



# Dolphin (P.G.) Institute of Biomedical & Natural Sciences

Affiliated to H.N.B. Garhwal Central University, Srinagar, Garhwal, Uttarakhand, India

NAAC Accredited 'B++' (2<sup>nd</sup> Cycle)

Approved by Government of Uttarakhand, IAP and NCTE

Recognized by Uttarakhand Paramedical Council and Recognized NPTEL - Local Chapter by IIT Madras.

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## **3.3.2 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five years**

This is to certify that documents from page number 2 to 123 are digitally attested.



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Total number of books and chapters in edited volumes/books published and papers in national/international conference proceedings year wise during last five years are 68.

## Summary sheet

Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
1	Aahuti Sharma, Pankaj Kumar, Vikas Pahal, Jitendra Kumar & Shiv Shankar Pandey	Endophytic Phytohormone Production and Utilization of Functional Traits in Plant Growth Promotion	2023	978-981-19-5028-5	Springer, Singapore
2	Suraj Kumar Parcha, Versha Parcha, Pankaj Bhandari	Water Conservation, Harvesting and Conversion to Portable Drinkable Water	2023	978-93-94424-71-5	ABS Books, New Delhi
3	Dr. Shailja Pant	Microbiological Aspects of Water Quality Monitoring	2023	978-93-94424-62-3	ABS Books, New Delhi
4	Versha Parcha, Pankaj Bhandari, Sukanya Chhetri, Uday Kumar, and Raju Chandra	Chemical Constituents and Medicinal uses of <i>Etrema japonicum</i> .	2023	978-10-03295-037	Taylor & Francis Group LLC.
5	Versha Parcha, Pankaj Bhandari, Sukanya Chhetri, Uday Kumar, and Deepak Kumar	A comprehensive review on the medicinal use of <i>Piper methysticum</i> (kava kava)	2023	978-10-03295-037	Taylor & Francis Group LLC.
6	Bhawana Jangra, Pooja Bhadrecha, Pankaj Kumar, Jitendra Kumar	Decoding Beneficial Plant Microbe association with latest techniques for sustainable agriculture	2023	978-981-19-5028-5	Springer, Singapore
7	Harshvardhan Chaudhary, Pankaj	Mechanism of disease development in host plants	2023	978-0-443-15443-0	Academic Press, Elsevier

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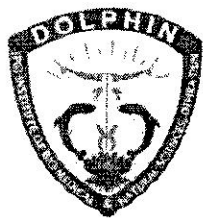
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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
	Kumar, Ramesh Chandra Dubey	by Macrophomina phaseolina			
8	Sangeeta, Payal Garg and Pankaj Kumar	Barnyard Millet ( <i>Echinochloa frumentacea</i> ): Chemistry Nutritional Attributes, Processing Innovations, Traditional and Modern Foods and Beverages, Anti-nutrition and Health Benefits	2023	9789390591633	NIPA, New Delhi
9	Anuj Gupta, Sugandh Chauhan, Sunil Dutt Tyagi, Pankaj Budakoti, Satpal Singh	Mustard Farming in North India	2023	978-93-5570-238-8	Aiknik Publication, New Delhi
10	M. Valan Arasu, Naif Abdullah Al-Dhabi and Ashok Kumar Singh	Biocatalytic activity of microbial catalases: perspective in industrial waste treatment, biosensor fabrication, food storage and pharmaceutical sectors.	2023	9.78311E+12	De Gruyter press
11	M. Valan Arasu, V. K. Gopalakrishnan, P. Vijayaragavan, M. A. Rathi, Naif Abdullah Al-Dhabi, Ki Choon Choi and Gauri Singh	Microorganisms and their enzymes in carbon storage and control of greenhouse gas emission	2023	9783111062235	De Gruyter press
12	Vidit Tyagi	Trends of water potential in Banj Oak ( <i>Quercus</i>	2023	978-93-91193-81-2	Manglam Publications

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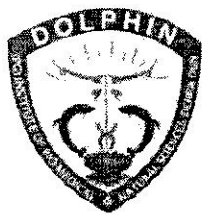
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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
		leucotrichophora A.Camus.) forest in Kumaun Central Himalaya			New Delhi,
13	Kanika Issar	Packaging Material for Agro Products: Importance and application	2022	978-81-939673- 4-8	S. F. Publication, Dehradun
14	Kanika Issar	Nutrient Requirements in Health and Disease	2022	978-81-953419- 6-2	Plantica Foundation. Dehradun
15	Bonnypesh Ch Sangma, Sandhya Goswami, Rashmi T Chamoli, Vikaspal Singh, Anil Kumar Uniyal and Manish Kumar	Indigenous Traditional Medicine Application by Traditional Healers in Garo Hills, Meghalaya, India	2022	978-1-957302- 34-8	Walnut Publications
16	Vikaspal Singh, DS Chauhan and S Dasgupta	A Study of Oak Dominant Forest in Garhwal Himalaya Relation to Different Aspects and Altitudes, Uttarakhand.	2022	978-1-957302- 34-8	Walnut Publications
17	Brijmohan, Rashmi T Chamoli, Vikaspal Singh, SandhyaGoswami, Anil Kumar Uniyal, Manish Kumar and Manju Rani	Relation of crown competition factor to D.B.H. for open- grown Shorea robusta stand	2022	978-1-957302- 34-8	Walnut Publications

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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
18	Renu Dixit, Manju Rani, Rashmi T Chamoli, and Jitendra Kumar	Effect of Pesticides on Plant and Human Health: A Review	2022	978-1-957302-34-8	Walnut Publications
19	Shailja Pant	Detection and Diagnosis of the Novel Corona virus (COVID-19) present and future challenges	2022	978-81-943323	Bishon Singh Mahendra Pal Singh, Dehradun
20	Sapna Negi, Pankaj Kumar, Jitendra Kumar, Ajay Singh and Ramesh Chandra Dubey	Indigenous nitrogen fixing microbes engineer rhizosphere and enhance nutrient availability and plant growth	2022	978-03-23899-73-4	Academic Press, Elsevier, USA
21	Simmi Goel, Pankaj Kumar, Mukul Sain, Ajay Singh	Anaerobic Treatment of Food Processing Wastes and Agricultural Effluents	2022	9781032062945	CRC press
22	D.K.Awasthi, Gyanendra Awasthi and Priyanka Raj	Immunological Tests in Pathology Laboratory	2021	978-620-3-83995-1	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
23	D.K.Awasthi, Bhavya Srivastva, Gyanendra Awasthi	Molybdenum : A Brief Study	2021	978-620-4-20435-2	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
24	D.K.Awasthi, Bhavini Srivastva, Gyanendra	Tungstan Mettaloenzymes and their	2021	978-620-4-	LAP LAMBERT

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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
	Awasthi	applications		21285-2	Academic Publishing, Saarbrucken, Germany
25	Kanika Issar	Post Harvest Management of Horticultural crops	2021	978-93-91538-93-4	Akinik Publishers, New Delhi
26	JitendraKumar, Pankaj Kumar, R.K.S. Kushwaha	Significance of keratinophiles in biofertilizer development from keratinous waste: Upcoming perspective.	2021	978-0-12-821667-5	Elsevier B.V.
27	Tripti Malik, Seema Rawat	Microbial Valorization of Coir Pith for Development of Compost and Bioethanol Production	2021	978-981-15-9696-4	Springer Nature Switzerland AG.
28	Ganesh Datt Bhatt, Mahesh Singh, Archana Bharti, and Deepali Ran	Traditional and Modern Agricultural Implements Used in Agro Sciences – A Case Study in the Part of National Capital Region of Uttar Pradesh, India	2021	978-3-030-79064-6	Springer Nature Switzerland AG
29	Deepali Rana, S. K. Gupta, and Rahul Rana	Water Quality Assessment of Streams of Doon Valley Dehradun, Uttarakhand	2021	978-3-030-79064-6	Springer Nature Switzerland AG
30	P K Mishra	Agronomy	2021	978-81-952372-	MedTech

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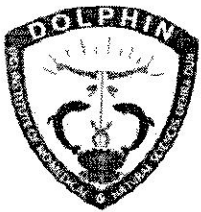
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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
				6-5	Science Press
31	Singh, N., Kumar, N. and Sonu Kumar	Mass rearing of the Trichogramma on <i>Coreyra cephalonica</i> eggs.	2021	978-93-915383-78	AkiNik Publications, Delhi
32	DK. Awasthi, G Awasthi	Biomedical Application of Silver Nanoparticles, 2020	2020	978-620-2-67721-9	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
33	Awasthi DK., Awasthi G.	Medicinal Applications of Titanium oxide, 2020	2020	978-620-2-91789-6	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
34	V. Singh, D. S. Chauhan and S. Dasgupta	Study on seedling population Response to disturbance of a Garhwal himalayan oak ( <i>quercus Leucotrichophora</i> a. Camus) forest	2020	978-1-53618-026-8	Nova Science Publishers, Inc
35	Tripti Malik, Seema Rawat	Biotechnological Interventions for Production of Flavour and Fragrance Compounds	2020	978-981-15-7321-7	Springer Nature Singapore Pvt. Ltd
36	Aashish Raturi	Nondestructive Assessment of Indian Forest: 134A Physicist	2020	978-93-84866-91-4	ANCIENT PUBLISHING HOUSE DELHI-110

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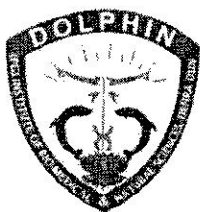
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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
		View			053 (INDIA)
37	Satpal Singh, Gopal Singh, Prashant Mishra, Anuj Gupta and Naimish Kumar	Modern Techniques for Detection of Plant pathogens	2020	978-93-90217-71-7	Akinik Publications.
38	Tripathi K.P. (Chief editor)	-	2019	978-81-907797-0-12	Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun
39	Sonali Mehrotra, Ashish Praveen, Dr. K.R Tripathi and Dr. Pramod Awind Shirke	Screening of different Cluster bean cultivars for better adaptive potential in eCO <sub>2</sub> Concentration under Free Air Concentration Enrichment System	2019	978-81-907797-0-12	Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun
40	Awasthi DK., Awasthi G.	Role of Kidneys in Acid Base Balance and Formation of Kidney Stone	2019	978-620-0-46468-2	LAP LAMBERT Academic Publishing, Saarbrücken, Germany
41	Awasthi G., Awasthi DK	Diagnostic Enzymology	2019	978-620-0-56598-3	LAP LAMBERT Academic Publishing, Saarbrücken, Germany

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42	Awasthi DK., Awasthi G., Singh Akshay	Gold Nanoparticles	2019	978-620-2-51695-2	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
43	Awasthi DK., Awasthi G., Raj P.	A Review on cytochromes, 2020	2019	978-620-3-02991-8	LAP LAMBERT Academic Publishing, Saarbrucken, Germany
44	Beena Joshi Bhatt	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
45	Arun Kumar and Rehab Gani	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
46	Dinesh Kumar Bhardwaj, Irfan Rashid wani, and G R Ganaie	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
47	Shalini Anand and Mohammad Abdul Quyoom	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
48	Beena Joshi Bhatt and Shaista Manzoor	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
49	P K Sehgal, Aafaq Nabi Rather and G M	Advances in zoology and	2019	978-81-907797-	Dolphin PG Institute,

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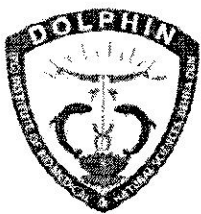
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	Mir	applied Sciences		0-11	Dehradun
50	Beena Joshi Bhatt and Suhail Ur Rehman	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
51	Dinesh Kumar Bhardwaj and Shamim Akhtar	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
52	Shalini Anand	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
53	Beena Joshi Bhatt and Aadil Mushtaq Lone	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
54	Deepali Rana, S. K. Gupta and Rahul Rana	Advances in zoology and applied Sciences	2019	978-81-907797-0-11	Dolphin PG Institute, Dehradun
55	Aasheesh Raturi, Vimal Kothiyal, P. D. Semalty	FT-NIR Spectroscopic Assessment of Compressive Strength of Wood of Eucalyptus tereticornis	2019		United States Department of Agriculture (USDA)
56	Sarangi MK, Rao MEB, Parcha V, Yi DK, Nanda SN	Marine Polysaccharides In Drug Delivery	2019	978-0-1281-7055-7	Elsevier Academic Press
57	Vinod Kumar, Neha Arora, Manisha Nanda, Vikas Pruthi	Different cell disruption and lipid extraction methods from microalgae for biodiesel production.	2019	978-981-13-2263-1	Springer Nature

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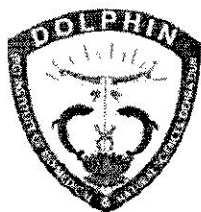
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Sr. No.	Name of the teacher	Title of the book/chapters published	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
58	Rishendra Kumar, Pankaj Kumar, Anchal Giri	Regional impact of psychrophilic bacteria on bioremediation	2019	978-0-12-818307-6	Elsevier Academic Press
59	Agarwal S. K.	A text Book of Differential Calculus	2018	978-93-85763-81-6	Vigyan Bodh Prakashan, Agra
60	Agarwal S. K.	Text Book of Forest Statistics	2018	978-9-374-73653-1	AITBS Publishers, New Delhi india
61	Agarwal S. K.	Text Book of Agricultural Statistics	2018	978-9-374-73654-8	AITBS Publishers, New Delhi india
62	Raturi Aasheesh Pragyee, Abhilasha, Kumar Vivek	A Text Book of Physics (Mechanics)	2018	978-93-85763-57-1	Vigyan Bodh Prakashan, Agra
63	P K Sehgal	A Text Book of Zoology (B. Sc 1st Semester)	2018	978-93-85763-58-8	Vigyan Bodh Prakashan, Agra
64	Dr. Suman Rawat	A Text Book of Chemistry (Inorganic Chemistry & Organic Chemistry)	2018	978-93-85763-56-4	Vigyan Bodh Prakashan, Agra
65	Harendra Kumar Gaur and Shalini Anand	The DBS Handbook of Biofertilizers and Biopesticides	2018	978-93-84229-81-8	DBS Imprints (Thomson Press)
66	P K Sehgal	Entomology	2018	978-93-86546-68-5	New India Publishing

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					Agency. New Delhi.
67	K.P Tripathi	Abstract Book- Multidisciplinary Approaches of Plant Science, Page 94.	2018	978-81-907797-0-10	Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun
68	Kumar V. & Nanda M.	Microalgae: A promising tool for Remediation of heavy Metals	2018	978-1-5225-4162-2	IGI Global, Hershey, PA, USA

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## **Supporting Documents**

## Chapter 15

# Endophytic Phytohormone Production and Utilization of Functional Traits in Plant Growth Promotion



Aahuti Sharma, Pankaj Kumar, Vikas Pahal, Jitendra Kumar, and Shiv Shankar Pandey

**Abstract** Microorganisms such as bacteria, fungi, or actinomycetes play an important role in plant growth and development. They are ubiquitous in nature. Endophytes are beneficial microbes that live within host plant tissue without causing harmful effects to their host. They are present in all plants species and show symbiotic association with them. Population of the endophytes depends on region where the host plant grows and also affected by climatic condition. Endophytic microbes utilize various mechanisms to enhance plant growth and productivity and also play important role in plant defense mechanism against different environmental condition (biotic and abiotic stresses). Phytohormones are small molecule growth regulators which are synthesized during the plant metabolism. The most common phytohormones are auxins, cytokinin, gibberellin, abscisic acid, ethylene, brassinosteroids, salicylic acid, jasmonates, and strigolactones. Endophytes also produce phytohormones which promote plant growth and change the morphology and physiology of the plant. During stress responses, biosynthetic and signaling pathways of phytohormones play major role in coordinating the development of plant. We have focused on endophytic phytohormone production and their role in plant growth in this chapter.

