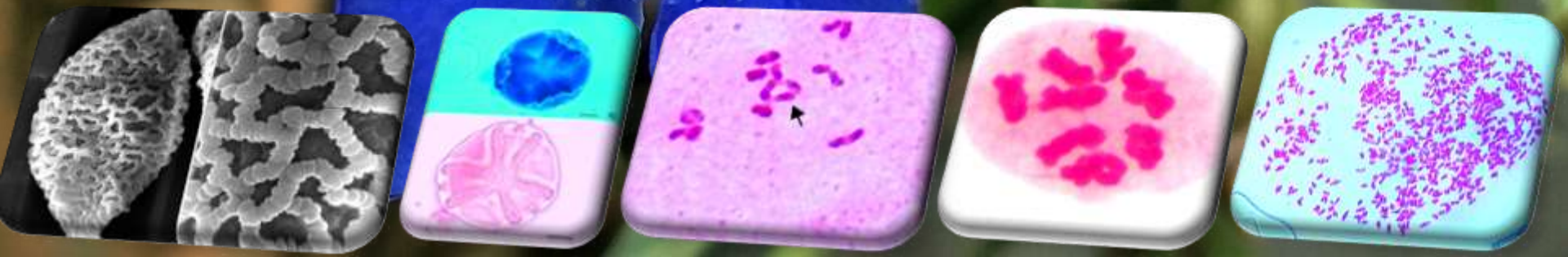
BSI

भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

ANNUAL SCIENTIFIC MEET 2021

BOTANICAL SURVEY OF INDIA, NORTHERN REGIONAL CENTRE, DEHRADUN

Dated: 3 & 4 May, 2021
Virtual mode



Yr 2020-21

PROJECT

✓**Project Title : Cytological studies in some selected chromosomally lesser-known/unknown plants and Liverworts from Botanic Garden of BSI, NRC, Dehradun, and adjoining areas.**

Executing officials: Dr. Puneet Kumar, Sci- 'C' & Dr. S.K. Singh, Sci.- 'E'

- **Date of initiation: July 2020**
- **Date of completion: April 2021**

Objectives & Methodologies

Objectives	Objective-wise Brief Methodology
• Collection of material for cytological studies. • To determine the chromosome number through male meiosis/mitosis. Depending on the availability of material, chromosome studies will be based on meiosis or mitosis, respectively. • The meiotic behaviour and pollen fertility will be studied for each species. • Aberrant genotypes/Morph-variants if found will be subjected to detailed cytological analysis.	• **Sample collection** • **Cytological studies** ✓ *Cytological preparations* ✓ *Meiotic products (sporads and pollen grains) analysis* ✓ *Karyotype analysis* ✓ *Photomicrographs* • **Identification**

Yr 2020-21

Annual Outcomes/ Results

Deliverables

- Collection of plant material.
- Cytological studies.
- Identification, compilation previous reports from online and offline chromosome databases(Darlington and Wyile (1955); Fedorov (1969); Ornduff (1966, 1967); Moore (1970, 1971, 1972, 1973, 1974, 1977); Löve and Löve (1982, 1986); Goldblatt (1981, 1984, 1985, 1988); Goldblatt and Johnson (1990, 1991, 1994, 1996, 1998, 2000, 2003, 2006), Kumar and Subramanian (1986); Khatoon and Ali (1993) and IAPT/IOPB and SOCGI Chromosome Reports and journals concerned with chromosome reports)and writing final report

Summary of Achievements

No. of field tours conducted :	Three One day local tours to Chakrata, Deoban , Bhadraj and adjoining areas of Dehradun
➢No. of species collected	47
➢No. of species identified	47
➢No. of species cytologically studied	37 (34 genera of 24 families)

Table: Information on taxa and basic number family, meiotic chromosome number, ploidy level, pollen fertility %age, and previous chromosome reports on the cytologically investigated species.

