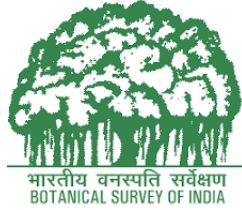




ANNUAL REPORT

2019-20



BOTANICAL SURVEY OF INDIA

Ministry of Environment, Forest & Climate Change

Govt. of India

ANNUAL REPORT 2019-20

Botanical Survey of India

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All Regional Centres of Botanical Survey of India

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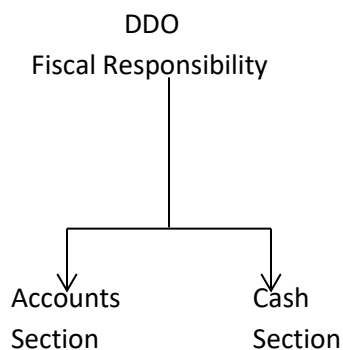
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Gangtok

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Coimbatore

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From the Director's Desk....



DR. A.A. MAO
Director
Botanical Survey of India

It is a proud moment for me to present the Annual Report of Botanical Survey of India for the year 2019-2020. The report highlights the brief accounts of all-round achievements of the institute in the field of exploration, survey, research, technological development and outreach programmes.

During the period 2019-20, Botanical Survey of India excellently performed in multifunctional disciplines in basics as well as applied streams of plant sciences. In this period, this Institute carried out 137 field tours (including several one day local tours) and 17 Herbarium Consultation tour under 68 Annual Action Plan Projects and 09 Funded Projects to collect plant specimens for floristic, ethnobotanical and ecological studies on flowering and non-flowering plants covering 10 Protected areas (National Parks and Wildlife Sanctuaries), 01 Biosphere Reserve and 03 Biodiversity Hotspots, *viz.* Himalayas, Indo-Burma and Western Ghats-Sri Lanka. During this survey, live germplasms of threatened, endemic and economically important species were collected for their *ex-situ* conservation. Extensive floristic exploration was conducted in a wide range of phyto-geographical regions including Western Himalaya, Eastern Himalaya, North-East India, Arid-Semi Arid regions, Gangetic Plains, Deccan peninsula, Western Ghats and Andaman Islands. During these field tours, a total of *c.* 17,200 specimens were collected which were identified into *c.* 5380 taxa. Apart from that, 17 Herbarium Consultation tour were conducted for identification of critical taxa. Revisionary studies of Gymnosperm of Andaman and Nicobar Islands, family Pyrenulaceae, genus *Gastrochilus* D.Don, *Adiantum* L. and *Impatiens* L. (Balsaminaceae) of Sikkim & Darjeeling Himalayas were carried out. Taking into consideration of recent trends in molecular taxonomy and phylogenetic study, BSI is shifting their mandate. In this regard, scientists of this Department opted isolation of genes from Indian specimens, making of phylograms and phylogenetic tree

for evolutionary study. Collection of ethno-botanically important plants and their ethnobotanical significance were documented from some tribal populated Districts of Bihar (Aurangabad, Madanpur, Maharajganj, Arwal, Purnea, Banmankhi, Katihar and Barsoi Forest Divisions of Aurangabad, Nawada, Araria, Kishanganj, Purnea, Katihar, Gaya and Nalanda Districts) and collected c. 962 ethnobotanical information from local Vaidyas and villagers. Habitat analysis of Orchids of Eastern Himalaya (Entire Sikkim, Darjeeling district of West Bengal and Arunachal Pradesh excl. Changlang and Tirap) was assessed including 770 taxa and concluded 74 taxa (03 are flagged as possibly extinct) as Critically Endangered (CR); 108 taxa as Endangered (EN); 505 taxa as Vulnerable (VU); 50 taxa as Near Threatened (NT); 18 taxa as Least Concern (LC) and 15 taxa as Data Deficient (DD). Study of seed morphology of some selected Orchids of Northern Western Ghats of India and leaf surface of the family Acanthaceae in BSA were carried out by BSI officials. Cytotaxonomic study of the Genus *Impatiens* of Sikkim/Darjeeling District was done and Meiotic studies of 09 *Impatiens* species were completed. Besides, augmentation, maintenance of various herbaria, gardens and museum in BSI, dissemination of information relating to plant diversity were continued. The Botanical Gardens of this institute are actively engaged in introduction, enrichment, conservation, propagation and multiplication of Rare, endangered and threatened plant species, medicinal plants, Zingibers, Rattans, Bamboos, Orchids, ornamental plants, ferns etc. Towards fulfilling the Global strategy for plant conservation targets on *ex-situ* conservation, 12 botanical gardens under this Department are spreading in different biogeographical regions of India and actively engaged in biodiversity conservation. A proto-type of GPS based navigation App for locating trees and shrubs of AJC Bose Indian Botanic garden, BSI, Howrah was developed. In Herbarium Digitization Programme, a total of 28030 herbarium sheets were scanned. During this period, BSI scientists initiated reinterpretation of the families Bignoniaceae, Clusiaceae and Orchidaceae in Roxburgh Icon with reference to recent ICN.

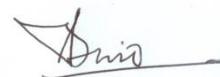
During 2019-20, the scientists of BSI added 253 taxa including seed plants and non-flowering plants to Indian flora. The research aptitude of the scientific officials of the institute was reflected through the publication of 165 research papers in peer reviewed journals, 18 books and 32 Hindi articles. This year, the Department published 07 books, 03 periodicals [NELUMBO (vol. 61: Issues 1 & 2), Plant Discovery 2019, Vanaspati Vani 2019] and Annual Report 2018-19. To reduce difficulties of exploration at species rich high altitude areas of Western Himalayas, specifically remote and difficult areas like Kashmir valley, Ladakh, Pir Panjal, Lahul & Spiti ranges, a new regional circle 'High Altitude Western Himalayan Regional Centre' was established at Solan, Himachal Pradesh on 10th December, 2019 at the campus of Dr Y.S. Parmar University of Horticulture and Forestry, Nauni.

This year Botanical Survey of India hosted several important events: International Symposium on 'Plant Taxonomy and Ethnobotany (ISPTTE 2020)' venues at Hotel Lalit Great Eastern, Kolkata, COP-14 (Conference of Parties) of UNCCD programme in Greater Noida, 4th Nomenclatural Course (coordinated by Dr. K.N. Gandhi); celebrated various National and International Days: National Science Day, International Day of Yoga, World Biodiversity Day (22nd May), World Ozone Day, World Environment Day (5th June), Himalayan day (9th September), Vanmahotsab etc. along with various experts' talks. Several conferences, symposia, training programmes and regional workshops were organized in collaborating with other Institutes, colleges and Universities. Rajbhasa Department of this institute organized various workshops, meetings and Hindi Pakhwara for spreading and popularization of Hindi language. In this period a team of three BSI scientists visited NHM, London, examined Indian specimens of the families Balsaminaceae, Caprifoliaceae, Leguminosaceae and digitized the sheets. For smooth function of research works especially PhD programme, MoU was signed between Botanical Survey of India, Kolkata and Chaudhary Charan Singh University, Meerut.

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

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

Jai Hind



A.A. Mao

(Director)

ANNUAL RESEARCH PROGRAMME

AJC BOSE INDIAN BOTANIC GARDEN, HOWRAH

PROJECT-1

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

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

Date of Initiation: April, 2019

Date of Completion: March, 2021

OBJECTIVE

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

BACKGROUND

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

AREA AND LOCALITY

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

SUMMARY AND ACHIEVEMENT

Two macrofungal survey tours *w.e.f.* 13.06.2017 to 27.06.2017 and 15.07.2019 to 24.07.2019 were undertaken to different parts of Uttarakhand namely, Baram, Kanar, Bahman, Tejam Khaaiar, towards Chippla Kedar of Kumaon Himalaya and Joshimath, Malari, towards Kuntibanar glacier, surroundings of Garhwal Himalaya and Lachung, Yumthang, Bichhuten, Dorji, Dombang, Jakthang, Khorathang, surrounding areas of alpine meadows and glacial moraines of North Sikkim respectively during which fruiting bodies of about 30 caterpillar fungi belonging to Ophiocordycipitaceae were collected from two major localities of Kumaon and Garhwal Himalaya and about 35 samples of alpine caterpillar fungi were collected from North Sikkim. 25 labelled photographs have been provided. Two genes (ITS, SSU) were isolated from the samples of Kumaon, Garwal, Sikkim and Arunachal Pradesh (provided by the Director, BSI) respectively. Based on the sequence data of these Indian materials several data-sets were

prepared from sequence derived from GenBank and other literature. Different phylograms were prepared with the help of RAxML GUI. High Performance Liquid Chromatography (HPLC) analysis of specimens gathered from different parts of Himalaya was also performed to get further confirmation of identity.

PROJECT-2

Wood rotting fungi of Valmiki National Park

Executing Scientist (s): Dr. Manoj E. Hembrom

Date of Initiation: November, 2018

Date of Completion: November, 2021

OBJECTIVE

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

BACKGROUND

The project was initiated in 2018. During 2018-19, one field tour was undertaken to the study area falling under the jurisdiction of Harnatar forest range and Raghia forest range during which macro-morphological characterization of basidiomata were studied of which a total of 10 taxa were identified and documented. All the collected specimens were properly preserved, numbered and brought out to CNH, BSI, Howrah.

AREA AND LOCALITY

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

SUMMARY AND ACHIEVEMENT

One field trip *w.e.f.* 27. 09. 2019 to 05.10. 2019 was undertaken to Valmiki National Park and adjoining areas and surveyed c. 80 sq. Km. areas during which microscopic characterization, identification, illustration and description of 39 species belonging to 51 specimens/field nos. along with molecular phylogenetic studies were completed. Some of the specimens studied and characterised are: *Phlebiopsis friesii* (Lév.) Spirin & Miettinen (Phanerochaetaceae), *Hymenochaete conchata* L.W. Zhou (Hymenochaetaceae), *Favolus grammocephalus* (Berk.) Imazeki (Polyporaceae), *Phellinus gilva* (Schwein.) Pat. (Hymenochaetaceae), *Pycnoporus sanguineus* (L.) Murill (Polyporaceae), *Trametes apiaria* (Pers.) Zmitr., Wasser & Ezhov (Polyporaceae), *Hymenochaete boddingii* Hembrom, A. Parihar, K. Das & A. Ghosh (Hymenochaetaceae), *Podoscypha petalodes* (Berk.) Boidin (Meruliaceae) etc.

PROJECT-3

Enrichment of Medicinal plant section (Charak Udyan) of AJC Bose Indian Botanic Garden through survey and introduction of medicinal plants

Executing Scientist (s): Dr. S.P. Panda

Date of Initiation: April, 2015

Date of Completion: March, 2020

OBJECTIVE

Enrichment of Charak Udyan, AJC Bose Indian Botanic Garden with introduction of medicinal plants.

BACKGROUND

This project was initiated in 2015. During 2018-19, one field tour was conducted to different places of Niyamgiri hill ranges of Rayagada District and saplings of about 31 medicinal plants were collected and introduced in garden. A total of 112 medicinal plant saplings were collected from 03 collection tours to North Bengal and introduced in Charak Udyan for *ex-situ* conservation.

AREA AND LOCALITY

Eastern Ghats

SUMMARY AND ACHIEVEMENT

All the medicinal plant saplings collected from Niyamgiri hill ranges of Rayagada District, Odisha were transferred to Charak Udyan for introduction. Field tours were not conducted due to non-availability of the necessary permission. Final Project Report is under preparation.

PROJECT-4

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

Executing Scientist (s): Dr. C.M. Sabapathy & Dr. B.K. Singh

Date of Initiation: April, 2015

Date of Completion: On going

OBJECTIVE

Mapping & digitization of shrubs & trees in AJC Bose Indian Botanic Garden.

BACKGROUND

This project was initiated in 2015. During 2018-19, about 4500 trees and shrubs were serially labelled in Division no. 1-7, 8, 14, 15, 18, 19, 20, 21, 22, 25 and approx. 60% plants were identified.

AREA AND LOCALITY

AJC Bose Indian Botanic Garden, Howrah

SUMMARY AND ACHIEVEMENT

Important trees were labelled along with scientific names, local names, distribution etc. by employing label writer in antique way. Re-fixing of Labels (Numbers) was done for the fast growing trees and maintenance of labels was monitored during regular intervals. All types of correspondence were made with the software developing persons from the Geo Climate Risk Solutions Pvt Ltd., and guided in developing the Mobile application by providing the data. The developed application was duly checked and made ready for further necessary actions.

PROJECT-5

Collection, documentation & *ex situ* conservation of Aromatic plants of India

Executing Scientist (s): Dr. M.U. Sharief & Dr. B. K. Singh

Date of Initiation: April, 2017

Date of Completion: March, 2020

OBJECTIVE

Development of a separate section on Aromatic plants in AJC Bose Indian Botanic Garden, Howrah for *ex-situ* conservation and public awareness.

BACKGROUND

This project was initiated in 2017. In 2018-19, one field tour was conducted to Arunachal Pradesh during which 35 aromatic plants/propagules belonging to 13 species were collected, identified, labelled and planted in suitable pots. A layout of separate section measuring approx. 1.5 acres was designated for Aromatic Plant Garden and ceremonial plantation was done on 15th August, 2018. In the first phase well established saplings of *Syzygium aromaticum*, *Santalum album*, *Artabotrys hexapetalus*, *Magnolia champaca* etc were successfully introduced in this section.

AREA AND LOCALITY

North-east India

SUMMARY AND ACHIEVEMENT

No field tours were conducted as the senior officer was transferred to SRC, Coimbatore in September, 2019 and in the HOO meeting held in Noida it was decided to collect the locally available plants and the plants received from the different Regional Centres. Accordingly the plants available in the garden nursery were introduced. Besides 40 saplings of aromatic plant species, collected during Nomenclature course in ERC, Shillong by another officer, kept in nursery I for acclimatization, plantation drive of Sandal Wood Tree (*Santalum album* L.), sapling of Gummy Gardenia (*Gardenia gummifera* L.f.) and propagules of *Mentha × piperita* L. and *Ocimum basilicum* L. were conducted in Aromatic Plant Garden. A total of 20 plant species were introduced in this section some of which are *Cinnamomum verum* J. Presl, *Santalum album* L., *Artabotrys hexapetalus* (L.f.) Bhandari, *Magnolia champaca* (L.) Baill. ex Pierre, *Jasminum sambac* (L.) Aiton, *Plumeria rubra* L., *Eryngium foetidum* L., *Murraya paniculata* (L.) Jack., *Plectranthus amboinicus* (Lour.) Spreng, *Cymbopogon citratus* (DC.) Stapf, *Ocimum gratissimum* L., *Vetiveria zizanioides* (L.) Nash etc.

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORTBLAIR

PROJECT – 1

Revision of Gymnosperms of Andaman and Nicobar Islands

Executing Scientist (s): Dr. Lal Ji Singh & Shri Gautam Anuj Ekka

Date of Initiation: April, 2018

Date of Completion: March, 2020

OBJECTIVE

Documentation of all the genera and species involved and preparation of a consolidated account of the group in the Islands along with survey of Literature and consultation of herbarium and find out the strategy for conservation.

BACKGROUND

This project was initiated in 2018. In 2018-19, 04 field tours were conducted to different Islands during which 30 field nos. were collected along with GPS data. One herbarium consultation tour was undertaken to CAL and 142 herbarium specimens were consulted.

AREA AND LOCALITY

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

SUMMARY AND ACHIEVEMENT

Three field tours to different Islands *viz.* South Andaman, Middle Andaman and North Andaman and one herbarium consultation tour were undertaken to CNH, Howrah (CAL) during which a total of 20 field numbers were vouched along with the GPS data and plants/seedlings of 13 species were collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. All the collected specimens were identified into 10 species under 4 genera *viz.* *Cycas dharmrajii* L.J. Singh, *Cycas pschanne* R.C. Srivast., *Cycas zeylanica* (J. Schust.) A. Lindstr. & K.D. Hill, *Gnetum gnemon* L., *Gnetum latifolium* Blume var. *funiculare* Markgr., *Gnetum latifolium* Blume var. *macropodum* (Kurz) Markgr., *Gnetum montanum* Markgr., *Gnetum scandens* Roxb., *Nageia wallichiana* (Presl.) O. Kuntze, and *Podocarpus neriifolius* D. Don. During Herbarium consultation in CAL, 144 specimens were *determinavit*.

PROJECT – 2

Revision of the lichen family *Pyrenulaceae* in India

Executing Scientist (s): Dr. Jagadeesh Ram T.A.M.

Date of Initiation: April, 2017

Date of Completion: March, 2022

OBJECTIVE

Revision of members of the family *Pyrenulaceae* in India.

BACKGROUND

The project was initiated in 2017. Thorough literature survey was carried out and a total of 132 species were listed under 4 genera viz. *Anthracotheicum*, *Lithothelium*, *Pyrenula* and *Pyrgillus*.

AREA AND LOCALITY

India.

SUMMARY AND ACHIEVEMENT

One field tour *w.e.f.* 09.03.2020 to 21.03.2020 was conducted to the Ernakulam, Idukki, Kollam, Kottayam and Thiruvananthapuram Districts of Kerala and Kanyakumari District of Tamil Nadu during which a total of 27 Field Nos. of family Pyrenulaceae were collected. A total of 152 specimens were examined and identified into 4 species of *Anthracotheicum* and 24 species of *Pyrenula*. This study reports 2 species [*Eremothecella ajaysinghii* Jagad. Ram & G.P. Sinha and *Eremothecella nicobarica* Jagad. Ram & G.P. Sinha] as new to science and 13 species [*Badimia cateilea* (Vain.) Lücking, Lumbsch & Elix, *Byssoloma catarinense* L.I. Ferraro & Lücking, *Byssoloma vanderystii* Sérus., *Coenogonium barbatum* Lücking, Aptroot & Umaña, *Eremothecella calamicola* Syd., *Eremothecella macrosperma* (Zahlbr.) Serus, *Eremothecella variratae* (Aptroot & Sipman) Serus, *Fellhanera punctata* Lücking, *Gyalideopsis minutissima* Lücking, *Porina foliicola* (Vězda) Lücking & Vězda, *Sporopodium pilocarpoides* (Zahlbr.) Lücking & Kalb, *Tapellaria leonora* Cáceres & Lücking, *Trichothelium pallescens* (Müll. Arg.) F. Schill.] discovered as new to India; 10 species [*Arthonia palmulacea* (Müll. Arg.) R. Sant., *Aspidothelium scutellarpum* Lücking, *Bapalmuia palmularis* (Müll. Arg.) Sérus., *Byssolecania deplanata* (Müll. Arg.) R. Sant., *Byssolecania fumosonigricans* (Müll. Arg.) R. Sant., *Fellhanera rhapsidophylli* (Rehm) Vězda, *Glyphis scyphulifera* (Ach.) Staiger, *Porina karnatakensis* Makhija, Adaw. & Patw., *Strigula concreta* (Fée) R. Sant., *Tapellaria nigrata* (Müll. Arg.) R. Sant.] as new records for Andaman and Nicobar Islands.

PROJECT – 3

Phenological Survey of Tree Species of Dhanikhari Experimental Garden-cum-Arboretum (DEGCA), Nayashahar

Executing Scientist (s) : Dr. Lal Ji Singh & Shri Bishnu Charan Dey

Date of Initiation : April, 2018

Date to be completion : Ongoing

OBJECTIVES

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

BACKGROUND

The knowledge of phenology of plants is critical for the successful management of forest genetic resources because it has helped to understand the influence of phenological events on regeneration of trees including feeding, movement patterns, and sociality of insects, birds and mammals. However, it is estimated that the tropical rain forests are fast disappearing and degrading in recent times not only in India but also at global level which necessitates scientific researches in great detail on conservation, regeneration and management of tropical rain forests

worldwide. This project is of immense practical utility for the Andaman and Nicobar Islands in terms of conservation of phyto-diversity especially tree species because trees play a vital role in maintaining the ecological balance and improving the livelihood of peoples. This project was initiated on 2018.

AREA AND LOCALITY

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

SUMMARY AND ACHIEVEMENT

This project was initiated on 2018 and sanctioned as ongoing project. During previous year, flowering and fruiting period of 73 tree species were surveyed and recorded.

PROJECT – 4

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

Executing Scientist (s) : Dr. C. S. Purohit & Dr. C. P. Vivek

Date of Initiation : August, 2019

Date to be completion : March, 2022

OBJECTIVE

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

BACKGROUND

The Botanical Survey of India is maintaining the Dhanikhari Botanic Garden cum Arboretum at Dhanikhari, Port Blair with a focus on both *in-situ* and *ex-situ* conservation of over 500 plant species which includes wild orchid, palms, nutmegs and some economically important species. Particular emphasis has given on *ex-situ* conservation and multiplication of Endemic, Endangered and Threatened species of the Islands. Conservation studies of plants in Andaman and Nicobar Islands are very much important in the present time as the process of reduction of their number and movement towards different categories of IUCN are increasing considerably due to various external threats in the wild. In this context, this project aims to conserve EET plants of the Andaman and Nicobar Islands by making collection, introduction and multiplication in the Dhanikhari Experimental Garden Cum Arboretum. The plants involved will be multiplied, conserved, studied and exhibited for the general public to generate awareness in them towards the conservation of biodiversity in these Islands.

AREA AND LOCALITY

The Andaman and Nicobar Islands, c. 8249 sq. km.

SUMMARY AND ACHIEVEMENTS

Two field tours *w.e.f.* 14.10.2019 to 26.10.2019 and 18.03.2020 to 26.03.2020 were undertaken to Diglipur in North Andaman and Campbell Bay, Nicobar Islands respectively during which a

total of 51 plant samples of EET species of Andaman and Nicobar Islands were collected and processed the specimens for preparing the herbarium. The GPS coordinates of the localities were recorded and captured the photos of the plants. During this study, a total of 635 seedlings of 33 species, 61 plantlets of 12 species, 4 rhizomes of one species, 573 seeds of 3 species, and 4 cuttings of one species were collected and introduced in the Dhanikhari Experimental Garden-cum-Arboretum. So far, a total of 1067 polybags of 30 species of EET plants belong to bamboos, palms, zingibers, and trees of Andaman and Nicobar Islands have been prepared for conservation and multiplication. Recording of growth data of 11 endemic/threatened plants grown in the garden is progressing.

ARID ZONE REGIONAL CENTRE, JODHPUR

PROJECT –1

Floral Diversity of Jambhughoda Wildlife Sanctuary, Gujarat

Executing Scientist (s) : Dr. Sriman Lal Meena

Date of Initiation : April, 2017

Date to be completion : March, 2020

OBJECTIVE

Study of floral diversity of Jambhughoda Wildlife Sanctuary, Gujarat.

BACKGROUND

This project was initiated in 2017. During 2018-19, a total of one field tour were conducted to the study area during which 89 field nos. comprising of 178 plant specimens were collected along with GPS data and digital photographs.

AREA AND LOCALITY

Panchmahal and Chhota Udepur District, Gujarat. The Jamughoda Wildlife Sanctuary is spreaded over 130.38 sq. km.

SUMMARY AND ACHIEVEMENTS

One field tour *w.e.f.* 09.10.2019 to 15.10.2019 was conducted to the study area during which 103 filed nos. (Comprising to 206 specimens) were collected along with GPS coordinates, more than 450 images of plants and different landscape of the sanctuary area were captured, 73 field numbers were identified and label writing of 146 field numbers completed, 57 photo-plates were prepared with the help of macro and microscopic photographs of live plants and plant parts for their easy identification. During this period, taxonomic description of 305 plant species was completed. Final Manuscript is under progresses which include taxonomic description of 536 plant species and 57 colour photo plates.

PROJECT –2

Flora of Navsari District, Gujarat

Executing Scientist (s) : Dr. Ramesh Kumar & Shri Vinod Maina

Date of Initiation : June, 2015

Date to be completion : March, 2020

OBJECTIVE

Floristic inventorization of Navsari District, Gujarat to provide base line data for conservation, protection and utilization of the plant resources of the area and enable identification of the families, genera and species.

BACKGROUND

This project was initiated in 2015. During previous period,

AREA AND LOCALITY

Navsari District, Gujarat, c. 2210 sq. km.

SUMMARY AND ACHIEVEMENTS

On the basis of collection and identification of 1748 plant specimens, a list of the 1059 plant species has been prepared, described and arranged under 133 families as per the Bentham & Hooker's system of Classification except few cases Hutchinson's and Airy Shaw's concepts of the families are adopted. Final Manuscript has been prepared and submitted to D/BSI.

PROJECT –3

Flora of Tadgarh-Raoli Wildlife Sanctuary, Rajasthan

Executing Scientist (s): Dr. C. S. Purohit

Date of Initiation: June, 2015

Date to be completion: March, 2020.

OBJECTIVE

Survey and documentation of floristic diversity of Tadgarh-Raoli Wildlife Sanctuary, Rajasthan.

BACKGROUND

This project was initiated in 2015. In 2018-19, 02 field tours were undertaken during which a total of 282 field nos. was collected. Taxonomic description of 21 species was completed.

AREA AND LOCALITY

Tadgarh-Raoli Wildlife Sanctuary, Rajasthan falls in between 73⁰40[']-74⁰10['] E and 25⁰20[']-26⁰00['] N encompassing an area of about 495.27 sq.km.

SUMMARY AND ACHIEVEMENTS

One herbarium consultation tour *w.e.f.* 22.06.19 – 19.07.19 was conducted to Botanical Survey of India, AZRC, Jodhpur, during which 357 plant species were studied and identified along with filling up of herbarium label data on 1025 herbarium sheets. During this period, taxonomic description of 375 plant species was completed along with incorporation of distribution data and distribution maps of 143 species, 50 photo-plates with the help of macro and microscopic photographs of live plants and plant parts for their easy and correct identification. Final manuscript comprising of taxonomic description of 611 plant species, including 143 species distribution maps and 50 colour photo plates have been finalised. Among the entire collection, 19 species were rare and endangered namely *Abelmoschus manihot* (L.) Medicus subsp. *tetraphyllus* (Roxb. ex Hornem.) Borssum; *Ammania octandra* L.f.; *Anisomeles malabarica* (L.) R.Br. ex Sines; *Bacopa monerii* (L.) Wettst.; *Capparis grandis* L.f.; *Commiphora wightii* (Arn.) Bhandari; *Dalechampia scandens* L.; *Dendrophthoe falcata* (L.f.) Etting.; *Justicia vahlii* Roth.; *Melhania futteypornesis* Munro ex Mast.; *Monsonia senegalensis* Guill. & Perr.; *Moringa concanensis* Nimmo.; *Nepeta bombaiensis* Dalz. & Gibs.; *Oropetium roxburghianum* (Steud.) Phillips; *Panicum walense* Mez.; *Tecomella undulata* (Sm.) Seem.; *Tribulus rajasthenensis* Bhandari & Sharma; *Trichosanthes bracteata* (Lam.) Voigt. and *Trichosanthes cucumerina* L.

PROJECT-4

Vegetation Characterization and Floristic studies in Bassi Wildlife Sanctuary, Rajasthan using Remote Sensing and GIS

Executing Scientist (s): Dr. Peddi Harikrishna & Shri Ramesh Kumar

Date of Initiation: April, 2017

Date to be completion: April, 2020

OBJECTIVE

Floristic exploration in different vegetation types; collection, identification and documentation of all the collected plant species, mapping of vegetation types by using Remote Sensing and GIS, collection of phytosociological data, ecological evaluation of the forest types including assessment of the existing threats with special emphasis on conservation strategies for Rare and Threatened species.

BACKGROUND

This project was initiated in 2017. During 2018-19, two field tours were undertaken to the study areas during which a total of 379 field nos. were collected of which 253 species were identified. Collected 41 quadrates (0.1 ha.) were overlaid in different vegetation types and phytosociological data were recorded. Vegetation type and land use map were prepared by using Sentinel-2 satellite data & GIS.

AREA AND LOCALITY

Bassi Wildlife Sanctuary, (74° 45' to 74° 57' N and 24° 53' to 25° 06' E), Chittorgarh near Bassi village, Rajasthan, c. 138.69 sq. km.

SUMMARY AND ACHIEVEMENTS

Four botanical exploration tours were undertaken to the study area during which 956 Field nos. and germplasm of 12 rare and threatened species for *ex-situ* conservation were collected. Floristic survey and quadrat data collection has been carried out by using GIS maps and GRID maps. Overlaid 100 quadrates (0.1Ha) in different vegetation types and data recorded by using random sampling method. Prepared spatial (GIS) map of all the field numbers collected in different tours. A total of 894 field numbers were identified to 467 species, 312 genera and 96 families. In addition, one Herbarium consultation tour *w.e.f.* 30.09.2019 to 05.10.2019 was conducted to MLS University, Udaipur, and Govt. College, Bhilwara. Multiplication of 12 rare and threatened plants was carried out in Botanical garden at AZRC, Jodhpur. Finalization of Checklist of Flora is under process.

PROJECT-5

GIS mapping of EET (Endemic, Endangered & Threatened) species of Rajasthan

Executing Scientist (s): Dr. C. S. Purohit, Sh. Vinod Maina and Dr. Ramesh Kumar

Date of Initiation: May, 2017

Date to be completion: March, 2020

OBJECTIVE

Preparation of distribution maps of Endemic, Endangered and Threatened species of Rajasthan by GIS mapping.

BACKGROUND

This project was initiated in 2017. During 2018-19, one field tour was conducted during which 100 Field nos. of rare plants including Endemic plants of Rajasthan were collected

along with 34 live plants belonging to 08 species and introduced in the Botanical Garden of campus. In this period, a total of 54 plant specimens collected from the study area were identified and 16 species were documented.

AREA AND LOCALITY

Rajasthan is one of the largest state of India, occupying an area of about 3,42,274 sq.km, located between 23°3' – 30°12' N latitude and 69°30' - 78°17' E longitude. Phytogeographically, it forms the eastern extremity of great arid and semi-arid belt of the world; the Great Sahara Desert belt passes through the western part of the state.

SUMMARY AND ACHIEVEMENTS

Three field tours were conducted to 200 locations surveyed during which 60 RET plants were collected.

PROJECT-6

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

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

Date of Initiation:

Date to be completion: Ongoing

OBJECTIVE

Collection of RET and Economically important species germplasm and introduction in the experimental garden for *ex-situ* Conservation along with documentation of phonological data of plants growing in Desert Botanic Garden.

BACKGROUND

The experimental Botanic Garden (Desert Botanical Garden) of this centre has been established during 1994 with an area of c. 8 acres. The main objective of the garden for maintenance of arid germplasm collection, growing and multiplication of rare / endangered / threatened plant species of North-western arid regions of India. About 300 species of vascular plants and 4 gymnosperms including of them are rare, endemic and economically plants are conserved in the garden. During 2018-19, routine field tours were conducted to different parts of Rajasthan and Gujarat during which a total of 20 Rare and Threatened and 29 medicinal plant species were collected and introduced in the Desert Botanical Garden.

AREA AND LOCALITY

Rajasthan & Gujarat

SUMMARY AND ACHIEVEMENTS

During various field tours to Rajasthan and Gujarat a total number of 13 rare and threatened, 6 medicinal and 8 economically important plant species were collected and introduced in the Desert Botanical Garden along with 400 photographs. Initiation of *ex-situ* conservation of RET plants was started along with their multiplication and noting phenological data.

ARUNACHAL PRADESH REGIONAL CENTRE, ITANAGAR

PROJECT-1

Fern Family Pteridaceae of India (excluding Genus *Pteris*)

Executing Scientist (s): Dr. V. K. Rawat

Date of Initiation : August 2018

Date to be completion : March 2022

OBJECTIVE

Taxonomic study of the Fern family Pteridaceae of India.

BACKGROUND

The project was initiated on August 2018. In 2018-19, two field tours were conducted to different parts of Meghalaya and Arunachal Pradesh during which more than 500 field numbers were collected along with 367 field photographs and GPS data. Till now a total of 500 specimens were identified to 111 species and all the identified specimens were incorporated in the herbarium. 43 live plants were also collected for introduction in Garden and conservation. Preliminary report comprising of keys and description of 47 species under 18 genera was prepared. In addition, one Herbarium Consultation Tour was undertaken to CNH, ASSAM, BSA and identified 135 specimens.

AREA AND LOCALITY

India

SUMMARY AND ACHIEVEMENTS

Two field tours *w. e. f.* 17.09.19 to 23.09.19 and 10.01.20 to 15.01.20 were conducted to different parts of Meghalaya and East and West Kameng District of Arunachal Pradesh during which , more than 496 field numbers were collected along with 200 photographs and GPS Data. 37 Live plants were also collected for conservation purpose. 217 field numbers of previously collected specimens have been identified along with incorporation of field data in 231 herbarium sheets. Till now a total of 364 specimens have been identified to 126 species and all the identified specimens were incorporated into the herbarium. Preliminary Report comprising of keys and description of 126 species under 18 has been prepared. Approx. 689 field numbers (approximate 2 duplicates of each field numbers) have been collected and description of 67 taxa under 18 genera are prepared till date. This study reports four new records and one rediscovery from the state.

PROJECT-2

Materials of the Flora of Arunachal Pradesh Vol. 4

Executing Scientist (s): Dr. M.R. Debta, Dr. Krishna Chowlu, Dr. U.K. Tiwari and Dr R. Daimary

Date of Initiation : July 2019

Date to be completion : June 2020

OBJECTIVE

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

BACKGROUND

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

AREA AND LOCALITY

Arunachal Pradesh.

SUMMARY AND ACHIEVEMENTS

M.R. Debta: Listed 149 taxa and prepared manuscript for 35 taxa; work is under progress.

Dr. Krishna Chowlu: Consulted all relevant literature for the addition to the Flora of Arunachal Pradesh. This study reports two new species (*Stereochilus arunachlensis* Chowlu & A.N. Rao and *Dendrobium nageswarayanum* Chowlu) based on previous collection.

Dr. U. K. L. Tiwari: Manuscript has been prepared for 132 taxa and work is under progress.

Dr R. Daimary: Checklist of 13 plant species has been prepared for addition to the 'Flora of Arunachal Pradesh'.

BOTANIC GARDEN OF INDIAN REPUBLIC, NOIDA

PROJECT-1

Collection of plants for introduction in BGIR

Executing Scientist (s): Dr. Sandeep Kr. Chauhan & Dr. M. K. Kandwal

Date of Initiation : 2018 – 19

Date to be completion : Ongoing

SUMMARY AND ACHIEVEMENTS

29 tree species of about 501 plants were collected from BSI, SRC, Coimbatore, ANRC, Portblair, ERC Shillong and DRC, Hyderabad for introduction in BGIR. About 18 species of cactus were procured locally from NRC and from Chandigarh & Dehradun to introduce in Cactus garden. Some of the plants received from various centres of BSI are *Citrus aurantiifoli*, *Citrus lemon*, *Holoptelea integrifolia*, *Hardwickia binita*, *Saraca asoca*, *Mimusops elengi*, *Dillenia indica*, *Pterocarpus marsupium*, *Drimia nagarjunae*, *Whihania somnifera*, *Syzium alterniflorum*, *Litchi chinensis*, *Garcinia morella*, *Baccaurea ramiflora*, *Bentinckia nicobarica*, *Knema andamanica*, *Pavetta indica*, *Shorea talura*, *Shorea tumbaggia*, *Rhynchosia beddomei* etc.

PROJECT-2

Development of Database of Introduced Plants (Trees) of BGIR

Executing Scientist (s): Dr. M. K. Kandwal

Date of Initiation : 2018 – 19

Date to be completion : Ongoing

SUMMARY AND ACHIEVEMENTS

Database of 45 tree species has been completed as per the standard format depicting Taxonomic classification, habit, habitat, morphology of leaf, flower, fruit, seed, seed germination methodology and economic uses. Some of the completed species are *Azadirachata indica*, *Stereospermum chelonoides*, *Guettarda speciosa*, *Lagerstroemia speciosa* (zone 4), *Stereospermum chelonoides*, *Ceiba pentandra*, *Elaeocarpus sphaericus* (MPS), *Terminalia alata*, *Helicteres isora*, *Desmodium giganticum*

PROJECT-3

Documentation of Phenological Data of Flowering and Fruiting of the endemic tree and medicinal plant species growing in BGIR

Executing Scientist (s): Dr. Sandeep Kr. Chauhan & Dr. M. K. Kandwal

Date of Initiation : 2018 – 19

Date to be completion : Ongoing

SUMMARY AND ACHIEVEMENTS

Phenological data of 58 species has been recorded in respect of flowering period, fruiting and seed setting.

PROJECT-4

Propagation and multiplication of Threatened and Endemic Plants collected from various Lead and Small Botanic Garden under Assistance to Botanic Garden (ABG) Scheme

Executing Scientist (s): Dr. Sandeep Kr. Chauhan & Dr. M. K. Kandwal

Date of Initiation : 2017-18

Date to be completion : Ongoing

SUMMARY AND ACHIEVEMENTS

16 rare, threatened and endemic plant species have been procured from the Lead & Small Botanic Gardens and placed in conservatories for acclimatization. List of the RET species includes *Andrographis beddomei*, *Andrographis nallamalyana*, *Boswellia serrata*, *Butea monosperma*, *Capparis spiralis*, *Ceropegia bulbosa*, *Croton scabiosus*, *Cycas sphaerica*, *Cyacus beddomei*, *Dalbergia latifolia*, *Dechaschistia cuddapahensis*, *Eriolena lushingtonii*, *Hildegardia populifolia*, *Hymeodictyon populifolia*, *Madhuca indica* and *Phyllanthus narayanaswami*.

CENTRAL BOTANICAL LABORATORY, HOWRAH

PROJECT-1

Ethnobotanical study of some tribal populated Districts of Bihar, India

Executing Scientist (s) : Dr. K. A. A. Kabeer, Sri A.C. Halder, Sri R. Saravanan, Dr. (Mrs.) Monika Mishra, Dr. Pankaj A. Dhole and Sri Somnath Gangully
Date of Initiation : April, 2018
Date to be completion : March, 2022

OBJECTIVE

Collection, identification and documentation of traditional knowledge in some tribal populated districts of Bihar.

BACKGROUND

The state Bihar, covering approx. 5720 sq. km. of total forest cover, including 3372 sq. km. dense forest and 2348 sq.km. open forest, inhabited by 28 tribal groups, is rich in floristic as well as in ethnic diversity and ideal state from ethnobotanical point of view. The total population of tribes in the state is 7,58,351 of which Santhal is the largest tribal community (3,67,612) followed by Oraon (1,20,362), Kharwar (1,00,735), Gond (51,792), Munda (17,754), Lohara (13,993) etc. Although several works were completed on several aspects of ethnobotany on undivided Bihar, but presently most of the areas fall under the jurisdiction of Jharkhand and only sporadic works have been performed. This project was initiated in 2018. During 2018-19, one library consultation tour was undertaken to Tribal Research Institute (TRI), State Library, L.P. Vidyarthi Library and Jharcraft, Ranchi during which 139 relevant ethnobotanical references were collected.

AREA AND LOCALITY

Bihar

SUMMARY AND ACHIEVEMENTS

Four field tours *w.e.f.* 30.06.19 to 14.07.19, 12.09.2019 to 23.09.2019, 19.11.2019 to 03.12.2019 and 19.02.2020 to 05.03.2020 were conducted to Aurangabad, Madanpur, Maharajganj, Arwal, Purnea, Banmankhi, Katihar and Barsoi Forest Divisions of Aurangabad, Nawada, Araria, Kishanganj, Purnea, Katihar, Gaya and Nalanda Districts and surveyed a total areas of 10,000 sq.km. during which a total of 535 field nos. were collected along with 962 ethnobotanical information with the help of medicine man (Baidya or older village people). Among the recorded ethnobotanical uses, 358 were as medicinal uses, 173 as food, 33 as veterinary medicine, 66 as fodder, 46 as timber, 41 as fuel wood, 29 as tooth brush, 02 as plate making, 05 as furniture making, 11 as gum, 05 as thatching hut, 10 as broom making, 21 as religious uses, 01 as agricultural implement, 01 as fish catching implement, 09 as fish poison, 01 as bio-fencing, 03 as insect repellent, 01 as snake repellent, 01 as scrubber, 11 as socio-economic importance, 19 as rope making, 04 as mat, 03 as toys, 10 as country liquor or alcoholic beverage, 01 as basket making, 03 as pickle preparation, 05 as oil, 14 as dye, 06 as magico-belief and 67 as miscellaneous uses. During this period, more than 850 good quality

digital images of collected plants and their uses by tribal people were taken. 176 plant specimens have been identified, documented and 80 plant specimens have been mounted. This study has documented traditional method of processing of jute fiber (*San patua*) in Araria Dist., Bihar and some less known uses of ethno-medicinal plants like *Callicarpa tomentosa* (L.)L. (Lamiaceae), *Melastoma malabathricum* L. (Melastomaceae), *Argemone ochroleuca* Sweet (Papaveraceae), *Marsilea aegyptica* Willd. (Marsileaceae), *Tamarix ericoides* Rottler & Willd. (Tamaricaceae) etc. A total of 03 exhibits have been collected for ethnobotanical museum.

PROJECT-2

Chromosome count of Genus *Impatiens* of Sikkim/Darjeeling

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

OBJECTIVE

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

BACKGROUND

The genus *Impatiens* belongs to the family Balsaminaceae and occurs mostly in tropical and subtropical regions growing in moist and shady places generally. In India, it is distributed well in Western Himalayas (North India), the hills of north Eastern States and Western Ghats (South India). *Impatiens* species are extremely variable and taxonomically difficult. The specific limits for these species are not always clear due to complexity in evolution and accordingly the taxonomy of the group is also in a state of confusion. Although the Himalayan region represents the centre of origin of the genus, cytological information on Himalayan *Impatiens* is scanty. As per the available literature so far, this genus is cytologically variable. Numerous aneuploid and euploid series are found in this group. Since the Himalaya is one of the most important region to study for obtaining better understanding of the chromosomal evolution in *Impatiens*, and also the taxonomy of the Himalayan *Impatiens* is very confusing, this study of chromosome number of Sikkim-Darjeeling Himalayas have been undertaken. In 2018-19, cytological investigation of five *Impatiens* species was carried out through meiotic study.

AREA AND LOCALITY

Sikkim and Darjeeling

SUMMARY AND ACHIEVEMENTS

Meiotic studies of nine *Impatiens* species have been completed which are enumerated below:

***Impatiens exilis* Hook.f.** (n=7): It seems to be diploid. Earlier workers (as per literature available online) reported this species as tetraploid having n=14

***Impatiens radiata* Hook.f.** (n=9)

***Impatiens discolor* DC.** (n=10)

***Impatiens spirifer* Hook. f. & Thomson:** Chromosome number in this species could not be studied because no dividing cells were noticed during study.

***Impatiens drepanophora* Hook.f.** (n=9)

***Impatiens scabrida* Hook. f.** (n=8): Earlier reported (as per literature available online) chromosome number in this species is n=7

***Impatiens racemosa* DC.** (n=9)

***Impatiens sulcata* Wall.** (n=9): Earlier reported (as per literature available online) chromosome number in this species is n=10

***Impatiens pulchra* Hook. f. & Thomson:** Chromosome number in this species could not be studied because no dividing cells were noticed during study.

This study reports different/new chromosome numbers for 03 *Impatiens* species viz. *I. exilis*, *I. scabrida* and *I. sulcata*.

PROJECT-3

Study of Micro-algae and monitoring of water quality of all lakes of AJCBIBG

Executing Scientist (s) : Dr. Pratibha Gupta

Date of Initiation : August 2019

Date to be completion : August 2020

OBJECTIVE

to study the periodicity, succession, distribution and analysis of Physico-chemical parameters of Micro-algae of Prain Lake, King Lake and Jora Pipe area to see the alteration in Micro-algal diversity and its abundance, both qualitatively and quantitatively in polluted environment. An attempt has been made to study the Micro-algae of Prain Lake, King Lake and Jora Pipe area.

BACKGROUND

All the Lakes of AJC Bose IBG, Howrah are interconnected and it has been observed that sewage / polluted water is being continuously entering from outside into the Prain Lake and King Lake through Jora Pipe area. This is a new project.

AREA AND LOCALITY

Lakes of AJCBIBG

SUMMARY AND ACHIEVEMENTS

All the interconnected Lakes of AJC Bose Indian Botanic Garden, Howrah have been surveyed which are continuously receiving efflux of sewage / polluted water from outside in to the Prain Lake and King Lake of the AJC Bose Indian Botanic Garden through Jora Pipe area. In this period, nine field visits were conducted during which total 90 numbers of water samples were collected for Microscopic studies along with 573 field photographs, 53 videos and GPS data. All the samples were brought into the Laboratory and preserved in Formalin and properly maintained for identification. Water Samples were analysed under Leica DM 2500 sophisticated Research Microscope using Leica Qvin 3.2 Image Analysis Software and Leica Application Suit V4 Software with annotation for Identification and 468 Photomicrographs were taken. Multiparameter water Proof Meter has been successfully

installed in BSI, 36 readings of each parameter of the samples from King Lake, Prain Lake and Jora Pipe Area were recorded after installation and analysed 08 parameters viz. pH, ORP, EC, TDS, Salinity, DO, Pressure and Temperature at a time. It has been observed that DO reading is below the permissible limit in Prain Lake and Jora Pipe area but much better in King Lake which is due to entering of sewage/ polluted water from outside into Prain Lake through Jora Pipe area and is almost completely covered with aquatic Macrophytes. Species observed in the samples like *Craticula halophila* (Grunow) D.G.Mann, *Fragilaria capucina* Desmazieres, *Fragilaria pinnata* Ehrenb., *Gomphonema angustum* C.Agardh, *Gomphonema minutum* (C. Agardh) C. Agardh, *Nitzschia communis* Rabenh, *Nitzschia vermicularis* (Kütz.) Hantzsch, *Pinnularia subcapitata* W.Gregory are water quality and pollution indicator. *Gomphonema parvulum* (Kütz.) Kütz, *Navicula veneta* Kütz., *Navicula viridula* var. *rostellate* (Küetz.) Cleve, *Nitzschia palea* (Kütz.)W.Smith, *Ulnaria ulna* (Nitzsch) Compère (*Synedra ulna* (Nitzsch) Ehrenb.) are pollution tolerant species, are dominant in the sample.

During this study, altogether 177 species have been identified of which 06 species namely *Gloeocapsopsis chroococcoides* (Nováček) Komárek, *Chroococcus ercegovicii* Komerk et Anagn., *Asterocapsa badia* Komárek, *Coelosphaeriopsis chlamydocystis* (Skuja) Komarek et Anagn., *Caloneis molaris* (Grunow) Krammer, *Caloneis macedonica* Hustedt are new record from India. Besides, *Oscillatoria sancta* Kütz. ex Gomont, an interesting species contains antibiotic activity against number of Bacterial and Fungal species, has been reported in the sample.

PROJECT-4

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

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

OBJECTIVE

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

BACKGROUND

The project was initiated in 2018.

AREA AND LOCALITY

N.E. India

SUMMARY AND ACHIEVEMENTS

A tour *w.e.f.* 28.01.2020 to 31.01.2020 was conducted to ERC, BSI to avail fluorescence microscopy and carry out Hemolytic toxicity, Hepatotoxicity and Genotoxicity studies of sixty plants. During this period, anti-nutrient composition, Oxalate estimation, Phytate content, Saponin content, Tannin content and Cyanogenic glycosides of 65 wild edible plants have been studied, quantitative estimation of Phenolic acids and flavonoids (Rutin, quercetin, kaempferol, apigenin, myricetin, gallic acid, catechin, ferulic acid, coumarin, naringin, p-

hydroxybenzoic acid, protocatechuic acid, gentisic acid, vanillic acid, aesculin, caffeic acid, syringic acid, p-Coumaric acid, naringenin, salicylic acid, ellagic acid, luteolin, and sinapic acid) content have been carried out in thirty wild edible plants using HPLC along with estimation of water soluble vitamin (Vit C, Vit B1, Vit B2, Vit B3, Vit B5, Vit B6 and Vit B9) in thirty plant samples. This study reports the lowest oxalate content in *Solanum kurzii* (0.086%) and highest in *Terminalia bellerica* (0.792%), Phytate content ranges between 0.16 (*Diplazium esculentum*) to 0.56% (*Ficus geniculata*), range of saponin, tannin and cyanogenic glycosides have been estimated between 0.016-0.228%, 0.036-1.94% and 0.00043-0.0091% respectively. The level of antinutrients in the investigated plants was very low and may not cause any harmful effect on human beings. All the investigated plants have been found to contain the phenolic acids and flavonoids in varying amounts. The fruits of *Perkia roxburghii* and nuts of *Castanopsis indica* have showed the presence of significant amount of Gallic acid 37.02 and 14.67 mg/gm dry extract respectively for which they might be used as anticarcinogenic, antimicrobial, antimutagenic, antiangiogenic and anti-inflammatory agents. Very high amount of Protocatechuic acid in *Viburnum foetidum* (65.08 mg/gm Dry extract) helps in prevention and therapy of various oxidative stress related diseases such as neurodegenerative and hepatic diseases. In this study, good amount of Vitamin C have been detected in the fruits of *Eleagnus pyriformis* (95.54 mg/100gm Dry plant materials DPM), *Myrica esculenta* (75.70 mg/100gm DPM), *Flemingia vestita* (61.51mg/100gm DPM), nut of *Castanopsis indica* has been found to contain excellent amount of Vitamin B9. The Vitamin B1, B2, B3, B5 and B6 obtained in the investigated plants are very much comparable with common vegetables and fruits and regular consumption would supply adequate vitamins necessary to regulate numerous body functions, nervous system optimal maintenance of fat and also plays an important role as an antioxidant *in vivo*, both by preventing the adverse effect of reactive oxygen species (ROS), as well as by inhibiting lipid peroxidation. The percentage viability of RBC and hepatocytes cell for all plant extracts at all concentrations (100-1000µg/ml) were very much comparable to the negative control (100.18%) whereas the percentage viability of both RBC and hepatocytes cell using H₂O₂ (Positive control) at a concentration 200µM were less than 50%. The outcome of genotoxicity study has demonstrated that Olive tail moment (OTM) of the aqueous concentrate of all investigated plants at a concentration of 1000 µg/ml falls within the range of 2.11- 5.09. The OTM value 1.79 has been acquired utilizing negative control and positive control (mixture of whole blood, RPMI 1640 and 200 µM H₂O₂) showed OTM 21.38. The consequences of haemolytic poisonous quality, cytotoxicity and genotoxicity of fluid concentrates of every edible plant uncovered that these are non-harmful at cell and genomic level and furthermore safe to consume.

