
National Mission on Himalayan Studies (NMHS)
HIMALAYAN RESEARCH FELLOWSHIP
(FORMAT FOR THE HALF YEARLY PROGRESS REPORT)

[Reporting Period: July to December 2020]

Name of the Project: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.

Sanction Order No.: GBPNI/NMHS-2017-18/HSF-08, dated: 28.03.2018.

1st installment received: Rs. 33,56,232/-

Name of the Institution/ University:	Botanical Survey of India, Sikkim Himalayan Regional Centre Gangtok, Sikkim
No. of Himalayan Research/Project Associate:	One
No. of Himalayan Junior Research/Project Fellows:	Six (6)

H-RAs Profile Description:

Sl. No.	Name of RA	Date of Joining	Name of the PI	Qualification
1A.	Dr. SAMIRAN PANDAY	17.12.2018 (Resigned on - 23.8.2019)	Dr. D.K. AGRAWALA	M.Sc., Ph. D. (BOTANY)
1B.	Dr. RIJUPALIKA ROY	14.10.2019	Dr. D.K. AGRAWALA	M.Sc., Ph. D. (BOTANY)

Progress Report: To be filled for each HRA in separate row.

RA No.	Research Objectives	Achievements	Addressed Deliverables	Location of Field Site with Details, if any
H-RA 1A.	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Sub-families Vanilloideae, Orchidoideae and Epidendroideae with 22 genera and 76 species.</p> <p>Objectives:</p> <ul style="list-style-type: none"> •Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. •Morphological characterization. •Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. •Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. •Assess the threat status by applying IUCN criteria. •Develop distribution and species richness map. •Germplasm collection and ex-situ conservation. 	<ul style="list-style-type: none"> •Morphological Characterization done for 15 species under 8 genera •Assigned geo co-ordinates: 23 species (425 sheets). •Literature on selected species has been collected and studied. •Protologues, types & images of herbarium specimen from various Indian herbaria is being collected and studied. 	<ul style="list-style-type: none"> •Literature survey conducted. •Collection of type, protologue & herbarium specimen continued. 	<ul style="list-style-type: none"> •Study area for the project is entire Indian Himalayan Region covering 12 states.

<p>H-RA 1B.</p>	<p>The same work and objective has been taken over from the outgoing RA</p>	<ul style="list-style-type: none"> •Distribution of different orchid taxa in IHR reported in different publication has been completed. •Endemic species has been identified from the published literature and tabulated for all orchid species of IHR. •Less known species are being identified. •Distributional pattern with altitudinal gradient for the allotted taxa has been tabulated and computed. •Phenological calendar of allotted taxa has been prepared. •Protologues & types of herbarium specimen from various Indian herbaria and abroad are collected and studied. •Inputs were provided in editing IUCN Red-list datasheets of 32 taxa. •Inputs were provided in preparing IUCN Red-list datasheets of 54 taxa. •Abstract was submitted and accepted for the poster presentation at International Symposium organized by Botanical Survey of India, Kolkata. •Attended the lecture delivered by Dr. Rajib Gogoi, HoO & Scientist 'E' on 07.11.2019. 	<ul style="list-style-type: none"> •Literature survey conducted. •Collection of type, protologue & herbarium specimen continued. •Endemics, less known species in their known localities are to be recorded. 	<ul style="list-style-type: none"> •Study area for the project is entire Indian Himalayan Region covering 12 states.
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Himalayan Junior Research/Project Fellows

H-JRFs Profile Description:

Sl. No.	Name of JRF	Date of Joining	Name of the PI	Qualification
1.	MR. AAZHIVAENDHAN G.	13.07.2018	Dr. D.K. AGRAWALA	M.Sc. (BOTANY)
2	MS. SHREYASI NAYAK	27.07.2018	Dr. D.K. AGRAWALA	M.Sc. (BOTANY)
3.	MS. SANCHAYITA SENGUPTA	01.08.2018	Dr. D.K. AGRAWALA	M.Sc. (BOTANY)
4.	MR. SAYAK CHAKRABORTY	01.08.2018	Dr. D.K. AGRAWALA	M.Sc. (BOTANY)
5.	MR. SHUVADIP SARKAR	01.08.2018	Dr. D.K. AGRAWALA	M.Sc. (BOTANY)
6.	MS. OINDRILA CHAKRABORTY	19.3.2019	Dr. D.K. AGRAWALA	M.Sc. (ENVIRONMENTAL SCIENCE)

Progress Report: To be filled for each JRF in separate row.

JRF No.	Research Objectives	Achievements	Addressed Deliverable	Location of Demonstration/ Study Site with Details
H-JPF 1	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Tribe Malaxideae with 5 genera and 86 species.</p>	<ul style="list-style-type: none"> •Live specimens of 12 species have been studied for complete macro morphological characteristics. •Literatures on allotted species are being consulted and data on Molecular biology, Phylogeny and Histology are being compiled. •Methodology for Molecular studies and Histology is being standardized. 	<ul style="list-style-type: none"> •Literature survey continued. •Collection of type & herbarium specimens continued •One field tour 	<ul style="list-style-type: none"> •Study area for the project is entire Indian Himalayan Region covering 12 states. •One field tour