S. No	Taxa (1)	Family (2)	Meiotic/mitotic chromosome number (n) (3)	Ploidy level (4)	Pollen/ spore fertility %age (5)	Previous reports if any*/ Remarks (6)
1.	*Aconitum heterophyllum* Wall. ex Royle (x=8)	Ranunculaceae	8	2x	100	***2n***=16
2.	*Agrimonia eupatoria* L. (x=14)	Rosaceae	28	4x	100	***2n***=28, 56,70, 84
3.	*Allium stracheyi* Baker (x=8)	Amaryllidaceae	8	2x	100	***2n***=14, 14+2-10B, 16, 16+1B, 32, 48
4.	*Allium victorialis* L. (x=8)	Amaryllidaceae	8	2x	100	***2n***=16, 24, 32, 36
5.	*Alstonia venenata* R. Br. (x=11)	Apocynaceae	11	2x	19.67	**2*n*=22 First ever chromosome count**
6.	*Asparagus racemosus* Willd. (x=11)	Asparagaceae	11	2x	100	**2*n***=20, 22, 30, 40, 40+1-3B, 48
7.	*Astragalus melanostachys* Benth. ex Bunge (x=6)	Fabaceae	6	2x	100	**2*n***=12
8.	*Boenninghausenia albiflora* (Hook.) Rchb. ex Meisn (x=10)	Rutaceae	10	2x	100	**2*n***=16, 18, 20
9.	*Catamixis baccharoides* Thomson (x_2=17)	Asteraceae	17	2*x*	100	**2*n*=34 First ever chromosome count**
10.	*Christella papilio* (C. Hope) K. Iwats.] (*x*=36)	Aspleniaceae	36	2*x*	100	**2*n***=72, 144
11.	*Delphinium ajacis* L. (*x*=8)	Ranunculaceae	8	2*x*	100	**2*n***=16, **3*n*=** 24, 26

Table contd…..

S. No	1	2	3	4	5	6
12.	*Delphinium brunonianum* Royle (*x*=8)	Ranunculaceae	8	2*x*	100	**2*n***=16, 32
13.	*Eulophia dabia* (D.Don) Hochr. (*x*=6 ?)	Orchidaceae	24	8*x*	100	**2*n***=48, 54
14.	*Gentiana kurroo* Royle (*x*=13)	Gentianaceae	13	2*x*	100	**2*n***=26
15.	*Hedychium flavum* Roxb. (*x*=17)	Zingiberaceae	17	2*x*	100	**2*n***=34, 52
16.	*Hedysarum microcalyx* Baker (*x*=6)	Fabaceae	7	2*x*	100	**2*n***=14
17.	*Himalaiella heteromalla* (D.Don) Raab-Straube (*x*=8)	Asteraceae	16	4*x*	100	**2*n***=16, 32, 34
18.	*Ipomoea nil* (L.) Roth (*x*=15)	Convolvulaceae	15	2*x*	100	**2*n***= 30, 30+0-3B
19.	*Jasminum parkeri* Dunn (*x*=13)	Oleaceae	13	2*x*	100	**2*n***=26 **New record for India.**
20.	*Kaempferia rotunda* L. (*x*=11)	Zingiberaceae	11	2*x*	100	**2*n***=22, 24
21.	*Lilium polyphyllum* D. Don ex Royle (*x*=12)	Liliaceae	12	2*x*	100	**2*n***=24
22.	*Mahonia jaunsarensis* Ahrendt (*x*=14)	Berberidaceae	14	2*x*	100	**2*n***=28 **First ever chromosome count**
23.	*Nervilia crociformis* (Zoll. & Moritzi) Seidenf. (*x*=10 ?)	Orchidaceae	2*n*=40	4*x*	100	**2*n***=20, c 40, 144
24.	*Ophioglossum reticulatum* L. (*x*=30)	Ophioglossaceae	*c* 630	21*x*	100	**2*n***=720,870, 900, 960, 990, 1020, 1140,1260
25.	*Oxalis debilis* Kunth (*x*=7)	Oxalidaceae	14	4*x*	100	**2*n***=14, 22, 28, 30

Table contd…..

S. No	1	2	3	4	5	6
26.	*Papaver rhoeas* L. (*x*=7)	Papaveraceae	7	2*x*	100	**2*n***=14, 21, 28, 30, 36, 42
27.	*Persea odoratissima* (Nees) Kosterm. (*x*=12)	Lauraceae	12	2*x*	100	**2*n***=24+0-2B
28.	*Phlomoides superba* (Royle ex Benth.) Kamelin & Makhm. (*x*=11)	Lamiaceae	11	2*x*	100	**2*n***=22
29.	*Physalis angulata* L. (*x*=12)	Solanaceae	24	4*x*	100	**2*n***=48
30.	*Physalis minima* L. (*x*=12)	Solanaceae	24	4*x*	100	**2*n***=48
31.	*Pogostemon pumilus* (Graham) Press (*x*=8)	Lamiaceae	16	2*x*	100	**2*n***=32 **First ever chromosome count**
32.	*Rhynchoglossum obliquum* Blume, (*x*=10)	Gesneriaceae	10	2*x*	100	**2*n***=10 **New record for India.**
33.	*Sophora mollis* (Royle) Baker (*x*=9)	Fabaceae	9	2*x*	100	**2*n***=18
34.	*Stephania glabra* (Roxb.) Miers (*x*=13)	Menispermaceae	13	2*x*	100	**2*n***=26 **New record for India.**
35.	*Tricholepis roylei* Hook.f. (*x*=8)	Asteraceae	16	4*x*	100	**2*n***=32
36.	*Vitex negundo* var. *purpurascens* Sivar. & Moldenke (*x*=6,8)	Lamiaceae	16	4*x*	100	**2*n***=24, 26, 32, 34 **First ever chromosome count at *variety* level**
37.	*Withania somnifera* (L.) Dunal (*x*=12)	Solanaceae	24	4*x*	100	**2*n***=24, 48,72

