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भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

BOTANICAL SURVEY OF INDIA
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

2024

From the Director's Desk
Dr. A.A. Mao
Director
Botanical Survey of India

I feel extremely proud to present the Annual Report of Botanical Survey of India for the year 2023-24. This report highlights the brief accounts of all-round achievements of the institute in the field of exploration, survey, research, technological development and outreach activities. During the period 2023-24, Botanical Survey of India has performed exceptionally well in multifunctional disciplines in basics as well as applied streams of plant sciences. As per the recommendation of the RAMC, BSI conducted 66 Annual Research Projects (ARPs) on various aspects of the floristic research of the country. Under these projects, BSI conducted 132 floral surveys (including local tours) in different phyto-geographical regions of the country and 16 Herbarium Consultation Tour (HCT) in various herbaria. A total of 6,060 plant specimens were collected and identified. In order to complete the inventory of the nation's floral resources, BSI documented 55,387 taxa of plants, which are divided into 22,108 taxa of angiosperms, 83 taxa of gymnosperms, 1,319 taxa of Pteridophytes, 15,701 taxa of Fungi, 9,035 taxa of Algae, 2,819 taxa of Bryophytes, and 3,044 taxa of Lichens. Towards fulfilling the Global strategy for plant conservation targets on *ex-situ* conservation, 23,765 plants of 96 species were multiplied and conserved in various gardens of Botanical Survey of India spreading in different phyto-geographical regions of India. Towards digitization, total of 70,930 herbarium sheets were digitized and 1,85,238 metadata were prepared at the different Regional Centres and Units of BSI.

During this year, the scientists of BSI published 32 taxa as new to science and 19 taxa as new additions to Indian flora. The research wisdom and brilliance of the scientific officials of the institute was reflected through the publication of 12 Books, 4 e-books and 211 research papers in peer reviewed journals. Besides, BSI published 03 periodicals [NELUMBO (vol. 65: Issues 1 & 2), Plant Discovery 2022, Vanaspati Vani vol. 31, 2022]. The 16th volume of 'Plant Discoveries 2022' which was released on 5th June, 2023, presented details of 339 taxa either as new to science or as distributional novelties. This includes 125 Angiosperms, 5 Pteridophytes, 19 Bryophytes, 55 Lichens, 27 Algae, 99 Fungi and 09 Microbes to the floristic wealth of India. Now the current number of plants taxa from India has been updated to 55387 including 1278 microbes.

Botanical Survey of India, on its 135th Foundation Day, 13th February, 2024 organized a meeting in Hybrid mode at the Central National Herbarium, Howrah. Dr. A.A. Mao, Director, BSI delivered a talk on the achievements made by BSI and also established the target vision of BSI to be achieved by 2047, keeping in view with the need of the hour. Scientists and staff from all the regional centres of BSI also actively participated in the event. Besides, BSI organized a

three-day training workshop on “Plant Identification and Nomenclature” for the Indian Forest Service (IFoS) officers nominated by the Ministry of Environment, Forest, and Climate Change, Govt. of India, New Delhi w.e.f., 3rd-5th January, 2024, at the Central National Herbarium. In this workshop 14 IFS officers participated and got trained from different resource persons. During this period, 5 MoUs were signed with other organisations such as (National Digital Library of India (NDLI), IIT Kharagpur; Indian National Trust for Art and Cultural Heritage (INTACH), New Delhi; University of Delhi, New Delhi; Atlanta Botanic Garden, USA and Consortium of Simpson & Brown LLP, architects of Edinburgh and Alleya and Associates of Kolkata.).

During this period, BSI has developed a ‘NATURE TRAIL’ spreading over an area of 15 acres with a trail span of nearly 2.2 km has in Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah which was inaugurated by Ms. Leena Nandan, IAS, Secretary, MoEF&CC on 10th August, 2023. The trail has a repository of 307 of different plant species and is one of its kind in providing a forest like experience within the urban life.

During 2023, 1191 awareness campaign were organized and more than 1,36,330 people were sensitized under the Mission LiFE campaign. BSI has installed 20 selfie stands across country covering different sections of society to create awareness among public. By recruiting 475 people from a various group during the 2023 mission recruitment, BSI was able to bring its overall strength up to 722 out of the 1197 sanctioned strength.

Scientists from the Botanical Survey of India have received national awards and recognitions from various professional associations and organizations for their work in plant taxonomy. Furthermore, 1628 plant specimens were submitted for identification by researchers, students, and members of the public. Additionally, images of 1182 herbarium specimens were distributed to various scientists, academics, and stakeholders worldwide. In order to confer with experts on plant identification, 1455 visitors and students visited the BSI libraries and herbarium. Furthermore, 38,39,368 individuals visited the Indian Virtual Herbarium and BSI archives websites.

My sincere congratulations to my scientists, technical staffs and administrative colleagues for their invaluable collaboration and tireless efforts to improve and supplement the work environment with dedication, teamwork, innovation, and creativity. I express my gratitude to the whole staff for their dedication to achieving the institution's objectives and upholding the reputation of the Botanical Survey of India, which conducts taxonomic and floristic studies, surveys, recording, and conservation of the nation's plant resources.

Jai Hind

A.A. Mao
(Director)

CONTENTS

RESEARCH PROGRAMME

Blitum virgatum L.

AJCB INDIAN BOTANIC GARDEN, HOWRAH

AJC BOSE INDIAN BOTANIC GARDEN, BSI, HOWRAH

Project 1: **Development and maintenance of Aquatic Plant Section in AJCBIBG**
Executing Officials: Dr. Devendra Singh, Scientist E, Dr. S. P. Panda, Scientist- D, Dr. J. Swamy, Scientist-C, Dr. R. Saravanan, Botanist, Ms. Titir Saha, Botanical Assistant
Duration: On-going

Background: To enrich AJCBIBG with different species and cultivars of aquatic plants with major objective of AJCBIBG serving as an *ex-situ* conservatory of aquatic plant germplasm.
Area & Locality: AJC Bose Indian Botanic Garden, Howrah

Achievements: At present the Aquatic Section of AJCBIBG, Howrah harbours **25** cultivars of *Nelumbo* including Ameri Camelia, Charming lips, White puff etc., **26** cultivars of *Nymphaea* like Blue capensis, Bulls eye, Pink pearl etc. and **39** different species of aquatic plants including *Azolla nilotica* Decne..(Salviniaceae), *Cyperus papyrus* L. (Cyperaceae), *Sagittaria japonica* E.Vilm.(Alismataceae) etc. During this period, the seeds of *Victoria amazonica* (Poepp.) Klotzsch were also harvested from the aquatic section on 12-04-2023 and various treatments were done to induce germination from the seeds (More than 100 seeds). During this period new species of *Trapa natans* L. (Lythraceae), *Utricularia aurea*, *Sagittaria sagittifolia, Cryptocoryne* sp. *Lindernia* spp. *Typha Potamogeton nodosus* Poir*., Aponogeton natans* (L.) Engl. & K.Krause and *Ottelia alismoides* (L.) Pers., *Hygrophila* ringens (L.) R.Br. ex Steud. In addition to this, 7 cultivars of Lilies, 5 cultivars of lotus from Kerala and 7 other plants were introduced in the garden. Two cultivars of lotus were also procured and introduced into the aquatic plant section. Further, 68 seedlings of *Victoria amazonica* and 24 seedlings of *Euryale ferox* were raised from seeds and successfully introduced in several lakes (Kunstler Lake, Shadir lake, Leram lake, King Lake, Nature trail) of AJCBIBG and also distributed to various botanic gardens. The curatorial management work in connection to this project included the preparation of natural space of Euryle ferox to re-establish its natural habitat at Learam lakeafter 8-9 years, preparation of 36 additional (3.5ft. × 2) tank was done in the aquatic section in addition to the regular monitoring and maintenance of the section.

Aquatic Section of AJCBIBG

Ludwigia sedioides

Project 2: Curatorial work in the Garden and Maintenance
Executing officials: All scientific staff of AJCBIBG up to the level of Preservation Asst. cum Garden Overseer
Duration: On-going

Background: Maintenance and smooth functioning of different sections of AJCBIBG with with major objective of AJCBIBG serving as an *ex-situ* conservatory of plant germplasm.
Area & Locality: AJC Bose Indian Botanic Garden, Howrah

Achievements: During the tenure of 2023-24, AJCBIBG several upgradations, installations, restorations, cleaning works were domne under the purview of this project. The different sections and divisions, lakes, woodlands and raised saplings of palms, woody and endemic species were cleaned and maintained regularly. Flowers were collected, dissected and prepared descriptions and photo

plates for 75 cultivars of *Hibiscus rosa-sinensis*. Under this project 5 new *Hibiscus rosa-sinensis* cultivars and published four cultivars namely, *Hibiscus rosa-sinensis* cv. *Janaki Ammal, Hibiscus rosa-sinensis* cv. *A.A. Mao, Hibiscus rosa-sinensis* cv. *Krishna's Radiance* and *Hibiscus rosa-sinensis* cv. *Achraya Jagdish Chandra Bose* were developed.Further, more than 100 crosses were made between various *Hibiscus* cultivars and 10 capsules were successfully harvested from female parents for further breeding process. In addition to this, overall 100 germplasm of different species and cultivars of *Hibiscus.* The *Hibiscus* section was regularly maintained with the application of organic fertilizers (Neem Cake, Mustard Cake, Bone Meal, Horns Meal, Leather meal, Vermicompost etc.), plant growth regulators (Miraculan (PGR), NPK, Agromingold, Super Sonata, etc.) and pesticides (Amistar Top, Confidor, Blitox, etc.). A field tour was undertaken to Singur, Hooghly and the surrounding areas on 2nd December, 2023. During this exploration 30 new cultivars of three species namely *Hibiscus rosa-sinensis, Hibiscus liliiflorus and Hibiscus mutabilis* were collected, procured and introduced in Hibiscus Section.

Recently a new section 'NATURE TRAIL' has been developed in the garden on one of its undisturbed habitats (Division-X) spreading over an area of 15 acres with a trail span of nearly 2.2 km. It was inaugurated by the Hon'ble secretary, MoEF & CC on 10th August, 2023. It is a repository of 307 plant species which includes several endemic and threatened plants. The 'NATURE TRAIL' besides its aesthetic beauty will also serves the purpose of environmental awareness and education to the visitors.

During the reference period a total number of 1076 plant saplings of 43 plant species belonging to different families of native and important economic and high medicinal potential were multiplied in both the nurseries of AJCBIBG for further introduction and distribution.Moreover, seeds of 75 tree species were collected, conserved/stored and successfully germinated in nurseries. A total of 4071 plant saplings belonging to 359 plant species were planted in different sections/division of AJCBIBG during 2023-24. Phytosociology work has also been carried out and it has generated baseline data for Carbon sequestration of Great Banyan Tree. Survey of different sections have been carried out and reported on every fortnight basis. Plant procurement was also done for plantation of the same Aquatic section, Gangadhar section, GBT lawn, Main gate roads area was regularly supervised.

Project 3: **Legumes of AJC Bose Indian Botanic Garden, Howrah, West Bengal, India.**
Executing Officials: Dr. Devendra Singh, Scientist E, Dr. J. Swamy, Scientist-C, Dr. Vijay Matsakar, Botanist
Duration: On-going

Background: This project was taken up for the enumeration of Leguminosae members present in AJCBIBG.
Area & Locality: AJC Bose Indian Botanic Garden, Howrah

Achievements- During 2023-24, literature was surveyed extensively on legumes family and garden plants. Regular field surveys have also been conducted in Division numbers 1, 2, 3,4,5,6,7,8 & 9 and more than 61 species were enumerated from these divisions and the description made for 25 species.

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORT BLAIR


Cookeina sp.


Carissa andamanensis L.J. Singh & Murugan

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORT BLAIR

Project 1: Multiplication and Nursery development of Bamboos, Palms, Zingibers, Endemic trees species of Andaman & Nicobar Islands at Dhanikhari Experimental Garden Cum Arboretum.

Executing Officials (s) : Dr. Anil Kumar Midigesi, Botanist, Dr. Pankaj A. Dhole, Botanist and Shri Gautam Anuj Ekka, Bot. Assist.

Duration: 2022 – 2024

Raised Nursery

Psilotum complanatum Sw.

Background: The Botanical Survey of India is maintaining the Experimental garden cum Arboretum at Dhanikhari, Naya Sahar, about 16 km from Port Blair with a focus on both *in-situ* and *ex-situ* conversation of over 500 plant species with some economically important species. Comprising an area of ca 30 h. of forest land, with 2 h. of cleared land earmarked for nurseries, the garden has become an important conversation centre for several rare and endangered plant species collected and introduced from vulnerable areas and islands with a view of multiplication and propagation for the germplasm conservation.

This garden is also a natural abode of many important endemic plants including orchids, zingibers, canes, rattans, bananas, ferns, etc. Our scientists and researchers venture the remote localities of the islands and collect the germplasm in the form of whole plants, seedlings, propagules, rhizomes, seeds and fruits for introduction and multiplication in the garden. Inside the garden, different sections such as Medicinal plot, Pomological plot, Cane plot, Palm plot, Endemic plants plots, Orchidarium, Ornamental plants, Cactarium, Nursery and Greenhouse are being maintained. Besides concentrating on the plants of adjacent areas of the Dhanikhari Dam, rare and endangered plants collected from different areas of mainland are also being introduced in the garden.

The current project aims at *ex-situ* conservation of Endemic species with special emphasis on Bamboos, Palms, Zingibers, etc. species of the islands in the garden.

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

Achievements: Total two (02) field exploration tours were conducted in the areas of Nicobar group of Islands and South Andaman during 17.10.2023 to 27.10.2023 and 14.12.2023 to 18.12.2023 and collected plantlets, seedlings, fruits and seeds of 45 plant species belonging to palms, Zingibers, and Endemic tree species of the Andaman and Nicobar Islands including *Ceropegia andamanica* Sreek., Veenakumari & Prashanth, *Cyathea albosetacea* (Bedd.) Copel., *Dillenia andamanica* C.E. Parkinson, *Eulophia nicobarica* N.P. Balakr. & N.G. Nair, *Korthalsia rogersii* Becc., *Macaranga nicobarica* N.P. Balakr. & Chakr., *Mangifera andamanica* King, *Kayea manii* King, *Mimusops*

andamanensis King & Gamble, *Myristica andamanica* Hook. f., *Psilotum complanatum* Sw., *Psychotria andamanica* Kurz., *Rhopaloblaste angustata* (Kurz) Moore, *Sterculia villosa* Roxb and raised nursery of them at Dhanikhari Botanical Garden cum arboretum (DEGCA).

Project 2: Macrofungi of Andaman & Nicobar Islands
Executing Officials (s) : Dr. Mahadevakumar, S. Scientist-C
Duration: 2023 – 2027


Cookeina sp. Kuntze


Deadalea sp. Pers.

Background: Research on the taxonomy and variety of macrofungi is becoming more and more important since environmental degradation is putting many macrofungi at risk of going extinct. Wild mushrooms have significant effects on biology and the economy. Since ectomycorrhizal fungi play a vital role in both natural and organized eco-schemes, information on mushroom diversity is important. The fungus community forms an important part in reforestation initiatives. They are also important as a source of food for both humans and animals. India is a rich source of macrofungal resources and has been investigated by several researchers in search of bigger fungus. Taxonomy research on Indian macrofungi is declining, yet it is still necessary to comprehend their biodiversity and conservation. Numerous forest forms with diverse biodiversity found all over the world have mostly been undiscovered by fungi. Recent studies have made it clear that many species remain undiscovered, and in many regions, efforts to explore the microbial world have not yet begun. Much research on India's macrofungal diversity has been done in the Western Ghats, Western Himalaya, Jammu and Kashmir, Central India, and North Eastern Parts. Many workers have expended a lot of effort into documenting and harnessing their uses as food, medications, pharmaceuticals, ectomycorrhizal relationships, toxic mushrooms, and other things. However, there haven't been any current scientific studies on the Andaman Islands' macrofungal resources. From this angle, it is imperative that the fungal diversity of the Andaman and Nicobar Islands be investigated right now. The planned effort will provide the groundwork for future researchers to investigate and conduct Bioprospection on the macrofungi of the Andaman and Nicobar Islands. The baseline data for future study and advancement will come from the suggested endeavor.
Area and Locality: Andaman and Nicobar Islands: *c.* 8249 sq. km.

Achievements: Two field tours were conducted so far. First field tour was conducted to South Andaman from 09.09.2023 to 26.09.2022 and 04.11.2023 to 07.11.2023 and collected *ca.* 140 Macrofungal specimens. The second field tour to Middle Andaman is conducted from 30.12.2023 and will be conducted up to 18.01.2024. A total of 300 macrofungal specimens were collected and the identification process is going on. During the field trip, macrofungi belonging to *Cookeina* sp., *Daldinia* sp., *Ganoderma* sp., *Gymnopilus* sp., *Hypoxylon* sp., *Lentinus* sp., *Microporous* sp., *Pluteus* sp., *Schizophyllum* sp., *Trametes* sp. *Xylaria* sp. and others were collected.

Project 3: Ethnobotanical Study of Ranchi community/ settlers of Andaman Islands
Executing Official (s): Dr. Pankaj A. Dhole, Botanist, Shri Gautam Anuj Ekka, Bot. Assistant and Dr. Lal Ji Singh, Scientist-F
Duration: 2023 – 2025

Background: The ANI's are rich and unique in terms of plant diversity in India with higher number of endemism. This part of India is famous for its indigenous and authentic traditions. During British period a large number of tribal people (Munda, Oraon, Kharia, Ho and Santhal) from Chota Nagpur region Jharkhand brought to Andaman as forest labors. As their recruitment station was Ranchi, these people are commonly known as RANCHI in Andaman Nicobar Islands. The most interesting feature associated with these indigenous and ethnic has been found that, they live in localities which are immensely rich in biodiversity. Virtually their requirements ranging from food, fuel, fodder, medicine, and various other domestic needs are met from the local vegetation. So far, the existing information on ethnobotanical knowledge of these communities reveals that although there is a great floristic diversity in the region, very few are reported for their ethnobotanical and economic value. The culture of the Ranchi communities as well as traditional knowledge of uses of plant wealth are dwindling day by day. Hence, it is proposed to undertake a detailed Ethnobotanical study of Ranchi community / settlers of Andaman Islands to document their precious knowledge before complete extinction
Area and Locality: Andaman Islands: *c.* 6408 sq. km.

Achievements: Total two (02) field exploration tours were conducted in different areas of South Andaman from 05.08.2023 to 08.08.2023 and 28.11.2023 to 03.12.2023. During the field trip a total of 58 field numbers of specimens were collected with a total of 196 ethnobotanical information (Medicine–71, Edible–11, Fodder–22, Veterinary–7, Timber/Wood–24, Religious–10, Socio-economic–6, Magical-belief-04, Tooth Brush–05, Broom–3, Fiber/Rope– 4, Fuel–09, Miscellaneous–22. A total of 4 exhibits collected for museum.

Officials engaged in collection of Ethnobotanical information at Mannarghat

Leea guineensis G. Don – Fresh leaf juice applied on skin to cure rashes, herpes and boils

Project 4: Flora of Cinque Wildlife Sanctuary, South Andaman
Executing Official (s) : Dr. Anil Kumar Midigesi, Botanist, Shri Gautam Anuj Ekka, Bot. Assistant and Dr. Lal Ji Singh, Scientist-F
Duration: 2023 - 2025

Background: Andaman and Nicobar archipelago is a group of 572 Islands which are situated in Bay of Bengal which are rich in florist diversity. The islands have been floristically explored time to time by many workers, but still some of the remote islands are unexplored, the study area is one of them comes under Andaman group of Islands. The study area 'Cinque Wildlife Sanctuary' is located at southeast to the Rutland Island, it consist a pair of islands namely North Cinque Island and South Cinque Island. The Cinque group of Islands is lies on the north side of Duncan Passage, between Rutland Island and Passage Island. The Cinque group of islands are uninhabited islands, belongs to the South Andaman Administration. Both North and South Cinque Islands are belongs to Rutland Archipelago, located 5.5 km and 7 km southeast of Rutland island respectively. The Islands are known for its unique flora, marine fauna and natural beauty. Since, the islands are remote so far there is no comprehensive work has been done. There are few collections from North Cinque since it is accessible somehow, but from the South Cinque the collections are very few. It is very tough to reach South Cinque because of the heavy tidal current from the open sea. If one can want to reach there need to be get down in the 5 ft. of sea waters. It is sure that around 90% of the South Cinque Island area not yet been explored, hence the Cinque Island has been selected for the present study.

Area and Locality: Cinque Island is one of the remote Islands of group of Andaman Islands and designated as Cinque Wildlife Sanctuary in the year of 1987. Cinque Wildlife Sanctuary a place endowed with spectacular natural beauty and encompasses three small adjoining remote Islands *viz.* Passage (0.62 sq. km); Sisters – North & South (0.36 sq. km.); Brothers - North & South (1.99 sq. km.). These proposed study area Cinque Wildlife Sanctuary (North and South Islands) covers about 9.53 Sq. km area. This sanctuary is an uninhabited set of two Islands and houses a great biodiversity in terms of flora and fauna. Till date there is no floristic survey on Cinque Wildlife Sanctuary. Hence, we are proposing the present work to carry out the complete floristic inventory of the same.

Achievements: Two field tours were conducted to the Cinque Wildlife Sanctuary, South Andaman. First field tour was conducted during 04-11-2023 to 08-11-2023 and the second was during 05-12-2023 to 09-12-2023 and a total of 74 herbarium specimens (in quadruplicates) and 66 herbarium specimens (in quadruplicates) were vouched respectively. Morphological characterization of collected specimens is in progress and specimens identified in to spp. of genera *viz*. *Artocarpus*, *Canarium*, *Carissa*, *Cleistanthus*, *Cycas*, *Cyperus*, *Cymbopogon*, *Digitaria*, *Dendrobium*, *Eragrostis*, *Euphorbia*, *Goodenia*, *Memycelon*, *Syzygium*, *Setaria, Terminalia, Vitex* and identification remaining specimens is in progress.

Carissa andamanensis L.J. Singh & Murugan

Cleistanthus andamanicus N. Balach., Gastmans ef Chakrab

Project 5: A pictorial guide to Flora of Mount Manipur National Park, South Andaman
Executing Official (s): Dr. Pankaj A. Dhole, Botanist, Shri Gautam Anuj Ekka, Bot. Assistant and Dr. Lal Ji Singh, Scientist-F
Duration: 2023 – 2025

Background: Andaman and Nicobar Islands (ANI's) are located about 1200 km from the Mainland, India, comprising 572 Islands and Islets and has a geographical area of 8,249 sq. km, constituting 0.25% of the total geographical area of the country. The ANI's are rich and unique in terms of plant diversity in India with higher number of endemism (Singh *et al.* 2014, 2021a, b). Considered as a centre of plant endemism, the *flora* has been *explored and* recorded time to time by various workers (Parkinson 1923; Mathew 1998; Sinha 1999; Dixit & Sinha 2001; Pandey & Diwakar 2008; Singh et al. 2014, 2020 a & b, 2021 a & b; Murugan et al. 2016; Singh & Misra 2020; Naik et al. 2020). However, some of the forest areas including protected forests and national parks of these Islands require intensive floristic surveys that will contribute to the knowledge of Indian flora. A floristic research report by Mr. S. P. Mathew in 1993, a checklist of plants of this National Park is only available resource, in his documentation a very few plant species were listed. Apart from that there is no comprehensive authenticate floristic account on this national park and its seems that intensive floristic surveys are still required. Hence, we are proposing the present work to prepare the A pictorial guide to the Flora of Manipur National Park, South Andaman.
Area and Locality: Mount Manipur National Park was formerly known as Mount Harriet National park, located in the ANI's, Union territory of India. The National park was established in 1969 which covers an area about 46.62 Sq. km. The general topography of the hill is highly irregular and undulating. The elevation of the National park ranges from zero at the coast to 481 metres at highest peak. The National park has tropical evergreen forests, and moist deciduous forests. It

represents one of the floristically rich diversified areas which generated a lot of interest among naturalists and taxonomists.

Achievements: Total two (02) field exploration tours were conducted in areas of Mount Manipur National Park, South Andaman from 10.09.2023 to 17.09.2023 and 11.12.2023 to 18.12.2023. During the field trip total 170 high quality digital photographs of plants & forest views taken with GPS data. Also wild germ plasm of *Ceropegia andamanica* Sreek., Veenakumari & Prashanth, *Dillenia andamanica* C.E. *Dipterocarpus* sp., *Elaeocarpus* sp. *Mangifera andamanica* King, *Mimusops andamanensis* King & Gamble, *Myristica andamanica* Hook.f. *Semecarpus kurzii* Engl. *Terminalia bialata* (Roxb.) Steud.,etc was collected and introduced in the Garden as a part of ex-situ conservation.

An entrance of Mount Manipur National Park, South Andaman

Mucuna gigantea (Willd.) DC.

Project 6: A pictorial guide to Flora of Shaheed Dweep (Neil Island), South Andaman
Executing Official (s): Dr. Pankaj A. Dhole, Botanist and Dr. Lal Ji Singh, Scientist-F
Duration: 2023 – 2025

Background: Shaheed Dweep (11.83°N & 93.04°E) was formerly known as Neil Island situated in the South Andaman of Andaman and Nicobar Islands, Union territory of India. The Island is located between Swaraj Dweep (Havelock Island) and Netaji Subhas Chandra Bose Island (Rose Island) with an elevation of 101 m. Shaheed Dweep lies 36 km from the northeast of Port Blair and south of Fusilier Channel. Mageswaran et al., (2015) reported that the forest area covers about 735.17 ha which contributes 40% of the Island. Only a few studies assessed the mangrove floristics and associated plant species of Shaheed Dweep (Immanuel et al., 2016; Kannan et al., 2021). The floristic study of this Island remains unexplored. Therefore, the proposed work will provide the detailed floristic account of Shaheed Dweep, South Andaman.

Area and Locality: The Island covers a total area of 13.7sq.km.

Achievements: Total two (02) field exploration tours were conducted in areas of Shaheed Dweep (Neil Island), South Andaman from 20.09.2023 to 26.09.2023 and 23.12.2023 to 29.12.2023. During the field trip total 210 high quality digital photographs of plants & forest views taken with GPS Data. Also wild germ plasm of *Boesenbergia siphonantha* (King ex Baker) M. Sabu, Prasanthk. & Skornick., *Curcuma* sp., *Gloriosa superba* L., *Hybanthus enneaspermus* (L.) F. Muell, etc. was collected and introduced in the Garden as a part of *ex-situ* conservation.

ARUNACHAL PRADESH REGIONAL CENTRE, ITANAGAR

Pleione arunachalensis Hareesh, Kumar & M.Sabu

ARUNACHAL PRADESH REGIONAL CENTRE

Project 1: Pteridophytes of Arunachal Pradesh: A Pictorial Guide
Executing officials: - Dr. Vineet Kumar Rawat, Scientist-E, Mr. Suman Halder, Botanist and Mr. Arijit Ghosh, Botanical Assistant
Duration: - 2023-2024.

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

Achievements: Thorough literature survey was carried out to determine the reported ferns and fern allies from the state of Arunachal Pradesh. Herbarium specimens were consulted from ARUN, the herbarium of BSI, APRC, Itanagar. A list of the reported species of Arunachal Pradesh have been prepared, a total of ca. 600 species have been enlisted. Photo plates of the respective species are being prepared from photographs clicked previously; around 200 photo plates have been prepared so far.

Equisetum arvense subsp. *diffusum* (D. Don) Fraser-Jenk

Project 2: **Taxonomic Studies on Wild edible Mushrooms of Arunachal Pradesh**
Executing official: Dr. Arvind Parihar, Scientist 'C'
Duration: 2023-2026.

Background: Arunachal Pradesh, a biodiversity hotspot in India, boasts diverse flora and fauna. Its lush, rainy climate and dense forests, harbors a wealth of macrofungi, including a variety of wild edible mushroom species. While local communities utilize wild mushrooms, their edibility remains unclear, leading to potential poisoning incidents. Despite the region's rich fungal diversity, no comprehensive studies have been conducted onWild Edible Mushrooms. To address this critical gap, Botanical Survey of India, Arunachal Pradesh Regional Centre, Itanagar has proposed a timely project entitled "Taxonomic Studies on Wild Edible Mushrooms of Arunachal Pradesh.
Area & locality: Arunachal Pradesh

Achievements: Literature study of Earlier Taxonomic Study in the Arunachal Pradesh has been done and various research articles were studied. One Field Tour to different locations and Forest Areas of

West Kameng District, of Arunachal Pradesh was undertaken w.e.f. 09.08.2023 to 23.08.2023. During the tour extensive survey of different forest areas was done, and specimens of probable wild edible mushrooms were collected and GPS data was recorded for various collection sites. During the field tour 82 field numbers were collected and their macromorphological characterization was done in the base camp. All the collected specimens were dried and preserved for the future study. One Herbarium Consultation Tour to Central National Herbarium (CAL) for the Microscopic study of collected specimens in the CAL was undertaken w.e.f. 15.10.2023 to 01.11.2023. During the Tour 10 specimens were identified and their Microphotographs were undertaken. Camera Lucida drawing for the same is also completed. Ten specimens including *Auricularia auricula-judae* (Bull.) Quél., *Hydnum rependum* L., *Russula virescens* (Schaeff.) Fr. Etc. have been identified based on their morphological characters is given below:

Cantharellus versicolor S.C. Shao & P.G. Liu

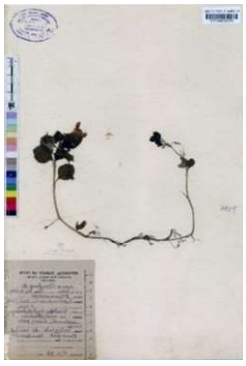
Hydnum repandum L.

Project 3: Metadata preparation and Digitization of ARUN Herbarium.
Executing Officials : Dr. Ranjit Daimary, Botanist.
Duration: Ongoing.

Background : The ARUN Herbarium of BSI, APRC, Itanagar is holding more than 40000 herbarium specimens at present and the numbers are increasing. Out of this the angiosperms include more than 30000, Pteridophytes more than 5000 and the Gymnosperms more than 40 herbarium specimens. The herbarium specimens deposited here are mostly collected from the state of Arunachal Pradesh which is the jurisdiction of this centre. The objective of this project is to complete the digitization and metadata preparation of all the herbarium specimens.
Area & Locality: The ARUN Herbarium is located in the office building of BSI,APRC, Itanagar.

Achievements : Under the purview of this project, digitization and metadata preparation has been completed for 243 herbarium specimens of ARUN Herbarium.

Impatiens_marianae



Impatiens_porrecta

ARID ZONE REGIONAL CENTRE, JODHPUR

ARID ZONE REGIONAL CENTRE, JODHPUR

Project 1: Flora of Mount Abu Wildlife Sanctuary, Rajasthan (India).
Executing officials: Dr. Sanjay Mishra, Scientist-C & Dr. S. L. Meena, Scientist-E
Duration: November, 2021-2023 (Extended upto August, 2023)

Background: The Mt. Abu Wildlife Sanctuary, Rajasthan (India) is situated between 24° 30' and 24° 43' N longitude and 72° 38' and 72° 53' E latitude in the southern part of the state in Sirohi district close to the south-western extremity of the Aravalli ranges. The sanctuary is spread in 326.09 sq km and comprised of entire Mt. Abu hill which is known as Arbudanchal. It is the highest point not only within the state of Rajasthan, but also between the Himalayas in the north and the Nilgris and other hills in the far south of India. The highest peak of Mount Abu is Guru Shikhar at 1722 m (5,650 ft) above sea level. The vegetation of Mount Abu supports dry, semi-deciduous and evergreen species, which changes with the increase in altitude. The sanctuary exhibits great ethnic, cultural, floral, faunal diversity and is a very popular destination for eco-tourism. Several endemic, rare and endangered species are found in this sanctuary. As earlier floristic studies were conducted in limited areas and there is a longtime gap. So, the present study was proposed for complete study of the area. The complete floristic study of the protected area will provide insights in to the composition of the forest, which in turn will form the basis for monitoring changes in the floristic diversity of Mount Abu WLS. Therefore, this project was proposed.

A total four exploration tours were conducted during different seasons and 727 field numbers were collected. One Herbarium and Library consultation tour was undertaken to Botanical Survey of India, Western Regional Centre Herbarium (BSI), Pune and Blatter Herbarium (BLAT), St. Xavier's College, Mumbai. About 500 sheets consulted/examined and 35 unidentified specimens were identified along with library consultation. Seeds/seedlings of 65 species were collected for *ex-situ* conservation.
Area and locality: 326.09 sq.km, Mount Abu Wildlife Sanctuary, District Sirohi, Rajasthan.

Achievements: Identification of 294-field nos. has been done. Taxonomic description of 529 species has been documented. The compilation of final report is under progress.

Didymocarpus pygmaeus C.B. Clarke

Gmelina arborea Roxb. ex Sm

Project 2: Vegetation of Indian desert of Rajasthan and Gujarat: present scenario, GIS mapping and IUCN Assessment of Endemic, Endangered and regionally rare species.
Executing officials: Dr. C.S. Purohit (Scientist-D); Dr. S.L. Meena (Sci.-E); Ramesh Kumar (Bot. Asstt.); Amit Kumar (Sr. Pres. Asstt.)
Duration: July, 2023 to 31st March, 2027

Background: Thar Desert or the Great Indian Desert is situated in the arid western part of Rajasthan state (India) and includes the adjoining sandy terrain of Pakistan up to the Indus River. It forms a distinct but integral part of the arid lands of western India that runs through the state of Punjab, Haryana, Rajasthan and Gujarat. The eastern limit of Thar Desert is defined by the moisture availability index, which divides the arid from semi-arid tract. This boundary roughly passes through the foot hills of the degraded Aravalli Hills Range through Rajasthan. In the west, the desert extends up to the fertile alluvial plains of the Indus River in Pakistan. In the South, the Thar boundary lies along the Great Rann of Kachchh (GRK) and the sandy plain and sand dunes system of north Gujarat.

About 85% of Thar Desert is located within India and it covers about 170,000 km^2. The area consisting of sandy and saline plains is the driest part of the state having thorny scrub type vegetation. Total angiospermic flora of western Rajasthan including both indigenous and naturalised plants, comprises about 775 species and 48 varieties belonging to 384 genera under 90 families (Jain, 1972; Bhandari, 1990). Beside this, there are about 50 taxa of Angiosperms and one species of Gymnosperm which are considered to be rare and threatened in Rajasthan [Pandey et al. (1983), Sharma (1983), Pandey et al. (2012) and Kumar and Purohit (2015).

Area and locality: The study area the Great Indian Desert of Rajasthan and Gujarat, has been demarcated to north and western part of the Rajasthan which includes 14 districts namely Ajmer, Alwar, Barmer and Bikaner etc.

Achievements: During the year prepared a preliminary list of reported plant species from Indian desert based on in housed herbarium specimens (BSJO) and literature. Besides this, an extensive field tour from 20.10.23 to 05.11.23 was carried out in arid region of Rajasthan and collected 461 field numbers and 02 live plant samples i.e. *Nymphoides spp.* And *Desmostachya bipinnata*. Also collected of seeds of *Tephrosia falciformis* and *Meremmia dissecta.*

During the period under report 241 plant species were identified. Prepared species distribution maps for 15 plant species and 15 photo-plates with the help of macro and microscopic photographs of live plants and plant parts for their easy identification. Taxonomic description prepared for 15 plant species. Among the entire collection, 14 species were found in threatened category which included *Achyranthes bidentata* Blume [Amaranthaceae]; *Euphorbia pycnostegia* Boiss. [Euphorbiaceae]; *Ichnocarpus frutescens* (L.) R.Br. [Apocynaceae]; *Ziziphus truncata* Blatt. & Hallb. [Rhamnaceae] etc.

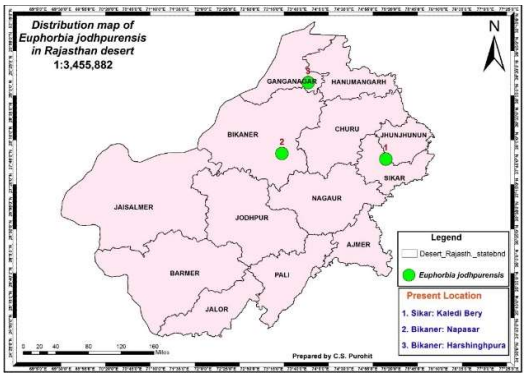


Fig. 1: Distribution map of *Euphorbia jodhpurensis* in Indian desert of Rajasthan

Euphorbia jodhpurensis Blatt. & Hallb.

Photography of desert tree during field survey

Polycarpaea corymbosa (L.) Lam.

Phyllanthus fraternus G.L. Webster

Project 3: **Maintenance and conservation of Economically important, Endemic and Threatened species of the Arid region.**

Executing officials: Dr. S.L. Meena, Scientist-E, Dr. C.S. Purohit, Scientist-D, Shri Amit Kumar, Sr. Pres. Asstt.

Duration: Ongoing

Background: The experimental Botanic Garden (Desert Botanical Garden) of this centre was established during 1994 with an area of *c.* 8 acres. The main objective of the garden is the maintenance of arid germplasm, collection and multiplication of rare/endemic/ endangered/threatened/ medicinal/economically important and other plant species arid and semi-arid regions of Rajasthan and Gujarat. About 300 species of vascular plants and 4 gymnosperms of various categories are conserved in the garden.

Area and locality: Arid and semi-arid regions of Rajasthan & Gujarat state.

Achievements: During the year total **45 plant species** were collected and identified from arid zone of Rajasthan & Gujarat. Among the entire collection, **08 species were under threatened category** *viz*. *Abutilon bidentatum* (Hochst) A.Rich. [Malvaceae]; *Achyranthes aspera* var. *argentea* (Thwaites) Hook.f. [Fabaceae]; *Barleria prionitis* subsp. *pubiflora* (Benth. Ex Hohen.) Brummit & J.R.I. Wood [Acanthaceae]; *Ipomoea carnea* subsp. *fistulosa (*Mart. ex Choisy) D.F. Austin [Convolvulaceae]; *Neurada procumbens* L. [Neuradaceae]; *Oxystelma esculentum* (L.f.) Decne. [Asclepiadaceae]; *Tephrosia pentaphylla* (Roxb.) Sweet [Fabaceae]; *Ziziphus truncata* Blatt. & Hallb. [Rhamnaceae]. A new section of *Santalum album* L. has been developed in AZRC garden premises and 15 new sapling of the same have been transplanted there. Besides these, a local field survey was undertaken to Kailana, Machiya Biological Park and Indroka area in Jodhpur and seeds of *Acacia jacquemontii* Benth and *Pavonia arabica var. massuriensis* Bhandari were collected for further multiplication.

***Ex-situ* conservation**: Work done in Botanical garden: 25 seedlings of *Anogeissus sericea var. nummularia* King ex Duthie, *Bauhinia racemosa* Lam., *Ficus tsjakela* Burm.f., *Guazuma ulmifolia* Lam., *Moringa oleifera* Lam. and *Santalum album* L. were transplanted in various blocks. Collected seeds and tubers of 12 plant species viz. *Albizia lebbeck* (L.) Benth., *Holoptelea integrifolia* (Roxb.) Planch., *Gmelina arborea* Roxb. ex Sm., *Ceiba pentandra* (L.) Gaertn., *Caralluma fimbriata* Wall., *Dalichampia scadens* var. *cordafana Pavonia arabica* var. *massuriensis* Bhandari, *Euphorbia jodhpurensis* Blatt. & Hallb., *Seddera latifolia* Hochst. ex Steud., *Senna alata* (L.) Roxb., *Dichrostachys cinerea* (L.) Wight & Arn. and *Anogeissus pendula* Edgew. for multiplication in garden. Sown approx. 1,000 seeds of 25 plant species viz. *Prosopis cineraria* (L.) Druce, *Sapindus laurifolius* Vahl, *Moringa concanensis* Nimmo ex Dalzell & Gibs., *Pongamia pinnata* (L.) Pierre, *Anogeissus sericea var. nummularia* King ex Duthie, *Holoptelea integrifolia* (Roxb.) Planch, *Senna alata* (L.) Roxb., *Gmelina arborea* Roxb. ex Sm., *Cassia fistula* L., *Albizia lebbeck* (L.) Benth., *Tecoma stans* (L.) Juss. ex Kunth, *Moringa oleifera* Lam., *Colophospermum mopane* J.Kirk ex Benth., *Dichrostachys cinerea* (L.) Wight & Arn., *Terminalia arjuna (*Roxb. ex DC.) Wight & Arn, *Terminalia sericea* Buch. ex DC., *Anogeissus sericea var. nummularia* King ex Duthie, *Dalbergia lanceolaria* L.f., *Manilkara hexandra* (Roxb.) Dubard, *Carissa carandas* L., *Santalum album* L., *Justicia adhatoda* L., *Murraya koenigii* (L.) Spreng. and *Tephrosia falciformis* Ramaswami in poly bags for multiplication and conservation in garden and also provided saplings to various institutions, visitors as well as researchers and forest department on demand.

Pavonia arabica var. *massuriensis* Bhandari

Moringa concanensis Nimmo ex Dalzell & A.Gibson

Commiphora wightii (Arn.) Bhandari

Caralluma fimbriata Wall.

Tecomella undulata (Sm.) Seem.

Dalechampia scandens var. *cordofana* (Hochst. ex Webb) Müll.Arg.

Visitors getting information on *ex-situ* conservation from BSI, AZRC official

Project 2: Curatorial work at Herbarium and digitization of Herbarium specimens.

Executing officials: Dr. R.K. Singh, Botanist, Dr. P.K. Deroliya, Bot. Asstt., Shri Ramesh Kumar, Bot. Asstt., Shri Amit Kumar, Sr. Pres. Asstt.

Background : BSJO herbarium is holding plant specimens of Rajasthan and Gujarat state in total approx. 53160 specimens. Out of which metadata from *ca*. 42,257 specimens have been entered in excel sheet till date. Maintenance of BSJO is in progress.

Achievements: During the period under report Metadata entry: 4512; Scanning of Herbarium specimens: 1821 (TIFF and JPG format); Specimens Identification: 235; Specimens Accession: 1602; Specimens incorporated: 1662.

Scanning of herbarium sheet

Sorting of specimens for mounting

Project 4: **Landscape analysis and Floristic diversity of** Keoladeo National Park and Sambhar Lake **Ramsar sites of Rajasthan, India**
Executing Officials: Dr. Ravi Kiran Arigela, Scientist – C, Dr. S.L. Meena, Scientist – E, and Dr. Purushottam Kumar Deroliya, Botanical Assistant
Duration: 2023–2026

Background: The Amrit Dharohar strategy, with four main components namely, Species and Habit Conservation, Nature Tourism, Wetlands Livelihoods and Wetlands Carbon has a vision to maintain a healthy and effectively managed network of Ramsar sites in India. The goal further extends to devise and develop biodiversity inventories for these ecologically vulnerable Ramsar sites in India ensuring effective conservation measures to safeguard and enhance their biological diversity. Present research will bring out the capacious account of plants of Keoladeo National Park and Sambhar Lake Ramsar sites which is essential for long time monitoring and conservation at species level.
Area and locality: 268.73 km2 (Keoladeo NP - 28.73 km^2 + Sambhar Lake - 240 km^2)
Keoladeo National Park (Figure 1 B.) or Keoladeo Ghana National Park (formerly known as the Bharatpur Bird Sanctuary) is a famous avifauna sanctuary in Bharatpur district of Rajasthan, India. It is a complex of ten artificial, seasonal lagoons, varying in size which is situated in a densely populated region. The area was designated as a bird sanctuary on 13 March 1976 and a Ramsar site under the Ramsar Convention in October 1981 and with the Reference site number 230. Because of its exceptional avian biodiversity, in 1985 Keoladeo National Park was also declared a UNESCO World Heritage Site in 1985, under critera iv but, after 2005 criteria update it fell under criteria x. Keoladeo National Park is 2 km (1.2 mi) south-east of Bharatpur and 55 km (34 mi) west of Agra. It is spread over approx. 28.73 km^2. One third of the Keoladeo National Park is wetland with mounds, dykes, and open water with or without submerged or emergent plants.

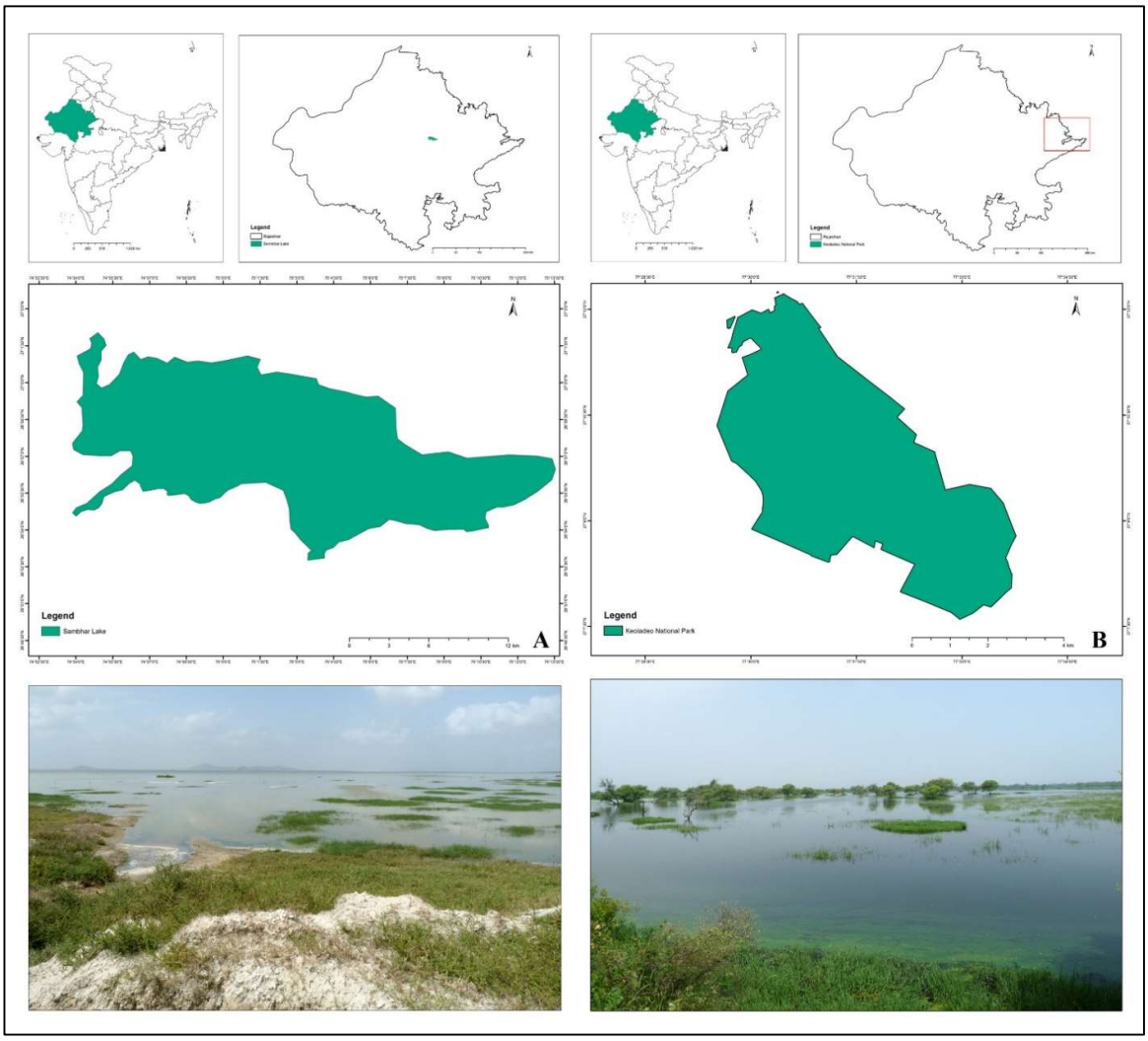


Figure 1. Ramsar sites of Rajasthan. A. Sambar Lake, B. Keoladeo National Park

The Sambhar Lake, India's largest inland salt lake occupies 240 km^2 geographical area lies between 26°52′–27°02′N, 74°54′–75°14′E (Singh & Sen, 2023) and located in Jaipur, Ajmer and Nagaur districts of Rajasthan (Figure 1 B). It is surrounded by sand flats and dry thorn scrub and fed by seasonal rivers Mendha, Runpangarh, Khandel, and Karian and streams. Sambhar lake has been designated as a Ramsar site on 23 March 1990 with reference site number 464 (recognized wetland of international importance) because the wetland is a key wintering area for tens of thousands of pink flamingos and other birds that migrate from northern Asia and Siberia. The vegetation present in the catchment area is mostly xerophytic type dominated by thorn scrub.

Achievements: During 2023 to 2024 two field tour conducted [Nine Days (10 August, 2023 to 18 August, 2023) & 8 days (30 January, 2024 to 06 February, 2024] and collected 380 filed numbers. Procured the Ramsar sites of Rajasthan shape files for mapping from the Wetlands International South-Asia, New Delhi. 380 ground truth points were collected for mapping the land resources of the Keoladeo National Park and Sambhar Lake Ramsar Sites of Rajasthan. 300 filed numbers were identified and digital herbarium labels were prepared. Collected tubers of *Pancratium* sp., fruits of *Creteva* sp., *Corallocarpus epigaeus* and *Vincetoxicum spirale* and planted at AZRC garden for further studies. Critically endangered plant *Commiphora wightii*, Halophytes like species of *Suaeda* from Sambhar Lake, medicinal plants like *Rauvolfia tetraphylla* and *Luffa echinata* from Keoladeo National Park were collected. Recorded the plant bird interaction as these 2 Ramsar sites are important bird areas (IBA).

Commiphora wightii (Arn.) Bhandari

Flamingos in Sambhar Lake

Paspalum distichum L.

