BIO-DATA

1. **Name and Full correspondence address**: DR. Ashish R. Warghat
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   CSIR-Institute of Himalayan Bioresource Technology
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3. **Institution :** CSIR-IHBT, Palampur
4. **Date of Birth :** October 28, 1985
5. **Gender :** Male
6. **Category :** OBC
7. **Whether differently abled :** No
8. **Academic Qualification :**

S. No.	Degree	Year	Subject	University/Institution	% of marks
1	B.Sc.	2006	Chemistry, Botany and Zoology	R.T.M. Nagpur University, Nagpur	67.90
2	M.Sc.	2008	Botany	R.T.M. Nagpur University, Nagpur	74.90
3	Ph. D.	2015	Biotechnology	DIHAR, DRDO, Leh Ladakh Registered to: Jaypee University of Information Technology, Waknaghat, Himachal Pradesh	-

9. **Ph. D. thesis title: "**Biodiversity and conservation of *Dactylorhiza hatagirea* (D. Don) from Trans-Himalayan Ladakh region of India" **Guide's name :** Dr. Ravi Srivastava
   Institute: DIHAR, DRDO, Leh Ladakh Registered to Jaypee University of Information Technology, Waknaghat, Himachal Pradesh)
   Year of Award: 2015

10. **Work experience**

Sr. No.	Positions held	Name of Institute	From	To	Pay Scale
1	Principal Scientist	CSIR-IHBT, Palampur	10th Dec. 2023	Till now	Pay Level GP: 130600
2	Senior Scientist	CSIR-IHBT, Palampur	10th Dec. 2019	09th Dec. 2023	Pay Level 12 RS. 6.78,800-2,09,200

					(7th Pay commission)
3	Scientist	CSIR-IHBT, Palampur	10th Dec. 2015	09th Dec. 2019	Rs.15600-391 00 with Grade Pay of Rs.6600
4	Research Associate	DIHAR, DRDO, Chandigarh	1st Jan. 2014	1st Nov. 2015	(Rs. 28,000) 24000+20% HRA

11. Fellowship/ Certificates received by the applicant.

S. No.	Name of fellowship	Fellowship agency	Year
1	Junior Research Fellowship	DRDO	2009-2011
2	Senior Research Fellowship	DRDO	2011-2014
3	RA Fellowship	DRDO	2014

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

Sr. No.	Title	Author	Year	Journal	IF	Volume	Page No.	Link
1.	Insight into hydroponic nutrient solution mediated morpho-physiological, iridoid glycosides accumulation and gene expression modulations in *Picrorhiza kurroa* Royle ex Benth	Kanika, Ashrita, Shiv Shanker Pandey, Pawan Kumar, Dinesh Kumar & **Ashish R. Warghat***	2025	Plant Biotechnology Reports	1.6	Vol. 19	741–761	https://doi.org/10.1007/s11816-025-01016-5
2.	From growth to survival: Aux/IAA genes in plant development and stress management	Amit Kumar, Mahinder Partap, **Ashish R. Warghat***	2025	Plant Science	4.1	362, 112750	-	https://doi.org/10.1016/j.plantsci.2025.112750
3.	Identification of an endangered and medicinally important Himalayan orchid, *Dactylorhiza hatagirea* D.Don Soo using DNA	Pratibha Jaryal, Promila Pathak, Vandana Jaiswal &	2025	In Vitro Cellular & Developmental	1.9	-	-	https://doi.org/10.1007/s11627-025-10556-y