CENTRAL NATIONAL HERBARIUM, HOWRAH

PROJECT-1

Angiospermic flora of Neora Valley National Park, Darjeeling District, West Bengal

Executing Scientist (s) : Dr. Vinay Ranjan, Dr. Anant Kumar, Dr. Gopal Krishna
Date of Initiation : April 2017
Date to be completion : March 2021

OBJECTIVE

To study floristic diversity of Neora Valley National Park, Darjeeling District

BACKGROUND

This project was initiated in 2017. In 2018-19, three field tours were undertaken and survey of Reshit Beat, Lava 7 & 8, Rolbong 3, Rashet 1,2,3,4,5, 3C, 3B, Amblok Beat, Doley Beat and Kuwapani was completed during which 497 field nos. were collected.

AREA AND LOCALITY

Neora Valley National Park, Darjeeling District, c. 159 sq.km.

SUMMARY AND ACHIEVEMENTS

Three field tours *w.e.f.* 26.03.2019 to 09.04.2019, 24.05.2019 to 06.06.2019 and 17.09.2019 to 30.09.2019 were conducted to the study areas during which 543 field numbers were collected in duplicate along with GPS data and 1747 photographs. All the collected specimens have been processed and 343 field numbers have been identified so far. This study reports two orchids, *Oreorchis patens* and *Epipogium japonicum* as new to state and new to India respectively.

PROJECT-2

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

Executing Scientist (s) : Dr. Avishek Bhattacharjee
Date of Initiation : 2018
Date to be completion : 2021

OBJECTIVE

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

BACKGROUND

The project was initiated in 2018. In 2018-19, one field cum Herbarium Consultation Tour was conducted in West District of Sikkim and Darjeeling District of West Bengal during which 22 specimens belonging to the genus were studied and taxonomic account of six species was prepared.

AREA AND LOCALITY

India

SUMMARY AND ACHIEVEMENTS

Two field tours *w.e.f.* 11.9.19 to 19.9.19 and 10.11.19 to 18.11.19 have been conducted to Uttarakhand and South India respectively during which three species *viz.* *Gastrochilus acutifolius* (Lindl.) Kuntze, *G. inconspicuus* (Hook.f.) Kuntze and [*Gastrochilus flabelliformis* (Baltt. & McCann) C.J. Saldanha (earlier misidentified as *G. acaulis* (Lindl.) Kuntze)] have been collected. Besides Herbarium Consultation Tour have been undertaken to BSD, DD, MH and TBGT during which total 289 specimens of *Gastrochilus* (Orchidaceae) have been studied. Description of 20 species *viz.* *Gastrochilus acaulis* (Lindl.) Kuntze, *G. affinis* (King & Pantl.) Schltr., *G. acutifolius*, *G. arunachalensis* A.N. Rao, *G. bellinus* (Rchb. f.) Kuntze, *G. calceolaris*, *G. dasypogon* (Sm.) Kuntze, *G. distichus*, *G. flabelliformis*, *G. garhwalensis* Z.H. Tsi, *G. inconspicuus*, *G. intermedius* (Griff. ex Lindl.) Kuntze, *G. linearifolius* Z.H. Tsi & Garay, *G. nilagiricus* Kuntze, *G. obliquus* (Lindl.) Kuntze, *G. platycalcaratus* (Rolfe) Schltr., *G. pseudodistichus* (King & Pantl.) Schltr., *G. rutilans* Seidenf., *G. sessanicus* A.N. Rao and *G. sonamii* Lucksom have been drafted.

PROJECT-3

Bryoflora of Jharkhand

Executing Scientist (s): Dr. Devendra Singh

Date of Initiation: 2018

Date to be completion: 2022

OBJECTIVE

Study of Bryophyte diversity of the state of Jharkhand.

BACKGROUND

One field tour was undertaken in different areas of the state Jharkhand during which 186 specimens of bryophytes were collected along with 2650 photographs. A total of 44 specimens belong to 21 species of liverworts, hornworts and mosses were identified along with preparation of 13 species. Besides oil bodies of 06 freshly collected species were studied. A checklist of bryophytes of Jharkhand were prepared and nomenclature of all taxa were updated.

AREA AND LOCALITY

Jharkhand

SUMMARY AND ACHIEVEMENTS

Two field tours *w.e.f.* 30.10.2019 to 12.11.2019 and 18.02.2020 to 27.02.2020 were conducted to different study areas of the state of Jharkhand of which one tour was undertaken to Rajmahal Hills *viz.* Pakur (Hiranpur, Littipara, Labda Ghati, Kanchan Gupha, Kunjbona, Makari Pahad, Satia, Gamaria), Dumka (NC Charch campus, Durgapur, Kathikund, Masanjor Dam, Durbarpur, Jitpur, Chaklata, Bagnal, Hansdiha), Godda (Daldali, Sundarpahari, Aamgadha, Pahadpur, Mohanpur, Chanda, Majitola, Damaru) and Sahibganj (Madansahi, Motijharana, Maharajpur, Karanpura, Jhaja tola, Taljhari, Jaskuti, Tin Pahad, Brindavan, Rajmahal, Radhanagar, Shivagadi, Barharawa) and second tour was conducted to Betala, Aoranga river bank, Koyal river bank, Khechaki, Chipadohar, Mahuwadnar, Garu, Sirasi mod, Upper Ghangari, Lower Ghangari, Tahir, Netarhat, Banari, Ghangara, Marada river,

Sundaridih, Palkot, Keratoli, Pithartoli, Sizang during which 199 specimens were collected. During this period, a total of 107 specimens belonging to 47 species of bryophytes collected from Jharkhand have been identified along with preparation of illustrations, microphotographs and description of 30 species belonging to 15 families and 20 genera viz. viz. *Anthoceros punctatus* L., *Asterella wallichiana* (Lehm. & Lindenb.) Pande, K.P. Srivast. & Sultan Khan ex Grolle, *Bryum coronatum* Schwaegr, *Bryum pseudotriquetrum* (Hedw.) Schwaegr, *Cololejeunea latilobula* (Herzog) Tixier, *Cyathodium aureonitens* (Griff.) Mitt., *Erpodium mangifereae* Müll. Hal., *Fissidens crenulatus* Mitt., *F. sylvaticus* Griff., *Funaria hygrometrica* Hedw., *Hydrogonium arcuatum* (Griff.) Wijk. & Marg., *H. gracilentum* (Mitt.) P.C. Chen. *Hyophila involuta* (Hook.) A. Jaeger, *H. nymaniana* (Fleisch.) Menzel, *Lejeunea devendrae* (Sushil K. Singh) P.K.Verma & K.K.Rawat, *Lopholejeunea sikkimensis* Steph., *Notothylas kashyapii* D.K.Singh, *Octoblepharum albidum* Hedwig., *Plagiochasma appendiculatum* Lehm. & Lindenb., *Riccia billardierei* Mont. & Nees, *R. curtisii* (James ex Austin) Austin, *R. frostii* Austin, *R. huebeneriana* Lindenb., *Riccia perssonii* Sultan Khan, *R. sorocarpa* Bisch., *Solenostomata stephanii* (Schiffn.) Amakawa, *S. tetragonum* (Lindenb.) R.M.Schust. ex Vána & D.G. Long, *Solmsiella biseriata* (Austin) Stree, *Spruceanthus minutilobulus* (Udar & U.S. Awasthi) Sushil K. Singh, *Targionia hypophylla* L. In addition, oil-bodies of 6 species [(*Cololejeunea latilobula* (Herzog) Tixier, *Lopholejeunea sikkimensis* Steph., *Lejeunea devendrae* (Sushil K. Singh) P.K.Verma & K.K.Rawat, *Solenostoma tetragonum* (Lindenb.) R.M.Schust. ex Vána & D.G. Long, *Spruceanthus minutilobulus* (Udar & U.S.Awasthi) Sushil K. Singh from freshly collected specimens have been studied. This study reports *Solmsiella biseriata* (Austin) Stree as new record from **Central India** and 05 species viz. *Fissidens crenulatus* Mitt., *F. sylvaticus* Griff., *Hyophila nymaniana* (Fleisch.) Menzel, *Lejeunea devendrae* (Sushil K. Singh) P.K. Verma & K.K. Rawat, *Solenostoma tetragonum* (Lindenb.) R.M.Schust. ex Vána & D.G. Long as new record from Jharkhand.

PROJECT 4

Liverworts and Hornworts Flora of Darjeeling District, West Bengal.

Executing Scientist (s): Dr. Monalisa Dey

Date of Initiation: 2016

Date to be completion: 2021

OBJECTIVE

Survey and documentation of diversity of liverworts and hornworts of Darjeeling District, West Bengal.

BACKGROUND

Two field tours were conducted to various localities of study area (Mouchuki, Todey, Rongo forest, Paren, Jhandi, Charkhole, Sittong, Mangpoo, Latpanchar etc.) during which 254 field numbers were collected of which 179 specimens belonging to 29 species were identified. Besides illustration of 08 species were completed.

AREA AND LOCALITY

Mirik, Okayti, Gopaldhara, Simana, Sukhia, Jorepokhri, Bungkulung, Kurseong, Bagora, Chimney village, Sonada, 11 Mile, Senchal lake area.

SUMMARY AND ACHIEVEMENT

During the period, one field tour *w.e.f.* 28.10.2019–09.11.2019 was conducted to various localities of Darjeeling District of West Bengal during which 98 field numbers of specimens were collected. 211 specimens belonging to 38 species collected by self from Darjeeling District, West Bengal have been identified. Studied camera lucida illustration and microphotography of 07 species, viz. *Cheilolejeunea trapezia* (Nees) Kachroo & R.M.Schust., *Cololejeunea latilobula* (Herzog) Tixier, *Cololejeunea trichomanis* (Gottsche) Steph., *Drepanolejeunea angustifolia* (Mitt.) Grolle, *Drepanolejeunea erecta* (Steph.) Mizut., *Lejeunea tuberculosa* Steph., *Microlejeunea punctiformis* (Taylor) Steph.

CENTRAL REGIONAL CENTRE, ALLAHABAD

PROJECT-1

SEM studies of the species belonging to family Acanthaceae available at BSA

Executing Scientist (s) : Dr. Nitisha Srivastava

Date of Initiation : September 2018

Date to be completion : March, 2021

OBJECTIVE

Scanning Electron Microscopic studies of seed and epidermal features of the species belonging to the family Acanthaceae available at BSA herbarium

BACKGROUND

The project was initiated in 2018. In previous year, epidermal features of both surfaces (abaxial and adaxial) of leaves of ten species and seed epidermal details of four species of the family Acanthaceae were studied in SEM.

AREA AND LOCALITY

The jurisdiction of CRC viz. Chhattishgarh, Madhya Pradesh and Uttar Pradesh.

SUMMARY AND ACHIEVEMENTS

Study of leaf epidermal morphology of both surfaces (abaxial and adaxial) has been carried out for 17 species of the family Acanthaceae housed at BSA herbarium through Scanning Electron Microscopy. List of the completed species are *Blepharis integrifolia* (L.f.) E. Mey. & Drège ex Schinz, *B. maderaspatensis* (L.) B. Heyne ex Roth, *Dyschoriste nagchana* (Nees) Bennet, *D. vagans* (Wight) Kuntze, *D. erecta* (Burm.f.) Kuntze, *Hygrophila auriculata* (Schumach.) Heine, *H. erecta* (Burm. F.) Hochr., *H. polysperma* (Roxb.) T. Anderson, *H. ringens* (L.) R. Br. ex Spreng., *Lepidagathis fasciculata* (Retz.) Nees, *L. hamiltoniana* Wall., *L. incurva* Buch.-Ham. ex D. Don, *L. trinervis* Nees, *L. purpuricaulis* Nees, *L. cristata* Willd., *Rungia pectinata* (L.) Nees, *R. repens* (L.) Nees. Besides, detailed study of morphology of Seed of following three species were also carried out viz., *Dyschoriste erecta* (Burm.f.) Kuntze, *D. vagans* (Wight) Kuntze and *Hygrophila polysperma* (Roxb.) T. Anderson.

PROJECT-2

Revision of Genus *Adiantum* L. (Adiantaceae) in India

Executing Scientist (s) : Dr. Brijesh Kumar

Date of Initiation : April, 2016

Date to be completion : March, 2020

OBJECTIVE

Revisionary study of the genus *Adiantum* L. in Indian context

BACKGROUND

This project was initiated in 2016. In previous years, checklist of c. 38 taxa under the genus *Adiantum* L. was updated along with nomenclature data of 20 species. A total of 25 Species were described along with their updated distribution data. One field tour to different areas of Chamoli and Rudraprayag districts of Uttarakhand was undertaken and total 110 field nos. were collected along with good quality field photographs. Three herbarium consultation tours to various herbaria viz., BSA, CAL, BSHC, ARUN, ASSAM and GUBH were carried out during which a total 796 herbarium specimens were examined and studied, among these 674 specimens were reconfirmed and 122 specimens were determined/Identified.

AREA AND LOCALITY

India

SUMMARY AND ACHIEVEMENTS

Two herbarium and library consultation tours w.e.f. 17.9.2019 -04.10.2019 and 0.12.2019-01.01.2020 to DD, BSD, PAN, PUN and LWG respectively during which total 730 specimens have been studied of which 642 specimens have been re-examined and 88 specimens have been determined/ Identified. Type specimens of *A. philippense* subsp. *intermedium* S.C. Verma & Fraser-Jenk. and *A. philippense* subsp. *teestae* S.C. Verma & Fraser-Jenk (Holotype) have been studied. Final manuscript is under preparation.

DECCAN REGIONAL CENTRE, HYDERABAD

PROJECT-1

Flora of Manjeera Wildlife Sanctuary, Telangana

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

OBJECTIVE

Botanical exploration and documentation of the floral diversity of Manjeera Wildlife Sanctuary, Telangana

BACKGROUND

Manjeera Wildlife Sanctuary, covering an area of 20 sq. km., located in Sangareddy District of Telangana, India (17°57'52"N 78°02'22"E), is a fresh water ecosystem. The man-made reservoir was notified as wildlife sanctuary on 20th May 1978 to conserve marsh crocodiles, fresh water terrapins and other water birds. The riverine ecosystem has many small islets viz. Puttigadda, Bapangadda, Sangamadda, Karnamgadda, which harbor good vegetation and the extensive marshy fringes act as nesting sites for water birds.

AREA AND LOCALITY

Sangareddy district, Telangana

SUMMARY AND ACHIEVEMENTS

Two plant explorations tours *w.e.f.* 26.08.19 to 31.08.19 and 11.12.19 to 15.12.19 have been undertaken to Bapangadda, Peddagaddu, Puddigadda, Policegadda, Nizampurgadda, Mubarakpur, Nizampur, Kolukoor, Pottipalli, Yettigaddasangam, Singur dam, Gangojipet and Gongulur of Manjeera Wildlife Sanctuary during which a total of 291 field numbers have been collected among which 70 field numbers have been identified up to species level. One Herbarium Consultation Tour *w.e.f.* 15.02.20 to 21.02.20 was conducted to CAL, Howrah and consulted specimens of Poaceae and Lauraceae.

PROJECT-2

Grasses of Telangana

Executing Scientist (s) : Mr. Nagaraju Siddabathula
Date of Initiation : April 2019
Date to be completion : March 2022

OBJECTIVE

Study of grass flora of Telangana

BACKGROUND

The state of Telangana, covering an area of c. 114,840 sq. km., lies between 15°50'-19° 55' N and 77° 14'-78° 50' E. Earlier literature Reddy & Reddy (2018 & 2019) documented c. 228 grass species. The present project was proposed to make a comprehensive study on this

family to fill the gap areas by exploring the under and un explored areas for bringing out a dedicated taxonomic study of Poaceae.

AREA AND LOCALITY

Telangana State

SUMMARY AND ACHIEVEMENTS

Four field tours and two Herbarium Consultation Tours have been conducted to different regions of the state during which about 190 field nos. have been collected and identified. A total of 107 descriptions have been drafted.

PROJECT-3

Flora of Kinnerasani Wild Life Sanctuary, Telangana

Executing Scientist (s) : Dr. J. Swamy

Date of Initiation : 2019

Date to be completion : 2022

OBJECTIVE

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

BACKGROUND

The Protected Areas (PAs) in the Telangana State include three National Parks, two Tiger Reserves and seven Wildlife Sanctuaries. These PAs harbour much of the representative flora of the State. As detailed floristic studies have not been undertaken intensively so far in most of these protected areas, the study of the flora of Kinnerasani Wildlife Sanctuary is proposed. Kinnerasani Wildlife Sanctuary, named after the name of the river, Kinnerasani, lies between 17.58330⁰ (17⁰.35') and 18.00000⁰ (18⁰.00'") N and 80.41667⁰ (80⁰-25') and 80.50000⁰ (80⁰-30') E, was established in 1977 for *in-situ* conservation of native biodiversity.

AREA AND LOCALITY

Bhadradi –Kothagudem District of Telangana State, Kinnerasani Wildlife Sanctuary, c. 635.41 Sq. Km

SUMMARY AND ACHIEVEMENTS

Four field tours have been conducted during which 420 field numbers have been collected of which 120 field numbers have been identified.

EASTERN REGIONAL CENTRE, SHILLONG

PROJECT-1

Flora of Nagaland [Vol. I & II]

Executing Scientist (s) : Dr. A.A. Mao, Dr. N. Odyuo & Dr. D.K. Roy
Date of Initiation : April, 2016
Date to be completion : March, 2021

OBJECTIVE

Documentation of vascular plant resources in the state of Nagaland

BACKGROUND

The project was initiated in 2016. During previous year, two botanical exploration tours were conducted and total of 704 field numbers were collected along with 336 live plant samples for introduction in Experimental Botanical garden, BSI, ERC, Barapani, Shillong.

AREA AND LOCALITY

Nagaland; c. 16579 sq. Km.

SUMMARY AND ACHIEVEMENTS

Two field tours *w.e.f.* 12.08.2019 to 31.08.2019 and 31. 10. 19 to 23. 11. 2019 have been conducted to Phek, Wokha and Mokokchung districts of Nagaland during which 631 field numbers have been collected of which total 172 taxa have been identified. Description of 148 species has been completed along with proper citation, phenology and distribution. A total of 397 live plants have been collected for introduction in the Experimental Garden of Botanical Survey of India, ERC. This study reports 03 new taxa for science.

PROJECT-2

DNA barcoding and phylogenetic analysis of 20 selected endemic species of North-east India and phytochemical screening of 11 medicinal plants.

Executing Scientist (s) : Dr. Deepu Vijayan & Dr. Dilip Kr Roy
Date of Initiation : April, 2017
Date to be completion : March, 2020

OBJECTIVE

DNA barcoding of selected endemic species, Phytochemical screening of selected medicinal plants

BACKGROUND

Genomic DNA was extracted from *Pyrenaria chirapunjeana*, *Rhododendron johnstoneanum*, *Rhododendron formosum*, *Sonorella squarrosa*, *Sonorella maculata*, *Osbeckia capitata*, *Bulbophyllum odoratissimum*, *Melastoma* sp., *Cymbidium elegans*, *Denfrasium* sp., *Pyrenaria chirapunjeana*, *Oxyspora vagans*, *Medinilla erythrophylla*, *Pyrenaria khasiana* var. *lakhimpurensis*, *Habenaria* sp., *Platanthera* sp. and the extracted DNA was quantified on 0.8% agarose gel and documented. Field tours were conducted to Pungtung Reserve forest,

Dawki, Meghalaya, Assam and Arunachal Pradesh during which seedlings and mature fruits of two endemic species viz, *Pyrenaria barringtoniifolia* and *Pyrenaria khasiana* var. *lakhimpurensis* were collected for *ex situ* conservation and tissue culture, population status, distribution patterns in the located sites (Sonai Rupai Wildlife Sanctuary and Bogali Reserve Forest), documentation of mature individuals and seedlings of different age groups as well as their area of occupancy and extent of distribution. Medicinal plants namely *Stemona tuberosa*, *Natsiatum herpeticum*, *Aristolochia* spp. were collected for the phytochemical analysis. Qualitative phytochemical analysis of 12 plants was carried out to check the presence of bioactive compounds (proteins, carbohydrates, flavonoids, saponins, glycosides, phenols and tannins, steroids and terpenoids) using standard methodology. Besides solvent extraction of four plants (*Pyrenaria barringtonifolia*, *Pyrenaria camelliflora*, *Ficus auriculata* and *Syzygium megacarpum*) was completed using Soxhlet apparatus and Rotary Evaporator along with processing of the plant samples of *Mahonia napaulensis* DC (fruits and seeds), *Ficus auriculata* (fruits) and *Debregeasia longifolia* (fruits) by washing, drying and grinding and quantitative phytochemical analysis of *Pyrenaria barringtonifolia* using U.V spectroscopy by Folin-Ciocalteu reagent method.

AREA AND LOCALITY

North East India

SUMMARY AND ACHIEVEMENTS

A local field trip on 04.11.2019 was undertaken to Dawki, Meghalaya and collected several live plants (*Argostemma khasiana*, *Stemona tuberosa*, *Hedychium flavescens* and *Hedychium* sp. etc.). Subculturing of *in vitro* raised plants of *Pyrenaria khasiana* was carried out in Woody Plant Medium (WPM) and transferred 260 nos. of plants for acclimatization in the greenhouse. PCR amplification of extracted genomic DNA using chloroplast based DNA barcodes has been completed along with PCR product sequencing of PCR amplified DNA for phylogenetic analysis. DPPH radical scavenging activities of *Pyrenaria barringtonifolia* (leaves), *P. camelliflora* (leaves), *P. var. lakhimpurensis* (leaves) have been completed. ABTS radical scavenging activities of *Pyrenaria barringtonifolia* (leaves), *P. camelliflora* (leaves), *P. var. lakhimpurensis* (leaves) have been completed. Crude extracts of selected medicinal plants are outsourced for LC-MS analysis.

PROJECT-3

Micropropagation of EET Plants of North East India Phase-II

Executing Scientist (s) : Dr. Deepu Vijayan & L. Ibemhal Chanu
Date of Initiation : April 2015
Date to be completion : Ongoing

OBJECTIVE

Standardization of *in vitro* propagation protocol, mass multiplication, of EET Plants of North East India namely *Rhododendron coxianum*, *Ilex khasiana* and *Paphiopedilum hirsutissimum*.

BACKGROUND

The project was initiated in 2015. During the previous years, protocol development, statistical analysis and micropropagation of *Armadorum senapatianum*, *Rhododendron coxianum* and *Cymbidium tigrinum* were completed. Some new *in-vitro* seed germination was successful for *Ilex khasiana* and *Armadorum senapatianum*.

AREA AND LOCALITY

North East India

SUMMARY AND ACHIEVEMENTS

***Cymbidium tigrinum*:** Plant genomic DNA has been isolated from *Cymbidium tigrinum* for molecular taxonomic work. For this purpose leaf samples from three different localities have been taken and sent for PCR product sequencing for primers *viz.*, rbcL-a F and R, Maturase K (mat K) -390 F, Mat K 1326 R. About 300 seedlings of the above species are being multiplied in tissue culture laboratory. Approx. 100 seedling, earlier transferred from lab to land, are survived in the National Orchidarium, Shillong, attained a height of 10-12 cm and are under continuous observation. All the plates, botanical illustrations and paintings of *Cymbidium tigrinum* have been completed.

***Armadorum senapatianum*:**

Plant genomic DNA was isolated from *Armadorum senapatianum* for molecular taxonomic work. For this purpose leaf samples from three different localities were taken and sent for PCR product sequencing for primers *viz.*, rbcL-a F and R, Maturase K (mat K) -390 F, Mat K 1326 R. Approx. 85 seedling, earlier transferred from lab to land, are surviving in the National Orchidarium, Shillong, attained a height of 10-17 cm and are under continuous observation. All the plates, botanical illustrations, paintings of *Armadorum senapatianum* have been completed along with SEM analysis of seed.

***Rhododendron coxianum*:**

Approx. 50 seedlings of *Rhododendron coxianum*, earlier transplanted from lab to land to the garden of Botanical Survey of India Shillong, have been acclimatized and growing healthy.

***Ilex khasiana*:**

In-vitro seed germination has been successful and 20 seedlings have been transferred from lab to land.

***Paphiopedilum hirsutissimum*:**

In-vitro seed germination of *Paphiopedilum hirsutissimum* recently collected from Khonghampat, Orchidarium, Manipur are set and is under observation.

All the parameters of the present work have been studied except sequencing and also for genetic diversity Inter-Simple Sequence Repeat (ISSR Markers is under progress).

PROJECT-4

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

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

OBJECTIVE

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

BACKGROUND

The Experimental Botanic Garden, BSI, ERC, Umiam [Barapani], with an area of c. 25 acres, caters to the *ex-situ* conservation of plants of North-east India and conserve about 500 species of vascular plants, 13 gymnosperms, 75 pteridophytes and 53 bryophytes of North-East India many of them are rare, endemic and economically important. This project was initiated in for enrichment of the flora of the garden with particular reference to EET and other economically important plants. During 2018-19, two field tours were conducted to different areas of Manipur and Meghalaya during which 251 live plant species were collected including 68 RET species. Besides 405 plant specimens belonging to 26 species were collected from six local field tours for introduction in EBG, 971 seedlings were developed from 18 plant species, 1695 plants were developed from 17 species by cutting method, 6580 seeds of 12 plant species were sown in germination beds and 82 orchid plantlets were propagated from parent plants.

AREA AND LOCALITY

The entire Northeastern states of India

SUMMARY AND ACHIEVEMENTS

One field tour *w.e.f.* 14.10.19 to 18.10.19 has been conducted to East Khasi Hills district, Meghalaya during which 24 Field numbers comprising of 76 EET plant species have been collected. Beside one local field trip has been undertaken to Pinebrook Umbang Forests, Ri-Bhoi and collected 16 plant species with special emphasis to EETs. Phenological data of flowering and fruiting of 176 plant species in EBG has been observed and recorded. A new plant sections *viz.* Gymnosperms, Impatiens and Theaceae has been established in the garden along with beautification and revamping in few earlier established sections and pathways through initiation of Rock Garden sections and paving of paths for foot trek. A total of 2642 plant seedlings/saplings have been raised along with propagation of 481 orchid plantlets from parent plants for multiplication purpose. 2059 numbers of plant seedlings/saplings have been distributed for plantation purpose.

BSI HEADQUARTER, KOLKATA

A. PUBLICATION SECTION

PROJECT-1

Interpretations of Roxburgh's Icons in respect to current nomenclature: Family Bignoniaceae and Clusiaceae

Executing Scientist(s) : Dr. Debasmita Dutta Pramanick & Dr. S.S. Dash

Date of Initiation : April, 2020

Date of completion : March, 2020

OBJECTIVE:

Interpretation of the illustrations of the members of the families Bignoniaceae and Clusiaceae in *Icones Roxburghianae*.

BACKGROUND:

'*Icone Roxburghianae*', a brief account of systematically described plants, was comprising of 2,542 number of full sized illustrations most of which were represented in '*Flora Indica*'. The present work focuses on nomenclatural status and taxonomic identity of Roxburgh's Icon under the families Bignoniaceae and Clusiaceae which account for approx. 16 and 19 drawings respectively.

SUMMARY & ACHIEVEMENT/:

During 2019-20, 19 taxa of the family Clusiaceae taxonomically interpreted along with present status, brief description, flowering & fruiting, distribution and ecology. Finalization of Mss. is on process.

PROJECT-2

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

Executing Scientist(s) : Shri Sanjay Kumar & Dr. S.S. Dash

Date of Initiation : April, 2018

Date of completion : March, 2022

OBJECTIVE: To conduct detailed floristic Survey in Eagle nest Wild life Sanctuary and Documentation of the flora occurring within the boundary of the sanctuary and its adjacent regions. To preparation of a pictorial guide of the sanctuary and its adjacent region. Provide GPS based database with help of ArcGIS software.

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

SUMMARY & ACHIEVEMENT/OUTCOME: During this period material has been processed and second exploration tour was undertaken *w.e.f.* 10.07.2019 to 03.08.2019 and 208 field numbers in triplets total 624 collections were made from Eagle Nest Wild Life Sanctuary and its adjacent region. During the same tour more than 3000 photographs and 20

short videos were also taken along with the GPS coordinates. All collected specimens are well processed, dried and poisoned as per standard herbarium procedure.

B. TECHNICAL SECTION

PROJECT-1

Marine Macro Algal Flora of West Bengal coast, India

Executing Scientist(s) : Dr. S.K. Yadav & Shri K. Majumdar

Date of Initiation : April 2019

Date of completion : March 2021

OBJECTIVE:

Exploration of Marine Macro Algal Flora of West Bengal coast

BACKGROUND:

This is a new project.

AREA AND LOCALITY

West Bengal Coastal areas, including Sundarban Biosphere Reserve

SUMMARY & ACHIEVEMENT/OUTCOME:

During the reporting period, around 65 references pertaining to the marine macro algal taxonomy and diversity of the India coast has been collected. One field tour in January, 2020 has been conducted to the coastal areas of West Bengal, including Sundarban Biosphere Reserve (SBR) during the low tides during which 50 field numbers of marine macro algal samples have been collected in duplicate / triplicate. All the relevant field details such as habit, habitats, nature of the locality and its GPS position (using Garmin 12 channel XL), vegetation patterns etc. have been recorded and photographed using digital camera. All the collected samples were processed properly and preserved in both wet form (in containers) and in dry form *i.e.* herbarium sheets. Of the collected 50 field numbers, 42 F.N. have been identified. Descriptions of 05 species *i.e.* *Ulva clathrata* (Roth) C. Agardh; *U. compressa* L.; *U. lactuca* L., *U. flexuosa* Wulfen and *U. linza* L. (Family Ulvaceae) have been completed.

**HIGH ALTITUDE WESTERN HIMALAYAN REGIONAL CENTRE,
SOLAN**

PROJECT-1

Flora of Himachal Pradesh, Vol.-1 Ranunculaceae [Estt. sp.: 107]

Executing Scientist (s) : Dr. Kumar Ambrish & Shri Purushottum Derolia
Date of Initiation : April, 2017
Date to be completion : March, 2020

OBJECTIVE

Documentation of the flora of Himachal Pradesh

BACKGROUND

Described 48 species of the family Ranunculaceae

AREA AND LOCALITY

Himachal Pradesh

SUMMARY AND ACHIEVEMENTS

Completed and finalized the taxonomic account of the family Ranunculaceae comprising of 116 taxa (21 genera, 109 species and 7 varieties) for the Flora of Himachal Pradesh Vol. 1.

PROJECT-2

Flora of Himachal Pradesh, Vol.-1 Brassicaceae & Caryophyllaceae [Estt spp.: 148]

Executing Scientist (s) : Dr. Kuldip S. Dogra
Date of Initiation : April, 2017
Date to be completion : March, 2020

OBJECTIVE

Documentation of the flora of Himachal Pradesh

BACKGROUND

Described 48 species of the family Caryophyllaceae

AREA AND LOCALITY

Himachal Pradesh

SUMMARY AND ACHIEVEMENTS

After careful scrutiny of the available literature, protologues and herbarium records (BSD & DD), a total of 167 species of the families Brassicaceae & Caryophyllaceae have been documented along with updated nomenclature and other relevant information. Final project report in progress.

PROJECT-3

Documentation and database of Alien Invasive species of Himachal Pradesh (North-Western Himalaya)

Executing Scientist (s) : Dr. Kuldip S. Dogra
Date of Initiation : April, 2017
Date to be completion : March, 2020

OBJECTIVE

Preparation of a database of invasive alien species of Himachal Pradesh

BACKGROUND

One collection tour was conducted to different districts of Himachal Pradesh during which 130 field nos. of specimens belonging to 100 species of invasive alien plants and its associates were collected. About 341 herbarium specimens for 59 alien species were examined, documented and described from DD and BSD along with listing of 157 alien species. Database of 50 species was prepared in the prescribed format.

AREA AND LOCALITY

Himachal Pradesh

SUMMARY AND ACHIEVEMENTS

One field tour *w.e.f.* 24.09.19 to 05.10.19 have been conducted to different regions of the state and a total of 141 field nos. were collected out of which 50 species have been identified in the field. It has been observed that species like *Fagopyrum esculentum* Moench is rapidly invading in the temperate zone in the grasslands, un-attended areas, orchards as understory in different forest types. More than 1200 photographs of plants, forest types, rivers and landscape have been taken during the tour. Nine alien species also have been listed from the literature. Database and fact sheets have been prepared for 100 invasive alien plant species. The preparation of final manuscript is in process.

INDUSTRIAL SECTION INDIAN MUSEUM, KOLKATA

PROJECT-1

Collection of Economic Plant materials for enrichment & replacement of exhibits of the Botanical Gallery

Executing Scientist (s) : Dr M. Bhaumik, Mrs. G. Chaudhury, and Shri S.K. Sharma
Date of Initiation : April, 2019
Date to be completion : March, 2020 (Ongoing)

OBJECTIVE

Collection of economically important plant materials and replacing with the old damaged exhibits in Botanical Gallery of ISIM

BACKGROUND

This is an ongoing project and was taken up for collection samples of economic plant materials. The collection of the new plant materials from different phytogeographical regions of India is usually added as exhibits replaces with the older or damaged one in the Botanical Gallery. The database on nomenclature, distribution and vernacular names of plant species is updated. Two field tours were undertaken to Ranchi and its adjacent areas and Meghalaya during which 63 samples of food, medicine, gum, resin, oil, dye etc were procured.

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

It has been planned to enrich Tobacco Section of Botanical Gallery by collecting different varieties of tobacco samples from Central Tobacco Research Institute, Rajamundi, Andhra Pradesh or Dinhata, West Bengal.

COMPLETED PROJECT

PROJECT-1

Interpretation of Roxburgh Icones: Family Orchidaceae

Executing Scientist (s) : Dr. M. Bhaumik & Dr.(Mrs.) K. Pagag
Date of Initiation : April, 2018
Date to be completion : March, 2020

OBJECTIVE

Enumeration of nomenclatural status and taxonomic identity of the family Orchidaceae in Roxburgh's Icon.

BACKGROUND

This project was initiated in 2018. During previous year, 26 taxa were interpreted and 15 species were described along with their validity and common synonym.

SUMMARY AND ACHIEVEMENTS

This study reports that out of 46 icons of the family Orchidaceae, six names are correct as per recent Code. After nomenclatural updation, it has also been found that 12 new combinations have been established in later publications and 23 cases where new correct names were proposed due to synonymize of names as mentioned in icons. Four names have been found to be illegitimate and new correct names have been proposed. One name is unresolved till now. Brief description of 46 taxa have been prepared. Final report has been submitted to Hqrs.

PROJECT-2

Studies on natural dye from some selected plants of West Bengal for dyeing cotton fabrics

Executing Scientist (s) : Dr. M. Bhaumik, Dr. K. Pagag & Dr. S. Datta

Date of Initiation : April, 2019

Date to be completion : March, 2020

OBJECTIVE

Study of selected plants yielding natural dyes and using dyes on cotton cloth

BACKGROUND

Natural dyes or dyes are derived from the plants, invertebrates or minerals. Different parts of plants such as leaves, barks, roots, flowers and wood contain dye pigments. Textiles dyeing from the plant dyes were practiced from ancient time. To adhere with the fabric, dye needs mordant which are chemical or natural alum or salt or vinegar which help to bind the dye with textiles or fabrics.

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

Plants commonly grown in Kolkata were selected to extract dye and used it to dye with cotton fabrics. Till now Plant parts like leaves, flowers, barks of *Dimocarpus longan*, *Rivina humilis*, *Ixora coccina* have been used in extraction of dyes. Three process i.e., pre-mordanting, post-mordanting, simultaneous dipping of mordant have been used to dye cotton cloth. Fabrics have been dyed in different shades of colours like grey, brown, yellow and blue. Final report has been submitted to Hqrs.

PROJECT-3

Listing of 8000 Dicot Herbarium Specimens at BSIS

Executing Scientist (s) : Smt. Geeta Chaudhury, Sri Bishnu Charan Dey & Sri S.K. Sharma

Date of Initiation : April, 2016

Date to be completion : September, 2019

OBJECTIVE

Preparation of a digital catalogue of economically important plants collected from different parts of India in the pre & post-independence era, documentation and proper maintenance.

BACKGROUND

BSIS is an important economic herbarium where plants collected from different parts of India in the pre & post independence era by various eminent botanists namely I.H. Burkill, J.H. Lace, H.G. Carter, S.N. Bal, K.S. Srinivasan, Bijoy Krishna, K.C. Malick, S.K. Mandal were deposited. This project was initiated in 2016. In 2018-19, 2415 herbarium specimens were documented.

AREA AND LOCALITY

NA

SUMMARY AND ACHIEVEMENTS

A catalogue of 97 numbers of families with 8017 number of herbarium specimens of dicotyledonous plants has been prepared with all detail information. While studying the dicotyledonous collections it was observed that amongst the European collectors the maximum collection was by I.H. Burkill while K. S. Srinivasan and K. C. Malick were the major contributors amongst the Indian collectors. Based on number of species catalogued, Leguminosae tops the list with 895 numbers of specimens. Final report has been submitted to Hqrs.

NORTHERN REGIONAL CENTRE, DEHRADUN

PROJECT-1

Flora of Sechu Tuan Nalla Wildlife Sanctuary, Chamba District, Himachal Pradesh

Executing Scientist(s) : Dr. Puneet Kumar
Date of Initiation : April, 2016
Date to be completion : March, 2020

OBJECTIVE

Study of floristic diversity in the Sechu Tuan Nalla Wild Life Sanctuary

BACKGROUND

The project was started in 2016. A total of five tours were undertaken to the study area in the months of May-October (2016-2019) during which 1134 field nos. were collected and 436 species identified and listed.

AREA AND LOCALITY

Pangi Valley, Chamba District, Himachal Pradesh; c. 390.29 sq.km.

SUMMARY AND ACHIEVEMENTS

One field tour w.e.f. 06.07.2019-17.07.2019 has been conducted to the study area during which 202 field numbers were collected of which 178 species were identified. Additionally 195 species have been identified from previous year's collection. Besides, 14 RET plant species have also been collected from Pangi Valley for *ex-situ* conservation.

PROJECT-2

Pictorial Flora of Pteridophytes of Uttarakhand

Executing Scientist(s) : Dr. B.S. kholia
Date of Initiation : April, 2018
Date to be completion : March, 2021

OBJECTIVE

Preparation of a pictorial guide of Pteridophytic flora of Uttarakhand

BACKGROUND

This project was initiated in 2018. During 2018-2019, relevant literature on taxonomy of Pteridophytes of Uttarakhand was consulted and a checklist of 332 species, 38 subspecies and c. 15 hybrids Pteridophytes of Uttarakhand was prepared along with prioritization of some important fern localities for common as well as rare species for taking *in-situ* images in right season. Two collection tours were undertaken in both Kumaun and Garhwal regions during which 63 field numbers belonging to 42 species were collected. Further, 340 herbarium sheets belonging to 42 species of Pteridophytes were identified and Label information on 410 herbarium sheets were written and 42 species were worked out.

AREA AND LOCALITY

Uttarakhand State

SUMMARY AND ACHIEVEMENTS

Six survey, collection and photography tours have been undertaken to different places of Dehradun, Mussoorie foot hills, Chakrata, Deoband, Nagdev, Nainital, Almora, Bageshwar, and Pithoragarh during which 243 field numbers have been collected. Besides identified 373 herbarium sheets belonging to 94 species of Pteridophytes and worked out total 94 species (42 nos. in 2018, 52 nos. in 2019) for the final report. Label information on 345 herbarium sheets and accession of 277 sheets of Pteridophytes in BSD Herbarium have also been completed. This study reports seven species (*Oleandra cumingii* J. Sm., *Davallia platylepis* Baker, *Katoella yunnaneisis* Fraer-Jenk. & Kholia, *Arthromeris nigroleacea* S. L. Gu, *Lepisorus oligolepidus* (Baker) Ching, *Neocheriopteris venosa* (Ching) Fraser-Jenk. and *Pichisermollodes glaucopsis* (Franch.) Fraser-Jenk.) as new record for India. In addition, three lectotypes (*Polypodium excavatum* var. *bicolor* Takeda, *Polypodium cuspidatum* D. Don and *Polypodium clathratum* C.B. Clarke (second step) and one neotype (*Polypodium fieldingianum* Kunze ex Mett.) have been designated along with establishment of three new nomenclatural combinations (*Katoella yunnaneisis* Fraer-Jenk. & Kholia, *Neocheriopteris maculosa* (Christ) Fraser-Jenk. & Kholia and *Osmunda acuta* (Burm.f.) Fraser-Jenk. & Kholia).

PROJECT-3

Micropropagation of endangered *Tricholepis roylei* Hook.f. (Asteraceae) and *Jasminum parkeri* Dunn (Oleaceae)/ *Eulophia dabia* (D. Don) Hochr (Orchidaceae)

Executing Scientist(s) : Dr. Giriraj Singh Panwar & Dr. Bhavana Joshi
Date of Initiation : April, 2018
Date to be completion : March, 2020

OBJECTIVE

Assessment of the seed germination potential of the above mentioned species; standardization of micropropagation protocol for the selected species by direct and indirect organogenesis methods using different explants such as shoot tip, nodal segment, axillary bud, young leaves and other meristematic tissues and hardening of plantlets in the green house/net house and shifting of acclimatized plants to the open environment as well as field.

BACKGROUND

This project was initiated in 2018. In 2018-19, explants/live plants of all the three selected species were collected from the wild and inoculated in MS medium of different medium of different composition fortified with different plant growth regulators. Seed germination and organogenesis was induced in *Tricholepis roylei* and *Jasminum parkeri*. SEM analysis of the seeds of *Eulophia dabia* was conducted to observe effect of different chemicals on the seed coat.

AREA AND LOCALITY

North-West Himalaya

SUMMARY AND ACHIEVEMENTS

Plant propagules (seeds, live plant materials) of three selected species have been collected from different wild locality. Tissue culture experiments and optimization of plant tissue culture media for the organogenesis (bud break, multiple shoot development, callusing and rooting) in selected threatened & endemic species have been designed along with optimization of plant growth regulators (PGRs) concentration for the induction of organogenesis in the targeted threatened species individually or in combination. Standardization of micropropagation protocol for the targeted species, hardening and acclimatization of the *in vitro* regenerated plantlets in the polyhouse and net house and their successful transfer to open environment and maintenance of stock cultures in the culture room are being carried out. During the study, three threatened and medicinal species have been successfully conserved through *ex-situ* conservation approach by using the tissue culture technology, efficient and reproducible micropropagation protocols have been standardized for the *Tricholepis roylei* Hook.f. (a point endemic & threatened species of the North-West Himalaya) and *Eulophia dabia* (D.Don) Hochr (a terrestrial medicinal orchid species), micropropagation of *Jasminum parkeri* has been tried from different explants (seed, nodal segment, leaf, petiole etc.) and callusing is achieved in nodal segment explants but further organogenesis was not observed in callus or any other explant of *J. parkeri*. *In vitro* raised plantlets of all the species have successfully been acclimatized and transferred to the open environment. The *in vitro* raised protocol might be of great significance in elucidating the molecular and phytochemical potential of the species.

PROJECT-4

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

Executing Scientist(s) : Dr. .K. Singh, Dr. B.S. Kholia, Shri Sachin Sharma & Dr. Purushottam Kumar Deroliya
Date of Initiation : Ongoing
Date to be completion : Ongoing

OBJECTIVE

Conserving endemic threatened and economic plant species in the associated garden of Northern Regional Centre, BSI, Dehradun along with documentation of monthly phenological data.

BACKGROUND

This is an ongoing project. In 2018-19, two field tours were undertaken to different areas of Himachal Pradesh and Uttarakhand during which 17 pteridophytic taxa were collected some of which are *Aleuritopteris albomarginata*, *Aleuritopteris bicolor*, *Athyrium strigillosum*, *Dryopteris cochleata*, *Dryopteris juxtaposita*, *Equisetum ramosissimum*, *Polystichum disrectum*, *Pseudocyclosorus cannus* etc.

AREA AND LOCALITY

North West Himalaya

SUMMARY AND ACHIEVEMENTS

One 15 days and 5 one day field tours have been conducted to different areas of Uttarakhand (Nainital, Almora, Bageshwar, and Pithoragarh) of Kumaun during which 16 plant species of threatened and economically importance have been collected viz., *Alpinia zerumbet* (Pers.) B.L. Burtt & R.M. Sm., *Alpinia calcarata* (Haw.) Roscoe, *Zingiber roseum* (Roxb.) Roscoe, *Globba orixensis* Roxb., *Hedychium spicatum* Sm., *Crepidium acuminatum* (D.Don) Szlach., *Roscoea purpurea* Sm., *Dendrobium crepidatum* Lindl. & Paxton, *Luisia trichorrhiza* (Hook.) Blume, *Vanda cristata* Wall. ex Lindl., *Nervilia concolor* (Blume) Schltr., *Nervilia crociformis* (Zoll. & Moritzi) Seidenf., *Nervilia mackinnonii* (Duthie) Schltr., *Goodyera repens* (L.) R.Br., *Calanthe triplicata* (Willemet) Ames, *Platanthera edgeworthii* (Hook.f. ex Collett) R.K. Gupta. In addition, 45 fern species viz. *Adiantum capillus-veneris* L., *Adiantum incisum* Forssk., *Adiantum philippense* L., *Aleuritopteris albomarginata* (Clarke) Ching, *Aleuritopteris anceps* (Blanf.) Panigrahi, *Ampelopteris prolifera* (Retz.)Copel., *Asplenium prolongatum* Hook., *Asplenium dalhousiae* Hook., *Blechnum orientale* L., *Botrychium lanuginosum* Sw., *Christella appendiculata* (C. Presl) Holttum, *Coniogramme fraxinea* (D.Don) Fée ex Diels, *Deparia boryana* (Willd.) M. Kato, *Dicranopteris lanigera*(D.Don) Fras.-Jenk., *Diplazium esculentum*(Retz.) Sw., *Diplazium spectabile* (Wall. ex Mett.) Ching, *Dryopteris cochleata* (D.Don) C.Chr., *Dryopteris juxtaposita* Christ, *Dryopteris sparsa* (D. Don) Kunze, *Equisetum diffusum* L., *Gymnopteris vestita* (Hook.) Underw., *Helminthostachys zeylanica* (L.) Hook., *Lepisorus kashyapii* (Mehra ex Bir) Fraser-Jenk., *Lepisorus tenuipes* Ching, *Loxogramme involuta* (D. Don) C. Presl, *Onychium siliculosum* (Desv.) C.Chr., *Polypodium lachnopus* Wall.ex Hook., *Polystichum discretum* (D.Don) J.Sm., *Polystichum piceopaleaceum* Tagawa, *Polystichum squarrosum* (D. Don) Fee, *Pteris vittata* subsp. *vittata* L., *Pteris cretica* L., *Pteris biaurita* L., *Pyrrosia costata* (C. Presl) Tagawa & K.Iwats., *Pyrrosia flocculosa* (D. Don) Ching, *Pyrrosia lanceolata* (L.) Farw., *Pyrrosia porosa* (C.Presl) Hovenkamp, *Selaginella chrysocaulos* (Hook. & Grev.) Spring, *Sphenomeris chinensis* (L.) Maxon, *Tectaria polymorpha* (Wall. ex Hook.) Copel., *Thelypteris auriculata* (J. Sm.) Ching, *Thelypteris erubescens* (Wall. ex Hook.) Ching, *Thelypteris dentata* (Forssk.) E.P. St. John, *Thelypteris nudata* (Roxb.) C.V. Morton and *Woodwardia unigemmata* (Makino) Nakai have also been collected, introduced and being maintained in the Botanic Garden under *ex situ* conservation along with maintenance of the existing collections (Bamboo: 05 sp., Herb: 242 sp., Shrub: 100 sp., Trees: 210 sp., Climber / Liana: 31 sp.) growing in the garden. Besides regular weed removal, pruning, manuring etc. are being continuously carried out.

The monthly statement of phonological data documented is as follows: April [Flowering (Fl.) 14; Fruiting (Fr.) 10], May [Fl. 13; Fr. 28], June [Fl. 7; Fr. 28], July [Fl. 11; Fr. 18], August [Fl. 11; Fr. 17], September [Fl. 11; Fr. 17], October [Fl. 10; Fr. 16], November [Fl. 16; Fr. 23], December [Fl. 16; Fr. 22]. (Fl.: Flowering; Fr.: Fruiting).

