

PRESENTATION OF WORK DONE AT BSI FROM  
February, 2004 to February, 2017

(Including a brief outline of pre-BSI work done  
at CSIR-NBRI)

By

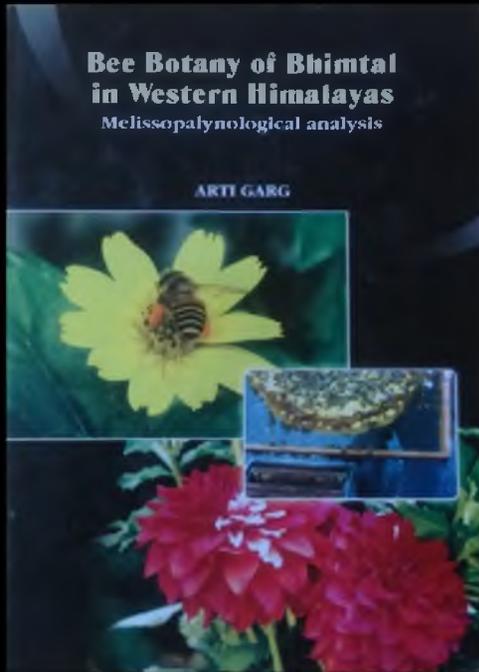
Dr. Arti Garg  
Scientist – ‘D’

Botanical Survey of India, Central Regional Centre,  
Allahabad -211002

Email: [kad\\_arti396@yahoo.com](mailto:kad_arti396@yahoo.com)

Pre-BSI Period was A Journey to my destination (1985 – 2004)

Completed my Ph.D on  
Bee Botany of Bhimtal  
in Western Himalayas  
- A melittopalynological  
analysis



Dr. P.K.K.Nair  
Father of Indian Paynology  
(6<sup>th</sup> Feb., 1930 to 21<sup>st</sup> Jan., 2017)

As CSIR-NBRI JRF and SRF  
1992

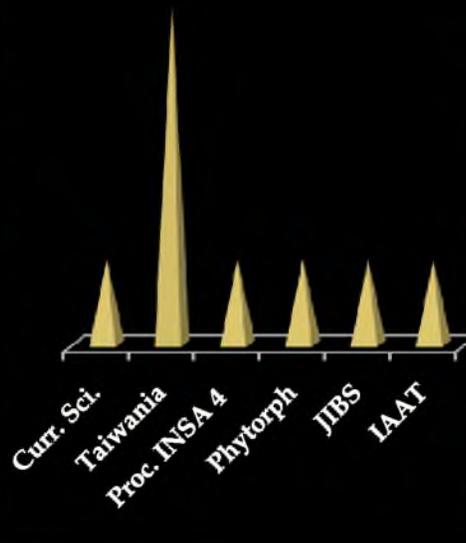
# Post Doctoral Projects at CSIR-NBRI (1992-2004)

RA 1992-97 under Dr. R. R. Rao

1. Reproductive Biology of critically endangered  
*Eremostachys superba* Royle ex Benth. (Lamiaceae)

Causes of rarity: IAAT – **M. Sabu award**

- Pollinator limitation due to pollinator specificity
- Inbreeding depression due to narrow population size  
(Through breeding experiments)

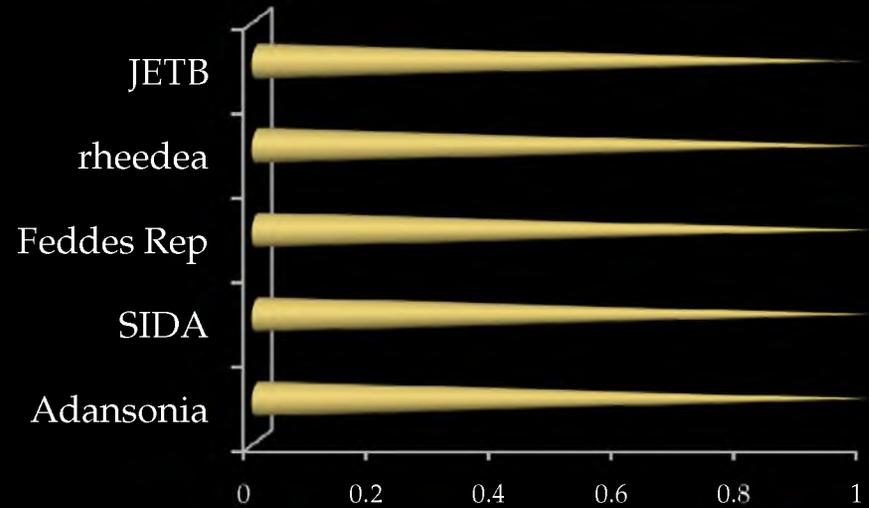


# Palynotaxonomic and Revisionary studies of the genus *Berberis* L. in India

1. *Berberis* L. was revised, with 55 taxa.
2. Pollen morphology of 35 representative species using both LM and SEM
3. Taxa inter-relationships and phylogeny: monophyletic apertural evolution from inaperturate in *B. macrosepala* (*primitive*) to spiraperturate in *B. asiatica* (adv) ... while connecting link was *B. lycium* with intermediate forms.
4. Evolution of surface ornamentation was parallel



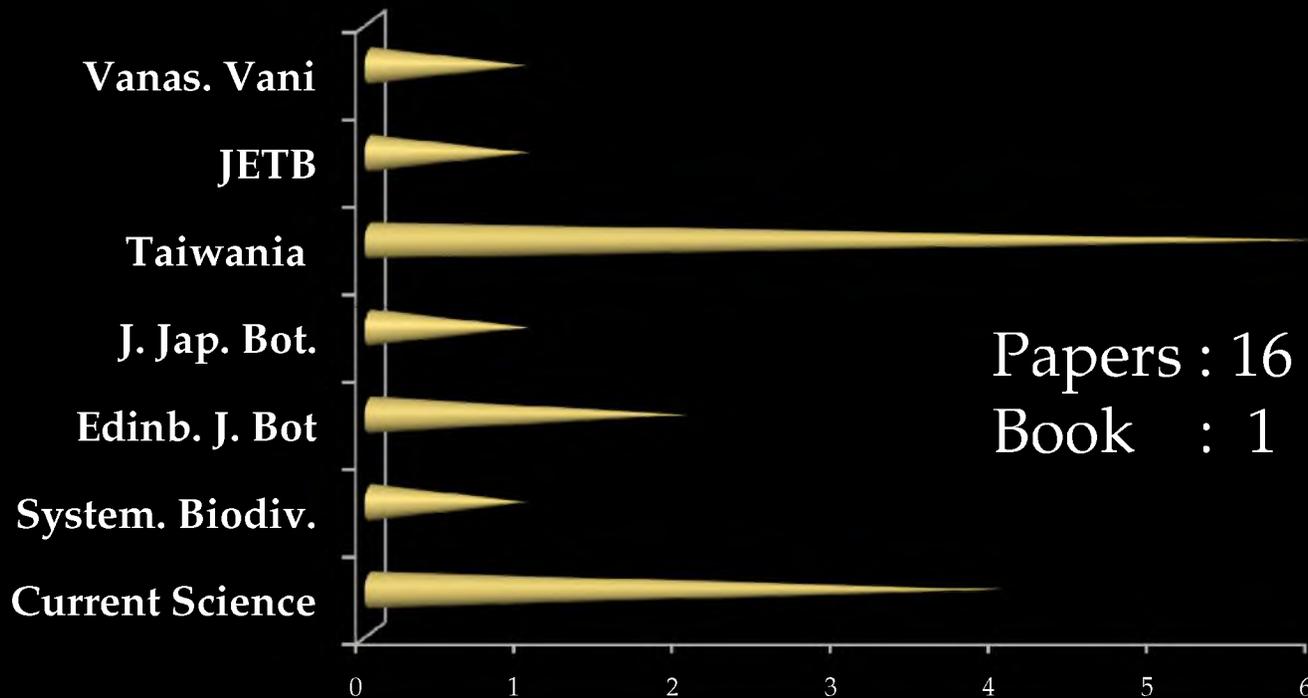
- New species – *Berberis sanei*
- Species complex resolved – *B. lycium* complex
- Identity of two taxa resolved.