	barcodes and development of an efficient in vitro propagation protocol utilizing embryo culture technique	**Ashish R. Warghat**		Biology - Plant				
4.	Spectral light treatment and exogenous feeding of precursors enhanced the picrosides content in dedifferentiated cell culture of Picrorhiza kurroa	Mahinder Partap, Amit Kumar, Pawan Kumar, Dinesh Kumar, **Ashish R. Warghat***	2025	Biocatalysis and Agricultural Biotechnology	3.8	64, 103501	-	https://doi.org/10.1016/j.bcab.2025.103501
5.	Elicitors mediated enhancement of picrosides and their pathway precursors in dedifferentiated cell suspension culture of *Picrorhiza* *kurroa* Royle ex Benth	Mahinder Partap, Amit Kumar, Pawan Kumar, Dinesh Kumar, **Ashish R. Warghat***	2024	Journal of Plant Growth Regulation	3.9	-	-	https://doi.org/10.1007/s00344-024-11537-y.
6.	Fritillaria steroidal alkaloids and their multi-target therapeutic mechanisms: insights from network pharmacology	Pankaj Kumar, Vinay Kumar, Shagun Sharma, Rohit Sharma, Ashish R. Warghat	2024	Naunyn-Schmiedeberg's Archives of Pharmacology	3.1	-	-	https://doi.org/10.1007/s00210-024-03502-z
7.	Jasmonic Acid: A Versatile Phytohormone Regulating Growth,	Amit Kumar, Mahinder Partap,	2024	Journal of Plant Growth	3.9	-	1-24	https://doi.org/10.1007/s003

	Physiology, and Biochemical Responses	**Ashish R. Warghat**		Regulation				44-024-11376-x
8.	Endophyte-based fungal elicitors for enhanced production of valepotriates and sesquiterpenoids in leaf cell suspension cultures of *Valeriana jatamansi* Jones	Ankita Thakur, Kanika Thakur, Anil Kumar, **Ashish Rambhau Warghat**, Dinesh Kumar, Shiv Shanker Pandey	2024	Journal of Applied Microbiology	3.2	135	lxae242	https://doi.org/10.1093/jambio/lxae242
9.	Physiological and biochemical regulation of *Valeriana jatamansi* Jones under water stress	Ankita Thakur, Anil Kumar, Dinesh Kumar, **Ashish Rambhau Warghat**, Shiv Shanker Pandey	2024	Plant Physiology and Biochemistry (0981-9428)	6.5	208	108476	https://doi.org/10.1016/j.plaphy.2024.108476
10.	Hydroponic cultivation enhances the morpho-physiological traits and quality flower production in three cultivars (marigold scarlet red, marigold orange, and marigold yellow) of French marigold (*Tagetes patula* L.)	Ujala, Diksha Sharma, Mahinder Partap, **Ashish R. Warghat**, Bhavya Bhargava	2024	Scientia Horticulturae (0304-4238)	4.3	327	112803	https://doi.org/10.1016/j.scienta.2023.112803
11.	The influence of ex-vitro acclimatization of elicitor-treated *Stevia rebaudiana* (Bertoni),	Ashrita, Shiv Shanker Pandey,	2024	Journal of Plant Growth	3.9	43(9)	3204-3217	https://doi.org/10.1007/s003

	on growth biomass, physiological traits, steviol glycosides accumulation, and biosynthesis pathway gene expression pattern.	**Ashish R. Warghat***		Regulation				44-023-11109-6
12.	Integration of biotechnological approaches for the production of phenylethanoids and phenylpropanoids in in vitro cultures of *Rhodiola* sp. a comprehensive review	Shiv Rattan, **Ashish R Warghat***	2023	Industrial Crops and Products	5.6	206	117625	https://doi.org/10.1016/j.indcrop.2023.117625
13.	Comparative analysis of salidroside and rosavin accumulation and expression analysis of biosynthetic genes in salicylic acid and methyl jasmonate elicited cell suspension culture of *Rhodiola imbricata* (Edgew.)	Shiv Rattan, **Ashish R. Warghat***	2023	Industrial Crops and Products	5.6	198	116667	https://doi.org/10.1016/j.indcrop.2023.116667
14.	Comparative quantification of dactylorhin among different wild tissues and in vitro cultures of *Dactylorhiza hatagirea* (D. Don) Soó, an endangered medicinal orchid of Western Himalayas	Archit Sood, Kanika Thakur, Robin Joshi, Dinesh Kumar, **Ashish R Warghat***	2023	South African Journal of Botany	3.11	153	172-177	https://doi.org/10.1016/j.sajb.2022.12.024
15.	Understandings of bioactive composition, molecular regulation,	Kamal Thakur, Mahinder	2023	Journal of Food Composit	4.52	116	105070	https://doi.org/10.1016/j.jfca.