PROJECT-5

Flora of Pushpagiri Wildlife Sanctuary, Karnataka

Executing Scientist(s) : Mr. Sameer Patil & Dr. P. Lakshminarasimhan
Date of Initiation : April, 2016
Date to be completion : March, 2020

OBJECTIVE

Study of floristic diversity in the PushpagiriWild Life Sanctuary

BACKGROUND

This project was initiated in 2016. Till now, a total of seven field tours were conducted to the study area for survey and collection of the plants. Intensive and extensive exploration tours covering all seasons and every corners of the sanctuary resulted in collection of 990 field numbers comprising of about 3000 specimens. The flora comprises of 767 taxa belonging to 460 genera spread across 114 families of Angiosperms and two taxa of Gymnosperms. Out of the 769 plant species recorded, 257 species are found to be endemic to Indian region, which forms almost 33% of the flora of the sanctuary. The study recorded 19 monotypic genera and 92 oligotypic genera from the sanctuary. Identification and listing of all the species is completed.

AREA AND LOCALITY

Pushpagiri Wildlife Sanctuary, Karnataka; c. 102 sq. km.

SUMMARY AND ACHIEVEMENTS

Identification of 550 species of plants has been completed along with attaching label of herbarium specimens. Description writing of 450 species has been completed with preparation of 31 photographic plates. This study has documented 769 plant species which included 257 endemic taxa, seven endemic genera and 19 monotypic genera. Ecological study showing the exact limit of shola grasslands occur from 1000 m and above, contradictory to the previous assigned limit of 1700 m and above. Ethnobotanical data of 33 previously neglected species has been documented during the study. During this study, 158 plant species have been added to district flora, twenty plants have reported as new to the state flora, one plant newly recorded for mainland India (previously Andama & Nicobar Is.) and two new species have been described. Ecological Niche Modelling for habitat specific conservation conducted for two species (*Anoectochilus elatus* Lindl. and *Ceropegia ciliata* Wight).

PROJECT-6

Flora of Himachal Pradesh Vol. 1.[Estt spp.:584 species]

Executing Scientist(s) : Dr. S.K. Singh, Dr. Ambrish Kumar, Dr. Kuldip S. Dogra, Dr. M. R. Debta, Dr. Puneet Kumar, Mr. Sameer Patil, Mr. Sachin Sharma & Dr. Purushottam Kumar Deroliya

Date of Initiation : April, 2017
Date to be completion : March, 2020

OBJECTIVE

Documentation of the flora of Himachal Pradesh

BACKGROUND

This project was initiated in 2017. In 2018-19, 48 species from the family Ranunculaceae, 78 species belonging to Vitaceae, Aceraceae, Anacardaceae, Rutaceae, Meliaceae, Balsaminaceae, Aequifoliaceae, Celastraceae, Beibersteiniaceae and Oxalidaceae, 31 species belonging to Malvaceae, Tiliaceae and Linaceae, 15 species from Polygalaceae, Flacourtiaceae, Capparaceae and Pittosporaceae were described.

AREA AND LOCALITY

Himachal Pradesh

SUMMARY AND ACHIEVEMENTS

Dr. S.K. Singh and Dr. Purushottam Kumar Deroliya: Described 51 taxa belonging to 11 families *viz.*, Paeoniaceae, Magnoliaceae, Calycanthaceae, Schisandraceae, Menispermaceae, Berberidaceae, Podophyllaceae, Lardizabalaceae, Nymphaeaceae, Nelumbonaceae and Papaveraceae.

Sh. Sachin Sharma : Described 51 taxa belonging to the families namely Vitaceae, Celasteraceae, Rhamnaceae, Geraniaceae and Rutaceae.

Sh. Sameer Patil: Described 43 species belonging to the families Tamaricaceae, Elatinaceae, Hypericaceae, Theaceae, Saurauiaceae, Dipterocarpaceae, Tiliaceae, Linaceae, Malpighiaceae and Zygophyllaceae.

Dr. Puneet Kumar: Described 23 taxa belonging to the families Pittosporaceae, Fumariaceae, Capparaceae and Violaceae.

Dr S.K. Singh: Editing of nomenclature, taxonomic description and distribution of all the species described in this volume is under process.

Flora of Himachal Pradesh: Introduction Part of vol. 1[2019 - 2020]: Dr. S.K. Singh, Dr. Puneet Kumar, Sh. Sachin Sharma, Sh. Sammer Patil & Dr. P.K. Deroliya prepared chapters belonging to Physiography, Geology and Soil, Drainage, Climate, Vegetation, Floristic explorations and botanical studies, Review of literature, Protected area network, Endemic and Threatened species, Ethnobotany, Medicinal and other economic plants belonging to Himachal Pradesh, and key to the families and listed 540 references.

This study has documented more than 600 species against the earlier record of 584 species so far. In 2019-20, a total of 206 species have been documented.

SIKKIM HIMALAYAN REGIONAL CENTRE, GANGTOK

COMPLETED PROJECT

PROJECT-1

Taxonomic revision of *Impatiens* L.(Balsaminaceae) of Sikkim & Darjeeling Himalayas

Executing Scientist(s) : Dr. Rajib Gogoi

Date of Initiation : April, 2017

Date of completion : March, 2020

OBJECTIVE:

Revisionary study of the genus *Impatiens* L. (Balsaminaceae) in Sikkim & Darjeeling Himalayas

BACKGROUND:

This project was initiated in 2017. In 2018-19, two field tours were conducted in the study area during which 22 species were collected and identified along with 1800 photographs of habit, habitat, vegetation etc. In this period, three species were recollected after type collection (more than 100 years) and four names were lectotypified.

AREA AND LOCALITY

Sikkim, Darjeeling and Kalimpong Districts of West Bengal

SUMMARY & ACHIEVEMENT/OUTCOME:

Three field tours *w.e.f.* 12.08.19 to 21.08.19, 05.09.19 to 10.09.19, 2019 and 13.11.19 to 23.11.19 have been undertaken covering an area of c. 2500 sq. km., to North Sikkim, East Sikkim, West Sikkim & Darjeeling District of West Bengal respectively during which altogether 464 field nos. have been collected along with photographs of c. 500 species. A total of 6 species and one variety of *Impatiens* have been collected viz. *Impatiens occultans* Hook.f., *Impatiens laxiflora* Edgew., *Impatiens laxiflora* Edgew. var. *sikkimensis* Hook.f., *Impatiens serratifolia* Hook.f., *Impatiens sulcata* Wall., *Impatiens falcifera* Hook.f., *Impatiens spirifera* Hook.f., *Impatiens cymbifera* Hook.f., *Impatiens thomsonii* Hook.f., *Impatiens kingii* Hook.f., *Impatiens scitula* Hook.f., *Impatiens urticifolia* Wall., *Impatiens gamblei* Hook.f., *Impatiens jurpia* Buch.-Ham., *Impatiens stenantha* Hook.f., *Impatiens racemosa* DC., *Impatiens arguta* Hook.f. & Thomson. From the time of inception, six field tours, covering an area of c. 4500 sq. km. has been conducted to the study area and identified 42 species of *Impatiens* from Sikkim & Darjeeling Himalaya. This study reports recollection of 09 species after almost 100 years which remain in oblivion in wild viz. *Impatiens cathcartii* Hook.f., *Impatiens florifera* C.B. Clarke ex Hook.f., *Impatiens gamblei* Hook.f., *Impatiens hobsonii* Hook.f., *Impatiens infundibularis* Hook.f., *Impatiens kingii* Hook.f., *Impatiens longipes* Hook.f. & Thomson, *Impatiens scitula* Hook.f., *Impatiens sikkimensis* Goverts & T.Chakrab. *mpatiens occultans* Hook.f. been recollected after its type collections in Indian territory. Existence of *Impatiens laxiflora* Edgew., *Impatiens thomsonii* Hook.f. and *I. laxiflora* Edgew in Sikkim Himalaya and taxonomic identity of *I. laxiflora* Edgew. var. *sikkimensis* Hook.f. have been validated. *Impatiens mengtzeana* Hook.f., *Impatiens humilis*

Hook.f. has been synonymised with *I. discolor* DC. & *I. uncipectala* C.B. Clarke ex Hook.f. respectively. The name *I. longipes* Hook.f. is been lectotypified.

Final report of the project containing 42 species along with 35 coloured photo plates submitted to D/BSI.

PROJECT-2

Red listing of Orchids of Eastern Himalaya (*Entire Sikkim, Darjeeling district of West Bengal and Arunachal Pradesh excl. Changlang and Tirap*) as per IUCN criteria

Executing Scientist(s) : Dr. Dinesh Kumar Agrawala, Dr. David Lalsama Biata and Dr. Krishna Chowlu

Date of Initiation : April, 2013

Date of completion : November, 2019

OBJECTIVE :

Red list threat assessment of Orchids of Eastern Himalaya and Arunachal Pradesh as per IUCN criteria

BACKGROUND:

The project was initiated in 2013. In 2018-19, 26 field tours, covering an area of 1900 sq.km., were conducted at different regions of study area during which 502 samples were collected along with 440 live plants for introduction and *ex-situ* conservation in Campus garden. Confirmed the presence and analysed population of c. 450 taxa. Over 20,000 herbarium specimens deposited at CAL, ASSAM, ARUN, APFH, OHT, NERIST, ARRI, North Bengal University and Lloyd Botanic Garden, Darjeeling were consulted and label data were collected for plotting the distribution map. 4300 photographs of herbarium specimens, procured from OHT, ASSAM & CAL were sorted according to their name and checked their identity, 2250 specimens at BSHC were finalized in respect of their identity, geocoordinates and entry in excel sheet. A total of 627 taxa were identified from study of 1120 specimens containing own collection including unidentified and wrongly identified specimens at BSHC. 761 taxa were illustrated by using digital macro-microscopic images of live specimens. Taxonomy and nomenclature of many orchid taxa were resolved.

AREA AND LOCALITY

Eastern Himalaya (Eastern Sikkim, Darjeeling District of West Bengal, Arunachal Pradesh excluding Changlang and Tirap)

SUMMARY & ACHIEVEMENT/OUTCOME:

Taxon data sheets of 770 taxa have been prepared along with evaluation of threat status as per IUCN Criteria. The assessments are of Indian perspective for non-endemics and of global perspective for endemics. The project has been completed and manuscript is submitted in two volumes (2150 pages). The 770 taxa have been assessed as follows: Critically Endangered (CR): **74 taxa** (03 are flagged as possibly extinct); Endangered (EN): **108 taxa**; Vulnerable (VU): **505 taxa**; Near Threatened (NT): **50 taxa**; Least Concern (LC): **18 taxa**; Data Deficient (DD): **15 taxa**

SOUTHERN REGIONAL CENTRE, COIMBATORE

PROJECT-1

Flora of Kodaikanal Wildlife Sanctuary, Tamil Nadu

Executing Scientist(s) : Dr. K. Althaf Ahamed Kabeer & Mr. A. Ravi Kiran

Date of Initiation : April, 2015

Date of completion : March, 2020

OBJECTIVE

Preparation of details floristic account of Kodaikanal Wildlife Sanctuary, Tamil Nadu along with preparation of vegetation type map.

BACKGROUND

This project was initiated in 2015. In 2018-19, three field tours were conducted to the study area during which 282 field nos. were collected along with 1050 field photographs of habit, habitat and vegetation. Poisoning and re-poisoning work, segregation of duplicate specimens, mounting and stitching work of all the collected specimens were completed. A checklist of the threatened species in and around the Kodaikanal Wildlife Sanctuary has been prepared. Besides several endemic and rare species pertaining to this Sanctuary were collected and sent to NOEG, Yercaud germplasm Centre and BSI, SRC garden for conservation and further studies.

AREA AND LOCALITY

Kodaikanal Wildlife Sanctuary, Tamil Nadu; 736.9 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

One field tour w.e.f. 10.09.19 to 18.09.19 has been conducted to the study area during which totally 75 field numbers have been collected. Approx. 156 field nos. have been identified so far. Several endemic plants viz. *Agrostis peninsularis* Hook.f., *Brachycorythis splendida* Summerh., *Elaeocarpus munroii* Mast., *Ficus dalhousiae* Miq., *Glyptopetalum lawsonii* Gamble, *Leucas vestita* Benth., *Ophiorrhiza roxburghiana* Wight, *Phyllanthus narayanswamii* Gamble, *Strobilanthes foliosa* T. Anderson, *Uleria salicifolia* Bedd. ex Hook.f. and one addition to Flora of The Palni Hills *Ormocarpum sennoides* (Willd.) DC. have been collected. seeds of *Elaeocarpus blascoi* Weibel and *Psydrax ficiformis* (Hook.f.) Bridson have been deposited at BSI SRC museum and BSI DRC museum respectively.

PROJECT-2

Flora of Kanniyakumari Wildlife Sanctuary, Tamil Nadu

Executing Scientist(s) : Dr. Sujana. K. A. and Shri. Rakesh G Vadhyar

Date of Initiation : April, 2015

Date of completion : March, 2020

OBJECTIVE

Preparation of floristic account of Kanniyakumari Wildlife Sanctuary, Tamil Nadu

BACKGROUND

This project was initiated in 2015. In 2018-19, two field tours were undertaken in the study area during which 291 field nos. were collected and 209 species were documented.

AREA AND LOCALITY

Kanniyakumari Wildlife Sanctuary, Tamil Nadu; c. 402.4 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Three field tours have been undertaken to the study area in different seasons for plant collection as well as observations on the habit, habitat and phenological events of the species. All the five ranges have been explored with special attention to Bhoothapandi, Kulasekaram, Azhagiapandipuram ranges covering a total of c. 360 sq.km. area during which 620 field numbers have been collected along with 5200 photographs of vegetation and plants and GPS locations for rare and threatened plants. Herbarium processing of 2480 specimens has been carried out along with identification of 344 field nos. This study reports 02 new species and 02 new distributional records to Tamil Nadu.

PROJECT-3

Floristic Assessment of Megamalai Wildlife Sanctuary, Tamil Nadu

Executing Scientist(s) : Dr. C. Murugan and Dr. S. Arumugam

Date of Initiation : April, 2016

Date of completion : March, 2020

OBJECTIVE

Preparation of details floristic account of Megamalai Wildlife Sanctuary, Tamil Nadu along with collection of data about distribution, ecology, economic uses of the plants available in the Sanctuary

BACKGROUND

This project was initiated in 2016. In 2018-19, four field tour were conducted and vouched 540 field nos. Approx. 4000 photographs were taken during survey. 630 field nos. of specimens of earlier collection were identified.

AREA AND LOCALITY

Megamalai Wildlife Sanctuary, Tamil Nadu; c. 269.11 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Three botanical exploration tours *w.e.f.* 17.6.19 to 26.06.19, 05.09.19 -14.09.19 & 25.11.19 – 07.12.19 have been conducted to the study area during which 476 field nos. have been vouched along with 2500 plant images of which 790 field nos. including previous collections has been identified. Some of the interesting plant species collected from the study area include *Andrographis megamalayana* Gnanasek., Karupp. & G.V.S.Murthy (Acanthaceae), *Cissampelopsis calcadensis* C.Jeffrey & Y.L.Chen (Asteraceae) *Eria pseudoclavicaulis* Blatt. & McCann (Orchidaceae), *Anisochilus henryi* K.Ravik. & V.Lakshm. (Lamiaceae), *Eugenia megamalayana* Murugan & Arum. & *Eugenia seithurensis* Gopalan & S.R.Sriniv.(Myrtaceae), *Hedyotis rajasekaranii* Karupp. & Ravich., *Hedyotis shettyi* K.Ravik. & V. Lakshm., *Impatiens flavescens* Karup. & V. Ravichandran, *Sonerila parameswaranii* K.Ravik. & V.Lakshm, *Syzygium sriganesanii* K.Ravik. & V. Lakshm., *Elaeocarpus munronii* (Wl.) Masters (Elaeocarpaceae) etc.

PROJECT-4

Cyperaceae of Tamil Nadu

Executing Scientist(s) : Dr. C. Murugan and Dr. S. Arumugam

Date of Initiation : April, 2015

Date of completion : March, 2020

OBJECTIVE

Survey, study and documentation of the members of Cyperaceae in Tamil Nadu

BACKGROUND

The project was started in 2015. In 2018-19, one field tour was conducted to different parts of the state during which 47 field nos. were collected along with 150 photographs, 60 field nos. were identified including earlier collections and description of 60 species was completed.

AREA AND LOCALITY

Tamil Nadu

SUMMARY & ACHIEVEMENT/OUTCOME:

One field tour *w.e.f.* 16.12.2019 to 23.12.2019 was undertaken to different areas of the state of Tamil Nadu during which 50 field nos. were vouched along with 200 photographs and description of 06 genera was completed *viz.* *Cyperus* (40 spp.); *Bulbostylis* (05 spp.); *Courtoisia* (01 sp.) *Bolboschoenus* (01 sp.), *Carex* (29 spp.); *Fimbristylis* (50 spp.). Some of the interesting species collected are *Bulbostylis densa* (Wall.) Hand. - Mazz., *Carex baccans* Nees, *Carex filicina* Nees, *Carex hokarsarensis* E.U. Haq.&Dar, *Carex kotagirica* A. Maji & V.P. Prasad *Cyperus compressus*; *Cyperus cyperoides* (L.) Kuntze; *Cyperus javanicus* Houtt., *Cyperus arenarius* Retz., *Fimbristylis argentea*; *Fimbristylis aestivalis* (Retz.) Vahl, *Fimbristylis carpopoda* Govind etc.

PROJECT-5

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

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

Date of Initiation : April, 2017

Date of completion : March, 2021

OBJECTIVE

Survey, identification and inventorization of the floristic diversity of Cauvery North Wildlife Sanctuary, Tamil Nadu and their traditional utilization and conservation practices

BACKGROUND

This project was initiated in 2017. In 2018-19, two field tours were conducted to the study area during which 381 field nos. were collected along with 350 photographs. Besides 15 RET plant species were collected for introduction in SRC Garden.

AREA AND LOCALITY

Cauvery North Wildlife Sanctuary, Tamil Nadu; c. 504.33 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Three field surveys w.e.f. 27.06.2019 to 02.07.2019, 18.09.2019 to 27.09.2019 and 02.01.2020 to 11.01.2020 have been conducted to the study area during which total 468 field nos. were vouched of which 360 species have been identified. Besides 18 live plants including seeds/tubers have been collected for *ex-situ* conservation. Some endemic plants, collected from the Wildlife Sanctuary, are *Alysicarpus bupleurifolius* var. *hybridus* DC. (Fabaceae); *Argyreia cuneata* Ker Gawl. (Convolvulaceae); *Barleria montana* Nees (Acanthaceae); *Boswellia serrata* Roxb. ex Colebr. (Burseraceae); *Cryptolepis grandiflora* Wight (Apocynaceae); *Cyanotis tuberosa* (Roxb.) Schult. & Schult.f.(Commelinaceae); *Glossocardia bosvallia* (L.f.) DC. (Asteraceae); *Hardwickia binata* Roxb. (Fabaceae); *Indigofera mysorensis* DC.(Fabaceae); *Ochna gamblei* King ex Brandis (Ochnaceae); *Thunbergia tomentosa* Wall. ex Nees (Acanthaceae), *Achyranthes coynei* Santapau (Amaranthaceae); *Artocarpus hirsutus* Lam. (Moraceae); *Asystasia dalzelliana* Santapau (Acanthaceae); *Cissus woodrowii* (Stapf ex Cooke) Santapau (Vitaceae); *Dolichandrone falcata* (Wall. ex DC.) Seem. (Bignoniaceae); *Dyschoriste vagans* (Wight) Kuntze (Acanthaceae); *Eranthemum capense* var. *concanense* (Clarke) Santapau (Acanthaceae); *Habenaria rariflora* A.Rich.(Orchidaceae); *Habenaria roxburghii* Nicolson (Orchidaceae); *Hemidesmus indicus* var. *pubescens* Hook.f. (Apocynaceae); *Ixora brachiata* Roxb. (Rubiaceae) etc.

PROJECT-6

Marine Macro Algal flora of India

Executing Scientist(s) : Dr. R. Palaniswamy and Dr. S.K. Yadav

Date of Initiation : April, 2019

Date of completion : March, 2022

OBJECTIVE

Preparation of Checklist of marine macro algae in India

BACKGROUND

This is a new project

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Two field exploration tours w.e.f. 19.02.2020 to 25.02.2020 & 10.03.2020 to 21.03.2020 have been conducted to coastal areas of Tamil Nadu, Kerala, Karnataka and Goa during which 263 field nos. have been collected along with 90 nos. of live specimens. Total 526 nos. of herbarium sheets have been prepared in this period. In addition, one herbarium consultation tour w.e.f. 15.12.2019 to 20.12.2019 to Central National Herbarium (CNH), Howrah & Industrial Section Indian Museum (ISIM), Kolkata has been undertaken during which a sum of 263 marine macro algae herbarium deposits (CAL) has been studied and checked 60 Nos. of missidentified specimens. In addition 156 Nos. of longstanding and meritorious collection of marine macro algae by K. S. Srinivasan has been properly identified and determinavit slip

pasted. Till now more than 3500 collections have been deposited in BSI, SRC, CBE which includes algal diversity of the maritime states of Tamil Nadu, Kerala, Karnataka & Goa.

PROJECT-7

Ex-situ conservation of endemic endangered and threatened plants of the region and recording of phenology of species in the NOEG, Yercaud

Executing Scientist(s) : Dr. S. Kaliamoorthy and Dr. T. S. Saravanan

OBJECTIVE

Ex-situ conservation of endemic endangered and threatened plants of the region and recording of flowering and fruiting data of species in NOEG, Yercaud

BACKGROUND

This is an ongoing project. Two field tours were conducted to Mukurthi National Park, The Nilgiris, Tamil Nadu during which 69 species belonging to 36 genera under 15 families were collected along with GPS data. Besides 27 species under 16 genera belonging to 27 families were also collected along with GPS data and 42 photographs. During live plant collection tour, rare and threatened plant species were collected and introduced in the garden for multiplication.

AREA AND LOCALITY

NA

SUMMARY & ACHIEVEMENT/OUTCOME:

Two Plant exploration tours *w.e.f.* 19.09.2019 to 27.09.2019 and 09.12.2019 to 15.12.2019 have been conducted to Wayanad District, Kerala during which 69 species belonging to 36 genera under 15 families have been surveyed and collected along with GPS data resulting Orchidaceae as most dominant family with 42 species under 20 genera. In addition, 27 species under 16 genera belonging to 27 families of other Angiosperms have also been collected *viz.* *Acampe praemorsa* (Roxb.) Blatt. & McCann, *Aerides crispa* Lindl., *A. ringens* (Lindl.) C. E. C. Fisch., *Bulbophyllum elegantulum* (Rolfe) J. J. Sm., *B. fischeri* Seidenf., *B. kaitense* Rchb. f., *B. sterile* (Lam.) Suresh in D. H. Nicolson, C. R. Suresh & Manilal, *B. tremulum* Wight, *Ceropegia ciliata* Wight, *Cheirostylis flabellata* (A. Rich.) Wight, *Cheirostylis parvifolia* Lindl., *Cleisostoma tenuifolium* (L.) Garay, *Coelogyne breviscapa* Lindl., *C. nervosa* A. Rich., *C. odoratissima* Lindl., *Crepidium densiflorum* (A. Rich.) Sushil K. Singh, Agarwala & Jalal, *C. versicolor* (Lindl.) Sushil K. Singh, Agarwala & Jalal, *Cymbidium aloifolium* (L.) Sw., *C. bicolor* Lindl., *Dendrobium aqueum* Lindl., *D. herbaceum* Lindl., *D. heterocarpum* Wall. ex Lindl., *Pholidota mbricate* Hook., *Polystachya concreta* (Jacq.) Garay & H. R. Sweet, *Rhynchostylis retusa* (L.) Blume, *Satyrium napalense* D. Don, *Sirhookera lanceolata* (Wight) Kuntze, *S. latifolia* (Wight) Kuntze, *Vanda thwaitesii* Hook. f., *Zeuxine gracilis* (Breda) Blume etc. Flowering/fruiting phenology details of the following taxa have been recorded: **Orchids:** Flowering Phenology: 55 species under 31 genera; Fruiting phenology: 14 species under 12 genera; **Other Angiosperms:** Flowering phenology: 49 species under 40 genera; Fruiting phenology: 06 species under 06 genera.

PROJECT-8

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

Executing Scientist(s) : Dr. Mayur Y. Kamble and Dr. T. S. Saravanan

Date of Initiation : Ongoing

Date of completion : Ongoing

OBJECTIVE

Collection of live endemic plant species for introduction, multiplication and *ex-situ* conservation in Experimental Garden, BSI, SRC, Yercaud

BACKGROUND

This is an ongoing project. In 2018-19, two field tours were conducted during which propagules of 38 endemic tree species were collected along with 100 images and introduced in garden.

AREA AND LOCALITY

NOEG, Yercaud

SUMMARY & ACHIEVEMENT/OUTCOME:

Two Field tours *w.e.f.* 24.05.2019 to 01.06.2019 and 23.12.2019 to 31.12.2019 have been undertaken to Agasthyamalai Biosphere Reserve, Kerala during which 32 endemic tree species have been collected *viz.* *Actinodaphne bourdillonii* Gamble (Lauraceae); *Arenga wightii* Griff. (Arecaceae); *Artocarpus hirsutus* Lam. (Moraceae); *Baccaurea courtallensis* (Wight) Muell.-Arg. (Euphorbiaceae); *Croton malabaricus* Bedd. (Euphorbiaceae); *Diospyros foliolosa* Wall. ex A. DC. (Ebenaceae); *Dipterocarpus indicus* Bedd. (Dipterocarpaceae); *Dialium travancoricum* Bourd. (Fabaceae-Caesalpinioideae); *Garcinia gummi-gutta* (L.) Robs., *Garcinia imberti* Bourd., *Garcinia rubro-echinata* Kosterm., *Garcinia talbotii* Raizada ex Santapau, *Garcinia travancorica* Bedd. (Clusiaceae); *Gluta travancorica* Bedd., (Annonaceae); *Goniothalamus wightii* Hook.f. & Thomson (Annonaceae); *Gymnacranthera canarica* (Bedd. ex King) Warb. (Myristicaceae); *Hopea parviflora* Bedd (Dipterocarpaceae); *Humboldtia decurrens* Bed. ex Oliv., *Humboldtia trijuga* (J. Joseph & V. Chandras.) M. Mohanan, *Humboldtia vahliana* Wight (Fabaceae-Caesalpinioideae); *Hydnocarpus pentandrus* (Buch.-Ham.) Oken (Flacourtiaceae); *Ixora brachiata* Roxb. (Rubiaceae); *Knema attenuata* (Hook.f. & Th.) Warb., (Myristicaceae); *Monosis travancorica* (Hook.f.) H. Rob. & Skvarla (Asteraceae); *Palaquium ellipticum* (Dalz.) Baill. (Sapotaceae); *Sanjappa cynometroides* (Bedd.) E.R. Souza & Krishnaraj (Leguminosae– Caesalpinioideae) etc. In addition, live plants of following endemic/indigenous/medicinal species collected and introduced in NOEG, Yercaud: *Archidendron bigeminum* (L.) I.C. Nielsen, Medicinal; *Begonia malabarica* Lam., Medicinal & Wild Ornamental; *Cymbopogon flexiosus* (Nees ex Steud.) W. Watson, Aromatic; *Globba sessiliflora* Sims, Medicinal & Wild Ornamental; *Lophopetalum wightianum* Arn., Timber is useful; *Myristica beddomei* King, Medicinal and spice; *Pellionia heyneana* Wedd., Medicinal; *Zingiber zerumbet* (L.) Roscoe ex Sm., Medicinal and Wild Ornamental; *Caryota urens* L. Medicinal and Ornamental; *Bixa orellana* L. Medicinal and Ornamental.

WESTERN REGIONAL CENTRE, PUNE

PROJECT-1

Floristic Diversity of Wan Wildlife Sanctuary

Executing Scientist(s) : Dr. Priyanka Ingle

Date of Initiation : April, 2016

Date of completion : March, 2020

OBJECTIVE

Survey and documentation of floristic diversity of Wan Wildlife Sanctuary along with collection of ethnobotanical data from different communities dwelling in the area

BACKGROUND

This project was initiated in 2016. In 2018-19, three field tours were conducted to the study area during which 109 field nos. were collected along with GPS co-ordinates and 290 images of which 31 taxa were documented. Ethnobotanical data of 44 plants and 60 wild edible plants were recorded from 'Rathi' and 'Korku' tribal communities. In this period, several live plants such as *Butea monosperma*, *B. superba*, *Ougenia oogeinensis*, *Curcuma inodora*, *C. pseudomontana*, *Barleria gibsonii*, *Gloriosa superba* etc. were collected from the study area and introduced in the garden of BSI, WRC, SRC for *ex-situ* conservation.

AREA AND LOCALITY

Wan Wildlife Sanctuary, Maharashtra; c. 211 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Out of 572 field nos. of plant specimens, collected so far, 234 field nos. has been identified along with documentation of 261 taxa which belongs to 82 families, 334 genera, 485 species, 02 subspecies and 06 Pteridophytic taxa and labelling of approx. 1400 herbarium specimens.

PROJECT-2

Seed Morphology and Cytotaxonomy of some selected orchids of Northern Western Ghats of India

Executing Scientist(s) : Mrs. A. M. Neelima

Date of Initiation : July, 2017

Date of completion : March, 2020

OBJECTIVE

Study of seed morphology and cytotaxonomy of some selected orchids of Northern Western Ghats of India

BACKGROUND

This project was initiated in 2017. In 2018-19, one field tour was conducted to Amboli, Chandgarh, Asyniae, Ajara, Vaghotri patar and Radhanagari during which 20 field nos. were collected and identified. SEM and light microscopic studies of 19 species were conducted and cytology of 03 species was completed. During field trip, 07 endemic orchids were collected to conserve in garden.

AREA AND LOCALITY

Northern Western Ghats, Maharashtra

SUMMARY & ACHIEVEMENT/OUTCOME:

One field tour in December 2019 and three one day tours in July 2019, September 2019 and February 2020 have been conducted to Lonavala, Bhamburde van vihar and Rahimatpur areas during which 24 field nos. belonging to 11 species (fruits and flowers) have been collected along with 320 photographs and preserved for further studies. 09 species of orchids have been introduced in BSI garden for further cyto-taxonomic studies. Voucher specimens have been preserved for making herbarium along with preservation of orchid parts in 100% alcohol for microscopic studies. Beside SEM and microscopic studies have been conducted on 21 orchid samples. During this study, SEM & Light microscopic studies has been conducted for 13 species viz. *Acampe praemorsa*, *Oberonia recurva*, *Eria reticosa*, *Habenaria longicorniculata*, *Aerides crispa*, *Habenaria stenopetala*, *Dendrobium barbatulum*, *Cheirostylis parviflora*, *Aerides maculosa*, *Eulophia pretensis*, *Oberonia brounoniana*, *Smithsonia viridiflora*, *Luisia zeylanica*. In addition cytological study has been conducted on 03 species such as *Dendrobium ovatum* – chromosome number n= 13; *Oberonia brounoniana* – No result found; *Geodorum densiflorum* - No result found. 05 endemic orchids *Aerides maculosa*, *Dendrobium barbatulum*, *Aerides crispa*, *Smithsonia viridiflora* and *Dendrobium crepidatum* have been collected and introduced in the garden for further studies. *Eulophia pratensis* is added to the collection of BSI after 65 years.

PROJECT-3

Taxonomic studies of Microfungi of Sanjay Gandhi National Park, Maharashtra along with its 10 % peripheral area

Executing Scientist(s) : Dr. Rashmi Dubey & Mr. Amit Diwakar Pandey

Date of Initiation : April 2016

Date of completion : March 2020

OBJECTIVE

Taxonomic studies of microfungi found in the phyllospheric region and soil of the National Park

BACKGROUND

This project was initiated in 2016. In 2018-19, one exploration tour was undertaken in the forest cover study area during which a total of 167 samples were collected along with 600 field photographs which include 34 Follicolous, 56 leafy litter, 45 wooden samples, 01 water and 32 soil samples. 38 litter samples collected from different sites of the study area were cultured on Malt extract agar, Potato carrot agar media by applying soil dilution method and the same were subcultured on the correspondent media. A total 55 fungal colonies from 06 samples were sub-cultured and their slides were made. Molecular studies were conducted on three species.

AREA AND LOCALITY

Sanjay Gandhi National Park, Mumbai; 103.36 sq.km.

SUMMARY & ACHIEVEMENT/OUTCOME:

One Field tour *w.e.f.* 16.12.2019 to 21.12.2019 was conducted to Tulsi Range – Tulsi (North) and Yeoor range – 1136, 1137, Chhena East & West (110, 111 & 112) and other locations south of Vasai Creek. 3) during which 124 samples including 29 Foliicolous, 35 leaf litter, 40 wooden, 02 water and 18 soil samples have been collected along with 300 field photographs. 74 litter samples, collected from different sites of SGNP, have been cultured on Malt Extract Agar, Potato carrot Agar media by applying Particle filtration method. In this method, the litter samples have been subjected to particle plating method. The litter has been thoroughly washed under running tap water followed by sterile distilled water and ground into fine particles. The pulverized sample is then filtered through two superimposed metal sieves of mesh size of 250 and 100 μm . The particles trapped in the lower sieve, those between 100 and 250 μm size, has been washed repeatedly with sterile distilled water and plated on Potato Dextrose Agar or any suitable medium with antibiotics. The plates are incubated at 22-25°C. Colonies originating from each particle are individually and aseptically has been transferred to fresh plate. This study has identified following litter fungi viz. *Apiospora indica* Theiss. & Syd. (1915)-Apiosporaceae-Litter-SGNP 543-Yeoor Range, *Arthrinium sporophlaeum* Ces. 1863-Apiosporaceae-Dead twig-209232-Nagla Block, Yeoor range, SGNP, Thane, *Aquilomyces rebunensis* Kaz. Tanaka & K. Hiray.2015-Lentitheciaceae-Decaying bark-209264-Sarjamori, North of Vasai Creek, Yeoor range, SGNP, Thane, *Bahusandhika indica* (Subram.) Subram. 1956-Pezizomycotina-Dead twig-205590-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Bahusandhika intercalaris* (E.K.Cash & A.M.J Watson) Subram. 1956-Pezizomycotina-Dead twig-205591-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Brevistachys globosa* L. Lombard & Crous 2016-Stachybotryaceae-Dried twig-205585-Pankhand, Yeoor Range, *Chaetosphaeria* sp.-Botryobasidiaceae-Dry twig litter-209288-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Circinotrichum olivaceum* (Speg.) Piroz. 1962-Xylariaceae-Dead bark-210006-1140, Kavesar, Yeoor Range, SGNP, Thane, *Colletotrichum acutatum* J.H. Simmonds 1965-Glomerellaceae-Dry twig litter-210009-1140, Kavesar, Yeoor Range, SGNP, Thane, *Corynespora cassicola* (Berk. & M.A. Curtis) C.T. Wei 1950-Corynesporaceae-Leaf litter-205582-Nagla Block, Yeoor Range, SGNP, Thane, *Corynespora cassicola* (Berk. & M.A. Curtis) C.T. Wei 1950-Corynesporaceae-Leaf litter-210008-1140, Kavesar, Yeoor Range, SGNP, Thane, *Corynespora cassicola* (Berk. & M.A. Curtis) C.T. Wei 1950-Corynesporaceae-Leaf litter-205588-Panchpakhadi, Yeoor Range, SGNP, Thane, *Diatrype loranthi* Tend. 1971 - Diatrypaceae-Dead twig-SGNP 547 (2)-Nagla Block, Yeoor Range, SGNP, Thane, *Diplococcium* sp.-Vibrissaceae-Leaf Litter-SGNP 549 (b)-Yeoor Range, *Elotespora mumbiansis* sp. nov.-Pezizomycotina-Dead Twig litter-205597-Nagla Block, Yeoor range, SGNP, Thane, *Exosporium gymnemae* P.N. Singh & S.K. Singh 2015-Anamorphic Pezizomycotina-on branch litter-205389-Shilonda Trail, Tulsi range, SGNP, Mumbai, *Exserohilum elongatum* Hern.-Restr. & Crous 2018-Pleosporaceae-Dead Bark litter-205577-Kavesar, Yeoor range, SGNP, Thane, *Fusarium concentricum* Nirenberg & O'Donnell 1998 - Nectriaceae-Leaf Litter-210066 [molecular]-Tiger Reserve Areas, Krishnagiri Range, *Fusarium proliferatum* (Matsush.) Nirenberg ex Gerlach & Nirenberg 1982-Nectriaceae-Leaf Litter-SGNP 563(b)-Yeoor 111, Yeoor Range, SGNP, Thane, *Janetia indica* B.S. Reddy, V. Rao & Manohar. 2004-Pezizomycotina-Dry twig litter-205594-Pankhand, Ovale, Yeoor

Range, SGNP, Thane, *Janetia indica* B.S. Reddy, V. Rao & Manohar. 2006-Pezizomycotina-Dead Wood-205595-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Janetia indica* B.S. Reddy, V. Rao & Manohar. 2007-Pezizomycotina-Dry twig litter-205596-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Kamalomyces bambusicola* Y.Z. Lu & K.D. Hyde 2017-Dothideomycetes-Dead bamboo stem-209256-Sarjamori, North of Vasai Creek, Yeoor range, SGNP, Thane, *Lacellina macrospora* M.B. Ellis 1957-Pezizomycotina-Leaf Litter-210007-1140, Kavesar, Yeoor Range, SGNP, Thane, *Lacellina macrospora* M.B. Ellis 1957-Pezizomycotina-Leaf Litter-210003-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Lasiodiplodia mahajangana* Begoude, Jol. Roux & Slippers-Botryosphaeriaceae-Leaf Litter-209203-Sarjamori, North of Vasai Creek, Yeoor range, SGNP, Thane, *Moorella speciosa* P.Rag. Rao & D. Rao 1964-Anamorphic Pezizomycotina-Leaf Litter-SGNP 563(b)-Yeoor 111, Yeoor Range, SGNP, Thane, *Monodictys putredinis* (Wallr.) S. Hughes 1958-Pezizomycotina-Fallen Twig litter-205592-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dead stem litter-210004-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dead stem litter-210005-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dry twig litter--Yeoor Hills, Yeoor range, SGNP, Thane, 209291, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dead stem litter-209292-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dead stem litter-209278-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium diffractum* Matsush. 1996-Paradictyoarthriniaceae-Dead stem litter-209285-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Paradictyoarthrinium hydei* N.G. Liu & J.K. Liu 2018-Paradictyoarthriniaceae-Dead wood litter-209239-Sasunavaghar, Nagla Block, North of Vasai Creek, Yeoor range, SGNP, Thane, *Periconia britannica* M.B. Ellis 1976-Pleosporales-Dead stem litter-209227-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Phaeoisaria clematidis* (Fuckel) S. Hughes 1958-Diatrypaceae-Dead twig litter-210010-Kanheri caves, Krishnagiri Range, SGNP, Mumbai, *Pithomyces ellisii* V.G. Rao & Chary 1972-Didymellaceae-Dead twig litter-209234-Sasunavaghar, Nagla Block, North of Vasai Creek, Yeoor range, SGNP, Thane, *Pithomyces pulvinatus* (Cooke & Masee) M.B. Ellis 1965-Didymellaceae-Dead twig litter-205584-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. 1863-Sordariaceae-Dead stem litter-209275-Krishnagiri Range, SGNP, Mumbai, *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. 1863-Sordariaceae-Twig litter-209298-Tulsi Range, SGNP, Mumbai, *Sordaria fimicola* (Roberge ex Desm.) Ces. & De Not. 1863-Sordariaceae-Stem litter-209282-1140, Kavesar, Yeoor Range, SGNP, Thane, *Sorocybe resinae* (Fr.) Fr. 1849-Amorphothecaceae-Dry twig litter-210002-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Sporidesmium ehrenbergii* M.B. Ellis 1958-Amorphothecaceae-Dry twig litter-205589-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Sporidesmium* sp. 1-Dothideomycetes-Dry twig litter-209243-Nagla Block, Yeoor range, SGNP, Thane, *Sporidesmium* sp. 2-Dothideomycetes-Dry twig litter-209219-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Stachybotrys charatum* (Ehrenb.) S. Hughes 1958-Stachybotryaceae-Dry twig litter-205586-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Stachybotrys levisporus* (Subram.) Yong Wang bis, K.D. Hyde, McKenzie, Y.L. Jiang & D.W. Li 2015-

Stachybotryaceae-Dry twig litter-205590-Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Torula herbarum* (Pers.) Link 1809-Torulaceae-Dry twig litter-205578-Kavesar, Yeoor range, SGNP, Thane, *Torula herbarum* (Pers.) Link 1809-Torulaceae-Dry twig litter-205581-1140, Kavesar, Yeoor Range, SGNP, Thane, *Volutina concentrica* Penz. and Sacc. 1902 - Nectriaceae-Dead stem litter-209233-Panchpakhadi, Yeoor Range, SGNP, Thane, *Xenosporium indicum* Panwar, Purohit & Geholt 1973-Tubeufiaceae-Dry twig litter-209260-Panchpakhadi, Yeoor Range, SGNP, Thane.

SOIL SAMPLES: The isolation of soil fungi has done by serial dilution technique. Total 43 soil samples have been processed, from that 50 fungi have been isolated on different media at different concentrations. Some of the spoil fungi identified are *Aspergillus brasiliensis* Varga, Frisvad & Samson 2007 - Aspergillaceae - 205537 - MEA - $10^{(-2)}$ - Kavesar, Yeoor Range, SGNP, Thane, *Aspergillus brasiliensis* Varga, Frisvad & Samson 2007 - Aspergillaceae - 205539 - PDA - $10^{(-1)}$ - Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Aspergillus candidus* Link 1809 - Aspergillaceae - 205535 - MEA - $10^{(-1)}$ - Kavesar, Yeoor Range, SGNP, Thane, *Aspergillus flavipes* (Bainier & R. Sartory) Thom & Church 1926 - Aspergillaceae - 205453 - MEA - $10^{(-1)}$ - Tulsi lake, Tulsi Range, *Aspergillus flavipes* (Bainier & R. Sartory) Thom & Church 1926 - Aspergillaceae - 205536 - PCA - $10^{(-2)}$ - Kavesar, Yeoor Range, SGNP, Thane, *Aspergillus fumigatus* Fresen. 1863 - Aspergillaceae - 205374 - PDA - $10^{(-2)}$ - Chena Lake, Yeoor Range, SGNP, Thane, *Aspergillus fumigatus* Fresen. 1863 - Aspergillaceae - 205522 - MEA - $10^{(-2)}$ - Tulsi lake, Tulsi Range, *Aspergillus fumigatus* Fresen. 1863 - Aspergillaceae - 205536 - PCA - $10^{(-2)}$ - Kavesar, Yeoor Range, SGNP, Thane, *Aspergillus nidulans* (Eidam) G. Winter 1884 - Aspergillaceae - 205513 - PCA - $10^{(-2)}$ - Near boating lake, Upwan, Krishnagiri Range, *Aspergillus nidulans* (Eidam) G. Winter 1884 - Aspergillaceae - 205536 - MEA - $10^{(-1)}$ - Kavesar, Yeoor Range, SGNP, Thane, *Aspergillus niger* Tiegh. 1867 - Aspergillaceae - 205453 - MEA - $10^{(-3)}$ - SGNP, *Aspergillus niger* Tiegh. 1867 - Aspergillaceae - 205534 - MEA - $10^{(-3)}$ - Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Aspergillus niger* Tiegh. 1867 - Aspergillaceae - 205535 - MEA - $10^{(-1)}$ - Pankhand, Ovale, Yeoor Range, SGNP, Thane, *Aspergillus niger* Tiegh. 1867 - Aspergillaceae - 205536 - MEA - $10^{(-2)}$ - Kavesar, Yeoor Range, SGNP, Thane etc.

WATER SAMPLES: 05 water samples collected from various water bodies of SGNP have been processed using PDA, PCA & MEA media. Total 55 fungal colonies from 06 samples have been sub cultured and their slides are made. Genomic DNA has been isolated from pure colony grown on PDA media plate for 14 days following a rapid and simple DNA extraction protocol (HiPurA™ Fungal DNA Purification Kit). Sequences obtained have been submitted to NCBI GenBank accession numbers MT586317 (LSU), and MT586318 (ITS). The sequences obtained in the form of chromatograms have been analysed using megablast search algorithm and sequences of related strains have been retrieved from NCBI to compare with the already known taxa of respective genus/species. The sequences have been deposited in GenBank and the chosen strains used in the construction of the phylogenetic tree along with their accession numbers. The details of species studied by molecular techniques are : *Aspergillus sydowii* (Bainier & Sartory) Thom & Church (1926) - Water - Godhbhandar Yeoor Range, SGNP, Thane - 205516 (SM2), *Aspergillus jaipurensis* Samson, Visagie &

Houbraken 2014 - Soil - Panchpakhadi Yeeor Range, SGNP, Thane - 210065 (SM9), *Lasiodiplodia mahajangana* Begoude, Jol. Roux & Slippers, 2010 - Wooden sample - Yeeor Range, SGNP, Thane - SGNP 576 (SM10), *Fusarium concentricum* Nirenberg & O'Donnell 1998 - Soil - Krishnagiri - 210066 (SM7), *Aspergillus germanicus* Varga, Frisvad & Samson, 2011 - Water sample - Krishnagiri range - 205389 (SM21), *Aspergillus westerdijka* Frisvad & Samson 2004 - Soil - Pankhand - 205541 (SM22), *Fusarium proliferatum* (Matsush.) Nirenberg 1976 - Dry litter - Point111, Yeeor Range, SGNP, Thane - SGNP 563(b) (SM29), *Penicillium chrysogenum* Thom 1910 - Soil - Kavesar - 205536 (SM30), *Aspergillus melleus* Yukawa 1911 - Soil - Kavesar - 205554 - 205555- (SM33) and *Aspergillus ochraceopetaliformis* Bat. & Maia 1957 - soil - Pankhand - 2205541 (SM22).

This study reports one species (*Brevistachys yeoorensis* sp.nov. - Stachybotryaceae - Dead stem - 209284) as new to Science and 03 new records (*Lasiodiplodia mahajangana* Begoude, Jol. Roux & Slippers, 2010 - Botryosphaeriaceae - Leaf Litter - Sarjamori, North of Vasai Creek, Yeeor range, SGNP, Thane, *Acanthonitschkea pulchella* (Sacc.) Nannf. 1975 - Nitschkiaceae - stem litter - Sarjamori, North of Vasai Creek, Yeeor range, SGNP, Thane and *Natantiella ligneola* (Berk. & Broome) Réblová 2009 - Boliniaceae - Leaf litter - Magar Dam, Tulsi range, SGNP, Mumbai) for India. Beside SEM study has been conducted on *Kamalomyces bambusicola*, *Elotespora mumbiansis* sp.nov., *Janetia indica*, *Dictyosporium* sp., *Memnoniella* sp., *Helicosporium* sp. SGNP 5605; *Heteroconium* sp, *Acanthohelicospora guianensis*, *Taeniolella breviuscula*, *Chaetosphaerulina bambusae*, *Xenosporium indicum*.

PROJECT-4

Pteridophytic Flora of Pushpagiri Wildlife Sanctuary, Karnataka with 10% Periphery

Executing Scientist(s) : D. Jesubalan & A. Benniamin

Date of Initiation : April 2016

Date of completion : March 2020

OBJECTIVE

Preparation of comprehensive floristic account of pteridophytic flora of Pushpagiri Wildlife Sanctuary, Karnataka and its surroundings

BACKGROUND

One field tour was conducted to the study area during which 96 field nos. were collected along with GPS data out of which 55 species were identified. Two threatened species *viz.* *Osmunda helsenbergii* and *Huperzia phlegmaria* was collected from higher elevation of the Sanctuary and introduced in the BSI, WRC Garden. Spore morphology of 20 species were studied under Scanning Electron Microscope.

AREA AND LOCALITY

Pushpagiri Wildlife Sanctuary, Coorg Dist., Karnataka; c. 102.92 sq. km.

