

ANNUAL REPORT

2018-19



BOTANICAL SURVEY OF INDIA

Ministry of Environment, Forest & Climate Change

ANNUAL REPORT 2018-19



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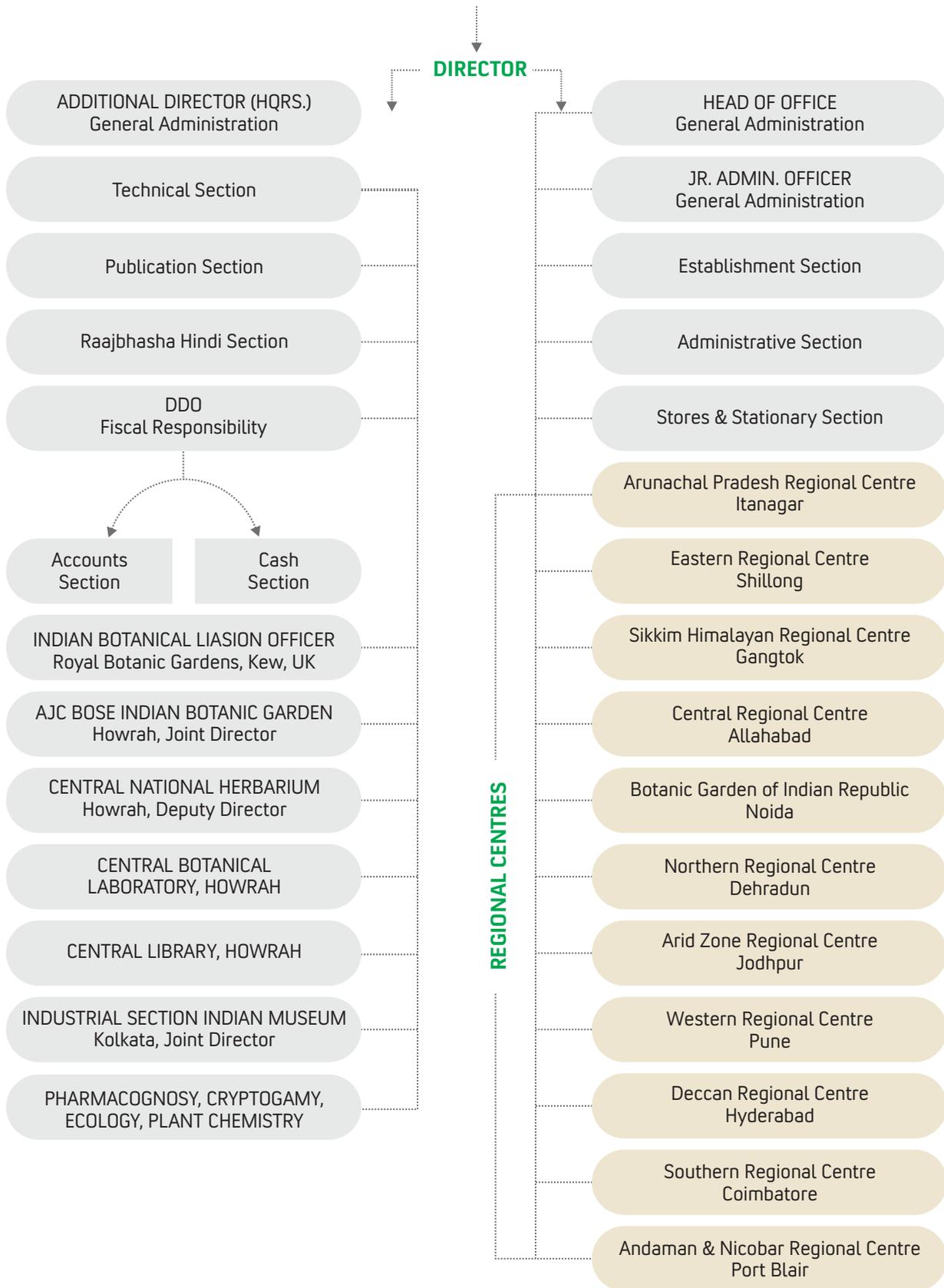
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RAMC ← **BSI** → **PMC**



From the DIRECTOR'S Desk



A.A. Mao
Director
Botanical Survey of India

It is a great honor for me to present the Annual Report of Botanical Survey of India (BSI) for the year 2018-19. Similar to previous years, BSI, outshined this year too in the field of floristic inventory, biodiversity conservation, quality research and book publications, infrastructure development and outreach programme. A steady increase of progressive research facilitated us to carry forward the legacy of this premier research organization.

In 2018-19, Scientists of BSI have undertaken 146 exploration tours under 102 Annual Action Plan projects in different biogeographic zones of India. In addition, tours were also conducted in 23 protected areas, 01 fragile ecosystem and 01 sacred grove which yielded enormous number of plant specimens. About 24 germplasms collection tours were taken for collection of about 680 live specimens for garden and 28 herbarium consultation tours were taken for consultation and identification. During this year, revisionary studies on the families *Pyrenulaceae*, *Metzgeriaceae*, *Cycadaceae* and genera *Riccia*, *Adiantum*, *Gastrochilus* and *Impatiens* of Sikkim & Darjeeling were continued along with the state flora of Himachal Pradesh, Nagaland, Chattishgarh, Bihar & Jharkhand. During the year 2018 the scientists of BSI published 02 new genus, 65 new species and 03 new infra specific taxa of plants as new to science and discovered 01 family, 02 genus, 39 species, 3 varieties, 1 forma as new records for India, which constitutes 26% of the total discoveries in India. Interestingly, this year's discoveries include wild relatives of many potential horticulture, agriculture, medicinal and ornamental plants such as *Amomum* (wild cardamom), *Cycads*, *Rubus* (raspberry), *Syzygium* (Wild Jamun), *Terminalia*, Balsams, Zingibers and also 7 trees and 10 orchids.

I am also glad to mention that, the mandate of BSI is gradually shifting from the pure classical taxonomical studies to applied experimental study. During 2018-19, phylogenetic study of aquatic fungi of NE India; DNA barcoding & phylogenetic study of 20 endemic plants of NE India and phytochemical screening of 11 medicinal plants are being carried out. Ethnobotanical studies in the tribal dominated districts of Bihar were initiated to documentation of traditional knowledge. The correct identity and nomenclature of icons of families Bignoniaceae, Clusiaceae,

Poaceae, Orchidaceae and Pteridophytes from '*Icone Roxburghianae*' were done. All the experimental botanic gardens located at different regional centers of Botanical Survey of India enriched with successful introduction and conservation of useful & economically important plants.

Towards herbarium digitization of herbarium specimens, a total of 11,755 sheets were digitized. BSI has already completed plant checklist database, e-Flora of India, digitization of rare holdings, BSI publications, and OJMS portal for its official journal *Nelumbo*. During 2018-19, BSI scientists published 175 research papers in peer reviewed journal of national and international repute. The Publication Unit has published 07 books, 03 periodicals (*Plant Discoveries*, *Vanaspati Vani* and *Nelumbo*) and 01 Annual Report.

During 2018-19, the different regional centers of BSI have organized a number of outreach programme to disseminate knowledge. The 'Third Botanical Nomenclature Course' successfully completed at Southern Regional Centre, Coimbatore with 99 participants; Regional Workshop on Wetlands was organized by MoEFCC at Central National Herbarium, Howrah; one two weeks in-service training programme for Botanical Assistants was organized at CNH towards the fulfillment of the partial eligibility criteria for the in-situ promotions to Botanist. The regional centers of BSI have also organized National seminars and symposiums with collaboration of local Universities and academic institutions. Central Regional Centre, Allahabad in collaboration with Blue Planet Society, Allahabad and Govt. P.G. College, Saibabad organised an International Seminar on 'Recent Trends in Agriculture, Biodiversity and Social Sustainability (ABSS-2018)'; AZRC in collaboration Zoological Survey of India Organised National Workshop on "Recent Trends in Taxonomy" at Jodhpur. Under the National Mission for Himalayan Studies ERC, Shillong has organized three days training on 'GIS Mapping, Database Management and Spatial Analysis, ERC, Shillong'. The Annual Scientific Meet of BSI Scientist was organized in CNH for the appraisal of the progress of individual Annual Action Plan projects.

It is a matter of great pride that, BSI has successfully completed four courses under Green Skill Development Programme (GSDP) towards fulfilling the Ministries programme for empowering the unemployed youth. I am happy that, during this programme 133 individuals were trained, of which 20% were employed in number of research projects, state forest departments or self-employed. During 2018-19, one MoU was signed between Deen Dayal Upadhyay University, Gorakhpur and Botanical Survey of India for exchange of faculty, research scholars and also to facilitate the research scholars of BSI to pursue their Ph.D programme. A team of three officials were visited Natural History Museum (NHM) towards the repatriation of digitized Indian herbarium specimens belonging to family Balsaminaceae, Caprifoliaceae and Leguminosae.

I take this opportunity to thank all my scientific and administrative colleagues for their determined efforts in delivering our organizational goal and targets. I wish in future also we will demonstrate to accomplish all our research and development programmes to bring out a tangible outcome. I extend my sincere thanks to Shri C.K.Mishra, Secretary, MoEF&CC; Shri Ravi Agrawal, Add. Secretary, MoEF&CC as well as officers of CS Division of Ministry for their constant encouragement and support. I hope this Annual Report will draw the attention of all our well-wishers. This organization is also open to receive suggestions, advice and respond to ease us to complete our responsibilities.

Jai Hind



(A.A. Mao)
Director

RESEARCH PROGRAMMES



Elaeocarpus serratus L.

AJC BOSE INDIAN BOTANIC GARDEN, HOWRAH

PROJECT-1

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, 2019



Aromatic Plant Saplings collected from Arunachal Pradesh

OBJECTIVE

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

AREA AND LOCALITY

Eastern Ghats

SUMMARY AND ACHIEVEMENT

During 2018-19, one tour w.e.f. 15.02.2019 to 26.02.2019 was conducted to Raygada District, Odisha during which 31 species of medicinal plant saplings were collected and introduced in Nursery for hardening.

PROJECT-2

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



Plantation of Aromatic Plant Saplings in the garden

OBJECTIVE

Development of a separate section on Aromatic plants in AJC Bose Indian Botanic Garden, Howrah for *ex-situ* conservation and public awareness. This will also help the researchers and scientists to study the active components in wild aromatic plants.

AREA AND LOCALITY

North-East India

SUMMARY AND ACHIEVEMENT

During 2018-19, one field tour was conducted to Arunachal Pradesh during which 35 aromatic plants/propagules belonging to 13 species were collected; propagules like fruits, seeds, rhizomes were planted in suitable pots, fruits were sun dried from which seeds were obtained. Plants were identified and labeled. In this period, a separate section measuring approximately 1.5 acres was designated for Aromatic Plant Garden. A layout plan was prepared and ceremonial plantation was done on 15th August, 2018. Well established saplings of plants like *Pimenta dioica*, *Syzygium aromaticum*, *Cinnamomum verum*, *C. camphora*, *Santalum album*, *Artabotrys hexapetalus*, *Magnolia champaca*, *Jasminum sambac*, *Coleus amboinicus*, etc. were planted in this section.

PROJECT-3**Herbaceous Flora of AJC Bose India Botanic Garden**

Eriocaulon quinquangulare, an marshyland monocot weed of AJCBIBG



Globba marantina - a medicinally important weed wildly growing in AJCBIBG

started showing the sign of recovery/growth but condition of *Avicennia alba*, *Rhizophora mucronata* and the seedlings of *Nypa fruticans* is somehow critical. Only 02 out of 06 cuttings of *Excoecaria agallocha* produced sprouts. The seeds of *Nypa fruticans* has not germinated yet but a single seed of *Xylocarpus granatum* germinated and produced a healthy sprout. The project is completed and the final report is under process.

PROJECT-5**A re-assessment and re-validation of *Phoenix loureiri* Kunth and its variants in India**

Executing Scientist (s): Dr. S.S. Hameed

Date of Initiation : April, 2017

Date of Completion: March, 2019

OBJECTIVE

A thorough study of this species in India by assessing its morphological and ecological variation and examining the herbarium collections and literature in regional



Mangrove saplings in village nursery of Sunderban Biosphere Reserve



Natural regeneration of Mangrove saplings in Sunderban Biosphere Reserve

centres of BSI and CAL is also to be done for re-assessment and re-validation study and as well as to clear the ambiguity of the species. Live plants, seeds, seedlings etc. of the variants are also to be collected, introduced and conserved in AJCBIBG for future reference and study.

AREA AND LOCALITY

Eastern & Western Ghats

SUMMARY AND ACHIEVEMENT

During 2018-19, one field tour was conducted to various parts of Deccan region namely Thiruppathi forest division, Rajam pet and Kadappa regions etc., of Andhra Pradesh to explore the variants of *Phoenix loureirei* Kunth. The project is completed and the final report is under process.

PROJECT-6

Documentation of woody climbers of AJC Bose Indian Botanic Garden, Howrah

Executing Scientist (s) : Smt. Nita Sarkar

Date of Initiation : April, 2017

Date of Completion : March, 2019

OBJECTIVE

Documentation of woody climbers of AJC Bose Indian Botanic Garden in to the form of a pictorial guide for public awareness and research.

AREA AND LOCALITY

AJC Bose Indian Botanic Garden, BSI, Howrah

SUMMARY AND ACHIEVEMENT

During 2018-19, more than 80 woody climbers are documented along with Flowering & fruiting time, latitude & longitude from the garden. The project is completed and the final report is under preparation .

PROJECT-7

Study of Microalgae and monitoring of water quality of Leram Lake of AJCBIBG

Executing Scientist (s): Dr. Pratibha Gupta

Date of Initiation : April, 2017

Date of Completion : March, 2019

OBJECTIVE

study of microalgae with emphasis on monitoring of water quality of Leram Lake of AJCBIBG.



Phoenix loureiri Kunth-Population

AREA AND LOCALITY

Leram Lake, AJC Bose Indian Botanic Garden, BSI, Howrah

SUMMARY AND ACHIEVEMENT

During 2018-19, 11 field visits were conducted during which 61 species identified. It is very interesting to observe that some of the micro-algal species before installation of the Grander Unit of the water are the indicator of water pollution found in abundance and now gradually decreasing quantitatively and replaced by some other species. Species like *Chlorella vulgaris* is now a days used for treatment of municipal waste water and bio-diesel production. This species observed in few month samples which is also suitable pioneer organisms for soil restoration. The project is completed and the final report is under preparation.

PROJECT-8

Introduction and ex-situ conservation & monitoring of indigenous plants of India at AJCBIBG

Executing Scientist (s) : All working Scientists and Botanists of AJC Bose Indian Botanic Garden, Howrah

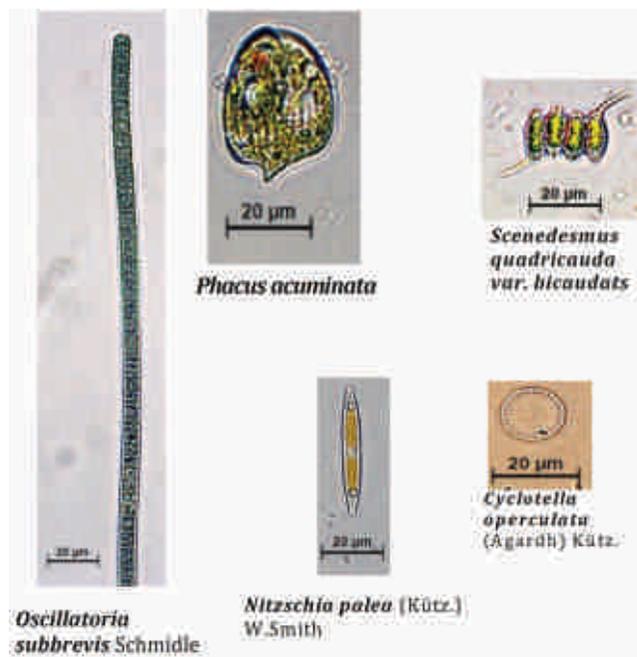
Date of Initiation : April, 2017

Date of Completion : Ongoing

OBJECTIVE

Introduction, ex-situ conservation & monitoring of indigenous plants of India in AJCBIBG.

AREA AND LOCALITY



Macroalgae of Leram Lake

AJC Bose Indian Botanic Garden, BSI, Howrah

SUMMARY AND ACHIEVEMENT

During 2018-19, under *ex-situ* conservation programme, nurturing and properly monitoring, up keeping and transplanting of the previously introduced threatened & endemic plants were completed as earlier tour collections got accumulated in the nursery and their division wise plantation was very much essential. Accordingly arrangement was made and target was fulfilled for plantation of about 150 valuable plants including RET&E plants in the respective divisions through Environmental Day, Van Mahotsava Week Celebration, During the 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. Plant saplings collected during the other AAP tours to Arunachal Pradesh, Deccan Region and Eastern Ghat in 2018-19 were also kept in nursery for hardening.

PROJECT-9

GIS Phyto-mapping & Digitization of Shrubs & Trees



Collected plants from Deccan region (1)



Collected plants from Deccan region (2)

in AJC Bose Indian Botanic Garden

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

Date of Initiation : April, 2015

Date of Completion : Ongoing

OBJECTIVE

Mapping & digitization of shrubs & trees in AJCBIBG.

AREA AND LOCALITY

AJC Bose Indian Botanic Garden, BSI, Howrah

SUMMARY AND ACHIEVEMENT

During 2018-19, Out of 25 divisions, around 4500 trees and shrubs were serially labelled in 1-7, 8, 14, 25, 22, 21, 18, 19, 20, 15, divisions and around 60% were identified. As a sample the Total Station survey work was done for 90 labelled trees in only two hours in the last year and the rest has to be done by outsourcing. The divisions of 9,10,11,12,13,16, 17, 22, 23, 24 along with few Islands of the lakes is yet to be labelled with quality labels which can withstand quite long durations. Processed and floated tender for carrying out the Total Station work and Numbering of Trees through outsourcing could not be materialized. Re-fixation of the old labels and the labelling of important trees by traditional method is under progress. As per instructions sorted out the fallen and dead trees inside the garden and prepared the map of the same was submitted to the Office for further necessary action. This study reported *Eulophia graminea* Lindl. (Orchidaceae) as new report from Tripura.



Metallic number tags on trees in the garden

ANDAMAN AND NICOBAR REGIONAL CENTRE, PORTBLAIR

PROJECT-1

Revision of family *Cycadaceae* in Andaman and Nicobar Islands

Executing Scientist (s): Dr. Lal Ji Singh

Date of Initiation : April, 2018

Date of Completion : March, 2020

OBJECTIVE

Documentation of all the species of the genus under the family Cycadaceae and preparation of consolidated account of the genus along with detailed description, status, distribution and finding out the strategies for their conservation; consultation of relevant literature and herbarium specimens.

BACKGROUND

Present study assesses the taxonomic status and identity of the genus *Cycas* in Andaman and Nicobar Islands, India. The earlier studies on the cycads of Andaman and Nicobar Islands resulted six taxa viz. *C. andamanica*, *C. darshii*, *C. dharmrajii*, *C. sainathii* and *C. zeylanica* but till date the species diversity is unresolved and complex. Therefore the genus in Andaman and Nicobar Islands remains very much in need of revision. The present study was proposed to thoroughly examine the morphology and anatomy of all the species of *Cycas* recorded in the flora of Andaman and Nicobar Islands in comparison with the other species available in the other parts of India and their live as well as herbarium specimens.

AREA AND LOCALITY

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

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, four field tours were conducted to different Islands and geographical region namely North Andaman, Little Andaman Islands, Nicobar Islands, Acharya Jagadeesh Chandra Bose Indian Botanic Garden (AJCBIG), West Bengal during which total of 30 field numbers were vouched along with the GPS data and plants/seedlings of 28 species were collected for introduction in the Dhanikhari Experimental Garden cum Arboretum. In addition one herbarium consultation tour was undertaken to CNH, Howrah during which determinavit slips were pasted on 142 herbarium specimens.



Cycas pschannae R.C. Srivast. L.J. Singh

ACHIEVEMENTS/ OUTCOMES

Present study reported three species viz. *Crotalaria grahamiana* Wight & Arn. (Fabaceae), *Heliotropium marifolium* Koenig ex Retz. (Boraginaceae) and *Solanum incanum* L. (Solanaceae) as new records for flora of Andaman and Nicobar Islands. The plants/seedlings of 28 rare, endangered, threatened, endemic tree species, zingibers and rattans were collected from various forest areas and introduced in the Dhanikhari Experimental Garden Cum Arboretum (DEGCA), Nayashahar as a part of *ex-situ* conservation.

PROJECT-2

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



Cleisostoma williamsonii Rchb.f. Garay

Executing Scientist (s): Dr. Lal Ji Singh

Date of Initiation : April, 2018

Date of Completion : Ongoing

OBJECTIVE

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

BACKGROUND

The knowledge of phenology of plants is critical for the successful management of forest genetic resources because it helps 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 tropical rain forests are fast disappearing and degrading in recent times not only in India but also at global level. Obviously there is a need for scientific research 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 phytodiversity especially tree species because trees play a vital role in maintaining the ecological balance and improving the livelihood of peoples.

AREA AND LOCALITY

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

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, flowering and fruiting period of 73 tree species were surveyed and recorded.

PROJECT-3

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. One Field tour was undertaken to the states of Arunachal Pradesh and Meghalaya and 82 Field Numbers were collected. A total of 83 specimens of Genus *Pyrenula* were examined and identified into 11 species. Literature survey was carried out and a total of 132 species were listed under 4 genera viz. *Anthracothecium*, *Lithothelium*, *Pyrenula* and *Pyrgillus*. One Herbarium consultation tour was undertaken to Botanical Survey of India, Eastern Regional Centre, Shillong during which total of 204 specimens in 9 species of *Anthracothecium* Hampe and 32 species of *Pyrenula* Ach. were consulted.

AREA AND LOCALITY

India

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one field tour *w.e.f.* 1.3.2019 to 22.3.2019 was conducted to the states of Tamil Nadu and Kerala during which a total of 68 Field Numbers of family *Pyrenulaceae* and 14 Field Numbers of allied families were collected. A total of 157 specimens were examined and identified into 6 species of *Anthracothecium* and 26 species of *Pyrenula*.

ACHIEVEMENTS/ OUTCOMES

This study reports 23 species discovered as new to India [*Arthonia aciniformis* Stirt., *Arthonia nigratula* (Müll. Arg.) R. Sant., *Badimia cateilea* (Vain.) Lücking, Lumbsch & Elix, *Byssoloma catarinense* L.I. Ferraro & Lücking, *Byssoloma vanderystii* Sérus., *Coenogonium barbatum* Lücking, Aptroot & Umaña, *Coenogonium disciforme* Papong *et al.*, *Echinoplaca diffluens* (Müll. Arg.) R. Sant., *Eugeniella psychotriae* (Müll. Arg.) Lücking, Sérus. & Kalb, *Fellhanera pilomarginata* Lücking, *Fellhanera punctata* Lücking, *Gyalideopsis minutissima* Lücking, *Physcia fragilesceus* Zahlbr., *Porina foliicola* (Vězda) Lücking & Vězda, *Porina subnitidula* Colín & B. Peña, *Pseudopyrenula subnudata* Müll. Arg., *Sporopodium pilocarpoides* (Zahlbr.) Lücking & Kalb, *Sporopodium subflavescens* Lücking & Lumbsch, *Syncesia albiseda* (Nyl.) Tehler, *Tapellaria leonora* Cáceres & Lücking, *Tricharia santessoniana* Kalb & Vězda, *Trichothelium pallescens* (Müll. Arg.) F. Schill., *Trichothelium sipmanii* Lücking] and 23 species [*Amandinea diorista* (Nyl.) Marbach, *Arthonia palmulacea* (Müll. Arg.) R. Sant., *Aspidothelium scutellarpum* Lücking, *Bapalmuia*

palmularis (Müll. Arg.) Sérus., *Buellia betulinoidea* R. Schub. & Klem., *Buellia curatellae* Malme, *Byssolecania deplanata* (Müll. Arg.) R. Sant., *Byssolecania fumosonigrans* (Müll. Arg.) R. Sant., *Coenogonium subluteum* (Rehm) Kalb & Lücking, *Cratiria dissimilis* (Nyl.) Marbach, *Crocynia gossypina* (Sw.) A. Massal., *Echinoplaca pellicula* (Müll. Arg.) R. Sant., *Fellhanera bouteillei* (Desm.) Vězda, *Fellhanera rhapsidophylli* (Rehm) Vězda, *Glyphis scyphulifera* (Ach.) Staiger, *Heterodermia incana* (Stirt.) D.D. Awasthi, *Physcia clementei* (Turner) Lynge, *Physcia undulata* Moberg, *Porina appanata* Vain., *Porina karnatakensis* Makhija, Adaw. & Patw., *Strigula concreta* (Fée) R. Sant., *Tapellaria nigrata* (Müll. Arg.) R. Sant., *Tricharia vainioi* R. Sant. etc] as new records for Andaman and Nicobar Islands.

PROJECT-4

Ex-situ conservation of RET species of Andaman & Nicobar Islands and collection, introduction and multiplication of Orchids at Dhanikhari Garden cum Arboretum

Executing Scientist (s) : Dr. Sanjay Mishra

Date of Initiation : July, 2017

Date of Completion : March, 2019

OBJECTIVE

Survey, collection and introduction of the RET species with special emphasis on wild orchid species of Andaman and Nicobar Islands at Dhanikhari Experimental Garden cum Arboretum.

BACKGROUND

This project was initiated in 2017. During previous year, one field tour was conducted to Middle Andaman during which 42 species were collected along with photographs.

AREA AND LOCALITY

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

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, One exploration tour w.e.f. 05.01.2019 to 11.01.2019 was undertaken to North Andaman during which seeds/ seedlings/ of 51 RET species and plants of medicinal and economic importance were collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. The project is completed and the final report is under preparation.



Knema andamanica Warb. W. J. de Wilde

ARID ZONE REGIONAL CENTRE, JODHPUR

PROJECT-1

Flora of Navsari District, Gujarat

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

Date of Initiation : June, 2015

Date of Completion : March, 2020

OBJECTIVE

Preparation of a handbook of flowering plants of Navsari District, Gujarat.

BACKGROUND

The project was initiated in September 2015, during the previous year 06 field tours were under taken in different seasons during which 1871 field nos. were collected and a total of 784 species were identified.

AREA AND LOCALITY

Navsari district, Gujarat, 2211 sq. Km.

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one survey cum exploration tour w.e.f. 01.01.19-11.01.19 was conducted to Navsari District, Gujarat during which a total number of 138 field numbers were collected of which 334 species were identified along with taxonomical citation of 215 species were prepared; label writing of 1150 herbarium sheets for the Flora of Navsari District, Gujarat were also completed. In addition a Herbarium Consultation tour w.e.f. 28.09.18-06.10.18



Butea monosperma (Lam.) Taub.

was also undertaken to Botanical Survey of India, Western Regional Centre, Pune during which c. 500 specimens pertaining to Gujarat were consulted and 78 spp were identified.

ACHIEVEMENTS/ OUTCOMES

During this study, one species viz. *Bolboschoenus planiculmis* (F. Schmidt) T. V. Egorova (Cyperaceae) was recollected after a long gap.

PROJECT-2

Flora of Sariska Tiger Reserve, Alwar District, Rajasthan

Executing Scientist (s) : Dr. M.K. Singhadiya & Shri Ravi Prasad

Date of Initiation : April, 2015

Date of Completion : March, 2019

OBJECTIVE

Documentation of angiosperm diversity of Sariska Tiger Reserve, Alwar District of Rajasthan.

BACKGROUND

The project was initiated in 2015. During 2017-18, two field tours were conducted to study areas during which 119 field numbers were collected along with GPS data, field photographs and 151 field numbers were identified.

AREA AND LOCALITY

Sariska Tiger Reserve, Alwar District., Rajasthan c. 1213.33 sq. km



Martynia annua L.



A view of mixed forest, Sariska Tiger Reserve, Alwar, Rajasthan

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one botanical exploration tour *w.e.f.* 16.10.18 to 29.10.18 was conducted to the study area during which 104 field numbers were collected along with GPS data and digital photographs. In addition, one Herbarium Consultation tour *w.e.f.* 25.03.19 to 28.03.19 was conducted Herbarium, Department of Botany, University of Rajasthan, Jaipur (RUBL) during which morphological studies and listing of 262 Herbarium sheets of 85 plant species previously collected from Sariska Tiger Reserve, Alwar District (Rajasthan) were completed. Mounting and processing of the collected specimens are under progress. During these survey, three live plants of *Pandanus odorifer* & two live plants of *Moringa oleifera* were collected and introduced in the garden; collected and deposited four botanical artefacts *viz:* two Jhadu made up of *Phoenix sylvestris* and two Chhabadi made up of *Phoenix sylvestris* for museum. During this period, a total of 284 field numbers were identified and label writing of 440 herbarium sheets collected during previous explorations to Sariska was completed. The project is completed and the final report is under preparation.

PROJECT-3

Flora of Tadgarh-Raoli Wildlife Sanctuary, Rajasthan

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

Date of Initiation : June, 2015

Date of Completion : March, 2020

OBJECTIVE

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

BACKGROUND

The project was initiated in 2015. During previous year, one field tour was conducted to the study area during



Plumbago zeylanica L.

which a total of 244 field numbers were collected along with GPS data, of which 173 field numbers were identified to 173 species. Taxonomic description of 106 species was completed. In addition, one Herbarium Consultation tour was undertaken to DCH, Govt. Dungar College, Bikaner during which 2500 herbarium specimens belonging to 325 species were studied.

AREA AND LOCALITY

Tadgarh-Raoli Wildlife Sanctuary, Rajasthan; c. 495.27 sq.km.

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field exploration tours *w.e.f.* 30.08.18 to 11.09.18 and 21.02.19 to 08.03.19 were undertaken during which 282 field numbers were collected along with 10 live plant species. Taxonomic description of a total of 21 species was completed.

PROJECT-4

Floral Diversity of Jambhughoda Wildlife Sanctuary, Gujarat (India)

Executing Scientist (s) : Dr. Sriman Lal Meena

Date of Initiation : April, 2017

Date of Completion : March, 2020

OBJECTIVE

Study of floral diversity of Jambhughoda Wildlife Sanctuary, Gujarat

BACKGROUND

This project was initiated in 2017. During the year 2017-18, two botanical exploration tours were conducted and collected a total of 514 field numbers comprising of 1542 plant specimens of which 264 field numbers were identified.



Seseli diffusum (Roxb. ex Sm.) Santapau & Wagh



Anogeissus sericea var. *nummularia* King ex Duthie



Butea monosperma

AREA AND LOCALITY

Panchmahal and Chhota Udepur districts, Gujarat; c. 130.38 sq. km.

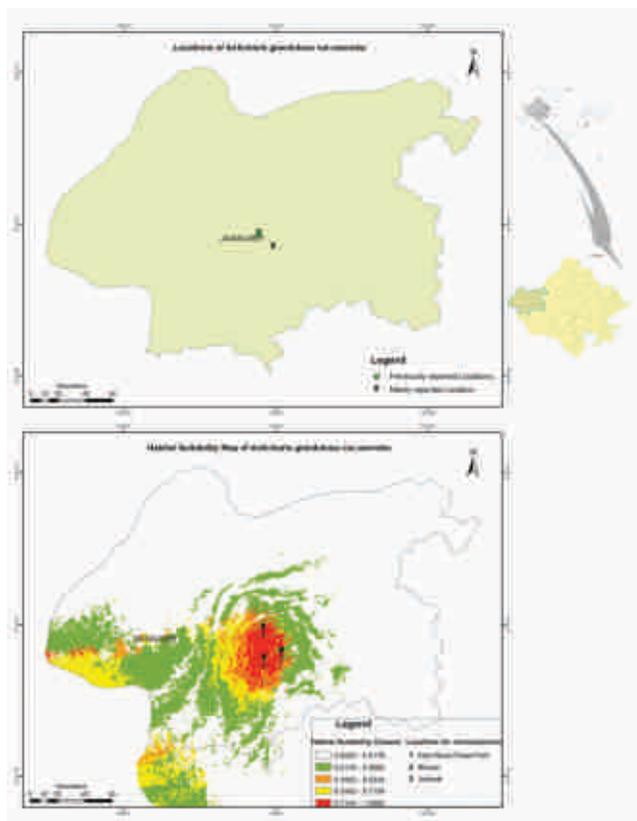
SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one botanical exploration tour *w.e.f.* 01.01.19 to 09.01.19 was conducted to the study area during which 89 field numbers comprising of 178 plant specimens were collected along with GPS data and digital photographs of almost each plant and vegetation types. During the period under report, a total of 210 field numbers were identified along with taxonomical citation of 50 species for the family Boraginaceae for Flora of India (vol.17).

PROJECT-5

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

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



Location map and habitat suitability map of *Anticharis glandulosa* Aschers. var. *caerulea* Blatt. & Hallb. ex Sant.

Ramesh Kumar

Date of Initiation : April, 2017

Date of Completion : March, 2020

OBJECTIVE

Conducting floristic survey in different vegetation types; collection, identification and documentation of all the collected plant species; mapping of vegetation types by using Remote Sensing and GIS; phytosociological data collection in all the vegetation types; ecological evaluation of the forest types including assessment of the existing threats; suggesting conservation strategies for Rare and Threatened species.

BACKGROUND

The project was initiated in 2017. During previous year, two field tours were conducted to the study area during which 539 field numbers were collected of which 230 species were identified. During field tour, 05 live plants were collected for ex-situ conservation and introduced in botanic garden, AZRC, Jodhpur.

AREA AND LOCALITY

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

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours *w.e.f.* 01.10.18 to 14.10.18. and 12.03.18-19.03.18 were conducted to the study area during which a total of 379 field numbers were collected of which 253 species were identified. During field survey, also gathered information of individuals of Rare & Threatened species with their associates and noted GPS points for mapping, collected 6 live plants of Rare and Threatened species for *ex-situ* conservation and introduced in botanic garden, AZRC, Jodhpur. Collected 41 quadrates (0.1 ha) were overlaid in different vegetation types and phytosociological data was recorded. Vegetation type & Land use map is prepared by using Sentinel-2 satellite data & GIS.

PROJECT-6

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

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

Date of Initiation : May, 2017

Date of Completion: March, 2020

OBJECTIVE

Preparation of distribution map of Endemic, Endangered and threatened species of Rajasthan by GIS mapping.

BACKGROUND

The project was initiated in 2017. During 2017-18, 03 botanical exploration tours were conducted to Desert National Park, Akal Fossil Park, Kapoordi & Jalipa Lignite mine, Jaisalmer District, Nagaur, Bikaner, Churu and Hanumangarh and collected 56 field numbers along with their geo-coordinates. 35 quadrates of 10 x 10m laid in 07 locations. A total of 26 field numbers were identified to 16 species along with completion of taxonomic description of 16 species.

AREA AND LOCALITY

Rajasthan; c. 3, 42,274 sq.km.

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19. one botanical exploration tour *w.e.f.* 18.09.18 to 24.09.18 was conducted to Mount Abu Wild Life Sanctuary, Sirohi and Sunda Mata, Jalore, covering c. 390 sq.km area including core region during which 100 collection numbers 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 species collected from the study area were

identified. Prepared 12 photo plates for the report. Documented 16 species. In addition, one Herbarium Consultation tour *w.e.f.* was conducted to BLATT (Blatter Herbarium, St. Xavir College, Mumbai) during which 35 Type specimens and 31 normal herbarium specimens were studied.

PROJECT-7

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

Executing Scientist (s) : Shri Vinod Maina, Dr. Ramesh Kumar, Dr. C.S. Purohit, Dr. M.K. Singhadiya, Dr. Peddi Harikrishna & Mr. Ravi Prasad

Date of Initiation :-

Date of Completion: Ongoing

OBJECTIVE

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

BACKGROUND

The experimental Botanic Garden (Desert Botanical Garden) of this centre has been established during 1994 with an area of c. 8 acres. The main objective of the garden 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 04 gymnosperms including of them are rare, endemic and economically plants are conserved in the garden. In addition, seeds of 14 species were collected for raising seedlings in nursery. Phenological data of existing plant species in the Botanic Garden was recorded throughout the year.

AREA AND LOCALITY

Rajasthan & Gujarat.

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, various field tours were conducted to Rajasthan and Gujarat during which a total number of 20 Rare and Threatened and 29 Medicinal plant species were collected and introduced in the Desert Botanical Garden. Besides, about 500 photographs were also taken.

ARUNACHAL PRADESH REGIONAL CENTRE, ITANAGAR

PROJECT-1

Fern Family Pteridaceae of India

Executing Scientist (s): Dr. Vineet Kumar Rawat

Date of Initiation : August, 2018

Date of Completion: March 2022

OBJECTIVE

Study of the Fern Family Pteridaceae of India

BACKGROUND

This is a new project. The family Pteridaceae is represented by 155 species within 19 Genera from India, of which 95 species (excluding *Pteris*) are reported from India.



Asplenium Yoshinagae



Thelypteris dentata

AREA AND LOCALITY

All states of India.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, Three field tours *w. e. f.* 29.01.19 to 07.02.19 and 17.03.19 to 27.03.19 were conducted to different parts of Meghalaya, Lower Dibang Valley, Siang, Tirap and Changlang, Arunachal Pradesh during which more than 500 field numbers were collected along with 367 photographs and GPS Data. In this period, 43 Live plants were also collected for conservation purpose. 325 field numbers of previously collected specimens were identified, field data incorporated in 123 herbarium sheets. Preliminary Report comprising of keys and description of 47 species fewer than 18 genera is under process. A total of 500 specimens were identified to 111 species and all the identified specimens were incorporated into the herbarium.

ACHIEVEMENTS/ OUTCOMES

This study reports two new species and four new records for the state of Arunachal Pradesh.

PROJECT-2

Flora of East Kameng District, Arunachal Pradesh

Executing Scientist (s): Dr. Umeshkumar L. Tiwari

Date of Initiation : August, 2015

Date of Completion: July, 2019



Impatiens khasiana



Hedychium efilamentosum Hand-Mazz. P4 BBT THAM

OBJECTIVE

Documentation of the floristic diversity of the vascular plants of East Kameng District, Arunachal Pradesh and highlighting the plant wealth of the district along with threats associated and relative conservation measures to be proposed.

BACKGROUND

This project was proposed in 2015. During previous year, four field tours were undertaken to Kasse bagang village in Chiyang Tajo block, Chiyang Tajo, Seppa to Pipu block, Loffa village, Pakhe Tiger Reserve, Upper Dibang Valley dist., along Talong river till Maliney and Dri River valley during which 455 field numbers were collected of which 252 field numbers were identified and description of 250 species were completed.

AREA AND LOCALITY

East Kameng District, Arunachal Pradesh

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, one Field tour *w.e.f.* 23.08.18 to 04.09.2018 was conducted to Chiyang Tajo, Pipu and Seppa block during which 221 field numbers were collected (498 accessions). In addition, one herbarium consultation tour was conducted to ASSAM, 78 unidentified specimens were identified and determinate was placed on sheets. 579 species were identified among 628 filed numbers and description of 571 species were completed. The project is completed and the final report is under preparation.

ACHIEVEMENTS/ OUTCOMES

This study reports two new additions to the Flora of India and five new record for the state of Arunachal Pradesh.

PROJECT-3

Red listing of orchids of Arunachal Pradesh as per IUCN criteria

Executing Scientist (s): Dr. Krishna Chowlu

Date of Initiation : April, 2015

Date of Completion: March, 2020

OBJECTIVE

Resolving the taxonomy and nomenclature of Orchids of Arunachal Pradesh, evaluation of their population in natural habitats, studying of herbarium specimens of Arunachal Orchids in respect of their identity, localities, assigning geo-coordinates and entry in the excel sheet for mapping, survey in different districts of Arunachal and introduction of the live specimens in the campus for further studies and *ex-situ* conservation.

BACKGROUND

This project was initiated in 2015. During 2017-18, two field tours were undertaken to West Kameng, Tawang Dist., Dibang Valley dist., Arunachal Pradesh during which 109 field numbers were collected of which 32 specimens were taxonomically worked out. Germplasm of 50 field numbers was introduced in the campus for *ex-situ* conservation. During field survey, several orchid species were rescued from fallen trees in and around Itanagar.

AREA AND LOCALITY

Arunachal Pradesh

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, one field tour *w.e.f.* 26



Galeola falconeri Hk.f. P5 BBT Tham

BOTANIC GARDEN OF INDIAN REPUBLIC, NOIDA

PROJECT-1

Collection of plants introduction in BGIR

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

Date of Initiation : 2017 – 18

Date of Completion: Ongoing

SUMMARY OF THE WORKDONE DURING 2018-19& ACHIEVEMENTS/ OUTCOMES

During 2018-19, 45 tree species of about 3500 plants and 42 species of about 5100 plants were collected from Local Forest Dept Nurseries, BSI-ARC, Jodhpur,

Rajasthan and BSI, NRC, Dehradun respectively, Delhi State Forest Dept. Besides above, about 8000 plants of 60 species of trees, shrubs, herbs as well as ornamental plants were collected from local Forest Nurseries of NCR, Sonapat, Meerut, Saharanpur, U.P., about 25 species from wild and 40 species (including 5 bamboo and 8 species of grasses) from various forest nurseries of Uttarakhand were procured during field visit in Uttarakhand. Wild species collected are being acclimatized in nursery bed and will be introduced in the garden.