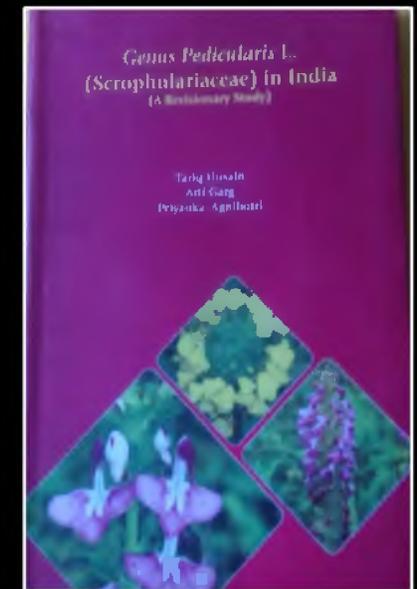
## Revision of genus *Pedicularis* L. in India (Dr. T. Husain, PI)

1. 83 species in India, mostly Himalayan
2. New species – *P. pushpangadanii* (Adansonia)
3. New subsp. – *P. zeylanica* subsp. *Anamalayansis* (Syst. Biodiv.)
4. **Best paper award at IAAT 2002** at NBRI, Lucknow
5. Survival strategies - Alpine zones (Curr. Sci.)
6. Speciation in *Pedicularis* L. (Curr. Sci.)
7. Presented paper in BSIP conference

- Lectotypification of few species
- Species complexes resolved
- Sikkim Himalaya with 34 endemic species - Megadiversity centre



Papers : 16  
Book : 1



## Beakless corolla and dissected labium



*P. roylei*



*P. oederi*

**Beaked galaea - open flowers**



*P. bifida*



*P. punctata*

## Variations in beak of galaea



*P. pectinata* – gradually curved beak



*P. jainii* – loosely curled long beak

**Species with relatively encased galaea and long corolla tubes**



***P. longiflora* –elongated corolla tube *P. hoffmeisteri*- galaea encased within labium**



*P. porrecta* – beak angled



*P. siphinantha* – beak sharply curved

**Species occurring at higher altitudes (4000 – 5000 m)  
have closed flowers with labium encasing the galaea**



***P. megalantha*  
galaea partly exposed**



***P. rhinanthoides*  
galaea encased within labium**

# Adaptation proceeding towards concealment of reproductive organs



1000 -2500m



4000-5000 m

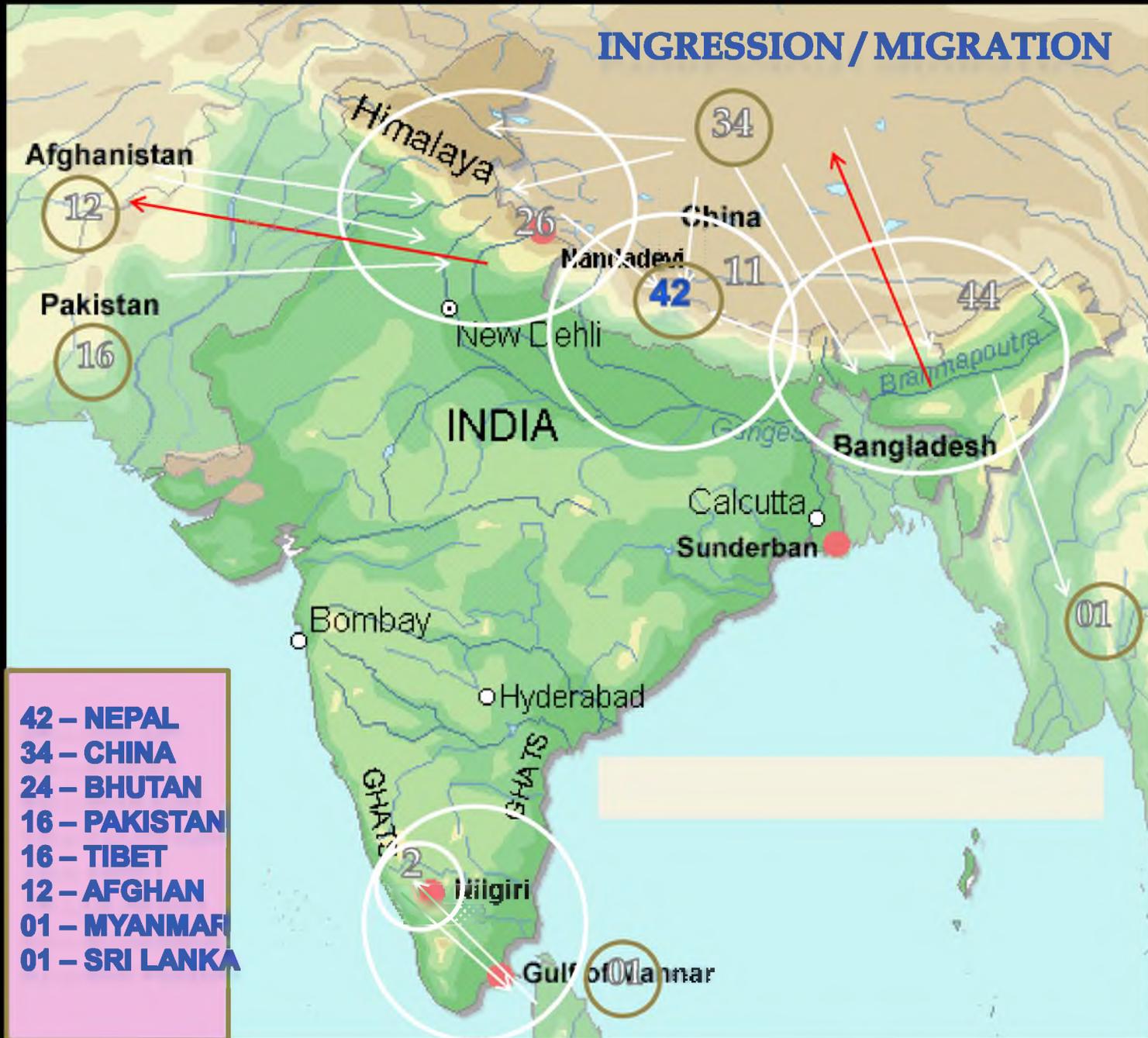
Intermediate forms

*P. punctata* – open flowers

*P. bicornuta* – ball shaped flowers



# INGRESSION / MIGRATION

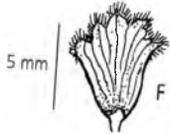
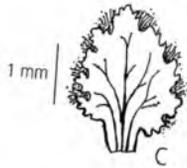
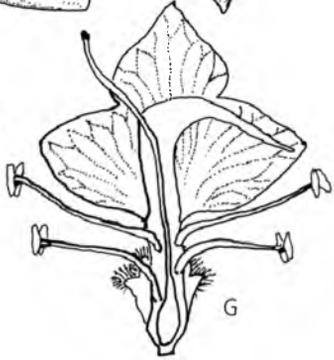
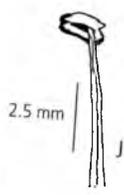
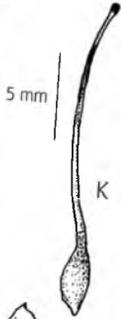
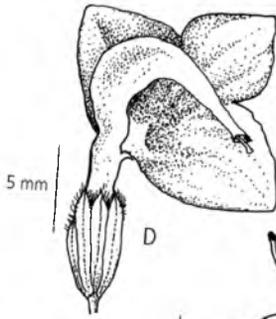
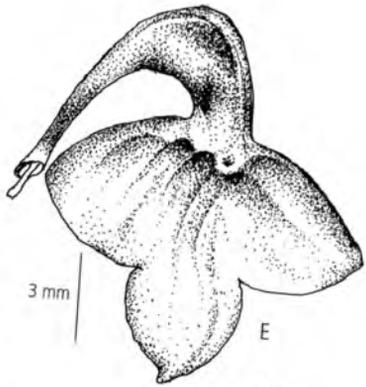
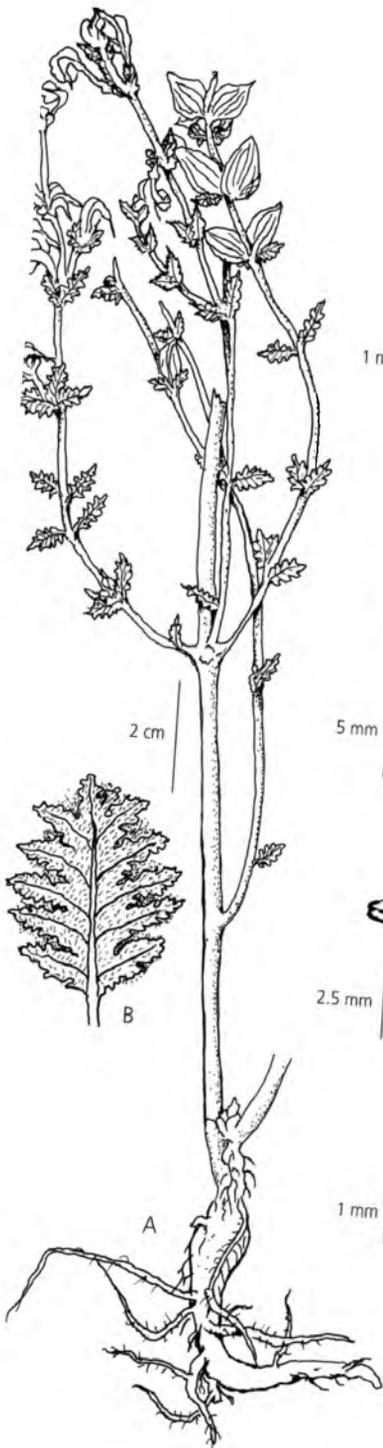