SUMMARY & ACHIEVEMENT/OUTCOME:

Two field tours *w.e.f.* 30.03.19 to 08.04.19 and 11.09.19 to 22.09.19 have been undertaken to the unexplored forest areas of the Pushpagiri Wildlife Sanctuary such as Vanachale, Kadamakkal, Kujumale, Beedali, Marigundi, Kadamakkal, Kujumale, Girigadda, Beedali and

adjoining forest areas during which total 88 field nos. including 78 species have been collected along with GPS data and 381 field photographs. Some of the common terrestrial species viz. *Adiantum philippense* L., *Athyrium hohenackerianum* (Kunze) T.Moore, *Dicranopteris linearis* (Burm. f.) Underw., *Pteris biaurita* L., *Sphenomeris chinensis* (L.) Maxon, *Tectaria coadunata* (J.Sm.) C. Chr., *Pteris pellucida* C. Presl, *Tectaria polymorpha* (Wall. ex Hook.) Copel.; epiphytes viz. *Asplenium indicum* Sledge, *Microsorium membranaceum* (D.Don) Ching, *Selliguea hastata* (Thunb.) Fraser-Jenk., *Asplenium indicum* Sledge and lithophytes *Mickelopteris cordata* (Roxb. ex Hook. & Grev.) Fraser-Jenk., *Pteris vittata* L. have been found in and around the wildlife sanctuary. In addition one herbarium consultation tour w.e.f. 15.02.20 to 18.02.20 has been conducted to CAL, Botanical Survey of India, Howrah during which more than 500 Pteridophytes herbarium specimens and type specimens of *Cyrtomium* sp. has been consulted. The present investigation led to find three new records for the state of Karnataka viz. *Pronephrium triphyllum* (Sw.) Holttumm, *Bolbitis virens* (Wall. ex Hook. & Grev.) Schott. and *Athyrium nigripes* (Blume) T. of which *Pronephrium triphyllum* (Sw.) Holttumm is an endemic fern to southern India. Endemic and Endangered Pteridophytes documented from Pushpagiri Wildlife Sanctuary are: *Huperzia niligarica* (Spring) Dixit, *Selaginella miniatospora* (Dalz.) *Botrychium daucifolium* Wallich ex Hooker & Greville, *Osmunda hilsenbergii* Grev. & Hook., *Hymenophyllum gardneri* Bosch, *Trichomanes bimarginatum* (Bosch) Bosch, *Trichomanes obscurum* Blume., *Trichomanes latemarginale* D. C. Eaton, *Cyathea crinita* (Hook.) Copel., *Cyathea nilgirensis* Holttum, *Anogramma leptophylla* (L.) Link, *Pellaea boivinii* Hook., *Pteris otaria* Bedd., *Pronephrium triphyllum* (Sw.) Holttum, *Diplazium travancoricum* Bedd., *Bolbitis appendiculata* (Wild.) Iwatsuki, *Bolbitis beddomei* Fraser-Jenk. & Gandhi *Bolbitis feeiana* (Copel.) Fraser-Jenk. & Gandhi. *Bolbitis semicordata* (Baker) Ching. *Bolbitis virens* (Wall. ex Hook. & Grev.) Schott, *Elaphoglossum beddomei* Sledge, *Elaphoglossum nilgircum* Krajina ex Sledge, *Leptochilus lanceolatus* Fée, *Oreogrammitis pilifera* (Ravi & J. Joseph) Parris.

PROJECT-5

Pteridophytes of Goa

Executing Scientist(s) : Dr. A. Benniamin

Date of Initiation : April 2018

Date of completion : March 2020

OBJECTIVE

Study of Pteridophytic diversity of Goa state

BACKGROUND

This project was initiated in 2018. In previous year, two field tours were undertaken to different localities of Madei WLS, Bhondla WLS, Molem WLS, Cortigao WLS, Nethravati WLS and surrounding forested areas during which 95 field nos. belonging to 49 species were collected along with study of chromosome no. of 04 species. In addition spore morphology of 10 species was studied under SEM. Total 05 species were collected and introduced in Botanical Garden of WRC, Pune.

AREA AND LOCALITY

Goa state

SUMMARY & ACHIEVEMENT/OUTCOME:

Two field tours have been undertaken to different localities of Madei Wildlife Sanctuary, Molem National Park, Mahavir Wildlife Sanctuary and nearby forest areas of Goa during which 118 field numbers including 45 species have been collected. All the earlier collection have been identified. A checklist of 70 species of Pteridophytes of Goa from study area has been prepared along with 30 Photoplates. Spore Morphology of 20 species has been studied under Scanning Electron Microscope (SEM). In this period, chromosomes number of 05 species has also been studied. This study reports *Pteris heteromorpha* Fee as New record for the state of Goa from Madhei Wildlife Sanctuary, Goa. The final Report of Annual Action Plant is under progress.

PROJECT-6

Ecology and taxonomy of psychrophilic benthic and lithic algal community from inland Antarctica

Executing Scientist(s) : Dr. Sukumar Bhakta

Date of Initiation : 2017

Date of completion : 2020

OBJECTIVE

Study of ecology and taxonomy of psychrophilic benthic and lithic algal community from inland Antarctica

BACKGROUND

The most abundant and cold stress tolerant photosynthetic organism in Antarctic habitat is algae, which is a major primary producer to provide food and energy to rest of food chain. Snow melts Streams and lakes as well as terrestrial habitat are most preferable for colonization of benthic and lithic form of algae. Monitoring of climate change, biodiversity and distribution of polar algae is become urgent which has never been more apparent than present. Out of the three Indian Antarctic research stations, Schirmacher Oasis (Maitri) region is somehow explored for the microbial studies so far including diatoms and cyanobacteria. Bharati is a third research station of India situated on Bharati island (North Grovenes peninsula) of Larsemann Hills (60° 20' - 69° 30'S and 75° 55'-76° 30'E) is a 50 sq.km. stretch coastal Oasis of Antarctica. More than 150 freshwater lakes and ice melt streams found in Larsemann hills (Gillieson & al., 1990). Most of the terrestrial and aquatic habitats for algae of Larsemann hills remain snow covered and frozen. However, during summer temperature rises up to 12°C resulting the snow melt which provides the favourable condition for the growth of algal community. The snow-melt stream washes out trace metals or micronutrients which confer the ideal condition for microalgae both in terrestrial and near shore aquatic habitats. Therefore, the present work is focused on the ecology and taxonomy of algae occurring in form of benthic and lithic form to understand their habitat specificity, taxonomy and species interaction among the community progressively.

AREA AND LOCALITY

Fisher Island, EasterIsland, Harley Island, Betts Island, Qasim island (proposed name), Broknes peninsula, Grovnes peninsula and Stornes peninsula (ASPA-174) of Antarctica

SUMMARY & ACHIEVEMENT/OUTCOME:

During the period of summer 38th Indian Scientific Expedition to Antarctica (38th ISEA) a total of 170 algal samples have been collected occurred in form of Chasmolithic, hypolithic, benthic, moss associate, epilithic, endolithic and surface snow from different islands. Microscopic observation and microphotography have been carried out for 120 algal samples collected from these islands and peninsula regions. Indexing of all algal samples for preservation and Designated Repository (DR) has been carried out with an accession number for Botanical Survey of India, Western Regional Centre, Pune. Physico-chemical parameter of water samples collected from different aquatic habitats have been determined which revealed that pH ranges between 4.7 – 7.4, Conductivity 70.1 - 1498 μ S, Total dissolve solids (TDS) 49.8ppm – 1.06 ppt and total salt 38.3 – 755 ppm. Lake water of Easter Island has shown maximum range in all respect. During the study occurrence of microalgae in terrestrial habitats has been observed to have occurred as epiphyte (with bryophyte community), chasmolithic (growing on the rock surface interspersed between the mineral crystals and thus hidden and inconspicuous), endolithic (inside rock), epilithic (Surface of rock or soil), benthic and subsurface of the gravel soil. The sublithic or hypolithic algae has been mostly observed below the quartz stones which is very unusual and unlike to tropical regions. Quartz stones have a translucent property made up of SiO₂ which facilitates the growth of these algae providing diffused light and controlled temperature during winter also. The study areas of Larsemann hills, East Antarctica is rich in source of mineral crystals, stones of quartzes, mica, garnets, quartzite, hematite, magnetite and precious borosilicate. The stones are usually niece, paraniece, ignite, metamorphic and sedimentary. Apart from bryophytes and lichens, microalgae and cyanobacteria which are among the dominating flora mostly occurred in subsurface of the gravel soil and rocks. The study areas of Larsemann hills, East Antarctica is rich in source of mineral crystals, stones of quartzes, mica, garnets, quartzite, hematite, magnetite and precious borosilicate. The stones are usually niece, paraniece, ignite, metamorphic and sedimentary. Apart from bryophytes and lichens, microalgae and cyanobacteria which are among the dominating flora mostly occurred in subsurface of the gravel soil and rocks. The study reports the occurrence of the members of chroococcales algae under the genera *Chroococcus*, *Aphanocasa*, *Gleocapsa*, *Gloeotheca*, *Synechococcus*, *Myxosarcina*, *Synechocystis*, *Gloeocapsa*, *Pleurocapsa*, *Chlorogloea*, *Pseudocapsa* and *Gloeocapsopsis* in the lithic form with huge pigment content carotenoids and MAA/Scytonemins. Epilithic algae found growing profusely in the areas where the birds defecates and the dead organic remnants were accumulated. Though green algae found less diverse in terrestrial form, occurrence of nitrophilous epilithic/hypolithic green thallus with different stages of *Prasiola* sp. was most abundant and habitat specific. This is mainly occurring in the area where the birds lays their eggs or dead remnant of birds or organic accumulation found. It has been reported earlier from the aquatic habitats of polar and low temperature regions of the world. Skua (*Catharacta maccormicki*) is a natural scavenging bird in Antarctica hunts different other birds like snow petrel (*Pagodermis nivea*), storm petrel and penguins leaving behind the feathers and bones. Feathers, carcasses and faecal

matters usually composed of keratins which is a source of C, N, P, H and S elements which significantly play an important role in phosphorus cycle in terrestrial ecosystems facilitating the growth of algae in terrestrial habitats of Antarctica. Nonheterocystous cyanobacteria under order Oscillatoriales were more often found in extreme habitats. The genera *Oscillatoria*, *Phormidium*, *Pseuanaabaena*, *Leptolynbya*, *Jaaginema*, *Schizothrix*, *Romeria* and *Lyngbya* occur in this study mostly found in hypolithic form. Among heterocystous genera most abundant taxa were *Nostoc* sp. with a wide range of morphotypes. *Petalonema involvens*, *Rivularia compacta*, *Rivularia atra*, *Tolypothrix* sp., *Dichothrix* sp., *Scytonema* sp. and *Stigonemasp.* epiphytic to mosses were recorded during the study. Though similar species occur in soils of tropical region, there are significant variations in their morphotypes. Therefore, those mesophilic organisms found in Antarctica may have been transferred to Antarctica in result of horizontal gene transfer or due to their nutritional or morphological adaptation. Diatoms were mainly occurring in the benthic form and the diversity is less. The recent molecular studies on micro chlorophyte isolated from lacustrine habitats of Antarctica point to a wide phylogenetic diversity of apparently endemic Antarctic lineages at different taxonomic levels. Thus supports the hypothesis of long term acclimatization took place in glacial refugia leading in to a specific Antarctic flora. Occurrence of thick lamellated mat and pinnacles of cyanobacterial biomass in aquatic ecosystem contributing melting of subglacial lakes and fjords by trapping the solar radiation and reducing albedo during austral summer. Heterocystous filamentous thallus recorded also contained a thick sheath as well as lamellate outer thickening. Presence of hormogonia, heterocyte, necredia and distorted filament depicted the extreme adaptation to cold temperature. Green algae are mostly confined to the area rich in nitrogen due to accumulation of faecal and dead remnants of Antarctic birds. However, most dominating genus was *Prasiola* sp. recorded during the study. Hypolithic, chasmolithic and endolithic algae occurred mostly which is showing an adaptation towards cold and one of the contributors of soil formation through bioleaching and rock withering. Soil particles containing algal spores and desiccated colonies disseminated to a remote distant of continental ice sheet and ice shelf to form cryoconite microclimatic zones.

Present study revealed a significant occurrence of terrestrial algae and more to be studied in connection to their taxonomical approach. Molecular study will resolve the ambiguity among the morphometric similar algae occurring in a wide distribution and the work is under process. Enumeration of all the algal taxa and their identification will be carried out subsequently. Observation of endolithic algae has an insight towards one of the mechanisms for soil production and corrosion of rock of the continent. Hypolithic and endolithic habitats also showed an adaptive feature of the organism which needed to be studied in biochemical and proteomic level. Sediment biomasses of subglacial lake and algal consortium therein have been facilitating the melting of the habitat.

**PROJECT
FLORA OF INDIA**

Flora of India Vol. 8 Family Rosaceae, Chrysobalanaceae & Neuradaceae (c. 523 taxa)

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

OBJECTIVE

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

BACKGROUND

This is new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

One Herbarium consultation tour *w.e.f.* 16.02.2020 to 26.02.2020 was conducted to DD & BSD during which a total 1364 no. of specimens were studied and reconfirmed identity of 12 specimens at DD. Updated nomenclature and description of 120 taxa along with proper citation, basionym, relevant synonyms, phenology, distribution, uses, chromosome nos. and taxonomic notes. A checklist comprising of 36 genera and 523 taxa was prepared for 'Checklist of Flora of India'.

Flora of India Vol. 10: Family Melastomataceae, Lythraceae, Altingiaceae, Sonneratiaceae, Crypteroniaceae, Punicaceae, Onagraceae, Trapaceae, Turneraceae, Passifloraceae, Caricaceae, Cucurbitaceae, Begoniaceae, Datisceae (c. 475 taxa)

Executing Scientist(s) : Dr. B. K. Sinha, Dr. S.S. Dash & Dr. Sudeshna Dutta
Date of Initiation : 2018
Date of completion : 2020

OBJECTIVE

Updating nomenclature of each taxon of the family Cucurbitaceae in India

BACKGROUND

This project was initiated in 2018. In 2018-19, an exhaustive checklist of the family Cucurbitaceae was prepared followed by conventional method of taxonomy and literature survey. All the type materials housed at CAL or JSTOR were studied along with study of herbarium specimens deposited at CAL, ASSAM, BLATTER, BSA and BSIS. The accepted name were inferred after resolving nomenclatural ambiguity.

AREA AND LOCALITY

India

Flora of India Vol. 11: Family Cactaceae, Aizoaceae, Molluginaceae, Apiaceae, Araliaceae, Cornaceae, Alangiaceae, Nyssaceae, Caprifoliaceae, Adoxaceae (10 families, 94 genera, 375 species)

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

OBJECTIVE

Updating nomenclature and description of 10 families of Flora of India Volume 11.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. C. Murugan & Dr. W. Arisdason: Description of 66 species and 13 varieties under 14 genera of the family Araliaceae was completed. Key to genera and species is in progress.

Dr. W. Arisdason: Description of 20 species and 02 varieties under 09 genera belong to the families Cactaceae, Aizoaceae and Molluginaceae was completed. Final formatting is under progress.

Dr. R. Manikandan: One herbarium consultation tour *w.e.f.* 20.10.2019 to 27.10.2019 was undertaken to Botanical Survey of India, Northern Regional Centre, Dehradun (BSD) and Herbarium of Botany Division, Forest Research Institute, Dehradun (DD) during which 159 specimens were studied. In addition consulted literature at MH Herbarium. Prepared, completed and submitted the Checklist for the Family Apiaceae (part-2) comprising of 64 genera, 163 species including few cultivated species for Flora of India Checklist. Updated taxonomic account along with nomenclatural citations, standardization of author citation, books, journals, description, phenological data, habitat, distribution data, uses and notes (if any) were prepared for 163 taxa under 64 genera of the family Apiaceae (Part-2). Preparation of key to the genera and species and finalization of the manuscript are in progress.

Dr. K.A. Sujana: Updated taxonomic account of the families Cornaceae, Alangiaceae, Nyssaceae, Caprifoliaceae and Adoxaceae. Final formatting is in progress.

Dr. M. Murugesan: One field tour *w.e.f.* 29.10.2019 to 31.10.2019 was conducted to Mukurthi National Park, Nilgiri District of Tamil Nadu during which 95 field nos. were vouched along with a good numbers of field photographs. Beside one Herbarium consultation tour *w.e.f.* 25.11.2019 to 29.11.2019 was undertaken to CAL, Howrah and accessed 109 species under 10 genera of the family Apiaceae. A total of 166 taxa (156 species & 10 varieties) under 12 genera were documented and updated, *viz.* *Acronema* (10 species), *Bupleurum* (34 species and 05 varieties), *Heracleum* (23 species), *Hydrocotyle* (09 species), *Karnataka* (01 species), *Kedarnatha* (04 species), *Peucedanum*: (09 species and 01 variety), *Pimpinella* (26 species and 02 varieties), *Pleurospermum* (21 species and 01 variety), *Selinium* (07 species and 01 variety), *Sinocarum* (11 species), *Vanasushava* (01 species). This study records *Bunium nothum* (Clarke) P.K.Mukh., rediscovered after its type collection (c.

136 years). In addition, a narrow endemic species to the Nilgiris viz. *Heracleum hookerianum* Wight & Arn. was collected during this period.

Flora of India Vol. 15: Family Stylidiaceae, Goodeniaceae, Campanulaceae, Sphenocleaceae, Ericaceae, Clethraceae, Pyrolaceae, Monotropaceae, Epacridaceae, Diapensiaceae, Plumbaginaceae, Primulaceae

Executing Scientist(s) : Dr. A.A. Mao, DR. S.S. Dash, Dr. Umeshkumar L. Tiwari
& Dr. Vijay Mastakar
Date of Initiation : 2019
Date of completion : 2020

OBJECTIVE

Updating nomenclature and upgradation of description of 500 species belong to 41 genera of the above families in India.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

One Herbarium consultation tour was conducted to BSHC, DD and BSD in October-November 2019. Mss. comprising of 08 genera and 210 taxa (including 192 species, 09 subspecies, 09 varieties) of the family Primulaceae in India was prepared along with key for the easy identification of the taxa. Mss. comprising of 10 genera, 50 species and 03 subspecies of the family Campanulaceae along with key for the easy identification of the taxa was prepared.

Flora of India Vol. 17: Family Asclepiadaceae, Loganiaceae, Buddlejaceae, Gentianaceae, Menyanthaceae

Executing Scientist(s) : Dr. J. Jayanthi & Dr. Prachiti D. Mule
Date of Initiation : 2019
Date of completion : 2020

OBJECTIVE

Updation of nomenclature and description of 114 genera and 641 species under 05 families of Volume 17 of Flora of India

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Updated checklist of the families Asclepiadaceae (306 sp.), Menyanthaceae (12 sp.) and Gentianaceae (185 sp.) along with completion of updated nomenclature and current distribution. Taxonomic description of 200 species of the family Asclepiadaceae was

prepared as per Flora of India format. Mss. of the families Loganiaceae (10 species), Buddlejaceae (28 species), Gentianaceae and Menyanthaceae received from Dr. P. Lakshminarasimhan, Dr. P.V. Prasanna, Dr. Sharmishta Gupta and Dr. P.G. Diwakar respectively were submitted.

Flora of India Vol. 18: Families Polemoniaceae, Hydrophyllaceae, Boraginaceae, Convolvulaceae, Cuscutaceae and Solanaceae

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

OBJECTIVE

Upgradation of nomenclature and description of c. 625 species belong to 73 genera in the available Manuscripts of the above families in India.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Nomenclature and taxonomic description of the species of the families Polemoniaceae, Hydrophyllaceae, Boraginaceae, Convolvulaceae, Cuscutaceae & Solanaceae were updated along with preparation of Generic & Species keys. Data regarding distribution, Chromosome numbers of each species were incorporated. Information regarding mentioned families Polemoniaceae (01species, 01 subspecies), Hydrophyllaceae (01 species, 02 varieties) Boraginaceae (193 species, 26 subspecies, 29 varieties, 04 formas) Convolvulaceae (164 species, 04 subspecies, 29 varieties) Cuscutaceae (08 species, 04 varieties) Solanaceae (92species, 09 varieties, 03 formas) were provided for the preparation of 'Flora of India Check List'. Final manuscript of 'Flora of India, volume 18' is under progress.

Flora of India Vol. 19: Family Scrophulariaceae [(Genus – *Veronica* & *Lagotis*); Series Pseudosolaneae & Series Antirrhinideae]; Orobanchaceae and Lentibulariaceae

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

OBJECTIVE

Updating nomenclature and description of c. 570 species belong to 68 genera of the families Scrophulariaceae, Lentibulariaceae and Orobanchaceae

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. Arti Garg: Two field tours *w.e.f.* 28. 07. 2019 to 09. 08. 2019 and 17.09.2019 to 25.09.2019 were conducted to Chamba valley, Bairagarh, Sach Pass, Dalhousie, Jot, Dharamsala, Rohtang pass of Himachal Pradesh and Lachung, Katau, Nathula and adjoining areas of Sikkim during which 130 field nos. were collected along with 700 photographs of 28 species of *Pedicularis* L. and of genera *Lagotis* Gaertn., *Mazus* Lour., *Wulfenia* Jacq. and *Scoparia* L. Description of 40 taxa under the genus *Pedicularis* L. comprises of 103 taxa under 80 species, 14 subspecies and 09 varieties in India was completed for the Flora of India Volume 19. Nomenclature of all the species were updated alongwith distribution, flowering and fruiting time, ecology, nomenclatural notes and uses if any. The final Mss. is under process. Checklist of the genus *Pedicularis* L. (Scrophulariaceae) was completed with citations, synonyms if any, and distributional data for 103 taxa under 80 species, 14 subspecies and 09 varieties. The complete checklist of family Scrophulariaceae comprising of 62 genera, 336 species, 21 subspecies and 20 varieties was edited for the checklist volume and submitted.

Dr. A. N. Shukla: A field tour *w.e.f.* 17.09.2019 to 25.09.2019 was conducted to Sikkim Himalayan regions covering the areas Lachung, Katau, Nathula and adjoining areas during which 85 field numbers of plant specimens were vouched and 500 photographs of the habit of plants, flowers and landscape vegetation were taken. Checklist of the allotted family was revised and submitted. Described 20 species of different genera of family Scrophulariaceae for the flora of India. Final Mss. is under progress.

Dr. Ashutosh Kumar Verma: Compiled and updated checklist of allotted taxa of the family Scrophulariaceae and described thirteen species namely *Scoparia dulcis* L., *Striga angustifolia* (D. Don) C.J. Saldanha, *S. asiatica* (L.) Kuntze., *S. densiflora* (Benth.) Benth., *S. gesnerioides* (Willd.) Vatke, *S. indica* K.M.P. Kumar, P. Jayanthi, A. Rajendran & M. Sabu, *S. kamalii* Omalsree, K.M.P. Kumar, M. Sabu & Sunojk., *S. masuria* (Buch.-Ham. ex Benth.) Benth., *S. sulphurea* Dalzell & A. Gibson, *Hemiphragma heterophyllum* Wall., *Melampyrum indicum* Hook.f. & Thomson, *Micrargeria wightii* Benth. and *Wulfenia amherstiana* Benth. Preparation of the final manuscript is under progress.

Dr. O.N. Maurya & Dr. Anand Kumar: One herbarium consultation tour *w.e.f.* 18.09.19 to 30.09.19 was undertaken to DD & BSD during which type specimens of *Lindernia hookeri* subsp. *kumaunensis* Pennell, *Scrophularia decomposita* Royle ex Benth., *S. exserta* Pennell, *S. himalensis* Royle ex Benth., *S. petraea* Aitch. & Hemsl. and *Gleadovia banerjiana* Deb deposited at DD were studied, 29 type herbarium specimens were sorted out from the general herbarium and handed over for digitization. The sorted type specimens belong to *Scrophularia dentata* Royle ex Benth. (01), *S. farinosa* Boiss. (01), *S. koelzii* Pennell (12), *S. robusta* Pennell (06 specimens), *S. scoparia* Pennell (01), *S. stewartii* Pennell (01), *S. variegata* M.Bieb. f. *himalayensis* Gard. (01), *Vanellia hookeri* C.B. Clarke ex Hook.f. (02) under family Scrophulariaceae and *Gleadovia ruborum* Gamble & Prain (04) under family Orobanchaceae. Checklist of series Pseudosolaneae and Antirrhinideae of Scrophulariaceae comprising of 163 taxa and of Orobanchaceae comprising of 38 taxa were completed and submitted to Team Leader. Besides, the checklist of Scrophulariaceae (62 genera, 336

species, 21 subspecies and 20 varieties), Orobanchaceae (07 genera, 37 species and 01 variety) and Lentibulariaceae (02 genera and 38 species) was checked, rectified and submitted to Dr. Arti Garg, Scientist-E for submission to Hqrs.

Dr. Manas Ranjan Debta : One Herbarium consultation tour was undertaken to ASSAM, CNH, DD and BSD during October-November 2019. Mss. of the family Scrophulariaceae (Genera *Veronica* & *Lagotis*) comprising of 09 taxa of the genus *Lagotis* and 38 taxa of genus *Veronica* in India along with key for easy identification were finalized along with 06 photographs and 02 illustrations. Mss. of the family Lentibulariaceae comprising of 02 genera and 38 taxa from India along with key for easy identification of the taxa was completed and submitted along with 02 photographs.

Flora of India vol. 20: Family Gesneriaceae, Bignoniaceae, Pedaliaceae, Acanthaceae

Executing Scientist(s) : Dr. P. Lakshminarasimhan, Dr. W. Arisdason, Dr. K. Karthigeyan & Dr. Gopal Krishna
Date of Initiation : 2018
Date of completion : 2019

OBJECTIVE

Upgradation of the description and updating names in available Mss. of the above families in India.

BACKGROUND

This project was initiated in 2018.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

This project was initiated in 2018. The family Gesneriaceae, consists of 27 genera, 144 species, 05 varieties, 01 subspecies (wild), and 14 cultivated species in India, was updated as per Flora of India format. The soft copy of Mss. was submitted to D/BSI.

Flora of India vol. 21: Family Plantaginaceae, Labiatae/Lamiaceae (*Leucas* and *Gomphostemma*), Avicenniaceae, Verbenaceae, Symphoremataceae, Phrymaceae

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

OBJECTIVE

Updation of description of c. 500 species belong to 73 genera of the family Avicenniaceae, Lamiaceae, Verbenaceae, Symphoremataceae along with nomenclature update.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. V. Sampath Kumar: Approx. 600 taxa found in the families, Avicenniaceae, Labiatae/Lamiaceae, Phrymaceae, Plantaginaceae, Symphrometaceae and Verbenaceae were compiled. The galley proof of mss. of these families were corrected and submitted for publication. For the family Labiatae/Lamiaceae, description of 100 species belongs to the genera *Achyrospermum* Blume, *Ajuga* L., *Anisomeles* R.Br., *Chelonopsis* Miq., *Colquhounia* Wall., *Craniotome* Rchb., *Dracocephalum* L., *Eriophyton* Benth. and *Galeopsis* L. etc. were completed. Mss. of the families Plantaginaceae and Symphrometaceae received from the team members were corrected and suggested some modifications. Further, the corrections in the galley proof of the family Lecythidaceae, submitted earlier, was thoroughly revised and resubmitted the updated version in April 2020. The updation includes the reinstatement of the subspecies *spicata* (Blume) Payson of *Barringtonia acutangula* (L.) Gaertn., transfer of some merged Literature to the respective genera and inclusion of *Barringtonia macrostachya* (Jack) Kurz as excluded species. This study reports *Salvia roborowskii* Maxim. an addition to flora of Western Himalaya. Based on Flora of India work, new combinations and new names were proposed in Checklist.

Dr. Gopal Krishna & Dr. Anant Kumar: Consulted relevant literature and herbarium for the family Plantaginaceae. Descriptions of 12 species and 03 subspecies viz. *Plantago amplexicaulis* Cav., *P. amplexicaulis* Cav. subsp. *bauphula* (Edgew.) Rech.f., *P. asiatica* L., *P. asiatica* L. subsp. *erosa* (Wall.) Z.Yu Li, *P. ciliata* Desf., *P. depressa* Willd., *P. exigua* Murray, *P. gentianoides* Sibth. & Smith subsp. *griffithii* (Decne.) Pilger, *P. himalaica* Pilger, *P. indica* L., *P. lanceolata* L., *P. major* L. and *P. ovata* Forssk. were completed along with key to the genera and species. Updated checklist of Plantaginaceae and the genus *Leucas* R.Br. comprising of 45 species and 11 varieties was prepared and submitted. Besides descriptions of 21 species and 09 varieties viz. *L. anandaraoana* Umamaheshwari & Daniel, *L. angularis* Benth., *L. angustissima* Sedgwick, *L. aspera* (Willd.) Link, *L. beddomei* (Hook. f.) Sunojk., *L. beddomei* (Hook.f.) Sunojk., *L. biflora* (Vahl) R.Br., *L. cephalotes* (Koen. ex Roth) Spreng., *L. clarkei* Hook.f., *L. deodikarii* Billore & Hemadri, *L. dhonimalayensis* Sunojk. & Vimal, *L. diffusa* Benth., *L. decemdentata* (Willd.) R.Br., *L. decemdentata* (Willd.) R.Br. var. *angustifolia* (Wall. ex Benth.) Singh, *L. decemdentata* (Willd.) R.Br. var. *sebastiana* (Subbarao & Kumari) Singh and *L. ciliata* Benth. var. *angustifolia* (Hook.f.) Sunojk., *L. ciliata* Benth. var. *oblongifolia* (Hook.f.) Sunojk., *L. ciliata* Benth. var. *sericostoma* (Hook.f.) Sunojk., *L. ciliata* Benth. var. *vestita* (Benth.) Sunojk., *L. eriostoma* Hook. f., *L. eriostoma* Hook. f. var. *lanata* Hook. f. , *L. eriostoma* Hook. f. var. *latifolia* Hook. f., *L. helianthemifolia* Desf., *L. helicterifolia* Haines, *L. hirta* (Heyne ex Roth) Spreng., *L. hyssopifolia* Wall. ex Benth., *L. lamiifolia* Desf., *L. lanata* Wall. ex Benth. , *L. lanata* Wall. ex Benth. var. *candida* Haines were edited. Completed the checklist and description of the families Avicenniaceae, Verbenaceae, Symphoremataceae comprising of 01 genus and 04 taxa (03 species and 1 variety), 21 genera and 113 taxa (108 species, 04 varieties and 01 forma) and 03 genera and 06 taxa (04 species and 02 varieties) respectively.

Flora of India vol. 22 Families Nyctaginaceae, Amaranthaceae, Chenopodiaceae, Basellaceae, Phytolaccaceae, Polygonaceae, Podostemaceae, Nepenthaceae,

Rafflesiaceae, Mitrastemonaceae, Aristolochiaceae, Piperaceae, Saururaceae, Chloranthaceae, Myristicaceae, Monimiaceae, Lauraceae, Hernandiaceae, Proteaceae, Thymelaeaceae and Elaeagnaceae

Executing Scientist(s) : Dr. M. Bhaumik, Dr. A.K. Sahoo, Dr. Debasmita Dutta
Pramanick, Dr. Sankar Rao, Mrs. Geeta Chaudhury, Dr.
Sudeshna Datta & Shri S.K. Sarma
Date of Initiation : 2019
Date of completion : 2020

OBJECTIVE

Upgradation of description of 21 families for Flora of India volume 22 and updating nomenclature of c. 762 species.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Finalization of the Mss. of volume 22 comprising 22 families, 132 genera, 650 species, 06 subspecies and 81 varieties is in progress.

Flora of India Vol. 24 Family Fagaceae

Executing Scientist(s) : Dr. Prashant K. Pusalkar, Dr. Vinay Ranjan &
Dr. Priyanka
Ingle
Date of Initiation : 2019
Date of completion : 2020

OBJECTIVE

Upgradation of the families Fagaceae, Urticaceae, Moraceae, Cannabaceae, Ulmaceae, Platanaceae, Juglandaceae, Myricaceae, Casuarinaceae, Betulaceae, Salicaceae, and Ceratophyllaceae

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. Prashant K. Pusalkar & Dr. Priyanka Ingle: One field tour was conducted to parts of Western Ghats during which 138 specimens were collected. In addition one Herbarium consultation tour was undertaken undertaken to MH for study, data record and checking recent additions of specimens of the plant families for Flora India Volume 24. Prepared a checklist (with distribution) of 'Flora India - Volume 24' comprising families Urticaceae, Moraceae, Cannabaceae, Ulmaceae, Platanaceae, Juglandaceae, Myricaceae, Casuarinaceae, Betulaceae, and Ceratophyllaceae. Coordinated finalization of checklists and submission for

the families Fagaceae, Salicaceae and Moraceae (partly) submitted by other authors. Besides assisted in updation of Flora of India, Volume 6 (Leguminosae). Description, distribution and nomenclature for the families Urticaceae, Moraceae (excluding genus Ficus), Betulaceae, Myricaceae, Casuarinaceae, Platanaceae and Juglandaceae, including additions of new taxa and new records were documented.

Dr. Vinay Ranjan: Completed taxonomic descriptions of 55 species belonging to 04 genera of the family Fagaceae. Manuscript submitted to team leader.

Flora of India volume-25 (c. 85 genera & 725 species) and 26 (c. 83 genera & 579 species): Families Hydrocharitaceae, Burmanniaceae and Orchidaceae (in part)

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

OBJECTIVE

Upgradation and documentation of the families Hydrocharitaceae, Burmanniaceae and Orchidaceae along with nomenclature update

BACKGROUND

This is a new project. Earlier revisionary work was not available for nearly 500 species. The work had been started fresh.

Sub-family: Vanilloideae (05 genera, 14 species)

Sub-family: Orchidoideae (9 genera 22 species)

Sub-family: Epidendroideae (67 genera, 586 species)

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. D. K. Agarwala: Content of Volumes 25 and 26 were structured including preparation of working plan and presented during the meeting of Flora of India committee held at BSI, BGIR, Noida on 15.04.2019. Co-ordinated with team members (data sharing, nomenclature and taxonomy) for compilation of their part. Literature, herbarium images, worked out specimen details and other materials sent to all team members for their respective group. Format for drafting the manuscript has been finalized; literature for citation has been listed and a genus *Cryptochilus* Wall. with two species completed and circulated to the team members as template. Materials were collected and compiled for all 624 species from various sources. Finalization of Mss. for 100 species under 16 genera [*Corybas*, *Cryptochilus*, *Dactylorhiza*, *Eria*, *Erythrorchis*, *Galeola*, *Galearis*, *Gymnadenia*, *Hemipilia*, *Hsenhsua*, *Lecanorchis*, *Odisha*, *Plectoglossa*, *Pogonia*, *Ponerorchis*, *Vanilla*] was completed. This study reported *Hemipilia purpureopunctata* (K.Y. Lang) X.H. Jin, Schuit. & W.T. Jin as new addition to Flora of India, *Peristylus orbicularis* (Hook.f.) Agrawala, H.J. Chowdhery & S. Chaudhury as new record for Arunachal Pradesh, *Vanilla andamanica* Rolfe as conspecific with *Vanilla albida* Blume. The complex of *Vanilla aphylla* Blume, *Vanilla pilifera* Holtt., *Vanilla borneensis* Rolfe and *Vanilla parishii* Rchb.f. in Indian context was solved in

consultation with type and authentic materials. The entire Indian materials were treated under *Vanilla parishii*.

Dr. J.S. Jalal & Dr. Chaya Deori: 12 species under 03 genera (*Burmannia*, *Haplothismia* & *Thismia*) were completed and updated as per flora of India format. Under the family Orchidaceae, 20 genera (*Androcorys*, *Bhutanthera*, *Brachycorythis*, *Diplomeris*, *Dithrix*, *Disperis*, *Habenaria*, *Herminium*, *Pecteilis*, *Peristylus*, *Platanthera*, *Dactylorhiza*, *Odisha*, *Plectoglossa*, *Cottonia*, *Diplocentrum*, *Ipsa*, *Luisia*, *Pachystoma* and *Sirhookera*) comprising of 171 species were updated so far as per flora of India format.

Dr. Avishek Bhattacharjee: Completed editing, updated taxonomic account of the family Hydrocharitaceae (36 taxa) based on herbarium specimens and published literature. Editing and updating/ preparing taxonomic accounts of 130 taxa under the subfamily Epidendroideae and Orchidoideae were completed based on herbarium specimens, published and unpublished literature. The Mss. of the entire allotted work was submitted to Team leader.

Flora of India Vol. 26 & 27: Family Orchidaceae

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

OBJECTIVE

Upgradation and documentation of the family Orchidaceae along with nomenclature update.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

One herbarium consultation tour was undertaken to ASSAM herbarium during which 134 species belonging 30 genera has been consulted. Taxonomic account of 184 taxa was completed and the remaining is under progress. Photo plates of 30 species were prepared.

Flora of India Vol. 27: Family - Asparagaceae, Liliaceae, Aloeaceae, Amaryllidaceae, Bromeliaceae, Cannaceae, Costaceae, Hypoxidaceae, Iridaceae, Marantaceae, Stemonaceae, Taccaceae

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

OBJECTIVE

Updating the families for Flora of India vol. 27.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. Rajib Gogoi: Two herbarium consultation tour *w.e.f.* 07.12.2019 to 16.12.2019 and 19.11.19 to 27.11.19 were undertaken to NBRI, CDRI & BSIP, Lucknow and BSD & DD respectively during which herbarium sheets of the genera *Fritillaria* L., *Lilium* L., *Gloriosa* L., *Hemerocallis* L., *Lloydia* Salisbury ex Reichenbach, *Paris* L., *Allium* L., *Cardiocrinum* Lindl., *Clintonia* Rafin, *Fritillaria* L., *Gagea* Salisb., *Lilium* L., *Streptopus* Michx., *Tricyrtis* Wall, *Tulipa* L. and *Notholirion* Wall. ex Boiss were studied and required photographs are taken. Description of 05 genera i.e. *Cardiocrinum* Lindl., *Clintonia* Raf., *Fritillaria* L., *Notholirion* Wall. ex Boiss., *Streptopus* Michaux. were completed along with description of 12 species and one variety i.e. *Cardiocrinum giganteum* (Wall.) Makino, *Clintonia udensis* Trautv. & Meyer, *Fritillaria cirrhosa* D. Don, *Fritillaria delavayi* Franch., *Fritillaria imperialis* L., ***Fritillaria imperialis* var. *kashmirensis*** Wietsma, *Fritillaria raddeana* Regel, *Notholirion bulbuliferum* (Lingelsh.) Stearn, *N. macrophyllum* (D. Don) Boiss., *N. thomsonianum* (D. Don) Stapf, *Streptopus simplex* D. Don, *Streptopus chatterjeeanus* S. Dasgupta, *Streptopus parasimplex* Hara & Ohashi.

Dr. J.H. Franklin Benjamin : One Herbarium Consultation Tour *w.e.f.* 15.02.20 to 23.02.20 was conducted to CAL, Howrah and specimens of allotted families were studied. Draft description of the family Amaryllidaceae comprising of 06 genera, 32 species, Hypoxidaceae containing 02 genera and 10 species, Stemonaceae comprising of 02 genera & 03 species, Bromeliaceae with 02 genera & 02 species were prepared in the flora of India format with updated citations, description, flowering and fruiting and distribution. Nomenclatural changes in 03 species were carried out. Cultivated species in these families were segregated and listed separately.

Dr. B. K. Singh : Collected relevant references and literature on the taxa of the family Asparagaceae. Edited description of *Chlorophytum* (20 sp.), *Tupistra* (7 sp.) and *Polygonatum* (08 sp.) as per format of Flora of India along with preparation of key to the genus *Chlorophytum*. Updated checklist of the family compliance with recent publications.

Dr. Mahua Pal: One herbarium consultation tour *w.e.f.* 19.11.19 to 27.11.19 was conducted to DD and BSD during which the herbarium sheets of the genera *Cardiocrinum* Lindl., *Clintonia* Rafin, *Fritillaria* L., *Gagea* Salisb., *Lilium* L., *Streptopus* Michx., *Tricyrtis* Wall, *Tulipa* L. and *Notholirion* Wall. ex Boiss were studied and required photographs were taken. Descriptions of 07 genera, 24 species and 04 variety of the family Liliaceae were prepared and phenology, habitats and distribution (Indian and world) were noted down. The taxa described are *Cardiocrinum giganteum* (Wall.) Makino, *Clintonia udensis* Trautv. & Meyer, *Fritillaria cirrhosa* D. Don, *Fritillaria delavayi* Franch., *Fritillaria imperialis* L., ***Fritillaria imperialis* var. *kashmirensis*** Wietsma, *Fritillaria raddeana* Regel., *Streptopus simplex* D. Don., *Streptopus chatterjeeanus* S. Dasgupta, *Streptopus parasimplex* Hara & Ohashi., *Notholirion bulbuliferum* (Lingelsh.) Stearn, *N. macrophyllum* (D. Don) Boiss., *N.*

thomsonianum (D. Don) Stapf., *Tulipa clusiana* DC. and *Tulipa lanata* Regel., *Lilium davidii* Duch. ex Elwes, *Lilium davidii* var. *willmottiae* (E.H.Wilson) Raffill, *Lilium mackliniae* Sealy, *Lilium duchartrei* Franch. and *Lilium nanum* Klotzsch, *Lilium nanum* var. *flavidum* (Rendle) Sealy., *L. nepalense* D. Don, *L. polyphyllum* D. Don, *L. primulinum* Baker, *Lilium souliei* (Franch.) Sealy, *Lilium lankongense* Franch., *L. wallichianum* Schult. f., *wallichianum* Schult. f. var. *neilgherrense* (Wight) Hara.

Flora of India Vol. 28: Juncaceae, Juncaginaceae, Musaceae, Dioscoreaceae, Arecaceae, Pandanaceae, Aponogetonaceae, Potamogetonaceae, Najadaceae, Triuridaceae, Butomaceae, Zannichelliaceae, Cymodoceae, Lemnaceae, Ruppiaceae, Typhaceae, Xyridaceae, Alismataceae, Aponogetonaceae, Commelinaceae, Flagellariaceae, Limnorchartaceae, Philydraceae, Pontederiaceae, Trilliaceae, Uvulariaceae, Zannichelliaceae

Executing Scientist(s) : Dr. M.U. Sharief, Dr. S.S. Hameed, Dr. Rajib Gogoi, Dr. Vinay Ranjan, Dr. Anant Kumar and Dr. B.K. Singh
Date of Initiation : 2019
Date of completion : 2020

OBJECTIVE

Upgradation of available Mss. of revisionary studies of the families under Volume 28

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Dr. M.U. Sharief: The genera and species of the families – Pontederiaceae, Flagellariaceae, Limnorchartaceae and Philydraceae were scrutinized based on the literature available, Herbarium specimens and references. The data on citations, description, classification of the plant, habit, distribution along with standardization of author citations were updated based on Floras and Research Journals. Taxonomic data pertaining to morphology, phenology, uses and notes (if any) of the genera belonging to 04 families – Pontederiaceae (02 genera), Flagellariaceae (01 Genera) Limnorchartaceae (01) and Philydraceae (01 Genera) were updated along with preparation of key to the genera and species. Beside taxonomic details, distribution pattern, phenological data, uses and notes (if any available) of the following genera and species in parenthesis were documented and updated: *Eichhornia* (01), *Monocharia* (02), *Flagellaria* (01), *Limnocharis* (01) and *Philydrum* (01). For the family Commelinaceae, Mss. of Tribe Tradescantiae comprising of 05 genera and 24 species and Commelineae comprises of 07 genera, Mss. of 04 Genera comprising 34 species were received from Dr. Mayur Nandikar were checked along with incorporation of necessary corrections. Descriptions of remaining 03 genera and some ornamental species are under process. The Mss. of the families Alismataceae, Uvulariaceae and Trilliaceae were formatted from PDF to word file and incorporated minor corrections.

Dr. S.S. Hameed: Updated description of the family Pandanaceae was prepared and submitted to Team leader for necessary correction and formatting.

Dr. Rajib Gogoi: Two field tours in August & September 2019 were conducted to North Sikkim & East Sikkim Districts during which 17 species were collected along with photographs such as *Juncus concinnus* D.Don, *Juncus benghalensis* Kunth, *Juncus clarkei* Buchenau, *Juncus effusus* L., *Juncus himalensis* Klotzsch, *Juncus khasiensis* Buchenau, *Juncus nepalicus* Miyam. & H.Ohba, *Juncus wallichianus* J.Gay ex Laharpe, *Juncus cephalotes* Thunb., *Juncus bufonius* L., *Juncus grisebachii* Buchenau, *Juncus inflexus* L., *Juncus sphacelatus* Decne., *Juncus cephalostigma* Sam., *Juncus leucanthus* Royle ex D.Don, *Juncus harae* Miyam. & H.Ohba, *Juncus trichophyllus* W.W. Sm. Descriptions of all 54 species were completed along with key to the section, genera and species. Final Mss. were submitted to D/BSI for publication. Description of 02 species of Juncaginaceae, 12 species of the family Musaceae and 15 species of family Dioscoreaceae were completed and submitted along with the illustrations. 03 species were identified during herbarium consultation tour to NBRI, CDRI & BSIP. Finalized the checklist for Flora of India for the families: Balsaminaceae, Marantaceae, Musaceae, Najadaceae, Pandanaceae, Melanthiaceae, Colchicaceae, Liliaceae, Asphodelaceae, Alliaceae, Asparagaceae, Uvulariaceae and Trilliaceae.

Dr. Vinay Ranjan: Taxonomic description of 02 species under 01 genus of the family Ruppiaceae, 11 species under 02 genera of the family Typhaceae and 06 species under 01 genus of Xyridaceae were completed and submitted to Team leader.

Dr. Anant Kumar : An updated list of the species for the families Lemnaceae, Zannichelliaceae and Cymodoceae found in India was prepared after consulting the literature. Taxonomic account of two genera and two species viz. *Butomopsis latifolia* (D.Don) Kunth, *Butomus umbellatus* L. belonging to Butomaceae and four genera and seven species viz. *Cymodocea rotundata* Asch. & Schweinf., *C. serrulata* (R.Br.) Asch. & Magnus, *H. pinifolia* (Miki) Hartog, *H. uninervis* (Forsk.) Asch., *H. wrightii* Asch., *Syringodium isoetifolium* (Asch.) Dandy, *Thalassodendron ciliatum* (Forsk.) Hartog belonging to Cymodoceae were completed.

Dr. B.K. Sigh : Arecaceae-approx. 90 species under 17 genera were described along with editing of the Mss. Rest is under process.

Pandanaceae –Mss. comprising of 18 species under 03 genera was submitted. Relevant references and published literature on the families Aponogetonaceae, Potamogetonaceae & Najadaceae and taxa under the mentioned families were collected. Key to the family Aponogetonaceae was edited as per format of Flora of India. Updated checklist of the families with recent publications.

Flora of India Vol. 29: Family –Cyperaceae

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

OBJECTIVE

Upgradation of available Mss. of the family Cyperaceae and updating nomenclature of the taxa.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Editing of the manuscripts of the genus *Courtoisina* comprising 01 species and *Kyllinga* comprising of 10 species were completed. Checked 14 type specimens of 07 species, namely *Cyperus atroglossus* Govind., *C. curvibracteatus* Govind., *C. decumbens* Govind., *C. lurida* Govind., *C. polyanthelus* Govind., *C. plurinodosa* Govind. and *C. stricticulmis* Govind. Descriptions of *Fimbristylis pierotii* Miq. and 01 *Fimbristylis* (*sp. nov.*?) were completed including identification of 10 unidentified or wrongly identified loan specimens as *Cyperus congolmeratus* and *Pycneus flavidus* - received from BSJO, Jodhpur and *Fimbristylis suarrosa*, *F. dichotoma* (03 specimens), *F. aestivalis* and *F. aphylla* (03 specimens) – received from BSHC, Gangtok. Studied the type specimen of *Fimbristylis multinervia* Govind. and suggested its exclusion from the Flora of India. A Checklist of family Cyperaceae comprising of 33 genera, 555 species, 23 subspecies and 32 varieties in India was prepared and submitted to D/BSI. This study reported 03 new combinations and proposed 01 new name. In addition 14 taxa were excluded along with 13 doubtful taxa.

Flora of India Vol. 30: Family – Poaceae, Bambusoideae (c. 30 genera and 150 species)

Executing Scientist(s) : Dr. Pushpa Kumari

Date of Initiation : 2019

Date of completion : 2020

OBJECTIVE

Upgradation of available Mss. of revisionary study of the family Poaceae, Bambusoideae for 'Flora of India' project.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

The Mss. was submitted to D/BSI. This study reported 151 species including indigenous, cultivated and doubtful taxa under 30 genera.

Flora of India Vol. 30 & 31 : Family - Poaceae (Gramineae)

Executing Scientist(s) : Dr. M. K. Kandwal, Mr. Nagaraju Siddabathula

Date of Initiation : 2019

Date of completion : 2020

OBJECTIVE

Upgradation of available Mss. of revisionary study of the family Poaceae for 'Flora of India' project.

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY & ACHIEVEMENT/OUTCOME:

Upgradation of the family Poaceae, comprising 210 genera and 1268 species (includes infraspecific taxa) of Indian grasses (excluding Bambusoideae) was initiated. A team of 16 experts were involved to compile the flora. During 2019-2020, manuscripts for first volume (31st) was compiled and submitted to D/BSI. Correction, upgradation of descriptions and illustrations were done. Final mss. is under process.

Dr. L. Rasingam & Dr. J. Swamy: Submitted Mss. of the family Poaceae for vol. 31 comprising 99 taxa belonging to 42 genera.

Dr. Sankararao Mudadla: Completed description of 01 species under 01 genus of the family Saururaceae and submitted the Mss.

Dr. M. K. Kandwal: Mss. comprising of 24 genera and 155 species were described supplemented with key for each genera. The genera include *Pseudodanthonia*, *Duthiea*, *Helictotrichon*, *Avena*, *Trisetum*, *Trisetaria*, *Koeleria*, *Rostrari*, *Deschampsia*, *Holcus*, *Aira*, *Hierochloe*, *Anthoxanthum*, *Phalaris*, *Agrostis*, *Aniselytron*, *Calamagrostis*, *Deyeuxia*, *Lagurus*, *Polypogon*, *Cyathopus*, *Alopecurus*, *Phleum*, *Stipa* and *Piptatherum*.

Mr. Nagaraju Siddabathula: Described 09 species of the genus *Chloris* of the family Poaceae and submitted the Mss.