	and biotechnological interventions in the development and usage of specialized metabolites as health-promoting substances in *Siraitia grosvenorii* (Swingle) C. Jeffrey	Partap, Pankaj Kumar, Rajnish Sharma, **Ashish R Warghat***		ion and Analysis				2022.105070
16.	In vitro propagation and omics breakthroughs for understanding specialized metabolite production in high-value Himalayan *Fritillaria* species	Shagun Sharma, Pankaj Kumar, Rohit Sharma, **Ashish R. Warghat**	2023	Industrial Crops and Products	5.6	205	117541	https://doi.org/10.1016/j.indcrop.2023.117541
17.	Bioprocess development for enhancing cell biomass, differential picrosides accumulation, and gene expression profiling at shake flask levels in suspension cultures of *Picrorhiza kurroa*	Mahinder Partap, Shiv Rattan, Dinesh Kumar, **Ashish R. Warghat***	2022	Industrial Crops and Products	6.44	187	115311	https://doi.org/10.1016/j.indcrop.2022.115311
18.	Growth dynamics and differential accumulation of picrosides and its precursor metabolites in callus cell lines of *Picrorhiza kurroa* with distinct anti-steatotic potential	Mahinder Partap, Jyoti Chhimwal, Pawan Kumar, Dinesh Kumar, Yogendra Padwad, **Ashish R. Warghat***	2022	Process Biochemistry	4.88	120	85-100	https://doi.org/10.1016/j.procbio.2022.06.002
19.	Comparative transcriptome and	Shiv Rattan,	2022	Gene	3.91	836	146672	https://doi.org/10.1

	tissue-specific expression analysis of genes reveal tissue-cultured plants as an alternative source for phenylethanoids and phenylpropanoids in *Rhodiola imbricata* (Edgew.)	Pankaj Kumar, Ekjot Kaur, Archit Sood, Vishal Acharya, **Ashish R. Warghat***						016/j.gene.2022.146672
20.	Fruit derived callus and cell suspension culture as promising alternative sources for mogrosides production in *Siraitia grosvenorii* (Swingle) C. Jeffrey: a zero-caloric natural sweetener	Mahinder Partap, Pankaj Kumar, Pawan Kumar, Probir Kumar Pal, Dinesh Kumar, **Ashish R. Warghat*,** Sanjay Kumar	2022	Journal of Food Composition and Analysis	4.52	108	104450	https://doi.org/10.1016/j.jfca.2022.104450
21.	Nutrient feeding approach enhances the vegetative growth biomass, volatile oil composition, and myristicin content in hydroponically cultivated *Petroselinum crispum* (Mill.) Nyman	Shiv Rattan, Mahinder Partap, Kanika, Shiv Kumar, **Ashish R. Warghat***	2022	Journal of Applied Research on Medicinal and Aromatic Plants	3.94	26	100359	https://doi.org/10.1016/j.jarmap.2021.100359
22.	The influence of phenylalanine feeding on cell growth, antioxidant activity, phenylpropanoids content, and yield in cell suspension	Shiv Rattan, Dinesh Kumar & **Ashish R. Warghat***	2022	Plant Cell, Tissue and Organ Culture (PCTOC)	2.72	151	347–359	https://doi.org/10.1007/s11240-022-02356-8

	culture of *Rhodiola imbricata* (Edgew.)							
23.	In vitro propagation and phyto-chemical assessment of *Cymbidium aloifolium* (L.) Sw.: An orchid of pharma-horticultural importance	Akhil Kumar, Seema Chauhan, Shiv Rattan, **Ashish R. Warghat**, Dinesh Kumar, Bhavya Bhargava*	2022	South African Journal of Botany	3.11	144	261-269	https://doi.org/10.1016/j.sajb.2021.06.030
24.	Enhanced Production of Phenylethanoids Mediated Through Synergistic Approach of Precursor Feeding and Light Regime in Cell Suspension Culture of *Rhodiola imbricata* (Edgew.)	Shiv Rattan, Anil Kumar, Dinesh Kumar & **Ashish R. Warghat***	2022	Applied Biochemistry and Biotechnology	3.09	194	3242-3260	https://doi.org/10.1007/s12010-022-03914-8
25.	Genetic diversity studies of apricot of trans-himalaya based on morphological and SARP markers	Avilekh Bhardwaj, AK Bhardwaj, KB Bhushan, Rohit Kumar, **Ashish R Warghat**, Tsering Stobdan	2022	Indian Journal of Horticulture	0.15	78	9-16	https://doi.org/10.5958/0974-0112.2021.00002.5
26.	Cambial meristematic cell culture: a sustainable technology toward in vitro specialized	Mahinder Partap, **Ashish R Warghat***,	2022	Critical Reviews in Biotechnology	9.062	-	1-19	https://doi.org/10.1080/07388551.202