PROJECT-2

Development of Database of Introduced Plants (Trees) of BGIR, Noida

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

Date of Initiation: 2017 – 18

Date of Completion: Ongoing

SUMMARY OF THE WORKDONE DURING 2018-19& ACHIEVEMENTS/ OUTCOMES

During 2018-19, database of 25 tree species was completed, which were prepared as per the standard format depicting: taxonomic classification, habit, habitat, morphology of leaf, flower, fruit, seed, seed germination methodology and economic uses.

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. Manish K. Kandwal

Date of Initiation : 2017-18

Date of Completion : Ongoing

SUMMARY OF THE WORKDONE DURING 2018-19& ACHIEVEMENTS/ OUTCOMES

During 2018-19, phenological data of 65 species was recorded in respect of flowering period, fruiting and seed setting as per standard format.



Arboretum of BGIR



Net house in BGIR

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. Manish K. Kandwal

Date of Initiation : 2017-18

Date of Completion : Ongoing

SUMMARY OF THE WORKDONE DURING 2018-19& ACHIEVEMENTS/ OUTCOMES

During 2018-19, 28 threatened and endemic plant species were collected from the Lead & Small Botanic Gardens and placed in conservatories for acclimatization. A RET species plant block was prepared for conservation of about 80 RET plants to be collected in RET block of BGIR Noida. A total of 19 live plants/seeds of threatened (IUCN categorised) species were collected from Shivaji university Kohlapur, Tehri, Uttarakhand and AJC Bose IBG, Howrah for multiplication in Botanic garden.



Hilgardia populifolia conservation of a threatened species

CENTRAL BOTANICAL LABORATORY, HOWRAH

PROJECT-1

Survey and documentation of economical and ethnobotanical uses of endemic trees of India

Executing Scientist(s): Dr. Sujana K.A. & Mr. R. Saravanan

Date of Initiation : April, 2016

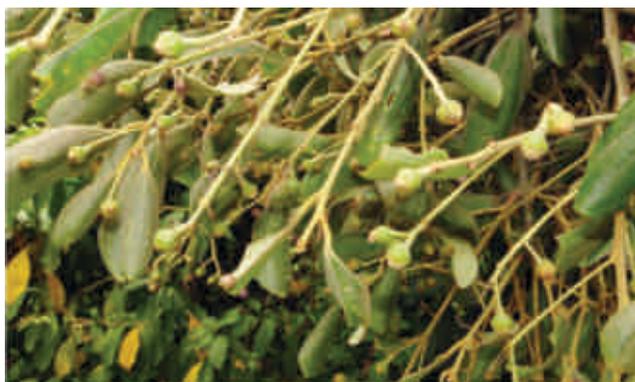
Date of Completion : March, 2019

OBJECTIVE

Survey and documentation of economical and ethnobotanical uses of endemic trees of India

BACKGROUND

This project was proposed in 2016 to study the endemic trees of India with special emphasis on documenting traditional knowledge & ethnobotanical data and making a comprehensive account on economic and ethnobotanical information on endemic trees of India. So far 05 field tours were conducted and 695 field numbers were collected with 950 ethnobotanical data.



Cinnamomum sulphuratum



Atuna travancorica

AREA AND LOCALITY

India

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 09.07.18 to 18.07.18 and 29.10.2018 to 05.11.2018 were carried out to Western Ghats and North East India respectively during which 162 field numbers were collected of which 241 field numbers were identified (including previously collected specimens). Field data of 64 endemic trees collected from Western Ghats & North East India was documented. A total of 242 ethnobotanical information along with 320 field photographs were documented during this period. A Library and Herbarium consultation was also conducted in ERC, BSI Shillong for collection of secondary data and documented 26 economic uses of endemic trees of India. The project is completed and the final report is under preparation.

ACHIEVEMENTS/ OUTCOMES

During this study, a total of 242 ethnobotanical information was documented (Medicine-68, edible-52, fibre/rope-15, fodder-28, furniture- 18, agriculture implements/tools - 12, timber - 13, fuel- 24, oil/dye/resin/gum-12).

PROJECT-2

Ethnobotanical study of some tribal populated districts of Bihar, India

Executing Scientist (s) : Dr. Harish Singh, Dr. Monika Mishra & Dr. P.A. Dhole

Date of Initiation : April, 2018

Date of Completion : March, 2022

OBJECTIVE

The project was proposed to undertake a detailed ethnobotanical study of some highly populated districts of Bihar with objectives as Folklore survey and field work in highly tribal populated areas and nearby forests; collection, identification and documentation of traditional knowledge about plants and preparation of inventories of folklore plants. Comparative study with already published literature and live collection of rare and important ethnobotanical plants for *ex-situ* conservation.

BACKGROUND

Bihar, covering 5,720 sq. km of total forest cover, including 3,372 sq. km dense forests and 2,348 sq.km open forest, is an ideal State from ethnobotanical point of view, has rich in floristic as well as in ethnic diversity. The State is inhabited by 28 tribal groups (Asur, Baiga, Bathudi, Bedia, Birhor, Chero, Gond, Ho, Karmali, Kharia, Kharwar, Khond, Munda, Oraon, Paharia, Santal, Savar etc with a total population of 7,58,351 tribes. These tribes are mainly depends on agriculture and working in various Government and private sectors for earning their livelihood. Various papers have been published on several aspects of Ethnobotany on undivided Bihar, but presently most of the area falls under the jurisdiction of Jharkhand. Only few sporadic ethnobotanical papers have been published by some workers (Singh & al., 2013); (Singh & al., 2015); (Sudha & al., 2015) mainly confined on general ethnobotany of Bihar. Thus the project was proposed to thoroughly study ethnobotanical aspects related to tribal population.

AREA AND LOCALITY

Bihar

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, a library consultation tour *w.e.f.* 07.10.2018 to 13.10.2018 was undertaken to Tribal Research Institute (TRI), State Library, L. P. Vidyarthi Library and Jharcraft, Ranchi during which a total of 139 ethnobotanical references pertaining to Ethnobotany and tribals of Bihar and Jharkhand were collected and documented. About 921 high quality digital photos of the pages of literature were taken.

PROJECT-3

Ethnobotanical Survey on Jamui and Banka districts

Executing Scientist (s) : Dr. Sujana, K. A., Sri. A.C. Halder & Sri. R. Saravanan

Date of Initiation : April 2018

Date of Completion : March 2019

OBJECTIVE

Survey of ethnobotanical knowledge of Jamui and Banka districts

BACKGROUND

Literature survey revealed that only scattered ethnobotanical work done in two-three tribal pockets in the districts of Jamui and Banka (Upadhyay & al., 2008). Major tribes of the districts are Santal, Oraon, Gond, Kharwar and Munda. The total population of Jamui dist. is 1,760,405 of which tribal population represents 78,793.

The total population of Banka district is reported as 2,034,763 with tribal population 90,432.

AREA AND LOCALITY

Jamui (c. 3122 sq.km) and Banka districts (3019 sq.km.), Bihar

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, an ethnobotanical field tour *w.e.f.* 27.09.2018 to 07.10.2018 was conducted to Jamui and Banka Forest Divisions of these districts and surveyed. Tribal populated areas and villages of all the forest ranges of both the Forest Division were visited. A total of 166 field numbers were collected along with duplicate voucher specimens which were poisoned, dried and mounted. Altogether 152 plant specimens were identified and documented with GPS recorded data of 44 different locations. 180 photographs of different plant specimens and tribal habitation were taken up.

ACHIEVEMENTS/ OUTCOMES

This study reports ethnobotanical importances of *Aerva lanata*, *Alstonia scholaris*, *Hibiscus cannabinus* collected from the study area. During this field tour, 166 field numbers with 190 ethnobotanical information were documented (Medicine-135; Edible-22; Broom-4; Fodder-4; Insect repellent-4; Furniture-3; Rope-3; Dye-2; and 16 other purposes). The project is completed and the final report is under preparation.

PROJECT-4

Ethnobotanical Survey on Kaimur and Rohtas districts of Bihar, India

Executing Scientist (s) : Dr. Harish Singh, Dr. Monika Mishra & Dr. P. A. Dhole

Date of Initiation : April 2018

Date of Completion : March 2019

OBJECTIVE

Ethnobotanical survey of Kaimur and Rohtas districts of Bihar, India

BACKGROUND

Kaimur (Bhabua) District is one among 38 Districts of the state of Bihar with population (c. 16, 26,900). The district covers an area of c. 3332 sq.km. The hilly area of the district comprises of Kaimur plateau. The district Rohtas covers an area of about 3847.82 sq. km. with 29, 59,918 population (Census, 2011). The tribal population of Kaimur is 35,662 and Rohtas is 25,663.

AREA AND LOCALITY

Kaimur (3362 sq. km.) and Rohtas districts (3847.82 sq.km.), Bihar

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, a field tour *w.e.f.* 14.11.2018 to 28.11.2018 was undertaken to various tribal localities of Kaimur and Rohtas districts of Bihar and total 129 tribal villages and forest areas of Kaimur and Rohtas was surveyed during which 222 field numbers of specimens were collected with a total of 438 ethnobotanical information and more than 450 good quality digital photographs. A total of 8 exhibits collected for ethnobotanical museum.

ACHIEVEMENTS/OUTCOMES

This study reports one new record for the state of Bihar [*Abutilon pannosum* (G.Forst.) Schltl. (Malvaceae)]; ethnobotanical uses of *Agave Americana* and *Dendrophthoe falcate* in the tribal populated villages of Kaimur and Rohtas districts. In this period, a total of 222 field numbers of specimens were collected with a total of 438 ethnobotanical information (Medicine – 197; Edible – 53; Fodder – 28; Veterinary – 17; House Hold Articles – 20; Timber/Wood – 14; Fiber/Rope – 12; Thatching Huts – 12; Magical-belief – 12; Gum – 7; Tooth Brush – 7; Fish Poison – 7; Oil – 7; Broom – 6; Religious – 5; Dye – 5; Fuel – 3; Insecticide – 3; Alcoholic drink – 2; Bio-fencing - 2; Mat – 2; Detergent – 2; Basketry – 1; Bio-Diesel – 1; Rain Coat-1; Plates – 1; Beedi (country made cigarettes) – 1; other purposes – 10). The project is completed and the final report is under preparation.

PROJECT-5

Ethnobotanical Survey West Champaran district of Bihar, India

Executing Scientist (s) : Dr. Harish Singh, Dr. Monika Mishra & Dr. P.A. Dhole

Date of Initiation : April 2018

Date of Completion : March 2019

OBJECTIVE

Ethnobotanical Survey of tribal populated villages of West Champaran district of Bihar

BACKGROUND

West Champaran district is confined by Hilly region of Nepal on North, Gopalganj & part of Purbi Champaran District on South, Purbi Champaran District on East and Padrauna & Deoria District of Uttar Pradesh on West. The total area of the District is 5,228 sq. km. and has 3 subdivisions, 18 blocks and 1483 Villages with a total population of 39, 35,042. West Champaran district has very rich tribal population (44,912) out of total tribal population of Bihar (7.5 Lakh). After through survey of the available ethnobotanical literature it is found that only few ethnobotanical publications pertain to West

Champaran District. Keeping this in mind the project was initiated in 2018.

AREA AND LOCALITY

West Champaran District, Bihar; c. 5229 sq. km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, a field tour *w.e.f.* 05.01.19 to 17.01.19 was conducted to various tribal localities of West Champaran district of Bihar during which 108 tribal villages and forest areas of Mangurah, Gobardhana, Harnatand, Gonauli, Valmikinagar, Madanpur, Naurangia Don Forest Ranges of West Champaran district (approximate of 3,500 sq. km) was visited and a total of 247 field numbers of specimens were collected along with 405 ethnobotanical information, more than 540 good quality digital photographs/ video and 08 museum exhibits. Bulk collection of 02 plants (*Artemisia nilagirica*, *Clausena kanpurensis*) was made and supplied to chemistry section for phytochemical analysis.

ACHIEVEMENTS/OUTCOMES

This study reports ethnobotanical uses of *Clausena kanpurensis*, *Vernonia amygdalina* and *Artemisia nilagirica* among tribal populations of the villages of West Champaran district. During this period, a total of 247 field numbers of specimens were collected with a total of 405 ethnobotanical information (Medicine – 128; Edible – 95; Fodder – 39; Fuel – 15; Religious – 13; Tooth Brush – 13; Bio-fencing -09; Broom – 09; Fiber/Rope – 09; House Hold Articles – 09; Building Materials – 08; Mat – 07; Magical-belief – 06; Beverages – 05; Thatching Huts – 05; Veterinary – 05; Fish Poison – 04; Agricultural Implements – 04; Basketry – 04; Dye – 02; Plates & Bowls – 02; Insecticide – 01; Detergent – 01; other purposes – 12). The project is completed and the final report is under preparation.

PROJECT-6

Chromosome count of Genus *Impatiens* of Sikkim/Darjeeling

Executing Scientist (s) : Dr. (Mrs.) Monika Mishra

Date of Initiation : September, 2018

Date of Completion : March, 2022

OBJECTIVE

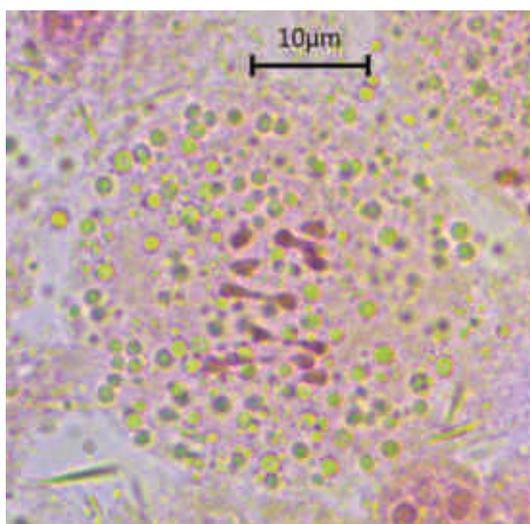
Chromosome count of 4-5 *Impatiens* species of the area to be studied (materials to be provided by Dr. R. Gogoi)

BACKGROUND

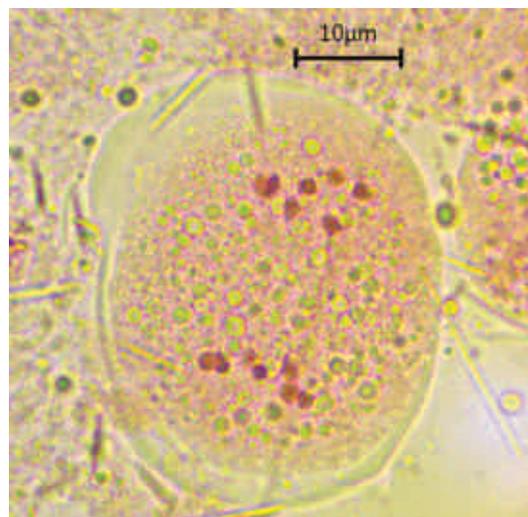
The genus *Impatiens* belongs to the family Balsaminaceae and occurs mostly in tropical and subtropical regions growing in moist and shady places. In India, it is distributed well in Western Himalayas (North India), the



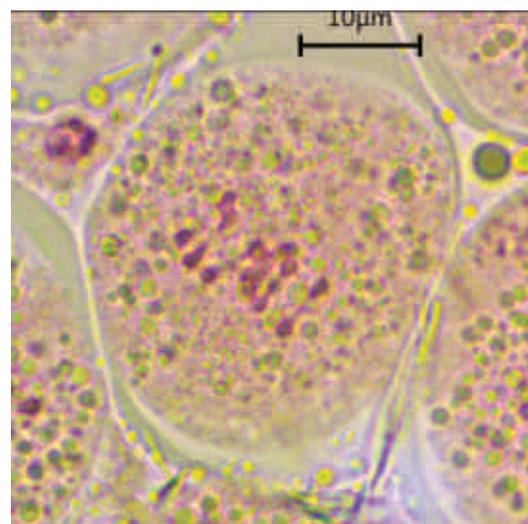
Impatiens falcifera



PMC showing 7 bivalents at Metaphase I



PMC showing equal segregation of chromosomes at Anaphase I



PMC showing 7 bivalents at Metaphase I

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. According to Jones and Smith (1966), the Himalayan region represents the centre of origin of the genus. However, the cytological information on Himalayan *Impatiens* is scanty. As per the available literature so far, this genus vary cytologically. Numerous aneuploid and euploid series are found in this group ranging in gametic chromosome number from $n=3$ to $n=33$ in which $n=7$, 8 and 10 are most common and the species having these numbers are mainly concentrated in Indo-Himalayan region (Western Himalayas). 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 was undertaken.

AREA AND LOCALITY

Sikkim and Darjeeling States

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, Cytological investigations through Meiotic studies of 05 *Impatiens* species were carried out: In *Impatiens stenantha* chromosome number $n=9$ and in *Impatiens falcifera* chromosome number $n=7$ was noticed. In case of *Impatiens arguta*, *Impatiens tripetala* and *Impatiens gammae* chromosome number could not be studied because no active cell division was found in collected material.

ACHIEVEMENTS/ OUTCOMES

During this study, chromosome count of 02 *Impatiens* species i.e., *Impatiens stenantha* ($n=9$) and *Impatiens falcifera* ($n=7$) were completed.

CENTRAL NATIONAL HERBARIUM, HOWRAH

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

Revision and documentation of the genus *Impatiens* (Balsaminaceae) in Sikkim & Darjeeling Himalayas.

BACKGROUND

The project was started from March 2017. During



Impatiens infundibularis Hook.f.



Impatiens kathmaduensis Grey-Wilson

previous year, two field tours and one Herbarium consultation tour were undertaken and determined 28 species; SEM imaging of seeds was done for 07 species of *Impatiens* collected in last 2 tours to Sikkim.

AREA AND LOCALITY

Whole state of Sikkim and Darjeeling and Kalimpong area.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 10.08.18-26.08.18 and 21.11.18-05.12.18 were undertaken to Sikkim and Darjeeling Himalaya covering c. 2400 sq. Km area during which 22 species were collected and identified alongwith 1800 photographs of plants, vegetations, habit and habitat etc. Some of the identified species are *Impatiens spirifera*, *Impatiens stenantha*, *Impatiens jurpia*, *Impatiens arguta*, *Impatiens pradhanii*, *Impatiens drepanophora*, *Impatiens pulchra*, *Impatiens graciliflora*, *Impatiens puberula*, *Impatiens longipes*. Besides, 14 species namely *Impatiens arguta*, *I. stenantha*, *I. discolor*, *I. racemose*, *I. exilis*, *I. tripetala*, *I. drepanophora*, *I. scabrida*, *I. gammae*, *I. sulcata*, *I. radiata*, *I. falcifera*, *I. spirifera* and *I. pulchra* were collected for Cytological study.

ACHIEVEMENTS/ OUTCOMES

During this study, three species [*Impatiens longipes* (Darjeeling), *I. infundibularis* (Darjeeling), *I. sikkimensis* (Kalimpong)] collected after type collection/more than 100 years. In addition, four names (*Impatiens acuminata*, *I. citrina*, *I. tropeolifolia* and *I. duclouxii*) were also lectotypified.

PROJECT-2

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

Executing Scientist (s) : Drs. Vinay Ranjan, Anant Kumar and Gopal Krishna

Date of Initiation : April, 2016

Date of Completion : March, 2021

OBJECTIVE

Study of diversity of Angiosperm flora of Neora Valley National Park, Darjeeling district.



Begonia xanthina Hook.



Clematis gouriana Roxb. ex DC.

BACKGROUND

This project was initiated in 2016. During previous year, one field tour was conducted to the study area during which 94 field numbers were collected of which 44 species were identified.

AREA AND LOCALITY

Darjeeling District, West Bengal; c. 159 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, three field tours *w.e.f.* 27.09.18 to 09.10.18, 06.12.18 to 18.12.18 and 27.03.19 to 09.04.19 were undertaken to Reshit Beat, Lava 7, 8, Rolbong 3, Rashet 1, 2, 54, 5, 3C, 3B, Ambiok beat, Doley beat, Kuwapani, Samsing, Ashaley camp, Samsing-17, Sakam beat, Gogune Camp, Jorphokhri, Mouchaki-4, Mouchaki-3 and Mouchaki-14 during which a total of 477 field numbers were collected of which 238 field numbers were identified.

ACHIEVEMENTS/ OUTCOMES

This study reports one species as new to science (*Ceropegia* sp.) and one new record for India (*Epipogium japonicum* Makino.).

PROJECT-3

Flora of Udaipur Wildlife Sanctuary, West Champaran, Bihar

Executing Scientist (s) : Dr. O.N. Maurya, Saurabh Sachan and Anand Kumar

Date of Initiation : April, 2017

Date of Completion : March, 2019

OBJECTIVE

Survey and documentation of floristic diversity of Udaipur Wildlife Sanctuary, West Champaran, Bihar.

BACKGROUND

This project was started in 2017. During 2017-18, one field tour was conducted to the study area during which 102 field numbers were collected of which 49 species were identified.

AREA AND LOCALITY

Udaipur Wildlife Sanctuary, West Champaran, Bihar; c. 8.86 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 18.06.18-27.06.18



Rauwolfia serpentina (L.) Benth. ex Kurz



Cynoglossum wallichii G. Don

and 22.09.18-30.09.18 were conducted to the study area during which 147 field numbers were collected of which 85 species were identified. Taxonomic enumeration of 128 species were prepared. The project is completed and the final report is under preparation.

ACHIEVEMENTS/ OUTCOMES

Two species (*Rauvolfia serpentina* and *Vanda tessellata*) listed in CITES were collected during the field tours

PROJECT-4

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

Executing Scientist (s) : Dr. Avishek Bhattacharjee

Date of Initiation : April, 2017

Date of Completion : March, 2020

OBJECTIVE

Revision of the genus *Gastrochilus* D. Don (Orchidaceae) for 'Flora of India'.

BACKGROUND

The genus *Gastrochilus* D. Don is represented by c. 53 species distributed from India to Japan and in India it is represented by 23 species. No comprehensive work/revisionary study is done on the genus in Indian context. The identification, nomenclature and affinity of the members of Indian *Gastrochilus* are some of the major problems for the researchers. In this milieu the revisionary study on Indian member of the genus *Gastrochilus* is an attempt to provide an up to date and comprehensive taxonomic account based on critical study of fresh and preserved specimens (herbarium/pickled specimens) and available authentic literature.

AREA AND LOCALITY

Indian context

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one field-cum-herbarium consultation tour was conducted in West district of Sikkim and Darjeeling district of West Bengal in March, 2019. Herbarium of the Lloyd Botanical Garden, Darjeeling was consulted during this tour where 22 specimens belonging to the genus were studied and specimens (1 each) of *G. calceolaris* and 2 specimens of *G. distichus* were identified. Taxonomic accounts of 6 species [*Gastrochilus acaulis*, *G. calceolaris*, *G. distichus*, *G. intermedius*, *Gastrochilus nilagiricus*, *G. pseudodistichus*] were prepared during this period.

PROJECT-5

Flora of Betla National Park, Latehar, Jharkhand

Executing Scientist (s) : Shri Partha P. Ghoshal

Date of Initiation : April, 2015

Date of Completion : March, 2019

OBJECTIVE

Thorough exploration of the protected area for a comprehensive floristic assessment; preparation of herbarium specimens and identification of all the voucher specimens collected during field surveys; recording the habitat, phenology and distribution; making a list of RET (Rare, Endangered and Threatened) taxa from the area and their documentation.

BACKGROUND

The project was initiated in 2015. During previous year, one field tour was conducted to the study area during which 300 plant specimens under 125 field numbers were collected among which 60 taxa were identified.

AREA AND LOCALITY

Betla National Park, Latehar district, Jharkhand; c. 226 sq. km.

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one field tour *w.e.f.* 10.09.18-23.09.18 was conducted to different forest blocks of Baresand, Maromar, Ramandag, Saidhup and Betla forest ranges during which a total of c. 400 specimens under 185 field numbers were collected along with 3700 field photographs pertaining to the habitat and habit of plants; close up of leaves, flowers, fruits and landscape vegetation. Identified 128 species during that period and made description of 112 species. The project is completed and the final report is under preparation.

ACHIEVEMENTS/ OUTCOMES

During this study, live 'White Nelumbo' was collected from the study area and introduced in AJCBIBG.



Eranthemum purpurescens Wight ex Nees

CENTRAL REGIONAL CENTRE, ALLAHABAD

PROJECT-1

Floristic diversity of Kishanpur Wildlife Sanctuary, Lakhimpur Kheri, UP

Executing Scientist (s) : Dr. G.P. Sinha & Vineet Kr. Singh (Re-allotted in 2018)

Date of Initiation : April, 2016

Date of Completion : March, 2019

OBJECTIVE

Estimating floristic wealth of Kishanpur Wildlife Sanctuary, Lakhimpur Kheri, U.P.

BACKGROUND

The project, was planned to make inventory of floral diversity and to study of endangered and endemic species of the area, initiated in 2016. During previous year, one field tour was conducted to the study area



Dovyalis caffra Warb.



Helicteres isora L.

during which 580 field numbers were collected of which 262 species were identified.

AREA AND LOCALITY

Kishanpur Wildlife Sanctuary, Lakhimpur Kheri, UP

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 361 species were identified and documented from the area. Manuscript preparation is under process. The project is completed and the final report is under preparation.

PROJECT-2

Cyto-taxonomical studies of selected taxa of Indian subtribe *Cassiinae* Irwin & Barneby

Executing Scientist (s): Dr. Ashutosh Kumar Verma

Date of Initiation : April, 2017

Date of Completion: March, 2019

OBJECTIVE

Study of cytology of the subtribe *Cassiinae*

BACKGROUND

This project was initiated in 2017. During previous year, more than 25 local field trips were conducted for collection of suitable plant materials for cytological investigation and collected a total of 49 field numbers along with 150 field photographs. 09 species of subtribe *Cassiinae* were cytologically worked out.



Sarcographa difformis (Vain.) Zahlbr.

AREA AND LOCALITY

Various locations of India where species of subtribe *Cassiinae* are available

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, for collection of requisite plant material for cytological investigations 03 field tours were undertaken during which About 250 photographs of plants and forest views were taken. Eight species of subtribe *Cassiinae* were cytologically worked out (*Cassia javanica* var. *indochinensis* (28) *Chmaecrista absus* (2n=28); *C. pumila*; *C. mimosoides* (L.) (2n=28), *S. alaxandrina* (2n=28); *S. hirsuta*; *S. italica* (2n=28); *Senna polyphylla* (Jacq.); *S. surattensis* var. *glauca*; *S. sophera* and data on various cytological parameters were also recorded. 'Cytological Voucher Specimens, (CVS) of worked out species were also prepared. A reciprocal cross was also performed between *Senna tora* and *S. obtusifolia* and observation were recorded.

ACHIEVEMENTS/ OUTCOMES

During 2018-19, a reciprocal cross was also performed between *Senna tora* and *S. obtusifolia* and observation were recorded. The project is completed and the final report is under preparation.

PROJECT-3

Identification of Old unidentified specimens of BSA

Executing Scientist (s) : All the scientific officials of BSI, CRC, Allahabad

Date of Initiation : Ongoing

Date of Completion: Ongoing

OBJECTIVE

Identification of old unidentified specimens available in the herbarium (BSA)

BACKGROUND

This is an ongoing project.



Hiptage benghalensis (L.) Kurz



Mallotus philippensis (Lam.) Müll.Arg.

AREA AND LOCALITY

Entire jurisdiction of Central Regional Centre, Allahabad, viz. Chhattisgarh, Madhya Pradesh and Uttar Pradesh.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 320 old specimens were identified. Besides, the entire Herbarium was reorganized according to Genera Plantarum to accommodate over 15000 additionally identified specimens of different families.

PROJECT-4

Phenological studies of existing plant species in the botanic garden of CRC

Executing Scientist (s) : Dr. Sheo Kumar & Sri Vineet Kr. Singh

Date of Initiation : On going

Date of Completion : On going

OBJECTIVE

Month-wise compilation of generated data as per field observation and reporting.

BACKGROUND

Phenology is described as an art of observing life cycle phases or activities of plants and animals in their temporal occurrence throughout the year (Lieth, 1974). This is an ongoing project and was proposed to record field data of flowering and fruiting.



Clerodendrum chinense (Osbeck) Mabb.

AREA AND LOCALITY

The jurisdiction of Central Regional Centre, Allahabad, viz. Chhattisgarh, Madhya Pradesh and Uttar Pradesh.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, for phenological studies, walk-over survey of whole Botanic Garden of CRC was undertaken in every month from April, 2018 to March, 2019 and live plants with mature flowers and fruits were photographed for record. The specimens were identified consulting relevant literatures, previously identified species, web pages and month-wise total number of studied plant species for phenological data were recorded.

ACHIEVEMENTS/ OUTCOMES

The phenological data of 1703 plants were recorded from April 2018- March 2019.

PROJECT-5

Updation of families Valerianaceae and Dipsacaceae under Flora of India, Vol. 14

Executing Scientist (s): Dr. Arti Garg

Date of Initiation : October, 2018

Date of Completion : March 2019

OBJECTIVE

Documentation of the Indian species of families Valerianaceae and Dipsacaceae for Flora of India, Vol. 14.

BACKGROUND

India, a rich centre of botanical wealth, is with c. 18532 species of angiosperms, comprising 37.13% of the Indian flora. Survey and documentation of the flora of India is an objective of the BSI and in this light, two families, Valerianaceae and Dipsacaceae were worked out for detailed description of component species and/or infraspecific taxa, if any, nomenclature, flowering and fruiting season, distribution, ecological notes and uses.

AREA AND LOCALITY

India

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, updation of the families Valerianaceae and Dipsacaceae were completed for the Flora of India, Volume 14. The family Valerianaceae comprises of 4 genera, 22 species and 4 varieties [viz. *Nardostachys jatamansi*; *Patrinia monandra*; *Valeriana assamensis*, *V. beddomei*, *V. clarkei*, *V. hardwickii* var. *hardwickii*, *V. hardwickii* var. *arnottiana*, *V. himachalensis* etc] and the family Dipsacaceae comprises of 4 genera and 14 species [viz. *Dipsacus asper*, *D. atratus*, *D. inermis*, *D. leschenaultii*, and *D. strictus*; *Morina betonicoides* etc.]. All species were updated for their nomenclature, distribution, flowering and fruiting time, ecology, nomenclatural notes and uses (if any). Taxonomic keys to Genera and species were prepared. The project is completed.

PROJECT-6

Floristic Diversity of Alwara Wetland, Kaushambi, Uttar Pradesh, India

Executing Scientist (s): Dr. G.P. Sinha & Vineet K. Singh

Date of Initiation : April 2018

Date of Completion : March 2019

OBJECTIVE

Documentation of the Floristic diversity of the Alwara Wetland in Kaushambi of Uttar Pradesh, India

BACKGROUND

Wetlands are the lands saturated with water for most part of the year, and are recurrently flushed with water during floods and rains which keeps the soil water saturated for almost throughout the year. These serve as water recharge zones and possess highly fertile soil, most suited for agriculture. Due to the suitable soil conditions these regions possess a good biodiversity. The present area of Alwara wetland was selected to inventorize the plant diversity.

AREA AND LOCALITY

Alwara Wetland, Kaushambi, Uttar Pradesh; c. 7.5 sq.km.



Ochna thomasiana Engl. & Gilg

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours were conducted to the Alwara wetland during which 167 field numbers were collected of which 85 were identified into their respective species. The taxonomic description of 20 species were completed. Among these some species namely *Biophytum sensitivum*, *Martynia annua*, *Cardiospermum halicacabum*, *Neptunia oleracea* etc. are of special significance.

PROJECT-7

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

Executing Scientist (s): Dr. Nitisha Srivastava

Date of Initiation : April, 2018

Date of Completion : March, 2021

OBJECTIVE

Study of the seed and epidermal features of the species belonging to the family Acanthaceae available at BSA.

BACKGROUND

It is a new project. This project was proposed to study epidermal features of leaves and seeds of species belonging to family Acanthaceae at BSA.

AREA AND LOCALITY

The jurisdiction of Central Regional Centre, Allahabad, viz. Chhattisgarh, Madhya Pradesh and Uttar Pradesh.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, literature consultation on family



Suregada multiflora (A.Juss.) Baill.

Acanthaceae and SEM techniques were completed. Epidermal details of both surfaces of leaves of 8 species viz. *Justicia adhatoda*, *Barleria cristata*, *Barleria gibsonii*, *Barleria prionitis*, *Barleria strigosa*, *Andrographis paniculata*, *Andrographis echoides*, *Crossandra infundibuliformis* were studied in SEM and a comprehensive account of epidermal features was prepared. In addition, seed epidermal details of 4 species viz. *Barleria strigosa*, *Barleria prionitis*, *Andrographis paniculata*, *Andrographis echoides* was studied in SEM.

PROJECT-8

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

Executing Scientist (s): Dr. Brijesh Kumar

Date of Initiation : April, 2016

Date of Completion: March, 2020

OBJECTIVE

Revision of the genus *Adiantum* L. in India

BACKGROUND

The project was initiated in 2016. During previous year, two Herbarium Consultation tours were undertaken to CAL and BSA during which 472 specimens were examined among which identity of 396 were reconfirmed, 76 were determined. A checklist of 38 taxa was updated.

AREA AND LOCALITY

India

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, one field tour was conducted to Anusuiya Devi, Rudranath, Mondal and Chopta areas in

Chamoli and Rudraprayag Districts during which 110 field numbers were collected. Five species were described some of which are *Adiantum concinnum*, *A. caudatum*; *A. flabellulatum*; *A. myriosorum*; *A. latifolium* etc. Nomenclature updation of five taxa [*A. caudatum* var. *edgeworthii*, *A. assamicum*, *A. lomesam*, *A. ramyam* etc.] was completed along with with distribution data/Notes of 11 species [*A. concinnum*, *A. flabellulatum*, *A. tenerum*, *A. caudatum* etc.]. In addition, 324 specimens were studied during Herbarium Consultation tour to BSHC, ARUN, ASSAM and Gauhati Univ. Herbarium (GUBH).

ACHIEVEMENTS/ OUTCOMES

During this study, typification of two name viz. *Dryopteris redactopinnata* S.K. Basu & Panigrahi (Neotype) and *Athyrium falcatum* Bedd. Was done. Seven (07) species of pteridophytes viz., *Cyathea spinulosa*, *Peranema cyatheoides*, *Athyrium micropterum*, *Polystichum lentum*, *Polystichum stimulans*, *Selaginella involvens*; two (02) species of orchid viz. *Dendrobium* sp. & *Cymbidium* sp. and nine (09) species of pteridophytes viz., *Asplenium nidus*, *Elaphoglossum stelligerum*, *Loxogram meinvoluta* were collected and introduced in BSI, NRC botanical garden.

PROJECT-9

ex situ conservation of Endemic, threatened and economic plant species in botanic garden of CRC

Executing Scientist (s): Dr. Sheo Kumar & Sri Vineet Kr. Singh

Date of Initiation : On going

Date of Completion: On going

OBJECTIVE

Collection and Introduction of minimum 10 plant species

belonging to endemic, threatened and economic plant categories from Chitrakoot area in U.P. and Pachmarhi area, M.P.

BACKGROUND

As per Convention on Biological Diversity, 1992, globally conservation of threatened and other plant species become imperative to protect them in a safe and conducive environment viz. a botanic garden for further development for use in future for propagation/°and restoration to its native places. Thus, this project has been approved to undertake such work on year-to-year basis to conserve as much as possible such flora including threatened species known for its occurrence in the territorial jurisdiction under the Central Regional Center.

AREA AND LOCALITY

Chitrakoot, Chitrakoot district of Uttar Pradesh; Pachmarhi, Deccan Peninsula

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 10 species were proposed for their conservation under *ex-situ*. However, altogether 131 individuals of 42 species of 39 Genus under the categories endemic (4), threatened (5), medicinal (25), economic (25) and ornamental (8) plant species from different places were brought and introduced in the Botanic Garden of Central Regional Centre, Allahabad for *ex-situ* conservation. For example: Endemic plant species: 04; Threatened plant species: 05; Medicinal plants species: 25; Economic plant species: 25; Ornamental plant species: 08



Frerea indica Dalzell

CRYPTOGAMIC UNIT, HQRS., KOLKATA

PROJECT-1

Hot Springs Algae of Rajgir and Mungar, Bihar

Executing Scientist (s): Dr. R. K. Gupta

Date of Initiation : April 2018

Date of Completion: March, 20021

OBJECTIVE

Survey and study of Hot Springs Algae of Rajgir and Mungar, Bihar

BACKGROUND

Hot springs are thermal aquatic ecosystems distributed all over the world. There are several reports on the systematic account of algae and cyanobacteria of thermal springs (Prasad & Srivastava, 1965; Vasishtha, 1968; Prasad & al., 1984; Hindák, 1978, 2001, 2008). Thermal springs are specialized habitats characterized by high temperature of water and Sulphur emission. The thermal aquatic environment provides special situations for studying the distribution of algae in natural temperature gradients. In India, about 131 thermal springs are documented so far which are located in geologically active regions of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Maharashtra, Meghalaya, Odisha, Tripura, Uttrakhand, Sikkim and West Bengal. Structurally, hot springs in India have two principal components i.e. the Main tank or the source and the outer channels, which are prepared for touristic purpose. The average temperature in the main tank ranges from 50°C to 110°C and exhibit limited microbial diversity whereas the diversity increases with down flow. About 386 thermal algal taxa were recorded in India including 336 cyanobacteria, 35 diatoms, 12 green algae and 3 euglenoids. Out of these about 15 novel taxa were described by several authors. Due to their thermos tolerance capacity cyanobacteria dominate documentation is essential of such important habitat along with limnological parameters.

AREA AND LOCALITY

Rajgir Hot Spring (25.03° N & 85.42° E; c. 61 sq.km.);
Munger Hot Spring (25.381° N & 86.465° E; c. 25sq.km.)

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours *w.e.f.* 29.06.18 to

06.07.18 and 17.12.18 to 28.12.18 were undertaken to the study area during which 115 algal samples were collected along with GPS, concerned limnological data (temperature, pH, dissolved oxygen, total dissolved solid etc.) and 55 field photographs. A total of 45 algal specimens were incorporated in the algal herbarium.

PROJECT-2

Studies on wild mushrooms of East and South Sikkim (except Agaricaceae, Hygrophoraceae, Boletaceae, Suillaceae and Cantharellaceae)

Executing Scientist (s) :Dr. Kanad Das

Date of Initiation : April, 2014

Date of Completion: March, 2019

OBJECTIVE

Study of wild mushroom diversity of East and South Sikkim (except Agaricaceae, Hygrophoraceae, Boletaceae, Suillaceae and Cantharellaceae)

BACKGROUND

Diverse undescribed mushroomoid mycobiota of West and North district of Sikkim were witnessed by Botanical Survey of India and thoroughly being documented subsequently. Therefore, in continuation of the present ongoing mission to uncover the enormous diversity of wild mushrooms (one of the most important components of ecosystem functions) of entire Sikkim State, emphasis should be given to remaining two districts: East and South. Keeping in view the availability of myriad ectomycorrhizal hosts with different climatic variations (in East and South districts) with unexplored or poorly explored forested areas of 5 protected areas of these two districts the present project has been proposed to undertake thorough macrofungal survey, collection, macro- and micromorphological characterization, identification and systematic documentation of the wild mushroomoid mycobiota which undoubtedly is the need of the hour to inventorise monitor and conserve the entire biological flora of the State Sikkim. Only five families are excluded from this project as they have already been assigned to the research fellow.

AREA AND LOCALITY

East and South districts of the State of Sikkim; c. 1714 sq.

Km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, a macrofungal survey tour w.e.f. 30.07.18 to 13.08.18 was undertaken to different parts of East districts aiming to survey, collection, macro- (field) and micromorphological characterization and to undertake chemical spot tests of wild mushrooms for identification in near future. The exploration was mainly focused on the wild mushrooms of subtropical to subalpine forested areas namely Gangtok, Gnathang, Gnathang Firing Range Forest, Opposite to the Firing Range Forest, Tugla valley, Memainchu, Kyangnosla, Panthang, Churten and Chipsu during which 63 field numbers were collected. All the materials are well preserved and under study. A total of 65 field numbers of wild mushrooms were collected along with 35 photographs. In this period, 18 taxa were documented. 20 specimens were incorporated in the Herbarium during the study. SEM studies of 7 species were also undertaken. 38 field numbers belonging to 26 species were identified during this period from the ongoing project.