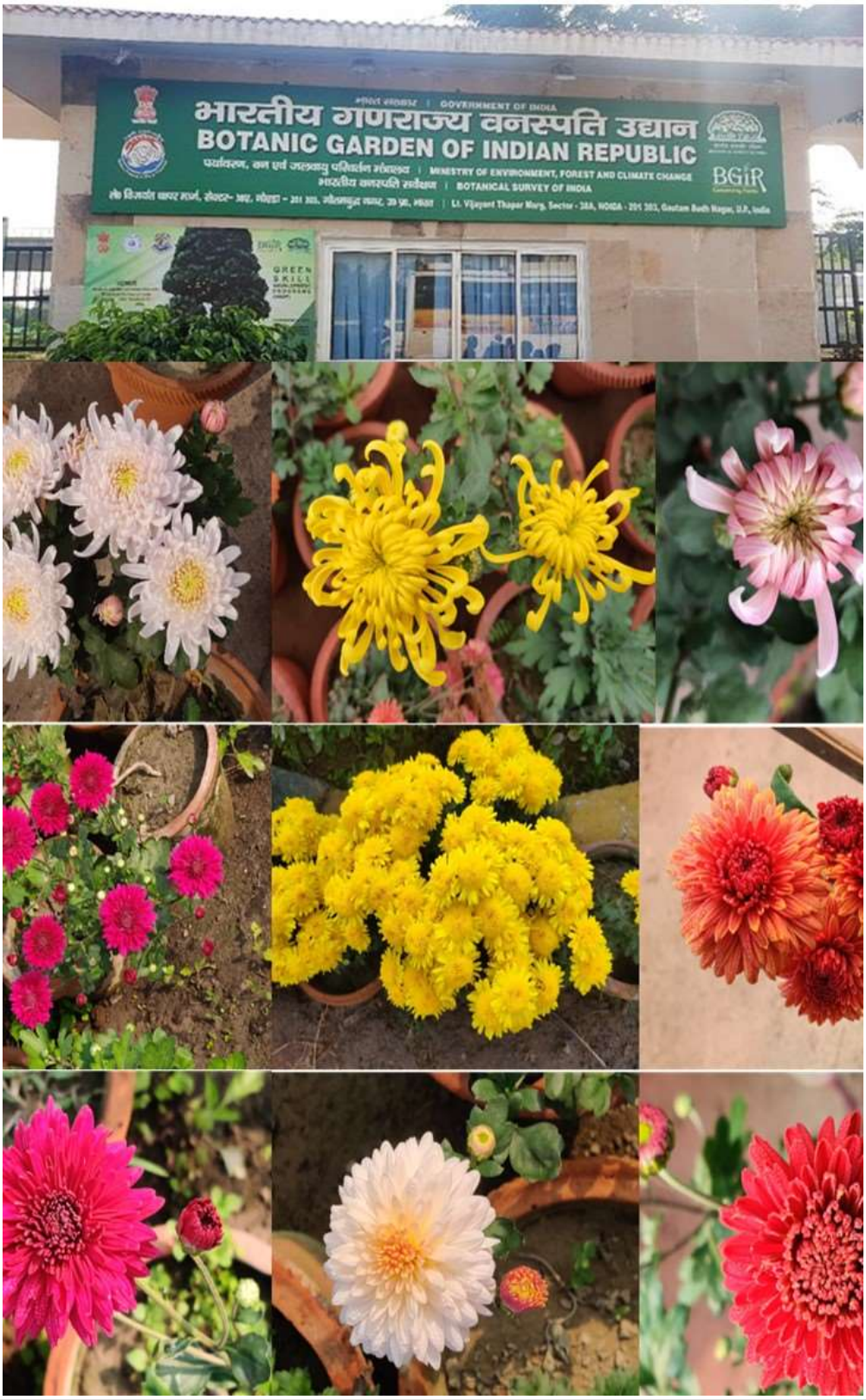
Sarus Crane in Keoladev NP

Project 5: Grasses of Rajasthan.
Executing official: Dr. Pushpa Kumari, Scientist- E
Duration: 2023-2026

Area & locality: Rajasthan is the largest Indian state by area and the seventh largest by population. It covers 342,239 sq.km or 10.4 per cent of India's total geographical area. It is on India's northwestern side, where it comprises most of the wide and inhospitable Thar Desert (also known as the Great Indian Desert) and shares a border with the Pakistani provinces of Punjab to the northwest and Sindh to the west, along the Sutlej-Indus River valley. It is bordered by five other Indian states: Punjab to the north; Haryana and Uttar Pradesh to the northeast; Madhya Pradesh to the southeast; and Gujarat to the southwest. Its geographical location is 23°3' to 30°12' North latitude and 69°30' to 78°17' East longitude, with the Tropic of Cancer passing through its southernmost tip. The geographic features of Rajasthan are the Thar Desert and the Aravalli range, which runs through the state from southwest to northeast, almost from one end to the other, for more than 850 km. The Aravalli range runs across the state from the southwest peak Guru Shikhar (Mount Abu), which is 1,722 m in height, to Khetri in the northeast.

Achievements: The team has consulted several books on the grass flora of India as well as other countries for reference. As a preliminary checklist of grasses from Rajasthan 280 species under 100 genera have been listed from the different literature available. Study of Grass morphology: For identifying features of the different genera and species, morphological study is being done with the help of literature manuals and specimens. The work needs a proper stereo zoom microscope for good results. Local trips were carried during the season in nearby the Jodhpur surrounding areas and *ca*. 30 species of grasses from in and around Jodhpur (Kailana, Machia, Mehrangarh, Machia fort) were collected. Further, more than 250 herbarium specimens under *Acrachne, Aeluropus, Alloteropsis, Andropogon, Apluda, Aristida, Arthraxon, Arundo,* and *Avena* genera have been studied and 22 species have been identified from the collected specimens.

BOTANICAL GARDEN OF INDIAN REPUBLIC, NOIDA



BOTANICAL GARDEN OF INDIAN REPUBLIC, NOIDA

Project 1: QR based plant modeling based plant labeling for the Plant species in entire woodland of BGIR, Noida

Executing officials: Dr. Sandeep Kr. Chauhan, Scientist-F, Dr. Giriraj Singh Panwar, Scientist-E, Dr. Priyanka A. Ingle, Scientist-D and Dr. Mahendra Kumar Singhadiya, Botanist

Duration: 2023-2026.

Background: Recent advances in digital technology, coupled with rapidly increasing interest in the creation and dissemination of digitized specimen data for use in broad-scale research by botanists and other organismal scientists, have encouraged the development of a variety of new research opportunities in the botanical sciences. The task of QR code inventory of the plant diversity of BGIR campus was undertaken systematically and intensively to cover the significant information about the species such as flowering, fruiting, uses etc. and also to covers most species in various seasons. Field observations will be recorded and plant will be photographed with proper identification of the species.

Area Surveyed/locality of the allotted Project: NA

Achievements (from 17th July, 2023* to till date): The demographic Survey of plant species growing in different Zones of the garden was conducted viz. Zone-4 (Tropical Deciduous Forest), Zone-5 (Tropical Thorny/Scrub Forest), Zone-6 (Tropical Broadleaf Forest), Zone-7 (Subtropical Dry Evergreen Forest), and Taxonomical Section of the Garden. The Botanical names of plant species growing in the zones 4-7 have been updated as per POWO. Plant species description of 56 species growing at BGIR garden for the development of QR code was done for plants including *Acacia catechu* (L.) Willd., *Aegle marmelos* (L.) Correa, *Albizia lebbeck* (L.) Benth. *Eucalyptus globules* Labill. etc.

CENTRAL BOTANICAL LABORATORY, HOWRAH

CENTRAL BOTANICAL LABORATORY, HOWRAH

Project 1: Nutraceutical value of wild edible plants of North-East Region in India
Executing Officials: Dr. Tapan Seal, Dr. Kausik chaudhuri, Ms Basundhara Pillai
Duration: 2022-2025

Background: Most vegetables are commonly cooked before being consumed. Cooking is known to cause major chemical changes in vegetables, affecting the concentration and bioavailability of beneficial components. However, depending on changes in process circumstances and physical and nutritional properties of vegetable species, both positive and negative impacts have been documented (1-4). Heat treatments have a significant impact on the physical qualities of vegetables (5). Texture and colour are crucial factors in the cooking quality of vegetables, and they can have a significant impact on customer purchases of these foods. Because of the disruption of the membrane and the resulting loss of turgor, textural changes are frequently significant (5). Furthermore, when compared to fresh veggies, cooked vegetables have a worse colour quality (6). Although it is frequently recommended that people eat fresh, unprocessed plant foods, evidence is accumulating showing cooking vegetables increases the in vivo bioavailability of numerous beneficial chemicals (7). However, there is currently a lack of information on the influence of cooking on the nutritional characteristics of vegetables (7). In reality, most published research on the nutritional qualities of cooked vegetables focuses on a single vegetable (2), a group of vegetables (4), or a single phytochemical group (4). To gain insight into the effect of cooking, a more comprehensive investigation of nutritional and physical aspects of vegetables is required. The impact of cooking methods (boiling, microwave heating, and frying) on nutritive content (protein, fat, carbohydrate, minerals, vitamin, antinutrients) and overall antioxidant capabilities of vegetables will be assessed in this study.
Area & Locality: North-Eastern Region in India

Achievements: Effect of boiling and microwave cooking on protein, carbohydrate, and fat content in twenty wild edible plants were studied. Effect of boiling and microwave cooking on percent concentration of various minerals like Na, K, Ca, Cr, Mg, Cu, Zn, Mn and Fe in twenty wild edible plants were studied. Effect of boiling and microwave cooking on the antioxidant properties (TPC, TFC, RP, DPPH and ABTS) in twenty wild edible plants were studied. Effect of boiling and microwave cooking on the antinutritional properties (Oxalate, tannin, saponin, phytate and cyanogenic glycoside) in twenty wild edible plants were studied.

Project 2: Diversity of Soil Cyanoprokaryotes and Algae in AJC Bose Indian Botanic Garden, Howrah
Executing officials: Dr Pratibha Gupta, Scientist-F
Date of initiation: July, 2022 & Date of completion: March, 2025
Objectives : The main aim and objectives of the study is to survey, collection and identification of soil cyanoprokaryotes and algal samples from various sites of 25 divisions of AJCBIBG, Howrah to carryout taxonomic studies to assess the diversity of soil cyanoprokaryotes and algae and its distribution.

Background : Cyanoprokaryotes and algae are the most primitive photosynthetic organism on this earth. The most primitive forms of cyanoprokaryotes and algae are found initially in aquatic environment from where actually the life originated. Lots of studies have been done on freshwater and marine algae but work on soil algae is being done very sparsely. The AJC Bose Indian Botanic Garden (AJCBIBG), Howrah is having wide range of variety of the soil and climatic conditions. Studies have been done in the Garden on cyanoprokaryotes and algae in the water, on the trees and other plants of the Garden but the study of cyanoprokaryotes and algal profile on the soil is still remain untouched. So keeping in view studies were initiated to study the pattern of soil cyanoprokaryotes and algal diversity inside the Garden in different areas of all divisions.

Area and locality of the allotted project: Soil cyanoprokaryotes and algal samples from all 25 Divisions of the AJC Bose Indian Botanic Garden area year wise. In first phase studies were initiated and samples collected from 01 to 09 division of AJCBIBG (up to June, 2023). In second phase samples collected from 10 to 18 division of AJCBIBG from July, 2023 to continuing).

Achievements/ Summary of work done: Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah is situated on the west bank of river Ganga (Hooghly) and spread in 273 acres. The garden is divided into 25 divisions. Soil cyanoprokaryotes and algal samples have to be collected from all 25 Divisions of the AJC Bose Indian Botanic Garden area and year wise. So the attempt has been made to study Soil cyanoprokaryotes and algae for that the samples were collected from 10 to 18 divisions of AJCBIBG in second phase. During survey in 09 field visits 2175 field Photographs and 116 Videos were taken. GPS readings were recorded from the sample collected areas of different divisions. Total 100 numbers of soil samples were collected for Microscopic studies. Maximum soil samples were collected on the month of June, 2023 followed by September, May, April, July, August, October, December and November, 2023. Division wise maximum samples were collected from Division no. 06 followed by Division nos. 01, 09, 07, 02, 03. 04, 05 and 08. All the samples were brought into the Laboratory and preserved in Formalin and properly maintained for identification. Soil Samples were analysed under Leica DM 2500 sophisticated Research Microscope using Leica Qvin 3.2 Image Analysis Software and Leica Application Suit V4 Software with annotation for Identification and 744 Photomicrographs were taken. Altogether 109 species of different classes have been identified and 04 new records from India. Some of the species repeatedly observed in the samples. Further work is in progress.

Project 3: Study of Cyanoprokaryotes and Algal Samples of Shillong :

Achievements/ Summary of work done : During tour to Eastern Regional Centre, Shillong to attend the HOO meeting water and soil samples were collected. The circle has one associated Garden having an area of ca 25 acres situated at Barapani, Ri-Bhoi District. Two nos. of soil samples were collected from BSI Shillong Garden. Three nos. of samples (one from water body and two from soil) were collected from Barapani Garden. During survey 42 field Photographs and 05 Videos were taken. Altogether 05 numbers of samples were collected from BSI Shillong Garden and Barapani Garden for Microscopic studies. All the samples were brought into the Laboratory and preserved in Formalin and properly maintained for identification. Samples were analysed under Leica DM 2500 sophisticated Research Microscope using Leica Qvin 3.2 Image Analysis Software and Leica Application Suit V4 Software with annotation for Identification and 102 Photomicrographs were taken. Total 23 species of different classes of cyanoprokaryotes and algae have been identified. Some of the species repeatedly observed in the samples. Work is in progress.

CENTRAL NATIONAL HERBARIUM, HOWRAH

CENTRAL NATIONAL HERBARIUM, HOWRAH

Project 1: Molecular phylogeny, morphology and taxonomy of Boletoid mushrooms in Uttarakhand
Executing official: Dr. Kanad Das, Scientist-F
Duration: 2022-2025

Background: Boletoid mushrooms are fleshy, readily decaying (putrescent) poroid macrofungi (mushrooms) in the order Boletales of Agaricomycotina (Basidiomycota). They belong to three families namely: Boletaceae, Suillaceae and Gyroporaceae. They are reported to be most popular edible fleshy mushrooms and appreciated widely around the globe. As ectomycorrhizal fungi they are also known to play the key role in forest ecosystem by establishing mutual association with forest trees. These fungi also protect host trees (ectomycorrhizal partners) from attack by parasites, predators, nematodes and other soil pathogens. Presently Boletoid mushrooms comprise over 1050 species from the world belonging to about 73 genera. Earlier, systematics of these mushrooms was mainly established considering their macro- and micromorphology. But this scenario has drastically changed during past one decade when molecular phylogeny was applied in combination with morphology to revise the systematics of these mushrooms. This resulted in the discovery of several novel genera and numerous new species from all over the world especially in Boletaceae.

Mycobiota of Uttarakhand (western Himalaya) is exceptionally diverse in terms of ectomycorrhizal macrofungi as evidenced in numerous relevant literatures. Boletoid mushrooms represent the dominant ectomycorrhizal mycobiota and controls the growth and development of forest trees in Uttarakhand. Present project will be a pioneer and holistic study in applying combined approach of molecular phylogeny and morpho-taxonomy of immensely important Boletoid mushrooms of Uttarakhand. This will reveal 1) the diversified mycobiota of the valuable group of wild mushrooms 2) unveil evolutionary relationship among the existing genera 3) uncover novel genera and new species from this state 3) resolving species complexes (if any).
Area & Locality: The entire region of Uttarakhand.

Achievements: A macrofungal survey was undertaken to four districts of Uttarakhand (Rudraprayag, Chamoli, Bageshwar and Haridwar) w.e.f. 31.07.2023 to 19.08.2023. Baniakund, Chopta, Mandal, Lohajung, Cooling, Didna, Bageshwar, Dhur, Dhakuri, Motichur, Raiwala and adjoining forests were surveyed during this period. About 56 field nos. belonging to 35 species of Boletoid mushrooms were collected. Macromorphological characterization of all the samples were done in the field or basecamp. All the collections are well preserved and under study.

A total of nine new species (*Cyanoboletus paurianus* K. Das & A. Ghosh, *Harrya olivaceobrunnea* K. Das, *Leccinellum binderi* K. Das, A. Ghosh & Vizzini, *Russula boddingii* Hembrom, D.Chakr., A.Ghosh & K.Das, *Russula pseudoflavida* A.Ghosh, Hembrom, I.Bera & Buyck, *Russula shoreae* D.Chakr., A.Ghosh, K.Das & Buyck, *Thaxterogaster shoreae* A. Ghosh, D. Chakr., K. Das & Vizzini, *Xerocomellus himalayanus* D. Chakr & A. Ghosh, *Xerocomus uttarakhandae* K. Das, Sudeshna Datta & A. Ghosh,) and seven species as new record to India (*Aureoboletus miniatoaurantiacus* (C.S. Bi & Loh) Ming Zhang, N.K. Zeng & T.H. Li, *Boletus bainiugan* Dentinger, *Cyanoboletus macroporus* Sarwar, Naseer & Khalid, Phylloporus gajari Hosen & Zhu L. Yang, *Rugiboletus extremiorientalis* (Lj.N. Vassiljeva) G. Wu & Zhu L. Yang, *Veloporphyrellus latisporus* J. Khan & S. Ullah, *Xerocomus fraternus* Xue T. Zhu and Zhu L. Yang) has been discovered. A total of 33 collections belonging to 19 species of family Boletaceae (Boletales, Basidiomycota) were identified during this period.

Project 2: Bio-Prospecting and Economic Potential of Selected Marine Macro Algae of India
Executing official: Dr. M. Palanisamy, Scientist-E
Duration: 14th November, 2022–31st March, 2024

Background: Marine flora is taxonomically very diverse and fall into mangroves, seagrasses, microalgae and marine macro algae (seaweeds). Among them marine macro algae (Seaweeds) play a vital role in the regulation of marine ecosystem. The plant body of marine macro algae is

differentiated into holdfast for anchoring, stipe to keep erect the thallus and fronds for photosynthesis and storage of food materials. Marine macro algae belong to the division thallophyta of the sub–kingdom cryptogamae and broadly classified into three classes viz. Chlorophyceae (Green), Phaeophyceae (Brown) and Rhodophyceae (Red), based on the nature of colour, storage of food materials, cell wall and type of photosynthetic pigments (Myslabodski, 2001). In recent years the importance and the economic values of this promising resources has got more momentum throughout the world. India (8°–37° N and 68°–97° E) comes in seventeen megadiversity countries (www.conservation.org) and turn out to be 7th largest country in the world with 2.4% of the global geographical area. Coastline of India endowed of ca 7,500 km long with Exclusive Economic Zone (EEZ) of around 2.5 million km^2. The marine macro algal diversity is vaster in West coast of India than the East Coast of India. Marine algae represent one of the richest sources of bioactive compounds, and algae-derived products are increasingly used in medical and biochemical research (Mayer &Lehmann, 2002). Among the marine organisms, the macroalgae occupy a special site as a source of biomedical compounds (Manilal & al., 2010) and recognized as potential sources of the antibiotic substances. Synthesis of different metabolites from seaweeds is an indicator of the presence of antimicrobial active compounds (Chiheb & al., 2009).
Area & Locality: The entire region of India.

Achievements: Two field tours were conducted to selected coastal areas of Tamil Nadu, Kerala (30.07.2023 to 08.08.2023) and Gujarat (24.12.2023 to 31.12.2023) for collection of biomasses of selected marine macro algae. Totally 55 number of marine macro algal samples biomass were collected and all samples were washed properly and shade dried and stored in airtight containers for further use. Out of 55 samples 15 samples were selected for bio profiling analysis. Using standard methodologyS biochemical, phytochemical and cytotoxicity analysis were done and the results were quite interesting. Samples preparation work is in progress for GCMS analysis to find out the useful chemical compounds.

Fifteen Marine macro algae samples were taken for genomic DNA isolation using DNeasy Plant Prokit (QIAGEN). DNA quality and quantity were checked using NanoDrop Lite UV spectrophotometer and by running the genomic DNA on 0.8% agarose gel. The genomic DNA quantity ranged from 20-100 ng/µl. Alshehri *et al*., (2019) recommended rbcl marker for seaweed identification with species level. Synthesized the primers for rbcl marker. Primers diluted for working concentration and the primer sequence size are 20–26 bp. Successfully two green algal samples given good result of DNA sequence and PCR amplification. The remaining samples DNA sequence and PCR amplification and NCBI GenBank submission of sequence will be completed timely.

Padina pavonica (L.) Thivy

MM Algae drying

Project 3: Morpho-Molecular and Phytochemical identification of 30 CITES Listed Plants in High International Trade
Executing official: Dr. Avishek Bhattacharjee, Scientist-D, Dr. Tapan Seal, Scientist-E, Mr. Ranjith Layola M.R., Botanist, Ms Farheen Banu, Preservation Assistant cum Garden Overseer
Duration: 1st July, 2023 – 31st March, 2026

Background: Identification of threated species is one of the primary mandates of BSI. The proposed project will help in identifying the highly traded CITES listed plants with fragments of samples. The 'Wild Life (Protection) Amendment Act, 2022' now included implementation of the provisions of the CITES. A new chapter titled "Chapter VB: Regulation of International Trade in Endangered Species of Wild Fauna and Flora as per Convention on International Trade in Endangered Species of Wild Fauna and Flora" provides the mechanism for fulfilling government obligations under CITES. Hence, it is just a matter of time when BSI, being a Scientific Authority of CITES, must play more active role in identification of CITES listed plants.
Area & Locality: The entire region of India.

Achievements: Two field tours were sanctioned for this project during 2023-2024 as per the final Annual Research Programmes (ARP) 2023-24 BSI (vide File no. BS1-288/1/ARP/2023-24-Tech./ 313 dated 6th July 2023. However, due to unavailability of TE grant, the second tour could not be conducted and the tentative target for working on 10 species in the first year could not be achieved.

Consulted the ASSAM herbarium, BSI ERC, Shillong and Orchid Research Centre Herbarium, Tippi, Arunachal Pradesh for finding the geographical distribution of CITES listed plants available in Northeast India. Collected six CITES listed plants from different parts of northeast India such as *Aquilaria malaccensis* Lam., *Picrorhiza kurroa* Royle ex Benth., *Podophyllum hexandrum* Royle, *Calanthe sylvatica* (Thouars) Lindl., *Thunia alba* (Lindl.) Rchb.f., and *Vanda cristata* Wall. ex Lindl. Phytochemistry of 4 accessions have been done (*Vanda cristata, Aquilaria malaccensis;* (95306, 95307, 95349, 95324). Rest of the accessions have been dried for subsequent phytochemistry.

DNA Sequencing done (nuclear and chloroplast markers) of the 20 samples including *Aquilaria malaccensis, Vanda cristata, Podophyllum hexandrum* etc. Checked quality control report of samples sent for Sanger sequencing and correspondence were made. The quality of the sequences obtained after Sanger sequencing were checked and contigs were prepared. The identity of each species was confirmed by blasting at NCBI GenBank.

Project 4: **Taxonomic Revision of *Meconopsis* Vig. (Papaveraceae) in India**
Executing officials: Dr. Kumar Avinash Bharati, Scientist-D, Dr. Anand Kumar, Botanist, Dr Rajib Gogoi, Scientist-F
Duration: 2023–2026

Background: The members of the genus *Meconopsis* are confined to Indian Himalayan regions. The latest taxonomic account of the genus in the Indian context was published by Debnath & Nayar (1993) in 'Flora of India, vol. 2' about 30 years back and the work was with insufficient nomenclature citation, without precise information on distribution, without any information on types and other specimens examined, no information on conservation status and threats, no information on uses or their potential scope for sustainable utilization, with only a few line drawings and photographs. After Debnath & Nayar's work, no revisionary studies / comprehensive work covering all species of *Meconopsis* have ever been attempted in Indian context.
Area & Locality: The entire region of India.

Achievements: The 26 days long field tour was conducted in the state of Uttararkhand from 17.07.2023 to 11.08.2023. We trekked about 150 km during the field tour and reached as the maximum altitude of 4400 m. We located and collected *Meconopsis aculeata* Royle which is endemic to Western Himalaya and observed a small population of *Meconopsis robusta* Hook.f. & Thomson which is restricted to only Uttarakhand in India. We also located *Meconopsis simplicifolia* (D.Don) G.Don from Sikkim. Second field tour was not conducted due to lack of fund.

We consulted the herbarium of Wildlife Institute of India (WII) on 17th July and located only specimen of *Meconopsis aculeata* Royle collected by G.S. Rawat on the way to Hemkund in 1986. Besides, we also consulted Forest Research Institute, Dehradun herbarium (DD) and Botanical Survey of India, Northern Regional Centre herbarium (BSD). All the 129 specimens belonging to *Meconopsis* spp. at DD have taken photographed. These belong to *Meconopsis aculeata* Royle, *M. bella* Prain, *M. grandis* Prain, *M. horridula* Hook.f. & Thomson, *M. integrifolia* (Maxim.) Franch., *M. latifolia* Prain., *M. lyrata* (H.A.Cummins & Prain) Fedde, *M. napaulensis* DC., *M. paniculata* Prain, *M. robusta*

Hook.f. & Thomson, *M. simplicifolia* G.Don, *M. superba* King ex Prain and *M. wallichii* Hook. Besides, we have also located one type specimen of *Meconopsis robusta* Hook.f. & Thomson which was mixed with general herbarium specimens. This type specimen was collected by Strachey and Winterbottom form Pass above Namik, Kumaon in Uttarakhand at 8000 ft. There are a total of 82 herbarium specimens at Botanical Survey of India, Northern Regional Centre (BSD) and we have taken photographs of all specimens. All specimens belong to only two species, *Meconopsis aculeata* Royle and *M. robusta* Hook.f. & Thomson which is restricted to Western Himalaya.

Project 5: **Digitization of herbarium specimens (about 5000) belonging to the family Asteraceae**
Executing officials: Dr. Kumar Avinash Bharati, Scientist-D, Dr. Anand Kumar, Botanist
Duration: 2023–2024

Background: The Central National Herbarium holds about 2 million specimens. Type specimens are stored separately which are available on IVH portal (https://ivh.bsi.gov.in/). From the General Herbarium, all Ranunculaceae and Balsaminaceae specimens and representative specimens of the species appeared in Flora of India vols. 1-5, 12, 13 & 23 have been digitized and available on IVH portal. Asteraceae is one of the largest plant families and CAL holds about 40000 specimens. So, the assignment has been taken to digitize specimens of Asteraceae.
Area & Locality: NA

Achievements: A total of 5321 specimens belonging to the family Asteraceae have been digitized. This starts from *Sparganophorus* (G.P. No. 1) and ends with *Eupatorium* (G.P. no. 66). The genera include *Adenoon* Dalzell, *Adenostemma* J.R.Forst. & G.Forst., *Ageratum* L., *Albertinia* Spreng., *Alomia* Kunth, *Blanchetia* DC., *Bolanosa* A.Gray, *Bothriocline* Oliv. ex Benth., *Carminatia* Moc. ex DC., *Centratherum* Cass., *Corymbium* Gronov., *Decachaeta* DC., *Elephantopus* L., *Erlangea* Sch.Bip., *Ethulia* L., *Eupatorium* L., *Fleischmannia* Sch.Bip., *Gutenbergia* Sch.Bip., *Haplostephium* Mart. ex DC., *Herderia* Cass., *Lachnorhiza* A.Rich., *Oliganthes* Cass., *Paquerina* Cass.,, *Phania* DC., *Piptocarpha* R.Br., *Piptocoma* Less., *Piqueria* Cav., *Rolandra* Rottb., *Sclerolepis* Cass., *Sparganophorus* Vaill. ex Crantz, *Spiracantha* Kunth, *Stevia* Cav., *Stokesia* L'Hér., *Trichocoronis* A.Gray and *Vernonia* Schreb. The images and associated metadata have been uploaded on the Indian Virtual Portal (https://ivh.bsi.gov.in/).

Project 6: **Taxonomic Revision of *Ligularia* Cass. (Asteraceae) in India**
Executing officials: Dr. Partha Pratim Ghoshal, Botanist; Dr. Shyam Biswa, Botanical Assistant
Duration: 2023–2026

Background: The genus *Liguraia* is a rhizomatous perennial herb belongs to the family Asteraceae, with couple of ornamental plants with revolute leaves. This genus has known medicinal value because of the presence of eremophilane sesquiterpenoids, which has cytotoxic properties (Xie et al. 2010). The proposed project aims to undertake a comprehensive taxonomic revision of the genus *Ligularia* Cass. in India. *Ligularia*, also known as the Leopard plant distributed in Temperate Eurasian region (mostly in China) represented by 125 spp. There has been no revisionary study done in India to date. So, it is thus essential to have a proper documentation of current status of the genus *Ligularia* in India, which will contribute to a better understanding of the genus within the Indian region and proper management and planning for their conservation and economic utilization.
Area & Locality: The entire region of India.

Achievements: Thorough literature survey revealed that *Ligularia*, mainly distributed in Temperate Eurasian region (mostly in China) represented by 125 spp. India is known to harbour 21 taxa of *Liguria* (Karthikeyan & al., 2020) with varying morphological characteristics. Studied protologues of 12 names. Studied 200 herbarium specimens both online and offline. Made thorough list of plant authors and the associated herbaria. Sorted & identified *Ligularia fischeri* (Ledeb.) Turcz. from specimens collected by Dr. Avishek Bhattacharjee, Scientist 'C' from Valley of flowers (Uttarakhand).

CENTRAL REGIONAL CENTRE, ALLAHABAD

CENTRAL REGIONAL CENTRE, ALLAHABAD

Project 1: Flora of Madhya Pradesh vol. 1 including pictorial checklist (Revised edition):
Executing officials: Dr. Arti Garg Scientist-E: (Team Leader) 07 Families (35 Species), Dr. O.N. Maurya, Sci-D: 18 Families (135 Species), Dr. Arti Garg & Mr. B. Lakshmanudu, Sr. Pres., Asstt.: 10 Families (66 Species), Dr. A.K. Verma, Sci-C: 12 Families (129 Species), Dr. Nitisha Srivastava, Botanist: 15 Families (127 Species), Dr. N. Stalin, Botanist: 08 Families (11 Species), Dr. N. Stalin, Botanist & Dr. Arti Garg, Sci-E: 03 Families (266 Species) and Dr. Saurabh Sachan, Bot. Asst.: 11 Families (84 Species).
Duration: 2022-2024

Background: This project was initiated with the goal to revise and update the old flora of Madhya Pradesh
Area & Locality: The entire state of Madhya Pradesh

Achievements:

Official	Achievements
Dr. Arti Garg Scientist-E (Team Leader)	Completed literature survey
Dr. O.N. Maurya, Sci-D:	Completed Literature Survey
Dr. Arti Garg and Mr. B. Lakshmanudu, Sr. Pres., Asstt.:	Completed and submitted the report, for the work assigned by the team leader.
Dr. A.K. Verma, Sci-C:	Completed and submitted the report, for the work assigned by the team leader.
Dr. Nitisha Srivastava, Botanist:	Completed and submitted the report, for the work assigned by the team leader.
Dr. N. Stalin, Botanist:	Completed and submitted the report, for the work assigned by the team leader.
Dr. Saurabh Sachan, Bot.Asst.:	Completed and submitted the report, for the work assigned by the team leader.

Project-2: Flora of Haiderpur wetland-A Ramsar site, Bijnor & Muzaffarnagar, Uttar Pradesh
Executing Officials: Dr. O. N. Maurya, Sci-D and Dr. Saurabh Sachan, Botanical Assistant
Duration: 2022-24

Background: The 47th Ramsar site of India declared in 2021 and has never been floristically explored except some sporadic collection and bird census. Haiderpur is a floodplain wetland of River Ganga located in close proximity to the Bijnor Barrage between 29º25‟25” N latitude and78º00‟00” E longitude falling in Muzaffarnagar and Bijnor Districts of Uttar Pradesh in the Hastinapur Wildlife Sanctuary. Towards the east of the wetland is River Ganga, to the west is Nizampur and Haiderpur Reserved Forest and Bijnor Barrage on the south of the wetland. This human-made wetland was formed in 1984 by the construction of the Madhya Ganga Barrage on a floodplain of the River Ganga. The entire wetland area is located within the Hastinapur Wildlife Sanctuary and is thus protected under the Wildlife Protection Act of 1972. This freshwater human-made wetland receives backwater flow from River Ganga during monsoons and retains water till the end of February. It comprises varied deep upstream reservoir, shallow flooded land and stretches of river (River Ganga and Solani). In addition to the perennially inundated patches, the wetland boundary also takes into account the seasonal patches and ecologically sensitive areas between these patches. This mosaic is the key to the rich biodiversity associated with the wetland and hence has been included in the wetland boundary. This diverse aquatic habitat thrives with life forms and provides a significant abode specially for the migratory waterbirds. Globally threatened species such as black-bellied tern, sarus crane, Indian skimmer, common pochard, lesser white-fronted goose, woolly-necked stork, Indian spotted eagle, greater spotted eagle, tawny eagle, imperial eagle, smooth-coated otter and swamp deer inhabit the wetland. Aquatic vegetation includes Typha, Phragmites, Ipomoea, Trapa, Nelumbo, Nymphea and

several species of grasses and reeds are also found. This rich aquatic vegetation makes the wetland a very productive ecosystem supporting over 300 species of birds every year. Also, species such as leopard, wild cat, wild boar, spotted deer, python, cobra and mugger are found in the fringes and the c atchment areas of the wetland. The livelihoods of the local community is linked to the wetland. The locals depend on the wetland for fisheries and livelihood options like water chestnut cultivation.
Area & Locality: Muzaffarnagar and Bijnor district,Uttar Pradesh. Majority of the part(90%) of Wetland lies in the Muzaffarnagar district and rest of the part lies in Bijnor district on both sides of Madhya Ganga Barrage.

Achievements: During the study period, 04 field tours were conducted, where overall 319 field numbers and 900 total specimens were collected. A total of 655 photographs were taken and 200 field numbers and 107 species were identified.

Haiderpur gate

Haiderpur view

Ludwigia adscendens (L.) H.Hara

Barleria prionitis L.

DECCAN REGIONAL CENTRE, HYDERABAD

Project 1: Flora of Sri Lankamalleswara Wildlife Sanctuary (464.42 sq.km) Kadapa District, Andhra Pradesh.
Executing Officials: Dr. Sankararao Mudadla, Scientist-D and Dr. Peddi Harikrishna, Bot. Asst.
Duration: 11th November 2022 – 2025

Background: In India, 21.3% of the total geographical area is under forest cover and out of this 1,62,099.5 Km2 (4.93% of the total area) is under protected area network featuring 104 National parks, 544 Wild life sanctuaries, 46 community reserve area, 77 conservation reserves. Among them wild life sanctuaries comprise of larger extent of area 118931.80 Km2 (3.62%) and they are demarcated from reserve forests to protect certain rare species/habitats (WII-ENVIS, 2021). The wildlife protected areas in India are once originally reserve forests and hence have had a history of exploitation and certain rights are provided for the people in the form of collection of non-timber forest products leading to disturbances in addition to back ground natural disturbance in these forests (Tripathi and Singh, 2009). Hence, for fulfilling the conservation goals under REDD+ mechanism of UNFCCC which focuses on preserving forest diversity, forest carbon stock as well as socio-economic upliftment of forest dependent people; the information on plant resources and relationship between vegetation and environment will be of most useful (Aye et al., 2014). Thus, information on plant

diversity of wildlife protected areas is of immense importance to design the conservation strategies to strengthen the conservation modules by involving the local people in these protected areas.

Sri Lankamalleswara Wild Life Sanctuary in one among the 13 sanctuaries present in Andhra Pradesh established in the year 1998. It was extended over 464.42 Sq. Kms (Fig. 1.). Although the sanctuary was declared with the sole purpose of protecting the habitat of the Jerdon's Courser, many other species are also benefited, perhaps more than the target species. This project was initiated with the objective of Survey, Collection and Identification of the Flora of Sri Lankamalleswara Wildlife Sanctuary (464.42 sq.km) Kadapa District, Andhra Pradesh

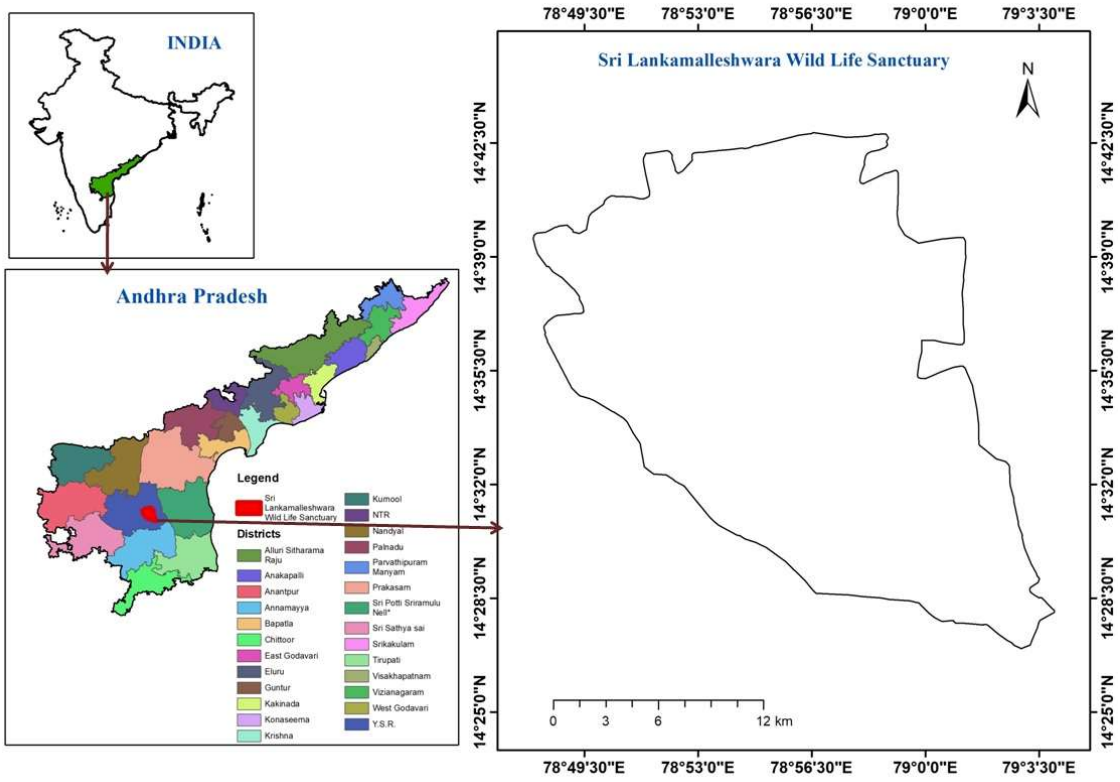


Fig.1. Sri Lankamalleswara Wild Life Sanctuary map

Achievements: During the reference period, the team conducted one field tour to Sri Lankamalleswara Wild Life Sanctuary from 23.09.2023 to 28.09.2023 and collected 107 field Numbers, identified 31 field numbers. Another field Conducted field tour to Sri Lankamalleswara Wild Life Sanctuary from 30.12.2023 to 04.01.2024 and collected 65 filed numbers. The relevant literature was collected from the DFO, Office, Kadapa.

Project 2 : Flora of Pakhal Wildlife Sanctuary (839 sq.km), Telangana.
Executing Officials: Dr. L. Rasingam, Scientist-E
Dr. Peddi Harikrishna, Bot. Asst.
Date of initiation: 28th June, 2023 - March, 2026

Background: One the mandates of Botanical Survey of are the floristic survey and documentation of Protected Areas. The Deccan Regional Centre of BSI being located in Telangana it is necessary to cover the floristically rich areas of this newly formed state. The Protected Areas (PAs) in the Telangana State include three National Parks (Kasu Brahmananda Reddy, Mahavir Harina Vanasthali and Mrugavani), two Tiger Reserves (Kawal and Amarabad) and seven Wildlife Sanctuaries

(Eturunagaram, Pakhal, Pranahita, Kinnerasani, Manjira, Pocharam and Shivaram). These PAs harbour much of the representative flora of the State.

Pakhal Wildlife Sanctuary is located beside the Pakhal Lake, which is an artificial lake, situated in the vicinity, was constructed during the first decade of the 13th century (1213 AD), by Ganapati Deva, the Kakatiyan Ruler. The name of Pakhal Wildlife Sanctuary was derived from the name of the person who excavated the lake. The Sanctuary is situated in Bhupalapally district of Telangana state and lies between 17°57′ N - 79°59′ E. and covers an area of 839 km2. The altitude varies between 280-300 feet, the temperature varies from 150 C to 450 C., and annual rainfall around 1,225 mm.

The sanctuary was established in the year 1952. It consists of a large plateau bounded by low hill and is rich with diverse natural vegetation, which includes tropical dry deciduous mixed forests, mixed teak and bamboo forests. There are also various species of animals which can be found here. The natural picturesque magnificence and landscape of Pakhal Wildlife Sanctuary is extremely captivating and attracts several tourists throughout the year.

The major objective of this project was survey, collection and identification of Flora of Pakhal Wildlife Sanctuary (839 sq.km), Telangana.

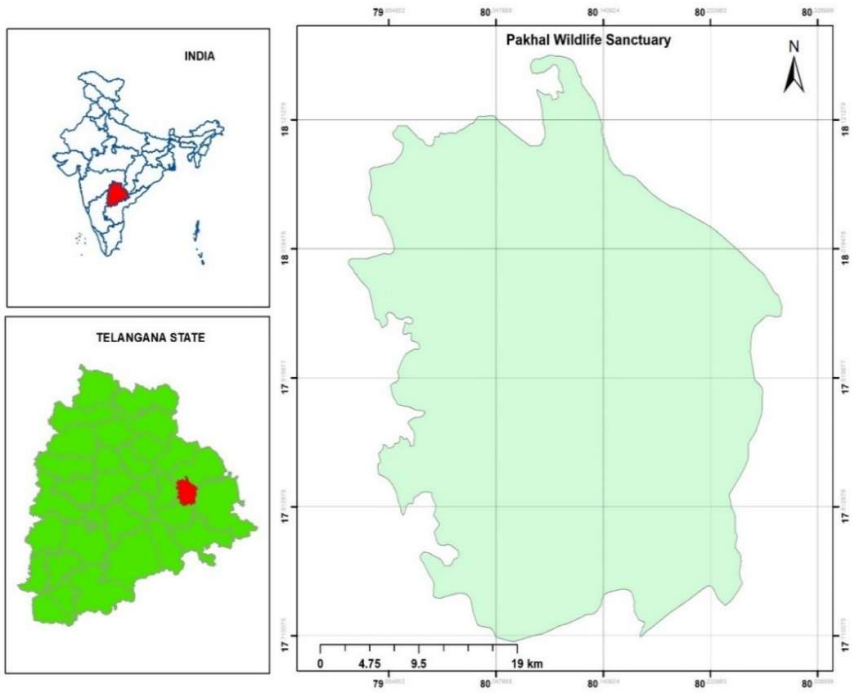


Fig.1. Pakhal Wildlife Sanctuary map

Acievements: During the reference period, the team conducted one field tour to Pakhal Wild Life Sanctuary from 03.11.2023 to 10.11.2023 and collected 197 field Numbers. Further, they have identified 17 field numbers and have also collected relevant literature.

Project 3 : Development of Museum of DRC, Hyderabad
Executing officials (s): Dr. G. Swarnalatha, Botanist
Duration: November 2021-March 2024

Background: This project was initiated in November 2021 with the aim of development of the Museum of DRC, Hyderabad. During the period of November 2021 to March 2023, one wooden display cabinet and five customized display boards were procured. LED lights were installed in one display unit. Fluid preservatives of museum specimens had changed wherever required. Thematic

rearrangement of Museum specimens is completed in one display unit. New labels were prepared wherever necessary. Added several new specimens to the museum
Area and Locality: BSI, DRC, Hyderabad

Achievements: During 2023-24, the team has thematically, re-arranged specimens in racks. They have also replaced liquid preservatives in the specimens. The damaged specimens were discarded and new labels were prepared for the specimens wherever required. The remaining development work will be completed by March 2024.

Project 4: Lichens of Telangana State
Executing officials: Dr. G. Swarnalatha, Botanist
Duration: November 2022 - March 2026
Objective: Detailed survey and study of lichens and to provide a comprehensive account of lichens of the Telangana state.

Background: As far as Lichens of Telangana state is concerned there is no noteworthy contribution. Limited work has been done and only few species i.e. 23 species under 11 genera have been reported by Manoharachary (1979); Venugopal Rao & Manoharachary (1980); Sujatha (2014); Sujatha et al. (2016); Manoharachary & Nagaraju (2017). Of which, 16 species under eight genera are macrolichens. However, a vast part of the state remains unexplored with respect to the lichens and moreover, neither the precise diversity inventory of lichens of the state is available. Therefore, detailed survey and study of lichens from the state is needed. Thus, this project has been proposed for detailed survey and study of lichens and to provide a thorough and comprehensive account of lichens of the state.

Area and Location: Telangana State. Telangana, is situated on the Deccan Plateau and in the center of the Indian peninsula. It lies between 77°14' E to 81°19' E longitude and 15°50' N to 19°55' N latitude with its area of 1,12,077 sq. km. Politically the state has been divided in to 33 districts. The forest area in the states is 21,213 sq. km, which is 18.93% of the state geographical area (India State of Forest Report, 2021). Telangana has four National Parks, 108 Wild life Sanctuaries.

Achievements: During 2023-24, one field tour was undertaken to Bhadradri Kothagudem district as a result collected 75 voucher specimens. During the field tour different localities of Palvancha Forest division and Kinnerasani Forest Wildlife Sanctuary were surveyed. A checklist of lichens reported earlier from the study area was prepared. The relevant literature was collected. In connection to this project, one proposed field tour will be undertaken tentatively from 26th January 2024**.**

EASTERN REGIONAL CENTRE, SHILLONG

Nepenthes khasiana Hook.f.

EASTERN REGIONAL CENTRE, SHILLONG

Project 1: Micropropagation of EET plants of Northeast India
Executing Official[s]: Dr. Deepu Vijayan, Scientist-D
Duration: September, 2020- ongoing

Background: 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.
Area and locality: North East India

Achievements: *In vitro* raised seedlings of *Cymbidium tigrinum* (100 Nos) were transferred for hardening. *In vitro* raised seedlings of *Cymbidium tigrinum* (20 Nos) were transferred for hardening. Maintenance of *in vitro* raised plants of *Armodorum senapatianum* and *Cymbidum tigrinum* in plant tissue culture, garden and polyhouse. Subculturing of *Cymbidium tigrinum* in MS Medium (190 Nos). Maintenance, documentation and hand pollination of *Micropera rostrata* was done for the formation of seed pods. Subculturing of multiple shoots of *Eriodes barbata* in MS Medium (30 Nos). Splitting and maintenance of *Pholidota katakiana*. Subculturing of *Eriodes barbata* in MS Medium supplemented with 0.2% Activated charcoal (33 Nos).

Fig 1: Hand pollination of Micropera rostrata (Roxb.) N.P. Balakr

Fig 2: Multiple shoot experiment of *Eriodes barbata* (Lindl.) Rolfe

Fig 3: Multiple shoot induction in subcultured *Cymbidium tigrinum* C.S.P. Parish ex Hook

Project 2: Understanding the phylogenetic relationships between the genus *Tupistra* and *Rohdea* complexity in Indian phyto-geographical context based on the analysis of DNA Sequences.
Executing officials: Dr. David Lalsama Biate, Scientist 'D'
Duration: 2022-2024

Background: The flowering plant Asparagaceae are placed in the order Asparagales of the monocots. The family comprises about 128 genera containing about 2,929 species and 164 interspecific taxa (The Plant List 2018). There are 7 subfamilies under Asparagaceae (APG III). In India, subfamily Nolinoideae contains 4 genera namely *Aspidistra, Tupistra, Peliosanthes* and *Rohdea*. But, the taxonomic relationship between *Rohdea* and *Tupistra* is poorly understood. In floral morphology, *Rohdea extrorsandra* shows closer relationship with Rohdea whereas in vegetative morphology it shows close relationship with *Tupistra*. But in pollination ecology, the species is much more advanced than both the *Rohdea* and *Tupistra* in evolutionary point of view. The present proposed study aims to understand the phylogenetic relationships between the genus *Tupistra* and *Rohdea* complexity in Indian phyto-geographical context based on analysis of DNA sequences
Area & Locality: Assam, Meghalaya, Nagaland and Arunachal Pradesh

Achievements

a. Field exploration tour

During the period, two local field tours were undertaken to Sumer, Kyrdem Kulai, Zero Point, Raid Nongbri and surrounding areas of Ri Bhoi District, Meghalaya. *Tupistra tupistroides* (Kunth) Dandy and *Peliosanthes* sp., and a total of 21 live specimens of RET plants including nine orchid taxa were collected for *ex situ* conservation at EBG, Barapani and Shillong. Three field tours were also undertaken to Dima Hasao District, Assam, Mokokchung District, Nagaland and West Kameng and Tawang Districts, Arunachal Pradesh for a period of 19 days. During the field tour 5 different species of *Tupistra* and *Rohdea eucomoides* were collected. A total of 108 live specimens of RET plants including 40 orchid taxa were collected for *ex situ* conservation at EBG, Barapani and Shillong. The collections in the field were accompanied by field photography of different plants, landscapes, forest types, vegetation etc.

b. Molecular Biology

i) Extraction of genomic DNA: High quality genomic DNA were extracted from leaves of *Rohdea extrorsandra (=Tupistra extrorsandra*), *Rohdea delavayi, R. eucomoides, R. nepalensis, R. wattii, Tupistra clarkei, T. khasiana, T. leonidii, T. nutans, T. nagarum, T. stoliczana* (= *T. ashihoi*), *T. tupistroides* using CTAB method (Murray and Thomson, 1980) with minor modifications. The quality of the extracted DNA was checked in 0.8% agarose in 1X TBE buffer.

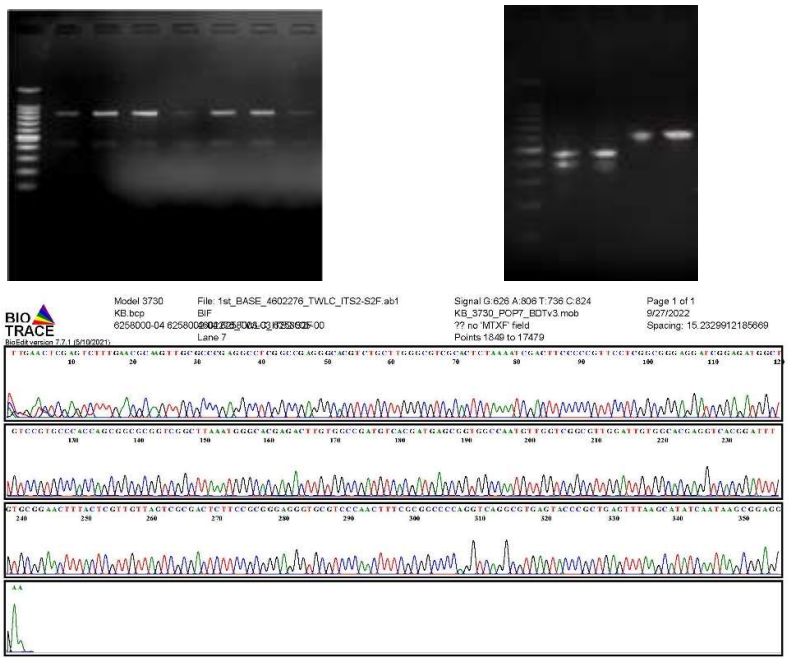
ii) Polymerase Chain Reaction: PCR amplifications of the extracted genomic DNA were carried out using nuclear ITS markers and chloroplast markers (matK, and psbA-trnH).