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A. Sharma · S. S. Pandey  
Department of Biotechnology, CSIR-IHBT, Palampur, Himachal Pradesh, India

P. Kumar (✉)  
Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Science, Dehradun, Uttarakhand, India

V. Pahal  
Department of Microbiology, Dolphin (PG) College of Science and Agriculture, Fatehgarh, Punjab, India

J. Kumar  
Department of Biosciences, UIBT, Chandigarh University, Mohali, Punjab, India

# 5.

## Water Conservation, Harvesting and Conversion to Portable Drinkable Water

Suraj Kumar Parcha<sup>1</sup>

Versha Parcha<sup>2</sup>

Pankaj Bhandari<sup>3</sup>

### Introduction

“Thousands have lived without love, no one without water” By W. H. Auden



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<sup>1</sup>Wadia Institute of Himalayan Geology, Dehradun, Uttarakhand, India.

<sup>2,3</sup>Department of Pharmaceutical Chemistry & Chemistry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Manduwala, Dehradun, Uttarakhand, India.

# 7.

## **Microbiological Aspects of Water Quality Monitoring**

Dr. Shailja Pant<sup>1</sup>

### **Introduction**

**T**o ensure public health, easy availability of safe water is extremely important, not only for drinking purposes but also for other domestic use and/or recreational uses. The UN General Assembly has put emphasis on the human rights related to water and sanitation, all human beings must have access to continuous, safe, adequate, physically reachable and affordable water for individual and domestic use.<sup>[1]</sup>

Water suitable for human drinking is called potable water. This water in addition to being drinkable and safe should not have unpleasant odors, tastes and colors. Also, it should be devoid of any toxins, carcinogens, pathogenic microorganisms and other hazardous contaminants within the reasonable temperature limits.

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<sup>1</sup>Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand.



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# 4 Chemical constituents and medicinal uses of *Eutrema japonicum*

Versha Parcha, Pankaj Bhandari, Sukanya Chhetri,  
Uday Kumar, and Raju Chandra

## ABBREVIATIONS USED

ITCs: Isothiocyanates

AITC: allylisothiocyanate

BITC: 3-butenyl isothiocyanate

5-MPITC: 5-(methylthio) pentylisothiocyanate

6-MHITC: 6-(methylthio) hexyl isothiocyanate

6-MITC: 6-(methylsulphinyl) hexyl isothiocyanate

NMR: Nuclear Magnetic Resonance

HRESIMS: High-Resolution Electrospray Ionization–Mass Spectrometry

## 4.1 INTRODUCTION

Wasabi (*Eutrema japonicum* (Miq.) Koidz. [syn *Wasabia japonica*]) of the family Brassicaceae is a perennial plant native to Japan and has, since time immemorial, also been used medicinally. The paste of the rhizome is used as one of the ingredients in raw fish sashimi, sushi, and noodle (soba) (Kinae et al., 2000). Wasabi grows naturally in gravel beds in mountain streams in Japan. The *E. japonicum* plant is cultivated in two conventional ways: grown in or water in specially built flooded beds (Chadwick et al., 1993) to create enormous rhizomes for the production of leaves and petioles products. It is cultivated in Japan, China, Taiwan, and New Zealand. Regular consumption of *E. japonicum* may contribute to the longevity and health of the Japanese. By adding unique flavour, greenish colour and heat to foods, wasabi is a highly valued plant in Japanese cuisine. Now, scientific studies are being done to analyse *E. japonicum*, a superfood and effective herbal remedy.

Possessing a certain degree of firmness and freshness with a pungent smell is characteristic of *E. japonicum* but the heat element is different from what we find across chillies since it is quickly dissipated as soon as it is in the mouth and ends up with a delicious vegetable-like taste, without a fiery taste. It is considered a common condiment in the Japanese diet since the elegant appetizing appeal of a variety of foods is also achieved by *E. japonicum*. Using the aesthetic contrast of the light green colour, it may transform an everyday meal into something exceptional and attractive, making it a new flavouring ingredient for the rest of the globe, so that it has become very popular as a spice in Western *cordon bleu* cooking.

Undoubtedly, this herb has a consistent flavour but it can vary in the level of crispness achieved after consumption (Sultana et al., 2000, 2003) and can be adapted for many purposes. It is a potential consumable in wasabi-flavour processed foods, or as a savoury condiment, or alongside a dish, or in a dish. Rhizomes are used to prepare a fresh paste that can be spread on raw fish. Sometimes, soya sauce and vinegar are mixed with grated wasabi to prepare a dip for use.

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# 12 A Comprehensive Review on the Medicinal Use of *Piper methysticum* (Kava)

Versha Parcha, Pankaj Bhandari, Sukanya  
Chhetri, Uday Kumar, and Deepak Kumar

## 12.1 INTRODUCTION

*Piper methysticum* (G. Forst), of the family Piperaceae, is an evergreen bush (Figure 12.1), popularly referred to as kava or awa, meaning 'bitter', which is a favourable edible medicinal herb, indigenous to Oceania (Stevinson et al., 2002). It has been grown all over the areas of the islands of the Pacific Ocean, Micronesia, Polynesia, and Melanesia (Figure 12.2) and is considered to be by far the most important medicinal plant. Kava is used as a muscle relaxant, analgesic, and anti-anxiety agent (Bilia et al., 2002), for reducing weight, counteracting fatigue, nervousness, and insomnia. In earlier times, the conventional use of kava was ubiquitous, and it was consumed as a beverage, either as an anxiolytic agent or a nutritional supplement; these days, it is more likely to be consumed in kava bars as a recreational beverage.

In ancient times, it is said that the principal users of awa were the chiefs and priests but it has now become widely used. Particularly in more recent times, those who conduct tiresome, repetitive tasks value the characteristics of kava as a source of respite from stress and exhaustion of the muscles, especially for weary farmers, fishermen, hunters, and paddlers. Kava is consumed by spiritual leaders during rituals such as canoe race-meets, a social rite undertaken to express appreciation to the divine both before and after events. In Fijian, Samoan, and Tongan societies, the conventional herbal drink made of kava was used as a ritual beverage and as a medicine, playing a key role in ceremonies performed to unite participants, greet visitors, and authenticate their community identities. In the South Pacific Islands, kava is used as a pious herb used in prayer, as well as being particularly consumed for pleasure. In recreational and social gatherings, kava can be found as a popular drink for high-profile heads and elders, a welcome drink for visitors, for the commencement and final completion of an event or of a piece of work, to substantiate prestige, mark childbirth, marriage ceremony, and death, act as a stress buster, etc. To celebrate the naming of children, birth of male children, traditional hula of young girls, and chanting, kava is served as the chief drink in some other parts of Pacific countries (Figure 12.3). A prayer of gratitude is offered when awa cups are filled and gobbled up rather than sipped, leaving some liquid in the container to be poured upon the earth for paying thanks and gratitude to God. It is believed to be a sacred symbol and finds its vitality in religious libation instead of drinking – it is spread onto the ground in Tikopia. Kava is also taken to mark relationships and headship rites, for public redemption of offences. On Wallis Island, during the kava ceremony, official decisions are made and even enemies are reconciled and friendships are restored. Kava has a prominent role in community gatherings and can be visualized where you see Pope John Paul II and former first lady Mrs. Johnson drinking upon their visit to the Pacific. Not only serving and drinking, but kava is sometimes the only approach to mend broken relationships but kava root is presented to dignitaries as a symbol of salutation and harmony (Turner et al., 1986).

## Chapter 9

# Decoding Beneficial Plant Microbe Association with Latest Techniques for Sustainable Agriculture



**Bhawana Jangra, Pooja Bhadrecha, Pankaj Kumar, and Jitendra Kumar**

**Abstract** One of the most precious treasures offered by mother nature to humans is plants and to aid in their outstanding performances, plants maintain allelopathic relationships with microorganisms, especially in roots and rhizosphere, along with providing food, fodder, and employment. But plants have to face various detrimental conditions such as abiotic and biotic stress conditions caused through pollution, climatic situations, pathogenic microorganisms, competing herbs, and weeds. Association of beneficial microorganisms with the plant roots and rhizosphere provide privilege to plant development, potential to resist stress, hence maximize yield even in adverse environment. Therefore, researchers worldwide have concentrated their attention toward exploring the rhizospheric microbiota with the help of conventional methods as well as latest techniques like metabolomic tools and CRISPR/Cas system. Here we discuss various beneficial and mutualistic relationships between plants and associated rhizospheric microbiota and spotlight the latest research techniques and findings aimed at understanding and utilizing microorganisms for sustainable agricultural practices.

**Keywords** Omics technologies · GC-MS · Maldi TOF · NMR · Sustainable agriculture

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B. Jangra · P. Bhadrecha  
University Institute of Biotechnology, Chandigarh University, Mohali, Punjab, India

P. Kumar  
Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Science,  
Dehradun, Uttarakhand, India

J. Kumar (✉)  
Department of Biosciences, UIBT, Chandigarh University, Mohali, Punjab, India

# Mechanism of disease development in host plants by *Macrophomina phaseolina*

Harshvardhan Chaudhary<sup>1</sup>, Pankaj Kumar<sup>2</sup> and Ramesh Chandra Dubey<sup>1</sup>

<sup>1</sup>Department of Botany and Microbiology, Gurukula Kangri (Deemed to be University), Haridwar, Uttarakhand, India; <sup>2</sup>Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India

## 10.1 Introduction

*Macrophomina phaseolina* (Tassi) Goid. is one of the most ruinous necrotrophic fungi which is known to infect more than 700 plant species including major food, pulse and oil crops, such as maize, sorghum, common bean, soybean, sunflower, sesame, etc. It is a member of the family *Botryosphaeriaceae* and also known by several synonyms like *Sclerotium bataticola* (Taub.), *M. phaseoli* (Maubl.) Ashby, *M. philippinensis* Petrak, *M. carchori* Sawada, *M. sesame* Sawada, etc. Basically, *M. phaseolina* is the pycnidial stage (perfect stage) and *Rhizoctonia bataticola* (Taub.) Butler is the sclerotial stage (imperfect stage). But the name *Macrophomina* has become popular and used by most of the researchers. Earlier there was no report on physiological races or subspecies based on morphological or genetic characterizations (Crous et al., 2006; Dhingra & Sinclair, 1978). Recently, two new species of *Macrophomina* have been reported, such as *M. pseudophaseolina* isolated from okra (*Abelmoschus esculentus*), groundnut (*Arachis hypogea*), roselle (*Hibiscus sabdariffa*), and cowpea (*Vigna unguiculata*) (Sarr et al., 2014), and a new phylogenetic species, *M. euphorbia* is known to cause charcoal rot in castor bean (*Ricinus communis*) and bellyache bush (*Jatropha gossypifolia*) (Machado et al., 2019).

*M. phaseolina* is characterized by light to dark brown septate hyphae having thick wall. Branches from the primary hyphae are framed at right angles on parent hyphae, narrowing at the starting point. Microsclerotia (the small-sized sclerotia) are the closely packed mass of numerous fungal mycelia; these are round, oval, or elliptical, light brown in the initial stage becoming more obscure (brown to dark) with the attainment of maturity (Fig. 10.1). Sclerotia are multicellular structures where each cell comprises of 1–3 nuclei, mitochondria, lipid droplets, etc. and are usually dark brown or black in color with barrel-shaped cells (Wyllie & Brown, 1970). An individual sclerotium usually comprises of 50–200 or even more cells that are united by a septal pore present in each cell. All the cells are tightly cemented together to form a microsclerotium that have variable size (50–150  $\mu\text{m}$ ) depending on the availability of nutrients in the substrate on which the propagules are produced (Short & Wyllie, 1978). A single sclerotium of *M. phaseolina* germinates and forms numerous hyphae, which in turn also form secondary sclerotia, thus increases its number in soil (Fig. 10.1). *Macrophomina* causes a wide range of diseases in plants such as charcoal rot, root rot, collar rot, stem rot, etc., with a favored temperature range of 28–35°C and low moisture content of soil (Sandhu et al., 1999). Pycnidia, which are seldom seen under normal circumstances, are bigger than microsclerotia, dim brown to dark, rough, globose or sporadic, bent, and ostiolate (Lakhran et al., 2018).

In addition, humans are also susceptible to a variety of fungal infections, and they have increased considerably over the last few decades, more particularly invasive mycosis. People who are at higher risk of developing these fungal infections are the ones that usually have a compromised immune system. There are some reports of *Macrophomina* infection in humans also. The first case of *M. phaseolina* infection in humans was reported in a Sri Lankan-born Canadian man who went through a renal transplant in India.

Pathogenesis of *M. phaseolina* in plants involves the action of several cell wall-degrading enzymes (CWDEs) and toxins. *M. phaseolina* comes in action by making contact with the host plants and initiates infection by adhering to plant cell surface followed by invasion of host epidermis through appressoria formation being established in different plant tissues.

# 6

## **Barnyard Millet (*Echinochloa Frumentacea*); Chemistry, Nutritional Attributes, Processing Innovations, Traditional and Modern Foods and Beverages, Anti-nutrition and Health Benefits**

*Sangeeta<sup>1</sup>, Payal Garg<sup>1</sup> and Pankaj Kumar<sup>2</sup>*

*<sup>1</sup>Food Processing Department, Guru Nanak College Budhlada, Mansa, Punjab*

*<sup>2</sup>Department of Microbiology, Dolphin (PG) Instt of Biomedical and Natural Sc., Dehradun, Uttarakhand*

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### **Introduction**

Chemistry and Nutritional attributes

Processing innovation

Traditional and modern foods and beverages

Anti-nutrition and health benefits

Health benefits

Diabetes Mellitus

Cardiovascular Diseases

Gastrointestinal Disorders

Detoxification (Antioxidant Properties)

Anti-nutritional compounds

Conclusion

### **Introduction**

The non-glutinous, easily digestible and alkaline forming characteristics make millets superior in nutritional point of view. Among various cultivated millets in India, barn-yard millet, little millet, brown top millet, guinea millet and kodo

# Chapter - 4

## Mustard Farming in North India

Anuj Gupta, Sugandh Chauhan, Sunil Dutt Tyagi, Pankaj Budakoti and Satpal Singh

### Abstract

Mustard is one of the earliest domesticated crop plants by man. It contains an essential oil known as allyl-isothiocyanate which when applied to the outside of the body, increases the circulation and so helps the elimination of toxic wastes. This makes it of a great value in treating a number of complaints, from a simple chill to rheumatism. It helps in controlling the symptoms of asthma, prevents gastrointestinal cancer, helps in weight loss, it is anti-ageing, helps in lowering cholesterol and stimulates hair growth. The leaves of young plants are used as vegetables which is a good source of sulphur and other minerals in diet.

