

## Evaluative Report of the Department (2009-2013)

1. **Name of the Department :** Botany
2. **Year of establishment :** Established in 1919 at Lahore and shifted to Chandigarh in 1960
3. **Is the Department part of a School/Faculty of the university?** Yes
4. **Names of programmes offered (UG, PG, M.Phil., Ph.D., Integrated Masters; Integrated Ph.D., D.Sc., D.Litt., etc.):**  
UG (Hons. Sch.) PG (Hons. Sch.), M.Phil. and Ph.D.
5. **Interdisciplinary programmes and departments involved:**  
U.G. (Hons. School), M.Sc. (Hons. School), M. Phil and Ph.D.
6. **Courses in collaboration with other universities, industries, foreign institutions, etc. :** Nil
7. **Details of programmes discontinued, if any, with reasons:** NIL
8. **Examination System: Annual/Semester/Trimester/Choice Based Credit System:**  
Semester System
9. **Participation of the department in the courses offered by other departments**  
Department of Zoology, Bio-chemistry English (subsidiary courses), Pharmacy, Bio-physics and Biotechnology (for basic botany)
10. **Number of teaching posts sanctioned, filled and actual (Professors/Associate Professors/Asst. Professors/others):**

	Sanctioned	Filled	Actual Including CAS & MPS)
Professor	13	09	3+9 (RPS) +1 P.N. Mehra Professor of Botany
Associate Professors	05	02	3+2 (RPS)
Asst. Professor	09	02	09
Others	-	-	-

**11. Faculty profile with name, qualification, designation, area of specialization, experience and research under guidance.**

Name	Qualification	Designation	Specialization	No. of year of Experience	No. of Ph.D./ M. Phil students guided for the last four years
A. S. Ahluwalia	Ph.D.	Professor	Phycology, Environment & Biodiversity	33	Ph.D. =2 M. Phil =1
Daizy R. Batish	Ph.D.	Professor	Ecology, Biodiversity, Forestry, Pteridophytes	19	Ph.D. =3 M. Phil =2
C. Nirmala	Ph.D.	Professor	Cytogenetics, Biotechnology	23	Ph.D. =2 M. Phil =3
Promila Pathak	Ph.D.	Professor	Plant Tissue Culture and Biotechnology, Plant Morphogenesis, Angiosperms, Micropropagation and Conservation, Indian Orchids	19	Ph.D. = 3
Harsh Nayyar	Ph.D.	Professor	Plant Physiology, Plant Anatomy Environmental stresses	25	Ph.D. =3 M. Phil =1
Sunita Kapila	Ph.D.	Professor	Bryology, Cytogenetics	27	M. Phil = 3
I. B. Prasher	Ph.D.	Professor	Mycology and Plant Pathology	29	Ph.D. =3 M. Phil =1
Rich Puri	Ph.D.	Professor	Economic Botany, Taxonomy, Seed	18	Ph.D. =3 M. Phil =2

			Physiology, Medicinal Plants		
Neera Garg	Ph.D.	Professor	Plant Physiology, Plant-microbe interactions, Stress Physiology	21	Ph.D. =4 M. Phil =2
Anju Rao	Ph.D.	Associate Professor	Plant Tissue Culture, Morphogenesis, Bryology, Cytogenetics	19	M. Phil = 2
Kamajit Singh	Ph.D.	Associate Professor	Plant Physiology & Biochemistry	14	Ph.D. =1 M. Phil =4
M. C. Sidhu	Ph.D.	Assistant Professor	Cytogenetics, Plant Breeding, Medicinal Plants	11	M. Phil =3
Dr. A. N. Singh	Ph.D.	Assistant Professor	Ecology & Environment, Restoration Ecology; Forestry Engineering, Forest Ecology, Plant Ecology, Soil Biology & Biochemistry, Invasion Ecology; Phytoremediation	11	M. Phil = 2

