumini, Morus alba, Prunus pensylvanica, Citrus sinensis, Pyrus pyrifolia, Malus pumila, Citrus medica*.

Experimental Botanic Garden, Western Regional Centre, Mundhwa, Pune

During 2021-22, two field tours were conducted to Torana hills, Pune, seeds of following Endemic and Critically Endangered species of Maharashtra was collected, 1. *Abutilon ranadei* Woodraw & Stapf (more than 100 nos.) 2. *Barleria sepalosa* C.B. Clarke. (more than 500 nos.). Some Endemic and Least Concern species of Maharashtra was also collected. *Echinops sahyadricus* S. More, F. Conti & H.S. Bhosale (more than 200 nos.). Collected seeds were stored as well as few were processed for germination. One field tour was also conducted to Sajjangad hills, Satara. More than 50 nos. plantlets and branches of an Endemic and Endangered species *Bocerosia frerei* (G.D. Rowley) Meve & Liede. was surveyed and collected. Collected planting materials were potted in the earthen pots for rooting.

Following EET and native species were multiplied in the office garden BSI, WRC, Pune through seeds from existing germplasm in the garden as well as recently collected seeds from Northern Western Ghats. Total 889 nos. of saplings

under 8 nos. of species (trees 5 species, shrubs 2 species, herb 1 species) were multiplied *viz. Alstonia venenata* R.Br, *Garcinia indica* (Thouars) Choisy, *Croton gibsonianus* Nimmo, *Abutilon ranadei* Woodraw & Stapf, *Barleria sepalosa* C.B. Clarke., *Bocerosia frerei* (G.D. Rowley) Meve & Liede, *Sterculia foetida* L., *Caryota urens* L.

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

Following EET species were nultiplied in NOEG, Yercaud through seeds or stem cuttings from existing germplasm in the garden as well as previously collected seeds from Agasthyamalai Biosphere Reserve, Western Ghats: 285 nos. of saplings under 9 nos. of species(trees 5 species, shrubs 3 species, liana 1 species) were multiplied *viz. Alstonia venenata* R. Br., *Bentinckia condappana* Berry ex Roxb., *Euphorbia vajravelui* Binojk. & N.P. Balakr., *Garcinia imberti* Bourd., *Cyathea nilgirensis* Holttum, *Barleria acuminata* Nees, *Barleria grandiflora* Dalzell., *Maytenus ovata* (Wall. ex Wight & Arn.) Loes., *Gnetum ula* Brongn.

PUBLICATIONS

भारतीय वनस्पति सर्वेक्षण

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Hindi Article

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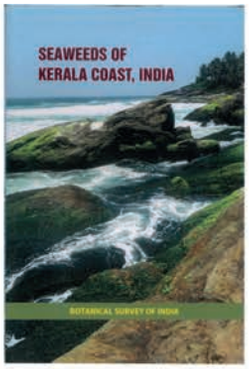
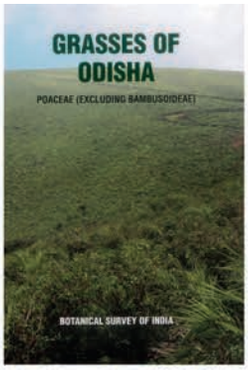
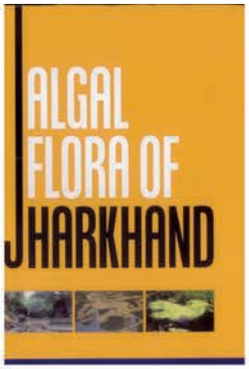
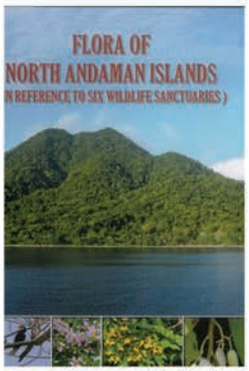
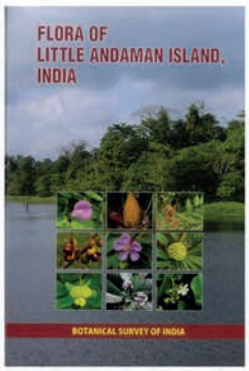
BOOKS PUBLISHED BY BOTANICAL SURVEY OF INDIA DURING 2022-23

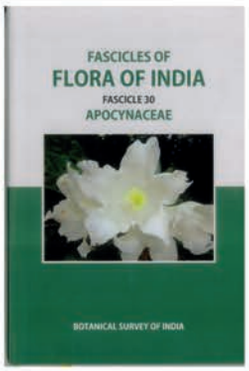


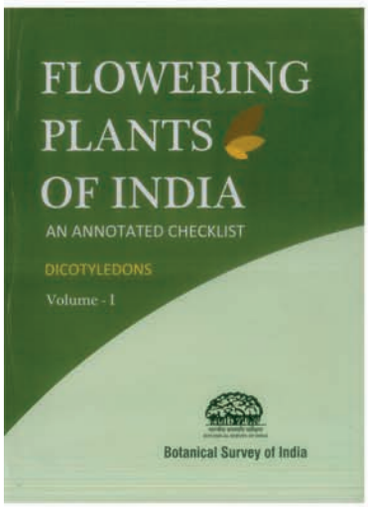


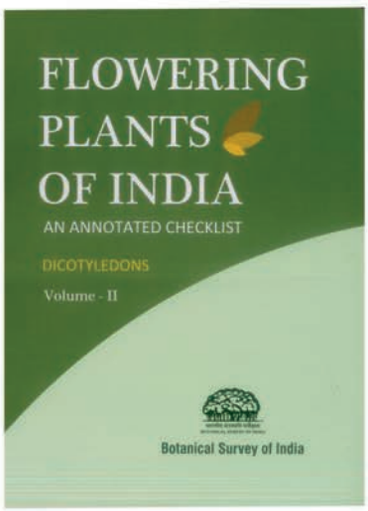


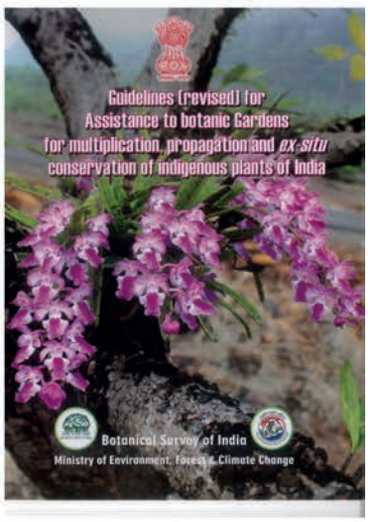


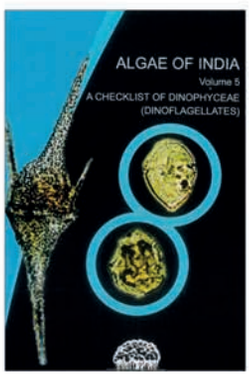












SEMINAR, CONFERENCE, SYMPOSIUM AND WORKSHOP

Organized by BSI

- BSI organized a virtual Annual Scientific Meet from 03.05.2021 – 05.05.2021. On this occasion, all the Heads of Offices and scientists of BSI presented their annual scientific progress report.
- Webinar on 'Integration of ecosystem and biodiversity values into national and local development planning', organized by BSI on 22.05.2021.
- National Webinar, jointly organized by Department of Botany, Telangana Social Welfare Residential Degree College for Women, L.B. Nagar, Hyderabad, Telangana and Botanical Survey of India, Deccan Regional Centre, Hyderabad on the occasion of World Environment Day held on 05.06. 2021.
- BSI organized a virtual meeting with all the heads of offices regarding 'Digitization of Herbarium Database in BSI' on 15.06.2021.
- BSI organized a virtual meeting with all the heads of offices and scientists for discussion on the tentative tour schedules/ area of mutual research under MoU between BSI and NBPGR, New Delhi on 18.06.2021 and 30.06.2021.
- BSI and NBPGR, New Delhi jointly organized a virtual meeting on planning and Management of joint research programmes under the MoU, on 5.07.2021.
- Meeting on 'Ongoing Research and Future Collaboration between BSI, Allahabad & FRCER, Prayagraj' at BSI, CRC, Allahabad on14.07.2021.
- BSI, Central National Herbarium (CNH), Howrah and T.M. Bhagalpur University, Bhagalpur, Bihar jointly organized one day virtual National Workshop cum Hands-on Training on 'Plant Identification and Herbarium Methodology' on 20.07.2021. Around 105 participants from various parts of the country attended this workshop.
- International day for the preservation of the ozone layer event, jointly organized by the Zoological Survey of India (ZSI) and the Botanical Survey of India (BSI) on 16.09.2021 at ZSI, Hyderabad auditorium.
- BSI organized its 10th RAMC (Research Advisory & Monitory Committee) at BGIR, Noida from 20.09.2021-21.09.2021 under the chairmanship of Prof. A. K. Kaul, Shri Ravi Agrawal, the addl. Secretary and Smt. Manju Pandey, Joint Secretary, MoEFCC inaugurated the RAMC meeting.
- BSI-AJCB IBG, Howrah, in collaboration with the Regional Outreach Bureau, Kolkata (Ministry of Information and Broadcasting, GOI) organized a 5 days photo exhibition for the general public from 29.09.2021-03.10.2021.
- BSI organized two days National Workshop (online) on Plant Identification and Herbarium Methodology in collaboration with Bareilly College, Bareilly, UP on 29.10.2021 (for higher plants) and 01.11.2021 (for lower plants). During the workshop, more than 600 faculties, research scholars and students of Botany participated actively and learnt the methods of plant identification and herbarium preparation.
- Workshop on Cyber Security- साइबर सुरक्षित भारत, organized by BSI-CNH on 15.11.2021.
- Two months certificate course on Waste Management under Green Skill Development Programme organized by ANRC as a joint venture with the C.P.R. Environmental Education Centre, Port Blair as a part of 75 years Azadi ka Amrit Mahotsav from 17.11.2021 to 18.01.2022.
- Workshop on 'Plant Taxonomy: Classical to Molecular' from 29.11.2021 to 04.12.2021 at Bhopal which was jointly organised by Mansarovar Global University, Bhopal and Botanical Survey of India.