* Darlington and Wyile (1955); Fedorov (1969); Ornduff (1966, 1967); Moore (1970, 1971, 1972, 1973, 1974, 1977); Löve and Löve (1982, 1986); Goldblatt (1981, 1984, 1985, 1988); Goldblatt and Johnson (1990, 1991, 1994, 1996, 1998, 2000, 2003, 2006), Kumar and Subramanian (1986); Khatoon and Ali (1993) and IAPT/IOPB and SOCGI Chromosome Reports and journals concerned with chromosome reports.

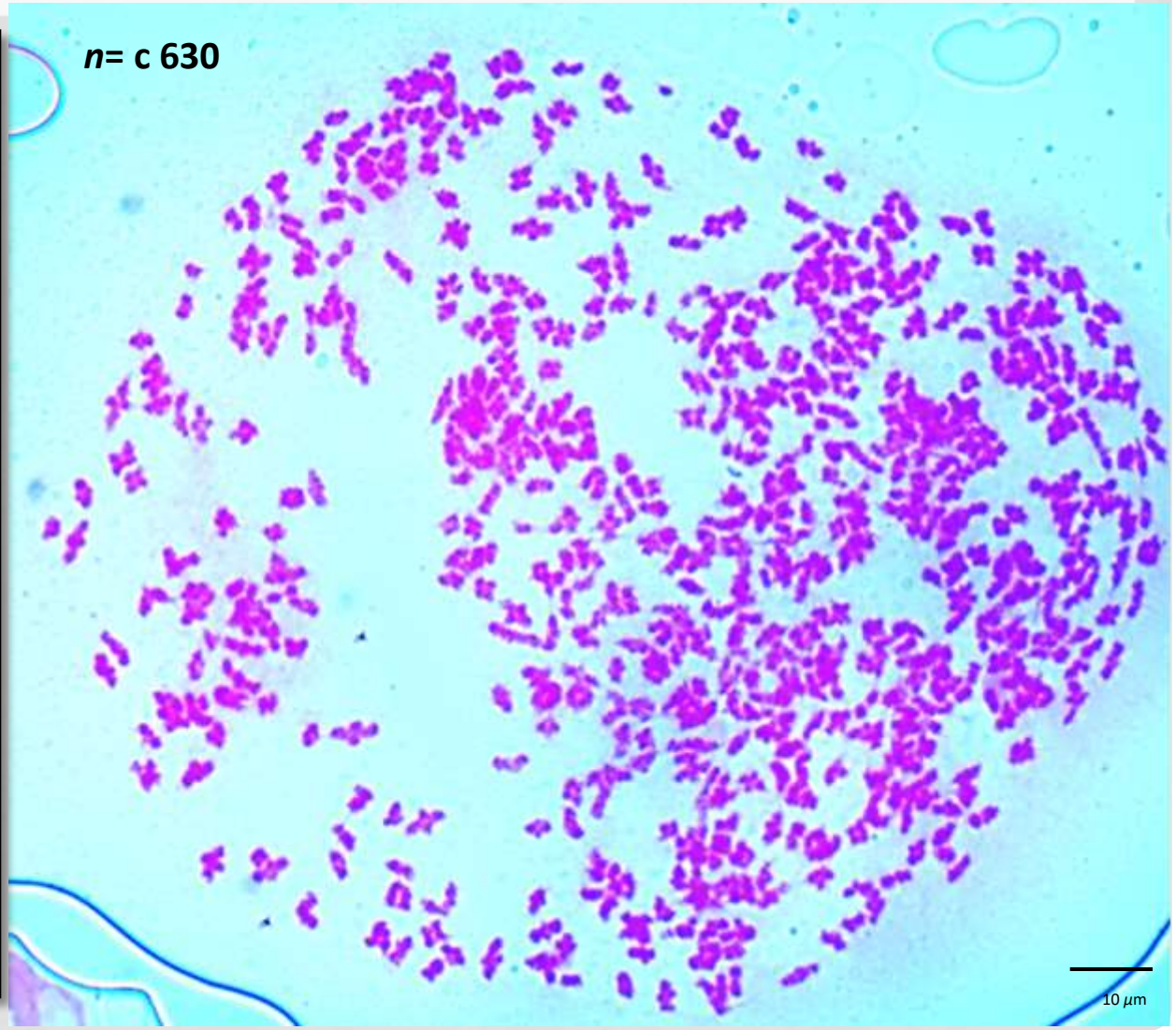
OUTCOME OF THE PROJECT

Chromosome count/s New to Science: 04	1. *Catamixis baccharoides* Thomson, 2n=2x =34 2. *Mahonia jaunsarensis* Ahrendt, 2n=2x=28 3. *Pogostemon pumilus* (Graham) Press, 2n=2x=32 4. *Vitex negundo* var. *purpurascens* Sivar. & Moldenke, 2n=4x=32
Chromosome count/s New to India: 03	1. *Rhynchoglossum obliquum* Blume, 2n=2x=20 2. *Stephania glabra* (Roxb.) Miers, 2n=2x=26 3. *Jasminum parkeri* Dunn, 2n=2x=26
First ever mitotic counts : 02	1. *Phlomoides superba* (Royle ex Benth.) Kamelin & Makhm., 2n=2x=22 2. *Jasminum parkeri* Dunn, 2n=2x=26
Chromosome count/s New to western Himalaya: 01	1. *Sophora mollis* (Royle) Baker, 2n=2x=18
First ever SEM based study in the species: 02	1. *Alstonia venenata* R. Br. 2. *Lilium polyphyllum* D. Don ex Royle
Threatened species studied: 14	*Aconitum heterophyllum* Wall. ex Royle (CR); *Allium stracheyi* Baker; *Alstonia venenata* R. Br.; *Catamixis baccharoides* Thomson (CR); *Eulophia dabia* (D.Don) Hochr; *Gentiana kurroo* Royle (CR); *Hedysarum microcalyx* Baker; *Jasminum parkeri* Dunn (Point endemic); *Lilium polyphyllum* D. Don ex Royle; *Mahonia jaunsarensis* Ahrendt (Endemic to Jaunsar); *Nervilia crociformis* (Zoll. & Moritzi) Seidenf.; *Phlomoides superba* (Royle ex Benth.) Kamelin & Makhm.; *Sophora mollis* (Royle) Baker; *Tricholepis roylei* Hook.f. (Point endemic)

OPHIOGLOSSUM RETICULATUM L.

ORGANISM WITH THE **HIGHEST** RECORDED CHROMOSOME NUMBER,

***2n*= 1260**



SUMMARY