Amplification of ITS region were performed in 20µl reaction volume containing 50 ng DNA sample, 5X PCR buffer, 2µM of $MgCl_2$, 200uM dNTPs, 2µM of both the forward and reverse primer and 0.6U of Taq polymerase. The PCR amplification was performed using Thermal cycler using the cycle: initial denaturation at 94ºC for 4mins followed by 35 cycles of denaturation for 40secs, annealing temperature at the range of 55-60ºC for 40secs and extension at 72ºC for 1min followed by final extension at 72ºC for 8mins.

All the amplified PCR products obtained from ITS markers were resolved by electrophoresis on 1.5% agarose gel in 1X TBE buffer. PCR amplified fragments were visualized under UV light and photographed using Gel Documentation system.

DNA sequences using nuclear ITS markers have been obtained for *Rohdea extrorsandra, R. nepalensis, R. wattii, Tupistra leonidii, T. nutans,* and *T. stoliczana* (= *T. ashihoi*). DNA sequencing based on the utilized markers will be carried out for all the target species.

Tupistra sp.



Project

Project 3: Curatorial works at herbarium of ERC, Shillong (ASSAM)
Executing Officials: Smt. Nandita Sarma, Bot. Asst., Shri. Vijay, Bot. Asst., Miss. Debala Tudu, Bot. Asst., Dr. Harminder Singh, Bot. Asst., Dr. Harekrushna Swain, Senior Presv. Asst., Dr. Y Mahesh, Senior Presv. Asst. under the supervision of Dr. Chaya Deori, Sc.-E.
Duration: Ongoing

Background: Regular maintenance of herbarium, Preparation of database and incorporation of metadata of all herbarium specimens and Digitization of herbarium specimens of ASSAM.
Area and locality of the allotted Project: Herbarium of Eastern Regional Centre, Botanical Survey of India, Shillong (ASSAM).

Achievements : During 2023-24, 15354 Sheets were scanned, 500 Sheets were cleaned, 50 Sheets were remounted and 500 Species/genus were cover made. In addition to this, 12000 Barcodes were posted and 8689 metadata was prepared.


Officials engaged in Curatorial works at herbarium of ERC

Project 4: Backlog clearance of unidentified Herbarium sheets at ASSAM
Executing Officials: Mrs. Nandita Sarma, Bot. Asst., Mr. Vijay, Bot. Asst., Dr. Harminder Singh, Bot. Asst., Miss.DebalaTudu, Bot. Asst., Dr. Harekrushna Swain, Sr. Preservation Asst., Dr. Y. Mahesh, Sr. Preservation Asst. under the supervision of Dr. Chaya Deori, Sc-E.

Duration: June, 2022-ongoing

Background: Segregation of herbarium sheets, collecting the field-related information whose field books are not available, data entry of herbarium sheets, identification of plants, fumigation & incorporation of identified sheets.
Area and locality of the allotted Project: Herbarium of Eastern Regional Centre, Botanical Survey of India, Shillong (ASSAM).

Achievements: Under the present backlog clearance of unidentified herbarium sheets at ASSAM a total of 942 (as on 24 Jan 2023) were identified (at generic/specific level). All these sheets were cleaned properly, dusted and remounted wherever required. Field data from old field books housed at ASSAM was entered on 285 sheets and the rest of sheets will be completed by March 2024. 70 backlog sheets accessioned.

Officials engaged in Backlog clearance of unidentified Herbarium sheets at ASSAM

Project 5: DNA barcoding and Phylogenetic analysis of the endemic genus *Hypericum* of North-East India and Chemical composition, antioxidant activities of the essential oil produced.

Executing officials: Dr. Deepu Vijayan, Scientist-D and Dr. Harekrushna Swain, Senior Preservation Assistant
Duration: September, 2022-March 2024

Background: The proposal seeks to carry out inter-specific and intra-specific diversity and bioprospecting oils and extracts obtained from different plant parts of Genus *Hypericum* from different geographical locations in Northeast India. There are very few scientific studies on the chemical evaluation of the Genus *Hypericum* and bioprospection. Based on the results, information, marketing strategies as well as scientific know-how can be extended to other stakeholders such as farmers, local communities, NGOs and the forest department.
Area and locality: Meghalaya, Assam and Nagaland

Achievements: During the year tours were conducted to different areas of Assam, Meghalaya and Nagaland by the executing officials. *Hypericum williamsii* N.Robson, *Hypericum japonicum* Thunb., *Hypericum hookerianum* Wight & Arn., *Hypericum lobbii* N.Robson., *Hypericum elodeoides* Choisy, *Hypericum gracillipes* Stapf ex C.E.C. Fisch were collected from different localities. Antioxidant activity of the plant extracts of *Hypericum williamsii* N.Robson, *Hypericum japonicum* Thunb, *Hypericum gracillipes* Stapf ex C.E.C. Fisch and *Hypericum hookerianum* Wight & Arn.was carried out by following *in vitro* assays viz., DPPH assay, ABTS assay, Reducing power ability.

GC–MS analysis was performed to estimate the essential oil composition extracted from the aerial part of *Hypericum japonicum* Thunb. The compounds are α-Pinene, Camphene, Sabinene, Myrcene, 3-Carene, α-Terpinene, Limonene, trans-β-Ocimene, γ-Terpinene, Terpinolene, exo-Fenchol, Camphene hydrate, Terpinen-4-ol, α-Terpineol, Neral, Geraniol, trans-Myrtanol, Bornyl acetate, trans-Pinocarvyl acetate, Myrtenyl acetate, Myrtanyl acetate, Geranyl acetate, trans-Myrtanyl acetate, β-Caryophyllene, γ-Gurjunene, α-Humulene, allo-Aromadendrene, Germacrene-D, cis-β-Guaiene, Elemol, Caryophyllene oxide, Viridflorol, Eudesmol, β-Eudesmol, Aromadendrene oxide-II, Farnesol,

Farnesyl acetate, Palmitic acid, cis-13-Octadecenoic acid, Stearic acid. GC–MS analysis was performed to estimate the essential oil composition extracted from the aerial part of *Hypericum gracillipes* Stapf ex C.E.C. Fisch. The compounds are α-Pinene, Camphene, Sabinene, Myrcene, 3-Carene, α-Terpinene, Limonene, trans-β-Ocimene, γ-Terpinene, Terpinolene, exo-Fenchol, Camphene hydrate, Terpinen-4-ol, α-Terpineol, Neral, Geraniol, trans-Myrtanol, Bornyl acetate, trans-Pinocarvyl acetate, Myrtenyl acetate, Myrtanyl acetate, Geranyl acetate, trans-Myrtanyl acetate, β-Caryophyllene, γ-Gurjunene, α-Humulene, allo-Aromadendrene, Germacrene-D, cis-β-Guaiene, Elemol, Caryophyllene oxide, Viridflorol, Eudesmol, β-Eudesmol, Aromadendrene oxide-II, Farnesol, Farnesyl acetate, Palmitic acid, cis-13-Octadecenoic acid, Stearic acid.

GC–MS analysis was performed to estimate the essential oil composition extracted from the aerial part of *Hypericum hookerianum* Wight & Arn. There is the presence of 159 compounds. The major compounds are Butanoic acid, 3-methyl ($C_5H_{10}O_2$), beta.-Myrcene ($C_{10}H_{16}$), 1,2-Cyclohexanedione ($C_6H_8O_2$), Cycloheptanone ($C_7H_{12}O$), 3-Carene ($C_7H_{16}N_2$), Catechol ($C_6H_6O_2$), 2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, acetate, [R-[R*,R*-(E)]] ($C_{22}H_{42}O_2$), n-Hexadecanoic acid ($C_{16}H_{32}O_2$), 2-Acetyl-2-allylpent-4-enoic acid, ethyl ester ($C_{12}H_{18}O_3$), 2-Cyclohexen-1-one-4-carboxylic acid, 4-(3,7- dimethyl-2,6-octadien-1-yl)-3-ethyl-, methyl ester ($C_{20}H_{30}O_3$), 9,12,15-Octadecatrienoic acid ($C_{18}H_{30}O_2$), D-Alanine, N-(2-fluoro-5-trifluoromethylbenzoyl)-butyl ester ($C_{15}H_{17}F_4NO_3$), 3-Cyclopenten-1-one,3-hydroxy-2-(1-hydroxy-3-methylbutylidene)-5-(3-methyl-2 butenylidene)($C_{15}H_{20}O_3$), Supraene ($C_{30}H_{50}$), 1-Tricosene ($C_{23}H_{46}$).

GC–MS analysis was performed to estimate the essential oil composition extracted from the aerial part of *Hypericum williamsii* N.Robson. There is the presence of 90 compounds. The major compounds are Octane 2-methyl (C_9H_{20}), Propanoic acid 2-methyl ($C_4H_8O_2$), Nonane (C_9H_{20}), Undecane ($C_{11}H_{24}$), 5-Hydroxy-2,2,6,6-tetramethyl-4-cyclohexene-1,3-dione ($C_{10}H_{14}O_3$), Petasitene ($C_{15}H_{24}$), Phenol 2,6-bis(1,1-dimethylethyl)-4-mercapto ($C_{14}H_{22}OS$), 2-Acetylmethylamino-5,5-dimethyl-5,6-dihydro-4Hbenzothiazol-7-one ($C_{12}H_{16}N_2O_2S$), Neophytadiene ($C_{20}H_{38}$), Hexadecanoic acid methyl ester ($C_{17}H_{34}O_2$), 6-Methoxy-2,7,8-trimethyl-2-(4,8,12-trimethyltridecyl)chroman ($C_{29}H_{50}O_2$), 1-Heneicosanol ($C_{21}H_{44}O$), cis-13-Octadecenoic acid methyl ester ($C_{19}H_{36}O_2$), 9,12-Octadecadienoic acid (Z,Z)-, methyl ester ($C_{19}H_{34}O_2$), 1,Z-5,E-7-Dodecatriene ($C_{12}H_{20}$), Methyl stearate ($C_{19}H_{38}O_2$), Desaspidinol ($C_{11}H_{14}O_4$), Silane diethylhexyloxyoctyloxy ($C_{18}H_{40}O_2Si$).

During the survey it is reported that *Hypericum williamsii* N. Robson is a new record to the flora of Meghalaya, Assam and Nagaland and *Hypericum lobbii* N. Robson is a recollection after 133 years of type collection.

Project 6: Morphotaxonomy and Molecular Phylogeny of Wild Edible Mushrooms of Meghalaya.

Name of the executing officials: Dr. Dyutiparna Chakraborty Scientist-'C' and Ms. Debala Tudu, Botanical Assistant

Duration: July, 2023- March 2026

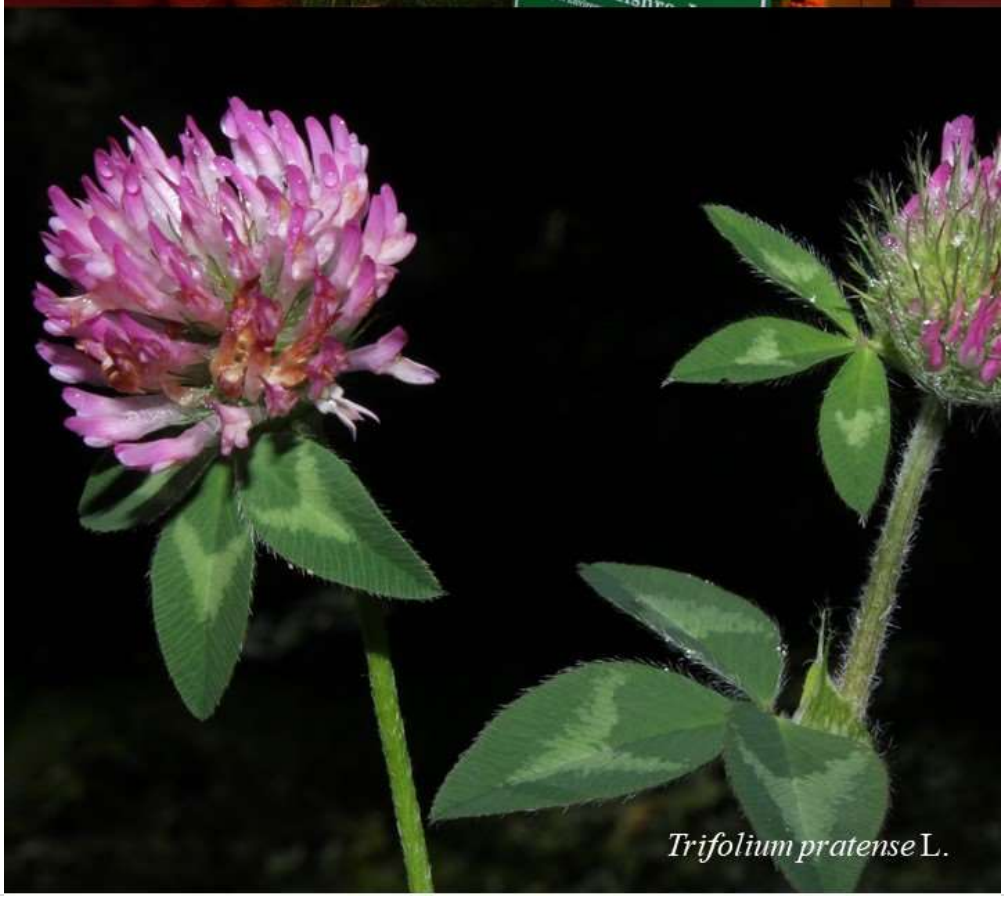
Background: Collection tour in different areas of Meghalaya and processing of the collected wild edible mushroom specimens towards Herbarium preparation related work; detail macro- and micromorphological characterization of all collected edible mushrooms for taxonomically correct identification and separation from morphologically lookalikes; single to multigene phylogenetic analysis of wild edible mushrooms of Meghalaya; documentation of possible ethnomycological data of wild edible mushrooms; recording the correct distribution of wild edible mushrooms with the help of GPS.

Area and Locality: Meghalaya

Achievements: A total six survey and collection tours were conducted locally in different forested areas of East Khasi Hills which includes two field tours to Ishyrwat Reserve Forest and Sumer Village during July, two field tours to Nongkhlym Wild Life Sanctuary on 02.08.2023 and 04.08.2023; One local field tour to Upper Shillong Reserve Forest on 09.08.2023 and two local field trips to Thangsalai on 21.08.2023 and 26.09.2023. A total 24 (twenty-four) wild edible mushrooms were collected during field trips to different forested areas of East Khasi Hills and Ri-Bhoi. All collected mushrooms were identified upto genus level, 15 mushrooms are identified upto species level and molecular

phylogeny of 10 edible mushrooms (*Albatrellus confluens* (Alb. & Schwein.) Kotl. & Pouzar *; Butyriboletus pseudospeciosus* Kuan Zhao & Zhu L. Yang *; Craterellus* cf *luteus* T.H. Li & X.R. Zhong; *Inocybe* cf. *sphaerospora* Kobayasi; *Lactarius hatsudake* Nobuj. Tanaka; *Russula virescens* (Schaeff.) Fr.; *Scleroderma yunnanense* Y. Wang; *Termitomyces microcarpus* (Berk. & Broome) R. Heim; *Termitomyces radicatus* Natarajan; *Tricholoma olivaceum* Reschke, Popa, Zhu L. Yang & G. Kost) were done. Among the identified species, 5 edible mushrooms (*Butyriboletus pseudospeciosus*, *Scleroderma yunnanense*, *Rugiboletus extremiorientalis* (Lj.N. Vassiljeva) G. Wu & Zhu L. Yang, L, *Lactarius hatsudake* and *Tricholoma olivaceum*) were found to be new record for India and 3 inedible mushroom members were recorded for the first time from India (*Leccinellum sinoaurantiacum* (M. Zang & R.H. Petersen) Yan C. Li & Zhu L. Yang; *Retiboletus fuscus* (Hongo) N.K. Zeng & Zhu L. Yang and *Tylopilus atroviolaceobrunneus* Yan C. Li & Zhu L. Yang).

HIGH ALTITUDE WESTERN HIMALAYAN REGIONAL CENTRE, SOLAN



HIGH ALTITUDE WESTERN HIMALAYAN REGIONAL CENTRE, SOLAN

Project: Flora of Himachal Pradesh Vol. III. BORAGINACEAE, (Estt. 63 Spp.).
Executing Officials: Dr. Kumar Ambrish, Scientist-F and Dr. Kuldip S. Dogra, Scientist-E
Duration: 2023-25.

Background: Flora of Himachal Pradesh Vol. III; BORAGINACEAE, (Estt. 63 Spp.).
Area & Locality: 55,673 sq. km, Himachal Pradesh, India

Achievements: As per the allotted ARP, 2023-24, conducted a herbarium consultation tour to BSD & DD Dehradun w.e.f. 31.08.2023- 06.09.2023 under the AAP, 2023-24 for the Flora of Himachal Pradesh Vol. III. BORAGINACEAE, (Estt. 63 Spp.). Studied 246 specimens for the family Boraginaceae in Himachal Pradesh in both the herbaria. Data on distribution, ecology, date of collection, collectors, Flowering and Fruiting months and economic uses have been recorded. Identified 14 unidentified herbarium specimens of family Boraginaceae collected from Solan and Sirmaur districts of H.P. A total of 40 species have been described and their nomenclature updated.

Ageratina adenophora invaded area

Trichodesma indicum (L.) Lehm.

Ehretia laevis Roxb.

Ageratum houstonianum

INDUSTRIAL SECTION INDIAN MUSEUM, KOLKATA

INDUSTRIAL SECTION INDIAN MUSEUM, KOLKATA

Project 1: Collection of economically important plants/ plant products for enrichment and upliftment of Toto Section in Botanical Gallery, ISIM, BSI
Executing Officials: Dr. Debasmita Dutta Pramanick, Scientist – D, Dr. Mahua Pal, Botanist and Shri Ranjit Patra, Sr. Preserv. Asstt.
Duration: 2023-2024

Background: Industrial Section Indian Museum (ISIM), represented by Botanical Gallery, earlier known as 'Economic Botany gallery,' has been a part of Botanical Survey of India since 1911. At present Botanical Gallery of Industrial Section Indian Museum holds c. 20,000 economically important plants and plant products which have been classified into 8 bays/ sections based on their uses. Apart from these eight permanent sections, one ethno-botanical section of Toto tribe, ethnobotany of tribes of Odisha, several dioramas, kiosks, and digital displays are installed in the Gallery. During routine maintenance works in the gallery, it is noticed that in the section 'Ethnobotany of Toto,' the information on their life, medicinal practices, food habit, culture, local fest etc. has not been updated for long.
Area And Locality: Totopara, Ballalguri Gram Panchayat and surrounding areas, Alipurduar District, W.B.

Achievement: An ethnobotanical survey cum collection tour was conducted *w.e.f.* 24.11.2023 – 03.12.2023 to Totopara village, Ballalguri panchayat, Alipurduar, West Bengal. During this period, 38 Toto families residing in Panchayet gaon, Pujagaon, Paragaon, Tinkuthi, Chamba line, upper & lower Toto basti areas, Mitrangaon, Subbagaon, Nubai, Mandal gaon, Dhunchigaon, Gaurigaon, were selected for interaction and sharing traditional medicinal knowledges by random sampling method. Local medicine man, veterinary doctor, gaon burron and local villagers were interviewed. All together 42 field numbers were collected of which 23 taxa have been identified and found useful in daily life of Toto people.
This study highlights 05 new ethnobotanical information in Toto culture: i) use of 'Gulancha' (*Tinospora cordifolia*) leaf paste as 'lep' and as oral medicine to remove tick insect on cattle (pig, cow, goat etc.); ii) Use of 'Mayrushai' (*Mabea angustifolia*) & 'Birshai' young leaves as vegetables in daily diet with marua rice; iii) use of wild rai shaag (*Brassica campestris*) in preparation of pork meat to make the dish healthy; iv) use of 'Basak'(*Justicia adhatoda*) leaf extract in high blood pressure, vomiting, stomachache, insomnia; v) *Sida rhombifolia* dried uprooted plants (in bundle) used as broom.
Another tour *w.e.f.* 24.02.2024 – 03.03.2024 will be conducted to Dinhata, Coochbehar, W.B. for collection of tobacco leaves for Gallery.

Project 2: Barcoding, Database and Digitization of BSIS Herbarium.
Executing Officer: Smt. Sushreya Pal, Botanical Assistant and Smt. Shrabasti Das, Sr. Pres. Assistant.
Duration : 2023-2024.

Background : To digitize BSIS herbarium contributing to the preservation and accessibility of valuable information on taxonomy, distribution, and collection history. This project aimed to digitize the Economic Herbaria specimens present in the Industrial Sections of the Indian Museum (BSIS), with separate sections for dicot and monocot specimens. The BSIS herbarium boasts a vast collection, particularly collected by Reporter of Economic Products of India and Curators during pre and post-independence period who were posted at I.S.I.M.

Achievements: Barcoding, digitization and metadata creation of 765 herbarium specimens (Hardcopy & Softcopy submitted); Barcode no. from BSIS000013385 to BSIS000014149.

NORTHERN REGIONAL CENTRE, DEHRADUN


Maharanga emodi (Wall.) DC.

NORTHERN REGIONAL CENTRE, DEHRADUN

Project 1: Assessment of Plant diversity in Rajaji National Park, Uttarakhand.
Executing Officials (s): Dr. Puneet Kumar, Scientist-D, Dr. S. K. Singh, Scientist-F, Dr. P. K. Deroliya, Bot. Asst. & Poulami Ghosh, Bot. Asst. (PKD) was transferred to BSI, AZRC Jodhpur in 30.09.2022.
Duration: 2021–2024.

Background: The largest issue we are currently experiencing is uncontrolled damaging human intervention, which depletes natural resources and is evident in these protected areas. We are facing several environmental issues in addition to a notable increase in natural disasters, warming and cooling cycles, and weather patterns. Protected areas are established with certain goals in mind, such as maintaining the local species and preventing human involvement with activities like deforestation, cultivation, and animal grazing. Making a systematic record of the floristic abundance of a region or area available is a satisfying experience. In order to record any flora changes that may occur in a particular area, it is important to periodically monitor the floristic diversity. Moreover, comprehending and assessing the biodiversity evaluation of that region requires a taxonomic study and compilation of the flora. This study aimed to assess the plant diversity of the National Park using herbaria database, surveys, identification, and documentation, as well as a review of the literature.
Area & Locality: Rajaji National Park, Uttarakhand.

Achievements: During the period of this report, two field tours were conducted covering two ranges (Chilla, Ramgarh Range) of the National Park. A total of 105 field numbers, comprising about 315 plant specimens, were collected during the collection tours. In this period 391 field numbers have been identified. Among them 373 field numbers belong to 71 families and 312 species of angiosperms, 1 field from gymnosperm and 17 field of 8 families of pteridophytes. In addition, 598 taxa of 51 families of dicots and 206taxa of 23 families of monocots have been described during the report period. During 2022-2023, eight tours were conducted and 626 field numbers, comprising about 1878 plant specimens, were collected during the collection tours. Out of these, 470 field numbers have been identified, belonging to 87 families under 284 genera and 363 species. In addition, 109 species have been described over this time period. Of these identified plant species, 30 were new distributional records to the National Park. During 2021-2022, three tours were conducted and 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. Till now 13 field tours have been conducted and 1059 field numbers have been collected and of these 1043 field number have been identified. Description, nomenclature, citation, phenology, habitat & ecology, distribution and uses if any have been documented for 913 taxa belonging to 151 families.

Project 2: Grass flora of Western Himalaya
Executing Officials (s): Dr. Manish Kandwal, Scientist-E
Duration : 2021–2024 (extension requested for 01 year 2024 -2025).

Background: The Western Himalayas refers to the western half of the Himalayas, in north western India and covers more than two lakh Square kilometer of covered area. More than 700 species of grasses are found in the area which is still not documented. The main objective of the study is to document the grass flora of entire Western Himalaya updating its nomenclature and distribution records.
Area & locality : Narender Nagar, Rishikesh, Rajpur and Mussoorie, Jammu, Patani top, Banihal, Jawahar tunnel Shopian district, Srinagar Sonmarg in Jammu and Kashmir and Zozhila pass, Kargil, Dras, Chulichan, Nimmo, Khardungla, and Sianchinbase in Ladakh. Renuka lake, Solan, Rohru, Chanchal, Tiuni, Barkot, Yamunotri and Mussoorie, Jairampur, Kullu, Manali, Sissu, Palampur, Nand Nandan.

Achievements: In the last 2 and half years four short tour of one day each were conducted and three long tour of more than one week were conducted in various parts of western Himalaya. In all 996 specimens were collected and 75 % are identified. Photo plates of 25 species of grasses were made during this period and 402 species were described after studying of the specimens. 75% of the collected specimens are processed and identified in the past two years. More than 1700 specimens from various herbarium like CAL, PUN, PAN, RRLH and IHBT were studied in detail during herbarium visit. In addition about 600 specimens pertaining to Western Himalaya were listed/studiedfrom BSD.

Project 3: SEM study of spores of Fern & Fern allies of Western Himalaya.
Executing Officials(s): Dr. Brijesh Kumar, Sci.-C, Dr. S.K. Singh, Sci.-F & Ms. Latika Sagarwal, Bot. Asstt.
Duration:2023–2026

Background: Spore of Fern & Fern allies are the units of asexual reproduction and function as storehouse of genetic information. Their sporoderm morphology plays a significant role in taxonomy and deciding fern phylogeny, which used as an important tool to understand the generic and specific delimitations of the taxa. Therefore, to understand the above said facts, the present study has been undertaken.
Area & Locality:Western Himalaya

Achievements: During the period, the spores of 35 species of Fern and fern Allies Spores of 35 species of Fern and Fern Allies have been extracted and photographed with the help of SEM and 17 samples have been described so far. In addition, three one-day field tours also have been conducted in nearby areas, and 20 samples were collected for spore studies. Scrutinized the available published literature in departmental library and online. Besides, Twenty-Three live germplasms were also collected and introduced in Fern House and Garden.

a) **Photographs:**
   Image 6: *Adiantum venustum* D.Don
   Image 7: *Botrychium lanuginosum* Wall. ex Hook. & Grev.

Project 4: Flora of Himachal Pradesh, Vol. 3 [Rubiaceae- Solanaceae, c. 800 taxa]
Executing Officials(s): Dr. S.K. Singh, Scientist-F; Dr. Puneet Kumar, Scientist-D; Dr. Brijesh Kumar, Scientist-C; Dr. Sameer Patil, Botanist; Dr. Bhavana Joshi, Botanist; Dr. Monika Mishra, Botanist; MsPoulami Ghosh, Bot. Asst.; Mr. Subhasmit Bhattacharyya, Bot. Asstt.; Ms. LatikaSagarwal, Bot. Asstt.; Mrs. PritiGangwar, Senior Pres. Asstt.; [Boraginaceae c. 56 taxa, Dr. Kumar Ambrish, Scientist-F; Dr. Kuldip S. Dogra, Scientist- D (High Altitude Western Himalayan Regional Centre, Solan)]
Duration: 2023–2025

Background: Himachal Pradesh is the northernmost state of India and is characterized by an extreme landscape featuring several peaks and extensive river systems, their height varying from 244 m to 6750 m. Due to its undulating topography, varying ranges of altitudes and subtropical to subarctic climate the state abode diverse and rich vegetation ranging from tropical deciduous and dry scrub forests at lower altitudes to alpine pastures and cold desert at higher altitudes. No comprehensive attempt has been made to compile the flora of the state so far. Therefore, attempt was made to bring out the flora of state.
Area &locality: Himachal Pradesh.

Achievements: A total of 309 taxa belonging to fifteen families have been documented till December 2023. Dr. S. K. Singh & al. documented 196 taxa belonging to Asteraceae. Dr. Puneet Kumar documented 44 taxa belonging to 5 families. Dr. Brijesh Kumar documented 15 taxa belonging to 2 families. Dr. Sameer Patil documented 27 taxa belonging to 2 families. Dr. Bhavana Joshi documented 27 taxa belonging to 6 families.

Project 5: Flora of Madhya Pradesh vol. 1. (2022-2024) including pictorial checklist
Executing Officials: Dr. Arti Garg Scientist-E; Dr. A.K. Verma, Scientist C, Mr. B. Lakshmanudu, Sr. Pres., Asstt. Dr. O.N. Maurya, Sci-D; Dr. Nitisha Srivastava, Botanist; Dr. Saurabh Sachhan, Bot. Asstt.
Duration: 2022–2024

Background: The Flora of Madhya Pradesh volume I, was published in1993, about 30 years back. Although the volume comprised of illustrations of many plant species but colored field photographs were lacking, which give ready source of field identification of most of the plants. The present project aimed at updating the flora with plant representatives of present boundaries of Madhya Pradesh, after segregation of state of Chhattisgarh, in 2000 and documentation of independent and updated Pictorial checklist of the Flora of Madhya Pradesh Volume I.
Area &locality: Madhya Pradesh State. 3.08L Km^2

Achievements:Completed and submitted 29 species under 7 families allotted: Polygalaceae: 12 species, Ochnaceae: 03 species, Lecythidaceae: 02 species, Punicaceae: 01 species, Cactaceae: 02 species, Myrtaceae: 04 species and Flacourtiaceae: 05 species. The manuscript was submitted with updated nomenclature and distribution in districts of Madhya Pradesh. In addition of this Flora of India vol. 19: Upgraded and sent Flora of India vol. 19 with 116 colored photographs and 45 illustrations. Flora of Chhattisgarh, volume 3 (Monocot): Upgraded and sent 108 photographs to publication section.

SIKKIM HIMALAYAN REGIONAL CENTRE, GANGTOK

SIKKIM HIMALAYAN REGIONAL CENTRE, GANGTOK

Project 1: **Flora of Kitam Bird Sanctuary (KBS), South District, Sikkim**
Executing Officials: Dr. Rajib Gogoi, Dr. Monalisa Dey and Dr. B.K. Singh
Duration: 2022-2024

Background: Sikkim is part of the 'Eastern Himalayan Agrobiodiversity Region', one of 22 agrobiodiversity hotspots in India and also part of the 'Himalaya' biodiversity hotspot. 82.31 percent of the total geographic area of the State is under the forest cover with 46.93 percent of the total area of the state brought under the Protected Area Network. Gogoi & al. (2021) reported 5068 taxa (including 152 cultivated taxa) under 1491 genera from Sikkim. Kitam Bird Sanctuary (88°20' E and 27°06' N to 88°22' E and 27°07' N) with about 6 km^2 of area is the only low-elevation (320–875 m) protected area in Sikkim and serves as the refuge for various species of flora and fauna. The low-elevated parts of Himalayan region are under immense anthropogenic pressure due to less representation in the Protected Area Network. Since most of the lowland areas are human-dominated, Kitam Bird Sanctuary plays a major role in conservation of biodiversity of this part of the region. Though faunal surveys, especially with respect to birds and butterflies have been done by different groups of zoologists, the flora of the sanctuary has not been documented yet. Hence, the present work will not only fill the gap with respect to floral documentation of the sanctuary, it will also fulfil the demand of the State Forest Department for better management of this Protected Area and also by serving one of the mandates of Botanical Survey of India (BSI). In these contexts, the present work is being carried out.

Area and locality: Kitam Bird Sanctuary, South Sikkim located along the southern boundary of Sikkim state between $88^0$27"$27^0$06" and $88^0$22"$27^0$07" and 320 to 875 amsl within the tropical ecoregion. The total area is 6 sq. km. and total perimeter is 10 km. The sanctuary is located within the south district and bounded by great Rangit river in the south (which is also the boundary of Sikkim state to West Bengal state), Namchi-Manpur SPWD road in north, Goam Khola in the West and Manpur Khola in the East. The sanctuary was established in 2005 for protection of wildlife and its environment. The area was reserve forest before being declared a sanctuary.

Achievements: Under the purview of this project, 2 field tours were undertaken to KBS during 12.09.2023 to 19.09.2023 (Q2) and 13.12.2023 to 20.12.2023 (Q3) and collected 500 specimens under 182 field numbers and 380 specimens under 147 field numbers respectively. Local names and uses of plant species were also recorded. More than 3000 photographs taken for flowering/fruiting of plants, general vegetation, habit and habitat of individual species, etc. Processing & preparation of herbarium specimen collected during last tours are currently under progress. 190 field numbers have been identified into 176 species. Preparation of description of 210 taxa has been completed. Sorting of photographs and preparation of photo-plates under process.

Azanza lampas (Cav.) Alef.

Diploknema butyracea (Roxb.) H.J.Lam

Project 2: **Wild edible plants of Sikkim and Darjeeling Himalaya.**
Executing Officials: Dr. Rajib Gogoi & Dr. J. H. Franklin Benjamin
Duration: 2021-2024

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

Achievements: During the reference period, 1 field tour to North Sikkim was conducted during 13.08.2023 to 21.08.2023 and the documentation of 36 taxa of wild edibles done. Consolidation and compilation of Wild Edible Plants collected from literature and field work is being done. In this, the WEPs are categorised as per their utility viz., leafy vegetables, fruits, flowers and inflorescence, stem, roots, rhizomes and tubers, etc. In each category, the WEPS are arranged systematically in the following format: 1. Plant Name, 2. Family, 3. Local Name, 4. Uses, 5. Parts used. The Final report is under compilation for submission.

WEP *Actinidia callosa* Lindl.

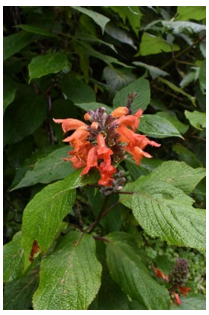
WEP *Zanthoxylum acanthopodium* DC.

Project 3: **Curatorial works and maintenance of Germplasm of *Rhododendron* L. (Ericaceae) and Impatients Riv ex L. (Balsaminaceae) in EBG, BSI-SHRC.**
Executing Officials: Dr. Rajib Gogoi, Dr. J. H. Franklin Benjamin & Norbu Sherpa
Duration: Ongoing

Background: Collection and maintenance of *Rhododendron* L. (Ericaceae) and *Impatiens* Riv ex L. (Balsaminaceae) in Experimental Botanic Gardens, Gangtok were the major objectives of this project.
Area and locality: Experimental Botanic Garden, BSI-SHRC

Achievements: One tour was conducted to North Sikkim, from 13.08.2023 to 21.08.2023 and collected 9 plant species including *Rhododendron niveum* Hook.f. (Threatened) from ex-situ conservation.

One tour was conducted to West and South Sikkim, from 01.12.2023 to 06.12.2023 and collected 3 species of *Rhododendrons* L., and 4 species of *Impatiens* Riv. ex L. for ex-situ conservation viz. *Rhododendron arboreum* Sm.; *Rhododendron dalhousieae* Hook.f.; *Rhododendron vaccinioides* Hook.f.; *Impatiens pulchra* Hook.f. & Thomson; *Impatiens pradhanii* H.Hara; *Impatiens spirifera* Hook.f.; *Impatiens stenantha* Hook.f. Regular maintenance and monitoring of the germplasm were carried out.



Colquhounia coccinea Wall.

Diplomeris hirsuta (Lindl.) Lindl.

Hypericum tenuicaule Hook.f. & Thomson

SOUTHERN REGIONAL CENTRE, COIMBATORE

SOUTHERN REGIONAL CENTRE, COIMBATORE

Project 1: FLORA OF TAMIL NADU VOLUME 1 (Ranunculaceae – Connaraceae)
Executing Officials: Dr. W. Arisdason, Scientist 'E' & Dr. M. Anantha Lakshmi, Botanical Assistant
Duration : September 2021– March 2024
Background: Under this project taxa belonging to Families: Ranunculaceae – Connaraceae were studied, identified and documented.
Area & Locality: Tamil Nadu

Achievements: Scrutinized all the species and genera of families based on available literature, herbarium specimens housed in various herbaria, especially in MH, and digital images of specimens in foreign herbaria, journals, revisions and monographs for the Flora of Tamil Nadu, Volume 1. The complete taxonomic account, which includes bibliographic citations, descriptions, local names (Tamil), distribution, flowering and fruiting period, and uses or remarks, if any, of the following 26 flowering plant families (altogether representing 51 genera, 202 species, 01 subspecies, 07 varieties and 40 cultivated taxa), such as Actinidiaceae, Zygophyllaceae, Tropaeolaceae, Averrhoaceae, Simaroubaceae, Surianaceae, Balanitaceae, Ochnaceae, Flindersiaceae, Opiliaceae, Erythropalaceae, Aquifoliaceae, Leeaceae, Aceraceae, Melianthaceae, Sabiaceae, Corynocarpaceae, Geraniaceae, Icacinaceae, Hippocrateaceae, Papaveraceae, Fumariaceae, Cruciferae, Flacourtiaceae, Salicaceae and Balsaminaceae. Further, Database is completed for 4119 herbarium specimens. 14 Papers have been published. Further, 3 new discoveries *viz. Lepidagathis gandhii Gnanasek.,* A.F.J. King, S.M. Kasim & Arisdason*, Lepidagathis dayanandanii* A.F.J. King, Gnanasek. & Arisdason and *Lepidagathis narasimhanii* Gnanasek., A.F.J. King & Arisdason were made.

Humboldtia bourdillonii Prain

Cynometra travancorica Bedd.

Guilandina bonduc L.

Mucuna gigantea (Willd.) DC.

Project 2: FLORA OF TAMIL NADU, VOLUME 2 (Leguminosae – Apiaceae)
Executing Officials: Dr. Sujana, K.A., Scientist 'E' & Dr. Rakesh G. Vadhyar, Botanical Assistant
Duration : September 2021– March 2024

Background: Volume 2 covers the documentation of flowering plants belonging to 36 polypetalous families distributed in Tamil Nadu. The families are Fabaceae, Caesalpiniaceae, Mimosaceae, Rosaceae, Chrysobalanaceae, Vahliaceae, Parnassiaceae, Hydrangeaceae, Crassulaceae, Droseraceae, Haloragaceae, Rhizophoraceae, Combretaceae, Myrtaceae, Lecythidaceae, Memecylaceae, Melastomataceae, Lythraceae, Sonneratiaceae, Punicaceae, Onagraceae, Trapaceae, Turneraceae, Passifloraceae, Caricaceae, Cucurbitaceae, Datiscaceae, Begoniaceae, Cactaceae, Aizoaceae, Molluginaceae, Apiaceae, Araliaceae, Alangiaceae, Cornaceae, and Caprifoliaceae.
Area & Locality: Tamil Nadu

Achievements

A field tour conducted to Kolli Hills from 31st October to 4th November and collected 87 field numbers in triplicate. Among them, 80 field numbers were identified. Nomenclatural citations, descriptions, phenological data, distribution and taxonomic keys were prepared for 56 taxa of the family Melastomataceae and 48 taxa of the family Myrtaceae. Descriptions were prepared for 259 taxa of the family Fabaceae. More than 200 photographs of plants and the environment were taken. During the study period, 3 species were recorded as additions to the State Flora of Tamil Nadu, Momordica sahyadrica Kattuk. & V.T. Antony (Cucurbitaceae), Psidium guineense Sw. and Syzygium syzygioides (Miq.) Merr. & L.M. Perry (Myrtaceae).

Project 3: FLORA OF TAMIL NADU VOLUME 3 (Rubiaceae – Gentianaceae)
Executing Officials: Dr. C. Murugan, Scientist - F, Dr. M. Murugesan, Scientist -C and Dr. S. Arumugam, Botanist
Duration: September 2021 – March 2024

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

Achievements: Scrutinized all the species and genera under allotted 26 families based on available literature, herbarium specimens available in various herbaria (MH, CAL), virtual herbaria (K, E, GH, RAW, UC, US, NY, BM, G, P, L), from various online sources, books, journals, revisions and monographs.

Conducted 04 field tours to various parts of Nilgiri Biosphere Reserve and Anamalai Tiger Reserve, collected endemic and threatened plant species, and photographed different natural habitats, vegetation and plants with flowers and fruits.

Completed detailed descriptions of 236 species belonging to 12 families along with details, such as recent and accepted names and bibliographic citations, distribution, status and phenological details as per the given format for Flora of Tamil Nadu, based on herbarium specimens and relevant literature pertaining to the flora of Tamil Nadu. The details are as follows: Asteraceae (117 taxa); Salvadoraceae (3 taxa); Loganiaceae (09 species); Gentianaceae (02 species); Asclepiadaceae (45 taxa); Apocynaceae (25 species); Symplocaceae (04 species); Oleaceae (12 species); Sphenocleaceae (01 species); Vacciniaceae (02 species); Ericaceae (09 species); Primulaceae (06 species) and Theophrastaceae (01 species).

Herbarium Metadata has been prepared as per the prescribed format for 570 herbarium sheets that are deposited in Madras Herbarium (MH), belonging to the following families, namely Asteraceae, Rubiaceae, Valerianaceae, Ericaceae, Sapotaceae, Loganiaceae, Asclepiadaceae, Oleaceae, Salvadoraceae and Apocynaceae during this period. Further, there were 3 species were

Project 4: FLORA OF TAMIL NADU, VOLUME 4 (Menyanthaceae to Plantaginaceae)
Executing Officials: Dr. V. Sampath Kumar, Scientist 'E' (Team Leader)
Ms. Lydia M Thomas, Bot. Asst. &
Ms. Rini Vijayan, Sr. Presv. Asst. (Team Members)
Duration: September 2021 – March 2024

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.
Area & Locality: Tamil Nadu **(**Six Ramsar Sites, viz., Vaduvur Bird Sanctuary, Point Calimere Wetland, Udayamarthandapuram Bird Sanctuary, Pitchavaram Mangrove Site, Vedanthangal and Karikili Bird Sanctuaries in September 2023 and Kolli Hills, Namakkal District in November 2023)

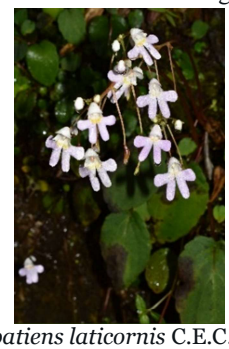
Achievements: For the families Acanthaceae (40 genera and 217 spp.), Lentibulariaceae (01 genus and 19 spp.), and Orobanchaceae (04 genera and 08 spp.) bibliographic citations, phenology, distribution were prepared by the team and work on the families Bignoniaceae (21 genera and 31 spp.), Scrophulariaceae (40 genera and 106 spp.), Solanaceae (19 genera and 102 spp.), and Verbenaceae are in progress. Preparation of Database in the prescribed format for all the allotted families completed except Acanthaceae and Lamiaceae, which are on progress.

In connection with the Implementation of Amrit Dharohar Strategy, for rapid assessment of floral diversity of the Ramsar Sites, a 04-day field tour was conducted along with the team members to six Ramsar Sites, viz., Karikili Bird Sanctuary, Pichavaram Mangrove, Point Calimere Wildlife Bird Sanctuary, Udayamarthandapuram Bird Sanctuary, Vaduvur Bird Sanctuary and Vedanthangal Bird Sanctuary from 12th to 14th September 2023. Prepared the checklist of plants of all the six surveyed Ramsar Sites; provided necessary synonyms, including basionym, flowering and fruiting period and Indian distribution along with the vernacular names.

Impatiens verticillata Wight

Ceropegia fimbriifera Bedd.

Hedyotis nairii Murug. & V.Ravich.



Impatiens laticornis C.E.C.Fisch

Strobilanthes lanata Nees

Impatiens tangachee Bedd.

Project 5: Flora of Tamil Nadu, Volume 5
Executing Officials: Dr. R. Manikandan, Scientist E, Smt. Mehala Devi R., Botanical Assistant and Mr. Soumitra Bera, Pres. Asstt.-cum-Garden Overseer
Duration: 2021-2024

Background: Under this project taxa belonging to Families: Nyctaginaceae to Ceratophyllaceae were studied, identified and documented.

Area & Locality: Nilgiri Biosphere Reserve, Anamalai Tiger Reserve and 6 Ramsar sites of Tamil Nadu

Achievements Conducted a one-day botanical exploration tour along with a team of scientists on 07.09.2023 to Vellode Bird Sanctuary, Vellode, Erode District of Tamil Nadu to document plant wealth. A total of 134 taxa belonging to 120 genera spreading over 54 families have been documented during this field trip. Around 300 colour photographs of different vegetation types and plants either with flowers or fruits were photographed.

A two-day botanical exploration tour conducted along with a team of scientists from 09.09.2023 to 10.09.2023 to 07 different Ramsar Sites, namely Chitrangudi and Kanjrankulam bird sanctuaries of Ramanathapuram District, Koonthankulam Bird Sanctuary of Tirunelveli District, Vembannur Bird Sanctuary and Suchindrum and Theroor Wetland Complex of Kanyakumari District, and the Gulf of Mannar Marine National Park. During this survey, a total of 597 taxa of vascular plants belonging to 220 genera under 74 families have been documented in Suchindram and Theroor Wetland Complex; 233 taxa belonging to 172 genera in 68 families in Vembannur Wetland; 96 taxa belonging to 76 genera under 37 families, Koonthankulam Bird Sanctuary; 83 taxa under 67 genera of 31 families from Chitrangudi Bird Sanctuary; 82 species under 69 genera belonging to 35 families from Kanjirankulam Bird Sanctuary; and 278 taxa belonging to 193 genera in 66 families from Gulf of Mannar Marine National Park have been documented. Photographed (around 750) the different vegetation/habitat types and plants either with flowers or fruits.

Conducted a 04-day botanical exploration tour to different parts of Nilgiri Hills, Western Ghats, Tamil Nadu, along with a team of scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 16.10.2023 to 19.10.2023. Explored and collected plant specimens from Naduvattam, Mukurthi Peak, Bangitappal and Western Catchment areas and their surrounding; collected about 140 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Nilgiris; also photographed different habitats and plants either in flowering or in fruiting condition.

Conducted a 02-day botanical exploration tour to different parts of Anamalai Hills, Western Ghats, Tamil Nadu, along with a team of Scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 08.11.2023 to 09.11.2023. Explored and collected plant specimens from Karian Shola, Varagalaiyar, Manambolly Range and Aanai Kundhi shola and their surrounding; collected about 87 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Anamalai Hills; also photographed different habitats and plants either in flowering or in fruiting condition.

Conducted a 02-day botanical exploration tour to different parts of Anamalai Hills, Western Ghats, Tamil Nadu, along with a team of Scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 06.12.2023 to 07.12.2023. Explored and collected plant specimens from Akkamalai, Valparai, Sholaiyar, Rottikadai and Iyerpadi areas and their surrounding; collected about 115 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Anamalai Hills; also photographed different habitats and plants either in flowering or in fruiting condition.

Completed detailed descriptions for the following 411 taxa belong to the families, Euphorbiaceae (223 taxa), Phyllanthaceae (73 taxa), Urticaceae (51 taxa), Polygonaceae (30 taxa), Loranthaceae (22 taxa), Aristolociaceae (09 taxa) and Balanophoraceae (03 species) along with recent and accepted names, bibliographic citations, distribution, status and phenological details as per the given format for Flora of Tamil Nadu, based on herbarium specimens, relevant literature.

Herbarium Metadata has been prepared as per the prescribed format for 3357 herbarium sheets that are deposited in Madras Herbarium (MH), belonging to the following families: Aristolochiaceae, Asparagasceae, Balanophoraceae, Casuarinaceae, Ceratophyllaceae, Chloranthaceae, Fagaceae, Lauraceae, Loranthaceae, Plantaginaceae, Salicaceae, Ulmaceae and Urticaceae during this period.

Project 6: FLORA OF TAMIL NADU, VOLUME 6 (Hydrocharitaceae to Ruppiaceae)
Executing Officials: Dr. M.U. Sharief, Scientist 'F', Dr. S.S. Hameed, Scientist 'F', Dr. W. Arisdason, Scientist 'E' and Dr. V. Ravichandran, Sr. Pres. Asst.

Duration : September 2021– March 2024

Background: A checklist is prepared for the different families by referring various floras. Citations, Descriptions, Phenology, Distribution, key to the genera and species have been made for the species and infraspecific taxa for the families Hydrocharitaceae (20 taxa), Burmanniacae (4 taxa), Cannaceae (1 taxa), Hypoxidaceae (3 taxa) Marantaceae (3 taxa) Stemonaceae (1 taxa) Xyridaceae (2 taxa) Asparagaceae (27 taxa) and Flagellariaceae (1 taxa). While the descriptions and artificial keys are being prepared for the other families.
Area & Locality: Tamil Nadu

Achievements : As a part of Annual Research Programme Project, "Flora of Tamil Nadu" undertaken a one- day local botanical exploration to Pykara and Terrace Estate of Nilgiris District, Tamil Nadu on 26.06.2023, and vouched 18 field numbers including 11 endemic species.
Conducted a one-day botanical exploration tour along with a team of scientists on 07.09.2023 to Vellode Bird Sanctuary, Vellode, Erode District of Tamil Nadu to document plant wealth. A total of 134 taxa belonging to 120 genera spreading over 54 families have been documented during this field trip. Around 300 colour photographs of different vegetation types and plants either with flowers or fruits were photographed.

A two-day botanical exploration tour conducted along with a team of scientists from 09.09.2023 to 10.09.2023 to 06 different Ramsar Sites, namely Chitrangudi and Kanjrankulam bird sanctuaries of Ramanathapuram District, Koonthankulam Bird Sanctuary of Tirunelveli District, Vembannur Bird Sanctuary and Suchindrum and Theroor Wetland Complex of Kanyakumari District of Tamil Nadu. During this survey, a total of 319 taxa of vascular plants belonging to 220 genera under 74 families have been documented in Suchindram and Theroor Wetland Complex; 233 taxa belonging to 172 genera in 68 families in Vembannur Wetland; 96 taxa belonging to 76 genera under 37 families, Koonthankulam Bird Sanctuary; 83 taxa under 67 genera of 31 families from Chitrangudi Bird Sanctuary; 82 species under 69 genera belonging to 35 families have been documented from Kanjirankulam Bird Sanctuary. Photographed (around 650) the different vegetation/habitat types and plants either with flowers or fruits.