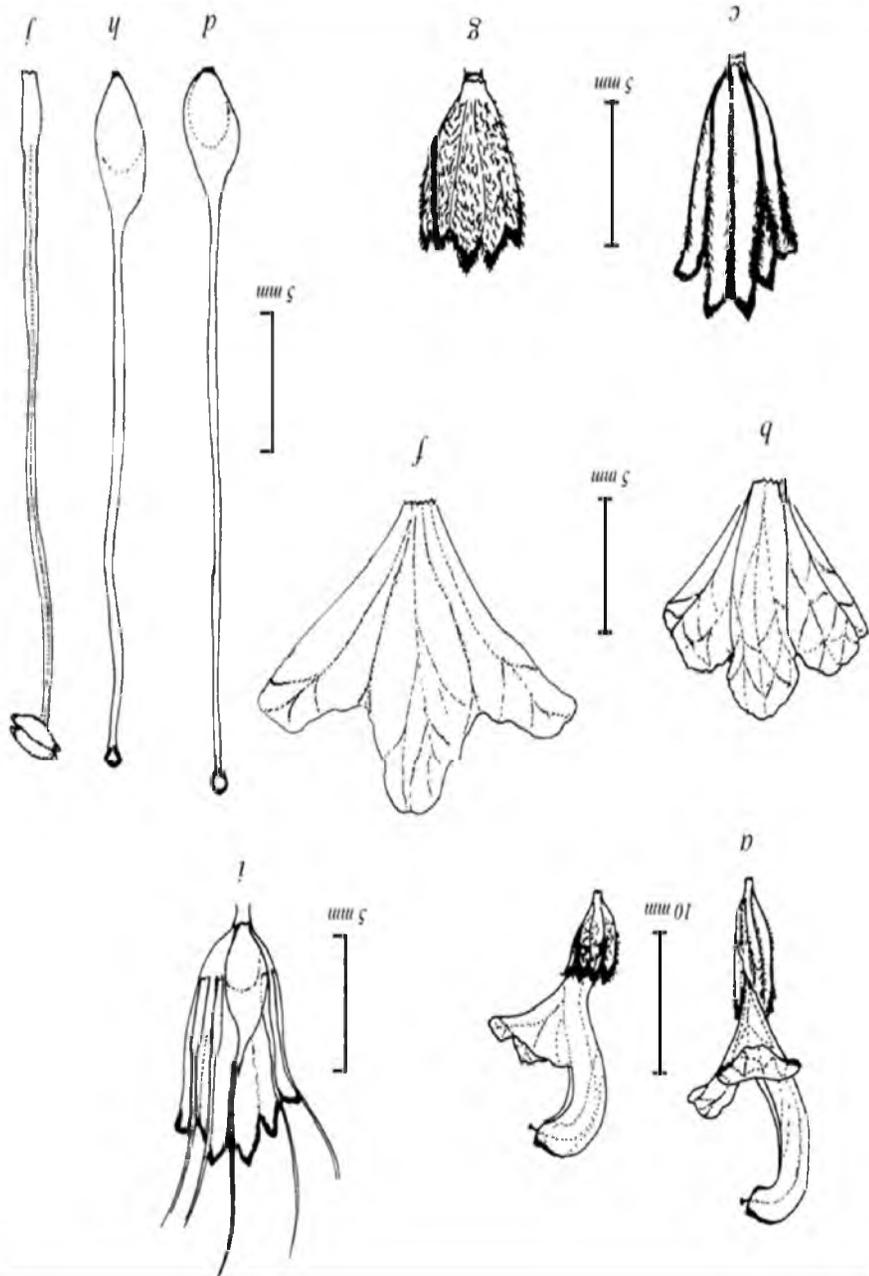
- 42 – NEPAL
- 34 – CHINA
- 24 – BHUTAN
- 16 – PAKISTAN
- 16 – TIBET
- 12 – AFGHAN
- 01 – MYANMAR
- 01 – SRI LANKA

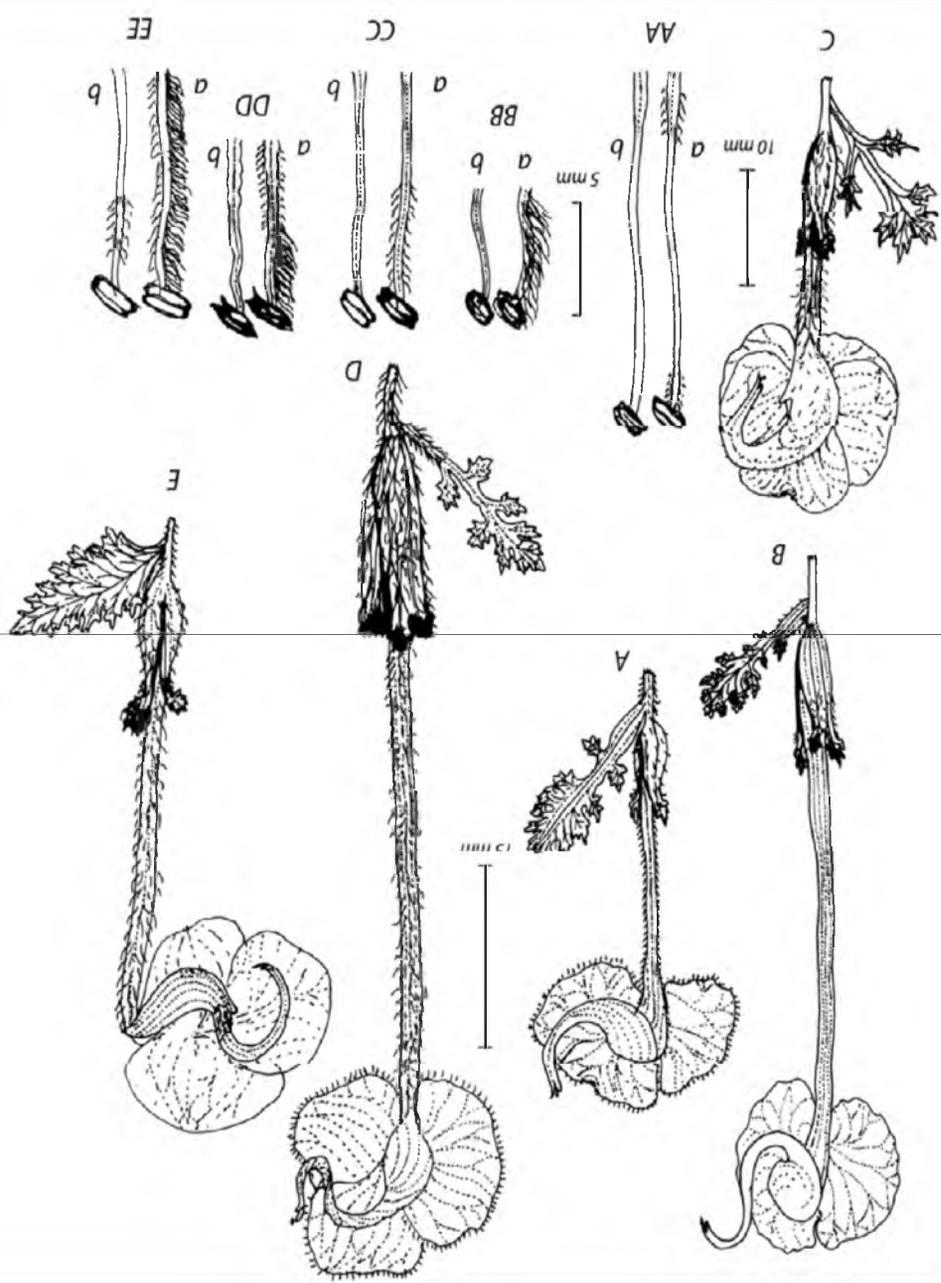


5 mm







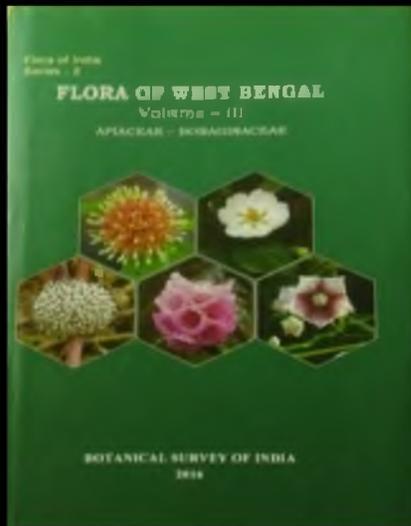


# Project 1

## FAMILY ASTERACEAE FOR FLORA OF WEST BENGAL VOL. III (AAP - 2004-6)

Project Report Submitted

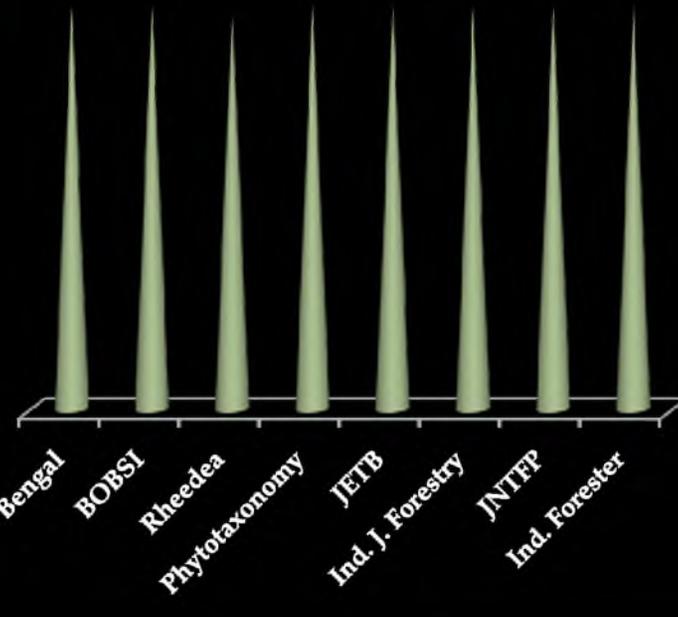
Total number of Taxa : 108 genera, 239 species, 2 subspecies & 10 varieties in West Bengal



| Contributors     |                     |
|------------------|---------------------|
| S. C. Srivastava | S. K. Mandal        |
| M. K. Pathak     | Dipanwita Banik     |
| Jun Wen          | S. Mirmou           |
| G. V. S. Murthy  | R. B. Ghosh         |
| K. L. Maity      | G. S. Giri          |
| U. P. Samadder   | Debika Mitra        |
| D. C. S. Raju    | V. Sampath Kumar    |
| Gopal Krishna    | M. K. Manna         |
| A. K. Ghosh      | K. Kurthigeyan      |
| Anant Kumar      | S. Chandra          |
| T. K. Paul       | S. R. Kundu         |
| N. R. Murmu      | P. Lakshminarasimha |
| Arti Garg        | Vinay Ranjan        |
| S. K. Das Das    | Chhabi Ghora        |
| B. Saha          | Mahua Pal           |