- Herbarium Methodology to the trainee Scientists from NBPGR on 6.12.2021 at Central National Herbarium.
- Seminar on 'Endangered Plant species and their conservation' organized by Raja Bahadur Venkata Rama Reddy Women's College (RBVRR), Narayanguda, Hyderabad in collaboration with Botanical Survey of India on 30.12.2021.
- One day Training Programme on 'Quantitative Assessment of Floristic Diversity' organised by BSI, SHRC, Gangtok (funded by NHIDCL) on 03.02.2022.
- BSI, on the occasion of its 133rd Foundation day, organised two days National webinar on 'Floristic Research in India, Contribution of BSI to the Nation: Present and Future' on 13.02.2022 and 14.02.2022. On this occasion, 5 lead lectures were delivered by the eminents speakers and 26lectures by the senior scientists of BSI. 701 participants, including 235 faculties from various universities and colleges, 214 students, 112 research scholars, 111 BSI officials and 29 participants attended this webinar.
- Workshop/ Training of youth on 'Jal Jagran Abhiyan' organized by CNH and Neheru Yuva Kendra on 13.03.2022.
- BSI ENVIS RP organized a workshop on 'Herbarium Methodology and Plant Nomenclature' at P.G. Dept. of Botany, Ramakrishna Mission Vivekananda Centenary College, Rahara, Kolkata on 15.03.2022 & 16.03.2022. Around 135 students and research scholars from various colleges attended and benefitted from the workshop.
- Webinar on 'Management of water resource with emphasis on mangrove ecosystem', organized by BSI-ERC on 22.03.2021.
- T.N. Khoshoo Memorial lecture in the 'International conference cum workshop on agrotechnology, value addition, global trade and sustainability of medicinal/neutraceutical orchids & orchid show', organized by The Orchid Society of India (TOSI), in association with BSI, Kolkata; Dr YSR Horticultural University, Venkataramannagudem, Andhra Pradesh & ICAR-NRC for Orchids, Pakyong (Sikkim) from 25.03.2022 – 27.03.2022.
- Botanical Survey of India as National Mission on Himalayan Studies (NMHS) project partner organized a 'National seminar on Invasive Alien Species: as undesirable guest to the natural ecosystem' on 30.03.2022 at BSI-CNH, Howrah in hybrid mode. Around 260 participants from all over India attended this seminar. Dr. J.T. Mathew, PCCF & Head of Forest Forces, Govt. of WB; Dr. Mark Watson, Head of major flora, Royal Botanic Garden, Edinburgh, Scotland, and Dr. (Mrs.) D. Banerjee, Director, ZSI Kolkata, Prof. Anzar A. Khurroo, Univ. of Kashmir graced the events and delivered the talks. Dr. S.S. Dash, Scientist 'E' & Incharge, Tech. Sect. HQ convened the seminar. Dr. Mark Watson, Head of major flora, Royal Botanic Garden, Edinburgh, Scotland also delivered a special talk on "Nathaniel Wallich: his catalogue and correspondence" on 31.03.2022 at BSI-CNH, Howrah.
- In collaboration with B-CAF, West Bengal Arts Leadership Council (WICCI), Paschim Rarh Itihaas o Sanskriti Charcha Kendra, Library & Museum and Lok Sanghita Foundation (Local partner), BSI, ISIM participated as resource partner in a Community Leadership Programme cum Capacity Building Workshop for Bharatpur Patuas on 26.03.2022-27.03.2022 venued at Bharatpur village, Susunia, Bankura.

Participated by BSI

- Webinar on' Corona Awareness 2nd Wave & Vaccination', organised by People's Association for Science and Environment (PASE), Kolkata on 11.04.2021.
- Webinar on the occasion of International Earth Day 2021 – 'Restore Our Earth' organised by DG P. G. College, Kanpur and Glocal Environment Social Association (GESA), New Delhi on 22.04.2021.
- Science Academics Virtual Lecture Workshop on 'Taxonomy, Floristics and Conservation' organized by Department of Botany, Krishnammal College for Women, Coimbatore on 27.04.2021.
- Lecture on Ex-situ conservation of Plants at AJC Bose Indian Botanic Garden, Howrah for the Tamil Nadu Forest Academy, Coimbatore on 29.04.2021.
- 'Setting up of Bio-NEST Incubator to develop women Bio-entrepreneurship through orchid floriculture in Meghalaya' monitoring committee meeting on 13.05.2021.
- Webinar on 'Time to transform the food organized by Telangana State Biodiversity Board on the occasion International Day for Biological Diversity system' on 20.05.2021.
- International Webinar on Close to Nature on the occasion of International Day for Biological Diversity organized by Department of Botany on 22.05.2021.
- Webinar Green Talk on International Biodiversity day organized by G B Pant Institute on 22.05.2021.
- Webinar on 'Biodiversity Conservation: We are part of the Solution for the Nature' organized by Tamil Nadu Biodiversity Board (TNBB), On the occasion of the International Day for Biological Diversity (IDBD) on 22.05.2021.
- Webinar organized by Delhi Biodiversity Parks of DDA On the occasion of the International Day for Biological Diversity (IDBD) on 22.05.2021.
- Webinar organised by Sidho-Kanho Birsha University on 22.05.2021.
- Webinar organised by Raidighi College, South 24 Parganas on 22.05.2021.
- Virtual lecture on the occasion of World's Biodiversity Day organized by the GB Pant institute, Mohal, Kullu (H.P.) on 22.05.2021.
- National Webinar on Biodiversity in India-Special reference to Eastern Ghats held at Dept. of Botany & Microbiology, Dr. BRR Govt. College, Jedcherla, TS on 22.05.2021.
- Green Talk 3 Webinar Lecture on Plant diversity for Bio economy and conserving threatened plants of India given by Dr. S. K. Barik, Director, CSIR-NBRI, Lucknow on 24.05.2021.
- Two day webinar organized by Department of Botany, St. Mary's College, Shillong on 25.05.2021.
- Virtual meeting of the 'Post-2020 Global Biodiversity Framework - Thematic Stakeholder Consultations' (Theme: Floral Diversity), organized by ministry on 28.05.2021 and submitted their feedbacks / suggestions on the floral resources of the country.
- Webinar on Ethnobotany in India: Era of Dr. S. K. Jain and the way forward by, given by Dr. Arvind Saklani on 30.05.2021.
- Webinar organized by Trans Disciplinary University, Bengalauru on 30.05.2021.
- Webinar on the occasion of World Environment Day organised by Indian Institute of Public Administration (IIPA), Delhi, India in collaboration with NMCG, Ministry of Jal Shakti (Department of Water Resources, River Development & Ganga Rejuvenation), Government of India and joined a *COLLOQUIY: GANGA SAMVAD 2021* from 04.06.2021-05.06.2021.

- Webinar on 'Ecosystem Restoration' organized by Monsarovar Global University, Bhopal on 05.06.2021.
- Workshop on Prioritizing Actions for Restoration of High Altitude Wetlands in Sikkim Himalaya' organized by GBPNIHE on 05.06.2021.
- The twenty-fifth meeting (online) of the CITES Plants Committee organised by the CITES Secretariat, Geneva (Switzerland) on 8.06.2021 (on production of a cites checklist for Dalbergia spp.).
- Virtual Conference in connection with the preparation of People's Biodiversity Register (PBR) organized by Port Blair Municipal Council, Port Blair on 08.06.2021.
- The twenty-fifth meeting (online) of the CITES Plants Committee organised by the CITES Secretariat, Geneva (Switzerland) on 9.06.2021 (on products containing specimens of Appendix-II Orchids).
- Webinar on 'Role of Ethnobotany in sustainable uses of plant resources' arranged by Dept. of Botany, Central University of Kashmir on 14.06.2021.
- National Webinar 'World day to combat desertification and drought' organised by Arid Forest Research Institute, Jodhpur on 17.06.2021.
- Online workshop on 'Nature conservation for combating desertification" organized by GBPNIHE, Sikkim Unit on 17.06.2021.
- National Webinar on 'Role of Microorganism in accelerating or mitigating impacts of anthroprogenic climate change' organised by Mandsaur University, Mandsaur on 18.06.2021.
- Webinar on 'Medicinal, Aromatic and Dye Yielding Plants of Assam: Prospects and problems of conservation, scientific assessment and entrepreneurship development' by NECTAR, DST, Shillong on 18.06.2021.
- Webinar of Botany Dept., Guwahati University on "Plant Taxonomy: Classical to Modern trends" on 19.06.2021.
- Webinar on 'Plant Taxonomy: Classical to Modern Trends' organized by Botany Department, Guwahati University, Guwahati, Assam, on 19.06.2021.
- Webinar organized by East Himalayan Society for Spermatophyte Taxonomy for 'Kasturi and Kanchi Gandhi Award 2021' on 19.06 2021
- 'Orchid Conservation Symposium' (webinar) organised by Australian Network for Plant Conservation from 22.06.2021-23.06.2021.
- 3-day Online Course on DNA Taxonomy & Phylogeny conducted by Sathyabama Institute of Science & Technology, Chennai from 23.06.2021-25.06.2021.
- One day National Webinar: 'Plant Science: Some Contemporary Issues and Challenges' organized by Burdwan University on 26.06.2021.
- Webinar organized by PSG Arts and Science College, Coimbatore, Tamil Nadu on Plants Identification using taxonomic keys for their UG and PG students (140 participants) on 01.07.2021 (in commemoration with the celebration Van Mahotsav 2021).
- National Level Lecture Series under the Aegis of DBT Star College Scheme organized by Department of Botany, R.D. and S.H. National College & S.W.A. Science College & IQAC, Prin. K. M. Kundnani College of Pharmacy, Mumbai to Celebrate Vanmahotsav Week,01.07.2021-07.07.2021.
- Webinar on 'Madhya Pradesh-A Treasure Trove of Ethnobotanical Studies in India' organized by The University of Trans-Disciplinary Health Sciences, Bengaluru and Technology and AKS University on 03.07.2021.
- Virtual workshop on Planning and Management of CWR and RET Species of PGR Importance in India on 05.07.2021.

- International webinar on 'Ecological Restoration: Urgent Action required' organized by Dept. of Environmental Science Graphic Era Hill University, Dehradun (U.K.) on 06.07.2021.
- Global consultation workshop on Climate Change Statistics and Indicators (MoEF&CC, New Delhi) on 08.07.2021.
- Webinar on 'Plagiarism and Publication Ethics with Reference to Academic Integrity', organised by Central Library, Arya Vidyapeeth College, Guwahati on 10.07.2021.
- Webinar organized by Kongunadu Arts and Science College, Coimbatore, Tamil Nadu on Botanical Nomenclature on 12.07.2021.
- Executive Council meeting (online) of Indian Association for Angiosperm Taxonomy on 12.7.2021.
- Webinar on 'Mycology series: Fungi world : application of fungi in food industry (flavour and texture, fermentation, banking, organic acids, enzymes, mycoproteins) ; Agriculture (biofertilizer) ; Biological control (mycofungicides, mycoherbicides, mycoinsecticides, myconematicides) ; Medical mycology with reference to black fungi, blue fungi, yellow fungi etc in the context of Covid 19 pandamic' organized by Nistarini College , Purulia, W.B on 13.07.2021 to 15.07.2021.
- Webinar on 'Global Ethnobotany Research on Traditional Plant Management as Resource Sovereignty by Dr. Alex C. Mc Alvay, Assistant Curator, Institute of Economic Botany, NewYork Botanical Garden, USA Organized by the Centre for Conservation of Natural Resources (CCNR), The University of Trans-Disciplinary Health Sciences and Technology, Bangalore, India on 16.07.2021.
- Webinar on 'Assessment of Medicinal & Aromatic plant spp.' organised by FRLST, Bangalore and Sikkim Forest dept. for the project Secure Himalaya on 16.07.2021.
- Virtual Training Programme on Plant Genetic Resources Management and Utilization 19 July to 01 August, 2021 at NBPGR, New Delhi.
- National webinar on 'Paryavarnam 2021, Research in Biological and Environmental science: challenges and opportunities' organised by the Dept. of Zoology and Dept. of Environmental sciences, B. K. Birla College (Autonomous), Kalyan under DBT star status on 23.07.2021.
- National Webinar on 'Fodder management for sustainable production in arid zone' organised by SKRAU, Bikaner on 24.07.2021.
- 'Mangroves of Andaman and Nicobar Islands' on the occasion of International Mangrove Day-2021 organised by CPR Environmental Education Centre, Chennai on 26.07.2021.
- National webinar on 'International Day for The Conservation of Mangrove Ecosystem' organized by National Museum of Natural History, New Delhi on 26.07.2021.
- International webinar on 'Plant tissue culture: Micropropagation to genetic transformation' organised by Bioingene.com an online platform for the promotion of international plant science research on 28.07.2021.
- National Webinar" on 'Conservation of Nature - A Way of Life' held at Dhempe college of Arts & Science, Goa, on 28.07.2021.
- Esri India User Conference 2020-21 from 28.07.2021-29.07.2021.
- Webinar on 'Rare plants of Western Ghats - Their potential and utilization in sustainable development' organized by FRLH- Herbarium and Raw Drug Repository of Medicinal plants used in Indian System of Medicine, Centre for Conservation for Natural Resources, The University of Trans Disciplinary Health Sciences and Technology, Bengaluru on 31.07.2021.
- 'Knowledge networking on Orchids' under Himalayan Knowledge Network (HKN) in GB Pant. Inst. of Himalayan Environment on 02.08.2021.