**Keyword:** Mustard, oil, allyl-isothiocyanate, asthma, toxic, sulphur, minerals

### Introduction

Indian mustard (*Brassica juncea* L. Czern & Coss.), which is cultivated throughout the world belongs to the family *Cruciferae* (*Brassicaceae*) under the genus *Brassica*, cultivated all over India and it is the major *rabi* oilseed crop of northern India. It has 38 to 42% oil & 24% protein. Other common names of *Brassica juncea* are "brown mustard", "Indian mustard", and "oilseed mustard". The mustard plant is also called *rai* or *raya* in India. In India, Mostly the cultivation of mustard is done with wheat, barley, gram, potato, etc., as intercrop. Since this crop is cultivated mainly in the rain-fed and resource scarce regions of the country, their contribution to livelihood security of the small and marginal farmers in these regions is also very important. Due to its low water requirement (80-240 mm), rapeseed-mustard crops fit well in the rainfed cropping system. Its cultivation is also being extended to non-traditional areas of Southern States like Karnataka, Tamil Nadu and Andhra Pradesh.

India is the third-largest producer of mustard in the world after Canada and china. In India mustard grown in an area of 6.41 million ha.

M. Valan Arasu\*, Naif Abdullah Al-Dhabi\*, Ashok Kumar Singh

## **19 Biocatalytic activity of microbial catalases: perspectives in industrial waste treatment, biosensor fabrication, food storage, and pharmaceutical sectors**

**Abstract:** Catalase is involved in the breakdown of hydrogen peroxide into oxygen and water. Most living organisms produce catalases; however, microbial catalases have a lot of potential than other sources. It has the potential to decompose hydrogen peroxide exponentially more than other enzymatic reactions. This enzyme is widely used in various applications, including wastewater management, drug discovery, hydrogen peroxide sensors, storage of foods at room temperatures, and protecting packed food. This chapter gives an overview of their source, application in the field of hydrogen peroxide removal from the bleaching effluent discharged from the textile industries, improving availability of oxygen in the reactor or aerobic system, fabrication of biosensors, hybrid enzyme production in pharmaceutical sectors, and their application in food industries. The major industrial application of catalase is to remove hydrogen peroxide from the bleaching industry.

**Keywords:** Biocatalyst, catalases, bacteria, bioremediation, bleaching, hydrogen peroxide

### **19.1 Introduction**

Catalases are the groups of enzymes and were initially identified by Loew in 1901, and these enzymes are one of the important enzymes for molecular biologists and biochemists. These enzymes involved in the breakdown of two hydrogen peroxide molecules into oxygen and water. There are two different phases to this catalytic process; however, each stage largely depends on the catalase type [1]. First, the heme is subjected to an oxidation reaction using a  $H_2O_2$  molecule to generate an oxyferryl species, in which one oxidation equivalent is removed from the iron and another from the porphyrin ring to generate a porphyrin cation radical. In the second stage of the en-

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\*Corresponding author: **M. Valan Arasu** Department of Botany and Microbiology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia, e-mail: mvalanarasu@gmail.com

\*Corresponding author: **Naif Abdullah Al-Dhabi**, Department of Botany and Microbiology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia, e-mail: naldhabi@ksu.edu.sa

**Ashok Kumar Singh**, Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun 248007, Uttarakhand, India

P. Vijayaragavan, M.A. Rathi, Naif Abdullah Al-Dhabi, M. Valan Arasu\*, V.K. Gopalakrishnan\*, Ki Choon Choi, Gauri Singh

## **21 Microorganisms and their enzymes in carbon storage and control of greenhouse gas emission**

**Abstract:** The major thrust area of microbial ecology is to understand the composition of microbial structure in the terrestrial environment because these communities affect biogeochemical cycles in an ecosystem. In this chapter, we analyze the soil microbial structure, the influence of microbial species and ecosystem processes in carbon storage, and control of greenhouse gas emission. We analyze the interactions of bacteria with plants and their metabolites. We then analyze the possible conditions for differences among types of microbes to influence C cycling and storage. The community structure involved in the generation of organic matter in detritus and in the rhizosphere. The microbial extracellular enzymes are one of the important factors that influence C cycling. Moreover, these ecosystem processes are very narrow and the specific niche plays a major role in biogeochemical cycles. In ecosystem processing a group of organisms is mostly involved in ecosystem functioning and responsible for the C cycle. In the soil C system broad processes are responsible for C storage and decomposition. In this chapter, therefore, we will focus on the role of microbes associated with C storage and decomposition.

**Keywords:** Bacteria, fungi, rhizosphere, carbon storage, C cycling, greenhouse gas

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\*Corresponding author: **M. Valan Arasu**, Department of Botany and Microbiology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia, e-mail: mvalanarasu@gmail.com

\*Corresponding author: **V.K. Gopalakrishnan**, Centre for Plant Tissue Culture and Central Instrumentation Facility, Karpagam Academy of Higher Education, Coimbatore 641 021, Tamil Nadu, India, e-mail: vkgopalakrishnan@gmail.com

**P. Vijayaragavan**, Bioprocess Engineering Division, Smykon Biotech Pvt Ltd., Nagercoil, Kanyakumari, Tamilnadu 629201, India

**M.A. Rathi**, Department of Biochemistry and Cancer Research Center, FASCM, Karpagam Academy of Higher Education, Coimbatore 641 021, Tamil Nadu, India

**Naif Abdullah Al-Dhabi**, Department of Botany and Microbiology, College of Science, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia

**Ki Choon Choi**, Department Grassland and Forage Division, National Institute of Animal Science, RDA, Seonghwan-Eup, Cheonan-Si, Chungnam, Republic of Korea

**Gauri Singh**, Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun 248007, Uttarakhand, India



# Recent Advances in Biological Science, Biodiversity and Environment



**Edited by**

**Dr. Ashok Kumar**

**Dr. Amrita Singh**

**Dr. Poonam Mehrotra**

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# 10

## Packaging Material for Agro Products: Importance and application

*Kanika Issar*

Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun  
[kanika.phd@gmail.com](mailto:kanika.phd@gmail.com)

### Introduction and Importance

**F**ruits and vegetables are part of our daily food they act as an important supplement for balanced diet as they provide the essential minerals, vitamins and dietary fiber (roughage) which are needed for maintaining proper growth and functioning of the body. Apart from their nutrition value fruit and vegetables are highly valued for their freshness and visual appearance they are highly perishable. Fresh fruits have high water content (70-96%), varying amount of carbohydrate (3-27%) and fiber (0.2-3.1%) and a low content of protein, fat and minerals. Fruits are important source of Pro-vitamin A and vitamin C. They have to kept or stored under ambient conditions of temperature and humidity due to their highly perishable nature. They soon lose their freshness and become subjected to molds and bacterial attack, and consequently decay and become useless. The loss of moisture causes them to wilt and become limp. In addition, vegetables also supply fair amount of carbohydrates, protein and energy and add colour, flavor and aroma to human diet.

Packaging is the science and technology used to preserve the quality of fresh produce so that it can be sold to markets far away from where it is grown and harvested. Packaging also helps to extend the marketing period by offering a layer of additional protection to keep the items safe for consumption and providing a barrier against pathogens and infestation, thus helping distributors and retailers reduce food waste. Packaging provides quality and quantity assurance besides creating hygienic environment for food product. It offers security through tamper proof designs and contributes to the product image through structural and graphical design. The primary objective or packaging is to protect the contents during storage, transportation and distribution against deterioration. It may be physical, chemical or biological. According

## **NUTRIENT REQUIREMENTS IN HEALTH AND DISEASE**

*Kanika Issar*

### **Abstract**

Food is any nutritious substance that people or animals eat or drink, or that plants absorb, in order to maintain life and growth. There are many socio, physiological and psychological functions of food viz., Social, Psychological and Physiological. Social functions means sharing foods with any person. Food is an integral part of all the body functions. Food is also served for the religious purpose. Psychological functions i.e. Nutrition is the assimilation by living organisms of food materials that enable them to grow, maintain and reproduce. Good nutrition is an important part of leading a healthy life. Nutrition is a biochemical and physiological process by which an organism uses food to support its life. It includes ingestion, absorption, assimilation, biosynthesis, catabolism and excretion. Physiological functions are energy giving, body building, protective and regulatory functions. The energy giving functions of food is performed by carbohydrates and fats. This is why these nutrients are also called body fuels. Food is also required for growth and repair, which is done by proteins. The other major physiological functions performed are the protective and regulatory functions.

# Indigenous Traditional Medicine Application by Traditional Healers in Garo Hills, Meghalaya, India

Bonnypesh Ch Sangma<sup>1</sup>, Sandhya Goswami<sup>2\*</sup>, Rashmi T Chamoli<sup>3</sup>, Vikaspal Singh<sup>4</sup>, Anil Kumar Uniyal<sup>5</sup> and Manish Kumar<sup>6</sup>

<sup>1</sup>M.Sc. Forestry Student Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

<sup>2,5</sup>Associate Professor, Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

<sup>3,4,6</sup>Assistant Professor, Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

**\*Corresponding author: Dr. Sandhya Goswami**  
**Email: sandhya.goswami@gmail.com**

## Abstract

*The use of plants as medicine is not a new concept. Plants has been and are very important part of traditional healing systems. In the culture of indigenous people, it is an integral part. Though this traditional knowledge is slowly extinct due to following reasons: lack of mechanism for transfer of knowledge, lack of appropriate documentation, current generation is not interested in practicing it, gap in the inclusion of modern science in age-old ethnic knowledge. Due to lack of scientific intervention & documentation many plant species those need conservation efforts are unattended. It is an important but usually underestimated resource. The present study is an effort to document the traditional healer's knowledge on plant-based medicine system to fill the gap in knowledge dissemination and documentation. Study highlights the indigenous uses of medicinal plant by Garo tribe of Gangbanga, Asimgri & Megua Songma village of Meghalaya. Data were collected through a structured questionnaire and observations were made during the field visit. Villagers and traditional healers (Ojhas) were consulted to gather information on medicinal plants. Total of 56 medicinal plants belonging to 47 genera and 31 families were documented. Herbs were the main source as medicinal plants followed by trees, shrubs, climbers and epiphyte. The recorded plants species were used for pneumonia, ulcer, gall-stones, UTI, menstruation problem, jaundice, Mental disorder, paralysis, body weakness, piles, sickness in women, cramps, cancer, gastric, late delivery.*

# A Study of Oak Dominant Forest in Garhwal Himalaya Relation to Different Aspects and Altitudes, Uttarakhand.

Vikaspal Singh<sup>\*1</sup>, D.S. Chauhan<sup>2</sup> and S. Dasgupta<sup>3</sup>

<sup>1</sup>Department of Forestry, Dolphin P.G. Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India

<sup>2</sup>Department of Forestry and Natural Resources, H.N.B.G.U., Srinagar Garhwal, Uttarakhand, India

<sup>3</sup>Department of Forestry and Biodiversity, Tripura University, Suryamaninagar, Tripura (West), India

\*Correspondence author: Vikaspal Singh

Email ID: vikaspals@gmail.com

## Abstract

*A study was carried out to investigate the plant diversity and composition in an Oak Forest of Garhwal Himalaya. Three altitudinal zones in both north facing and south facing aspects were explored for plant quantitative study. In all studied aspects and altitudes, a total of 23 tree species with 14 families, 29 shrubs with 16 families and 37 herbs species with 20 families were recorded. The proportion of species, family and genus in all altitudes was found greater for herb and shrub layer as compare to tree layer. Comparing both the aspects, north aspect showed higher tree species, family and genus while south aspect was richer in terms of shrub and herb layer of vegetation.*

**Keywords:** altitude, north aspect, south aspect, species, family, genus

## Introduction

The Indian subcontinent is a region of moderate to very high biodiversity including two of the global hot spot of vascular plant endemism in the Western Ghats and the Eastern Himalaya<sup>1</sup>. The plant diversity is found extremely rich from the valley regions to the highly elevated alpine meadows<sup>2</sup>. Biodiversity is used variously for fodder, fuel wood, timber, leaf litter, construction, industrial raw material and several non-timber forest produce<sup>3</sup>. The Garhwal Himalaya is one of the hot spots of biodiversity situated in the western part of Central Himalaya. The unusually wide altitudinal ranges make it interesting for studies<sup>4,5</sup>. Forest diversity is the main source of livelihood of the people living in Uttarakhand. In Uttarakhand, composition of forest is diverse varies from place to place because of varying topography such as plains, foothills and upper mountains<sup>6</sup>. Substantial amount of work has been carried out at regional and local levels in various parts of Indian Himalayan region (IHR),

# Relation of crown competition factor to D.B.H. for open-grown *Shorea robusta* stand

Brijmohan<sup>1</sup>, Rashmi T Chamoli<sup>2\*</sup>, Vikaspal Sing Rawat<sup>3</sup>, Sandhya Goswami<sup>4</sup>, Anil Kumar Uniyal<sup>5</sup>, Manish kumar<sup>6</sup>, and Manju Rani<sup>7</sup>

<sup>1</sup>M.Sc. Forestry Student Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

<sup>2,3,6</sup>Assistant Professor, Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

<sup>4,5</sup>Associate Professor, Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

<sup>7</sup>Assistant Professor, Department of Botany, Harsh Vidya Mandir PG College, Raisi, Haridwar, Uttarakhand

\*Corresponding author: Dr. Rashmi T.Chamoli

Email: rashmi3chamoli@gmail.com

## Abstract

Tree crown size determines among others tree's growth, carbon sequestration, shading, filtering of fine air particulates, and risk of wind-breaking. The dependence of crown size on species, resource supply, and tree age complicates an accurate evaluation of a tree's space requirement, and its size-dependent functions and services in urban as well as in forested areas. The data of the sample trees which is collected from four forest sites of Dehradun, with this collected data we can find out the stand density of the forest trees, maximum crown area (MCA), crown competition factor (CCF) and also average diameter of trees of that particular forest. Now, by adding MCA's for all trees on the average hectare of forest land, an expression of stand density called CCF is obtained. Thus,  $CCF = 1/A (0.002938 \sum N_i - 0.2000 \sum D_i N_i + 3.4019 \sum D_i^2 N_i)$ . The measurement of stand density has been one of the most trying problems in forestry. Maximum stand density was observed in Mohahand stand as compare to Manduwala forest stand. Density, as foresters commonly use the term, is the relation between the number of trees or some volumetric or areal unit to a specific area, usually 1 acre. Measures of density are usually restricted to trees larger than some minimum size, usually expressed as a minimum dbh. Specifying this minimum size is important because absolute density usually differs with differences in the minimum measured tree size.

**Keywords:** Stand density, Maximum crown area (MCA) and crown competition

# Effect of Pesticides on Plant and Human Health: A Review

Renu Dixit, Manju Rani\*, Rashmi T Chamoli, and Jitendra Kumar

Assistant Professor, Department of Botany, Gochar Mahavidyalaya, Rampur Maniharan, Saharanpur, Uttar Pradesh

Assistant Professor, Department of Botany, H.V.M. (PG) College, Raisi, Haridwar, Uttarakhand, India

Assistant Professor, Department of Forestry, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehrdaun, Uttarakhand

Scientific Officer, Uttarakhand State Council for Science and Technology (UCOST), Dehradun, Uttarakhand

\*Corresponding author: Dr. Manju Rani

Email Id: drmanjubaniya@gmail.com

## Abstract

Approximately 50% of the world's population and 75% of India's population is engaged in agriculture activity. Agriculture fulfills the basic needs like food, shelter, and clothing of the vast human population. The 20<sup>th</sup> century saw a massive change in agricultural practice, particularly in agricultural chemistry. Agriculture chemistry includes the application of chemical fertilizers, chemical insecticides, chemical pesticides, chemical fungicides, soil makeup, analysis of agriculture products, etc. A pesticide is any substance, which is aimed to prevent, extinguish, repel pests, or regulate plants. There are considerable benefits to using pesticides. While pesticides increase the yield of crops and livestock results, pesticides are also involved in damaging environmental health, human health, and livestock. The effect of chemical pesticides on plants can no doubt solve the problem of pests to great extent, but the use of such pesticides has developed many problems in the normal growth and development of crop plants. In the current study, we will discuss the effect of pesticides on plant growth, human health, and environmental health.