Publications: 7 + 1

(Flora West Bengal, III)



Significant finding

New record of 17 taxa for State of West Bengal

## Project 2

# FAMILY LAMIACEAE (*p.p.*) and CANNABACEAE (one species) FOR FLORA OF WEST BENGAL

(AAP - 2006-8)

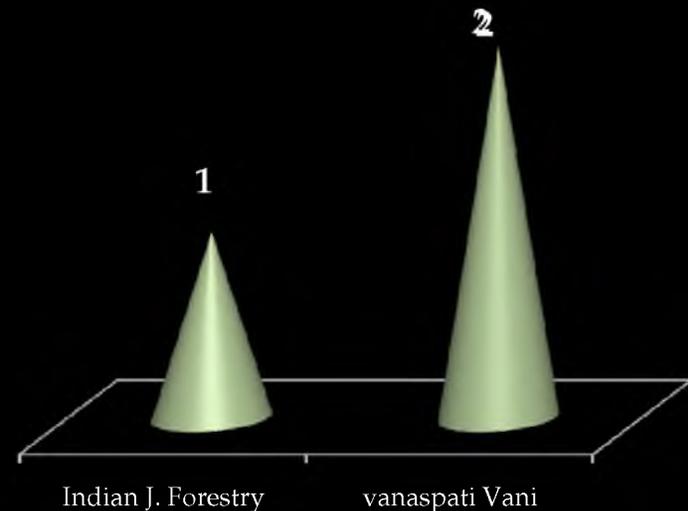
Project report submitted and Editorial corrections incorporated.

Lamiaceae Tribes : *Stachydeae, Prasieae, Ajugoideae*  
Total number of taxa : 16 genera, 32 species, 3 varieties.  
Publications : 2

Cannabaceae : 1 genus and 1 species  
Publication : 1

Significant finding

New record of 3 taxa for  
State of West Bengal



## Project 3

### SIX FAMILIES FOR FLORA OF WEST BENGAL

(AAP – 2006-8)

Completed 6 families:

|                     |                     |                            |
|---------------------|---------------------|----------------------------|
| 1. Proteaceae       | 1 genus, 1 species  | A.K. Ghosh and Arti Garg   |
| 2. Chenopodiaceae   | 7 genera, 9 species | L. K. Ghara and Arti Garg  |
| 3. Elaeagnaceae     | 1 genus, 3 species  | D. Basu and Arti Garg      |
| 4. Ceratophyllaceae | 1 genus, 1 species  | A. A. Ansari and Arti Garg |
| 5. Betulaceae       | 2 genera, 3 species | K.L. Maity and Arti Garg   |
| 6. Chloranthaceae   | 1 genus, 2 species  | A.K. Ghosh and Arti Garg   |

Total number of taxa : 13 genera, 19 species

Manuscripts submitted and Editorial corrections incorporated

## Project 4

# PALYNOLOTAXONOMIC STUDIES ON FAMILY THYMELAEACEAE IN INDIA (AAP – 2008-11)

Project report Submitted

Total taxa worked : 23

Conference papers :

2009. Pollen Atlas of India – it's implications in taxonomy. IAAT , NBRI, Lucknow

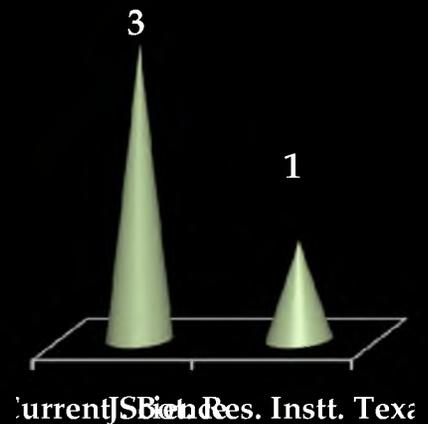
2013. Palynological basis for phylogenetic implications of the family Thymelaeaceae in India. National Conference on RD PES. BSIP, Lucknow.

2015. Palynotaxonomy - it's role in stemming the dichotomy between classical and modern Taxonomy, TNB, Bhagalpur

**Delivered lecture as resource person in NBRI on modern techniques**

### Significant findings

- Complexity of *Daphne papyracea* and *D. Bholua* resolved.
- Affinity of Thymelaeaceae and Euphorbiaceae established.

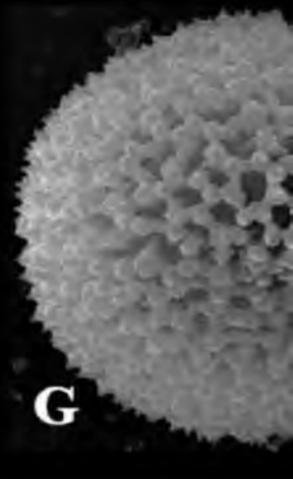
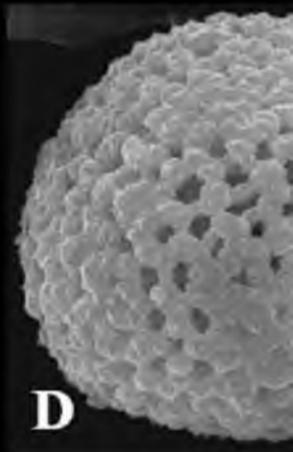
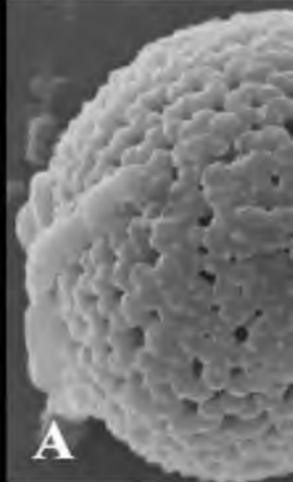


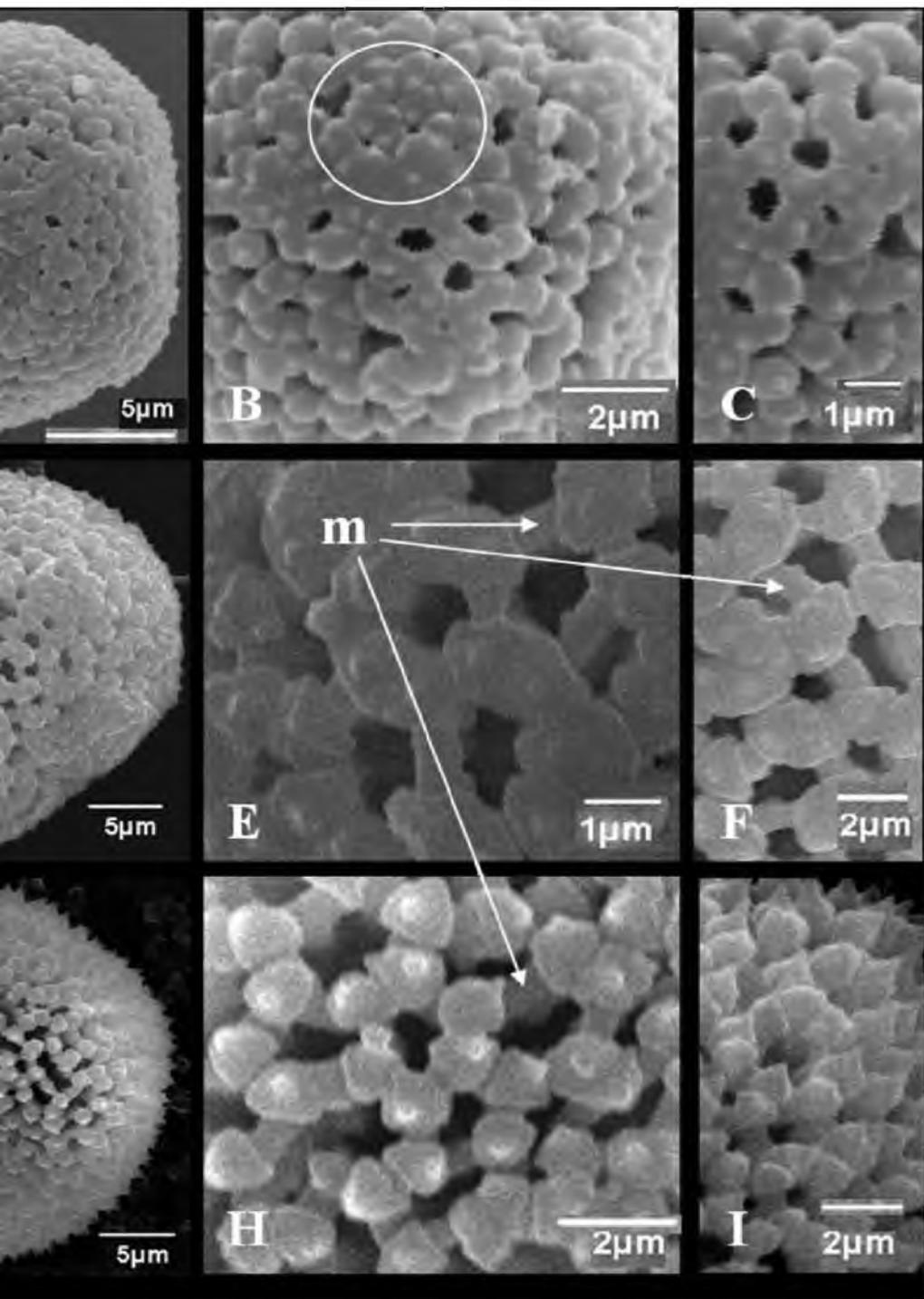
Solved *Daphne*  
*bholua* complex –  
paper coauthored by  
Zachary Rogers