Conducted a 04-day botanical exploration tour to different parts of Nilgiri Hills, Western Ghats, Tamil Nadu, along with a team of scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 16.10.2023 to 19.10.2023. Explored and collected plant specimens from Naduvattam, Mukurthi Peak, Bangitappal and Western Catchment areas and their surrounding; collected about 140 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Nilgiris; also photographed different habitats and plants either in flowering or in fruiting condition.

Conducted a 02-day botanical exploration tour to different parts of Anamalai Hills, Western Ghats, Tamil Nadu, along with a team of Scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 08.11.2023 to 09.11.2023. Explored and collected plant specimens from Karian Shola, Varagalaiyar, Manambolly Range and Aanai Kundhi Shola and their surrounding; collected about 87 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Anamalai Hills; also photographed different habitats and plants either in flowering or in fruiting condition.

Conducted a 02-day botanical exploration tour to different parts of Anamalai Hills, Western Ghats, Tamil Nadu, along with a team of Scientists, as part of Annual Research Programme, Flora of Tamil Nadu, from 06.12.2023 to 07.12.2023. Explored and collected plant specimens from Akkamalai, Valparai, Sholaiyar, Rottikadai and Iyerpadi areas and their surrounding; collected about 115 (tentatively identified in the field) flowering plant species, including good number narrow endemic species of Anamalai Hills; also photographed different habitats and plants either in flowering or in fruiting condition.

Checklist is prepared for the different families by referring various floras. Bibliographic citations, descriptions, phenology, distribution, key to genera, species and infraspecific taxa for the families: Hydrocharitaceae (20 taxa), Burmanniacae (04 taxa), Cannaceae (01 taxon), Hypoxidaceae (03 taxa), Marantaceae (03 taxa), Stemonaceae (01 taxon), Xyridaceae (02 taxa), Asparagaceae (27

taxa) and Flagellariaceae (01 taxon). While the descriptions and artificial keys are being prepared for the other families.

Project 7: FLORA OF TAMIL NADU, VOLUME 7 (Cypereaceae and Poaceae)
Executing Officials: Dr. C. Murugan, Scientist 'F' (Hqrs.)
Dr. A.A. Kabeer, Scientist 'E' (Central Botanical Laboratory)
Dr. S. Arumugam, Botanist
Duration : September 2021– March 2024

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. The objective of the project was completion of Flora of Tamil Nadu, Volume 7 comprising the detailed descriptive of all taxa belonging to two families (Cyperaceae&Poaceae)

Area & Locality: Tamil Nadu

Achievements: Updated bibliographic citations and completed descriptions for the following genera belonging to the family Cyperaceae: **Abildgaardia** (**01** sp.), **Actinoscirpus** (**01** sp.), **Ascopholis** (**01** sp.), **Bolboschoenus** (**01** sp.), **Bulbostylis** (**05** spp.), **Carex** (**36** spp.), **Cyperus** (**84** spp.), **Diplacrum** (01 sp.), **Eleocharis** (09 spp.) and **Erioscirpus** (**01** sp.) The bibliographic citations and descriptions have been completed for about **250** taxa.

Project 8: Lichens of Tamil Nadu
Executing Officials: Dr. T.A.M. Jagadeesh Ram, Scientist 'E'
Duration : 2023-2026

Background: This project was initiated with the intent of documenting the lichen flora of the state of Tamil Nadu and establish a lichen herbarium.
Area & Locality: Tamil Nadu State (Kanyakumari and Tirunelveli Districts)

Achievements: Completed literature survey, 910 previously reported species have been listed from various publications and 94 specimens were identified into 46 species.

Project 8: Flora of Andaman and Nicobar Islands, Volume
Executing Officials: K. Karthigeyan, Scientist 'F'
Duration: 2023–2026

Background: The project was started with the intention of collecting data regarding new additions from different sources and library.
Area & Locality: Andaman and Nicobar Islands

Achievements: Editing of Flora of Andaman and Nicobar Islands Volume 3 is under progress and the team has checked the 2nd proof of Flora of Andaman and Nicobar Islands, Volume 2 and added descriptions for 14 species

Impatiens neo-orchioides V.Ravich. & al.

Impatiens karuppusamyi P.S.S.Rich. & V.Ravich.

Litsea megamalayana Karupp. & al.

Gynochthodes nilagiriensis P. Murugan & al.

Eriocaulon nairii Chandrab. & V.Chandras.

Dendrobium anilii P.M.Salim & al.

Habenaria richardiana Wight

Oberonia verticillata Wight

WESTERN REGIONAL CENTRE, PUNE

Murdannia lanuginosa (Wall. ex C.B. Cl.) Brueck

WESTERN REGIONAL CENTRE, PUNE

Project 1: **PTERIDOPHYTE FLORA OF INDIA**
Executing officials: Dr. A. Benniamin, Scientist 'F'and Dr. Jesubalan, Bot. Asst.
Duration: August 2020 – March 2025

Background: The Pteridophytic flora of India project comprises the political boundaries of India and it is planned to be published in four volumes. The Vol. I was completed and submitted to the Director, BSI, during the last RAMC held at Northern Regional Centre, Dehradun on 6th May 2023. The Volume-I consist of 254 species belonging to 19 families and 31 genera such as Lycopodiaceae, Selaginellaceae, Isoetaceae, Equisetaceae, Psilotaceae, Ophioglossaceae, Marattiaceae, Osmundaceae, Plagiogyriaceae, Dipteridaceae, Gleicheniaceae, Lygodiaceae, Schizaeaceae, Marsileaceae, Cyatheaceae, Dicksoniaceae, Hymenophyllaceae, Dennstaedtiaceae, Lindsaeaceae. The soft copy of the Pteridophytic flora of India Vol.I is also submitted to Dr. V. Irudayaraj, Associated Professor (Retd.) St. Xavier's College, Palayamkottai, Tamil Nadu for Review. Family names are followed as per Nomina Familiarum Conservanda of International Code of Botanical Nomenclature (ICBN). Alternative name if given in parentheses. The family descriptions are compiled here to reflect important characteristics worldwide. The general distribution of the genus and the total number of genera and species in India are mentioned. Keys to genera and lower classes are strictly dichotomous type. Families are listed in alphabetical order. The general description includes important characters of the family. The next section contains the distribution and total number of species in the world and India. The species are arranged serially in alphabetical order. The correct name of the species appears in bold letters followed by its authors name and full reference to original publication. Basionyms, if any are given with full citation. The entire important synonym related to Indian flora and Indian works have been given in this volume. A detailed taxonomic description of the species is provided for proper identification of the species. For Data gathered from Herbarium specimens and correlated with those available literatures. Distribution of the species is given in two paragraphs. The first one gives state wise distribution in India. The next line provides country wise distribution in the world. Distribution Map also given for easy reference. Illustrations and photos also provide for important species for easy identification. In this series, we are presenting Volume-II containing 371 species covering from Pteridaceae to Blechnaceae.
Area and locality of the Allotted Project: India

Achievments:

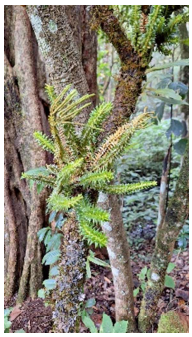
Pteridophytic Flora of India: Vol.1 The complete report of Pteridophytic flora vol 1 has submitted to BSI, Hqrts.Kolkata on 5th May 2023. The reportludes detailed description of 253 species under 19families including Key to Genera and species for all the species. In addition, to Distribution map for all the species (253spp) through QGIS software. Photographs of More than 100spp has also included.

Pteridophytic Flora of India: Vol.II

The complete list was completed for AAP Project Report of Pteridophytic flora of India Vol. II and the family Thelypteridaceae is in progress of preparation of details i.e. description, distribution, fertile information, threatened status and cooridinates. The Volume-II will be submitted in the month of March 2024 to the Director, BSI. The report consists of description, distribution, Ecology, fertile information, threatened status, photo plates and distribution map for all Pteridophytes belonging five families, 28 genera and 371 species.

Curatorial works and maintenance of the Herbarium of BSI, Pune: During the year 2023 Digitization of Herbarium of 1, 11,131specimens Metadata has prepared and Photographs of 1,11,131 Herbarium have taken with the assistance from Scientific staffs of WRC, Pune. The Final Report along with photographs of the Curatial Works has submitted to BSI,Hqrts, Kolkata on 5th May 2023.

Cyrtomium micropterum (Kunze) Ching



Huperzia phyllantha (Hook. & Arn.) Holub

Project 2: DNA Barcoding of Endemic Plants from the Northern Western Ghats of Maharashtra
Executing Officials: Dr. Nithaniyal Stalin A, Dr. A. Benniamin A, and Shri. Subir Biswas BSI, WRC, Pune
Duration: Nov 2023 – Oct 2027

Background: Endemic plants are living treasures that act as an irreplaceable national heritage of a country. India's rich biodiversity gained the spotlight in the world's taxonomic research by holding 4036 endemics out of 21,849 angiosperms which are crucial in supporting the monophyly of the existing phylogenetic classification. The Western Ghats of India alone support the habitat for more than 1273 endemic species. The Northern Western Ghats (NWG) of Maharashtra requires special attention since it represents 39% (71/181) of total endemic taxa restricted to a single location, and 53% (38/71) of them from type location require immediate conservation measures. DNA barcode identification is adopted worldwide in taxonomic research to resolve issues of ambiguous identification, and such studies are very much limited in India. Therefore, the proposed study is sharply focused on the DNA barcode assessment of endemics at Northern Western Ghats (NGW). Developing a reference DNA barcode library of NWG endemics is crucial because these taxa are not found elsewhere. The current DNA barcoding study will be beneficial to assess and characterize endemic plants, discover of new cryptic species, resolve the species complex in congeners, and understand phylogenetic relationships.

Area & Locality: The Northern Western Ghats (NWG) of Maharashtra comprises the tropical moist broadleaf forests at higher elevations (1000 MSL) and is surrounded by moist deciduous forests at lower elevations at the Indian peninsula. This region covers about 30,900 sq. km, lies between 14.8o to 21o N, and provides a microhabitat for many specialized stenoendemics (Fig. 1.). The NWG encompasses the most significant protected forested areas as wildlife sanctuaries like Koyna, Radhanagari, Bhadra, & Tansa, and national parks include Mollem, Anshi, and Chandoli. Protected areas comprise moist Tropical Forests, Southern Tropical Wet Evergreen Forest, Southern Tropical Semi-evergreen Forest, and West Coast Semi-Evergreen Forests (Puri 1960). The mixed escarpment forests and valleys, grasslands, rocky outcrops, dense network of east-flowing rivers, and interspersed laterite plateaus are ecologically significant. This region also provides shelter for endangered species, thus reinforcing implementation of conservation policies and gene pool preservation. However, anthropogenic pressures impact the NWG vegetation due to several developmental activities in cities like Mumbai, Pune, Kolhapur, Nashik, and Surat. Climate change, on the other side, leads to habitat loss and extinction of species. The unique geography of biodiversity and the implications of conservation action makes it imperative to study the area in better detail.

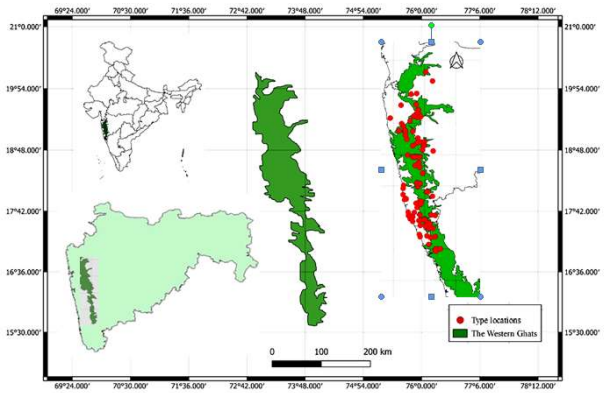


Fig. 1. Map showing type localities of local endemic species of Northern Western Ghats

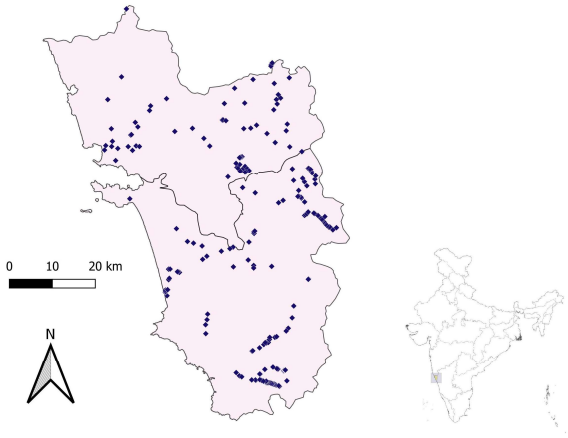
Achievements: New project proposal titled "DNA barcoding of endemic plants from the Northern Western Ghats of Maharashtra" (2023 – 2027) under Annual Action Plan Project is approved by the Director, Botanical Survey of India on 14th November 2023. Review of literature on endemic plant type locations in Northern Western Ghats is being prepared. Habitat wise distribution based on the forest types of Maharashtra is being prepared. One day field tour was conducted at Mahabaleswar, Pune, Maharashtra on 17th December 2023. Sample collected for preliminary standardization of wet lab work.

Project 3: Bambusicolous fungi of Goa
Executing Officials: Dr. Rashmi Dubey, Scientist 'F', BSI, WRC, Pune
Duration: 2020 – 2024

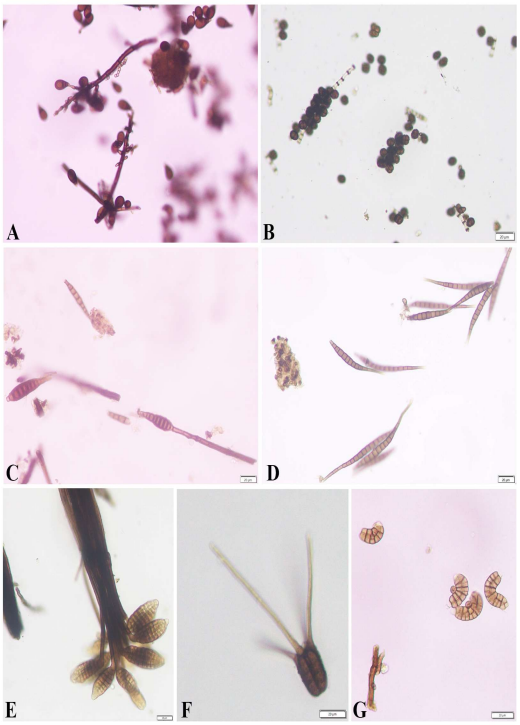
Background: India is the second richest country in terms of bamboo genetic resources next only to China and is likely to support an equally diverse mycota. Most bamboo species are found in the wild and have not yet been domesticated for phytopathological scrutiny. The complex lifestyle of bamboo species which encompasses fast growth, giant height, often growing in difficult terrain, limits surveillance and impedes insights on bamboo pathology. Though there are sporadic reports on the morphological aspects of bambusicolous fungi of India, our knowledge of bamboo-inhabiting fungi from India is still at the cataloguing stage. State of Goa encompasses an area of 3,702 sq. km (1,429 sq mi). Goa lies on the west coast of India and exhibits diverse geography encompassing Western Ghats to the east and coastal plains of Konkan towards the west, which is an escarpment rising up to the Western Ghats of India. Equatorial forest cover in the state stands at 1,424 sq. km (549.81 sq mi). The state thus offers an ideal niche for the occurrence of diversified bambusicolous fungi. Therefore, the project has been undertaken for a comprehensive understanding of complex of bambusicolous fungi with the objective of conducting the morpho-molecular characterisation of fungal species associated with different parts of Bamboo (leaves, culms, branches, sheathes, lowers, rhizomes, and roots). Standard methodology involved field surveys for collection of samples; laboratory processing for morphological and Scanning Electron Microscopic studies; molecular studies (DNA extraction, PCR amplification, DNA sequencing) and phylogenetic analyses to evaluate the validity of bambusicolous fungal taxa and clarify their phylogenetic relationships by multigene sequencing; cataloguing, preservation and maintenance of fungal germplasm.

Area and Locality: Protected areas of Goa along with their adjoining areas.

Achievements: During previous tours one national park and six wildlife sanctuaries (viz., Mollem National Park, Bondla Wildlife Sanctuary, Mhadei Wildlife Sanctuary, Bhagwan Mahavir Wildlife Sanctuary, Cotigao Wildlife Sanctuary, Netravali Wildlife Sanctuary, Dr. Salim Ali Bird Sanctuary) of Goa were surveyed, therefore no field tour was conducted this year. In laboratory conditions, 804 bambusicolous fungal sections were crossed checked, 1132 slides were prepared and 639 photomicrographs were captured.



Survey Map of Goa showing collection locations prepared by plotting GPS data using QGIS 3.14 'Pi' version



Some Interesting Bambusicolous Fungi from Goa: A. *Brachysporiella gayana*; B. *Dictyoarthrinium rabaulense*; C. *Distoseptispora bambusicola*; D. *Janetia capnophila*; E. *Kostermansinda magna*; F. *Tetraploa aristata*; G. *Xenosporium indicum*.

A total of 194 fungal isolates were identified under 79 fungal species viz., *Acrodictys bambusicola* M.B. Ellis 1961; *Acrodictys* sp.; *Apiospora* sp.; *Arthrinium phaeospermum* (Corda) M.B. Ellis 1965; *Arthrinium* sp.; *Arthrobotryum* sp.; *Aspergillus* sp.; *Aureobasidium* sp.; *Bambusaria bambusa* (J.N. Kapoor & H.S. Gill) Jaklitsch, D.Q. Dai, K.D. Hyde & Voglmayr 2015; *Berkleasmium pandani* McKenzie 2008; *Berkleasmium* sp.; *Bhatia malabarica* (Subram. & Bhat) W.A. Baker & Morgan-Jones 2009; *Brachysporiella gayana* Bat. 1952; *Brachysporiella bambusicola* Rashmi Dubey sp. nov.; *Brachysporiella* sp.; *Camposporium* sp.; *Capnodium* sp.; *Chloridium* sp.; *Coniothyrium* sp.; *Cordana* sp.; *Coronospora dendrocalami* M.B. Ellis 1971; *Corynespora cassiicola* (Berk. & M.A. Curtis) C.T. Wei 1950; *Corynespora* sp.; *Craspedodidymum fimbriatum* Bhat & W.B. Kendr. 1993; *Cyclotheca* sp.; *Diatrype stigma* (Hoffm.) Fr. 1849; *Diatrype* sp.; *Dictyoarthrinium rabaulense* Matsush. 1971; *Dictyoarthrinium sacchari* (J.A. Stev.) Damon 1953; *Dictyoarthrinium thailandicum* G.C. Ren & K.D. Hyde 2022; *Dictyoarthrinium* sp.; *Distoseptispora bambusae* Y.R. Sun, I.D. Goonasekara, Yong. Wang bis & K.D. Hyde 2020; *Distoseptispora bambusicola* X. Tang, Jayaward., J.C. Kang & K.D. Hyde 2023; *Distoseptispora bispolaris* Rashmi Dubey sp. nov.; *Distoseptispora obpyriformis* Z.L. Luo & H.Y. Su 2018; *Distoseptispora* sp.; *Endophragmiella uniseptata* M.B. Ellis ex S. Hughes 1979; *Eutypella* sp.; *Geotrichopsis* sp.; *Janetia capnophila* S. Hughes 1983; *Hypoxylon* sp.; *Janetia* sp.; *Kostermansinda magna* (Boedijn) Rifai 1968; *Leptoxyphium glochidion* H. Yang & K.D. Hyde 2014; *Leptoxyphium* sp.; *Lophiostoma* sp.; *Melanographium bambusicola* Rashmi Dubey sp. nov.; *Melanographium* sp.; *Meliola* sp.; *Microsphaeropsis olivacea* (Bonord.) Höhn. 1917; *Mollisia* sp.; *Monodictys* sp.; *Penzigomyces indica* Rashmi Dubey sp. nov.; *Penzigomyces* sp.; *Periconia* sp.; *Phragmocapnias* sp.; *Pithomyces ellisii* V.G. Rao & Chary 1972; *Pithomyces* sp.; *Polytretophora*

calcarata Mercado 1983; *Rhizoctonia* sp.; *Roussoella* sp.; *Scolecoxyphium* sp.; *Scopulariopsis* sp.; *Scorias* sp.; *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. 1863; *Sordaria* sp.; *Spiropes guareicola* (F. Stevens) Cif. 1955; *Spiropes* sp.; *Sporidesmium flagellatum* (S. Hughes) M.B. Ellis 1958; *Sporidesmium* sp.; *Sporoschisma nigroseptatum* D. Rao & P.Rag. Rao 1964; *Tetraploa aristata* Berk. & Broome 1850; *Thermomyces* sp.; *Trimmatostroma* sp.; *Xenosporium indicum* Panwar, Purohit & Geholt 1973; *Xenosporium* sp.; *Xiuguozhangia macrospora* Rashmi Dubey sp. nov.; *Xiuguozhangia* sp.; *Xylohyphopsis* sp. Besides, a total of 39 fungal isolates were grown on semi-synthetic media (PDA, MEA). The nomenclature of all documented fungi was updated using worldwide myco online databases viz., MycoBank and Index Fungorum (2023). Description of 47 accessioned fungal species was completed. Molecular protocols for identification of fungi were standardized. Molecular phylogenetic analyses were carried out for 06 fungal species.

Project 4: Phyto Data-Base of Konkan, Maharashtra

Executing Official: Dr. Prashant K. Pusalkar, Scientist-F
Duration: 2021-2024

Background: The Konkan region, forming northern west coast of India between Arabian Sea and Western Ghats has unique floristic diversity. The signature landscape with coastal vegetation (including dense coastal and inland mangrove forests) and unique laterite plateaus (Konkan Sadas) harbor diverse flora with many endemics. The projects aim at the creation of floristic database of the region to be available for further phyto research, conservation and management as well as contribution to consolidated plant diversity documentation of 'Indian Coast' Biogeographic zone.

Area and Locality: The Konkan region of Maharashtra state comprising coastal regions of Palghar, Thane, Mumbai, Raigad, Ratnagiri and Sindhudurg districts.

Achievements:

Phyto-Data-base: Completed documentation for 622 species under different categories such as General Floristic Diversity, Tree diversity, Special and Unique Plant Groups, Rock outcrops (Phyto-diversity of Konkan Sadas – Laterite Plateaus), Coastal flora and Halophytes (including Mangrove Diversity), Aquatic and wetland flora, Conservation Dependent Species (Endemic and Threatened Flora), Economic Phyto-Resources (including Ethno-Botanical resources and Medicinal Flora), Phyto-potential, Unique Sites, etc.

Undertaken One floristic survey tour (Q2-September 2023) to different regions of Konkan and surveyed different zones such as coastal belt (sandy, muddy and rocky beaches), estuarine banks, lakes, riverine, mangrove (coastal and inland) forests, coastal and inland fort-associated flora, hill forests and laterite plateaus (Sadas) for record of vegetation, species field data and floristic documentation. Collected 168 specimens and identified 143 specimens.

Memecylon umbellatum Burm.f

Aegiceras corniculatum (L.) Blanco

BSI HEADQUARTERS, KOLKATA

Publication section:

Project 1: Red Listing of Indian endemics as per IUCN criteria: Family Ranunculaceae
Executing Officials: Dr. Debasmita Dutta Pramanick, Scientist-D, Dr. D.K. Agrawala, Scientist-E, Dr. J.S. Jalal, Scientist E & Dr. S.S. Dash, Scientist F.
Duration:: 2021 - 2023

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 medicinal 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. This projects with an objective to Evaluation of threat status of Indian endemics belonging to the family Ranunculaceae and Spatial representation of the endemic species on the global atlas.

Achievements:

Collection and compilation of data for 42 endemic taxa of the family Ranunculaceae in India has been completed. Literature review has been completed for citation. Studied Type materials of the endemic taxa from different National herbaria (CAL, MH, BSD, DD, KFRI, ASSAM, ARUN). Data sheet of 42 taxa belonging to the genera *Aconitum* (08), *Anemone* (03), *Caltha* (01), *Clematis* (13), *Consolida* (01), *Delphinium* (04), *Isopyrum* (01), *Nigella* (01), *Oxygraphis* (01), *Paraquilegia* (01), *Ranunculun* (06) and *Thalictrum* (03) (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 the 42 taxa have incorporated in excel sheet along with latitude-longitude data procured from Google earth. Mapping of the taxa and red list assessment are in progress.

Project 2: Revision of the genus *Aristida* L. (Poaceae) in India
Executing Official: Dr. Nagaraju Siddabathula, Botanist
Duration: 2022 Target date of completion: 2024
Objectives:

- Taxonomic revision of the genus Aristida (Poaceae) for India
- To understand species diversity and solve the species complex within the genus
- To resolve the problems related nomenclature, taxonomy, typification and distribution
- To identify the status and distribution of endemic and threatened species in this genus
- To recognize the economic potential of the species in this genus
- Conservation status assessment of endemic Aristida species

Background: The genus *Aristida* belongs to the family Poaceae tribe Aristideae (Clayton & Renvoize, 1986). It comprises about 300 species (POWO, 2023), spreads in Tropical & Subtropical to Mongolia and N. America, primarily it grows in subtropical climate. Presently, 10 species have been reported from India (Prasanna & al., 2020, Nagaraju & al., 2020), namely 1). *Aristida adscensionis*; 2). *A. cumingiana*; 3). *A. cyanantha*; 4). *A. funiculata*; 5). *A. hystricula*; 6). *A. hystrix*; 7). *A. mutabilis*; 8). *A. redacta*; 9). *A. setacea*; 10). *A. stocksii*. The genus is characterised by terete lemma with convolute margins. The lemma apex has a spirally twisted trifid awn or sometimes without (Lazarides, 1994). The genus is classified into 5 sections: *Aristida, Arthratherum, Pseudarthratherum, Pseudochaetaria* and *Schizachne* based on the awn and the lemma column (Clayton & Renvoize, 1986). This genus has some taxonomical/nomenclature issues, a comprehensive study required to resolve those issues. Therefore, a taxonomic revision of the genus *Aristida* for India, project under taken.

Achievements:
The literature pertaining to 10 species under the genus have been studied and consulted CNH at Howrah. A complete description of 10 species with photo plates have been prepared and specimens were deposited at DRC, Hyderabad (Which were my earlier collections from Telangana state). Project has completed and report under preparation.

Technical section:

Project 3: Plants of Kolkata
Executing Scientist: Dr. S. S. Dash, Scientist-F, Dr. R. K. Chakraborty, Retired. Scientist., Dr. A. A. Mao, Director and Dr. Umeshkumar L. Tiwari, Scientist-D (with assistance of Ms. Sinchita Biswas, Botanical Assistant)
Duration: 2021-2024

Background: Kolkata, situated at the bank of the Hooghly river is a city of cultural heritage. The city has always occupied a very significant part in the History of India. It is the capital of the state of West Bengal. By virtue of its geographical location, it is blessed with the predominant alluvium of the Indo-Gangetic plain. The fertile alluvial soil promotes the growth of grasses, crop plants and many trees. This project started in 2021 with the aim to document all the plants seen in the different localities of Kolkata. Special emphases were given to localities around places of historical importance in Kolkata. The plants found around these places were documented.
Area and Locality: Kolkata, West Bengal.

Achievements: During 2023-24, vernacular (Bengali) of 150 plants were documented. The descriptions of the plants were updated wherever required emphasizing on the conclusive details or special features observed. Additional photographs were taken through few local exploration. Overall, description of 350 plants have been completed so far. The plants were found to be spread over 67 families. The data is being organized and the final report is under preparation.

Cassia javanica L.

Lagerstroemia duperreana Pierre ex Gagnep.

Project 4: Wild useful/edible plants of Arunachal Pradesh.
Executing officials: Dr. U.L. Tiwari, Scientist -D,
Dr. S. S. Dash, Scientist -F
Dr. K. Chowlu, Scientist-D
Duration : April, 2021-March, 2024.
Area and Locality: Entire Eastern Arunachal Pradesh.

Background:
Arunachal Pradesh is the largest state in Northeast India. The state is represented with 32 major tribes and 110 sub tribes. Arunachal Pradesh has a rich and diverse cultural heritage. And the food habit of each tribe is so unique and different there. The method of preparations of item and the type of

composition is so unique in each tribe. So to know the more about the edible plants of Arunachal Pradesh and also to know the way of preparation of the traditional food dishes including detailed food habits of the people living there, this study was carried out. The primary objective of this project is to identify and document all the wild/useful plants of Arunachal Pradesh which are used by the local people in various purpose. Further, the study aims to prepare a chronicle on the different food habits including all the plant species used by them and the traditional techniques of food preparation in Arunachal Pradesh.

Achievements:

Around the world, there is widespread use of edible wild plants to augment diet, medicine, and food. It is estimated that 20000 wild plants are edible worldwide, and more than 85% of the world's population has been able to obtain their daily caloric needs from nearly 20 plant species. In the biodiversity-rich Indian state of Arunachal Pradesh, the aim of this study was to determine the current diversity status and utility patterns of wild edible plants (WEPs) for the purpose of plant identification and conservation of potential species. To this end, a systematic field study was conducted, and all published works were consulted. There are 664 species in all, from 340 genera and 126 families, most of which are utilized as fruits, vegetables, medicines, spices, and sauces. These include 6 Gymnosperm species, 632 Angiosperm species, and 24 Pteridophyte species. The use of above-ground plant parts is discovered to be significantly higher than that of underground plant parts, despite the fact that both are proven to be helpful. The majority of the above-ground plant parts that are chosen are the fruits (45.33% spp.), young shoots (23.34% spp.), leaves (30.87% spp.), and flowers (10.54%). The least used portions are the petiole, bark, culm and bulbil, and seeds (< 10.0 % spp. in each). The most favored sections are discovered to be tubers and rhizomes, with underground portions (7.98%) being less used (Fig. 1).

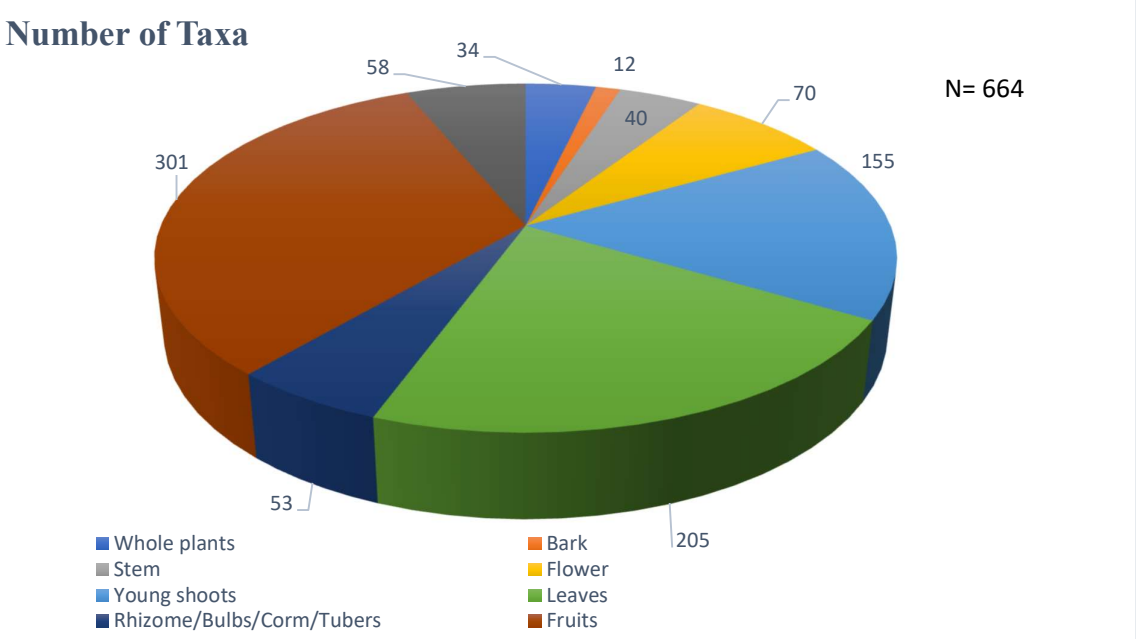


Fig. 1. Major edible usange grup of WEPs of Arunachal Pradesh

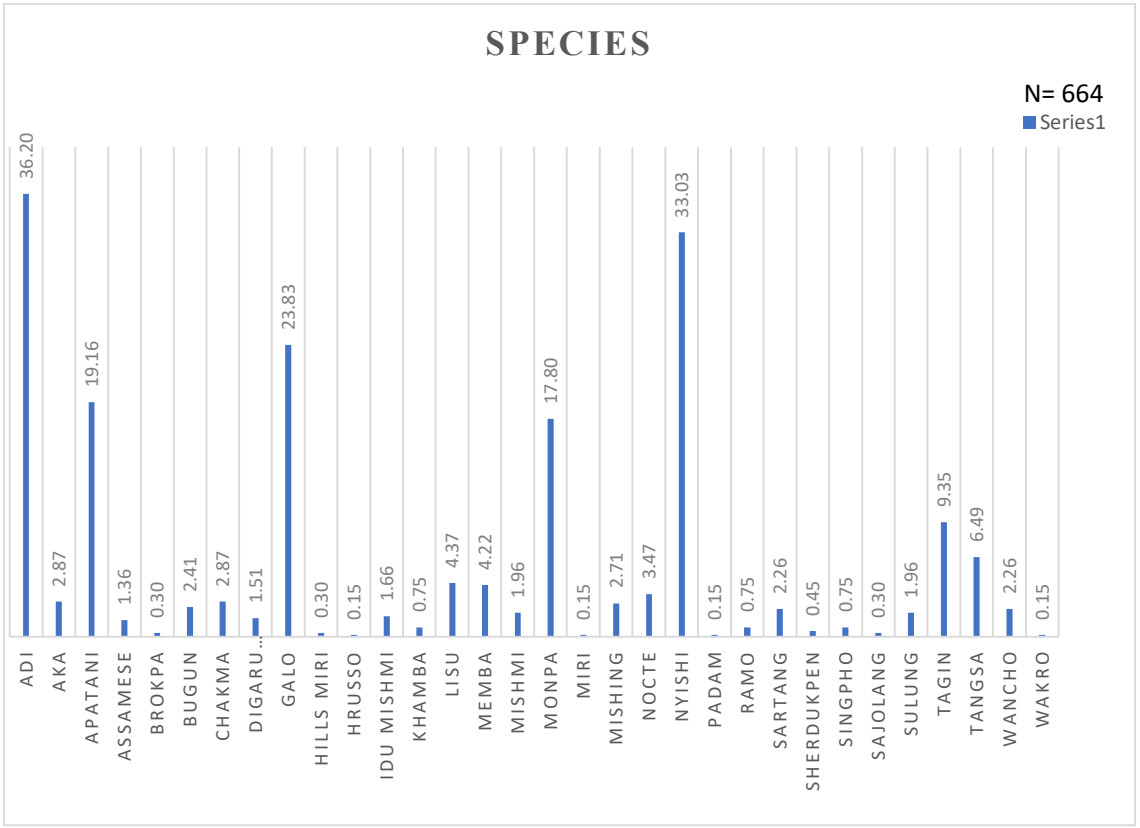


Fig. 2. Dominant WEPs use by diffrent Ethenic Groups of Arunachal Pradesh

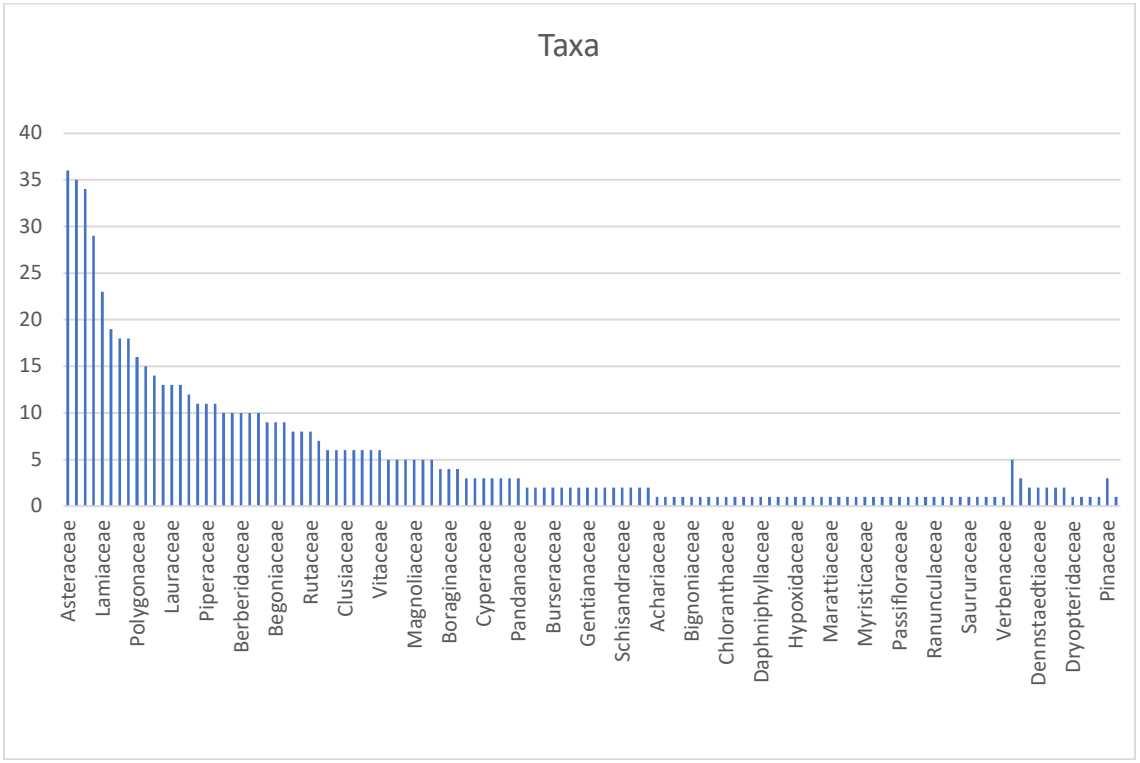


Fig. 3. Dominant plant families of WEPs of Arunachal Pradesh

In order to understand the specific consumption of individual WEPs, information was gathered from several locations of Arunachal Pradesh, and 32 major ethnic groups were identified, visited and data collected. Data was then categorized based on the use patterns of these ethnic groups. The results of the analysis exhibited that the Adi ethenic group (36.20% spp.) is the group that uses plant resources to the greatest extent, followed by the Nyishi (33.03 % spp.), Galo (23.83% spp.), Apatani (19.16%), Monpa (17.80%), and so on (Fig. 2). Among Angiosperms family Asteraceae accounted for 36 species, making it the dominant taxon in terms of number of species. This was followed by the Urticaceae (35 species), Rosaceae (34 species), Moraceae (29 species), and Lamiaceae (23 species). In terms of Pteridophytes (12 families; 17 genera) Thelypteridaceae (5 species) and Cyatheaceae (3 species) and the remaining families have one species each. It was discovered that gymnosperms were underutilized, with only 3 families such as Taxaceae (1 species), Pinaceae (3 species), and Gnetaceae (2 species). Within the genera, the greatest number of species was found in *Ficus* (20 species), which is followed by *Rubus* (18 species), *Dioscorea* (17 species), *Piper* (11 species), *Solanum* (10 species), *Calamus* (10 species), and so on (Fig. 3).

Project 5: Documentation of economically important seaweeds of the Indian coast
Executing Official : Dr. S.K. Yadav, Botanist
Date of initiation : April 2022
Date of completion : March 2025

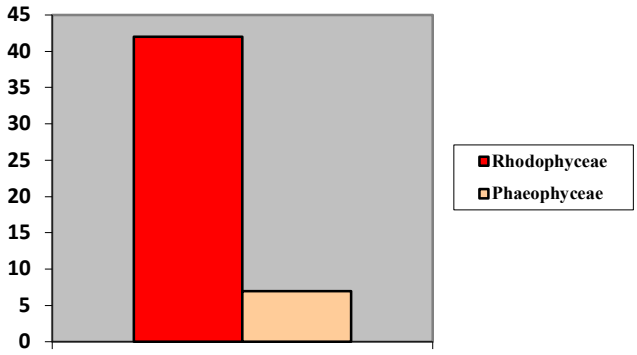
Background:
Seaweeds are one of the important marine natural resources, with great economic potential. It is directly linked with the SDG goals No. 14 *i.e. Life below water*. India is a maritime country with a coastline of c. 7500 km length, spreading into 9 states and 4 Union territories. The Indian coastline supports significant diversity of seaweeds. However, only sporadic and intermittent information is available on the economic aspects of these promising marine resources. Therefore, considering the above facts, the present works has been undertaken.

Area And Locality:
Indian coastline (c. 7500 km length)

Achievements:
Based on the study of relevant literature and field observation, tentative list of 49 taxa of economically important seaweeds, comprising **7** taxa of Phaeophyceae and 42 taxa of Rhodophyceae. These seaweeds are of high economic and therapeutic potentials and widely used in various forms such as food, fodder, Manure, Seaweed Liquid Fertilizers (SLF) and also in Pharmaceuticals, Biochemicals, Agar-Agar, Textile, Paper, Biodiesel industries. Seaweeds are the important natural source of phycocolloids, with are of high economic potential. The three major phycocolloids are Agar-Agar, Alginates and Carrageenan, mainly extracted from the red seaweeds like species of *Gelidium, Gelidiella, Gracilaria* etc. Similarly, *Alginate*, (Algin or Alginic acid) is a polysaccharide and is mainly extracted from the brown seaweeds like species of *Sargassum, Turbinaria, Cystoceira, Dictyota, Padina, Hormophysa, Colpomenia, Spatoglossum, Stoechospermum* etc.

Some of the economically important seaweeds which have been documented from the Indian coast are *Sargassum myriocystum* J. Agardh, *Sargassum polycystum* C. Agardh, *Sargassum ilicifolium* (Turner) J. Agardh, *Sargassum tenerrimum* J. Agardh, *Turbinaria conoides* (J. Agardh) Kutz., *Porphyra indica* V. Krishnam. & Baluswami, *Pyropia kanyakumariensis* (V. Krishnam. & Baluswami) Santiañez & M.J.Wynne, *Pyropia vietnamensis* (Tak. Tanaka & P.H. Ho) J.E. Sutherland & Monotilla, *Gelidium micropterum* Kutz. *Gelidiella acerosa* (Forssk.) J. Feldmann & G. Hamel, *Gracilaria corticata* (J. Agardh) J. Agardh, *Gracilaria edulis* (S.G.Gmel.) P.C.Silva, *Asparagopsis taxiformis* (Delile) Trevis., *Chondracanthus acicularis* (Roth) Fredericq, *Hypnea valentiae* (Turner) Montagne, *Champia compressa* Harv., *Gelidiopsis intricata* (C. Agardh) Vickers, *Gelidiopsis repens* (Kuetz.) Weber Bosse, *Ceramium cruciatum* Collins & Herv., *Bostrychia tenella* (J.V. Lamour.) J. Agardh etc.

Map showing the Indian coastlines



Graph showing economically important brown and red seaweeds.

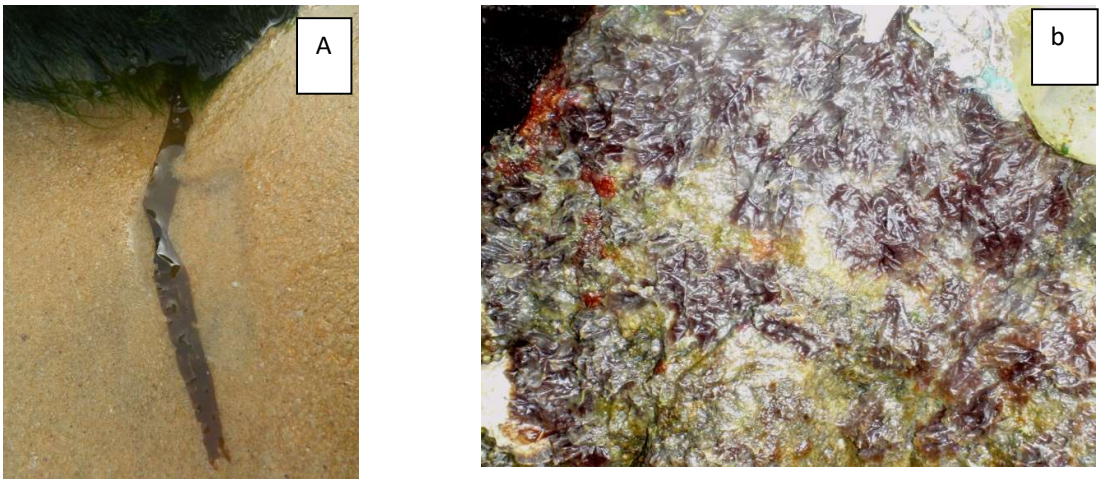


Fig. A. *Pyropia kanyakumariensis* (V. Krishnam. & Baluswami) Santiañez & M.J.Wynne, **B.** *Pyropia vietnamensis* (Tak. Tanaka & P.H. Ho) J.E. Sutherland & Monotilla

FLORA OF INDIA PROJECT

As approved by the RAMC during the last meeting, the editorial committee for completion of Flora of India volumes has been set up with following members.

1. Dr. A. A. Mao
2. Dr. S. S. Dash
3. Dr. J. Jayanthi
4. Dr. J.S. Jalal
5. Dr. D. K. Agrawala
6. Dr. U.L. Tiwari
7. Dr. C. P. Vivek
8. Dr. Gopal Krishna

The Editorial Committee has gone through the submitted manuscripts of Flora of India volumes and checked thoroughly the nomenclature, inclusion/exclusion of species, checked the synonymy, made the manuscript uniform, arranged the photographs and illustrations. Volumes 6, 15, 20 and 22 has been sent to press for publication. Volume 31 and 32 have been reassigned to Dr. K.A.A. Kabeer for updating. Volumes 8, 10, 14, 16, 18, 19, 25, 26, 28 and 30 are being worked for consistency check. Volume 09, 17 and 24 has been published.