- The total numbers of species cytologically studied in this whole project are **37**. These species are distributed among 34 genera, belonging to 24 families of dicots, monocots and ferns.
- New chromosome count/s to Science/ New to India, First ever mitotic counts, Chromosome count New to western Himalaya & First ever SEM based study
- **Meiotic abnormalities**: Cytomixis, Laggards, Micronuclei in sporads, Pyknotic chromatin (pollen fertility not affected to greater extent) – In three species
- **Structural heterozygosity-** High sterility (80.33%)- *Alstonia venenata* R. Br.
- **Secondary associations-** *Withania somnifera* (L.) Dunal
- **Polyploidy**: Chromosome analysis showed that 70.27 % (26) species are polyploids (4x to 21x) while only 29.73 % (11) existed at diploid level. Basic chromosome number in studied taxa ranges between 6 to 36.
- **Aneuploidy** (30%) is also common among the taxa.
- From above analysis it is quite evident that polyploidy has played important role in the evolution these species.
- Further detailed studies such as reproductive biology, karyomorphology and palynology using SEM are suggested in *Catamixis baccharoides* Thomson and *Jasminum parkeri* Dunn.

PUBLICATIONS

RESEARCH PUBLICATIONS FROM AAP 2020-2021

1. **PUNEET KUMAR**, H. SINGH AND S.K. SINGH. 2021. Karyomorphological and SEM studies in newly discovered populations of a critically endangered medicinal plant —*Lilium polyphyllum* D. Don ex Royle from a high altitude protected area of north-western Himalaya. *Microscopy Research and Technique*. Published online 0n 20 April, 2021, https://doi.org/10.1002/jemt.23784 (Impact factor= **2.117**; NAAS RATING=8.12; SCOPUS).
2. **PUNEET KUMAR**, AND S.K. SINGH. 2021. High pollen sterility relatable to structural heterozygosity, and SEM study in Poison Devil Tree (*Alstonia venenata* R.Br.). *Cytologia* **86**(2); (*In press*). (Impact factor=**0.795**; NAAS RATING=6.80; SCOPUS)