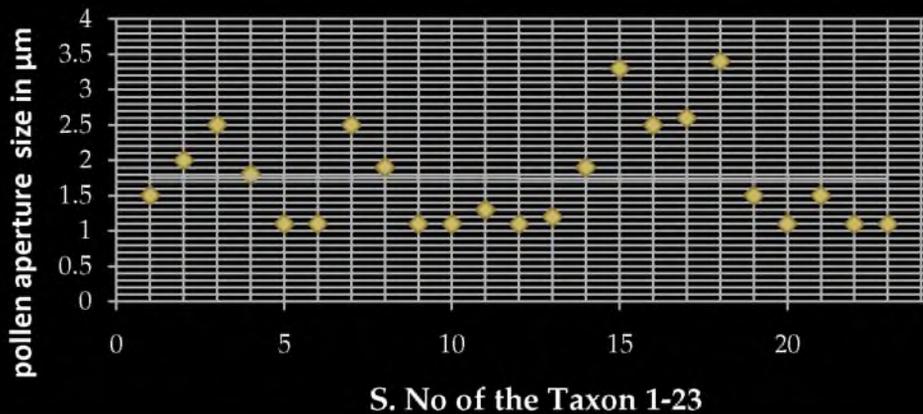
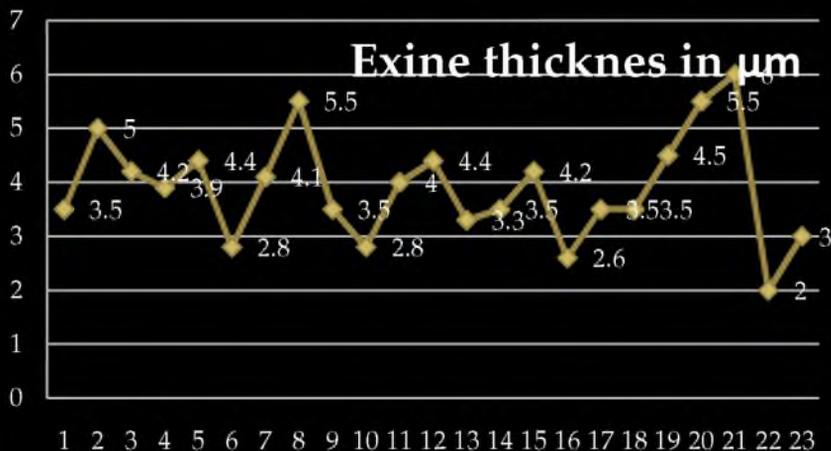
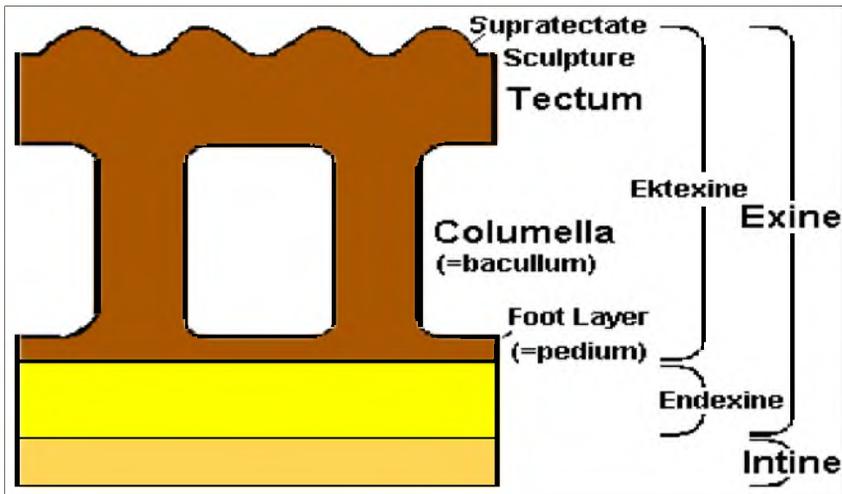
Taxa inter-  
relationships  
drawn.

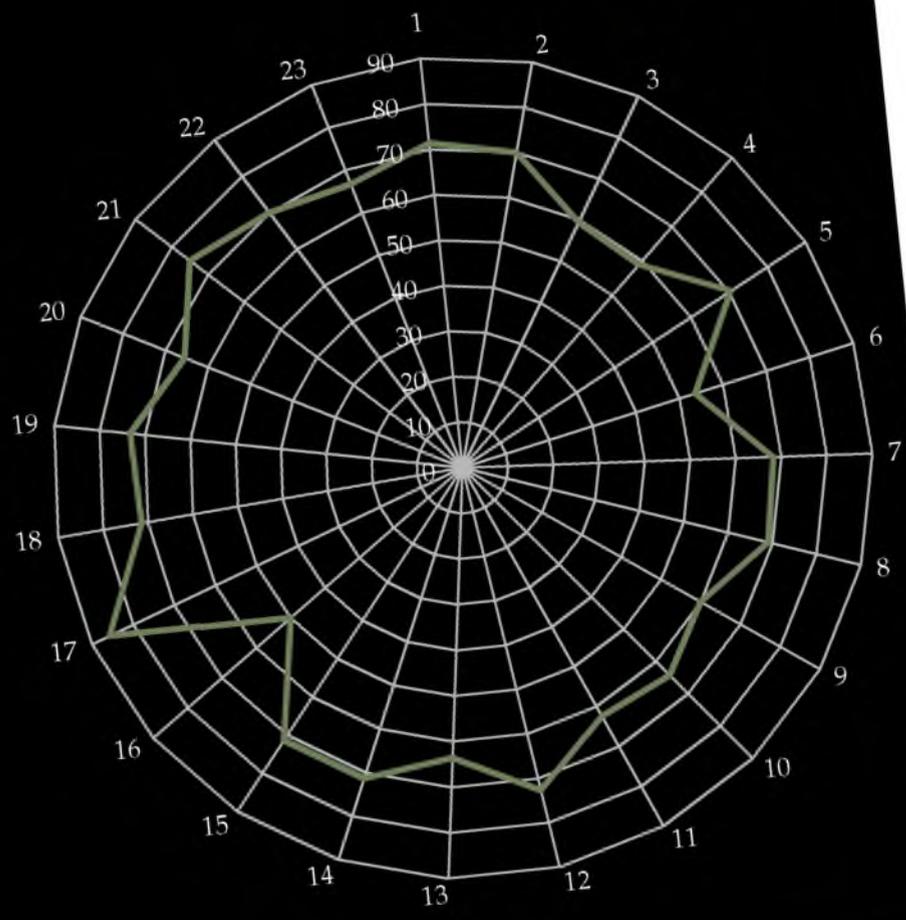
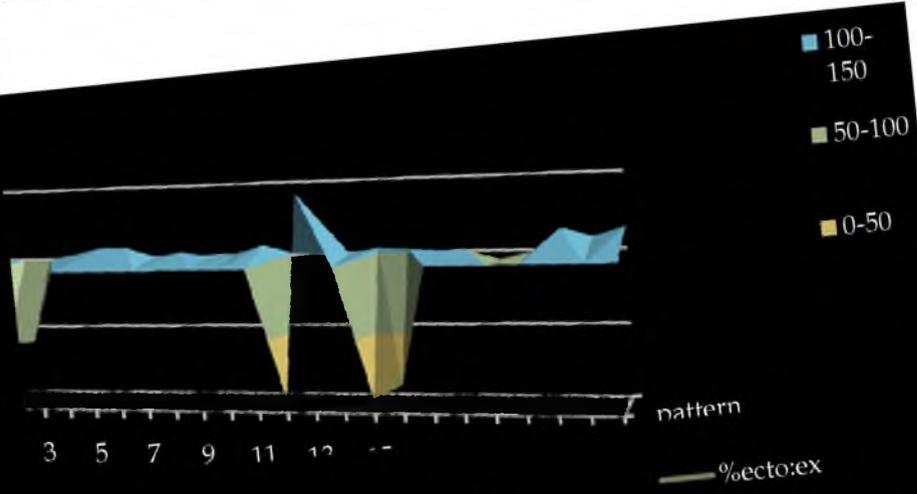
Affinity of the family  
with Euphorbiaceae  
portrayed.