Flora of India, Volume 6 [Fabaceae (Leguminosae) Part-I]

Flora of India, Volume 20 [Gesneriaceae–Acanthaceae]

Flora of India, Volume 15 [Stylidiaceae–Primulaceae]

NEW DISCOVERIES

NEW TO SCIENCE: 33

ANGIOSPERM
New Species: 13

1. *Dendrophthoe longensis* L.J. Singh
2. Morindopsis ashihoi M.C.Naik, L.J.Singh & Arriola
3. *Lysiontus namchoomii* Chowlu, C.H Nguyen, K. Gogoi & Aver
4. *Trigonella kargilensis*
5. *Justicia tamilnadensis* P.Raja & Soosairaj
6. *Pedicularis revealiana* Arti Garg & al.
7. *Mussaenda conferta* Sujana & Vadhyar
8. *Blbophyllum gopalianum* Sawmalina & al.
9. *Gastrodia sikkimensis* Khanal, M. & al.
10. *Symplocos sisaparensis* B. Karthik & al.
11. *Impatiens rajibgogoii* Khanal, M. & al.
12. *Assystasia venui* A. Kumar & al.
13. *Osbeckia yercaudensis* Sarvanan T.S. & S. Kaliamoorthy

ALGAE
New Species: 01

1. *Avrainvillea ridleyi* A.Gepp & E.S.Geep

FUNGI
New Species: 19

1. *Thaxterogaster shoreae* A. Ghosh, D. Chakr., K. Das & Vizzini
2. *Russula boddingii* Hembrom, D.Chakr., A.Ghosh & K.Das
3. *Russula pseudoflavida* A.Ghosh, Hembrom, I.Bera & Buyck
4. *Russula shoreae* D.Chakr., A.Ghosh, K.Das & Buyck
5. *Amanita aurantialba* A. Kumar, Mehmood, A. Ghosh & Y.P. Sharma
6. *Amanita indovaginata* A. Ghosh, D. Chakr. & K. Verma
7. *Amanita pseudohemibapha* A. Ghosh, Mehmood A. Kumar & Y.P. Sharma
8. *Cyanoboletus paurianus* K. Das & A. Ghosh
9. *Harrya olivaceobrunnea K*.Das
10. *Leccinellum binderi* K. Das, A. Ghosh & Vizzini
11. *Russula boddingii* Hembrom, D.Chakr., A.Ghosh & K.Das
12. *Russula pseudoflavida* A.Ghosh, Hembrom, I.Bera & Buyck
13. *Russula shoreae* D.Chakr., A.Ghosh, K.Das & Buyck
14. *Thaxterogaster shoreae* A. Ghosh, D. Chakr., K. Das & Vizzini
15. *Xerocomellus himalayanus* D. Chakr & A. Ghosh
16. *Xerocomus uttarakhandae* K. Das, Sudeshna Datta & A. Ghosh
17. *Xerocomellus himalayanus* D. Chakr & A. Ghosh
18. *Russula boddingii* Hembrom, D. Chakr., A. Ghosh & K. Das
19. *Russula shoreae* D. Chakr., A. Ghosh, K. Das & Buyck

NEW DISTRIBUTIONAL RECORDS TO INDIA: 19

ANGIOSPERMS

1. *Anoectochilus medogensis* H.Z. Tian & Y. Jin
2. *Loxostigma puhoatense* N.D Do, N.S Ly, D.H. Nguyen & T.H. Le
3. *Strobilanthes sunhangii* T. Deng, J.T. Chen & Y.F. Deng
4. *Varronia curassavica* Jacq.
5. *Parnassia* yui Z.P. Jien
6. *Pluchea sagittalis* (Lam.) Cabera

FUNGI

1. *Avrainvillea ridleyi* A.Gepp & E.S.Geep
2. *Aureoboletus miniatoaurantiacus*(C.S. Bi & Loh) Ming Zhang, N.K. Zeng & T.H. Li
3. *Boletus bainiugan* Dentinger
4. *Cyanoboletus macroporus* Sarwar, Naseer & Khalid
5. *Phylloporus gajari* Hosen & Zhu L. Yang
6. *Rugiboletus extremiorientalis* (Lj.N. Vassiljeva) G.Wu & Zhu L. Yang
7. *Veloporphyrellus latisporus* J. Khan & S. Ullah
8. *Xerocomus fraternus* Xue T. Zhu and Zhu L. Yang
9. *Veloporphyrellus latisporus* J. Khan & S. Ullah
10. *Cyanoboletus macroporus* Sarwar, Naseer & Khalid
11. *Phylloporus gajari* Hosen & Zhu L. Yang
12. *Rugiboletus extremiorientalis* (Lj.N. Vassiljeva) G. Wu & Zhu L. Yang

PTERIDOPHYTES

1. *Asplenium austrochinense* Ching

EX-SITU CONSERVATION

Botanical Survey of India, a premier organization under Ministry of Environment, Forest and Climate Change is custodian of 11 botanic gardens covering different geographical regions of India. Through these gardens BSI practices *ex-situ* conservation of different Endemic, 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 EET plants. Since their inception, all these gardens are doing excellent work 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
1	AJC Bose Indian Botanic Garden, Howrah	Howrah
2	Andaman & Nicobar Regional Centre, BSI, Experimental Garden, Dhanikhari	Port Blair
3	Arid Zone Regional Centre, Jodhpur: Experimental Garden, Jodhpur	Jodhpur
4	Arunachal Pradesh Regional Centre, Itanagar: Experimental Garden, Sankie View	Itanagar
5	Botanic Garden of Indian Republic, Experimental Garden, Noida	Noida
6	Central Regional Centre, Experimental Garden, Allahabad	Allahabad
7	Eastern Regional Centre, Shillong: Experimental Garden, Barapani	Shillong
8	National Orchidarium and Experimental Garden, Yercaud	Coimbatore
9	National Gymnosperm collection cum Botanic Garden, Pauri	Dehradun
10	Sikkim Himalaya Regional Centre, Experimental Garden, Gangtok	Gangtok
11	Western Regional Centre, Pune, Experimental Garden, Mundhwa	Pune

AJC Bose Indian Botanic Garden, Howrah

Project 1: Maintenance, mass multiplication of germination of plants at AJC Bose Indian Botanic Garden, Howrah

During the period, a total of 3705 plant saplings, seeds, bulbs and tubers were collected including gymnosperms and pteridophytes representing 429 species belonging to 123 families and 298 genera are introduced in AJCBIBG. Of which 231 were newly added to the garden. Out of 429 species 37 species are endemic, 16 species are Vulnerable, 6 are Endangered and 4 are Critically Endangered. Newly added plants are as follows: *Acacia mangium* Willd., *Acer acuminatum* Wall. ex D.Don, *Acer campbellii* Hook.f. & Thomson ex Hiern, *Acer oblongum* Wall. ex DC., *Acrocarpus fraxinifolius* Wight & Arn., *Actinidia deliciosa* (A.Chev.) C.F.Liang & A.R.Ferguson, *Actinodaphne* sp., *Adansonia gregorii* F.Muell., *Aesculus assamica* Griff., *Aglaia elaeagnoidea* (A.Juss.) Benth., *Aglaia perviridis* Hiern, *Ailanthus triphysa* (Dennst.) Alston, *Aiphanes horrida* (Jacq.) Burret, *Alnus nepalensis* D.Don, *Alpinia malaccensis* (Burm.f.) Roscoe, *Alstonia venenata* R.Br., *Amomum fenzlii* Kurz, *Amomum subulatum* Roxb., *Amoora rohituka* (Roxb.) Wight & Arn., *Amorphophallus konkanensis* Hett., S.R.Yadav & K.S.Patil, *Anamirta cocculus* (L.) Wight & Arn., *Angiopteris erecta* Desv., *Annona squamosa* Vell., *Anodendron parviflorum* (Roxb.) I.M.Turner, *Aphanamixis polystachya* (Wall.) R.Parker, *Aphananthe cuspidata* (Blume) Planch., *Aquilaria malaccensis* Lam., *Araucaria bidwillii* Hook., *Araucaria cunninghamii* Mudie, *Ardisia elliptica* Thunb., *Areca triandra* Roxb. ex Buch.-Ham., *Arenga wightii* Griff., *Argyreia nervosa* (Burm.f.) Bojer, *Bambusa mizorameana* H.B.Naithani, *Bambusa polymorpha* Munro, *Piliostigma malabaricum* (Roxb.) Benth., *Bauhinia phoenicea* B.Heyne ex Wight & Arn., *Beilschmiedia dalzellii* (Meisn.) Kosterm., *Bentinckia*

condapanna Berry ex Roxb., *Berberis napaulensis* (DC.) Spreng., *Berrya cordifolia* (Willd.) Burret, *Betula alnoides* Buch.-Ham. ex D.Don, *Boesenbergia longiflora* (Wall.) Kuntze, *Bolbitis heteroclita* (C.Presl) Ching, *Boswellia serrata* Roxb., *Brainea insignis* (Hook.) J.Sm., *Brucea mollis* Wall. ex A.W.Benn., *Brunfelsia pauciflora* (Cham. & Schltdl.) Benth., *Buchanania barberi* Gamble, *Buchanania lanzan* Spreng., *Bursera serrata* Wall. ex Colebr., *Butea buteiformis* (Voigt) Grierson, *Butea superba* Roxb. ex Willd., *Butia capitata* (Mart.) Becc., *Calamus baratangensis* Renuka & Vijayak., *Calamus metzianus* Schltdl., *Calamus rheedei* Griff., *Calamus travancoricus* Bedd. ex Becc., *Calamus floribundus* Griff., *Calamus leptospadix* Griff., *Calophyllum apetalum* Willd., *Camellia sinensis* (L.) Kuntze, *Camellia japonica* L., *Canarium strictum* Roxb., *Carallia brachiata* (Lour.) Merr., *Boucerosia umbellata* (Haw.) Wight & Arn., *Cassia leiandra* Benth., *Elaeodendron glaucum* (Rottb.) Pers., *Castanopsis hystrix* Miq., *Castanopsis indica* (Roxb. ex Lindl.) A.DC., *Castanopsis tribuloides* (Sm.) A.DC., *Catunaregam spinosa* (Thunb.) Tirveng., *Celtis tetrandra* Roxb., *Cephalotaxus griffithii* Hook.f., *Cerbera odollam* Gaertn., *Chamaedorea costaricana* Oerst., *Chlorophytum tuberosum* (Roxb.) Baker, *Choerospondias axillaris* (Roxb.) B.L.Burtt & A.W.Hill, *Chrysojasminum parkeri* (Dunn) Banfi, *Chrysophyllum roxburghii* G.Don, *Chukrasia tabularis* A.Juss., *Chukrasia velutina* M.Roem., *Cinnamomum malabatrum* (Burm.f.) J.Presl, *Cinnamomum verum* J.Presl, *Cinnamomum wightii* Lukman., *Cissus quadrangularis* L., *Cissus repanda* (Wight & Arn.) Vahl, *Citrus indica* Yu.Tanaka, Citrus × limetta Risso, *Clerodendrum laevifolium* Blume, *Clerodendrum colebrookeanum* Walp., *Cochlospermum vitifolium* (Willd.) Spreng., *Commiphora caudata* (Wight & Arn.) Engl., *Commiphora wightii* (Arn.) Bhandari, *Costus pictus* D.Don, *Hellenia speciosa* (J.Koenig) S.R.Dutta, *Crateva adansonii* DC., *Croton tiglium* L., *Cupressus sempervirens* L., *Cupressus torulosa* D.Don ex Lamb., *Curculigo capitulata* (Lour.) Kuntze, *Gymnosphaera gigantea* (Wall. ex Hook.) S.Y.Dong, *Cynometra iripa* Kostel., *Daphniphyllum neilgherrense* (Wight) K.Rosenthal, *Dendrocalamus asper* (Schult. & Schult.f.) Backer, *Dendrocalamus brandisii* (Munro) Kurz, *Dendrocalamus longispathus* (Kurz) Kurz, *Dendrocalamus membranaceus* Munro, *Dendrocalamus somdevae* H.B.Naithani, *Dendrocalamus strictus* (Roxb.) Nees, D*erris trifoliata* Lour., *Diospyros ebenum* J.Koenig, *Diplazium esculentum* (Retz.) Sw., *Dipteris wallichii* (R.Br.) T.Moore, *Dodonaea viscosa* Jacq., *Drepanostachyum falcatum* (Nees) Keng f., *Dypsis decaryi* (Jum.) Beentje & J.Dransf., *Eyspxylum binectariferum* (Roxb.) Hook.f. ex Bedd., *Elaeocarpus munroi* (Wight) Mast., *Elaeocarpus sphaericus* (Gaertn.) Heer, *Elettaria speciosa* Blume, *Entada rheedei* Spreng, *Epiphyllum oxypetalum* (DC.) Haw., *Eremostachys superba* Royle ex Benth., *Eriobotrya japonica* (Thunb.) Lindl., Erythrina × bidwillii Lindl., *Erythrina crista*-galli L., *Euphorbia fusiformis* Buch.-Ham. ex D.Don, *Euphorbia vajravelui* Binojk. & N.P.Balakr., *Exbucklandia populnea* (R.Br. ex Griff.) R.W.Br., *Feronia elephantum* Corrêa, *Ficus lyrata* Warb., *Ficus mollis* Vahl, *Flacourtia indica* (Burm.f.) Merr., *Flacourtia jangomas* (Lour.) Raeusch., *Flacourtia montana* J.Graham, *Flemingia semialata* Roxb. ex W.T.Aiton, *Garcinia cowa* Roxb. ex Choisy, *Gaultheria fragrantissima* Wall., *Gigantochloa albociliata* (Munro) Kurz, *Ginkgo biloba* L., *Glycosmis pentaphylla* (Retz.) DC., *Gnetum gnemon* L., *Grevillea robusta* A.Cunn. ex R.Br., *Grewia optiva* J.R.Drumm. ex Burret, *Grewia robusta* Burch., *Guaiacum officinale* L., *Gynocardia odorata* R.Br., *Hedychium greenii* W.W.Sm., *Hedychium stenopetalum* G.Lodd., *Hedychium villosum* Wall., *Heliconia rostrata* Ruiz & Pav., *Heritiera fomes* Banks, *Heynea trijuga* Roxb. ex Sims, *Hodgsonia heteroclita* (Roxb.) Hook.f. & Thomson, *Holigarna arnottiana* Hook.f., *Holoptelea integrifolia* (Roxb.) Planch., *Hopea parviflora* Bedd., *Hopea ponga* (Dennst.) Mabb., *Hopea racophloea* Dyer, *Horsfieldia irya* (Gaertn.) Warb., *Hovenia dulcis* Thunb., *Humboldtia decurrens* Bedd. ex Oliv., *Humboldtia vahliana* Wight, *Hyophorbe lagenicaulis* (L.H.Bailey) H.E.Moore, *Indigofera cassioides* Rottler ex DC., *Jacaranda mimosifolia* D.Don, *Juglans regia* L., *Koelreuteria paniculata* Laxm., *Kopsia fruticosa* (Roxb.) A.DC., *Kydia calycina* Roxb., *Lagerstroemia microcarpa* Hance, *Languas speciosa* (J.C.Wendl.) Small, *Larsenianthus careyanus* (Benth. & Hook.f.) W.J.Kress & Mood, *Leea alata* Edgew., *Leea indica* (Burm.f.) Merr., *Leea robusta* Roxb., *Licuala spicata* Becc., *Litsea coriacea* (B.Heyne ex Nees) Hook.f., *Litsea glutinosa* (Lour.) C.B.Rob., *Litsea wightiana* (Nees) Benth. & Hook.f. ex B.D.Jacks., *Lophopetalum wightianum* Arn., *Macaranga peltata* (Roxb.) Müll.Arg., *Machilus edulis* King ex Hook.f., *Machilus glaucescens* (Nees) Wight, *Madhuca insignis* (Radlk.) H.J.Lam, *Magnolia nilagirica* (Zenker) Figlar, *Mahonia nepalensis* DC. ex Dippel, *Majidea zanguebarica* Kirk ex Oliv., *Mallotus roxburghianus* Müll.Arg., *Malus domestica* (Suckow) Borkh., *Mammea suriga* (Buch.-Ham. ex Roxb.) Kosterm., *Mappia foetida* (Wight) Miers, *Mappia*

nimmoniana (J.Graham) Byng & Stull, *Melia dubia* Cav., *Meliosma simplicifolia* (Roxb.) Walp., *Memecylon umbellatum* Kostel., *Mimusops hexandra* Roxb., *Morus alba* L., *Moullava digyna* (Rottler) Gagnon & G.P.Lewis, *Musa markkui* R.Gogoi & S.Borah., *Musa sikkimensis* Kurz, *Musa velutina* H.Wendl. & Drude, *Musa nagensium* Prain, *Neolitsea zeylanica* (Nees & T.Nees) Merr., *Nepenthes mirabilis* (Lour.) Druce, *Nephelium lappaceum* L., *Nothapodytes nimmoniana* (J.Graham) Mabb., *Olea dioica* Roxb., *Pancratium zeylanicum* L., *Parkia biglandulosa* Wight & Arn., *Parkia timoriana* (DC.) Merr., *Passiflora coccinea* Blanco, *Phoenix dactylifera* L., *Pogonatherum paniceum* (Lam.) Hack., *Prunus ceylanica* (Wight) Miq., *Prunus domestica* L., *Pteris ensiformis* Burm.f., *Pterospermum suberifolium* (L.) Raeusch., *Quassia indica* (Gaertn.) Noot., *Salix babylonica* L., *Shorea roxburghii* G.Don, *Symplocos cochinchinensis* (Lour.) S.Moore, *Syzygium palodense* Shareef, E.S.S.Kumar & Shaju, *Terminalia mantaly* H.Perrier, *Tetracera scandens* (J.R.Forst. & G.Forst.) Gilg & Werderm., *Triplaris weigeltiana* (Rchb.) Kuntze, *Vateria indica* L., *Vitex pinnata* L., *Xylosma longifolia* Clos.

Andaman and Nicobar Regional Centre, BSI, Dhanikhari Experimental Garden cum Arboretum, Port Blair.

As part of *ex-situ* conservation of EET plants of Andaman and Nicobar Islands, several species are being collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. Some of the plant species are: *Annona reticulata* L., *Antidesma ghaesembilla* Gaertn., *Azolla* sp., *Calotropis gigantea* (L.) W.T.Aiton, *Cerbera manghas* L., *Ceropegia andamanica* Sreek., Veenakumari & Prashanth, *Clerodendrum calamitosum* L., *Cordia subcordata* Lam., *Curcuma* sp., *Cyathea albosetacea* (Bedd.) Copel., *Dicranopteris* sp., *Dillenia andamanica* C.E.Parkinson, *Dioscorea bulbifera* L., *Dioscorea oppositifolia* L., *Etlingera fenzlii* (Kurz) Škorničk. & M.Sabu, *Eulophia nicobarica* N.P.Balakr. & N.G.Nair, *Hernandia* sp., *Hybanthus enneaspermus* (L.) F. Muell., *Impatiens balsamina* L., *Intsia bijuga* (Colebr.) Kuntze, *Kayea manii* King, *Korthalsia rogersii* Becc., *Macaranga nicobarica* N.P.Balakr. & Chakr., *Mangifera andamanic*a King, *Microcos calophylla* (Kurz ex Mast.) Burret, *Mimusops andamanensis* King & Gamble, *Mucuna gigantea* (Willd.) DC., *Myristica andamanica* Hook.f., *Nymphaea caerulea, Psilotum complanatum* Sw., *Psychotria andamanica* Kurz, *Rhopaloblaste* sp. *Salvinia natans* (L.), *Selenicereus undatus* (Haworth) D.R.Hunt, *Semecarpus kurzii* Engl., *Sterculia villosa* Roxb. ex Sm., *Syzygium samarangense* (Blume) Merr. & Perry, *Taxotrophis taxoides* (B.Heyne ex Roth) Chew ex E.M.Gardner, *Terminalia bialata* (Roxb.) Steud., *Vanilla sanjappae* Rasingam, R.P.Pandey, J.J.Wood & S.K.Srivast.

***Rhopaloblaste angustata*(Kurz) Moore**

Project 2: Maintenance, mass multiplication and Nursery development of Bamboos, Palms, Zingibers, Endemic trees species of Andaman & Nicobar Islands at Dhanikhari Experimental Garden Cum Arboretum.

Executing Officials (s) : Dr. Anil Kumar Midigesi, Botanist, Dr. Pankaj A. Dhole, Botanist, Shri Gautam Anuj Ekka, Bot. Assist. Duration of the Project: 2022 - 2024.

Background: The Botanical Survey of India is maintaining the Experimental garden cum Arboretum at Dhanikhari, Naya Sahar, about 16 km from Port Blair with a focus on both *in-situ* and *ex-situ* conservation of over 500 plant species with some economically important species. Comprising an area of ca 30 h. of forest land, with 2 h. of cleared land earmarked for nurseries, the garden has become an important conservation centre for several rare and endangered plant species collected and introduced from vulnerable areas and islands with a view of multiplication and propagation for the germplasm conservation. This garden is also a natural abode of many important endemic plants including orchids, zingibers, canes, rattans, bananas, ferns, etc. Our scientists and researchers venture to the remote localities of the islands and collect the germplasm in the form of whole plants, seedlings, propagules, rhizomes, seeds and fruits for introduction and multiplication in the garden. Inside the garden, different sections such as Medicinal plot, Pomological plot, Cane plot, Palm plot, Endemic plants plots, Orchidarium, Ornamental plants, Cactarium, Nursery and Greenhouse are being maintained. Besides concentrating on the plants of adjacent areas of the Dhanikhari Dam, rare and endangered plants collected from different areas of mainland are also being introduced in the garden.

Raised Nursery

Psilotum complanatum Sw.

The current project aims at *ex-situ* conservation of Endemic species with special emphasis on Bamboos, Palms, Zingibers, etc. species of the islands in the garden. Area and Locality: Andaman and Nicobar Islands: *c.* 8249 sq. km. Achievements(from the date of initiation of the project): Total two (02) field exploration tours were conducted in the areas of Nicobar group of Islands and South Andaman during 17.10.2023 to 27.10.2023 and 14.12.2023 to 18.12.2023 and collected plantlets, seedlings, fruits and seeds of 45 plant species belonging to palms, Zingibers, and Endemic tree species of the Andaman and Nicobar Islands including *Ceropegia andamanica* Sreek., Veenakumari & Prashanth, *Cyathea albosetacea* (Bedd.) Copel., *Dillenia andamanica* C.E. Parkinson, *Eulophia nicobarica* N.P. Balakr. & N.G. Nair, *Korthalsia rogersii* Becc., *Macaranga nicobarica* N.P. Balakr. & Chakr., *Mangifera andamanica* King, *Kayea manii* King, *Mimusops andamanensis* King &

Gamble, *Myristica andamanica* Hook. f., *Psilotum complanatum* Sw., *Psychotria andamanica* Kurz., *Rhopaloblaste angustata* (Kurz) Moore, *Sterculia villosa* Roxb and raised a nursery of them at Dhanikhari Botanical Garden cum arboretum (DEGCA).

Experimental Botanic Garden, Arid Zone Regional Centre, Jodhpur

Ex-situ **conservation**:Work done in Botanical garden: 25 seedlings of *Anogeissus Sericea var. nummularia* King ex Duthie, *Bauhinia racemosa* Lam., *Ficus tsjakela* Burm.f., *Guazuma ulmifolia* Lam., *Moringa oleifera* Lam. and *Santalum album* L. were transplanted in various blocks. Collected seeds and tubers of 12 plant species viz. *Albizia lebbeck* (L.) Benth., *Holoptelea integrifolia* (Roxb.) Planch., *Gmelina arborea* Roxb. ex Sm., *Ceiba pentandra* (L.) Gaertn., *Caralluma fimbriata* Wall., *Dalichampia scadens* var. *cordafana Pavonia arabica* var. *massuriensis* Bhandari, *Euphorbia jodhpurensis* Blatt. & Hallb., *Seddera latifolia* Hochst. exSteud., *Senna alata* (L.) Roxb., *Dichrostachys cinerea* (L.) Wight &Arn. and *Anogeissus pendula* Edgew. for multiplication in the garden. Sown approx. 1,000

Pavonia arabica var. *massuriensis* Bhandari

Euphorbia jodhpurensis Blatt. & Hallb.

Commiphora wightii (Arn.) Bhandari

Caralluma fimbriata Wall.

Tecomella undulata (Sm.) Seem.

Dalechampia scandens var. *cordofana* (Hochst. ex Webb) Müll.Arg.

seeds of 25 plant species viz. *Prosopis cineraria* (L.) Druce, *Sapindus laurifolius* Vahl, *Moringa concanensis* Nimmo ex Dalzell &Gibs., *Pongamia pinnata* (L.) Pierre, *Anogeissus sericea var. nummularia* King ex Duthie, *Holoptelea integrifolia* (Roxb.) Planch, *Senna alata* (L.) Roxb., *Gmelina arborea* Roxb. ex Sm., *Cassia fistula* L., *Albizia lebbeck*(L.) Benth.,*Tecoma stans* (L.) Juss. ex Kunth, *Moringa oleifera* Lam., *Colophospermum mopane* J.Kirk ex Benth., *Dichrostachys cinerea* (L.) Wight & Arn., *Terminalia arjuna (*Roxb. ex DC.) Wight & Arn, *Terminalia sericea* Buch. ex DC., *Anogeissus sericea var. nummularia* King ex Duthie, *Dalbergia lanceolaria* L.f., *Manilkara hexandra* (Roxb.) Dubard, *Carissa carandas* L., *Santalum album* L., *Justicia adhatoda* L., *Murraya koenigii* (L.) Spreng. And *Tephrosia falciformis Ramaswami* in poly bags for multiplication and conservation in the garden and also provided saplings to various institutions, visitors as well as researchers and forest department on demand.

Experimental Botanic Garden, Botanic Garden of Indian Republic, Noida

Project 3: Mass Germination and Multiplication of Horticulture and Ornamental plant /seasonal flowers in BGIR Noida.
Executing Scientist (s): Dr. Sandeep Chauhan, Scientist F, Mrs. L.I.Chanu, Botanist, Mr. Yogesh Lahane, Botanist,
Duration of the project: Ongoing.

Background: The Botanic garden of Indian Republic, Noida is located in the NCR region of the country and a large number of visitors regularly visits the garden every year. To showcase the garden for the visitors every year we grow different seasonal flowering plants/cultivars in the garden. Thus, the project focuses on the multiplication and germination of different seasonal cultivars of flowering plants and bulbaceous species. Garden also maintains a succulent section and medicinal plants. Area and locality of the Allotted Project: Botanic Garden of Indian Republic, Noida. The study aimed to establish a standardized seed and bulb germination protocol. Three key parameters were investigated: soil mixtures (soil: sand, soil: sand: leaf compost in ration, soil: sand: leaf compost: coco- peat) (1:1, in ratio 1:1:1, 1:1:1:2), sowing techniques (raised, flat, sunken seedbeds, seed trays), and soil depths (1cm below surface, superficially covered). Preventive fungicides (Bavistin 0.5gm/lit, Amistar 0.5ml/lit) were applied. Additionally, a seasonal time study for bulb germination was conducted. The methodology emphasized controlled conditions, daily monitoring, and rigorous quality control, with the goal of contributing a reliable and standardized germination protocol for winter ornamental flowers.

Achievements: All around the year the entire focus was given on overall systematic maintenance and improvement in various garden sections through integrated practices. Achievements included the development of standardized seed and bulb germination protocols, successful pest control measures, acclimatization of new plant species, and the introduction of new fruit cultivars such as *Artocarpus*

heterophyllus, Litchi chinensis, Pyrus communis, Pyrus pyrifolia, and Syzygium jambos. A dedicated effort was made to prepare a 3-acre area for a flower show. To support these work, a standardized germination protocol for 45 winter seasonal flower ornamental plant cultivars was established, addressing critical factors such as soil mixture and sowing techniques. Seeds were germinated in raised, flat, and sunken seedbeds. Furthermore, a standardized bulb germination protocol for eight species (Tulip, Irises, Lilium, Ixia, Ranunculus, Nargis, Hyacinths, Anemone) was implemented, incorporating preventive fungicides (Bavistin, Amistar) for protection against fungal diseases. Approximately 50,000 winter seasonal ornamental flowering plant saplings were transferred into small-sized germination bags and transplanted in the field. The propagation of various species was accomplished through stem cuttings, including Bougainvillea, *Hamelia, Tecoma, Duranta, Inermis, Barleria, Euphorbia cotinifolia*, and *Plumeria alba*. Effective management of stem borer and termite infestations was achieved through strategic treatments involving Chlorantraniliprole, Carbofuran, and Dichlorvas. Regular training and pruning operations in the EPS and arboretum sections contributed to optimal plant canopy development. Cutting of *Syngonium* (200), *Epipremnum aureum* (100), *Bougainvillea* (300), 4. *Lawsonia inermis* (200), 5. *Champa*(3000), *Plumeria pudica*(3000), *Tabernaemontana divaricate* (1000), *Eranthemum* red (3000). *Salvia officinalis* (3000), *Jatropa curcas* (2000), *Phyllanthus* sp. (2000). These plantations are under observation visit the location time to time and plants ,work are under the supervision of Dr. Sandeep Kr. Chauhan, Scientist-F and Mr. Rajpal team work. 171 beds are prepared by team under supervision of Dr. Sandeep Kr. Chauhan, Scientist-F, cow dungs manure prepared in bulk, *Iberies* (candytuft), *Alyssum, Dianthus, Calendula, Gazania, Nasturtium*, hardy ice plant, *Matthiola incana* (stock), *Verbena, Centaurea cyanus* (Corn flower), Sweet Sultan, Babuna flower, Bluepin, *Dianthus barbatus* (the sweet William), *Petunia,* marigold, paper flower and Daisy. Observation, maintainance etc. Around 1 lakh seedlings are transplanted by a team. Watering, weeding and trimming are always in process.

Project 4: Establishment and enrichment of existing Forest Types and Proposed Phytodiversity at BGIR Noida (zone 5, 6, 7, 8) by introduction of plant sps., based on respective forest types and phyto-diversity region, Development of Sacred Section.

Executing Scientist (s): Dr. Priyanka A. Ingle, Scientist-D, Mr. Yogesh Lahane, Botanist, **Duration of the project:** Ongoing,

Background: The main objective of this project was to enrich the phytodiversity in the existing forest types established in zone, 5, 6, 7 and 8. Ex-situ conservation of different plant species according to their respective forest types in aforesaid zones will help to create a miniature of major forest types of India at Botanic Garden of Indian Republic (BGIR), NOIDA. Area and locality of the Allotted Project: Botanic Garden of Indian Republic, Noida.

Achievements: During the period conducted two plant collection tours, one plant collection tour was conducted during 20th to 26th July, 2023 to different localities of Dehradun. Altogether 2279 saplings belonging to 135 taxa have been procured. All saplings are kept in net house for acclimatization. Second plant collection tour was conducted during 20th to 24th October, 2023 to JNTBGRI, Palode, Kerala. Procurement of 1595 saplings belong to 160 taxa is in process. Endangered (EN) species *Syzygium stocksii* (5 saplings), *Commiphora stocksiana* (2 saplings) are conserved at BGIR. Procured

Plant shifted and grow inbags for acclimatization

Syzygium stocksii (Duthie) Gamble

saplings of 20 species and seeds of 12 species including endemic species *Tephrosia jamnagarensis* from Maharaja Sayajirao University of Baroda, Vadodara, Gujarat. Saplings are conserved in net house for acclimatization. Prepared the list of the 198 tree species present at forest zones. Altogether 3072 saplings belonging to 68 taxa have been shifted in zone 6 & 7 and Fruit Section from BGIR nursery such as *Acer oblongifolium* 50, *Aegle marmelos* 9, *Albizia lebbeck* 75, *Alstonia microcarpa* 21, *Alstonia venenata* 4, *Annona muricata 29, Annona squamosal 8, Artocarpus artilis 5, Artocarpus heterophyllus 13, Bauhinia variegata* 131, *Bombax ceiba* 6, *Butea monosperma* 25, *Carissa congesta* 33, *Casuarina junghuhniana* 6, *Catunaregam spinose* 6, *Ceiba pentandra* 7, *Chochlospermum religiosum* 2, *Chukrasia tabularis* 24, *Citrus lemon* 5, *Cocos nucifera* 2, *Delonix regia* 8, *Diospyros ebenum* 4, *Diospyros* sp. 4,*Conocarpus lancifolius* 35, *Dalbergia sissoo* 25, *Fernandoa adenophyllum* 28, *Ficus auriculata* 2, *Ficus krishnae* 2, *Ficus religiosa* 10, *Ficus virens* 5, *Garcinia imberti* 5, *Garcinia indica* 20, *Gmelina arborea* 14, *Gnetum gnemon* 24, *Grevelia robusta* 12, *Hibiscus rosa-sinensis* 350, *Holoptelia integrifolia* 8, *Hymenodictyon orixense* 9, *Jacaranda mimosifolia* 7, *Jasminum sambac* 20, *Jatropha curcus* 320, *Mangifera indica* 5, *Manilkara hexandra* 2, *Melaleuca viminalis* 1, *Melia azadirach* 7, *Mimusops elengi* 34, *Morinda citrifolia* 2, *Moringa oleifera* 11, *Oroxylum indicum* 4, *Pedilanthus tithymaloides* 41, *Phyllanthus emblica* 9, *Phyllanthus neruri* 5, *Pithecellobium dulce* 75, *Plumeria alba* 213, *Pongamia pinnata* 158, *Psidium gujava* 5, *Putranjiva roxburghii* 624, *Salvadora persica* 20, *Saraca ashoka* 57, *Simarouba glauca* 30, *Spondia pinnata* 57, *Swietenia mohagani* 22, *Syzygium cumini* 95, *Syzygium guajava* 13, *Syzygium guajava* (Black) 3, *Tabernaemontana divaricate* 40,

Commiphora stocksiana (Engl.) Engl.

Terminalia arjuna 30, *Terminalia bellirica* 45, *Vitis vinifera* 3, *Ziziphus mauritiana* 3. Conducted regular training and pruning operations in EPS and arboretum sections for optimal plant canopy development. Successfully implemented control measures for stem borer and termite infestations, utilizing Chlorrantraniliprole, Carbofuran, and Dichlorvas treatments. Collected Phenology data (flowering & fruiting) for 80 species with photographs and GPS data. Prepared the list of Sacred trees worshiped by different religions in India and developed the Sacred Section by planting 22 species of religious importance in grow bags.

Project 5: Establishment of Seed bank lab unit and studies of seed germination protocol of endemic and threatened plant species vis a vis setting of Plant conservatoires and vermicomposting unit at BGIR Noida.

Executing officials: Dr. Sandeep Kr. Chauhan, Scientist-F, Dr. Giriraj Singh Panwar, Scientist-E, Mrs. L. Ibemhal Chanu, Botanist.
Duration of the Project: April 2023 to March 2026.

Background: Botanic Garden of Indian Republic, Noida is holding around 5000 tree species of 160 genus. All the species are representative of different phytogeographic region of India. Thus, to develop the seed bank for these key species and other threatened species of the garden is an important aspect of conservation & multiplication of these species. The routine viability assessment and

Polyalthia suberosa (Roxb.) Thwaites

Cullen corylifolium (L.) Medik.

Bauhinia purpurea L.

Diploknema butyracea (Roxb.) H.J. Lam

Germination testing of the stored seeds needs to be carried out. Keeping the aspect in view the present study was proposed for the establishment of a seed bank and development of germination protocol for various threatened species of the garden. The seed germination test is often the most reliable way of assessing viability of the stored seeds. Optimal germination conditions should allow all viable seeds to germinate using the simplest method possible.

Achievements (from 17th July, 2023* to till date): Consulted literature in the library and review of the previous work on the seed germination study of endemic and threatened plant species. Inspected all the equipment available in the seed Bank laboratory and requested Scientist Incharge, BGIR for the repair of existing equipment and purchase of some new equipment. Collected the seeds of garden species eg. *Spondias pinnata* (L. f.) Kurz (500gm), *Sena surattansis* (100 gm), *Thuja occidentalis* (50 gm), *Lagerstroemia speciosa* (L.) Pers. (100 gm), *Dalbergia lanceolaria* L.f. (50 gm), *Albizia lebbeck*

(L.) Benth. (50 gm), *Cassia fistula* L. (100 gm), *Feronia limonia* (L.) Swingle (100 gm), *Helicteres isora* (100 gm), *Strychnosnux-vomica* L. (50 gm), *Oroxylum indicum* (L.) Benth. ex Kurz. (100 gm), *Putranjiva roxburghii* Wall. (500 gm), *Cordia dichotoma* G. Forst. (100 gm). Seeds germination experiment was conducted for *Spondias pinnata* (L. f.) Kurz (50 seeds), *Jatropha curcas* L. (50 seeds), *Oroxylum indicum* (L.) Benth. ex Kurz. (50 seeds), *Sena surattansis* (100 seeds), *Bauhinia acuminate* L. (50 seeds), *Putranjiva roxburghii* Wall. (50 seeds) *Ceiba pentandra* (L.) Gaertn and *Spondias pinnata* (L. f.) Kurz. Arranged the shifting of all the collected seeds in display almirah in the seed lab. Segregated the healthy seeds of the collected species. Collected the phonological data of 31 garden species viz. *Santalum album* L. (Santalaceae), *Tinospora cordifolia* (Menispermaceae), *Senna siamea* (Lam.) H.S. Irwin & Barneby (Fabaceae), *Litsea glutinosa* (Lour.) C.B.Rob. (Lauraceae), *Kydia calycina* Roxb. (Malvaceae), *Diploknema butyracea* (Roxb.) H.J.Lam. (Sapotaceae) etc. (List attached Table 1). Demographic data of plant species growing in different Zones of the garden has been recorded viz. Zone-4 (Tropical Deciduous Forest), Zone-5 (Tropical Thorny/Scrub Forest), Zone-6 (Tropical Broadleaf Forest), Zone-7 (Subtropical Dry Evergreen Forest), and Taxonomical Section of the Garden. Updated the Botanical names of plant species growing in the above zones as per POWO. Compiled the list of Dry Tropical Forest plant species ca. 300 (Dry deciduous, Dry semi evergreen & Thorny plants) and Moist Tropical Forest plant species ca. 300 (Tropical wet evergreen, tropical semi evergreen and tropical moist deciduous Forest) and submitted to HoO, BGIR.

Phenological data of plant species growing in the Botanic Garden of Indian Republic (BGIR) Noida.

Sr. No.	Botanical Name	Family	Phenological Data	
			Flowering	Fruiting
1.	*Acacia auriculiformis*	Fabaceae	Sept.- January	
2.	*Acacia catechu* (L.) Willd.	Fabaceae	August - October	November -
3.	*Vachellia nilotica* (L.) P.J.H. Hurter & Mabb.	Fabaceae	August – November	December-January
4.	*Senegalia senegal* (L.) Britton (Acacia senegal)	Fabaceae	August - September	October
5.	*Carissa macrocarpa* (ECKL.) A.D.C.	Apocyanaceae	June - July	August
6.	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	July	August
7.	*Colophospermum mopane* (Benth.) Leonard	Fabaceae	September	October
8.	*Cordia dichotoma* G.Forst.	Boraginaceae	July-August	September
9.	*Fernandoa adenophyllum* Steen.	Bignoniaceae	September	October
10.	*Feronia limonia* (L.) Swingle	Rutaceae	July	Sept - October
11.	*Jatropha multifida* L.	Euphorbiaceae	July	August
12.	*Jatropha curcas L.*	Euphorbiaceae	July	September
13.	*Kigelia Africana* (Lam.) Benth.	Bignoniaceae	June	August
14.	*Lagerstroemia* speciosa (L.) Pers.	Lythraceae	August-Sept.	October -
15.	*Lawsonia innermis* L.	Lythraceae	July - August	August - November
16.	*Senna surattensis* (Syn: *Cassia surattensis*)	Fabaceae	August - November	October-December
17.	*Putranjiva roxburghii* Wall.	Putranjivaceae	July – August	September - Early October
18.	*Wrightia tinctoria* (Roxb.) R.Br	Apocynaceae	July – August	September - October

19.	*Tinsosporan cordifolia*	Menispermaceae	August - September	October -
20.	*Ziziphus jujuba* Mill.	Rhamnaceae	September - October	October -
21.	*Mimusops elengi* L.	Sapotaceae	July - September	October-November
22.	*Thespesia populnea*	Malvaceae	September - October	October -
23.	*Kydia calycina* Roxb.	*Malvaceae*	October	November - December
24.	*Litsea glutinosa*	*Lauraceae*	October	November - December
25.	*Santalum album* L.	Santalaceae	October	November
26.	*Cassia fistula L.*	Fabaceae	October	October-November
27.	*Bauhinia acuminate* L.	Fabaceae	October-December	November-January
28.	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Fabaceae	October-November	December-January
29.	*Diploknema butyracea* (Roxb.) H.J.Lam.	Sapotaceae	November	November - December
30.	*Litsea glutinosa* (Lour.) C.B.Rob.	Lauraceae	October end-	November - December
31.	*Pterospermum xylocarpum* (Gaertn.) Santapau & Wagh	Malvaceae	Mid November-December	

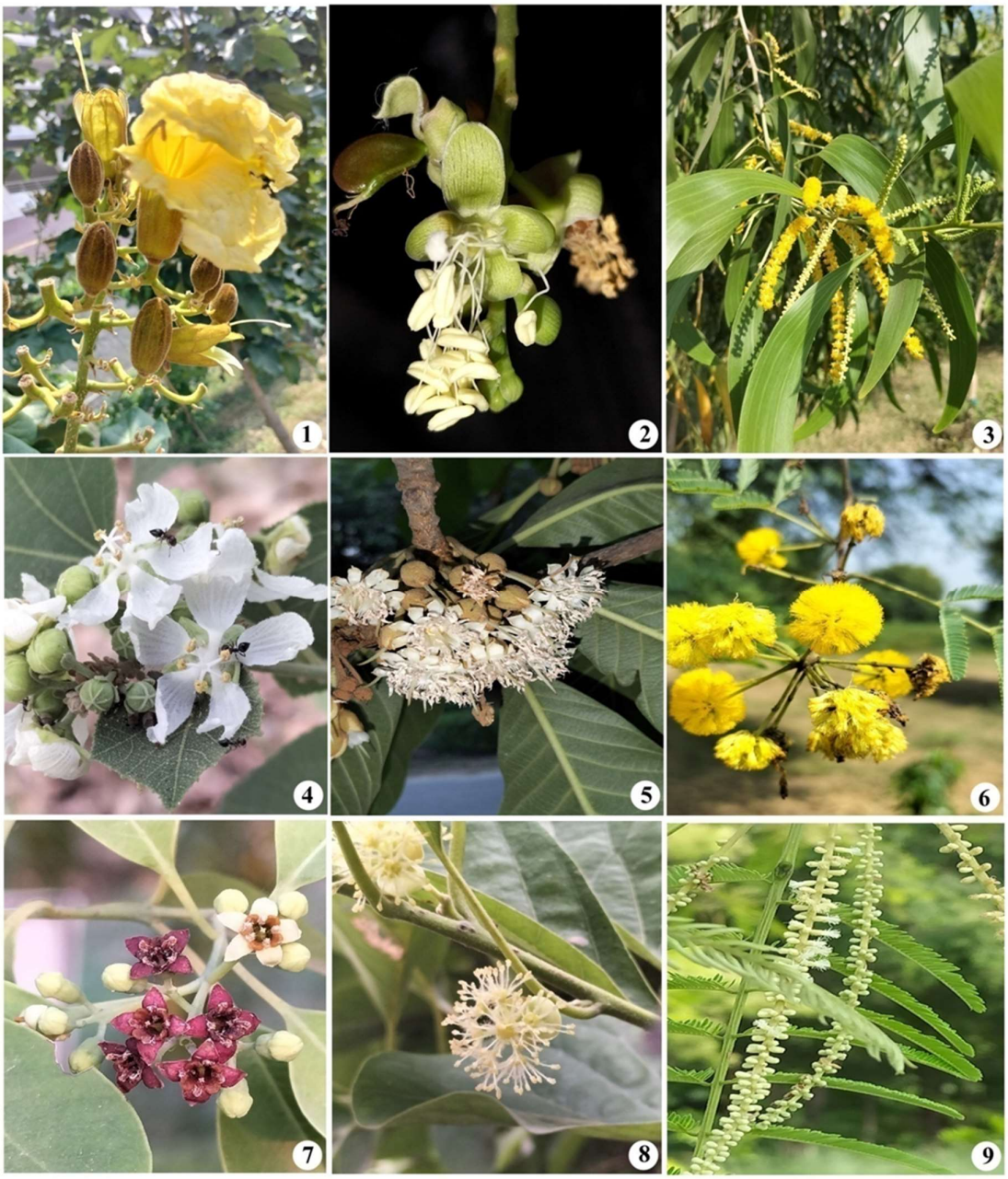


Plate: Flowering in different species of BGIR (1) *Fernandoa adenophylla* (Wall. ex G.Don) Steenis, (2) *Colophospermum mopane* (Benth.) Leonard, (3) *Acacia auriculiformis* A.Cunn. ex Benth., (4) *Kydia calycina* Roxb., (5) *Diploknema butyracea* (Roxb.) H.J.Lam., (6) *Vachellia nilotica* (L.) P.J.H.Hurter & Mabb., (7) *Santalum album* L., (8) *Litsea glutinosa* (Lour.) C.B.Rob.& (9) *Acacia catechu* (L.) Willd.

Experimental Botanic Garden, Central Regional Centre, Allahabad

Following species have been introduced in BSI, CRC Allahabad garden for conservation: *Sterculia Urens* Roxb.(Malvaceae): 02 Plants, *Hardwickia binata* Roxb.(Fabaceae): 02 plants, *Pterocarpus marsupium* Roxb.(Fabaceae): 02 plants, *Cordia macleodii* Hook. (Boraginaceae): 02 plants, *Aesculus assamica* Griff.(Sapindaceae): 04 plants

Project 6: Maintenance of the Experimental Botanic Garden, BSI, ERC, Umiam (Barapani) & Ex-situ conservation and multiplication of rare, endangered, threatened, endemic and economically important plants of North East India.
Executing Officials: Shri B.B.T. Tham, Shri L.R. Meitei
Duration: On-going

Background:
The NER is very rich in Plant species diversity and is home to many rare, endangered and endemic species. Considering the present scenario of threats from Climate change and Anthropogenic activities leading to destruction of nature through deforestation and land acquisition, Ex-situ conservation of these species is of utmost priority for BSI through the process of introduction/acclimatization and paying considerable attention towards maintenance of germplasm collection, growing and multiplication of rare / endangered / threatened plant wealth of North-east India in order to save them from extinction. About 1200 species of vascular plants, 13 Gymnosperms, 71 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. The garden serves as a repository of rare, endangered, threatened and economic plant resources of North-east India and also creates awareness of the importance of its conservation. Besides this, the Botanic Garden also serves as a living museum to highlight the wealth of the region. Through multiplication of these species the Centre is also able to distribute it to different stakeholders for reintroduction.

Achievements: Conducted 1 field tour to Manipur and 7 local field trips in Meghalaya. During the period, 34 Rare/Threatened/Endemic (RET) species, 66 Medicinal/Economically Important Species And 25 Ornamental species are introduced in EBG, BSI, Umiam (Barapani). 6 RET Species are newly introduced in the EBG: *Gnetum montanum* (3 nos.), *Habenaria khasiana* (20 nos.), *Impatiens khasiana* (6 nos.), *Impatiens marianae* (3 nos.), *Peristylus lacertifer*(2 nos.).and *Thelasis longifolia* (4 nos.). 28 RET plant species are re-introduced in the EBG: *Agrostophyllum brevipes*(2 nos.), *Anthogonium gracile*(3 nos.), *Brainia insignis* (7 nos.), *Caulokaempferia secunda* (2 nos.), *Ceropegia khasiana* (1 no.), *Coelogyne prolifera* (2 nos.), *Crepidium acuminatum* (4 nos.), *Dendrobium anceps* (2 nos.), *Dendrobium aphyllum* (2 nos.), *Dendrobium formosum* (1 no.), *Dendrobium moschatum* (3 nos.), *Dendrobium transparens* (2 nos.), *Dipteris wallichii* (3 nos.), *Eria acervata* (2 nos.), *Goodyera procera* (2 nos.), *Impatiens angustifolia* (7 nos.), *Papilionanthe teres* (2 nos.), *Papilionanthe vandarum* (2 nos.), *Pelatantheria insectifera* (1 no.), *Peristylus goodyeroides* (2 nos.), *Pholidota articulata* (6 nos.), *Pholidota imbricata* (2 nos.), *Platycerium wallichii* (2 nos.), *Pleione praecox* (3 nos.), *Spathoglottis pubescens* (2 nos.), *Tainia angustifolia* (2 nos.), *Tainia latifolia* (5 nos.) and *Taxus wallichiana* (3 nos.). 43 orchid plantlets belonging to 7 species were propagated. 2800 plant seedlings from germination beds to sapling bags were transplanted. Phenological data of flowering and fruiting of 120 plant species in the EBG was observed and recorded.

Goodyera procera

Dipteris wallichii

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

Project 7: Ex-situ conservation of Endemic, Endangered and Threatened Plants (Orchids, Medicinal, Economic Important and Ornamental Plants)
Executing Scientist: Kaliamoorthy, Scientist 'E', Dr. T.S. Sarvanan, Bot. Asst. and Mr. Arjun, S.K. Bot. Asst. Project
Duration: April 2021- March 2024.
Area Surveyed: Tamil Nadu

Plant exploration was conducted from 04.10.2023 to 11.10.2023 (Quarter 2); and from 12.12.2023 to 19.12.2023 (Quarter 3) to Kalakad Mundandurai Tiger Reserve Forests, Tirunelveli District, and Kanyakumari Wildlife Sanctuary, Kanyakumari District, Tamil Nadu. Totally, 67 species under 41 genera belonging to 19 families were collected and GPS data were recorded (Table 1 & 2). Among the 67 species collected the family Orchidaceae recorded 32 species under 19 genera. Out of these 12 species were epiphytes, 17 species were terrestrial and 03 species were lithophytes. The most dominant genera were *Dendrobium* (05 species) followed by *Habenaria* (04 species) and *Bulbophyllum* (03 species); *Brachycorythis, Calanthe, Crepidium* and *Oberonia* (02 species each); *Anoectochilus, Arundina, Chrysoglossum, Cylindrolobus, Cymbidium, Liparis, Luisia, Papilionanthe, Sirhookera, Tainia, Vanda* and *Zeuxine* (01 species each). A total of 35 species under 22 genera belonging to 18 flowering families were also collected. Of which, herbs were dominant (16 species), followed by trees (09 species), twiners/climbers (05 species), shrubs (04 species) and liana (01 species). The dominant families were Balsaminaceae (07 species) followed by Apocynaceae, Begoniaceae and Piperaceae (04 species each), Fabaceae (03 species), Aristolochiaceae, Asteraceae, Burseraceae, Clusiaceae, Elaeocarpaceae, Euphorbiaceae, Gesneriaceae, Hypoxidaceae, Lauraceae, Malvaceae, Musaceae, Myrtaceae and Solanaceae (01 species each). The collected plant species were introduced in the National Orchidarium and Experimental Garden, Southern Regional Centre, Yercaud for ex situ conservation.

Table 1

Name of the Plants	Habit	Status	Elevation (m)	No. of Plants introduced
Arundina graminifolia (D. Don) Hochr.	Terrestrial	Rare	1250	04
Brachycorythis iantha (Wight) Summerh.	Terrestrial	Endemic	1200	01

Brachycorythis splendida Summerh.	Terrestrial	Endemic to Southern India	1233	02
Bulbophyllum fischeri Seidenf.	Epiphyte	Rare	1315	10
Bulbophyllum fuscopurpureum Wight	Lithophyte	Endemic to Southern India	1350	02
Bulbophyllum tremulum Wight	Lithophyte	Endemic to Peninsular India	838	10
Calanthe masuca (D. Don) Lindl.	Terrestrial	Rare	825	02
Calanthe sylvatica (Thouars) Lindl.	Terrestrial	Common	0	01
Chrysoglossum ornatum Blume	Terrestrial	Rare	0	05
Crepidium densiflorum (A. Rich.) Sushil K. Singh, Agrawala & Jalal	Terrestrial	Rare	12	02
Crepidium versicolor (Lindl.) Sushil K. Singh, Agrawala & Jalal	Terrestrial	Rare	6	02
Cylindrolobus pauciflorus (Wight) Schuit., Y.P. Ng & H.A. Pedersen	Epiphyte	Endemic to Southern India	1025	20
Cymbidium haematodes Lindl.	Terrestrial	Rare	110	02
Dendrobium aqueum Lindl.	Epiphyte	Endemic to Peninsular India	1254	02
Dendrobium heterocarpum Wall. ex Lindl.	Epiphyte	Common	1300	05
Dendrobium heyneanum Lindl.	Epiphyte	Endemic to Peninsular India	1210	10
Dendrobium jerdonianum Wight	Epiphyte	Rare	1232	05
Dendrobium wightii (A.D. Hawkes) A. H. Heller	Lithophyte	Rare	1350	10
Liparis gigantea C.L. Tso*	Terrestrial	Rare	1246	05
Luisia tenuifolia Blume	Epiphyte	Rare	815	02
Oberonia brunoniana Wight	Epiphyte	Endemic to Peninsular India	1225	05
Oberonia wynadensis Sivad. & R.T. Balakr.	Epiphyte	Endemic to Southern India	1210	10
Papilionanthe subulata (Willd.) Garay	Epiphyte	Rare	1252	10
Sirhookera lanceolata (Wight) Kuntze	Epiphyte	Rare	1151	01
Tainia bicornis (Lindl.) Rchb.f.	Terrestrial	Rare	6	05
Vanda testacea (Lindl.) Rchb.f.	Epiphyte	Common	18	02
Zeuxine longilabris (Lindl.) Trimen	Terrestrial	Common	10	04

* New record for Peninsular India

Table 2:

Name of the plants	**Family**	**Habit**	**Status**	**Altitude (m)**	**No. of plants Introduced**
Aristolochia acuminata Lam.	Aristolochiaceae	Twiner	Common	655 710	04 cuttings
Begonia albococcinea Hook.	Begoniaceae	Herbs	Endemic to Peninsular India	1310 1350	07

Begonia floccifera Bedd.	Begoniaceae	Herbs	Endemic to South India	21	10
Begonia malabarica Lam.	Begoniaceae	Shrubs	Rare	845 910	05
Begonia nelumbiifolia Schltdl. & Cham.	Begoniaceae	Herbs	Rare	752 810	04
Canarium strictum Roxb.	Burseraceae	Trees	Rare	935	04 seedlings & 10 seeds
Ceropegia candelabrum var. *biflora* (L.) Ansari	Apocynaceae	Twiner	Endemic	25	10 cuttings
Ceropegia intermedia Wight	Apocynaceae	Twiner	Endemic to Peninsular India	825 910	03 cuttings
Ceropegia omissa H. Huber	Apocynaceae	Climber	Endemic to South India	1250 1285	03 cuttings
Cinnamomum verum J. Presl	Lauraceae	Tree	Common	12 25	15 seedlings
Cullenia exarillata A. Robyns	Malvaceae	Tree	Endemic to Western Ghats	19 48	14 seeds
Curculigo sabui S. P. Gaikwad & Gore*	Hypoxidaceae	Herbs	Endemic to Peninsular India	15	03
Decalepis arayalpathra (J. Joseph & V. Chandras.) Venter	Apocynaceae	Sub Shrubs	Endemic to Western Ghats	1158	04 seedlings
Elaeocarpus tuberculatus Roxb.	Elaeocarpaceae	Tree	Rare	35	10 seeds
Entada rheedei Spreng.	Fabaceae	Liane	Common	52	02 seeds
Euphorbia vajravelui Binojk. & N. P. Balakr.	Euphorbiaceae	Tree	Endemic to Western Ghats (Vulnerable)	846	01
Garcinia gummi-gutta (L.) N. Robson var. *gummi-gutta*	Clusiaceae	Small tree	Common	11	01 seedling
Henckelia incana (Vahl) Spreng.	Gesneriaceae	Herbs	Endemic to Peninsular India	1365	01
Impatiens acaulis Arn.	Balsaminaceae	Herbs	Rare	1354	04
Impatiens cordata Wight	Balsaminaceae	Herbs	Endemic to Western Ghats (Vulnerable)	1187	05
Impatiens grandis B. Heyne	Balsaminaceae	Herbs	Vulnerable	855	01
Impatiens henslowiana Arn.	Balsaminaceae	Herbs	Vulnerable	1354	10

Impatiens maculata Wight	Balsaminaceae	Herbs	Endemic to Western Ghats (Vulnerable)	1354	04
Impatiens travancorica Bedd.	Balsaminaceae	Herbs	Endemic to Western Ghats (Endangered)	1285	02
Impatiens uncinata Wight	Balsaminaceae	Herbs	Endemic to Western Ghats (Endangered)	1354	05
Mucuna atropurpurea (Roxb.) DC. ex Wight	Fabaceae	Climber	Endemic to India	23	05
Musa acuminata Colla	Musaceae	Herbs	Rare	847	100 seeds
Peperomia blanda (Jacq.) Kunth	Piperaceae	Herbs	Common	815	02
Peperomia rotundifolia (L.) Kunth	Piperaceae	Herbs	Common	885	05
Peperomia tetraphylla (G. Forst.) Hook. & Arn.	Piperaceae	Herbs	Common	1237	10
Piper nigrum L.	Piperaceae	Climbing shrubs	Common	18	05 cuttings
Pterocarpus marsupium Roxb.	Fabaceae	Tree	Common	835	03 seeds
Solanum vagum Nees	Solanaceae	Shrubs	Rare	15	25 seeds
Syzygium zeylanicum (L.) DC.	Myrtaceae	Small tree	Common	12	10 seedlings
Vernonia vivekanathanii Uniyal	Asteraceae	Tree	Endemic to Western Ghats	815	30 cuttings

* Extended Distribution to Western Ghats of Tamil Nadu.