PLANT DISCOVERIES 2019

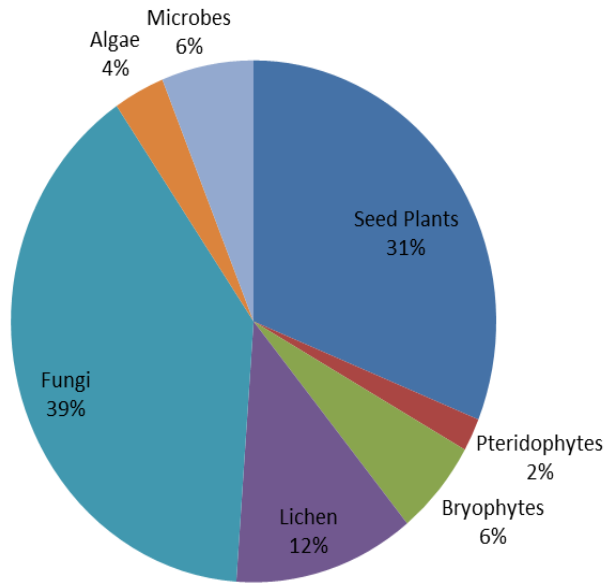
India, with its varied geography, topography, climatic regimes, altitude and ecological habitats exhibits a rich floristic diversity. India has only 2.4 % of the total geographical area of the world, but harbours nearly 8 % of the globally known floral species, of which 28 percent is endemic to the country. The Indian flora is concentrated in four floristic hotspots viz., 1. Indo-Burma covering Mizoram, Manipur, Nagaland, Meghalaya, Tripura and Andaman Islands, 2. Himalaya covering Jammu & Kashmir, Himachal Pradesh, Uttarakhand, northern part of West Bengal (Darjeeling), Sikkim, northern part of Assam and Arunachal Pradesh, 3. Western Ghats falls within the states of Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat and 4. The Sundaland covering the Nicobar Islands, which are amongst the thirty six identified 'global bio-diversity hotspots'. Presently, India has more than 49000 species of plants (Angiosperm, Gymnosperm, Pteridophytes, Bryophytes, Lichens, Fungi, Algae, etc.) already identified and classified, but there are still many yet to be identified and described.

Current estimation revealed that a total of 18,800 taxa of angiosperms, 82 taxa of Gymnosperms, 1307 taxa of Pteridophytes, 15447 taxa of Fungi, 7334 taxa of Algae, 2786 taxa of Bryophytes, 2917 taxa of Lichens in India and 1239 species of microbes which is approximated 8 per cent of total recorded plant species of the world. The group wise current status of number of taxa known from India is given in the table below.

Group	No of species in India	Percentage of Indian flora
Virus/Bacteria	1239	2.47
Algae	7434	14.86
Fungi	15447	30.90
Lichens	2917	5.83
Bryophytes	2786	5.57
Pteridophytes	1307	2.61
Gymnosperms	82	0.16
Angiosperms	18800	37.6
Total	50,012	100

During the year 2019, scientists of BSI and other organization discovered 13 new genera, 175 new species, 5 infraspecific taxa from India while 64 species and 2 infraspecific taxa were reported for the first time from India. 52 % of novelties published are of seed plants, 20 % Fungi, 9 % Algae and 8% Microbes. This year, one new family has been discovered from Microbes. Among plant groups seed plants contributed the maximum discoveries of which dicotyledons contributes 72 % and monocotyledons 28 %.

28% of the total discoveries were made from Western Ghats during 2019 followed by eastern Himalayas (21%), east coast (11%) and eastern plains (10%). The west coast has contributed 7% of the total discoveries, while Western Himalayas have contributed 6% of the discoveries. The South Deccan, North Deccan and Eastern Ghats have contributed 3% each,



while the minimum contribution has been made by Northern plains and Central Highlands i.e., 2% each. The North eastern regions have contributed only 4% of new discoveries during 2019. The hotspot regions such as Western Ghats, Himalayas and North-eastern regions have contributed 59 % of the total discoveries. Maximum discoveries were made from the state of Kerala followed by Maharashtra, Tamil Nadu and Arunachal Pradesh.

NEW TO SCIENCE

SEED PLANT

Acrachne borii J. Swamy & Rasingam, *Nelumbo* Vol 61 (1).10.2019 (Poaceae)

The species has been discovered and described based on the collection made from Seshachalam Biosphere Reserve, Rayachoti range, Korthimadugu, Kadapa district of Andhra Pradesh, India at 521m altitude.

Arnebia ladakhensis K. Ambrish & P. Singh, *J. Jpn. Bot.* 94(3): 160.2019. (Boraginaceae)

The species has been discovered and described based on the collection made from Mahee bridge Tsomorari, Ladakh, Jammu and Kashmir, India at 4148m.

Castanopsis pathakii Shankhamala Mitra, Ranjan & D.Maity, *Kew Bulletin* 74:33.2.2019 (Fagaceae)

This new tree species has been discovered and described based on the collection made from Itanagar to Tuting, Upper Siang district of Arunachal Pradesh, India.

Ceropegia khasiana Murug., A.A. Mao, Meitei & Kambale, *Gardens' Bulletin Singapore* 71 (2): 520.2019 (Apocynaceae)

The species has been discovered and described based on the collection made from Sumer forests of East Khasi Hills, Ri-Bhoi District of Meghalaya, India at 950m altitude.

Eugenia megamalayana Murugan & Arum, *Taiwania* 64(1): 23.2019 (Myrtaceae)

This new tree species has been discovered and described based on the collection made from Vellimalai West Beat, on the way to Amman Estate, Theni District of Tamil Nadu, India at 1422m altitude.

Eugenia velliangiriana Murug., V. Ravich., Murugan & Arum, *Webbia: J. Pl. Tax. Geog.* 74(1):23.2019 (Myrtaceae)

This new tree species has been discovered and described based on the collection made from Velliangiri hills, Coimbatore District of Tamil Nadu, India at 1539m altitude.

Glossocardia andamanica Karthig., Rasingam & Arisdason, *Phytotaxa* 400 (2): 072.2019 (Asteraceae)

The species has been discovered and described based on the collection made from Chidiyatapu, South Andaman of Andaman & Nicobar Island, India.

Habenaria agasthyamalaiana Jalal, Jayanthi & Sureshkumar, *Lankesteriana* 19(2): 93.2019 (Orchidaceae)

This new terrestrial orchid species has been discovered and described based on the collection made from Shendurney Wildlife Sanctuary, on the way to Rosemala, Kollam district of Kerala, India at 550m altitude.

Habenaria keralensis K. Prasad, *Webbia: J. Pl. Tax. Geog.*, 74:1, 63.2019 (Orchidaceae)

The species has been discovered and described based on the collection made from Agasthyakoodam, Thiruvananthapuram District of Kerala, India at 1528m altitude.

Impatiens kamrupana Gogoi, J.Sarma, Borah, *Phytotaxa* 395 (1): 036.2019 (Balsaminaceae)

This new balsam species has been discovered and described based on the collection made from Nokedonga, Simla Reserve Forest, Kamrup district of Assam, India at 190m altitude.

Impatiens tanyae R.Kr.Singh, Arigela & Kabeer, *Kew Bulletin* 74:48.1.2019 (Balsaminaceae)

This new balsam species has been discovered and described based on the collection made from Polur Forest beat, Kodaikanal Wildlife Sanctuary, Dindigul district of Tamil Nadu, India at 2014m altitude.

Pecteilis korigadensis Jalal & Jayanthi, *Phytotaxa* 388 (2): 169.2019 (Orchidaceae)

This new orchid species has been discovered and described based on the collection made from Korigad-Aamby Valley, Pune district of Maharashtra, India at 640m altitude.

Phanera murthyi Vadhyar & J.H.F. Benj, *Phytotaxa* 401 (2): 140.2019 (Leguminosae: Cercidoideae)

The species has been discovered and described based on the collection made from Malabar Wildlife Sanctuary, near to Ambalapara Waterfalls, Kozhikode district of Kerala, India at 710m altitude.

Rhomboda monensis Odyuo, D.K Roy, Av. Bhattacharjee & Ormerod, *Phytotaxa* 405(1):061.2019 (Orchidaceae)

This new orchid species has been discovered and described based on the collection made from Tobu village, Mon district of Nagaland, India at 1800m altitude.

Senna andhrlica P.V. Ramana, J. Swamy & M. Ahmedullah, *Nordic Journal of Botany*, e02148:2.2019 (Fabaceae: Caesalpinioideae)

The species has been discovered and described based on the collection made from Kaviti Mandal, Ramayya Puttiga, Srikakulam district of Andhra Pradesh, India at 12m altitude.

Sonerila coimbatorensis Murug., V.Ravich. & Murugan, *Phytotaxa* 405(1):059.2019 (Melastomataceae)

The species has been discovered and described based on the collection made from Anamalai Tiger Reserve, near Umayandi mudakku, Coimbatore district of Tamil Nadu, India.

Themeda palakkadensis Chorghe, K. Prasad & Lakshmin, *Taiwania* 64(3): 231.2019 (Poaceae)

The species has been discovered and described based on the collection made from Elivai Malai, Palakkad district of Kerala, India at 1858m altitude.

Tripogon ashihoi Murug., Arum. & Kabeer, *Indian J. Forest.* 42(1): 67.2019. (Poaceae)

This new orchid species has been discovered and described based on the collection made from Ayyamalai, Coimbatore district of Tamil Nadu, India at 600-1200m altitude.

PTERIDOPHYTES

Pteris subiriana Piu Das, *Phytotaxa* 391 (4): 247.2019 (Pteridaceae)

This new species has been discovered and described based on the collection made from Mahabaleshwar, Maharashtra, India.

LICHEN

Buelliella indica Pushpi Singh and Kr. P. Singh, *Acta Botanica Hungarica* 61(3–4):436. 2019

This new species has been discovered and described based on the collections made from Chozuba road, on *Graphis longiramea*, Phek district of Nagaland, India at 1700m altitude.

Cryptothecia panchganiensis Pushpi Singh, *Phytotaxa* 409 (2): 101. 2019 (Roccellaceae)

This new species has been discovered and described based on the collections made from Panchgani, on way to Table land, on *Ficus benghalensis*, Satara district of Maharashtra, India at 1297m altitude.

Enterographa assamica Pooja Gupta, S. Joseph & G.P. Sinha, *Taiwania* 64(1): 1. 2019 (Roccellaceae)

This new species has been discovered and described based on the collections made from the state of Assam.

Eremothecella ajaysinghii Jagad. Ram & G. P. Sinha, *The Lichenologist* 51(6): 507. 2019.
(ARTHONIACEAE)

This new species has been discovered and described based on the collections made from both the Andaman and Nicobar Islands.

Eremothecella nicobarica Jagad. Ram & G. P. Sinha, *The Lichenologist* 51(6): 509. 2019.
(ARTHONIACEAE)

This new species has been discovered and described based on the collections made from the Nicobar Islands.

FUNGI

Bondarzewia indohimalayana U. Singh, M.E. Hembrom, R.P. Bhatt & K. Das, *Nova Hedwigia* 109: 444. 2019.

This new species has been discovered and described based on the collection made from mixed temperate forest of Uttarakhand state, India.

Elotespora indica R. Dubey & S. Sengupta Chatterjee, *Mycoscience* 60(5):271. 2019

This new species has been discovered and described based on the collection made from Dhupabare foothills, Biligiri Rangaswamy Temple Wildlife Sanctuary, Karnataka, India.

Hymenochaete sharmae M.E. Hembrom, K. Das & A. Parihar, *Cryptogamie Mycologie* 40(5): 58. 2019.

This new species has been discovered and described based on the collection made from Rajmahal hills, Jharkhand.

Laccaria indohimalayana K. Das, I. Bera & Vizzini, *Cryptogamie Mycologie* 40(5): 65. 2019.

This new brownish-orange mushroom species has been discovered and described based on the collection made from South and East district of Sikkim, India.

Lactarius viridinigrellus I. Bera, P. Uniyal & K. Das, *Phytotaxa* 415 (1): 59. 2019.

This new milkcap mushroom species has been discovered and described based on the collection made from Gnathang firing range forest, East district of Sikkim and Tawang district of Arunachal Pradesh, India.

Marasmius desjardinii K. Das, Antonín & D. Chakr., *Kew Bull.* 74(2): 19, 2019.

This new mushroom species has been discovered and described based on the collection made from Sikkim, India.

Russula clavatohyphata R.P. Bhatt, A. Ghosh, Buyck & K. Das, *Cryptogamie Mycologie* 40(5): 84. 2019

This new mushroom species has been discovered and described based on the collection made from Uttarakhand, Hariyali Devi forest, Rudraprayag district of Uttarakhand, at 1651 m altitude.

ALGAE

Dermatochrysis himalayensis S.K. Das, P. Basu and R.K. Gupta, *Taiwania* 64(3):259.2019. (Chrysocapsaceae)

This new species has been discovered and described based on the collection made from Madhuri Lake, Tawang, Arunachal Pradesh, India at 3736m altitude.

Haslea subsalina S. Mishra, A.K. Bastia & S. Bhakta, *Indian Hydrobiol.* 18 (1&2): 182-193. 2019

This new species has been discovered and described based on the collection made from Balaramgadi, Balasore, Odisha.

NEW DISTRIBUTION RECORDS

SEED PLANT

Epigonium japonicum Makino (Orchidaceae)

This species earlier known only from Japan, Central Taiwan, Southern China, Nepal, has been reported for the first time from India based on the collection made from Neora Valley National Park, Near PHE source map, Darjeeling district of West Bengal, India at 2197m altitude.

Impatiens duclouxii Hook.f. (Balsaminaceae)

This species earlier known only from China, Yunnan has been reported for the first time from India based on the collection made from Jamiri, West Kameng District of Arunachal Pradesh, India.

Monolophus coenobialis Hance (Zingiberaceae)

This species earlier known from China has been reported for the first time from India based on the collection made from Poting, papum Pare District of Arunachal Pradesh, India at 450m altitude.

Oberonia gigantea Fukuy. (Orchidaceae)

This species earlier known from Taiwan has been reported for the first time from India based on the collection made from Gaili village of Peren district of Nagaland India at 900m altitude.

Porpax lanii Seidenf. (Orchidaceae)

This species earlier known from Vietnam and Thailand has been reported for the first time from India based on the collection made from Monyakshu village, Mon district of Nagaland India at 1800m altitude.

Sarcoglyphis mirabilis (Rchb. f.) Garay. (Orchidaceae)

This species earlier known from Vietnam and Thailand has been reported for the first time from India based on the collection made from Gaili village of Peren district of Nagaland India at 900m altitude.

Zeuxine parvifolia (Ridl.) K. Schum. & Fedde (Orchidaceae)

This species earlier known from Malaysia and Singapore has been reported for the first time from India based on the collection made from Umrangso, Dima Hasao district, Assam, India.

LICHEN

Badimia cateilea (Vain.) Lücking, Lumbsch & Elix (Pilocarpaceae)

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

Byssoloma catarinense L.I. Ferraro and Lücking (Pilocarpaceae)

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

Byssoloma vanderystii Sérus. (Pilocarpaceae)

This species, earlier known from Brazil, Congo, Costa Rica and French Guiana has been reported for the first time from India based on collections made from Nicobar Islands.

Coenogonium barbatum Lücking, Aptroot and Umaña (Coenogoniaceae)

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

Eremothecella calamicola Syd. (Arthoniaceae)

This pantropical species has been reported for the first time from India based on collections made from both the Andaman and Nicobar Islands.

Eremothecella macrosperma (Zahlbr.) Sérus. (Arthoniaceae)

This species earlier known from Indonesia, Japan and Papua New Guinea has been reported first time from India based on the collection made from both the Andaman and Nicobar Islands, India.

Eremothecella variratae (Aptroot & Sipman) Sérus. (Arthoniaceae)

This species earlier known from Papua New Guinea has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Fellhanera punctata Lücking (Pilocarpaceae)

This species earlier known from Brazil and Columbia has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Gyalideopsis minutissima Lücking (Gomphillaceae)

This species earlier known from Costa Rica and French Guiana has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Porina foliicola (Vězda) Lücking and Vězda (Porinaceae)

This species earlier known from Sri Lanka and Vietnam has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Sporopodium pilocarpoides (Zahlbr.) Lücking and Kalb (Pilocarpaceae)

This species earlier known from Brazil, Costa Rica, French Guiana, Indonesia, Mexico, and The Philippines has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Tapellaria leonorae Cáceres and Lücking (Pilocarpaceae)

This species earlier known from Brazil and Mexico has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

Trichothelium pallescens (Müll. Arg.) F. Schill. (Pilocarpaceae)

This species earlier known from Central and South America has been reported first time from India based on the collection made from Nicobar Islands, Andaman & Nicobar Island, India.

FUNGI

Aithaloderma viride L.R. Fraser

This fungal species has been reported for the first time from India on living leaves of *Olea dioca* of family (Oleaceae) from the collection made from Chandoli National Park, Sangli Dist., Maharashtra, India.

EX-SITU CONSERVATION

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

Botanic Gardens under control of Botanical Survey of India are:

Sr. No.	Name of the Gardens/ <i>ex-situ</i> conservatory	Focal area	No. of species conserved	Regional Centres jurisdiction
1.	Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah, W.B. (erstwhile Indian Botanic Garden, Howrah), c. 273 acre	A national repository of plants. Conserves economically important plant species of India and all over world.	c. 1400 species	Howrah
2.	Experimental Botanic Garden, Andaman & Nicobar Island Regional Centre, Dhanikhari, c. 70 acres	Endemic and threatened plants of Andaman & Nicobar Islands	c. 250 species	Portblair
3.	Experimental Botanic Garden, Arid Zone Regional Centre, Jodhpur, c. 12 acres	Endemic and threatened plants of Rajasthan and Gujarat and Cactus collection	c. 185 species	Jodhpur
4.	Experimental Botanic Garden, Arunachal Pradesh Regional Centre, Sankie View	Endemic and threatened plants of Arunachal Pradesh	c. 200 species	Itanagar
5.	Botanic Garden of Indian Republic (BGIR), Noida, U.P. c. 163.79 acres	An under construction garden showcasing wide variety of regional flora from 23 states	c. 900 species	Noida
6.	Experimental Botanic Garden, Central Regional Centre, Allahabad, c. 07 acres	Endemic and threatened plants of Uttar Pradesh and Madhya Pradesh; wild rose and its cultivars	c. 600 species	Allahabad
7.	Barapani Experimental Garden, Barapani & National Orchidarium, Eastern Regional Centre, Shillong, Meghalaya, c. 25 acres	Orchids, Nepenthes, Insectivorous plants, Medicinal plants, endemic, threatened plants of North east India including well equipped tissue culture laboratory for micro propagation and storage of germ	c.750 species	Shillong

plasm

- | | | | | |
|-----|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------|
| 8. | Experimental Botanic Garden and National Orchidarium, Yercaud, Southern Regional Centre, Coimbatore, c. 40 acres | Endemic orchids of Western & Eastern Ghats, Endemic plants of Western Ghats and others along with well-equipped Tissue culture laboratory | c. 1200 species | Coimbatore |
| 9. | Experimental Botanic Garden, Western Regional Centre, Mundhwa, Pune, c. 38 acres | Endemic and threatened plants of Maharashtra, Goa and Karnataka; Pteridophytes, Gymnosperms | c. 500 species | Pune |
| 10. | Experimental Botanic Garden, Sikkim Himalayan Regional Centre, Gangtok | Endemic and threatened plants of Sikkim Himalaya, Orchids and Gymnosperms | c. 200 species | Gangtok |
| 11. | Experimental Botanic Garden, Northern Regional Centre, Dehradun, c. 05 acres | Endemic and threatened plants of Uttarakhand and Uttar Pradesh | c. 350 species | Dehradun |

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

Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah, W.B.

During 2019-20, under the project 'Collection, Introduction, *ex-situ* conservation & Monitoring of Indigenous Plants of India at AJCBIBG, Howrah', enormous amount of works have been carried out in the form of nurturing, properly monitoring, up keeping and transplanting the previously introduced Rare/Endangered/Threatened & Endemic (RET & EET) plants. Due to accumulation of the earlier collected plants in the nursery, their division wise plantation was very much essential rather than making fresh collections through field tours. Accordingly arrangement has been made and target has been fulfilled for plantation of about 100 valuable plants including RET&EET plants in the respective Divisions through Environmental Day, Van Mahotsava Week Celebration, visit of dignitaries, VIPs from MOEF &CC, New Delhi, other occasions like Independence Day, Republic Day and as a usual course of compensatory plantation and their subsequent upkeep and monitoring. Besides, BSI officials have also collected a good number of saplings (c. 350) viz. *Cycas beddomei* Dyer, *Cycas sphaerica* Roxb., *Hildegardia populifolia* Schott & Endl., *Syzygium alternifolium* (Wight) Walp., *Pterocarpus santalinus* L.f., *Bursera delpechiana* Engl., *Bursera ovalifolia* (Schltdl.) Engl., *Bursera serrata* Wall. ex Colebr., *Withania somnifera* (L.) Dunal, *Phoenix loureiroi* Kunth. etc. during official tours and have introduced pots in Nursery I. Under another project 'Collection, documentation & *ex situ* conservation of Aromatic plants of India', plants available in the garden nursery were introduced, 40 saplings of certain aromatic plants, collected from local and other official tours have been kept in the garden nursery for acclimatization. The following plants namely *Cinnamomum verum* J. Presl, *Mentha × piperita* L., *Ocimum basilicum* L., *Pimenta dioica* (L.) Merr., *Santalum album* L., *Artabotrys hexapetalus* (L.f.) Bhandari, *Murraya paniculata* (L.) Jack., *Gardenia gummifera* L. f., *Magnolia champaca* (L.) L. etc. have been planted in Aromatic Plant Garden. The historic harvesting of a "Double Coconut" in the country has been made in the month of February, 2020 from a 125 year old single female palm conserved in India at AJCBIBG, Howrah. This harvesting of 'Double Coconut' seeds have been achieved after a long period of 6.5 years of vigilant scientific observation and due care after artificial pollination. The first and second fruits have been harvested on 15.02.2020 and 26.02.2020 weighing 8.5 kg and 18 kg respectively. Both the fruits are properly stored and kept under constant care in a safe chamber. This remarkable achievement provides a ray of hope for raising second generation of 'Double Coconut' palms in India.

In connection with Mangrove plantation and conservation project, more than 2100 mangrove plant saplings under 06 species viz. *Xylocarpus mekongensis* Pierre, *Rhizophora mucronata* Lam., *Sonneratia apetala* Buch.-Ham., *Ceriops tagal* (Perr.) C.B.Rob., *Bruguiera gymnorrhiza* (L.) Sav. and *Excoecaria agallocha* L. have been successfully planted along the bank of Hooghly River. This mass plantation is a ray of hope for further study of morphology, phenology and other ecological aspects of mangrove along with a site for public awareness. Moreover, this will also increase the beauty of river front of the garden and protect the bank from soil erosion.

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

As part of *ex-situ* conservation of EET plants of Andaman and Nicobar Islands, propagules (plantlets, rhizomes, seeds, seedlings, bulbs and cuttings) of about 53 species are being collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. Details of the plants introduced in Dhanikhari Experimental Garden cum Arboretum during 2019-20 and their mortality rate is enumerated below: *Alpinia sp.* (05 plantlets/rhizomes introduced of which 03 dies out, 02 surviving), *Amomum aculeatum* Roxb. (10 rhizomes introduced of which all are surviving), **Angiopteris evecta** (G. Forst.) Hoffm. (05 plantlets introduced of which all are surviving), *Boesenbergia siphonantha* (King ex Baker) M. Sabu & al. (100 plantlets/rhizomes introduced and all are surviving), *Boesenbergia sp.* (20 plantlets/rhizomes introduced of which 16 dies out, 4 surviving), *Bulbophyllum rufinum* Rchb.f. (50 bulbs introduced and all survived), *Calamus andamanicus* Kurz (10 seedlings of which 07 dies out and 03 surviving), *Cycas pschannae* R. C. Srivast. & L. J. Singh (12 seeds sowed but not germinated), *Cycas zeylanica* (J. Schust.) A. Lindstr. & K.D. Hill (12 seeds sowed but not germinated), *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson (10 plantlets introduced and all survived), *Dendrobium shompenii* B.K. Sinha & P.S.N. Rao. (10 plantlets introduced and all survived), *Dillenia andamanica* C.E. Parkinson (03 seedlings and all survived), *Diospyros marmorata* R. Parker (10 seedlings introduced of which 08 dies out, 02 surviving), *Etilingera fenzlii* (Kurz) Škornick. & M. Sabu (5 plantlets introduced of which 02 dies out and 03 surviving), *Euphorbia epiphyllodes* Kurz (6 cuttings introduced of which 04 dies out and 02 surviving), *Garcinia dhanikhariensis* S.K. Srivast. (100 seeds sowed and all surviving), *Garcinia dulcis* (Roxb.) Kurz (15 seeds sowed of which 05 not germinated, 10 germinated and surviving), *Grewia calophylla* Kurz ex Mast. (100 seedlings introduced and surviving), *Hedychium coronarium* J. König (10 plantlets introduced of which 08 dies out, 02 surviving), *Knema andamanica* (Warb.) W.J. de Wilde (10 seedlings introduced and all surviving), *Korthalsia rogersii* Becc. (03 seedlings planted and all survive), *Mangifera andamanica* King (100 seedlings introduced of which 80 dies out, 20 surviving), *Mangifera nicobarica* Kosterm. (20 seedlings introduced of which 17 dies out and 03 survive), *Mapania cuspidata* (Miq.) Uittien (05 plantlets introduced and all surviving), *Mimusops andamanensis* King & Gamble (07 seedlings introduced and all survive), *Musa balbisiana* Colla (08 rhizomes/plantlets introduced and all survive), *Musa indandamanensis* L.J. Singh (02 rhizomes/plantlets of which all survive; 200 seeds sowed of which 136 not germinated, 64 germinated and surviving), *Myristica andamanica* Hook.f. (10 seedlings introduced and all surviving), *Nymphaea pubescens* Willd. (02 rhizomes introduced and surviving), *Nypa fruticans* Wurm. (03 seedlings introduced and all survive), *Otanthera nicobarensis* Teijsm. & Binn. (56 seeds sowed but not germinated so far), *Pandanus leram* Jones ex Voigt (12 seedlings planted as well as 100 seeds sowed of which all surviving), *Peristylus sp.* (44 plantlets introduced of which 20 dies out, 24 surviving), *Phalaenopsis sp.* (10 bulbs introduced of which 07 dies out, 3 surviving), *Phoenix andamanensis* S. Barrow (10 seedlings introduced of which 04 dies out, 6 surviving), *Pinanga andamanensis* Becc. (144 seeds sowed of which 36 not germinated, 86 surviving), *Pinanga manii* Becc. (07 seedlings introduced and all survive), *Planchonia valida* (Blume) Blume (25 seedlings introduced and all survived), *Pterocarpus dalbergioides* Roxb. ex DC. (10 seedlings introduced and all surviving), *Pteroceras muriculatum* (Rchb.f.) P.F. Hunt (10 bulbs planted of which 05 dies out, 05 surviving), *Rhopaloblaste angustata* (Kurz) Moore (150 seedlings & 482 seeds introduced and all survive), *Rotula aquatica* Lour. (05 cuttings planted of which 03 dies out and 02 surviving), *Sageraea elliptica* (DC.) Hook.f. & Thomson (10 seedlings planted of which 08 dies out and 02 surviving), *Schizostachyum andamanicum* M. Kumar & Remesh (10 plantlets introduced of which 07 dies out and rest are surviving), *Schoenorchis minutiflora* (Ridl.) J.J. Sm. (50 bulbs introduced and all survive), *Semecarpus kurzii* Engl. (110 seeds sowed of which 40 dies out and 70 surviving), *Sphaeropteris albo-setacea* (Bedd.) R.M. Tryon (12 plantlets introduced of which 04 dies out, 08 surviving),

Terminalia manii King (65 seedlings planted and all surviving). The mortality rate of the introduced taxa in 2019-20 is approx. 77.26%.

Experimental Botanic Garden, Arunachal Pradesh Regional Centre, Sankie View

As part of *ex-situ* conservation project, during the period of 2019-20, ten species have been introduced in the botanical garden of BSI, APRC namely *Acampe rigida* (Sm.) P.F.Hunt, *Amentotaxus assamica* D.K.Ferguson, *Anthogonium gracile* Lindl., *Arundina graminifolia* (D. Don) Hochr., *Calanthe plantaginea* Lindl., *Cleisostoma subulatum* Blume, *Coelogyne ovalis* Lindl., *Gastrochilus acutifolius* (Lindl.) Kuntze, *Hedychium spicatum* Sm., *Thunia alba* (Lindl.) Rchb.f.

Experimental Botanic Garden, Arid Zone Regional Centre, Jodhpur

As part of *ex-situ* conservation project, during 2019-20, a no. of field tours have been conducted to Rajasthan and Gujarat during which 34 saplings of rare and threatened, medicinal and aromatic, ornamental and economic plants have been collected, introduced, conserved and multiplied in Desert Botanic Garden, BSI, Arid Zone Regional Centre, Jodhpur. Phenological data of existing plant species of Desert Botanic Garden have been recorded thorough out the year and flowering in five species namely *Sapindus laurifolius* Vahl, *Anogeissus Pendula* Edgew., *Anogeissus latifolia* (Roxb. ex DC.) wall. ex Bedd., *Anogeissus sericea* Brandis var. *nummularia* and *Manilkara hexandra* (Roxb.) Dubard have been observed for the first time after introduction. The mortality rate of which is as follows:

S.No.	Plant name	Category	Mortality rate %
1	<i>Barleria prionitis</i> L. var. <i>dicantha</i> Blatt & Hallb	Threatened	75.00
2	<i>Butea monosperma</i> (Lam.) Taub. var. <i>lutea</i> (Witt.) Maheshwari	Threatened	50.00
3	<i>Moringa concanensis</i> Nimmo	Threatened	40.00
4	<i>Pterocarpus marsupium</i> subsp. <i>acuminatus</i> (Prain) Thoth.	Threatened	0.00
5	<i>Dalbergia latifolia</i> Roxb.,	Threatened	0.00
6	<i>Rosa involucrata</i> Roxb.	Threatened	0.00
7	<i>Caralluma edulis</i> (Edgew.) Hook. f.	Threatened	100.00
8	<i>Dipcadi erythraeum</i> Webb & Berthel.,	Threatened	0.00
9	<i>Ceropegia bulbosa</i> Roxb. var. <i>bulbosa</i>	Threatened	0.00
10	<i>Ceropegia bulbosa</i> var. <i>lushii</i> (Graham) Hook.f.	Threatened	0.00
11	<i>Pavonia arabica</i> Hochst. & Steud. ex Boiss var. <i>massuriensis</i> Bhandari	Threatened	0.00
12	<i>Lasiurus scindicus</i> Henrard	Threatened	0.00
13	<i>Commiphora stocksiana</i> (Engl.) Engl.,	Threatened	0.00
14	<i>Pterocarpus santalinus</i> L.f.	Threatened	0.00
15	<i>Aristolochia indica</i> L.	Medicinal	100.00
16	<i>Adenantha pavonina</i> L.	Medicinal	0.00
17	<i>Dioscorea bulbifera</i> L.	Medicinal	0.00
18	<i>Curculigo orchioides</i> Gaertn.,	Medicinal	50.00
19	<i>Curcuma inodora</i> Blatt.	Medicinal	0.00
20	<i>Solanum trilobatum</i> L.	Medicinal	50.00
21	<i>Ougeinia oojeinensis</i> (Roxb.) Hochr.	Economically important	0.00
22	<i>Madhuca longifolia</i> (J. König ex L.) J. F. Macbr.	Economically important	0.00
23	<i>Mangifera indica</i> L.	Economically important	100.00

S.No.	Plant name	Category	Mortality rate %
24	<i>Senegalia catechu</i> (L.f.) P.J.H.Hurter & Mabb.,	Economically important	0.00
25	<i>Butea monosperma</i> (Lam.) Taub.	Economically important	20.00
26	<i>Pterocarpus marsupium</i> Roxb. subsp. <i>acuminatus</i> (Prain) Thoth.,	Economically important	0.00
27	<i>Swietenia macrophylla</i> King	Economically important	0.00
28	<i>Sterculia urens</i> Roxb.	Economically important	0.00
29	<i>Couroupita guianensis</i> Aubl.	Ornamental	0.00
30	<i>Guazuma ulmifolia</i> Lam.	Ornamental	0.00
31	<i>Cassia fistula</i> L.	Ornamental	66.67
32	<i>Erythrina suberosa</i> Roxb.	Ornamental	0.00
33	<i>Solanum seafortianum</i> Andrews	Ornamental	0.00
34	<i>Bauhinia variegata</i> L.	Ornamental	0.00

Botanic Garden of Indian Republic (BGIR), Noida

As part of *ex-situ* conservation project, during 2019-20, 29 tree species of about 501 plants namely *Citrus aurantiifoli*, *Citrus lemon*, *Saraca asoca*, *Mimusops elengi*, *Dillenia indica*, *Drimia nagarjunae*, *Aegle marmelos*, *Syzygium cumini*, *Terminalia chebula*, *Litchi chinensis*, *Garcinia morella*, *Hardwickia binita*, *Holoptelea integrifolia*, *Brucea mollis*, *Helminthostachys zeylanica*, *Knema andamanica*, *Pavetta indica*, *Pterocarpus santalus*, *Shorea talura*, *Shorea tumbaggia*, *Withania somnifera* etc. have been collected from BSI, SRC, Coimbatore, BSI, ANRC, Portblair, BSI, ERC, Shillong and BSI, DRC, Hyderabad for introduction in BGIR. The cactus garden has been redesigned by forming some new cactus bed. About 13 species of cactus namely *Martylocactus fukuryuzimboku*, *Astrophytum myriostigma*, *Mammillaria plumose*, *Mammillaria elongata*, *Notocactus leninghausii*, *Notocactus scopa*, *Euphorbia clump* etc. have been procured locally from NRC and from Chandigarh & Dehradun to introduce in Cactus garden. In this period, 16 RET species namely *Andrographis beddomei*, *Andrographis nallamalyana*, *Boswellia serrata*, *Butea monosperma*, *Capparis spiralis*, *Ceropegia bulbosa*, *Croton scabiosus*, *Cycas sphaerica*, *Cycas beddomei*, *Dalbergia latifolia*, *Dechaschistia cuddapahensis*, *Eriolena lushingtonii*, *Hildegardia populifolia*, *Hymedictyon populifolia*, *Madhuca indica*, *Phyllanthus narayanaswami* have been collected from various Lead and Small Botanic Gardens, and placed in conservatories for acclimatization. Approx. 3000 seeds of 25 species have been sown in the beds and distributed to various agencies and also planted in garden. The seeds raised in the net house have been planted during the monsoon season in various places at garden. Approx. 3500 seedlings of 20 species have been raised in the nurseries for distribution and plantation. Cuttings of 12 new climber rose cultivars and seeds of 34 varieties of winter annual propagated have been propagated in Rose garden and Winter Flower Sections respectively.

Experimental Botanic Garden, Central Regional Centre, Allahabad

During 2019-20, 14 plants (*Adansonia digitata* L., *Cordia macleodii* Hook.f. & Thomson, *Dalbergia latifolia* Roxb., *Desmodium oojainense* (Roxb.) H. Ohashi, *Dillenia pentagyna* Roxb., *Gloriosa superba* L., *Grewia asiatica* L., *Hardwickia binata* Roxb., *Phlomis superba* (Royle ex Benth.) Kamelin & Makhm., *Pterocarpus santalinus* L.f., *Radermachera xylocarpa* (Roxb.) Roxb. ex K.Schum. etc.) have been introduced in the garden of which all (except *Gloriosa superba* L.) are surviving in healthy condition. To combat Climate Change, more than 24,000 seeds of 35 tree species have been collected from Botanic Garden of CRC and nearby areas, dried under shade, cleaned and sown during monsoon in organic matter rich soil to get seedlings for plantation. Out of these sown seeds, 11,216 seedlings of 24 species have been developed and planted in paper glass (instead of

plastic bags to beat plastic pollution and to keep environment Clean and Green). Phenological data of 266 species of CRC garden is being continuously monitored and recorded.

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

The garden serves as a repository of Endemic, endangered, threatened and economic plant resources of Northeast India and also creates awareness of the importance of its conservation. As part of *ex-situ* conservation project, during 2019-20, 105 EET plant species and 13 medicinal plant species have been collected from various field tours and planted in EBG, Umiam (Barapani) and conserved accordingly. List of the taxa include *Acampe ochracea*, *Acanthephippium sylhetense*, *Acer laevigatum*, *Aerides multiflora*, *A. odorata*, *Agrostophyllum brevipes*, *A. callosum*, *Anoetochilus roxburghii*, *Anthogonium gracile*, *Arachnis labrosa*, *Arundina caespitosa*, *Brachycorythis galeandra*, *Brainea insignis*, *Bulbophyllum cauliflorum*, *B. gamblei*, *B. griffithii*, *B. gymnopus*, *B. leopardinum*, *B. odoratissimum*, *B. trichocephalum*, *Costus pictus*, *Camellia kissii*, *Cephalantheropsis obcordata*, *Cephalotaxus griffithii*, *Cleisostoma racemiferum*, *Coelogyne flaccida*, *C. ovalis*, *C. prolifera*, *C. punctulata*, *C. viscosa*, *Crepidium acuminatum*, *C. calophyllum*, *Cryptochilus sanguinea*, *Cymbidium aloifolium*, *C. cyperifolium*, *C. ensifolium*, *C. lancifolium*, *Dendrobium bicameratum*, *D. ochreatum*, *D. fimbriatum*, *D. formosum*, *D. parishii*, *Gastrochilus distichus*, *Globba multiflora*, *G. procera*, *Eria coronaria*, *E. tomentosa*, *Esmeralda cathcartii*, *E. clarkei*, *Dendrobium longicornu*, *D. nobile*, *D. primulinum*, *D. ruckeri*, *D. stuposum*, *Eulophia pauciflora*, *Gnetom gnemon*, *Ilex khasiana*, *Impatiens arguta*, *I. citrina*, *I. glandulifera*, *I. jurpia*, *I. porrecta*, *I. racemulosa*, *Habenaria dentata*, *Hedychium ellipticum*, *H. hookeri*, *H. spicatum*, *Hoya lobbii*, *H. parasitica*, *Ilex excelsa*, *Liparis cordifolia*, *L. deflexa*, *L. elliptica*, *L. viridiflora*, *Luisia tristis*, *Micropera rostrata*, *Mycaranthes pannea*, *Neogyna gardneriana*, *Oberonia acaulis*, *O. mucronata*, *Panisea uniflora*, *Paphiopedilum insigne*, *P. villosum*, *Peristylis lacertifer*, *Phaius flavus*, *P. mishmensis*, *P. tankervilleae*, *Pinalia acervata*, *P. amica*, *Pleione maculata*, *P. praecox*, *Pholidota articulata*, *P. imbricata*, *Polystachya concreta*, *Rhododendron formosum*, *Satyrium nepalense*, *Smitinandia micrantha*, *Stahlianthus involucratum*, *Sonerila khasiana*, *Tainia angustifolia*, *T. latifolia*, *Thunia alba* var. *bracteata*, *Vanda coerulea*, *Zingiber rubens*, *Zingiber zerumbet*, *Alpinia galanga*, *Angiopteris helferiana*, *Begonia hatacoa*, *Begonia palmata*, *Cinnamomum bejolghota*, *Citrus latipes*, *Dioscorea bulbifera*, *Homalomena aromatica*, *Magnolia champaca*, *Piper longum*, *Terminalia chebula*, *Stephania glabra* and *Viburnum foetidum*.

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

As part of *ex-situ* conservation project, during 2019-20, total four field tours have been conducted to Wayanad District and Agasthyamalai Biosphere Reserve, Kerala during which 101 species have been collected along with GPS data of which 32 are endemic plants. Some of the taxa include *Actinodaphne bourdillonii* Gamble, *Arenga wightii* Griff., *Artocarpus hirsutus* Lam., *Baccaurea courtallensis* (Wight) Muell.-Arg., *Croton malabaricus* Bedd., *Diospyros foliolosa* Wall. ex A. DC., *Dipterocarpus indicus* Bedd., *Dialium travancoricum* Bourd., *Garcinia gummi-gutta* (L.) Robs., *Garcinia imberti* Bourd., *Garcinia rubro-echinata* Kosterm., *Garcinia talbotii* Raizada ex Santapau, *Garcinia travancorica* Bedd., *Gluta travancorica* Bedd., *Goniothalamus wightii* Hook.f. & Thomson, *Gymnacranthera canarica* (Bedd. ex King) Warb., *Hopea parviflora* Bedd., *Humboldtia decurrens* Bed. ex Oliv., *Humboldtia trijuga* (J. Joseph & V. Chandras.) M. Mohanan, *Humboldtia vahliana* Wight, *Hydnocarpus pentandrus* (Buch.-Ham.) Oken, *Ixora brachiata* Roxb., *Knema attenuata* (Hook.f. & Th.) Warb., *Monosis travancorica* (Hook.f.) H. Rob. & Skvarla, *Palaquium ellipticum* (Dalz.) Baill.; *Sanjappa cynometroides* (Bedd.) E.R. Souza & Krishnaraj; *Semecarpus auriculatus* Bedd.; *Syzygium munronii* (Wt.) Chandrab., *Syzygium palodense* Shareef, E.S.S. Kumar & Shaju, *Syzygium travancoricum* Gamble; *Tabernaemontana alternifolia* L., *Tabernaemontana gamblei* Subram. & Henry, *Xanthophyllum arnottianum* Wight. of which *Archidendron bigeminum* (L.) I.C. Nielsen (Medicinal), *Begonia malabarica* Lam. (Medicinal)

& Wild Ornamental), *Cymbopogon flexiosus* (Nees ex Steud.) W. Watson (Aromatic), *Globba sessiliflora* Sims (Medicinal & Wild Ornamental), *Lophopetalum wightianum* Arn., (Timber), *Myristica beddomei* King (Medicinal and spices), *Pellionia heyneana* Wedd. (Medicinal), *Zingiber zerumbet* (L.) Roscoe ex Sm. (Medicinal and Wild Ornamental), *Caryota urens* L. (Medicinal and Ornamental), *Bixa orellana* L. (Medicinal and Ornamental plants) have been collected and introduced in NOEG, Yercaud.

Experimental Botanic Garden, Western Regional Centre, Mundhwa, Pune

During 2019–20, 70 species were collected and introduced such as, Ferns such as *Elaphoglossum beddomei*, *Huperzia phlegmaria*, Bulbous & rhizomatous plants such as *Arisaema tortosum*, *Ammomum* sp., *Ceropegia* sp., *Elaetoria cardomum*, *Etingera elatior*, *Thunbergia mysorensis*, *Zingiber diwakarianum* and orchids such as, *Acampe ochracea*, *Aerides ringens*, *Cheirostylis flabellate*, *Chrysoglossum ornatum*, *Cleisostoma tenuifolium*, *Dendrobium fimbriatum* var. *fimbriatum*, *Dendrobium chrysotoxum*, *Epigeneium amplum*, *Eria bambusifolia*, *Eria pauciflora*, *Gastrochilus acaulis*, *Gastrochilus calceolaris*, *Habenaria perrottetiana*, *Liparis wighteana*, *Luisia abrahami* etc.

Experimental Botanic Garden, Sikkim Himalayan Regional Centre, Gangtok

As part of *ex-situ* conservation project, during 2019-20, local and official field tours have been conducted to Hanuman Tok, Kabi -Mangan-Dikchu-Pangthang, Sikkim and Darjeeling District, West Bengal during which 33 live plant species (including 11 epiphytic orchid) have been collected for plantation in the garden, some of which are *Acampe papillosa*, *Cleisocentron pallens*, *Dendrobium anceps*, *Dendrobium fimbriatum* var. *oculatum*, *Dendrobium moschatum*, *Eria lasiopetala*, *Flickingeria fugax*, *Podochilus cultratus* etc. Approx. 79 live plants namely *Bulbophyllum bisetum* Lindl., *Bulbophyllum cauliflorum* Hook.f., *Bulbophyllum leopardinum* (Wall.) Lindl., *Bulbophyllum purpureofuscum* J.J. Verm. & al, *Bulbophyllum umbellatum* Lindl., *Cleisostoma linearilobatum* (Seidenf. & Smit.) Garay, *Coelogyne prolifera* Lindl., *Crepidium khasianum* (Hook.f.) Szlach., *Crepidium purpureum* (Lindl.) Szlach., *Cryptochilus sanguinea* Wall., *Eria coronaria* (Lindl.) Rech.f., *Gastrochilus inconspicuus* (Hook.f.) Kuntze, *Habenaria* sp., *Liparis* sp., *Liparis dongchenii*?, *Oberonia acaulis* Griff., *Peristylus goodyeroides* Lindl., *Phalaenopsis taenialis* (Lindl.) Christenson & Pradhan, *Pholidota imbricata* Hook., *Pholidota pallida* Lindl., *Pleione maculata* (Lindl.) Lindl., *Pleione praecox* (J.E. Sm.) D. Don, *Rhododendron edgeworthii* Hook. f., *R. formosum* Wall., *R. griffithianum* Wight, *R. ciliatum* Hook.f., *R. camelliiflorum* Hook. f., *R. dalhousieae* Hook. f., *R. arboreum* J.E. Smith, *R. maddenii* Hook. f., *Magnolia doltsopa* (Buch.-Ham. ex DC.) Figlar, *Smallanthus sonchifolius* (Poepp.) H.Rob., *Camellia sinensis* (L.) Kuntze, *Musa rubra* Wall. ex Kurz, *Musa velutina* H.Wendl. & Drude, *Canna edulis* Ker Gawl. , ***Vaccinium vacciniaceum* (Roxb.) Sleumer**, *Taxus baccata* L., ***Thomsonia nepalensis*** Wall., *Ginkgo biloba* L., *Phoenix rupicola* T.Anderson, *Digitalis purpurea* L., *Sinopodophyllum hexandrum* (Royle) T.S.Ying, *Pleione hookeriana* (Lindl.) Rollisson, *Agapetes hookeri* (C.B.Clarke) Sleum., *Roscoea purpurea* Sm., *Roscoea purpurea* Sm., *Impatiens uncipectala* C.B. Clarke ex. Hook. f., *Hedychium densiflorum* Wall., *Vaccinium vacciniaceum* (Roxb.) Sleumer, *Tofteldia himalaica* Baker, *Helwingia himalaica* Hook.f. & Thomson ex C.B.Clarke etc.

Experimental Botanic Garden, Northern Regional Centre, Dehradun

As part of *ex-situ* conservation project, during 2019-20, one 15 days and 05 one day tours have been conducted to different areas of Kumaun, Uttarakhand (Nainital, Almora, Bageshwar, and Pithoragarh) during which 75 threatened and economically important plant species and ferns *viz.*, *Alpinia zerumbet* (Pers.) B.L. Burtt & R.M. Sm., *Alpinia calcarata* (Haw.) Roscoe, *Zingiber roseum* (Roxb.) Roscoe, *Globba orixensis* Roxb., *Hedychium spicatum* Sm., *Crepidium acuminatum* (D.Don) Szlach., *Roscoea purpurea* Sm., *Dendrobium crepidatum* Lindl. & Paxton, *Luisia trichorrhiza* (Hook.) Blume, *Vanda cristata* Wall. ex Lindl., *Nervilia concolor* (Blume) Schltr., *Nervilia crocififormis* (Zoll. & Moritzi) Seidenf., *Nervilia mackinnonii* (Duthie) Schltr., *Goodyera repens* (L.) R.Br., *Calanthe triplicata*

(Willemet) Ames, *Platanthera edgeworthii* (Hook.f. ex Collett) R.K. Gupta., *Adiantum capillus-veneris* L., *Adiantum incisum* Forssk., *Adiantum philippense* L., *Aleuritopteris albomarginata* (Clarke) Ching, *Aleuritopteris anceps* (Blanf.) Panigrahi, *Ampelopteris prolifera* (Retz.) Copel., *Asplenium prolongatum* Hook., *Asplenium dalhousiae* Hook., *Blechnum orientale* L., *Botrychium lanuginosum* Sw., *Christella appendiculata* (C. Presl) Holttum, *Coniogramme fraxinea* (D. Don) Fée ex Diels, *Deparia boryana* (Willd.) M. Kato, *Dicranopteris lanigera* (D. Don) Fras.-Jenk., *Diplazium esculentum* (Retz.) Sw., *Diplazium spectabile* (Wall. ex Mett.) Ching, *Dryopteris cochleata* (D. Don) C. Chr., *Dryopteris juxtaposita* Christ, *Dryopteris sparsa* (D. Don) Kunze, *Equisetum diffusum* L., *Gymnopteris vestita* (Hook.) Underw., *Helminthostachys zeylanica* (L.) Hook., *Lepisorus kashyapii* (Mehra ex Bir) Fraser-Jenk., *Lepisorus tenuipes* Ching, *Loxogramme involuta* (D. Don) C. Presl, *Onychium siliculosum* (Desv.) C. Chr., *Polypodium lachnopus* Wall. ex Hook., *Polystichum discretum* (D. Don) J. Sm., *Polystichum piceopaleaceum* Tagawa, *Polystichum squarrosum* (D. Don) Fee, *Pteris vittata* subsp. *vittata* L., *Pteris cretica* L., *Pteris biaurita* L., *Pyrrosia costata* (C. Presl) Tagawa & K. Iwats., *Pyrrosia flocculosa* (D. Don) Ching, *Pyrrosia lanceolata* (L.) Farw., *Pyrrosia porosa* (C. Presl) Hovenkamp, *Selaginella chrysochaucos* (Hook. & Grev.) Spring, *Sphenomeris chinensis* (L.) Maxon, *Tectaria polymorpha* (Wall. ex Hook.) Copel., *Thelypteris auriculata* (J. Sm.) Ching, *Thelypteris erubescens* (Wall. ex Hook.) Ching, *Thelypteris dentata* (Forssk.) E.P. St. John, *Thelypteris nudata* (Roxb.) C.V. Morton and *Woodwardia unigemmata* (Makino) Nakai. have been collected, introduced and being maintained in the Botanic Garden under *ex situ* conservation. In addition routine maintenance of existing collections (Bamboo: 05 sp., Herb: 242 sp., Shrub: 100 sp., Trees: 210 sp., Climber / Liana: 31 sp.) growing in the garden, weed removal, pruning, mauling etc. are being carried out time to time. Phenological data [April (Fl. 14; Fr. 10), May (Fl. 13; Fr. 28), June (Fl. 7; Fr. 28), July (Fl. 11; Fr. 18), August (Fl. 11; Fr. 17), September (Fl. 11; Fr. 17), October (Fl. 10; Fr. 16), November (Fl. 16; Fr. 23), December (Fl. 16; Fr. 22). (Fl. Flowering; Fr. Fruiting)] of the existing plant species are recorded. One funded project on *ex-situ* conservation of economical, endemic and threatened plant species of Western Himalaya has been initiated during which one twelve days and 06 one day field tours undertaken to areas of Himachal Pradesh (Kinnaur) and Uttarakhand (Mussoorie, Bajawala, Halduwala, Golatappar, Kodyala) and 09 economic and threatened plant species were collected introduced and propagated namely *Crepidium acuminatum* (D. Don) Szlach.; *Rauvolfia serpentina* (L.) Benth. ex Kurz; *Luisia trichorrhiza* (Hook.) Blume; *Asparagus racemosus* Willd.; *Gloriosa superba* L.; *Nervilia crocifformis* (Zoll. & Moritzi) Seidenf.; *Incarvillea emodi* (Royle ex Lindl.) Chatterjee; *Catamixis baccharoides* Thomson; *Abrus pulchellus* Thwaites. About 150 individuals of threatened/economic species are being maintained in the Botanic garden in addition to already existing species. Multiplication of 16 other RETs and valuable plant species collected and introduced in the Botanical Garden are also being done including propagation of c. 2400 individuals from seeds, bulbs, pseudobulbs, stem, cuttings etc. Two new Sections *viz.* one for Zingiber and another of Pteridophytes have been developed which includes more than 80 species.