- National webinar on 'Conservation and Sustainable use of Ecological Biodiversity' organised by Jamshedpur workers college, Jamshedpur on 12.08.2021.
- National webinar on 'Ecosystem Sustainability' organised by Department of Botany, Jyoti Nivas College (Autonomous), Bengaluru on 18.08.2021.
- Webinar on 'Ethnobotany of Kerala' organized by the FRLH Herbarium and Raw Drug Repository of Medicinal Plants, CCNR, The University of Trans-Disciplinary Health Sciences and Technology, Bengaluru on 21.08.2021.
- National webinar on 'Plant life in Antarctica' organised by Department of Botany and IQAC, Shyampur Siddheswari Mahavidyalaya on 22.08.2021.
- National webinar on 'Application and utilization of modern teaching learning techniques in Higher education' organised by Dept. of Botany Govt. College, Patharia dist., Damoh (M.P.) on 25.08.2021.
- 'Status and Distribution of Seaweeds in Indian Coast' in the One-day Virtual Training Program on Seaweed Culture & Utilization organized by Jehovah Shamma Aqua One Centre (JSAOC) & Jehovah Shamma Centre for Marine and Wildlife Research (JSCMWR) Ramanathapuram, Tamil Nadu on 27.08.2021.
- National Webinar on 'Himalayan Environment: Issues & Challenges' organized by Dr. Y.P.S. Pangtey Research Foundation Society on 28.08.2021.
- SHEpreneur Talk Series 'Empowering Women Entrepreneurs to Steer Indian Economy' on 03.09.2021 organised by Jigyasa Narula, Deputy Resident Director, PHD Chamber of Commerce & Industry.
- International webinar on 'Ethics in research and Publications' organised by bioingene.com on 05.09.2021.
- Online training workshop on 'Island Biodiversity, Conservation and Challenges' organized by Zoological Survey of India, Port Blair on 07.09.2021.
- Faculty Development Programme (FDP) on Drug Engineering through Bioprospecting sponsored by AICTE Training and Learning (ATAL) Academy and organized by Department of Biotechnology, Dr. N.G.P. Arts & Science College, Coimbatore on 12.07.2021-16.07.2021.
- Webinar titled 'The Science in Antarctica – Discovery of Bryum bharatiense' organized by PG & Research Department of Botany, Catholicate College, Pathanamthitta, Kerala on 07.09.2021.
- National webinar on "The Himalayan Day" organized by Department of Environmental Science, Graphic Era Hill university, Dehradun on 07.09.2021.
- 3-Days Online Training Programme on 'Sustainable Developmental Goals (SDGs) and Onshore and Offshore Blue Ecomony in Indian Ocean Islands' jointly organized by The National Institute of Disaster Management, Ministry of Home Affairs, New Delhi and Andaman Collage (ANCOL), Port Blair w.e.f. 08.09.2021 to 10.09.2021.
- Webinar on Himalayan Day on 'The Himalaya & Nature' organized by Department of Environmental Science, Hill University, Dehradun on 09.09.2021.
- Lecture on 'Prospects of Agarwood cultivation and utilization in North East India' organized by GB Pant National Institute of Himalayan Environment, Itanagar, Arunachal Pradesh & North East Regional Centre, Itanagar, Arunachal Pradesh on 10.09.2021.
- International (Web) conference on 'COVID-19 Second Wave: Challenges for Sustainable Development (CCSD 2021)' on 14.09.2021. Presentation by Sanjeev Shankar on Living root bridge cultural landscapes, UNESCO

World Heritage site tentative nomination under Govt. of Meghalaya on 14.09.2021.

- Webinar on 'Ethnobotanical studies and publication in a world of Nagoya Protocol and post SARS-CoV-2', organized by the FRLH Herbarium and Raw Drug Repository of Medicinal Plants, CCNR, The University of Trans-Disciplinary Health Sciences and Technology, Bengaluru on 15.09.2021
- Webinar on 'Urban Ethnobotany in India: Prospects and Challenges' organized by the FRLH Herbarium and Raw Drug Repository of Medicinal Plants, CCNR, The University of Trans-Disciplinary Health Sciences and Technology, Bengaluru on 18.09.2021.
- Five days webinar on 'Information Science - Management Development Programme' organized by C.V.M. University and Gio Institute during 13.09.2021–17.09.2021.
- Workshop on Climate change organized by Forest Department of Arunachal Pradesh, Itanagar on 20.09.2021.
- Webinar on 'Darwin's abominable mystery and the search for the first flowering plants' organized by Department of Botany & Delhi University Botanical Society in honour of Prof. H Y Mohan Ram on 24.09.2021.
- Online Haryana Energy Transition Summit on 24.09.2021.
- First session of 'Rastriya Vagyanic Sangosthi on 'Gramin Ajivika Mein Akasth Van Utpado Ka Yogdan' organized by ICFRE- FRCER, Prayagraj on 24.09.2021.
- Webinar on 'Advancement of Plant Sciences for Food Diversity and Nutritional Security' organized by NBU on 30.09.2021.
- Single-use plastic sensitisation workshop organized by MOEF&CC on 04.10.2021.
- Workshop on 'Development of Trees Theme parks at KVBR Botanical Garden', Hyderabad on 05.10.2021.
- Wildlife week celebrations conducted at BRK Govt. Degree College & Telangana Botanical Garden, Jadcharla, Telangana on 05.10.2021.
- International webinar on 'Recent trends in autotrophic cryptogam research' being organized jointly by Assam University, CSIR-NBRI and Indian Lichenological Society during 07.10.2021-.8.10.2021.
- Webinar organized by Department of Botany, Government Arts College, the Nilgiris District, Tamil Nadu, on Botanical Key preparation and Nomenclature on 11.10.2021.
- Online 'Prof. (Dr.) D. D. Pant Memorial Lecture' on the topic 'Palaeobiogeography of Tropical Angiosperms: Evidences from fossil records' by Dr. (Mrs.) Vandana Prasad, Director, BSIP, Lucknow on 18.10.2021.
- XLIV All India Botanical Conference - 2021 of The Indian Botanical Society & National Symposium on 'Plant Science Research in Present Scenario: Opportunities and Challenges' organised by Dept. of Botany, J.N.V. University, Jodhpur (Raj.) during 18.10.2021-20.10.2021.
- National Webinar on 'Western Ghats: Past, Present and Future' organised by St. Aloysius College (Autonomous), Mangaluru on 28.10.2021.
- 'Two day national workshop on Basic and Applied aspects of Plant Taxonomy' held at University College of Women, Koti, Hyderabad on 28.10.2021.
- Virtual brainstorming session of the Biodiversity of Eastern Ghats on 02.11.2021 organized by Andhra Pradesh Biodiversity Board, Guntur.
- National Webinar on 'AJC Bose Indian Botanical Garden & Central National Herbarium', organised by Ethnobotanical Group of India, Rewa Govt. College, Madhya Pradesh on 03.11.2021.
- Professor Panchanan Maheshwari Memorial Lecture - 2021, Organized by the Delhi

University Botanical Society (DUBS),Department ofBotany, University of Delhi on 09.11.2021.

- 'National Policy and Action Plan on Management of Alien Invasive Species' organized by MoEF&CC on 10.11.2021.
- National Webinar to commemorate National Education day 2021, organized by national Museum of natural History, new Delhi in Collaboration with Govt. of Tamil Nadu Dept. of Environment on 11.11.2021.
- Two days All India Conference on Rajbhasha at Varanasi from 13.11.2021 to 14.11.2021 organized by TOLIC.
- Webinar 'To Get More Harvest: Traditional Plant Management Systems of Northwestern North America' organized by the Centre for conservation of natural resources(CCNR), The University of Trans-Disciplinary Health Sciences and Technology, Bangalore on 24.11.2021.
- International conference on Cyber law, Cybercrime and Cyber security (ICCC) organised by Cyber law Net and Pavan Duggal Associates on 24.11.2021-26.11.2021.
- Water education Lecture series: a lecture on 'Recent Advances in Water Quality Analysis by Dr. Rajesh Singh, Scientist D, National Institute of Hydrology, Roorkee on 25.11.2021.
- National Webinar on 'Environmental Protection in part of our cultural values and traditions' organized to commemorate Constitution day by National Museum Natural History, New Delhi on 26.11.2021.
- Webinar on 'Hybrid Rice Seed Production' organized by International Rice Research Institute, Philippines on 01.12.2021.
- Workshop on tree production and Forests for livelihood organized by ICFREE-FRCER, Prayagraj, on 01.12.2021.
- National webinar on 'Solid Waste Management' on the eve of National Pollution Control Day, organized by CAS in Marine Biology, Annamalai University (ENVIS Partner, MOEF&CC, New Delhi) on 02.12.2021.
- International webinar on world soil day 2021 on 'Halt soil salinization, boost soil productivity' organized by FAO of United nation, on 3.12.2021.
- International conference on 'Textile heritage of India' organized by Dept. History, Mohanlal Sukhadia University, Udaipur in collaboration with centre for Civilization Studies & Indus International Research Foundation on 3.12.2021-4.12.2021.
- Assam Botany Congress (ABC - 02) and International Conference on Plant Science organized by Assam Botanical Society and Department of Botany, Cachar College, Silchar, Assam, India from 03.12.2021-05.12.2021.
- Two days' workshop on 'Coastal and Marine Biodiversity of Island Ecosystems' under the 'Training of Personnel of Other Services & Training of Personnel of other Stakeholders' organized by Zoological Survey of India, Andaman and Nicobar Regional Centre, Port Blair on 07.12.2021-10.12.2021.
- 'National Webinar on Ethno botany in Human Welfare' by NWEHW-2021 on 08.12.2021.
- Webinar on 'Studies in wild palms of India' organized by Shibaji University, Kolhapur on 09.12.2021.
- Workshop cum stake holders meet on 'Mainstreaming Landscape approach for conservation & Sustainable development in Khangchendzonga Landscape India' 2021 organised by G B Pant Institute, Gangtok on 09.12.2021.
- National webinar and lecture on 'Mountain tourism issue of conservation in connection to Eastern Himalaya by Dr. Rajib Gogoi, Scientist E BSI, SHRC organized by NHNM New Delhi to commemorate International Mountain Day on 10.12.2021.