Achievements (New to Science): *Osbeckia yercaudensis* (Melastomataceae), a new species described from the Eastern Ghats, India. Rare, Endangered and Economic important plants collected and details of conservation initiations: Multiplication of threatened plant species, *Vernonia vivekanathanii* Uniyal and *Solanum vagum* Nees were collected and introduced in the garden. Multiplications of these species were initiated using conventional vegetative propagation method.

Experimental Botanic Garden, Sikkim Himalaya Regional Centre, Experimental Garden, Gangtok

Project 8: Maintenance and Germplasm collection of *Rhododendron* L. (Ericaceae) and *Impatiens* Riv ex L. (Balsaminaceae) in EBG, BSI-SHRC
Executing Officials: Dr. Rajib Gogoi & Dr. J. H. Franklin Benjamin & Norbu Sherpa; **Duration:** Ongoing; Target for 2023-24: Maintenance of Germplasm, Botanical exploration tour to North Sikkim District, West Sikkim District and North Sikkim District

Achievements: One tour was conducted to North Sikkim, from 13.08.2023 to 21.08.2023 and collected 9 plant species: *Rhododendron niveum* Hook.f. (Threatened), *Diplomeris hirsuta* (Lindl.)

Lindl. [Orchidaceae], *Colquhounia coccinea* Wall. [Lamiaceae], *Hypericum tenuicaule* Hook.f. & Thomson [Hypericaceae], *Strobilanthes* sp. [Acanthaceae], *Magnolia campbellii* Hook.f. & Thomson [Magnoliaceae], *Rhododendron niveum* Hook.f. [Ericaceae], *Lilium wallichianum* Schult. & Schult.f. [Liliaceae], *Begonia* sp. [Begoniaceae], *Roscoea auriculata* K. Schum. [Zingiberaceae] for ex-situ conservation. One tour was conducted to West and South Sikkim, from 01.12.2023 to 06.12.2023 and collected 3 species of *Rhododendrons* L., and 4 species of *Impatiens* Riv. ex L. for ex-situ conservation viz. *Rhododendron arboretum* Sm.; *Rhododendron dalhousieae* Hook.f.; *Rhododendron vaccinioides* Hook.f.; *Impatiens pulchra* Hook.f. & Thomson; *Impatiens pradhanii* H. Hara; *Impatiens spirifera* Hook.f.; *Impatiens stenantha* Hook.f.. Regular maintenance and monitoring of the germplasm were carried out.

Mundhwa Experimental Botanic Garden, Western Regional Centre, Pune

Collected 23 Pteridophyte specimens and they were introduced into the green house of the Botanical Survey of India, Western Regional Centre, Pune. The species collected are mostly under the rare and threatened category. *Oreogrammitis pilifera* (Ravi & J. Joseph) Parris, *Pellaea boivinii* Hook., *Cyrtomium micropterum* (Kunze), *Elaphoglossum beddomei* Sledge, *Osmunda hilsenbergii* Grev. & Hook., *Angiopteris helferiana* Presl., *Pteris cretica* L., *Bolbitis asplenifolia* (Bory) K. Iwats., *Pteris longipes* D.Don, *Microlepia speluncae* (L.) T.Moore, *Bolbitis subcrenata* (Hook. & Grev.) Ching, *Leptochilus axillaris* (Cav.) Kaulf., *Leptochilus lanceolatus* (L.) Zoll., *Tectaria polymorpha* (Wall. ex Hook.) Copel. *Tectaria paradoxa* (Fée) Sledge, *Huperzia phyllantha* (Hook. & Arn.) Holub, *Lepisorus nudus* (Hook.) Ching, *Bolbitis semicordata* (Baker) Ching, *Angiopteris helferiana* Presl, *Leptochilus decurrens* Blume, *Microlepia speluncae* (L.) T. Moore, *Loxogramme involuta* (D. Don) C. Presl, 23. *Loxogramme parallela* Copel.

Conservation of Pteridophytes

Huperzia phyllantha (Hook. & Arn.) Holub

Elaphoglossum beddomei Sledge

Hemionitis concolor (Langsd. & Fisch.) Christenh.

PUBLICATIONS

Scientific Articles/ Research Papers

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Book Chapters

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Books

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SEMINAR/SYMPOSIUM/CONFERENCE

ORGANISED BY BSI

A two day National Workshop on "Herbarium Techniques & Plant Nomenclature: Research Methodology Skill Development" organized by Department of Botany, Vedanta College, Kolkata–54 in collaboration with CNH & EIACP-PC-RP, BSI on 11th and 12th April 2023.

A week-long field training and orientation workshop was organized for the 32 newly recruited JRFs of the Botanical Survey of India at the West Bengal Forest School, Dowhill, Kurseong (WB) from 27.04.2023 to 29.04.2023 which was inaugurated by Mr. Ujjwal Ghosh, IFS, Additional PCCF (North Bengal) in the presence of Senior Scientists of BSI, Dr. S. S. Dash and Dr Rajib Gogoi. The programme was designed to impart training on Plant identification and documentation of floral biodiversity as well as to share field expertise with the JRFs.

Two day National Workshop on "Herbarium Techniques &Macrofungal Taxonomy including Phylogenetic Analysis" organized by P.G. Department of Botany, Bidhannagar College, Kolkata in collaboration with CNH & EIACP-PC-RP, BSI on 25th and 26th April 2023.

The 12th RAMC of BSI was held at BSI, NRC, Dehradun on 5th& 6th May, 2023 under the Chairmanship of Prof. C.R. Babu, Emeritus Professor, Delhi University and auspicious presence of Ms. Nameeta Prasad (IA&AS), JS, MoEF&CC, New Delhi and other members of the Committee.

BSI, ANRC, Port Blair organized the G20 India Mega Beach Clean Up event at the Wandoor Beach, Port Blair on 21st May 2023. All BSI officers and staff members along with officials of the Forest Range office, Manglutang, South Andaman participated in the event.

One day Training programme on "Herbarium Techniques & Plant Identification" organized by CNH & EIACP-PC-RP, BSI to UG. & P.G. students, Department of Botany, Serampore College, Hoogly W.B. on 8th June 2023.

The officers and officials attended a seminar on "**Global Challenges: Where do we go next**", delivered by John Jackson, Head of Science Policy and Communication, Natural History Museum, London organized by CNH on 04.07.2023.

Staff of AJCBIBG attended the online invited talk "**Molecular Markers and DNA Extraction**" by Lars Chatrou and Dr. Ana Rita Simoes, organized by Botanical Survey of India on 10.07.2023.

A two-days training programme on "**Landscaping and Horticultural Practice**" was organized by AJCBIBG for the officials for capacity building from 10.07.2023 to 11.07.2023. The training imparted by **Dr. Naresh Pancholi**, Palash Associates, Surat, Gujarat. Staff attended the lectures and field training.

BSI organized Heads of office meetings on 29th July, 2023 at ERC, Shillong. The Director, BSI and the Heads of the Office from all the regional centers and Section In-charges attended this meeting for reviewing the annual programe of research activities.
On August 25, 2023, 5 BMCs (Biodiversity Management Committees) from five villages of East Khasi Hills, collaborated with BSI, ERC, Shillong, and Meghalaya Biodiversity Board, organized a tree plantation drive in which 1500 saplings provided by BSI ERC, were planted with the active participation of the residents of the villages.

Northern Regional Centre, BSI along with FSI & ZSI conducted a four-days training program from 8th to 11th August, 2023 for the identification of Plant, Animal, and Hands-on Training for Zonal Staff of FSI under the NIRANTAR vertical of MoEF&CC, New Delhi.

Organized a workshop on 'Coconut craft making' on 02.09.2023, at BSI, ISIM Heritage Gallery. Participated by students of Govt. Art &Craft college, Kolkata.
BSI, APRC, Itanagar organized one workshop in collaboration with Centre for Earth Sciences and Himalayan Studies in Namsai on 'Expansion of skill development in interior villages of Arunachal Pradesh for alternative Livelihood for Socio-Economic Upliftment' on 03-04 Sept. 23.

Two-days National Level Workshop On Identification & Nomenclature of Plants including Lower Groups (Algae, Fungi & Bryophyte) organised by BSI EIACP PC-RP on Biodiversity (Flora), Botanical Survey of India and Central National Herbarium, BSI, Howrah in collaboration with Ramananda College, Bishnupur, Bankura on 5th & 6th October 2023 at the Department of Botany, Ramananda College, Bishnupur.

Under the aegis of the Chief Vigilance Commission of India, all offices, units, and regional centres of the Botanical Survey of India celebrated Vigilance Awareness Week 2023 from 30th October to 5th November 2023 with the theme - "Say no to corruption; commit to the Nation". On the same occasion an workshop was organized in hybrid mode at Central National Herbarium, Howrah on 1.11.2023 where Dr. PritiMahato, Chief Vigilance Officer and Sh. SubrataSarkar, IRSME, Chief Workshop engineer, from Eastern Railways headquarters, Kolkata delivered interactive talk on the said theme.

Botanical Survey of lndia in collaboration with the Indian Fern Society conducted International Symposium in the Department of Botany, University of Kalyani from 22-24th November, 2023.

Botanical Survey of India in collaboration with University of Calcutta conducted 33rd IAAT Conference where Scientists and Researchers from BSI actively participated from 25-27th November 2023.

BSI, Central National Herbarium, Howrah organized a three days' workshop on "*Plants/ Fungi collection Identification, Nomenclature and Botanical Illustration*" at the Department of Botany, Dr. Shyama Prasad Mukherjee University, Ranchi, Jharkhand, in association with EIACP PC-RP on Biodiversity (Flora) on 10th to 13th December, 2023.

Dr. A.A. Mao, Director, BSI conducted virtual meeting of NIRANTAR Vertical 1 (*Ecosystem Survey and Analysis*) with the Heads of the ZSI, FSI, NMNH and NBA on 11th, 13th and 14th December, 2023 for review of the progress.

BSI conducted ABG Screening committee meeting at BGIR, Noida on 19th December, 2023, under the Chairmanship of Ms. Nameeta Prasad, JS, (CS-II), MoEF&CC, New Delhi. Dr. A.A. Mao, Director, BSI and Dr. S.S. Dash, Scientist F & Incharge, and Dr. U.K.L. Tiwari, Scientist D, Tech. Sect. BSI, Kolkata attended this meeting.

A three-day training workshop on "Plant Identification and Nomenclature" for the Indian Forest Service (IFoS) officers nominated by the Ministry of Environment, Forest, and Climate Change, Govt. of India, New Delhi, was organized by Botanical Survey of India *w.e.f.,* 3rd-5thJanuary, 2024, at the Central National Herbarium, Howrah. The objectives of the training program included understanding the basics of plant identification incorporating all groups of plants, nomenclature and

biodiversity in a taxonomic context, learning tools and techniques for naming of a plant, to understand the biodiversity, the policies, challenges and the future prospective along with field-based interactive session and role of Plants in Human well-being.

PARTICIPATED BY BSI OFFICIALS

An International Webinar on "*A Gap in our knowledge to overcome the food insecurity under the Impact of Climate Change"* was organized by Department of Botany, St. Joshep's College, Triuchirappalli, TN on 03.04.2023.

The *International Conference on Biodiversity, Food Security, Sustainability, and Climate Change (ISBFSCC-2023)* on 25th April, 2023. Further, BSI-Arunachal Pradesh Regional Centre, Itanagar organised an awareness campaign at the Assam Agriculture University, Jorhat, Assam on 25th April, 2023.

The *5th World Congress on Homeopathy and Traditional Medicine* on 27th May, 2023 at Kolkata.

the 5 days Faculty Development Programme on *'Plant Taxonomy and Biodiversity Conservation'* on 21st May 2023 at MSCB University, Baripada, Odisha.

BSI, ISIM, Kolkata participated in the *International Museum Expo 2023* organized by the Ministry of Culture at Pragati Maidan New Delhi from 18th – 20th May 2023, under the supervision of Dr. Manas Bhaumik, Scientist E, ISIM, Kolkata.

Staff of CNH & ISIM of BSI, actively participated in the 26th National Exhibition "Contribution to Make Advanced Powerful and Great India," organized by the Central Calcutta Science & Cultural Organization for Youth at Central Park, Salt Lake City, Kolkata, from 24th- 27th August, 2023.
2nd International Conference on "Prospects and Challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS-2023)" at ICAR-CIARI, Port Blair from 18.09.2023 to 20.09.2023

Technical Session VII entitled Natural resource management for climate small agriculture, resource conservation technologies and conservation of agro biodiversity of 2nd International Conference on "Prospects and Challenges of Environment and Biological Sciences in Food Production System for Livelihood Security of Farmers (ICFPLS-2023)" at ICAR-CIARI, Port Blair from 18.09.2023 to 20.09.2023.
CITES '*International Expert Workshop on Non-Detriment Findings (NDFs)*' held in United Nations Complex, UN Avenue in Nairobi, Kenya from 4th to 8th December, 2023 as a member of 'Indian Delegation, and actively contributed to the Working Group 10 (NDFs of Plants; Module 11) as a WG member to develop/improve the NDF guidance.

The Central National Herbarium and Central Botanical Laboratory of Botanical Survey of India, participated in the APC Roy Science Fair and Exhibition at Belgachia, Kolkata *w.e.f.,*5th-7thJanuary, 2024.

The three units of the Botanical Survey of India (CNH, CBL and ISIM) successfully participated in the 55thSri Ramakrishna Mela & Exhibition 2024 *w.e.f.,*18th- 21stJanuary, 2024.

ACTIVITES OF RESEARCH FELLOWS

Project 1: Taxonomic studies and documentation of the Bryophyte of Nagaland (Liverworts, Hornworts and Mosses)
Name of the JRFs- Meghna Paul and Sk Nasim Ali
Name of the supervisor- Dr. Devendra Singh, Scientist – 'E' & H.o.O, AJCBIBG.
Duration of the Project- 5 years

Achievement : A checklist of Liverworts, hornworts and mosses of Nagaland has been prepared which includes 163 species of Liverworts & Hornworts and 232 species of mosses. The team has reviewed various literatures on bryo-floristic works and also surveyed 3 districts viz., Kohima, Kiphire and Dimapur districts of Nagaland from 18.11.2023 to 01.12.2023 and collected 342 plant samples from those areas. Worked out, prepared camera lucida illustrations, took microphotographs and described of the 53 species of liverworts.

Project 2: Liverworts and Hornworts Flora of Andaman and Nicobar Islands.
Name of the Research Associate- Dr. Shashi Kumar
Name of the supervisor - Dr. Devendra Singh, Scientist – 'E' & H.o.O, AJCBIBG.
Duration of the Project- 3 years

Achievement : The relevant scientific literatures were collected on Liverwort and Hornworts. During the study period 75 field numbers were identified, which is deposited in CAL herbarium. Thirteen (13) species including *Lopholejeunea ceylanica* Steph., *Cololejeunea ceratilobula* (P.C.Chen) R.M.Schust., *Cololejeunea lanciloba* Steph. and *Cololejeunea trichomanis* (Gottsche) Steph., *etc.* were illustrated from herbarium specimens deposited in CAL herbarium from Andaman & Nicobar Islands. Plant survey was done for the different forest areas of Andaman Islands viz. South Andaman Islands (Wimberlygunj Junction; Near DFO, Office, Bamboo flate; Mount Herate to Kala Pathar; Soalbay-10; Dhanikhari Experimental Garden, BSI; Chidiya Tapu; Burma nala, near rivers; Ross Islands; Near Karbin beach, forest areas, Wan door Islands), Middle Andaman Islands (Panchwati Mountain, near river side, Rampur, Rangat, Middle Andaman; Goal Pahar, Rangat), North Andaman Islands (Lamia bay to Shaddle Peak base, East River side; Shaddle Peak, base to middle, Deglipur; Shaddle peak, middle to apex/tope (Flag), Deglipur; Lamia bay, south river side to Saddle peak, Deglipur; Lamia bay, south river side to Saddle peak, Deglipur) from 14th December 2023 to 8th January 2024. During this period the of Andaman Islands tour, a total of **495** Bryophytes specimens collected.

Project 3: Assessment of Endemic species of Andaman and Nicobar Islands
Name of the JRF: Ms. Sagarika Kumari
Name of the Supervisor: Dr. Lal Ji Singh
Duration of the project: 2023-2028

Achievement : Prepared list of the endemic species of Andaman & Nicobar Islands. Conducted local field tours to South Andaman (Mount Harriet, Munda Pahar (Chidiyatapu), Ferrargunj, Shoal Bay-19, Beach Dera).Consulted library at BSI-ANRC Port Blair. Consulted 1478 herbarium specimens at BSI-ANRC Port Blair. Collected and preserved 24 plant samples. Identified 3 endemic plant specimens.

Project 4: Revisionary studies on the tribe *Aveneae* (Pooideae, Poaceae) in India.
Name of the JRF: Veeresh H Ari
Name of the Supervisor: Dr. K. Althaf Ahamed Kabeer, Sci-E, CBL, BSI.
Duration of the Project: 2023-2028. (5 years)
Brief note on the Achievements: As per the proposal of the Project below mentioned works have been undertaken.

a) Initially it was important to understand the basic structural and morphological diversity of the family Poaceae so, as per the suggestions given by the supervisor efforts were made to learn

the basic methodology to describe and dissect the Poaceae members generally. Then moving on to understand the detailed taxonomy of the tribe *Aveneae*.

b) Global classifications of the family Poaceae and classifications given by earlier workers of the Indian subcontinent were referred to understand the basic patterns and modifications that have been made in the systems while an integrated approach of Morpho and Molecular taxonomy was included. Such systems of Classifications include Soreng et al. 2015, 2017, and 2022. Bor, 1960. Clayton & Renvoize, 1986. Etc.
c) Preparation of a detailed checklist of all the taxa which includes the circumscription given by Clayton & Renvoize (1986) for the tribe *Aveneae* Dumort. Initially, a total of 116 taxa were enumerated and further, it was updated to 124 taxa which belong to 23 genera. By referring to Flowering Plants of India an annotated checklist by Mao A.A. and S.S. Dash 2020, Checklist of Grasses of India by Kellogg et al. 2020.
d) National, State, and Regional floristic works specifically highlighting the diversity of grasses were referred to understand the morphology, phenology and distribution pattern of the tribe.
e) Indexing of herbarium specimens of tribe *Aveneae* preserved at CAL by compiling the data of all the specimens examined into an excel sheet is ongoing and so far, 515 sheets have been processed belonging to the genera *Duthiea*, *Avena, Agrostis, Alopecurus, Hierochloe and Polypogon.*
f) Referred c. 100 works of literature (Flora, Revision, Checklist and Doctoral Dissertations) were referred to understand the Taxonomic history of the tribe Aveneae in India.
g) First field study cum herbarium consultation trip was conducted to Meghalaya from 25/09/2023 to 13/10/2023 in that particular trip a total of 41 Field collections were made and the herbarium of Botanical Survey of India, Eastern Regional Centre, Shillong. (ASSAM) was Consulted and a total of 236 sheets belonging to different genera of tribe Aveneae were examined. (Photos enclosed)
h) Second field study cum consultation trip was conducted to BSI, SRC and parts of Western Ghats in this particular trip a total of 22 field collections were made and 5 major herbaria were consulted, which include the herbarium of Botanical Survey of India, Southern Regional Centre, Coimbatore (MH), Fischer Herbarium of IFGTB (FRC), Shivaji University, Kolhapur (SUK), Agarkar Research Institute, Pune (AHMA) and Herbarium of Botanical Survey of India, Western Regional Centre, Pune (BSI). From all these herbaria a total of 266 herbarium sheets were consulted. (Photos enclosed)
i) From these two field cum herbarium consultation trips a total of 502 herbarium sheets were processed and the data has been compiled into respective Excel sheets for the different herbaria consulted. A total of 63 field collections were made and are poisoned and processed for preparation of herbarium sheets with the primary identifications.
j) Online datasets such as POWO, IPNI, Tropicos, WFO and GBIF were referred to understand the taxonomic and nomenclatural history of the taxa and parallelly communications to different herbaria such as K, BM, E etc. via emails were made requesting high-resolution images of the type specimens and original materials availability belonging to the members of tribe *Aveneae*.
k) Tracing out the type specimens and original materials belonging to tribe *Aveneae* using the GBIF portal is ongoing, certain names with confusion over their type specimens have been identified and the detailed study is under progress.
l) Assisted in preparation of dichotomous key of *Agrostis* L. for flora of India.
m) Attended the XXXIII International Symposium of the Indian Association for Angiosperm Taxonomy held at Ballygunge Science College campus, Calcutta University, Kolkata. On 25/11/2023 to 27/11/2023.

Project 4: **Freshwater Red Algae of India**

Name of the RA : Dr. U. Elaya Perumal (BSI-RA 2023)
Name of the Supervisor : Dr. M Palanisamy, Scientist 'E', CNH, BSI, Howrah-711103.
Duration of the project : 2023-2026

Achievement : As per the research proposal one field tour was conducted to 8 northern districts of West Bengal. Totally 86 samples were collected and preserved properly for the further studies. During the sample collection in different locations physico chemical parameters *i.e.* atmospheric and water temperature, pH, light intensity, salinity, total dissolved solids and electrical conductivity were recorded. Also, recorded the Geo-coordinates and altitudes of different collection locations. During the field tour more than 100nos. of photographs of habit and habitat were taken. All the collected samples were preserved in liquid form and few of them were made into herbarium sheets. While preliminary screening of collected samples under microscope 34 samples were showing the occurrence of red algal species belonging to 3 families (Batrachospermaceae, Compsopogonaceae, Audouinellaceae) and 4 genera viz. *Audouinella, Compsopogon, Sheathia and Sirodotia.* Initiated the detailed studies of individual samples using microscope and taking photomicrographs. *Compsopogon* genus were observed from 22 locations, *Sheathia* genus observed from 6 locations, *Sirodotia* genus observed from 4 locations and *Audouinella* specimens were observed from 2 locations. Out of 8 districts Jalpaiguri recorded with highest number of red algae [11 members (9-*Compsopogon*,1-*Sheathia* & 1 *Sirodotia*)], Alipurduar district stands second with 9 members (7 *Compsopogon*, 2 *Sheathia*), Darjeeling district recorded with 7 members (2-*Compsopogon*, 2-*Sheathia*, 3-*Sirodotia*); Malda (1-*Compsopogon* & 1- *Audouinella*), Dakshin Dinajpur (1-*Compsopogon* & 1- *Audouinella*), and Uttar Dinajpur (1-*Compsopogon* & 1- *Sheathia*), recorded with 2 members each, New Cooch Behar recorded with 1 red algal member and no regal members were recorded from Kalimpong district during this collection. Arc GIS mapping is in progress using the different collection locality GPS coordinates. Preparation of checklist on freshwater red algae of India is in progress. So far 7 families including 20 genera have been listed using the published protologue of individual species in India. Five more families yet to be listed. Out of seven families Batrachospermaceae was dominated with 11 genera and 63 species.

Project 5: **Quantifying the significance of economic importance and Bio-Prospecting of selected Marine Macro Algae**
Name of the JRF : Reetika Srivastava
Name of the Supervisor : Dr. M. Palanisamy, Scientist 'E', CNH, BSI, Howrah
Duration of the Project: 5 years (2023- 2028)

Achievement : During 22/12/2023 to 02/01/2024 marine macro algal biomass collection field tour to Gujarat coastal regions were conducted. (Localities: Jamnagar Coastal areas *i.e.* Sikka and Rozi coastal areas, Mithapur coast, Dwarka coast, Shivrajpur coast and Veraval coast). Totally 22 species of marine macro algal biomass samples were collected [seven species of green algae (*Caulerpa racemosa var. occidentalis, Chaetomorpha crassa , Cladophora sp., Halimeda macroloba , Udotea indica, Ulva fasciata,* and *Valoniopsis pachynema*), six species of brown algae (*Cystoseira trinodis, Hormophysa cuneiformis, Hydroclathratus clathratus, Iyangaria stellta Padina boergesenii,* and *Sargassum swartzii*) and nine species of red algae (*Centroceras clavulatum, Champia indica, Gracilaria edulis, Gracilaria salicornia, Halymenia porphyroides, Hypnea valentiae, Jania rubens, Laurencia platyclada,* and *Solieria robusta,*)] . All the collected samples were properly cleaned and dried in shade condition and packed properly for further use. Also, samples were processed properly and made herbarium. Description writing and identification conformation is in progress. Learnt about seaweed herbarium preparation, DNA extraction and amplification using standard primers (rbcL). Collected about 200 references in different sources pertaining to bioprospecting studies of marine macro algae. Referred nearly 100 literatures pertaining to marine macro algal molecular studies and taxonomy including description writing. An article was published *viz.* "Paul M, S. Goswami, B. Mondal, A. Mondal, V. H. Ari, P. S. Bhagure, S. Pandey, Pradhyumnan M.R., P. S. Kushwaha, Parthiban A., Navya S., S. Bera, P. B. Sahoo, S. Jash, D. Shukla, Hrudya A., A. Mitra, A. Siga, A. Bose, Athira P. P., E. A. Felicia, M. Pal, M. Jandial, P. Bhandari, R. Mondal, **R. Srivastava**, R. K. Singh, S. Kumari, S. Kaur, S. N. Ali, Y. Rout & K. Bhattacharji 2023. Lectotypification of two names in *Calanthe* R.Br. (Orchidaceae). *Nelumbo* Vol. 65(1): 189–192."

Project 6: Flora of India (Taxonomic Study of Family Caryophyllaceae in India)
Name of the JRF: Seemarjit Kaur

Supervisor : Dr. Chaya Deori, Scientist-E
Duration of the Project: 5 years (26th June 2023 till 26th June, 2028)

Achievement : During the period from June, 2023 to January, 2024, total field tours conducted 11 (for 15 days) to Meghalaya: East Khasi hills district and 1(one) herbarium consultation tour to CNH CAL. A total of 54 field numbers of specimens collected and pressed for herbarium preparation [Caryophyllaceae (29) & other associated species (25)]. Identified all the collected 9(nine) species and all the collected 9 species were worked out for morphological studies. Total 347 photographs taken of habitat, habit, characters and dissected parts of the collected species. Photographic illustrations completed and descriptions written for *Drymaria diandra* Blume; *D. cordata* (L.) and *D. villosa* Cham. & Schlecht. SEM images of seed samples taken for 5 species DNA extraction and electrophoresis done for *Drymaria diandra* Blume for preliminary molecular analysis of the genus. Meta data entry and photography done for 200 sheets of Caryophyllaceae sp. in ASSAM herbarium, Shillong. Meta data entry of 120 sheets from CAL herbarium done, herbarium photographs taken 1,215. Literature accessed includes Online Checklists and databases: 11(eleven); Offline Checklists: 4(four); Floras: 20(twenty); Other books: 17(seventeen); Journals: 11 (18 articles) & Protologues: 40(forty); Curated and arranged all the herbarium sheets of the family Caryophyllaceae available in the ASSAM herbarium and revised the scientific names of the genera and species on the genus covers and species covers; (ii). Pictorial field manual created for field identification of the Caryophyllaceae species found in Arunachal Pradesh, Meghalaya and Assam. Prepared list of Caryophyllaceae species endemic to India through literature survey. 20(twenty) species of Caryophyllaceae were found endemic to India . Listed IUCN status of the 160 Indian Caryophyllaceae species; (vi). Distribution Maps and graphs created for Caryophyllaceae species using Arc-Gis and M.S Power point and Geo-cordinate entered in Meta data. Distribution list prepared for 160 Indian Caryophyllaceae species state wise. Phenology chart prepared for 160 Indian Caryophyllaceae species. Attended Lecture on Botanical Gardens and its importance delivered by Dr. Scott from Atlanta Botanical Garden, USA. Also, participated in Hindi Pakhwada Program and other programs organized by BSI, ERC, Shillong.

Project 7: **Flora of India (Phylogeny of the Subfamily Lamioideae Harley (Lamiaceae) in India)**
Name of the JRF: Appu Siga
Supervisor: Dr. David L. Biate, Scientist-D
Duration of the Project: 5 years (26th June 2024 – 26th June 2028)

Achievement : Metadata have been collected for 22 species under genus *Pogostemon* from 313 Herbarium specimens and 28 species under 12 genera from 216 Herbarium specimens housed at ASSAM, ERC, Shillong and ARUN, APRC, Itanagar respectively.

A total of 11 botanical Field tours have been Undertaken spanning over 20 days between, July 2023 to January 2024 to Meghalaya and to Arunachal Pradesh. Field Collection of 22 species have been done of which 16 species have been identified. Photoplates and description of the identified species have been prepared while flowers of all the collected species have been dissected and pressed for the herbarium preparation.

Genomic DNA extraction using CTAB method has been done for *Pogostemon auricularius* (L.) Hassk., *Pogostemon brachystachyus* Benth., *Pogostemon hispidus* (Benth.) Prain, etc. PCR standardisation of the isolated DNA using nuclear ITS marker for the 13 species and using rbcL marker for 10 species was carried out. PCR amplification of the isolated DNA of 13 species was done using ITS marker while amplified product of *Leucas ciliata* Benth. was subjected to PCR purification. Amplified isolated DNA of ten species have been sent for DNA sequencing. Currently, a herbarium consultation tour to Tamil Nadu and Kerala is undergoing where a few species have been collected.

Project 8: **Ecological status of dominant invasive alien plant species, patterns of plant invasions and their impact on the native plant diversity in the North-western Himalaya (Himachal Pradesh, Ladakh and Jammu region).**
Name of the JRF- Ritesh Kumar Singh

Name of the supervisor- Dr. Kuldip S. Dogra, Scientist-E
Duration of the Project- 26th June, 2023 to 8th February 2024.
Brief note on the achievements :
Preparation of inventories: Primary and secondary data on Invasive Alien Plant Species was collected during the period and inventories of Alien Plant Species of Himachal Pradesh (consists of 754 plants) and Ladakh (consists of 134 plants) have been prepared. The inventories were prepared based on the botanical name of the alien plants along with their family, habit, nativity and ecological status (invasive/casual/naturalized).
Field tours and area surveyed: A total of 4 field tours have been conducted (3 short tours of 1-2 days & 1 long tour of 17 days).
Areas surveyed: In Himachal Pradesh- A total of 5 districts (Solan, Shimla, Kangra and Mandia. In Jammu region of J&K, (U.T.)- A total of 3 districts (Jammu, Reasi and Rajouri).

Achievement : A total of 104 quadrats (invaded as well as control) have been laid down in the regions of Himachal Pradesh and Jammu focusing on the areas invaded by the major dominant invasive alien plant species [*Lantana camara* L. (Verbenaceae), *Ageratum conyzoides* (L.) L. (Asteraceae), *Ageratum houstonianum* Mill. (Asteraceae), *Ageratina adenophora* (Spreng.) R.M.King & H.Rob. (Asteraceae), *Tecoma stans* (L.) Juss. ex Kunth (Bignoniaceae)] and collected the data to calculate basal area, density, dominance, abundance, frequency, importance value index. The diversity indices of the invaded and control area were also evaluated. Further, during the study a total of 127 plan species were collected (includes both alien plants and native plants) and processed for herbarium records at BSI, Solan. Out of the total alien plant species, 6 alien plants are found to be as the 1st collection from the region in which 3 are invasive in nature and drastic effects on the native plant species of the regions.

Project 9: **Taxonomic revision of the genus *Bupleurum* L. (Apiaceae) in India**
Name of the Research Associate: Dr. Jayanta Ghosh
Date of Initiation of the Project: 1st September 2023
Date to be completed the Project: 30th September 2026

Achievement: Literature pertaining to the genus *Bupleurum* has been studied elaborately till date to get a comprehensive list of the species. Representative specimens of the genus *Bupleurum* deposited at different world digital herbaria have been cross checked for Indian materials (BM, E, K, P, G, GH, US, NY, etc.). A comprehensive list of names of species has been prepared and cross checked for its validity and synonymy as well as their actual distributional ranges. A field trip to Nagaland has been conducted (21.09.2023-01.10.2023) in search of *Bupleurum* species from different part of the state. A total of 14 field number collected from that trip of different species of Apiaceae. Herbarium consultation has been done before the collection trip to Nagaland from CAL and as well as the stand images of the herbarium specimens collected from Nagaland deposited at ASSAM have been considered before the filed survey to pin point the locality of the species in detail. The collected specimens were properly dried, poisoned and mounted on herbarium sheets for future reference and deposited at BSIS. Dissection of floral parts, characterization and identification has been done for 10 field numbers. Detailed illustration fopr four taxa has been prepared.

Literature pertaining to the taxonomic revision as well as molecular phylogeny has been searched and documented for further study. Previously collected specimens of *Bupleurum* from different parts of the country deposited at CAL have been studied for two days. A list of the representative specimens has been prepared with detailed information regarding each herbarium sheet. Protologue for most of the species (taxa) of *Bupleurum* found in India have been catalogued and studied critically. A comprehensive search for the type specimen of the taxa has been carried out and continuing till date. About 10 names of *Bupleurum* typified previously by different authors have been searched and catalogued. The type materials for most of the species of *Bupleurum* has been gathered from different digital herbaria including CAL. Detailed characterization of the type specimens of names of *Bupleurum* species is going on to ascertain their type status.

Till date, one previously collected specimens of *Bupleurum* from Sikkim has been illustrated, characterized in detailed and identified by using relevant literatures. The citation of species names

from relevant literatures has been initiated including all their synonyms from POWO. One interesting species of the family Apiaceae collected during the Nagaland trip has been targeted and critical study is going on to ascertain its taxonomic status.

Project 10: Taxonomic Study of Some Selected Genera of Apiaceae. *(Heracleum, Pimpinella, Pleurospermum, Physospermopsis, Pternopetalum, Sinocarum)*
Name of the JRF: Priyanka Bhandari
Name of the Research Supervisor: Dr. Manas Bhaumik, Scientist -'F'
Duration: 2023-2028.
Brief note on the Achievements: To provide a comprehensive taxonomic revisionary account of *Heracleum, Pimpinella, Pleurospermum, Physospermopsis, Pternopetalum, Sinocarum* in India, solving nomenclatural anomalies following latest ICN. To document the diversity, population dynamics, endemicity and other aspects of these genera in India.

Achievement : About 400 herbarium sheets of Apiaceae are examined, which are deposited at CAL, along with their author, collector, occurrence, locality, altitude. Study and Descriptions of 25 taxa prepared from herbarium sheets of CAL. Prepared draft checklist of all species of family Apiaceae distributed in India, along with their nomenclatural status, occurrence, flowering season, altitude etc. Prepared a list of allotted genera from Sikkim, Arunachal Pradesh, Meghalaya, Madras, Assam flora. Also, prepared list of endemic species of family Apiaceae in India, along with their locality/states. Completed herbarium consultation at SHRC, about 150 herbarium sheets are examined and studied their author, collector, occurrence, locality, altitude. Collected 11 genera and 17 species at the field tour of Sikkim, along with their GPS location, abundance data, soil type, associated plants type, economic importance etc. Descriptions of 28 taxa prepared for the purpose of identification, viz. *Heracleum nubigenum*, *Heracleum obtusifolium*, *Physospermopsis obtusiuscula, Sinocarum sikkimensis, Selinium wallichianum*, *Pleurospermum dentatum, Sinocarum wolffianum, Trachydium hispidum, Bupleurum candollei, Acronema hookeri, Pleurospermum apiolens, Heracleum nepalense, Sinocarum clarkeanum, Hydrocotyle javanica, Hydrocotyle nepalense, Pimpinella diversifolia, Oenanthe thomsonii,* from Sikkim field tour. Anatomical study of various type of fruits of Apiaceae done. Prepared Botanical illustration of *Pleurospermopsis sikkimensis*, *Pleurospermum pulszkyi, Pleurospermum benthamii, Sinocarum minus.* Prepared Photo plates of *Pleurospermopsis sikkimensis* and *Pleurospermum pulszkyi, Pleurospermum benthamii, Sinocarum minus.*

Project 11: Threat assessment, distribution mapping and development of conservation protocol for Endemic, Threatened and lesser-known plants of Indian Himalayan Region
Name of the RA : Dr. Amber Srivastava (Research Associate & PI)
Name of the Supervisor: Dr. S.K. Singh (Scientist F & Supervisor)
Duration of the Project: Nov, 2023–Oct, 2026.

Achievement : Compiled data on the occurrence of *Calotropis acia* Buch.-Ham. in Western Himalayan region. Written detailed taxonomic description of *Tricholepis roylei* Hook. f. on the basis of live plant material and dissected flower for developing photoplate. **Ex-situ conservation:** Introduced 18 species viz., *Crocus sativus* L., *Butea superb* Roxb. Ex Willd., *Pterocarpus marsupium* Roxb., *Pterocarpus dalbergioides* Roxb. ex DC., *Codariocalyx motorius* (Houtt.) H. Ohashi, *Nymphaea nouchali* Burm.f., *Ehretia laevis* Roxb., *Spatholobus parviflorus* (Roxb. ex G.Don) Kuntze, *Euphorbia mayuranathanii* Croizat, *Euphorbia nivulia* Buch.-Ham., *Euphorbia sahyadrica* Sardesai & Malpure, *Euphorbia cattimandoo* Elliot ex Wight, *Euphorbia tortilis* Rottler ex Ainslie, *Euphorbia trigona* Mill., *Euphorbia vajravelui* Binojk. & N. P. Balakr., *Euphorbia lacteal* Haw., *Euphorbia antiquorum* L. and *Euphorbia susan-holmesiae* Binojk. & Gopalan in the botanical garden of BSI, Dehradun. Collected seeds of *Trachycarpus takil* Becc. from Kumaon University campus, Nainital and *Trapa kashmirensis* Wójcicki from Wular lake, Kashmir.

Project 12: Revisionary Study of Wild Balsams (Impatiens Riv. ex L. Balsaminaceae) of Indian Himalayas (excluding Arunachal Pradesh & Sikkim)

Name of the JRF: Brahmarshi Mondal
Name of the Supervisor: Dr Rajib Gogoi, Scientist 'F', HoO, BSI, SHRC, Gangtok.
Duration of the Project: 5 years
Allotted Centre: Botanical Survey of India, SHRC, Gangtok.

Achievement : Prepared checklist of *Impatiens* L. of Indian Himalayas which includes 142 species of *Impatiens*. Surveyed various taxonomic literature related to the genus *Impatiens* L. which includes- Balsams of Darjeeling & Sikkim Himalaya, Balsams of eastern Himalaya, Balsaminaceae of Myanmar, Flota of India, etc. & different website like POWO, IPNI, WFO, eFlora India, etc. Surveyed 3 states of Indian Himalayas Viz., Meghalaya, Manipur & Nagaland and collected 34 field numbers including 24 species of *Impatiens* under the family Balsaminaceae. Studied more than 600 Herbarium Specimens of ASSAM herbarium during the field tour to BSI, ERC, Shillong. Worked out, Prepared photo plate & took photographs of 20 Species of *Impatiens* L. A total of 52 protologues have been studied.

Project 13: **A morphological and molecular approach to infer systematic relationships and species delineation in *Sonerila* Roxb. (Melastomataceae) in India, with special emphasis on inflorescence development and floral ontogeny**
Name of the RA and Supervisor: Dr. Resmi S. & Dr. K. Karthigeyan
Duration of the Project: 3 years

Achievement : During this period five field trips were conducted to different parts of Western Ghats (Kerala, Tamil Nadu and Maharashtra). As a result, 12 species were collected, identified and described viz., *Sonerila versicolor* Wight*, S. speciosa* Zenker*, S. janakiana* Ratheesh, Mini & Sivad., *S. sreenarayaniana* Sunil, Naveen Kum. & T.S. Rajeev, *S. tenera* Royle, *S. wallichii* Benn, S. *veldkampiana* Ratheesh, Mini & Sivad., *S. balasubramaniamii* Murug., Arun, Nikhil Raj, P.A.Azeez & M.K.Sebastian, *S. rheedei* Wall. ex Wight & Arn., *S. brunonis* Wight & Arn., *S. tenella* Bedd. and *S. axillaris* Wight. Samples were preserved for molecular and developmental studies with ongoing efforts to standardize methodology. Progress has been made on drafting three manuscripts, one focusing on nomenclature and the other two on morphology, which are currently undergoing final editing and review. Furthermore, Attended and presented papers in two conferences viz., XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy & International Seminar on Advances in Plant Systematics, Biogeography and Biodiversity Conservation held at University of Calcutta, Kolkata (25^{th} - 27^{th} November, 2023) and 46^{th} All India conference of Indian Botanical Society held at Sant Gadge Baba Amravati University Maharashtra (04^{th} - 06^{th} November, 2023), and bagged the Woman Botanist Award-2023. Received the approval for the survey and collection *Sonerila* specimens in Andaman and Nicobar Islands from the Department of Forests, Andaman & Nicobar Administration.

Project 14: **Taxonomic studies on the tribe Miliuseae (Subfamily Malmeoideae: Annonaceae) in India.**
Name of the JRF: Sukdeb Bera
Name of the Supervisor: Dr. K. Karthigeyan, Scientist 'F',
Duration of the Project: 2023-2028 (Ongoing)

Achievement : Updated checklist of Annonaceae in India by using regional Flora, Monographs, check lists, recent research articles of new species and POWO (2023). Endemic plants of Annonaceae and their distributional data has been listed. Protologues and Type specimens of all the name of the tribe Miliuseae (Subfamily Malmeoideae: Annonaceae) have been traced from different herbarium (CAL, MH, K, BM, G, P, TBGT, KFRI, CALI). More than 1000 voucher specimens have been referred at CAL. More than 100 books of different Flora, Monograph, revisionary work, check list and 70 research articles were referred. Successfully caried out field survey at Wayanad district of Kerala from 24^{th} November to 1^{st} December. Carried out the herbarium consultation-cum-field survey in Kerala viz. Calicut University Herbarium, KFRI, TBGT from 15-12-2023 to 23-12-2023 and more than 1,234 voucher specimens and 8 type specimens of 3 herbaria were examined, photographed and

all the data were noted down in Excel sheet. Six live specimens of Annonaceae were collected among them 3 specimens are endemic to India *viz*. *Polyalthia longipedicellata* (Alister, G.Rajkumar, Nazarudeen & Pandur.) Shailaj., B.Parthipan, A.K.Sreekala & E.S.S.Kumar (Endemic), *Meiogyne ramarowii* (Dunn) Gandhi (Endemic), *Monoon fragrans* (Dalzell) B.Xue & R.M.K.Saunders (Endemic), *Artabotrys zeylanicus* Hook.f. & Thomson, *Orophea* sp. & *Sageraea* sp. All collected specimens were preserved (Dry & Wet methods) for herbarium preparation. Dissected and described 3 collected specimens *viz*. *Polyalthia longipedicellata* (Alister, G.Rajkumar, Nazarudeen & Pandur.) Shailaj., B.Parthipan, A.K.Sreekala & E.S.S.Kumar (Endemic), *Meiogyne ramarowii* (Dunn) Gandhi (Endemic), *Monoon fragrans* (Dalzell) B.Xue & R.M.K.Saunders (Endemic) & *Orophea* sp. Forest permission letters for Andaman & Nicobar Islands and Kerala have been prepared and submitted to respective forest offices. Published one research article on Lectotypification of two names in *Calanthe* R.Br. (Orchidaceae), it was the outcome of 3 months research-oriented training at CNH.

Project 15: Floristic studies on the Lichens of three southern districts (Madurai, Theni and Virudhunagar) of Tamil Nadu.
Name of the JRF: Ms. Hrudya, A
Name of the Supervisor: Dr. Jagadeesh Ram, T.A.M., Scientist 'E'
Duration: 2023–2028

Achievement : Reffered various published Floras and research articles published in different national and foreign journals. Totally 134 samples were segregated based on their morphology. A total of **57** specimens have been characterized and identified into the species. Data entry made for 30 earlier collected lichen samples. Prepared 860 lichen herbarium packets with labels for maintaining the specimens after proper segregation and identification. Secondary metabolites of 37 specimens belonging to Parmeliaceae have been identified by Thin Layer Chromatography. One article was published *viz.* "Lectotypification of two names in *Calanthe* R. Br. (Orchidaceae)". Nelumbo 65(1): 2023.

Project 16: Taxonomic Studies on the Family Asparagaceae Juss. in India.
Name of the JRF: Ms. Athira, P.P
Name of the Supervisor: Dr. R. Manikandan, Scientist 'E'
Duration: 2023–2028

Brief note on the Achievements: Prepared a comprehensive checklist of the family Asparagaceae of India based on scrutiny of various published Floras and research articles published in different national and foreign journals. One article was published *viz. "Lectotypification of two names in Calanthe* R. Br. (Orchidaceae)*".* Nelumbo 65(1): 2023. Consulted the holdings of different species of Chlorophytum, Scilla, Urginea and Asparagus housed in MH and prepared the data sheets. Conducted a Herbarium Consultation-cum-Field Tour to BSI-WRC, Pune (BSI), Agarkhar Research Institute (AHMA), Pune and Blatter herbarium, St. Xavier's College, Mumbai (BLAT). Referred voucher specimens of Asparagaceae (447) at BSI, Pune, Asparagaceae (263) at Agharkar Research Institute Herbarium, Pune (AHMA) and Asparagaceae (785) at Blatter Herbarium, St. Xaviers College, Mumbai (BLAT). Gathered the protologues and digital images of type specimens of various names in Chlorophytum, Dipcadi, Drimia, Maianthemum, Peliosanthes, Rohdea and Tupistra from Indian Virtual Herbarium. Dissected and observed the morphological characters of specimens of different species of *Asparagus, Chlorophytum, Dipcadi* and *Ophiopogon* under microscope.

Project 17: Shola Forests: Floristic Composition, Structure and Dynamics in the Context of Climate Change 2023-2028
Name of the JRF: Ms. Navya S
Name of the Supervisor: Dr. Sujana, K.A., Scientist 'E'
Duration: 2023–2028

Achievement : Literature pertaining to the allotted project was consulted. Based on various literature a checklist of **970** taxa reported from shola forest was prepared. During the period of the report, six

field tours were conducted to the shola forests of Sugandhagiri of Wayanad and Naduvattam of Nilgiris, Agasthyamala, South Wayanad, Thaichola of Nilgiris, Karimpuzha Wildlife Sanctuary, and Megamalai Wildlife Sanctuary. A total of **310** field numbers were collected with GPS locations and identified **275** taxa. Participated in a 02-day National Seminar on 'Sustainable Development through Biodiversity Conservation' (06 and 07 December 2023) Conducted by St. Mary's College, Thrissur and Kerala State Biodiversity Board and presented a paper on "Endemic Angiosperms of Shola Habitat and Significance of Conservation". Also participated in a three-day online workshop on Q-GIS conducted by the Centre for Tropical Biodiversity Conservation-CTBC, from 22 to 24 September 2023.

Project 18: **A Taxonomic Revision of the Family Oleaceae in India**
Name of the JRF: Ms. E. Angelin Felicia
Name of the Supervisor: Dr. W. Arisdason, Scientist 'E'
Duration: 2023–2028

Achievement : Prepared a comprehensive checklist of the family Oleaceae of India based on scrutiny of various published Floras and research articles published in different national and foreign journals. One article published *viz.* "Lectotypification of two names in *Calanthe* R. Br. (Orchidaceae)". Nelumbo 65(1): 2023. Protologues of names in genera, such as Chionanthus and Chrysojasminum were collected.

