

ONGOING MAJOR RESEARCH PROJECT

Principal Investigator: **Dr. Subhasis Panda** (Principal, Govt General Degree College, Chapra).

Co-Principal Investigator: **Dr. Dipak Kumar Som**, Associate Professor, PG Dept. of Zoology, Maulana Azad College, Kolkata (Entomologist).

Title of the Project: “**PHENOLOGICAL DIVERSITY, ALTITUDINAL VARIATION, QUANTITATIVE ETHNOBOTANY AND POLLINATORS OF THE GENUS *Rhododendron L.* (ERICACEAE) IN WEST BENGAL**”.

Funding Agency: Department of Science & Technology and Biotechnology, Govt. of West Bengal-----vide Sanction Letter No. 325(Sanc.)/ST/P/S&T/5G-5/2018 dated 06/03/2019.

Tenure of the Project: 3 Years

Date of Initiation: 3rd May, 2019

Date of termination: 2nd May, 2023 (excluding 1 year due to COVID 19).

JRF: Mr. Rajat Thakuri (3/5/19 to 31/01/20); Mr. Priyankar Roy (15/01/21 to continued...)

Total Sanction of the Project: 11,37000/- (Eleven Lakh Thirty Seven thousand only).

OBJECTIVES OF THE PROJECT:

The project proposal was based on four major Objectives viz., Phenological diversity, Altitudinal variation, Quantitative Ethnobotany and pollinators of the genus *Rhododendron L.* in Darjeeling-Kalimpong-Himalayas of West Bengal. First two objectives viz., Phenological data and Altitudinal variation were investigated based on GPS Data and DSLR Camera images. Under Quantitative Ethnobotany, first hand oral ethnobotanical data from the informants (only from local Nepalese during 1st year) were documented to prepare an accurate Informants Profile to prove more authenticity. Flower visitors including Pollinators were observed, photographed, collected and studied in the Entomology Laboratory of Zoology Department, Maulana Azad College, Kolkata with the help of Garmin GPS, Canon 1500D DSLR Camera, Olympus Binocular, Trinocular Microscope, different sizes of Insect net and various colours of Pan Traps.

Objectives achieved are:-

- i) studied and documented vegetative and flowering phenological data of 14 taxa from Darjeeling Himalaya based on Ten Field visits (May 2019; June 2019; July 2019; August 2019; September 2019; October 2019; November 2019; December 2019; January 2020; March 2020) .

ii) studied altitudinal variation of 13 taxa including their variable phenological data.