(B) IN-VITRO / MICROPROPAGATION OF RET PLANTS:

Eastern Regional Centre, Shillong:

As part of *ex-situ* conservation project, during 2019-20, micro propagation experiments have been carried out on the following taxa:

***Cymbidium tigrinum*:** Plant genomic DNA has been isolated for molecular taxonomic work of *Cymbidium tigrinum*. For this purpose leaf samples from three different localities has been taken and sent for PCR product sequencing for primers *viz.*, rbcL-a F and R, Maturase K (mat K) -390 F, Mat K 1326 R. About 300 seedlings in tissue culture laboratory are being multiplied. Earlier lab to land transferred 100 seedlings attained a height of about 10-12 cm and are under observation in the National Orchidarium, Shillong.

***Armadorum senapatianum*:** Plant genomic DNA has been isolated for molecular taxonomic work of *Armadorum senapatianum*. For this purpose leaf samples from three different localities has been taken and sent for PCR product sequencing for primers *viz.*, rbcL-a F and R, Maturase K (mat K) -390 F, Mat K 1326 R. Earlier lab to land transferred 85 seedling attained a height of about 10-17 cm and are under observation in the National Orchidarium, Shillong.

Rhododendron coxianum: 50 seedlings of *Rhododendron coxianum* earlier transplanted lab to land to the garden of Botanical Survey of India Shillong have been acclimatized and growing healthy.

Ilex khasiana: *In-vitro* seed germination in *Ilex khasiana* was successful, 20 seedlings have been transferred from lab to land.

Paphiopedilum hirsutissimum: *In-vitro* seed germination of *Paphiopedilum hirsutissimum* recently collected from Khonghampat, Orchidarium, Manipur are set and is under observation.

In this period, protocol standardization, mass multiplication, statistical analysis, Botanical paintings, SEM analysis, Molecular works including isolation of genomic DNA and genetic diversity have been completed. Result of genetic diversity Inter-Simple Sequence Repeat (ISSR) is under progress.

Northern Regional Centre, Dehradun:

As part of *ex-situ* conservation project, during 2019-20, plant propagules (seeds, live plant materials) of three selected species viz. *Tricholepis roylei* Hook.f., *Jasminum parkeri* Dunn and *Eulophia dabia* (D.Don) Hochr, collected from different wild localities, have been selected for micropropagation purpose. Tissue culture experiments and optimization of plant tissue culture media for the organogenesis (bud break, multiple shoot development, callusing and rooting) in selected threatened & endemic species have been designed along with optimization of plant growth regulators (PGRs) concentration for the induction of organogenesis in the targeted threatened species individually or in combination. Standardization of micropropagation protocol for the targeted species, hardening and acclimatization of the *in vitro* regenerated plantlets in the polyhouse and net house and their successful transfer to open environment and maintenance of stock cultures in the culture room are being carried out. During the study, three threatened and medicinal species have been successfully conserved through *ex-situ* conservation approach by using the tissue culture technology, efficient and reproducible micropropagation protocols have been standardized for the *Tricholepis roylei* Hook.f. (a point endemic & threatened species of the North-West Himalaya) and *Eulophia dabia* (D.Don) Hochr (a terrestrial medicinal orchid species), micropropagation of *Jasminum parkeri* has been tried from different explants (seed, nodal segment, leaf, petiole etc.) and callusing is achieved in nodal segment explants but further organogenesis was not observed in callus or any other explant of *J. parkeri*. *In vitro* raised plantlets of all the species have successfully been acclimatized and transferred to the open environment. The *in vitro* raised protocol might be of great significance in elucidating the molecular and phytochemical potential of the species. One Funded project (NMHS-LG) on 'Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building' is being carried out 17 field tours have been conducted to different regions of Uttarakhand and Himachal Pradesh. Mass scale propagation of following species viz., *Indopiptadenia oudhensis* (5000), *Gentiana kurroo* (2200), *Sophora mollis* (500), *Aconitum heterophyllum* (2000), *Mahonia jaunsarensis* (500), *Jasminum parkeri* (1000) and *Prunus cerasoides* (1000) has been done along with standardization of micropropagation protocol of *Phlomis superba* and *Sophora mollis* and plantlets have been successfully transferred to the open environment.

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A. RESEARCH ARTICLES

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C. हिन्दी लेख (Hindi Articles)

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NELUMBO vol. 61(1 & 2). 2019.

Plant Discoveries 2019.

BSI Annual Report 2018-19.

TRAINING/WORKSHOP/SEMINAR/SYMPOSIUM/CONFERENCE/ ORGANISED BY BSI

Three-days National workshop on Basics of Plant identification and Nomenclature

Organized by the Department of Botany, R D & S. H. National College under DBT Star Scheme in collaboration with Botanical Survey of India (BSI) from 22nd-24th November, 2019 in R. D. & S. H. National College, Bandra (W.), Mumbai in which a total of 51 participants (19 faculty members including 03 faculty members from junior colleges, 32 research scholars, PG students and 01 UG student) from 06 different states were participated. The workshop was inaugurated by Dr. M. K. Vasudeva Rao, Ex-Joint Director, Botanical Survey of India (BSI) along with Dr. Neha Jagtiani, I/C Principal, RDNC, Mr. Dinesh Himat singhani, I/C Vice Principal, RDNC, Dr. Vibha Mehra, Head, Department of Botany, RDNC and Dr. P. Lakshminarasimhan, Retired Scientist, BSI on 22nd November 2019 and the chief guest for valedictory function (24th December, 2019) was Dr. Rajendra Shinde, Principal, St. Xaviers College, Mumbai, Chairperson, BOS in Botany, University of Mumbai & Director, Blatter Herbarium (BLAT), Mumbai. The 3-days scientific session was enriched by 12 lectures and 02 practical sessions delivered by 07 resource persons. A test module was also scheduled after the technical session and result was declared along with distribution of certificates. After all the deliberations, there was a discussion on the outcome of the workshop and how this knowledge can be implemented in regular curriculum. The entire session was broadcasted through Zoom to international taxonomic community.

Two-days International Symposium on Plant Taxonomy and Ethnobotany, BSI, Kolkata (ISPTE 2020)

Organized at Hotel Lalit Great Eastern, Kolkata by Botanical Survey of India on 13th-14th February, 2020 in which a galaxy of plant taxonomists from various parts of India as well as from various prestigious institutions throughout the world like Royal Botanical Garden, Kew; Natural History Museum, London, Edinburgh Herbarium etc. were attended. The programme was divided into Plenary session and Technical sessions followed by valedictory session. The event was inaugurated by Hon'ble Addl. Secretary, MoEF & CC. The Plenary session was chaired by Dr. J.R. Bhatt, Advisor, MoEF & CC and Co-Chaired by S.N. Tyagi, PCCF (Rtd.), Gujarat State Forest Dept. preceded by Dr. Kanad Das & Dr. Dinesh Agrawala as Rapporteurs. Key note address was delivered by Prof. A.K. Koul, Chhairman, RAMC, BSI, followed by four plenary lectures by Dr. K.N. Gandhi, Senior Nomenclature Registrar, Harvard University Herbaria, Cambridge, USA, Dr. Balakrishna Pisupati, Chairperson, FLEDGE, Prof. C.R. Babu, University of Delhi and Dr. David E. Boufford, Harvard University Herbaria, USA. Some of the eminent taxonomists, delivered lectures in four parallel sessions are Dr. Henry Noltie, Royal Botanic Garden, Edinburgh, Prof. Ashok K. Jain, Jiwaji University, Gwalior, Ms. Rani Om Prakash, National History Museum, UK, Nabin Kumar Dhal, Environment & Sustainability Dept., CSIR-IMMT, Bhubaneshwar, **Dr. S. Natesh**, DST, Centre for Policy Research, Indian Institute of Technology, New Delhi, **Dr.**

M.K. Vasudev Rao, Former Joint Director, BSI, Dr. S.K. Chaturvedi, Dept. of Botany, Nagaland University, Lumami, Nagaland and others. The symposium witnessed presence of around 500 researchers from 33 Universities, 15 Institutions and 56 colleges from various parts of India and ten experts from abroad. The symposium was enriched with a series of lecture on Plant Taxonomy and Ethnobotany, 130 oral presentations and 134 poster presentations.

Five-days training program entitled “National Workshop on Advanced Trends in Marine Macro Algal Taxonomy, Cultivation & Utilization”, BSI, SRC, CBE

was conducted at BSI, SRC, CBE *w.e.f.* 21st – 25th, October 2019 during which a total of 49 applications were received and 20 Nos. of participants were selected based on the eligible criteria such as, field of interest, designation, percentage, awards, etc. the workshop tends to edify the knowledge of the marine macro algal collection, herbarium preparation, identification, taxonomy, cultivation and utilization. A sum of 16 Nos. of plenary lectures were delivered by the eminent dignitaries from the various part of our nations. In addition to that, the participants were brought to Gulf of Mannar (Rameswaram) to enhance their skills on collection, processing, preservation, preparation of herbarium, identification of marine macro algae. Training on ‘preparation of materials for seaweed cultivation’ was imparted to the candidates. Participants visited and learnt about the seaweed-based industries and trained for the production of agar-agar, alginates, carrageenan and other by products from seaweeds. ‘Souvenir of the workshop’ and seaweed manual entitled ‘Field manual: Marine Macroalgal collection, preservation, identification, cultivation and utilization’ were launched at the inauguration session of the workshop.

One day training program for Students of Amity university

was organized by Botanic Garden of Indian Republic, Noida on ‘Taxonomy of Herbarium and Botanical gardens’ on 20.02.2020. The training was provided with field survey and power point presentation.

One day training programme for the Technical Officers of Forest Survey of India

was organized at BSI, NRC, Dehradun in July, 2019 in which Technical Officers of FSI were made aware about role and various activities of BSI and given training on Herbarium techniques.

One day Workshop on “Flowering and Non-Flowering Plant Identification and Herbarium Methodology”, Kolkata

was jointly organised by BSI ENVIS RP and Dum Dum Motijheel College, Kolkata on 7th June, 2019 where in Dr. B.K. Singh acted as resource person and explained the steps involved in plant identification.

Two days Workshop on “Flowering & Non-Flowering Plant Identification and Herbarium Methodology”, Kolkata

was jointly organised by BSI ENVIS RP and Gurudas College, Kolkata – 54 on 26th – 27th February, 2020 where in Dr. M.E. Hembrom delivered a lecture and conducted practical classes. Dr. B.K. Singh acted as resource person and explained the steps involved in plant identification.

National Workshop on Forestry Interventions in Eco-Rehabilitation

Was organised by BSI, CRC, Allahabad in collaboration with Forest Research Centre for Eco- Rehabilitation, Prayagraj on 3rd March, 2020. The theme of the workshop was current challenges and or key issues on degraded forest rehabilitation in terms of policy, institutional, ecological technical and social economic aspect, Forest researches in ecological rehabilitation, Climate change mitigation and adaptation and Forest Rehabilitation, Policy and institutional aspects of rehabilitation. Academicians, Scientists, Teachers, Students and Research Scholars from different Universities, Institutions of National repute, Post Graduate Degree Colleges, Graduate Degree Colleges, Agriculture Colleges, Representatives of Non Government Organizations, Officials from Forest Department and other Stakeholders participated in this National Workshop. A key note address and lectures on different aspects of Restoration were delivered by Dr. G.P. Sinha, Head of office, BSI, CRC, Dr. Sheo Kumar and Dr. Arti Garg respectively.

Summer training program

One day summer training programme was organized for the students of Deshbandhu college (Univ. Of Delhi) on 03.05.2019 at BGIR, Noida in which Power point presentations were delivered to the students on ‘Botanical survey of India and its role in conservation’, ‘Grasses identification’, ‘Cucurbits molecular taxonomy’ and ‘Herbarium technique with field survey in Botanic garden’ by Dr. Manish Kandwal and Dr. Mayank Dewedi.

Awareness and Capacity Building Workshop

was organised at Kohima, Nagaland and Tadubi, Manipur under NMHS project on 26th July, 2019 and 27th July 2019 and attended by Dr. A. A. Mao, Director, BSI, Dr. N.Odyuo, Dr. D. L. Baite and Research Scholars of the project.

Two days workshop on “Biodiversity Conservation Issues and Challenges”

was conducted by NMHS project at Wokha Forest Division, Nagaland, at Wokha town and Pangti village, Nagaland on 21st and 22nd November, 2019. During the program, 600 saplings of *Prunus cerasoides* was distributed. The programme was attended by Dr. N. Odyuo (Co-PI), Dr. David Biata (Co-Investigator), Dr. Kh. Sangeeta Devi (RA), Ms. Bidisha Mallick (JPF), Mr. Kerlang Khonglam (JPF) and Mr. Charles Wahlang (JPF). Dr. David Biata (Co-Investigator) delivered a lecture on the topic “Why Plant Matters” during the workshops.

4th Botanical Nomenclature Course

was organised at Botanical Survey of India, Eastern Regional Centre, Shillong from 27th –31st January, 2020. Dr. A. A. Mao, Director, BSI was Convener of the course, Late Dr. P.

Lakshminarasimhan, and Dr. N. Odyuo ERC, BSI, Shillong served as Coordinator and Facilitator, respectively. Dr. K. N. Gandhi, Sr. Nomenclatural Registrar, Harvard University Herbaria, USA was the course director. The main objective of the course was to train young taxonomists in the field of plant taxonomy and nomenclature as per recent ICN code. The course drew 83 participants from across the country, including 51 from outside.

National Seminar on Green Technology for Environment Management and 44th Annual Conference for Botanical Society

was organised by BSI in collaboration with North Orissa University, Baripada, Odisha on 22nd-23rd January, 2020.

Special Lecture

Was organized a special lecture on “The Changing Paradigm of Flowering Plants Systematics” by prof. (Dr.) Arun K. Pandey, Vice Chancellor, Mansarovar Global University, Bhopal at Auditorium, ANRC, Port Blair on 17.12.2019.

Hindi Workshop/Training/Pakhwara

Different Regional Centres of BSI organised one/two-days Hindi workshops, trainings, Hindi Pakhwara, competitions (essay, quiz, noting-drafting, debate etc.) in Hindi Saptah. BSI, AZRC, Jodhpur organised two Hindi workshops cum training programmes during ‘Hindi Saptah-2019’ on the topics: (i) “**Vigyan Lekhan Par Vyaakhyaan**” by Dr. D.D. Ojha, Ex-scientist, DMRC, Jodhpur on 23rd Sept., 2019 and “**Tippn Lekhan** (Noting) by Dr. D.K. Tripathi, Sci.-F & Jt. Director, Rajbhasa Section, ISRO, Jodhpur on 24th Sept., 2019 in which all the Scientists and staff members participated actively. After successful completion, prizes were given in both Hindi and non-Hindi sectors in all the Centres and offices of BSI.

PARTICIPATION OF BSI OFFICIALS IN SEMINAR/SYMPOSIUM/CONFERENCE/TRAINING

Dr. Pratibha Gupta

Delivered invited Lecture on the topic on ‘Diversity of Cyanoprokaryotes and Algae on Feather of Bird - Snow Petrel (*Pagodroma nivea* Forster) in Broknes Peninsula of Larsemann Hills, East Antarctica : First Report’ on 21.05.2019 in session IV, Global Conference on Our Biodiversity, Our Food and Our Health at Conference Hall of BSI, Allahabad.

Delivered invited lecture on ‘Diversity of Cyanoprokaryotes and Algae from Aero-terrestrial Biofilms on Roxburgh Building of Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah’ on 22.12.2019, in 1st International Conference on Environment and Society (ICES) - Socio-economic Challenges of Agriculture, Biodiversity & Environment at Hurcourt Butler Technical University (HBTU), Kanpur.

Delivered Special Invited Lecture on the topic entitled ‘Amazing Antarctica and its Biodiversity’ on 24.12.2019 at B.N.D.P.G. College, Kanpur to graduate and post graduate students and researchers in special orientation session.

Presented a paper on ‘Diversity of Epiphytic Cyanoprokaryotes and Algae from Great Banyan Tree (*Ficus bengalensis* L.) of Great importance and uses : An Identity of Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah’ in International Symposium on ‘Plant Taxonomy and Ethnobotany’ at Lalit Great Eastern Hotel, Kolkata from 13th to 14th Feb., 2020.

Dr. S.S. Dash

Delivered a lecture “Present status of Invasive Alien Species in Mizoram” during the second term duration progress meeting of Invasive Alien Pl ants of Himalaya Project at Chandigarh on 25 April 2019.

Delivered an invited talk “Plant Taxonomic Research in India: Challenges and Prospects” in the National Seminar “Eco-friendly Approaches to Control Biohazards” at Rayagada (Auto) College, Odisha on 22.06.2019.

Delivered a talk on Biodiversity issues of Arunachal Pradesh during the outreach program organized during the 42-foundation day of APRC, Itanagar on 8.8.2019.

Attended and delivered a lecture “Past, Present and future Work Modules of BGIR” before the Addl. Secretary in the brainstorming meeting at BGIR, Noida on 22.10.2019 arranged for selection of tree species for BGIR.

Chaired a session in the National Seminar cum Workshop on Biodiversity conservation and sustainable use of Medicinal plants and aromatic plants held at Ch. Charan Singh University, Meerut on 31st August 2019. Facilitated for signing a MoU between CCSU and Botanical

Survey of India for sharing for research activities and recognizing BSI as a sister research organization.

Attended the COP 14 on desertification and successfully organized the side event “on Floristic diversity of Indian deserts (Hot & cold) ecosystems: status and challenges 7th September 2019 at Indian Pavilion UNCCD, COP 14.

Presented the gold medal lecture Biodiversity Hotspot: Arunachal Pradesh: Characteristics and Diversity on the award ceremony of V.V.Sivrajan gold medal on taxonomy awarded by IAAT.

Delivered a invited lecture “Biodiversity of Eastern Himalaya: an overview” at National seminar “Himalayan Matters in a Changing World” during December 9-11, 2019 at GBPNIHESD, Almora” as subject expert and delivered at talk on “at Almorah, Uttarakhand on 9th Dec. 2019.

Deliver an invited talk “Qualitative and quantitative assessment of Rare, Endemic and threatened taxa and their conservation “in the National Seminar on “*Green Technology for Environment Management*” (GTEM Seminar-2020) on 23rd January” at Department of Botany, North Orissa University, Baripada, Odisha.

Presented the talk on the project progress of the Large grant NMHS Project “Biodiversity assessment through long term monitoring plots in Indian Himalayan landscape” in the 3rd monitoring & evaluation workshop held at INSA, New Delhi.

Attended the release ceremony of Plant discoveries 2018 and Orchids of India: a pictorial guide during World Environment Day 2019 organized by MoEFCC at New Delhi.

Undertaken a one-day training on Grievance officers at DOPT at Sardar Patel Bhawan, New Delhi on 25.7.2019.

One-day workshop on capacity Building for Adaptation Planning under NMSHE, West Bengal is being organized by this Department to enhance knowledge on the science and policy aspect of climate change at global, national and state level to understand the mechanisms for different project planning on 26th November 2019 at the CII - Swesh Neotia Centre, Kolkata.

Delivered an invited talk “Invasive Alien Plants in Himalayas: Status and Trends; in special reference to Mizoram” in the one day awareness and capacity building workshop organized under National Mission on Himalayan studies” as a part of the project “ Ecological Investigations to understand causes and consequences of invasion in Tripura and Mizoram” held at Department of Botany, Central University, Mizoram on 24. 4. 2019.

Deliver an invited talk “Floristic Diversity in North-East India and Role of BSI in Strengthening Floristic Research” in the one day awareness and capacity building workshop organized under National Mission on Himalayan studies” as a part of the project “ Ecological Investigations to understand causes and consequences of invasion in Tripura and Mizoram” held at Department of Botany, Central University, Mizoram on 24. 4. 2019

Dr. Kanad Das

Participated in the 9th training programme on “Science Technology & Emerging Trends in Governance” for Scientists & Technologists from 21st -25th October, 2019 at Indian Institute of Public Administration, New Delhi.

Dr. Lal Ji Singh

Presented a poster titled “Diversity of family Loranthaceae in Andaman and Nicobar Islands, India” in the International Symposium on Plant Taxonomy and Ethnobotany, organized by Botanical Survey of India, Kolkata from 13.02.2020 to 14.02.2020.

Delivered an invited lecture on ‘Endemic Plant Diversity of Andaman and Nicobar Islands’ for Forest Trainees at Forest Training Institute, Wimberlygunj, South Andaman on 21.08.2019.

Shri Vinod Maina

Attended one day interactive workshop on ‘Preparation of Detailed Project Report (DPR) For Rejuvenation of Major Indian Rivers through Forestry Interventions’ on 27.05.2019 at Arid Forest Research Institute (AFRI).

Dr. N. Odyuo

Attended a brainstorming Meeting to select best Tree and Medicinal plants for various thematic sections for new Plant scape of BGIR, Noida on 22nd October, 2019.

Dr. Chaya Deori

Delivered a talk on the theme “Our Biodiversity, Our Food, Our Health” on International Biological Diversity at ERC, Shillong on 22nd May, 2019.

Delivered an invited lecture as a resource person on the topic ‘Diversity, Conservation and Sustainable utilization of Orchid Flora of Northeast India’ and acted as a Rapporteur for technical session at Anandaram Dhekial Phookan College ADP College, Naogaon on 30th August, 2019.

Attended International Symposia on Plant Taxonomy & Ethnobotany organised by BSI, Kolkata *w. e. f.* 13th to 14th February, 2020 and acted as a Rapporteur for technical session and anchored the plenary session.

Delivered a talk on the theme ‘Women in Science’ on National Science Day on 28th February, 2020.

Dr. M. U. Sharief

Attended the 14th National Meeting of State Biodiversity Board on 27th & 28th November 2019 and co-chaired a session.

Attended and inaugurated “Science Carnival” on 06.03. 2020 and delivered a talk on “Importance of Plant Science in solving problems of Climate Change” at Mother Teresa University for Women, Coimbatore.

Inaugurated and delivered Inaugural Lecture in a week long National Workshop sponsored by DST-SERB on “Taxonomy of Angiosperms: Field to Laboratory” from 9th -13th, December, 2019 conducted at the PSGR Krishnammal College for Women.

Attended Science Carnival at Mother Teresa Women’s University Research and Extension Centre, R.S. Puram, Coimbatore on 06.03.2020 and delivered a Talk on “Importance of Plant Science in Solving Problem of Climate Change”.

Dr. C. Murugan

Attended inaugural Department Association of Botany and Zoology, PSG Krishnammal college for Women as Chief Guest and delivered lecture on Nature conservation on 18-07-2019.

Participated and delivered welcome address during the world ozone day celebrations on 16.09.2019.

Inaugurated National Conference on Promotion of Livelihood & entrepreneurship opportunity through Medicinal and Aromatic Plants, organized by Vivekanandha College of Arts and Science for Women, Elayampalayam, Tiruchengode 637 205 and delivered inaugural address.

Dr. M. Palanisamy

Delivered a plenary lecture on the ‘Marine macro algae and their aspects’ to the M.Sc. Students from Kannur University, Kerala on 18.12.2019.

Delivered a plenary lecture on the marine macro algae and their aspects to the M.Sc. Students from Kannur University, Kerala on 18.12.2019.

Delivered a lecture on the marine macro algae occurrence and their aspects to the M.Sc. Students from Sree Narayana College, Kollam, Kerala.

Attended and delivered an oral presentation on the topic ‘*Reinvestigation on Flora of Gulf of Mannar Biosphere Reserve after Tsunami- A preliminary study*’ at International Symposium held at BSI, Kolkata on 13th and 14th February.

Attended the International Symposium on Plant Taxonomy and Ethnobotany (ISPTEB - 2020) *w.e.f* 13th - 14th February, 2020, held at BSI, Kolkata and delivered oral presentation on “Marine Macroalgal and Seagrass Diversity in India with Reference to their Threats and Conservation Measures” on 14.02.2020.

Delivered a special lecture on “Marine Macro Algal Resources in India” at Botany Department, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore on 27.02.2020.

Delivered an invited lecture on “Marine Macro Algal and Seagrass Diversity in India” at Botany Department, Bharathiar University, Coimbatore on 06.03.2020.

Dr. Vinay Ranjan

Acted as Rapporteurs for parallel sessions of the theme, ‘Floristics & Biodiversity, Revisionary Studies’ during International Symposium on Plant Taxonomy and Ethnobotany’ organised by BSI, Kolkata, held on 13.02.2020.

Dr. R. Manikandan

Delivered a lecture on ‘Herbarium methodology’ to participants/trainees of Training on 13.05.19 to 24.05.19 and also attended inaugural meetings.

Dr. S.K. Singh

Delivered a lecture on ‘Biodiversity Conservation’ in a Workshop/Awareness Programme organized under the NMHS project in Green Lawn Academy, JaintanWala, Dehradun on 01st August, 2019.

Delivered a lecture on ‘Role and various activities of BSI’ to Forest Survey of Indian trainee on 05.07.2019.

Attended brainstorming session held at New Delhi on 22.10.2019 for development and finalization of plant species to be cultivated at BGIR, Noida.

Delivered a talk on ‘BSI and Floristic studies’ to the Forest range officer trainees at BSI, NRC on 23.12.2019.

Attended two days International Symposium on Plant Taxonomy held in Kolkata on 13th - 14th February, 2020 and acted as a judge for evaluation of scientific posters displayed at BSIPTTE on 13.02.20 & 14.02.20.

Acted as Rapporteurs in a session on “Biodiversity and RET” for 03 lead lectures and 20 oral presentations and submitted the report on 14.02.20.

Dr. Harish Singh

Delivered a talk on “Ethnobotany and Traditional Conservation” at Green Lawn Academy, Jaintanwala, Garhi Cantt., Dehradun on 01.08.2019.

Attended a National Seminar on “Conservation of Bio-resources of Medicinal Value: Current Scenario and Way forward” (organized by CCRAS, New Delhi) on 13.08.2019 at A.P. Shinde Symposium Complex, ICAR, PUSA Campus, New Delhi as special/ invited guest & chaired a Technical session and also participated in Panel discussion.

Attended a meeting on *Nagar Rajbhasha Karyanawansamiti* at Survey of India, Dehradun as representative of BSI, NRC on 25-11-19.

Attended an International Conference on 'Plant Taxonomy and Ethnobotany' at Kolkata, West Bengal on 13 to 14 February 2020 and presented an oral talk on "Ethnobotanical Wisdom amongst Tribal and Rural people of Odisha". Displayed two posters entitled "Some selected Ethnomedicinal plants of Kaimur and Rohtas districts of Bihar" and "Ethnomedicinal plants used by the tribal communities of West Champaran district of Bihar" in the conference. Acted as a judge for evaluation of 36 scientific posters and also acted as Rapporteur in a session on "Traditional Knowledge and Ethnobotany" for 4 lead lectures and 13 oral presentations.

Dr. Manas baowmik

Attend COP14 Convention at India Expo Mart, Greater Noida, Uttar Pradesh w.e.f.7-8.9.2019. Also participated side event organized by BSI, ZSI and Consulate of China.

Dr. Ambrish Kumar

Attended International Symposium on Plant Taxonomy and Ethnobotany, organized by Botanical Survey of India, Kolkata from 13th -14th February, 2020.

Attended Ladakh Summit 2020 at Leh (3rd -5th March, 2020) as speakers.

Dr. Rajib Gogoi

Attended 9th Training Programme on Science Technology and Emerging Trends in Governance for Scientists & Technologists, (October 21-25, 2019) at Indian Institute of Public Administration, New Delhi.

Delivered an oral presentation 'Taxonomy & diversity of Balsams (*Impatiens* L.; Balsaminaceae) of Indian Himalayan region, its utility and conservation priorities with special emphasis on Eastern Himalaya' in International Symposium on Plant Taxonomy & Ethnobotany organised by BSI on 13th & 14th February 2020.

Delivered a talk on 'Phytodiversity of NE India' at Department of Biotechnology, Goalpara College, Assam.

Delivered a talk on 'Balsams of Eastern Himalaya' in Birbal Sahni Inst. of Paleosciences & CSIR, National Botanical Research Institute, Lucknow on 10.12.2019 & 11.10.2019 respectively.

Delivered lead lecture entitled "Wild Edible plants: Challenge of identification, inventorisation and value addition" in National Seminar on- Resurgence of Non Conventional Wild Edible Plants of NE India at Department of Biotechnology, Gauhati University, Assam on 17th February, 2020.

Delivered a talk on ‘Biodiversity of NE India-a global Biodiversity hotspot’ at Pandu College, Guwahati, Assam on 18th February, 2010.

Dr. T.A.M. Jagdeesh Ram

Attended and presented a Research Paper titled ‘Foliicolous lichens of the Andaman and Nicobar Islands’ in the International Symposium on Plant Taxonomy and Ethanobotany organized by Botanical Survey of India, Kolkata from 13.02.2020 to 14.02.2020.

Dr. V. Sampath Kumar

Delivered lectures on “Importance of Herbarium and its role in Plant Taxonomy” as well as “Categories and Hierarchies” on 25.09.2019 in the Refresher Course in Bioinformatics Department for the University and College Teachers, organised by Human Resource Development Center, Bharathiar University, Coimbatore *w.e.f.* 12.09.2019 to 25.09.2019.

Attended a DST-SERB sponsored week long workshop on “Taxonomy of Angiosperms: Field to Laboratory” conducted at the PSGR Krishnammal College for Women from 9-13, December, 2019 and acted as one of the Resource persons.

Delivered a lecture on “Basics in Botanical Nomenclature” which covered five major topics including Major rules, Rank of Taxa (Categories and Hierarchy), Typification of Plant names, The rule of priority, Effective and Valid publication, Author citation and Illegitimate names on 09th December, 2020.

Dr. B.S Kholia

Delivered a lecture on ‘Herbarium techniques of lower plants’ to Forest Survey of Indian trainee of 05.07.2019.

Participated a seminar on Himalayan Matter in a Changing World during 09.11.2019 to 11.12.2019 at G. B. Pant National Institute of Himalayan Environment and Development, Koshi, Katarmal, Almora and presented an Invited lecture.

Attended a meeting of State Wildlife board on 26.11.2019 chaired by Hon C. M. of Uttarakhand and discussed on various agenda points related to conservation of wildlife, permission of developmental projects, introduction of new species in National parks of the state etc.

Dr. W. Arisdasn

Delivered a lecture on “Naming of Plants with Special Emphasis on Carl Linnaeus” in the Workshop held at PSGR Krishnammal College for Women, Coimbatore on 09.12.2019.

Dr. Giriraj Singh Panwar

Delivered a lecture on Biodiversity Conservation in a Workshop/Awareness Programme organized under the NMHS project in Green Lawn Academy, Jaintan Wala, Dehradun on 01st August, 2019.

Attended the Environment Day celebrations at NRC BSI on 4th June, 2019 and also participated in the awareness rally on beating the air pollution by NRC-BSI Dehradun.

Attended and presented poster in International Symposium entitled “Plant Taxonomy and Ethnobotany” organized by the Botanical Survey of India, Kolkata, West Bengal held on 13th-14th February, 2020.

Dr V. K. Rawat

Attended the International Seminar on ‘Plant Taxonomy and Ethnobotany’ organized by BSI at Kolkata *w.e.f.* 13-14th February, 2020 and delivered oral presentation.

Dr. Devendra Singh

Attended ‘International Symposium on Plant Taxonomy and Ethnobotany’ organized by Botanical Survey of India, Kolkata on 13th –14th February, 2020 and presented a paper entitled ‘Taxonomic studies of family the Metzgeriaceae in India’.

Attended meeting at ZSI on 2nd National consultation for the National Mission for Biodiversity and Human well-being and prepared a proposal for the status of Bryophytes in India.

Delivered six lectures and demonstrated practical on Bryophytes to the M.Sc. Botany students of University of Calcutta with the permission of D/BSI covering the topics, General habit, habitat, life forms, classification, morphology, anatomy, evolutionary significance, vegetative reproduction and cytogenetics of bryophytes.

Dr. Dinesh Kumar Agrawala

Delivered a lecture as resource person on ‘Conservation perspectives of Indian Orchids’ during Farmers training programme at ICAR NRC (Orchids) on 25.09.2019.

Delivered a lecture on ‘Indian Orchids-Research and Livelihood prospects’ in the conference “Himalaya Matters in a Changing World” at GBPNIHESD, Almora during 09.12.2019 – 11.12.2019.

Delivered a lecture on ‘Collection, Identification and preservation of Orchid specimens’ for the visiting faculties and students of T.M. Bhagalpur University on 27.11.2019.

Delivered a lead lecture on ‘Application of GIS Technology in IUCN Red list Assessments’ during SAIARD’s Geospatial Conclave, A national Policy making conference, organized by

The Center for Applied Geo-Informatics, South Asian Institute for Advanced Research and Development on 14.01.2020.

Delivered a lecture on ‘Current status of Orchid research in India’ at ISPTTE, organized by BSI, during 13th -14th February, 2020.

Delivered a lecture on ‘Orchid diversity and Eco-tourism development’ during the Green Skill Development Programme on Ecotourism and Livelihood enhancement organized by GBPNIHESD, Sikkim Unit, Pangthang on 19.02.2020.

Delivered a lecture on ‘Field and Herbarium methodology’ at training cum workshop on “Statistical Applications in Ecological Research” organized by GBPNIHESD, Gangtok, on 03.03.2020.

Attended the 3rd Himalayan Researchers Consortium at GBPNIHESD, Almora from 14.05.2019 to 19.05.2019 and presented the concept note and progress of NMHS fellowship at BSI, Gangtok.

Attended Farmers training programme at ICAR NRC (Orchids) on 25.09.2019 and delivered an invited lecture on ‘Conservation perspectives of Indian Orchids’.

Attended International workshop on “Preservation and promotion of Sowa-Rigpa in Asia”, organized by Ministry of AYUSH, at Gangtok from 28.02.2020 to 29.02.2020 and participated in organizing a display stall by BSI.

Delivered a lecture on “Collection, preservation and identification of Orchids” to 30 visiting students and faculties from Ranaghat College, West Bengal, on 26.02.2020.

Dr. Sandeep K. Chauhan

Attended training – cum – workshop for development and Management of Botanic Garden and related aspects at Shanghai , China on August-September, 2019.

Dr Manish Kandwal

Delivered a lecture on grasses at Amity university, NOIDA on 5.03 .2020.

Dr. K.A. Sujana

Delivered two talks on ‘Diversity of flowering plants of Kerala’ and ‘Janaki Ammal- an unsung heroine’ at St.Mary’s College, Thrissur, Kerala on 11.12.19.

Dr. M. Y. Kamble

Delivered a lecture on “Plants in National Orchidarium & Experimental Garden and their Conservation” to the 35 students, grade 11 & 12 of the Government Model Higher Secondary

School, Yercaud during their Educational Visit to BSI, SRC, NO&EG, Yercaud on 13th August 2019.

Dr. L. Rasingam

Delivered a lecture on “Introduction to plant taxonomy, taxonomy and its relevance to biodiversity studies, system of plant classification, phylogeny and binominal nomenclature” to the GSDP trainees on 2nd December, 2019 at EPTRI, Hyderabad.

Attended and presented a paper on “Floristic diversity of Nagarjunasagar Srisailem Tiger Reserve, Andhra Pradesh” at the International Symposium on Plant Taxonomy and Ethnobotany at Kolkata organized by Botanical Survey of India from 13th & 14th February, 2020.

Dr. Deepu Vijayan

Attended a workshop on "Molecular Phylogeny" at University of Calicut, Kerala *w.e.f.* 23rd to 27th September, 2019.

Participated and displayed BSI activities and BSI Publications in the Science exhibition: Science Fest Theme: Climate Change and its effects on Living Organism organised by Synod college, Shillong, Meghalaya on 20th September, 2019.

Dr. K.S. Dogra

Attended and presented a paper in International symposium on Plant Taxonomy and Ethnobotany on 13-14th February, 2020 at Kolkata.

Attended the Environment Day celebrations at NRC BSI on 4th June, 2019 and also participated in the awareness rally on beating the air pollution by NRC-BSI Dehradun.

Attended the NMHS workshop and delivered a talk on plant conservation and its importance in the Higher Secondary School near Santla Devi on 01st August, 2019.

Dr. J.H. Franklin Benjamin

Delivered a lecture on ‘Biodiversity and Sustainable ecotourism’ for the trainees of GSDP in Certificate Course on Ecotourism & Livelihood enhancement conducted by GB Pant National Institute of Himalayan Environment & Sustainable Environment.

Dr. M. Murugesan

Delivered a lecture and Hands on training programmes on ‘Preparation of taxonomic keys’ to the UG and PG students (60 students) of PSGR Krishnammal college for Women on 28.08.2019.

Delivered a lecture and Hands on training programmes on 'Identification of plants and Preparation of taxonomic keys' to the UG and PG students (55 students) of Government Arts College, Coimbatore on 13.09.2019.

Delivered a lecture entitled 'Identification of plants and preparation of taxonomic keys' along with practical session on 09.12.2019 to the participants in a five day workshop on Plant taxonomy "Field to Laboratory" Organized by PSGR Krishnammal College, Coimbatore in collaboration with Botanical Survey of India, Southern Regional Centre, Coimbatore from 09.12.2019 to 13.12.2019.

Delivered a lecture entitled 'How to describe an Angiosperm plant along with practical session' on 10.12.2019 to the participants in a 5 day workshop on Plant taxonomy "Field to Laboratory" Organized by PSGR Krishnammal College, Coimbatore in collaboration with Botanical Survey of India, Southern Regional Centre, Coimbatore from 09.12.2019 to 13.12.2019.

Dr. Puneet Kumar

Attended the Environment Day celebrations at NRC BSI on 4th June, 2019 and also participated in the awareness rally on beating the air pollution by NRC-BSI Dehradun.

Attended one day training programme organized for the technical officer of Forest Survey of India at BSI, NRC-Dehradun in July, 2019.

Attended Workshop/Awareness and Plantation Programme on the theme "Biodiversity Conservation" organized on the eve of BSI Foundation Day on 01st August, 2019 in collaboration with NMHS (LG) project in Green Lawn Academy, Jaintan Wala, and Halduwala village near Santala Devi, Dehradun.

Delivered a guest lecture to M.Sc. Botany students on the topic entitled 'Cytology in relation to Taxonomy' at Dolphin PG Institute, Dehradun on 23.11.2019.

Attended and participated as resource person in a Workshop cum consultation meet on Application of process based vegetation models to assess forest vulnerability organized at FRI on 30th December, 2019.

Attended and presented a poster in *International symposium on Plant Taxonomy and Ethnobotany* on 13th -14th February, 2020 at Kolkata.

Dr. David Lalsama Biate

Attended Recruitment Committee Meeting for selection of Senior Scientist and Technical Assistant of Bio-Resource Development Centre, Government of Meghalaya at Additional Secretariat Building, Shillong on 14th May, 2019.

Attended as Expert Member of Interview Board for selection of Senior Scientist of Bio-Resource Development Centre, Government of Meghalaya at State Council of Science Technology and Environment (SCSTE), Nongrim Hills, Shillong on 19th June, 2019.

Attended as Expert Member of Interview Board for selection of Technical Assistant of Bio-Resource Development Centre, Government of Meghalaya at State Council of Science Technology and Environment (SCSTE), Nongrim Hills, Shillong on 1st July, 2019.

Attended as External Member for DPC at Directorate of Census, Meghalaya on 5th July, 2019.

Attended Five days IV Botanical Nomenclature training programme to be organized by ERC, Shillong from 27th to 31st January, 2020

Dr Manas Ranjan Debta

Participated and delivered an oral presentation on “The Spermatophytic Flora of Singalila National Park, West Bengal” in an International Seminar on ‘Plant Taxonomy and Ethnobotany’ organized by BSI at Kolkata *w.e.f.* 13-14th February, 2020.

Dr U.L. Tiwari

Presented a paper on ‘Angiosperm diversity in East Kameng District, Arunachal Pradesh’ in International Seminar on ‘Plant Taxonomy and Ethnobotany’ organized by BSI at Kolkata *w.e.f.* 13th -14th February, 2020.

Dr. Avishek Bhattacharjee

Represented the country as a member Indian delegation to attend the 18th Meeting of the Conference of Parties (CoP18) to the CITES held in Geneva, Switzerland *w.e.f.* 17.08.19 to 28.08.19 during which acted as invited panel member and provided inputs to improvise the 9-step NDF guidelines of CITES in the side event on NDF of plants held in Palexpo, Geneva on 21.08.2019. Also prepared comments on plant related Agenda Items (including *Dalbergia sissoo*) for CITES CoP 18 on behalf of Govt. of India. The delegation advocated in favour of delisting of *Dalbergia sissoo* from CITES Appendix II/ amendment of Annotation #15 with respect to *Dalbergia* sp. and some *Guibourtia* spp. in the CITES-CoP18; as part of the delegation participated in ‘Working Group’ in the CITES-CoP18 to develop further revisions of Annotation #15. The amendment concluded that a maximum weight of wood of the listed species (including *D. sissoo*) of up to 10 kg per shipment (from 500 gm per item), and finished musical instruments, finished musical instrument parts, and finished musical instrument accessories were allowed to export without CITES control; the delegation successfully prevented inclusion of the entire genus *Cedrela* under CITES Appendix II during the CITES-CoP18. However, CITES control was allowed by amendment and by adding Annotation #6 to restrict the trade to non-plantation species and only neotropics range species.

Attended CITES Cell meeting at MoEF&CC, New Delhi on 8.4.19 and 20.06.19 wherein provided inputs on India's proposal on delisting of *Dalbergia sissoo* from the Appendix II of CITES.

Invited as a Councillor to attend the 29th IAAT Annual Conference and National Symposium on "Modern trends in Biosystematics of Angiosperms" from 11th to 13th November, 2019, at the Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Thiruvananthapuram and delivered a lecture on 'An introduction to CITES Non-Detriment Findings (NDFs) and a case study of *Dalbergia latifolia* Roxb. in India'. Also acted as one of the judges to evaluate the oral presentations for Fr. Antony Mukkath – K.S. Manilal Award on the category 'Modern Techniques in Plant Taxonomy'.

Dr. K. Avinash Bharati

Presented a poster entitled 'Mapping of ethnobotany research in India' in International Symposium on Plant Taxonomy and Ethnobotany organised by BSI from 13th to 14th February, 2020, at Lalit Great Eastern, Kolkata.

Attended 4th Botanical Nomenclature Course at BSI, ERC, Shillong from 27th–31st January, 2020.

Dr. Debasmita Dutta Pramanick

Participated in the International Symposium on Plant Taxonomy and Ethnobotany on 13th & 14th February, 2020 and conducted parallel session II in Banquet hall II on 13th February, 2020 and parallel session II in Legacy hall III on 14th February, 2020.

Dr. Monalisa Dey

Participated as a resource person in the one day workshop organized by ENVIS RP on Biodiversity of Botanical Survey of India in collaboration with Dum Dum Motijheel College, Kolkata on "Flowering & Non-flowering Plant Identification and Herbarium Methodology" on 7th June 2019 at Department of Botany, Dum Dum Motijheel College, Kolkata and gave lecture as well as practical demonstration on Identification and Herbarium Methodology of Bryophytes.

Participated as a resource person in the two day workshop organized by ENVIS RP on Biodiversity of Botanical Survey of India in collaboration with Department of Botany, Gurudas College, Kolkata-54 on "Flowering & Non-flowering Plant Identification and Herbarium Methodology" on 26th February 2020 at Department of Botany, Gurudas College, Kolkata and gave lecture as well as practical demonstration on Identification and Herbarium Methodology of Bryophytes.

Participated in the International Symposium on Plant Taxonomy and Ethnobotany on 13th & 14th February, 2020 and conducted parallel session III in Legacy hall III on 13th February, 2020 and parallel session II in Banquet hall II on 14th February, 2020.

Dr. A.N. Shukla

Delivered an invited lecture on the topic 'Organization and Policy Initiatives for Environmental Protection and Climate Change' dated 6.8.2019 at Regional Training Institute (RTI), O/o Pr. Accountant General, Allahabad.

Delivered invited Radio talk on Green Earth and Clean Environment at Prashar Bharti, broadcasted on Vibidh Bharti FM on 13.07.2019.

Delivered a talk on 'Diversity, vegetation and adaptation in different landscapes of Cold Desert' in the side event organized by Botanical Survey of India on the topic 'Floristic Diversity of Indian Desert (Hot and Cold Desert) Ecosystem: Status and Challenges', at United Nations Convention to Combat Desertification (UNCCD-COP 14): Indian Pavilion Greater Noida on 07.09.2019.

Dr. A.K. Verma

Participated in training course on "Biodiversity Conservation" sponsored by DST, New Delhi at Wildlife Institute of India, Dehradun from 04.11.2019 to 08.11. 2019.

Dr. Sanjay Mishra

Attended one day interactive workshop on 'Preparation of Detailed Project Report (DPR) For Rejuvenation of Major Indian Rivers through Forestry Interventions' on 27.05.2019 at Arid Forest Research Institute (AFRI).

Dr. S.P. Panda

Delivered an invited lecture on 'Mangroves of Odisha' in National Brainstorming Workshop on Conservation of Horseshoe Crabs and its Habitats on 26th April, 2019.

Delivered two invited lectures as a Resource person on 'Common and differentiating characteristics of medicinal plants according to natural order including macro- and microscopic identification of useful parts of plants of herbal garden' and 'Cultivation, propagation, collection, preservation/storage techniques of common medicinal plants including preparation of herbarium and museum specimens' for CME Programme for Teachers on Dravyaguna on 13th June, 2019.

Gopal Krishna and Anant Kumar

Attended 4th Botanical Nomenclature Course at BSI, ERC, Shillong from 27th-31st January, 2020.

Shri B.B.T. Tham

Delivered Lectures to trainees selected for Green Skill Development Programme (GSDP) at BSI, Itanagar during the Month of April, 2019.

Delivered a Lecture on “Role of Botanical Survey of India in Plant Science” to the Life Science Degree Students and Faculty of Saint Mary’s College, Shillong on 16th September, 2019.

Participated and displayed BSI activities and BSI Publications in the Science exhibition: Science Fest Theme: Climate Change and its effects on Living Organism organised by Synod college, Shillong, Meghalaya, on 20th September, 2019.

Delivered a lecture on the ‘Importance of Conservation and Afforestation’ during the Tree Plantation Drive Programme (FSP) Shillong at Mynsain and Pynthor Villages, Ri Bhoi District organised by SOS, CVI, Shillong in collaboration with Botanical Survey of India and Shillong Expressway Pvt. Ltd. on 28th September, 2019.

Conducted a programme with SOS Children’s Villages of India in collaboration with Confederation of Indian Industries (CII) for National Volunteering week 2020 exposing to the issues related with the environment and its conservation on 23rd February, 2020.

Dr. M.E. Hembrom

Delivered an invited talk with practical session at Botany Department, University of Kalyani, Kalyani for a Certificate course on “People’s Biodiversity register Under the GSDP, sponsored by MoEF & CC by ENVIS RP, Kalyani on “Identifying Common Macrofungi” on 27th November, 2019.

Miss. L. Ibemhal Chanu

Attended one week course on RS & GIS applications in Forestry and Ecology organised by NESAC, Shillong *w.e.f.* 21st to 25th October, 2019.

Attended five days IV Botanical Nomenclature training programme organized by ERC, Shillong *w. e. f.* 27th to 31st January, 2020.

Participated and displayed BSI activities and BSI Publications in the Science exhibition: Science Fest Theme: Climate Change and its effects on Living Organism organised by Synod college, Shillong, Meghalaya on 20th September, 2019.