- A lecture, as a part of Indian Science Congress Association (Chandigarh chapter in collaboration with Bhai Ghanaiya Ji Institute of Health Punjab University Chandigarh) on dengue vaccine Remains Elusive because of Rough antibodies by Dr. Navin Khanna, ICGEB, New Delhi on 10.12.2021
- Webinar on 'Investing for Impact: Towards Healthier and Sustainable Diets through research' organized by International Rice Research Institute, Philippines on 10.12.2021.
- Webinar on 'Tree talks in the forest: The wood wide web organized by Dept. of Botany, Punjab University, Chandigarh on 13.12.2021.
- Webinar 'Are 19th century botanical collections relevant to 21st century problems?' by Professor Mark Nesbitt, Senior Research Leader, Interdisciplinary Research, Royal Botanic Gardens, Kew, England on 14.12.2021.
- Nomenclature workshop organized by Department of Botany, Maratha Vidya Prasarak Samajs, Arts, Commerce and Science College, Nandgaon, Dist. Nashik, Maharashtra on 15.12.2021.
- Workshop on 'Eco literacy of Eco Risk Managers for Building Resillence of Mountain Ecoscapes' organized by Department of Environment, Dr. Y.S. Parmar University Nauni on 17.12.2021.
- Joint Regional Official Conference for East & North East Regions which was hld at Dibrugarh, Assam on 18.12.2021
- Itanagar Biodiversity Walk organized by Arunachal Pradesh Biodiversity Board on 18.12.2021.
- Two days training and workshop on Climate Vulnerability mapping, risk assessment and Climate action plan organized by state forest dept. on 20.12.2021-21.12.2021.
- National Webinar on 'Diversity and Systematics of Wild Mushrooms' organized by Dept. of Botany, Sri Shikshayatan College, Kolkata on 23.12.2021.
- 3rd International Conference on Environment and Society (ICES 2021) New Delhi, from 23.12.2021 to 25.12.2021.
- National Seminar on Biodiversity Conservation Strategies for a better tomorrow organised by University College of Science, Osmania University, Hyderabad on 24.12.2021.
- Skill Based Internship Program titled 'Advanced Techniques for Micro algal Cultivation' [(SBIP) Under ECH-RUSA 2.0] Organized by CAS in Botany, Guindy Campus, University of Madras 29.12.2021.
- Webinar 'Recent trends in Bio-resource conservation research" organized by F.M. Univers ity, Balasore, Odisha on "Role of AJCBIBG in Plant Conservation" on 30.12.2021.
- Online training programme on 'Integrated Scientific Project Management for Women Scientists/Technologists' organized by Centre for Organization Development (COD), Hyderabad, sponsored by the Department of science and Technology held on 3.01.2022-07.01.2022.
- NIAS-DST Online Training Programme for Women Scientists on 'Science and Sustainability in India', organised by National Institute of Advanced Studies, Indian Institute of Science Campus, Bangalore and delivered an online lecture on 'Advancement of Fungal studies in Botanical Survey of India' during 03.01.2022-7.01.2022.
- National webinar on changing paradigms in plant Taxonomy organized by Department of Botany Central University of Jammu on 06.01.2022.
- Online refresher course in Life Sciences organised by UGC-HRDC, Osmania University, Hyderabad on 07.01.2022.
- National webinar on 'Scope and Importance of Medicinal Plants in Present Scenario' Organized by Department of Botany and Eco-Club of Govt. Motilal Vigyan Mahavidyalaya, Bhopal (M.P.) on 21.01.2022.

- National Workshop 'Green Biotechnology and Therapeutic Potential of Medicinal Plants' organized by S. S. Khanna Girls' Degree College, Prayagraj, U.P on 28.01.2022.
- Online lecture on 'Best Laboratory Practices' as part of 'Water Education Lecture Series' organized by Uttarakhand Science Education and research Centre (USERC), Dehradun on 29.01.2022.
- National webinar on Wetlands Action for People & Nature 2022 organized by JNU ENVIS RP & SCST ECOTOURISM ENVIS on 02.02.2022.
- Online talk organized by St. Berchmans College, Changanassery, Kerala on 'Building, Using and Teaching the Tree of Life' by Prof. Douglas Soltis on 02.02.2022.
- Virtual workshop of Kolhapur University on 4.02.2022.
- Online 10th Guest lecture of the Global Ethnobotany Research Webinar series on 'Grass root medicinal plant conservation in North America' organised by the Centre for Conservation of Natural Resources (CCNR), The University of Trans Disciplinary Health Sciences and Technology, Bangalore and Tropical Botany and Ethnobiology Lab (TRIBE), Faculty of Tropical Agrisciences (FTA), Czech University of Life Sciences (CZU), Prague, Czech Republic on 05.02.2022.
- CSIR-NCL's skill initiative program course on 'Targeted Proteomics (SDP_NCL22_2022)' organized by CSIR- National Chemical Laboratory, Pune from 10.02.2022 -12.02.2022.
- Attended Webinar on the occasion of International Day for Women and Girls in Science organised by Central University of Punjab (CUP), Department of Botany, Bathinda on 11.02.2022.
- Lecture on 'Are we doing ethnobotany or information collection?' organized by Ethnobotanists India on 13.02.2022.
- National level Webinar on 'Plant Diversity of India – Opportunities, Challenges and Scope' on 13.02.2022 & 14.02.2022.
- Training-cum-Workshop on Biodiversity Conservationo rganized byon 15.02.2022.
- DST-SERB, Govt. of India sponsored 'Hands-on training on Transmission Electron Microscope (TEM)' organized by ICAR-National Rice Research Institute, Cuttack from 15.02.2022-22.02.2022.
- 'Reimagining Museums of India: A Global Summit' organized by the Ministry of Culture, in partnership with Bloomberg on 15.02. 2022-16.02.2022.
- National webinar on 'Scientometric visualization of computational and natural products chemistry (SVCNPC 2022)' organized by Dept. of Chemistry, V.V. Vanniaperumal College for Women on 16.02.2022-17.02.2022.
- Webinar on 'Plant taxonomy and traditional knowledge in the Himalayas and north east India' organized by Rajiv Gandhi university on 21.02.2022-22.02.2022.
- Valedictory function of VIGYAN SARVATRA PUJYATE Festival of SCoPE for all (Science and Technology Communication, Popularization and its Extension) organized by Zoological Survey of India, Port Blair on 28.02.2022.
- International Conference (Online) on Agriculture for Sustainable Future (Agri Vision-2022), at Ravenshaw University, Cuttack, Odisha from 06.03.2022-08.03.2022.
- Online function 'Release of Report of Evaluation of Innovation Excellence Indicators' by CII on 10.03.2022.
- DBT Star College Scheme Invited Lecture Series, organized by PG and Research Department of Botany, Jamal Mohamed College, Tiruchirappalli on 10.03.2022.

- XVI Conference of the Indian Fern Society and International Symposium on Research in Pteridology: Priorities and Challenges at Calicut University from 17.03.2022-19.03.2022.
- National Webinar on 'Disaster and Management' organized by Telangana University, Telangana and National Institute of Disaster Management, New Delhi on 19.03.2022.
- 'Workshop by experts on Thematic planning for Biodiversity Conservation in Andhra Pradesh Involving Biodiversity Management Committees' organised by Andhra Pradesh State Biodiversity Board on 19.03.2022.
- Botanical Garden congress at NBRI, Lucknow on 20.03.2021 to 22.03.2021.
- Webinar on 'Conserving Nature in a Dual Society' organized by Botany Alumni of Maharaja's College, Ernakulam on 21.03.2022.
- Webniar on 'Management of water resources with emphasis on Mangrove ecosystem on 22.03.2021.
- National workshop on 'Hands on Training on Biological & Environmental techniques' organized by Department of Botany, University of Allahabad at Botany Department, University of Allahabad from 24.03.2022-26.03.2022.
- Webinar on 'Fundamental and Applied Dimensions in Plant Sciences' organized by JNTBGRI, Thiruvananthapuram on 24.03.2022-25.03.2022.
- International Orchid Conference organized by the Orchid Society of India at YSR Horticultural University, Tadepalligudem from 25.03.2022-26.03.2022.
- 'Science Leader Conclave', organized by the CSIR- Indian Institute of Chemical Technology (IICT), Hyderabad on 26.03.2022-27.03.2022.
- Lecture on 'Taxonomy-What, Why and How?' organized by Department of Botany, Raiganj University, West Bengal.
- Workshop on 'Identifying priority thematic areas of the state under Himalayan Knowledge Network (HKN)'project to GBPNIHE-NERC & SCST, Itanagar.
- Workshop on 'Advanced Phylogenetics' conducted by Dept. of Zoology, Mahishadal Raj College, Midnapore.
- Webinar on 'Wetlands Action for People and Nature' conducted by University College of Women, Osmania University, Koti.
- National webinar on "Botanical Gardens of India" organized by Botany Department by SSM Panchal Science College, Gujrat.
- Workshop cum hands on training at All India Institute of Ayurveda, New Delhi.

PhD

Ph. D. synopsis presentation on "Marine Bryozoans (Bryozoa Ehrenberg, 1831) of the Andaman and Nicobar Islands" at Zoological Survey of India, ANRC Port Blair on 01/09/2021.

Ph.D. synopsis presentation of Shri S. Senthil Kumar, Research Scholor on the topic "Ecological studies on wetland birds of Andaman and Nicobar Islands, India" at ZSI, Port Blair on 29/10/2021.

online Ph.D. viva-voce 'Genetic transformation of rice (Oryza sativa L.) for improving abiotic stress tolerance' of Mr. Rakesh, Dept. of Botany, Bharathidasan University, Tiruchirappalli on 16.11.2021.

Online Ph.D. viva-voce 'Molecular Characterization of ABA Receptors in Rice (Oryza sativa L.)' by Mr. V.V.Santhosh Kumar, Dept. of Botany, Bharathidasan University, Tiruchirappallion 16.11.2021.

Online Ph.D. Viva-voce of Shri. R.G. Vadhyar, "Floristic studies in Malabar Wildlife Sanctuary, Kerala, India" on 08.02.2022.

Online Ph.D.Viva on the topic 'Screening Quantification in vitro and in Silico Evaluation of Secondary Metobolities in Adiantum latifolium Lam' on 22.11.2021.

Online Ph.D Viva Voce on the topic "Comparative Study of Soral Anatomy in Selected South Indian ferns" on 22.11.2021

Ph.D Viva of Mr. Ronak Kanchiapatil on the topic 'Systematic and Molecular Studies on Diversity of Pteridophytes and Gymnosperms of Gujarat' on 16.02.2022.

Book release ceremony

Book release ceremony of 'Faunal Diversity of Biogeographic zones of India: Northeast' on 01.04. 2021 organized by Zoological Survey of India, Northeastern Regional Centre, Shillong.

ACTIVITIES OF RESEARCH FELLOWS

ACTIVITIES OF RESEARCH FELLOWS

Flora of Nagaland by Rikertre Lytan and Dr. Nripemo Odyuo

During 2021-22, Descriptions of 216 species, Key for 101 taxa, and identification of 55 taxa were done. Morphological studies and dissections were done for *Henckelia anachoreta* (Hance) D.J. Middleton & Mich. Möller. Three field tours were undertaken to Doyang, Wokha Districts, Nagaland for 22 days and a total of 194 field numbers were collected. During this tenure one new species *Aglaonema manabendrae* and one new generic record to India *Stadiochilus burmanicus* R. M. Sm. were published and two species of *Aspidistra* sp. were communicated (one new species and one new record to India).

Phytochemical screening, proximate composition, nutritional analysis and mineral element status of selected wild edible fruits of northeast India by Larima Sten and Dr. Deepu Vijayan

During 2021-22, qualitative & quantitative analysis, antioxidant activities, Nutritional and Mineral analysis were performed. It was observed that proteins, carbohydrates, phenols/tannins, saponins, glycosides, steroids and terpenoids were present in the fruits of *Ficus cryptophylla* while Carbohydrates, phenols/tannins, saponins, glycosides, steroids, terpenoids and alkaloids were present in the fruits of *Syzygium tetragonum*. Also *Tetrastigma planicule* and *Tetrastigma dubium* found to possess phenols while flavonol content was detected in *Syzygium tetragonum*, *Tetrastigma planicule, Tetrastigma obavatum*. Protein was traced from *Artocarpus lakoocha* (fruit and flower), *Meyna spinosa* (fruit), *Ficus auriculata* (fruit), *Hodgsonia heteroclita* (seed kernel), *Citrus latipes* (immature fruit and mature fruit), *Calamus erectus* (fruit), *Vaccinium griffithianum* (fruit), *Quercus semiserrata* (fruit), *Ichnocarpus frutescens* (fruit and leaves), *Syzygium megacarpum* (fruit and seed peel), *Prunus jenkinsii*, *Citrus latipes* (mature peel) and *Aphananthe cuspidata* (fruit). The Inhibition Concentration (IC50) of ascorbic acid was measured for *Prunus jenkinsii* and *Anodendron paniculatum*. Total carbohydrate, free amino acid, reducing, non-reducing sugar, iron, zinc and manganese was measured for *Syzygium megagarpum*, *Citrus latipes, Vaccinium griffithianum, Ichnocarpus frustescens Calamus erectus*.