	<p>Objectives:</p> <ul style="list-style-type: none"> •Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. •Morphological characterization. •Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. •Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. •Assess the threat status by applying IUCN criteria. •Develop distribution and species richness map. •Germplasm collection and ex-situ conservation. 	<ul style="list-style-type: none"> •Checklist of species endemism and distribution has been prepared. •Types & images of herbarium specimen from various Indian herbaria is being collected and studied. •Plant description prepared for 17 species •Geo co-ordinates were assigned for 60 species (1954 sheets) •Inputs were provided for IUCN Red-list datasheets of 182 species. <p>FIELD TOURS</p> <ul style="list-style-type: none"> •16/07/2019 to 21/07/2019: Cherrapunjee, Mawsmmai, Jowai, Nongpoh (Meghalaya). C. 500 km² were covered, 28 species were collected and introduced in BSI SHRC campus for further studies and ex situ conservation. •27/07/2019 to 30/07/2019: Nongstoin, Mawsynram, Dwaki (Meghalaya). C. 600 km² were covered and 20 species were collected and introduced in BSI SHRC campus for further studies & ex situ conservation. During this field trip many epiphytic orchid species were rescued from fallen tree logs. <p>HERBARIUM CONSULTATION</p> <ul style="list-style-type: none"> •22/07/2019 to 26/07/2019: Botanical Survey of India Eastern Regional Centre herbarium (ASSAM) Shillong, Meghalaya. Total of 530 herbarium sheets of respective groups has been studied for complete morphological characters. <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> •Abstract was submitted for the poster presentation at International Symposium organized by Botanical Survey of India, Kolkata. 	<p>conducted.</p> <ul style="list-style-type: none"> •Germplasm of 48 species introduced for ex-situ conservation 	<p>has been conducted at Meghalaya.</p>
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<p>H-JPF 2</p>	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Genus <i>Bulbophyllum</i> with 135 species.</p> <p>Objectives:</p> <ul style="list-style-type: none"> • Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. • Morphological characterization. • Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. • Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. • Assess the threat status by applying IUCN criteria. • Develop distribution and species richness map. • Germplasm collection and ex- 	<ul style="list-style-type: none"> • Live specimens of 10 species have been studied for complete macro morphological characteristics. • Methodology for Molecular studies and Histology is being standardized. • Checklist of species endemism and distribution has been prepared. • Types & images of herbarium specimen from various Indian herbaria is being collected and studied. • Plant description prepared for 29 species • Geo co-ordinates were assigned for 3 genera (886 sheets) • Inputs were provided for IUCN Red-list datasheets of 106 species. <p>FIELD TOURS</p> <ul style="list-style-type: none"> • 16/07/2019 to 21/07/2019: Cherrapunjee, Mawsmi, Jowai, Nongpoh (Meghalaya). C. 500 km² were covered, 28 species were collected and introduced in BSI SHRC campus for further studies and ex situ conservation. • 27/07/2019 to 30/07/2019: Nongstoin, Mawsynram, Dwaki (Meghalaya). C. 600 km² were covered and 20 species were collected and introduced in BSI SHRC campus for further studies & ex situ conservation. During this field trip many epiphytic orchid species were rescued from fallen tree logs. <p>HERBARIUM CONSULTATION</p> <ul style="list-style-type: none"> • 22/07/2019 to 26/07/2019: Botanical Survey of India Eastern Regional Centre herbarium (ASSAM) Shillong, Meghalaya. Total of 350 herbarium sheets of respective groups has been studied for complete morphological characters. 	<ul style="list-style-type: none"> • Literature survey continued. • Collection of type & herbarium specimens continued • One field tour conducted. • Germplasm of 48 species introduced for ex-situ conservation 	<ul style="list-style-type: none"> • Study area for the project is entire Indian Himalayan Region covering 12 states. • One field tour has been conducted at Meghalaya.
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	situ conservation.	<p>MISCELLANEOUS</p> <ul style="list-style-type: none"> • Abstract was submitted for the poster presentation at International Symposium organized by Botanical Survey of India, Kolkata. 		
H-JPF 3	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Sub-tribes Vandinae, Decetorineae and Phalaeonopsidineae with 19 genera and 94 species.</p> <p>As per The 3rd Himalayan Consortium 2019 recommendations, the research objectives are as follows:</p> <ul style="list-style-type: none"> • Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. • Morphological characterization. • Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. • Confirm the presence of endemics, near endemics and 	<ul style="list-style-type: none"> • Live specimens of 4 species have been studied for complete macro morphological characteristics. • Digital macro-microscopic photographs were taken for 4 species. • Plant description prepared: 3 species • 37 Literature on selected species has been collected and studied. • Protologues of 65 names and 64 types are collected • Excel sheets based tabulating Herbarium label data: 39 • Assigned geo co-ordinates: 730 sheets under 11 species • Data sheets prepared for Red listing: 73 species • Germplasm of 61 samples introduced. <p>FIELD TOURS</p> <p>25.07.19 to 11.08.19: A tour has been conducted to Tippi, Sessa, Doimara, Shergaon, Morshin, Dirang, Shangti Basti, Thembang, Namsu, Munna camp, Chug, Rahung and Mandla located in West Kameng district and Itanagar and Doimukh in Papum Pare district. A total of 82 orchid species could be observed of which specimens of 62 field numbers collected and 51 are introduced in the campus garden for further studies and ex situ conservation. Out of 62 orchid species 12 are terrestrial, of which 2 are mycoheterotrophic.</p> <p>HERBARIUM TOURS</p>	<ul style="list-style-type: none"> • Complete inventory of orchid species • Digital database on target orchid group • Morpho-molecular characterization of all species • Long standing problems on many species complex will be solved. • Inventory of Endemics and less known species 	<ul style="list-style-type: none"> • Study area for the project is entire Indian Himalayan Region covering 12 states. • Field tours A tour has been conducted to Tippi, Sessa, Doimara, Shergaon, Morshin, Dirang, Shangti Basti, Thembang, Namsu, Munna camp, Chug, Rahung and Mandla located in West Kameng district and Itanagar and Doimukh in Papum Pare district.

	<p>less known species in their known localities and predict the likely habitat with habitat modeling technique.</p> <ul style="list-style-type: none"> •Assess the threat status by applying IUCN criteria. •Develop distribution and species richness map. <p>Germplasm collection and ex-situ conservation.</p>	<p>18.07.19 - 20.07.19: Herbarium consultation was done at ARUN from 18.07.2019- 20.07.2019 and 40 sheets under 28 species were examined.</p> <p>MISCELLANEOUS</p> <p>An abstract for poster presentation on <i>Esmeralda</i> Rchb.f- one of the important horticultural orchid genera in India was sent on 30.10.19 for poster presentation at The International Symposium on Plant Taxonomy and Ethnobotany to be organized by Botanical Survey of India, Kolkata on 13.02.19 - 14.02.19.</p>		
H-JPF 4	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Tribes Arethuseae, Nervilieae, Gastrodieae, Tropideae and Neottieae with 18 genera and 75 species.</p> <p>As per the 3rd Himalayan Consortium, Almora 2019 recommendations, the research objectives are as follows:</p> <ul style="list-style-type: none"> •Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. •Morphological characterization. 	<ul style="list-style-type: none"> •Live specimens of 10 species have been studied for complete macro morphological characteristics. •Digital macro-microscopic photographs were taken for 10 species. •Literatures on selected species has been collected and studied. •Protologues, types & images of herbarium specimen from various Indian herbaria is being collected and studied. •Plant description prepared for 17 species and 4 genera. •Assigned geo co-ordinate for 9 species. •Datasheets prepared for 55 species. •Old herbarium sheets studied and data entered in the excel sheet: A total of 45 sheets under 9 species. •Germplasm of 8 samples introduced along with another team member, Mr. Shuvadip Sarkar, JPF <p>FIELD TOURS</p> <ul style="list-style-type: none"> • 11.07.2019 to 15.07.2019: Surveyed areas are Dombyang Valley, Yumthang Hotspring area, Shingba Rhododendron Sanctuary, Katao and adjoining areas. 	<ul style="list-style-type: none"> •Complete inventory of orchid species •Digital database on target orchid group •Morpho-molecular characterization of all species •Long standing problems on many species complex will be solved. •Inventory of Endemics and less known species 	<ul style="list-style-type: none"> •Study area for the project is entire Indian Himalayan Region covering 12 states. •Field tours have been conducted at North districts of Sikkim.