	metabolites production	Sanjay Kumar						2.205599 5
27.	Comparative transcriptome analysis infers bulb derived in vitro cultures as a promising source for sipeimine biosynthesis in *Fritillaria cirrhosa* D. Don (Liliaceae, syn. *Fritillaria roylei* Hook.) – High-value Himalayan medicinal herb	Pankaj Kumar, Ashrita, Vishal Acharya, **Ashish R. Warghat***	2021	Phytochemistry	4.00	183	112631	https://doi.org/10.1016/j.phytochem.2020.112631
28.	Steviol glycoside accumulation and expression profiling of biosynthetic pathway genes in elicited in vitro cultures of *Stevia rebaudiana*	Kanika Thakur, Ashrita, Archit Sood, Pawan Kumar, Dinesh Kumar & **Ashish R. Warghat***	2021	In Vitro Cellular & Developmental Biology - Plant	2.34	57	214-224	https://doi.org/10.1007/s11627-020-10151-3
29.	Growth kinetics, metabolite yield, and expression analysis of biosynthetic pathway genes in friable callus cell lines of *Rhodiola imbricata* (Edgew)	Shiv Rattan, Dinesh Kumar & **Ashish R. Warghat***	2021	Plant Cell, Tissue and Organ Culture (PCTOC)	2.72	146	149-160	https://doi.org/10.1007/s11240-021-02057-8
30.	Phenylethanoids, phenylpropanoids, and phenolic acids quantification vis-à-vis gene expression profiling in leaf and root derived callus	Shiv Rattan, Archit Sood, Pankaj Kumar, Anil Kumar,	2020	Industrial Crops and Products	6.44	154	112708	https://doi.org/10.1016/j.indcrop.2020.112708

	lines of *Rhodiola imbricata* (Edgew.)	Dinesh Kumar, **Ashish R. Warghat***						
31.	Growth Kinetics, Metabolites Production and Expression Profiling of Picrosides Biosynthetic Pathway Genes in Friable Callus Culture of *Picrorhiza kurroa* Royle ex Benth	Mahinder Partap, Pankaj Kumar, Ashrita, Pawan Kumar, Dinesh Kumar, **Ashish R. Warghat***	2020	Applied Biochemistry and Biotechnology	3.09	192	1298-1317	https://doi.org/10.1007/s12010-020-03391-x
32.	Effect of Elicitors on Morpho-Physiological Performance and Metabolites Enrichment in *Valeriana jatamansi* Cultivated Under Aeroponic Conditions	Mahinder Partap, Pankaj Kumar, Anil Kumar, Robin Joshi, Dinesh Kumar and **Ashish R. Warghat***	2020	Frontiers in Plant Science	6.62	11	01263	https://doi.org/10.3389/fpls.2020.01263
33.	Metabolite and expression profiling of steroidal alkaloids in wild tissues compared to bulb derived in vitro cultures of *Fritillaria roylei* – High value critically endangered Himalayan medicinal herb	Pankaj Kumar, Mahinder Partap, Ashrita, Divya Rana, Pawan Kumar, **Ashish R. Warghat***	2020	Industrial Crops and Products	6.44	145	111945	https://doi.org/10.1016/j.indcrop.2019.111945
34.	Enhancement of picrosides content in *Picrorhiza kurroa*	Kanika Thakur, Mahinder	2019	Industrial Crops	6.44	133	160-167	https://doi.org/10.1016/j.indc