**Keywords:** Agriculture chemistry, pesticide, human health, environmental health.

## Introduction

Agriculture is the process of cultivating plants for food, fiber, fodder, and many desired products. Agriculture is defined with varying scopes, in its broadest sense using natural resources to "produces commodities which maintain life, including food, and their related services". Agricultural practice is also known as farming. The scientists, inventors, and other people who are devoted to improving farming



# Detection and Diagnosis of the Novel Coronavirus (COVID-19) present and future challenges

## ABSTRACT

COVID-19, a novel corona virus emerged with an outbreak of atypical viral pneumonia in Wuhan, China in the month of December, 2019. In the family *Coronaviridae*, Coronaviruses belongs to the subfamily *Coronavirinae* and the order *Nidovirales*, COVID-19 belongs to genera *Betacoronavirus* on the basis of the phylogenetic relationships and genomic structures. The clinical manifestations have been reported from mild respiratory infection to severe pneumonia with organ function damage. World Health Organization (WHO) has declared the outbreak a pandemic as it has effected more than 215 countries. COVID-19 being highly infectious disease the sample collection to process for diagnosis need to follow precise guidelines and biosafety norms that are recommended by Centre for Disease Control, Atlanta, USA (CDC). This article is an effort to provide an overview that how testing is critical and what are the diagnostic facility available for COVID-19 infection and its limitations. It also highlights the present and future challenges which are associated with (SARS-CoV-2) infection, it's handling, therapeutic management, vaccine development, new therapies and socioeconomic impact. To prevent the rise in numbers of COVID-19 cases, coordinated public health action, rapid testing, isolation of the cases, social distancing and use of the personal protective equipment is most important.

**Keywords:** COVID-19, WHO, CDC, SARS-CoV-2, Biosafety.

Dr. Shailja Pant\*

Professor, Department of Microbiology,  
Dolphin (PG) Institute of Bio-medical  
and Natural Sciences, Dehradun

✉: \*shailjapant@yahoo.com

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## 1. INTRODUCTION

In the month of December 2019, detected in Wuhan, China, the Coronavirus disease 2019 (COVID-19) is the latest infectious disease and the causative agent for which is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The earlier outbreaks of human coronavirus (HCoV) were, Middle East respiratory syndrome (MERS-CoV), first identified in Saudi Arabia in 2012 and before this severe acute respiratory syndrome, SARS in 2002-03 appeared in November 2002 in the Guangdong province

# Indigenous nitrogen fixing microbes engineer rhizosphere and enhance nutrient availability and plant growth

Sapna Negi<sup>a</sup>, Pankaj Kumar<sup>b</sup>, Jitendra Kumar<sup>c,d</sup>, Ajay Singh<sup>e</sup>, and Ramesh Chandra Dubey<sup>f</sup>

<sup>a</sup>Department of Microbiology and Biotechnology, DBS (PG) College, Dehradun, Uttarakhand, India <sup>b</sup>Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India <sup>c</sup>Department of Botany, Dolphin (PG) College of Science and Agriculture, Fatehgarh Sahib, Punjab, India <sup>d</sup>Department of Biosciences, UIB, Chandigarh University, Mohali, Punjab, India <sup>e</sup>Department of Food Technology, Mata Gujri College, Fatehgarh Sahib, Punjab, India <sup>f</sup>Department of Botany and Microbiology, Gurukul Kangri Vishwavidyalaya, Haridwar, Uttarakhand, India

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## 2.1 Introduction

Nitrogen is an essential element for plant development and a limiting factor in plant growth. It represents about 2% of the total plant dry matter that enters the food chain (Miller & Cramer, 2005). Nitrogen is abundant in the earth's atmosphere in the form of N<sub>2</sub> gas, but it cannot be used directly by the living organisms to produce chemicals for their growth and reproduction (Wansik et al., 2016). However, there is a continuous depletion of N by some processes, such as soil erosion, chemical volatilization, denitrification, soil leaching, and removal of N-containing crop residues from the land (Vitousek & Matson, 2009).

---

# 16 Anaerobic Treatment of Food Processing Wastes and Agricultural Effluents

*Simmi Goel,<sup>a</sup> Pankaj Kumar,<sup>b</sup> Mukul Sain,<sup>c</sup> and Ajay Singh<sup>d</sup>*

<sup>a</sup>Department of Biotechnology, Mata Gujri College Fatehgarh Sahib, Punjab, India

<sup>b</sup>Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, India

<sup>c</sup>Dairy Engineering Division, National Dairy Research Institute, Karnal, Haryana, India

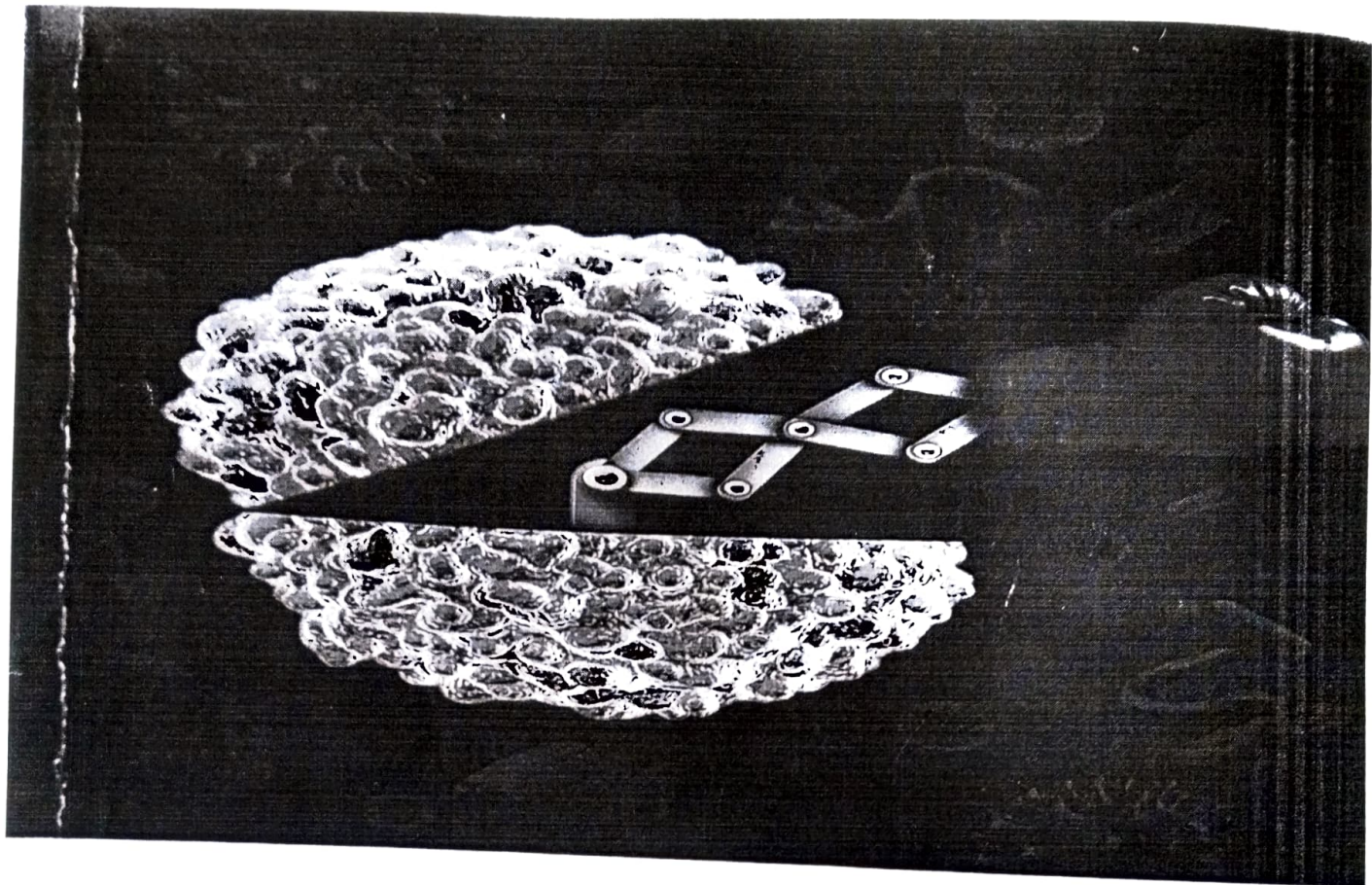
<sup>d</sup>Department of Food Technology, Mata Gujri College Fatehgarh Sahib, Punjab, India

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## 16.1 INTRODUCTION

A massive rate of industrialization and urbanization impacts everyone as a result of which, natural resources are on the forefront and are being exhausted at a very fast pace. A large number of effluents such as agricultural waste, food processing waste, municipal waste, fruit and vegetable waste have been generated annually. Among developing nations, a lack of proper transportation, storage, disposal, and treatment facilities for waste poses a great risk to the environment in



D.K. Awasthi  
Gyanendra Awasthi

# Immunological Tests in Pathology Laboratory

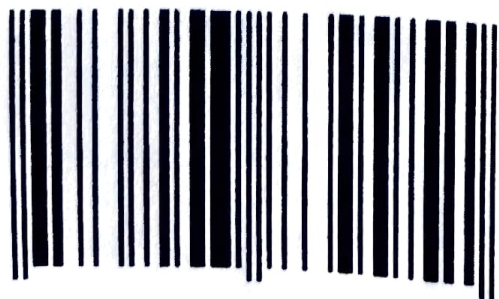
A Guide to Important Important Investigations in  
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This book covers the important investigations involving antigen and antibody interactions in pathology laboratories. Main emphasis is on the rapid investigations involving immunology as basic techniques. These tests are simple to perform and can be used at point of care testing. The publication also includes working of cell counter for counting of cells involved in immunology. The book also deals with ELISA technique, an important tool for estimation of various parameters.

Dr. D.K. Awasthi is working as Associate Professor and Head, Department of Chemistry, JNM (PG) College, Lucknow. He has 40 years of experience in teaching and research.

Dr. Gyanendra Awasthi is working as Associate Professor and Head, Department of Biochemistry, Dolphin (PG) Institute, Dehradun. He has more than twenty years of experience.



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D.K. Awasthi  
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# Molybdenum: A Brief Study

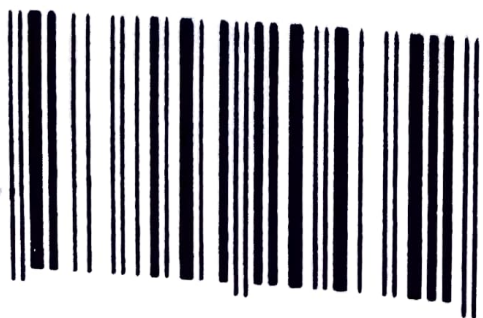
A Brief Review of Various Aspects of Molybdenum



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Molybdenum is a transition metal in Group 6 of the Periodic Table between chromium and tungsten. Although molybdenum is sometimes described as a 'heavy metal' its properties are very different from those of the typical heavy metals, mercury, thallium and lead. It is much less toxic than these and other heavy metals. Its low toxicity makes molybdenum an attractive substitute for more toxic materials. Molybdenum is the first of the transition metals to have an extensive sulfur chemistry shown, for example, having as its principal ore molybdenum disulfide,  $\text{MoS}_2$ , its binding by sulfur ligands in molybdenum containing enzymes, application of  $\text{MoS}_2$  as an important industrial catalyst, and formation of many sulfur complexes some of which are used as soluble lubricating oil additives. Molybdenum-based technical chemicals exploit the versatility of molybdenum chemistry in oxidation states (VI), (V) and (IV). Materials made from molybdates are oxidation catalysts, are photoactive, and semiconducting. Many of the properties of molybdenum provide development opportunities and new commercial applications through the exploitation of its chemistry.

Dr. R. Awasthi is presently working as Associate Professor and Head of Department of Chemistry, J. N. M. P. G. College Lucknow U.P. Dr. Awasthi is doing collaborative research work with national and international scientists and his major thrust area is clinical chemistry, radioactive properties of the inner transition inner transition metals.





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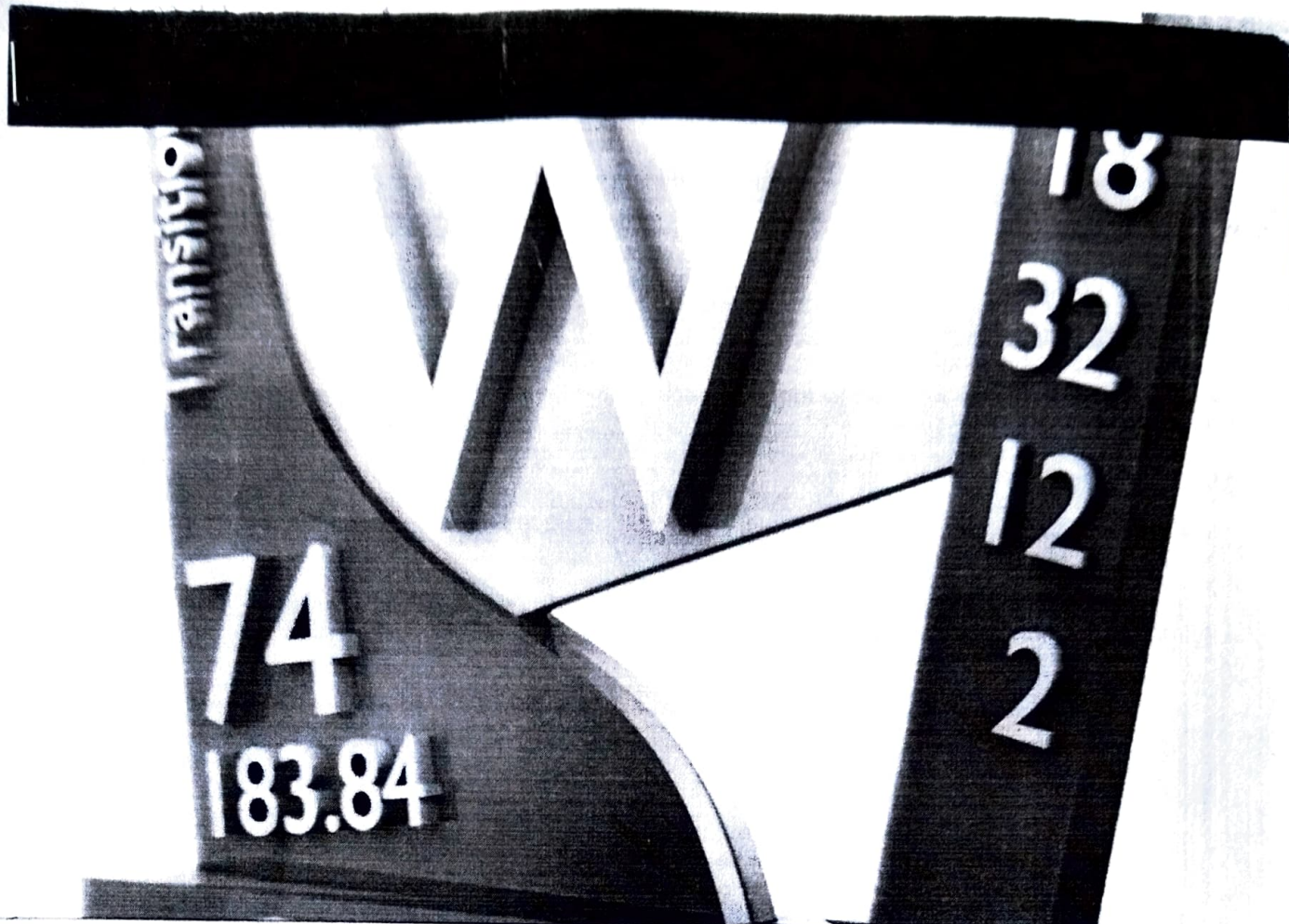
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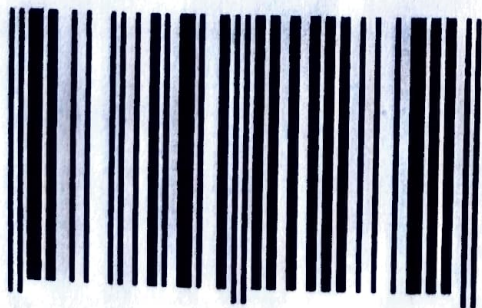
# Tungsten Mettaloenzymes And Their Applications

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The melting point of tungsten is the highest among all metallic elements, and its density ( $19.3 \text{ g / cm}^3$ ) is very high, close to gold. The hardness of tungsten is also very high, and the hardness of tungsten carbide is close to that of the diamond. In addition, tungsten has good electrical conductivity, resonance, small expansion coefficient, and other characteristics, so it is widely used in the industry and our daily life. The present book deals with the history, properties, uses and application of metalloenzymes.