Taxonomic revision and phylogenetic study of Zingiberaceae with special reference to endemic and endangered species of North East India by Suparna Debnath and Dr. Deepu Vijayan

In 2021-22, three field tours were conducted to different areas of Nagaland (Pfutsero, Kohima, Kiphire, Phek, Khonoma), Manipur (Shirui, Ukhrul, Imphal, Moirang) and Barapani Experimental Garden, BSI during which different plants of the family Zingiberaceae were collected, dissected and photographs and measurements of plant parts of eight species of the family were recorded. Pollen morphology of *Z. bipinianum, Z. perense, Z. dimapurense and Z. pherimeanse* was studied using Scanning Electron Microscope. As a part of molecular phylogeny, agarose gel electrophoresis, PCR standardization using nuclear (ITS) and chloroplast (rbcL) markers was carried out with isolated genomic DNA of different Zingiberous plants. DNA sequences were used to construct phylogenetic tree.

Taxonomic studies of *Ficus* L. of Northeast India by Sreyoshee Sensarma and Dr. Chaya Deori

During 2021-22, three tours, one local tour to West Jaintia hill and one herbarium consultation tour were conducted and all the citations were completed. 36 specimens were collected of which 10 specimen were identified. Description of 70 spp. was done along with submission of 30 Ficus spp. For the Flora of India Project photo plates and illustrations were prepared, numerous prologues were consulted, indented key, Checklist were prepared for the genus *Ficus* L. of North-east India along with maps (Google Earth) of Surveyed areas of Manipur, Nagaland, Tripura were. During this study 12 spp. of Ficus were Dissected and 4000 photographs were recorded. Consultation of type specimens of CAL Herbarium was also done.

Micropropagation of some selected endemic and threatened plants of Northeast India by Ms. Dawanri Marwein & Dr. Deepu Vijayan

During 2021- 22, in vitro propagation protocol and genetic fidelity analysis of *Rhododendron formosum* Wall. was standardized along with manuscript preparation. Standardization of surface sterilization protocol, *in vitro* and *ex vivo* seed germination experiments, multiple shoot induction and rooting experiments of *Rhododendron inaequale* Hutch., *Pyrenaria barringtoniifolia* Seem., *Rhododendron iteophyllum* Hutch. and *Adinandra griffithii* Dyer. was carried out. Regular subculturing and rooting of *Rhododendron wattii* Cowan., *Pyrenaria khasiana* R.N. Paul., *Cymbidium tigrinum* and *Cymbidium whiteae* was done along with seed germination experiments of *Calanthe masuca, Coelogyne corymbosa, Coelogyne viscosa, Pholidota katakiana* and *Micropera rostrata*. *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. Watering and maintenance of the seedlings of *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 were carried out regularly . The hardened seedlings of *Rhododendron inaequale* Hutch., *Rhododendron formosum* Wall. and *Pyrenaria khasiana* R.N.Paul. were reintroduced in the garden of BSI, ERC, Shillong and BSI, Experimental Garden, Barapani. *Rhododendron inaequale* Hutch. seedlings from Laitlyngkot were rehabilitated and planted in the garden of BSI, ERC, Shillong. Twelve local tours were conducted to different forest areas of Meghalaya for the collection of plant samples.

Fern And Fern-Allies of Dihang-Dibang Biosphere Reserve Of Arunachal Pradesh by Chhandam Chanda & Dr. V. K. Rawat

During 2021-22 one field tour (one month) was undertaken in Anini, Mipi, Dambuen and Seven lake areas of Dibang Valley and Yinkiong, Geku, Tuting, Gelling, Bishing and Singa of Upper Siang districts. 800 colour photographs were taken and 242 field specimens were collected. So far, 112 species are identified and described. All the collections have been mounted. Some of the interesting species collected were *Diplazium burmanicum, Athyrium anisopterum, Christensenia aesculifolia,, Dryopteris lepidopoda, Arthrommeris himalovata, Polypodioides simonsiana* etc.

Arachniodes assamica (Kuhn) Ohwi

Blechnum melanopus Hook.

Taxonomy and Ecology of Pteridophytes of Lower Subhansiri District with special focus to Tale Wildlife Sanctuary of Arunachal Pradesh by Ashish K. Soni & Dr. V. K. Rawat

In 2021-22, one field tour was conducted in different localities of Lower Subansiri District and Tale Beat of Tale Wildlife Sanctuary. During this, a total of 295 field numbers were collected along with 630 photographs. Detailed description of newly listed species like *Pteris taiwanensis, Polystichum discretum, Polystichum longipaleatum, Loxogramme porcata, Loxogramme grammitidiodes, Selliguea rhyncophylla, Selliguea oxyloba, Pichisermollodes*

nepalensis, Osmunda claytoniana subsp. *vestita* and for *Ophioglossum petiolatum* etc. were made. During this study eight new additions to the North-eastern states of India namely *viz. Adiantum flebellulatum, Asplenium aethiopicum, Pteris amoena, Thelypteris stegnogrammopsis, Polystichum polyodon, Selaginella bryopteris, Leptochilus minor, Drynaria propinqua, Microlepia trichocarpa* and one for India (*Diplazium mettenianum*) were reported. Some Endangered, Endemic and Vulnerable pteridophytic species from this research site were also listed such as *Polystichum polyodon* (Endemic to North East India), *Arthromeris tomentosa* (VU), *Loxogramme graminiotiodes* (EN in India) and some rare species were also found namely *Dryopteris manipurensis, Dryopsis nidus, Asplenium griffithianum, Paradavallodes multidentata, Pichisermollodes nepalensis, Neocheiropteris maculosa* and *Salvinia natans*. A checklist of pteridophytes of allotted research site was also prepared.

Diplazium stoliczkae Bedd.

Onychium siliculosum (Desv.) C.Chr.

Elaphoglossum marginatum T.Moore

Arthromeris tomentosa W.M.Chu

Studies on the genera *Lactarius* and *Lactifluus* (russulaceae) from Tawang and West Kameng districts of Arunachal Pradesh: biosystematics and neutraceutical properties by Ishika Bera and Dr. Kanad Das

Four macrofungal survey tours (2018–2022) to different forest areas of the allotted districts, Tawang and West Kameng in Arunachal Pradesh were undertaken in the rainy season from 2018 to 2022. About 66 specimens belonging to 28 species of the genera *Lactarius* and *Lactifluus* were collected. Detailed account of taxonomic treatment along with the description coupled with illustrations, phylogenetic inferences (when needed), and specimens examined, type details, distribution supported by GPS-based map, comparison with the allied taxa, etc. were prepared for identified species. The identified dry specimens including type were deposited in CAL Herbarium. Molecular phylogenetic estimation was used to check conspecificity/ novelty/ to solve dubious taxonomic positions. Nutraceutical analysis (carbohydrate, protein, vitamin, minerals, antioxidant property) to estimate the potent edibility of the following collected species of *Lactarius* and *Lactifluus* were undertaken. During this study three species were reported as new to science and six as new to Indian mycoflora.

Thermal Algae of Eastern India by Pritha Basu and Dr. R. K. Gupta

Conducted 8 field tours and collected 198 species out of which 150 species were identified, described along with camera lucida drawings and micro-photographs. Among these species *Isocystis messanensis* collected from Atri thermal spring of Odisha is new to India. A new species of *Hyella* collected from Taptapani thermal spring has been described. *Romeria chlorina, Trichormus thermalis, Geitlerima jasorvense* and *Westiellopsis india* were reported new to Odisha state.

Taxonomic revision of the subtribes Eleusininae Dumort., Aleuropodinae P.M. Peterson *et al.*, Perotidinae P.M. Peterson *et al.* and Gymnopogoninae P.M. Peterson *et al.* (Poaceae: Chloridoideae: Cynodonteae) in India by Shrabasti Das and Dr. K. Karthigeyan

Herbarium consultation tour was conducted to Arid Zone Regional Centre, Jodhpur and field tour to Jodhpur, Bikaner, Jaisalmer, Mount Abu of Rajasthan and Rann of Kutch of Gujarat. 937 herbarium specimens were documented and 107 specimens were verified from Arid Zone Regional Centre. 14 species were collected from Rajasthan and Gujarat. 28 species were identified, 25 illustrations, 15 photoplates were made, 25 descriptions were completed. During this two publications were published.

Revision of the subtribes- Boivinellinae Pilg. and Anthephorinae Benth. (Poaceae) by Shreya Chaudhuri and Dr. Vinay Ranjan

Three herbarium consultation tours were conducted along with work out of 30 species with illustrations from herbarium and live specimens, description of about 20 species were completed, protologues of all the species were collected, photo plates of 20 species were prepared.

Grass flora (Poaceae) of Andaman and Nicobar Islands by Reshma Lakra and Dr. Pushpa Kumari

Conducted five field tours to Andaman and Nicobar Islands and collected 331 nos. of specimens of which 160 species were described (taxonomic) and 90 nos. of herbarium specimens were prepared. One new species (*Dimeria fasciculate* P.Kumari and R.Lakra), one new record to India (*Apocopis collinus* Balansa), one generic record, to Andaman and Nicobar Islands were published during this study and ENM mapping and conservation status of one endemic bamboo (*Gigantochloa andamanica* (Kurz) Kurz) after gregarious flowering in Andaman Islands was studied and published.

Taxonomic revision of Polygonaceae in Eastern Himalaya by Monalisa Das and Dr. Sudhansu Sekhar Dash

During 2021-2022, one plant exploration tour was conducted at the different parts of Arunachal

Pradesh. *viz.* different areas of Dirang sub division of West Kameng district (Mandala, Thembung, Namsu, Yak research farm etc.) Tawang district (Bumla pass, Madhuri/ Sungester Lake, Zemithang, Zung waterfalls etc.) during which Thirty-eight field numbers of plant sample under eight genera of the family Polygonaceae were collected along with individual GPS coordinate data and prepared distribution map. Beside these sixty-four photographs of plants at reproductive stage along with their habitat were taken. In addition, pollen, seed and leaf samples of each species has been separately collected following standard procedure for further LM & SEM study. Processing of the collected specimens completed. One SEM consultation tour to ERC, BSI, Shillong was undertaken and achene morphologies of 58 taxa of Polygonaceae were investigated in detailed through Scanning Electron Microscope. Micromorphological Investigation of the ochrea surface of 23 Taxa was undertaken through SEM. During the period, one herbarium consultation tour to LWG, CSIR-NBRI, Lucknow, India was undertaken and have studied details morphological characters of 79 Herbarium sheets belonging to 28 species.One SEM consultation tour to SRC, BSI, Coimbatore was undertaken. Pollen morphologies of 63 taxa of Polygonaceae were also investigated. pollen acetolysis and LM of those taxa has studied in details. Complete morphological and micromorphological characterization has been done for 23 species, illustrated and prepared Photo plates of live specimens.