	Royle ex Benth. mediated through nutrient feeding approach under aeroponic and hydroponic system	Partap, Dinesh Kumar, **Ashish R. Warghat***		and Products				rop.2019.03.021
35.	Plant stem cells: what we know and what is anticipated	**Ashish R. Warghat*,** Kanika Thakur & Archit Sood	2018	Molecular Biology Reports	2.74	45	2897–2905	https://doi.org/10.1007/s11033-018-4344-z
36.	High efficiency in vitro plant regeneration and secondary metabolite quantification from leaf explants of *Rhodiola imbricata*	Ashwani Kumar Bhardwaj, Avilekh Naryal, Pushpender Bhardwaj, **Ashish Rambhau Warghat**, Balpreet Arora, Shikha Dhiman, Shweta Saxena, Pratap Kumar Pati, Om Prakash Chaurasia	2018	Pharmacognosy Journal	-	10(3)	470-475	10.5530/pj.2018.3.77
37.	Effect of various dormancy breaking treatments on seed germination, seedling growth and seed vigour of medicinal plants	Ashwani Kumar Bhardwaj, Sahil Kapoor, Avilekh Naryal, Pushpender Bhardwaj,	2016	Tropical plant research	-	3(3)	508-516	10.22271/tpr.2016.v3.i3.067

		Ashish Rambhau Warghat, Bhuvnesh Kumar, Om Prakash Chaurasia						
38.	Culturable fungal diversity associated with forest leaf litter from Bhandara District of Maharashtra, India	Sunil M Akare, Walay Y Tagade, **Ashish R Warghat**, Avilekh Naryal, Ashwani Bhardwaj	2016	Biodiversitas Journal of Biological Diversity	-	17	-	https://doi.org/10.13057/biodiv/d170147
39.	In Vitro Callus Induction and Plantlet Regeneration of *Saussurea lappa* (Clarke.) from Ladakh Region of India	**Ashish R Warghat**, Prabodh K Bajpai, Stanzin Rewang, Sahil Kapoor, Jitendra Kumar, Om P Chaurasia, Ravi B Srivastava	2016	Proceedings of the National Academy of Sciences, India Section B: Biological Sciences	-	86	651-660	https://doi.org/10.1007/s40011-015-0496-y
40.	High phenotypic variation in *Morus alba* L. along an altitudinal gradient in the Indian trans-Himalaya	Prabodh K. Bajpai, **Ashish R. Warghat**, Ashish Yadav, Anil Kant, Ravi B. Srivastava	2015	Journal of Mountain Science	2.37	12	446-455	https://doi.org/10.1007/s11629-013-2875-2

		& Tsering Stobdan*						
41.	Effect of salicylic acid on the activity of PAL and PHB geranyltransferase and shikonin derivatives production in cell suspension cultures of *Arnebia euchroma* (Royle) Johnst-a medicinally important plant species	Pawan Pawan Kumar & Mahak Saini & Shashi Bhushan & **Ashish R. Warghat** & Tarun Pal & Nikhil Malhotra & Archit Sood	2014	Applied Biochemistry and Biotechnology	3.1	173	248–258	10.1007/s12010-014-0838-x
42.	Detecting molecular signatures of natural selection in *Morus alba* populations from trans-Himalaya	Prabodh K Bajpai, **Ashish R Warghat**, Anil Kant, Ravi B Srivastava, Tsering Stobdan*	2014	Journal of Systematics and Evolution	3.54	52	589-597	https://doi.org/10.1111/jse.12109
43.	Variability and relationship of fruit color and sampling location with antioxidant capacities and bioactive content in *Morus alba* L. fruit from trans-Himalaya, India	Prabodh K. Bajpai, **Ashish R. Warghat**, Priyanka Dhar, Anil Kant, Ravi B. Srivastava, Tsering Stobdan*	2014	LWT - Food Science and Technology	6.05	59	981-988	https://doi.org/10.1016/j.lwt.2014.07.055
44.	In vitro protocorm development and mass multiplication of an endangered orchid, *Dactylorhiza hatagirea*	**Ashish Rambhau Warghat**, Prabodh Kumar Bajpai, Ravi	2014	Turkish Journal of Botany	1.429.	38	737-746	10.3906/bot-1308-48