ACHIEVEMENTS/ OUTCOMES

This study reports discovery of one (01) new genus [*Indoporus* A. Parihar, K. Das, Hembrom & Vizzini], 15 novel species [*Hydnum berkeleyanum* K. Das, Hembrom, A. Baghela & Vizzini; *Marasmius pseudohypochroides* K. Das & Antonín; *Urnula himalayana* K. Das & D. Chakr.; *Indoporus shoreae* A. Parihar, K. Das, Hembrom & Vizzini; *Russula gnathangensis* K. Das, Hembrom & Buyck, *Russula indohimalayana* K. Das, I. Bera, A. Ghosh & Buyck; *Russula pseudokrombholzii* K. Das, Hembrom, A. Ghosh & Buyck; *Russula subalpinogrisea* K. Das, I. Bera, A. Ghosh & Buyck; *Lactarius indozonarius* Uniyal, K. Das & Nuytinck; *Lactarius thindii* Uniyal, K. Das & Nuytinck; *Gliophorus glutinosus* K. Das, D. Chakr. & Vizzini; *Amanita tullossiana* Mehmood, Iqbal Hosen, K. Das & R.P.; *Russula darjeelingensis* S. Paloi, K. Acharya & K. Das; *Hericium rajendrae* U. Singh & K. Das and *Lactarius pleuromacrocystidiatus* Uniyal, K. Das & R.P. Bhatt] and 03 new records [*Cantharellus vaginatus* S.C. Shao, X.F. Tian & P.G. Liu; *Phylloporus yunnanensis* N.K. Zeng, Zhu L. Yang & L.P. Tang & *Phylloporus maculatus* N.K. Zeng, Zhu L. Yang & L.P. Tang] for India. In addition notes on edible uses of 03 mushroom species was also noted down.

PROJECT-3

Wood rotting fungi of Valmiki National Park

Executing Scientist (s) : Dr. Manoj Emanuel Hembrom

Date of Initiation : September 2018

Date of Completion : August 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

Valmiki National Park is geographically lies in between 83°0 50'–84°0 10' E and 27°010' – 27°0 03' N of Bihar state in India covering an area of 335.6 sq.km. with cliffs, ridges, gorges, hills, streams and valleys; dense forests, open woodlands, grasslands, swamps and riverine fringe. This protected area is not only famous for conservation of tigers but also for the well protected fauna and flora. Diversity and distribution of wood rotting fungi in this park area will be of immense ecological and economic significance. Because they are directly involved in cycling of minerals by decaying the wood. Besides, causing serious disease to the living trees and rot of the fallen wood, they form staple food for many small organisms playing key roles in the food chain. Recording of taxo-ecological relationship of said fungi from the said localities will definitely serve as basic initiative in the field of diversity study of fungi. After reviewing noteworthy list and references to trace the record of wood rotting fungi (Bilgrami *et al.* 1991; Jamaluddin *et al.* 2004; Ranadive 2013 and Sharma 2012, Sorbhoy *et al.* 1996 and <http://www.cybertruffle.org.uk/robitalia>) from Valmiki National Park, no mycological survey and collection history were found. It shows that this important protected area is not yet surveyed in terms of wood rotting macro fungi. To fulfill this lacuna, the above project was proposed.

AREA AND LOCALITY

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

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, one field tour w.e.f. 05.01.19 to 06.01.19 was undertaken and surveyed about 10 sq. km. areas falling under the jurisdiction of Harnatar forest range and Raghia forest range during which field macromorphological characterization was made with the fresh basidiomata. Field photographs of these fresh basidiomata were taken with the aid of Sony Cyber shot DSC-RX100 digital camera. Colour codes and terms (mostly) follow Methuen Handbook of Colour (Kornerup and Wanscher, 1978) for fruiting bodies of wood rotting

fungi. Sun drying and mild heat preservation (temperature range of 45°C–55°C with the help of 200W electric bulb as heat source in field dryer) were done and they were processed for further identification and documentation in the institute. All the collected samples (10) are properly preserved, numbered and brought to CNH, BSI, Howrah. During this period, 10 taxa were identified and documented.

ACHIEVEMENTS/ OUTCOMES

Most of the specimens represent dry resistance species with crusty and bracket habit dwelling on wood while only one species *Amylosporus cambellii* was fleshy and stalked growing on soil probably attached with decaying root.

PROJECT-4

Bryoflora of Jharkhand

Executing Scientist (s) : Dr. Devendra Singh

Date of Initiation : April, 2018

Date of Completion : March, 2022

OBJECTIVE

Study of Bryophyte diversity of the state of Jharkhand

BACKGROUND

Bryophytes are atracheate, archegoniate microscopic plant growing in terrestrial, corticolous, epiphyllous and aquatic habitats. So far 39 species of Bryophyte, 14 species of liverworts one species of hornwort and 24 species of mosses were recorded from Jharkhand and the bryophyte related studies were carried out only at fragmentary locations like Chhota Nagpur, Ranchi, Rajmahal Hills and Topchachi. Studies on Bryophytes of Jharkhand dates back to Stephani (1900) who reported *Riccia bulbifera* Steph. (= *Riccia billardierei* Mont. & Nees from Rajmahal Hills of the Sahibganj district. Further, Gangulee (1969–1980) reported 24 species of mosses from Chhota Nagpur, Parasnath, Topchachi and Ranchi. Bischler (1979) reported *Plagiochasma appendiculatum* Lehm. & Lindenb. from Chhota Nagpur. Nath and Gupta (2011) also reported *Hyophila involuta* (Hook.) A. Jaeger from Chhota Nagpur. Recently Singh and Kumar (2016) reported two species of family Lejeuneaceae viz. *Cololejeunea latilobula* (Herzog) Tixier and *Spruceanthus minutilobula* (Udar & U.S. Awasthi) Sushil K. Singh from Jharkhand. Recently Singh and Kumar (2018) reported 9 species of liverworts and one species of hornwort from Jharkhand. Hence, our knowledge about the diversity, distribution and uses of bryophytes in the state of Jharkhand is not only inadequate but widely scattered and need to extensive survey, collection and documentation of Bryophytes of the state as bryophyte

provide vital ecosystem services such as soil formation, habitat modification, nutrient cycling, pollution detection and monitoring, flavonoids and terpenoids present in majority of the bryophytes exhibit many biological activities of considerable pharmaceutical significance.

AREA AND LOCALITY

Jharkhand

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one field tour *w.e.f.* 22.10.18 to 04.11.18 was conducted to Jharkhand (Madhuvan, Kuria, Vidut Goda, Thiraki, Pirtad, Above Chatrapal, Kathpulawa, Hatiya Patthar, Gandharv Nala, Sita Nala, Chandra tok, Jalmandir, Parasanath top, Dakbangalow, Tiger trap, Bagmara Chakdam, Dumari, Rajderwa, Pokharia, Pokharia Khal, Kaile river, Barahi, Fulwariya, Mangalamaran, Dhajadhari Hill, Lalaki, Khalak thanbhi Nala, Lalaki mod, Lokaie) during which 186 specimens of bryophytes were collected along with 250 photographs (18 photographs were identified) of which 44 specimens belonging to 21 species of liverworts, hornworts and mosses were identified [*Anthoceros punctatus*, *Plagiochasma appendiculatum*, *Targionia hypophylla*, *Spruceanthus minutilobula*, *Solenostomata stephanii* etc.]; illustrations of 13 species [*Anthoceros punctatus*, *Bryum pseudotrichum*, *Cyathodium aureonitens*, *Cololejeunea latilobula*, *Lopholejeunea sikkimensis*, *Notothylas indica*] were prepared; studied oil-bodies of 06 species [*Cololejeunea latilobul*, *Lejeunea* sp., *Lopholejeunea sikkimensis*, *Solenostomata stephanii*] in freshly collected specimens and prepared a checklist of bryophytes of Jharkhand with updated nomenclature.

ACHIEVEMENTS/ OUTCOMES

This study reports one species [*Udaria lamellicaulis* D.K. Singh, S. Majumdar & D.Singh] as new to science and 07 species [*Lopholejeunea sikkimensis* Steph., *Bryum pseudotrichum* (Hedw.) P. Gaertn., *Cyathodium aureonitens* (Griff.) Mitt., *Targionia hypophylla* L., *Jungermannia stephanii* (Schiffn.) Amakawa, *Anthoceros punctatus* L., *Notothylas indica* Kashyap.] as new records for the state.

PROJECT-5

Liverworts and Hornworts Flora of Darjeeling District, West Bengal

Executing Scientist (s): Dr. Monalisa Dey

Date of Initiation : April, 2016

Date of Completion: March 2021

OBJECTIVE

Survey and documentation of liverworts and hornworts diversity of Darjeeling district, West Bengal

BACKGROUND

The project was initiated in 2016. During previous year, 118 unidentified specimens belonging to 25 species were identified. Microphotography and description of seven species were completed.

AREA AND LOCALITY

Darjeeling district, West Bengal

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours were conducted to various localities of Darjeeling District of West Bengal covering Suntaleykhola, Mouchuki, Khambuhang, Todey,

Rongo forest, Dalgaon, Paren, Jhandi, Charkhole, Nimbong, Jogighat, Sittong, Mangpoo, Ranju Valley, Latpanchar, parts of Mahananda WLS, Bara Mangwa, Chatakpur and Kalej Valley during which 254 field numbers were collected of which 254 field numbers were collected; 179 unidentified specimens belonging to 29 species collected by self from Darjeeling District, West Bengal were identified. Study, documentation, camera lucida illustration and microphotography of 08 species were completed. Two specimens obtained on loan from Conservatoire et Jardin botaniques de la Ville de Genève, Switzerland (G), viz., *Plagiochila cuspidata* Levier no. 5649 (Lectotype: G-010992) and *Plagiochila parvifolia* C.P. Belanger s.n. (Isotype: G-010968) were studied and photographed.

DECCAN REGIONAL CENTRE, HYDERABAD

PROJECT-1

Inventory of Macrolichen diversity of Odisha State

Executing Scientist (s): Dr. G. Swarnalatha

Date of Initiation : August, 2015

Date of Completion: March, 2020

OBJECTIVE

Study diversity of macrolichen of the state of Odisha

BACKGROUND

This project was initiated in 2015. During previous year, a total of 90 macrolichen specimens were studied from earlier collection of which 76 specimens were identified upto species level and 14 specimens were identified upto genus level. In this period, details description of 05 species was completed. One Herbarium Consultation tour was conducted to CAL.

AREA AND LOCALITY

Odisha; C. 155,707 sq. km.



Phyllopsora nemoralis Timdal & Krog



Remototrachyna awasthii (Hale & Patw.) Divakar & A. Cresp

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, three field tours were undertaken to Balasore, Gajapati and Puri districts of Odisha during which 274 voucher specimens of macro and microlichen were collected. In this period, a total c. 120 Macrolichen specimens were studied of which 107 specimens were identified up to the species level (in to 42 species under 19 genera) and 13 specimens were identified to the genus level. Detailed descriptions of nine species were completed. Two herbarium and library consultation tour were conducted to National Botanical Research Institute, Lucknow and borrowed lichen specimens of Odisha state on loan for detailed study and also collected lichen literature from library.

ACHIEVEMENTS/ OUTCOMES

This study reports four species viz., *Hyperphyscia minor*; *Lepraria santosii*; *Leptogium cookii*; *Staurolemma omphalarioides* as new to India and the following 42 species as new to the state of Odisha: *Canoparmelia aptata*; *Canoparmelia owariensis*; *Canoparmelia pustulescens*; *Canoparmelia texana*; *Coccocarpia erythrocardia* ; *Collema japonicum*; *Collema subflaccidum*; *Dirinaria picta*; *Heterodermia albicans*; *Heterodermia antillarum*; *Heterodermia dissecta*; *Heterodermia isidiophora*; *Heterodermia japonica*; *Heterodermia koyana*; *Leptogium denticulatum*; *Leptogium phyllocarpum*; *Myelochroa aurulenta*; *Parmeliella endomilta* var. *achromatica*; *Parmeliella pannosa*; *Parmeliella stylophora*; *Parmelinella wallichiana*; *Parmotrema chinense*; *Parmotrema mesotropum*; *Parmotrema praesorediosum*; *Parmotrema rampoddense*; *Parmotrema saccatilobum*; *Peltula euploca*; *Phaeophyscia hispidula*; *Phaeophyscia pyrrophora*; *Phyllopsora buettneri*; *Phyllopsora corallina* var. *subglaucella*; *Phyllopsora furfuracea*; *Phyllopsora manipurensis*; *Phyllopsora nemoralis*; *Pyxine coralligera*; *Pyxine farinosa*; *Pyxine meissneriana*; *Pyxine reticulata*; *Pyxine yercaudensis*; *Remototrachyna awasthii*; *Scytinium gelatinosum* and *Xanthoparmelia congensis*.

PROJECT-2

Grasses of Telangana State, India

Executing Scientist (s) : Sri Nagaraju Siddabathula

Date of Initiation : April, 2018



Imperata cylindrica (L.) Raeusch.

Date of Completion :March, 2021

OBJECTIVE

Study of grass flora of Telangana

BACKGROUND

Telangana state is situated on the Deccan Plateau, in the central stretch of the eastern seaboard of the Indian Peninsula. The state lies between 15° 50'- 19° 55' North latitudes and 77° 14'-78° 50' East longitudes, and covers 114,840 km². Telangana is bordered by the states of Maharashtra to the north and northwest, Karnataka to the west, Chhattisgarh to the northeast and Odisha to the east and Andhra Pradesh to the south. The region is drained by two major rivers, with about 79% of the Godavari River catchment area and about 69% of the Krishna River catchment area, but most of the land is arid. It also drained by several minor rivers such as the Bhima, the Manjira and the Musi. The state has 3 National Parks (Kasu Brahmananda Reddy, Mahavir Harina Vanasthali and Mrugavani), 7 Wildlife Sanctuaries (Eturunagaram, Pakhal, Pranahita, Kinnerasani, Manjira, Pocharam and Shivaram) and 2 Tiger Reserves (Kawal and Nagarjunasagar - Srisailem). Pullaiah & al. (2015) reported a total of 208 species of grasses from Telangana state based on earlier literature. Moreover, there is no report/record on the diversity of grasses in Warangal, Khammam and Mahabubnagar districts. Hence, the present study has been taken up to explore the unexplored areas in 2018.

AREA AND LOCALITY

Telangana State



Leersia hexandra Sw.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one field tour w.e.f. 04.01.2019 to 12.01.2019 was conducted to Bhadradi Kothagudem District, Telangana during which 105 field numbers were collected of which 08 field numbers were identified.

PROJECT-3

Flora of Kinnerasani Wild Life Sanctuary, Telangana

Executing Scientist (s) : Dr. J. Swamy

Date of Initiation : April, 2018

Date of Completion: March, 2021

OBJECTIVE

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

BACKGROUND

One the mandate of Botanical Survey of India is the floristic survey and documentation of Protected Areas. The Deccan Regional Centre of BSI being located in Telangana it is necessary to cover the floristically rich areas of this newly formed state. The Protected Areas (PAs) in the Telangana State include three National Parks, 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 is named after the river which is a tributary to Godavari by name Kinnerasani. The geographical location of the Sanctuary lies between 17.58330° (17°35') and



Xylocarpus xylocarpa (Roxb.) Taub.

18.00000° (18°00") north latitudes and 80.41667° (80°-25') and 80.50000° (80°-30') east longitudes was established in 1977 for the *in-situ* conservation of native biodiversity and covers an area of 635.41 sq. km.

AREA AND LOCALITY

Kinnerasani Wild Life Sanctuary , Bhadradi -Kothagudem districts, Telangana State; c. 635.41 sq. km.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one field tour w.e.f. 04.01.2019 to 12.01.2019 was conducted to the study area during which 200 field numbers were collected of which 20 field numbers were identified.



Petalidium barlerioides (Roth) Nees

EASTERN REGIONAL CENTRE, SHILLONG



Porpax lanii Seidenf. (New to India)



Cheirostylis tabiyahanensis (Hayata) N. Pearce & P.J. Cribb.

PROJECT-1

Flora of Eastern Nagaland (Mon, Tuensang, Kiphire and Longleng)

Executing Scientist (s) : Dr. Nripemo Odyuo & Dr. Ranjit Daimary

Date of Initiation : April, 2014

Date of Completion : March, 2019

OBJECTIVE

Documentation of the floral diversity of Eastern Nagaland.

BACKGROUND

This project was initiated in 2014. During previous year, two field tours were undertaken to Peren district (Gaili Mountain), Mon district (Pessao and Nyoang Mountain) in Eastern Nagaland and Kohima, Peren and Wokha District in Eastern Nagaland during which a total of total 750 field numbers of specimens were collected along with 850 photographs of which 95 plant species were identified and 90 plant species were documented.

AREA AND LOCALITY

Eastern Nagaland; c. 8335 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 19.05.2018 to 08.06.2018 and 09.10.18 to 21.10.18 were conducted to Longleng district, Kiphire and Tuensang district of Nagaland during which 704 field numbers were collected along with 200 colour photographs. In this period, 104 plant species were identified and documented. A total of 236 live plants were collected for *ex situ* conservation in the garden. In addition, one Herbarium consultation tour *w.e.f.* 26.11.18 to 08.12.18 was conducted to CAL. The final manuscript comprising of 1260 species of Angiosperms, Gymnosperms and Pteridophytes was finalized and ready for submission.

ACHIEVEMENTS/ OUTCOMES

This study reports 02 species [*Porpax lanii* & *Cheirostylis tabiyahanensis*] as new addition for Orchid flora of India.

PROJECT-2

Diversity and phylogeny of aquatic fungi from North east India

Executing Scientist (s) : Dr. Ashish Venkatesh Prabhugaonkar

Date of Initiation : April, 2018

Date of Completion : March, 2020

OBJECTIVE

Taxonomic study of species diversity of Ingoldian fungi and Aero-aquatic fungi in streams of north-east India (excluding Sikkim); preparation of illustrated manual of isolated fungi; development of collection of Ingoldian and Aero-aquatic fungi in *ex-situ* culture for future

studies; molecular phylogenetic analysis of taxonomically interesting fungi.

BACKGROUND

New project

AREA AND LOCALITY

Meghalaya, North East India

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, nine field tours were conducted to different parts of Assam, Manipur and Mizoram during which 123 fungal collections belonging to approx. 98 species were isolated, photo-documented, preserved herbarium and slides in collection. Out of these 20 were isolated in pure culture. Approx. 80 taxa were identified upto species level some of which are *Acrogenospora megalospora*, *Acrogenospora megalospora*, *Brachysporiella gayana*, *Canalisporium caribense*, *Cancellidium appianatum*, *Candelabrum brocchiatum*, *Caryospora aquatica*, *Chalara* sp., *Cladorrhinum* sp., *Cladosporium* sp., *Clonostachys* sp., *Codinaea* sp., *Cordana triseptata* etc. Eighteen more isolates are not yet identified. Efforts are being made to get more interesting fungi in culture. Few of these are being further studied as novel species and first cultures reported of rare fungi. 10 potential cultures will be selected for molecular phylogenetic study during current year. Molecular phylogeny of following fungi was worked out in current year.

ACHIEVEMENTS/OUTCOMES

This study reports three new species, *Aureobasidium khasianum* Pratibha & Prabhug., *Neosporidesmium khasianum* Prabhug. & J. Pratibha and *Neosporidesmium garoense* Pratibha J. & Prabhug. A phylogenetic analysis based on ITS and LSU gene regions was also made to support the taxonomic treatment of described species and sequence data was submitted to NCBI Genbank with accession numbers *MH188305*, *MH188306* and collection data was submitted to Mycobank with accession number *MB828278*. Holotype was submitted to Herbarium cryptogamiae Indiae orientalis, IARI, New Delhi with accession number HClO 52163 and ex-type culture to National fungal culture collection of India, ARI, Pune with accession number NFCCI- 4275.

PROJECT-3

Flora of west & south-west khasi hills district of Meghalaya with reference to the sacred groves

Executing Scientist (s) : Dr. Chaya Deori & Shri S. R. Talukdar

Date of Initiation : April, 2016

Date of Completion : March, 2019



Hedychium stenopetalum Lodd.



Impatiens acuminata Benth. ex Hook.f. & Thomson. endemic to Meghalaya

OBJECTIVE

Intensive botanical exploration in the entire West and South West Khasi hills district of Meghalaya covering its sacred groves season wise for collection of floristic elements (including endemic, rare and threatened plant species) and preparation of a comprehensive floristic account.

BACKGROUND

This project was initiated in 2016. During previous year, 03(Three) field tours were conducted season wise and collected 551 field numbers, 89 live plant specimens and more than 1200 coloured digital field photographs; a list of 30 species from two districts was prepared from

relevant literatures. Also a list of 200 species from two districts was prepared from ASSAM herbarium. Identified and documented 300 species from specimens collected during tours.

AREA AND LOCALITY

West (c. 5247sq.km.) & south-west khasi hills district (c.1341sq.km.) of Meghalaya

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, literatures pertaining to the two districts were consulted and listed 166 species of the two districts from ASSAM herbarium. Two field tours *w.e.f.* 31.03.2018- 05.04.2018 and 08.08.2018-14.08.2018 were conducted to Dongkingding area, Rani near Assam border, Amrangchinga, Hahim near Assam border, Mairang, Mannai Law Lyngdoh, Mawroh Law Lyngdoh, Kynsi area, Mawasawa Pvt forest, Nongkhlaw, Nongstoin, Kyllang Rock area, Mawkyrwat, Jakrem, Ranikor, during which a total of 442 field numbers were collected along with more than 1000 coloured photographs and 60 live plants for introduction in garden. In this period 290 species were identified and documented from specimens collected during the tours. The final manuscript of “Flora of West and South West Khasi Hills district of Meghalaya with reference to the sacred groves” finalised and ready for submission comprising of 1150 species for angiosperms, gymnosperms and pteridophytes along with photoplates.

ACHIEVEMENTS/ OUTCOMES

Final Manuscript (Flora of West and South West Khasi Hills district of Meghalaya with reference to the Sacred groves finalised and ready for submission comprising of 1150 species for Angiosperms, Gymnosperms and Pteridophytes along with photoplates. 35 rare, ornamental orchids collected for ex situ conservation in the garden. Lectotypification of *Impatiens acuminata* Benth. ex Hook.f. & Thomson an endemic species of Meghalaya was published. Two new records to Meghalaya (*Bulbophyllum xylophyllum*, *Flickingeria abhaycharanii*) were reported.

PROJECT-4

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 of Completion: March, 2021

OBJECTIVE

Documentation of the vascular plant resources in the state of Nagaland in two volumes (*Flora of Nagaland*, Vol. I & II) excluding Orchids and Ferns.



Coelogyne ovalis Lindl.



Zingiber kangleipakense

BACKGROUND

The project was initiated in 2016. During previous year, two botanical exploration tours were conducted to different districts of the state during which a total of 750 field numbers were collected along with 390 live plant samples for introduction in Experimental Botanic garden, BSI, ERC, Shillong.

AREA AND LOCALITY

Nagaland; c. 16,579 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 09.05.18 to 08.06.18 and 09.10.18 to 21.10.18 were conducted to Longleng and Tuensang and Kiphire districts of Nagaland

during which 704 field numbers of herbarium specimens were collected and about 336 live plant samples were introduced in the garden of Botanical Survey of India, ERC, for *ex-situ* conservation. Total 222 plant taxa were identified, along with 118 plant taxa documented taxonomically with proper citation, description, phenology and distribution. About 10 Photographic illustrations were made. All the collections so far collected from Nagaland (ca. 2246 field numbers of Herbarium specimens) were sorted out in to families (ca. 116 families) and folders (ca. 126 numbers) to make them easy for further works namely identification, filling up of Field Data, Accession and finally incorporation.

ACHIEVEMENTS/ OUTCOMES

This study reports 03 new and 05 taxa newly recorded for the flora of India.

PROJECT-5

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

Executing Scientist (s): Dr. Dilip Kr. Roy & Shri L. R. Meitei

Date of Initiation : Ongoing

Date of Completion: Ongoing

OBJECTIVE

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

BACKGROUND

Collection of endemic, rare, threatened and economically important plants of North-East India for *ex-situ*



In vivo raised seedlings of *Pyrenaria barringtonifolia*



Collection of *Pyrenaria barringtonifolia* seedlings

conservation and multiplication purpose in Experimental Botanic Garden, BSI, ERC, Umiam (Barapani). The existing Experimental Botanic Garden is located ca. 22 km away from Shillong near Umiam Lake at Umiam, with an area of ca 25 acres at an altitude ca 1000m (3000 ft.). It is in the process of introduction/acclimatisation and paying considerable attention towards maintenance of germplasm collection, growing and multiplication of endemic, rare, endangered, threatened plant wealth of North-East India in order to save them from extinction. About 1500 species of vascular plants, 13 gymnosperms, 75 pteridophytes and 53 bryophytes of North-East India are conserved here. Many of them are rare, endemic and economically important plant species of this region. To enrich the flora of the garden with particular reference to RET and other economically important plants, field tours will be conducted in various parts of NE India for collection and introduction of RET plants in the garden.

AREA AND LOCALITY

Northeast India is the eastern-most region of India. It comprises the contiguous Seven Sister States (Arunachal

Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura) and Sikkim. The areas of the North Eastern States are Arunachal Pradesh- 83,743 sq.km., Assam- 78,438 sq.km., Manipur- 22,327 sq.km., and Meghalaya- 22,429 sq.km., Mizoram- 21,081 sq.km., Nagaland- 16,579 sq.km., Tripura- 10,486 sq.km. and Sikkim- 7,096 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, supervision and general maintenance of works carried out in the Experimental Botanic Garden, BSI, ERC, Umiam (Barapani). Supervised and guided the Junior Project Fellows, Field Assistant, MTS and Mali staffs for maintenance of the garden. Conducted two field tours: 1. Senapati and Kangpokpi districts of Manipur *w.e.f.* 20th to 26th July 2018 (collected 104 live plant species including 29 RET species, 26 field numbers and 500 photographs) and 2. Garo Hills, Meghalaya *w.e.f.* 22nd to 29th September 2018 (collected 147 live plant species including 39 RET species, 19 field numbers and 1050 photographs). Also conducted 6 one day local field tours: 1. Moopun Falls, Jaintia Hills, Meghalaya on 29th April 2018 (collected 60 live plant species including 12 RET species), 2. Sohra, East Khasi Hills, Meghalaya on 12th May 2018 (collected 30 live plant species including 5 RET species), 3. Mardon, Ri-Bhoi, Meghalaya on 21th June 2018 (collected 13 live plant species including 3 RET species), 4. Upper Shillong, East Khasi Hills, Meghalaya on 11th August 2018 (collected 36 live plant species including 13 RET species), 5. Sumer, Ri-Bhoi, Meghalaya on 12th August 2018 (collected 15 live plant species) and 6. Elephant falls, East Khasi Hills, Meghalaya on 15th December 2018 (collected 12 live plant species including 7 RET species). 119 rare, endangered, threatened and endemic plant species have been collected from field tours and planted in EBG. 74 economically important and medicinal plant species were collected from field tours and planted in the garden. Multiplication of plants: (i) 971 numbers of seedlings are raised from 18 plant species. (ii) 1695 numbers of plants are raised from 17 plant species by cuttings method. (iii) 6580 seeds of 12 plant species are sown in the germination beds. 82 numbers of orchids plantlets are propagated from parent plants. Observed and recorded phenological data of flowering and fruiting of 229 plant species which are available in the garden. 801 numbers of plant seedlings/saplings were distributed for plantation purpose. Guided 874 visitors who visited the garden during this period.

ACHIEVEMENTS/ OUTCOMES

During this study, 119 rare, endangered, threatened and endemic plant species were collected from field tours and planted in EBG, Umiam. 74 economically important and medicinal plant species were collected from field

tours and planted in the garden. Three new species: 2 *Ceropegia* and 1 ginger species were discovered during the field tours. The above mentioned three new species were accepted for publication by International Journals. Also, *Cephalanthera damasonium* is reported as a new addition and generic record to the orchid flora of Meghalaya.

PROJECT-6

Micropropagation of EET Plants of North East India Phase-II

Executing Scientist (s): Dr. A. A. Mao & L. Ibemhal Chanu

Date of Initiation: April, 2015

Date of Completion: Ongoing

OBJECTIVE

Standardization of 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 previous year, Protocol development, statistical analysis and micropopagation of *Armadorum senapatianum*, *Rhododendron coxianum* and *Cymbidium tigrinum* were completed.



Pyrenaria diospyricarpa Kurz var. *camelliiflora* (Kurz) S.X. Yang



Invitro seedlings of *Ilex khasiana*

AREA AND LOCALITY

North East India

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, following works were done:

***Cymbidium tigrinum*:** Subculturing, maintaining *C. tigrinum* in tissue culture and also glass house. Subculturing now at present in 10 % banana with MS. Treatment of *C. tigrinum* protocorm with TDZ for shoot development (to multiply more, given some plants to research scholars too) Reading of bulb improvement for the plants in glass house. Culture root tip slices of *C. tigrinum* in fungal growth medium for fungal isolation purpose to make the orchids plants acclimatizable to tough environment by introducing symbiotic association to provide more nutrients to the orchids by the fungus. *C. tigrinum* is extremely sensitive to heat, moisture, water, sunlight.

***Armadorum senapatianum* :** Transplanted *A. senapatianum* in greenhouse, glass house, the garden of Botanical Survey of India, Shillong. Plants are growing more healthy in National Orchidarium, it about 2-10 cm tall all the plants are under observation.

***Rhododendron coxianum* :** Transplanted *R. coxianum* in the garden of Botanical Survey of India, Shillong. For further experiment seeds are not available so plan for the seedlings grown in the garden to grow little more.

***Ilex khasiana*:** Local tour to Mawklot taken photograph of fruiting of *I. khasiana*, Local tour to Mawklot again taken photograph of fruiting of *I. khasiana*, seeds cultured in tissue culture laboratory. *I. khasiana* seeds are cultured in different composition of medium, taking readings of seed germination, in dark, light, different room temperatures, with seed coats and without seed coats and halves. Seed germination of *Ilex khasiana* (collected from Jakrem). *Ilex khasiana* 432 seeds coat are removed, for new experiment for three different temperate and its germination. Seeds are germinated, new seedlings are 1-2cm approximately, now culturing inside the tissue culture room. Further experiment will be statistically analyse. Presently seedlings are 4-5 cm tall.

Paphiopedilum hirsutissimum*:** Study of pelotons. Culture root tip slices of *Paphiopedilum hirsutissimum* in fungal growth medium for fungal isolation namely for genus tumor mycorrhizal (Epulorhiza sp.***) 12 different fungus are cultured and kept as stock.. Now waiting for the capsule to mature, plan to culture in August 2019.

INDUSTRIAL SECTION INDIAN MUSEUM, KOLKATA

PROJECT-1

Collection of economic plant materials for enrichment and replacement of exhibits of the Botanical Gallery

Executing Scientist (s): Dr. A. K. Sahoo

Date of Initiation : April, 2018

Date of Completion: March, 2019

OBJECTIVE

Collection of samples of Plant materials and replacing with the old damaged exhibits in the Botanical Gallery of ISIM.

BACKGROUND

Enrichment and replacement of exhibits of Botanical Gallery by collection of economic plant materials particularly edibles and medicinal use samples by availing a field/consultation tour.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours w.e.f. 17.01.19-24.01.19 and 01.03-11.03.19 were conducted to Ranchi and adjacent area of Gumla, Simdega of Jharkhand state and Meghalaya during which 63 samples of food, medicine, gum and resin yielding, oil yielding, dye yielding, medicine, artifact and foods were procured . The project is completed and the final report is under preparation.

PROJECT-2

Collection of economic plant materials for enrichment and replacement of exhibits of the Botanical Gallery

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

Date of Initiation : April, 2018

Date of Completion : March, 2019

OBJECTIVE

Collection of samples of Plant materials and replacing with the old damaged exhibits in the Botanical Gallery

BACKGROUND

Enrichment and replacement of exhibits of Botanical

Gallery by collection of economic plant materials particularly edibles and medicinal use samples by availing a field/consultation tour.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one tour w.e.f. 25.03.19 to 02.04.19 was scheduled but cancelled due to urgent election training programme of concerned tour party members. The project is completed and the final report is under preparation.

PROJECT-3

Interpretation of the Family : Poaceae in Icones Roxburghianae

Executing Scientist (s) : Dr. B. K. sinha, Dr. M. Bhaumik & Sudeshna Datta

Date of Initiation : April, 2017

Date of Completion : March, 2019

OBJECTIVE

Enumeration of the nomenclatural status and taxonomic identity of Roxburgh's Icon under family poaceae (about 150 entries)

BACKGROUND

Roxburgh drawing at CAL with reference to the Flora Indica manuscript is being updated for the family Poaceae.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, listing of 45 entries of Poaceae members was completed along with nomenclatural interpretation of 84 taxa. The project is completed and the final report is under preparation.

PROJECT-4

Interpretation of Roxburgh's icon for family Orchidaceae

Executing Scientist (s): Dr. M. Bhaumik, & Dr. (Mrs.) Kangkan Pagag

Date of Initiation : April 2018

Date of Completion: March, 2020

OBJECTIVE

Enumeration of the nomenclatural status and taxonomic identity of Roxburgh's Icon under family Orchidaceae (about 45 entries)

BACKGROUND

Roxburgh's drawing at CAL with reference to the Flora Indica manuscript is being updated for the family Orchidaceae.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 26 taxa were interpreted and 15 species were described along with their validity and common synonym.

PROJECT-5**Interpretation of Roxburgh's Icon for members of Pteridophytes**

Executing Scientist (s): Dr.(Mrs.) Kangkan Pagag

Date of Initiation : April 2018

Date of Completion: March, 2019

OBJECTIVE

Enumeration of the nomenclatural status and taxonomic identity of Pteridophyte members in Roxburgh's Icon (about 47 entries)

BACKGROUND

Roxburgh's drawing at CAL with reference to the Flora Indica manuscript is being updated for the members of Pteridophytes.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, a list of 47 members of Pteridophytes was prepared. The project is completed and the final report is under preparation.

PROJECT-6**Listing and Identification of Dicot herbarium specimens at BSIS**

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

Date of Initiation : April, 2016

Date of Completion: March, 2019

OBJECTIVE

Documentation of dicot herbarium collections from different parts of India and surrounding countries deposited at BSIS to prepare a digital database which helps to conserve all the important information written on the labels at the time of collection. These herbarium collections are now being preserved and digitized which will help future Botanists for further work on Economic Botany.

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 rich collection leads to prepare a digital catalogue of those herbarium specimens for documentation and proper maintenance.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, 2415 herbarium specimens were documented. The project is completed and the final report is under preparation.

ACHIEVEMENTS/ OUTCOMES

Total documentation of 5723 data compiled and report 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 of Completion: March, 2020

OBJECTIVE

Extensive floristic exploration in the Wild Life Sanctuary and study of floristic diversity

BACKGROUND

The project was started in 2016. During previous year, two field tours were conducted to the study area during which a total of 440 field numbers were collected of which 76 species were identified and 72 species were described. Besides 09 RET plant species were collected for *ex-situ* conservation.

AREA AND LOCALITY

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

SUMMARY OF THE WORK DONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 01 field tour w.e.f. 29.05.2018-08.06.2018 was undertaken to Sechu Tuan Nalla Wildlife Sanctuary, Chamba District, Himachal Pradesh in which 254 field numbers of c 1020 plant specimens were collected by covering an area of about 150 sq. km. Out of these, 121 species were identified and 73 species described. Besides, eight endemic and threatened plant species namely *Aconitum heterophyllum*; *Bergenia stracheyi*; *Bunium persicum*; *Dactylorhiza hatagirea*; *Ferula jaeschkeana*; *Fritillaria cirrhosa*; *Sinopodophyllum hexandrum*; *Trillium govianum* were collected, examined and field data recorded from the sanctuary.



Vegetation along Triund Nallah in Sechu Tuan Nalla Wildlife Sanctuary



Sinopodophyllum hexandrum (Royle) T.S.Ying

PROJECT-2

Pictorial Flora of Pteridophytes of Uttarakhand

Executing Scientist (s): Dr. B.S.Kholia

Date of Initiation : April, 2018

Date of Completion: March, 2021

OBJECTIVE

Preparation of a pictorial guide of Pteridophytic flora of Uttarakhand

BACKGROUND

Uttarakhand is a hilly Himalayan state of India formed in November 2000 after annexing from Uttar Pradesh; it comprises two regions Kumaun and Garhwal. Pteridophytes are the second highest group of vascular plant in Uttarakhand, they can be seen in everywhere from plains to alpine region, however, their diversity is more in montane and subalpine broad leaved forests. The Pteridophytes of Uttarakhand are yet not documented properly. Though there are several regional or district floras and checklists but most of them lacking full illustrations or coloured images. Further, most of these works were completed before 1990 and now outdated due to recent nomenclature changes and several



Aspenium



Cyathia

novelties in Ferns and Fern-allies. Furthermore, recently many remote localities are now connected to the network of roads, on the one hand this facilitated the reach of botanists in many plant rich zones and new habitats, on the other hand the structure of vegetation is changed due these recent developmental activities, climate change and invasion of alien flora etc. Therefore, all the previous works from Uttarakhand are needed to be updated. In recent studies (Fraser-Jenkins 1997, 2008, Fraser-Jenkins et al. 2016, 2018) it was found that, some earlier work is based on erroneous identification and incomplete in many ways, thus a complete, comprehensive and updated fern flora of Uttarakhand with live images is urgently required for botanists and forest managers. Further recently the Botanical Survey of India has published the Flora of Uttarakhand comprising all the families and genera of the Angiosperms but the lower plants including Pteridophytes were not undertaken. Therefore, to fill this gap on vascular flora of Uttarakhand present Pictorial work is initiated here.

AREA AND LOCALITY

Uttarakhand State

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, studied relevant literature on taxonomy of Pteridophytes of Uttarakhand. Prepared a checklist of Uttarakhand. 332 sp. 38 subsp, c. 15 hybrids. Prioritized some important fern localities for common as well as rare species for taking in- situ images in right season. Identified 340 herbarium sheets belonging to 42 species of Pteridophytes from Pithoragarh. Label information on 410 recently mounted herbarium sheets of Pteridophytes were written. Accession of 112 sheets of Pteridophytes in BSD Herbarium from Kumaun. Two Photography and collection tours undertaken in the areas of Kumaun (Thal, Ghat, Pithoragarh, Didihat) and

Garhwal (Dehradun, Mussoorie, Pachwa Doon) regions and collected. 63 field numbers belonging to 42 species. 42 species of Pteridophytes from Uttarakhand were worked out with preparation of final plates for final report.

PROJECT-3

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

Executing Scientist (s): Dr. Kuldeep Singh Dogra

Date of Initiation : April 2017

Date of Completion: March, 2020

OBJECTIVE

Preparation of a database of invasive alien species of Himachal Pradesh.

BACKGROUND

The invasive alien species are rapidly spreading in the state of Himachal Pradesh in the last two decades. It was reported that these species along with other species had wide impact on the structure and composition of natural vegetation of Himachal Pradesh. Keeping in view of the rapid spread of these species this project was undertaken to document the invasive alien species of the state. It was reported by several researcher that there are more than 400 Invasive Alien Species in Himachal Pradesh. Invasive plant species like *Ageratum conyzoides* L. (Asteraceae), *Parthenium hysterophorus* L. (Asteraceae), *Ageratina adenophora* Sp. (Asteraceae) and *Lantana camara* L. (Verbenaceae) have widely invaded the state of Himachal Pradesh.

AREA AND LOCALITY

Himachal Pradesh



Solidago canadensis L

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, an invasive alien plant collection tour *w.e.f.* 17.11.18 to 26.11.18 was conducted to the different districts (Sirmour, Solan, Shimla, Mandi, Kangra, Bilaspur) of Himachal Pradesh during which a total of 130 field number of about 100 plant species were collected which included mostly invasive alien species and associate vegetation. A total of 59 alien species listed, documented and described during the period from the DD (FRI) and BSD (BSI-NRC) herbaria. About 341 herbarium specimens examined for 59 Alien species. Along with this 157 alien species were also listed from the published literature. Database for 50 species prepared in the prescribed format as fact sheet. Some of the species are *Ageratum conyzoides*, *Ageratum houstonianum*, *Ageratina adenophora*, *Lantana camara*, *Artemisia vestita*, *Artemisia vulgaris*, *Asclepias curassavica*, *Bidens tripartita*, *Bidens wallchii*, *Boerhavia diffusa*, *Ipomoea cairica*, *Ipomoea carnea*, *Ipomoea nil*, *Ipomoea pentaphylla*, *Ipomoea purpurea*, *Ipomoea quamoclit*, *Tagetes minuta*, *Tagetes erecta*, *Thevetia neriifolia*, *Tecoma stans*, *Xanthium strumarium*, *Broussonetia papyrifera*, *Sapium sebiferum*, *Martynia annua* and *Parthenium hysterophorus*.

ACHIEVEMENTS/ OUTCOMES

During this study, 09 species [*Ageratum conyzoides*, *Ageratum houstonianum*, *Ageratina adenophora*, *Lantana camara* and *Parthenium hysterophorus* Further, *Tecoma stans*, *Solidago canadensis*, *Jasminum mesnyi* and *Spartium junceum*] found to be new invaders in the State of Himachal Pradesh.