FUNDED/COLLABORATIVE PROJECTS

Sl. No.	Name of the project	P.I.	Tenure	Remarks
1.	'Molecular phylogeny, morphology and nutraceutical potentials (for edible members) of fleshy wild mushrooms in Kalatop-Khajjiar Wildlife Sanctuary of Himachal Pradesh'.	Dr. Dyutiparna Chakraborty, N-PDF	2020 – 2022 (2 years 6 months) (Rs. 25,96,000/-)	BSI-HQ
2.	'Multigene molecular phylogeny and morphotaxonomy of fleshy wild mushrooms of Rajmahal hills, Jharkhand alongwith nutraceutical properties of edible taxa'	Dr. Aniket Ghosh, N-PDF	2022 – 2024 (2 years) (Rs. 22,36,800/-)	BSI-CNH
3.	'Taxonomic assessment of the lichen biodiversity of Agasthiyamalai Biosphere Reserve, Southern Western Ghats'	Dr. Jagadeesh Ram TAM, Scientist E	2022-2025 (3 years) (Rs. 20,77,920/-)	BSI-SRC

4. Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species

Co-ordinated and supervised seven Research Fellows under the project "Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species" funded by NMHS. In this project, the taxonomy and nomenclature of many species could be solved, species with erroneous identity were merged, few were splitted and species with dubious occurrence were excluded from India.

HERBARIUM INFORMATION

Sr. No.	Herbarium Maintenance	APRC	BGIR	CNH	ERC	ISIM	SHRC	NRC
1	No. of specimens mounted/ remounted/labelled/changing, pressing, processing for mounting	2210		10239	2566			3607
2	No. of herbarium sheets stitched/ restitched/cleaned/poisoned/ fumigated/dusted	3993		14364	11047	4354		24,849
3	No. of herbarium sheets accessioned/ reaccessioned/scanning of accession registers	1458			2826		239	3340
4	No. of old specimens/new specimens incorporated/ reincorporated/ scanning of type sheets			4869	788	2034	149	1371
5	No. of specimens sent on loan			850				
6	No. of loaned/gifted specimens received/returned/exchanged			85	135			
7	No. of specimens identified(inhouse)/for visitors/data field up of backlog specimens		74	134	119		22	237
8	No. of genus/species covers changed/ new genus/species cover prepared/ No. of type specimens folders made/ listing	285		2089	2356	555		
9	No. of specimens segregated			10158				4228
##	Documentation of existing herbrium sheets at herbaria/entry in excel sheet/field data written			18772				

Herbarium Digitization (2021-22)					
	CBL	NRC	ERC	APRC	CNH
No. of sheets digitized	4499	103000 (METADATA) + 1183 (SCANNED)	94121 (METADATA) + 372 (SCANNED)	16539 (METADATA) + 780 (SCANNED) + 22499 (BARCODE)	10052 (Scanning) + 17964 (Metadata)

AWARDS & HONOURS

भारतीय वनस्पति सर्वेक्षण

BOTANICAL SURVEY OF INDIA

Awards & Honours

Dr Pratibha Gupta: Recived Certificate of Appreciation and Best Scientific Research Award and Memento for outstanding work in the field of Scientific Research and for the society by Elevation and Education Trust on 08.03.2022 on the occasion of International Women's day.

Miss Sreyoshee Sensarma: Received 'Kanchi Gandhi Merit Award for Young Scientists' for presenting a paper on the Genus: Ficus Subgenus: Sycomorus in Northeast India: Taxonomy, Distribution and Economic Importance during a webinar organized by East Himalayan Society for Spermatophyte Taxonomy on 19th June, 2021.

Shri Harekrushna Swain: Received Research Wizard Award to recognize the quality of research work at Agri Vision-2022: International Conference on Agriculture for Sustainable Future, held at Ravenshaw University, Cuttack, Odisha from March 06th -08th, 2022 in association with the Department of Botany, Ravenshaw University.

Dr A. Benniamin: Received "Outstanding Scientist Award 2021" organised by VD GOOD, Chennai in the International Scientist Awards on Engineering, Science and Medicine which was held on 21&22-May-2021 in Chennai.

Received "*Best Poster Presentation Award*" for the paper entitled "In vitro Ontogeny of Tectaria zeilanica (Hout)Lour (Dryopteridaceae) from Western Ghats of India during XVI Conference of the Indian Fern Society and International Symposium on Research in Pteridology: Priorities and Challenges at Calicut University from 17-19th March, 2022.

Received "*Best Stall Award 2022*"during Shining Maharashtra 2022 exhibition at Phaltan, Maharasthra fron 25-27th, March 2022 organized by Sansa Foundation, New Delhi.

Dr Anant Kumar: Secured 1st position under flower category in Photography competition conducted by Ministry of Environment, Forest and Climate Change, New Delhi.

BSI-AJCB IBG , Howrah received '*Howrah Gorbo Award*'in a program at Sarat Sadan, Howrah on 02.10.2021

Dr. A.A. Mao, Director, BSI received T.N. Khoshoo Memorial Award by The Orchid Society of India (TOSI).

Dr. C. Murugan, received NESA Fellowship of the year Award 2021 from National Environment Science Academy.

SERVICE RENDERED

भारतीय वनस्पति सर्वेक्षण

BOTANICAL SURVEY OF INDIA

Academic expert services:

Review of paper

As a potential reviewer BSI scientists reviewed 62 manuscripts for national and International journals such as Int. J. Agricultural Sci, Nelumbo, JETB, South African Journal of Botany, Asia-Pacific Biodiversity, Biodiversitas: Journal of Biological Diversity, Plant Archives, Journal of Threatened Taxa, International Journal of Advance Agricultural Research (IJAAR), Philippine Journal of Science (PJS), Nordic Journal of Botany, Phytotaxa, Acta Botanica Hungarica, American Fern Journal, Biologia Plantarum, Current Science, Journal of Bryology, Journal of Bombay Natural History Society, Phyton, The Nucleus, Taiwania, Rheedea, Cytologia, Ecology and Evolution, Caryologia, Plants, People, Planet, Botany Letters, CATENA, Ecologia Balkanica, Kew Bulletin, Indian Journal of Forestry, ENVIS Newsletter, Annales Botanici Fennici, Journal of Fungi, European Journal of Taxonomy, Biodiversity: Research and Conservation, Plant Science Today, Feddes Repertorium, Academia Letters etc.

Supervision of PhD and M. SC. Internship

BSI scientists have supervised PhD of a number of students and dissertation works of 16 M.Sc. students of different Universities and Institutes.

Evaluation of PhD thesis/viva voce

BSI officials evaluated 4 PhD theses from different Universities and Institutes.

Expert service

- queries on plant distribution, ecology, nomenclature, conservation status etc. were attended and solved by BSI experts.
- Drafte a no of (6) scientific project proposals. 62 scientific projects evaluated, 12 scientific projects were reviewed for different institutions by BSI officials.
- About 850 images and replies to numerous queries were provided to researchers and scientific officials in pursuing researches on plant taxonomy and allied disciplines.
- BSI officials were invited as external members/ External Referee to recruitment committee/ selection committee/ panel of interviewers for different posts (JRF/) to different institutions such as CSIR (NEIST), Jorhat,
- BSI official acted as a member of the committee to evaluate the work of Research scholars of BSI and other institutions from time to time.
- BSI scientists attended as Expert Committee Member of various institutes like State Forest Department, Arunachal Pradesh, Regional Institute of Ayurveda (AYUSH).
- BSI scientists attended several meetings and provided technical inputs as committee member of state research advisory committee/ State Medicinal Plants Board/SFRI/AYUSH Dept./NABARD/Science Centre / CRPF/ITBP /POWER GRID/ZSI /GBPNHE Institute, ICAR-National Research Centre for Orchids etc.

Identification & authentication of plant samples

Visitors attended: *c.* 10803 visitors including VIPs, dignitaries, foreign delegates, scientists, academicians, researchers and students. Some of the mentionworthy VIPs visitors include Mr. Nick Low, Deputy British High Commissioner, Kolkata, Sri Soumen Mitra, IPS, Commissioner of Kolkata, Sri V.K. Yadav, PCCF, Research & Monitoring, West Bengal, Prof. Pulok Kumar Mukherjee, Director, Institute of Bioresources and Sustainable Development (IBSD), Manipur. VIP visitors include VIPs visitors include Mr. Nick Low, Deputy British High Commissioner, Kolkata, Sri Soumen Mitra, IPS, Commissioner of Kolkata, Sri V.K. Yadav, PCCF, Research & Monitoring, West Bengal, Prof. Pulok Kumar Mukherjee, Director, Institute of Bioresources and Sustainable Development (IBSD), Manipur.

Saplings/propagules distribution: Approx. 5599 saplings/propagules of *Amomum aculeatum* Roxb., *Artocarpus heterophyllus* Lam., *Baccaurea ramiflora* Lour., *Bentinckia nicobarica* (Kurz) Becc., *Garcinia dhanikhariensis* S.K. Srivast., *Grewia calophylla* Kurz ex Mast., *Hetrotis rotundifolia* (Sm) Jac-Fel., *Knema andamanica* (Warb.) W.J. de Wilde, *Mangifera indica* L., *Manilkara littoralis* (Kurz) Dubbard, *Musa velutina* H. Wendl. & Drude, *Myristica andamanica* Hook.f., *Pinanga andamanensis* Becc., *Pinanga manii* Becc., *Pterocarpus dalbergioides* Roxb. ex DC., *Rhopaloblaste angustata* (Kurz) Moore, *Semecarpus kurzii* Engl., *Terminalia manii* King etc. were distributed to different Colleges, Universities, Institutes, Departments, Eminent Researchers and public on different events.

Additionally AJC Bose Indian Botanic Garden has time to time prepared and provided 220 different Saplings, seeds, seedlings, cuttings of *Swietenia macrophylla* King, *Saraca asoca* (Roxb.) Willd., *Couroupita guianensis* Aubl., *Polyalthia longifolia* (Sonn.) Thwaites, *Delonix regia* (Hook.) Raf., *Bauhinia variegate* L., *Pachira insignis* (Sw.) Savigny, *Putranjiva roxburghii* Wall., *Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr, *Brownia hybrid, Rhapis excelsa* (Thunb.) Henry, *Hyphaene thebaica, Syzygium travancoricum, Amherstia nobilis, Victoria cruziana, Syzygium cumini, Murraya koenigii, Calophyllum inophyllum, Diospyros malabarica, Mimusops elengi, Schleichera oleosa, Cinnamomum verum, Dipterocarpus turbinatus* C.F.Gaertn, *Pterogota alata* Thwaites, *Terminalia chebula* Retz, *Cassia fistula* L., *Mesua ferrea* L., *Mallotus philippensis* H.Karst., species of succulents and cactus plant species to different schools, Institutes, Departments, Eminent Researchers, other regional centres and public on different events.

Identification and authentication of plant samples:

BSI officials of different Regional Centres identified *c.* 602 specimens of Angiosperms, Pteridophytes, Gymnosperms, Bryophytes etc. received from different Institutes, Colleges, Universities. Additionally Authentication of 59 plant samples (*Pterocarpussantalinus, Valerianajatamansi* and others) received from Different institutions/offices were carried out by HPLC fingerprinting studies.

More than 100 Seaweeds samples were identified for Research Scholars from different universities and other Research Institutions

Plantation and Plant exchange:

In BSI-NRC Plantation programme organized on 06.08.2021 in collaboration with NGO and 634 individuals of tree species of medicinal value were planted in Jahari Malli Village Panchayat of Pauri District under Sarv Green Mission headed by Dr. S.K. Singh associated by Dr. Ramesh Kumar and Dr. Puneet Kumar. *Acer oblongum* Wall. ex DC. (Nos 100); *Cinnamomum zeylanicum* Garcin ex Blume (50); *Cinnamomum tamala* T.Nees & Eberm .(150); *Jatropha curcas* L. (80); *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn. (55), *Terminalia belirica* Wall. (50), *Terminalia chebula* Retz. (41), *Terminalia elliptica* Willd. (100), *Zanthoxylum armatum* DC. (8). Plants sent BGIR Noida: 818 plants saplings of 120 species.