		Bihari Srivastava, Om Prakash Chaurasia, Rajinder Singh Chauhan, Hemant Sood*						
45.	Structure and Genetic Diversity of Natural Populations of *Morus alba* in the Trans-Himalayan Ladakh Region	Prabodh K Bajpai, **Ashish R Warghat**, Ram Kumar Sharma, Ashish Yadav, Anil K Thakur, Ravi B Srivastava, Tsering Stobdan*	2014	Biochemical genetics	2.22	52	137-152	https://doi.org/10.1007/s10528-013-9634-5
46.	Effect of auxins on adventitious rooting from hardwood cuttings of *Hippophae rhamnoides* under Ladakh Himalayas	Janifer raj x., basant ballabh, m. pal murugan, priyanka dhar, amol b. tayade, **Ashish R. warghat**, o.p. chaurasia and r.b. srivastava	2013	Indian Forester		139 (3)	228-231	https://typeset.io/papers/effect-of-auxins-on-adventitious-rooting-from-hardwood-4wuvssouxg
47.	Population genetic structure and conservation of small fragmented locations	**Ashish R. Warghat**, Prabodh K. Bajpai, Ravi	2013	Scientia Horticultu rae	4.34	164	448-454	https://doi.org/10.1016/j.scie

	of *Dactylorhiza hatagirea* in Ladakh region of India	B. Srivastava*, Om P. Chaurasia, Hemant Sood						nta.2013.09.044
48.	Carbon sequestration potential of *Scenedesmus* species (Microalgae) under the fresh water ecosystem	Vinod R Maraskolhe ,**Ashish R Warghat**, Guru Charan, PB Nandkar	2012	African Journal of Agricultural Research	-	18	2818-2823	10.5897/AJAR11.2196
49.	Genetic diversity among natural populations of *Rhodiola imbricata* Edgew. from trans-Himalayan cold arid desert using random amplified polymorphic DNA (RAPD …	Sunil Gupta Sunil Gupta, MS Bhoyar, Jitendra Kumar Jitendra Kumar, **AR Warghat**, PK Bajpai, Muzamil Rasool Muzamil Rasool, GP Mishra, PK Naik, RB Srivastava	2012	Journal of Medicinal Plants Research	-	6	405-415	10.5897/JMPR11.1064
50.	Nutritional composition of rice (*Oryza saliva* L.) varieties growing in Northern India under the ambient environmental conditions	**Ashish R. Warghat** and A.B. Abidi Guru Charan	2012	Journal of progressive agriculture	-	3	63-67	https://www.indianjournals.com/ijor.aspx?target=ijor:jpa&volume=3&issue=2&article=016

51.	Genetic diversity and population structure of *Dactylorhiza hatagirea* (Orchidaceae) in cold desert Ladakh region of India.	**Ashish R. Warghat*,** Prabodh K. Bajpai, Ashutosh A. Murkute, Hemant Sood, Om P. Chaurasia and Ravi B. Srivastava	2012	Journal of Medicinal Plants Research	-	6(12)	2388-2395	10.5897/JMPR11.1007
52.	Morphometric analysis of *Dactylorhiza hatagirea* (D. Don), a critically endangered orchid in cold desert Ladakh region of India	**Ashish R. Warghat** Prabodh K. Bajpai Hemant Sood Om P. Chaurasia Ravi B. Srivastava	2012	African Journal of Biotechnology	-	56	11943-11951	10.5897/AJB11.4242