PROJECT-4

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

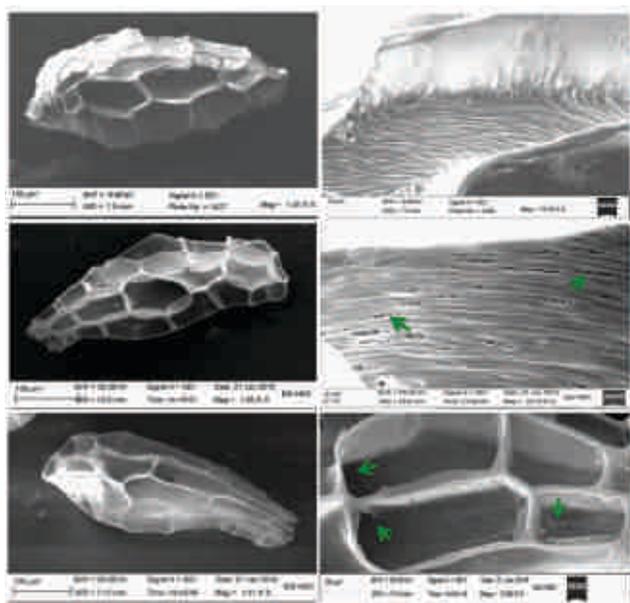
Executing Scientist (s): Dr. Giriraj Singh Panwar & Dr. Bhavana Joshi

Date of Initiation : April 2018

Date of Completion: March, 2020

BACKGROUND

The North-Western Himalaya is a rich reservoir of plant biodiversity and harboring immense floristic wealth of the country. Owing to increasing anthropogenic pressure, loss of habitat, climate change and overexploitation of natural resources, plant species are gradually dwindling from the wild and many more are in threatened category. Keeping in view the threatened species of the North-West Himalaya, efforts are being put

Shoot induction in *Tricholepis roylei*

E. dabia SEM analysis

forth for their ex-situ conservation with the help of Biotechnological tools. With the help of tissue culture technology so far micro-propagation protocol has been standardized for many threatened and endemic species of the North-West Himalaya and was successfully planted in the wild viz. *Eremostachys superba*, *Pittosporum eriocarpum* and *Lilium polyphyllum* etc.

AREA AND LOCALITY

North-West Himalaya

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, explants/live plant materials of all the three selected species were collected from the wild. Artificial media with different composition and combinations of plant growth hormones were prepared.

Different explants/seeds have been inoculated in MS 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 the effect of different chemicals on the seed coat.

ACHIEVEMENTS/ OUTCOMES

Organogenesis (shooting) was induced in *Tricholepis roylei* and callus was induced in *Jasminum parkeri* Inclusion of this germinated seeds of *Eulophia dabia* was sub-cultured for *in-vitro* development of protocorm.

PROJECT-5

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. Kumar Ambrish, Dr. B.S. Kholia, Dr. P.K. Pusalkar, Dr. K.S. Dogra, Dr. M.R. Debta, Sri P.K. Deroliya, Shri Sachin Sharma, Shri Brijesh Kumar

Date of Initiation : Ongoing

Date of Completion : Ongoing

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-9, two tours were undertaken to Nahan Himachal Pradesh and Binog Wildlife Sanctuary, Mussoorie Uttarakhand for the *ex-situ* conservation of plants, mainly focused on Ferns and following ferns namely *Aleuritopteris albomarginata*, *Aleuritopteris bicolor*, *Athyrium strigillosum*, *Dryopteris cochleata*, *Equisetum ramosissimum*, *Onychium lucidum*,

Polystichum obliquum, *Pronephrium penangianum*, *Pteris senophylla*, *Aleuritopteris anceps*, *Asplenium dalhousieae*, *Diplazium maximum*, *Dryopteris juxtaposita*, *Glaphyopteridopsis erubescens*, *Polystichum disrectum*, *Polystichum squarrosom*, *Pseudocyclosorus cannus* were collected from near.

PROJECT-6

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

Executing Scientist (s) : Dr. Kumar Ambrish, Dr. Puneet Kumar, Dr. K.S. Dogra, Dr. M.R. Debta, Sri P.K. Deroliya, Shri Sachin Sharma

Date of Initiation : April, 2017

Date of Completion: March, 2020

OBJECTIVE

Documentation of the flora of Himachal Pradesh

BACKGROUND

State Flora of Himachal Pradesh

AREA AND LOCALITY

Himachal Pradesh

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19

Dr. Kumar Ambrish, Sci. D & Sri P.K. Deroliya, Botanical Assistant: Described 48 species for the family Ranunculaceae (1/10) : *Eriocapitella* (1/1), *Halerpestes*

(1/2), *Isopyrum* (1/1), *Nigella* (1/2), *Oxygraphis* (1/1), *Paraquilegia* (1/3), *Pulsatilla* (1/1), *Ranunculus* (1/21), *Thalictrum* (1/15), *Trollius* (1/1), and consulted BSD and DD herbaria.

Sh. Sachin Sharma: Described 78 species belonging to Vitaceae, Aceraceae, Anacardiaceae, Rutaceae, Meliaceae, Balsaminaceae, Aquifoliaceae, Celastraceae, Beibersteiniaceae, Oxalidaceae. Consulted BSD for the above mentioned families.

Dr. Manas Ranjan Debta: Consulted herbarium for taxa belonging to Malvaceae, Tiliaceae and Linaceae and apart from that described 31 species have been described belonging to above mentioned families.

Dr. K.S. Dogra : During the period a total of 68 species listed (41 from family Brassicaceae & 27 from family Caryophyllaceae) after consulting the BSD, BSI-NRC, Dehradun and DD, FRI, Dehradun herbaria. Out of these 48 species have been described for which c 289 herbarium specimens were studied.

Dr. Puneet Kumar: Documented 15 species out of which six species are belonging to family Polygalaceae, *four species to Flacourtiaceae and 3, 2 species to Capparaceae and Pittosporaceae*, respectively. Studied c 65 herbarium specimens housed at BSD.

ACHIEVEMENTS/ OUTCOMES

During this study total 220 taxa were described for the allotted families.

PHARMACOGNOSY UNIT, HQRS, KOLKATA

PROJECT - 1

Pharmacognostic studies in Indian Cycads

Executing Scientist (s): Dr. A.B.D. Selvam

Date of Initiation : April, 2016

Date of Completion: March, 2021

OBJECTIVE

Study of Indian Cycas particularly on pharmacognostic aspects.

BACKGROUND

The project was initiated in 2016. During previous year,

two field tours were conducted to different parts of Kerala and Karnataka during which 13 field numbers were collected. Pharmacognostic studies on 03 species of Cycas were completed.

AREA AND LOCALITY

Western Ghats & Eastern Ghats

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two tours were conducted to Andaman & Nicobar Islands. Unfortunately the executing scientist Dr. A.B.D Selvam expired on 14th February, 2019 due to cardiac arrest.

PLANT CHEMISTRY UNIT, HQRS, KOLKATA

PROJECT-1

Bioprospective assessment of phytodiversity

Executing Scientist (s): Dr. Tapan Seal

Date of Initiation : April, 2008

Date of Completion: March, 2018

OBJECTIVE

Estimation of chemical composition and nutritive value of edible plants of NE India.

BACKGROUND

The project was initiated in 2008. During previous year, proximate composition, mineral contents, antioxidant properties of 14 wild edible plants were carried out along with quantitative estimation of phenolic acids and flavonoids. Estimation of water soluble vitamin was carried out in 20 plant samples. In-vitro antidiabetic activity study of 10 wild edible plants was also completed.

AREA AND LOCALITY

N.E. region, India

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, Oxalate content of 65 wild edible plants, Phytate content of 65 wild edible plants, Saponin content in 65 wild edible plants and Cyanogenic glycosides in 65 wild edible plants were estimated; Quantitative estimation of Phenolic acids and flavonoids (Rutin, quercetin, kaempferol, apigenin, myricetin, gallic acid, catechin, ferulic acid, coumarin, naringin, p-hydroxybenzoic acid, protocatechuic acid, gentisic acid, vanillic acid, aesculin, caffeic acid, syringic acid, p-Coumaric acid, naringenin, salicylic acid, ellagic acid luteolin, and sinapic acid) content in Ten wild edible plants were carried out using HPLC were carried out; estimation of water soluble vitamin (Vit C, Vit B1, Vit B2, Vit B3, Vit B5, Vit B6 and Vit B9) in thirty plant samples were carried out by HPLC and Toxicity studies of 90 plants.



Clerodendrum colebrookianum



Tetradium fraxinifolium



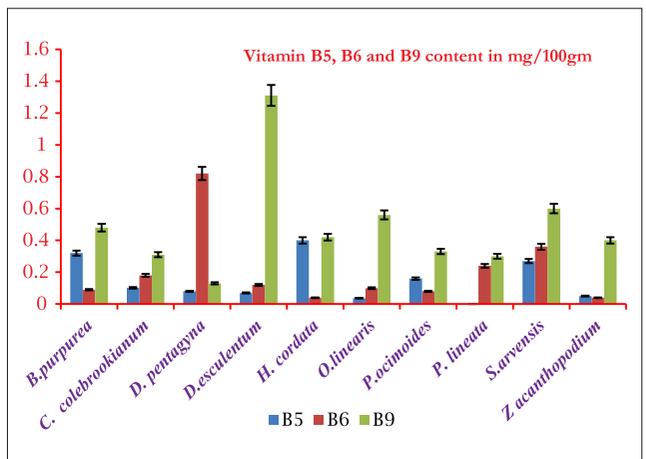
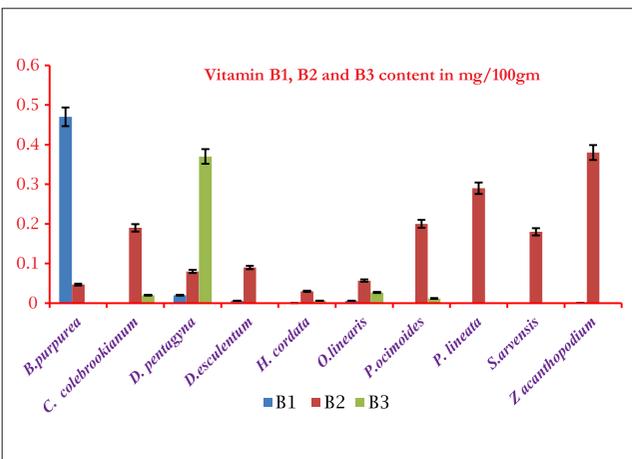
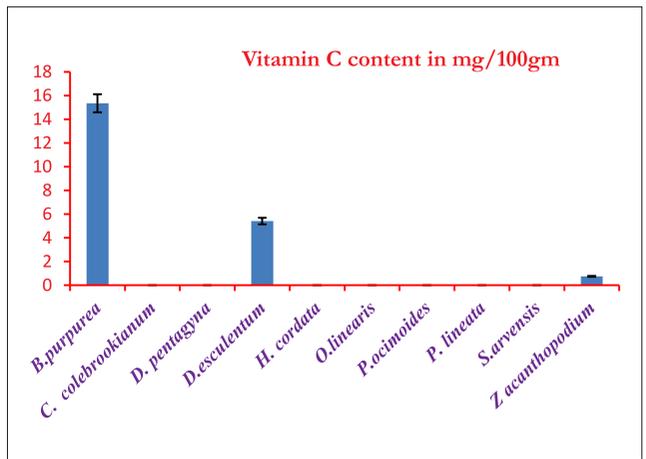
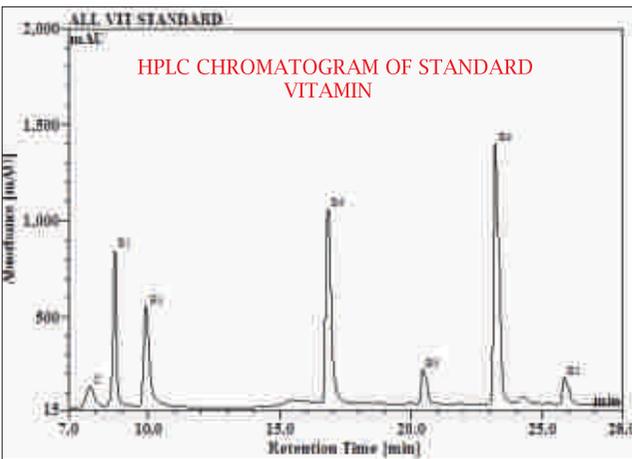
Phlogocanthus thrysiflorus



Gomphogyne cissiformis



Diploknema butyracea



PUBLICATION SECTION, HQRS, KOLKATA

PROJECT-1

Interpretation of Roxburgh's Icon: Family Bignoniaceae and Clusiaceae

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

Date of Initiation : April, 2018

Date of Completion: March, 2020

OBJECTIVE

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

BACKGROUND

This is a new project.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, 06 taxa of *Calophyllum*, 12 taxa of *Garcinia* and 01 taxon of *Mesua* were taxonomically interpreted along with present status, brief description, flowering & fruiting, distribution and ecology.

PROJECT-2

Updating of Family Cucurbitaceae (ca. 96 spp.) under Flora of India Vol. 10

Executing Scientist (s): Dr. B. K. Sinha, Dr. S.S. Dash & Smt. Sudeshna Dutta

Date of Initiation : April, 2018

Date of Completion: March 2020

OBJECTIVE

Updating the Nomenclature of the each of the species occur in India and to submit the updated manuscript for flora of India Vol 10.

SUMMARY OF THE WORKDONE DURING 2018-19

An exhaustive checklist of the Cucurbitaceae is prepared. During the study the conventional method of taxonomy followed ; literature were extensively surveyed, examined the herbarium specimens in different herbarium(CAL, ASSAM. BLATTER, BSA, BSIS). All the type material at CAL or JASTOR were studied,(when

available). The accepted names were inferred after resolving any nomenclatural problem if any

ACHIEVEMENTS/ OUTCOMES

The entire updated list of Indian Cucurbitaceae has been prepared, which revealed 30 genera, 95 species, out of which 10 endemics, Nomenclature interpretation of all the India species to the current accepted name. Recent taxonomic changes resulted in the acceptance of 96 species. Genera which are longer accepted are *Biswarea* (= *Herpetospermum*), *Cucumella* (= *Cucumis*), *Dicoelospermum* (= *Cucumis*), *Edgaria* (= *Herpetospermum*), *Gymnopetalum* (= *Trichosanthes*), *Mukia* (= *Cucumis*), *Neoluffa* (= *Siraitia*), *Praecitrullus* (= *Benincasa*), *Sechium* (= *Sicyos*). *Melothria* in its modern circumscription is confined to the New World and does not occur in India. Its two Indian species have been moved to *Cucumis* and *Solena*

PROJECT-3

Flora of Eagle Nest Wild Life Sanctuary And Its Adjacent Regions, West Kameng District, Arunachal Pradesh (New Project)

Executing Scientist (s): Dr. S.S. Dash and Mr. Sanjay Kumar

Date of Initiation: April, 2018

Date of Completion: March, 2022

OBJECTIVES

To conduct detailed floristic Survey in Eagle nest Wild life



Impatiens tripetala Roxb. ex DC

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 OF THE WORK DONE DURING 2018-19

During this period literature consultation was carried out in first and second quarter. One field tour was undertaken w.e.f. 12.11.2018 to 30.11.2018 and 112 field numbers in triplets were collected from Eagle Nest Wild Life Sanctuary and its adjacent region. During the same tour 1754 photographs were also were taken. All collected specimens are well processed, dried and poisoned as per slandered herbarium procedure.



Sigesbeckia orientalis L.

SIKKIM HIMALAYAN REGIONAL CENTRE, GANGTOK

PROJECT-1

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 and Dr. David Lalsama Biate

Date of Initiation : April, 2013

Date of Completion : March, 2019

OBJECTIVE

Red List Threat assessment of Orchids of Eastern Himalaya (Entire Sikkim, Darjeeling district of West



Dendrobium moschatum



Eria spicata

Bengal and Arunachal Pradesh excl. Changlang and Tirap) as per IUCN criteria.

BACKGROUND

The project was initiated in 2013. During previous year, 11 local tours were collected at different parts of Sikkim during which population of 150 orchid taxa was observed; 44 field numbers were collected and introduced in the campus garden for *ex-situ* conservation; 41 taxa were identified; 08 taxa were illustrated. Datasheet of 600 species were prepared with updated nomenclature, synonyms and taxonomic accounts.

AREA AND LOCALITY

Eastern Himalaya (Entire Sikkim, Darjeeling district of West Bengal and Arunachal Pradesh excl. Changlang and Tirap).

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, 306 taxon data sheets were Compiled to finalize different components including synonyms, taxonomic history (citation), phenology, habitat, distribution (global and Indian context) and exsicata; taxonomic descriptions of 13 genera and 55 species of orchids were finalized; assigned geo-coordinates to 36 species and 406 herbarium sheets of orchids from old herbarium housed at TIPPI, CAL. ASSAM, ARUN, LBG, BSD, SFRI, NBU, TBGT, Calicut University.

ACHIEVEMENTS/ OUTCOMES

Final manuscript is being finalized for submission.

PROJECT-2

Flora of Kanniyakumari Wildlife Sanctuary, Tamil Nadu (Project carried out at BSISRC, Coimbatore till November 2018)

Executing Scientist (s): Dr. J.H. Franklin Benjamin & Mr. R.G. Vadhyar

Date of Initiation : April 2016

Date of Completion: March, 2021

OBJECTIVE

Preparation of a detailed floristic account of the protected area.

BACKGROUND

This project was initiated in 2016. During previous year, two field tours were conducted to the study region during which 384 field numbers were collected along with 400 field photographs of which 366 species under 274 genera and 94 families were identified.

AREA AND LOCALITY

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



Syncolostemon comosus (Wight ex Benth.) D.F.Otieno

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours were undertaken to the study area during which 291 field numbers were collected and 209 species were documented.

ACHIEVEMENTS/ OUTCOMES

This study reports 01 new record for the state. During field tour, 04 Endangered, 04 Vulnerable and 35 endemic plants were collected for *ex-situ* conservation.



Artabotrys zeylanicus Hook.f. & Thomson

SOUTHERN REGIONAL CENTRE, COIMBATORE

PROJECT-1

Floristic studies in Kodaikanal Wildlife Sanctuary, TamilNadu, India

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

Date of Initiation: April, 2015

Date of Completion: March, 2020

OBJECTIVE

Preparation of a detailed flora of Kodaikanal Wildlife Sanctuary along with vegetation type map

BACKGROUND

The project was started in 2015. During previous year, four field tours were conducted to the study area during which 426 field numbers were collected along with 1565 photographs. Vegetation type map of the sanctuary was prepared with the help of NRSC-ISRO, Hyderabad by using Sentinel-2 satellite multi seasonal images. In

addition, many endemic and rare plants were collected for introduction in garden.

AREA AND LOCALITY

Kodaikanal Wildlife Sanctuary, TamilNadu.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, 03 field tours were conducted to Kodaikanal WLS during which 282 field numbers were collected along with 1050 photographs of plants and habitat vegetation. Nomenclature citations, description and descriptions of taxa are in progress. In addition several endemic and rare species pertaining to this sanctuary were collected and sent to NOEG, Yercaud germplasm centre and BSI SRC garden for conservation purpose and further studies.

ACHIEVEMENTS/ OUTCOMES

This study reports 02 plants as additions to Flora of Palni Hills [*Pseudanthistiria umbellata* and *Wahlenbergia hookeri*] and 04 grass species as addition to this WLS.



Shola vegetation at Siruvani

PROJECT-2**Floristic Assessment of Megamalai Wildlife Sanctuary, Tamil Nadu**

Executing Scientist (s) : Dr. C. Murugan & Dr. Arumugam

Date of Initiation : April, 2016

Date of Completion : March, 2020

OBJECTIVE

Intensive floristic survey in the Wildlife Sanctuary along with collection of information about distribution, ecology, economic uses of the plants available in the protected area.

BACKGROUND

The project was initiated in 2016. During previous year, four field tours were conducted to the study area during which 697 field numbers were collected along with 5000 images of which 565 taxa were identified upto species level.

AREA AND LOCALITY

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



Canavalia rosea (Sw.) DC.



Abelmoschus ficulneus (L.) Wight & Arn.



Sonerila kannanorensis G. S. Giri & M. P. Nayar

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, four field survey *w.e.f.* 9.04.2018 - 28.04.2018, 16.08.2018 - 23.08.2018, 16.11.2018 - 22.11.2018 & 01.02.2019 - 08.02.2019 were conducted to the study area during which 540 field numbers were collected along with 4000 photographs of which 630 field numbers were identified.

ACHIEVEMENTS/ OUTCOMES

This study reports One new species (*Eugenia megalayana* Murugan & Arumugam); one plant species (*Drypetes porteri* - Putranjivaceae) rediscovered after 120 years from type locality.

PROJECT-3**Assessment of Plant diversity in Cauvery North Wildlife Sanctuary, Tamil Nadu**

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

Date of Initiation : September, 2017

Date of Completion : March, 2021

OBJECTIVE

Survey, identification and inventorization of the floristic diversity of Cauvery North Wildlife Sanctuary to assess plant resources and their traditional utilization and conservation practices.

BACKGROUND

This project was initiated in 2017. During previous year, two field tours were undertaken to study area during which 457 field numbers were collected alongwith 307 photographs of which 376 species were identified. In addition 08 RET plants were collected for introduction in garden.

AREA AND LOCALITY

Cauvery North Wildlife Sanctuary, Tamil Nadu; c. 504.33

sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field tours *w.e.f.* 06.06.2018 – 15.06.2018 and 09.10.2018 – 17.10.2018 were conducted to the study area during which 381 field numbers were collected alongwith 350 plant images. Besides, label writing of 300 specimens were completed. 15 RET species were collected and 7 live plants were introduced in SRC Garden.

PROJECT-4

Seaweed Flora of Goa Coast

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

Date of Initiation : April, 2017

Date of Completion : March, 2019

OBJECTIVE

Survey and collection of seaweeds in Goa coast in different seasons; herbarium preparation and documentation; study of the endemic, medicinally and economically important seaweeds; liquid preservation of economically important seaweeds in BSI, SRC museum, Coimbatore; study of associated and epiphytic seaweeds of the coast and compilation of documented data on seaweeds in the form of Seaweed Flora of Goa coast.

BACKGROUND

This project was started in 2017. During previous year, three field tours were undertaken to the coastal areas of Goa during which a total of 838 field numbers were collected and 1676 herbarium sheets were made whereas 130 field numbers were preserved in wet form.



Mixed seaweeds vegetation on calcified rocks at Bandarvanipeta

Total 615 field numbers were identified and taxonomic description of 26 taxa of seaweeds were completed.

AREA AND LOCALITY

Coastal region of Goa

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field tours *w.e.f.* 19.06.2018 to 26.06.2018 & 22.10.2018 to 02.11.2018 were conducted to different coastal areas of Goa during which 287 field numbers were collected along with 450 plant images. Besides 96 taxa were documented during this years. Significant diversity was recorded in vegetation pattern of seaweeds. Due to the post monsoon season, the green seaweeds (Chlorophyceae) show maximum diversity, followed by brown seaweeds (phaeophyceae) and red seaweeds (Rhodophyceae). Species like *U. compressa*, *U. Fasciata*, *U. flexuosa*, *U. prolifera*, *Acrosiphonia orientalis*, *Chaetomorpha antennina*, *Dictyota ciliolata*, *Padina boergesenii*, *Padina boryana*, *Padina tetrastrumatica*, *Stoechospermum marginatum*, *Sargassum cinereum*, *Sargassum wightii*, *Sargassum polycystum*, *Gelidium micropterum*, *Gelidium pusillum*, *Gracilaria corticata*, *Acanthophora spicifera*, *Amphiroa fragilissima*, *Cheilosporum spectabile*, *Hypnea musciformis*, *Gelidiopsis variabilis* etc were recorded with scanty / sparse distribution. Over all analysis shows that class Chlorophyceae was dominant in distribution, followed by Rhodophyceae and Phaeophyceae. In addition, 40 economically useful macro marine algae are collected and documented.

ACHIEVEMENTS/ OUTCOMES

This study reports 13 taxa as new distributional records for Goa.



Padina tetrastrumatica Hauck



Cyperus arenarius Retz.

PROJECT-5

Cyperace of Tamil Nadu, India

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

Date of Initiation: April, 2015

Date of Completion : March, 2020

OBJECTIVE

Survey, study and documentation of the members of Cyperaceae in TamilNadu.

BACKGROUND

The project was started in 2015. During previous year, three field tours were conducted to different regions of Tamil Nadu during which 241 field numbers were collected along with 500 field photographs.

AREA AND LOCALITY

Tamil Nadu

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, one field survey *w.e.f.* 14.12.2018 –22.12.2018 was conducted to different parts of the state during which 47 field numbers were collected along with 150 photographs. A total of 60 field numbers were identified including previous collections and 60 species description were completed.

ACHIEVEMENTS/ OUTCOMES

During this study, some interesting species like *Cyperus compressus*; *Cyperus cyperoides*; *Fimbristylis argentea*; *Fimbristylis eragrostis*; *Lipocarpha chinensis* were collected.

PROJECT-6

Study of Nutlets of tribe Cyperae and Fimbristyledeae from south India using SEM

Executing Scientist (s) : Mehala Devi R & Anantha Lakshmi M



Cyperus bulbosus Vahl

Date of Initiation : April, 2016

Date of Completion : March, 2029

OBJECTIVE

Collection of nutlets of the tribes Cyperae and Fimbristyledeae from field and duplicates; study of variations in nutlet shape, size and ornamentation pattern.

BACKGROUND

This project was initiated in 2016. During previous year, nutlets of 50 species were studied using SEM with special emphasis on ornamentation, shape and size and 300 images were taken.

AREA AND LOCALITY

South India

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, 24 species from Tribe Fimbristyledeae and 25 species from Cyperae were studied using SEM with special emphasis on ornamentation, shape and size. A total of 3493 images were taken using SEM.

ACHIEVEMENTS/ OUTCOMES

During this study, some variations in nutlet surfaces were determined which can be used for Taxonomic keys or for identification purpose. Based on the interpretation of the SEM images of the nutlets in Cyperaceae, the 6 genera studied can be broadly categorized in to two groups based on the presence and absence of Silica bodies. In tribe Cyperae, the 3 genera studied can be broadly categorised into two groups based on the Orientation. In some cases the mericarp surfaces were relatively smooth with sculpturing at lower levels created by the outer walls of the exocarp cells. The nature of the individual exocarp cells has shown to be an informative character in other groups and certainly varies significantly across the both the tribes with smooth or pitted cells common and convex to conical or papillose cells present in tribe Cyperae.

PROJECT-7**Study of Pollinia of South Indian Orchids using SEM: Phase II**

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

Date of Initiation : April, 2017

Date of Completion: March, 2020

OBJECTIVE

Studying morphology and exine micromorphology of pollen of South Indian Orchids.

BACKGROUND

This project was started in 2017. During previous year, pollinia of 05 species were collected from NOEG, Yercaud; SEM study was completed for 10 species and 20 SEM images were taken.

AREA AND LOCALITY

South India

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/OUTCOMES

During 2018-19, pollinia of 20 orchid species was studied using SEM.

PROJECT-8**Updation of families Altingiaceae, Sonneratiaceae, Crypteroniaceae, Punicaceae, Trapaceae, Caricaceae, Datisceae for Flora of India Vol. 10**

Executing Scientist (s): Dr. M. Murugesan

Date of Initiation : April, 2018

Date of Completion : March, 2019

OBJECTIVE

Updating taxa belonging to the families Altingiaceae, Sonneratiaceae, Crypteroniaceae, Punicaceae, Trapaceae, Caricaceae, Datisceae for Flora of India Vol. 10

BACKGROUND

This is new project

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, scrutinized the species under each family based on available literatures, herbarium specimens and from various websites, prepared description of each species as per the recent volume of Flora of India (vol.23), based on herbarium specimens as well as relevant literatures, prepared a complete checklist comprising of 23 taxa and 2 natural inter-specific hybrid species along with citation and



Mangrove vegetation in Pullivasal Island

distribution details of each species under allotted families.

ACHIEVEMENTS/OUTCOMES

This study describes 07 species and 02 Natural inter-specific hybrid species under Sonneratiaceae; 01 species under Punicaceae, 04 species under Altingiaceae; 02 species under Crypteroniaceae; 05 species under Trapaceae; 02 species under Datisacaceae and Caricaceae each.

PROJECT-9

ex-situ conservation & multiplication of endemic, rare, threatened, medicinal and economically important plants of North East India

Executing Scientist (s) : Dr. M. Murugesan & Shri L.R. Meitei

Date of Initiation : Ongoing

Date of Completion : Ongoing

OBJECTIVE

Collection, conserve and multiply endemic, rare, threatened and economically plants of NE India at Experimental Botanic Garden, Barapani, Shillong; recording phenology of plants available in the garden.

BACKGROUND

This project was initiated, as soon as the establishment of ERCon 1st April 1956, to conserve the endemic, threatened and economically important plants of North East India by *ex-situ* conservation method and multiplication in Experimental Botanic Garden, BSI, ERC, Umiam (Barapani). Experimental Botanic Garden, Barapani is located ca. 22 km away from Shillong near Umiam Lake at Barapani, with an area of ca 25 acres at an altitude ca 1000m. It is in the process of introduction/acclimatisation and paying considerable attention towards maintenance of germplasm collection, growing and multiplication of rare / endangered



Strobilanthes aurita J.R.I. Wood

/threatened plant wealth of North-east India in order to save them from extinction.

Presently about 1300 species of vascular plants, 13 gymnosperms, 77pteridophytes and 58 bryophytes of North-east India are being conserved here. Many of them are rare, endemic and economically important plant species of this region. To enrich the flora of the garden with particular reference to RET and other economically important plants, field tours are being conducted regularly to various parts of NE India for collection and introduction of RET plants and introducing in the garden.

AREA AND LOCALITY

Entire N.E. India

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, two field surveys *w.e.f.* 20.07.18-26.07.18 and 22.09.18-29.09.18 were conducted to Senapati and Kangpokpi districts, Manipur and Garo Hills, Meghalaya during which 45 field numbers were collected along with 1550 photographs. In addition, 251 live plants including 68 RET plants were collected. During this period, also conducted 6 local one day field tours to various parts of Meghalaya: 1. Moopun Falls, Jaintia Hills, Meghalaya on 29th April 2018 (collected 60 live plant species including 12 RET species). 2. Sohra, East Khasi Hills, Meghalaya on 12th May 2018 (collected 30 live plant species including 5 RET species) 3. Mardon, Ri-Bhoi, Meghalaya on 21st June 2018 (collected 13 live plant species including 3 RET species) 4. Upper Shillong, East Khasi Hills, Meghalaya on 11th August 2018 (Collected 36 live plant species including 13 RET species) 5. Sumer, Ri-Bhoi, Meghalaya on 12th August 2018 (Collected 15 live plant species). A total of 700



Schoenoplectiella erecta Poir. Lye

photographs were taken. Almost all identified. A total of 293 species of live plants have been collected, identified and planted in Experimental Botanical Garden, Barapani, including 103 endemic, rare and threatened plants. 23 species of Zingiberaceae, Piper (7), Musa (6), Dioscorea (3), Bamboo (2), Ceropegia (5 species), Citrus (4), Medicinal plants (32), Aquatic plants (6) and 19 species of ferns have been planted in the respective sections of the garden during this period. About 2860 seedlings/saplings were multiplied from 27 RET spp. (1920 saplings of 15 species by stem cutting and 940 seedlings of 12 species by seed germination).

ACHIEVEMENTS/OUTCOMES

This study reports 03 species [*Ceropegia meghalayensis* (Apocynaceae); *Ceropegia khasiana* (Apocynaceae); *Zingiber manipurensis* (Zingiberaceae)] as new to science; one new record for India [*Eulopia pauciflora* (Orchidaceae)] and 04 new species [*Mazus dentatus* (Phrymaceae); *Cephalanthe radamasonium* (Orchidaceae); *Hedychium longipedunculatum* (Zingiberaceae); *Zingibe rkangleipakense* (Zingiberaceae)] for Meghalaya.

PROJECT-10

ex-situ conservation of endemic endangered and threatened plants of the region and recording of phenology of flowering / fruiting of species in garden

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

Date of Initiation : Ongoing

Date of Completion : Ongoing

OBJECTIVE

ex-situ conservation of endemic endangered and threatened plants of the region; recording of phenology of flowering / fruiting of species in garden.

BACKGROUND

Mukurthi National Park (MNP) is a 78.46 sq. km. protected area located in the western corner of the Nilgiris Plateau west of Ootacamund hill station in the northwest corner of Tamil Nadu state in the Western Ghats mountain range of South India. Mukurthi National Park has an elongated crescent shape facing to the west between 11°10' to 11°22' N and 76°26' to 76°34' E with a highest peak elevation of 2554m. It is bordered on the west by Nilambur South Forest Division in Kerala, to the northwest by Gudalur Forest Division, to the northeast, east and southeast by Nilgiri South Forest Division and to the south by Mannarghat Forest Division, Kerala. At its southwest tip the peaks of this park straddle the northeast corner of Silent Valley National Park of Kerala.

The park is characterised by montane grasslands and shrublands interspersed with sholas in a high altitude area of high rainfall, near-freezing temperatures and high winds. The park has a harsh environment with annual rainfall varying from 2010 mm to 6330 mm (79–249 inches), night temperature sometimes below freezing in the winter and wind speeds ranging up to 120 km/h (75 mph). The area is home to numerous endemic plants particularly of the scapigerous annual Impatiens plants. *Alchemilla indica* and *Hedyotis verticillaris* are found only within or on the fringes of this park. *Rhododendron arboreum* subspecies *nilagiricum*, are seen throughout the grasslands. Other common shola trees and shrubs among the 58 species found here include: *Syzygium calophyllifolium*, *Daphniphyllum neilgherrense*, *Cinnamomum wightii*, *Vaccinium leschenaulti*, *Mahonia leschenaulti*, *Litsea* sp., *Lasianthus* sp., *Psychotria* sp. and *Michelia nilagirica*. The edges of most sholas are lined with the shrubs: *Gaultheria fragrantissima*, *Rhodomyrtus tomentosa*, *Rubus* sp., *Bergeris tinctoria*, *Eurya nitida*, *Strobilanthes* sp., and *Helichrysum* sp. The orchids *Eria abliflora*, *Oberonia santapau*, *Aerides ringens*, *Aerides crispa* and *Coelogyne odoratissima* are found on the high west edge of the park. Among the grasslands are a plethora of *Brachycorythis iantha*, *Satyrium nepalense*, *Habenaria cephalotes*, *Seidenfia densiflora*, *Spiranthes sinensis* and *Liparis atropurpurea*.

AREA AND LOCALITY

Mukurthi National Park; c. 78.46 sq. km.

SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field surveys were undertaken to Mukurthi National Park, The Nilgiris, Tamil Nadu during which 69 species belonging to 36 genera under 15 families were collected with GPS data. In addition, 27 species under 16 genera belonging to 27 families of other Angiosperms were also collected and recorded GPS data. 42 Photographs of plant species were recorded with identification. During the live plant collection tour, the Collection of rare and threatened plant species *viz.*, *Ceropegia pusilla*, *Habenaria polyodon*, *Habenaria richardiana* were collected and introduced in the garden for multiplication.

ACHIEVEMENTS/OUTCOMES

This study reports two new records for the state [*Ledebouria hyderabadensis* M. V. Ramana, Prasanna & Venu-Hyacinthaceae; *Cheirostylis parvifolia* Lindl. (Orchidaceae)].

PROJECT-11

ex-situ conservation of Endemic tree species of the region

Executing Scientist (s) : Dr. Mayur Y. Kamble & Mr. B.S. Elango

Date of Initiation : Ongoing

Date of Completion : Ongoing

OBJECTIVE

Live plant collection and introduction of 10 endemic tree species for multiplication and *ex situ* conservation in Experimental Garden, BSI, SRC, Yercaud.

BACKGROUND

The Agasthyamalai Biosphere Reserve (ABR) is located in two states, viz. Kerala and Tamil Nadu. It has a total area of about 3500 sq km; 1828 sq km is in Kerala and 1672 sq km is in Tamil Nadu. The Agasthyamalai region is located on the southern end of Western Ghats. One of the regions in Agasthyamalai is the Kalakad-Mudanthurai Tiger Reserve (KMTR) and it is located right in the Agasthyamalai Hills in Tamil Nadu state. Since the ecosystem of entire ABR is highly diverse and biologically very rich, the rate of endemism is also high. Considering high rate of endemism, during Annual Action Plan of 2018-2019, two live plant collection trips were planned to Agasthyamalai Biosphere Reserve, Western Ghats for collection, introduction and multiplication of 10 endemic trees species at National Orchidarium and Experimental Garden, Yercaud for *ex-situ* conservation.

AREA AND LOCALITY

Agasthyamalai Biosphere Reserve (ABR) and Tamil Nadu, Kalakad Mundanthurai Tiger Reserve; c.

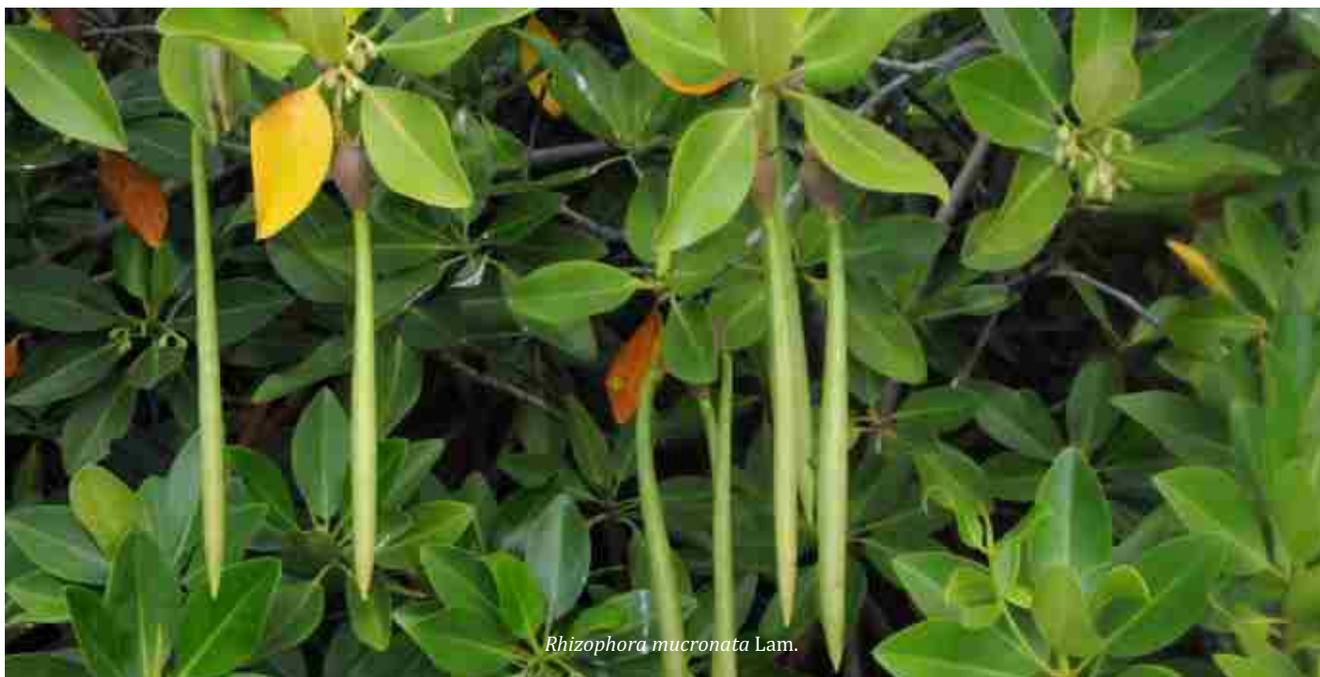
SUMMARY OF THE WORKDONE DURING 2018-19

During 2018-19, two field survey *w.e.f.* 14.05.2018 to

23.05.2018 and 22.10.2018 to 31.10.2018 were conducted to the study area during which 38 endemic tree species were collected along with 100 plant images. Collected and introduced propagules of following 38 endemic tree species: *Actinodaphne bourdillonii*, *Agasthiyamalaia pauciflora*, *Arenga wightii* Griff. (ARECACEAE); *Artocarpus hirsutus* (MORACEAE); *Baccaurea courtallensis* (EUPHORBIACEAE); *Cadaba trifoliata* (CAPPARACEAE); *Calophyllum apetalum* (CLUSIACEAE); *Cinnamomum heyneanum* (LAURACEAE); *Cycas cercinalis* (CYCADACEAE); *Dipterocarpus indicus* (DIPTEROCARPACEAE); *Eugenia singampattiana* (MYRTACEAE) etc. In addition, live plants of following endemic/indigenous/medicinal species collected and introduced in NOEG, Yercaud: *Acrotrema agastyamalayanum*, *Dillenia pentagyna*, *Cleisostoma tenuifolium*, *Tainia bicornis*, *Vanda testacea* etc.

ACHIEVEMENTS/ OUTCOMES

During this study, following RET taxa [18 trees (*Artocarpus hirsutus*, *Baccaurea courtallensis*, *Calophyllum apetalum*, *Cullenia exarillata*, *Eugenia singampattiana* etc.), 07 shrubs (*Abutilon ranadei*, *Barleria acuminata*, *Strobilanthes kunthiana*), 01 climber (*Thunbergia mysorensis*)] and 10 indigenous taxa (*Anoectochilus elatus*, *Mesua ferrea*, *Psilotum nudum*, *Phlegmariurus mirabilis* etc.) were collected and multiplied in Experimental Botanic Garden. 14 endemic plants were maintained in newly developed Arboretum.



