

Dr Shashi Bhushan,

Senior Scientist



Division of Biotechnology

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1. Institution: CSIR-Institute of Himalayan Bioresource Technology, Palampur – 176061 (HP) India
2. Date of Birth: January 10, 1971
3. Academic Qualification (Undergraduate Onwards)

S. No.	Degree	Year	Subject	University/Institution	% of marks
1	B.Sc.	1994	Horticulture	Dr YS Parmar, UHF Solan (HP)	60.4
2	M. Sc.	1997	Post Harvest Technology	-do-	71.2
3	Ph.D.	2002	Post Harvest Technology	-do-	70.1

4. Ph.D thesis title, Guide's Name, Institute/Organization/University, Year of Award.

Thesis Title: Apple pomace utilization for the production of Baker's Yeast (*Saccharomyces cerevisiae* var *diastaticus*): Process optimization, Evaluation and Performance.

Guide's Name: Dr VK Joshi

University: Dr YS Parmar, UHF Solan (HP)

Year of award: 2002

5. Work experience (in chronological order).

S. No.	Positions held	Name of the Institute	From	To	Pay Scale (Rs)
1	Research Associate	CSIR-IHBT, Palampur, HP, India	Oct. 2002	March 2006	12000.00
2	Assistant Professor	College of Horticulture and Forestry (CAU), Pasighat, Arunachal Pradesh, India	Oct., 2006	Feb., 2007	8000- 275-13500
3	Scientist	CSIR-IHBT, Palampur, HP, India	April 19, 2007	April 18, 2011	15600 – 39100 (GP- 6600)
4	Sr Scientist	CSIR-IHBT, Palampur, HP, India	April 19, 2011	Cont.	15600 – 39100 (GP- 7600)

6. Professional Recognition/ Award/ Prize/ Certificate, Fellowship received by the applicant.

S. No	Name of the Award	Awarding agency	Year
1	Young Scientist Fellow	Department of Science & Technology, India	2006
2	National Productivity Council Fellowship	Asia Productivity Organization, Japan	2012
3	Raman Research Fellowship	Council of scientific and Industrial Research, India	2015

7. Recent ongoing and completed projects

Ongoing project			
1	Development of alternative <i>in vitro</i> systems for mass production of nutraceutical ingredient from high value Himalayan medicinal plants such as <i>Arnebia</i> spp., <i>Picrorhiza kurroa</i> , <i>Panax ginseng</i> , <i>Valeriana jatamansi</i> , <i>Rheum emodi</i> etc.	CSIR	<ul style="list-style-type: none"> Plant cell and organ culture technology based alternative <i>in vitro</i> systems for production of high value nutraceutical ingredient Screening for high metabolite producing cell/organ culture lines based on metabolic profiling and flow cytometry Understanding growth and production kinetics to boost high metabolic yield Scale up of <i>in vitro</i> production technology in specially designed bioreactors Bioprocess designing and modulation for higher metabolic productivity
2	Value addition of seasonal vegetables/ traditional foods for improved nutritional and livelihood opportunities among highlanders	DST-SEED, GOI, New Delhi (GAP 174)	Processing of seasonal cruciferous vegetables to minimize post harvest losses and increase availability for utilization by highlander population during off season <u>Contributing as PI</u>
Completed project			
1	Comparative evaluation of <i>Arnebia</i> species with specific reference to metabolome related to shikonin synthesis– <i>in situ</i>	Department of Biotechnology, GOI, New Delhi National programme on Metabolomics	Sapio-temporal collection of samples of different <i>Arnebia</i> species from high altitude region, quantification of shikonin parameters, metabolic profiling and gene and studies on genes and protein expression <u>Contributed as PI</u>
2	Improvement of apple through biotechnological interventions	Department of Biotechnology, GOI, New Delhi	Sub-programme IV- Utilization of apple pomace for high end products (antioxidants) <u>Contributed as PI</u>
3	New initiatives to boost agriculture productivity through maximizing pre- and post-harvest yields (AGROPATHY)	CSIR Network project	Screening of Himalayan MAPs for fruits and vegetable preservation activities and development of biopreservative formulation <u>Contributed as PI</u>