***Denotes the corresponding author

Books/Chapters

1. Amit Kumar, Mahinder Partap, Shiv Rattan, Pankaj Kumar, **Ashish R Warghat* (2025)** Soilless Cultivation for the Production of Spice and Essential Oil-Bearing Plants. Biotechnology for Fruit, Vegetable and Spice Crops, CRC Press, ISBN: 1040414648, 9781040414644.
2. Shashi Rani, Amit Kumar & **Ashish R. Warghat* (2025)** Role of Nanotechnology in Aeroponics and Hydroponics. Nanobiotechnology in Agri-food Sector, pp. 81-102, Springer, ISBN: 978-981-96-7756-6.
3. Rakesh Kumar, Shalika Rathore, Kanchan Kundlas, Shiv Rattan, **Ashish R. Warghat* (2023)** Vertical farming and organic farming integration: a review. Organic Farming (Second Edition), Global Perspectives and Methods, Woodhead Publishing Series in Food Science, Technology and Nutrition. pp. 291-315, ISBN: ISBN: 978-0-323-99145-2.
4. Mahinder Partap, Abhishek Kumar, Pankaj Kumar, Shiv Shanker Pandey, and **Ashish R. Warghat* (2023)** Metabolomic studies of medicinal plant-fungi interaction. Plant-Microbe Interaction—Recent Advances in Molecular and

Biochemical Approaches. Volume 2: Agricultural Aspects of Microbiome Leading to Plant Defence, Elsevier, pp 1-407, ISBN: 978-0-323-91876-3.

5. Shiv Rattan, Mahinder Partap, Ashrita, Kanika, Pankaj Kumar, Archit Sood, **Ashish R. Warghat* (2022)** Callus culture approach towards production of plant secondary metabolites. Agricultural Biotechnology: Latest Research and Trends, Springer, pp 171-183, ISBN: 978-981-16-2338-7.
6. Mahinder Partap, Shiv Rattan, Kanika, Ashrita, Archit Sood, Pankaj Kumar, **Ashish R. Warghat* (2022)** Hydroponic and Aeroponic Cultivation of Economically Important Crops for Production of Quality Biomass. Agricultural Biotechnology: Latest Research and Trends, Springer, pp 573-585, ISBN: 978-981-16-2338-7.
7. Pankaj Kumar, Ashrita, Mahinder Partap and **Ashish R. Warghat* (2021)** *Fritillaria roylei*; Himalayan Medicinal Plants, Advances in Botany, Production & Research Elsevier, pp 57-64. ISBN: 9780128231517.
8. Pushpender Bhardwaj, Shiv Rattan, Avilekh Naryal, Ashwani Bhardwaj and **Ashish R. Warghat* (2021)** *Valeriana jatamansi*, Himalayan Medicinal Plants, Advances in Botany, Production & Research Elsevier, ISBN: 9780128231517, pp. 259-268.

Research Projects:

Sr. No.	Title	Cost in Lakh	Month of submission	Role as PI/CO-PI	Agency	Status
1.	Phytopharmaceutical mission	81	08 Dec, 2017 - 31 Dec, 2020	PI	CSIR, India	Completed
2.	Optimization of aeroponic and hydroponic conditions for increasing commercial crop productivity	150	22 Feb, 2019 - 21 Feb, 2020	CO-PI	CSIR, India	Completed
3.	Advanced diploma program in Plant Tissue Culture	52	22 Feb, 2018 - 21 Feb, 2021	PI	DBT, India	Completed
4.	Ex-situ conservation and development of gene bank of	70	12 Dec, 2018 - 11 Dec, 2021	PI	NMHS, India	Completed

	commercially important threatened medicinal plants in the high altitude areas, Himachal Pradesh					
5.	Development of Probiotics for Plant Tissue Culture Boosting the performance of micro propagated plant materials by supplementing plant associated useful endophytes	48.38	20/01/2021 - 19/01/2024	CO-PI	NMPB, India	Completed
6.	Endophytes of Valeriana jatamansi and *Podophyllum* *hexandrum* under Endophytes Network Project entitled "Deciphering the mechanism(s) of host-endophytes' coevaluation, enhanced secondary metabolite production and crop productivity"(FBR)	68.12	22-07-2020- 31-03-2023	CO-PI	CSIR, India	Completed
7.	Understanding the molecular mechanism underlying cambial meristematic cells (CMCs) differentiation and their utilization for specialized metabolite	48.87	21 June, 2023 to	PI	SERB, New Delhi	Ongoing

	production in *Picrorhiza kurrooa*					
8.	Cultivation and Production of Kutki and Jatamansi plant under hydroponic system	3.78	17-03-2021-16-03-2026	PI	Sponsored	Ongoing
9	Establishment of hydroponic facility for production of Lilium and Tulip plants	3.28	01-03-2021- 28-02-2026	PI	Sponsored	Ongoing
10.	Cultivation and production of medicinal plants (Picrorhiza, Valeriana) under hydroponic system, tissue culture protocols and extraction of the produce	4.20	02-07-2021-01-07-2026	PI	Sponsored	Ongoing