In BSI-ISIM 16 Raphis Palm (*Rhapis excelsa*) planted at entrance of ISIM, BSI main Gate on 18.08.2021 to commemorate 75th Independence day. The sapling procured from AJCBIBG.

Plant exchange programme with Uttarakhand state forest department, Haridwar range, plant species provided for plantation at Haridwar: *Hedychium rubrum, H. flavum, H. coronarium, H. coccinium; Curcuma zeodaria; Alpinia malaccensis, A. zerumbet; Globba schomburgkii; kaempferia rotunda; Zingiber montana* and *Z. roseum*.

Miscellaneous:

A total of 68 NDPS samples reported to Miscellaneous Law Enforcement authorities with assistance from BSI Officials.

Completed Red Listing of *Impatiens cothurnoides, Impatiens sikkimensis, Impatiens dalaiensis, Impatiens*

zeroniana, Aphyllorchis alpina, Phreatia albofarinosa, Bulbophyllum nodosum, Gastrochilus yei, Liparis torta, Cephalanthera erecta var. *oblanceolata, Gatsrochilus sessanicus* as per IUCN criteria.

CITES:

- Assisted the Director, BSI in preparing draft comment for India on production of a CITES checklist for *Dalbergia* spp. in connection to the 25th meeting of the CITES Plants Committee. Some of the recommendations proposed by India have been considered by the CITES Plant Committee.
- Provided assistance in preparing draft comment for India on products containing specimens of Appendix-II Orchids in connection to the 25th meeting of the CITES Plants Committee. Some of the recommendations proposed by India have been considered by the CITES Plant Committee.

Evaluation of People's Biodiversity Registers(PBRs):

- All the senior scientists of BSI attended meeting with the State Biodiversity Board regarding evaluation of PBR.
- BSI officials prepared the evaluation report of different districts for Monitoring Framework for Evaluating Quality of People's Biodiversity Registers (PBRs), allotted by WBBB.

IT/Digitization works :

- **Two new websites launched:** E-Archive website (https://archive.bsi.gov.in) was inaugurated on 25.08.2021 and was opened to public. It includes about 5800 Botanical drawings, about 3000 Natural dyes samples, about 1782 Textile design samples, about 20000 Economic botany specimens and about 28000 Type specimens. After inauguration, 784 type specimens of Phanerogams and 3200 medicinal plants were uploaded to e-Archive website (https://archive.bsi.gov.in). At present, the e-Archive database contains 62,566 images with metadata.
- E-Flora of India (8 volumes) and Plant checklist of India has been opened to the public in 10th RAMC meeting (BGIR, Noida) on 20.09.2021 (https://efloraindia.bsi.gov.in). It is hosted on the cloud provided by INFLIBNET (https://inflibnet.ac.in/).
- This databases has two sections, "e-flora of India" and "Plant check-list of India". In the e-flora of India, there are 7,280 records and in the "Plant check-list of India", angiosperm section has 21000 taxa with more than 2.5 lakhs synonyms, Algae has 9553 species, Bryophytes 926, lichen about 3000 and gymnosperm about 100.
- Maintenance of Official website of BSI including e-archive and flora of India:
- Maintenance and management of information resources of 3 websites/applications: https://bsi.gov.in, https://archive.bsi.gov.in and https://efloraindia.bsi.gov.in.
- A total of 715 Rare books were uploaded on BSI website (https://bsi.gov.in) and opened for public.
- A total of 229 books published by BSI have been uploaded on website.
- Medicinal plant database of India containing 1915 species was uploaded on the BSI website for access to the public.

Visitors:

https://bsi.gov.in: 1947918, https://archive.bsi.gov.in: 883297

Training courses/ Demonstration

- BSI scientists provided HPLC training programme to the Post-Graduate students, Department of Botany, Burdwan University, Department of Physiology, University of Calcutta, Department of Physiology, Sreerampore College, and University of Calcutta.
- One month taxonomic training of two

Scientists of ICAR-NBPGR (Dr. Pavan Kumar Malav and Dr Ravi Kishore Pamathri) coordinated by BSI-Scientists.

- Outreach activities in KV Ballygunge, West Bengal on 17.02.2022. Demonstration on plant identification was given to students and also plants of the campus and the plants in the Medicinal garden of the School were identified.
- BSI-WRC organized 11batches training Programme organized on 'Herbarium Digitization of Plants'. Each Training course 15 students have participated. More than 120 Students from different colleges and University had participated through Physical mode.

REVENUE

- Revenue earned through sale of BSI publication: Rs.92017/-
- Revenue earned through miscellaneous services (identification/authentication of plant specimens/guest house charge, photocopy/ Ph.D. registration charges etc): Rs. 137970/-

EVENTS, CELEBRATIONS & ACTIVITIES

World Earth Day celebration

Zealous celebration of World Earth Day was observed all over Botanical Survey of India on 22.04.2021 with plantation drive and other activities like drawing competition, quiz competition, awareness campaign etc.

- On this occasion, BSI-NRC organized a plantation drive.
- International Biological Diversity Day
- All the regional centers of Botanical Survey of India celebrated International Biological Diversity Day ("We are part of the solution") on 22.05.2021.
- On this occasion, BSI-SHRC, Gangtok organized a webinar and Prof. S. K. Barik, Director CSIR-NBRI delivered a talk on 'Bio-economy and Conservation of threatened plants of India' while other regional centers organize various activities like tree plantation programs, drawing competition for students etc.

World Environment Day

World Environment Day was observed with much enthusiasm in all the regional centers of Botanical Survey of India on 05.06.2021. On this occasion plantation program, drawing competition etc were organized to create awareness to the staffs, students and local people. Besides these activities Botanical Survey of India also organized a webinar and Dr. A. A. Mao, Director Botanical Survey of India delivered a lecture on the 'Role of Botanical Survey of India in Ecosystem Restoration'

BSI-NRC also organized a webinar and Dr. Brijlal, Formar Chief Scientist and Head, Department of High Altitude Biology, IHBT-CSIR, Palampur, Himachal Pradesh delivered a talk on 'Socio-economic and Environmental Relevance of Seabuckthorn (Hippophae)'.

World Environment Day at BSI, NRC, Dehradun

Van Mahatsav Week

Botanical Survey of India celebrated Van Mahatsav Week 2021 w.e.f. 01.07.2021 to 07.07. 2021. On this occasion, plantations drives were organized in various botanic gardens of BSI.

BSI-ANRC, Port Blair and planted approximately 142 numbers of seedlings of rare, threatened and endemic plants (*Bentinckia nicobarica* (Kurz) Becc., *Cycas zeylanica* (J.Schust.) A.Lindstr. & K.D. Hill, *Licuala peltata* Roxb. ex Buch.-Ham., *Licuala spinosa* Wurmb. and *Pinanga andamanensis* Becc.).

In **BSI-ERC,** 58 numbers of tree saplings were planted at Shillong and Barapani garden as follows. It was attended by all the officers and staffs.

1. *Hodgsonia heteroclita* (Roxb.) Hook.f. & Thomson - 3 nos
2. *Ilex khasiana* Purkay. - 8 nos
3. *Docynia indica* (Wall.) Decne. - 7 nos
4. *Aphananthe cuspidata* (Blume) Planch. - 5 nos
5. *Parkia timoriana* (DC.) Merr. - 2 nos
6. *Cephalotaxus mannii* Hook.f. - 7 nos
7. *Garcinia xanthochymus* Hook.f. ex T.Anderson - 4 nos
8. *Myrica esculenta* Buch.-Ham. ex D. Don - 2 nos
9. *Aglaia perviridis* Hiern- 5 nos
10. *Hovenia dulcis* Thunb.- 2 nos
11. *Garcinia cowa* Roxb. ex Choisy - 2 nos
12. *Pithecellobium dulce* (Roxb.) Benth. - 2 nos
13. *Illigera khasiana* C.B. Clarke - 4 nos
14. *Adinandra griffithii* Dyer - 5 no

Van Mahotsav at BSI, ANRC, Port Blair

Van Mahotsav at BSI, ERC, Shillong

Also 73 plant saplings/seedlings belonging to 16 species were planted in EBG during this celebration.

Tree plantation program on 6th July 2021 on account of Van-Mahotsav was organized by Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya and Barapani garden.

BSI-SRC Organized the Van Mahotsav on 6th July, 2021. Dr. V. A. Sathyamoorthy, Professor and Head, Horticultural Research Centre, TNAU, Yercaud and Mr. Keerthi Vasan, Manager, SBI, Yercaud were present as invited guests and tree saplings were planted by them. Apart from that staffs of SBI, staffs of HRS and BSI were also present during the occasion. Three important plant species were planted namely 1. *Glutta travancorica* Bedd., 2. *Hopea parviflora* Bedd., 3. *Garcinia gummi-gutta* (L.) Robs. This was followed by brief awareness speech on the importance of Forests by Dr. V.A. Sathyamoorthy. Mr. Keerthi Vasan, Manager reiterated the importance of Forests as well. Dr. S. Kaliamoorthy, Scientist - E given the vote of thanks. On behalf of BSI the guests were honoured with plant saplings.

Plants like *Roystonea regia* (Royal Palm), *Borassus flabellifer* (Palmyra Palm), *Shorea robusta* (Sal), *Nypa fruticans* (Mangrove Palm) etc. were planted in the AJCB IBG, Howrah by Dr. A.A. Mao, Director, BSI and other senior scientists and invited guests.

World Ozone Day

World Ozone Day was celebrated on 16.09.2021 across all centers of BSI with different activities.

World Ozone day was celebrated at BSI-ERC, Shillong

In BSI-ERC World Ozone day was celebrated at Barapani Experimental Garden by plantation of *Prunus cerasoides* (also called the wild Himalayan cherry) along the boundary walls of BSI, EBG Barapani and was attended by all the Scientists Botanists, Scientific Staffs, of ERC and EBG. Rehabilitation of *Rhododendron inequale*, a rare and endemic species to Meghalaya was also carried out on this day at BSI Shillong campus. The species were collected from Mawkajem locality of East Khasi Hills, Meghalaya where their habitat is being currently disturbed due to the 4 lane construction of the Shillong to Dawki road.

Rehabilitation of *Rhododendron inequale,* a rare and endemic species to Meghalaya

BSI-ANRC, BSI-SHRC organized virtual drawing competition for school students while BSI, CBL conducted Quiz Competition.

BSI-SRC celebrated World Ozone at NOEG, Yercaud. Dr. Senthilkumar, Senior Scientist from Horticultural Research Station, TNAU, Yercaud was the chief guest and Dr. Sharief, Scientist – E & HoO, BSI, Coimbatore presided over the function. Vote of thanks was given by Dr.S. Kaliamoorthy, Scientist – E, NOEG, BSI, SRC, Yercaud. This was followed by plantation of tree saplings by the Chief Guest and other staff members.

On this occasion a program was arranged at CNH Auditorium so as to create awareness about the importance of ozone layer to our environment.

Swachh Bharat Harit Bharat Green Pledge was observed on 24th November, 2021 at November, 2021 at Shillong

Fit India Movement

Different regional centers of BSI organized Fit India Movement on 01.10.2021. BSI-APRC organized Fit India Freedom Run at IG park, Itanagar on 14.09.2021 in collaboration with CRPF and Power Grid India

Central Vigilance Awareness Week

BSI observed Vigilance Awareness Week w.e.f. 26.10.2021 – 1.11.2021 and organized a 'Workshop on Vigilance Awareness' with the theme 'Independent India@ 75: Self Reliance with Integrity' on 28.10.2021 at CNH, Howrah.

Swachh Bharat Harit Bharat Green Pledge

Nationwide celebration of Swachh Bharat Harit Bharat Green Pledge took place on 24.11. 2021. Different regional centers of BSI participated in the same.