Rhizophora mucronata Lam.

WESTERN REGIONAL CENTRE, PUNE

PROJECT-1

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

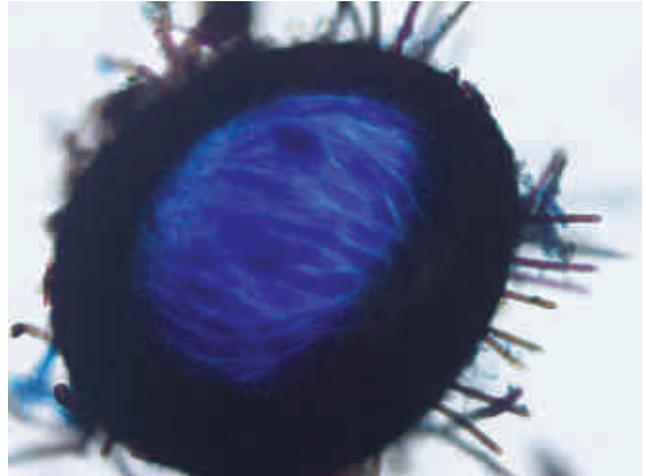
Taxonomic studies of microfungi found in the phyllospheric region and soil of the National Park.

BACKGROUND

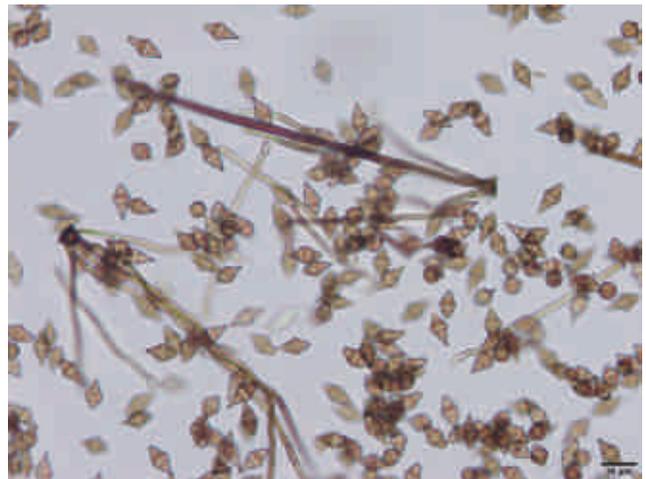
This project was started in 2016. During previous year, two field tours were conducted to the study area during which 37 field numbers of infected foliicolous specimens, more than 120 pkts of Litter samples, more than 100 pkts of twigs, 14 water samples and 04 infected mangrove samples were collected of which 46 samples including 66 branches/twigs wooden logs were processed in laboratory.



Brachysporiella gayana Bat.



Chaetomella sp.



Beltrania mangifera

AREA AND LOCALITY

Sanjay Gandhi National Park , Maharashtra; c. 103.36 sq.km.

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, one exploration tour *w.e.f.* 18.10.2018-24.10.2018 was undertaken in the forest areas of Sanjay Gandhi National Park during which a total of 167 samples were collected (along with 600 field photographs) which included: 34 Foliicolous, 56 leafy litter, 45 wooden, 1 water and 32 soil samples. 38 litter samples collected from different sites of SGNP, Mumbai were cultured on

Malt Extract Agar, Potato carrot Agar media by applying soil dilution method and the same were subcultured on the correspondent media. Total 55 fungal colonies from 6 samples were sub cultured and their slides were made. Molecular studies of three species *Lasiodiplodia macrospora*, *Trichoderma erinaceum*, and *Paradictyoarthrinium diffractum* were done.

PROJECT-2

Pteridophytes of Goa

Executing Scientist (s): Dr. A. Benniamin

Date of Initiation : April, 2018

Date of Completion: March, 2020

OBJECTIVE

Study of diversity of Pteridophyte flora of the state Goa

BACKGROUND

Pteridophytes form a conspicuous element of vegetation of Western Ghats. Goa is one of the important states that harbour a rich forests. Little work on pteridophytes of Goa is available. The present proposal will fill this gap and proposed for the pteridophytic account of Goa state.

AREA AND LOCALITY

Goa

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, two field tours were undertaken to different localities of Madei Wildlife Sanctuary, Bhondla Wildlife Sanctuary, Molem Wildlife Sanctuary, Cortigao Wildlife Sanctuary, Nethravathi Wildlife Sanctuary and its nearby forested regions during which 95 field numbers belonging to 49 species were collected. Besides, chromosome number of 4 species namely *Thelypteris Papilio*, *Thelypteris dentata*, *Bolbitis subcrenoitoides* and *Bolbitis appendiculata* were also studied. SEM image of



Luisia birchea Blume-An endemic species to Western Ghats hotspot

10 species taken, 5 species introduced in the garden. Studied the spore morphology of 10 species under Scanning Electron Microscope. During this period, five species namely *Osmunda hilsenbergii*, *Cyathea gigantea*, *Angiopteris helferiana*, *Thelypteris caudipinna*. *Bolbitis asplenifolia* and *Bolbitis presliana* were collected and introduced in Botanical Garden of Western Regional Centre, Pune.

ACHIEVEMENTS/ OUTCOMES

The Present work recorded 06 species [*Asplenium inaequilaterale*, *Thelypteris tylodes*, *Thelypteris ochthodes*, *Asplenium cheilosorum*, *Psilotum nudum*, *Microlepia speluncae*] as a new record for the state of Goa.

PROJECT-3

Updation of family Asclepiadaceae for Flora of India, Volume 17

Executing Scientist (s): Dr. J. Jayanthi

Date of Initiation : September, 2018

Date of Completion: March, 2020

OBJECTIVE

updating the family Asclepiadaceae for Flora of India

BACKGROUND

This is a new project.

AREA AND LOCALITY

India

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one Herbarium consultation tour *w.e.f.* 30.01.2019 to 31.01.2019 was conducted to the herbarium of Agharkar Research Institute (AHMA), Pune and studied Type specimens and other specimens of Asclepiadaceae. The herbarium of Blatter (BLAT), St.Xavier's college, Mumbai on 01.02.2019 was also visited to the study the herbarium specimens. In addition, the herbarium specimens deposited in BSI herbarium was consulted and indexed. Literature survey was carried out in BSI, WRC, library. Updation of nomenclature from the Fascicles Flora of India, volume 24 was done. Research papers, recent floras, authentic web data bases were referred to prepare an updated checklist. An updated checklist was completed with uptodate nomenclature.

ACHIEVEMENTS/ OUTCOMES

This study reports an updated checklist of Asclepiadaceae provides a total of 306 species (including infraspecific taxa) distributed in 48 genera for Flora of India.

PROJECT-4

A Taxonomic revision of the genus *Luisia* Gaudich. (Orchidaceae) from India for Flora of India, Volume 26

Executing Scientist (s): Dr. Jeewan Singh Jalal

Date of Initiation : September, 2018

Date of Completion: March, 2020

OBJECTIVE

Provide a taxonomic revision of the genus with up to date nomenclature, citation of correct names and synonyms, descriptions, distribution and photo-plate/ illustrations 26; mapping the distribution of all the species as well as assessing the conservation status of endemic species.

BACKGROUND

The genus *Luisia* Gaudich., was established by Charles Gaudichaud-Beaupre, is one of the most taxonomically critical genera of the Sub-tribe Aeridinae. *Luisia* species grow in moist deciduous forests from sea level up to 1600 m altitude. They are predominantly epiphytes, but in humid environments some species can grow as lithophytes. Approximately 40 species of *Luisia* are collectively distributed in Australia, Sri Lanka, India, Bhutan, China, Thailand, Indochina, Korea, Japan, Malaysia, Indonesia, the Philippines, New Guinea, and east to Fiji and Samoa in the Pacific Islands. In India there

are nineteen species which are mainly found in the North-eastern states, Peninsular India, Andaman & Nicobar Islands, of these only four species viz., *Luisia abrahami*, *Luisia balakrishnanii*, *Luisia macrantha* and *Luisia trichorrhiza* var. *flava* are endemic to India. Taxonomically, it is a very difficult genus due to low morphological variations among the different species. No comprehensive revisionary study is done on the genus in Indian context. There has been much uncertainty over the identity of some species. Hence, a revisionary work is being proposed to resolve the taxonomic ambiguity.

AREA AND LOCALITY

India

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, two field cum herbarium consultation tours *w.e.f.* 10.10.2018 – 25.10.2018 and 28.01.2019 – 17.02.2019 were executed to different parts of south India, Shendurney Wildlife Sanctuary, Vadattupara, Punneckada, Kothamangalam in Kerala state and Yercaud, Glendale, Nigliri district in Tamil Nadu, South Andaman, Middle Andaman and North Andaman and herbaria of Jawaharlal Nehru Tropical Botanic Garden & Research Institute (TBGRI), Palode, Kerala Forest Research Institute (KFRI), Peechi, University of Calicut and Botanical Survey of India, Southern Regional Centre,



Mallalli falls

Coimbatore (MH). During field tours 53 field numbers were collected along with 320 field photographs. During field survey, Population (total count of mature individuals), host species and threats to the orchid population were also recorded. total four *Luisia* species viz., *Luisia abrahami*, *Luisia birchea*, *Luisia macrantha* and *Luisia zeylanica* were collected and three species were reported in flowering. A total of 55 live specimens were collected and introduced in office garden of the Western regional Centre, Pune. Some of which are *Acampe ochracea*, *Aerides ringens*, *Cheirostylis flabellata*, *Chrysoglossum ornatum*, *Cleisostoma tenuifolium*, *Dendrobium fimbriatum* var. *fimbriatum*, *Dendrobium chrysotoxum*, *Epigeneium amplum*, *Eria bambusifolia*, *Eria pauciflora*, *Gastrochilus acaulis*, *Gastrochilus calceolaris*, *Liparis wighteana*, *Luisia abrahami*, *Luisia macrantha*, *Luisia birchea*, *Luisia zeylanica*, *Oberonia anamalayana*, *Oberonia sp.*, *Oberonia mucronata*, *Phalaenopsis deliciosa*, *Pomatocalpa spicata* etc.

PROJECT-5

Floristic Diversity of Wan Wildlife Sanctuary

Executing Scientist (s): Dr. Priyanka Ingle

Date of Initiation : April, 2016

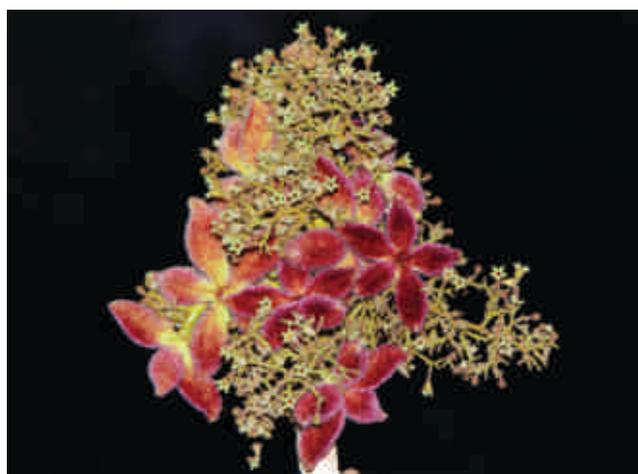
Date of Completion: March, 2020

OBJECTIVE

Survey and documentation of floristic diversity of Wan Wildlife Sanctuary; collection of ethnobotanical data from different communities around the protected area.

BACKGROUND

This project was initiated in 2016. During previous year, two field tours were conducted to the study area during which 238 field numbers were collected along with 700 photographs and GPS data among which 140 field numbers were identified and described.



Sterculia urens Roxb.



Abrus precatorius L.

AREA AND LOCALITY

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

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, three field tours w.e.f. 15.08.18 to 31.08.18, 28.12.18 to 11.01.19 and 22.03.19 to 29.03.19 were conducted Wan Wildlife Sanctuary during which 109 field number were collected along with their GPS coordinates and 290 photographs of which 31 taxa were documented. Ethnobotanical data of 44 plants and 60 wild edibles were recorded from 'Rathi' and 'Korku' tribal communities as well as from local Forest Workers.

PROJECT-6

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

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

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. During previous year, one field tour was conducted to different regions of Northern Western Ghats during which 13 orchid species were collected along with GPS data. About 37 species were preserved for microscopic study.

AREA AND LOCALITY

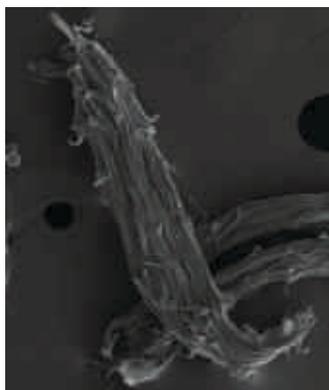
Northern Western Ghats, Maharashtra

SUMMARY OF THE WORKDONE DURING 2018-19 & ACHIEVEMENTS/ OUTCOMES

During 2018-19, One field tour was conducted to



Seed morphology of *Rhynchostylis retusa* under SEM



Seed morphology of *Smithsonia straminea* under SEM



Seed morphology of *Zuexine stratumatica* under Light microscope at 40x

Amboli, Chandgargh, Radhanagari, Asyniae, Ajara, Vaghotri patar, Radhanagari in October 2018 and 02 one day tours were conducted to the areas of Lonavala, Matheran, Mahabaleshwar, Koyna and Tahmini ghat, Bhamburde van vihar, Satatra areas during which 20 field numbers were collected and identified. SEM and light microscopic studies were conducted for 19 species (*Luisia berchea*, *Vanda testacea*, *Eulophia spectabilis*, *Porpax reticulata* etc.); cytology of 03 species was completed so far (*Nervilia plicata* – chromosome number $2n= 36$; *Dendrobium lawianum*- chromosome number $2n= 24$; *Bulbophyllum sterile* – chromosome number $2n= 38$). During field exploration, 07 endemic orchids are collected and conserved in the garden for further studies.

PROJECT-7

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

Executing Scientist (s): D. Jesubalan and Dr. A. Benniamin

Date of Initiation : April, 2016

Date of Completion: March, 2020

OBJECTIVE

Preparation of comprehensive floristic list of Pteridophytic flora of Pushpagiri Wildlife Sanctuary, Karnataka along with surrounding areas.

BACKGROUND

This project was initiated in 2016. 02 field tours were conducted to the study area during which 134 field numbers were collected with GPS data and 265 photographs. Spore morphology of 20 species was studied under SEM.

AREA AND LOCALITY

Pushpagiri Wild Life Sanctuary , Kodagu (Coorg) district, Karnataka; c.102.92 sq.km.

SUMMARY OF THE WORK DONE DURING 2018-19

During 2018-19, one field tour *w.e.f.* 21.11.18 to 05.12.18 was conducted to the study area during which a total of 96 field numbers were collected along with GPS data out of which 55 species were identified. Some of the common terrestrial species namely *Andiantum raddianum*, *Adiantum concinnum*, *Pteris biaurita*, *Dicranopteris linearis* and *Tectaria polymorpha*. Lithophytes such as *Lepisorus nudus*, *Bolbitis appendiculata* and epiphytes *viz.* *Microsorium membranaceum*, *Microsorium punctatum* and *Asplenium indicum* were found in and around the wildlife sanctuary. Two threatened species namely *Osmunda helsenbergii* and *Huperziaphlegmaria* was collected in the high elevation zone from Pushpagiri Wildlife Sanctuary and introduced in the Botanical Survey India, Western Regional Centre garden. Spore morphology of 20 species was studied under the Scanning Electron Microscope.

ACHIEVEMENTS/ OUTCOMES

This study reports three species namely *Diplazium travancoricum*, *Cyathea crinita* and a filmy fern *Trichomanes bimarginatum* as new record for the State of Karnataka



Leptochilus decurrens



Postia caesia (Schrad.) P. Karst.



NEW DISCOVERIES

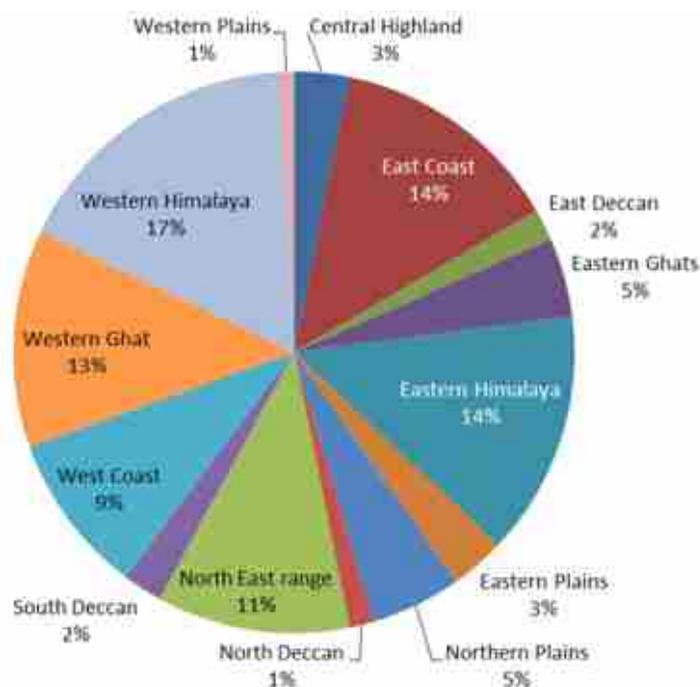
Impatiens anjawensis

NEW DISCOVERIES

Current estimation revealed that of total 18,666 species of angiosperms, 82 species of Gymnosperms, 1302 Pteridophytes, 15396 species of Fungi, 7411 species of Algae, 2780 species of Bryophytes, 2581 species of Lichens in India and 1223 species of microbes which is approximate 11.5 per cent of total recorded species of the world. The group wise current status of number of species known from India is given in the table below :

Group	No. of species in India	Percent of Indian Flora
Virus/Bacteria	1223	2.47
Algae	7411	14.98
Fungi	15396	31.14
Lichens	2581	5.22
Bryophytes	2780	5.62
Pteridophytes	1302	2.63
Gymnosperms	82	0.16
Angiosperms	18666	37.78
Total	49441	100

During the year 2018, the Scientist of BSI published 02 new genera, 65 new species and 03 new infra specific taxa of various groups of plants as new to science and discovered 01 family, 02 genus, 39 species, 3 varieties and 1 forma as new records for India.



NEW TO SCIENCE

NEW GENUS

BRYOPHYTES

Udaria D.K. Singh, S.Majumdar & D.Singh, *Curr. Sci.* 115 (8): 1537.2018. (LOPHOCOLEACEAE). This new bryophyte genus has been discovered and described based on the collection made from Zakthang, North District, Sikkim at 3360m altitude.

FUNGI

Indoporus A. Parihar, K. Das, Hembrom & Vizzini, *Cryptogamie Mycologie*, 39 (4): 453 2018. (BOLETACEAE). This new mushroom genus has been discovered and described based on the collection made from tropical dry deciduous Shorea dominated forests in Jharkhand, India.

NEW SPECIES

SEED PLANTS

Begonia dampae Odyuo, Sinha, Murugesan & Uddin, *Pleione* 12(1):99.2018 (BEGONIACEAE). This new species has been discovered and described based on the collection made from Dampa Tiger Reserve, Mizoram at 450m altitude.

Brachystelma ananthapuramense K. Prasad, A. Naray., & Meve, *Kew Bulletin* 73:16.2018 (APOCYNACEAE). This new species has been discovered and described based on the collection made from Gorantla hills, Ananthapuramu district of Andhra Pradesh at 800m altitude.



Begonia dampae



Crotalaria nallamalayana

Brachystelma vemanae A. Madhusudhana Reddy, M.V. Suresh Babu & K. Prasad, *Nordic J. Bot.* 36(10)-e02067: 2. 2018 (APOCYNACEAE). This new species has been discovered and described based on the collection made from Veligonda hills, Seetharamapuram, Nellore district of Andhra Pradesh at 280m altitude.

Crotalaria nallamalayana Rasingam & J. Swamy, *Phytotaxa* 345 (2):159. 2018 (FABACEAE). This new species has been discovered and described based on the collection made near Mallayalodhi, Amrabad Tiger Reserve at Mahabubnagar district of Telangana.

Cycas seshachalamensis P.V. Chalapathi Rao, N.V. Sivaram Prasad, P. Madhu Babu, K. Prasad and P.V. Prasanna, *Asian J. Conservation Biol.* 5(1): 55. 2016 (CYCADACEAE). This new species has been discovered and described based on the collection made near Chamala Range, Bakarapet forest area, Mayurasarovaram, Seshachalam hills, Chittoor district of Andhra Pradesh at 520m altitude.

Dimeria fasciculata P. Kumari & R. Lakra, *Int. J. Adv. Res.* 6(7): 485. 2018 (POACEAE). This new species has been discovered and described based on the collection made near Panchvati, Middle Andaman of Andaman & Nicobar at 875m altitude.

Henckelia pathakii G. Krishna & Lakshmin, *Taiwania* 63(4): 397.2018 (GESNERIACEAE). This new species has

been discovered and described based on the collection made on the way Tuting to Yingkiang, Upper Siang district of Arunachal Pradesh at 1870–2000m altitude.

Impatiens anjawensis Borah, Kandwal, G.M. Chhetri & Gogoi, *Balsam of Eastern Himalaya –A Regional Revision*, Botanical Survey of India, Kolkata, 55.2018 (BALSAMANACEAE)

This new species has been discovered and described based on the collection made near Walong, Anjaw district of Arunachal Pradesh at 3690m altitude.

Impatiens idumishmiensis Gogoi, W. Adamowski, Borah & G.M. Chhetri, *Balsam of Eastern Himalaya –A Regional Revision*, Botanical Survey of India, Kolkata, 100.2018 (BALSAMANACEAE). This new species has been discovered and described based on the collection made ahead 15 km towards Hunli from 65 point, Mayodia, Lower Dibang Valley district of Arunachal Pradesh.

Knoxia hookeri Lakshmin., *Harvard Papers in Botany*, 23(2).333.2018 (RUBIACEAE). This new species has been discovered and described based on the collection made from Pulney mountains, Tamil Nadu.

Leucas pachmarhiensis A.P. Tiwari, Mujaffar, S.K. Gavade, Lekhak & Sunojk., *Nordic J. Bot.* 36(4)-e01636: 2. 2018. (LAMIACEAE). This new species has been discovered and described based on the collection made from Rori Ghat, Pachmarhi Biosphere Reserve, Hoshangabad district of Madhya Pradesh at 750m altitude.

Lysionotus bijantiae D. Borah & A. Joe, *Taiwania* 63(3): 232.2018. (GESNERIACEAE). This new species has been discovered and described based on the collection made from Potin, Lower Subansiri district, Arunachal Pradesh.

Molineria jashpurica A.P. Tiwari, Mujaffar & A. N. Shukla, *Nordic J. Bot.* 36(11) - e02157: 1.2018 (HYPOXIDACEAE). This new species has been discovered and described based on collection made from Khudiyarani, Jashpur district of Chhattisgarh at 700m altitude.



Rubus ramachandrae



Leucas pachmarhiensis

Oberonia muthikulamensis K. Prasad, K.M.P. Kumar & P. Sudheshna, *Nordic J. Bot.* 36(5)-e01797: 2. 2018 (ORCHIDACEAE). This new species has been discovered and described based on the collection made from Muthikulam, on way to Elival hills, Palakkad district of Kerala at 1846m altitude.

Peliosanthes arunachalensis D. K. Roy, A. A. Mao & Aver., *Turczaninowia* 20 (3): 14. 2018 (ASPARAGACEAE). This new species has been discovered and described based on the collection made near Aka Hills, Bomputa Camp of Arunachal Pradesh at 9000ft altitude.

Rhododendron shingbae C.S. Purohit & Ram. Kumar, *Rhododendron (Melbourne)* 58: 79. 2018. (ERICACEAE). This new species has been discovered and described based on the collection made Shingba Rhododendron Wildlife Sanctuary, North district of Sikkim at 3200m altitude.

Rubus ramachandrae S. S. Dash & Chand. Gupta, *Blumea* 63(1):26.2018 (ROSACEAE). This new species has been discovered and described based on the collection made between Daporijo and Raga village, Upper Subansiri district of Arunachal Pradesh at 1270m altitude.

Tripogon nallamalyanus Rasingam & J. Swamy, *Phytotaxa* 351(4):296.2018 (POACEAE). This new species has been discovered and described based on the collection made from Umamaheshwaram, Mahbubnagar district of Telangana at 700m altitude.

Tupistra leonidii D.K. Roy & A.A. Mao, *Taiwania* 63(1): 37.2018 (ASPARAGACEAE). This new species has been discovered and described based on a collection made from Experimental Garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya.

Tupistra nagarum N. Odyuo, D.K. Roy & A.A. Mao, *Nelumbo* 60(1):2.2018 (ASPARAGACEAE). This new species has been discovered and described based on the collection made from Hekeshe village forest, Medziphema sub-division, Dimapur district of Nagaland at 1003m altitude.

PTERIDOPHYTES

Diplazium manickamii Fraser-Jenk & Kholia, *Annot. Checkl. Ind. Pterid.* 2: 126. 2018. (WOODSIACEAE). This new species has been discovered and described based on the collection made between Perar and Dodabetta, East of Ottacamund (Udhagamandalam), Nilgiri hills of Tamil Nadu.



Microlepia shubhangiae

Dryopsis arunachalensis Fraser-Jenk & Benniamin, *Annot. Checkl. Ind. Pterid.* 2: 219. 2018. (DRYOPTERIDACEAE). This new species has been discovered and described based on the collection made from Teju, Lohit district of Arunachal Pradesh.

Microlepia shubhangiae S. Sharma & Kholia, *Webbia* 73(2):192.2018. (DENNSTAEDTIACEAE). This new species has been discovered and described based on the collection made from Murlen National Park, Champhai district of Mizoram.

BRYOPHYTES

Cololejeunea khawanglungensis Sushil K. Singh, *Nelumbo* 60(1): 70. 2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Khawanglung Wild Life Sanctuary, Lunglei, Mizoram at 714m altitude.

Cololejeunea murlensis Sushil K. Singh, *Nelumbo* 60 (1): 70. 2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Murlen National Park, Champhai, Mizoram at 1492m altitude.

Drepanolejeunea mizoramensis Sushil K. Singh, *Nelumbo* 60 (1): 73. 2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Lawngtlai, Ngengpui Wild Life Sancturay, Mizoram at 138m altitude.

Lejeunea bukpuiensis Sushil K. Singh, *Nelumbo* 60 (1): 73.2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Bukpui forest, Kolasib, Mizoram at 945m altitude.

Lejeunea kolasibensis Sushil K. Singh, *Nelumbo* 60 (1): 76. 2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Bukpui forest, Kolasib, Mizoram at 894m altitude.

Leptolejeunea mizoramensis Sushil K. Singh, *Nelumbo* 60(1): 80. 2018. (LEJEUNEACEAE). This new species has been discovered and described based on the collection made from Pualreng Wild Life Sanctuary, Kolasib, Mizoram at 466m altitude.

Metzgeria mizoramensis Sushil K. Singh & D. Singh, *Cryptogamie Bryol.* 39 (1): 48. 2018. (METZGERIACEAE). This new species has been discovered and described based on the collection made from Phuldungsei Range of Dampa Tiger Reserve, Mamit, Mizoram at 932m altitude.

Udaria lamellicaulis D.K. Singh, S. Majumdar & D. Singh, *Curr. Sci.* 115 (8): 1537. 2018 (LOPHOCOLEACEAE). This new species has been discovered and described based on the collection made from Zakthang, North district, Sikkim at 3360m altitude.

ALGAE

Gomphonema dirangense Sudipta K. Das, C. Radhakrishnan, Kociolek & B. Karthick, *Nova Hedwigia* Beiheft 147: 360. 2018. (GOMPHONEMATACEAE). This new algal species has been discovered and described based on the collection made from a village between Dirang and Sangey, in Sapar, Dirang river, West Kameng district, Arunachal Pradesh at 1594m altitude.

Gomphonema mayamae Sudipta K. Das, C. Radhakrishnan, Kociolek & B. Karthick, *Nova Hedwigia* Beiheft 147: 360. 2018. (GOMPHONEMATACEAE). This new algal species has been discovered and described based on the collection made from Sapar Village, Dirang River, West Kameng district, Arunachal Pradesh at 1594m altitude.

Gomphonema saparense Sudipta K. Das, C. Radhakrishnan, Kociolek & B. Karthick, *Nova Hedwigia* Beiheft 147: 364. 2018. (GOMPHONEMATACEAE). This new algal species has been discovered and described based on the collection made from a village between Dirang and Sangey, in Sapar, Dirang River, West Kameng district, Arunachal Pradesh at 1594m altitude.

Oscillatoria pseudoanguina Keshri et Das, *Phykos* 47(1): 36. 2017. (OSCILLATORIACEAE). This new algal species has been discovered and described based on the collection made from a water tank in Dewanhat, Koch Bihar, West Bengal, India.

FUNGI

Amanita argenteoalba Mehmood, K. Das, Iqbal Hosen, R.P. Bhatt & Uniyal, *Phytotaxa* 367 (3): 222.2018. (AMANITACEAE). This new fungal species has been discovered and described based on the collection made from Dhakuri (on pindari trek), Bageshwar district, Uttarakhand, India.

Amanita dhakuriana Mehmood, K. Das, Iqbal Hosen, R.P. Bhatt & U. Singh, *Phytotaxa* 367 (3): 226. 2018 (AMANITACEAE). This new fungal species has been discovered and described based on the collection made from Dhakuri, Bageshwar district, Uttarakhand, India.



Amanita dhakuriana



Indoporus shoreae

Amanita tullossiana Mehmood, Iqbal Hosen, K. Das & R.P. Bhatt, *MycKeys* 37: 79. 2018. (AMANITACEAE). This new fungal species has been discovered and described based on the collection made from *Quercus semicarpifolia* and *Abies pindrow* dominated temperate mixed forest at Baniyakund, Rudraprayag district, Uttarakhand, India, at 2350-2655m altitude.

Aureobasidium khasianum Pratibha & Prabhug., *Phytotaxa* 374(3):260.2018. (AUREOBASIDIACEAE). This new fungal species has been isolated from decomposing fallen leaves of *Wightia speciosissima* (D. Don) Merr. (Paulowniaceae), near Puriang village, Khasi hills, Meghalaya, India.

Boletellus shoreae A. Parihar, K.Das & Vizzini, *Nordic J. Botany* doi: 10.1111/njb. 02089.2018. (BOLETACEAE) This new fungal species has been discovered and described based on the collection made from Chatarbar, Koderma district, Jharkhand, at 368m altitude.

Gliophorus glutinosus K. Das, D. Chakr. & Vizzini, *MycKeys* 44: 128. 2018. (HYGROPHORACEAE). This tiny new mushroom species has been discovered and described from Thangse of South district of Sikkim, at 1962m altitude.

Hygrocybe rajendrae U. Singh, K. Das, Uniyal & Mehmood, *Nordic J. Bot.* 36(1-2): 2. 2018. (HYGROPHORACEAE). This new species has been discovered and described from Pabdhur forest,



Amanita tullossiana

Rudraprayag district, Uttarakhand, India, at 2354m altitude.

Indoporus shoreae A. Parihar, K. Das, Hembrom & Vizzini, *Crypto. Mycol.* 39 (4): 453. 2018. (BOLETACEAE). This new species has been discovered and described based on a collection from dry deciduous forest and under the *Shorea* tree in Koderma Wild Life Sanctuary, Koderma, Jharkhand, at 357 m altitude.

Lactarius indozonarius Uniyal, K. Das & Nuytinck, *Cryptogamie Mycologie* 39(4): 471 2018. (RUSSULACEAE). This new fungal species has been discovered and described based on collection made from mixed temperate forests dominated by *Quercus*, *Rhododendron*, *Myrica*, *Cedrus* and *Pinus* sp., at Chaurikhal, Pauri district, Uttarakhand, India, at 1989m altitude.

Lactarius thindii Uniyal, K. Das & Nuytinck, *Cryptogamie Mycologie* 39(4): 476. 2018. (RUSSULACEAE). This new fungal species has been discovered and described based on collection made from mixed subalpine forest dominated by *Quercus*, *Rhododendron*, *Lyonia*, *Myrica* and *Abies* spp., at Chopta-Baniyakund, Rudraprayag district of Uttarakhand state, India, at of 2653 m. altitude.

Neosporidesmium garoense J. Pratibha & Prabhug., *Mycobiota* 8: 10. 2018. This new fungal species has been isolated and described from dead culms of *Bambusa* sp., Baghmara, Garo hills, Meghalaya, India.



Hygrocybe rajendrae

Neosporidesmium khasianum Prabhug. & J. Pratibha, *Mycobiota* 8: 10. 2018. This new fungal species has been isolated and described from litter of *Wightia speciosissima*, forest patch near Purian village, East Khasi Hills, Meghalaya, India, at 1280m altitude.

Russula butyroindica K. Das & B. Buyck, *Nova Hedwigia* 106 (3-4):298.2018. (RUSSULACEAE). This novel mushroom species has been discovered and described from Maenam Wild Life Sanctuary, Sikkim, South district, India, at 2159m altitude.

Russula darjeelingensis S. Paloi, K. Acharya & K. Das, *Phytotaxa* 358(1): 84.2018. (RUSSULACEAE). This new



Russula darjeelingensis

*Boletellus shoreae*

species has been discovered and described from temperate broadleaved forest (under *Quercus*) of West Bengal, near Love Road, Darjeeling district, West Bengal, India, at 2084 m altitude.

Russula gnathangensis K. Das, Hembrom & Buyck, *Crypto. Mycol.* 39(4): 40. 2018. (RUSSULACEAE). This new mushroom species has been discovered and described based on the collection made from *Abies densa* associated subalpine mixed forest near Memeinchu lake in East district of Sikkim at 3539 m altitude.

Russula indohimalayana K. Das, I. Bera, A. Ghosh & Buyck, *Crypto. Mycol.* 39(4): 405. 2018. (RUSSULACEAE). The species discovered and described from a collection made in *Abies densa* dominated subalpine mixed forest at Kyangnosla, East district of Sikkim.

Russula pseudokrombolzii K. Das, Hembrom, A. Ghosh & Buyck, *Crypto. Mycol.* 39(4): 409. 2018. (RUSSULACEAE). This species is discovered and described from a collection made from the forest opposite to firing range at Gnathang, Sikkim, East district at an elevation of 3885 m.

Russula subalpinogrisea K. Das, I. Bera, A. Ghosh & Buyck, *Crypto. Mycol.* 39(4): 412. 2018. (RUSSULACEAE). This species discovered and described from a collection made under *Abies densa* tree in subalpine mixed forest at Chipsu in East district of Sikkim state, India at an elevation of 3352 m.

Temerariomyces indicum Dubey, *Journal New Biological Reports* 7(2): 106. 2018. This new fungal species has been isolated and described from the leaf hairs of *Nymphae rubra* Roxb. ex Andrews, collected from Sanjay Gandhi National Park, Maharashtra, India

Thelephora sikkimensis K. Das, Hembrom & Kuhar, *Nova Hedwigia* 107(3-4): 341. 2018. (THELEPHORACEAE). This new species has been collected and described from Maenam Wild Life Sanctuary, Sikkim, South district, India, at 2096 m altitude.

*Tylophilus himalayanus*

Thirumalacharia thanensis Dubey, *Species* 19:3. 2018. This new fungal species has been isolated and described from the living leaves of *Coix lacryma-jobi* L., collected from Pulachiwadi, Thane district Konkan Division, Maharashtra, India.

Tylophilus himalayanus D. Chakr., K. Das & Vizzini, *Myckeys* 33: 109. 2018. (BOLETACEAE). This new boletoid mushroom species has been discovered from upper Chandmari, East district, Sikkim, India, at 1977 m altitude.

Tylophilus pseudoballoui K. Das, D. Chakr & Vizzini, *Myckeys* 33: 112. 2018. (BOLETACEAE). This boletoid mushroom species has been discovered from *Quercus* sp. in temperate mixed forests, Maenam Wild Life sanctuary, South district, Sikkim at 2136 m altitude.

NEW VARIETY

SEED PLANTS

Dichocarpum adiantifolium (Hook.f. & Thompson) Wang & Hsiao var. **meghalayense** Murugesan, Mao & Chanu, *Indian J. Forestry* 41(4): 377. 2018. (MALVACEAE). This new variety has been discovered and described based on the collection made from East Khasi hills, East Khasi Hill district, Meghalaya at 1400 m altitude.

BRYOPHYTES

Lejeunea eifrigii var. **indica** Sushil K. Singh, *Nelumbo* 60 (1): 76. 2018. (LEJEUNEACEAE). This new variety has been discovered and described based on the collection made from Bukpui forest, Kolasib, Mizoram, at 900 m altitude.

Spruceanthus semirepandus var. **indicus** Sushil K. Singh, *Nelumbo* 60 (1): 83. 2018. (LEJEUNEACEAE). This new variety has been discovered and described based on the collection made from Khawanglung wild life sanctuary, Lunglei, Mizoram, at 721 m altitude.

NEW DISTRIBUTIONAL RECORDS

FAMILY

SEED PLANTS

Petrosaviaceae Hutch. This family has been reported for the first time from India based on the collection of species *Petrosavia sakurarii* (Makino) J.J. Sm. ex van Steenis, made from Talle Valley Wildlife Sanctuary, Lower Subansiri district of Arunachal Pradesh at 2012m altitude.

GENUS

SEED PLANTS

Petrosavia Becc. (PETROSAVIACEAE). This genus has been reported for the first time from India based on the collection made from Talle Valley Wildlife Sanctuary, Lower Subansiri district of Arunachal Pradesh at 2012m altitude.

FUNGI

Temerariomyces Sutton, This fungal genus has been reported for the first time from India based on the collection made from Sanjay Gandhi National Park, Maharashtra, India.



Petrosavia sakurarii (Makino) J.J. Smith ex van Steenis



Cheirostylis tabiyahanensis (Hayata) N. Pearce & P. J. Cribb

SPECIES

SEED PLANTS

Cheirostylis tabiyahanensis (Hayata) N. Pearce & P. J. Cribb (ORCHIDACEAE). This species has been reported for the first time from India based on the collection made from Tobu, Mon district of Nagaland at 1600m altitude.

Eleocharis wichurae Boeckeler (CYPERACEAE). This species has been reported for the first time from India based on the collection made on the route of Chungthang-Lachen, Chungthang district of Sikkim.

Jasminum fuchsifolium Gagnep. (OLEACEAE). This species has been reported for the first time from India based on the collection made from near Helipong forest area, Tuensang district of Nagaland at 2123m altitude.

Ornithochilus yingjiangensis Z.H. Tsi, (ORCHIDACEAE). This species has been reported for the first time from India based on the collection made from Murlen National Park, Champhai district, Mizoram at 1584m altitude.

Petrosavia sakurarii (Makino) J.J. Smith ex van Steenis (PETROSAVIACEAE). This species has been reported for the first time from India based on the collection made from Talle Valley Wildlife Sanctuary, Lower Subansiri district of Arunachal Pradesh at 2012m altitude.

Stylosanthes hamata (L.) Taub. (FABACEAE). This species has been reported for the first time from India based on the collection made from Betul district, Madhya Pradesh.

BRYOPHYTES

Anastrophyllum lignicola Schill & D.G.Long (ANASTROPHYLLACEAE). This species has been recorded for the first time from India based on the collection made on way to Jachhup from Hotspring,

Anjaw district of Arunachal Pradesh at 3400m altitude.

Radula cavifolia Hampe ex Gottsche, Lindenb. & Nees (RADULACEAE). This species has been recorded first time from India based on the collection made on the way to Jachhup from Hotspring, Anjaw district Arunachal Pradesh at 3400m altitude.

LICHENS

Arthonia aciniformis Stirt. (ARTHONIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Arthonia nigratula (Müll. Arg.) R. Sant. (ARTHONIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Astrothelium interjectum R.C. Harris (TRYPETHELIACEAE). This species has been reported for the first time from India based on collections made from Kandhamal district, Odisha.

Coenogonium disciforme Papong, Boonbragob & Lücking (COENOGONIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Echinoplaca diffluens (Müll. Arg.) R. Sant. (GOMPHILLACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Fellhanera pilomarginata Lücking (PILOCARPACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Graphis mikuraensis Y. Ohmura & M. Nakan. (GRAPHIDACEAE). This species has been reported for the first time from India based on collections made from North Andaman, Andaman and Nicobar Islands.

Leucodecton minisporum Lücking (THELOTREMATAACEAE). This species has been reported for the first time from India based on collections made from Arunachal Pradesh.

Physcia fragilescens Zahlbr. (PHYSICIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Porina subnitidula Colín & B. Peña (PORINACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Pseudopyrenula subnudata Müll. Arg.



Trypethelium xanthoplatystomum Flakus & Aptroot

(TRYPETHELIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Sarcographa difformis (Vain.) Zahlbr. (GRAPHIDACEAE). This species has been reported for the first time from India based on collections made from North & Middle Andaman, Andaman and Nicobar Islands.

Sporopodium subflavescens Lücking & Lumbsch (ECTOLECHIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Syncesia albiseda (Nyl.) Tehler (ROCELLACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Trichothelium sipmanii Lücking (TRICHOTHELIACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Tricharia santessoniana Kalb & Vězda (GOMPHILLACEAE). This species has been reported for the first time from India based on collections made from the Nicobar Islands, Andaman and Nicobar Islands.