8. Publications (*List of few related papers published in SCI Journals, in year wise descending order*).

S.No.	Author(s)	Title	Name of Journal	Volume	Page	Year
1	Isolation and purification of acetylshikonin and β -acetoxyisovalerylshikonin from the cell suspension cultures of <i>Arnebia euchroma</i> (Royle) Johnston using rapid preparative HPLC.	Sharma N, Sharma UK, Malik S, Bhushan S , Kumar V, Verma SC, Sharma N, Sharma M and Sinha AK	J. Sep. Sci.	31	629-635	2007
2	Production of Naphthoquinone Pigments in Cell Suspension Cultures of <i>Arnebia euchroma</i> (Royle) Johnston: Influence of pH on Growth Kinetics and Acetylshikonin.	Malik S, Bhushan S , Verma SC, Sharma N, Sinha AK, Sharma M and Ahuja PS	Medicinal and Aromatic Plant Science and Biotechnology	2	43-49	2008
3	Regeneration in <i>Rheum emodi</i> Wall.: a step towards conservation of an endangered medicinal plant species.	Malik S, Kumar R, Vats Surender K, Bhushan S , Sharma M and Ahuja PS	Eng. Life Sci.	9	130-134	2009
4	Qualitative and quantitative analysis of anthraquinone derivatives in rhizomes of tissue culture-raised <i>Rheum emodi</i> Wall. plants.	Malik S, Sharma N, Sharma, U.K., Singh, N.P., Bhushan S , Sinha AK, Sharma M and Ahuja PS.	Journal of Plant Physiology	167	749-756	2010
5	Physico-chemical factors influencing the shikonin derivatives production in cell suspension cultures of <i>Arnebia euchroma</i> (Royle) Johnston, a medicinally important plant species.	Malik S, Bhushan S , Sharma M and Ahuja PS	Cell Biology International	35	153-158	2011
6	Cell suspension culture of <i>Arnebia euchroma</i> (Royle) Johnston - A potential source of naphthoquinone pigments	Kumar R, Sharma N, Malik S, Bhushan S, Sharma UK, Kumari D, Sinha AK, Sharma M and Ahuja PS	Journal of Medicinal Plants Research	5	6048-6054	
7	<i>In vitro</i> cytotoxicity, antimicrobial, and metal-chelating activity of triterpene saponins	Joshi R , Sood S, Dogra P, Mahendru M, Kumar D,	Med Chem Res.	22	4030-4038	2012

	from tea seed grown in Kangra valley, India,	Bhangalia S, Pal HC, Kumar N, Bhushan S , Gulati A, Saxena AK & Gulati A..				
8	Biotechnological approaches to the production of shikonins: a critical review with recent updates.	Malik Sonia, Bhushan S , Sharma Madhu, Ahuja Paramvir Singh	Critical Reviews in Biotechnology	36	327-340	2014
9	Nutrigenomics and its impact on life style associated metabolic diseases	S Rana, S Kumar, N Rathore, Y Padwad, S Bhushan	Current genomics	17	261-278	2016
10	Concurrent NP-HPTLC Determination of Shikonin and β,β -dimethylacryl shikonin in <i>Arnebia benthamii</i> .	Katoch P, Rana S, Kumar S, Kumar D, Bhushan S.	Journal of Chromatographic Science	54	1421-27	2016

9. Detail of patents.

S.No	Patent Title	Name of Applicant(s)	Patent No.	Award Date	Agency/ Country	Status
1	Method and apparatus for the separation of seeds from fruit pulp/slurry/pomace	Bhushan S, Gupta S, Kiran Babu GD, Sharma M, Ahuja PS	US9011952 B2, 0116NF2011 EP2775864A1, EP2775864B1, US20140255575, WO2013069028A1, WO2013069028A8	2015	CSIR/ India	Published

10. Books/Reports/Chapters/General articles etc.

S.No	Title	Author's Name	Publisher	Year of Publication
1	Apple Pomace: Source of Dietary Fibre and Antioxidant for Food Fortification	S Bhushan, M Gupta	Springer New York	2013
2	Processing Cultivars of Fruits and Vegetables	S Bhushan, SD Sharma	Indus Publishing	2000
3	Fruit and Vegetable Fermentation Technology: Present Status and Future Strategies.	VK Joshi, S Bhushan	Department of Horticulture, Govt. H.P., India	2001

11. Any other Information (maximum 500 words):

Plants produce varieties of natural compounds having immense importance in healthcare, food, cosmetics and pharmaceutical industries. However, their continuous extraction from natural resources has resulted in overexploitation and even most of them are on the verge of extinction. In this regard, plant cell culture technology has proved to be a useful biotechnological tool with commercial successes in production of secondary metabolites like shikonin derivatives, taxol, berberine, ubiquinone-10 etc. At CSIR-IHBT, work on micro-propagation of medicinal and

aromatic plants, *in vitro* production of secondary metabolites through cell culture and scale up in bioreactors is being done. It includes the optimization & standardization of *in vitro* protocols, characterization & quantification of secondary metabolites and manipulation of secondary metabolism through various biotechnological approaches for high metabolite production. Presently, our focus is on natural pigment (shikonin derivatives) production using *Arnebia* species cell culture. Continuous efforts are going on for screening of high pigment production cell line and biosynthetic regulation of secondary metabolism at cellular level to increase the metabolite yield.

In addition, the traditionally employed resources for healthcare system by local inhabitant of western Himalayan region is also being explored. The main aim is to provide scientific validation, documentation and their value addition through development of dietary supplement (s) or nutraceuticals. It not only helps in meeting the growing consumer demand of natural ingredients, but will also assist or support the government efforts in conservation of valuable endangered western Himalayan bioresources.

Research Team: Dr. Ashok Gehlot, Mr. Roushan Kumar, Ms. Jyoti, Mr. Rahul