Referred the voucher specimens of different genera of Oleaceae housed at Madras Herbarium (MH): *Jasminum arborescens* Roxb. (**20**), (ii) *J. cordifolium* Wall. ex G. Don (**48**), (iii) *J. malabaricum* Wight (**29**), (iv) *J. multiflorum* (Burm.f.) Andrews (**16**), *J. rottlerianum* Wall. ex DC. (**09**), (v) *J. sambac* (L.) Aiton (**62**), *J. rigidum* Zenker (**25**), *J. rottlerianum* Wall. ex DC. (**63**) and *J. sessiliflorum* Vahl (**85**). Conducted a Herbarium Consultation-cum-Field Tour to BSI-WRC, Pune (BSI), Agarkhar Research Institute (AHMA), Pune and Blatter herbarium, St. Xavier's College, Mumbai (BLAT), and the details of examination of voucher specimens of the family Oleaceae housed in the three herbaria *viz.* Western Regional Centre, Botanical Survey of India, Pune (BSI): **1216** specimens. Blatter Herbarium, St. Xavier's College, Mumbai (BLAT): **618** specimens. Agharkar Research Institute Herbarium, Pune (AHMA): **155** specimens
Microscopic Studies: Dissected the specimens of following taxa and observed the macro- and micro-morphological features under microscope: (i) *Jasminum grandiflorum* L., (ii) *J. auriculatum* Vahl, (iii) *Ligustrum robustum* (Roxb.) Blume subsp. *perrottetii* (A. DC.) de Juana, (iv) *Olea paniculata* R. Br., (v) *Cartrema matsumurana* (Hayata) de Juana, (vi) *Chionanthus courtallensis* Bedd., (vii) *C. mala-elengi* (Dennst.) P.S. Green, and (viii) *C. ramiflorus* Roxb.

Project 19: Morpho-Molecular Characterization of Micro-Fungi of Pushpagiri Wildlife Sanctuary, Karnataka
Name of the JRF and Supervisor: Sayantan Jash, Junior Research Fellow, under the guidance of Dr. Rashmi Dubey, Scientist 'F', Botanical Survey of India, Western Regional Centre, Pune – 411001
Duration: 2023-2028 (5 years)

Achievement : A letter sent to Principle Chief Conservator of Forests (PCCF), Govt. of Karnataka for acquiring permission to conduct surveys and research in Pushpagiri Wildlife Sanctuary, Karnataka, which has not been approved till date. Planned to take one field tour at end of February 2024. Studied Checklist of Fungi reported from Karnataka and also prepared a list of Fungi reported from Kodagu district (where Pushpagiri Wildlife Sanctuary is situated) of Karnataka. Studied Flora of Pushpagiri Wildlife Sanctuary to understand the vegetation of the study area. Conducted detail literature review on the genera *Arthrinium* Kunze, *Apiospora* Sacc., *Dictyoarthrinium* S. Hughes, *Kostermansinda* Rifai, *Melanographium* Sacc., *Penzigomyces* Subram., and *Xiuguozhangia* K. Zhang, R.F. Castañeda, Jian Ma & L.G. Ma, and made comparison charts of those genera based on morphological characters. Distribution and Host ranges of Indian species of those genera are also documented based on literature. Prepared artificial keys of the orders (up to family level) Asterinales M.E. Barr ex D. Hawksw. & O.E. Erikss., and Meliolales Gäum. ex D. Hawksw. & O.E. Erikss.; and

families (up to genus level) Antennulariellaceae Woron., Asterinaceae Hansf., Capnodiaceae Höhn. ex Theiss., Coccodiniaceae Höhn. ex O.E. Erikss., Erysiphaceae Tul. & C. Tul., Meliolaceae G.W. Martin ex Hansf. Metacapnodiaceae S. Hughes & Corlett, and Readerielliopsidaceae Abdollahz. & Crous based on morphological descriptions provided in different literatures. Learned preparation of PDA and MEA plates and slants, and different aseptic methods like isolation, culturing and sub-culturing of microfungi which are prior essentials for my project. Learned DNA extraction from fungal tissue, their amplification and purification. Attended 'Workshop on Molecular Phylogenetics' (1 November – 6 November 2023) organized by National Institute of Science Education and Research (NISER), Bhubaneswar in association with IISc, Bangalore, CCMB, Hyderabad, and Tel Aviv University, Israel.

Project 20: Biosystematics of Mycorrhizal Fungi associated with Terrestrial Orchids of Northern Western Ghats of India.
Name of the RA : Dr. Dheeraj Pandey,
Name of the Supervisor : Dr. Rashmi Dubey, Scientist 'F'
Duration of the Project: 2023-2026 (3 years)

Achievement : One collection tour was conducted to various forest areas of the Northern Western Ghats of India namely Mahabaleshwar, Panchgani, Bhimashankar Wildlife Sanctuary, Mulshi and Mhatoba forest from 18th to 23rd Dec. 2023. A total of 06 terrestrial Orchids (*Geodorum densiflorum* Lam. (Schltr.), *Pecteilis gigantea* (Sm.) Raf., *Malaxis rheedii* Swartz., *Malaxis* sp.1, *Eulophia* sp*., Zuexine* sp.) and 03 epiphytic Orchid species (*Aerides crispa* Lindln., *Oberonia falconeri* Hook f., and *Dendrobium* sp.) were collected, terrestrial orchids were potted in earthen pots for experimental purposes. Collected mature capsules of *Habenaria furcifera* Lindl, *Habenaria longicorniculata* J. Graham., *Geodorum densiflorum* Lam. (Schltr.) and *Malaxis rheedii* Swartz for symbiotic germination test. Collected five species of terrestrial orchids (*Peristylus plantagineus* (Lindl.) Lindl. *H. longicorniculata* J. Graham., *Malaxis versicolor* (Lindl.) Abeyw., *Habenaria* sp.1 and *Habenaria* sp. 2;) of terrestrial Orchid from different regions of Northern Western Ghats, Maharashtra during September - October 2023. Isolation of mycorrhizal fungi was conducted on *Habenaria fercifera* Lindl. (04 morphotypes); *H. longicorniculata* J. Graham (02 morphotypes); *Malaxis versicolor* (Lindl.) Abeyw (02 morphotypes); *Eulophia* sp. 1 (02 morphotypes). The identification of following mycorrhizal fungi up was completed, i.e. *Rhizoctonia solani* J.G. Kühn from *Habenaria longicorniculata* J. Graham., and *Eulophia* sp. 1, *Rhizoctonia* sp*., Ceratobasidium* sp., *Tusnella* sp. were identified from *Habenaria fercifera* Lindl. Orchid Root-Mycorrhizal symbiosis slides were prepared from the *H. fercifera* Lindl., *H. longicorniculata* J. Graham., *Malaxis versicolor* (Lindl.) Abeyw., and *Eulophia* sp. 1.

Project 21: Systematic studies in Genus *Hibiscus* L. (Malvaceae) from India
Name of the RA : Dr. Jagdish Vishnu Dalavi
Name of the Supervisor: Dr. M.Y. Kamble
Duration of the Project: 3 years (August 2023-August 2026)

Achievement : Collected 8 species of his project and processed for specimens, photo plate making, description and map preparation. The soil sample, GPS co-ordinates, samples for molecular studies, pollens for palynological studies have been collected. 10 saplings of *Hibiscus syriacus* L. 5 of *Hibiscus hirtus* L*.,* 10 of *H. acetosella* Welw ex Hiern*.,* and 2 of *Hibiscus fragrans* Roxb. Total 100 specimens of angiosperms have been prepared for research and enrichment of Herbarium. Consulted specimens of *Hibiscus* L. at CAL! (Botanical Survey of India, Central National Herbarium Kolkata) and BSI (Herbarium of BSI, WRC, Pune)

Project 22: Studies on the endemic tree diversity of Maharashtra and its ex-situ conservation.
Name of the JRF : Ms. Pooja S. Bhagure
Name of the Supervisor: Dr. M.Y. Kamble
Duration of the Project: 5 years (2023-2028)

Achievement : Collection & analysis: Collected 27 species of endemic and threatened trees of project and processed for specimens, photo plate making, description and map preparation. Collected saplings, seeds, stem cuttings and processed for various treatments for conservation. Raised seedlings of endemic and threatened tree species. Total 60 specimens of endemic and native trees have been prepared for research and enrichment of Herbarium.Consulted specimens of endemic and threatened trees of Maharashtra at SUK! (Shivaji University Kolhapur) and BSI! (BSI, WRC, Pune).

Publications:

1. Pooja S. Bhagure, M.Y. Kamble & Jagdish Dalavi (2023) Nomenclatural notes on *Bombax insigne* Wall. (Malvaceae). *Phytomorphology* 73 (3&4) (In press)
2. M. Y. Kamble, Jagdish V. Dalavi, Rahul R. Thakur, Anubhab Mondal, Pooja Shivaji Bhagure (2024) Seed germination biology and frugivory of an endemic and endangered wild nutmeg - *Myristica magnifica* Bedd. (Myristicaceae) *Journal of the Bombay Natural History Society*
3. R. B. Bhagat, M.Y. Kamble, Anubhab Mondal & Pooja S. Bhagure (2023) Extended distribution of Ariopsis macrosperma (Araceae) from Mulshi region of Northern Western Ghats (NWG), India. *Phytomorphology*

Project 23: **Documentation and Assessment of Threatened and Endemic Pteridophytes of Central Western Ghats of Karnataka by Using IUCN Criteria**
Name of the JRF: Mrs. Sakshi Pandey
Name of the Supervisor : Mr. Rajat Mondal
Duration of the Project: 2023-2028

Brief note on the achievements: One field tour was undertaken to Pushpagiri Wildlife Sanctuary and BRT Tiger Reserve of Karnataka are one of the richest repositories of Pteridophytes diversity in Central Western Ghats. The objective of the tour was to study the vegetation, distribution patterns, and ecology of Threatened and Endemic Pteridophytes in Central Western Ghats. GPS data was collected and documented for IUCN Study. A total of 46 species were collected, including 5 endemic species namely, *Cyathea crinita* Copel., *Elaphoglossum beddomei* Sledge, *Osmunda hilsenbergii* Grev. & Hook. *Bolbitis semicordata* (Baker) Ching, *Oreogrammitis pilifera* (Ravi & J.Joseph) Parris] and 5 threatened species [*Huperzia phyllantha* (Hook. & Walker-Arnott) Holub, *Hymenophyllum denticulatum* Sw., *Trichomanes obscurum* Blume, *Diplazium cognatum* (Hieron.) Sledge, *Botrychium daucifolium* Wall. ex Hook. & Grev. Distribution maps for threatened and endemic species were created using ArcGIS software.

Project 24: Taxonomic Revision of the Zingiberaceae Martinov (excluding genera *Amomum, Bosenbergia, Cautleya, Curcuma, Hedychium, Meistera* & *Wurfbainia*)
Name of the JRF: Aishwaryya Mitra
Name of the Supervisor: Dr Manas Ranjan Debta
Duration of the Project: March 2023 – February 2028 (05 years)

Achievement :

- Number of Protologue consulted: **15**; Type materials consulted and studied: 16; communication made for holotype images: **02** to BLAT and BM.
- Number of species described: **15** (*Globba clarkei* Baker*, Globba racemosa* Sm., *Kaempferia rotunda* L.*, Kaempferia angustifolia* Roscoe, *Kaempferia parviflora* Wall. ex Baker, *Kaempferia galanga* L., *Kaempferia evansii* Blatt.*, Kaempferia elegans* Wall.*, Zingiber zerumbet* (L.) Roscoe ex Sm.*, Zingiber rubens* Roxb.*, Zingiber capitatum* Roxb.*, Zingiber squarrosum* Roxb.*, Zingiber roseum* (Roxb.) Roscoe*, Zingiber capitatum* Roxb.*, Roscoea alpina* Royle)
- Number of distributional maps prepared based on herbarium and literature data: **18** (*Alpinia abundiflora* Burtt. & R.M. Sm.*, Alpinia calcarata* (Andrews) Roscoe*, Alpinia conchigera* Griff.*, Alpinia fax* (Thw.) B.L.Burtt & R.M.Sm.*, Alpinia malaccensis* (Burm.f.) Roscoe*, Globba clarkei* Baker*, Globba racemosa* Sm.*, Kaempferia rotunda* L.*,*

Kaempferia angustifolia Roscoe*, Kaempferia parviflora* Wall. ex Baker*, Kaempferia galanga* L.*, Kaempferia evansii* Blatt.*, Kaempferia elegans* Wall.*, Roscoea alpina* Royle, *Zingiber zerumbet* (L.) Roscoe ex Sm.*, Zingiber rubens* Roxb.*, Zingiber capitatum* Roxb.*, Zingiber roseum* (Roxb.) Roscoe)

- Number of Herbarium tour: **One** (to ASSAM, Shillong); 11 Types studied in detail in addition to more than 500 general herbarium specimens housed at ASSAM; took photographs of almost all the specimens for future study.
- Number of Field tour undertaken: **One** to Meghalaya; collected 03 species, namely *Caulokaempferia linearis* (Wall.) K.Larsen, *Globba clarkei* Baker and *Globba racemosa* Sm.
- Number of Photoplates prepared: **One** of *Globba clarkei*; the other one of *G. racemosa* is being prepared.
- Abstract Published: **One** on 'Taxonomic studies in the genus *Kaempferia* L. in India'; poster will be presented at the forthcoming International Seminar on "Plant Systematics: Present Status and Future Prospects" to be organized by the Department of Botany, University of Calicut from 15th to 17th February 2024.

Project 25: Assessing Impact of Climate Change on Floristic and Migration of Vascular Plants in Alpine Subalpine Landscape of Western Arunachal Pradesh.
Name of the JRF/SRF/RA and Supervisor: Dr. Subhajit Lahiri, RA under the supervision of Dr. S.S. Dash, Scientist-F
Duration of the Project: 2023–2026

Brief note on the achievements: To achieve the project's goal, an attempt was made to understand the hypothesis that climate change influences the distribution pattern and migration of high-altitude plants. Creating a comprehensive plant database from the alpine-subalpine region of West Arunachal Pradesh has begun, using herbarium data from ARUN, ASSAM, and CAL. Meanwhile, objective-wise baseline data for the planned study project have been collected. Geo-coordinate data from herbarium specimens was collected and converted to a CSV file to construct a composite database incorporating georeferenced locations, flowering and fruiting dates, altitudinal differences, and other information. An herbarium consultation tour was conducted in ARUN and ASSAM. Initial compilation of ASSAM, BSHC, ARUN, and CAL data primarily ten indicator species [viz., *Codonopsis bhutanica* Ludlow, *Codonopsis foetens* Hook.f. & Thomson, *Cyananthus sherriffii* Cowan, *Cyananthus spathulifolius* Nannf., *Silene nepalensis* Majumdar, *Silene birgittae* Bocquet, and *Rhodiola cretinii* (Raym.-Hamet) H. Ohba, *Rhodiola fastigiata* (Hook.f. & Thomson) S.H. Fu, *Rhodiola sherriffii* H. Ohba, *Diapensia himalaica* Hook.f. & Thomson, has been chosen for the study of plant migration pattern, phenology, and IUCN assessment. During this tenure two research articles were published and one was accepted. During same period one book chapter was published and one in communication.

Project 26: Molecular systematics and historical biogeography of the genus *Justicia* L. (Acanthaceae) in India
Name of the JRF/SRF/RA and Supervisor: Dr. Soumya P., RA under the supervision of Dr. S.S. Dash, Scientist-F
Duration of the Project: 2023–2026

Achievement :

- Collected literature related to the research topic from online sources and floras in the CNH library.
- The probable number of *Justicia* and *Rungia* species found in India has been listed.
- Downloaded sequences of *Justicia* and *Rungia* from NCBI and studied research papers on molecular phylogenetic studies.
- Consulted two herbaria (ASSAM, BSI-ERC) (MH, BSI-SRC) for herbarium consultation.
- Conducted field tour to various places of Kerala, Tamil Nadu, Meghalaya and Assam.

- Collected 10 species of *Justicia* and 3 species of *Rungia*
- Participated in an online training program on molecular phylogeny and biogeography from 20/11/2023 to 08/12/2023.
- Published one manuscript “A taxonomic revision of the genus *Justicia* (Acanthaceae) in Peninsular India" in journal Rheedea.

Project 27: Systematics of the genus *Ceologyne* Lindl. (Orchidaceae: Epidendroideae) in India and assessment of threat status as per IUCN criteria’
Name of the JRF/SRF/RA and Supervisor: Dr. Rijupalika Roy, RA under the supervision of Dr. Dinesh Kumar Agrawala, Scientist-E
Duration of the Project: 2023–2026

Achievement :
Objective 1: Taxonomic study of the genus based on morphological characters, type materials, protologues.
- Key characters of the genus were noted to understand the life cycle pattern of the genus.
- A working list of species and infra-specific taxa of the genus *Coelogyne* in Indian circumscription was prepared.
- A list of endemic, near endemic and non-endemic species of Indian *Coelogyne* prepared.
- Protologues were recorded for 21 species (*C. breviscapa*, *C. nervosa*, *C. odoratissima*, *C. mossiae*, *C. albolutea*, *C. arunachalensis*, *C. assamica*, *C. barbata*, *C. calcicola*, *C. corymbosa*, *C. fimbriata*, *C. flaccida*, *C. fuliginosa*, *C. flexuosa*, *C. ghatakii*, *C. griffithii*, *C. hajrae*, *C. hitendrae*, *C. holochila*, *C. micrantha*, *C. suaveolens*)

Objective 2: Molecular characterization of available samples
- Available relevant literatures on *Coelogyne* and allied group was studied to understand molecular techniques and presentation of data.
- Available molecular data in different websites were searched and recorded.

Objective 3: Assessment of threat status as per IUCN criteria supported by distribution map of each species.
- Datasheet on distributional records of 23 species (*C. breviscapa*, *C.nervosa*, *C. odoratissima*, *C. mossiae*, *C. barbata*, *C. calcicola*, *C. corymbosa*, *C. cristata*, *C. fimbriata*, *C. flaccida*, *C. fuliginosa*, *C. flexuosa*, *C. ghatakii*, *C. griffithii*, *C. hajrae*, *C. hitendrae*, *C. holochila*, *C. fuscescens*, *C. longipes*, *C. micrantha*, *C. nitida*, *C. occultata*, *C. ovalis*) with available distribution from herbarium and secondary sources has been prepared.
- Herbarium data recorded from 5 herbaria of Southern India [Madras Herbarium (MH), Fischer Herbarium (FRC), Calicut University Herbarium (CALI), Kerala State forest Research Institute (KFRI), Jawaharlal Nehru Tropical Botanic Garden Research Institute (TBGT)] were recorded and updated in the existing distribution data sheet.
- Taxon data sheet in prescribed format prepared for *Coelogyne breviscapa*.
- Distribution in being geo-referenced.
- Species Information Service (SIS) was accessed from IUCN website to fetch data on Indian *Ceologyne*: Data on two species (*C. hajrae*, *C. rigida*) were found available.

Objective 4: Collection of data pertaining to ecological parameters like habitat quality, population size and host preference of every species.
- State wise distribution noted for all Indian *Coelogyne* species and tabulated.
- Phenology recorded from available literatures and herbarium data for all Indian species of the genus and tabulated.
- Habitat, host species noted from available herbarium data and available literatures.

Miscellaneous:
- Presented poster in Annual conference of IAAT 2023 held at University of Calcutta from 25/11/2023 to 27/11/2023.

- Herbarium and field tour conducted in selective regions of Kerala and Tamil Nadu from 7/12/2023 to 25/12/2023 (vide order no. BSI-292/2/RA/2023-Tech./1481/7234).

Project 28: Studies on the family Cortinariaceae (Basidiomycota) in India: Molecular and morpho-taxonomy
Name of the JRF/SRF/RA and Supervisor: Ms. Arunima Bose, JRF under the supervision of Dr. Kanad Das, Scientist-F
Duration of the Project: 2023–2028

Achievement :
Macrofungal surveys: - Undertaken a macrofungal survey tour to four different districts of Uttarakhand (Haridwar, Rudraprayag, Chamoli, and Bageshwar) w.e.f. 28th July to 21st August, 2023. The following areas were covered during this survey: Motichoor, Doiwala, Raiwala (Haridwar); Chopta, Ukhimat, Baniakund, Mondal, Tunganath (Rudraprayag); Lohajung, Kuling, Didna West, Didna Top, Devsthali (Chamoli); Dhur, Dhakuri, Dhakuri East, Dhakuri West, Dhakuri Top, Khati, Loharkhet (Bageshwar). About 45 field numbers belonging to 30 species from Cortinariaceae were collected. All the collections are well preserved and under study.

A second field tour to North & East Sikkim w.e.f. 30th Aug to 14th Sep 2023 was also undertaken. The following areas were covered during this survey: Churten, Ganeshtok, Hnumantok, Lachung (Shingba Rhododendron Sanctuary, Dombang Valley, Yungtang, Zero Point in North Sikkim), Gnathang (till Tibetian border, Firing range forests in East Sikkim), Memenchu Lake (East Sikkim) & Zuluk (East Sikkim). About 46 field numbers belonging to 30 species from Cortinariaceae were collected. All the collections are well preserved and under study. Macromorphological characterization of all 91 samples were collected in the field or respective basecamps.
Characterization of the collected samples: - Out of 45 samples collected from Uttarakhand, 10 specimens (AB23-022, AB23-026, AB23-029, AB23-040, AB23-042, AB23-021, AB23-025, AB23-033, AB23-039 and AB23-012) were micromorphologically studied under microscope in the laboratory. Micromorphological line drawings were also prepared.
Out of 45 samples collected from Sikkim, only 2 specimens (ABS23-029 and ABS23-045) were micromorphologically studied under microscope in the laboratory. Micromorphological line drawings were also prepared.
Identification: - Based on both morpho-taxonomy and ITS based molecular phylogeny 3 species namely, *Cortinarius pseudotorvus* A. Naseer, J. Khan, & A.N. Khalid (AB23-039), *Phlegmacium largum* (Fr.) Wünsche (ABS23-029) and *Phlegmacium ophiopus* (Peck) Niskanen & Liimat. (ABS23-045) have been identified as new records.
SEM study:- Undertaken a tour to BSI-ERC, Shillong w.e.f. 30.10.2023 to 06.11.2023 to study and capture the ornamentations of the basidiospores of samples AB23-022, AB23-025, AB23-039, AB23-021, AB23-029, AB23-042, AB23-040, AB23-038, AB23-012, AB23-023, AB23-041, AB23036, AB23-033, ABS23-006, ABS23-002, ABS23-009, ABS23-010, ABS23-033, ABS23-032, ABS23029, ABS23-045, ABS23-046, ABS23-027, ABS23-031, ABS23-037, ABS23-019, ABS23-026, ABS23-011, AB23-028 and ABS23-017.

Project 29: Red List Assessment of Endemic Angiosperms in India as per IUCN Guidelines (Selected 10 families)
Name of the JRF/SRF/RA and Supervisor: Mr. Pradhyumnan M R, JRF under the supervision of Dr. C. Murugan, Scientist-F
Duration of the Project: 2023–2028

Achievement :
- Prepared endemic species list, including current accepted name and distribution, from the families Melastomataceae, Myrtaceae, Oxalidaceae, Onagraceae, Crassulaceae, Sapindaceae, Olacaceae, Linaceae, Rhizophoraceae, Haloragaceae, Cornaceae and Connaraceae. 232 species are enlisted and recommended these families for this red list assessment project.
- Downloaded 108 articles including 74 protologues (Online).

- Created a detailed data sheet for each genera under Melastomataceae & Myrtaceae families including phenology, distribution, previous collection locations, protologues & other relevant literature data,major identification characteristics, geographical coordinates values etc.
- Checked 100+ literatures (Floras, Revision, Annual reports, PhD dissertations, Checklists etc.) from various libraries. Flora of India Vol. 9, Flora of Kerala, Endemic Vascular plants of India and Annotated Checklist of dicotyledons Vol.1 are major publications for conforming the endemic status of the selected plants.
- Conducted 3 field tours cum herbarium consultation to different institutes in Kerala, Tamil nadu and Meghalaya states (consulted MH, TBGT, KFRI, MSSRF, FRC, CALI & ASSAM herbaria). A total of 3500 herbarium sheets were consulted as part of the trip and 426 sheets of endemic taxa were examined from CAL.
- 1468 herbarium sheets data recorded and 1085 sheets are strictly endemic.
- Collected 60 plant specimens (11 endemic specimens) from the last 3 field tours. Live specimens were photographed and important collections were preserved for preparing herbarium.
- Participated in an oral presentation competition in the 33rd annual conferences of Indian Association for Angiosperm Taxonomy (IAAT). Presented a paper entitled 'the recent trends and breakthroughs in Myrtaceae-based research with the help of Bibliometrix'.
- Registered for the IUCN global assessment certificate course conducted by IUCN authorities. Completed IUCN global assessment course module 1, 2 & 3.

Project 30: Taxonomic Revision of the Subtribe Justiciinae (Acanthaceae) in India
Name of the JRF/SRF/RA and Supervisor: Mr. Samrat Goswami, JRF under the supervision of Dr. S.S. Dash, Scientist-F
Duration of the Project: 2023–2028

Achievement :
- Completed draft checklist of all species which belong to Subtribe Justiciinae.
  Total 116 accepted names are enlisted under this subtribe.
- Preparing distribution data of the species under *Justiciinae* from various floras and herbarium label data with a note on their Endemic status.
- Databasing and Documentation of Herbarium specimens in CAL, BSHC, ARUN, SFRI, ASSAM.
- Conducted a 15 days tour to different parts of East, West and South Sikkim, collected specimens and consulted herbarium at BSHC, Sikkim. Collected 22 field numbers in this tour.
- Conducted a 9 days (18^{th} December to 26^{th} November) Herbarium tour in Arunachal Pradesh. Additionally carried out few local field trips and collected 7 field numbers in this tour.
- Conducted a 16 days (9^{th} December to 24^{th} December) days Field cum Herbarium consultation tour in Meghalaya and consulted ASSAM Herbaria. Collected 32 field numbers in this tour.
- Herbarium consultation in BSHC (114), ARUN (91 with 23 unidentified sheets), SFRI (43 with 18 unidentified sheets) and ASSAM (319).
- Herbarium preparation of specimens collected from tour, preservation of samples for nodal anatomy and palynological studies, drying of leaf samples by silica gel for molecular studies.
- Dissection and description, photo plates preparation and illustrations of the species collected from the surveyed areas.
- Identified 28 species collected from the field tours by consulting protologues, types and took assistance from floras to measure the range of variations and also consulted various checklists.
- Study of pollens by S.E.M. images and their characterization and determining types of pollens in *Justicia*, *Dicliptera, Hypoestes* and *Rhinacanthus*.
- Working on problems related to various complexes in genus *Justicia* sp.
- Nodal anatomical studies of *Justicia* sp. and *Hypoestes* sp.

- Analyzing protologues and online sources for synonymy of different species of *Justicia*, *Dicliptera*.
- Study of classifications and re-classifications by authors previously worked on subtribe Justiciinae (Acanthaceae).
- Analyzing protologues and online sources for synonymy of different species of *Justicia*, *Dicliptera, Hypoestes* and *Rhinacanthus*.

Project 31: Taxonomic revision of the family Solanaceae in India
Name of the JRF/SRF/RA and Supervisor: Mr. Phani Bhusan Sahoo, JRF under the supervision of Dr. S.S. Dash, Scientist-F
Duration of the Project: 2023–2028

Achievement : Participated in the 12 week JRFs training programme from March-June 2023 at CNH by Botanical Survey of India. Conducted two field tours in different parts of the state Sikkim and Meghalaya and collected a total of 23 species of Solanaceae. The collected specimens are poisoned and preserved for preparation of herbarium. To study the range of variation in taxonomic complex groups particular plant species of Solanaceae is collected from different localities and studied properly. Consulted about 1100 herbarium sheets at CAL, BSHC, ASSAM, K, BM and G etc. and annotated on 7 sheets with the correct identity. In addition to this for nomenclatural study of Solanaceae, downloaded protologues of 35 names and found type specimens of 7 names. To solve taxonomic problems in complex groups of Solanum L., samples collected for molecular study, also downloaded some available molecular sequences from NCBI for phylogenetic analysis. Palynological study of 12 species of Solanaceae has been done for taxonomic interpretation.

Project 32 : Red List Assessment of Endemic Angiosperm in India as per IUCN guidelines (Dilleniaceae- Ixonanthaceae)
Name of the JRF/SRF/RA and Supervisor: Mr. Kundan Bhattacharji, JRF under the supervision of Dr. Dinesh Kumar Agrawala, Scientist-E
Duration of the Project: 2023–2028

Achievement :
- Available data on the IUCN Red List Assessment on the basis of the Indian plants were noted.
- Gathered relevant data for each species of allotted families and checked their endemic status from different available literature and articles.
- Enlisted endemic plants of each of the allotted families.
- Endemic status of each of the endemic species of India were recorded from allotted families based on available data were tabulated (according to Flora of India books, Vascular Endemic Plants, Flowering Plants of India: Annotated checklist (1 & 2) & Plant of World Online).
- Available herbarium sheets of those endemic species from CAL were photographed and identity of each sheet on the basis of their special characters are being checked.
- Herbarium label data are being retrieved and indexed in excel sheet for further study.
- Herbarium sheets belonging to the families Dilleniaceae to Cappridaceae (3 families: Dilleniaceae, Capparidaceae, Flacortiaceae) are geo-referenced with the help of Google Earth Pro.
- Conducted a 19 days tour to South India for consulting 5 major Herbaria (Madras Herbarium Southern Regional Center: Botanical Survey of India MH, Fischer Herbarium Institute of Forest Genomics and Tree Breeding FRC, Calicut University herbarium CALI, Kerala Forest Research Institute KFRI, Jawaharlal Nehru Tropical Botanical Garden & Research Institute TBGT) along with field visit to some specific localities.
- Relevant available herbarium sheets of the herbaria: MH 370 sheets, FRC 34 sheets, CALI 150 sheets, KFRI 56 sheets, TBGT 182 sheets were photographed for confirming their identity.
- Prepared Taxon data Sheets of 4 endemic species of Dilleniaceae.
- Protologues of 4 species of *Hybanthus*, 4 species of *Rinorea*, 31 species of *Viola*, and 1 type of *Hybanthus* and 11 types of *Viola* were collected from different sources and studying them for better

understanding. Citation of 39 species of the family Violaceae mentioned in Indian literatures were also recorded.

Project 33 : Taxonomic revision of the tribes Coreopsideae (Asteraceae) and Gnaphalieae (Asteraceae) in India
Name of the JRF/SRF/RA and Supervisor: Ms. Priya Singh Kushwaha, JRF under the supervision of Dr. Avishek Bhattacharjee, Scientist- E
Duration of the Project: 2023–2028

Achievement : Conducted two consecutive field tours covering several regions of NE India viz. Meghalaya, Assam and Arunachal Pradesh from 15.07.2023 to 1.08.2023 and North and East Sikkim from 30.08.2023 to 13.09.2023. Herbarium consultation at ASSAM and BSHC was also conducted. Species collected in the field tour are *Anaphalis contorta* (D.Don) Hook.f., *Anaphalis margaritacea* (L.) Benth. & Hook.f., *Anaphalis hookeri* C.B.Clarke, *Anaphalis busua*(Buch.-Ham.)DC., *Anaphalis xylorhiza* Sch.Bip. ex Hook.f., *Leontopodium* sp., *Gnaphalium* sp., *Bidens* sp., *Anaphalis triplinervis* (Sims) C.B.Clarke, *Anaphalis nepalensis* (Spreng.) Hand.-Mazz., *Pseudognaphalium* Kirp. Morpho-taxonomic studies including dissection, preparation of photoplate and description of the collected *Anaphalis* spp. (*A. contorta*, *A. margaritaceae*, *A. triplinervis*, *A. hookeri*, *A. busua*) has been done. Metadata formation and barcoding of the herbarium specimens of *Anaphalis* species (~200) has been completed. Correction of one major nomenclatural mistake on *Anaphalis yunnanensis* authorship and the true protologue which was being replicated since >40 years was done. DNA extraction of 25 samples for PCR amplification using nuclear (ITS and ETS) and two chloroplast (trn-LF, matK) markers and sequencing purpose has been done. Completed protologue searching for 37 species of *Anaphalis* DC. and 5 species of *Helichrysum* Mill. Poster presentation on the Title - Distribution and morphological diversity of the genus *Anaphalis* DC. (Asteraceae) in India in the 33rd Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on "Advances in Plant Systematics, Biogeography and Biodiversity Conservation" organized by Department of Botany; University of Calcutta in collaboration with Botanical Survey of India from November 25-27, 2023.

Project 34: Taxonomic study of family Lythraceae in India
Name of the JRF: Parthiban A, JRF
Name of the Supervisor: Dr. L. Rasingam, Scientist –E & HoO
Duration of the Project: 2023-28

Achievement : The compiled checklist of the Family Lythraceae in India was created by referencing relevant literature, gathering protologues of Indian Lythraceae names from library and online sources. Lythraceae specimens in ASSAM, BSID, and KFRI (Digital) General collections, along with Type collections, were examined. Additionally, Lythraceae Type collections at CAL were studied. Field collection tours were conducted in Anantapur and Nandyal Districts of Andhra Pradesh, Meghalaya, Pakhal Wildlife Sanctuary in Telangana, and the Western Ghats (from Kannur to Mahabaleshwar). During these tours, 19 distinct Lythraceae species were collected from various localities, totaling 75 specimens. The specimens were partially poisoned and preserved for further studies. Fresh collections were dissected, photographed, and morphologically described.

Project 35: Bryofloristic studies of Garhwal Region of Uttarakhand (Liverworts and mosses)" under 'Flora of India'.
Name of the JRF: Mr. Darshan Shukla (JRF), Ms. Manchi Jandial (JRF) and Dr. Sushil Kumar Singh (Scientist F & Supervisor)
Duration of the Project: March, 2023–March, 2028

Achievement :
Bryophytes are nonvascular cryptogamic plants and important contributors to the Indian Flora. A proper documentation of this group of plants is still lacking due to difficulty in identification and the

major reason is their diminutive size.The objective of the project is to identify, update the nomenclature status and document Bryophytic plants of Garhwal region of Uttarakhand.
Area and locality: Garhwal, Uttarakhand

Achievement : A four-month training session in CNH, Howrah was conducted, in whichseveral lectures delivered by various scientists on different aspects of taxonomy along with practical sessions, molecular techniques, Illustration making, photoplate preparation, effective scientific writing, GIS etc. In that training 1-week tour was also conducted to Dowhill Kurseong, West Bengal from 23rd April to 29th April, 2023. Field exploration tours undertaken: 5 [1sttour was undertaken to Rajaji N.P. (Uttarakhand) on 5th September, 2023 and collected 50 specimens of bryophytes; 2ndtour was undertaken to Mussourie (Jharipani, Mossy fall, Lal Tibba, Wookstock College) on 7th October, 2023 and collected more than 120 specimens of bryophytes; 3rdtour was undertaken to Chakrata (Deoban, JanglaChowki, Chirmiri top) on 28th& 29th October, 2023 and collected 30 specimens of bryophytes; 4thtour was undertaken to Pauri (Nagdev, Kandoliya, Teka), Khirsu, Srinagar, Lansdowne, Gumkhal from 29th November to 7th December, 2023 and collected more than 330 specimens of bryophytes; 5thtour was undertaken to Gopeshwar, Chamoli from 29thto 30th December and collected 58 specimens of bryophytes.
Total specimens collected: 578.
Total specimens identified: 33 species
Taxonomic description and illustration completed: 22 species [*Stereophyllum decorum* (Mitt.) Wijk Margad., *Hyophila involuta* (Hook.) A. Jaeger, *Bryum coronatum* Schwägr., *Thuidium meyenianum* (Hampe) Dozy & Molk, *Fissidens zippelianus* Dozy & Molk., *Leucodon secundus* (Harv.) Mitt., *Meteorium buchananii* (Brid.) Broth., *Hymenostylium recurvirostrum* (Hedw.) Dixon, *Atrichum pallidum* Renauld & Cardot, *Neckeropsis exserta* (Hook. ex Schwägr.) Broth., *Fissidens taxifolius* Hedw., *Oncophorus virens* (Hedw.) Brid., *Pohlia elongate* Hedw., *Anoectangium stracheyanum* Mitt., *Gymnostomiella orcuttii* E.D. Bartram, *Fissidens pallidinervis* Mitt., *Bartramia leptodonta* Wilson, *Pogonatum microstomum* Bridel, *Mnium marginatum* (Dicks.) P.Beauv., *Fissidens bryoides* Hedw., *Pogonatum neesii* (Müll. Hal.) Dozy, *Anomobryum julaceum* (Schrad. ex G. Gaertn., B. Mey. &Scherb.) Schimp.].

Project 36: Red List Assessment of Endemic species of some selected families of India (Apocynaceae, Asclepiadaceae, Loganiaceae, Gentianaceae and Menyanthaceae).
Name of the JRF: Madhumita Pal
Name of the Supervisor: Dr. J.Jayanthi, Scientist 'F', Botanical Survey of India,HQ.
Duration of the Project: 2023-2028

Achievement : Prepared the list of endemic species of the families Apocynaceae, Asclepiadaceae, Loganiaceae, Gentianaceae and Menyanthaceae by referring Flora of India Vol.17. in excel sheet. Prepared the list of endemic species of family Apocynaceae from Fascicles of Flora of India, Fascicle-30. A total of species of 224 endemic species was entered in excel work sheet from these 5 families. Type specimens of the families (Apocynaceae, Asclepiadaceae, Gentianaceae, Loganiaceae and Menyanthaceae) have been documented from different herbarium (Assam Herbarium, Shillong, MH Herbarium, Coimbatore, Fischer herbarium, Coimbatore, CALI herbarium, Kozhikode, KFRI, Thrissur and JNTBGRI herbarium, Thiruvananthapuram, are being consulted.). A total of 90 type specimens belonging to 39 species were documented. Carried out the herbarium consultation-cum-field survey in Meghalaya viz. Assam Herbarium, from 11.08.2023 to 05.09.2023. Consulted and documented 536 species. Collected 10 species in the field tour. Carried out local field tour to Bankura from 04.10.2023 to 06.10.2023. Collected and documented 5 species. Carried out herbarium consultation tour during 03.01.2024 to 07.02.2024. Consulted MH Herbarium, Coimbatore, Fischer herbarium, Coimbatore, CALI herbarium, Kozhikode, KFRI, Thrissur and JNTBGRI herbarium, Thiruvananthapuram, and documented a total of 3733 specimens from families such as Apocynaceae (984), Asclepiadaceae (1947), Loganiaceae (76), Gentianaceae (707) and Menyanthaceae (19) during the herbarium tour. Collected 60 specimens in the field tours and processed (Dry & Wet methods) for herbarium specimen preparation. Collected 10 live specimens such as Caralluma sp., Ceropegia sp for

introduction in garden. Published one research article "Lectotypification of Two names in Calanthe R.Br.(Orchidaceae),Nelumbo Vol.65(1): (189-192) 2023.

Ceropegia angustifolia Wight

Gymnema sylvestre (Retz.) R.Br. ex Sm.

Project 37: Red List Assessment of Endemic Orchids of India as per IUCN Criteria
Name of the JRF: Ms. Yasaswinee Rout
Name of the Supervisor: Dr. Jeewan Singh Jalal, Scientist-E, Hqrs, BSI, Kolkata
Duration of the project: 2023-2028 (5 Years)

Achievement : As per the objectives of the project a detailed checklist of 310 endemic orchids of India including current accepted name, flowering & fruiting time along with their distribution was prepared based on literature. Literature was consulted such as state floras, monographs, on line resources (IPNI, POWO, TROPICOS, WFO), national and international journals, district floras etc. Information such as flowering and fruiting, localities, elevation, habitat types, ecological information were collected and entered in the Excel sheets. After this general and type section of CAL herbarium was consulted. A total 619 herbarium sheets of types and 559 sheets of general herbarium were consulted and information were entered in the Excel sheet.

Two field cum herbarium tours were also undertaken during this period. The first field cum herbarium tour was undertaken during 11.08.2023 to 05.09.2023 to Meghalaya. During this tour 500 herbarium specimens of ASSAM were consulted. Apart from consulting the herbarium, nearby regions were explored for endemic orchids. A total 34 specimens prepared for endemic orchids and their current population and threats were also observed for the assessment.

Second Herbarium consultation tour was conducted during 03.01.2024 to 08.02.2024, which includes herbarium and library consultation tour to MH, Southern Regional Center, BSI; Fischer Herbarium (IFGTB, Coimbatore); CALI (Calicut University, Kozhikode); KFRI (Thrissur) and JNTBGRI (Thiruvananthapuram). During this tour a total 2564 herbarium sheets were consulted and detailed information entered in the Excel sheet. Besides near by areas were also surveyed and four species were collected of these two are endemic.

Habenaria khasiana

Thunia sp.

Project 38: Red List Assessment of Endemic Angiosperms in India as per IUCN Guidelines (Selected 10 families)
Name of the JRF: Pradhyumnan M R
Name of the Supervisor: Dr. C. Murugan, Scientist-F
Duration of the project: 2023-2028 (5 Years)

Achievement : During 2023-24, 7 Herbaria *viz.* MH-BSI,SRC, Coimbatore, FRC, ICFRE, Coimbatore, TBGT, TBGRI, Palode, KFRI, Thrissur, MSSRF, Wayanad, CALI, Kozhikode and ASSAM, BSI-ERC, Shillong. During this period more than 3500 herbarium sheet observed, 1468 herbarium sheets data were recorded and 16 misidentified sheets were validated through Det. Slips.

Syzygium laetum (Buch.-Ham.) Gandhi

Osbeckia wightiana Benth. ex Wight & Arn.

Project 39: **"Taxonomic Revision the family Celastraceae R. Br. of India"**
Name of the JRF: Mr. Ajay Mondal
Name of the Supervisor: Dr. C. Murugan, Scientist F
Duration of the Project: 2023-2028(05 Years)

Achievement : During the study period, detailed checklist of the family Celastraceae in India (updated to 18 genera, 132 taxa) were prepared. Further, 1210 sheets deposited in CAL, Howrah belonging to different genera like *Euonymus*, *Glyptopetalum*, *Celastrus*, *Lophopetalum*, *Microtropis*, and *Pleurostylia* were consulted. Different herbaria (i.e., ASSAM, BSI-ERC, Meghalaya., MH, BSI-SRC, Coimbatore, Tamil Nadu., FRC, ICFRE, Tamil Nadu., TBGT, JNTBGRI, Palode, Kerala., and CALI, Calicut University, Kerala.) were visited and consulted ca. 3990 herbarium sheets and the data has been compiled into respective Excel sheets for the different herbaria. During this period the accurate identification of nine sheets was confirmed through the use of Det Slip. 27 field collections and ca. 300 photographs taken from two field trips (Meghalaya, Tamil Nadu & Kerala). Descriptions and photo plates were prepared for the two taxa, *Euonymus hamiltonianus* Wall. and *Euonymus grandiflorus* Wall.

FUNDED/COLLABORATIVE PROJECT

Project 1: Multigene molecular phylogeny and morphotaxonomy of fleshy wild mushrooms of Rajmahal hills, Jharkhand, along with nutraceutical properties of edible taxa.

Name of the executing officials: Dr. Aniket Ghosh (PI)
Name of the funding agency: SCIENCE & ENGINEERING RESEARCH BOARD (SERB)
Duration of the Project: 07.02.2022 to 06.02.2024

Achievements: Under the above project, the following publications were made.
Publication:
Ghosh A., Chakraborty D., Hembrom M. E., Vizzini A. & Das K. (2023) – *Thaxterogaster shoreae*, a new species of *Thaxterogaster* subg. *Scauri* sect. *Purpurascentes* from Sal Forest of India based on morphology and molecular phylogeny. Taiwania 68(1): 23–30.
Ghosh A., Bera I., Chakraborty D., Hembrom M. E., Verbeken A. & Das K. (2022) – A new edible species of *Lactifluus* (Russulaceae) from *Shorea robusta* dominated forests in tropical India. Phytotaxa 564(3): 277–287.
Ghosh A., Buyck B., Chakraborty D., Hembrom M. E., Bera I. & Das K. (2023) – Three new species of genus *Russula* Pers. from Sal dominated forests of tropical India based on morphotaxonomy and multigene phylogenetic analysis. Cryptogamie, Mycologie 44(3): 27–50.
Ghosh A., Hembrom M. E., Chakraborty D., Gangwar R. & Das K. (2023) – First reports of *Phylloporus gajari* from India. Mycotaxon 137(4): 963–975.
Ghosh A., Kumar A., Hembrom M. E., Chakraborty D. (2024) – *Amanita indovaginata*, a new species from tropical Sal forest in India. Czech Mycology 76(1): 1–15.

Project 2: "Exploration and documentation with geo tagging of wild edible plants of Eastern Arunachal Pradesh for emergency use
Name of the Executing official: Dr. Krishna Chowlu & Dr. Arvind Parihar
Name of the funding agency:DRDO
Duration of the Project: 2 years

Achievements: The vegetation of Arunachal Pradesh falls under four broad climatic categories and can be classified in five broad forest types with six types of secondary forests. These are tropical forests, subtropical forest, pine forest, temperate forests and alpine forests. In the degraded forest bamboos and other grasses are of common occurrence. Different markets were surveyed properly and most of the parts of eastern Arunachal Pradesh were covered and so many local vegetables were collected. 6 districts were covered in 5 months. The local people of Arunachal Pradesh were interacted and information related to local food habits was recorded. Proper photographs were taken for the vegetables and the local name and uses of the particular species and the methods of preparation was noted. In total 120 species were recorded with their proper preparation methods. Arunachal Pradesh is the largest state in Northeast India and 25 major tribes use to stay and more than 110 sub tribes are there. The food habit of each tribe is so unique and different. The method of preparations of item and the type of composition is very unique for each tribe. So, to know the edible plants of Arunachal Pradesh and also to know the way of preparations and the compositions of food habits this study was carried out. From this study we will finalise the plant species eaten by the different communities and also the way of preparation methods. Consulting all the literatures all total 130 species were listed till March 2024. By doing proper survey and by interaction with the local people of eastern Arunachal Pradesh the information's were gathered. This was also completed by consulting the available literature available through different sources. Finally, the final report will be submitted by the office headquarter BSI, Kolkata and to DRDO Director, Tezpur.

Project 3: Non-Detriment Findings (NDF) of *Aquilaria malaccensis* Lam. (Agarwood) in India

Name of the Executing officials: Dr. Avishek Bhattacharjee, Scientist-E, Dr Ranjith Layola M R, Botanist, Mr Sudipta Sardar, Botanical Assistant, Ms Farheen Banu, Preservation Assistant cum Garden Overseer, Ms Shabnam Bandopadhyay, Preservation Assistant cum Garden Overseer, Ms Bidisha Mallick,Project Assistant, Mr Sayak Chakraborty, Project Assistant, Ms Oindrila Chakraborty, Project Assistant, Mr Sayan Chakraborty, Project Assistant, Ms Sanchaiyta Sengupta, Project Assistant, Mr Ranjan Shaw, Project Assistant
Name of the funding agency: Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India.
Duration of the project: 1st September, 2023–29th February, 2024

Achievements: Field surveys were conducted in Arunachal Pradesh, Assam, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal to estimate the population of the species.

The location data (latitude-longitude, elevation along with date and time of survey) were recorded either with GPS or with mobile where carrying GPS was prohibited. The length and Girth at Breast Height (GBH), age, regeneration/ growth, potential biological risk and anthropological threats, regime of harvest, impact of harvest, trade related data etc. were recorded during the surveys. Some data provided by the forest departments of Assam, Goa, Mizoram, Tripura were also considered. The major Agarwood markets in Hojai (Assam) and Calicut (Kerala) were surveyed. Several Agarwood processing units/ Agarwood-based units were visited in Assam, Karnataka, Kerala, Manipur, Nagaland, Tripura to record relevant information. Semi-formal field interviews with villagers/ local people, representatives of Agarwood associations, sellers, buyers, stakeholders, people associated with Agar processing centres and Agar industries were conducted, whenever possible, for retrieving relevant information on harvest, trade, management etc. Information were collected from the scientists/scientific staff/ researchers of different units and regional centres of BSI and scientists/researchers/academicians of other academic and research institutes of India. The data provided by the Wildlife Crime Control Bureau (WCCB) on export, import and illegal trade and the CITES Annual Reports published by the Ministry of Environment, Forest and Climate Change, Government of India were consulted to record the levels of illegal trade.

Extracted genomic DNA from around 200 accessions. Prepared the database of primers after consulting various literatures for selection of primers; Sixty SSR primer sets were retrieved from published literature and synthesized at Barcode biosciences; Dilution of 60 SSR primer pairs were done; Screening of 60 SSR markers were done to find the polymorphic markers using 10 representative accessions of Agarwood collected from five states; A total of 20 polymorphic markers were selected after screening for genotyping; The primer list of 20 markers were prepared for fluorescent labelling.
Area Surveyed: Arunachal Pradesh, Assam, Karnataka, Kerala, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, West Bengal.

Project 4: Investigation on Indian *Aster* L. (Asteraceae: Astereae) with emphasis on morpho-anatomical studies of cypsela
Name of the Executing officials: Dr. Avishek Bhattacharjee, Scientist-E, Dr. Bandana Bhattacharjee, Project Assistant
Name of the funding agency: SERB (Core Research Grant Project: CRG/2021/000790)
Duration of the project: 30.12.2021–29.12.2024

Achievements: Collected *Aster altaicus* Willd., *A. asteroides* (DC.) Kuntze, *A. falconeri* (C.B. Clarke) Hutch., *A. flaccidus* Bunge, *A. indamellus* Grierson, *A. peduncularis* Wall. ex Nees, *A. thomsonii* C.B. Clarke. DNA extraction, PCR amplification of one nuclear (ITS) and two chloroplast (trn-LF, matK) markers and sequencing of 28 samples (168 reactions) have been done. Morpho-anatomical studies of collected species have been done. Study (including dissection) and preparation of draft description of 10 species (*Aster altaicus*, *A. asteroides*, *Aster barbellatus* Grierson, *A. falconeri*, *A. flaccidus*, *A. indamellus*, *A. peduncularis*, *Aster pilosus* Willd., *A. neoelegans* and *A. thomsonii*) have been done.

Project 5 : Bio-survey of Eastern Ghats (Flora) of Andhra Pradesh
Name of the Executing official: Dr. L. Rasingam, Scientist –E & HoO, Miss. Ranjana Jamuda, Project Fellow, Miss. G. Susmitha, Mr. P. Ranjithkumar, Field Assistants.
Name of the funding agency: Andhra Pradesh State Biodiversity Board
Duration of the Project: 2022-24

Achievements: Six field tours were carried out in various parts of Andhra Pradesh and collected 444 field numbers and identified 369 field numbers. All the collections were poisoned and mounted 551 herbarium specimens. Stitching has been completed for 411 herbarium sheets. The preparation of field label is in progress. During the course of study, published two research papers.