Trypethelium xanthoplatystomum Flakus & Aptroot (TRYPETHELIACEAE). This species has been reported for the first time from India based on collections made from Kandhamal district, Odisha.

ALGAE

Chara muscosa J. Groves & Boll.-Webst. This algal species has been reported for the first time from India based on collection made from Baraila lake Salim Ali Jubba Sahni Bird Sanctuary, Vaishali district of Bihar.

Sphaerello cystis ellipsoidea Ettl. This algal species has been reported for the first time from India based on

collection made from Baraila lake Salim Ali Jubba Sahni Bird Sanctuary, Vaishali district of Bihar.

FUNGI

Amanita griseoverrucosa Zhu L. Yang. (AMANITACEAE). This fungal species is reported for the first time from India based on collections made from Phedkhal, Pauri district, Uttarakhand at 1900m altitude.

Amanita virgineoides Bas (AMANITACEAE). This fungal species has been reported for the first time from India based on the collections growing on soil in temperate mixed forest dominated by *Quercus leucotrichophora* and *Cedrus deodara*, in Phedkhal, Pauri district, Uttarakhand, at 1850-2050m altitude.

Cantharellus vaginatus S.C. Shao, X.F. Tian & P.G. Liu (CANTHARELLACEAE). This fungal species has been reported for the first time from India based on collections made from Churten, East district, Sikkim, at 1531m altitude.

Helicogloea globosa Chee J. Chen & Oberw. (PHLEOGENACEAE). This wood rotting crust fungal species has been reported for the first time from Rajmahal hills, Gariapani (Dumka-district, Gopikandar

block) and Amarpur-Puriabandar (Godda-district, Boarjor block) at 136 m and 369 m altitude respectively.

Paxillus orientalis Gelardi, Vizzini, E. Horak & G. Wu (PAXILLACEAE). This fungal species has been reported for the first time from India based on collections made from Tendong Biodiversity Park, South district, Sikkim.

Phylloporus maculatus N.K. Zeng, Zhu L. Yang & L.P. Tang (BOLETACEAE). This gilled boletus fungal species has been reported for the first time from India based on collections made from Kewzing, South district, Sikkim, at 2015 m altitude.

Phylloporus yunnanensis N.K. Zeng, Zhu L. Yang & L.P. Tang (BOLETACEAE). This gilled boletus fungal species, has been reported for the first time from India based on collections made from Jhandidhar-Dhakuri pathway, Dhakuri forest area, Bageshwar district, Uttarakhand, at 2857 m altitude.

Tyloporus neofelleus Hongo (BOLETACEAE). This fungal species has been reported for the first time from India based on the collection growing under *Castanopsis* sp. in temperate broadleaf forest, Fambonglo Wild Life sanctuary, East district, Sikkim, at 2021 m altitude.

VARIETY AND SUBSPECIES RECORD

SEED PLANTS

Acacia nilotica subsp. **kraussiana** (Benth.) Brenan (FABACEAE). This sub-species has been reported for the first time from India based on the collection made from Jetpur flyover, Rajkot district, Gujarat at 99m altitude.

Pyrenaria diospyricarpa Kurz var. **camelliiflora** (Kurz) S.X. Yang (COMMELINACEAE). This variety has been reported for the first time from India based on the collection made from Woashu village, Tuensang district, Nagaland at 2000-2100m altitude.

ALGAE

Oedogonium undulatum A. Braun ex Hirn var. **incisum** Hansgirg. This algal variety has been reported for the first time from India based on collection made from Baraila lake Salim Ali Jubba Sahni Bird Sanctuary, Vaishali district of Bihar.

FORMA RECORD

Oedogonium pratense Transeau f. **minus** Mrozińska-Webb. This algal forma species has been reported for the first time from India based on collection made from Baraila lake Salim Ali Jubba Sahni Bird Sanctuary, Vaishali district of Bihar.



Pyrenaria diospyricarpa Kurz var. *camelliiflora* (Kurz) S.X. Yang



Trichaptum abietinum (Pers. ex J.F. Gmel.) Ryvarden

ex-situ CONSERVATION



Barleria courtallica Nees

ex-situ CONSERVATION

Botanical Survey of India, the premier research organization under the Ministry of Environment, Forest and Climate Change, Government of India, in the field of plant taxonomy, is actively engaged in ex-situ conservation programme through its chain of eleven Botanic Gardens established in different regional centres. All the gardens have been designed for

collection, introduction, multiplication and maintenance of germplasm of orchids, bamboos, medicinal plants, palms, ferns, legumes, wild edible plants, insectivorous plants, gymnosperms and RET plants. Since their inception, all these gardens are doing excellent works in the field of ex-situ conservation, biodiversity conservation, education and awareness.

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

ex-situ CONSERVATION OF RARE/ THREATENED/ ENDEMIC PLANTS:

A.J.C. Bose Indian Botanic Garden, Howrah

During 2018-19, under *ex-situ* conservation, nurturing and properly monitoring, up keeping and transplanting the previously introduced Rare/Endangered/Threatened & Endemic (RET & E) plants were done due to the reason that said plants of the earlier tour collections got accumulated in the nursery and their division wise plantation was very much essential rather than making fresh collections through field tours prior to the plantation and establishment of previous lots. Accordingly arrangement was made. Plantation of about 150 valuable plants including RET & EET plants were introduced in different divisions through Environmental Day, Van Mahotsava Week Celebration, and during the 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. Plant saplings collected during the other AAP tours to Arunachal Pradesh, Deccan Region and Eastern Ghat during 2018-19 were kept in nursery for acclimatization in AJCBIBG, Howrah.

Andaman & Nicobar Regional Centre, BSI, Dhanikhari Experimental Garden-cum-Arboretum, Port Blair:

During 2018-19, exploration of seeds/ seedlings of 51 RET species and plants of medicinal and economic importance including orchids were collected and introduced in the Dhanikhari Experimental Garden cum Arboretum. Some of which are *Anoectochilus narasimhanii*, *Dendrobium gunnarii*, *Grosourdya muriculata*, *Oberonia gammiei*, *Korthalsia rogersii*, *Phoenix andamanensis*, *Porpax elwesii*, *Ficus andamanica*, *Podocarpus neriifolius*, *Dendrobium anceps*, *Zingiber zerumbet* etc.

Arid Zone Regional Centre, Experimental Garden, Jodhpur:

During 2018-19. various field tours were conducted to Rajasthan and Gujarat during which a total number of 20 Rare and Threatened *Anticharis senegalensis*, *Barleria prionitis* var. *dicantha*, *Caralluma edulis*, *Ceropegia bulbosa*, *Ceropegia bulbosa* var. *lushii*, *Ceropegia hirsuta*, *Citrullus colocynthis*, etc. and 29 Medicinal plant species, *Amomum subulatum*, *Aristolochia indica*, *Bryophyllum pinnatum*, *Butea monosperma*, etc. were collected and introduced in the Desert Botanical Garden. Besides, about 500 photographs were also taken. Plants of Botanical interests: *Carissa spinarum*, *Hibiscus rosa-sinensis*, *Holmskioldia sanguinea*, *Tabernaemontana divaricata*, *Vitis* sp., etc. Ethno-religious plants:

Adansonia digitata. Economically important plants: *Moringa oleifera*, *Madhuca indica*, *Phyllanthus emblica* and Pomology sections: *Manilkara hexandra*, *Morus indica*, *Punica granatum* etc. Multiplication of RET plants: The following plant species have been multiplied in the nursery: *Caralluma edulis*, *Pavonia arabica* var. *massuriensis*, *Dipcadi erythraeum* etc. Saplings prepared for plantation and exchange purposes: Saplings of following plant species have been prepared in the nursery: *Abrus precatorius*, *Asparagus racemosus*, *Azadirachta indica*, *Barleria prionitis*, *Bombax ceiba*, *Caesalpinia bonduc*, *Cascabela thevetia*, *Cassia roxburghii* etc.

Arunachal Pradesh Regional Centre, Experimental Garden, Sankie View, Itanagar:

During 2018-19, 74 live plants mainly belonging to 13 genera and 14 species to the family *Zingiberaceae* and *Musa* species were brought to BSI, APRC, Itanagar for plantation in the garden for planting and conservation. Among these 06 EET species were also part of the collection viz. *Galeola falconeri*, *Hedychium efilamentosum*, *Dendrobium wardianum*, *Coelogyne suaveolens*, *Dendrobium acinaciforme*, *Bulbophyllum uniflorum*.

Botanic Garden of Indian Republic, Experimental Garden, Noida:

During 2018-19, 28 threatened and endemic plant species were collected from the Lead & Small Botanic Gardens and placed in conservatories for acclimatization. A RET species plant block was prepared for conservation of about 80 RET plants to be collected in RET block of BGIR Noida. Live/seed of threatened (IUCN categorised) species introduced/procure in BGIR during (2018-19) a. Species collected from Shivaji university Kohlapur viz. *Kingiodendron pinnatum*, *Arenga wightii*, Plant collected from wild in Tehri, Uttarakhand viz. *Gentiana kurroo* and Plants collected from From AJC Bose IBG, Howrah-14 species namely *Kingiodendron pinnatum*, *Trachycarpus martianus*, *Olea dioica*, *Livistona jenkinsiana* etc.

Central Regional Centre, Experimental Garden, Allahabad

During 2018-19, 10 species were proposed for their conservation under *ex-situ* programme. However, altogether 131 individuals of 42 species of 39 Genus under the categories endemic (4), threatened (5), medicinal (25), economic (25) and ornamental (8) plant species from different places were brought and introduced in the Botanic Garden of Central Regional Centre, Allahabad for *ex-situ* conservation are as follows: Endemic plant species viz. *Alectra chitrakutensis*, *Vitex negundo*, *Bacopa monnieri*, *Chrysopogon zizanioides* and *Selaginella bryopteris*. Threatened plant species viz.

Shorea robusta and *Uraria picta*, *Swietenia macrophylla*, *Ginkgo biloba* and *Commiphora wightii*. Medicinal plants species (25) viz. *Asplenium nidus*, *Boswellia serrata*, *Chamaecrista absus*. Economic plant species (25) viz. *Azolla filiculoides*, *Blechnum orientale*, *Chlorophytum tuberosum*, *Cinnamomum camphora*, *Cissus rotundifolia*, *Curculigo orchioides*, *Dillenia indica*, *Elaphoglossum stelligerum* etc. and Ornamental plant species (8) viz. *Cassia roxburghii*, *Chlorophytum tuberosum*, *Jasminum mesnyi*, *Paederia foetida*, *Passiflora caerulea*, *Senna polyphylla* etc.

Eastern Regional Centre, Shillong: Experimental Garden, Barapani:

During 2018-19, the following 119 EET plant species were collected from field tours and planted in EBG, Barapani during the period and conserved viz. *Acanthephippium striatum*, *Acanthephippium sylhetense*, *Aerides rosea*, *Agrostophyllum brevipes*, *Amentotaxus assamica*, *Anoectochilus brevilabris*, *Anoectochilus roxburghii*, *Antidesma khasianum*, *Aristolochia platanifolia*, *Arundina caespitosa*, *Bambusa jaintiana*, *Bolbitis appendiculata*, *Brainea insignis*, *Bulbophyllum appendiculatum*, *Bulbophyllum cauliflorum*, *Bulbophyllum gamblei*, *Bulbophyllum moniliforme*, *Bulbophyllum polyrhizum*, *Bulbophyllum rothschildianum*, *Calanthe mannii*, *Camellia kissi*, *Caulokaempferia secunda*, *Cephalanthera damasonium*, *Ceratostylis himalaica*, *Ceropegia angustifolia*, *Ceropegia longifolia*, *Ceropegia meghalayense*, *Citrus indica*, *Cleisostoma paniculatum*, *Coelogyne griffithii*, *Coffea khasiana*, *Cryptochilus sanguinea*, *Curcuma yunnanensis*, *Cyathea khasyana*, *Cycas pectinata*, *Cymbidium cyperifolium*, *Cymbidium macrorhizon*, *Cymbidium sinense*, *Daphne papyracea*, *Dendrobium chapaense*, *Dendrobium mannii*, *Dendrobium parcum*, *Dendrobium delacourii*, *Dendrobium pulchellum*, *Dendrobium stuposum*, *Dendrobium williamsonii*, *Diplazium nagalandium*, *Diplopoda championii*, *Gnetum gnemon*, *Globba spathulata*, *Gymnocladus assamicus*, *Habenaria arietina*, *Hedychium greenii*, *Hedychium gomezianum*, *Hedychium longipedunculatum*, *Hedychium wardii*, *Hygrochilus parishii*, *Ilex khasiana* etc.

National Orchidarium and Experimental Garden, Yercaud:

During 2018–2019, two field surveys were undertaken and collected 69 species belonging to 36 genera under 15 families. In addition, 27 species under 16 genera belonging to 27 families of other Angiosperms were also collected and recorded GPS data. During the live plant collection tour, the Collection of rare and threatened plant species viz. *Ceropegia pusilla*, *Habenaria polyodon*, *Habenaria richardiana* were collected and introduced in

the garden for multiplication. Rare, Endangered and Economic important plants collected and details of conservation initiations: Multiplied following species and are being conserved in Experimental Garden: Trees: *Artocarpus hirsutus*, *Baccaurea courtallensis*, *Bentinckia condapanna*, *Calophyllum apetalum*, *Cullenia exarillata*. Shrubs: *Abutilon ranadei*, *Barleria acuminata*, *Barleria grandiflora*, *Barleria lawii*, *Barleria terminalis*. Indigenous species: *Anoectochilus elatus*, *Barleria involucreta*, *Barleria prionitis* subsp. *pubiflora*, *Barleria repens*, *Mesua ferrea*, *Cyathea nilgirensis* etc. Development of Arboretum: Following species has been planted and being maintained/conserved in newly developed Arboretum for endemic species-14 nos. *Abutilon ranadei*, *Actinodaphne bourdillonii*, *Bentinckia condapanna*, *Cullenia exarillata*, *Holigarna arnottiana* etc. The collected plant species were introduced into National Orchidarium and Experimental Garden, Southern Regional Centre, Yercaud for *ex-situ* conservation.

National Gymnosperm collection cum Botanic Garden, Pauri:

During 2017–18, two tours were undertaken to Nahan Himachal Pradesh and Binog Wildlife Sanctuary, Mussoorie, Uttarakhand for the *ex-situ* conservation of plants, mainly focused on Ferns and following ferns namely *Aleuritopteris albomarginata*, *Aleuritopteris bicolor*, *Athyrium strigillosum*, *Dryopteris cochleata*, *Equisetum ramosissimum*, *Onychium lucidum*, *Polystichum obliquum*, *Pronephrium penangianum*, *Pteris senophylla*, *Aleuritopteris anceps*, *Asplenium dalhousieae*, *Diplazium maximum*, *Dryopteris juxtaposita*, *Glaphyopteridopsis erubescens*, *Polystichum disrectum*, *Polystichum squarrosom*, *Pseudocyclosorus canus* were collected from near.

Sikkim Himalaya Regional Centre, Experimental Garden, Gangtok:

During 2018–19, 77 taxa were introduced in the campus garden for further studies and *ex-situ* conservation and Red listing of Orchids of Eastern Himalaya as per IUCN Criteria for further studies and *ex-situ* conservation. The campus garden was regularly visited to observe growth and survival of introduced species. A local field trip was conducted to Dikchu, Singtam, Rhinok & Ronjli with Dr. Tapan Seal, and collected 5 species for garden. Conducted local field tours to Pangthang area and collected 4 species of plants for Garden. Dr. D.K. Agrawala has visited the campus garden regularly to observe growth and survival of introduced species. He has also supervised the weeding, cleaning and maintenance of campus garden. Process of vertical plantation of orchids on the protection walls initiated in the campus. Introduced 50 field

numbers of orchids collected from local tour.

Western Regional Centre, Experimental Garden, Mundhwa, Pune:

During 2018-19, 75 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*, *Etlingera 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*, *Habeneria perrottetiana*, *Liparis wighteana*, *Luisia abrahami* etc.

IN-VITRO / MICROPROPAGATION OF RET PLANTS:

Eastern Regional Centre, Experimental Botanic Garden, Barapani:

During 2018-19, a local tour was conducted to Mawklot to take photograph of fruiting of *Ilex khasiana*, seeds cultured in tissue culture laboratory, and initiated some stem cutting experiment on *Cymbidium tigrinum*: subculturing, maintaining of *Cymbidium tigrinum* was done and transferred to glass house. Subculturing was done in 10 % banana with MS. Treatment of *Cymbidium tigrinum* protocorm with TDZ for shoot development (to multiply more, given some plants to research scholars too) was completed. Root tip slices of *Cymbidium tigrinum* was cultured in fungal growth medium for isolation of fungal species *Armadorum senapatianum*: Transplanted *A. senapatianum* in greenhouse, glass

house, the garden of Botanical Survey of India, Shillong. Plants were growing more healthy in National Orchidarium, and attained about 2-10 cm height under observation. *Rhododendron cymbidium*: Transplanted *R. cymbidium* in the garden. For further experiment seeds were not available so waiting for the seedlings which are grown in the garden to grow. *Ilex khasiana*: Local tour was undertaken to Mawklot taken during which photograph of fruiting of *Ilex khasiana* were taken. *Ilex khasiana* seeds were cultured in different composition of medium, taking readings of seed germination, in dark, light, different room temperatures, with seed coats and without seed coats and halves. For *Ilex khasiana*, 432 seeds coat were removed, for new experiment for three different temperate and its germination. Seeds were germinated, new seedlings raised were cultured inside the tissue culture room. Further experiment will be statistically analysis. *Paphiopedilum hirsutissimum*: Study of pelotons was done. Root tip slices of *Paphiopedilum hirsutissimum* was cultured in fungal growth medium for isolation of fungi namely. 12 different fungus were cultured and kept as stock. *Nypenthes khasiana* and *Cymbidium whittae*.

Northern Regional Centre, Dehradun:

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



Mixed vegetation





**RESEARCH
PUBLICATION**

Barleria cuspidata

RESEARCH PUBLICATION

- ARUMUGAM, S., V. RAVICHANDRAN, R. MANIKANDAN AND C. MURUGAN. 2018. Rediscovery and Lectotypification of *Drypetes porteri* (Putranjivaceae: Phyllanthoideae: Drypeteae) : a narrow endemic and endangered species of the Western Ghats, India. *Nelumbo* 60 (1): 10-12.
- BAGATH, S., D. JESUBALAN, AND M. S. SUNDARI. 2018. Tissue culture, histochemical, phytochemical analysis and anti-cancer activity study on a traditional medicinal plant - *Spharenthus indicus* L. *International Journal of Current Biotechnology* 6(7):1-7.
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हिन्दी प्रकाशन

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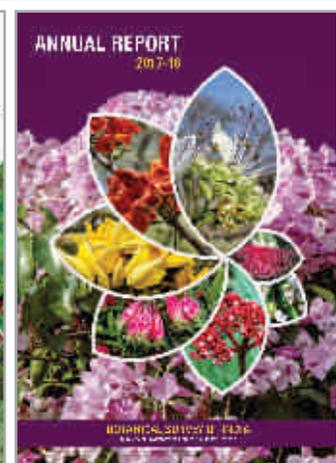
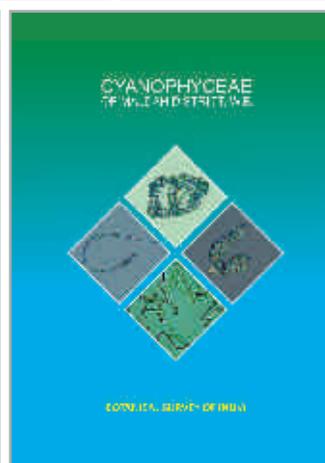
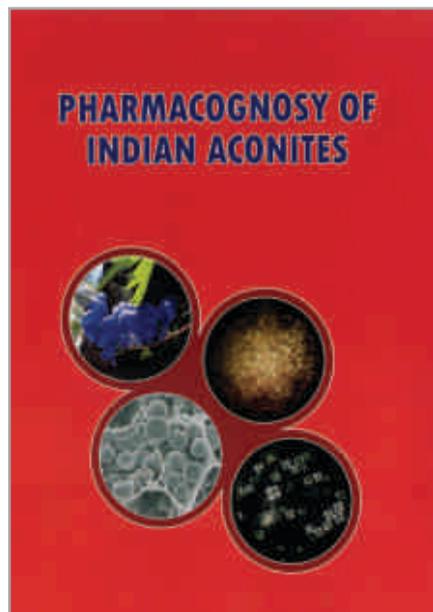
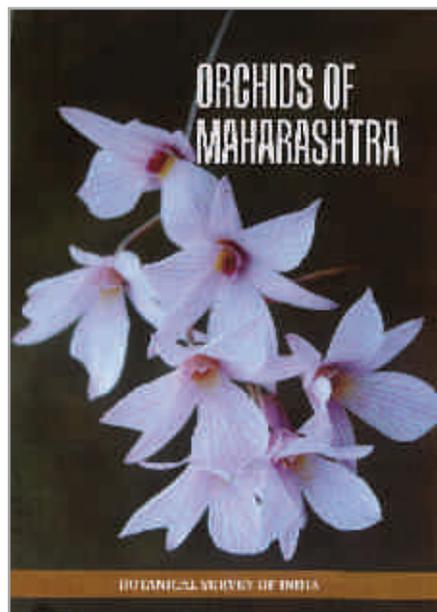
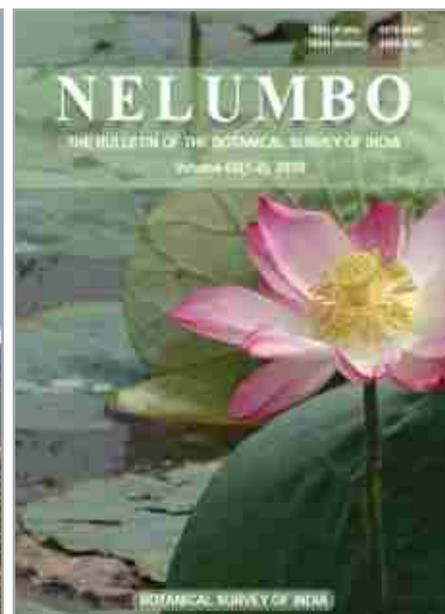
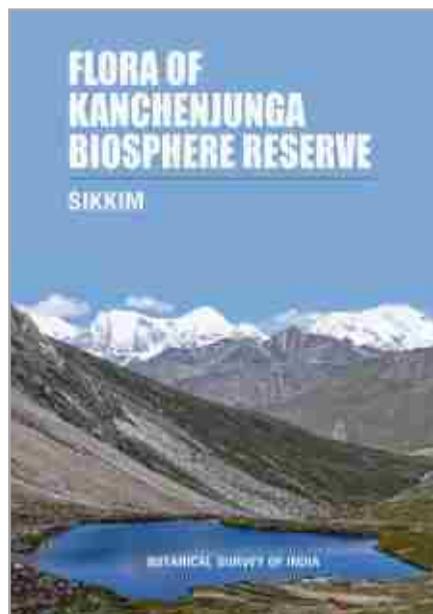
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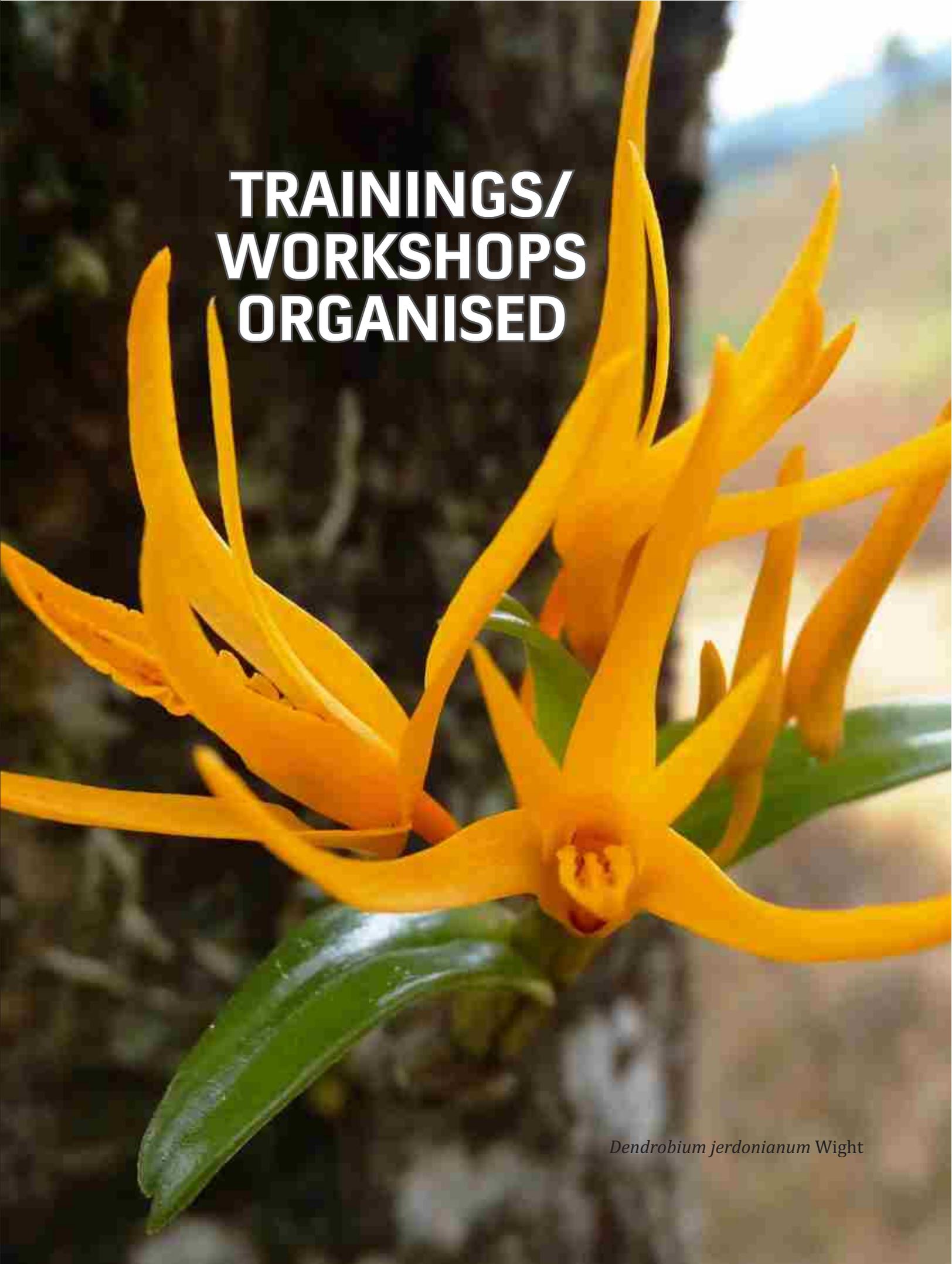
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BOOKS PUBLISHED BY BOTANICAL SURVEY OF INDIA DURING 2018-19





**TRAININGS/
WORKSHOPS
ORGANISED**

Dendrobium jerdonianum Wight

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

Two Weeks In-Service Training Programme for Botanical Assistants of Botanical Survey of India

Towards the fulfillment of the partial eligibility criteria for the in-situ promotions to Botanist (as mentioned in Recruitment Rules of Botanist), one the two weeks training programme for in-service Botanical Assistants of Botanical Survey of India (BSI) was organized by Ministry of Environment Forest and Climate Change New Delhi at Central National Herbarium from 22 June 2018 to 5 July 2018. A total of 45 Botanical Assistants from different regional centers have participated in this training programme.

The training was aimed to impart training on both scientific and administrative skills to the Botanical Assistants of BSI. The administrative course was comprised of hands on training on General Administration, Office Management, Filing Procedure, Record Management, Central Civil Service Conduct Rules, Disciplinary Proceedings, RTI, GFR 2017 & DFPR, Establishment Rules, Leave Rules, FRSR, GeM, e-Tender, e-Procurement, Contract Management, LTC Rules, Broad outlines of Reservation Rules, Handling court case, Grievance, NSDL, while the scientific training was planned for Plant taxonomy and modern trends, tools and different methodology, molecular systematics, Intellectual Property Rights, introductory geographic positioning systems, photographic techniques, scientific writing skills and publications ethics.

The course was inaugurated by Prof. C.R. Babu, former Pro Vice Chancellor, University of Delhi on 22 June 2018. On his inaugurated speech and subsequent talks Prof Babu spoke at length about conservation of threatened plants, rehabilitation of degraded ecosystems. The other resource persons who delivered their lectures in the training programs were Dr. V. Sampath Kumar, Scientist D on taxonomic hierarchy, Ms. Mayuri Bhattacharya, Senior Consultant (Remote Sensing & GIS) ESRI, Kolkata on role of ArcGIS and its applications in botanical research, Dr. Swati Sen Mandi, Assistant Professor, Bose Institute, Kolkata on molecular systematics, Mr. Gautam Dey on photography techniques. Dr. S. S. Dash, Scientist E, In Charge Publication section delivered on effective scientific writing skills and publications ethics.

Interestingly, this training programmers provided a good exposure to all the participants to a wide range of topics from different plant groups. Dr. Kanad Das, Scientist E, spoke about macro fungi and fungal taxonomy and the

relevance of molecular phylogeny; Dr. Anjar A. Khuroo, Professor, Kashmir University spoke on floristics and ecological studies with emphasis on Himalayan flora, Dr. S. K. Mitra, Deputy Controller, Patent & Design, spoke about the Intellectual Property Rights, Patent and Copyright rules; Dr. S. R. Yadav Professor (Retd.) Shivaji University, Kolhapur delivered a talk on "Need of Bio systematics studies in Bulbous monocots". Dr. B. S. Kholia, Scientist D, described the research methodology of Pteridophytes. Dr. R. R. Rao delivered a talk on "Floristic Diversity in India: Conservation and Bio-prospection: priority agenda for 21st century and plant taxonomy in India-current status and future trends". Botanical illustrations were taught by Mr Durga Das from SRC, Coimbatore.

In the administrative training Sh. Sandeep Mukherjee, Under Secretary, Ministry of Renewal Energy, expert on administrative matters, Institute of Secretariat Training & Management New Delhi and Mr. Partha Vasanya, Deputy Director, Ministry of Defence, New Delhi jointly take classes on various administrative subjects such as CCS conduct Rules, RTI Establishment Rules. Mr. Subrata Deasi, Pay and Account office of ZSI/BSI, Kolkata give brief lecture on PFMS & hands on training on PFMS portal. The participates were also imparted with a training on implementation of policy of official language and use of Hindi for the official purposes and on the before day of the valedictory, Prof. A. K. Koul, Chairman RAMC & former Professor, University of Jammu on his plenary lecture 'Plant taxonomy and role of young researchers and gap areas of taxonomic research in India and BSI responsibilities' emphasized different roles of Botanical Assistant in building up the BSI towards an exemplary research organization. On the same day Dr. A. A. Mao, the present Director spoke about the research methodology and techniques in plant tissue culture and its application in conservation.

The training was ended with a valedictory note by Dr. Paramjit Singh, Director, Botanical Survey of India that, institutionalized infrastructure on plant taxonomy research available only in handful countries in the world. We must be proud to be associated such an organization and work hard to bring the benefits arises from progressive taxonomic research and from 3 million herbariums specimens and 20,000 type collections housed at BSI to botanical research and fraternity. The valedictory programme was also graced by Ms. Manju Pandey, Joint Secretary, MoEFCC New Delhi as Chief Guest.

Regional Workshop on Wetlands, CNH, BSI, Howrah

Organized 'Regional Workshop on Wetlands' and a field trip to East Kolkata Wetlands for all participants on 07.07.2018 organized by MoEF & CC and hosted by BSI, Kolkata.

Third Botanical Nomenclature Course, Coimbatore was organised by BSI, SRC, Coimbatore, at IFGTB, Coimbatore, Tamil Nadu on 11.03.19-15.03.19 at auditorium of the *Institute of Forest Genetics and Tree Breeding (IFGTB)*. A total of 99 participants attended (including 55 from outside BSI and 44 from BSI) the course. In the said course, Er. A.K. Pathak, Director In-charge of the BSI, was the Convener; Dr. P. Lakshminarasimhan (Scientist 'E' & Head of Office, BSI, WRC, Pune) served as the Coordinator; and Dr. C. Murugan (Scientist 'E' & Head of Office, BSI, SRC, Coimbatore) served as the Facilitator and Dr. Kanchi N. Gandhi (Senior Nomenclatural Registrar, Harvard University Herbaria, U.S.A.) served as the course Director.

The course was inaugurated with a historical review of botanical nomenclature by Dr Gandhi where he elaborately discussed and reviewed the details Shenzhen Botanical Code article wise, with special emphasis on valid publication and solving nomenclatural problems.

In addition to that, he discussed 'hybrid names and fungal code'. At the end of each day, one hour session was scheduled strictly for discussion and interaction among the participants. Every participants were provided with an electronic copy of the Shenzhen Code.

The valedictory session was graced by the presence of Dr. S. Murugesan, Scientist G, IFGTB as the Chief Guest, Dr. M. Sanjappa, Dr. Y Thulajappa, Dr. V. S. Raju [Retd., Head & Chairperson, Board of Studies in Botany, Kakatiya University, Telangana] were Guests of Honour. The Chief Guest Dr. S. Murugesan and other guests shared their feedback about the course. Feedback from randomly selected participants was also taken. All of the participants were given certificates.



Dr. M. Sanjappa, former Director, BSI leading the discussion during Botanical Nomenclature Course at Coimbatore



Participant solving taxonomic problem during Botanical Nomenclature Course at Coimbatore

2nd Annual Scientific Meet of Botanical Survey of India was organised 13th and 14 February 2019 at CNH, Howrah. All the Scientists and scientific officials of BSI participated the meet and presented their progress of Annual Action Project for 2018-19. A total of 101 presentations were reviewed by Prof A.K Koul and Dr M. Sanjappa as independent evaluator and provided their valuable suggestions for further upgradation of the work done.

National Seminar cum Monitoring & Evaluation workshop

Organised a National Seminar at Almora, Uttarakhand, w.e.f. 04.02.19 to 07.02.19 in which Research Associates presented a poster showing half-yearly progress report.

GIS Mapping, Database Management and Spatial Analysis, ERC, Shillong

Organised a training programme on "GIS mapping, Database Management and Spatial Analysis" under NMHS Project on 23.01.2019 to 25.01.2019, at BSI, ERC, Shillong in which all the Research Scholars and officials of BSI, ERC, Shillong along with scholars from Northern circle, BSI were participated.

ArcGIS extension training

Organized two days ArcGIS extension training on 06.09.18 to 07.09.18.

International Symposium on 'Recent Trends in Agriculture, Biodiversity and Social Sustainability (ABSS-2018)'

Organised an International Seminar on 'Recent Trends in Agriculture, Biodiversity and Social Sustainability (ABSS-2018)' at Botanical Survey of India, CRC, Allahabad in collaboration with Blue Planet Society, Allahabad and Govt. P.G. College, Saidabad, Allahabad on 30th September & 01st October, 2018.

International Symposium on 'Indiscriminate Development: Current Scenario & Socio-Environmental Challenges (IDCSC 2018)'

Organised jointly by Botanical Survey of India, CRC, Allahabad with Blue Planet Society, Allahabad and Govt. P.G. College, Saidabad, Allahabad, on 18-19 March, 2018.

National Workshop on “Recent Trends in Taxonomy”

Organised jointly by Zoological Survey of India & Botanical Survey of India, Ministry of Environment, Forest & Climate Change, Govt. of India on 10 – 11th January, 2019 at Marugadh Venture Resort, Jodhpur.

One Day training programme on 'Introduction of GPF module in EIS/PFMS system'

Organised training programme on introduction of GPF module in EIS/PFMS system on 13.11.18 at ISIM, in which Shri Subrata Deasi, AAO, PAO (BSI/ZSI) shared his views as resource person.

Training and Digitization of Natural History Museum (NHM) Plant Specimens from India

As a part of inking of MoU between Botanical Survey of India and Natural History Museum, 25 days tour of three members team comprising Drs. Pushpa Kumari, Bhawna Joshi and Shyam Biswa was approved by the ministry for attending the training in Digitization and Curation methods of Herbarium Specimens at Natural History Museum, London, UK. The much focussed objectives were: to digitize Indian herbarium specimens belonging to plant families *viz.* Balsaminaceae, Caprifoliaceae and Leguminosae, which will be helpful in updating of manuscript for Flora of India; learning the curation techniques used in European herbarium suitable for implementation in India. The digitization programme of Indian Plant specimens were carried out with the help of Leaf Credo 80 Camera, accessories and Herbscan Light Box which could provide good quality high resolution images. Stub recording of 7739 herbarium specimens and Digitization of 3445 herbarium specimens belonging to plant families *viz.* Balsaminaceae, Caprifoliaceae and Leguminosae were completed by the team during this tour. This training and digitization programme has opened an arena for further scientific collaboration and exchange programme between BSI & NHM.

Green Skill Development Programme (GSDP)

The “Green Skill Development Programme/ Skilling the young people” is being conducted by the EI division of the MoEF & CC, New Delhi through various ENVIS RPs/HUBs. This course is aimed at honing the skills of youth who may get sufficient skill to find the better way to get jobs and they may even start their own venture. During 2018-19, total four courses under Green Skill Development Programme (GSDP) were proposed to conduct at different regional centers/units of Botanical Survey of India.

a) Certificate Course on 'Parataxonomy (including People's Biodiversity Register)' in seven Regional Centres and one unit of Botanical Survey of India:

Andaman & Nicobar Regional Centre (ANRC), Port Blair; Arid Zone Regional Centre (AZRC), Jodhpur; Arunachal Pradesh Regional Centre (APRC), Itanagar; Central National Herbarium (CNH), Howrah; Central Regional Centre (CRC), Allahabad; Central National Herbarium (CNH), Howrah; Southern Regional Centre (SRC), Coimbatore and Western Regional Centre (WRC), Pune. A total of 88 students were trained under this course.

b) Certificate Course on 'Plant Tissue Culture Techniques and its Application' in three Regional Centres of Botanical Survey of India:

Northern Regional Centre (NRC), Dehra Dun; Eastern Regional Centre (ERC), Shillong; National Orchidarium & Experimental Garden (NO&EG), BSI, Yercaud. A total of 26 students were trained under this course.

c) Certificate Course on 'Community-based Conservation of Mangroves' in Western Regional Centre of BSI, Pune

A total of 10 students were trained under this course.

d) Certificate Course on 'Management of Small Botanic Garden' in Botanic Garden at Indian Republic (BGIR), Noida

A total of 9 students were trained under this course.

Success Story of GSDP Programme:

After successful completion of this course, 13 trainees emerged as Master trainers; 01 trainee joined in NMHS project, ERC, Shillong.

Organised pavilions on miscellaneous awareness fair

Megnad Saha Smarak Science Fair & Exhibition Kolkata *w.e.f.* 09.11.2018 to 02.12.2018.

Damodar Mela Amta Howrah from *w.e.f.* 07.12.18-13.12.2018.

Sri Ramakrishna Mela & Exhibition Narendrapur Kolkata *w.e.f.* 18.1.19-21.1.2019.

Kumbh Mela 2019

Kumbh, 2019, the '*Ardh Kumbh Mela*', was held at Triveni/Sangam in Prayagraj (Allahabad), Uttar Pradesh from 15.01.19 to 04.03. 19 for 49 days. It was visited by ten millions of pilgrims of Hindu faith and considered the biggest human gathering and congregation of pilgrimage on the planet earth. Anticipating this, the Ministry of Environment, Forest and Climate Change (MOEF&CC), Govt. of India provided golden opportunity to its 10 selective premier Institutions of National repute to showcase their mandate, mission, vision, objectives & outcome in public interest covering the theme 'GREEN GOOD DEEDS under awareness programme. Institution-wise, exhibition Organizing Committee were formed, selective GREEN GOOD DEEDS were worked out, Model/Posters and Brochure were made, objects and

films/videos/ppt made/selected, etc. and participated at Stall No. 5 (measuring total 4,200 sq.ft. in Pavillion of Suchana and Jansamperk located in Sector - 1, Triveni Road, Prayagraj) of the Ministry along with publications. Such activities/deeds w.r.t. exploration of endemic and threatened flora and fauna for their uses in future and conservation, air/water/soil/garbage and watershed management, socio-economic livelihood generation, environmental up-gradation, sustainable management of natural resources, their uses as alternative of plastic, source of natural plastics and low-cost technologies. During the period, approximately 4.5 lakh individuals of varying age groups visited at the stall and inquired about each exhibit. The feedback, reactions and suggestions of 15,676 visitors were documented by them in the visitors register in 5 volumes.