Dr. Devendra Kumar Awasthi is presently working as Associate Professor and Head, Department of Chemistry in J.N.M.(PG) College, Lucknow. Dr Awasthi is doing collaborative research work with national and international scientists and his major thrust area include clinical chemistry and radioactive properties of the inner transition metals.



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### About the Author



Dr. Kanika Issar is currently working as an Assistant Professor in the Department of Horticulture, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand. She has completed her Master's programme in Agriculture (Horticulture) in 2006 from GBPUAT, Pantnagar and earned her Doctorate in 2012 from Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP). She has 10 years of teaching experience. Dr. Kanika has published 20 research papers, 8 review articles, 15 popular articles, 17 abstracts and 3 book chapters in various national and international journals. She has reviewed many articles in national and international journals. She has been awarded with Young Scientist Award (YSA) by Uttarakhand State Council for Science and Technology (UCOST), Dehradun and Plantica (Association of Plant Science Researchers, Dehradun). She has been a member of many scientific societies of India.

# POST HARVEST MANAGEMENT OF HORTICULTURAL CROPS



DR. KANIKA ISSAR



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## Chapter 8

# Significance of keratinophiles in biofertilizer development from keratinous waste: Upcoming perspective

Jitendra Kumar<sup>a</sup>, Pankaj Kumar<sup>b</sup>, and R.K.S. Kushwaha<sup>c</sup>

<sup>a</sup>Department of Botany, Dolphin (PG) College of Science & Agriculture, Fatehgarh Sahib, Punjab, India, <sup>b</sup>Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India, <sup>c</sup>Department of Botany, Christ Church College, Kanpur, Uttar Pradesh, India

## 8.1 Introduction

Consumption of chicken by individuals is increasing day by day due to technological development in food preparation. Chicken feathers are the waste of commercial poultry processing plants and chicken slaughter shops accumulating at a higher rate. Annually 24 billion chickens are killed and 8.5 billion tons poultry feathers are produced worldwide, while India contributes about 350 million tons (Mt) annually. These poultry feathers are generally dumped, used for land filling, or burning, which creates huge pollution in soil, water, and air (Sahoo et al., 2012). Keratinophilic fungi are a group of fungi that colonize different keratinous substrate and degrade them to components of low molecular weight. Various strategies are adopted to handle the huge volume of waste accumulating continuously. Feather waste is disposed of at waste disposal sites, incinerated, sent to the feather meal industry, gardeners, or farmers. These methods are inefficient or expensive adding to the cost for the producer. Traditionally, feather is processed by mechanical or chemical treatment and converted to feedstuff, fertilizers, glues, foils, etc. These methods of feather meal production lead to the destruction of heat nutritive amino acids such as lysine, alanine, methionine, etc. The process results in only a low nutritive value feed supplement thereby undermining the product value (Wang and Parsons, 1997).

### 8.1.1 Keratin

Keratins are a family of fibrous structural proteins that belong to the scleroprotein groups found in feathers, wool, horns, hooves, nails, claws, beaks, and hair of animals. The keratin chains are tightly packed into  $\alpha$ -helix ( $\alpha$ -keratin) or  $\beta$ -sheets ( $\beta$ -keratin) and then further turned into supercoiled structures which give good mechanical stability to these proteins. The extensive cross-linkages and disulfide bonds in keratin make them resistant to most of the known proteases such as trypsin, pepsin, and papain and results in polluting the environment. The presence of  $\beta$ -keratin in feathers causes high degree of recalcitrance in degradation process (Onifade et al., 1998). These proteins are extremely resistant to the action of physical, chemical, and biological agents. Mechanical stability and high resistance to proteolytic degradation of keratin are due to their disulfide bonds, hydrogen bonds, salt linkages, and cross-linkings (Kaluzewska et al., 1991). It is resistant to the action of pepsin, trypsin, and other specific protease. Keratins are also present in epithelial covering which is rich in beta helical coil linked through cysteine bridges (Vigneshwaran et al., 2010). Keratin can be divided into soft and hard keratin depending on the cystine content. Soft keratin occurs in skin and contains approximately 2% cystine, whereas hard keratin is present in hair and contains approximately 14% cystine. Due to the strength and stability of keratin, very few organisms are able to break it down and utilize it. Only a few insects, bacteria, actinomycetes, and fungi can use keratin as a resource.

### 8.1.2 Structure of keratin

The keratin appears as loose, parallel strands of fine filaments about 60–100 Å in diameter which aggregate to form fibrils. Birbeck and Mercer (1957) defined keratin as the hardened fibrils plus matrix material which ultimately fills the cells of hair cortex. It consists of two main components: a fibrous protein that gives the  $\alpha$ -keratin and X-ray diffraction pattern (or



# Microbial Valorization of Coir Pith for Development of Compost and Bioethanol Production

1

Tripti Malik and Seema Rawat

## Abstract

Coco pith, an agricultural by-product of coir industry, is a dust left after the extraction of coir fibers from coconut husk. It is accumulated outside the coir industries as huge heaps, which usually becomes an environmental hazard. It is degraded very slowly due to its high lignin and cellulose content. The tannins and phenols are leached out from coir pith heaps by rains which enter the soil and aquatic ecosystems leading to loss of soil fertility and have adverse effect on soil and aquatic biodiversity. Thus, the safe disposal of coir pith is the need of hour which can be achieved by its conversion into value-added products like compost and bioethanol. Due to its rich nutrient content, it has a good prospective as compost. The microbial valorization of coir pith has been proved not only to enrich nutrients in the agricultural soil, but also to increase the pathogen resistance and will surely resolve the environmental pollution problems. The high cellulose and hemicellulose content of coco pith make it a suitable candidate for conversion into bioethanol. This chapter will outline the future prospects in the processing and conversion of coir pith into commercially viable compost and bioethanol.

## Keywords

Agricultural waste · Coco pith · Biofertilizer · Bioethanol · *Saccharomyces*

T. Malik

Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India

S. Rawat (✉)

Microbiology Lab, School of Life Sciences, Central University of Gujarat, Gandhinagar, Gujarat, India

e-mail: seema.rawat@cug.ac.in

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1



# Traditional and Modern Agricultural Implements Used in Agro Sciences – A Case Study in the Part of National Capital Region of Uttar Pradesh, India



Ganesh Datt Bhatt, Mahesh Singh, Archana Bharti, and Deepali Rana

**Abstract** The research work was undertaken to discover a variety of conventional and modern crops growing; implements used for agriculture operations by the rural farmers of Dankaur and adjoining villages of National Capital Regions (NCR), a part of Gautam Buddha Nagar, Uttar Pradesh, India. The traditional and modern agriculture implements are very economical with respect to man power, finance and economy as well as saving of valuable time. The traditional and modern agriculture implements are prepared of the vicinity accessible resources which are: iron, fire-wood along with its substitute products. These agriculture implements are easily too operate without any special skills and training. The information related to agricultural implements was documented through the interactions with local villagers, personal observations and existing data are also used. The detailed information about each agriculture implements was collected and informative notes were taken during interview with the rural farmers. The information were collected during the field work from July 2018 to March 2020 and found approximately fifty three (53) traditional and modern agriculture implements were identified and briefly explained with scratched photographs prepared by a research team of School of Agriculture. These agriculture implements are: bill hook, hand trowel, secateurs, sickles, girdle, pruning knife, shovel, spud, knap-sack sprayer, pick axe, garden hoe, weeder etc. The traditional economy of farmers is for subsistence only not to profit. The farmers are characterizing by undersized and patchy land property, small yield of crop and domestic animals, disguised joblessness, reduced profits and short hazard manner skill.

**Keywords** Agriculture · Implements · Traditional and modern implement · GB nagar · NCR

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G. D. Bhatt (✉) · M. Singh · A. Bharti  
School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh 203201, India

D. Rana  
Department of Zoology, Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Manduwala, Dehradun, Uttarakhand 248007, India

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129

# Water Quality Assessment of Streams of Doon Valley Dehradun, Uttarakhand



Deepali Rana, S. K. Gupta, and Rahul Rana

**Abstract** Water quality of any stream depends on a variety of physico-chemical parameters. The present study was conducted to assess the water quality of various streams in Eastern and Western Doon. It was carried out on two river systems comprising of five main rivers—Baldi, Song, Suswa, Tons and Asan. Sampling was done regularly at 20 sampling stations established along these rivers. 15 physical and chemical parameters like depth, width, water velocity, air temperature, water temperature, dissolved oxygen, carbon dioxide, pH, turbidity, alkalinity, hardness, BOD, nitrate, phosphate and total dissolved solids were analyzed. The study reveals that the magnitude of different parameters is related to the climatic conditions, seasons and river discharge. The interplay of these parameters determines the water quality of the streams. The fluctuation pattern all through 3 different seasons reflected an increment pattern from summer to rainy in the parameters like depth, width, water velocity, CO<sub>2</sub>, turbidity and TDS. The declining trend in the values of the aforesaid parameters was noticed beyond rainy months. From rainy to winters, an increment in values was noticed in DO, pH, hardness, alkalinity, BOD, nitrate and phosphate. The parameters which showed increment in values from winters to summers include AT, WT, CO<sub>2</sub>. Width, depth and WV have been the chief physical factors with wide range of variations. BOD, Hardness, NO<sub>3</sub><sup>-</sup>, TDS, DO and CO<sub>2</sub> values seemed more important from the quality of water chemistry point of view. Seasonal variation in physical and chemical parameters have also been observed.

**Keywords** Water quality · Doon Valley · Physico-chemical parameters · Eastern and Western Doon

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D. Rana (✉)

Department of Zoology, Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India

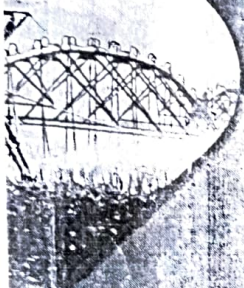
S. K. Gupta · R. Rana

D. B. S. (PG) College, Dehradun, Uttarakhand 248001, India

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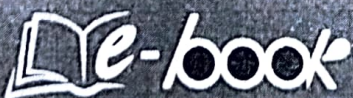
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अनिल कुमार चौधरी, डॉ. भीमसद आन्देडकर विश्वविद्यालय आगरा के आर. बी. (पी. जी.) कॉलेज के कृषि मैग्स आगरा में आनुवांशिकी एवं पादप प्रजनन के विभागाध्यक्ष के पद पर कार्यरत हैं। आप अब तक आनुवांशिकी, पादप प्रजनन व कृषि विषयों पर 20 पुस्तकें लिख चुके हैं। वर्तमान में आप हिन्दुस्तान कृषि अनुसंधान एवं कल्याण संस्था के महासचिव हैं तथा याशि रिसर्च फाउन्डेशन नई दिल्ली के उपसचिव के रूप में कार्य कर रहे हैं। आपको सरकारी अथवा गैर सरकारी संस्थाओं द्वारा राष्ट्रीय व अंतर्राष्ट्रीय स्तर पर FISGBRD, FYAF, FHARWS, FBMR, इनोवेटिव साइंटिस्ट अवॉर्ड, यंग साइंटिस्ट अवॉर्ड तथा सर्वश्रेष्ठ ब्रीडर अवॉर्ड से सम्मानित किया जा चुका है। 25 से अधिक शोध पत्र आपने राष्ट्रीय व अंतर्राष्ट्रीय स्तर पर प्रकाशित किये हैं। आपने राष्ट्रीय व अंतर्राष्ट्रीय स्तर पर सम्मेलन/कार्यशाला कराई हैं तथा आप डी.डी. किसान व डी.डी. नेशनल टी. वी. एवं आल इंडिया रेडियो (AIR) द्वारा समय-समय पर देश के किसानों का मार्गदर्शन करते रहे हैं। आपको सरसों के क्षेत्र में अनुसंधान का ख्याति पूर्ण अनुभव प्राप्त है। आपका सरसों की किस्म/लाइन तैयार करने में महत्वपूर्ण योगदान है।

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# Chapter - 5

## Mass Rearing of the *Trichogramma* on *Corcyra cephalonica* Eggs

Nirvesh Singh, Narender Kumar and Sonu Kumar

### Abstract

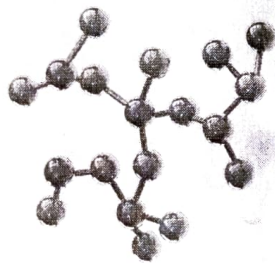
*Trichogramma* is the member of hymenoptera order. This is polyphagous bio-control agent that is act as endoparasitoids of insect eggs. *Trichogramma* primarily parasitise eggs of Lepidoptera, but parasitism also occurs in eggs of other orders such as Coleoptera, Diptera, Hemiptera, Hymenoptera and Neuroptera. It is important for plant protection because of its wide spread natural occurrence and its success as biological control agent by mass releasing. It has the distinction of being the highest produced and most utilized biological control agent in the world. The success of any pest control programme by bio-agents depends on quality of mass production of parasitoids and its parasitization rate and adult emergence. A stored grain pest (*Corcyra cephalonica*) has been proved to be one of the most efficient surrogate hosts for rearing a wide range of biological control agents. *C. cephalonica* commonly called as rice meal moth or rice moth is a pest of stored foods, viz., cereals, cereal products, oilseeds, pulses, dried fruits, nuts and spices. Many of the natural enemies mass-bred in the laboratory for use in field against crop pests are dependent on either egg or larval stages of *Corcyra* due to the simple reason that it is easier and cheaper to produce natural enemies on different stages of *Corcyra* than on their original hosts.