12. List of senior Visiting Fellows, adjunct faculty, emeritus professors:

Prof. Rakesh Tuli, FNA Director NABI, Mohali.	Prof. R. R. Rao, FNA CSIR Emeritus Scientist, CIMAP, Bangalore
Prof. H.D. Kumar, FNA Department of Botany, B.H.U., Varanashi	Prof. P. S. Ranakrishnan, FNA JNU, New Delhi
Prof. Anil Grover, FNA Head, Department of Plant Molecular Biology, University of Delhi, South Campus, New Delhi	Prof. J. P. Khurana, FNA Department of Plant Molecular Biology, University of Delhi, South Campus, Delhi
Prof. S.P. Singh, FNA Former Vice Chancellor Advisor, State Planning Commission Govt. of Uttarakhand, 41/I, Vasant Vihar, Dehradun -248006	Prof. A. K. Bhatnagar Department of Botany Delhi University, Delhi
Prof. G. R. Shivamurthy Department of Botany Mysore University, Mysore	Prof. Renu Bhardwaj Department of Botanical and Environmental Studies G.N.D. U., Amritsar (Pb.)
Prof. Inderjit Singh Department of Environmental Biology University of Delhi, Delhi	Prof. R. Baskar Department of Environmental Sciences of Enginnering Guru Jambheshwar University Hisar (Haryana)
Prof. Bijoy Singh (ICAR National. Professor), P.A.U., Ludhiana	Dr. Manjit Singh Director Directorate of Mushroom Research and Training Chambaghat, <b>Solan</b> (H.P.)
Dr. D. C. Uprety Emeritus Scientist and National Fellow Division of Plant Physiology Indian Agricultural Research Institute PUSA, New Delhi	Dr. Paramjit Singh Director Botanical Survey of India (BSI) Kolkata (W.B.)

Professor Kadambot H.M. Siddique. Chair in Agriculture and Director The UWA Institute of Agriculture The University of Western Australia, Australia	Prof. S. S. Chahal Vice-Chancellor Desh Bhagat University Mandi Gobindgarh (Pb.)
Prof. Prem Jauhar Professor of Cytogenetics USDA North Dakota, USA	Prof. C. Monoharachary Emeritus Professor Department of Botany, Osmania University Hyderabad
Ashok K. Dhawan Director, Centre for Plant Biotechnology Department of Science & Technology CCS HAU New Campus, Hisar	Prof. T. N. Lakhanpal H.P. University, Shimla

13. **Percentage of classes taken by temporary faculty – programme-wise information:**  
NIL

14. **Programme-wise Student Teacher Ratio** 1:10

15. **Number of academic support staff (technical) and administrative staff:**

Sanctioned	52
Filled	30
Vacant	22

16. **Research thrust areas as recognized by major funding agencies:**

**Some of the major areas of research are recognized by the major funding agencies:**

Diversity of Lower plants including Algae, fungi (UGC -SAP), MOE, CSIR

Tissue culture of Orchids, Bamboos (DBT, DST, UGC)

Medicinal Plants: Etho-botanical studies, Propagation studies, Active ingredients (DST, UGC)

Plant Physiology: Environmental stresses (MOA, DBT, DST, UGC)

Ecology: Invasive plants, Bio-herbicides (DST, UGC)

Restoration ecology: (UGC)

17. Number of faculty with ongoing projects from a) national b) international funding agencies and c) Total grants received. Give the names of the funding agencies, project title and grants received project-wise.

#### RESEARCH PROJECTS

Sponsor	Title	Funds Sanctioned (Rs.)	Duration From To	Principal Investigator and Research Team
DST	Award of JC Bose Fellowship	68,00,000/-	July 1, 2012 to June 30, 2017	Prof. R. K. Kohli
Ministry of Food Processing Industries, Govt. of India, New Delhi	Development of Processing Techniques for preserving Juvenile shoots of nutritionally rich edible bamboos of the sub Himalayan and Northeast region of India	1,06,92,000/-	Oct. 1, 2011 to Sept. 30, 2013	Prof. C. Nirmala Prof. M. S. Bisht (NEHU)
UGC	Role of silicon and Arbuscular mycorrhiza in mitigating the adverse effects of heavy metal stress in <i>Cajanus cajan</i> (L.) Millsp.	10,35,800/-	April, 2013 to March, 2016	Prof. Neera Garg
UGC, New Delhi	In-vitro propagation of some commercially important bamboos	11,25,800/-	April 1, 2012 to March 31, 2015	Prof. C. Nirmala
Ministry of Agriculture	Improving Heat Tolerance in chickpea or enhancing its productivity in Warm Growing Conditions and Mitigating Impacts of Climate Change with ICRISAT (International	37,59,000/-	March 2010 to February 2014	Prof. Harsh Nayyar