Shri Sameer Patil

Conducted one day herbarium training for FSI staff on 5 July 2019.

Delivered lecture to M.Sc. student of WII for their educational visit to BSI, Dehradun.

Dr. Kangana Pagag

Delivered a presentation with the theme of 2019 “32 years and healing” to the students for an educational visit on the occasion of World Ozone Day on 14th September, 2019.

Dr. S.K. Yadav

Attended an International Conference on Algae, Fungi and Plants: Systematics to Applications (AFPSA), held at the University of Calcutta on 24.01.2020 & 25. 01.2020 and presented a poster entitled ‘Economically important marine macro algae of west coast of India – a review’.

Delivered two lectures in Herbarium Methodology Training Program, 2019 viz. collection of Algae (13.05.2019) and Processing of Algal specimens (17.05.2019) and practically demonstrated the herbarium processing of Marine algal specimens.

Dr. Dilip Kr. Roy

Participated and displayed BSI activities and BSI Publications in the Science exhibition: Science Fest Theme: Climate Change and its effects on Living Organism organised by Synod college, Shillong, Meghalaya on 20th September, 2019.

Attended Five days IV Botanical Nomenclature training programme organized by ERC, Shillong w. e. f. 27th to 31st January, 2020.

Presented a poster on “Studies on Pollen-micro-morphology and exine sculpturing in some species of *Zingiber* from Northeastern India” in the International Symposium on Plant Taxonomy and Ethnobotany organized by Botanical Survey of India, Kolkata w.e.f. 13th – 14th February, 2020.

Dr. Satya Ranjan Talukdar

Presented a paper on “Sacred groves for conservation and sustainability of medicinal plants in West and South West Khasi hills districts of Meghalaya” in the National Seminar organised by Anandaram Dhekial Phookan College (ADP), Nagaon, Assam on 30th August, 2019.

Attended five days IV Botanical Nomenclature training programme organized by ERC, Shillong from 27th to 31st January, 2020.

Dr. B.K. Singh

Attended 5-days Nomenclatural Course Work organized by Botanical Survey of India and for herbarium consultation from 26.01.2020 to 02.02.2020 at Eastern Regional Centre, BSI, Shillong.

Shri Ravi Prasad

Attended & Participated in two days National Conference on “ Recent Trends in Environmental Sustainability and Green Practices” organised by Dept. of Botany, Govt. College Bundi, Rajasthan in collaboration with The Society of Life Sciences Satna (M.P.) on 15.11.2019-16.11.19 and given oral presentation on “Plants and Plant Products in the Life of Tribal’s in Dang, Gujarat’.

Dr. J. Swamy

Attended as Resource person to talk on ‘Biodiversity –conservation’ at MR Degree College for Women, Vizianagaram on 15.07.2019.

Attended as Resource person to talk on ‘Herbarium Methodology’ at Wesley College for Women, Secunderabad on 29.01.2020.

Shri Sachin Sharma

Attended two days International Symposium on Plant Taxonomy and Ethnobotany organised by BSI, Kolkata held on 13th-14th February, 2020, Kolkata and delivered an oral presentation.

Dr. P.K. Deroliya

Attended two days International Symposium on Plant Taxonomy and Ethnobotany organised by BSI, Kolkata held on 13th-14th February, 2020, Kolkata and delivered an oral presentation.

Shri Bishnu Charan Dey

Delivered a lecture on ‘Floral Diversity of Andaman & Nicobar Islands’ Forest Rangers & Deputy Rangers at Forest Training Institute, Wimberlygunj on 19.11.2019.

Delivered a lecture on ‘Floral Diversity of Andaman & Nicobar Islands’ to Foresters at Forest Training Institute, Wimberlygunj on 02.12.2019.

Dr. C. P. Vivek

Delivered a lecture on “*Phytodiversity of Andaman and Nicobar Islands*” at ZSI, ANRC, Port Blair on the occasion of celebration of World Environment Day.

Delivered a lecture on “Floral Diversity of Andaman and Nicobar Islands” at ZSI, Port Blair on 16.09.2019 in connection with Ozone Day, 2019.

Dr. S. Arumugam

Delivered lectures to various visiting students and researches about BSI history, objectives and functions time to time.

Sri S.K. Sharma

Actively participated in the Botanical Exhibition at the 14th Meeting of the Conference of Parties (COP-14) to the United Nations Convention to Combat Desertification (UNCCD) at India Exposition Centre and Mart, Greater Noida, New Delhi from 29th August to 13th September, 2019.

Smti. Nandita Sarma

Presented a paper on 'Diversity of Wild edible plants and their usage by the local people in Amchang Wildlife Sanctuary, Assam' in the National Seminar on "Bioresources, Conservation and Management Strategies for Rural Development" organised by University of Science & Technology, Meghalaya on 22nd - 23rd August, 2019.

Delivered an invited lecture as a Resource Person on the topic 'Botanical Survey of India: an overview' at Guwahati College, Guwahati, Assam on 20th September, 2019.

Attended 5 days IV Botanical Nomenclature training programme organized by ERC, Shillong *w.e.f.* 27th to 31st January, 2020.

Presented a poster on "An assessment of the invasive flora of Amchang Wildlife Sanctuary, Kamrup, Assam" in the "International Symposium on Plant Taxonomy & Ethnobotany" organized by Botanical Survey of India, Kolkata on 13th and 14th, 2020.

All the scientists and scientific staffs of Botanical Survey of India attended the two days International Symposium on 'Plant Taxonomy and Ethnobotany' on 13th & 14th February, 2020 organised by BSI in Kolkata.

Shri G. Rakesh

Delivered Class on Collection of Phanerogams, Processing of specimens & Maintenance of Herbarium to Herbarium Methodology Trainees on 14th, 17th & 18th May 2019.

Ms. R. Mehala Devi

Hosted inaugural function for Herbarium methodology Training Programme on 13th May 2019 & Delivered lecture on Bentham & Hooker System of Classification.

ACTIVITIES OF RESEARCH FELLOWS

Revision of the subtribe Cenchrinae (Poaceae) in India by Dr. Sangita Das Chowdhury (Dey), Research Associate –I (under AJC Bose Post-Doctoral Fellowship Programme)

The revision of the subtribe Cenchrinae has been completed by consultation of fresh and herbarium specimens and it has been found that in India it is represented by 06 genera (*Cenchrus* L., *Holcolemma* Stapf & C.E. Hubb., *Pseudoraphis* Griff. ex Pilg., *Setaria* P. Beauv., *Spinifex* L., and *Stenotaphrum* Trin.) and 47 species. Two genera *Pennisetum* Rich. (with 15 species) and *Paspalidium* Stapf (with 3 species) are treated as synonyms of *Cenchrus* and *Setaria* respectively. As many as 03 genera i.e. *Holcolemma*, *Spinifex* and *Stenotaphrum* are monotypic. Occurrence of 29 species has been verified by fresh collections. *Cenchrus rajasthanensis* Kanodia & Nanda and *Setaria homonyma* var. *depauperata* Babu described on the basis of superficial morphological features has been reduced to synonymy. During field tours in Kodaikanal and adjoining areas (August 2019), it has been observed that *Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone and *Setaria sphacelata* (Schumach.) Stapf & C.E. Hubb. ex M.B. Moss, introduced for fodder, are naturalized with gregarious growth in high altitudes of Kodaikanal. Occurrence of *Cenchrus flaccidus* (Griseb.) Morrone and *Cenchrus alopecuroides* (L.) Thunb. as a component of high altitude weed has been observed in Western Himalayas and Eastern Himalayas respectively during field tours to Dhanaulti, Uttarakhand (September 2019) and Dibang valley, Arunachal Pradesh (November 2019). During 2019-20, served as resource person in a national level workshop (22nd November-24th November 2019) entitled “Basics of Plant Identification and Nomenclature ” organised by Department of Botany, R.D. & S.H. National College, Bandra (W), Mumbai, Maharashtra in collaboration with Botanical Survey of India.

Revision of Indian Stereaceae Pilat by Dr. Deepa Mishra, AJC Bose Post-Doctoral Fellowship Programme

During 2019-20, (02) one field tour and two herbarium consultation tour have been conducted to BSI Coimbatore, TBGRI, Thiruanantapuram, Agharkar Research Institute (ARI) Pune, Jammu university and Chandigarh University during which 67 specimens have been collected from their surrounding areas and studied 29 species of Stereaceae from herbarium also (Central and Western India. All the collected specimens have been dried and preserved in the Cryptogamic section of herbarium at BSD. About 18 specimens belong to 14 species have been studied and described 33 species. The detailed studies of macroscopic and microscopic characters of all the specimens in the laboratory have done and identified. A total of 71 species under 14 genera have been documented in the study. This study reports 02 new combinations [*Hjortstamia fulva* (Lev.) Mishra Comb. Nov., *Hjortstamia papracea* (Jungh.) Mishra Comb. Nov.], 04 new record to Uttarakhand [*Stereum peculiare* Parmasto, Boidin & Dinghra; *Stereum rimosum* Berk.; *Stereum thindii* A.B. De; *Gloeocystidiellum clavuligerum* (Höhn. & Litsch.) Nakasone] and 03 new records [*Gloeocystidiellum irpiscens* Boidin, *Gloeocystidiellum kenyense* Hjortstam, *Gloeocystidiellum turpe* G.W. Freeman] for Western Himalaya.

**Taxonomic Revision of Family Davalliaceae M. R. Schomb ex A. B. Frank in India
by Dr. Pushpesh Joshi, AJC Bose Post-Doctoral Fellowship Programme**

During 2019-20, 01 plant survey and collection tour has been conducted to Nag Tibba, Dhanaulti, Kunjapuri and surrounding areas, during which a total of 68 field numbers have been collected including 140 field photographs. Collected specimens have been processed by standard method and identified with the help of authentic literature. Besides, 04 one day tours to Chakrata, Hathi Paon, Santala Devi and Jhilmil Jheel have been conducted along with Head of office during which 35 different live collections of pteridophytes and 09 orchids have been collected and introduced to BSI, NRC garden. In this period, one Herbarium tour has been conducted to Punjabi Univ. Patiala (PUN) and Panjab Univ. Chandigarh (PAN) during which a total of 136 specimens have been examined, 87 specimens reconfirmed and 45 specimens have been determined/identified. During this year, 06 species have been worked out and described in detail, illustrated, 05 type images procured from different herbaria have been studied and prepared 04 distributional maps. In addition to this, routine maintenance of fern specimens in BSD herbarium and live collection of ferns in BSI, NRC garden and Fern House have been carried out.

Taxonomic revision of Sub-tribe *Platantherinae* (Orchidaceae) from India by Dr. Kothareddy Prasad, AJC Bose Post-Doctoral Fellowship Programme

Final project report has been submitted.

GIS Mapping of Floristic Components with Special Reference to Threat Assessment of EET Plants of Desert National Park by Dr. Kulloli Ravikiran Ningappa, AJC Bose PDF:

During 2019-2020, bioclimatic variable data has been downloaded, processed and tagged with DNP boundary to carry out Ecological Niche Modelling (ENM). ENM has been completed for 12 targeted EET species to predict suitability of habitats in DNP area. Beside rainfall data of DNP area has been collected since 1985, downloaded and processed Landsat data to assess vegetation cover change for pre monsoon and post monsoon season since 1992, calculated area under different vegetation type for both pre and post monsoon season, classified different physiographic components of DNP such as Gravelly plains, Rocky uplands, Shifting sand dunes, Semi stabilized sandunes, Stabilized sand dunes, Interdunal plains, Grasslands, Khadins and Naadis for assessment of habitat requirement of each EET species. Information on different threats for EET species have been collected and analysed. During this period 08 EET species located in DNP area have been located along with their GPS locations among which *Tephrosia falciformis* Ramaswami, *Dipcadi erythraeum* Webb. & Berth., and *Moringa concanensis* Nimmo ex Dalz. & Gibs. have been located from DNP area, *Tribulus rajasthanensis* Bhandari & Sharma, *Ammania desertorum* Blatt. & Hallb., *Commiphora wightii* (Arn.) Bhandari, *Glossonema varians* (Stocks) Benth. ex Hook.f., *Dipcadi erythraeum* Webb. & Berth. and *Anticharis glandulosa* Aschers. var. *caerulea* Blatt.

& Hallb. ex Sant have been located from Akal Wood Fossil Park. Distribution maps of three species viz. *Dipcadi erythraeum* Webb. & Berth., *Anticharis glandulosa* Aschers. var. *caerulea* Blatt. & Hallb. ex Sant. and *Tephrosia falciformis* Ramaswami using Arc GIS software have been prepared. Ecological Niche Modelling using MAXENT software has been completed for 04 species (*Dipcadi erythraeum* Webb. & Berth., *Anticharis glandulosa* Aschers. var. *caerulea* Blatt. & Hallb. ex Sant., *Tephrosia falciformis* Ramaswami and *Tribulus rajasthanensis* Bhandari & Sharma. Ecological Niche Modelling revealed that habitat suitability of *Anticharis glandulosa* Aschers. var. *caerulea* Blatt. & Hallb. ex Sant in confined to sandstone rocky areas around Jaisalmer city only while for others extreme sandy area of Jaisalmer district. Analysis of population data of *Anticharis glandulosa* Aschers. var. *caerulea*, *Glossonema varians*, and *Commiphora wightii* that they follows IInd rank in species dominance while *Tephrosia falciformis*, *Tribulus rajasthanensis* follows IIIrd and IVth respectively revealing rarity of respective species. Seed germination study of *Dipcadi erythraeum* revealed 85% germination in nursery conditions. Germinated seedlings showed vigorous growth with average height 9.5 cm followed by 90% survival. This study results updation of Ecological Niche Modelling for 12 species, demarcation of habitat distribution of species in DNP, preparation of updated distribution maps, processing of Landsat data of DNP of various timescale and preparation of vegetation change maps. Compilation of final report is under progress. During this period, one research paper has been published.

Revision of *Elatostema* J.R. Forster & G. Forster (Urticaceae) in North-East India by Mr. Ashutosh Kumar Upadhyay & Dr. Rajib Gogoi:

During 2019-20, two field tours have been conducted to Upper, East and west Siang District, Arunachal Pradesh and East, West and North Sikkim along with three Herbarium consultation tours to BSD, DD, and BSHC. 26 field numbers of *Elatostema* species collected from Arunachal Pradesh and Sikkim have been dissected and 11 species of *Elatostema* have been identified. Besides, 05 illustrations, 17 photo plates and 12 distribution maps have been prepared. Distribution of *Elatostema cuneatum* Wight from Dehradun and Sikkim and *Elatostema obtusum* Wedd. from Sikkim, North East India has been recorded along with a checklist of *Elatostema* species and list of species in the family Urticaceae in North East India. Furthermore, a database of all the *Elatostema* species present in the North-East Indian region has been prepared from the herbarium sheets housed at CAL, DD, BSD, BSHC, ARUN and ASSAM. Three species namely, *Elatostema macintyreii* Dunn., *E. arcuans* Dunn. and *E. imbricans* Dunn. have been recorded from Arunachal Pradesh after a gap of century. In this period, received best paper presentation award for ‘The diversity of the Urticaceae in North East India’ presented in International Conference on Algae, Fungi and Plants: Systematics to Application (AFPSA-2020) at University of Calcutta, West Bengal. In addition a poster on “Generic delimitation of *Elatostema* J.R. Forster & G. Forster, *Pilea* Lindl. and *Pellionia* Gaudich. complex (Urticaceae) and their Ethnobotanical uses in India” at the International symposium on Plant Taxonomy and Ethnobotany (ISPT-2020).

Studies on the genera *Lactarius* and *Lactifluus* (Russulaceae) from Tawang and West Kameng districts of Arunachal Pradesh: Biosystematics and Nutraceutical properties by Ms. Ishika Bera & Dr. Kanad Das

During 2019-20, one field tour has been undertaken to forested areas of West Kameng, Arunachal Pradesh during which 12 specimens have been collected and identified after thorough macro- and micromorphological characterization and phylogenetic inferences (when required). Detailed account of taxonomic treatment of 06 species along with the description, illustrations and phylogenetic inferences has been prepared along with 02 holotypes, 03 paratypes and 04 species. During this period, total 17 species have been identified. This study has discovered three new species viz. *Laccaria indohimalayana* K. Das, I. Bera & Vizzini, *Lactarius viridinigrellus* K. Das, I. Bera & Uniyal, *Lactifluus indovolemus* I. Bera & K. Das and reported two species, *Lactifluus acicularis* (Van de Putte & Verbeken) Van de Putte, *Lactifluus crocatus* (Van de Putte & Verbeken) Van de Putte as a new record to India. Phylogenetic analyses of 05 species of *Lactarius* and *Lactifluus* and antioxidant analyses of 08 species of *Lactarius* and *Lactifluus* has also been studied. A poster on the topic “Demystifying *Lactifluus volemus* species complex through morphology, molecular phylogeny and nutraceutical properties” has been presented at International Symposium of Plant Taxonomy and Ethnobotany held on 14.02.2020. During this period, three research articles have been published.

Grass Flora (Poaceae) of Andaman and Nicobar Islands" by Ms. Reshma Lakra & Dr. Pushpa Kumari

During 2019-20, two field tours have been conducted to Andaman and Nicobar Islands (Nicobar group: Kamorta, Kachal, Car Nicobar; Andaman: North Andaman, South Andaman, Middle Andaman) during which 147 specimens belonging to 56 species have been collected of which 40 species has been identified along with documentation of 14 species. photographs/illustrations have been prepared for 15 species. Presented a paper on “Conservation Strategy and species reintroduction of two endemic and threatened Palms of Nicobar Islands” at ‘International Symposium on Plant Taxonomy and Ethnobotany’-organised by Botanical Survey of India from 13th to 14th February 2020.

Taxonomic revision of the genus *Poa* L. (Poaceae) in India by Ms. Ruma Bhadra & Dr. P. V. Prasanna

During 2019-20, one field tour has been undertaken to Sikkim during which 30 specimens belonging to 07 species have been collected. Beside one herbarium consultation tour has been conducted to BSD, DD and BSHC and made a datasheet. A total of 15 species have been identified along with documentation of 11 species, preparation of photo-plates and illustrations of all taxa. Distribution maps using csv files of GPS data of all taxa under the genus *Poa* has been prepared. Mss. of the genus *Poa* L. comprising of 65 taxa (62 species, 02 subspecies & 01 variety) has been completed for Flora of India, vol. 31 and submitted to Team leader. Presented poster at International Symposium on Plant Taxonomy and Ethnobotany, BSI and International Seminar on “Algae, Fungi and Plants: Systematics to Applications (AFPSA-2020)”.

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

During 2019-20, 11 taxa namely *Acroceras muroanum* (Balansa) Henrard, *A. tonkinense* (Balansa) C.E. Hubb. ex Bor, *A. zizaniodes* (Kunth) Dandy, *Echinochloa colonum* (L.) Link, *E. crus-galli* (L.) P.Beauv., *E. glabrescens* Munro ex Hook. f., *E. crus-pavonis* (Kunth) Schult., *E. frumentacea* Link, *E. pyramidallis* (Lam.-) Hitchc. & Chase, *E. stagnina* (Retz.) P. Beauv, *Oplismenus composites* (L.) P. Beauv have been studied along with preparation of illustrations.

Taxonomic studies of *Ficus* L. (Moraceae) of North-East India by Ms. Sreyoshee Sensarma & Dr. B. K. Sinha

During 2019-20, two field tours were undertaken to Khasia & Jaintia hills of Assam and Meghalaya and different areas of Sikkim during which a total of 35 field nos. belonging to 21 species have been collected of which 15 species have been identified along with preparation of illustration and photoplates for three species. One herbarium consultation tour has been conducted to DD, BSD & LWG during which 35 species have been studied.

Angiospermic plant diversity of wetlands of North Bihar, India by Mr. Tanay Shil & Dr. Onkar Nath Maurya

During 2019-20, three field tours have been conducted to different wetlands of Muzaffarpur, Samastipur, Begusarai, Khagaria and Katihar districts during which 130 specimens belonging to 100 species have been collected and mounted 50 species. Description of 60 species belonging to 15 families comprising of artificial identification keys of 14 species belonging to 05 genera and 04 families has been completed along with 20 photo-plates and 10 illustrations. A list of 60 species has been prepared along with their families, local names, parts used, uses and mode of uses. During this period, one research article has been published.

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

During 2019-20, two field tours have been conducted to the different area of East Sikkim viz. Fambong Lho Wildlife Sanctuary, Dikchu, Tsomgo Lake area, Gnathang Valley, Kupup, Zuluk, Memencho Lake area, Pangolakha Wildlife Sanctuary, various site of North Sikkim viz. Kabi, Langchuk, Phodong, various site of Kurung Kumey District, Arunachal Pradesh viz. Sangram, Koloriang and Sarlee during which a total of 140 specimens (each species in triplicate) has been collected of which 30 species have been identified. GPS co-ordinates of all collected sites have been recorded and prepared GIS maps of the study sites. Five herbarium consultation tours have been conducted to ASSAM, ARUN, SFRI, BSD and DD during which 76 species have been consulted and studied. About 21 species have been dissected along with habitat illustrations. Description of 18 species have been prepared from fresh collections as well as herbarium specimens. SEM studies of seeds of 14 species have been completed. During this period, a checklist of the family Polygonaceae has been prepared

on the basis of different literatures pertaining to Eastern Himalaya. During this period, two research articles have been published.

Revision of the genus *Plectranthus* L'Herit (including *Coleus* Lour.) of family Lamiaceae in India by Ms. Rupamanya Ghosh & Dr. V. Sampath Kumar

During 2019-20, two field tours have been conducted to Sikkim and Dehradun-Mussoorie during which a total of 57 specimens belonging to 18 species have been collected and processed the specimens according to standard herbarium technique for preparation of herbarium specimens. Herbarium consultation tours have been undertaken to SHC, DD, NBRI, BSD and CIMAP and a data base of the studied species has been prepared. During this period, seven species have been identified and prepared descriptions of the same. Prepared dried plant materials for the Phytochemical analysis. Participated and presented a poster at International Symposium on Plant Taxonomy and Ethnobotany, organized by BSI from 13-14th February, 2020.

Studies on the Flora of Kaimur Wildlife Sanctuary, Bihar by Mr. Kuntal Sen & Dr. V.P. Prasad

During 2019-20, two field tours have been undertaken to different localities of Kaimur and Rohtas ranges of Bihar and a total of 130 species under 75 genera and 24 families collected have been identified. Description of *Hardwickia binata* Roxb. has been prepared along with Photo-plates and illustrations of *Schoenoplectus articulatus* (L.) Palla, *Pennisetum orientale* Rich., *Persicaria maculosa* Gray *Pennisetum pedicellatum* Trin. Ethnobotanical studies of 50 species have been documented from the Sanctuary during the study.

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

During 2019-20, four field tours have been undertaken to 14 thermal springs of Bihar, Jharkhand, Odisha and West Bengal during which 198 specimens have been collected of which 130 specimens (67 genera belong to Cyanophyta and remaining belong to Chlorophyta and Heterokontophyta) have been identified. This study has been discovered a new species of *Hyella* from the thermal spring of Deulajhari, Odisha. During this period, one research article has been published.

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

During 2019-20, four field tours have been conducted to different localities of Meghalaya, Assam, Tamil Nadu, Arunachal Pradesh and Odisha during which 678 specimens have been collected. Herbarium consultation tours have been undertaken to ASSAM and MH. In this period, 16 species viz. *Acrachne racemosa* (B.Heyne ex Roth) Ohwi, *Chloris barbata* Sw., *C. bournei* Rang. & Tadul., *C. pycnothrix* Trin., *C. virgata* Sw., *Cynodon barberi* Rang. & Tadul., *C. dactylon* (L.) Pers., *Dactyloctenium aegyptium* (L.) Willd., *Eleusine coracana* (L.) Gaertn., *Eleusine indica* (L.) Gaertn., *Enteropogon monostachyos* (Vahl) K.Schum.,

Leptochloa chinensis (L.) Nees, *Perotis indica* (L.) Kuntze, *Tetrapogon roxburghiana* (Schult.) P.M.Peterson, *T. tenellus* (J.Koenig ex Roxb.) Chiov. and *T. villosus* Desf. A total of 12 species namely, *Acrachne racemosa* (B.Heyne ex Roth) Ohwi, *Chloris barbata* Sw., *C. pycnothrix* Trin., *Cynodon barberi* Rang. & Tadul., *C. dactylon* (L.) Pers., *Dactyloctenium aegyptium* (L.) Willd., *Eleusine coracana* (L.) Gaertn., *E. indica* (L.) Gaertn., *Enteropogon monostachyos* (Vahl) K.Schum., *Leptochloa chinensis* (L.) Nees, *Perotis indica* (L.) Kuntze and *Tetrapogon roxburghiana* (Schult.) P.M.Peterson, were documented. Made photographs/illustrations for seven species, *Eleusine indica* (L.) Gaertn., *Chloris barbata* Sw., *C. pycnothrix* Trin., *Cynodon dactylon* (L.) Pers., *Tetrapogon roxburghiana* (Schult.) P.M.Peterson, *T. tenellus* (J.Koenig ex Roxb.) Chiov. and *T. villosus* Desf. have been identified.

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

During 2019-20, one field tour has been undertaken to Lower Subhansiri District, Arunachal Pradesh covering the areas of Hapoli Forest Division, on the way to Zoram Top from Hapoli, Zoram Top Forest, Bamboo Forest at Hapoli Forest Division, Forest Range of Sikhe Lake, On the way to Siro from Ziro, Kardo Forest, Siro and Hakhe Tari village which is located at periphery of Talle valley Wildlife Sanctuary, On the way to Potin to Hydro Project, Potin, Rangadadi Dam and Yazali during which 300 fern specimens and 207 collection numbers have been collected with 750 Photographs from study areas which belong to the 19 families of Pteridophytes namely Lycopodiaceae; Selaginella, Selaginellaceae, Equisetaceae, Marattiaceae, Gleicheniaceae Polypodiaceae, Hymenophyllaceae, Cyatheaceae, Dennstaedtiaceae, Pteridaceae, Vittariaceae, Aspleniaceae, Helypteridaceae, Woodsiaceae etc. All the collected specimens have been mounted and 25 species have been identified, described and documented. During this period, one species of *Lindsaea* Drynder. has been collected first time to North East India from Arunachal Pradesh. The specimens of pteridophytes in ARUN has been re-arranged. In addition, a detail taxonomic account of family Pteridaceae in North-East India and Ferns of Meghalaya, a brochure on the Glimpses of the Ferns of Itanagar and enumerative checklist of ferns of Itanagar, Arunachal Pradesh and enumerative checklist and preliminary status of Ferns of Lower Subhansiri District, Arunachal Pradesh have been prepared.

Fern and Fern-allies of Dihang-Dibang Biosphere Reserve of Arunachal Pradesh by Chhandam Chanda & Dr. V.K. Rawat

During 2019-20, three field tours have been undertaken to Upper Siang district, Dibang Valley district and Mouling National during which 376 (tag number) specimens have been collected, 627 specimens have been mounted and scanned, 55 species have been identified, described and documented along with photographs of 46 specimens under microscope. One herbarium consultation tour has been undertaken to CAL. During this period, detail taxonomic account of genus *Athyrium* Roth in Arunachal Pradesh, brochure on the pteridophytic diversity of Dihang Dibang Biosphere Reserve have been prepared. The

specimens of pteridophytes in ARUN has been re-arranged. Participated in ‘International Symposium on Plant Taxonomy and Ethnobotany’ organized by Botanical Survey of India in Kolkata on 13th and 14th February, 2020 and an oral presentation was given on ‘Preliminary Status of Fern and Fern-allies of Dihang-Dibang Biosphere Reserve of Arunachal Pradesh’. Participated in ‘National Conference on Pteridology Today and Tomorrow: Relevance to Impact on Diversity and Climate Change’ organized by Indian Fern Society in Baroda, Gujarat on 24th and 25th February, 2020 and an oral presentation on ‘Change in the Pteridophyte Diversity in and around Itanagar: an Observation’ has been delivered.

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

During 2019-20, one field tour has been conducted to Laitmawsiang, Sohra, Botanical Garden and Shillong Peak for the collection of plant samples. Qualitative and quantitative phytochemical analysis of 15 plant samples have been carried out. Total Phenolic, total Flavonoid, total Tannin content, DPPH and ABTS radical scavenging activity have been carried out for quantitative analysis. Standardization of UHPLC (Ultra High Performance Liquid Chromatography) has been carried out using Gallic acid, Catechin, Caffeic acid, p-coumaric acid, Rutin, Quercetin, Apigenin and Kaempferol. Delivered an oral presentation entitled "Qualitative and quantitative phytochemical analysis of selected wild edible fruits of Northeast India" in the session Traditional Knowledge and Applied in the “International Symposium on Plant Taxonomy and Ethnobotany” organized by Botanical Survey of India, Kolkata which was held on 13th and 14th February, 2020. In connection with Flora of India Project, herbarium labelled information of 868 sheets of the family Orchidaceae have been recorded.

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

During 2019- 2020, 07 field tours have been conducted to different areas of Meghalaya such as Jarain, Upper Shillong, Barapani Experimental Garden, BSI, Shillong peak, Mawsynram and Dawki during which different plants of the family Zingiberaceae have been collected. As a part of molecular phylogeny, genomic DNA of 29 Zingiber plants has been isolated along with PCR standardisation in the genomic DNA of different Zingiber plants using nuclear (ITS) and chloroplast (matK, rbcL, trnH-psbA, trnC-ycf6), trnF-ndhJ, trnL intron) markers. The obtained sequences have been analysed with two different phylogenetic analysis methods—Maximum Parsimony using PAUP* version 4.0a and Bayesian inference using BEAST v1.10.4. Dissected, taken measurement and photographs of 33 species of the family Zingiberaceae. In addition, herbarium label information for 796 sheets from the family Zingiberaceae for metadata of the herbarium specimens of Assam has been recorded for Flora of India Project. Delivered oral presentations in the International Symposium of Plant Taxonomy and Ethnobotany organised by Botanical Survey of India, Kolkata, from 13-14 February, 2020, ‘the importance of Biodiversity’, Food and Health on the occasion of

International Day for Biological Diversity celebration on 22nd May, 2019 and on ‘Women in Science’ on the occasion of National Science Day celebration on 28th February, 2020 at Botanical Survey of India, ERC, Shillong.

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

During 2019-20, three local tours have been conducted to different forest areas of Meghalaya for the collection of plant samples. *In vitro* seed germination and standardization of surface sterilization protocol of *Rhododendron inaequale* Hutch. and *Adinandra griffithii* Dyer. have been initiated in different media and the percentage of seed germination have been recorded. Multiple shoot induction experiments have been successfully carried out in *Rhododendron formosum* Wall., *Rhododendron inaequale* Hutch. and *Pyrenaria barringtoniifolia* Seem. Rooting experiment of *Rhododendron formosum* Wall. has been carried out along with regular sub-culturing and rooting of *Pyrenaria khasiana* R.N.Paul. *In vitro* raised plants of *Rhododendron formosum* Wall. and *Pyrenaria khasiana* R.N.Paul have been transferred for hardening. *Ex vivo* seed germination of *Rhododendron formosum* Wall., *Rhododendron inaequale* Hutch. and *Adinandra griffithii* Dyer. in different substrata have been initiated and the percentage of seed germination has been recorded. Regular watering and maintenance of seeds and seedlings of *Pyrenaria camelliflora* Kurz., *Pyrenaria khasiana* R.N.Paul., *Rhododendron formosum* Wall., *Rhododendron inaequale* Hutch. and *Adinandra griffithii* Dyer. in the polyhouse and in the garden of BSI, ERC, Shillong are being continued. Herbarium metadata have been recorded for 657 sheets from the families Hydrocharitaceae, Burmanniaceae, Pontederiaceae, Xyridaceae and Commelinaceae. Participated and delivered a poster presentation entitled “*In vitro* seed germination and shoot multiplication of two endemic *Rhododendron* species of Northeast India” in the International Symposium on Plant Taxonomy and Ethnobotany on the 13th and 14th February, 2020 organized by Botanical Survey of India at Kolkata.

Flora of Nagaland by Rikertre Lytan & Dr. N. Odyuo

During 2019-2020, one field tour including one local tour have been conducted to Nagaland, Phek District, Wokha District and Jowai during which a total of 389 numbers of herbarium specimens have been collected along with 187 species of live plants and *Acer laevigatum* seeds for introduction in the garden, *ex-situ* conservation and germplasm conservation. During this period, 303 species have been identified along with description of a total number of 104 species collected from Nagaland. Compilation and listing of species have been documented from Nagaland for the preparation of ‘Flora of Nagaland’. In addition Herbarium Metadata of 1015 sheets from family Smilacaceae (698), Liliaceae (207) and Cyperaceae (110) have been recorded.

Flora of Kerala by Shri. P. Murugan & Dr. C. Murugan

During 2019-20, 27 field number has been vouched and c. 200 photographs taken. Based on the herbarium specimens at MH and literatures, description of the following species has been completed, viz. *Acanthospermum hispidum* DC., *Achillea millefolium* L., *Acmella calva* (DC.) R.K. Jansen, *A. paniculata* (Wall. ex DC.) R.K. Jansen, *A. uliginosa* (Sw.) Cass., *Ageratum conyzoides* L., *A. houstonianum* Mill., *Bidens biternata* (Lour.) Merr. & Sheriff, *B. pilosa* L. var. *minor* (Blume) Sherff, *B. sulphurea* (Cav.) Sch.-Bip., *Blepharispermum petiolare* DC., *Blumea axillaris* (Lam.) DC., *B. barbata* DC., *B. bifoliata* (L.) DC. and *B. heiracifolia* (D. Don) DC. var. *heiracifolia*, *Blumea lacera* (Burm. f.) DC., *Blumea laevis* (Lour.) Merr., *Blumea lanceolaria* (Roxb.) Druce, *Blumea membranacea* Wall. ex DC. and *Blumea obliqua* (L.) Druce *Blumea oxyodonta* DC., *Centipeda minima* (L.) A. Braun & Asch., *Centratherum intermedium* Less., *Chaetoseris cyanea* (D. Don) C. Shih., *Chromolaena odorata* (L.) King & Robins., *Chrysanthemum segetum* L., *Cichorium endivia* L., *Cirsium wallichii* DC., *Cissampelopsis ansteadii* (Tadul. & Jacob) Jeffrey & Chen., *Cissampelopsis corymbosa* (Wall. ex DC.) Jeffrey & Chen., *Cissampelopsis walkeri* (Arn.) Jeffrey & Chen., *Conyza aegyptiaca* (L.) Ait., *Conyza bonariensis* (L.) Cronq., *Conyza canadensis* (L.) Cronq. & *Conyza japonica* (Thunb.) Less., *Conyza leucantha* (D. Don) Ludlow & Raven, *C. stricta* Willd., *Coreopsis grandiflora* Hogg ex Sweet, *Cosmos caudatus* Kunth, *Cotula australis* (Sieb. ex Spreng.) Hook.f., *Crassocephalum crepidioides* (Benth.) S. Moore, *Cyathocline lutea* Lawson ex Wight, *C. purpurea* (D. Don) O. Ktze., *Dahlia hortensis* Guill., *D. imperialis* Roesl ex Ortgies, *Dichrocephala chrysanthemifolia* (Blume) DC., *D. integrifolia* (L.f.) O. Ktze., *Eclipta prostrata* (L.) L., *Elephantopus scaber* L., *Eleutheranthera ruderalis* (Sw.) Sch.-Bip., *Emilia alstonii* Fosberg, *E. javanica* (Burm.f.) Robs. & *E. ramulosa* Gamble, *Emilia scabra* DC., *E. sonchifolia* (L.) DC., *Epaltes divaricata* (L.) Cass., *Erechtites valerianaefolia* (Wolf.) DC., *Erigeron karvinskianus* DC., *E. sublyratus* DC., *Euryops pectinatus* Cass., *Gaillardia pulchella* Foug., *Gamochaeta pensylvanica* (Willd.) Cabrera, *Gerbera jamesoni* Bolus ex Adlam, *Glossocardia bosvallea* (L. f.) DC., *Gnaphalium coarctatum* Willd., *G. polycaulon* Pers., *Grangea maderaspatana* (L.) Poir. & *Gynura aurantiaca* (Blume) DC., *Kleinia grandiflora* (Wall. ex DC.) Rani, *Kleinia walkeri* (Wight) Uniyal, *Lagascea mollis* Cav., *Laggera alata* (D. Don) Sch.-Bip. ex Oliver, *Laggera crispata* (Vahl) Hepper & Wood, *Launaea acaulis* (Roxb.) Bab. ex Kerr. & *Launaea sarmentosa* (Willd.) Sch.-Bip. ex O. Ktze., *Leucanthemum vulgare* (Vaill.) Lam., *Melampodium paludosum* Kunth, *Mikania micrantha* Kunth, *Moonia heterophylla* Arn., *Myriactis wightii* DC. var. *bellidioides* Hook.f., *Myriactis wightii* var. *wightii*, *Parthenium hysterophorus* L., *Pentanema cernuum* (Dalz. & Gibs.) Ling, *Pentanema indicum* (L.) Ling, *Phyllocephalum courtallense* (Wight) Narayana, *Phyllocephalum indicum* (Less.) Kirkman, *Phyllocephalum phyllolaenum* (DC.) Narayana, *Phyllocephalum rangacharii* (Gamble) Narayana var. *agastyamalayanum* Geetha Kumary, Santhosh Kumar & Pandurangan, *Phyllocephalum rangacharii* var. *rangacharii*, *Phyllocephalum scabridum* (DC.) Kirkman, *Phyllocephalum sengaltherianum* (Narayana) Narayana, *Picris hieracioides* L., *Pseudoconyza viscosa* (Mill.) D'Arcy, *Pseudognaphalium affine* (D. Don) Anderb., *P. luteo-album* (L.) Hilliard & B.L. Burtt, *Psiadia ceylanica* var. *beddomei* (Gamble) Vajr. & P. Daniel, *P. ceylanica* (Arn.) Grierson, *Senecio edgeworthii* Hook.f., *S. hohenackeri* Hook.f., *S. lavandulaefolius* DC. and *S. lawsonii* Gamble, *Picris*

hieracioides L., *Pseudoconyza viscosa* (Mill.) D'Arcy, *Pseudognaphalium affine* (D. Don) Anderb., *P. luteo-album* (L.) Hilliard & B.L. Burtt, *Psiadia ceylanica* var. *beddomei* (Gamble) Vajr. & P. Daniel, *P. ceylanica* (Arn.) Grierson, *Senecio edgeworthii* Hook.f., *S. hohenackeri* Hook.f., *S. lavandulaefolius* DC. and *S. lawsonii* Gamble (Asteraceae). 12 Type specimens have been sorted out from the general herbarium and submitted to type section.

Flora of Kerala by Shri. M. Sulaiman & Dr. C. Murugan

During 2019-20, a plant exploration tour has been conducted in Aralam Wildlife Sanctuary, Kannur District, Kerala during which total 16 field numbers vouched and 250 photographs have been taken. Based on the MH herbarium specimens and literatures, descriptions of 65 species of the families Asteraceae and Rubiaceae viz. *Senecio lessingianus* (Wight & Arn.) C.B.Clarke, *S. ludens* C.B.Clarke, *S. macroglossus* DC., *S. multiceps* N.P.Balakr., *S. neelgherryanus* DC., *S. tenuifolius* Burm.f., *S. zeylanicus* DC., *Sigesbeckia orientalis* L., *Solidago canadensis* L., *Sonchus oleraceus* L., *S. wightianus* DC., *Sphaeranthus africanus* L., *S. amaranthoides* Burm.f., *S. indicus* L., *Struchium sparganophorum* (L.) O. Ktze., *Symphotrichum leave* (L.) A.Love & D.Love, *Synedrella nodiflora* (L.) Gaertn., *Tagetes erecta* L., *T. Patula* L. etc. and along with identification of 07 species. Besides compilation of species with respect to Flora of Kerala has been carried out. Descriptions for 26 genus of Orchidaceae have been completed in this period. In this period, sorted out 12 type specimens from general herbarium and submitted to type section. Identified two plant specimens for the authentication, viz. *Annona muricata* L. (Annonaceae) & *Jasminum multiflorum* (Burm.f.) Andrews (Oleaceae). Delivered a presentation on 'Systematic studies on Strict endemic taxa of the family Rubiaceae in Tamil Nadu' at ISPTE, Kolkata on 13th-14th February 2020.

Flora of Kerala by Shri Basil Paul & Dr. C. Murugan

During 2019-20, two botanical exploration tours have been conducted to Peruvannamoozhy forest range, Kozhikode, Kerala and Wildlife Sanctuary, Kannur, Kerala during which a total no. of 51 specimens belongs to 08 genus have been vouched. Based on the MH herbarium specimens and literatures, description of 123 taxa of Acanthaceae and Orchidaceae has been completed. Compilation of species with respect to Flora of Kerala has been carrying out.

FUNDED/COLLABORATIVE PROJECTS

Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building (NMHS LG) by Dr. A. A. Mao, D/BSI (PI), Dr. B. K. Sinha Scientist-F & Dr. S.S. Dash Scientist-E (Co-PI), Sri Deep Sekhar Das, Sri Subhajit Lahiri and Sri Rohan Maiti:

This project is mainly aimed for the conservation of rare, endemic and threatened plants of Indian Himalayan region. The jurisdiction of this project is Eastern Himalaya especially Arunachal Pradesh, Darjeeling district of West Bengal and Sikkim. The project deals with relocating selected threatened plants, their propagation, threat assessment, niche modelling and reintroduction in suitable habitats. Along with this, it also aims in creating mass awareness and skill development of local stakeholders for further conservation and cultivation of these threatened plants. During 2019-20, research staffs of this project has conducted altogether 07 field trips to all selected states including West Kameng district, Lower Subansiri district, Papumpare district, Kurung Kumey district, East Sikkim district, North Sikkim district for collecting germplasm of 15 selected threatened plant species for conservation initiatives under the project. Data related to distribution and earlier known records have been collected from available literature and herbarium specimens. Macro propagation of selected threatened plants for distribution and other conservational initiatives has been started. During this period research staffs has collected about 500 seeds of *Arenga micrantha* from Arunachal Pradesh, 200 saplings recovered from different forest area, 500 seedlings of *Oroxylum indicum* has been germinated, 100 pieces of rhizome cutting of *Curcuma caesia* have been planted on seed bed. This study has rediscovered *Ormosia fordiana* Oliv. after a gap of 79 years from India as well as first time reported from Arunachal Pradesh. This study also reports *Didymocarpus bhutanicus* W.T. Wang for first time from India. Lectotypification of four names viz. *Ormosia fordiana*, *Gentiana recurvata*, *Gentiana sikkimensis*, *Gentiana stylophora* have also been proposed during this study.

Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building (NMHS-LG) by Dr. A. A. Mao, D/BSI (PI), Dr. G. S. Panwar, Dr. Puneet Kumar, Dr. Amber Srivastava, Mr. Harminder Singh and Miss Aakriti Bhandari

The project aims at conservation of rare, endemic and threatened plants of Indian Himalayan region and deals in relocating of the selected threatened plants species, their propagation, threat assessment, niche modelling and reintroduction in suitable habitats. Along with this, it also aims in creating mass awareness and skill development of local stakeholders for further conservation and cultivation of these RET plants species. During 2019-20, a total number of 22 tours including 05 herbarium consultation tours have been conducted to different regions of Uttarakhand and Himachal Pradesh for survey, relocation, collection of propagating material of the selected RET species as well as collection of secondary data. Mass scale propagation of following species viz., *Indopiptadenia oudhensis* (5000), *Gentiana kurroo* (2200), *Sophora mollis* (500), *Aconitum heterophyllum* (2000), *Mahonia jaunsarensis* (500), *Jasminum parkeri* (1000)

and *Prunus cerasoides* (1000) has been done. Micropropagation protocol has been standardized for *Phlomis superba* and *Sophora mollis* and plantlets were successfully transferred to the open environment. Total More than 1000 plant saplings of *Aconitum heterophyllum*, *Gentiana kurroo*, *Indopiptadenia oudhensis*, *Jasminum parkeri*, *Phlomis superba*, *Pittosporum eriocarpum* and *Prunus cerasoides* have been planted, distributed or reintroduced in the wild in association with local communities for the conservation of species at Sahiya, Kalsi, Halduwala villages of Uttarakhand. Following the objective of the project, Ecological Niche Modelling (ENM) of the five species viz. *Jasminum parkeri*, *Gentiana kurroo*, *Phlomis superba*, and *Aconitum heterophyllum* has been done. Saplings of propagated species were also provided to Uttarakhand Forest Department, Dehradun; BSI, CRC, Allahabad; Botanic Garden of Indian Republic, Noida for plantation and *ex-situ* conservation. One day workshop cum awareness campaign was organized among the students of Green Lawn Academy, Jaitanwala, Dehradun which focuses at creating awareness among the young generation about conservation of RET species. The campaign also included plantation and distribution of saplings programme. Posters on threatened medicinal plants of Western Himalaya and pamphlets on RET species, their economic importance and identification were designed and printed.

Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species (NMHS) by Dr. D.K. Agrawala (PI), Dr. Samiran Panday (Resigned on 23.08.2019), Dr. Rijupalika Roy, Shri Aazhivaendhan, Ms Shreyasi Nayak, Shri Sayak Chakraborty, Shri Shuvodip Sarkar, Ms Sanchayita Sengupta and Ms Oindrila Chakraborty

During 2019-20, 10 field tours have been undertaken at different regions of Indian Himalayan Region i.e. Arunachal Pradesh, Darjeeling, Meghalaya, North Bengal and Sikkim during which 81 specimens have been collected for further study and *ex-situ* conservation. Orchid specimens rescued from the fallen trees have been introduced in the SHRC campus. Germplasm of 381 samples has been collected and introduced in the campus garden, 123 species have been studied live including preparation of illustration with digital macro-microscopic photographs. Morphological description of 161 species has been completed. Herbarium consultation tours have been conducted at ASSAM and ARUN during which Orchid specimens are studied for depicting range of variation, phenology, distribution and preparing descriptions. Distribution pattern and endemism has been analyzed for 972 orchid species of IHR. The phenology of the allotted groups has been recorded from the herbarium data and compiled to form a floral calendar segregating into three seasons. In this period, images from APFH, ARUN, ASSAM, BSD, CAL, CALI, NBU, OHT, TBGT and other herbaria in abroad have been studied for their identity and geo-coordinates studies of C. 220 species (more than 9000 herbarium specimens) have been completed for mapping. 610 data sheets have been prepared by considering taxonomic citation, distribution, diagnostic characters, threats etc. for assessment of threat status as per IUCN criteria. Protologues, Type specimens and images have been studied along with description of 15 genera. This study has identified 38 Species complexes from the allotted groups. Distribution maps has been prepared for 21 species in Arc-GIS platform. All the occurrence points in India are mapped after assigning geo-coordinates. Polygons and grids have been drawn for calculating EOO

and AOO. Threats and population size and decline have been analysed through direct observation and from secondary data.

Ex-situ conservation of Rare Endangered Threatened, Endemic & Economic plants of Rajasthan and Gujarat under ABG scheme at Desert Botanic Garden of Botanical Survey of India, Arid Zone Regional Centre, Jodhpur by Shri Vinod Maina (PI) & Dr. Sanjay Mishra (Co-PI):

The experimental Botanic Garden (Desert Botanical Garden) of Botanical Survey of India, Arid Zone Regional center, Jodhpur, was established in 1994 with an area of c. 08 acres. The main objectives of the garden is collection of arid germplasm, its maintenance and multiplication of rare / endangered / threatened plant species of North-western arid regions of India. During 2019-20, construction of nursery shed has been initiated and about to be completed. Sites for the development of Medicinal & economic plant section, Cacti and succulent plant section, Ethno botanical plant section, Ritual plant section, Ornamental plant section have been demarcated along with finalization of layout and designs. Preparation of database regarding known localities and potential localities of endangered plants is under progress. Till date 08 RET species have been raised in the respective section namely *Commiphora wightii* Arn. Bhandari [Burseraceae (20)], *Commiphora stocksiana* (Engl.) Engl. [Burseraceae (04)], *Caralluma edulis* (Edgew.) Benth. ex Hook.f. [Apocynaceae (25)], *Seddera latifolia* Hochst. & Steud. [Convolvulaceae (05)], *Ephedra foliata* Boiss. ex C.A.Mey. [Ephedraceae (10)], *Barleria prionitis* L. var. *dicantha* Blatt & Hallb [Acanthaceae (05)], *Withania coagulans* (Stocks) Dunal [Solanaceae(05)], *Tecomella undulata* (Sm.) Seem. [Bignoniaceae (10)], *Moringa concanensis* Nimmo. ex. Dalz. [(05)]. Following plant species have been raised in nursery for introduction in medicinal plant section: *Arisaema* spp., *Amomum subulatum* Roxb., *Aristolochia indica* L., *Bryophyllum pinnatum* (Lam.) Oken, *Butea monosperma* (Lam.) Taub., *Berberis* spp., *Cassia fistula* L., *Celastrus paniculatus* Willd., *Centella asiatica* (L.) Urb., *Clerodendrum indicum* (L.) Kuntze, *Clerodendrum phlomoides hort. ex DC.*, *Curcuma* spp., *Commiphora caudata* (Wight & Arn.) Engl., *Curcuma angustifolia* Roxb., *Curculigo orchioides* Gaertn, *Eclipta prostrata* (L.) L., *Euphorbia fusiformis* Buch.-Ham. ex D.Don, *Eulophia* sp., *Ficus carica* L., *Ficus virens* Aiton, *Gloriosa superba* L., *Hemidesmus indicus* (L.) R. Br. ex Schult., *Paederia foetida* L., *Phyllanthus emblica* L., *Nyctanthes arbor-tristis* L., *Ocimum* sp., *Pandanus odorifer* (Forssk.) Kuntze, *Jasminum sambac* (L.) Aiton, *Gardenia jasminoides* J. Ellis, *Urginea indica* (Roxb.) Kunth and *Zygophyllum simplex* L. etc, *Moringa oleifera* Lam., *Madhuca indica* J.F.Gmel., *Phyllanthus emblica* L., *Manilkara hexandra* (Roxb.) Dubard, *Morus indica* L., *Punica granatum* L., *Albizia lebbek* (L.) Benth., *Bombax ceiba* L. *Ceiba pentandra* (L.) Gaertn., *Dalbergia latifolia* Roxb., *Pterocarpus marsupium* var. *acuminata* Prain., *Syzygium cumini* (L.) Skeels, *Terminalia alata* Wall. and *Tecomella undulata* (Sm.) Seem.; saplings of the following plant species have been prepared in the nursery of Desert Botanic Garden, Botanical Survey of India, Arid Zone Regional Centre, Jodhpur for plantation and exchange programme to the other institutions: *Abrus precatorius* L., *Asparagus racemosus* Willd., *Azadirachta indica* A. Juss., *Barleria prionitis* L., *Tinospora cordifolia* (Thunb.) Miers, *Bombax ceiba* L., *Caesalpinia bonduc* (L.) Roxb., *Cascabela*

thevetia (L.) Lippold, *Cassia roxburghii* DC., *Ceropegia bulbosa* Roxb., *Clitoria ternatea* L., *Hibiscus rosa-sinensis* L., *Mimosa pudica* L., *Pongamia pinnata* (L.) Pierre, *Prosopis cineraria* (L.) Druce, *Syzygium cumini* (L.) Skeels, *Terminalia bellirica* (Gaertn.) Roxb., *Terminalia chebula* Retz., *Tylophora indica* (Burm. f.) Merr., *Vitex negundo* L., *Vitex trifolia* L., *Volkameria inermis* L., etc. Lands have been cleared & levelled for Lawn, cacti & Succulent Section, Ethnobotanical and Ritual plant sections (Navgrah Vatika and Nakshtra Vatica). The design and layout of the cacterium has been finalized.