Paper presented in  
Bhagalpur as  
resource person.









Project 5 (Joint)

**PALYNOLOTAXONOMIC STUDIES ON FAMILY LAURAEACEAE  
IN INDIA (2010-14) –Submitted**

Executing Officers :Dr. Arti Garg and Shri S. Sachan, Pres. Asstt.  
This work was carried out by Shri S. Sachan,  
under my supervision, at CNH.

(was initially intended for ph.D under my guidance)

Total taxa :55

While execution was under my supervision and guidance, I have trained him in palynological techniques, preparation of pollen slides, image analysis, study of pollen under SEM and method of describing pollen morphology. The project report was corrected by me and subsequently submitted in time.

## Project 6

### FLORA OF LAKSHADWEEP

(2008-2010)

Project report submitted and Editorial corrections incorporated.

Executing Officers : Drs. M. Sanjappa, P. Lakshminarsimhan and  
Arti Garg

Introduction completed and submitted

Total number of taxa described : c. 400 taxa (with citations, description,  
flowering and fruiting period, ecology, uses  
and specimens examined. This included all  
earlier collections housed in CAL

Examined c. 600 specimens at CAL

Publication : 1  
Arti Garg, P. Laxhminarsimhan and Pushpi  
Singh. 2015. Lakshadweep ki Jaiv  
vividhta. Vanaspati Vani. 24: 4-8. (in Hindi).

# Project 7

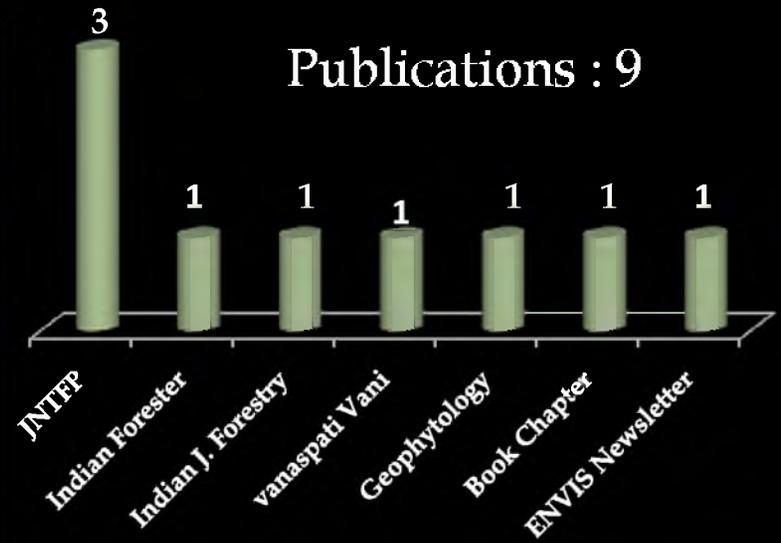
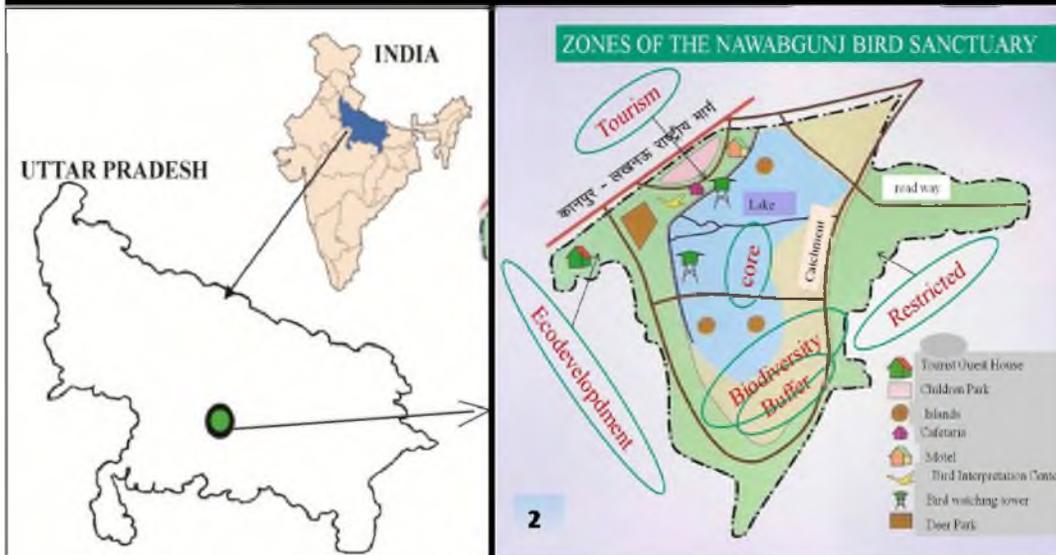
## FLORISTIC DIVERSITY OF NAWABGUNJ BIRD SANCTUARY IN UTTAR PRADESH (2011-2012)

Project Report Submitted and manuscript for book submitted

|                    |   |                               |
|--------------------|---|-------------------------------|
| Executing Officers | : | Dr. Arti Garg                 |
| Area               | : | 224.6 hectares                |
| Tours conducted    | : | 1-7 days (26.11.11- 2.12.11)  |
|                    |   | 2- 6 days (13.3.12 – 18.3.12) |
|                    |   | 3- 5 days (21.5.12 – 26.5.12) |



|                      |   |   |
|----------------------|---|---|
| Total Field numbers  | : | 269 (all identified)                    |
| Total number of taxa | : | 71 families, 172 genera and 243 species |



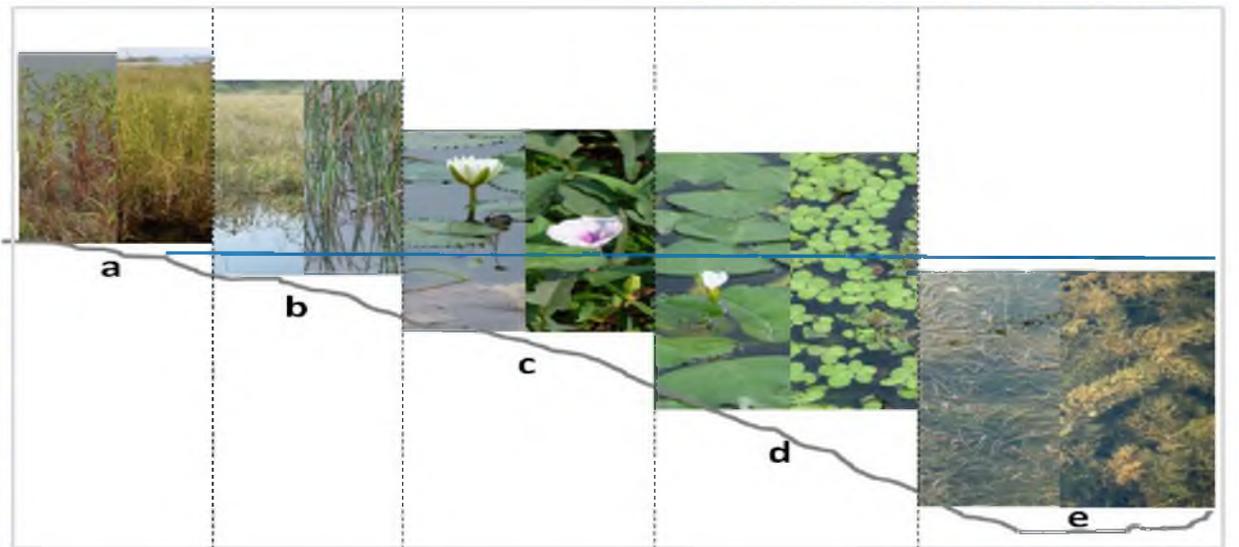


C

D



*Acacia nilotica* (L.)  
Willd. ex Delile and  
*Prosopis juliflora*  
(Swartz.) DC Resource  
nesting rees





## Project 8

# FLORISTIC DIVERSITY OF UPPER GANGA RAMSAR SITE IN UTTAR PRADESH (2012-2016) : Submitted

Executing Officers : Dr. Arti Garg

Area : 254482 ha covering 85 Km stretch  
of river Ganga from Brij Ghat in  
Ghaziabad to Narora in  
Bulandshahr

Tours conducted : 1- 8 days (20-27.9.2012)  
(4FT ; 1HCT) : 2- 9 days (4-12.3.2013 by V. Singh)  
: 3- 6 days (12-17.12.13)  
: 4- 9 days (15-23.2.16)