Project 6: Status assessment of threatened species of Andhra Pradesh
Name of the Executing official: Dr. L. Rasingam, Scientist –E & HoO, Dr. K. Nethaji, Project Fellow, Miss. G. Varshini, Field Assistant.
Name of the funding agency: Andhra Pradesh State Biodiversity Board
Duration of the Project: 2022-23

Achievements: Prepared a list of threatened species distributed in Andhra Pradesh by using various literature and herbarium collections. Undertook four field tours to various parts of Andhra Pradesh to collect threatened species, resulting in the collection of around 24 species. Prepared a detailed description and distributional map for all the species based on fresh collections and available resources to assess their threat status. The threat assessment is currently in progress.

Project 7: Survey and Documentation of less known Sacred Groves of Andhra Pradesh, India
Name of the Executing official: Dr. M. Sankara Rao, Scientist –D,
Name of the funding agency: Andhra Pradesh State Biodiversity Board
Duration of the Project: 2023-24

Achievements: Conducted 10 field tours to different parts of Andhra Pradesh and enumerated the plant diversity of 48 sacred groves. Information pertains to the deity, local peoples, history of the sacred groves and other geographical information were also collected. A total of 200 field numbers have been collected during the course of the study and identified 70 field numbers.

Project 8: **Herbarium derived DNA Barcode library of Gymnosperms and Phylogenomic of Selected Gymnosperms of NE India**
Name of the Executing official: Dr. David Lalsama Biate, Scientist-D
Name of the funding agency: DST-SERB
Duration of the project: 2021- 2024

Achievements:

a. Live plant collection

- Local field tours were conducted to different areas of Meghalaya during the period and specimens of the following species were collected - *Gnetum montanum* Markgr., *Gnetum* sp., *Cedrus deodara* (Roxb. ex D.Don) G.Don, *Cycas revoluta* Thunb., *Cedrus deodara* (Roxb. ex D.Don) G.Don.
- A field tour was conducted to Dima Hasao District, Assam during the period and specimens of the following species were collected - *Gnetum gnemone* L., *Pinus kesiya* Royle ex Gordon, *Araucaria heterophylla* (Salisb.) Franco, *Platycladus orientalis* (L.) Franco, *Juniperus flaccid* Schltdl., *Juniperus* sp.
- A field tour was conducted to Mokokchung District, Nagaland during the period and specimens of the following species were collected - *Juniperus chinensis* L., *Juniperus flaccid, Juniperus recurva* Buch.-Ham. ex D.Don, *Thuja* sp., *Juniperus communis* L., *Pinus kesiya* Royle ex Gordon, *Pinus patula* Schiede ex Schltdl. & Cham., *Cryptomeria japonica* (Thunb. ex L.f.) D.Don, *Gnetum gnemone* L.

- A field tour was conducted to West Kameng and Tawang District, Arunachal Pradesh during the period and specimens of the following species were collected - *Taxus* sp., *Abies* sp., *Juniperus* sp., *Thuja* sp., *Pinus* sp., *Pinus wallichiana* A.B.Jacks., *Pinus kesiya* Royle ex Gordon, *Juniperus* sp.. *Cycas pectinata* Buch.-Ham, *Tsuga* sp.

b. Molecular Biology:

Genomic DNA extraction from Live Specimens:

High quality genomic DNA were successfully extracted from 36 live specimens belonging to 30 species and three species from herbarium specimens of different age i.e, *Cryptomeria japonica* (Age 62 years), *Calocedrus formosana* (Age 57 years), *Cycas pectinata* (Age: 66, 57, 14 years) using both modified CTAB and DNeasy Plant Mini Kit (Qiagen) protocol (Fig.1).

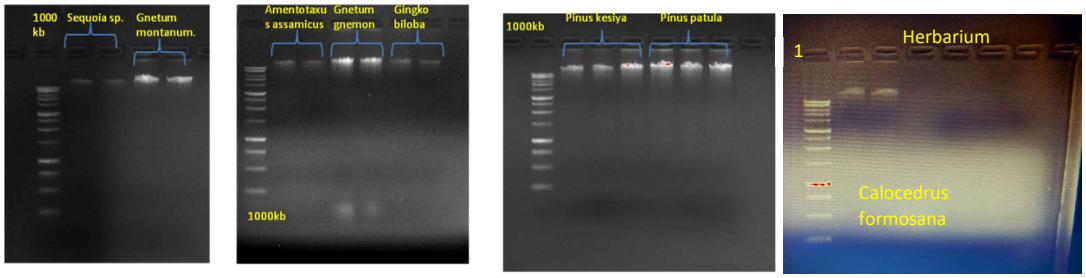

Fig. 1. Genomic DNA extracted from live and herbarium specimens of gymnosperms

c. Polymerase Chain Reaction amplification

i. PCR amplification using primers ITS2 and ITS4 targeting the Internally Transcribed Spacers region was successful achieved in 30 live plants representing 24 different species of gymnosperms and 1 species from herbarium specimens (Fig. 2) i.e., *Cycas pectinata* (Age: 14 years).

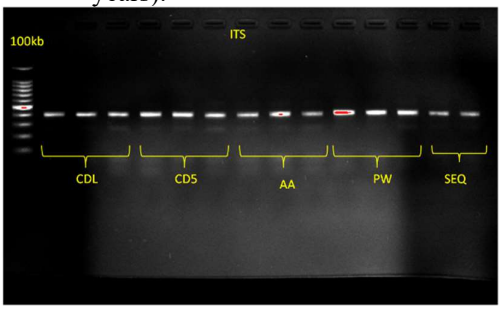

Fig.2. PCR amplification using ITS markers

ii. PCR amplification was successfully carried using the chloroplast genome derived primers matK Gym_F1A: matK Gym_R1A in 21 live plants representing 19 different species of gymnosperms and 1 herbarium specimens (Fig. 3) i.e *Cycas pectinata* (Age: 14 years).

iii. PCR amplification was also successfully carried using the chloroplast genome derived primers psbA trnH markers in 6 live plants representing 4 different species of gymnosperms (Fig. 4).

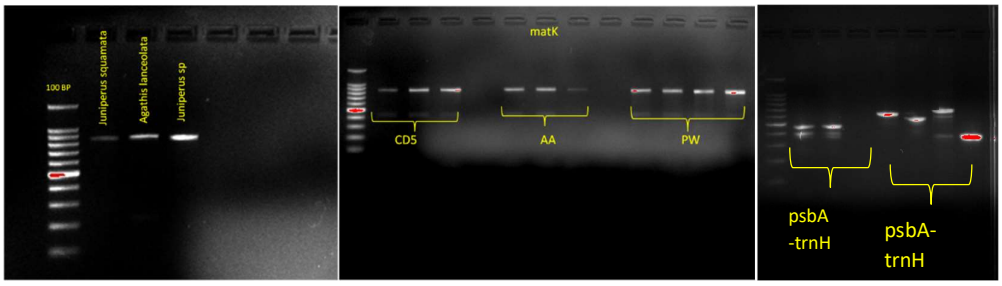

Fig.3. PCR amplification using matK markers

Fig.3. PCR amplification using psbA trnH markers

d. DNA Sequencing and analysis

- During the period, purified PCR amplified derived from ITS and matK markers were

successfully sequenced for 31 live samples and 2 herbarium samples from 30 different species of gymnosperms.

- Purified PCR amplified derived from ITS, matK and psbA markers of 26 different specimens of gymnosperms have been sent for sequencing during the period.

Project 9: Taxonomic assessment of the lichen biodiversity of Agasthiamalai Biosphere Reserve, Southern Western Ghats
Name of the executing officials: Dr. Jagadeesh Ram, T.A.M., Scientist 'E' and Mr. George N. Mathew, Research Scholar
Name of the funding agency:
Duration of the Project: 2022-2025

Achievements: Prepared over 500 blotting sheets packets for the field tour to Kanyakumari Wildlife Sanctuary and Kalakad Mundanthurai Tiger Reserve of the Biosphere Reserve.
Progress Report for the year 2022–23 has been prepared.
Five specimens have been characterized morphologically and anatomically and identified into 2 species. Carried out TLC of 110 specimens from the family Parmeliaceae and Caliciaceae to identify the secondary metabolites. Carried out Microcrystallography of 20 specimens of Family Parmeliaceae and 3 *Dirinaria* specimens to confirm the secondary metabolites. Twenty-three specimens have been identified into the following 13 species: *Dirinaria confluens* (Fr.) D.D. Awasthi, *Hypotrachyna endochlora* (Leight.) Hale, *Hypotrachyna neodissecta* (Hale) Hale, *Hypotrachyna sublaevigata* (Nyl. ex Tuck.) Hale, *Myelochroa aurulenta* (Tuck.) Elix & Hale, *Parmelia planatilobata* Hale, *Parmotrema crinitum* (Ach.) M. Choisy, *P. melanothrix* (Mont.) Hale, *P. rampoddense* (Nyl.) Hale *P. reticulatum* (Taylor) M. Choisy, *P. saccatilobum* (Taylor) Hale, *P. tinctorum* (Despr. ex Nyl.) Hale and *Remototrachyna crenata* (Kurok.) Divakar & A. Crespo

Lichen collections have been made from: Pechiparai, Mothiramalai, Appukulam, Mylar, Pathukani, Aanainiruthi, Kallipparai, Lower Kodayar, Kuttiyar, Pachamalai, Kallar, Balamore, Muthukuzhivial, Maramalai, Irutucholai, Inchikadavu, Asambu, Panakudi-Roshinipuram of Kanyakumari Wildlife Sanctuary and Sengalthery, Kulirati, Muthalar, Kalakad, Upper Kodhyar, Valukkuparai, Winch Point, Chinna and Peria Kurttiyar Dam, Oothu, Mundanthurai and Karaiyar, Kannikatty, Servalar and Kodamady of Kalakad Mundanthurai Tiger Reserve.

Over 800 field packets have been collected from the Biosphere Reserve. The actual field numbers will be assigned, after segregating the samples with stereomicroscope. The collected samples are being air-dried for preservation, and have been segregated and are being transferred to the herbarium packets with proper labelling. Entries are made in the lichen register. Over 100 images of foliicolous lichens from the above collections have been captured using stereo-microscope attached camera.

Five specimens have been identified into the following 05 species:
(i) *Opegrapha dekeselii* Ertz, (ii) *Zwackhia bonplandii* (Fée) Ertz, (iii) *Glyphis cicatricosa* Ach., (iv) *Dyplolabia afzelii* (Ach.) A. Massal., and (v) *Glyphis scyphulifera* (Ach.) Staiger
Over **850** herbarium packets were prepared by folding acid-free paper and labels are pasted for keeping lichen herbarium specimens. 44 specimens have been identified into the following 23 species: *Alyxoria apomelaena* (A. Massal.) Ertz, *Zwackhia viridis* (Ach.) Poetsch & Schied., *Dyplolabia afzelii* (Ach.) A. Massal., *Glyphis cicatricosa* Ach., *Letrouitia flavocrocea* (Nyl.) Hafellner & Bellem., *L. muralis* Hafellner, *L. leprolyta* (Nyl.) Hafellner, *L. subvulpina* (Nyl.) Hafellner, *L. transgressa* (Malme) Hafellner & Bellem., *Brigantiaea tricolor* (Mont.) Trevis., *Glyphis cicatricosa* Ach., *Thecaria quassiicola* Fé, *Dirinaria applanata* (Fée) D.D. Awasthi, *Hypotrachyna exsecta* (Taylor) Hale, *H. neodissecta* (Hale) Hale, *Myelochroa aurulenta* (Tuck.) Elix & Hale, *Parmelinella wallichiana* (Taylor) Elix & Hale, *Parmotrema crinitum* (Ach.) M. Choisy, *P. hababianum* (Gyeln.) Hale, *P. praesorediosum* (Nyl.) Hale, *P. reticulatum* (Taylor) M. Choisy, *P. saccatilobum* (Taylor) Hale, *P. subsumptum* (Nyl.) Hale, *P. tinctorum* (Despr. ex Nyl.) Hale, *Remototrachyna crenata* (Kurok.) Divakar & A. Crespo, *R. infirma* (Kurok.) Divakar & A. Crespo.

A total of 1130 Field Numbers were assigned to the segregated samples. Prepared a checklist of lichens already reported from ABR. Based on preliminary morphological studies, an approximate list is prepared for sorting the packets. That consist of 82 genera from 39 families. Arranged all 1171 specimens of ABR collections in the almirah, family wise based on the list prepared.

Project 10: Integrated and Sustainable Management of Agasthyamala Biosphere Reserve
Name of the Executing official: Dr. Sujana K. A., Dr. S. Arumugam and Dr. R. G. Vadhyar
Name of the funding agency: Biosphere Reserve Scheme of MoEF&CC
Duration of the project: 5 Years, April 2023-March 2028

Achievements: The Biosphere Reserve (BR) scheme is a sub-scheme under the umbrella scheme, "Conservation of Natural Resources and Ecosystems". The Standing Finance Committee desired that the "Biosphere Reserve Integrated Management Plan" for the five years shall be prepared for all the BRs instead of the Annual Plan of Operation. The management plan shall focus primarily on three factors namely, (i) Management authority, (ii) Lead institution, and (iii) Local people's participation, and also contributing to effective monitoring and measurable measures of action so that sustainable utilization and conservation of bioresources is achieved.

Under the program, the Botanical Survey of India is acting as the lead Institute for implementing the Integrated Management Plan. Proposal for the activities collected from the forest management authorities of Kerala and Tamil Nadu. After verification and modification, the revised proposal was submitted to the ministry. After the revision funds were released for both the states for a plan of operation. Field-level and state-level committees were formed by the management authorities and attended meetings on the plan of operation and convergence of activities and schemes. A field tour was conducted to the Kerala part of Agasthymala Biosphere Reserve and suggestions were given for the management and protection of critical habitat and also visited the potential ecotourism spots to check the viability to enhance the livelihood of the local community. A list of plants given to DFO, Kanyakumari for the implementation of a biodiversity museum in the Tamil Nadu part of Agasthyamala. A list of plants reported from ABR was compiled. GPS coordinates and KML files were given to the Forest Survey of India for studying spatial data.

ASSISTANCE TO BOTANIC GARDEN (ABG) PROGRAM

In the year 2023-24, the Revised Guidelines for the Assistance to Botanic Garden Program of MoEF&CC were published and Call for Proposals was published nationwide. Based upon the Call for Proposals and the Revised Guidelines under the ABG program, 60 project proposals were received from across the nation and were scrutinized thoroughly by the Expert Group under ABG program vide a meeting held on online mode on 29th November, 2023.

Based on the screening done under this meeting, 38 institutions were selected for determining the feasibility of the projects through an evaluation, 22 projects were rejected as they did not fulfill the mandatory requirements of the Program.

On the basis of the inspections conducted, the 7th Review Meeting of the Expert Group on the "Assistance to Botanic Gardens" Programme was organized on 19th and 20th December, 2023 in Botanic Garden of Indian Republic, Noida wherein all the Principal Investigators of 38 selected institutions were given an opportunity to present their proposals. Thereafter, 16 proposals have been selected for financial assistance in the current Financial Year.

The Expert Group has attempted to ensure that the selected projects encompass the entire nation and represent different phytogeographical regions so conservation efforts may be extended to projects that have hitherto not received funding under the program.

INFORMATION ON HERBARIUM MAINTENANCE

Name of the Regional Centre/ Unit	ANRC	APRC	AZRC	BGIR	CBL	CNH	CRC	DRC	ERC	HAWHRC	ISIM	NRC	SRC
Present status of Herbarium holdings	40,000	43,621	53160		12345	20,00,000	107649	23560	c. 1,52, 000	6050	70000	1,20076	**3.5 lakhs** (as on Feb 2024)

Herbarium maintenance	Numbers												
Name of the Regional Centre/ Unit	**ANRC**	**APRC**	**AZRC**	**BGIR**	**CBL**	**CNH**	**CRC**	**DRC**	**ERC**	**HAWHRC**	**ISIM**	**NRC**	**SRC**
No. of specimens mounted/remounted/labelled	150	2017/52/1500	995	Nil		133/NIL/842	380/00/278	948/72/437	3467/70/4861	465	78	5,892	**620/1895/620**
No. of Herbarium sheets stitched/re-stitched/ poisoned/ fumigated/ dusted		2017/52/1897/ 32517	944	2648	2000	NIL/ NIL/NIL/NIL/1884	341/00/625/00/440	673/0/0/0/0	2220/50/1833/1509/0/3705	465	458	61,145	**345/135/600/--/200**
No. of Herbarium sheets accessioned	100	41415	1602	Nil		NIL	1217	1858	2203	450		1,445	**101**
No. of Herbarium sheets incorporated/re-incorporated		500	1662	Nil		4224	561	1065/28	0/664	450	56	1,555	**48/365**
No. of specimens sent on loan		0	0	Nil		NIL	6	nil	46	NIL			**352**
No. of loaned/type specimens received/returned/exchanged		0/10/0/0	0	Nil		NIL/81/01/NIL	0	nil	0/0/0/0	NIL			**58**
No. of specimens identified		1400	235	Nil		313	48	nil	942	375		141	**200**
No. of Genus/species covers changed	110	80/120	63	Nil	50	995/1304	41	28/124	550	775/150	28	448	**20/30**
No. of specimens segregated		1257	42	Nil	2500	8821	270	nil	1000	525			**1000**
Documentation of existing herbarium sheets at herbaria/entry in Excel sheet/Field data written		29870	651	Yes (ca. 2474 specimens documented in Excel sheet)	2000	NA//7115/NIL	104269	nil	8261/8261/638	490			**1,20,996** specimens

NO. OF HERBARIUM SHEETS DIGITIZED

Contents	Numbers.												
	ANRC	**APRC**	**AZRC**	**BGIR**	**CBL**	**CNH**	**CRC**	**DRC**	**ERC**	**HAWHRC**	**ISIM**	**NRC**	**SRC**
Scanning	6978	2784	1821	53 sheets	**2000**	19583	4766	432	15354	**NIL**	**765**	6,394	**10,000specimens(600 dpi TIFF and JPEG images)**
Metadata preparation	6978	29870	4512	1228 Specimens	2000	7115	874	1099	8261	720	**765**	820	**1,20,996 specimens**
Remarks:			1 April 2023 to 31 January 2024								**About 685 botanical objects from Museum gallery cleaned, dusted, face-lifted, relabelled**		Due to ongoing office renovations and shortage of manpower, and the absence of a suitable scanner, the target work cannot be achieved with respect to the scanning work of the herbarium sheets. We have resolved the previous challenges and assigned a new MTS member for scanning the herbarium sheets, ensuring prompt progress.

AWARDS AND HONOURS

- **BSI, SRC, NOEG, Yercaud** received the **Shield and Certificate** from the Collector of Salem District on 28.05.2023 in the 46th Flower Show organized by the State Horticultural Department, Government of Tamil Nadu from 21.05.2023 to 28.05.2023.
- **Dr. C.S. Purohit, Scientist D** received **First Consolation prized in Poster presentation** entitled "Role of ENM, GeoCAT and Arc-GIS software's in Conservation, mapping and IUCN Assessments of Threatened Palms in Andaman & Nicobar Islands (ANI's), India" in 43INCA International Congress held on 06-08 Nov. 2023, organized by RRSC, ISRO at Jodhpur.
- **Dr. A. A. Mao,** Director, BSI received the prestigious **Prof. V. Puri Medal Award** by the Indian Botanical Society.
- **Dr. Avishek Bhattacharjee**, Scientist-E received the '**PROF. A.K. PANDEY AWARD MEDAL FOR REVISIONARY STUDIES 2023**' in the 'XXXIII Annual Conference of Indian Association for Angiosperm Taxonomy and International Seminar on Advances in Plant Systematics, Biogeography and Biodiversity Conservation' (Kolkata; 25–27 November, 2023).
- **Dr. Harekrushna Swain**, Senior Pres. Assistant received "**Shining Star Award**" at the 6th International Conference on Agriculture for Sustainable Development organized by Society for Agricultural Research & Management(SARM) and ICAR-National Rice Research Institute, Cuttack from 19th –21st January 2024, at ICAR-NRRI, Cuttack
- **Dr. Kanad Das**, Scientist-F was conferred with the "**FELLOW of the Mycological Society of India**" for the year 2023 by the Mycological Society of India (MSI) on 25.10.2023.
- **Dr. S.S. Dash,** Scientist–F & Incharge, Tech. Sect BSI received the prestigious **M.B. Raizada gold Medal 2022** by the Association of Plant taxonomy and **Dr. T.M. Hynniewta Biodiversity Gold Medal 2022** by East Himalayan Society for Spermatophyte Taxonomy (EHSST) during the review period.
- **Dr. Shashi Kumar, RA** received **Young Scientist Award 2023** at the International Conference on Ethnobotany, Environmental Sustainability and Multidisciplinary Researches (ICEESMR-2023) by the Academic Council of the Centre for Social and Environmental Research (CSER).
- **Dr. Sujana, K.A. Scientist E** received '**Sasya Mithra Award 2024**' instituted by the Kerala Society for Women Empowerment during the observation of the World Wetland Day – 2024 organised by the Centre for Innovation in Agriculture and Soil at Thrissur, Kerala.
- **Mr. Ritesh Kumar Singh, JRF** received 1st Prize in Poster Presentation during **National seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-west Himalayas** on 27-28th November, 2023 organized by Indian Society of Plant Genetic Resources (ISPGR), Shoolini University and ICAR- National Bureau of Plant Genetic Resources (NBPGR) at Shoolini University, Solan. Himachal Pradesh.
- The staff of NOEG, BSI, SRC, Yercaud participated in the 46th Flower Show organized by the State Horticultural Department, Government of Tamil Nadu from 21.05.2023 to 28.05.2023 (**08** days), and received the Shield and Certificate from the Collector of Salem District on 28.05.2023.

SERVICES RENDERED

During 2023-24, the different regional centres and units of BSI has provided several identification, guidance and authentication services to different individuals as well as institutes. A brief synopsis of the services provided by BSI in the reference period is given below:

AJCBIBG

The BSI-AJCBIBG, Howrah has provided scientific guidance for the educational visits of 120 Schools/College/Institution/Dignitaries and a total of 2805 attendees from different parts of the state and India.

APRC

The Scientific team of BSI-APRC, Itanagar has reviewed 5 international papers and guided 2 scholars.

AZRC

Identification services were provided to students/research scholar from colleges/ universities/ different research organizations including 15 species (20 specimens) and generated revenue Rs. 6000 as identification charge from BSI-AZRC, Jodhpur.

CBL

Authentication of twenty-six crude plant samples, received from various Institutes, Universities, Customs office have been done by the scientific team of BSI-CBL, Howrah.

CNH

Assistance to scientific fraternity: A number of images and replies to numerous queries were provided to researchers and scientific officials in pursuing researches on plant taxonomy and allied disciplines.
Identification & authentication of plant samples: 290 specimens of angiosperms and 22 samples of algae were identified.
Visitors attended: 1455 visitors including VIPs, dignitaries, foreign delegates, scientists, academicians, researchers and students. VIPs visitors include Ms. Leena Nandan, IAS, Secretary, MoEFCC, Mugdha Sinha, IAS, Joint Secretary, Ministry of Culture, Sh. Pravir Pandey, IA & AS, Financial Advisor, MoEFCC, Ms. Hemlata Pradhan, President- Himalayan Trust for Natural History Art, Dr. Tilottama Roy, Associate Professor, Dept. Of Biology, Missouri Western State University, USA, Dr. Ana Rita Simões, Royal Botanic Gardens Kew, Mr. John Jackson, Head of Science Policy and Communication, Natural History Museum, London, UK, Smt. Sonia Mehra Chawla, Royal Botanic Garden, Edinburgh, Prof. Hanno Schefer, Technical University Munich, Germany, Dr. G.K. Dhingra, Dean of Science, HoD, Sri Dev Suman Uttarakhand University.
Miscellaneous services: BSI Scientists/Scientific staffs reviewed manuscripts received from peer reviewed National and International journals viz. Kew Bulletin, Nordic Journal of Botany, Phytotaxa, Annales Botanici Fennici, South African Journal of Botany, Journal of Fungi, European Journal of Taxonomy, Rheedea, Biodiversity: Research and Conservation, Plant Science Today, Journal of Threatened Taxa, Nelumbo, Mycologia and Taiwania.

Dr. Kanad Das, Scientist-F has reviewed two papers for International SCI journals (Mycologia and Journal of Fungi)
Dr. M. Palanisamy, Scientist-E has authenticated seaweed samples to Research Scholars, UG and PG students of different universities and colleges. Twenty-three seaweed samples were authenticated to research scholar and students and earned an amount of ₹ 9750/- as revenue . Guided/internship training given to Mr. Subhrajyoti Misra (Reg No: 21MSMB107), M.Sc, Dept. Microbiology, Garden

City University, Bangalore, Karnataka, title of the project" Eeffect of seaweed extract on Vegetable Crop Radish (Raphanus raphanistrum subsp. sativus)". The final report of the project work was corrected and helped to submit the project report to the Dept. of Microbiology, and, he got awarded the PG Degree from Garden City University, Bangalore, Karnataka.Received Three Ph.D. thesis (in the field of Algae) from different Universities for evaluation and all the thesis were evaluated properly and submitted the evaluation report on thesis to the Universities. Delivered 15 Lecturers to Research Scholars, and Students

Dr. Sudeshna Datta, Botanist has visited Scottish Church College and explained collection and herbarium technique for macrofungi.

Dr. Shyam Biswa, Botanical Assistant has Identified/ authenticated most of the plant specimens which have come from different Educational institutes and organizations and also from customs and excise departments, and private organization. Attended researchers who come to visit Hall-1 for herbarium consultation. Assisted a research fellow from Herbal Medicine College in identification of 04 species. Replied to the queries and herbarium related herbarium methodology via phone or via email. Made correspondences with regard to identification of plant specimens.Attended and assisted Visitors for herbarium consultation and given lecture to college students about CNH and herbarium methodology.

Mrs. Ruma Bhadra, Senior Preservation Assistant has Attended and assisted 30 visitors for herbarium consultation from different organizations in Hall-5 and Monocot type section. Identified 21 specimens of Poaceae for providing authentication certificate. Attended a total of 479 students and 40 faculties from 23 different organizations and taken class on History of Central National Herbarium, Herbarium techniques and Mission Life. Attended 14 VIP visitors and shown Roxburgh's icon, Wallichian correspondence and large paintings.

CRC

Plant material *Boerhavia diffusa* (whole plant 1kg) supplied to Ms. Shwetanjli Jaiswal of Department of Biochemistry, University of Allahabad for M.Sc. dissertation work.
Plant material *Terminalia bellarica* (leaves 1kg) supplied to Ms. Shwetanjli Jaiswal of Department of Biochemistry, University of Allahabad for M.Sc. dissertation work.
Plant Identification and Authentication: 44 plants
Visitors attended: Dr. O.N. Maurya, Sci-D supervised visit of 60 D. Pharma students of R.K. College of Pharmacy on 29.03.2023 and 55 D. Pharma students of Sainik College of Pharmacy, Prayagraj on 06.04.2023. Dr. A.K. Verma, Sci-C attended 121 students of B. Pharma and organize Garden visit for them along with Dr. O.N. Maurya, Sci-D BSI, CRC, Allahabad. Dr. Saurabh Sachan attended Senior Deputy Accountant General (AMG-1) and provided information regarding the flora of Madhya Pradesh and also attended a curious farmer Mr. Mukesh Kumar Maurya, Anapur, Prayagraj and provided information on cultivation of medicinal plants on 20.06.2023. Sri B. Lakshmanudu attended Rahul Nishad, ICFRE-ERC for herbarium consultation at BSA, BSI,CRC, on 26-07-2023 . Dr. Saurabh Sachan, Smt. Neelima A. M and Sri B. Lakshmanudu attended and facilitated 15 students along with 01 professor for herbarium and garden visit from Ewing Christian College,Gaughat, Prayagraj on 18 /08/2023. Dr. Nitisha Srivastava attended four students of SHUATS, Prayagraj under training at ICFRE, Prayagraj and delivered lecture on Plant collection and herbarium techniques, felicitated BSI garden visit of Prof. N.B. Singh, retired professor, Botany Department, University of Allahabad, Allahabad and Two Research Scholars namely Mr. Prabhat Tandon and Mr. Rahul from Plant Taxonomy Laboratory, University of Allahabad. Smt. Neelima A. M and Sri B. Lakshmanudu attended and facilitated 6 students of ICFRE-ERC; visited herbarium &Garden of BSI,CRC,on 12-09-2023 for research purpose. Dr. Sanjay Mishra, Scientist D, Dr. Nitisha Srivastava, Botanist, Smt. Neelima A. M, Botanical Assistant, Shri. Lakshmanudu, Senior Preservation Assistant have 55 attended teachers and students of S.S. Khanna Girls Degree College, Prayagraj during visit to BSI, CRC, Allahabad.

Dr. Nitisha Srivastava, Botanist, Smt.Neelima A. M, Botanical Assistant, Shri. Lakshmanudu, Senior Preservation Assistant have attended Mr. Pankaj, research scholar, NBRI, Lucknow during his herbarium consultation to BSA.
Dr. O.N. Maurya, Scientist D attended 25 Auditors from RTI, Allahabad, who have visited herbarium and garden of BSI,CRC,on 22-09-2023 and explained the role of herbarium and garden.
Dr. S. Muthukuar guided Mr. Roshinikumar Ngangom, CSIR-NBRI, Lucknow for the consultation of BSA lichen herbarium from 16.10.2023 to 18.10.2023. Smt. Neelima A. M and Sri B. Lakshmanudu attended and facilitated 6 students of ICFRE-ERC; visited herbarium &Garden of BSI,CRC,on 12-09-2023 for research purpose. Dr. Nitisha Srivastava, Botanist has attended Research Scholar namely Ms. Tasbeeha, Taxonomy Laboratory, University of Allahabad given information about herbarium cosutation visit to CNH, Howrah.
Dr. L. Rasingam, Scientist-E, has reviewed 04 articles for Journal of Economic and Taxonomic Botany, 05 articles for Nelumbo, 01 article for Indian Journal of Forestry and 01 article for Nordic Journal of Botany.
Dr. M. Sankara Rao, Scientist –D, has reviewed three (03) Ph.D. theses form different universities and conducted a Viva voce and adjudicated a Ph.D. thesis for Andhra University, Vishakhapatnam.
Dr. P. Harikrishna has identified 56 plant specimens brought and sent by various universities and colleges, students, and faculty members to BSI, DRC, Hyderabad and issued authentication certificates.

ERC

Identification and authentication: **c. 244** specimens of angiosperms, pteridophytes, were authenticated. Total herbarium specimens Received, processed for Accession numbers deposited by visitors in ASSAM: **82**. Total excursion team visited during the period**: 13 team, 261 students along with 28 teachers.** Visitors attended: **c. 689** visitors including VIPs, dignitaries, foreign delegates, scientists, academicians, researchers and students.Plantation programme & sapling distribution: **5553** Saplings and seeds supplied to different Institutions, Universities, Biodiversity board of Meghalaya and NGOs.

- Total revenue earned: Rs. **71409/-**
- Identification charges of plant specimens-**Rs. 58,000/-**
- Sale of BSI publication: **Rs. 13409/-**

HAWHRC

Plant identification and generated revenue which was deposited in Bharat Kosh.

ISIM

Attended various Dignitaries, Scientists, Business personalities and students during their visit to Botanical Gallery, Indian Museum.
One Hundred and two (102) narcotic Drug samples identified for Law enforcement Agencies and Rs.2,55,000/- (Rupees Two lakh fifty five thousand) revenue earned for the department.

NRC

Assistance to Scientific fraternity/visitors: Distribution of scientific information, assistance to c. 303 researchers and scientific officials in pursuing researches on plant taxonomy and allied disciplines of different institutes.
Expert service: 12 queries on plant distribution, ecology, nomenclature, conservation status etc. were attended and solved by BSI experts.
Identification & authentication of plant samples: c.141 plant specimens were identified and authenticated.
Plantation programme, saplings and plant sample distribution: 250 Plant saplings belonging to 17 species [*Acer oblongum* Wall. ex DC., *Agathis lanceolata*Warb., *Elaeocarpus sphaericus* (Gaertn.) Heer, *Pittosporum eriocarpum* Royle, *Quercus leucotrichophora* A.Camus, *Sophora mollis* (Royle) Graham ex Baker, *Stevia rebaudiana* (Bertoni) Bertoni, *Terminalia elliptica* Willd., *Asparagus racemosus*Willd., *Jatropha curcas* L., *Chlorophytum tuberosum* (Roxb.) Baker, *Aloe vera* (L.) Burm.f., *Piper longum* L., *Cinnamomum tamala* (Buch.-Ham.) T. Nees & C.H. Eberm., *Cinnamomum*

camphora (L.) J.Presl, *Cinnamomum zeylanicum* Blume, *Terminalia bellirica* (Gaertn.) Roxb.] distributedin plantation drive under Mission Life Awareness activities carried out in Dehradun district between 10th May-5th June, 2023. BSI, NRC organized 03 plantation programmes1). near Audit colony, Dehradun by BHOMYA NGO Group on World Environment Day and planted 50 saplings of 7 tree species [*Acer oblongum* Wall. ex DC., *Agathis lanceolata* Warb., *Elaeocarpus sphaericus* (Gaertn.) Heer, *Pittosporum eriocarpum* Royle, *Quercus leucotrichophora* A. Camus, *Cinnamomum tamala* (Buch.-Ham.) T. Nees & C. H. Eberm., *Cinnamomum camphora* (L.) J.Presl]. Plant specimens were supplied by BSI, NRC, Dehradun. 2) at Govt Inter College Maldebta, Dehradun on 5th June, 2023 and planted 25 saplings of 6 tree species [*Pittosporum eriocarpum* Royle, *Elaeocarpus sphaericus* (Gaertn.) Heer, *Acer oblongum* Wall. ex DC., *Quercus leucotrichophora* A.Camus, *Cinnamomum tamala* (Buch.-Ham.) T. Nees & C. H. Eberm., *Cinnamomum camphora* (L.) J.Presl]. 3) at Dolphin (PG) Institute of Biomedical and Natural Sciences, Manduwala, Dehradun on 20th May, 2023 and planted 10 saplings of 3 species [*Elaeocarpus sphaericus* (Gaertn.) Heer, *Cinnamomum tamala* (Buch.-Ham.) T. Nees & C. H. Eberm., *Cinnamomum camphora* (L.) J. Presl].

Miscellaneous services: BSI scientist have guided dissertation works of 03 M.Sc students from different Universities; reviewed manuscript received from peer reviewed National and International journals viz. *Acta Botanical Hungarica, Current Science, Forest Science and Technology journal, Hattoria, Indian forester,, Proceedings of the National Academy of Sciences, India Section B: Biological Sciences.*

Revenue Earning:

- Revenue earned through sale of BSI publications: 21,482/-
- Revenue earned through miscellaneous services (plant identifications/ authentication of plant specimens/ Guest house charges/ photocopy etc.): 97,750/-

Total revenue earned 2023-2024: Rs. 1, 19, 232/-

SRC

- A total of 73 herbarium visitors were attended to during the specified timeframe. Within this period, 694 plant specimens were identified by the scientific staff of BSI, SRC.

- Scientist of BSI, SRC participated as a resource person and subject expert for a Board of Studies Meeting II (State Integrated Board of Studies) conducted by Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu on 01.04.2023. Also reviewed their modified syllabus recently introduced by The Tamil Nadu State Council for Higher Education (TANSCHE) to be followed for the Academic year 2023–2024.

- In May 2023, the scientific staff of BSI, SRC participated as a resource person for setting up of question paper on General Botany, towards the Phase I Final Examination conducted by Tamil Nadu Forest Academy (TNFA) Coimbatore, for the 18-month Training Programme of Forest Range Officers.

- Organized/conducted hands-on training in Herbarium Methodology to **06** laboratory attendants of different colleges and universities of Kerala and Tamil Nadu from 15.05.2023 to 26.05.2023.

- Scientists of BSI, SRC as resource persons actively participated in a two-day Conservation Assessment, Management and Prioritization (CAMP) Workshop for selected flowering plant species of Tamil Nadu State on 26th and 27th, September 2023 organized by ICFRE-Institute of Forest Genetics and Tree Breeding (ICFRE-IFGTB), Coimbatore and Tamil Nadu Biodiversity Conservation and Greening Project for Climate Change Response, Govt. of Tamil Nadu at ICFRE-IFGTB campus. During the workshop, interacted with experts from different academic and research institutes, and discussed about the occurrence, distribution, population and plausible threats of the provisionally selected flowering plant species of about 100, of which 25 have been selected prioritized species for effective conservation.

- As a part of assistance to Botanic Gardens in India Programme in December 2023, a team of scientists inspected the following **08** botanic gardens of different academic and research institutions in Tamil Nadu, Kerala and Puducherry: (i) Tamil Nadu Agricultural University, Coimbatore, (ii) ICFRE–Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore, (iii) University of Calicut, Kozhikode, University of Kerala, Kariavattom Campus, Thiruvananthapuram, (iv) M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Wayanad, (v) Sir Syed College, Taliparamba, Kannur, (vi) Payyannur College, Payyannur, (vii) Ahalia Foundation, Palakkad, and (viii) Avvaiyar Government College for Women, Karaikal, and discussed with the Principal Investigators, Co-Principal Investigators, Professors and Scientists of the respective botanic garden, and provided necessary suggestions. Subsequently, prepared the detailed feasibility report on the two botanic gardens with remarks and recommendations, and submitted the same to the Director and In-charge, Technical Section, BSI, Kolkata.

- Delivered lectures to various visiting students and researches about BSI History and its Role in Plant diversity documentation in India, Preparation, maintenance and utility of Herbarium, Historic Collections in MH, Type Concept and basic Literatures in Plant Taxonomy BSI history, objectives, functions at SRC, coimbatore: for 110 PG and UG students from JSA College of Agriculture and Technology, Cuddalore on 17.10.2023 and 25 UG students/3 staffs from Department of Botany, Sarada Vilas college, Mysore –570004 on 16.11.2023. 40 UG & PG students/3 staffs from Department of Botany, Providence college for women, coonoor, The Nilgiris on 27.09.2023, 31 PG & UG Botany students / 4staffs from Department of Botany, KVVS college of science and technology, Addor, Pathanamthitta, Kerala on 29.09.2023, 70 PG students/ 4staffs from Department of Botany, Annamalai University, Annamalai Nagar on 03.10.2023, 37PG &UG Students/2staffs, Department of Botany, PSG College of Arts & Science, Coimbatore on 06.10.2023. Attended 5 batches of PG/UG Botany (80) students from various colleges from Kerala; K.E. College, Mannanam, Kottayam (09.10.2023), MES College, Ponnani, Malappuram (11.10.2023), Kerala University, Thiruvananthapuram (17.10.2023) and Baithul Izza College, Kozhikode (18.10.2023) as part of their Institutional visit to BSI/SRC, 30 UG & PG students/4 staffs from Department of Botany, Womens Christian College, Nagercoil on 07.09.2023, 18PG students/2 staff from Department of Botany, Government Arts College, Coimbatore on 20.07.2023, 45 Trainees/2 staff, Forest Range offecier trainees, Tamil Nadu Forest Academy, Coimbatore -641002 on 21.07.2023, 12 students/2 staff from Delhi Public School, Coimbatore -641109 on 27.06.2023, 25 PG students/3 staffs from Depatemtn of Botany, Sri Krisnadevaraya University, Anantapuram, Andhra Pradesh on 11.07.2023, 21PG Students/3staffs from Department of Botany, Sharnbasva University, Kalaburgi, Karanataka - 585103 on 18.07.2023, 39 students /2 staff from TNAU Department of Biotechnology, Coimbatore -641003 on 23.05.2023, 7 students from Department of Botany PSG. College of Arts and Science, Coimbatore (Internship student) on 08.06.2023, 55 forester trainees/2 staff from Tamil Nadu Forest Academy, Vaigai dam, Theni District and 15 BSC botany students/2 staff from Arignar Anna Government Arts College, Attur - 636121 on 18.05.2023, 12 students of Department of Environmental Sciences, TNAU on 03.05.2023, 35 UG students / 2 staff of Department of Agriculture, MIT College of Agriculture and Technology , Coimbatore -641003 on 04.01.2024, 34 Forest Range officer trainees/2 staff of Tamil Nadu forest Academy, Coimbatore -2 on 11.01.2023.

- Explained the garden activities and conservation methods at Yercaud to 148 students and 8 faculty staffs and 151 students and 8 faculty staffs from Sri Saradha Vidyalaya Higher Secondary School, Salem visited the garden on 01.11.2023 and 09.11.2023, Dr. R. K. Gupta, Senior Commandant, Chennai visited the garden on 23.08.2023, 170 students and faculty staffs from Holy Angel School, Salem visited the garden on 30.08.2023, 22 students and faculty staffs from The Indian Public School (TIPS), Erode visited the garden on 08.09.2023,

- Delivered an online class for the students on Add-on Course "Herbarium Techniques and Management" conducting by Department of Botany, University of Kerala on 08-07-2023. And Delivered a class on Taxonomic Keys to the students from Department of Botany, Government Arts College, Coimbatore-18 on 20.07.2023.
- The thesis on 'Biosystematics and Conservation of selected taxa of Acanthaceae based on texts of Ayurveda' was reviewed and a report was submitted to the University of Mahatma Gandhi, Kottayam, Kerala.
- The thesis on 'Chromium (VI) uptake and tolerance potential in Amaranthus dubius Mart. ex Thell.: Effect on genotoxicity, cell culture, antioxidative activity, mineral nutrition, growth and nutritional value' was reviewed and a report was submitted to the University of Calicut, Malappuram, Kerala.
- Floristic Account for Working Plan of South Wayanad Forest Division: A rapid floristic assessment was conducted in South Wayanad from 27-11-23 to 1-12-23 and the report of 1528 plants was submitted to the working Plan Officer, Kozhikode along with information on endemic plants, NWFP plants, threatened plants and invasive plants.
- Review of Manuscripts from national/international journals: Phytotaxa – 02; Nelumbo – 03; National Academy Science Letters 1

1. Events and Activities

- Observed the World Environment Day on 05.06.2023 jointly with the Department of Biotechnology, KSR College of Technology, Tiruchengode. A rally was conducted at Yercaud with 48 students, staff members of BSI, NOEG, Yercaud and KSR College of Technology to create awareness about the solutions to plastic pollution. Also a seminar was conducted on the World Environment Day and its theme "Solutions to Plastic Pollution".
- BSI, SRC also facilitated a platform for herbarium studies to students, research scholars and teachers, besides plant identification and issuing of plant authentication certificate for students, research scholars, teaching faculties and general public from various academic and research institutes from different parts of Tamil Nadu and Kerala.
- Distributed plant saplings to the following departments: Tamil Nadu Forest Department, ICFRE–Institute of Forest Genetics and Tree Breeding (ICFRE-IFGTB), Coimbatore, Ahalia Foundation, Palakkad, Kerala, BSI, Eastern Regional Centre, Shillong, Forest Genetics Division, Coimbatore.
- BSI, SRC conducted various Swachh Bharat Activities (Swachhata Campaign 2.0 and 3.0) in the office premises of BSI, SRC, Coimbatore and NOEG, Yercaud.

WRC

Identification and consultation of angiosperm Herbarium services were provided for the students/researchers from different Colleges, Universities and Institutions of India.

Authentication were done for angiosperms include *Bixa orellana* L., *Anogeissus latifolia* (Roxb. ex DC.) Wall. Ex Guill. & Perr., *Lantana camara* L., *Amaranthus spinosus* L., *Amaranthus viridis* L. *Amaranthus hybridus* L., *Amaranthus retroflexus* L., *Amaranthus spinosus* L., *Alternanthera sessilis* (L.) R.Br. ex DC., *Amaranthus cruentus* L., *Alternanthera ficoidea* (L.) P.Beauv, *Gomphrena globosa* L., *Celosia argentea* L., *Achyranthes aspera* L. and *Alternanthera sessilis* (L.) R.Br. ex DC.

- Explained about the plant collection, identification, herbarium methodology and incorporation of Herbarium specimens for seventy students from the Kamala Nehru Mahavidyalaya, Nagpur during their educational visit to BSI, WRC on 5th October, 2023.
- Explained about the plant collection, identification, herbarium methodology and incorporation of Herbarium specimens for forty students from VIBGYOR School during their educational visit to BSI, WRC on 12th October, 2023.
- Explained about the plant collection, identification, herbarium methodology and incorporation of Herbarium specimen's twenty five students from Guru Nanak Public School & Junior College during their educational visit to BSI, WRC on 13th October, 2023.

EVENTS & ACTIVITIES

BSI celebrated Earth Day on 22nd April 2023 by distributing saplings and organizing several awareness programes. On this occasion, a short movie, prepared by a team of Junior Research Fellows of the BSI was also released.

Botanical Survey of India and all its regional centres observed the ***International Day for Biological Diversity*** on 22.05.2023. On this occasion, Dr. A. A. Mao, Director, BSI delivered a talk on the theme *From Agreement to Action*: *Build Back Biodiversity*. The speech was followed by a mass rally. Besides, Drawing and Quiz competitions were organized for the students.

BSI, ISIM, Kolkata observed its ***122nd Foundation Day*** on 29th May 2023. On this occasion, Dr. A. A. Mao, Director delivered a lecture on the value of the Botanical Gallery. Dr. Piyasi Bharasa, Assistant Professor, Department of Museology, University of Calcutta delivered a lecture on '*Plants and Museum: Issues and Opportunities*.

All the regional centres/ units of Botanical Survey of India celebrated World Environment Day on 5th June, 2023 at their respective office premises. On this occasion a series of awareness programme in the form of mass rally, plantation activities, sit &draw competitions and photography competitions was organized.

The different regional centres/ units Botanical Survey of India celebrated the 9th International Yoga Day on 21st June, 2023 in which all officers and staff participated. Different Asanas and Pranayams were performed by the staff members of BSI. The BSI, WRC, Pune in association with the Symbiosis International University celebrated the International Yoga Day on June 21, 2023 at Pune with participation of G20 delegates from 47 countries. The event showcases the power of yoga in promoting unity, well-being, and cultural exchange among nations.

Botanical Survey of India celebrated "Van Mahotsav" on 14th July, 2023 followed by a plantation drive and introduced 500 saplings of endemic and threatened plants. On this occasion a booklet on the AJC Bose Indian Botanic Garden was released by the Director, BSI.

On 15th August, 2023, Staff of Botanical Survey of India celebrated the 77th Independence Day with great enthusiasm and patriotic fervor and plantation of 76 saplings belonging to 40 species of Gymnosperms and Angiosperms was planted at Pinetum section of AJCB Indian Botanic Garden.

All the regional centres/ units of Botanical Survey of India celebrated World Ozone Day 2023 on 16th September, 2023 by organizing awareness campaign on the theme: Montreal Protocol - Fixing the ozone and reducing climate change. Essay writing competition, Drawing, Quiz, and Extempore competition were also arranged by various centres of BSI.

The Botanical Survey of India organized a "Mega Cleaning Drive" at AJC Bose Indian Botanic Garden, Howrah, under the "Swachhata Hi Sewa" campaign, aiming to generate awareness through community participation, provide impetus on the implementation of the Swachh Bharat Abhiyan, reinforce the concept of sanitation as everyone's business, and serve as a prelude for the Swachh Bharat Diwas (2nd October) with nationwide participation. During the Mega Cleaning Drive, all scientists and officials, research scholars, out-source staff, police personnel, municipality people, and morning walkers participated and cleaned the roads, collected more than 25 tons of garbage, and handed it over to Municipal Corporation Howrah. The cleaning drive included the Swachhta Pledge followed by an awareness rally and cleanliness drive by Shramdan for one hour in the 500-meter stretch area from the

garden main gate to Ganga Ghat. The program has been successfully led by Dr. A.A. Mao, Director, of the Botanical Survey of India.

Vigilance Awareness week is being observed in all our Offices from 30th October 2023 and more than 1000 persons participated in the Integrity Pledge ceremony.

Observed Rashtriya Ekta Diwas 2023 and organized, "Run for Unity" at all the offices of BSI and its regional centers on 31st October, 2023 where more than 1000 people participated.

Botanical Survey of India celebrated World Science Day for Peace and Development with the theme Building Trust in Science. Since its proclamation by UNESCO in 2001, World Science Day for Peace and Development World Science Day has emphasized the vital role of science in society and engaged the general population in discussions on arising scientific issues.

BSI, Industrial Section Indian Museum (ISIM), Kolkata celebrated *'International Millet Day'* on 6th December 2023 with 26 UG students of Botany and 03 faculty members of South Calcutta Girls' College, Kolkata. The programme was organised to spread awareness about the importance of millet in daily life and its role in combating food scarcity throughout the world.

Botanical Survey of India, Sikkim Himalayan Regional Centre, Gangtok and High Altitude Western Himalayan Regional Centre, Solan celebrated International Mountain Day with the theme '*Restoring Mountain Ecosystem*' on 11. 12. 2023.





Different activities conducted by BSI officials during the year 2023-24

AS PER MoEF & CC (COPY PROVIDED)		
BOTANICAL SURVEY OF INDIA		
OBJECT HEAD-WISE BREAK UP OF RE- 2023-2024		
		IN THOUSAND
OBJECT HEAD	**CODE**	**FINAL RE- 2023-24**
1	*2*	*3*
Salaries	1	335000
Wages	2	100
Rewards	5	3200
Medical Treatment	6	**5600**
Allowances	7	255000
Leave Travel Concession	8	7000
Training Expenses	9	700
Domestic Travel Expenses	11	12500
Foreign Travel Expenses	12	1500
Office Expenses	13	150000
Rent, Rates and Taxes	14	5000
Printing and Publication	16	4000
Rent for Others	18	1000
Digital Equipment	19	3000
Materials and Supplies	21	6500
Fuels and Lubricants	24	6000
Advertising and Publicity	26	700
Minor civil and electric Works	27	37500
Professional Services	28	1000
Repair and Maintenance	29	6000
Grants-in-aid-General	31	15000
Scholarships	34	32500
Awards and Prizes	40	200
Other Revenue Expenditure	49	1000
TOTAL OF REVENUE		**890000**
CAPITAL:		
Motor Vehicles	51	3600
Machinery and Equipment	52	4000
Information Computer, Telecommunication (ICT) Equipment	71	6700
Furniture & Fixtures	74	3000
Other Fixed Assets	77	1000
Buildings & Structures	72	106000
TOTAL OF CAPITAL		**124300**
	TOTAL	**1014300**

16/10/21

डा: सी. मुरुगन
Dr. C. Murugan
वैज्ञानिक एफ. व. कार्यालय अध्यक्ष
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