**Keywords:** *Trichogramma*, *Corcyra*, parasite, bio-agent

### Introduction

Bio-control has been a boon to primitive agriculture and has been economically successful in modern progressive intensive agriculture. The importance of biological control in IPM has been recognized in our country from early 1930 (Sankaran, 1974). During recent years, there has been considerable change in the status of pests in India due to many changes in the agro-ecosystem. Indiscriminate use of pesticides has disturbed the natural balance between the pest and natural enemy population, leading to an upsurge

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D. K. Awasthi  
Gyanendra Awasthi

# Biomedical Application of Silver Nanoparticles

Recent Application of Silver Nanoparticles in Medical  
Field

Dr. D. K. Awasthi is presently working as Associate Professor and Head, Department of Chemistry, J.N.M. (PG) College, Lucknow. He has 40 years of experience in teaching and research.  
Dr. Gyanendra Awasthi is presently working as Associate Professor and Head Department of Biochemistry, Dolphin (PG) Institute, Dehradun with wide exposure of applied research.



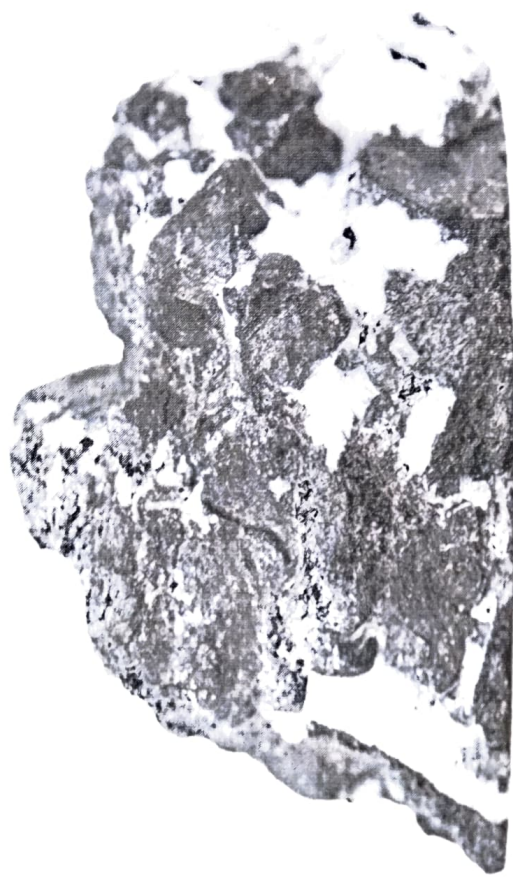
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Titanium dioxide (titanium(IV)oxide, Titania,  $\text{TiO}_2$ ) is an inorganic compound that owes its recent rise in scientific interest to photoactivity. After the illumination in aqueous media with UV light,  $\text{TiO}_2$  produces an array of reactive oxygen species (ROS). The capability to produce ROS and thus induce cell death has found application in the photo dynamic therapy (PDT) for the treatment of a wide range of maladies, from psoriasis to cancer. Titanium dioxide NPs were studied as photo sensitizing agents in the treatment of malignant tumors as well as in photodynamic inactivation of antibiotic-resistant bacteria. Both  $\text{TiO}_2$  NPs themselves, as well as their composites and combinations with other molecules or biomolecules, can be successfully used as photosensitizers in PDT. Titanium nanotubes (TNT) implants used in medical therapy have been demonstrated by various examples including dentistry, orthopaedic implants, cardiovascular stents, and so on. Finally, a future perspective of TNTs for clinical applications is provided. These nanostructures can reveal increased light absorption, allowing their further use in targeted therapy in medicine.



Dr. D. K. Awasthi is presently working as Associate Professor and Head, Department of Chemistry, J.N.M.(P.G) College, Lucknow, U.P. Dr Awasthi has more than thirty years of research and teaching experience. He has authored more than ten books and published more than eighty research papers in journals of repute.

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D. K. Awasthi  
Gyanendra Awasthi

# Medicinal Applications of Titanium Oxide

Biomedical applications of Titanium oxide



**Chapter 8**

**STUDY ON SEEDLING POPULATION  
RESPONSE TO DISTURBANCE OF A  
GARHWAL HIMALAYAN OAK (*QUERCUS  
LEUCOTRICHOPHORA* A. CAMUS) FOREST**

***V. Singh<sup>1,\*</sup>, D. S. Chauhan<sup>2</sup> and S. Dasgupta<sup>3</sup>***

<sup>1</sup>Department of Forestry, Dolphin PG Institute of Biomedical and  
Natural Sciences, Dehradun, Uttarakhand, India;

<sup>2</sup>Department of Forestry and Natural Resources, HNBGU, Srinagar  
Garhwal, Uttarakhand, India

<sup>3</sup>Department of Forestry and Biodiversity, Tripura University,  
Suryamaninagar, Tripura (West), India

**ABSTRACT**

An extensive study was conducted to access the population status of *Quercus leucotrichophora* seedlings in a part of Garhwal Himalaya Oak forest. Permanent plots were established in different altitudes and aspects.

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\* Corresponding Author's Email: vikaspals@gmail.com.

# Biotechnological Interventions for Production of Flavour and Fragrance Compounds

# 7

Tripti Malik and Seema Rawat

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## Abstract

Flavour and aroma are the important attributes which determine the sensory perception of food, pharmaceutical and cosmetic products. Traditionally, flavour and aroma compounds are extracted from plant and animal sources. In order to meet the huge demand and expenses for various products, the artificial chemicals are now being added. Due to the chemo-phobia and health hazards, artificial flavours and fragrances are not acceptable by the consumers. Biotechnological methods provide better and eco-friendly substitutes for artificial flavour and fragrances. The bio-routes for their synthesis are based on enzymes methods, de novo microbial processes, and bioconversion/biotransformation using microorganisms. Solid-state fermentation carried out by microorganisms can produce a variety of potentially valuable aromatic compounds. Different agro-industrial wastes such as plant residues, bran, straw, flowers, fruit pods can be used as the raw materials which reduces the manufacturing costs of these bio-products and also solves the problem of environmental pollution. Advances in genetic and metabolic engineering are newer approaches of biotechnology which has opened a fenestella in the production of flavour and fragrances.

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## Keywords

Bioeconomy · Biotransformation · de novo microbial processes · Enzymes · Flavour · Fermentation · Fragrance · Metabolic engineering · Plant tissue culture

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T. Malik

Department of Microbiology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, India

S. Rawat (✉)

Microbiology Lab, School of Life Sciences, Central University of Gujarat, Gandhinagar, India  
e-mail: seema.rawat@cug.ac.in

# 14

## Nondestructive Assessment of Indian Forest: A Physicist View

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Dr. Aasheesh Raturi

### Introduction

यथा काश्टं च काश्टं च समेयातां महोदधौ ।  
समेत्य च व्यपेयातां तद्वद् भूतसमागमः

*"Yatha kastham ch kastham ch sameyatam mahodadhau,  
sametya ch vyapeyatam tadvad bhuta samagamah"*

This is well known saying from our ancient Sanskrit spiritual and religious texts which means let us coming together of living beings is like the pieces of wood that come together in ocean and having come together, separate. These lines explain the importance of strength in the pieces of wood. The same analogy we extend and expected for our houses and other places where strength of wood surpass this phrase and mostly derived from our age less or everlasting forests. Wood is an important natural renewable resource; it is composed of cellulose, lignin, hemicelluloses, and minor amounts of extraneous materials (Izzekor and Fuwape 2010). Variations in the characteristics

# Chapter - 5

## Modern Techniques for Detection of Plant Pathogens

Satpal Singh, Gopal Singh, Prashant Mishra, Anuj Gupta and Naimish Kumar

### Abstract

Different pathogens such as bacteria, fungi and viruses cause 15 to 40% losses in Agriculture crops during growth, harvest and after postharvest handling. In order to minimize the damage in crops and maximize productivity, early disease detection and prevention of pathogens are highly important. For early detection and identification of pathogens which can control the spread of pathogen, direct, indirect and sensor based methods are being used as modern techniques in crops. In which direct detection methods includes molecular techniques while indirect methods are based on plant stress profiling and plant volatile profiling. Biosensors include DNA/RNA, Enzyme and Bacteriophage biosensor.

### Introduction

Food losses due to crop infections from pathogens such as bacteria, viruses and fungi are persistent issues in agriculture for centuries across the globe. In order to minimize the disease induced damage in crops during growth, harvest and postharvest processing, as well as to maximize productivity and ensure agricultural sustainability, advanced disease detection and prevention in crops are imperative. The direct and indirect identification methods are currently used in agriculture. Laboratory-based techniques such as polymerase chain reaction (PCR), immunofluorescence (IF), fluorescence *in-situ* hybridization (FISH), enzyme-linked immunosorbent assay (ELISA), flow cytometry (FCM) and gas chromatography-mass spectrometry (GC-MS) are some of the direct detection methods. Indirect methods include thermography, fluorescence imaging and hyperspectral techniques. A wide variety of sensors includes DNA/RNA, Enzyme, Bacteriophage biosensor, have been developed and commercialized for detection and identification of pathogens. These sensors are fully based on electrical, chemical, electrochemical, optical, magnetic or vibrational signals. These Biosensors are new tool for the early identification of plant pathogens.



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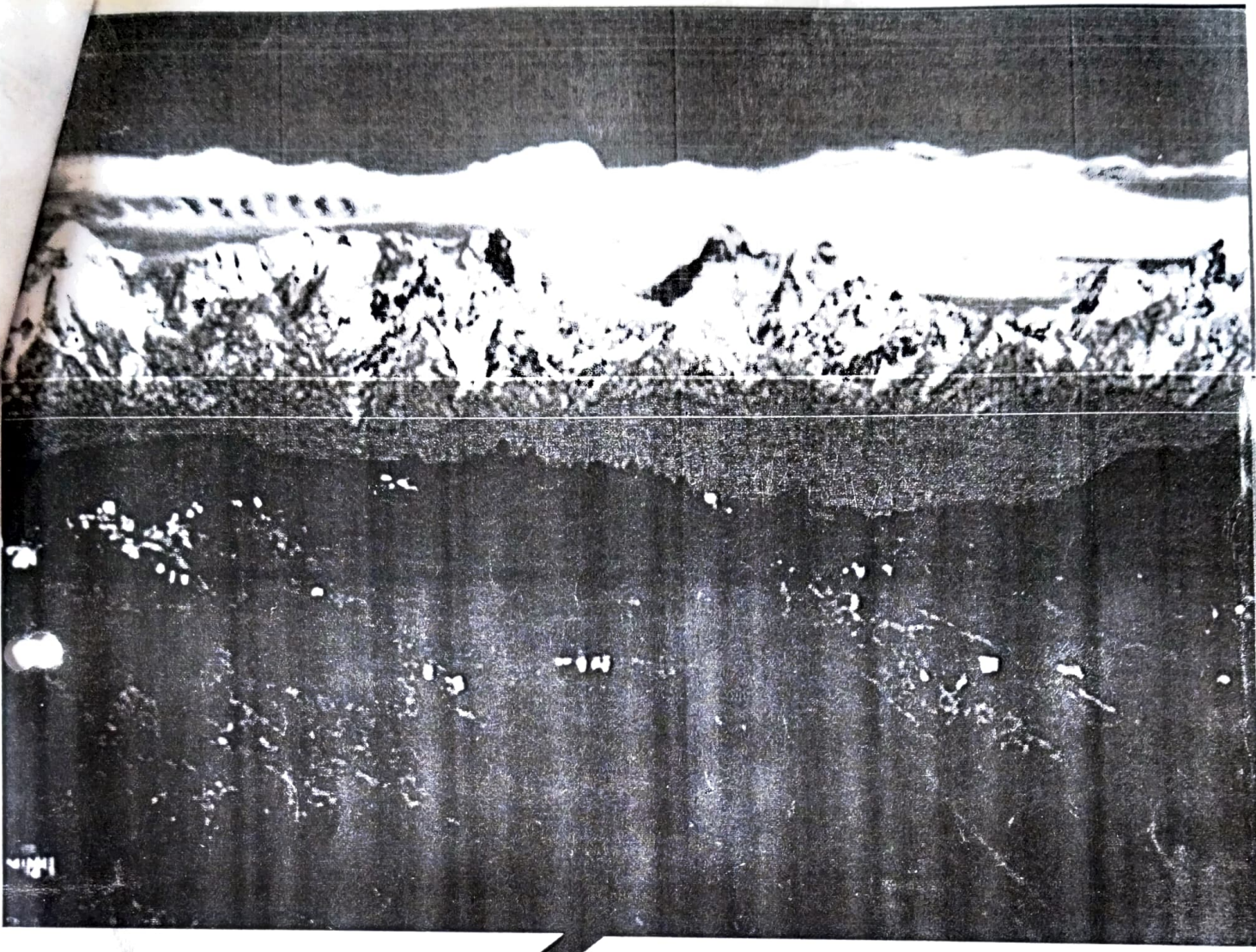
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## Screening of Cluster bean cultivars for better adaptive potential in eCO<sub>2</sub> Concentration under Free Air Concentration Enrichment System

Sonali Mehrotra<sup>1,3</sup>, Ashish Praveen<sup>1</sup>, K.P. Tripathi<sup>2</sup> and Pramod Arvind Shirke<sup>1</sup>

1. Plant Ecology & Environmental Sciences Division, CSIR-NBRI, Lucknow-226001, U.P.
2. Department Botany, Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehradun, UK
3. Life Science Department, Uttarakhand Technical University, Suddhuwala, Dehradun, U.K.

### Abstract

Eight Cluster bean (C<sub>4</sub>) cultivars 1066,936,1031,986,1002,471,1033,197 were grown in pots experiment and were screened under effect of elevated CO<sub>2</sub> [e[CO<sub>2</sub>]=550±20ppm] and ambient CO<sub>2</sub> [a[CO<sub>2</sub>]=420±20 ppm] for their better adaptive strategies under Free Air Carbon dioxide Enrichment (FACE). Plant growth, Morphological parameters, Yield, and Physiological parameters were estimated. Among eight cultivars plant height, plant fresh wt., dry wt. were found to increased significantly and affected under e[CO<sub>2</sub>] and were reported highest in 936(+43.43),197(+10.11),936(+2.65) and lowest in 1033(+17.57),1033(+4.68),1033(+0.79) plant varieties respectively. Similarly, the leaf area index also affected significantly and was reported highest in 1031(+0.54) to lowest in 1033(+0.27). Among yield parameters seed no./pod, seed/plant and seed weight were estimated and they also affected significantly, increased and were reported and highest in 1066(+6.6),1066(+90),1066(+4.80) to lowest in 936(+3.2),471(+20.8),197(+2.40) respectively. Total Chlorophyll almost doubles and were affected significantly being highest in 986(138.02) followed by 1066(+77.26),471(+72.19) and least in 197(+55.18). Leaf area also showed significant changes found highest in 1031(+0.57) to lowest in 1033(+0.27). Physiological parameters includes Photosynthetic rate, Stomatal Conductance, Transpiration, Vapour pressure density, Water use efficiency were also found significantly affected and were highest in 1066(+29.2),197(+0.197),1002(+9.533), 1022(+10.93),936(+25.7) and lowest in 986(+9.1),1033(+0.12),1066(+9.13),1033(+5.6),1033(-18.4). Internal carbon dioxide concentration inside the stomatal cavity also enhanced significantly under e[CO<sub>2</sub>] concentration, was reported highest in 1066(+392) followed by 1002(+363) and least in 1033(+302). Among all cultivars on an average overall 1066 and 1002 varieties were found to be showing higher yield, enhanced chlorophyll content, higher photosynthetic rate. Thus it can be inferred that higher synthesis of chlorophyll concentration promotes higher photosynthetic rate which is the chief cause of increased leaf area and higher carbon dioxide fixation at growing regions of plants. Increased leaf area and higher carbon dioxide fixation promote increased yield parameters in 1066 and 1002 thus both varieties were depicting better adaptive potential under e[CO<sub>2</sub>] and can serve as a boon to grow under e[CO<sub>2</sub>] and enhanced future food security in India.