	Crops Research Institute for Semi-arid tropics)			
DST (Indo-Australian Joint Research Project)	Securing chickpea productivity under contemporary abiotic stresses: Improvement of podding and seed-filling under heat, drought and salinity with University of Western Australia, Australia and ICRISAT(International Crops Research Institute for Semi-arid tropics)	32,34,000/-	Nov. 2, 2011 to Nov. 1, 2014	Prof. Harsh Nayyar
UGC SAP-DRS-III	Special Assistance Program (SAP) DRS-III	39,50,000/-	April 1, 2013 to 31.3.2018	Prof. I.B. Prasher Coordinator Prof. A. S. Ahluwalia Deputy Coordinator
DST	Screening, Selection and Propagation of Elite Genotypes of Some Selected Species of Medicinal Plants from the State of Punjab	12,00,000/-	Dec.1 2013 to Nov. 30, 2015	Dr. M.C. Sidhu
	G. Total	3,17,96,600/-		
	Rs.			

## 18. Inter-institutional collaborative projects and associated grants received

### a) National collaboration

The department has collaboration with the following institutes:

1. IHBT, Palampur (Tissue culture and biodiversity conservation)
2. T.C.C.P (Tissue Culture for Crop Plants) Foet Collins, Colorado, USA
3. H.P. Agricultural University, Palamapur (DBT Project)
4. P.A..U., Ludhiana (Indo-Australian Project)
5. Indian Institute of Pulse Research, Kanpur (MOA Project)

## **b) International collaboration**

International Crops Research Institute for Semi-arid tropics (MOA Project)  
CSIRO, Western Australia, Australia, Indo-Australian, DST Project  
University of Western Australia, Perth, Australia, Indo-Australian, DST Project

19. **Departmental projects funded by DST-FIST; UGC-SAP/CAS, DPE; DBT, ICSSR, AICTE, etc.; total grants received.** Rs. 3,17,96,600/-

### **20. Research facility / centre with**

- **state recognition collaborative project with:** PAU, Ludhiana
- **national recognition: collaborative projects with** PAU, Ludhiana and H.P. Agricultural University, Palampur
- **international recognition :** Projects with ICRISAT, Indo-Australian, DST Project

21. **Special research laboratories sponsored by / created by industry or corporate bodies :** No

### **22. Publications:**

- **Number of papers published in peer reviewed journals (national / international) :** 172
- **Monographs**
- **Chapters in---** Books: 7 \* Edited books: 3
- Books with ISBN with details of publishers
- Invasive Plant Ecology: (Eds. S. Jose, H.P.Singh, D.R.Batish and R.K.Kohli) CRC Press, Taylor and Francis Pub. USA Catalog no. 4398; 282 pp., ISBN: 978-1-4398-8126-2 (hardback) 2013.
- Invasive plants and Forest Ecosystems (Eds. Ravinder Kumar Kohli, Shibu Jose, Harminder Pal Singh, Daizy Rani Batish) CRC Press, Taylor and Francis Pub. USA Catalog no. 43374, 456 pp., ISBN: 978-1-4200-4337-2, ISBN 10: 1420043374; 2009.
- Number listed in International Database (For *e.g.* Web of Science, Scopus,
  - Humanities International Complete, Dare Database - International Social Sciences Directory, EBSCO host, etc.):
- **Citation Index:** 0-1000 – **range / average \* SNIP:** None Scopus:  
**SJR:** None **Impact Factor** 0.1 to 4.5 –**range/ average \* h-index :** 2-27

23. **Details of patents and income generated:** NIL

24. **Areas of consultancy and income generated:** NIL



**25. Faculty selected nationally / internationally to visit other laboratories / institutions industries in India and abroad: :**

08 Faculty members are selected nationally/ internationally to visit laboratories/ institutions in India and abroad.

**26. Faculty serving in**

- a) **National committees b) International committees c) Editorial Boards d) any other (please specify):**

09 Faculty members are serving in National, International Committees and Editorial board.

**27. Faculty recharging strategies (UGC, ASC, Refresher / orientation programs, workshops, training programs and similar programs).**

Faulty members are recharging their strategies through UGC-ASC Refresher/ Orientation Programs, Workshops, Training programmes etc. in various universities/ institutions.