Technology transferred-08

Sr. No.	Details of Technology	Technology status	Role
1)	Essential oil production process from aeroponically grown **Brahmi, Jatamansi, Thyme** and **Basil** using standardized nutrient recipe of **macro** (Nitrogen, potassium, calcium, phosphorus, magnesium, sulphur, oxygen, carbon and hydrogen) and **micronutrient** (Boron, iron, chlorine, manganese, copper, zinc, molybdenum and nickel).	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Suraj Shree Chemicals Ltd., New Delhi., **ToT**: Rs. 3.54 Lakhs for 5 yrs. Duration **Date:** 2nd July, 2025 **(Annexure 1, 1.19)**	Developer

2)	Process development for **shortening life cycle of leafy vegetable (**spinach, lettuce, kale, microgreens**)** using nutrient film techniques	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Himalayan Bliss, Gopalpur, Tehsil Palampur. **ToT**: Rs. 0.77 Lakhs for 5 yrs. duration **Date:** 05th September, 2024 **(Annexure 1, 1.20)**	Developer
3)	Development of **nutrient mist technology** for commercial scale production of *Valeriana jatamansi*. It involves the development of crop specific nutrient recipe for leaf and roots production enriched with valerenic acid and its derivatives.	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** M/s. Jnnani Nutritionals Private Limited, Dindigul, Tamil Nadu., **ToT**: Rs. 1.77 Lakhs for 5 yrs. duration **Date:** 2nd July, 2024 **(Annexure 1, 1.21)**	Developer
4)	Process development of **deep water culture** for steviol glycosides enriched leaf production and year round plant production using optimized nutrient solution	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Satvik Agritech Labs Pvt. Ltd., Surat, Gujarat. **ToT**: 0.70 Lakhs for 7 yrs. Duration	Developer

		Date: 19th June, 2024 **(Annexure 1, 1.22)**	
5)	**Bacosides enriched leaf biomass** production in mist spray nozzle technique. It involves the development of micro nutrient recipe formulations for early leaf biomass by reducing the cultivation time.	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Kangra Innovation and Wellness Initiatives Private Limited, Kangra **ToT**: 0.70 Lakhs for 5 yrs. Duration **Date:** 13th May, 2024 **(Annexure 1, 1.23)**	Developer
6)	**Hydroponic production of tissue cultured plants** (*Picrorhiza*, *Valeriana*); bypassing the plant hardening process thereby reducing the time period of 2 months.	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Amar Exports, Hyderabad **ToT**: 3.54 Lakhs for 5 yrs. Duration **Date:** 02nd July, 2021 **(Annexure 1, 1.24)**	Developer
7)	Metabolite enhancement in ***Kutki*** and ***jatamansi*** plants under developed hydroponic conditions and developed nutrient recipe for herb production (6 months: kutki; 5 months: jatamansi) compared to traditional farming (4 years: kutki; 2 years: jatamansi)	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to**: Hydrocrops India Pvt Ltd., Jalandhar, Punjab	Developer

		ToT: 4.13 Lakhs for 5 yrs. Duration **Date:** 17th March, 2021 **(Annexure 1, 1.25)**	
8)	Development of **crop-specific hydroponic nutrient recipe technology for *Lilium* and *Tulip*** production within a short span of time for getting access to the off-season flower market. Early flowering in Lilium (55 days) & in Tulip (30 days) as compared to traditional farming 4 (Lilium) and 2 (Tulip) months	The technology has been documented by Head Business Development and Marketing Unit (BDMU), CSIR-IHBT. **Transferred to:** Sh. Akshat Goel, address: 172, Sukhdev Vihar, New Delhi- 110025 **ToT**: 3.54 Lakhs for 5 yrs. Duration **Date:** 01st March, 2021 **(Annexure 1, 1.26)**	Developer