	<ul style="list-style-type: none"> •Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. •Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. •Assess the threat status by applying IUCN criteria. •Develop distribution and species richness map. •Germplasm collection and ex-situ conservation. 	<p>Total 22 field numbers collected along with other team member, Mr. Shuvadip Sarkar, JPF and 8 introduced in the BSI, SHRC campus glasshouse for further studies and ex-situ conservation. During this field trip many epiphytic orchids were rescued from fallen tree logs at road widening sites.</p> <p>HERBARIUM CONSULTATION</p> <ul style="list-style-type: none"> • 08.08.2019 to 09.08.2019: Visited Central National Herbarium, Howrah, West Bengal and studied respective specimens from herbarium and took photographs of 6 protologues from available literatures and consulted other literatures also in CNH library with permission. <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> • An abstract for poster presentation on “Diversity and distribution of the genus <i>Otochilus</i> Lindl. in India” was sent on 30.10.2019 for poster presentation at the International Symposium on Plant Taxonomy & Ethnobotany to be organized by Botanical Survey of India, Kolkata on 13.02.2020 and 14.02.2020. • Attended a lecture delivered by Dr. Rajib Gogoi, HoO & Scientist ‘E’ on 07.11.2019. • Prepared a list of IHR species. • IHR specific clustering table prepared for allotted species with their availability details. • Season specific clustering table prepared for allotted species. 		
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<p>H-JPF 5</p>	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Tribes Cymbidieae, Epidendreae, Collabieae and Podochileae with 29 genera and 77 species</p> <p>As per 3rd Himalayan Researchers Consortium, Almora-2019, the research objectives are as follows:</p> <ul style="list-style-type: none"> • Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. • Morphological characterization. • Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. • Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. 	<ul style="list-style-type: none"> • Live specimens of 8 species have been studied for complete macro morphological characteristics. • Digital macro-microscopic photographs were taken for 8 species. • Total 96 Literatures & regional papers on allotted species have been studied. • Protologues of 152 names along with synonymy are collected & images of herbarium specimen from various Indian herbaria is being collected and studied. • Plant description prepared: 8 species • Assigned geo co-ordinate: 53 species • Old herbarium sheets studied and data entered in the excel sheet: A total of 1922 sheets under 53 species. • Germplasm of 8 samples introduced & monitoring the survival, growth, flowering of previously collected specimens which are conserved in BSI Orchidarium <p>FIELD TOURS</p> <ul style="list-style-type: none"> • 11.07.19 to 15.07.19: Field tour conducted to Lachung of North Sikkim. Surveyed areas are Dombyng valley, Yumthang Hotspring, Shingba Rhododendron Sanctuary, Katao and adjoining areas. Total 36 field nos collected and 8 were introduced in introduced in BSI, SHRC campus for further studies and ex situ conservation. During this field trip many epiphytic orchids were rescued from fallen tree logs at road widening sites. • Field tour conducted to Pakyong on 23/07/2019 to study live specimens at ICAR- National Research Centre 	<ul style="list-style-type: none"> • Complete inventory of orchid species • Digital database on target orchid group • Morpho-molecular characterization of all species • Long standing problems on many species complex will be solved. • Inventory of Endemics and less known species 	<ul style="list-style-type: none"> • Study area for the project is entire Indian Himalayan Region covering 12 states. • Field tours have been conducted at North district of Sikkim.
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	<ul style="list-style-type: none"> •Assess the threat status by applying IUCN criteria. •Develop distribution and species richness map. •Germplasm collection and ex-situ conservation. 	<p>For Orchids</p> <ul style="list-style-type: none"> •Field tour conducted to North Sikkim on 20/09/19-23/07/19. Surveyed areas are Yumthang Hotspring, Shingba Rhododendron Sanctuary, Yumesamdong, Katao, Zekuphyak and adjoining areas. Total 16 field nos collected. <p>HERBARIUM CONSULTATION TOUR-</p> <ul style="list-style-type: none"> •Herbarium Consultation Tour conducted to CAL on 8th – 9th August and studied of allotted specimens from Herbarium and consulted 14 literatures from CNH library <p>PUBLICATION-</p> <ul style="list-style-type: none"> • Paper accepted: Vegetative propagation of <i>Phaius flavus</i> through back bulb cutting- a conservation tool in ENVIS Newsletter <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> • Providing inputs for the red listing datasheets for 84 species under 42 Genera • Compiled the references from newly published papers and different available literatures • An abstract communicated on Taxonomic studies on the Genus <i>Phaius</i> Lour. (Orchidaceae) in India on 30.10.19 for poster presentation at ‘The International Symposium on Plant Taxonomy and Ethnobotany’ organized by Botanical Survey of India, Kolkata on 13.02.19 - 14.02.19. • Attending a lecture delivered by Dr. Rajib Gogoi (Scientist ‘E’ & HoO) on 07/11/2019. 		
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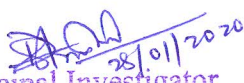
<p>H-JPF 6</p>	<p>Project name: Systematics and Conservation of Indian Orchids with special emphasis to Himalayan species.</p> <p>Allotted group: Vandeeae (Sub-Tribe: Aeridinae) with 86 species under 21 genera</p> <p>As per 3rd Himalayan Consortium Almorah 2019 the Research Objectives are as follows:</p> <ul style="list-style-type: none"> • Inventurization in Indian Himalayan region and find the occurrence, distribution pattern and affinities. • Morphological characterization. • Solve the taxonomy, nomenclature and decode the species complex (if any) with evidence from morphology, molecular biology and cytology. • Confirm the presence of endemics, near endemics and less known species in their known localities and predict the likely habitat with habitat modeling technique. 	<ul style="list-style-type: none"> • Live specimens of 5 species have been studied for complete macro morphological characteristics. • Digital macro-microscopic photographs were taken for 2 species. • Plant description prepared: 2 species. • Literature on selected species has been collected and studied. • Protologues of 154 names are collected. • Plant description prepared: 2 species • Old herbarium sheets studied and data entered in the excel sheet: A total of 323 sheets under 25 species. • Data Sheets prepared for Red Listing: 16 species under 2 genera. • Germplasm of 61 samples introduced. <p>FIELD TOURS 29.03.19 to 12.04.19: 25.07.19 to 11.08.19: A tour has been conducted to Tippi, Sessa, Doimara, Shergaon, Morshin, Dirang, Shangti Basti, Thembang, Namsu, Munna camp, Chug, Rahung and Mandla located in West Kameng district and Itanagar and Doimukh in Papum Pare district. A total of 82 orchid species could be observed of which specimens of 62 field numbers collected and 51 are introduced in the campus garden for further studies and ex situ conservation. Out of 62 orchid species 12 are terrestrial, of which 2 are myco heterotrophic.</p> <p>HERBARIUM TOURS: 18.07.19 - 20.07.19: Herbarium consultation was done at ARUN from 18.07.2019- 20.07.2019 and 40 sheets under 28 species were examined.</p>	<ul style="list-style-type: none"> • Complete inventory of orchid species will be prepared. • Morpho-molecular characterization of all species will be done. • Nomenclature and taxonomy of all species will be solved. • Long standing problems on many species complex will be solved. • Endemics and less known species will be relocated. • Over-exploited species will be evaluated in terms of load on natural population. • Red-listing as per IUCN criteria 	<ul style="list-style-type: none"> • Study area for the project is entire Indian Himalayan Region covering 12 states. <p>Field tours A tour has been conducted to Tippi, Sessa, Doimara, Shergaon, Morshin, Dirang, Shangti Basti, Thembang, Namsu, Munna camp, Chug, Rahung and Mandla located in West Kameng district and Itanagar and Doimukh in Papum Pare district.</p>
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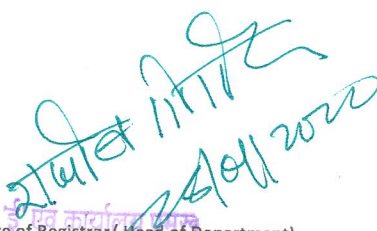
	<ul style="list-style-type: none"> • Assess the threat status by applying IUCN criteria. • Develop distribution and species richness map. • Germplasm collection and ex-situ conservation. 	<p>MISCELLANEOUS</p> <ul style="list-style-type: none"> • Providing inputs on Data Sheets for Red-Listing: 60 species under 12 genera. • An abstract communicated for poster presentation on “Concept of the genus <i>Acampe</i> Lindl. (Orchidaceae) in India” 30.10.2019 at The International Symposium on Plant Taxonomy and Ethnobotany to be organized by Botanical Survey of India, Kolkata on 13.02.19 - 14.02.19. 	<p>will be done and conservation measure proposed.</p> <ul style="list-style-type: none"> • Distribution map and species richness map will be prepared. • Likely habitat will be predicted through habitat modeling. • Fill the gap in producing the comprehensive illustrative Orchid Flora of India. 	
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Note: Data, table and figures may be attached as separate source file (.docx, .xls, .jpg, .jpeg, .png, .shp, etc.).

Separate source files have been attached for:

1. Species list for all JPFs in one .docx file (File name: Species list.docx)
2. List of live specimens studied and worked out for all JPFs in one .docx file (File name: Live specimens studied.docx)
3. List of germplasm collected and introduced for all JPFs in one .docx file (File name: Germplasm collected and Introduced)


 Principal Investigator
 (Signature of Principal Investigator)
 NMHS Fellowship Scheme
 GBPNI/NMHS-2017-18/HSF-08
 Botanical Survey of India
 Sikkim Himalayan Regional Centre
 Gangtok-737103, Sikkim


 (Signature of Registrar/ Head of Department)
 वैज्ञानिक सेवा कार्यपालक
 Scientist E & HoD
 भारतीय वनस्पति सर्वेक्षण
 Botanical Survey of India
 सिक्किम हिमालय क्षेत्रीय केन्द्र
 Sikkim Himalayan Regional Centre
 Gangtok-737103

Live Specimens Studied

H-JPF 1: Aazhivaedhan G.