**Keywords:** e[CO<sub>2</sub>], a[CO<sub>2</sub>], Free Air Carbon dioxide Enrichment (FACE).

### Introduction

Global climate changes are the challenges for future plant physiologist and plant biologist. Global climate changes comprise of high temperature, rising CO<sub>2</sub> emission, rising ozone concentration, drought stress, high precipitation rate etc. Empirical records justify that foremost among them is rising atmospheric carbon dioxide that is uniquely uniform globally, contributes highly in global climate changes and stimulates photosynthesis, biomass, and yield of major staple food crops.





D .K. Awasthi  
Gyanendra Awasthi

# **Role of Kidneys in Acid Base Balance and Formation of Kidney Stone**

Mechanism of Acid Base Balance by Kidneys and  
Formation of Kidney Stone

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The Proper pH is very important for the functioning of the human body and kidneys play vital in pH maintenance. The book highlights about various mechanisms for the acid base disturbance and role of kidneys in their correction. It also deals with types of kidney stones, the causes responsible for the formation of kidney stones and mechanism underlying the process. The book also briefly explains about the risk factors and treatment available for the kidney stones.

Dr. Devendra Kumar Awasthi is presently working as Associate Professor and Head, Department of chemistry, J. N.(P.G) College Lucknow U.P. Dr. Awasthi is doing collaborative research work with national and international scientists and his major thrust area is clinical chemistry, radioactive properties of the inner transition metals.

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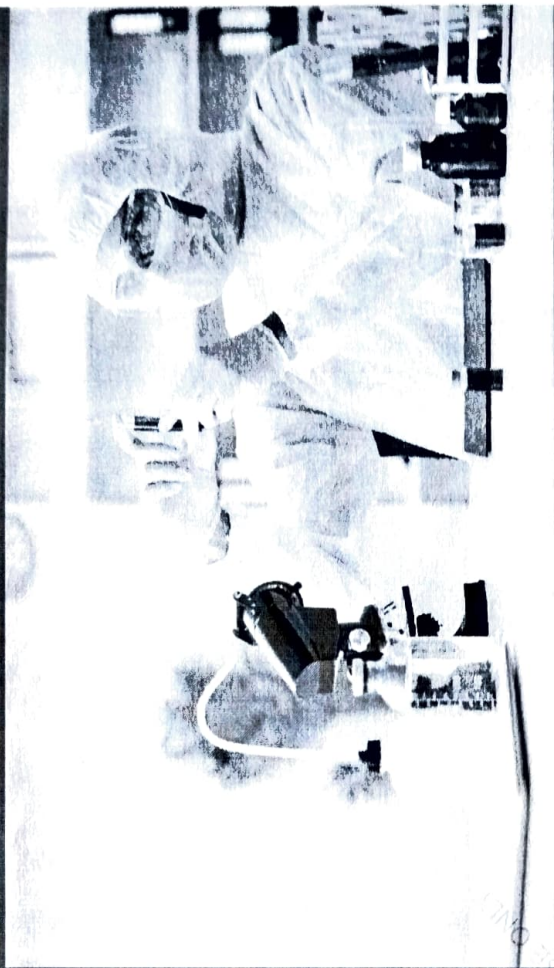
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Diagnostic Enzymology is designed as a textbook for the students of paramedical sciences; in addition it will also serve as an invaluable reference for the students pursuing undergraduate and postgraduate degree programmes in life sciences. The book is divided into two sections. The section of Enzyme basics deals with fundamentals of enzymology such as history, properties, classification, nomenclature, specificity, kinetics, factors affecting enzymatic activity, inhibition, control of enzymatic activity, enzyme assays and mechanisms responsible for abnormal enzyme levels. Specific enzyme section deals with important diagnostic enzymes in detail. Each chapter of diagnostic enzyme is further divided into three sections viz introduction, clinical significance and assay procedures. The exact protocol is discussed so that students can assay the enzymes in the laboratory.

## Diagnostic Enzymology

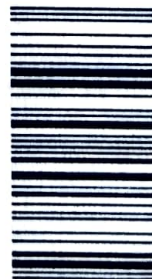


Gyanendra Awasthi  
D.K. Awasthi

# Diagnostic Enzymology

## Enzymes and Clinical Diagnosis

Dr. Gyanendra Awasthi is presently working as Associate Professor and Head, Department of Biochemistry in Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Dehradun. He is teaching Biochemistry to UG and PG students since last fourteen years. He also has wide experience in the field of diagnostics.

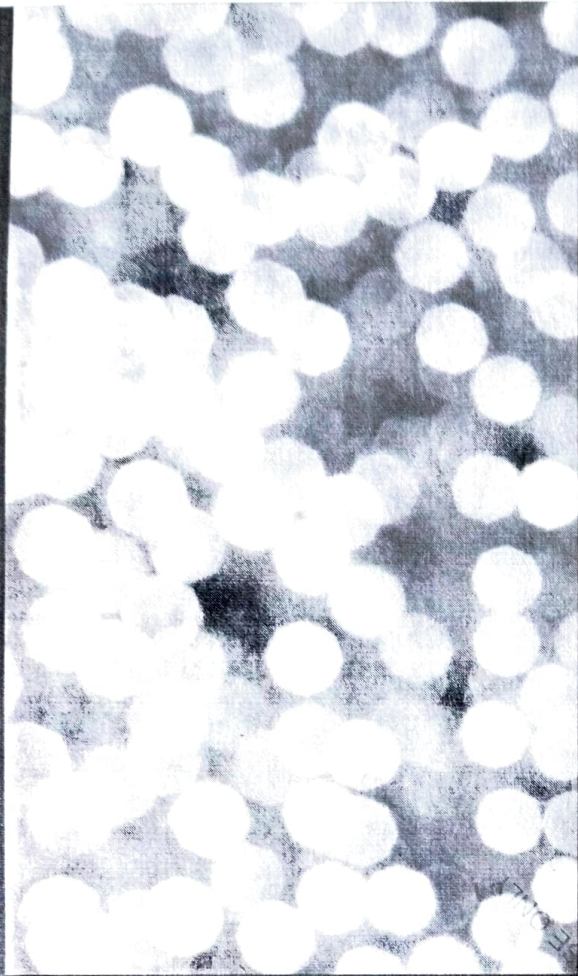


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Nanoparticles are increasingly becoming indispensable tool of modern day research in almost every field of science. Cancer nanotechnology has become a prime field of investigations for the scientists nowadays. There are several nanocarrier systems used for effective cancer therapeutic and gold nanoparticles have become promising vehicles for the delivery of anticancer drugs into their targets. Gold nanospheres, nanorods, nanoshells, nanocages, and surface enhanced Raman scattering nanoparticles will be discussed in detail regarding their uses in vitro assays, ex vivo and in vivo imaging, cancer therapy, and drug delivery. Gold nanoparticles are widely used in many fields as preferred materials for their unique optical and physical properties such as surface plasmon oscillations for labelling, imaging and sensing. Much advancement was made in biomedical applications with better biocompatibility in disease diagnosis and therapeutics. Multifunctionality is the key feature of nanoparticle-based agents.



Dr. D. K. Awasthi - Associate Professor and Head, Department of Chemistry, Jai Narain PG College.  
Dr. Gyanendra Awasthi - Associate Professor and Head, Department of Biochemistry, Dolphin (PG) Institute of Biomedical and Natural Sciences.  
Miss Akshay Singh - Research Scholar, Department of Chemistry, Jai Narain PG College.



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D .K. Awasthi  
Gyanendra Awasthi  
Akshay Singh

# Gold Nanoparticles

95-3-2020





D. K. Awasthi  
Gyanendra Awasthi  
Priyanka Raj

# **A Review on cytochromes**

An Important Protein in biological systems

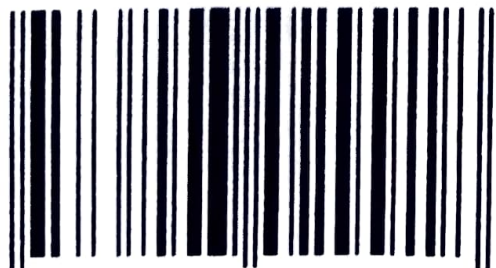
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Inorganic chemistry deals with synthesis and behaviour of inorganic and organometallic compounds. It has applications in every aspect of the chemical industry, including catalysis, materials science, pigments, surfactants, coatings, medications, fuels, and agriculture. Inorganic elements and Metal ions are important to various biological processes. Alkali & Alkaline earth metals are plays vital role as metalloenzymes/ metalloproteins, they triggers cellular response. Like, Cytochrome are electron transporting protein pigments concerned with cell respiration that contain an iron-containing molecule called heme, allied to that of haemoglobin. When the iron of heme accepts an electron, it changes from the oxidised ferric(III) state to reduced ferrous(II) state. Cytochrome is cellular pigments and it performs cellular activites, it acts as a mobile carriers in cellular respiration/oxidative photophosphorylation and photosynthesis in plants.

Dr D K Awasthi: Assoc.Prof. and Head,Dept.of Chemistry,J.N.M.(PG) College,Lucknow(UP).40 years of teaching and research experience.

Dr Gyanendra Awassthi: Assoc.Prof. and Head,Dept.of Biochemistry,Dolphin (PG) Institute,Dehradun(UK),wide exposure of applied research.

Miss Pritanka Raj is a PG student of chemistry. Interest in protein chemistry



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# Proceedings



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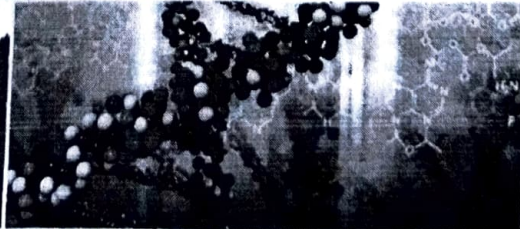
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### Advances in Zoology & Applied Sciences

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**Chief Editor**

Dr. Beena Joshi Bhatt  
Associate Professor and Head  
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# DIVERSITY OF ODONATA SPECIES AT ASAN CONVERSATION RESERVE (Dehra Dun Valley, Uttarakhand)

Arun Kumar\* & Rehab Gani

Department of Zoology, Dolphin (PG) Institute of  
Biomedical & Natural sciences, Dehradun

## ABSTRACT

The Odonata collection were made six times from a month of february to june by using sweep net method. Distribution of adults of order Odonata in Asan reservoir site are abundant. A total of 15 species of Odonata, out of which 12 were Anisoptera and 3 were Zygoptera were recorded in this study. The total number of individuals, total number of species richness in study area were calculated with the Shannon-weiner expression. *Crocothemis sevilla*, *Ishnura aurora* and *Trithemis aurora* was species of higher occurrence frequency. The species diversity of Odonata calculated by using Shannon-weiner diversity index was highest in trapa site. The family Libellulidae was most abundant. On the basis of number of identified species, number of identified species Libellulidae was most dominant family. The study confirmed that existences of a wide diversity of Odonata in the Asan reservoir site and this might be playing a potential role in keeping the insect pest population index in control.

**Key Words:** Odonata, Dragon flies, frequency, Asan reservoir, Shanon-weiner Index

## Introduction

India is uniquely rich in all aspects of biodiversity. It is estimated that over 89,000 species of fauna are found in India. India has about 4.1 million hectares of wetlands of which 1.5 million ha are natural and 2.6 million ha are man-made. They have played a major role in defining the ecology by providing natural drainage and providing habitat to the local flora and fauna. Class insecta is an ancient and largest group of arthropods. They are found through-out the world in all bio-geographical regions and ecological zones. The sanskrit term shatpada refers to the hexapoda condition of insects. Insects have long Evolutionary history. Appearing first in the Devonian period 400 million years ago, insects played an important role in sustaining the dynamics of ecosystem processes. The class insecta has been divided into 31 orders including order Odonata. The number of known Odonata species in the world is 6000. According to Janzen (1983), the high mobility of insects permits them to disperse long distances and invade new territories. Insects are dynamic group of organisms with a long evolutionary history. Appearing first in the Devonian period 400 million years ago, the insects have successfully diversified

# STUDIES ON THE FISH AND FISHERIES OF DISTRICT KUPWARA

Dinesh Kumar Bhardwaj\*, Irfan Rashid Wani\* and G. R. Ganaie<sup>1</sup>

\*Deptt of Zoology, Dolphin Institute of Biomedical and Natural Sciences,  
Dehradun (Uttarakhand).

Deptt of Zoology, Govt. Degree College, Kupwara (J & K)

## ABSTRACT

District Kupwara of Jammu and Kashmir is a hilly district having a vast area of freshwater bodies and hot water springs. These water bodies can be divided into two types i.e lotic and lentic types. The former includes the main water body Nallah Kupwara and its tributaries whereas the later one includes lakes, ponds, wet land etc. The activities of fisheries are explored on the basis of management of ichthyofauna area mainly include *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys molitrix*, *Schizothorax richardsonii*, *Cirrhinus cirrhosus*, *Salmo trutta fario*, *Oncorhynchus mykiss* and *Labeo rohita*. Among all these fish species *Schizothorax richardsonii* is dominant in the district. The culture fisheries resources are in the form of stagnant water bodies like lake, pond marshy ground fish farm etc.

## Introduction

District Kupwara, the hilly and remote sensing area has plenty of water resources mostly in the shape of streams, springs, sars and high altitude rivers. The water spread area about 50.8 hectares (about 21% of its total Geographical area) thus constituting about 1.56% of total water spread area of Kashmir Valley. In the present account an attempt has been made to high light the scope of fish and fishers and the infrastructure existing in the district Kupwara. It is one of 10 districts of Kashmir valley with district headquarter (Kupwara) situated at a distance of 100 kms from Srinagar. The study of fish and fisheries and the effect of drought and pollution on the fishes of district Kupwara is helpful for fish farmer and related people. It reveals that there is a vast potential of development of fisheries in the area. The development of fisheries has taken step but still more are needed for the development of fisheries sector so that the net production of fishes could be enhanced.