During this Mela, Botanical Survey of India, occupying an area of 50 sq. ft., showcased 53 exhibits including microscopic and macroscopic seeds, 17 bamboos and wooden products, 5 seeds, 1 bark of roots, 2 barks, 3 fruits, 6 oil seeds, 5 gum/resins, 6 fibres, 4 dyes, 2 woods including medicinal properties. A total of 37 posters (9 standing and 28 in 8 posters installed over 4 tables) subjecting BSI and Regional Centres, Herbarium, Sacred trees, Number of explored plants, National flowers, fruits and trees, Natural dyes, Textile designing, Leading *ex-situ* conservation Centres, Macro fungi etc were displayed. 25 slides and one brochure were prepared on GREEN GOOD DEEDS. 30 short film/videos on GSDP, Dye yielding plants, types of oil and their uses, Central National Herbarium, AJCB Indian Botanic Garden, documentation on Lantana, wild mushroom diversity, Bio-ethno-cultural diversity of NE India, Cold Desert 1 & 2, Rhododendron hunting 1 & 2 etc. were played. 30 officials from CRC, CBL and ISIM were in-charge of this exhibition. In addition, the 02 lectures on the theme of the Kumbh Mela was delivered at MD College, Patna and Kumbh Mela, Lal Sarak, Sector - 1, Prayagraj.

Educational & Environmental Awareness Programme (EEAP)

Botanical Survey of India organized a programme on EEAP during which lectures on various topics related to biodiversity and conservation were delivered to c. 896 school students by BSI experts. The students got the first-hand knowledge on economic and useful plants of India and other rare plants in the museum gallery as well as natural habitat in AJCBIBG, an acquaintance with the dried preservation of plants in Herbarium of CNH also learn its conservation as well.

International Day for Biological Diversity, all the Regional circles of BSI

Organised the International Day for Biological Diversity-

Celebrating 25 Years of Action for Biodiversity on 22 May 2018 at all the Regional Centres of Botanical Survey of India. Lectures on 'International Day for Biological Diversity since inception to date', 'Basics of Biodiversity and conservation', Biodiversity conservation' and 'sustainable development' were delivered by BSI scientists and resource persons and c. 56 participants from outside BSI attended the event.

World Environment Day on 05.06.2018

The different regional centres of BSI were organized the World Environment Day on 05.06.2018 with a theme "Beat plastic pollution". During the event, poster competition, quiz competition, sit and draw competition were organized in different Centers for school student students on the theme 'plastic eradication', in which more than 150 students participated throughout all the Regional Centers. On the World Environment Day BSI, WRC also joined and collaborated in the event of Jeevidhata Festival-2018 arranged by Maharashtra State Forest Department; Pune Municipal Corporation, Biospheres, Modern College, Ganeshkhind, Botanical Survey of India, Western Regional Centre, Pune and Samarth Bharat. BSI, WRC also participated in various environmental programs organized during the period 3rd - 6th June which included Plastic Collection Drive, Photo shooting competition and Exhibition on Biodiversity. The programme was ended with group discussion, prize and certificate distribution.

Van Mahotsav on 01.07.2018

Organized Van Mahotsav week during 1-7 July, 2018 at Botanical Survey of India, by undertaking plantation programme of c. 150 indigneous saplings at different Botanic Gardens of BSI. Students from different schools and colleges were participated in plantation programme and planted saplings of native tree species during the week.

Botanical Heritage Walk

A Botanical Heritage Walk was jointly organised by BSI, Biospheres & Dept. Of Botany, Modern College, Pune to commemorate the Kirloskar Vasundhara Film Festival at Botanical Survey of India, Western Regional Centre, Pune on 07.01.2019 which was scheduled a visit to different sections (Museum, herbarium, library, research labs, Garden, heritage building etc) by the participants. A total of 46 students participated in this walk.

Hindi Workshop/ Training/Pakhwara

Different Regional Centres organized Hindi workshops, trainings, competition on different events (essay, quiz, noting-drafting, debate etc) during Hindi Saptah. After successful completion, cash prizes were given to the participants in both Hindi and Non-Hindi sectors.



SEMINAR/SYMPOSIUM/ CONFERENCE ATTENDED BY BSI OFFICIALS



Hydnum berkeleyanum K. Das, Hembrom, A. Baghela & Vizzini

SEMINAR/SYMPOSIUM/CONFERENCE ATTENDED BY BSI OFFICIALS

Dr. A. A. Mao, Director

Delivered lectures as resource persons in a training programme on 'The importance and methods of harvesting medicinal plants for sustainability and collection of plant specimen for identification' organized by SCSTE, on 24.07.2018 & 25.07.2018 in BSI, ERC, Shillong.

Delivered an invited lecture on 'World Homoeopathy Day' on 10.04.2018, at North East Institute of Ayurveda and Homoeopathy, Shillong.

Dr. G. P. Sinha, Scientist E

Delivered an invited lecture entitled 'Taxonomy and Diversity of Lichens in India' in a Seminar on 'Future India: Science and Technology (Allahabad Chapter of ISCA)' on 23.02.2019 at Botany Department, University of Allahabad.

Dr. M. U. Sharief, Scientist E

Delivered lecture on 'Plant Tissue Culture' to GSDP Programme of Kalyani University, Kalyani at CNH, Howrah, on 10.01.2019.

Dr. Sheo Kumar, Scientist E

Delivered introductory lecture on 'International Day for Biological Diversity since inception to date' during celebration of International Day for Biological Diversity held on 22.05.2018.

Delivered a lecture on 'Beat Plastic Pollution' on 01.08.2018 in CRC Auditorium.

Delivered 22 lectures/classes for approx. 17 hr. under GSDP programme for the allotted areas.

Dr. Kanad Das, Scientist E

Delivered an invited lecture on 'Uncovering the mushroom treasure in Russulaceae (Basidiomycota) from Sikkim Himalaya with Morphology and Phylogenetic Inferences' in the International Symposium on Fungal Biology: Advances, Applications and Conservation & 45th Annual Meeting of Mycological Society of India on 19.11.2018 to 21.11.2018 conducted by Agharkar Research Institute, Pune.

Provided one day in service training as a resource person on 'DNA barcoding and Basics in Phylogenetic Analyses' organized jointly by ZSI & BSI on 17.05.2018 at Central National Herbarium, Botanical Survey of India.

Delivered a lecture as a resource person on 'Relevancy of morpho-taxonomy in the era of molecular phylogeny: case studies with Indian mushrooms' on 28.06.2018 during Two weeks training programme of Botanical Assistants.

Dr. S.S.Dash, Scientist E

Delivered invited lecturer before the Ph.D committee towards the fulfillment of criteria for recognition of independent Research Guide in University of Burdwan on

26.6.2018.

Delivered invited talk on "The Essentials of effective Scientific Writing" during the two weeks training programme for in-service Botanical Assistants of Botanical Survey of India on 25.6.2018.

Delivered an invited talk on a topic "Endemism in Indian Flora: Biological Aspects, Distribution And Current Status" during the INSA sponsored two days refresher course on plant Taxonomy for college teacher on the on 12th October, 2018 at Department of Botany, Maharshi Dayanand University, Rohtak.

Delivered a talk on the topic "Invasive Alien Plants in Himalayas: Status, Ecological Impact and Management" the during the National Seminar-cum- Workshop on 5th February 2019 at Almorah.

Delivered a talk on the topic "Invasive Alien Plants in Himalayas: Status, Ecological Impact and Management" the during the 2nd TPDM (Technical Program Discussion Meeting) Invasive Alien Plants in Himalayas: Status, Ecological Impact and Management on 26th March 2019 at Chandigarh University, Chandigarh.

Delivered a talk on the topic "An appraisal of genus *Codonopsis* Wall (Campanulaceae) in India" the during the XXVIII Annual Conference of Indian Association for Angiosperm Taxonomy & International Symposium on Conservation of Angiosperm Diversity: Hidden Treasure of Today and Tomorrow October 29-31, 2018 Organized by Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara 390002. Gujarat, India

Dr. Rajib Gogoi, Scientist E

Delivered an invited lecture on '*Impatiens* (Balsaminaceae of Eastern Himalaya' in the workshop on 'Vascular Plant Taxonomy: Field Skills, Plant Identification & Plant Nomenclature' - organized by Department of Botany, Calcutta University on 08.12.2018 at the auditorium of Calcutta University.

Delivered a lecture on 'Wetlands' to GSDP Students at Central National Herbarium, Howrah on 14.12.2018, on the topic.

Delivered an invited lecture on 'Biodiversity of NE India' at GBPNIHESD, Gangtok on the inaugural meeting of Green Skill Development Programme on 07.03.2019.

Dr. A. K. Sahoo, Scientist E

Participated and delivered a lecture entitled 'Ethnobotany: History & Perspectives in India' on the occasion of International day on Biological Diversity, held at CNH Auditorium, AJCBIBG Campus, Howrah, on 22.05.2018.

Delivered an invited lecture entitled 'A glimpse on seasonal useful flowering plants of Himalayan regions of India in monsoon' at Indian Museum committee room in connection of the symposium Programme on "Monsoon and Civilization" on 13.07.2018.

Dr. Lal Ji Singh, Scientist E

Delivered an invited lecture on various topics regarding 'Floristic diversity of Andaman and Nicobar Islands' to the trainees of Green Skill Development Programme, Para-Taxonomy Course by MoEF& CC at BSI, ANRC, Port Blair.

Delivered an invited lecture on 'Plant Diversity of Andaman and Nicobar Islands' for one day workshop on Marine Biotechnology, Biodiversity and Fisheries (WMBBF-2018) at National Institute of Ocean Technology, Ministry of Earth Science, Govt. of India. Port Blair on 28.06.2018.

Delivered an invited lecture on 'Flora of Andaman and Nicobar Islands' for Workshop on World Ozone Day-2018 at ZSI, ANRC on 14.09.2018.

Delivered an invited lecture on 'Floral Diversity of Andaman and Nicobar Islands for Eco-Eureka' on Youth engagement workshop on nature and labs at Forest Training Institute, Wimberlygunj, South Andaman on 11.10.2018.

Delivered an invited lecture on 'Floral Diversity of Andaman and Nicobar Islands' in one day workshop on Forest and Education in connection with World forestry day at Port Blair, on 15.03.2019.

Dr. M. Bhaumik, Scientist E

Participated and delivered a lecture on the occasion of International day on Biological Diversity held at CNH Auditorium, AJCIBIG Campus, Howrah, on 22.05.2018.

Attended and delivered a lecture on '*Indigofera* : botanical history, cultivation and dyeing processes in Seminar Technology Innovation : a saviour for Indigo farmer' organised by Asiatic Society and INSA at Vidhyasagar Hall Asiatic Society, Kolkata, on 06.03.2019.

Dr. Arti Garg, Scientist D

Delivered an invited lecture on 'Predicted Impact of Climate Change on the Upper Ganga Ramsar site in Uttar Pradesh, India *vis a vis* sustainable agriculture' in Seminar on Climate Change and Agriculture, at Allahabad University, on 21.4.2018.

Delivered 37 lectures in 'GSDP- Certificate course on Parataxonomy (including) People's Biodiversity Register (PBR)' at BSI, CRC, Allahabad on various topics included under section 'Basic concepts in Biodiversity and Taxonomy'. (November, 2018 to March, 2019).

Dr. B. S. Kholia, Scientist D

Attended two days seminar on 'Recent Trends in Taxonomy at Jodhpur and delivered an invited lecture on 10.01.2019 to 11.01.2019.

Dr. Chaya Deori, Scientist D

Delivered an invited lecture on 'Recent Discoveries in Medicinal and Aromatic Plants Research and its Sustainable Development in Northeast India' at National seminar on 'Orchid Diversity of Meghalaya, Northeast India and its Conservation mint of Herbal Science and Technology' at

Anandaram Dhekial Phookan College (ADP), Assam on 18.08.2018.

Dr. Kuldip Singh Dogra, Scientist D

Delivered a lecture on 'Introduction and Classification of Alien Invasive plants and Forest understory communities' during one week training of Forest Survey of India at NRC-BSI, Dehradun on 02.05.2018.

Delivered five lectures to GSDP students on various topics in January-March, 2019 and also organized and accompanied them in eight field tours.

Dr. L. Rasingam, Scientist D

Delivered a lecture on 'IUCN Red list Categories & Criteria with special reference to Threatened flora of specific regions - Introduction to CITES' - an overview to GSDP trainees at EPTRI, Gachibowli on 22.02.2019.

Dr. Vineet Kumar Rawat, Scientist D

Delivered a lecture on the Topic 'The Fern Diversity of Arunachal Pradesh' on World Environment Day, on 05.06.2018.

Delivered lecture on "Biological diversity and its importance" to local people around BSI, APRC on International Biological Diversity Day, celebrated on 22.05.2018.

Technical inputs and various suggestions were provided to state departments such as State Remote Sensing, State Horticulture Department, Forest Department, Biodiversity Board and Medicinal Plant Boards.

Dr. A. K. Verma, Scientist C

Delivered 30 lectures in 'GSDP- Certificate course on Parataxonomy (including) People's Biodiversity Register (PBR)' at BSI, CRC, Allahabad on various topics included under section 'Economic Botany & Traditional Knowledge'. (November, 2018 to March, 2019).

Dr. A. N. Shukla, Scientist C

Delivered an invited lecture on 'Herbarium Techniques and Methodology' in National Seminar organized by Govt. T.R.S. P.G. College, Rewa, Madhya Pradesh, on 30.03.2018.

Presented paper in XLI All India Botanical Conference of the Indian Botanical Society at Jiwaji University Gwalior, on 25.10.2018 to 27.10.2018.

Dr. Deepu Vijayan, Scientist C

Presented a paper entitled 'Phytochemical screening and GC-MS analysis of leaf extract of *Aristolochia saccata* Wall.' in International conference on Climate Change, Biodiversity and Sustainable Agriculture (ICCBSA) from 13.12.2018 to 16.12.2018, at Assam Agricultural University, Jorhat, Assam.

Participated and presented a paper entitled 'Genetic integrity analysis and reintroduction of *in vitro* raised plants of *Pyrenaria khasiana* R.N. Paul var. *lakhimpurensis* - an endemic plant to eastern Himalaya.' in International Conference on Trends in Plant Sciences and Agrobiotechnology-2019 (ICTPA-2019) from 14.02.2019 to 16.02.2019 at Indian Institute of Technology, Guwahati, Assam.

Presented a paper on 'Preliminary screening of crude leaf and bark extracts of *Ormosia pinnata* (Lour.) Merr. : a rare

and threatened species from Northeast India' in International conference on 'Climate Change, Biodiversity and Sustainable Agriculture (ICCBSA)' from 13th to 16th December 2018, Assam Agricultural University, Jorhat, Assam.

Dr. K. Karthigeyan, Scientist C

Delivered an invited lecture on 'Plant Collection and Herbarium Methodology' on the workshop on 'Vascular Plant Taxonomy: Field Skills, Plant Identification & Plant Nomenclature' – organized by Department of Botany, Calcutta University on 05.12.2018 at the auditorium of Calcutta University.

Dr. Puneet Kumar, Scientist C

Delivered a lecture on 'Gymnosperms' to Technical Associates from Forest Survey of India during one week training Programme on Field Botany and Preservation organized at BSI, NRC, Dehradun from 01.05.2018 to 07.05.2018.

Attended Annual Scientific Meet Project Review Meeting and presented one year (2018-2019) of AAP progress report through power point presentation held at CNH, Kolkata on 13.02.19 to 14.02.2019.

Delivered three hours lectures on 'Gymnosperms' to the trainees of Green Skill Development Programme in the Conference Hall of BSI, NRC on 01.02.2019.

Dr. Ashish V. Prabhugaonkar, Scientist B

Presented a paper entitled 'Study on diversity of micro-fungi in Meghalaya using traditional and modern molecular phylogenetic approach' in session 'Taxonomy, botanical and allied biological science research' in 'International Symposium on Climate Change, Biodiversity and Sustainable Agriculture (ICCBSA-2018)' on 13.12.2018 to 16.12.2018, organised by Assam Agricultural University at Jorhat, Assam.

Attended 'International Symposium on Fungal Biology: Advances, Applications and Conservation and 45th Annual meeting of mycological society of India' organised by National Fungal culture collection of India on 19.11.2018 to 21.11.2018, at Agharkar Research Institute, Pune, Maharashtra and delivered a lead lecture entitled 'Reinstating glory of Indian Anamorphic Fungi in the age of Molecular Phylogeny' and also co-chaired a session in the conference.

Delivered a lecture on 'Introduction on Fungi' on the occasion of 'International Biodiversity Day, on 22.05.2018.

Dr. Brijesh Kumar, Botanist

Delivered an invited talk and practical demonstration on topic 'Pteridophytes: collection, identification and uses' for trainees under green skill development programme organized by Botanical Survey of India, CRC, Allahabad on 16.06.2019.

Delivered a lecture on 'Pteridophytes' for trainees under the Green Skill Development Programme at BSI, CRC, Allahabad on 07.03.2018.

Dr. Dilip Kr. Roy, Botanist

Delivered an invited talk on 'Taxonomic novelties in the family Asparagaceae from northeast India', during the

workshop on 'Angiosperm Taxonomy, Bio-resource conservation and its utilization', at Indian Institute of Entrepreneurship, Guwahati, from 03.12.2018 to 07.12.2018.

Delivered a talk on 'Plant samples collection, preparation and maintenance of Herbarium at BSI/ERC' to a group of 10 members from NESFAS (North East Slow Food & Agrobiodiversity Society) on 27.11.2018.

Delivered a lecture on 'Training & Digitization of Indian Plant Specimens Housed at Natural History Museum (NHM), London, UK (18th November 2017 - 15th March 2018, on the occasion of "International Biodiversity Day" on 22nd May, 2018.

Delivered lectures as resource persons in a training programme on 'The importance and methods of harvesting medicinal plants for sustainability and collection of plant specimen for identification' organized by SCSTE, on 24.07.2018 & 25.07.2018 in BSI, ERC, Shillong.

Dr. G. Swarnalatha, Botanist

Delivered an invited talk on 'Lichenological studies in India: Review on diversity, distribution, endemism and gap areas' on 09.11.2018, at the Andhra Pradesh Science Congress (APSC) 2018 organized by Yogi Vemana University, Kadapa.

Partha Pratim Ghoshal, Botanist

Delivered an invited lecture on 'Floristics of Betla National Park, Latehar, Jharkhand' on the 'National Conference on recent trends in research in applied sciences: an interdisciplinary approach', Organised by Physics and Botany Dept., GLA College, Medininagar, Palamu, Jharkhand on 06.12.2018 to 07.12.2018.

Dr. J. Swamy, Botanical Assistant

Delivered lecture as a resource person on the topic 'Concept of endemism and threat status of species, IUCN classification, List of RET and Endemic species of Andhra Pradesh and Telangana' for Green Skill Development Programme – certificate course on preparation of PBRs at EPTRI on 14.06.2018.

Mr. S. Nagaraju, Botanical Assistant

Delivered a lecture as resource person on 'Geospatial Technologies in Botanical Research & Botanical Illustrations' in a two day National Workshop on "Experimental Approach on Vrikshaavaran" organized by Dept. of Botany at P. B. Siddhartha College of Arts & Science, Vijayawada, Andhra Pradesh on 17.08.2018 to 18.08.2018.

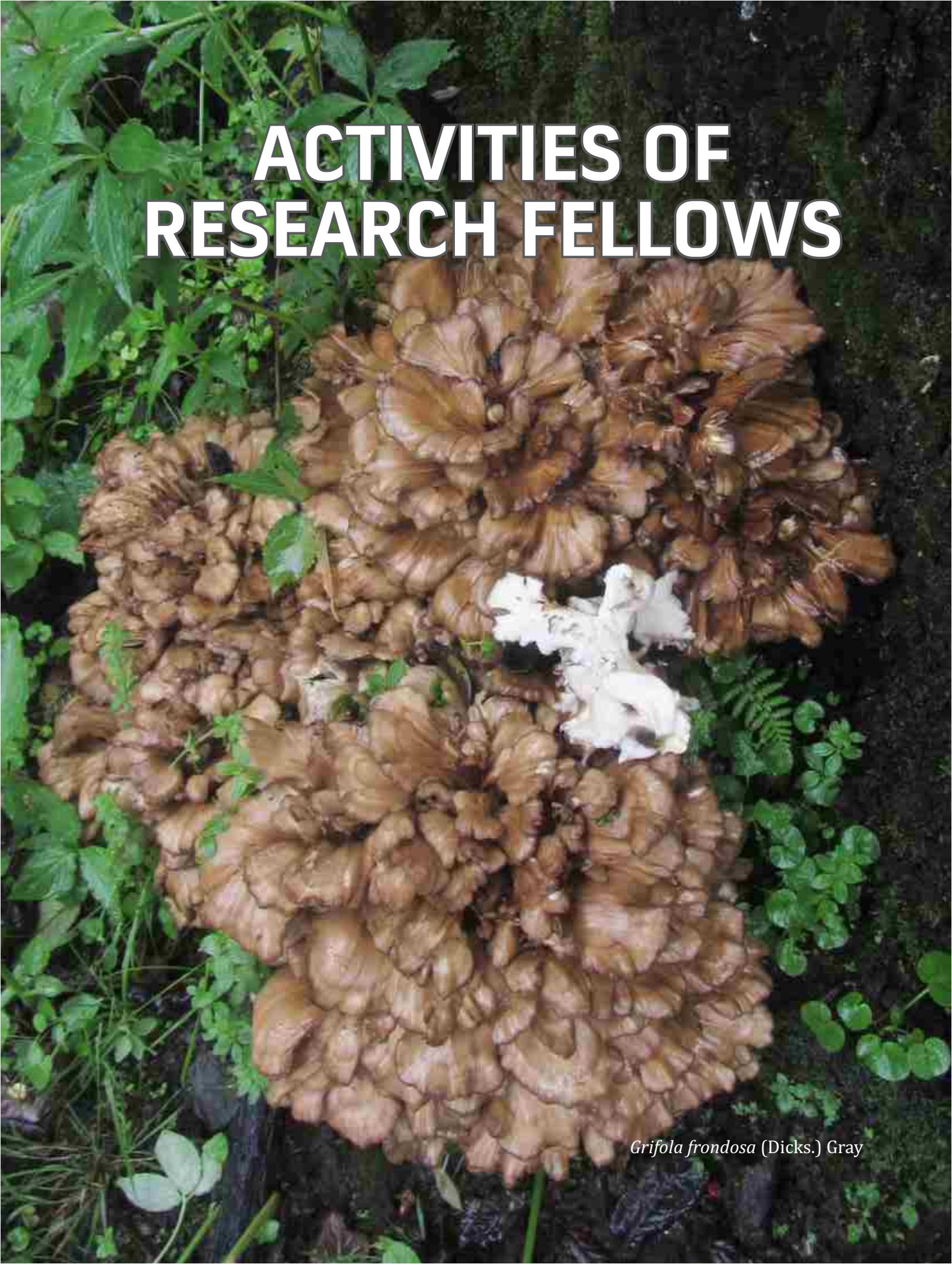
Dr. S. R. Talukdar, Botanical Assistant

Presented a paper entitled 'Floristic Diversity and Medicinal Plants from the West and South West Khasi Hills district of Meghalaya' at National seminar of 'Recent Discoveries in Medicinal and Aromatic Plants Research and its Sustainable Development in Northeast India', at Department of Herbal Science and Technology at Anandaram Dhekiel Phookan College (ADP), Nagaon, Assam on 18.08.2018.

Shri Vineet Kr. Singh, Botanical Assistant

Delivered a series of lectures on 'Flora, Herbarium, Collection of Plants, Monographs, Characters of different families etc.' under the Green Skill Development Programme at BSI, CRC, Allahabad since 19.01.2018 to 10.03.2019.

ACTIVITIES OF RESEARCH FELLOWS



Grifola frondosa (Dicks.) Gray

ACTIVITIES OF RESEARCH FELLOWS

Diversity and phylogeny of Bambusicolous fungi from Northeast India by Dr. Pratibha A. Prabhugaonkar, AJC Bose PDF

During 2018-19, 05 field tours were conducted to Experimental Botanical Garden, Barapani, Umiam, Kohima, Dimapur districts of Nagaland, Rangapahar forest and Nagaland Bamboo Resource Centre, Dimapur, Nagaland, Moopun fall, Jaintia hills, Meghalaya, Ukhrul, Tegnopaul and Loktak lake area in Manipur during which samples of 8 bamboo species were collected along with litter samples of 10 bamboo species including *Chimonocalamus griffithianus*. In this period, 03 fungal species were isolated: *Astrosphaeriella stellate*, *Chalara* sp., *Brachysporiella gayana* along with litter sample of *Bambusa* sp., *Dendrocalamus* sp. and some unidentified bamboo species. During this period, study of succession of fungi on Bamboo species were carried out along with ecological studies on bambusicolous fungi. Phylogenetic analysis of unidentified fungus similar to genus *Synnemellisia* was initiated during which a data set of LSU and SSU sequences was prepared for preparation of phylogenetic tree. Sequence dataset and phylogeny of *Synnemaseimatoides nipponica* in the order Pleosporales were worked out. During this study, morphology and phylogenetic analysis of new fungus- *Deejebhatia bambusae* Gen. & sp. Nov, *Synnemaseimatoides raghukumarensis* sp. nov. were worked out. In the above period, final report was compiled and submitted to D/BSI.

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 2018-19, 03 EET species viz. *Tephrosia falciformis*, *Anticharis glandulosa* var. *caerulea* and *Ziziphus truncata* were Collected. Distribution maps of these species were prepared, Ecological Niche Modelling for above species were conducted. During this study, new occurrence locality for *Anticharis glandulosa* var. *caerulea* was discovered. photo plates of above species were prepared using micro photographs; Landsat data of DNP of various timescale were

downloaded to find out vegetation change pattern over the time. A database of EET species was prepared.

Taxonomic revision of Sub-tribe Platantherinae (Orchidaceae) from India by Dr. Kothareddy Prasad, AJC Bose PDF

During 2018-19, an updated checklist of species and infraspecific taxa was made for all the genera in Sub-tribe Platantherinae from India. Study of types (from specimens as well as scanned images) was completed for *Hemipiliopsis* and *Hemipilia*. Two field tours were undertaken to Sikkim Himalyan Regional Center, Gangtok (Sikkim) for herbarium consultation and field tour and Coimbatore for herbarium consultation (MH & IFGT). A total of 20 field numbers and 08 taxa belonging to tribe Platantherinae were collected from these field tours. A total number of 80 herbarium specimens were studied in BSHC, MH, IFGT and among them identity of c. 20 were corrected and the rest were validated. A database of specimens belonging to above said genera available at BSHC was entered in excel format. All the collected field numbers were identified and prepared description for 10 taxa. During 2018-19, a total 3 research papers and one book were published.

Revision of Indian Stereaceae by Dr. Deepa Mishra, AJC Bose PDF

During 2018-19, 69 species under 13 genera were recognized for Indian Stereaceae. 02 field tours were conducted to Chakrata (Dist. Dehradun, Uttarakhand) and Narkanda (Dist. Shimla, Himachal Pradesh) during which a total of 44 field numbers were collected along with 70 photographs. Specimens collected during field survey were dried and preserved in the Cryptogamic section of herbarium at BSD. In addition, 03 Herbarium tours were undertaken to Agharkar Research Institute (ARI) and Pune University Maharashtra during which 132 specimens, 45 species. Besides, 07 specimens were studied and revised from Pathology Department FRI Dehradun. 21 species were studied in detail and completed in all respects; 44 field numbers were identified from the Western Himalaya; 52 specimens were reconfirmed and 32 specimens were determinavit /

identified from Agarkar Research Institute, Pune University Maharashtra and Pathology department FRI Dehradun. This study reports 03 species as new to western Himalaya (*Gloeocystidiellum irpiscenscens*, *Gloeocystidiellum kenyense*, *Gloeocystidiellum turpe*).

Taxonomic Revision of Family Davalliaceae M. R. Schomb ex A. B Frank in India Pushpesh Joshi, AJC Bose PDF

During 2018-19, 02 plant survey and collection tours were conducted to Chamoli district, Rudranath, Anusuiyya Devi, Mondal & surrounding areas, Nainital District, Kilbury, Pangote & surrounding areas during which a total of 195 field numbers were collected along with 281 field photographs. Collected specimens were processed by standard method and identified with the help of authentic literature, herbarium sheets and types. Beside 02 herbarium consultation tours were conducted to DSB Campus, Nainital and BSI, Shillong (ASSAM), BSI, Itanagar (ARUN) and Department of Botany, Guwahati University (GUBH) during which a total of 219 specimens were examined, 140 specimens were reconfirmed, 69 specimens were determined / identified. Besides this 07 species of family Davalliaceae were worked out and described in details, 05 species were illustrated, 06 type images were studied and procured from different herbaria and 05 distributional maps were prepared. In addition to this, routine maintenance of fern specimens BSD herbarium and BSI, NRC, Fern House was carried out.

Taxonomic Studies of the genus *Rubus* L. in India by Chandani Gupta, SPF & Dr. S.S. Dash, Scientist-E

The main objectives of the study are taxonomic revision of the genus *Rubus* L. (Rosaceae) in India with reference to correct identity and updated nomenclature and to characterize the macro-morphology and micro-morphological characters under SEM and to elucidate its systematic relevance in relation to the taxonomy of the genus *Rubus* L. As per the current estimate, 73 species and 6 varieties are belonging to the genus *Rubus* L. in India. About 500 photographs of 30 collected species or plant parts were taken during field tours; voucher specimens for all the collected materials were prepared. Detailed description, illustration and nomenclatural notes of 79 taxa were completed towards the preparation of the final report. In addition to this, SEM of pollen & seeds of 25 species were also carried out. This study published a new name *Alchemella purohitii* Lakhsmin., Bandyop. & Chand.Gupta for *A. sojakii* K. M. Purohit & Panigrahi.

Flora of Satkosia Tiger Reserve by Sri. K. Chandra Mohan, SPF & Dr. P.V. Prasanna, Scientist-F.

This project was completed and report submitted on 23.07.2018.

Flora of Kawal Tiger Reserve by Mrs. Annamma, SPF & Dr. P. Venu, Emeritus Scientist/Ex-Scientists

This project was completed and report submitted on 12.08.2018.

Taxonomic Studies on Lejeuneaceae Schizostipae (Marchantiophyta) in Northeast India including Sikkim (Flora of India): Mr. Shasi Kumar, SPF & Dr. S.K. Singh, Scientist-E

During 2018-19, 03 field tours were conducted to Nongstoin forest area, Smith, Upper Shillong forest area and Pynursla areas during which 126 Lejeuneaceae Schizostipae samples were collected; a total of 988 samples were identified; description and illustration of 05 taxa were prepared and 220 different species of Lejeuneaceae (Schizostipae) were found. In addition, a Herbarium Consultation tour was conducted to Lucknow University and CSIR- National Botanical Research Institute, Lucknow during which 55 samples were found confirmed and 8 samples were determined.

Micropropagation and screening of secondary metabolites of six medicinal orchids in Meghalaya by Miss Gargi Prasad , SPF, Dr. A.A. Mao & Dr. Deepu Vijayan

Mrs. Gargi Prasad, submitted her final report on "Micropropagation and screening of secondary metabolites of six medicinal orchids in Meghalaya" in August, 2018.

Revision of genus *Elatostema* J. R. Forst. & G. Forst. (Urticaceae) of North -East India by Ashutosh Kumar Upadhyay, JPF & Dr. Rajib Gogoi, Scientist-E

During 2018-19, one field tour was undertaken to various parts of NE India during which 27 field numbers were collected of which three species (*Elatostema hookerianum*, *E. parvum* and *E. platyphyllum*) were identified and detailed description of four species (*Elatostema hookerianum*, *E. parvum*, *E. platyphyllum* and *Elatostema* sp.) was prepared. Besides, three herbarium consultation tours to ASSAM, ARUN and MH were also undertaken. During this period, one research paper was communicated.

Studies on the Flora of Kaimur Wildlife Sanctuary, Bihar by Kuntal Sen, JPF & Dr. V.P. Prasad, Scientist-E

During 2018-19, one field tour was undertaken to Kaimur WLS, Bihar and 100 field numbers were collected of which 70 field numbers were identified and detailed description of eight species [*Cyperus platystylis*, *Schoenoplectus articulatus*, *Mitragyna parvifolia*, *Pennisetum orientale*, *Penisetum pedicellatum*, *Solanum xanthocarpum*, *Ipomoea carnea* and *Persicaria maculosa*] were made.

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

During 2018-19, 580 herbarium specimens deposited at CAL were documented in course of the study. Dissection and drawing of two species [*Acroceras munroanum* and *A. zizanioides*] of the genus *Acroceras* Staf. were prepared. Type specimens of three names [*Acroceras munroanum*, *A. tonkinense* (Balansa) and *A. zizanioides*] of *Acroceras* was studied along with protologues. Literature pertaining to the allotted project were consulted.

Studies on the genera *Lactarius* and *Lactifluus* (Russulaceae) from Tawang and West Kameng districts of Arunachal Pradesh: Biosystematics and Neutraceutical Properties by Ishika Bera, JPF & Dr. Kanad Das, Scientist 'E'

During 2018-19, one field tour was undertaken to the study area during which 16 field numbers were collected of which 8 field numbers were identified and four taxa were documented. This study reports two new species (*Lactifluus indovolemus* and *Lactarius viridinigrellus*) and two new records (*Lactarius acicularis* and *Lactarius crocatus*) for India.

Taxonomic revision of Polygonaceae in Eastern Himalaya by Monalisa Das, JPF & Dr. Sudhansu Sekhar Dash, Scientist E

During 2018-19, two herbarium consultation tours to BSHC and SRC were undertaken during which 10 field numbers were collected from the surrounding areas. Five field nos. were identified and 146 taxa were documented. Checklist of the Polygonaceae on the basis of different literatures regarding to Eastern Himalaya was also prepared. This study reports one species (*Bistorta longispicata*) as new record for India.

Thermal Algae of Eastern India by Pritha Basu, JPF & Dr. R.K.Gupta, Scientist-D

During 2018-19, three field tours were undertaken during which 44 field numbers were collected of which 15 field numbers were identified. This study reports an interesting species namely *Mastigocladus* sp. collected from Taptapani Hot spring, Orissa at temperature 60°C.

Studies of the genus *Ficus* of North-East India by Ms. Sreyoshee Sensarma, JPF & Dr. B.K. Sinha, Scientist F

During 2018-19, one herbarium consultation tour was undertaken and two field numbers were collected from the surrounding areas of which two field numbers were collected. A checklist of *Ficus* L. from North-East India was prepared.

Grass Flora (Poaceae) of Andaman and Nicobar Islands by Reshma Lakra, JPF & Dr. Pushpa Kumari, Scientist-D

During 2018-19, one field tour was undertaken to A & N Islands during which 50 species were collected among which 25 field numbers were identified and 8 taxa were documented. This study reports one new species (*Dimeria fasciculata* P. Kumari & R. Lakra).

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

During 2018-19, one field tour was undertaken during which 20 field numbers were collected; herbarium specimens of Eleusininae subtribe were studied and indexed; sorted out protologues of some genus of Eleusininae and a checklist of Eleusininae was prepared.

Selected wetlands of Bihar by Tanay Shil, JPF & Dr. Onkar Nath Maurya, Scientist-C

During 2018-19, two field tours were undertaken to different districts of Bihar during which 90 field numbers were collected of which 70 field numbers were identified and detailed description of five species (*Ranunculus sceretus*, *Nelumbo nucifera*, *Nymphaea rubra*, *N. nouchli*, *Oryza rufipogon*) was prepared.

Revision of genus *Plectranthus* L'Herit and *Isodon* (Schr. ex Benth.) Spach. (including *Coleus*) (Lamiaceae) in India by Rupamanya Ghosh, JPF & Dr. V. Sampath Kumar, Scientist-D

During 2018-19, one field tour was undertaken during which 10 species were collected. Three species [*Isodon*

rugosus, *Isodon scrophularioides*, *Plectranthus amboinicus*] were identified and detailed description of four species (*Isodon rugosus*, *Isodon scrophularioides*, *Plectranthus amboinicus* and *Plectranthus sp. (=Coleus)*] were made. Besides, two herbarium consultation tours to ASSAM and NEHU were also undertaken.

Fern and Fern Allies of Dihang-Dibang Biosphere Reserve By Mr. Chhandam Chanda JPF & Dr. Vineet Kumar Rawat, Scientist-D

During 2018-19, one field tour was undertaken in the district of Dibang Valley, covering some areas of Dibang Wild Life Sanctuary during which 110 specimens were collected along with 350 photos of plants from the Sancturay, Mipi village and its surroundings. 32 specimens were studied, photographed, identified and described till now some of which are *Dicranopteris linearis* var. *linearis*, *Cyathea brunoniana*, *Woodwardia magnifica*, *Odontosoria chinensis*, *Dryopteris lepidopoda*, *Arthrommeris wallichiana*, *Phymatopteris majonensis* etc.

Larima Sten, JPF & Dr. Deepu Vijayan, Scientist-C

During 2018-19, one field trip was conducted to Mawmluh, Sohrarim, Meghalaya for the collection of wild edible plant, *Embelia nagushia*. Qualitative phytochemical analysis of *Quercus semiserrata* (fruit) and *Syzygium tetragonum* (leaves and stem) were carried out using standard methodology to check the presence of bioactive compounds (proteins, carbohydrates, flavonoids, saponins, glycosides, phenols and tannins, steroid, terpenoid and alkaloid). Literature survey of the wild edible fruits *Cayratia japonica*, *Prunus bracteopadus*, *Ehretia acuminata*, *Ardisia floribunda* and *Vaccinium griffithianum* were continued for the prepararion of phytochemical analysis. Attended hands on training on "GIS Mapping, Database Management and Spatial Analysis" organized by Botanical Survey of India, Eastern Regional Centre, Shillong under NMHS Project on 23.01.2019 to 25.01.2019.

Suparna Debnath, JPF & Dr. S.K. Singh, Scientist-E

During 2018-19, a plant exploration tour was conducted to Mawlyndiar, East Khasi hills, Meghalaya during which zingibers were collected and planted in the office garden by creating a separate soil bed. Genomic DNA of *Hedychium flavescens* and *Hedychium gardenarium* was isolated by following CTAB extraction method, modified CTAB protocol and SDS extraction method. Prepared 0.8% agarose gel and

documented to check quality and quantity of extracted DNA of *Hedychium flavescens* and *Hedychium gardenarium*. In this period, PCR techniques and uses of different molecular markers were learned; genomic DNA of *Hedychium flavescens* and *Hedychium gardenarium* were isolated by following SDS extraction method. Agarose gel electrophoresis was run to check quality and quantity of extracted DNA of *Hedychium flavescens* and *Hedychium gardenarium*. Attended a hands on training in GIS mapping, database management and spatial analysis organized by Botanical Survey of India, Eastern Regional Centre, Shillong under NMHS project on 23.01.2019 to 25.01.2019.

Dawanri Marwein, JPF & Dr. Deepu Vijayan, Scientist-C

During 2018-19, one field tour was conducted to Sohrarim and Mawmluh for the collection of *Pyrenaria cherrapunjeana*. Preparation of Woody Plant Medium (WPM) (3L) for subculturing of *Pyrenaria khasiana*; subculturing of *Pyrenaria khasiana* (38 conical flasks) in Woody Plant Medium; preparation of Murashige and Skoog (MS) medium (2L) for seed germination of *Corymborkis veratrifolia* were done. Surface sterilization and inoculation of seeds of *Corymborkis veratrifolia* (30 conical flasks) were done in MS medium. *In vivo* germinated seedlings of *Pyrenaria camelliflora* (47 nos) were transferred to soil and kept under controlled conditions inside the greenhouse. Percentage of seed germination of *Pyrenaria camelliflora* was calculated. Literature study of micropropagation methods of *Pyrenaria camelliflora*, *P. barringtoniifolia*, *Rhododendron formosum* and *R. inaequale* was continued. During this period, a hands on training on "GIS Mapping, Database Management And Spatial Analysis" organized at Botanical Survey of India, Eastern Regional Centre, Shillong under NMHS project on 23.01.2019 to 25.01.2019 was attended.

Sorting of Nagaland specimens from the Herbarium. Learning families' character from "Flora of Assam" by U.N.Kanjilal by Rikertre Lytan, JPF

During 2018-19, one field tour was conducted to Khadarshnong, Kongthong, Laitmawsiang, Mawtongreng, Thangkyrta for Collection of *Areca triandra* species and for Collection of Wild edible Fruits. A total of 184 herbarium specimens of old collection were Recorded from Nagaland viz. *Leycesteria formosa*, *Lonicera ferruginea* var. *bullata*, *L. acuminata*, *Wendlandia tinctoria*, *Uncaria pilosa*, *U. sessilifructus*, *Adina oligocephala*, *Hymenodictyon flaccidum*, *Hedyotis scandens*, *H. stipulate*, *Heliotropium ovalifolium*, *O.*

oppositiflora, *O. succirubra*, *O. rosea*, *O. caudipetalata*, *O. villosa*, *Mussaenda incana* etc. Herbarium label information recorded for 433 species of collections from Nagaland. During 18-19, 990 seeds of *Garcinia xanthochymus* were sowing in the garden and processed 150 seedlings of *Prunus* species for introduction in the garden. In this time, a 'Hands-On Training on GIS Mapping, Data Base Management And Spatial Analysis' held at BSI, ERC, Shillong for three days from 23.01.2019 to 25.01.2019 was attended.