1. *Crepidium calophyllum* (Rchb.f.) Szlach.
2. *Crepidium purpureum* (Lindl.) Szlach.
3. *Epigeneium rotundatum* (Lindl.) Summerh.
4. *Flickingeria abhaycharanii* Phukan & A.A. Mao
5. *Liparis bistrinata* C.S.P Parish & Rchb.f.
6. *Liparis resupinata* Ridl.
7. *Liparis viridiflora* (Blume) Lindl.
8. *Liparis cespitosa* (Lam.) Lindl.
9. *Liparis cordifolia* Hook.f.
10. *Liparis nervosa* (Thunb.) Lindl.
11. *Liparis perpusilla* Hook.f.
12. *Liparis plantaginea* Lindl.

H-JPF 2: Shreyasi nayak

1. *Bulbophyllum cariniflorum* Rchb.f.
2. *Bulbophyllum cylindraceum* Wall. ex Lindl.
3. *Bulbophyllum griffithii* (Lindl.) Rchb.f.
4. *Bulbophyllum helenae* (Kuntze) J.J. Sm.
5. *Bulbophyllum striatum* (Griff.) Rchb.f.
6. *Bulbophyllum candidum* (Lindl.) Hook.f.
7. *Bulbophyllum careyanum* (Hook.) Spreng.
8. *Bulbophyllum cherrapunjeensis* Barbhuiya & D.Verma
9. *Bulbophyllum congestum* Rolfe
10. *Bulbophyllum retusiusculum* Rchb.f.

H-JPF 3: Sanchayita Sengupta

1. *Arachnis labrosa* (Lindl. & Paxton) Rchb.f.
2. *Gastrodia* sp
3. *Odontochilus grandiflorus* (Lindl.) Hook.f.
4. *Phalaenopsis deliciosa* subsp. *hookeriana* (O.Gruss & Roellke) Christenson

H-JPF 4: Sayak Chakraborty

1. *Amitostigma puberulum* (King & Pantl.) Schltr.
2. *Aphyllorchis alpina* King & Pantl.
3. *Arundina graminifolia* (D. Don) Hochr.
4. *Didymoplexis pallens* Griff.
5. *Galearis spathulata* (Lindl.) P.F. Hunt
6. *Neottia alternifolia* (King & Pantl.) Szlach.
7. *Neottia listeroides* Lindl. in J.F. Royle
8. *Neottia pinetorum* (Lindl.) Szlach.
9. *Neottia tenuis* (Lindl.) Szlach.
10. *Odontochilus elwesii* C.B. Clarke ex Hook.f.

11. *Otochilus albus* Lindl.
12. *Otochilus fuscus* Lindl.
13. *Panisea demissa* (D. Don) Pfitzer
14. *Panisea uniflora* Rolfe
15. *Pholidota articulata* Lindl.
16. *Pholidota articulata* Lindl.
17. *Pholidota imbricata* Hook.
18. *Pholidota recurva* Lindl.
19. *Pholidota wattii* King & Pantl.
20. *Platanthera stenantha* (Hook.f.) Soo
21. *Ponerorchis chusua* (D. Don) Soo

H-JPF 5: Shuvadip Sarkar

1. *Phaius tankervilleae* (Banks ex L'Her) Blume
2. *Phaius wallichii* Lindl.
3. *Ceratostylis himalaica* Hook f.;
4. *Thelasis pygmaea* (Griff.) Lindl..
5. *Thelasis longifolia* Hook.f.,
6. *Oreorchis micrantha* Lindl.
7. *Gastrochilus inconspicuus* (Hook.f.) Kuntze,
8. *Myrmechis pumila* (Hook.f.) T. Tang & F.T. Wang,
9. *Bulbophyllum congestum* Rolfe.
10. *Agrostophyllum brevipes* King & Pantl.
11. *Agrostophyllum planicaule* (Wall. ex Lindl.) Rchb.f.

H-JPF 6: Oindrila Chakraborty

1. *Cleisostoma racemiferum* (Lindl.) Garay
2. *Herminium lanceum* (Thunb.ex Sw.) Vuijk
3. *Micropera manii* (Hook.f.) Tang & F.T.Wang
4. *Spathoglottis plicata* Blume
5. *Pelatantheria insectifera* (Rchb.f.) Ridl.

GERMPLASM COLLECTED AND INTRODUCED

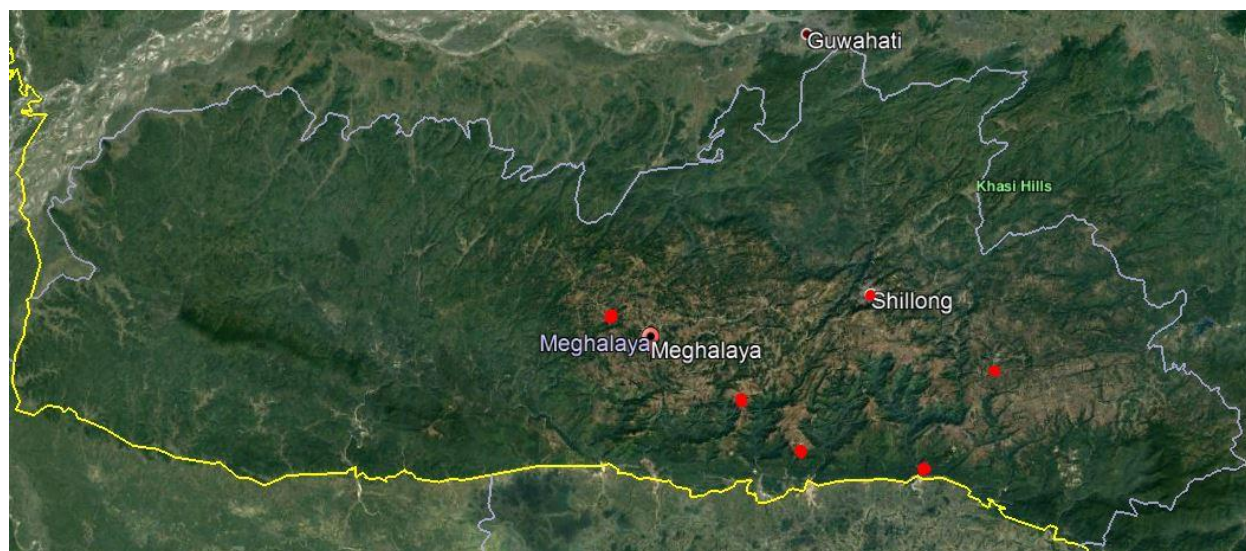


Figure 1: Map of Meghalaya showing the surveyed area

GPS points of the Locations Surveyed:

Study sites	Latitude & Longitude	Altitude
Shillong	26° 59' 44.90" N & 88° 16' 58.08" E	2464 m
Mawsmai	25° 16' 41.07" N & 91° 43' 29.30" E	1378 m
Jowai	27° 40' 05.03" N & 88° 43' 49.91" E	2581 m
Nongstoin	25° 30' 47.74" N & 91° 15' 24.52" E	1412 m
Mawsynram	25° 30' 53.98" N & 91° 34' 59.89" E	1402m
Dwaki	25° 11' 06.59" N & 92° 01' 46.81" E	57 m

LIST OF COLLECTED PLANTS

Sl. No.	
1.	<i>Agrostophyllum callosum</i> Rchb.f.
2.	<i>Agrostophyllum planicaule</i> (Wall. ex Lindl.) Rchb.f.
3.	<i>Anoectochilus</i> sp.
4.	<i>Anthogonium gracile</i> Wall.
5.	<i>Brachycorythis galeandra</i> (Rchb.f.) Summerh.
6.	<i>Bulbophyllum affine</i> Lindl.
7.	<i>Bulbophyllum ambrosia</i> sub sp. <i>nepalensis</i> J.J. Wood
8.	<i>Bulbophyllum congestum</i> Rolfe
9.	<i>Bulbophyllum griffithii</i> Rchb.f.
10.	<i>Bulbophyllum helenae</i> J.J. Sm.
11.	<i>Bulbophyllum khasyanum</i> Griff.
12.	<i>Bulbophyllum odoratissimum</i> Lindl.
13.	<i>Bulbophyllum reptans</i> Lindl.
14.	<i>Bulbophyllum rothschildianum</i> J.J. Sm.
15.	<i>Bulbophyllum</i> sp.