Swachh Bharat Harit Bharat Green Pledge was observed on 24th November, 2021 at November, 2021 at Shillong and Barapani

Samvidhan Diwas

Every year India celebrates its constitution day on 26.11.2021. Like every year, all staffs of BSI took part in the celebration of this glorious day. The activities included oath taking ceremony. BSI-CBL organized a quiz competition to commemorate this day.

The Preamble was read out by officials at ISIM.

International Mountain Day

International Mountain Day was celebrated on 11.12.2021. On this occasion International Mountain Day Exhibition was organized at MG Road, Gangtok on 10.11.2021. BSI-SHRC organized a display stall in the exhibition. Different brochures, banners were prepared and awareness and cleanliness drive in collaboration with villagers and panchayat of Rongey Maneydara Ward no. 2, Gangtok, Sikkim was organized. On 10.12.2020, Webinar cum Brainstorming on "Himalayan Mountain biodiversity – Threats and Solutions" was organized as a part of Mountain Day celebration at BSI, SHRC.

BSI-NRC also celebrated International Mountain Day.

75 lakhs Surya Namaskar Programme

On the occasion of Makar Sankranti, the Indian Ministry of AYUSH has organised a worldwide Surya Namaskar demonstration program for nearly 75 lakh people on 14.01.2022.

Photographs of Surya Namaskar by Barapani officials.

On this occasion all the regional centres of Botanical survey of India participated wholeheartedly to reach the target of 75 lakh.

World Wetlands Day

Across India all regional centres of BSI celebrated World Wetlands Day on 02.02.2022.

BSI, CNH, Howrah and BSI-ENVIS resource partner on Biocliversity (Flora) observed the day

Photographs of Surya Namaskar by ERC officials.

together. Dr. K. Karthigeyan, Scientist-E, CNH delivered a talk on "Floristic study of East Kolkata Wetlands". On this occssion, National level Drawing competition was organized for school children's under differentage groups in online virtual was made. Children of various age groups from all over the country attended this competitions. Winners were priovided e-Certificates.

BSI-ISIM celebrated 'World Wetland Day' on 02.02.2022, as part of 'Azadi ka Amrit Mahotsava' and organized a week-long National level Photography and Drawing competition in collaboration with Indian Museum. On this occasion Dr. M. Bhaumik, Scientist E & HOO, BSI-ISIM delivered a talk on the theme 'Wetland action for people and nature'.

Azadi Ka Amrit Mahotsav

The Ministry of Culture Govt. of India has allocated the week from 04.10.2021 to 10.10.2021 to MOEFCC under Azadi Ka Amrit Mahotsav and was celebrated for the theme "Awareness programmes to avoid the use of single use plastics."In pursuance BSI, ERC Campus was declared PLASTIC FREE ZONE w.e.f 10.10.2021. Awareness campaign at campus was organized, for the change starts at very door step. Cleaning drive was organized in the campus premises on 10.10.2021. Online drawing competition was organized to create awareness amongst younger generation on 9.10.2021.

BSI-SHRC Assisted the distribution of planting materials of Yacon [Smallanthus sonchifolius (Poepp.) H.Rob.] among the villagers of Labdah Busty, Mungpoo, Darjeeling district of West Bengal and Marchak-Singtam, East Sikkim to celebrate and commemorate Azadi Ka Amrit Mahotsav on 17.12.2021 and on 06.02.2022 respectively.

Oath taking Ceremony and Cleanliness Programme was organised as part of Azadi Ka

Group photo of BSI/ERC/Shillong celebrating "*Awareness programmes to avoid the use of single use plastics*" Under *Azadi Ka Amrit Mahotsav*.

Amrut Mahotsav on 25.11.2021 at BSI-CNH.

BSI-ISIM organized an exhibition on 'Textile collection of Botanical Gallery' w.e.f. 01.10.2021-10.10.2021 to dedicate Azadi Ka Amrit Mahotsav.

BSI-ANRC Organized a two months certificate course on Waste Management under Green Skill Development Programme from 17.11.2021 to 18.01.2022 as a joint venture with the C.P.R. Environmental Education Centre, Port Blair as a part of 75 years Azadi ka Amrit Mahotsav.

All other centers of BSI also celebrated Azadi Ka Amrit Mahotsav enthusiastically.

Ek Bharat Shreshtha Bharat

The following activities have been conducted by BSI-SHRC on the assigned paired states namely Tamil Nadu–Jammu & Kashmir and Kerala–Himachal Pradesh as part of 'Ek Bharat Shreshtha Bharat' along with BSI, High Altitude Western Himalayan Regional Centre (HAWHRC), Solan in local schools and colleges and assisted HoO in organizing 'Ek Bharat Shreshtha Bharat' programme:

- Children's Day 2021 was observed in BSI, SRC on 15.11.2021 and 20 students from different Classes (VII to X) of Shri Nehru Vidyalaya Matriculation Higher Secondary School, Coimbatore were invited and a lead lecture was delivered on the floristic diversity of the two states (Jammu & Kashmir and Himachal Pradesh) which included information's of the State symbols, vegetation types, medicinal and economically important plants of the above said Western Himalayan States. A video on the special ecosystem found in the Western Himalayas i.e., Cold Desert prepared by BSI-NRC, Dehradun has been shown to the students.
- Pongal Festival (Harvest Day Celebration): Due to covid-19 pandemic the Pongal festival could not be conducted. However the cultural event of the last year pongal celebrartion has been sent to media cell as well as BSI, High Altitude Western Himalayan Regional Centre, Solan.
- World Wetland Day: Observered World Wetland day on 02.02.2022, in view of this programme Power point presentation was prepared on Wetlands of Coimbatore District and sent to solan centre.

Activities to Promote Rajbhasha

Botanical Survey of India and its all regional centres organize different Hindi seminar, Hindi Workshops (Quarterly Hindi Workshop), Hindi Pakhwara, Quarterly Hindi Rajbhasha Meeting etc to promote Rajbhasha throughout the year.

Hindi Karyashala BSI, ERC Shillong

All the heads of offices organize necessary meetings and made preparations to attend Parliamentary Committee Inspection (Hindi).

One Day Online Hindi Workshop was organized by BSI-CBL, Howrah on the topic "Karyalaya Ki KaryadakshyataBadhaneHetu Hindi Ke Navintam Software Evam Apps KaUpyog on 02.03.2022.

In this occassion, the Brochure of Central Botanical Laboratory was released by the Director, Botanical survey of India on 02.03.2022.

Hindi Karyashala BSI, ANRC, Port Blair

BSI-AZRC organized Two Hindi workshops were organised on the occasion of Hindi Saptaha (week) *viz.*

1. 'Hindi ki Prasashan aur Vigyan me Upyogita' by Dr. D.D. Ojha, Ex-scientist, Central Ground Water Board, Jodhpur on 08.09.2021.
2. 'Samanya Hindi Me Vartani' by Prof. S.K. Meena, Hindi Dept., J.N.V. University, Jodhpur on 14.09.2021.

Miscellaneous

BSI-BGIR Organised a flower show at BGIR with the help of BGIR contractual Staffs from 03.03.2022-08.03.2022. Total 47 varieties of seasonal flowers were showcased during the event. Approximately 7k people visited the show.

BSI-NRC Organized 'World Day for Forests' on 21.03.2022, 'Himalayan day' on 09.09.2021. Also, organized a cleanliness drive on the occasion of 'Gandhi Diwas' on 02.10.2021.

BSI-ANRC Organized a special lecture on 'Handloom: An India Legacy.' as a part of the celebration of 7th National Handloom Day-2021.

An awareness program was also organized to avoid the use of single-use plastic on 08.10.2021. Organized pledge on Swachhta/ Single use plastic/ water saving/ National Unity in the language of states/UTs on 01.11.2021 and 15.11.2021.

BSI-APRC Organized a plantation program and plastic free awareness program along with participation of ZSI, AAYUSH, Power Grid, G, B. Pant Institute, Hornbill Public School & CRPF on behalf of National Environmental Awareness campaign in November, 2021.

Also, organized a cleanliness drive at BSI-APRC campus on 6.12.2021 in collaboration with GBPNIHE, Itanagar on the occasion of Swachhta Pakhwada.

Organized Plastic free awareness program on 16.10.2021 along with CRPF and ITBP.

BSI-SHRC organized a Virtual Program for release of the book 'Wild Balsams of Darjeeling & Sikkim Himalaya' among National & International on 07.09.2021 where the chief guest Dr. A. A. Mao, Director BSI released the book.

Also, participated in an exhibition during Regional Workshop cum Stakeholders meet on Mainstreaming Landscape approaches for Conservation and Sustainable Livelihood, at M.G. Marg on 10.12.2021.

Organized display stall at 'Vigyan Sarvatra Pujayate' exhibition organized by Sikkim State Council of Science and Technology from 23.02.2022-27.02.2022.

National Orchidarium and Experimental Garden, BSI-SRC, Yercaud and Indian Institute of Management, Trichy jointly conducted an awareness program on Biodiversity Conservation followed by 1000 tree saplings plantation drive at IIM, Trichy on 16.12.2021. During this occasion, Dr. S. Kaliamoorthy, Scientist – E, BSI-SRC gave a lecture entitled 'Conservation of plant genetic resources – the need of the hour'.

BSI-CBL organized 'Swachh Bharat Abhiyan' Programme on 01.10.2021, also an awareness program to avoid the use of single-use plastics on 08.10.2021.

BSI-CNH organized a photography competition on the occasion of World Wildlife Day on 03.03.2022, an awareness rally to 'Discourage the use of single-use plastic and conservation of water' on 02.11.2021 and an oath taking ceremony on 'World Water Day' on 22.03.2022.

BSI-ISIM Participated in an exhibition entitled 'Cluster of Museum' on World Heritage Week 2021 jointly organized by Kolkata centre for Creativity and Museum Association of West Bengal w.e.f.19.11.2021-25.11.2021. On this occasion, a talk on Botanical gallery, ISIM was delivered by Dr. M. Bhaumik, Scientist E & HOO, BSI-ISIM.

Nursery (BSI, AZRC) inauguration by Dr. A.A. Mao, Director, BSI

Nursery (BSI, AZRC) visit by Prof. PC Trivedi, Vice Chancellor, JNV University Jodhpur

Herbarium (BSI, AZRC) visit by Prof. PC Trivedi, Vice Chancellor, JNV University Jodhpur

Dr. P.K. Hajra (Chief Guest) addressing on the occassion of Earth Day at BSI, NRC.

Forest Trainee officials of State Forest Service at BSI, NRC

Forest personnels from Mussoorie Forest Division (Uttarakhand) at BSI, NRC

3rd Sub-Committee of Parliament on Official Language of the Central Government Offices in Port Blair

Dr. A. A. Mao, Director, Botanical Survey of India visited ANRC

Budget

BUDGET ESTIMATE
2021-22
Botanical Survey of India
Statement showing Monthly Expenditure

Object Head

FY 2021-22	Revised Budget Allotment	Exp. up to 31.03.2022	Balances as per actual Exp.
1. SALARIES	500000	485345	14655
2. WAGES	100	0	100
3. O.T.A	0	0	0
4. REWARD	1500	1500	0
5. MEDICAL	4000	6269	-2269
6. D.T.E	8000	7718	282
7. F.T.E	0	0	0
8. O.E.	70000	69661	339
9. RRT	5000	4770	230
10. PUBLICATION	2500	2472	28
11. OAE	100	99	1
12. S. & M.	500	289	211
13. ADV & PUB	50	16	34
14. MINOR WORK	38000	37982	18
15. PS	250	100	150
16. OCS	70000	67951	2049
17. GRANT IN AID	15000	7209	7791
18. SCH & STP	15000	8808	6192
TOTAL	**730000**	**700189**	**29811**