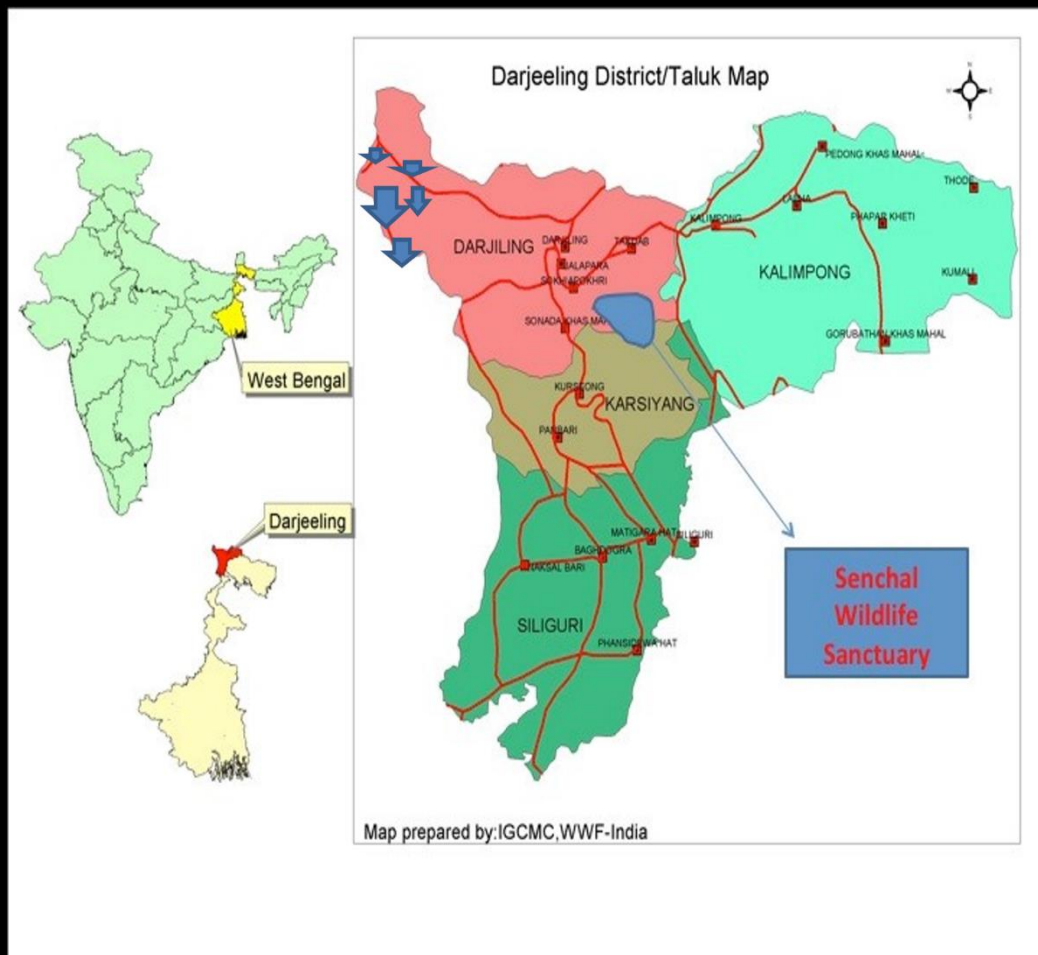
iii) studied co-existing and associated plants of eleven taxa of *Rhododendron* L.

iv) Documented nine Ethnobotanical new ITKs based on ten field visits.

v) documented and studied flower visitors including Pollinators (Both Bird and insects) of ten taxa of *Rhododendron* L. from Darjeeling Himalaya based on three Field visits (May 2019; June 2019 and March 2020).

vi) Audio-visual field documentation works made based on 4 field visits (May 2019; March 2020; November 2020 and December 2020).

STUDY AREA



Government of West Bengal
Department of Science & Technology and Biotechnology
"Vigyan Chetana Bhavan", Salt Lake,
DD 26/B, Sector-I,
Kolkata - 700064.

Annexure-A

File No.: ST/P/S&T/5G-5/2018

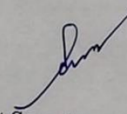
Name of the P.I. with Institute: Dr. Subhasis Panda, P.I. of the project, Maulana Azad College.

General Guideline must be followed by the P.I.:

1. The selection of JRF/SRF shall be made as per guidelines of this Deptt. (Science & Technology).
2. The remuneration to the JRF/SRF & project Asstt. Should be disbursed as per FD Memo No. 6261-F(Y) dt. 27.06.2011.
3. Follow FD Memo No. 5400-F(Y) dt. 25.06.2012 and Memo No. 3060-F(Y) dt. 11.06.2014 where applicable.
4. The UC along with the audited statement of expenditure should be obtained within prescribed time limit / before release of further installment of grant.
5. Follow the Budget break-up given below:

SUMMARY (in Rupees)