16.	<i>Bulbophyllum umbellatum</i> Lindl.
17.	<i>Calathe</i> sp.
18.	<i>Coelogyne fuscescens</i> Lindl.
19.	<i>Concidium</i> sp.
20.	<i>Crepidium acuminatum</i> (D. Don) Szlach.
21.	<i>Crepidium calophyllum</i> (Rchb.f.) Szlach.
22.	<i>Crepidium purpureum</i> (Lindl.) Szlach.
23.	<i>Cymbidium</i> sp.
24.	<i>Dendrobium</i> sp.
25.	<i>Dendrobium</i> sp.
26.	<i>Eria</i> sp.
27.	<i>Gastrochilus calceolaris</i> (Buch.-Ham. ex Sm.) D. Don
28.	<i>Habenaria acuiifera</i> Wall. ex Lindl.
29.	<i>Habenaria</i> sp.
30.	<i>Herminium lanceum</i> (Thunb. ex Sw.) Vuijk
31.	<i>Liparis bistrinata</i> C.S.P.Parish & Rchb.f.
32.	<i>Liparis bootanensis</i> Griff.
33.	<i>Liparis cespitosa</i> (Lam.) Lindl.
34.	<i>Liparis elliptica</i> Wight
35.	<i>Liparis nervosa</i> (Thunb.) Lindl.
36.	<i>Liparis plantaginea</i> Lindl.
37.	<i>Liparis resupinate</i> Ridl.
38.	<i>Liparis</i> sp.
39.	<i>Liparis viridiflora</i> Lindl.
40.	<i>Nepenthes khasiana</i> Hook.f.
41.	<i>Otochilus fuscus</i> Lindl.
42.	<i>Peristylus</i> sp.
43.	<i>Phalaenopsis difformis</i> (Wall. ex Lindl.) Kocyan & Schuit.
44.	<i>Pholidota</i> sp.
45.	<i>Spathoglottis pubescens</i> Lindl.
46.	<i>Spiranthes sinensis</i> (Pers.) Ames
47.	<i>Thelasis khasiana</i> Hook.f.
48.	<i>Vanda cristata</i> Wall. ex Lindl.

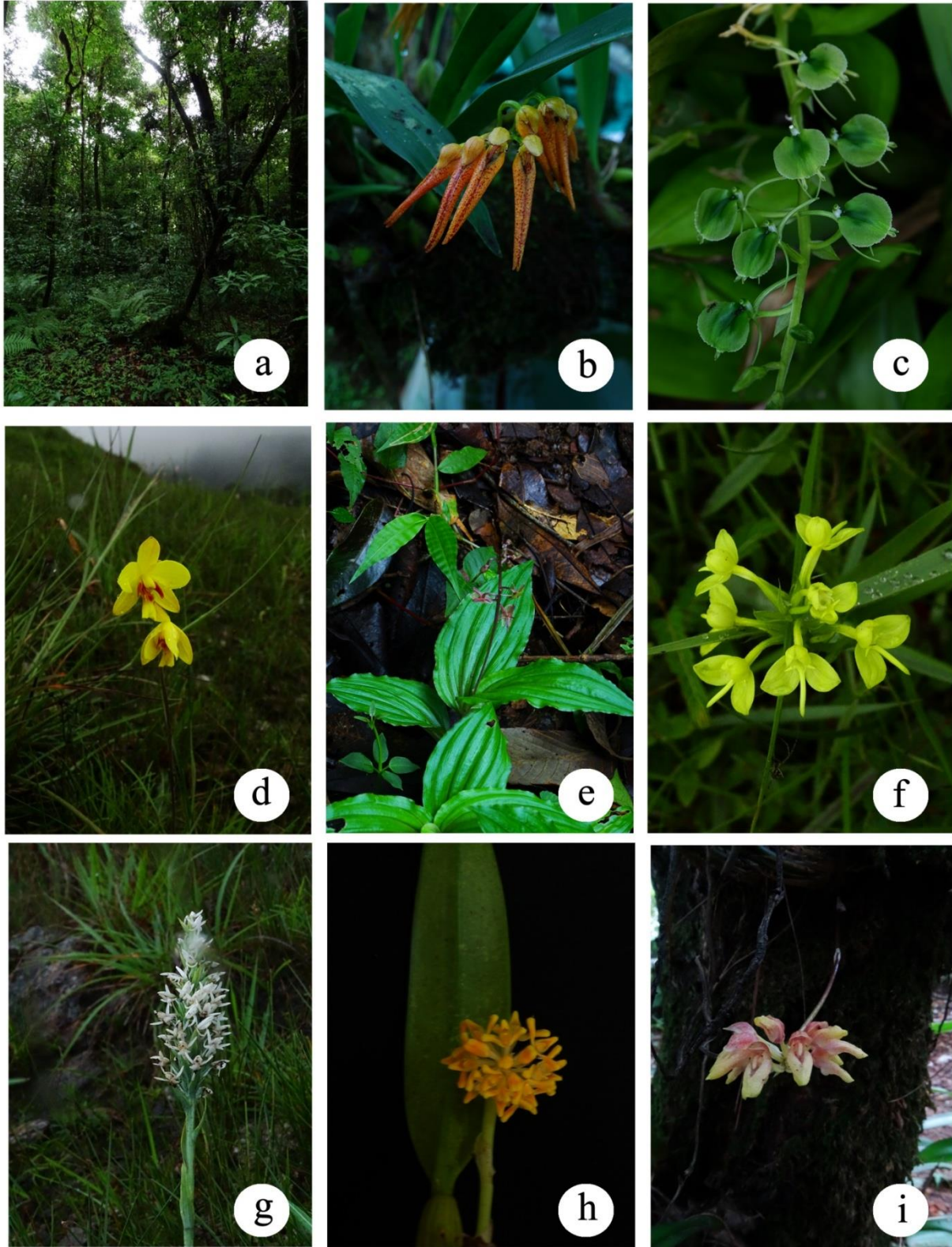


Plate - 2: a) View of Mawphlong sacred groove b) *Bulbophyllum helenae* J.J. Sm.
 c) *Liparis plantaginea* Lindl. d) *Spathoglottis pubescence* Lindl. e) *Crepidium acuminatum* (D. Don) Szlach. f) *Habenaria acuifera* Wall. ex Lindl. g) *Habenaria* sp.
 h) *Bulbophyllum congestum* Rolfe. i) *B. odoratissimum* (Sm.) Lindl. ex Wall.