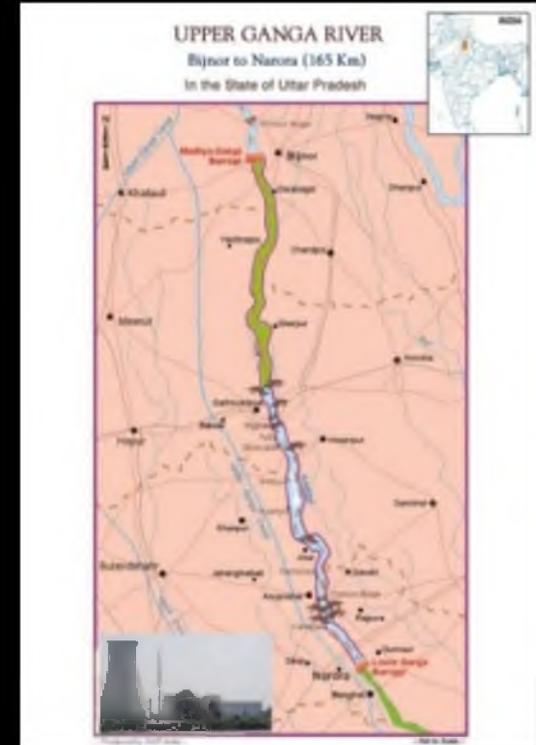


Field numbers collected : 587 (all identified)

Total number of taxa : 99 families, 291 genera and 420 species

Conference papers : 2015. Causes and consequences of Invasive plants on Ramsar sites wetlands. In. 5<sup>th</sup> international conference on Plants and environmental pollution (ICPEP-5) from 24-27 February at NBRI Lucknow.

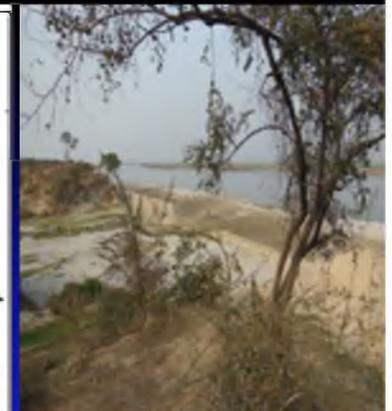
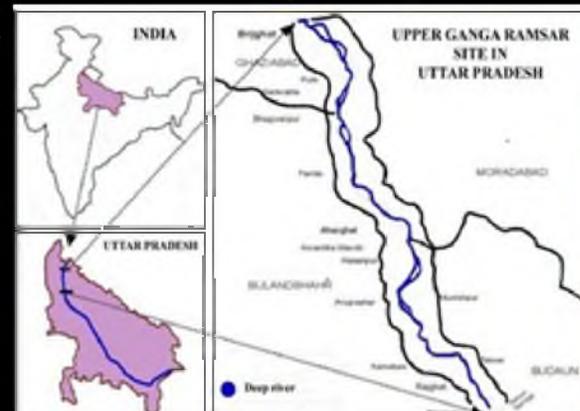
: 2016. The Ramsar convention. TNB, Bhagalpur

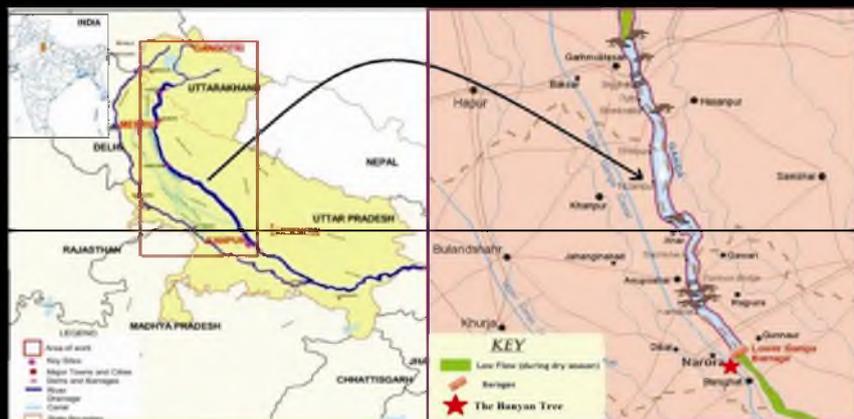


## Significant findings

- World's tenth largest and peculiar Banyan tree (*Ficus benghalensis* L.) with only 2 prop roots.
- *Mannilkara hexandra* (Roxb.) Dubard. population of c. 35 mature trees
- Two sacred groves.
- Two new records - *Emilia javanica* (Burm.f) C. B. Rob. and *Inula falconeri* Hook.f. (Asteraceae).
- Resource keystone trees, *Syzygium cumini* (L.) Skeels supporting the only population of Upper parakeets in plains of Upper

The Upper Ganga Ramsar site, U.P. (River)

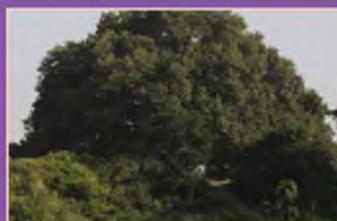




## CURRENT SCIENCE

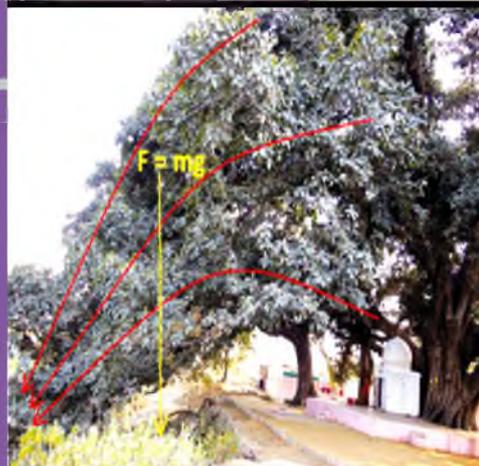
Volume 111 Number 5

19 September 2018

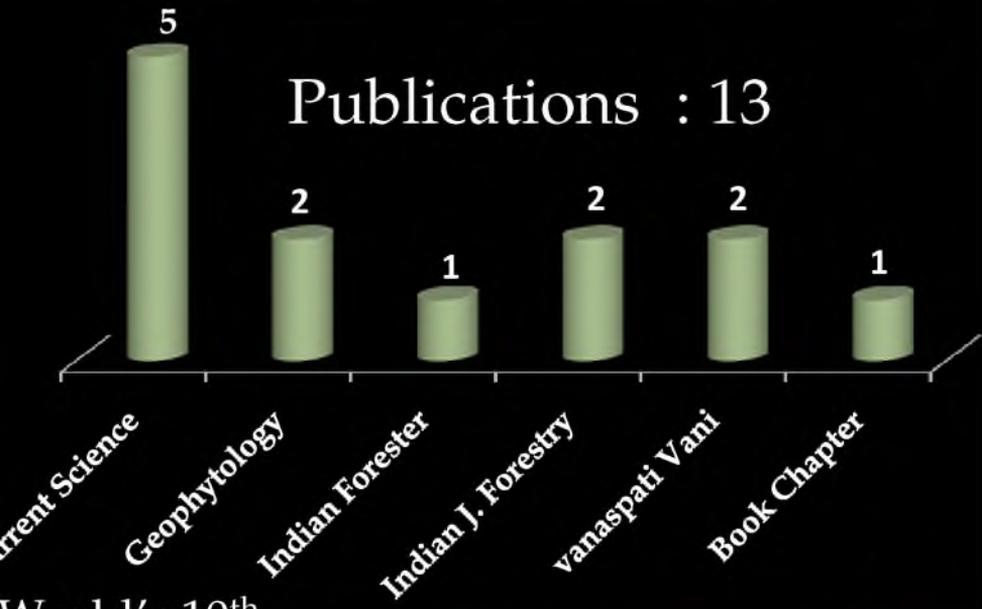


Bioresource information centre  
 Analysis of ocean surface warming  
 Crop damage by wild herbivores

Central Science Association Indian Academy of Sciences



# Publications : 13



World's 10<sup>th</sup>  
largest banyan tree  
.. Only 2 Prop  
roots, hanging  
down from mound



**FLORISTIC DIVERSITY OF BHOJ RAMSAR SITE IN  
MADHYA PRADESH (2016-18) : Ongoing**

|                         |  |
|-------------------------|--|
| Executing Officer       | : Dr. Arti Garg  |
| Area                    | : c. 4613 hectares core region,<br>: c. 79 Kms perimeter<br>: c. 1,04,563 ha catchment,          |
| Lat. 7 Long.            | : 23° 14' 46" N 77° 20' 31" E.   |
| Wetland Type            | : Inland-Manmade-Reservoir / barrage type,<br>split in two parts – the Upper and the Lower Lake. |
| Tour conducted 1FT      | : 30.11.16 to 9.12.16 (10 days)  |
| Field numbers collected | : 275  |
| Photographs taken       | : c. 940   |