Assessment of Diversity and Distribution of Plants, Algae and Macro fungi in the Sundarban Biosphere Reserve, India by Dr. K. Karthigeyan (PI), Dr. Animesh Maji, Mr. Kaushik Naskar and Mr. Amit Kumar

Sundarbans, the world's largest coastal mangrove forest, was marked as UNESCO world heritage site in 1987 and declared as a Biosphere Reserve on 29 March 1989. The total areas of the Biosphere Reserve is 9,630 sq.km. of which Indian part is estimated to be c. 4,110 sq.e km. The Sundarbans provides sustainable livelihoods to millions of people living in small villages surrounding the biosphere reserve, working as farmers, fisherman, honey gatherers and many others. Since the area is one of the most densely populated areas in the world, deforestation of fuel wood and other natural forest products is one of the major threats to the mangrove vegetation. Natural as well as man-made distresses are compelling the coastal human capital to shift to the mainland. Hence it was decided to do a comprehensive survey and documentation to understand the diversity and to plan conservation strategies. During 2019-20, two surveys have been undertaken to the study areas during which a total c. 800 specimens of 250 field nos. have been collected. Label data of about 3431 specimens, belonging to 42 families and 64 genera of true mangroves and mangrove associates were entered in Excel sheet for making a database of the Mangrove specimens at CAL. Photo-plates of *Porteresia coarctata* (Roxb.) Tateoka, *Brownlowia tersa* (L.) Kosterm, *Lumnitzera racemosa* Willd. and *Aegiceras corniculatum* (L.) Blanco have been prepared along with illustrations of eight species namely, *Brownlowia tersa* (L.) Kosterm., *Bruguiera gymnorhiza* (L.) Savigny, *Ceriops decandra* (Griff.) W. Theob., *Ceriops tagal* (Perr.) C.B. Rob., *Excoecaria agallocha* L., *Nypa fruticans* Wurmb, *Phoenix paludosa* Roxb. and *Xylocarpus mekongensis* Pierre. This study reports *Vigna marina* (Burm.) Merr., (Fabaceae) as new record for West Bengal; *Brownlowia tersa* (L.) Kosterm. (Tiliaceae), a nearly threatened plants, has been rediscovered after more than 117 years.

Non Detriment Findings (NDF) report on Red Sanders tree (*Pterocarpus santalinus* L.f.) in India by Dr. L. Rasingam, Dr. J. Swamy, Mr. S. Nagaraju and Dr. M. Sankararao:

This project, has been funded by MoEF&CC (Wildlife) and to prepare NDF report by assessing the status of wild population and cultivated stock of Red sanders.

Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building by Dr. A.A. Mao (PI), Dr. N. Odyuo (Co-PI), Dr. Deepu Vijayan & Dr. David L. Biate (Co-I), Dr. Khumuckcham Sangeeta Devi, Dr. Ashutosh Pathak, Ms.

Bashisha Rynjah, Ms. Bidisha Mallick , Mr. Charles Wahlang, Mr. Kerlang Khonglam & Mr. Rahul Das.

During 2019-20, Micro-propagation through ex-plants have been carried out for - *Rhododendron wattii*, *Nepenthes khasiana*, *Cymbidium tigrinum*, *Paris polyphylla* and *Cymbidium whiteae* and micro-propagation through seed have also been carried out for *Cymbidium cyperifolium*, *Cymbidium eburneum* and *Calanthe biloba*, *Calanthe masuca*, *Cephalantheropsis obcordata*, *Paphiopedilum venustum*, *Cephalotaxus mannii* and *Adinandra griffithii*. Standardization of protocols for culture initiation of ferns carried out in *Brainea insignis* and *Diplazium nagalandicum*. Lab to land transfer of *Rhododendron wattii*, *Nepenthes khasiana*, *Cymbidium tigrinum*, *Paris polyphylla* and *Cymbidium whiteae* have been carried out. A total of 1505 plantlets hardened plants with 883 surviving giving Survival percentage 59 %. Nuclear (ITS) and chloroplast markers (matK, rbcL) screened and amplified for generating DNA sequence fingerprint in selected species. Microsatellite markers used for studying the genetic variability in *Arundina graminifolia* & *A. graminifolia* var. *revoluta*. Significant genetic variability observed between the two taxa. *A. graminifolia* var. *revoluta* may be retained as a variety. Nuclear ITS DNA sequenced for *Schima wallichii* and *S. khasiana*. BLAST analysis confirmed the identity of the two species. Multiple sequence analysis of the sequences obtained from the two species showed distinct variations between the two species. Chloroplast *rbcL* DNA sequence analysis confirmed the uniqueness of *Diplazium nagalandicum*, as a species different from other known species. DNA sequence from this endemic fern from Nagaland has been submitted to genbank database. Quantitative analysis for Alkaloid, Tanin, Saponin, Flavonoid, Cardiac glycosides, Steroids and Triterpenoids has been carried out for 12 important medicinal plants. HPLC/LC-MS analysis of *Illigera grandiflora* leaves detected 10 important compounds including Reticuline - known to possess analgesic properties and effective in treatment of traumatic injuries. Macro-propagation through seeds was also undertaken for 47 indigenous medicinal and commercially important fruits plant species, rare and endangered plant species. Till date, around 50,000 seedlings have been generated out of which 7119 have been distributed to school, colleges, local villagers and NGOs. 8 Environmental Awareness/Capacity Building programmes conducted in 3 different states (Manipur, Nagaland & Meghalaya). A total of 1390 school & college students, farmers/ and villagers benefitted.

Strengthening Lead Botanical Garden, ERC, Barapani, Shillong funded by MoEF & CC (Under Assistance to Botanic Garden Scheme) by Dr. N. Odyuo (PI), Dr. D.K. Roy, (Co-PI), Mr. L.R. Meitei (Co-PI), Mr. Evenstone Wahlang and Field staffs

During 2019-20, four local field tours have been conducted to Pynursla, Pine Brook, Ri-Bhoi, Laitmawsiang village and Sohra, Meghalaya during which 73 live plants have been collected along with a total of 21 RET plant species for introduction and multiplication namely *Acer laevigatum*, *Adinandra griffithii*, *Anoetochilus roxburghii*, *Brucea mollis*, *Bulbophyllum griffithii*, *Bulbophyllum leopardinum*, *Camellia caduca*, *Castanopsis indica*, *Caulokaempferia secunda*, *Cephalantheropsis obcordata*, *Cephalotaxus mannii*, *Cyathea gigantea*, *Cymbidium lancifolium*, *Hedychium longipedunculatum*, *Hedychium spicatum*, *Liparis elliptica*, *Liparis nervosa*, *Mahonia pycnophylla*, *Pinalia spicata*, *Satyrium nepalense*

and *Schima khasiana*. Gene pool for the groups of plants, Citrus (10 species), Musa (8 species), Rhododendron (22 species), Dioscorea (11 species), Ginger (78 species), Piper (17 species), Bamboo (23 species), Asparagaceae (26 species), Paphiopedilum (6 species), *Nepenthes khasiana* plot, Fern (70 species), Medicinal plants (42 species) and Wild edible fruit plants (26 species) are conserved and maintained in the garden. Beautification and decoration has been done in few sections and pathways of the garden with stones and pebbles. C. 5088 seedlings/saplings have been raised from 42 species by seedlings, seed germination and stem cuttings during this period, 428 numbers of orchids plantlets belonging to 29 orchid species has been propagated. 1885 seedlings/saplings/rhizomes are distributed to various schools, colleges, offices and forest department for plantation purpose. Guided and delivered lecture on conservation of plants to 492 visitors viz., 27 scientists/officers, 32 professors/teachers, 06 research scholars, 402 students and 25 general visitors who visited the garden during this period.

***Ex-situ* conservation of economical, endemic and threatened plant species of Western Himalaya through augmentation of infrastructural facilities in existing botanic gardens of BSI Dehradun by Dr. S.K. Singh (PI), Dr. Puneet Kumar (Co PI) (*Earlier Dr. K.S Dogra worked as Co. PI from July 2019 to Dec. 2019)**

During 2019-20, one twelve days and 06 one day field tours have been conducted to areas of Himachal Pradesh (Kinnaur) and Uttarakhand (Mussoorie, Bajawala, Halduwala, Golatappar, Kodyala) for collection of threatened/endemic species during which 09 economic and threatened plant species have been collected, introduced and propagated namely *Crepidium acuminatum* (D. Don) Szlach.; *Rauvolfia serpentina* (L.) Benth. ex Kurz; *Luisia trichorrhiza* (Hook.) Blume; *Asparagus racemosus* Willd.; *Gloriosa superba* L.; *Nervilia crociformis* (Zoll. & Moritzi) Seidenf.; *Incarvillea emodi* (Royle ex Lindl.) Chatterjee; *Catamixis baccharoides* Thomson; *Abrus pulchellus* Thwaites. In addition to already existing species, about 150 individuals of above mentioned threatened/economic species are being maintained in the Botanic garden. Multiplication of 16 other RETs and valuable plant species collected and introduced in the Botanical Garden are also being done and c. 2400 individuals have been propagated from seeds, bulbs, pseudobulbs, stem, cuttings, etc. Besides, two new sections, one for Zingiber and another of Pteridophytes have also been developed which includes more than 80 species. The proposed work plan of establishment of nineteen light panels in Garden, construction of one new pond and enlargement of one existing pond in Botanic Garden, construction of Pathways has been completed successfully and grant sanctioned utilized. Signage preparation work is in progress. Awareness programme/lectures on biodiversity, plant conservation is being given to the visiting students and forest officials. Students from colleges and schools visiting the Garden are being taught the role of botanic garden in ex situ conservation programme.

ABG Project (Released upto 03/03/2020)				Total Fund Available		21200000.00	
Sl. No.	File No. & PI Name	Amount Sanctioned	Amount Released	Qtrs.	Cumulative Amount	Balance Rs.	Transfer Details
1	"Ex-Situ Conservation of Economical Endemic and Threatened plants species of Western Himalaya through augmentation of infrastructural facilities in Existing Botanic Garden in NRC, BSI, Dehradun"	47,23,300.00	35,00,000.00	1st	35,00,000.00	1,77,00,000.00	CP00000254 Dt.12/06/2019 UTR No. 133008415144 dt.17/06/2019
2	10/19/2018-CS/BG Dated 22/04/2019 Dr. M. S. Dhaniya, PI, Central University of Punjab/ "Ex-Situ conservation and rare endangered and Endemic Plant Species & Educational Purpose in Botanical Garden of Central University of Punjab, Bhatinda"	33,50,000.00	18,50,000.00	1st	53,50,000.00	1,58,50,000.00	CP00000283 Dt.17/06/2019 UTR No. 000010851098 Dt.20/06/2019
3	10/09/2015-CS/BG Dated 06/08//2019 Secretary FEEDS, Sylvan Botanic Garden COGCEHR, FEEDS HENGBUNG, Kangpokpi, Senapati Dist., Manipur.	94,52,955.00	24,15,602.00	3rd	77,65,602.00	1,34,34,398.00	CP00000550 Dt.20/08/2019 UTR No. 000028646966 Dt.23/08/2019
4	10/27/2019-CS/BG Dated 02/08/2019 Modern College, Kohima. "Ex-situ conservation of economical, endemic and threatened plant species in Botanical Garden of Modern College, Piphema Campus Kohima, Nagaland.	29,49,204.00	16,39,204.00	1st	94,04,806.00	1,17,95,194.00	CP00000639 Dt.11/09/2019 UTR No. 000035840712 DT.17/09/2019

5	10/20/2014-CS/BG Dated 18/09/2019 Botanical Survey of India (ERC) Shillong Lead Botanical Garden Project.		13,16,716.00	4th	1,07,21,522.00	1,04,78,478.00	CP00000689 Dt.24/09/2019 UTR No. 133009075051 Dt.30/09/2019
6	10/16/2016-CS/BG Dated 11/09/2019 Yogi Vemana University, Assistant to Botanic Garden Schene"		21,76,574.00	4th	1,28,98,096.00	83,01,904.00	CP00000698 Dt.25/09/2019 UTR No. 000039628259 Dt.01/10/2019
7	10/17/2014-CS/BG Dated 30/09/2019 Dr. Y S Parmar Univeersity. "Ex-situ conservation and propagation of Indigenous, Threatened and Endemic Plants through improvement of Infrastructural facilities in University Botanic Garden at Dept. of Forestry Products, Dr. Y S Parmar University."		14,32,200.00	4th	1,43,30,296.00	68,69,704.00	CP00000850 Dt.01/11/2019 UTR No. 000051676013 Dt.07/11/2019
8	10/28/2014-CS/BG Dt.30/10/2019National Orchidarum & Experimental Garden, Yarcaud, Coimbatore		13,04,479.00	3rd	1,56,34,775.00	55,65,225.00	CP00000863 Dt.06/11/2019 UTR No. 133009385626 Dt.08//11/2019

9	10/37/2019-CS/BG Dt.01/11/2019 Dr. S. K. Tiwari, PI Head & Chief Scientist Botanic Gargen Institute (CSIR) Lucknow. CSIR-NBRI. "Ex-situ conservation studies of Cucas species in India at CSIR-NBRI Botanic Garden at a Lead Botanic Garden: Phase-II"	77,10,000.00	35,70,000.00	1st	1,92,04,775.00	19,95,225.00	CP00001132 Dt.15/01/2020 UTR No. 000073515716 Dt.17/03/2020
10	10/08/2012-CS/BG Dt.18/02/2020 Dr. K. T. Prasanna, PI, Botanical Garden, University of Agricultural Science, GKVK, Bangalore. "Ex-situ Infrastructural Facilitied for conservation of endangered and endemic plant species and Development of Botanic Garden of University of Agricuilturas Science (GKVK) campus Bangalore"	75,00,000.00	5,28,273.00	5th	1,97,33,048.00	14,66,952.00	CP00001270 Dt.03/03/2020 UTR No. 0000996598 Dt.06/03/2020

HERBARIUM INFORMATION (2019-2020)

Sl. No.	Herbarium Maintenance	ANRC	APRC	AZRC	CBL	CNH	CRC	DRC	ERC	ISIM	NRC	SRC
1	No. of Specimens mounted /remounted/ labelled/processed	784	1465// 155/ 1465	2880/ 00/ 3200	635	3330/ 7621/ 4287	1392	950	1887/ 2252	-	8639	5018/ 638/ 3581
2	No. of herbarium sheets stiched / re-stiched/cleaned/ poisoned/ fumigated/ dusted	12600/ 3265/ 826	1875/ 02370/67/ 4800/	2721/	-	1144/ 3641/ 9891/ 3240/ 20898	-		2030/ 100// 1626/ 430/ 47854	1356/ 1356/ 1102	144073	2786/ 284/ 3890/ 3080/ 128
3	No. of herbarium sheets accessioned		295	593	-	-	512		1300		3362	164
4	No. of specimens incorporated / re-incorporated	7682	295	418	-	98886	920	950	3216		7263	1069
5	No. of specimens sent on loan	-	-	-	-	36	-		65		61	200
6	No. of loaned / gifted specimens/images received / returned / exchanged	-	-	-	-	36/119/02 /1016 Image	76 Image		9		-	200/70/3/18
7	No. of specimens Identified	-	188	618	-	1077	89		276		507	24
8	No. of Genus / species covers changed	751	25/ 120	20/ 35	-	2235/ 6289	-		1300/ 230	2045	154	366/ 1947+ 53/
9	No. of specimens segregated/rearranged	-	445	50	-	12698	-	177	-		2772	100
10	Documentation of existing herbarium sheets at herbaria /entry in Excel sheet / Field data written	-	475	5488	-	-	-		48542/ 1452		1921	1138

HERBARIUM DIGITIZATION(2019-2020)

REGIONAL CENTRES	ANRC	APRC	CNH	DRC	NRC
Herbarium sheets digitized	616 (Family Poaceae)	1250	23,084	1450	2246

AWARDS & HONOURS

Dr. G.P. Sinha : Received 'Life Time Achievement Award' by GESA Society, New Delhi for commendable contribution in Lichen biology.

Dr. Pratibha Gupta: Received 'Vigyan Ratna Puraskar' for commendable contribution in the field of Popularizing Science & Technology during Global Conference 'Our Biodiversity, Our Food & Our Health' on 21.05.2019 at Botanical Survey of India, Central Regional Centre, Prayagraj by Glocal Environment and Social Association, New Delhi.

'Eminent Taxonomist Award' for commendable contribution in the field of Taxonomy by Asian Biological Research Foundation, Prayagraj during 1st International Conference on Environment and Society (ICES 2019) at Harcourt Butler Technical University (HBTU), Kanpur by State Minister Public Service Management, Uttar Pradesh.

Dr. S.S. Dash: Awarded the Prestigious V. V. Sivarajan Gold Medal 2019 by the Indian Association of Angiosperm Taxonomy. (IAAT) for outstanding work in taxonomy.

Dr. S.P. Panda: Received a memento for significant contributions on the development of a new section of Roses (Rosarium) in AJC Bose Indian Botanic Garden by the Agri-Horticultural Society of India, Kolkata on the occasion of the Innaugural Ceremony of the Rosarium in connection with the World Regional Rose Convention on 12.01.2020.

Dr. A.N. Shukla: Conferred 'Fellowship of Glocal Environments and Social Association, New Delhi' for the year 2019 by International Academy of Science and Research, Kolkata' in Global Conference on Our Biodiversity, Our Food & Our Health (GCBD-2019)" Allahabad held on May 21-22, 2019.

Dr. Brijesh Kumar: Received 'Biodiversity Conservation Award' for the year 2019 by Prof. Neelima Gupta, V.C, Kanpur University, Prof. Rajendra Prasad, VC, Allahabad State University, from 'International Academy of Science and Research, Kolkata' in Global Conference (May 21-22, 2019) on Our Biodiversity, Our Food & Our Health (GCBD-2019)" Allahabad.

SERVICE RENDERED

A. PUBLIC SERVICE RENDERED

Academic expert services:

Review of paper: As a potential reviewer, BSI scientists reviewed 28 manuscripts for National and international journals such as Phytotaxa, Turkish Journal of Botany, Journal of Asia-Pacific Biodiversity, Mycotaxon, Journal of Biochemistry and Biotechnology Research, Journal of Threatened Taxa, Phytotaxonomy, Indian Journal of Horticulture, NELUMBO, ENVIS Newsletter, JDRAS, Taiwania, Phytaxonomy, Systematic Botany, Indian Journal of Forestry, Acta Botanica Hungarica, American Fern Journal, Biologia Plantarum, Current Science, Journal of Bryology, Journal of Bombay Natural History Society, Nordic journal of Botany, Phytan, The Nucleus, Rheedeia etc.

Supervision of PhD and Msc. Internship: BSI scientists have supervised Ph.D. of 08 students and dissertation works of 06 M.Sc. Students of different Universities and Institutes.

Evaluation of PhD thesis/viva voce: BSI Officials evaluated 03 Ph.D. thesis from different Universities and Institutes.

Technical advice given: BSI officials provided technical advices to the Lt. Col., Fort Williams, Dr. P. Radha, Research Officer (Botany), Sidha Clinical Research Unit, Chennai, SMPB, Forest Department, Govt. Arunachal Pradesh for finalization of medicinal plants for the state and lists were prepared for promotes cultivation for the commercial use.

Preparation of scientific reports/inputs: BSI officials conducted field visit to Nature Park, Taratala and East Kolkata Wetland to access the feasibility for bio-remediation, facilitated the selection and supply of aquatic weeds like *Typha*, *Pistia*, *Salvinia*, *Ipomoea*, *Cyperus* etc. for the phyto-remediation of East Kolkata Wetland, prepared a report on 'Bio-remediation using the plant species' including a report on the 'Plants of Rabindra Sarobar' and submitted to BSI (Hqrs.), finalized the Green Audit Report of Bankim Sardar College, South 24 Parganas and submitted the report to BSI (HQ). In addition report of 'NDF studies on Red Sanders tree (*Pterocarpus santalinus* L.f.)', a write up on 'Natural Dye and Textile design' by Thomas Wardle and JF Watson respectively have been prepared for BSI Website; a report on 'Several alternative plant resources and their sustainable economic utility in tribal lives', database of "Fabrics dyed with Indian dyes by Thomas Wardle (Vol. 1-12)" (1970); Educational brochure on the theme "Our Biodiversity, Our Health, Our Food" and a write up on 'History of Pencil' for Botanical Gallery have been prepared by BSI officials.

Assistance to ABG Schemes: To assess the feasibility of establishment of botanic gardens under ABG scheme, Dr. B.K. Singh, Botanical assistant, AJC Bose IBG, visited Jhanjra Area, Eastern India Coalfield Limited, Asansol on 19.09.2019 & 20.09.2019. Also visited Gunjan Park, Asansol to look into the feasibility of development of a Botanic Garden on 04.11.2019 and submitted to BSI, Hqrs.); Dr. David Lalsama Biarte acted as expert member

for Feasibility inspection under the Assistance to Botanic Garden Scheme at Mizoram University, Aizawl from Feasibility inspection on 10th-12th June, 2019; Dr. J.H. Franklin Benjamin along with Dr. D.K. Agrawala, conducted preliminary inspection cum feasibility of the Botanic Garden of Sikkim University, Yangang Campus and final report was submitted to the HOO, SHRC.

Office/ Garden/ establishment/development/maintenance:

Establishment of new Regional centre of BSI: A new Regional Centre, High Altitude Regional Centre was established in Solan, Himachal Pradesh on 10th December, 2019 including Himachal Pradesh, Jammu & Kashmir and Leh-Ladakh under its jurisdiction with an area of more than 200000 Sq. Kms. Initially the Centre has been established at Dr. YS Parmar University of Horticulture and Forestry, Nauni under headship of first Scientist In-charge, Dr. Ambrish Kumar, Sc.-E. The Centre has initiated establishment of major functional units *viz.* Herbarium, Library and Visual section with the Mandate as survey and documentation of floristic diversity, development of database of wild resources, conservation of EET species and capacity building and technology transfer. During the period after inauguration, the Centre has been setup with 06 rooms provided by the University. Regarding set up of herbarium, c. 2570 herbarium specimens, collected under various previous plant exploration tours to Western Himalaya have been brought from the BSI, NRC Dehradun and deposited. A new acronym BSS i.e. Botanical Survey at Solan has been proposed for registration as National Repository by MoEF & CC. In addition a small library containing c. 500 books of BSI publications on topics like floristics, plant taxonomy, ecology, phytogeography, cytology, genetics, environment, conservation and an audio-visual section have been established at this centre.

Garden establishment/development/maintenance:

During 2019-20, in addition to regular introduction of endemic, RET & EET plants in the Experimental Botanic Gardens of different Regional Centres of Botanical Survey of India, establishment and development of several important Sections have been set up as follows:

Rosarium: A 'Rosarium', has been inaugurated on 12th January, 2020 by Ms Henrienne de Briey, President World Federation of Rose Societies in presence of Dr. A.A. Mao, Director, Botanical Survey of India and around 250 delegates of World Regional Rose Convention including delegates from different countries and officials of all the local offices of BSI, has been developed just opposite to Roxburgh Monument and adjacent to the Great Banyan Tree, in AJC Bose IBG. The area, of more than 30000 sq. ft., is being converted into 29 plots or beds; each bed was of more or less 800 sq. ft having a walking path of 2ft made up of brick and sand all around the beds having a central decorated bed exclusively for introduction of the Indian Breed rose Janaki Ammal. The front side has a running bed of 2ft wide where different varieties of miniature roses have been introduced which act as hedge. A total of 2708 rose plants have been planted in the 29 beds and the front bed of more

than 248 cultivars with 16 colour combinations including stipes also. Out of the 29 beds, one bed only harbours Indian breeds and the others were introduced with foreign breeds. Some of the notable cultivars are Royal amethyst, Gary player, Swamy Ranganath Nanda, Spell work, Rina Hugo, Holly Wood, Double Delight, Victor Hugo, AK. Mishra, Marcopolo etc. along with number of scented varieties.

Bust of Acharya Jagadish Chandra Bose: A bust of Acharya Jagadish Chandra Bose has been installed near the main gate, AJC Bose IBG and unveiled by Dr. A.A. Mao, Director, BSI on the occasion of 162nd Birth Anniversary on 30.11.2019. Beautification of surrounding areas and fallow lands have also been carried out with labelling and laying of lawn grass and decorating with foliage and winter annuals and more than 4000 hedge plants are being procured through limited quotation process.

Renovation of Roxburgh Monument: Renovation works of Roxburgh Monument has been started in front of the Rosarium during which old, dilapidated, unreadable scripts have been replaced with steel plates with same inscriptions, grill fencing has been repaired and refabricated enhancing the beauty of the historic and legendary monument to a large extent.

Maintenance and care to the Great Banyan Tree (GBT): During 2019-20, old supports made up of 'Eucalyptus Pole' and bamboos to the prop roots have been replaced in 21 places, approx. 137 encaged aerial roots have been repaired in respect of refixing and replacing of bamboo cages fitted to them according to their growth as per necessity, about 93 new aerial roots are being engaged in bamboo cages for training them as prop root, new 'support' have been provided to the heavy branches of the tree in 26 places by bamboo only for lifting the drooping branches of GBT up to a suitable height, fungicide was painted at the bases of approx. 190 prop roots to check fungal infection, about 40 nos. of dead and dry branches/roots either in standing or uprooting position, are cut down to prevent further damage to the tree and the cut ends have been painted with insecticides resulting no further Termite attack. The entire area is being maintained and made presentable by grass cutting, sweeping, raking etc.

Nurseries, Economic plant section, medicinal plant section, Cactus section, Rose garden, Zingiber section, Fern section, ponds etc. have been established in different Experimental gardens of BSI wherein cleaning, weeding, application of insecticides, Plant labelling and their updates, seasonal plant growing and other routine works are being carried out. Previous Charak Udyan of BGIR, Noida, has been redeveloped with establishment of about 2 ft. pathways all around. 22 beds are prepared with smaller path ways in which 25 species are segregated for plantation and 32 nursery beds have been prepared near seed House. 12 new climber rose cultivar have been introduced in Rose Garden, BGIR through cutting.

Assistance and attending scientific fraternity, delegates & dignitaries: BSI officials have assisted approx. 15000 scientific fraternities, delegates, dignitaries, VIPS, students and

researchers in dissemination of information, solving queries and pursuing scientific researches.

Saplings / propagules distribution: Approx. 8470 saplings/ propagules of *Victoria cruziana*, *Mimusops elengi*, *Brownea hybrida*, *Terminalia arjuna*, *Licuala grandis*, *Saraca asoca*, *Polyalthia longifolia*, *Delonix regia*, *Lagerstromea thorelii*, *Swietenia macrophylla*, *S. mahagony*, *Peltophorum pterocarpum*, *Couroupita guianensis*, *Terminalia catapa*, *Calophyllum inophyllum*, *Madhuca indica*, *Pterigota alata*, *Diospyros*, *Putranjiba roxburghii*, *Artabotrys uncinatus*, *Polyalthia longifolia*, *Delonix regia*, *Lagerstromea thorelii*, *Swietenia macrophylla*, *Peltophorum pterocarpum*, *Calophyllum inophyllum*, *Bauhunia vahlii*, *Putranjiba roxburghii*, *Terminalia catappa*, *Pterigota alata*, *Artabotrys uncinatus*, *Lagerstromea thorelii*, *Swietenia macrophylla*, *Bentinckia nicobarica* (Kurz) Becc., *Knema andamanica* (Warb.) W.J. de Wilde, *Rhopaloblaste angustata* (Kurz) Moore, *Aphanamixis polystachya* (Wall.) R. Parker, *Areca triandra* Roxb. ex Buch.-Ham., *Cerbera odollam* Gaertn., *Cycas zeylanica* (J. Schuster) Lindsts et K. D. Hill., *Geophila repens* (L.) I.M. Johnst., *Horsfieldia irya* (Gaertn.) Warb., *Bentinckia nicobarica* (Kurz) Becc., *Myristica andamanica* Hook.f., *Pterocarpus dalbergioides* Roxb. ex DC., *Centella asiatica* (L.) Urb., *Piper nigrum* L., *Chloroxylon swietenia* DC., *Cymbopogon citratus* (DC.) Stapf, *Vitex negundo* L., *Drypetes assamica* Pax & K. Hoffm.. etc. are being distributed to different Colleges, Universities, Institutes, eminent researchers and public on different events.

Identification & authentication of plant samples: BSI officials of different Regional Centres have identified c. 1800 specimens of Angiosperms, Pteridophytes, Gymnosperms, Bryophytes etc. received from different Institutes, Colleges and Universities.

B. REVENUE

Revenue earned through sale of BSI Publication: **Rs. 4,04458/-**

Revenue earned through miscellaneous services (Identification/Authentication of plant specimens/ Guest charge, Photocopy/Ph.D. registration charges etc.): **Rs. 43,24232/-**

MEETINGS, EVENTS, CELEBRATIONS AND ACTIVITIES

MEETINGS

National Mission for Biodiversity: Series of meetings was held regarding database of species diversity of India at Zoological Survey of India and Botanical Survey of India on 10.10.2019, 11.10.2019, 16.10.2019, 17.10.2019.

AJC Bose IBG Arranged 23rd meeting of Joint Committee of Management of AJCBIBG with Chief Secretary to the Govt. of West Bengal and Principal Secretaries of Environment, Forest and Tourism, District Magistrate, Howrah, Police Commissioner, Howrah and Commissioner, Howrah Municipal Corporation at Nabanna on 18.02.2020.

An Memorandum of Understanding was signed between Botanical Survey of India and Shimpson and Brown, Scotland and their authorised representative in Kolkata M/s Alia Associates on 19.10.19 for the renovation and development of Roxburgh Building into Roxburgh Hub.

Officials of AJC Bose IBG attended meeting of the expert committee in connection with the Rabindra Sarobar, Kolkata in view of the Hon'ble National Green Tribunal direction on 10.07.2019 at Unnayan Bhawan, Salt Lake, Kolkata and on 09.08.2019 at Paribesh Bhawan. Prepared a report on the Plants of Rabindra Sarobar and submitted to BSI (HQ).

Officials of AJC Bose IBG visited Bankim Sardar College, South 24 Parganas from 23.09.2019 to 24.09.2019 for Green Audit and submitted the Green Audit Report to BSI (Hqrs.).

BSI, ANRC, Port Blair organized a review meeting of progress of GSDP Chaired by Dr. Anandi Subramanian, IES, Principal Advisor, MoEF & CC on 21.05.2019.

BSI, ANRC, Port Blair organized Valedictory function of Green Skill Development Programme: Para-Taxonomy (including People's Biodiversity Register PBR) at Main Office on 07.09.2019.

BSI established a New Regional Centre at AWHRC, Solan which was inaugurated by Hon'ble Secretary, MoEF & CC, Shri C.K. Mishra on 26th February, 2020 which has been witnessed by over 230 delegates and students.

Organised a meeting for the inking of MOU between Dr. A.A.Mao, Director, BSI and Prof Arun kumar pandey, Vice Chancellor, Mansarovar Global university, Bhopal for the cooperation of research and PhD between the two organizations on 05.06.2019.

'COP-14 (Conference of Parties)' of UNCCD programme was held at Greater Noida, G. B. Nagar, UP during 2nd to 13th September, 2019 during which transport arrangements, accommodation of participating scientists from various centres of BSI and headquarters, preparation of logo etc. were arranged by BGIR.

Organised a 'Brain storming meeting' under chairmanship of Additional Secretary, MoEF&CC, on 22nd October, 2019 for selection of best trees and medicinal plants for various thematic sections for new plant scape of BGIR in exhibition cum meeting hall wherein Joint Secretary, MoEF&CC, Director, BSI, all the Heads of Regional Centers of BSI and Senior officers were present.

Organised 'Head of the office meeting' under chairmanship of Dr. A.A.Mao, Director, BSI at BGIR auditorium, on 16. 04. 2019 in which all the heads of the Regional offices and Units of BSI were present.

Organised a meeting on 'Flora of India' under chairmanship of Dr. A.A.Mao, Director, BSI at BGIR auditorium, for the discussion and future plan of 'Flora of India' project. Concerned scientists and HOO of different circle attended the meeting.

Organised 'Steering committee meeting for landscaping of Botanic garden of Indian Republic' under the chairmen ship of Shri Ravi Agrawal, AS, MoEF&CC, at BGIR on 10th-11th April, 2019 and 8th May, 2019.

Organised quarterly meeting of Departmental Rajbhasha implementation committee by BSI, ANRC, Port Blair on 19.06.2019.

Organized Official Hindi Council meeting by BSI, ANRC, Port Blair on 23.08.2019.

EVENTS, CELEBRATIONS AND ACTIVITIES

International Biological Diversity Day

All the Regional Centres of BSI celebrated International Biological Diversity Day on 22.05.2019 by holding popular lecture, painting and slogan competition, film show, nature trail etc. to the students. A two days Global Conference on 'Our Biodiversity, Our Food and Our Health (GCBD-2019)' was successfully organized on 21-22 May, 2019 by Botanical Survey of India, Central Regional Centre, Allahabad in collaboration with Blue Planet Society (BPS) Prayagraj, Glocal Environmental & Social Association (GESA), New Delhi, Dept. of Zoology, Govt. P.G. College, Saidabad-Prayagraj and International Academy of Science and Research (IASR), Kolkata, W.B. Radio partner was Red FM. The prominent dignitaries graced the occasion include three Vice Chancellors viz., Prof. Neelima Gupta, VC, CSJM Kanpur University, Prof. Rajendra Prasad, VC, Rajendra Singh (Rajju Bhaiya) University, Prayagraj (formerly **Allahabad State University**), and Prof. R.K.P. Singh, VC, Dr. **Shakuntala Misra** National Rehabilitation **University, Lucknow** and **Hon'ble Justice Shri Rahul Chaturvedi and Dr. A.K. Vasney, Joint Director, Uttar Pradesh Higher education.** Welcome address and a lecture on 'Role of Botanical Survey of India in conservation of plant species' were delivered by dr. G.P. Sinha during Inaugural session. **100 plant saplings of lemon were distributed to the guests on various occasions viz., inaugural function, technical sessions and valedictory function during the conference.** Altogether nine technical sessions and one poster session were successfully conducted during the period. All the available scientists and employees of the CRC viz., Dr. Sheo Kumar, Dr. A.N. Shukla, Dr. Brijesh Kumar, Sri V.K. Singh, Dr. Nitisha Srivastava and staffs of BSI, CRC along with

members of the other collaborative units actively participated in this conference to make it a grand success.

Dr. Chaya Deori, Dr. Ashutosh, Ms. Suparna Debnath and Ms, Bidisha Mallick, ERC, BSI, delivered talks on the theme of the International Biological Diversity Day 2019. Plantation of 15 saplings (*Prunus cerasoides* and *Melia azadirachta*) was also carried out in the BSI campus to mark the occasion.

Organized jointly three-days exhibition at Indian Museum Campus to commemorate International Biodiversity Day 2019 with assistance from staff members of ISIM. A formal inauguration of the event, venued at Indian Museum main gate corridor, was made on lighting of lamp by Dr. A. A. Mao, Director, BSI in the presence of dignitaries of Thailand foreign embassy, official of BSI and Indian Museum along with participating school children, guide teachers and general public. A special exhibition on theme: 'Our Biodiversity , Our Food, Our Health' was arranged by BSI, ISIM Which contains display of some 40 plant materials related to food and medicine. The display of some 12 coloured charts related to theme was exhibited for three days from May 22nd -24th , 2019 for the general public. A six- page brochure containing coloured photographs of 'Sixteen Wild Edible' and 'Eleven Traditional Medicinal plant species' related to the theme with less known information was released on the occasion and distributed for public awareness. A six- page brochure containing coloured photographs of '16 Wild Edible' and '11 Traditional Medicinal plant species' related to Theme with less known information was released on the occasion and distributed for public awareness. A street play (performed by an NGO 'Urotaar') related to the theme on 'plantation, utilization and conservation of Biodiversity' was another attraction for the unprivileged school students. A visit to 'Botanical Gallery' and 'New Gallery on Botanical History' of BSI was arranged for the participating school students as the educational programme on 'Utilization and conservation of economical plants'. A feedback session with the guide teachers and participating students for future conservation of plant species was arranged.

International Day of Yoga

All the Regional Centres of BSI celebrated 5th International Day of Yoga on 21.06.2019 by practising yoga under guidance of invited Yoga trainer towards the aim of fitness.

World Environment Day

Different Regional Centres of BSI celebrated World Environment Day on 5th June, 2019 wherein all the scientists and staffs of the Centres actively participated in the events with great zeal. During this event, series of awareness programmes like rally, display of banners with slogans, sit and draw competition, quiz competition, plantation and free plant sapling distribution programmes were conducted, facilitated the plantation by dignitaries, monitored and distributed plant saplings to the public in Bi-centenary gate and Howrah Gate of AJCBIBG. Series of lectures were organised on the theme 'Air Pollution [Clearing the air; combating air pollution]'. Paper bags were distributed at metro station during for the

promotion and polythene free work culture. On successful completion of the competitions, prizes along with certificates were provided to the participants. The delegates and dignitaries were invited in different Regional Centres of BSI as Chief guests who shared their ideas for conservation of environment and forest, forests as important source of water, air and food, utmost necessity to conserve the forests for posterity and sustainability, Flora and Fauna of Anamalai Tiger Reserve, Earth is an Organism, Different kinds of pollutions and their control measures, how to compost the domestic waste effectively at home and Floristic Wealth of Agasthiyamalai Biosphere Reserve. Apart from that, a Herbarium visit to Madras Herbarium (MH), one of the oldest and renowned herbaria in India, was organised by BSI, SRC for the students and teachers participated during which collections of some of the eminent European botanists, Johan Peter Rottler, J.D. Hooker and T. Thomson, Robert Wight, T.F. Bourdillon, R.H. Beddome, M.A. Lawson, C.A. Barber, J.S. Gamble and C.E.C. Fischer were displayed to them along with 1,068 carpological, 215 seeds, 439 preserved specimens (FAA and Formaldehyde), 90 timber specimens, 09 tannin materials, 28 essential oils, 39 gums and resins, 100 illustrations/photographs of medicinal plants, 45 southern Indian drugs, 50 ethnobotanical exhibits and several charts and photographs in Museum section.

World Ozone Day

Different Regional Centres of BSI celebrated World Ozone Day on 16.09.2019 during which students of various schools and colleges participated in the organized events, exhibited their skill and innovative ideas through their paintings made on the theme '32 years and Healing' and extempore speech competition. Further, they learnt about how the whole process of healing of Ozone Layer taken place in last three decades by a lecture entitled 'Restoration of Ozone Layer' delivered by Dr. Sheo Kumar. The drawings were evaluated and best four paintings were selected for prizes. During celebrating the Day, brief talk on 'History about the botanical gallery & Indian Museum' and 'International day for the preservation of the Ozone Layer' was delivered by Dr. M. Bhaumik and Dr. (Mrs.) Kangkan Pagag respectively. Participating students visited Botanical Gallery and Other galleries of Indian Museum.

Van Mahotsav

Different Regional Centres of BSI observed 'Van Mahotsav week' during 01th-07th July, 2019 by undertaking plantation programme as well as displaying banner, plantation and distribution of saplings carried out in collaboration with NMNH and RAWs NGO Meta Flex to villagers to increase carbon sink. During 2019-20, c. 5148 saplings were distributed to different NGOs, villagers and students some of which are *Ougeinia oojeinensis* (Roxb.) Hochr., *Pterocarpus santalinus* L.f., *Pterocarpus marsupium* Roxb. *subsp. acuminatus* (Prain) Thoth., *Dalbergia latifolia* Roxb., *Madhuca indica* J.F.Gmel., *Butea monosperma* (Lam.) Taub. var. *lutea* (Witt.) Maheswari, *Butea monosperma* (Lam.) Taub., *Bauhinia variegata* L., *Cassia fistula* L., *Mimusops elengi* L., *Terminalia arjuna* (Roxb. ex DC.)Wight & Arn., *Licuala grandis* H. Wendl., *Saraca asoca* (Roxb.) Willd., *Polyalthia longifolia* (Sonn.)Thwaites, *Delonix regia* (Hook.) Raf., *Swietenia macrophylla* King, *Peltophorum pterocarpum* (DC.) K. Heyne, *Couroupita guianensis* Aubl., *Calophyllum inophyllum* L., *Artabotrys uncinatus* (Lam.) Merr., *Magnolia doltsopa* (Buch.-Ham. ex DC.)

Figlar, *Prunus nepalensis* k. Koch etc. Medicinal and other Economically important saplings were introduced in Experimental Botanic Gardens of different Regional Centres. During celebrating Van Mahotsav week, Botanical Survey of India focused on different ongoing Government programmes for forestation, highlighted the activities of BSI towards conservation of plants and organised awareness drives.

National Science Day

To celebrate National Science Day, Prof. Ramdeo Misra Memorial Lecture Series was organized as a tribute to the Father of Indian Ecology Prof. Ramdeo Misra, by BSI, CRC in collaboration with FRCER, Prayagraj, on 28th February, 2020 in which key note lecture was delivered by Prof. A.S. Raghuvanshi, BHU, Varanasi. Dr. Sheo Kumar, Dr. Arti Garg, Dr. A.N. Shukla, Dr. A.K. Verma and other staff members of BSI, CRC, Dr. Ajai Shankar, Srivastava, IFS, Retd. APCCF, Dr. Pradeep Srivastava, Head, Botany Department, ECC, Prayagraj, Dr. Anil Tewari, Botany Department, ECC, Prayagraj, Dr. Jha, Department of Environmental Sciences, Allahabad University, Dr. H.P. Pandey, Botany Department, Ishwar Saran Degree College and students from ECC, PG College Prayagraj, Allahabad University participated.

BSI, ERC, Shillong celebrated 'National Science Day' on 28th February, 2020 by organizing quiz competition which was conducted by Dr. Deepu Vijayan and Miss L. Ibemhal Chanu, on Science and general awareness in which all scientific staffs took part. Dr. Chaya Deori delivered a talk on the theme 'Women in Science' and Dr. K. Sangeeta Devi (NMHS), Mr. Charles Wahlang (NMHS), Ms. Suparna Debnath, Project Fellow, Ms Dawanri Marwein, (Flora of India) presented short educative slides on various aspects of the theme for the benefit and information of those gathered.

Special Lecture series

Organized a special lecture on "The Changing Paradigm of Flowering Plants Systematics" by prof. (Dr.) Arun K. Pandey, Vice Chancellor, Mansarovar Global University, Bhopal at Auditorium, ANRC, Port Blair on 17.12.2019.

Foundation Day Programme

Organised Awareness workshop and plantation drive on the theme "Biodiversity Conservation" in the eve of Foundation Day of BSI, NRC, Dehradun on 01st August, 2019 in collaboration with NMHS (LG) project in Green Lawn Academy, Jaintan Wala, and Halduwala village near Santala Devi, Dehradun in which school children, teachers and local peoples were sensitized about the threatened plants and their ethnobotany and conservation.

Kisan Mela Avam Krishi Navachar Divas

BSI, AZRC, Jodhpur participated in "Kisan Mela avam Krishi Navachar Divas", organised by Central Arid Zone Research Institute (ICAR), Jodhpur on 16th September, 2019. During this one day event, various activities of BSI were highlighted including display of 20 live plants (Threatened and Medicinal), several Museum Artefacts, Herbarium sheets and BSI

publications. Around 200 saplings raised in BSI, AZRC Nursery [*Tinospora cordifolia* (Thunb.) Miers, *Azadirachta indica* A. Juss. and *Asparagus racemosus* Willd.], were distributed free of cost to the farmers and interested persons. A large gathering of general public including farmers, students from various schools, researchers etc. visited BSI stall and they were informed about different activities of BSI and their queries related to plants were answered. Sri Vinod Maina, Dr. Sanjay Mishra, Sri Ravi Prasad, Sri Ramesh Kumar, Sri J.P. Yadava, Sri Bhoma Ram, Sri Jaspal Singh and Dr. Ravikiran kulloli represented the stall.

Meghnad Saha Smarak Mela

BSI, ISIM, Kolkata participated in ‘Meghnad Saha Smarak Mela’ held at Triangular Park, Kolkata from 23rd to 26th January, 2020.

Damodar Mela

BSI, ISIM, Kolkata participated in Damodar Mela held at Amta, Howrah from December 7th-13th, 2019.

Exhibition at Dilli haat

Participated in an exhibition at Dilli haat, Pitampura on 18th – 20th October, 2019 under the ‘Vibrant India’ program by booking a stall with display of Posters, Publications (Books etc.), live plants of botanical importance, fruits and seeds along with distribution of brochure, badges and caps.

Miscellaneous

Inauguration of green house and walk in germination chamber funded under the National Mission on Himalayan Studies (NMHS) was inaugurated by Dr. A. A. Mao, Director, Botanical Survey of India, on 10th August, 2019 and was attended by Dr. B. K. Sinha and all the officers and staffs of ERC, Shillong. During this event, powerpoint presentations narrating progress of work were delivered by Research Fellows of ERC, Shillong.

BSI, ANRC, organized review meeting of progress of GSDP Chaired by Dr. Anandi Subramanian IES, Principal Advisor, MoEF & CC on 21.05.2019.

Organized hoisting of 73rd Independence Day Celebrations at Main Office on 15.08.2019.

Organized 71st Republic Day Flag Hosting celebration, 2020 at BSI, ANRC, Port Blair on 26.01.2020.

Organised Sports Week from 14th to 18th October, 2019 by Phyton clun, ERC, Shillong in which all the staff members actively participated.

All the Regional Centres and BSI offices observed Vigilance Awareness Week (8th October to 2nd November, 2019) with integrity pledge with theme “Integrity- A way of life”. All the staff members attended the Oath taking meeting.

BUDGET ESTIMATE
2019-20
BOTANICAL SURVEY OF INDIA
STATEMENT SHOWING MONTHLY EXPENDITURE

Grant No. 25

3435- Ecology & Environment (Major Head)

01-Survey (Botanical) (Sub-Major Head)

01.001-Direction & Administration (Minor Head)

04-Attached / Subordinate Offices (Sub Head)

04.01-Botanical Survey of India (Detailed Head)

Object Head			
	REVISED - BUDGET	Exp. Up to	Balance as
FY 2019-2020	Allotment	31.03.2020	Per actual exp.
	2019-2020		
1 - Salaries	460000000	451926079	8073921
2 - Wages	100000	98602	1398
3 - Overtime Allowances	100000	81948	18052
5 - Rewards	1500000	0	1500000
6 - Medical Expenditure	4400000	4339344	60656
11 – Domestic Travel Expenses	18400000	17312153	1087847
12 – Foreign Travel Expenses	1000000	936104	63896
13 – Office Expenses	105000000	93271574	11728426
14 – Rents, Rates & Taxes	2000000	1853401	146599
16 - Publication	3500000	3439751	60249
20 – Other Administrative Expenses	1755000	1754302	698
21 – Supplies & Materials	4000000	2846890	1153110
26 – Advertising and Publicity	200000	191160	8840
27 – Minor Works	23000000	23000000	0
28 – Professional Services	200000	199194	806
30 - Oth. Cont. Services	70800000	56302482	14497518
31 – Grant - in - aid	50045000	49793464	251536
34 – Scholarship & Stipend	14000000	13728412	271588
Total - PLAN	760000000	721074860	38925140