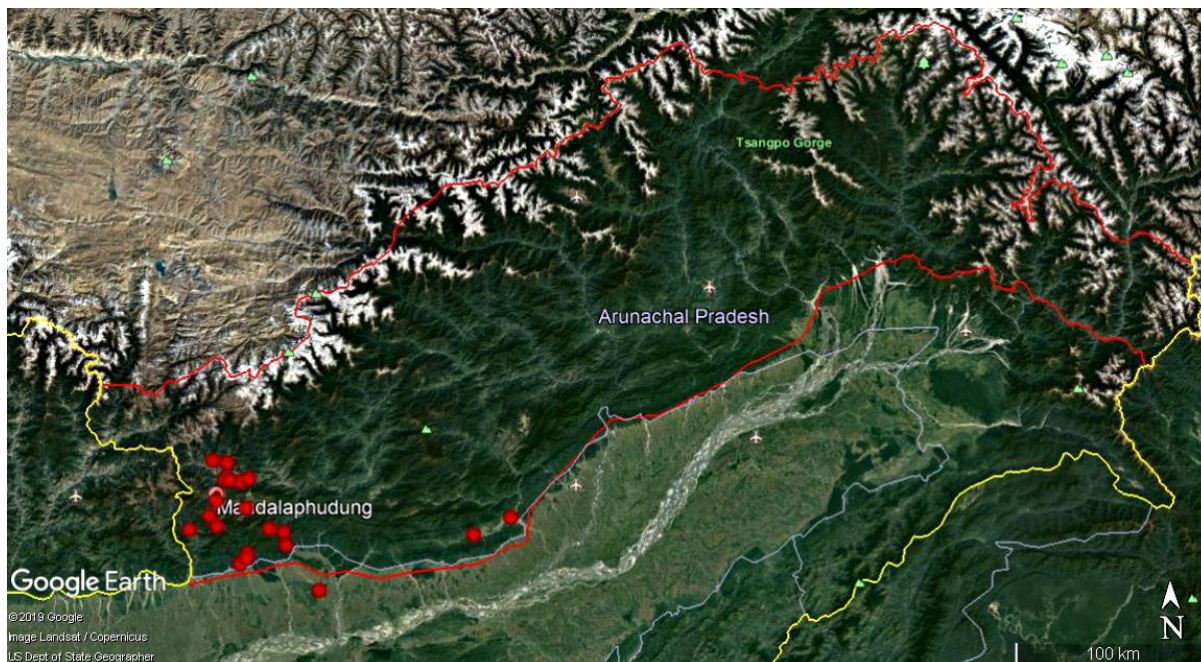


Figure 2: Map of Arunachal Pradesh showing the surveyed area

GPS points of the Locations Surveyed:

Study sites	Latitude & Longitude	Altitude
Itanagar	N 27°05'16.23", E 93°34'42.63"	368 m
Doimukh	N 27°08'58.45", E 93°46'08.49"	231 m
Tippi	N 27°01'56.42", E 92°36'21.03"	250 m
Sessa	N 27°01'03.71", E 92°33'10.89"	960 m
Pinjuli Nallah	N 27°05'30.28", E 92°35'40.80"	237 m
Doimara	N 26°58'50.68", E 92°24'41.42"	438 m
Foot Hills	N 26°56'44.90", E 92°22'09.34"	430 m
Khellong	N 27°06'32.86", E 92°31'40.66"	472 m
Balipara Road	N 26°58'19.04", E 92°45'33.57"	135 m
Shergaon	N 27°07'26.86", E 92°15'17.44"	2034 m
Kalaktang	N 27°06'16.04", E 92°06'50.54"	1120 m
Morshin	N 27°09'58.44", E 92°13'24.55"	2260 m
Rupa	N 27°12'06.53", E 92°23'43.76"	1558 m
Dirang	N 27°21'18.68", E 92°14'33.05"	1717 m
Shangti Basti	N 27°24'13.92", E 92°18'16.15"	1851 m
Munna Camp	N 27°19'35.36", E 92°19'12.58"	2136 m
Rahung	N 27°18'58.71", E 92°22'25.83"	1665 m
Namshu	N 27°20'22.63", E 92°18'06.15"	1575 m
Thembung	N 27°20'06.74", E 92°24'28.41"	1685 m
Chug	N 27°25'03.12", E 92°14'04.93",	2352 m
Mandala	N 27°16'25.71", E 92°14'26.01"	3205 m

LIST OF COLLECTED PLANTS

Sl. No.	
1.	<i>Acampe papillosa</i>
2.	<i>Aerides rosea</i> Lodd. ex Lindl. & Paxton
3.	<i>Aerides multiflora</i> Roxb.
4.	<i>Agrostophyllum callosum</i> Rchb.f.
5.	<i>Arachnis labrosa</i> (Lindl. & Paxton) Rchb.f
6.	<i>Anthogonium gracile</i> Wall. ex Lindl.
7.	<i>Bulbophyllum affine</i> Wall. ex Lindl.
8.	<i>Bulbophyllum odoratissimum</i> (Sm.) Lindl. ex Wall.
9.	<i>Bulbophyllum reptans</i> (Lindl.) Lindl. ex Wall.
10.	<i>Bulbophyllum tortuosum</i> (Blume) Lindl.
11.	<i>Bulbophyllum yoksunense</i> J.J. Sm.
12.	<i>Chrysoglossum ornatum</i> Blume
13.	<i>Cleisocentron pallens</i> (Cathcart ex Lindl.) N. Pearce & P.J. Cribb
14.	<i>Coelogyne corymbosa</i> Lindl.
15.	<i>Coelogyne griffithii</i> Hook.f.
16.	<i>Coelogyne occultata</i> var. <i>uniflora</i> N.P. Balakr.
17.	<i>Coelogyne ovalis</i> Lindl.
18.	<i>Coelogyne schultesii</i> S.K. Jain & S. Das
19.	<i>Cymbidium aloifolium</i> (L.) Sw.
20.	<i>Dendrobium falconeri</i> Hook.
21.	<i>Epigeneium fuscescens</i> (Griff.) Summerh.
22.	<i>Eria cornata</i> J. Joseph, S.N. Hegde & Abbar
23.	<i>Eria ferruginea</i> Lindl.
24.	<i>Eria javanica</i> (Sw.) Blume
25.	<i>Eria lasiopetala</i> (Willd.) Ormerod
26.	<i>Esmeralda cathcartii</i> (Lindl.) Rchb.f.
27.	<i>Goodyera schlechtendaliana</i> Rchb.f.
28.	<i>Herminium lanceum</i> (Thunb. ex Sw.) Vuijk
29.	<i>Habenaria lancifolia</i> A. Rich.
30.	<i>Liparis elliptica</i> Wight
31.	<i>Luisia zeylanica</i> Lindl.
32.	<i>Micropera manii</i> (Hook.f.) Tang & F.T. Wang
33.	<i>Oberonia acaulis</i> Griff.
34.	<i>Oberonia emarginata</i> King & Pantl.
35.	<i>Odontochilus grandiflorus</i> (Lindl.) Hook.f.
36.	<i>Otochilus lancilabius</i> Seidenf.
37.	<i>Phalaenopsis difformis</i> (Wall. ex Lindl.) Kocyan & Schuit
38.	<i>Papilionanthe teres</i> (Roxb.) Schltr.
39.	<i>Phaius wallichii</i> Lindl.
40.	<i>Pholidota imbricata</i> Lindl.
41.	<i>Rhynchostylis retusa</i> (L.) Blume
42.	<i>Platentera edgeworthi</i> (Hook.f. ex Collett) R.K. Gupta
43.	<i>Satyrium nepalense</i> D. Don, Prodr. var. <i>nepalense</i>
44.	<i>Spiranthes sinensis</i> (Pers.) Ames
45.	<i>Thelasis pygmaea</i> (Griff.) Lindl.