Sl no.	Item	BUDGET			
		1 st year	2 nd year	3 rd year	Total
A.	Non Recurring:	0	0	0	0
B.	Recurring				
1.a	Remuneration of one JRF: @ 16000/- per month + 15% HRA= 2400/- per month + medical allowance Rs. 300/- per month = Rs. 18700/- per month for two years, and one SRF on the third year @ 18000/- per month + 15% HRA= 2700/- per month + medical allowance Rs. 300/- per month =21000/- per month, if the same JRF continues or for a JRF who has completed two years.	224400	224400	252000	700800
2.	Consumables				
	i) Glass goods & Plastic wares	140000	20000	15000	175000
	ii) chemicals and reagents	30000	20000	10000	60000
3.	Audio visual complete documentation for future action plan	60000	20000	30000	110000
4.	TA for field work sampling (conference/ seminar travel not allowed)	9000	9000	3000	21000
5.	Reprography, photocopy etc.	5000	5000	5000	15000
6.	Postage & Stationary	5000	4000	2000	11000
7.	Report preparation & auditing of project	2000	2200	5000	9200
8.	Miscellaneous/ incidental expenditure	15000	10000	10000	35000
	TOTAL (A+B)	490400	314600	332000	1137000


Assistant Secretary to the Govt. of W.B.

OUTCOME OF THE PROJECT [based on 1st Year]

During First year period (May, 2019 to December, 2020), among 21 reported taxa of *Rhododendron* L., 14 taxa were studied only from different parts of Darjeeling Himalaya. No field visits were conducted to Kalimpong district yet, which will be made during 2nd Year period. Detailed phenological studies of vegetative, flowering, flowering time, fruiting, Lichen, bryophyte and pteridophytic associations, altitudinal variations, ethnobotanical first hand ITKs data from local Nepalese communities and flowers visitors including pollinators were observed, documented and studied in the Laboratory of Maulana Azad College, Kolkata for these 14 taxa of *Rhododendron* L. of Darjeeling district only.

Major Findings during first year time period are:-i) studied and documented vegetative and flowering phenological data of 14 taxa from Darjeeling Himalaya based on ten Field visits, ii) studied altitudinal variation of 13 taxa including their variable phenological data, iii) studied co-existing and associated plants of eleven taxa of *Rhododendron* L., iv) documented 9 Ethnobotanical new ITKs based on ten field visits, v) documented and studied flower visitors including pollinators (Both bird and insects) of ten taxa of *Rhododendron* L. from Darjeeling Himalaya based on three Field visits (May 2019; June 2019 and March 2020), vi) Audio-visual field documentation works made based on 4 field visits (May 2019; March 2020; November 2020 and December 2020).

Phenological observations viz. maturity of seeds, fruit is formed/not, seedling and sapling formation, time of inflorescence emergence (from main or branch shoot), bud development were not studied during first year. These will be studied during second year period. Altitudinal variations in respect to number of individuals for a particular locality based on Quadrat sampling will also be carried out during 2nd and 3rd year period. Ethnobotanical firsthand information in respect to different subgroups of Nepalese community viz., Gurung, Tamang, Chhetri, Mukhia, Sarki etc. will also be carried out during 2nd and 3rd year period to make an authentic Quantitative Ethnobotanical Profile.

Identification of collected lichens and bryophytic materials will be made with experts at Central National Herbarium, Howrah and NBRI, Lucknow during 2nd and 3rd year. Identification of insect and bird pollinators/flower visitors are under process with experts of Zoological Survey of India, Kolkata, which will be finalized during 2nd year period.

SOME SELECTED IMAGES



Fig. 1.



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Figs. 1-6: Lichen association with the stems of *Rhododendron* taxa in Darjeeling:-
Fig. 1. *R. lepidotum* (Gairibas, June); Fig. 2. *R. arboreum* subsp. *arboreum* (Jungle Busty, July); Figs.3-4. *R. arboreum* subsp. *arboreum* var *roseum* (Tumling, Sept); Figs. 5-6. *R. arboreum* subsp. *arboreum* var *roseum* (Kalipokhri, Sept).