**28. Student projects**

- **percentage of students who have done in-house projects including inter-departmental projects :** 100% for M. Sc students
- **percentage of students doing projects in collaboration with other universities : ASA, industry / institute:** Nil

**29. Awards / recognitions received at the national and international level by Faculty**

**Honours and Awards of Faculty:**

1. Best Scientist Award of Haryana (Haryana Vigyan Ratna Award) for 2008-09, carrying cash award of Rs 1 lac, a citation and trophy from the Government of Haryana. (D.O. No PS/1897 dated 03-12-09)
2. Nominated by Ministry of Environment GoI as Chairman of the State Expert Appraisal Committee for Environmental clearances for any developmental activities for UT Chandigarh under EIA (Vide Gazette Notification of Aug 21, 2009,)
3. Awardee of UGC special honorarium of Rs 15000/- pm till retirement for being Fellow of 2 academies
4. Certified Senior Ecologist (Highest global Accreditation) by Board of Professional Certification, ESA, USA, 2005-15
5. First Friday Forum Award for creativity in Environment – 10-9-2010

## **Fellowships and Academic Honours / Professional Leadership**

1. Fellow, Indian National Science Academy New Delhi, 2012 (FNA)
2. Fellow, Indian Academy of Sciences, Bangalore, 2011 (FASc.)
3. FNASc, Allahabad
4. FNAAS
5. J.C. Bose Award, New Delhi, 2012
6. Professor Y.S. R. K. Sarma Award, 2011
7. President, Asian Allelopathy, Society 2012-2015
8. Prof. P. N. Mehra Award 2012
9. Fellow Indian Fern Society
10. Awarded two Indo-Australian Projects under Australia-India Strategic Research
11. Elected Fellow Linnean Society of London, 2012
12. Mrs. Usha Vij Memorial Award, 2011 by The Orchid Society India at Allahabad,
13. UGC Research Award in 2009
14. Young Scientist Award in Botany (Society of Plant Research, India), 2012
15. Fellow, Indian Botanical Society, 2013.
16. Editors, members of editorial Board & Reviewers of various journals.

- **Doctoral / post doctoral fellows:**04 with some Faculty members

### **30. Seminars/ Conferences/Workshops organized and the source of funding (national/ international) with details of outstanding participants, if any.**

National Seminar Organized: 14,  
International Seminar: 02,  
Source of Funding: UGC, DST, DBT, ICAR, CSIR and  
Outstanding Participants: 40-50

### **31. Code of ethics for research followed by the departments:**

- Anti-plagiarism software being used to check plagiarism,
- No duplication of work is carried out,
- Research students are being monitored strictly on the basis of six-monthly reports and presentations before a Departmental committee
- Research work is being published in Peer-reviewed national and international journals
- Research is being monitored by external experts especially for UGC-SAP and International projects.
- Every synopsis for Ph.D. registration is presented for recommendation before research degree committee chaired by Dean Faculty of Science.

### 32. Student Profile Programme -wise

Session	Name of the Programme	Application Received	Selected		Pass percentage	
			Male	Female	Male	Female
2009-2010	B.Sc.(Hons.Sch.)1 <sup>st</sup> year	Record with Joint Admission Committee	-	10	-	80
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year		-	09	-	100
	B.Sc.(Hons.Sch.)3 <sup>rd</sup> year		02	03	100	100
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	143	06	38	100	100
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year		02	28	100	100
	M.Phil	10	01	09	100	100
	Ph.D.	-	01	04	-	-
2010-2011	B.Sc.(Hons.Sch.)1 <sup>st</sup> year	Record with Joint Admission Committee	06	13	100	61
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year		-	09	-	25
	B.Sc.(Hons.Sch.)3 <sup>rd</sup> year		-	09	-	100
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	137	06	29	100	100
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year		06	38	100	100
	M.Phil	27	01	14	100	100
	Ph.D.	39	03	23		
2011-2012	B.Sc.(Hons.Sch.)1 <sup>st</sup> year	Record with	01	09	100	87