46.	<i>Vanda testacea</i> (Lindl.) Rchb.f.
47.	<i>Vandopsis undulata</i> (Lindl.) J.J. Sm.
48.	<i>Acampe</i> sp
49.	<i>Acampe</i> sp
50.	<i>Aerides</i> sp
51.	<i>Aerides</i> sp
52.	<i>Bulbophyllum</i> sp
53.	<i>Calanthe</i> sp
54.	<i>Chamaegastrodia</i> sp
55.	<i>Cleisostoma</i> sp
56.	<i>Cymbidium</i> sp
57.	<i>Gastrochilus</i> sp
58.	<i>Gastrodia</i> sp.
59.	<i>Liparis</i> sp
60.	<i>Oberonia</i> sp
61.	<i>Odontochilus</i> sp.
62.	<i>Vanda</i> sp

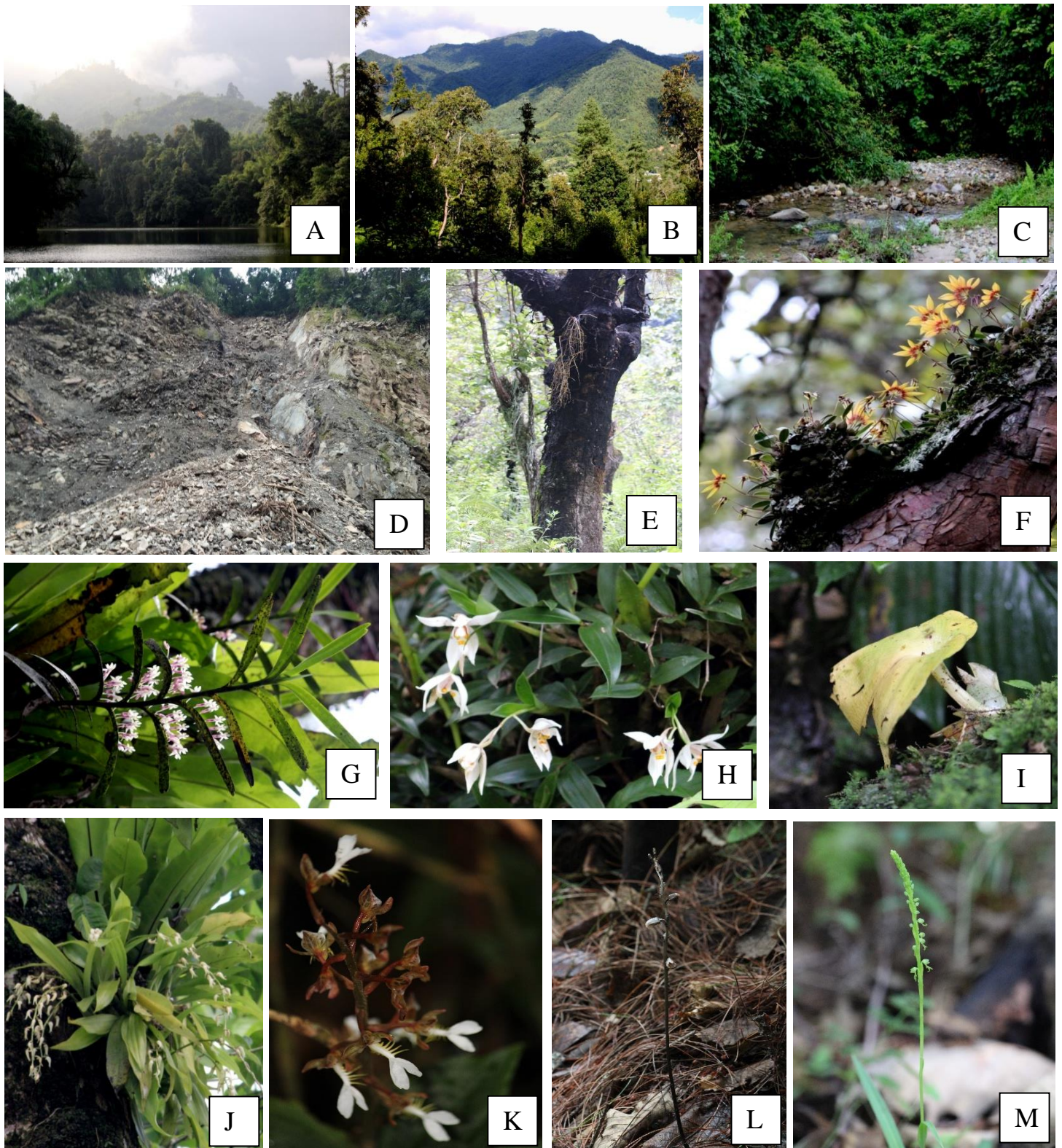


Plate I. Fig. A-C: Different vegetation types at Arunachal Pradesh; **D-E:** Major threats observed in the areas surveyed; **F:** *Bulbophyllum retusiusculum* Rchb.f.; **G:** *Cleisocentron pallens* (Cathcart ex Lindl.) N. Pearce & P.J. Cribb; **H:** *Coelogyne occultata* Hook.f.; **I:** *Liparis cordifolia* Hook.f.; **J:** *Eria javanica* (Sw.) Blume; **K:** *Anoectochilus brevilabris* Lindl.; **L:** *Gastrodia* sp.; **M:** *Herminium* sp.