Fig. 13



Fig. 14



Fig. 15



Fig. 16



Fig. 17



Fig. 18

Figs. 13-18: Bryophytic association with the stems & leaves of *Rhododendron* taxa in Darjeeling:- Figs. 13-14. *R. arboreum* subsp. *arboreum* (Tumling, Sept); Figs. 15-16. *R. arboreum* subsp. *arboreum* (Sonada, July); Fig. 17. *R. arboreum* subsp. *arboreum* (Jungle Busty, July); Fig. 18. *R. arboreum* subsp. *arboreum* var. *roseum*—leafy bryophyte on leaf surface (Tumling, Sept).

IMPORTANT FIELD IMAGES OF VEGETATIVE, FLOWERING & FRUITING PHENOLOGY OF *Rhododendron* taxa in DARJEELING HIMALAYA:-

Figs. 19-38. *R. barbatum* in Darjeeling Himalaya (Tonglu & Sandakphu)



Fig. 19 **Fig. 20** **Fig. 21**
Figs.19-21: Flowering branches & close up of flowers observed at Sandakphu in May, 2019



Fig. 22 **Fig. 23** **Fig. 24** **Fig. 25**
Figs.22-25: Vegetative & fruiting phenological observation at Tonglu in July, 2019



Fig. 26 **Fig. 27** **Figs. 28-29** **Figs. 30-31** **Figs. 32-33**
Figs.26-33: Lichen & Bryophytic association with stem of *R. barbatum* at Tonglu in July, 2019



Fig.34. **Fig.35** **Figs.36-37** **Fig.38**
Figs. 34-38: Fruiting phenology of *R. barbatum* at Tonglu in September, 2019 (Fig.38: fruit surface)

Figs. 90-98. *R. falconeri* in Darjeeling Himalaya in MAY 2019 (Tumling-Kaiakata-Kalipokhri):-



Fig. 90



Fig. 91



Fig. 92

Figs.90-92. Flowering phenology observation at Tumling (Fig.90) & Kaiakata (Figs.91-92) in May, 19



Fig. 93



Fig. 94



Fig. 95

Figs.93-95: Flowering phenology observation at Kaiakata-Kalipokhri Road in May, 2019



Fig. 96



Fig. 97



Fig. 98

Fig. 96. Flowering phenology observation by JRF at Kalipokhri vicinity in May, 2019; Figs. 97-98. Flowering phenology observation at Kalipokhri vicinity area in May, 2019.

Figs.39-54. *R. cinnabarinum* in Darjeeling Himalaya (Tonglu, Kaiakata & Sandakphu)



Fig.39



Fig.40



Fig.41

Figs.39-41: Flowering phenology of *R. cinnabarinum* in May (Tonglu, Tumling & Kaiakata)



Fig.42



Fig.43



Fig.44



Fig.45

Figs.42-45: Flowering phenology of *R. cinnabarinum* in May (Kalipokhri, BKB & Sandakphu)



Fig.46



Fig.48

Figs.46-47: Flowering in May 2019 (Sandakphu); Figs.48-49: Lichen association at Tonglu in July, 19



Fig.50



Fig.51



Figs.52-53



Fig. 54

Figs.50, 54: Bryophyte-lichen association at Tonglu in July 2019; Figs. 51-53: leaf surfaces observation at Kaiakata-Kalipokhri road in September, 2019.



Figs.239-241: Ethnobotanical oral interview with Smt. Pinki Sherpa at Alle village, Sandakphu in May, 2019 on *R. arboreum* subsp. *cinnamomeum* var. *cinnamomeum*.



Fig. 242



Fig. 243



Fig. 244



Fig. 245



Fig. 246

Figs. 244-245: Ethnobotanical first hand ITKs and oral interview conducted at Rajahatta, Sonada in July, 2019 on *R. arboreum* subsp. *arboreum* [Knowledge Informant: Bhakta Bahadur Pradhan, 89]. Fig. 246. Ethnobotanical ITKs documented at Alubari TN Road, Darjeeling in May, 2019 on *R. arboreum* subsp. *arboreum*. [Knowledge informant: Jai Kumar Thami, 76]

FOLK SONG RELATED TO LALI GURAS (*Rhododendron arboreum*)