	year	Joint Admission Committee				
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year		06	13	83	76
	B.Sc.(Hons.Sch.)3 <sup>rd</sup> year		-	08	-	87
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	137	04	36	100	100
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year		06	29	100	100
	M.Phil	29	01	14	100	100
	Ph.D.	19	03	09	-	-
2012-2013	B.Sc.(Hons.Sch.)1 <sup>st</sup> year	Record with Joint Admission Committee	02	18	50	62
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year		01	09	100	66
	B.Sc.(Hons.Sch.)3 <sup>rd</sup> year		06	13	100	100
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	115	03	30	100	100
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year		04	34	100	100
	Ph.D.	21	04	13	-	-

### 33. Diversity of students

Session	Name of the Programme	% of students from the same University	% of students from other Universities within the State	% of Students from universities outside the State	% of students from other Countries
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<b>2009-2010</b>	B.Sc.(Hons.Sch.)1 <sup>st</sup> year				
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year				
	B.Sc.(Hons.Sch.)3rd year				
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	73%	-	27%	
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year				
	M. Phil	60%	-	40%	
<b>2010-2011</b>	B.Sc.(Hons.Sch.)1 <sup>st</sup> year				
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year				
	B.Sc.(Hons.Sch.)3rd year				
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	77%		23%	
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year				
	M. Phil	87%	-	13%	
<b>2011-2012</b>	B.Sc.(Hons.Sch.)1 <sup>st</sup> year				
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year				
	B.Sc.(Hons.Sch.)3rd year				
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	62%		38%	
	M.Sc.(Hons.Sch.) 2 <sup>nd</sup> year				
	M. Phil	93%	-	7%	
<b>2012-2013</b>	B.Sc.(Hons.Sch.)1 <sup>st</sup> year				
	B.Sc.(Hons.Sch.)2 <sup>nd</sup> year				
	B.Sc.(Hons.Sch.)3rd year				
	M.Sc.(Hons.Sch.)1 <sup>st</sup> year	45%		55%	

	M.Sc.(Hons.Sch.) year	2 <sup>nd</sup>			
	M. Phil	93%		7%	

**34. How many students have cleared Civil Services and Defence Services examinations, NET, SET, GATE and other competitive examinations? Give details category-wise.**  
NET = 11 and GATE: 03

**35. Student progression**

Session	Student Progression	Percentage against enrolled
2009-2010	UG To PG	100
2010-2011	UG To PG	100
2011-2012	UG To PG	100
2012-2013	UG To PG	89

**36. Diversity of staff**

<b>Percentage of faculty who are graduates</b>	
of the same university	30%
from other universities within the State	35%
from universities from other States	35%
from universities outside the country	Nil

**37. Number of faculty who were awarded M.Phil., Ph.D., D.Sc. and D.Litt. during the assessment period:** NIL

**38. Present details of departmental infrastructural facilities with regard to**

a) **Library :** YES

b) **Internet facilities for staff and students:** YES

- c) **Total number of class rooms:** 06
- d) **Class rooms with ICT facility:** 02
- e) **Students' laboratories:** 05
- f) **Research laboratories:** 13

**39. List of doctoral, post-doctoral students and Research Associates**

**Post-Doctoral students**

- a) **from the host institution/university** = 02
- b) **from other institutions/universities** =01

**Number of post graduate students getting financial assistance from the university.**  
04

**40. Was any need assessment exercise undertaken before the development of new programme(s)? If so, highlight the methodology.**

As per UGC guidelines new course work comprising of 3 papers in one semester has been started for Ph.D. students.

The courses were designed following the UGC-CSIR-NET syllabus to improve the success rate in these examinations.

**41. Does the department obtain feedback from:**

a. Faculty on curriculum as well as teaching-learning-evaluation? If yes, how does the department utilize the feedback? All members give their suggestions on these aspects during BOC meetings, faculty meetings and academic council meetings.