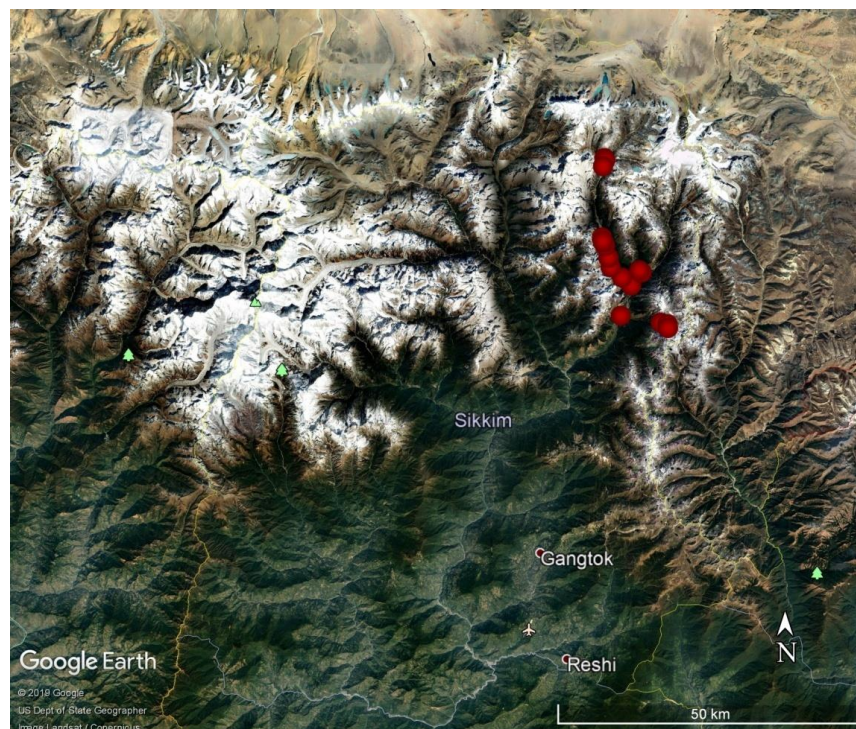


Figure 3: Map of North Sikkim showing the surveyed area

GERMPLASM COLLECTED AND INTRODUCED

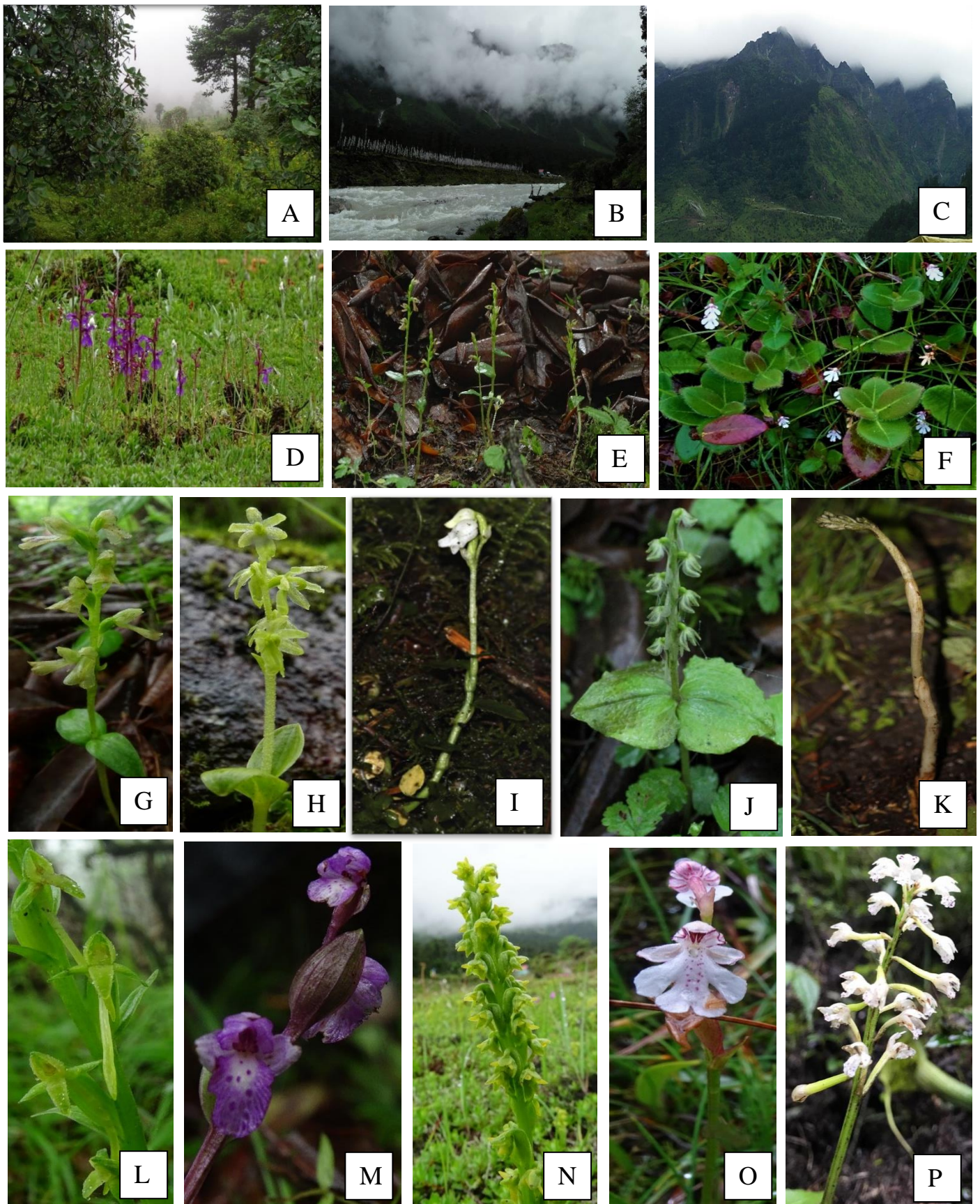
GPS points of the Locations Surveyed:

Locality	GPS points	Altitude
Lachung	N 27°41'10.55'', E 88°44'18.46''	2261 m
	N 27°41'30.56'', E 88°44'32.39''	2675 m
Dombyang Valley	N 27°43'47.45'', E 88°45'20.08''	3041 m
	N 27°44'14.57'', E 88°46'00.74''	3065 m
	N 27°44'55.70'', E 88°46'22.13''	3275 m
	N 27°45'07.63'', E 88°46'07.53''	3414 m
Shingba Rhododendron Sanctuary	N 27°44'28.26'', E 88°44'24.16''	3258 m
	N 27°44'29.05'', E 88°43'54.42''	3407 m
	N 27°45'21.28'', E 88°43'16.53''	3429 m
	N 27°46'10.51'', E 88°43'02.89''	3453 m
Yumthang Hotspring	N 27°47'36.89'', E 88°42'27.76''	3613 m
	N 27°47'42.71'', E 88°42'25.13''	3625 m
	N 27°47'55.68'', E 88°42'24.42''	3648 m
	N 27°47'11.23'', E 88°42'41.45''	3599 m
	N 27°47'29.43'', E 88°42'33.81''	3628 m
Yumesamdong	N 27°54'01.47'', E 88°42'27.41''	4538 m
	N 27°54'33.63'', E 88°42'40.59''	4610 m
	N 27°54'44.41'', E 88°42'35.47''	4680 m

Katao, Zekuphyak	N 27°40'03.47'', E 88°48'47.33''	4330 m
	N 27°40'23.10'', E 88°48'45.49'	4105 m
	N 27°40'31.32'', E 88°48'06.81''	3898 m

LIST OF COLLECTED PLANTS

Sl. No.	
1.	<i>Dienia muscifera</i> Lindl.
2.	<i>Habenaria clavigera</i> (Lindl.) Dandy
3.	<i>Myrmechis pumila</i> (Hook.f.) T. Tang & F.T. Wang
4.	<i>Oreorchis foliosa</i> var. <i>indica</i> (Lindl.) N. Pearce & P.J. Cribb
5.	<i>Oreorchis micrantha</i> Lindl.
6.	<i>Pleione hookeriana</i> (Lindl.) Rollisson
7.	<i>Ponerorchis chusua</i> (D. Don) Soo
8.	<i>Satyrium</i> sp.
	Plants observed and collected for dry specimen
9.	<i>Amitostigma puberulum</i> (King & Pantl.) Schltr
10.	<i>Bulbophyllum</i> sp.
11.	<i>Dienia cylindrostachya</i> Lindl.
12.	<i>Epipactis</i> sp.
13.	<i>Galearis spathulata</i> (Lindl.) P.F. Hunt
14.	<i>Habenaria latilabris</i> (Lindl.) Hook.f.
15.	<i>Herminium lanceum</i> (Thunb. ex Sw.) Vuijk
16.	<i>Neottia alternifolia</i> (King & Pantl.) Szlach.
17.	<i>Neottia listeroides</i> Lindl.
18.	<i>Neottia pinetorum</i> (Lindl.) Szlach
19.	<i>Neottia tenuis</i> (Lindl.) Szlach
20.	<i>Neottia</i> sp.
21.	<i>Peristylus macrophylla</i> (D. Don) Lawkush, V. Kumar & N.S. Bankoti
22.	<i>Platanthera stenantha</i> (Hook.f.) Soo
23.	<i>Platanthera</i> sp.
24.	<i>Spiranthes sinensis</i> (Pers.) Ames



A-C. Vegetation Type and landscape of Surveyed area; **D-F.** Distribution of Orchids in patches on open grasslands, swampy places and near streamlines; **G.** *Neottia* sp; **H.** *Neottia tenuis* (Lindl.) Szlach.; **I.** *Myrmechis pumila* (Hook.f.) T.Tang & F.T.Wang; **J.** *Neottia pinetorum* (Lindl.) Szlach.; **K.** *Neottia listeroides* Lindl.; **L.** *Platanthera stenantha* (Hook.f.) Soo; **M.** *Galearis Spathulata* (Lindl.) P.F.Hunt; **N.** *Peristylus macrophylla* (D. Don) Lawkush, V. Kumar & N.S. Bankoti; **O.** *Oreorchis micrantha* Lindl.; **P.** *Amitostigma puberulum* (King & Pantl.) Schltr.