Floristic Studies on Papikonda National Park, Andhra Pradesh by Y. Mahesh, JPF & Dr. L. Rasingam, Scientist – D

During 2018-19, one field tour was conducted to Papikonda National Park, Andhra Pradesh during which 85 field numbers were collected of which twenty (20) species were identified and description of 15 species was prepared. In addition, one Herbarium consultation

tour was conducted to Botanical Survey of India, Southern Regional centre (MH), Coimbatore, Tamil Nadu and consulted the members of the families Cyperaceae and Poaceae. During this study, one research paper was published in peer reviewed journal.

Reinvestigation on Flora of Gulf of Mannar Biosphere Reserve after Tsunami by Ms. Nithya S P, JPF, Dr. C. Murugan, Scientist- 'E' & Dr. R. Manikandan, Scientist- 'D'

During 2018-19, 02 field explorations were conducted to Rameswaram and Keezhakarai areas during which 593 field numbers were collected and c. 401 species were collected. The collected specimens were poisoned, dried and mounted on herbarium sheets. About 329 species were identified and descriptions of 72 species were completed. In this period, database of about 3400 sheets was prepared based on the earlier collected specimens which were housed at MH.



A view of Eagle Nest Wild Life Sanctuary West Kameng, Arunachal Pradesh

FUNDED/ COLLABORATIVE PROJECTS



Amomum aculeatum Roxb.

FUNDED/COLLABORATIVE PROJECTS

1. Systematics and Conservation of Indian Orchids with Special Emphasis to Himalayan Species by Dr. Dinesh Kumar Agrawala, Scientist-D (National Mission on Himalayan Studies (NMHS) under Himalayan Research, MoEF & CC):

The main objectives of the project are inventorization of Indian orchids in IHR to find the occurrence, distribution and affinities, solving the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology, confirming the presence of endemics, near endemics and less known species in their known localities and predicting the likely habitat with habitat modelling technique, assessment of threat status by applying IUCN criteria, development of distribution and species richness map, collection of germplasm and their *ex-situ* conservation.

During 2018-19, Sub-families Vanilloideae, Orchidoideae and Epidendroideae (22 genera, 76 species), Tribe Malaxideae (5 genera, 86 species), Genus *Bulbophyllum* (137 species), Sub-tribes Vandinae, Decetorineae and Phalaeonopsidinae (19 genera, 94 species), Tribes Arethuseae, Nervilieae, Gastrodieae, Tropideae and Neottieae (18 genera, 75 species), Tribes Cymbidieae, Epidendreae, Collabieae and Podochileae (29 genera, 77 species) and Tribe : Vandeeae, sub-tribe: Aeridinae (21 genera, 86 species) were allotted to project personnels. Major floristic account on regional orchid floras and other available literature consulted and compiled a Checklist of 630 species along with their synonyms and distribution. During the period, 04 field tours were conducted to different regions of Darjeeling and Sikkim, habitat and population of 90 orchid taxa was analysed; samples of 42 species collected for further study and *ex-situ* conservation. Germplasm of 56 species under 20 genera collected and introduced in the campus garden, 36 species under 21 genera studied live and illustration prepared with digital macro-microscopic photographs. Besides one Herbarium consultation tour was conducted at CAL, GU, LBG, MH, NEIST and c. 15837 Orchid specimens were studied for depicting range of variation, phenology, distribution and preparing descriptions. Morphological description of a total number of 350

species was completed along with distribution maps in Arc-GIS platform till date. Threats, population size and decline of their natural habitat were analysed through direct observation and from secondary data. All the Project Fellows attended and presented their progress of work in a National Seminar cum Monitoring & Evaluation workshop at Almora, Uttarakhand, *w.e.f.* 4th - 7th February, 2019.

2. 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 Scientist-D, Dr. Puneet Kumar Scientist-C, Sri Amber Srivastava, RA, Sri Harminder Singh & Miss. Aakriti Bhandari, JRFs:

This project is mainly aimed for the conservation of rare, endemic and threatened plants of Indian Himalayan region. The jurisdiction of this project is Western Himalaya especially Uttarakhand and Himachal Pradesh. 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 medicinal plants.

During 2018-19, ten threatened plant species were selected for conservation initiatives under the project. Data related to distribution and earlier known records were collected from available literature and herbarium specimens. Propagation of plants for distribution and other conservational initiatives started. In this period, a total of seven field tours were conducted in the different regions of the study area (Joshimath, Neelkanth, Pandukeshwar, Chakrata, Deoban, Shastradhara, Dhanaulti, Sangrah and Holi). Saplings of *Jasminum parkeri*, *Gentiana kurroo* and *Phlomooides superba* were propagated from the collected planting material through seeds and stem cuttings. Meiotic chromosome count in three species [*Jasminum parkeri* ($n=13$), *Phlomooides superba* ($n=11$) and *Sophora mollis* ($n=9$)] was determined among which *P. superba* depicted abnormal meiotic behaviour. *in vitro* propagation trial is continuing

in *Sophora mollis*, *Aconitum heterophyllum* and *Jasminum parkeri*. In connection with this project, one day mass awareness campaign was conducted in the villages Moila and Jaddi of Jaunsar region of Chakrata on 13th March, 2019, motivated local people for the conservation of the targeted plants of the project and distributed saplings of *Gentiana kurroo* and *Phlomis superba* for plantation.

This study discovered new localities of *Gentiana kurroo* from Suwakholi, Uttarakhand and Sangrah, Himachal Pradesh, of *Aconitum heterophyllum* from Neelkanth valley, Badrinath, Uttarakhand, first report of meiotic chromosome count of *Jasminum parkeri* ($n=13$) from India and of *Sophora mollis* ($n=9$) from Western Himalaya.

3. Exploration and Evaluation of Cytomorphological diversity in the Grasses of Cold desert of Pangri Valley (DST) by Dr. Puneet Kumar, Scientist-C & Harminder Singh (DST SERB) :

The project is mainly aimed at exploration and evaluation of cytomorphological diversity in the grasses of cold deserts of Pangri Valley (1601 km²), which is a remote isolated landlocked valley in North West Himalayas.

In this period, two field tours were conducted to Pangri valley for collection of cytological samples (40) and mature seeds of grasses. The collected cytological samples were worked out along with identification of the species. Mineral analysis of dominant grass species in Pangri valley and meiotic abnormalities were completed. Detailed study of meiotic behaviour of *Elymus nutans* was also carried out. Cytological workout of 35 species was done. In connection with the project, two research papers were published in peer reviewed journals.

4. Preparation of Non Detriment Findings (NDF) report on Red Sanders tree (*Pterocarpus santalinus* L.f.) in India by Dr. L. Rasingam, Scientist-D, Dr. M. Sankara Rao, Scientist-C, Dr. J. Swamy, Bot. Asstt., Mr. S. Nagaraju, Bot. Asstt., Dr. L. Rasingam, Dr. J. Swamy, Sri. S. Nagaraju & Dr. M. Sankara Rao, Miss. Pooja, Miss. A. Swathi, Mr. K. Nethaji, Mr. P. Chandu and Mr. S. Gurappa, Miss. Sharfa Naaz, Mr. A. Narasimha, Mr. P. Bharath Simha Yadhav, Mr. Ranjith, Mr. Patan Nazeer Khan & Mr. D. Ramesh, JRFs (Funded by MoEF&CC, New Delhi):

Pterocarpus santalinus, an endemic tree species belonging to the family Leguminosae-Faboideae, is mostly distributed in the southern districts of Andhra Pradesh viz. Chittoor, Kadapa, Nellore, Prakasam and

Kurnool and also reported from the northern districts of Tamil Nadu. The wood and wood products of Red Sanders continue to be in high demand and are traded internationally in large volumes that find use in the musical instruments, furniture, handicrafts, cosmetics, medicine and food industry. Over exploitation without commensurate replenishment of natural stands and illegal logging has posed a severe threat to the very existence of this precious timber species and classified as globally endangered in 1998, near threatened in 2018 in the IUCN Red List and Appendix II of CITES. The heartwood is highly priced in the international market, which is the main cause of illegal felling and smuggling. The primary objective is to prepare a Non-Detriment Finding (NDF) Report for the Red Sanders tree based on the CITES guidelines which includes assessment of the natural populations, distributional pattern, threat status, identification of factors affecting the population, regeneration capacity, phenology etc. through field surveys and mapping the species distribution by using the GIS tools.

During 2018-19, a total of 11 field tours were undertaken to the study area to assess the population of red sanders tree in wild and cultivation. Three 0.1 ha sampling plots in each beat were established randomly in three strata viz. plain, slope and plateau to study the population status of Red Sander species. All the tree species including *Pterocarpus santalinus* ≥ 10 cm gbh were enumerated. For multi-stemmed trees the bole girth was measured separately. Further, information pertain to the height of the trees, disturbances, cut stumps, latitude, longitude and altitude were also recorded. The collected data was entered in the Excel sheets and analysed for the relative density, relative dominance and relative frequency and the girth class wise distribution of all red sanders tree for all the divisions. Prepared maps for sampling points, multi-stems etc. In addition two herbarium consultation tours were conducted to CNH Howrah and IFGTB, Coimbatore. In this tenure a total of 40 species collected from the field tours were identified.

5. Studies of Fossils and living plants with reference to the impact of climate change on flora of Gangetic Plains and Central India by Dr. Arti Garg (PI), Dr. G. P. Sinha & Dr. A. N. Shukla (collaborated under MOA with BSIP, Lucknow) :

The main objectives of the project are to determine the impact of climate change on plant constituents through geological time scale through precise identification of pollen taxa recovered in Quaternary and pre-Quaternary

sedimentary deposits which may find utility to interpret the past vegetation diversity, climate and ecological conditions.

Pollen grains, recovered in fossils serve as most reliable evidences of past vegetational constituents on one hand and geological lineage of the parent plants on the other, reflect the impact of climate change on vegetational constitution through geological time scale. While quantitative pollen assemblages provide multivariate information for reconstructing past vegetation and climates, their qualitative interpretation is useful in the reconstructing climate and vegetation through the geological time scale, giving clue to the past species, their sustenance or succumbing through ages, when calibrated against the present pollen spectrum. Fossil pollen also serve as important climate proxy data indices for validating General Circulation Models with the help of data matrix of pollen morphological characters from extant and fossil records for predicting the possible magnitude of future climate change and its impact on ecosystems. Adding to these, the condition of stomata on leaf has a direct bearing on the impact of elevated CO₂ levels on plants, as stomata play key role in photosynthesis and absorb atmospheric CO₂. The present project is therefore intended to determine the impact of climate change on plant constituents through geological time scale. The precise identification of different pollen taxa recovered in Quaternary and pre-Quaternary sedimentary deposits would find utility to interpret the past vegetation diversity, climate and ecological conditions.

During 2018-19, detailed pollen morphometry of late Cretaceous, *Corsinopollenites* and Pleistocene *Ludwigia* fossil pollen from Karewa sediments (Kashmir) was studied by BSIP team, while pollen morphology and morphometrical analyses of seven extant species of the genus *Ludwigia* viz. *L. octovalvis*, *L. octovalvis* subsp. *sessiliflora*, *L. adscendens*, *L. perennis*, *L. peuviana*, *L. decurrens* and *L. hyssopifolia* was done under Field Emission Scanning Electron Microscope (FESEM) and Light Microscope (at BSIP) by BSI scientists. Pollen morphometric data matrix of Indian *Ludwigia* L. was created jointly through series of studies of detailed characters and followed by data correlation of all species with fossil pollen. The plausible lineage of extant *Ludwigia* species plotted against the fossil *Ludwigia* recovered at two different time frames were drawn on pollen aperture characters, size and sexine pattern. Multivariate Principal Component analysis (PCA) was applied on numerical data matrix of pollen morphometry of seven living species of *Ludwigia* L. and two fossil pollen

recovered.

During this study, critical pollen morphometric and morphological analysis for taxonomic characterization of pollen recovered from Late Cretaceous, *Corsinopollenites* and Pleistocene *Ludwigia* L. fossil pollen from Karewa sediments (Kashmir) through Modern Analogue of Indian *Ludwigia* L., for precise determination of fossil pollen identity to species level revealed close proximity of Pleistocene *Ludwigia* morphotype with that of *L. octovalvis* subsp. *sessiliflora* with remarkable variation from and between all seven species of *Ludwigia* L. The PCA analysis portrayed that Late Cretaceous, *Corsinopollenites* fell in an independent quadrant indicating independent character dominance and affinity with *L. octovalvis* subsp. *sessiliflora*. A pollen morphological identification key has been prepared for precise identification of *Ludwigia* fossil pollen extracts and construction of evolutionary lineage within the genus, based on fossil records and theory of primitivity. The present work has relevance in establishing plausible lineage of living species corresponding to their fossil counterparts in India as well as in other tropical and subtropical regions of the world. Based on this study the major conclusions drawn are: i) the Fossil pollen type *Corcinopollinitis* of Onagraceae, was recovered 65 mya (Early cretaceous) from Maharashtra; ii) China had reported Miocene age pollen of *Ludwigia*, 45 mya similar to our pollen type recovered; iii) similar Quaternary period pollen fossil was recovered from Karewa sediments in Kashmir, 1.3 mya; iv) the fossil pollen was found to be of *Ludwigia octovalvis* var. *sessiliflora* of the present day, which therefore is established as the oldest (earliest) species of *Ludwigia* L. in India, from which all other species evolved over the period of time; v) The present study is the first of its kind on fossil pollen of *Ludwigia* L. type pertaining to pollen fossil of 65mya recovered and identified to species level with the help of extant authentic representative species and is the oldest recovered fossil of *Ludwigia*; vi) *Ludwigia octovalvis* subsp. *sessiliflora* is the oldest species recorded; vii) indicates origin of Asian *Ludwigia* L. in India.

In connection with this project, a Crackle PPE Field Protocol training was conducted by the BSIP and French Institute of Pondicherry, Pondicherry, w.e.f. 22 – 25th January, 2019 in the Shaheed Chandra Shekhar Azaad Bird Sanctuary, Lucknow. Dr. Arti Garg participated in this training and interacted with Scientists of BSIP and French Institute of Pondicherry, Pondicherry and gave a talk and vivid discussion of role of taxonomy in palaeoscientific studies.

6. Non Detrimental Finding studies of *Dalbergia sissoo* DC. and *D. latifolia* Roxb. in India by Dr. Avishek Bhattacharjee, Scientist-C, Dr. Gopal Krishna & Sri Anant Kumar, Bot. Asstt., Ms. Sanchayita Sengupta, Mr. Sayak Chakraborty, Mr. Rahul Dhanavate, Mr. Shuvadip Sarkar, Mr. Ravi Kumar Sahu, Mr. Ashish Kumar Soni, Ms. Oindrila Chakraborty and Ms. Bidisha Mallick, Project Fellows [Funded by MoEFCC (WL) under the scheme 'Wildlife Crime Control Bureau']:

The tropical genus *Dalbergia* L.f. belonging to the family Fabaceae comprises about 250 species in world. In India, the genus, represented by about 35 species, includes various life-forms such as trees, shrubs and lianas. Several species of this genus are commonly known as “rosewood” or “palisander”, producing timbers of high economic value. The genus is native to the tropical regions of Central and South America, Africa, Madagascar and Southern Asia, with fragmented distribution. Many species are under threat due to non-sustainable harvest practices, natural and artificial fires and other anthropogenic activities. *Dalbergia nigra* (Brazilian rosewood) has been listed in Appendix I of CITES since 1992 and all other species belonging to the genus have been listed in Appendix II of CITES since 2nd January 2017 as they face severe threat for survival due to uncontrolled trade. The Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India commissioned a study through Botanical Survey of India (BSI) for conducting the Non-Detriment Findings (NDFs) on two tree species namely *Dalbergia latifolia* and *D. sissoo*.

During the tenure of the project, 42 field tours were conducted in different parts of India; measured population size, density, DBH of boles, height, tentative ages of plants; collected data on nursery stock, timber stock at depots, plantation, regeneration, harvest, trade, threats; assessed National conservation status following Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Ver. 4.0'; prepared GIS maps; executed molecular taxonomic study (using *ITS* and *matK*) to resolve identity crisis; prepared taxonomic accounts of two species. Data also collected from Regional Centres of BSI, scientists/ researchers/ academicians working in different institutes, State Forest Departments, villagers, traders and stakeholders. The final report was prepared by following 'CITES Non-Detriment Findings Guidance for Perennial Plants'. The project report, was submitted to Ministry in November 2018, which will be submitted by the Government of

India to the CITES soon. Based on the NDF report, a delisting proposal of *D. sissoo* was submitted (<https://cites.org/sites/default/files/eng/cop/18/prop/060319/E-CoP18-Prop-51.pdf>) by Govt. of India (co-proponents: Nepal, Bhutan, Sri Lanka) to CITES for its next Conference of Parties (CITES CoP18).

During the project, identity crisis of *Dalbergia sissooides* Wight & Arn. in southern part of the country was detected and informed to Ministry for further management of this economically important timber species. Nucleotide sequence of *D. sissooides* was submitted to GenBank (MK418451.1) for the first time in world.

7. Multidisciplinary Studies in Floristic Assessment, Ecological Analysis, Ecosystem Services, Conservation and Sustainable Management of Selected National Parks in Western Himalayas by Dr. B.K. Sinha, Scientist-F, Dr. Kumar Ambrish, Scientist-E, Mr. Rajni Kant, Mr. Kapil Kharkwal & Miss. Shalini Singh, SPFs:

The project was initiated in 2016 aiming to study Floristic Assessment, Ecological Analysis, Ecosystem Services, Conservation and Sustainable Management in GHNP, Kullu and VoFNP Chamoli.

During 2018-19, 634 plant species of flowering and non-flowering plants belonging to 277 genera under 70 families including 21 RET species as per IUCN criteria were recorded from VoFNP and 875 plant species of 427 genera under 128 families including 25 RET species as per IUCN criteria were recorded from GHNP, Kullu, Himachal Pradesh respectively. In the entire studies, ecosystem services and conservation aspects were observed and data upon them collected from both the sites. The major dominant families of flowering plant species found in the VoFNP are Asteraceae (78 species), Rosaceae (42 species), Ranunculaceae (40 species), Orchidaceae (39 species), Poaceae (38 species), Apiaceae (36 species), Lamiaceae (36 species), Gentianaceae (32 species), Caryophyllaceae (30 species) and Saxifragaceae (28 species), simultaneously in the GHNP are Asteraceae (86 species), Poaceae (72 species), Ranunculaceae (54 species), Fabaceae (48 species), Rosaceae (46 species), Lamiaceae (34 species), Brassicaceae (27 species) and Cyperaceae (26 species). Besides that, data on some non-flowering plant species viz., Gymnosperms (06); Pteridophytes (30 species); Bryophytes (02 species); Fungi 27 (species) and Lichens (16 species) were also collected. An assessment work of RET plants as per the IUCN status was also carried out and documented from these National Parks. A total of 49 species of lichens

belonging to 32 genera and 17 families were recorded from Valley of Flowers National Park. This study recorded 25 RET species from both the National Parks some of which are *Aconitum heterophyllum*, *Aconitum balforii*, *Angelica glauca*, *Arnebia benthamii*, *Bergenia stracheyi*, *Betula utilis*, *Dactylorhiza hatagirea*, *Dioscorea deltoidea*, *Fritillaria roylei*, *Malaxis muscifera*, *Meconopsis aculeate*, *Nardostachys jatamansi*, *Paris polyphylla*, *Picrorhiza kurrooa*, *Rheum australe*, *Rhododendron campanulatum*, *Saussurea gossypiphora*, *Saussurea obvallata*, *Saussurea simpsoniana*, *Sinopodophyllum hexandrum*, *Taxus wallichiana*, *Trillium govianianum* etc. In connection with this project, three research articles were published in peer reviewed journals. During this period, one workshop cum awareness campaign was organised on 04th July, 2018 at Shangarh village of Great Himalayan National Park, Kullu, Himachal Pradesh, under NMHS (MG) Project activities regarding biological conservation.

8. Study of Diversity of Marine Macro Algae of Andhra Pradesh by Dr. M. Palanisamy, Scientist – D & Shri. Aron Santhosh Kumar Y, Project Fellow (AICOPTAX Project):

The major objectives of the project are to study seaweed diversity and taxonomic account of the seaweeds in coastline of Andhra Pradesh, study of the physico-chemical parameters of coastal water, seaweed population density of various localities and Organising Capacity Building short-term and long-term training, workshops by involving well known resource persons from across the country in Seaweed-taxonomy.

During 2018-19, two field survey *w.e.f.* 4th – 16th September, 2018 & 16th – 25th March, 2019 were conducted to the study areas and vouched 73 field numbers from the 70 localities and 546 Nos. of herbarium sheets were prepared. Further, 40 field numbers of live specimens were preserved in wet form for lab studies. The hydrological parameters of seawater such as pH, Temperature, Salinity, DO, etc. Were recorded. GPS coordinates of all the collection locations were recorded with the help of GPS (Garmin *etrex10*) and 250 photos were taken on coastal nature, habit and habitat of seaweeds. Quadrates were plotted in various coastal locations of Andhra Pradesh to study the population, species diversity, richness and abundance of seaweeds in entire coast. Plantlets of *Ulva compressa*, *Ulva flexuosa*, *Ulva intestinalis*, *Ulva rigida*, *Chaetomorpha antennina*, *Padina boergesenii*, *Padina boryana*, *Padina tetrastratica*, *Sargassum cinereum*, *Gelidium pusillum*,

Gracilaria corticata, *Gracilaria foliifera*, *Gelidiopsis variabilis*, and *Centroceras clavulatum* were found to be spread over the various types of substratum. Maximum seaweed diversity was recorded at the northern part of the state, especially at Bheemlipatnam, Chintapalle, Akkupalli, Yerramukkam, Mangamaripeta, Thimmapuram and towards south in Pulicat Lake; Seaweed species richness was observed in Srikakulam and followed by Vijayanagaram, Visakhapatnam, & Kakinada. This study reports 20 taxa as new records for the state Andhra Pradesh and 35 economically important plants.

9. ex situ Conservation and Propagation of Indigenous, Threatened and Endemic Plants through Improvement of Infrastructure Facilities in National Orchidarium & Experimental Garden (NOEG), Yercaud. by Dr. S. Kaliamoorthy, Scientist – D (Ref. No. F. No. 10/28/2014-CS (BG) dated 24/07/2015 sponsored by MOEF&CC, New Delhi):

National Orchidarium & Experimental Garden (NOEG), established in 1963 under the Southern Regional Centre, situated in Yercaud, Salem District, Tamilnadu, is located in the Sanyasimalai Reserve Forest of Shevaroy Hills, of Eastern Ghats, at Yercaud in Salem District of Tamil Nadu with an area of 18.6 hectares. The garden has been entrusted with the mandate of conserving as many wild species of Indian orchids as possible so as to establish this group's germplasm centre. The Garden has been engaged in systematic survey, collection, introduction and botanical studies of rare, endangered and threatened plants, plants of potential economic value and wild relatives of cultivated plants and serves as a Centre for research, data storage, documentation and reference as well as for educational interpretive, conservation and public service activities. The major objectives of the project are survey, documentation, collection, introduction and multiplication of rare, endangered, threatened and endemic plant species of the Peninsular India, cultivation of indigenous species of economic or scientific importance, development of a nursery of plants from seeds which can both be maintained as germplasm and reintroduced in their natural habitat or else to be sold to the local public, to strengthen the infrastructure facilities of the Botanic Garden, to impart awareness among students and general public on the need for preservation of natural habitats and biodiversity, to act as a plant resource hub for researchers, general public and establishing information system and database for efficient communication with other gardens and with the general public.

During 2018-19, five field tours were conducted to Megamalai Wildlife Sanctuary, Agasthiyamalai Biosphere Reserve, Agamalai Reserve Forest, Kolli Hills Reserve Forest and Kalrayan Hills Reserve Forest during which 51 species were collected under 32 genera along with 77 field photographs. Besides, 41 orchid species were collected and introduced in the Botanic Garden. In connection with this project, plant tissue culture techniques were applied for the micropropagation of the following proposed rare, endemic plant species: *Crotalaria longipes*, *Monosis shevaroyensis*, *Aerides crispera*, *Xenikophyton smeeanum*, *Oberonia verticillata*, *Oberonia brunoniana*, *Monosis shevaroyensis* and *Crotalaria longipes*.

As part of the project the preparation of vermicomposting unit was initiated successfully.

10. Strengthening of Lead Botanical Garden, Barapani, BSI, ERC, Shillong by Dr. N. Odyuo, Scientist-D, Dr. D.K. Roy, Botanist, Mr. L.R. Meiti, Bot. Asstt. & Evenstone Wahlang, JPF (Funded by MoEF & CC):

The major objectives of the project are collection, introduction and multiplication of plant species in the Experimental Botanical Garden, Barapani and Shillong office garden.

During 2018-19, nine local tours were conducted to Longleng and Wokha districts, Nagaland, Senapati & Kangpokpi districts, Manipur, Garo Hills, Meghalaya, Moopun falls, Jaintia hills, Meghalaya, Sumer, Ribhoi, Meghalaya, Shillong Peak, Meghalaya, Umsning & surrounding areas, Meghalaya, Sohra, Meghalaya, Elephant falls, Upper Shillong, Meghalaya during which 583 live plants were collected (Citrus 10 sp., Musa 8 sp., Rhododendrons 22 sp., Dioscoreas 11 sp., Gingers 77 sp., Piper 17 sp., Bamboo 23 sp., Medicinal 40 sp., Fern House 72 sp., Wild edible fruits 26 sp. Recently made Sections:- Impatiens Section 13 sp. and Ceropegia Section 6 sp.). A total of 785 individuals were raised from 8 plant species by seedlings; 970 individuals from 12 plant species by cuttings and 6330 seeds of 16 plant species were sown in the germination beds. During this period, 230 signages (name plates) were prepared. A total of 663 seedlings/saplings were distributed to Forest Department, NESAC, ICAR, CAU and other institutes.

11. Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building by Dr. A.A. Mao, D/BSI, Dr. N. Odyuo, Scientist-D, Dr. Ashutosh Pathak, Ms. K. Sangeeta Devi, RAs, Ms. Bidisha Mallick, Ms. Bashisha Rynjah, Mr. Rahul Das, Mr. Kerlang Khonglam, JPFs & Field staffs:

During this period, one field survey tour was carried out to Khatar Shnong area, East Khasi Hills District, Meghalaya for survey, collection of *Areca triandra* seeds/saplings and identification. Regarding propagation work, prepared Woody Plant medium (WPM) with activated charcoal for *Rhododendron wattii*, ½ Murashige and Skoog (MS) medium incorporated with 0.5mg/l Benzylaminopurine (BAP) for setting up of experiments on *Paris polyphylla* rhizome sections, MS medium for *Cymbidium whiteae*, subculturing of *Rhododendron wattii* and *Cymbidium whiteae* cultures in WPM medium with activated charcoal and plain MS medium was done. For phytochemical studies, plant samples of *Areca triandra*, *Coptis teeta*, *Illigera grandiflora*, *Nepenthes khasiana* were dried, extracted in right solvent system, concentrated the extract and qualitative analysis of the extract done. For molecular work, Cetyltrimethyl ammonium bromide (CTAB) buffer was prepared for DNA extraction of plants included in the project. DNA Extraction using Doyle and Doyle, 1990 protocol were carried out for *Rhododendron wattii*, *Phiaus flavus*, *Phiaus longipes*, *Calanthe biloba*, *Cymbidium elegans*, *Asplenium nagalandicum*, *Cymbidium tigrinum* and *Nepenthes khasiana*. In nethouse and greenhouse, hand pollination for *Calanthe biloba*, *Cymbidium elegans*, *Cephalantheropsis obcordata* and *Phiaus flavus* was completed; *in-vivo* seed germination of *Prunus nepalensis* and *Aphananthe cuspidate* was maintained along with *ex-situ* conservation of *Cymbidium whiteae*. Subculturing of *Paris polyphylla* in ½ strength MS medium; *in vitro* seed germination (½ MS medium (pH 5.6) with activated charcoal), *Rhododendron wattii* cultures in various concentrations of growth hormones like IAA, IBA and NAA, *Cymbidium tigrinum* in MS medium (pH 5.8), *Ilex khasiana* in MS medium (pH 5.8), *Cymbidium wattii* in MS media with banana extract, pH 5.8. Maintenance and monitoring of *in vivo* seed germination of *Prunus* sp. and *Alphananthe* sp. in the greenhouse and *in vivo* seed germination of *Nepenthes khasiana* was done; Explant inoculation of *Diplazium nagalandicum* in the Woody Plant Medium (WPM).

ASSISTANCE TO BOTANIC GARDEN SCHEME

ABG GRANT-IN-AID, FUND DISBURSED IN FY 2018-19

Grant -in- Aid Available	Sl. No	Date of Sanction	Name of the Institution	Amount sanctioned in FY 2017-18	Balance Amount
2, 30, 00,000	1	No. 10/20/2014-CS/BG dt. 17/08/2018	BSI, ERC, Shillong	1077288	21922712
	2	No. 10/16/2016-CS/BG dt. 17/08/2018	Yogivemana University, Kadappa.	1820800	20101912
	3	No. 10/20/2014-CS/BG dt. 17/08/2018	Shivaji University, Kolhapur	1950000	18151912
	4	No. 10/02/2013-CS/BG dt. 18/09/2018	G. B. Pant Institute, Almorah.	528266	17623646
	5	No. 10/17/2014-CS/BG dt. 16/10/2018	Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan	2439200	15184446
	6	No.10/17/2018-CS/BG dt. 16/10/2018	Guru Nanak Dev University, Amritsar	3610000	11574446
	7	No.10/24/2018-CS/BG dt. 11/12/2018	KFRI Sub Centre, Kerala Forest Research Institute, Nilambur	1937750	1937750
	8	No.10/25/2018-CS/BG dt. 11/12/2018	Botanical Survey of India, Arid Zone Regional Centre, Jodhpur	26 22000	7014696
	9	10/09/2015-CS/BG dt. 12/12/2018	FEEDS Hengbung, P.O. Kangpokpi, Senapati District, Manipur	2315016	4699680
	10	No.10/20/2018-CS/BG dt. 13/12/2018	Kotgarh Forest Davison, HP State Forest Dept. Distt, Shimla	29 00000	1799680
	11	NO. 10/23/2018-CS/BG dt. 13/12/2018	Kumaun University, Nainital	1799680	0
Total				17478000	Nil

HERBARIUM INFORMATION (2018-19)

Sr. No.	Herbarium Maintenance	APRC	AZRC	CNH	CRC	CRYPTO GAMY	DRC	ERC	ISIM	SHRC	WRC	TOTAL
1.	No. of specimens mounted/remounted/labelled	3021/ 3021	5505/00/2 509	1221/ 3045/ 249	16629	18	436	1794/ 140	-	-	925	29549/ 6206/2758
2.	No. of herbarium sheets stitched/restitched/cleaned/poisoned/fumigated/dusted	3021/05/0/ 400/0/ 2750	4900	358/0/ 1440/ 902/0/ 580	19200	-	-	1312/ 1125/ 1106/ 3000/	110/ 1355/ 1550	7494	925	37320/ 2485/ 3558/4302 /
3.	No. of herbarium sheets accessioned	650	1975		1663	-	3440	2100	-	491	-	9729
4.	No. of specimens incorporated/re-incorporated	170	1445	3359	5222	54	776	785	-	436	112	12359
5.	No. of specimens sent on loan	-	0	83	-	-	-	271 Lichen specimens	-	-	-	354
6.	No. of loaned/gifted specimens received/returned/exchanged	27	0	10/38	19 lichen type from ARI	92	324	-	-	-	-	472/38
7.	No. of specimens identified	-	1478		320	19	440	525	-	142	-	2924
8.	No. of Genus/species covers changed	66/77	50/30	901/ 2446	1245	-	-	1060/ 700	45	62	-	3429/ 3253
9.	No. of specimens segregated	11	60	-	-	-	-	-	-	-	-	71
10.	Documentation of existing herbarium sheets at herbaria/entry in Excel sheet/Field data written	1254/ 3258	-	-	-	-	-	-	-	-	-	1254/3258

HERBARIUM DIGITIZATION (2017-18)

REGIONAL CENTERS	APRC	CNH	DRC	SHRC	WRC	TOTAL
Digitization	1250	1490	3440	5556	19	11755

AWARDS & HONOURS

Dr. A.A. Mao: Received the 'Prof. S.P. Vij Memorial Award 2018' for exemplary contribution to research and development in plant taxonomy during 'National Conference cum workshop on recent advances in Orchidology with special emphasis on biology, climate change, conservation and commercialization of floriculturally and therapeutically important taxa and orchid show' organized by The Orchid Society of India (TOSI) on 15th -17th February, 2019, venued at ICAR-CIARI, Port Blair.

Dr. Pratibha Gupta: Received the 'Scientist of the Year award' by International Academy of Science & Research, Kolkata for significant contribution in the field of Phycology in inaugural session of International Multidisciplinary Research Conference on Biodiversity, Climate Change, Physical and Life Sciences on 21st January, 2019.

Received a 'Certificate of appreciation and best oral paper presentation award' for research paper entitled "Diversity of Cyanaoprokaryotes and Algae from Grovnes Peninsula of Larsemann Hills, East Antartica: First Report" in Biodiversity session of the International Multidisciplinary Research Conference on biodiversity, Climate Change, Physical and Life Sciences on 22.01.2019 at DHSK College, Dibrugarh, Assam and honoured by Governor of Nagaland Shri P.B. Acharya.

Dr. G.P. Sinha: Received the 'Global Environment Sustainability Promotion Award 2018' of International Academy of Science and Research, Kolkata during International Symposium "Recent Trends in Agriculture Biodiversity and Social Sustainability (ABSS 2018)" Allahabad.

Dr. Sheo Kumar: Received the 'Biodiversity Conservation Award' with 'Ang Vastra' by the Blue Planet Society, Allahabad during organized **International Symposium on Recent Trends in Agriculture, Biodiversity and Social Sustainability (ABSS 2018)** on 30th September, 2018 in **BSI Auditorium, Chaitham Lines, Allahabad.**

Dr. L. Rasingam: Nominated for Member of the Board of Studies in Forestry under the Faculty of Science, Osmania University, Hyderabad.

Dr. A. N. Shukla: Received the 'Green India Promotion Award' from 'International Academy of Science and Research, Kolkata' by Hon'ble Justice High Court Shri Siddharth Verma during International Symposium "Recent Trends in Agriculture Biodiversity and Social Sustainability (ABSS 2018)" Allahabad.

Dr. Ashish V. Prabhugaonkar: Received the 'Best Presentation Award' for presenting '*Study on diversity of micro-fungi in Meghalaya using traditional and modern molecular phylogenetic approach*' in secession '*Taxonomy, botanical and allied biological science research*' in the 'International Symposium on Climate Change, Biodiversity and Sustainable Agriculture (ICCBSA-2018) from 13-16 December, 2018', organised by Assam Agricultural University at Jorhat, Assam campus.

Dr. Deepu Vijayan: Received the 'Best poster award' for the paper entitled 'Genetic integrity analysis and reintroduction of *in vitro* raised plants of *Pyrenaria khasiana* R.N. Paul var. *lakhimpurensis* - an endemic plant to eastern Himalaya in International Conference on Trends in Plant Sciences and Agrobiotechnology-2019 (ICTPA-2019) from 14th to 16th February, 2019 at Indian Institute of Technology, Guwahati, Assam.

Received the **3rd prize for oral presentation** in the paper 'Phytochemical Screening and GC-MS Analysis of Leaf Extract of *Aristolochia saccata* Wall. in International conference on climate change, biodiversity and sustainable agriculture (ICCBSA) from 13th to 16th December 2018, Assam Agricultural University, Jorhat, Assam.

M. E. Hembrom: Received the 'Prof. Kamal Merit Awards for Young Scientists' for significant contributions in macrofungi [by NFCCI-ARI]

SERVICE RENDERED

A. PUBLIC SERVICE RENDERED:

- Assistance to scientific fraternity: Distribution of scientific information, assistance to c. 3000 researchers and scientific officials in pursuing researches on plant taxonomy and allied disciplines.
- Expert service: 142 queries on plant distribution, ecology, nomenclature, conservation status etc. were attended and solved by BSI experts; c. 20 information were provided about history of AJC Bose IBG.
- Identification & authentication of plant samples: c. 1116 specimens of angiosperms, pteridophytes, bryophytes, fungi, lichens, algae including narcotic drugs were identified.
- Visitors attended: c. 9572 visitors including VIPs, dignitaries, foreign delegates, scientists, academicians, researchers and students; c. 4.0 lakhs general visitors exclusively visited AJC Bose Indian Botanic Garden.
- Plantation programme, saplings & plant samples distribution: c. 600 saplings and other plant materials of 67 plant species distributed to students, research scholars and different Institutions.
- Miscellaneous services: BSI Scientists have evaluated dissertation works of five M.Sc. and two M.Phil students and Ph.D. thesis of eight Ph.D. scholars from different Universities; reviewed manuscripts received from peer reviewed National and International journals viz. Blumea, Haseltonia, Nordic Journal of Botany, Phytotaxa, Current Science, Taiwania, Rheedeia, NELUMBO, Journal of Bombay Natural History Society, EVISE Journal of Asia Pacific Biodiversity, Plant Science Today, Journal of Threatened Taxa, Journal of Orchid Society of India, Mycokeys, Mycological Progress, Mycotaxon etc.

B. REVENUE EARNING:

- Total revenue earned : Rs. 6236634/-
- Identification charges of plant specimens/ crude drugs/narcotic drugs: Rs. 104050/-
- Sale of BSI publication: Rs. 2,04771/-
- Miscellaneous (Entry fee in Botanic Garden, photography charges, guest house charges, photocopy charges etc.): Rs.1,00725/-

EVENTS & ACTIVITIES



A. Visits of Honbl. Minister MoEFCC, Dr. Harsh Vardhan, at AJC Bose Indian Botanical Garden; **B.- E.** At Central National Herbarium, Howrah; **F.** At Deccan Regional Centre, Hyderabad



A.-C. Visit of Sh. C. K. Mishra, Secretary, MoEFCC to Central National Herbarium, BSI, Howrah; **D.** National conference-cum workshop on Orchidology organised by TOSI, Punjab University & BSI at Port Blair on 15-17 Feb. 2019; **E.** Inauguration of Green Skill Development Programme at Andaman & Nicobar Regional Center, Portblair; **F.** Sh. C. K. Mishra, Secretary and Ms. Manju Pandey, Joint Secretary, MoEFCC releasing the BSI publication "Balsam of Eastern Himalaya at Central National Herbarium, Howrah.



A. Dr. Sheo Kumar, Scientist E, Central Regional Centre, Allahabad, receiving 'Biodiversity Conservation Award' from Blue Planet Society, Allahabad; **B.-F.** Glimpse of "Eastern Regional Workshop on Conservation and Management of Wetlands" organized by MoEFCC and BSI on 6-7 July, 2018 at Central National Herbarium, Howrah.



A



B



C



D



E



F

A.-F. Glimpse of Two Week Training Programme for Botanical Assistants of Botanical Survey of India organized by MoEFCC from 22 June-5 July 2018 at Central National Herbarium, Howrah.



A. Dr. Umesh Tiwari explaining the plant morphology during Green Skill Development Programme at Arunachal Pradesh Regional Centre, Itanagar; **B.** Distribution of certificates to GSDP students at APRC, Itanagar; **C.** Dr. B. K. Singh interacting with students during their visit to AJC Bose Indian Botanical Garden, Howrah; **D.** Celebration of World Environment Day at CRC, Allahabad; **E.** Plantation in BSI regional office campus, Itanagar during Van-Mahotsava; **F.** Hindi Workshop organized in CRC, Allahabad.



A



B



C



D



E



F



G



H

A.-B. Awareness rally and sit & draw competition during World Ozone Day celebration at Central National Herbarium, BSI, Howrah; **C.** Students participating in Education Environment Awareness Programme in AJCBIBG, Howrah; **D.** Students visiting BSI stall at Central Regional Centre, Allahabad; **E.-F.** Sit and draw competition organized by different Regional offices of BSI; **G.** Beat Plastic Pollution awareness march organized by BGIR, Noida during World Environment Day, 5 June 2018; **H.** Students participating in cleaning drive of Peddatallakunta tank, upparpally, Hyderabad

BUDGET ESTIMATE

2018-19

BOTANICAL SURVEY OF INDIA

Government of India

DETAILED DEMANDS FOR GRANTS OF MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE FOR 2018-19

Grant No.27

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

(Figure in Rupees)

FY 2018-19	Allotment	Exp. Up to 31.03.2019
	2018-19	
1. Salaries	445000000	434034424
2. Wages	100000	64367
3. Overtime Allowance	300000	212651
6. Medical Expenditure	8000000	4508307
11. Domestic Travel Expenses	21100000	19156239
12. Foreign Travel Expenses	1000000	534526
13. Office Expenses	95200000	94302985
16. Publication	2000000	1999993
20. Other Administrative Expenses	3500000	2191273
21. Supplies & Materials	1000000	855464
26. ADV. & Public	1800000	0
27. Minor Works	22800000	22617892
28. Professional Services	4100000	4100000
30. Oth. Cont. Services	41000000	40579626
31. Grant-in-aid	50045000	37085695
34. Scholarship & Stipend	11055000	10637390
TOTAL-PLAN	708000000	672880832



भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

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