**b. students on staff, curriculum and teaching-learning-evaluation and how does the department utilize the feedback? :**

Yes, at class level Teachers, at the end of every semester, interact with the entire class for feed-back and incorporates the suggestions/concerns raised by the students in subsequent courses

**c. alumni and employers on the programmes offered and how does the department utilize the feedback?:**

Alumni are being invited for delivering lectures during orientation and refresher courses, frequently as also to interact with students from time to time.

**42. List the distinguished alumni of the department (maximum 10):**

Profs. P. N. Mehra, K. S. Thind, K. K. Nanda, P. S. Ramakant, C. P. Malik, P. K. Khosla, H.S. Sohi, Deepak Pental, S. C. Verma

**43. Give details of student enrichment programmes (special lectures / workshops / seminar) involving external experts:**

Prominent scientists are being invited in the department to deliver lectures to the Research scholars and P.G. students. The students of all the classes are encouraged to attend the special lectures and seminars conducted by the department.

**44. List the teaching methods adopted by the faculty for different programmes:**

In addition to teaching through modern techniques, seminars, symposia, workshops, and invited lectures, botanical excursions are an integral part of academic programme. Audio-visual aids, computers, online topics, software for analysis data.

**45. How does the department ensure that programme objectives are constantly met and learning outcomes are monitored?**

- Regular monitoring by departmental and University-level committees.
- Regular presentations by Research scholars before the Departmental committee at 6 monthly intervals to follow their research progress.
- Synopsis seminars are conducted frequently to facilitate the research of Ph.D students.
- Viva-voce examinations are conducted swiftly to avoid any delays
- Frequent and swift holding of various departmental committee meetings to stream-line and facilitate the academic, administrative and technical activities.
- Store purchases are being monitored by the technical committee to ensure rapid delivery of the research-related items to the research students.

**46. Highlight the participation of students and faculty in extension activities:**

The faculty of the department delivers lectures at various orientation and refresher courses. The students participate in extension activities being organised by the University and Students council. Research scholars and students participate in organization of conferences and cultural activities as well

**47. Give details of “beyond syllabus scholarly activities” of the department:**

Emphasis is being laid on to hold national and International Seminars, Quiz during students functions, Special lectures on special occasions, Orientations, Workshops, refresher courses, visits to forest areas, aquatic habitats etc.

**48. State whether the programme/ department is accredited/ graded by other agencies? If yes, give details. NIL**

**49. Briefly highlight the contributions of the department in generating new knowledge, basic or applied.**

**Algae**

**Contributions:** Mechanisms controlling heterocyst and Akinetes formation in Algae elucidated, algal culture, especially for Biofuels.



Refinements in culture conditions of various algal species to improve the output. Research initiated on *Spirulina-an alga enriched with proteins*, which will be useful for food industry. Studies on algal biodiversity in different north regions of the country.

**Future Plan:** Development of protocol for conditions for algal use in biofuel production through exploring algal forms with higher level of lipids and biomass.  
Improved use of algal proteins for hepatoprotection.  
Inventorization and ecological consideration of hillstream phytoplanktons.  
Role of algal consortia for wastewater treatment on a pilot scale and further upgradation.

## **Fungi**

**Contribution:** Inventorization of the fungal diversity of the North-Western Himalayas.  
Studies on fungal populations as sensors of water pollutions.

**Future Plan:** To ensure sustainable utilization of the fungal genetic resources of the N. W. Himalayas for the commercial production of organic acids, industrially important enzymes like lignocellulases and antimicrobial bioactive molecules.

## **Bryophytes**

**Contributions:** Collection, preservation and Cytology of Bryophytes of various regions of the country. Studies on the role of bryophytes in pollution monitoring by heavy metal uptake from the environment

**Future Plan:** Continuation of the previous aspects of research  
Biochemical studies in bryophytes to evaluate their pharmaceutical value.

## **Orchids**

**Contributions:** Diversity, Developmental biology, Micropropagation, and Conservation of commercially important and/or endangered Indian orchids.  
Development of Cost effective micropropagation protocols aimed at conservation and commercialization of orchids.  
Studies on mycorrhizal associations for replenishing natural stocks in some economically important species.  
Development of Synthetic seeds as an efficient storage and delivery system.