Research Publications from previous AAPs AND Non-AAP projects

1. SINGH, H., SINGH, J., **PUNEET KUMAR.**, SINGHAL, V.K., B.S. KHOLIA & L. M. TEWARI. 2020. Chromosome count, male meiotic behaviour and pollen fertility analysis in *Agropyron thomsonii* Hook.f. and *Elymus nutans* Griseb. (Triticeae: Poaceae) from Western Himalaya, India. *Caryologia* 73(2): 89-98. doi: 10.13128/caryologia-618 (Impact factor=**0.621**;NAAS RATING=6.62; SCOPUS)
2. **PUNEET KUMAR**., SINGH H. AND .JALAL J. S. 2020. A note on *Corallorhiza trifida* Chatel.: A lesser known partial myco-heterotrophic orchid from Himachal Pradesh, Western Himalaya, India. *Indian Forester*. 146(6): 565-566. (NAAS RATING=5.10)
3. **PUNEET KUMAR**, H.SINGH AND KUMAR A. 2020. Traditional knowledge of medicinal and threatened plants used by the local inhabitants dwelling in and around Sechu-Tuan Nalla: a high altitude wildlife sanctuary in Himachal Pradesh, northwest Himalaya. pp 329-333. In: *Proceedings of International Biodiversity Congress (IBC 2018)* held at Forest Research Institute, Dehradun, India, 4-6 October, 2018.
4. AAKRITI BHANDARI, HARMINDER SINGH, AMBER SRIVASTAVA, **PUNEET KUMAR**, G.S. PANWAR AND A.A. MAO. 2021. In vitro propagation and cytological analysis of Sophora mollis Royle: an endangered medicinal shrub. *Journal of Genetic Engineering and Biotechnology* 19:40, https://doi.org/10.1186/s43141-021-00140-3 (SCOPUS)
5. PÁEZ, V. DE LOS A., A.R.ANDRADA, **PUNEET KUMAR**, M. S. CARO. 2021. Cytomixis in Angiosperms from Northwestern Argentina. *Botany Letters*, Published online: https://doi.org/10.1080/23818107.2021.1903994 (Impact factor=**1.048**; SCOPUS)
6. SRIVASTAVA A., SINGH H., BHANDARI A., PUNEET KUMAR, PANWAR, G.S. AND MAO, A.A. Ornamental potential of *Gentiana kurroo* could be a boon for its survival: a critically endangered species. *Indian Forester*. Communicated.
7. **PUNEET KUMAR**, H. SINGH AND S.K. SINGH. Utilization and conservation of threatened plants in Sechu Tuan Nalla Wildlife Sanctuary: a high altitude protected area of Western Himalaya: Uses and conservation of threatened plants. *Journal of Threatened Taxa*. Communicated.
8. MISHRA, A. P., A. SRIVASTAVA., A. BHANDARI., **PUNEET KUMAR**., G. S. PANWAR AND A. A. MAO.. Site suitability analysis for the critically endangered *Aconitum heterophyllum* in Alpine regions of Uttarakhand using Analytic Hierarchy Process. *Journal of Herbs, Spices and medicinal Plants*. Communicated.
9. **PUNEET KUMAR**, P.K. DEROLIYA AND S.K. SINGH. *Veronica ciliata* subsp. *cephaloides (*Pennell) D.Y Hong: a new record for the flora of Himachal Pradesh (India) and an updated list of taxa of genus *Veronica* L. in India. *Indian Journal of Forestry*. Communicated.

OTHER RESPONSIBILITIES/DUTIES

- ✓ NMHS (LG)-Conservation of Threatened Plants in Indian Himalayan Region: Recovery and Capacity Building (2018-2021) as CoPI
- ✓ ABG-Ex-situ Conservation of Economical, Endemic and Threatened Plant Species of Western Himalaya through augmentation of infrastructural facilities in existing Botanic Gardens of Botanical Survey of India, Dehradun (2019-2022) as CoPI
- ✓ Compiled chromosome data of 259 taxa of Poaceae towards updating the Chromosome Atlas of Indian Plants
- ✓ At present compiling chromosome data for family Asteraceae of Cold Deserts of Western Himalayas.
- ✓ **Functioned as In-charge of Technical section:** Supervised the monthly, quarterly, annual progress reports as per AAP for the centre, etc.
- ✓ Attended all technical queries and provided necessary information as and when required by Head qtrs.
- ✓ Performed other assigned duties : E-tendering and member purchase department committee


Thank you