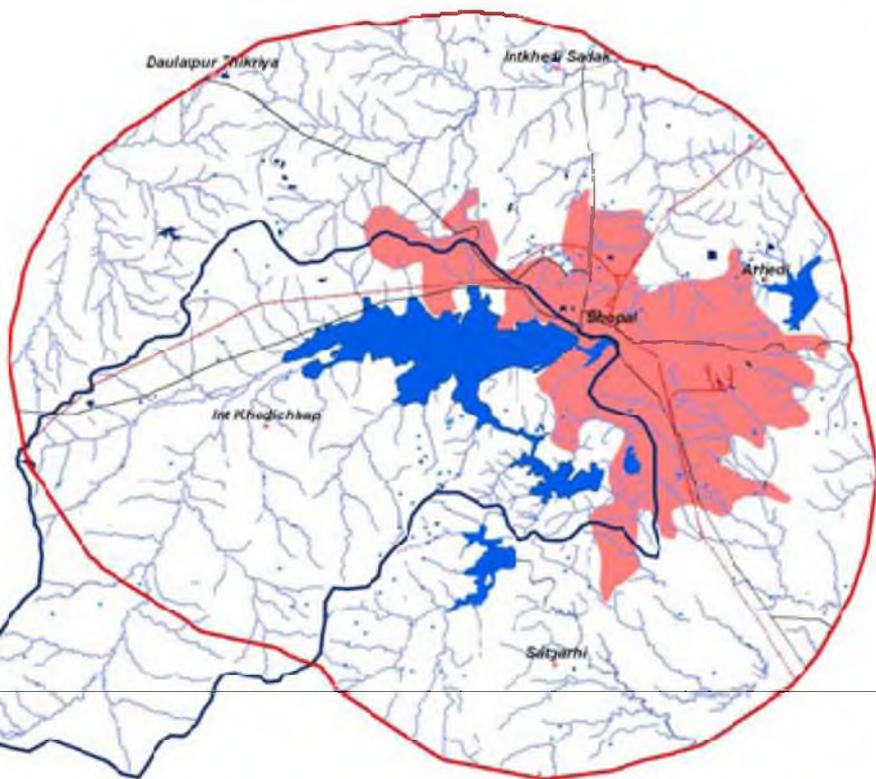
## Location Map



## Legend

- |   |  |
|---|--|
|  River/Stream        |  Drainage (lines) |
|  Reservoir           |  Canal            |
|  Tanks/Pond          |  Roads            |
|  Wetlands (<2.25 ha) |  Railway          |
|  Wetland boundary    |  Settlement       |
|  Direct catchment    |  Town/Settlement  |
|  12 km buffer area   |  |



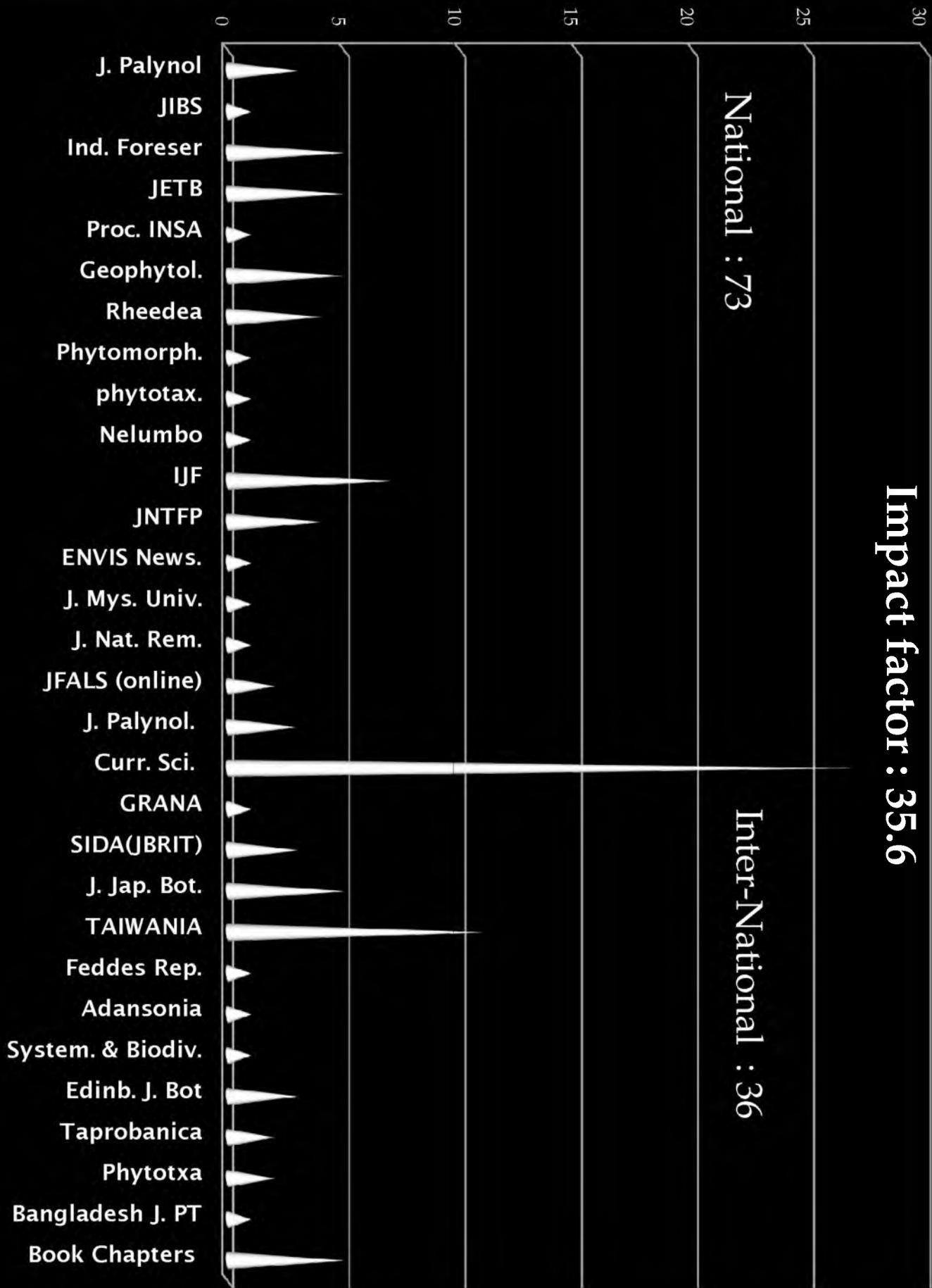




**FLORA OF CHHATTISGARH : MONOCOTS**  
**(2016-18)**

|                                |  |
|--------------------------------|--|
| Family Poaceae ( <i>p.p.</i> ) | : c. 120 species to describe                       |
| Completed                      | : Description of 20 Species                        |
| Remaining work                 | : Description of c. 100 species<br>to be completed |

# Impact factor : 35.6



# ADMINISTRATIVE WORKS CARRIED OUT

## At CNH, Howrah

1. Worked as Hall-in-charge, incharge-SEM, fumigation and identification till 2010.

## At CRC, Allahabad

1. Worked as DDO from February 2011-13 at CRC, Allahabad.
2. Officiated as office-in-charge during absence of the HoO, from September 2014 onwards.
3. Working as Hindi officer.
4. Worked and coordinated as chairperson of various committees - Purchase committee, tree pruning committee, Ms. Anuradha Singh's resignation case investigation committee, office vehicles auction committee, store and library physical verification committee etc.
5. Attended various meetings - Wild Life Board meeting, Hindi Narakash meetings, OCM meetings, Hindi karyanvaya samiti meetings etc.
6. Was instrumental in planning coordination, and finalization of MOA for scientific collaboration with the BSIP, Lucknow.

- Reviewed Indo-French collaborative project on “Indian vegetation and monsoon response to climate variability during the past one million years”, for the Indo-French centre for the
- promotion of advanced research – CEFIPRA – A model bilateral organization for international collaborative research in advanced areas of Science and Technology.

## SUMMARY OF WORK FROM 2004-2016

|  |   |
|--|---|
| a. Total Number of projects carried out      | 10 (Total)  |
| Individually                                 | 6 ( nos. 1,2,4,7,8 &10)   |
| Jointly                                      | 4 ( nos. 3,5,6 & 9)   |
| a. Number of Books written                   | 3 (Total)   |
| Individually                                 | 1 - Bee Botany of Bhimtal in W. Himalaya  |
| Jointly                                      | 2 ( 1. Revision of <i>Pedicularis</i> L. In India)<br>( family Asteraceae, Fl. W. Bengal 111) |
| a. Papers published                          | 115 (Total)   |
| Individually                                 | 28  |
| First Author                                 | 49  |
| Co-author                                    | 38  |
| a. Number of new taxa published              | 8   |
| b. Number of new combinations published      | 4   |
| c. Number of new reports published           | 24  |
| d. Projects evaluated mainly on Pollination. |   |

## FUTURE PLAN OF WORK

Work on the following four 4 projects :

1. Floristic diversity of 'Bhoj Ramsar Site' in Madhya Pradesh : (2016-18).
2. Flora of Chhattisgarh vol. II : (2016-18) To complete description of c. 110 species of Poaceae.
3. Studies of fossil and living plants with reference to the impact of climate change on flora of Gangetic Plains and Central India : (2017-20)  
This project is in collaboration with the BSIP, Lucknow.
4. Taxonomic Studies on genus *Strobilanthes* Blume in Northern India : (2017-20) Includes c. 120 species of northern India. (New project proposed).

# Thanks