**Future Plan:** Extensive field surveys to be undertaken in the Himalayan region especially in the unexplored areas so as to properly assess the orchid diversity in the region, prepare ethnobotanical notes and study pollination biology;  
To develop reproducible and cost effective propagation protocols for the commercially important and/or endangered Indian orchids; and  
To assess the role of mycorrhiza in reducing the mortality rate of TCP's, during lab to land transfer and study restoration ecology

## **Bamboos**

**Contributions:** Assessment of Bamboo shoots for their nutritional value.  
Tissue culture of some selective Bamboo species to increase the propagules

Survey of 128 species of bamboos from different parts of the country

**Future Plans:** Presently working on the nutritional value and phytochemicals of bamboo shoots. Attempts to extract and analyze the bioactive compounds from Bamboo shoots to develop them as functional foods and nutraceuticals  
Preparation of monograph of Bamboos of India.

### **Medicinal Plants:**

**Contribution:** Survey and collection of medicinal plants of Kinnaur, H.P, Chandigarh  
Assessment of Biodiversity and Cytomorphology of Medicinal Plants in Doaba Region of Punjab.  
Screening, Selection and Propagation of Elite Genotypes of Some Selected Species of Medicinal Plants from the State of Punjab in process.

**Future Plan:** Continuation of the ongoing research on medicinal plants and chromosomal studies  
Studies on Medicinal plants for their phytochemicals, micro & macroelements.  
Studies on antibacterial activity of medicinal plants  
Macro-and micro-propagation of elite genotypes of medicinal plants

### **Plant Ecology**

**Contributions:** Studies on role of allelopathy (a type of chemical-mediated interaction) to probe the establishment of weeds particularly invasive aliens.  
Studies on mode of action of allelochemicals.  
Use of volatile essential oils for the effective weed management that holds immense potential for organic farming and may lead to the development of commercially viable herbicides.

**Future Plans:** Focus on the role of volatile organic compounds from plants in alleviating environmental pollution.  
Development of natural herbicides from volatile essential oils of the aromatic plants.

### **Plant Physiology:**

#### **Contributions:**

- Several key responses of Leguminous crops such as Chickpea, Lentil and Mungbean to environmental stresses have been elucidated, which will be vital for screening against cold, heat, drought and salt tolerance.
- Cold tolerant chickpea cultivars have been identified which will be tested at various locations and incorporated into breeding programmes.
- Genes related to cold tolerance in Chickpea have been identified.
- Mechanisms related to heat, drought and salt tolerance have been worked out in various leguminous crops
- Some novel bacterial strains related to growth promotion in Chickpea have been identified
- Collaborations have been established with ICRISAT, Indian Institute of Pulse Research, Kanpur, PAU, Ludhiana, University of Western Australia, CSIRO Australia, ICARDA, Lebanon to jointly work on leguminous crops
- International Projects involving scientists from these organisations have been carried out and are in progress

**Future Plans:**

Identification of genes and QTLs related to cold and heat tolerance in legumes  
Breeding and genetics of cold and heat tolerance  
In-depth studies on Reproductive biology of stressed legumes  
Understanding the physiology of temperature tolerance in legumes

**50. Detail five major Strengths, Weaknesses, Opportunities and Challenges (SWOC) of the department.****Strengths:**

- Biodiversity of lower plants
- Well-equipped Library
- Well-equipped Cyberary
- Latest instrumentation
- Well-equipped Research and Practical Labs
- Botanical Garden
- Funding from all National Organisations

**Weaknesses:**

Lack of experimental fields  
Digital herbaria

**Opportunities and challenges:**

- Excellent facilities for Orientation, Refresher courses and workshops
- Central instrumentation Lab accessible to Teachers and Students of P.U..
- Botanical Garden for training and education
- Fellowships to Students of weaker sections
- Fellowships to toppers
- Research associateships from externally-funded projects
- Creating Jobs for the Students passing out from the department, at various levels

**51. Future plans of the department.****Plan of action of the department for the next five years.**

- Integrated course of M.Sc-Phd.
- Advanced Center for Biodiversity of lower plants
- Digitization of various herbaria
- Molecular biology and genetic engineering Lab
- Smart class rooms for every class
- Addition of advanced equipment in practical labs
- Up-gradation of Museum and herbarium
- Up-gradation of Botanical Garden
- To continue and initiate new research plans as mentioned above