Laliguras Ajambari Chap Chameli – Kunti Moktan

[*R. arboreum* Sm. subsp. *arboreum*: *Socio-cultural linking with the Nepalese*]

daali daalima ho daali daalima
Laaliguras ajambari chaap chameli
je bhaneni hunchha hajur ma ta nepali
daali daalima ho daali daalima
(fulirahu laagchha ni dilko baarimaa) 2
daali daalima ho daali daalima
laaliguras ajambari chaap chameli
je bhaneni hunchha hajur ma ta nepali
daali daalima ho daali daalima
(fulirahu laagchha ni dilko baarimaa) 2
(sungava hoon bhirmaa pani haasna sakchhu ni
nepali hoon peermaa pani bachna sakchhu ni)2
makhamali sayapatri beli baabari
je bhaneni hunchha hajur ma ta nepali
daali daalima ho daali daalima
(fulirahu laagchha ni dilko baarimaa) 2
kamal hoon ma hilo maa ni fulna sakchhu ni
gulaaf hoon maa kaadaa maa ni khulna sakchhu ni
laalupaate godavari champa kesari
je bhaneni hunchha hajur ma ta nepali
daali daalima ho daali daalima
(fulirahu laagchha ni dilko baarimaa) 2
laaliguras ajambari chaap chameli
je bhaneni hunchha hajur ma ta nepali
daali daalima ho daali daalima
(fulirahu laagchha ni dilko baarimaa) 4

PAN TRAPS: PHOTOGRAPHIC DOCUMENTATION IN DARJEELING HILLS

DEPLOYMENT OF PAN TRAPS 1st DAY: 18th May, 2019 at B.K. Bhanjyang



Fig. 259



Fig. 260



Fig. 261



Fig. 262

Figs. 259-262: Pan traps deployment at B. K. Bhanjyang-Sandakphu Road side *Rhododendron arboreum* subsp. *cinnamomeum*-*R. campanulatum* Forest on 18th May by CO-PI, JRF & expert.



Fig. 263



Fig. 264

Figs.263-264: After completion of Pan Traps deployment on the 1st Day (18th May, 2019) at B. K. Bhanjyang-Sandphu Road side *Rhododendron* Forest.

Figs.275-282: Collection and documentation of INSECT VISITORS in *R. cinnabarinum* in Darjeeling Himalaya:-



Fig.275. During Net Sampling at Tonglu in May, 2019; Fig. 276. Minute insect visitors inside flowers



Fig. 277

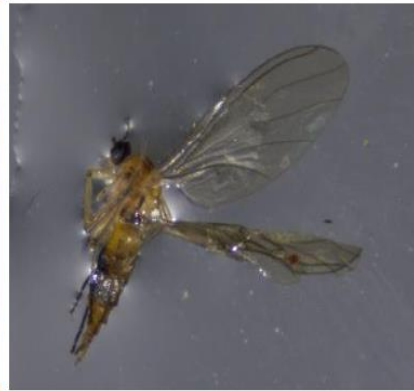


Fig. 278



Fig. 279

Fig. 277. Thrips (Order: Thysanoptera—Family: Phlaeothripidae); **Fig. 278.** Fungus Gnats (Order: Diptera Family: Mycetophilidae); **Fig. 278.** Nymphal stage of Leafhopper (Order: Hemiptera; Family: Cicadellidae).



Fig. 280



Fig. 281



Fig. 282

Fig. 280. Long legged Fly (Order: Diptera; Family: Dolichopodidae); **Fig. 281.** Plant bug or Leaf bug (Order: Hemiptera; Family: Miridae); **Fig. 282.** Soft-winged Flower beetle (Order: Coleoptera; Family: Melyridea; Genus: *Collops* sp.).

PROJECT TEAM MEMBERS

PI: Dr. Subhasis Panda



CO-PI: Dr. Dipak Kr.
Som



Mr. Priyankar Roy