## Materials and Methods

The fishes were collected from rivers (River Pohru, kishen Ganga, Mawar stream, Dringyal stream) and from fish farms (Diver, Batergam, Sogam, Kutlari) with the help of different type of net (Jaal, Fatiyata, Katori or Channi or Pot net, Hooks and line gear). The general fishes were preserved in 4% to 6% of

# FOOD AND FEEDING HABIT OF FISHES

**Shalini Anand\* and Mohammad Abdul Quyoom Bhat**

Department of Zoology, Dolphin (PG) Institute of Biomedical  
& Natural Sciences, Dehradun

## ABSTRACT

Present study was conducted to identify the type of food taken by *Labeorohita*, *Clairsbatrachus*, *Mystusseenghalas* been determined. These species were found to be an omnivorous, carnivorous and herbivorous respectively as evident from gut analysis and R.L.G. value. Gut analysis of *Labeorohita* indicates that this species is voracious feeder feeds mainly on algae and vegetable matter and this species is a surface feeder. Gut content of *Mystusseenghala* indicates that gut content consists of about 60-70% animal material, 5-10% plant material and rest was detritus. Gut content analysis of *Clairsbatrachus* indicates that this species is bottom feeder, feeds both on animal and plant material. It is also evident that R.L.G. value has a close relationship with the nature of food of fish. It is also known fact that vegetable matter requires more time for digestion due to which herbivorous fishes have higher R.L.G. than carnivorous and omnivorous.

**Key words:** *Labeo rohita*, *Mystus seenghala*, *Clarias batrachus*, R.L.G. GSI Gut content analysis Suddowala, Uttarakhand.

## Introduction

Food is the basic prerequisite for growth, development, survival and existence of all organisms. It plays important role in the migration, growth and spawning behavior of fish. Food and feeding habit of fish are important biological factors for selecting a group of fishes for culture in ponds to avoid competition for food among themselves and live in association to utilize all the available food. It is virtually impossible to gather sufficient information of food and feeding habit of fish in their natural habitats. Through knowledge on the food and feeding habit of fishes provide keys for selection of culturable species (Begum et al., 2008). The food habit of different fishes changes from month to month. This variation is due to changes in composition of food organisms occurring at different seasons of the year (Kausar et al 2010). Fishes require nutrients for growth, reproduction and other normal body physiological functions; food of fishes in natural aquatic environment includes phytoplankton zooplankton, plant materials, insects, worms and smaller fishes. Food eaten by various species of fishes has been divided into four categories. Basic, secondary, incidental, and obligatory food.



# A REVIEW ON STUDY OF FISH FARMING PRACTICES IN UTTARAKHAND

**Beena Joshi Bhatt & Shaista Manzoor**

Department of Zoology, Dolphin (PG) Institute of Biomedical  
& Natural Sciences, Dehradun

## ABSTRACT

The Uttarakhand is bestowed with vast and varied water resources in the form of rivers, streams, lakes, ponds and reservoirs. The diverse aquatic habitat of Uttarakhand harbour rich piscine diversity. The various traditional (unscientific) and scientific methods used for fishing include, Cast net or Jaal, Pattari, Karonchor or scoop net, Kanta (Angling), Side water diversion or dam formation, Mosquito Net or Cloth, Hand Picking, Gowda Trap, Patti Net, Katori, Fandi, Bori, Jali, Char (Rod), Jali-fandi, Dynamiting, Electric current, Ghan or Hammering, Bleaching powder. The production from the Uttarakhand is still at very low pace, because of the needs of fish farming and fisheries management is poorly recognized. The overall ignorance of various principles, recommended practices and input of fish farming, features of fishes and fishing in rivers are prevalent in the region. The lesser popularity of fish farming in Uttarakhand or any other region may be due to practical complexities involved and requirement of minimum workable knowledge in the farming, which limit its absorbance quickly by new farmers. In order to revolutionize the traditional and unscientific methods of fish farming, various techniques, based on modern scientific lines are employed for fish culturing in Uttarakhand.

The study is carried out to identify perceptions, myths and traditional knowledge and bring out a review of realities on various fisheries aspects including fishing, fish farming and fish consumption.

**Key Words:** Traditional knowledge, Scientific methods, Fish farming, fishery management

## Introduction

In Uttarakhand the needs of fish farming & fisheries management are poorly recognized as compared to agriculture, horticulture and livestock management by most of stakeholders. The fisheries study carried out in the past focused on fish taxonomic, fish distribution and fishing related aspects, but research on ethnobiological and aboriginal knowledge on fish farming and fisheries development are counting to be very less all over India including Uttarakhand. The lesser popularity of fish farming in Uttarakhand state or any other region may be due to practical complexities involved and requirement of minimum workable knowledge in the farming, which limit its absorbance quickly by new farmers. Thus, fishermen and farmers need to be properly educated on existing opportunities and benefits of fish

# SURVEY OF INSECT PESTS ASSOCIATED WITH FIELD (CEREAL) CROPS OF KASHMIR

**P. K Sehgal\***, **Aafaq Nabi Rather<sup>1</sup>** and **G.M. Mir<sup>2</sup>**  
\*Department of Zoology, Dolphin (PG) Institute of Biomedical  
& Natural Sciences, Dehradun  
<sup>1</sup>Department of Zoology, BFIT, Dehradun &  
<sup>2</sup> Division of Entomology, SKUAST-K, Srinagar ( J&K)

## ABSTRACT

Agriculture is the most important industry of the people of Jammu and Kashmir. Even those engaged in other industries depend on agriculture for raw material. About 80% people in the State are cultivators in one form or the other. The total area of the State according to the 1992 record of India is 24.15 lakh hectares. Out of this area 138,6867 Sq. K ms. are rural and only 305.4 Sq. K ms. are urban. Cultivation of rice requires hot and moist climate. It is a Kharief crop and is sown in March-April and harvested in Autumn. Sufficient water must cover the fields. It is grown mostly in the valley of Kashmir at 2100 metres above sea level. Total area under rice cultivation in the valley of Kashmir is 374000 acres having a yield of 25.5 quintiles hectare Arora et al (2009). Bhagat et al (1990). Bhat and Bali (1989). Sharma et al. (1966), Nayar et al. (1976). Sharma et al. (1966), Shukla and Kumar (2005) and Jalali and Singh (2002).

**Key Words:** Survey Of Insect Pests, Cereal, Crops Of Kashmir

## Introduction

Agriculture is the most important industry of the people of Jammu and Kashmir. Even those engaged in other industries depend on agriculture for raw material. About 80% people in the State are cultivators in one form or the other. The total area of the State according to the 1992 record of India is 24.15 lakh hectares. Out of this area 138,6867 Sq. Kms. are rural and only 305.4 Sq. are urban. This signifies that the entire State of Jammu and Kashmir is rural with 6503 villages. Out of the total area of 24.15 lakh hect. agricultural statistics are available only for about 8.26 lakh hectare. The rest of the area is under forests and mountains. Grasshoppers are relatively large insects that are capable of doing considerable damage in a very short time. Large numbers of grasshopper nymphs can develop in tall weedy areas attracting little attention. However, when become winged adults, they can fly greater distances and suddenly appear in crop fields. The rice skipper is a minor pest of rice, with extensive distribution in rice growing regions. Damage is caused by larvae that defoliate the rice plants. newly hatched larvae feed on tender leaves. Adults typically visit flowers and hold their wings together while feeding. They hold their

# STUDY OF THE SKULL OF *LABEO ROHITA* (HAMILTON, 1822) AND *CIRRHINUS MRIGALA* (HAMILTON, 1822)

**Beena Joshi Bhatt & Suhail Ur Reham**

Department of Zoology, Dolphin (PG) Institute of Biomedical  
& Natural Sciences, Dehradun

## ABSTRACT

The skulls a bony structure in the head of most vertebrates (in particular craniates) that supports the structure of the face and forms a protective cavity for the brain. Function of the skull include protection of the brain, fixing the distance between the eyes to allow stereoscopic vision, and fixing the position of the ears to help the brain use auditory cues to judge direction and distance of sounds. To study osteology of Indian major carps, need to good quality and fully matured fish. Rui was collected from various sources. Some rui was collected from local market, for studying theosteological features of Rui fish, and then washed the fish well in tap water. Then took a large steel bowl with tap water and put Potassium Hydroxide (KOH) into the water bowl, then these fishes were kept in bowl and heat it for about 20 minutes. And then the fish was kept on the tray for collecting total fish skeleton. Fish muscle was detached from fish from bone using forcep tissue carefully. When some bones were detached from main vertebrae, then these bones were joined by gum. The fish skeletal structure was kept in the room temperature for gentle air dry. The findings were counting all bones of Rui fish, there were four operculum bones from skull like opercular, preopercular, subopercular, and interopercular bone respectively, 6 first caudal vertebrae, 11 typical vertebrae, 11 typical trunk vertebrae. Streamlined vertebrae column having 35 vertebrae follows the pattern of body shape. The findings from the current study will help to broaden our understanding of the bone structure, sizes and shape of Rui fish and would extend the knowledge of rui osteology and the nature of the bone and their structure.

**Key Words:** Skull, Osteology, Vertebral Column, Operculum

## Introduction

Carp are cultivated in specially constructed water ponds, having adjacent breeding areas, mostly cultivated with catla in fresh water ponds and lakes in the absence of carnivores fish. It is also used as a game fish where it is specially introduced into water reservoirs for the purpose of sport fishing. Carp are teleost fish which means literally "bony". The body endoskeleton of *Labeo* is completely ossified. The axial skeleton includes skull, vertebral column and ribs, while the appendicular skeleton includes pectoral and pelvic girdles and supporting elements of fins. The vertebrate skeleton system has a positive correlation with their body weight. Also there is a strong positive correlation between the weight of different skeleton and the total skeleton system (Bahuguna and Bisht, 2005).

# SPECIES DIVERSITY OF ENTOMOFAUNA IN A CROPLAND OF SELAQUI REGION DEHRADUN, INDIA

**Dinesh Kumar Bhardwaj\* and Shamim Akhtar**

Deptt of Zoology, Dolphin (PG) Institute of Biomedical and  
Natural Sciences, Dehradun-248007

## ABSTRACT

The main crops of Selaqui region was wheat, mustard, sugarcane, maize, and rice. Wheat and mustard crop are grown extensively in the month of October and November and are harvested in the month of May. A total of five fields within five hectares were sampled for insects within four months duration i.e from March and June. All fields were sampled once in a week during morning and evening hours. Different collection methods were used for collecting the insects such as hand picking, with the help of forceps, collecting jars with the use of insect net to collect the insect which are flying in nature. The identification up to the species level was done with the help of available identification keys and cooperation of Zoological survey of India, Dehradun. The diversity index was calculated by Shannon Wiener expression. The present study shows the diversity index 0.762 which is little low due to the use of cropland for construction purposes and excessive use pesticides and fertilizers in the agriculture fields causing food limitation to insect and destruction of their habitation.

## Introduction

Biodiversity is the degree of variation of life. This can refer to genetic variation, species, variation or ecosystem variations within an planet. The study site is located at Selaqui (30° 19'N latitude and 78° 4'E longitude) of district Dehradun Uttarakhand, India. It is located 25 km toward West from District Dehradun. A total of 149 insects belonging to 6 orders with 31 species were collected in which Hemiptera with 6 species, Coleoptera with 8 species, Orthoptera with 4 species, Hymenoptera with 5 species, Lepidoptera with 7 species, Odonata with 3 species have been reported. Coleoptera ranked first with the large population of individuals and percentage (43 and 28.85%). The order followed by the Lepidoptera (33 and 22.14%), Hemiptera (31 and 20.80%), Hymenoptera (24 and 16.10%), Orthoptera (15 and 10.06%) and Odonata (3 and 2.01%). The diversity index is 0.762. It is little low due to excessive use of pesticides and fertilizer, construction purpose, causing food limitation to insects and destruction of their habitation.

## Materials and Methods

The study was carried in Selaqui region of district Dehradun. The study was conducted in an agricultural field having an area of 5 hectares. A total of 5 fields were sampled in four months i.e from March to

# STUDY OF PHYSICOCHEMICAL PARAMETERS OF ASAN RIVER IN DEHRADUN

**Shalini Anand**

Department of Zoology, Dolphin (P.G.) Institute of Biomedical and Natural Sciences Dehradun

## ABSTRACT

A systematic study has been carried out to assess the water quality of asan river Dehradun. 25 water samples from 25 sampling areas were collected and analysed for physico-chemical parameters (Temp, pH, dissolved oxygen, free CO<sub>2</sub>, C.O.D., B.O.D., total alkalinity, hardness, turbidity, total dissolved solids and total suspended solids.) The samples were collected and analysed. Each parameter was compared with the standard desirable limit of that parameter in river water as prescribed by different agencies.

The analytical data of various physicochemical parameters indicates that some parameters like pH, total dissolved solids, total suspended solids, turbidity and sodium are found to be in excess than the prescribed limit in some water samples of the study areas. The resulting values indicate that water samples of some sampling areas are quite unfit for drinking purpose because of high value of dissolved solids. Suitable suggestions were made to improve the quality of river water.

**Key words:** Water pollution, asan river water, physicochemical analysis, Water quality index, potability.

## Introduction

Water is an indispensable natural resource on earth. All life including human being depends on water. Due to its unique properties water is of multiple uses for living organism (Majumder and Dutta 2014, Singh 2014). Thus, water is a natural resource with limited and uneven distribution in time and space. All forms of life and all human activities are dependent on water. Water resources are of great importance to human life and economy and are the main source of meeting the demand for drinking water, for irrigation of lands and industries. Lack of water is considered as a limiting factor of socio-economic development of a country (Kępuska 2013). As of now only earth is the planet having about 70% of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases (Kotadiya et al. 2013). It is difficult to understand the biological phenomenon fully because the

# STUDY OF EFFECTS OF CADMIUM CHLORIDE (CdCl<sub>2</sub>) ON LIVER OF *Clarias batrachus* (LINN. 1758)

**Beena Joshi Bhatt\* & Aadil Mushtaq Lone**  
Department of Zoology, Dolphin (PG) Institute of Biomedical &  
Natural sciences, Dehradun-248007, Utrakhand, India

## ABSTRACT

The toxic effects of Cadmium Chloride on liver were observed after 30 days. The fishes when exposed to Cadmium chloride accumulates the heavy metal Cadmium which has toxic effects on fish. The Cadmium (from Cadmium chloride) being the heavy metal accumulates in body tissues of fish and affects the physiological activities of fish. In this study the liver were analyzed. The controlled fish was having good liver cells than the fishes, which were exposed to Cadmium chloride at different concentrations. The study also discovered that Cadmium being the heavy metal proved fatal at high concentrations. as during work there has been mortality of one fish exposed to 1 ppm of Cadmium chloride. The heavy metals pollution poses open threat to the fish industry as well to the consumers of fish. The heavy metal concentrates in the food chain and affects all the organisms whosoever consumes the fish. The eradication of heavy metals from aquatic bodies is necessary as these heavy metals accumulate in tissues and other organs thereby affecting the fish and indirectly the consumers.

**Key Words:** Cadmium chloride, liver, accumulation, heavy metal

## Introduction

The highest concentration of Cadmium has been found to be absorbed in the kidneys of humans, and up to about 30mg of cadmium is commonly inhaled throughout childhood and adolescence. The most dangerous form of occupational exposure to cadmium is inhalation of fine dust and fumes, or ingestion of highly soluble cadmium compounds. Inhalation of cadmium containing fumes can result initially in metal fume fever but may progress to chemical pneumonitis, pulmonary edema and death. Cadmium is also an environmental hazard. Moreover dissolved Cd levels in fresh water generally range from 10-500ng/L and in case of extreme water pollution, concentration of cadmium may exceed 17000ng/L and Zn concentrations of polluted freshwater in industrial zone rivers may produce total Zn residues of 3ng/L in receiving waters. Cu concentrations that occur in the vicinity of some metal mines are 0.5-2mg/l. Although Cu and Zn are essential elements for some metallo enzymes, high concentrations cause acute and chronic toxicity to fish. Most aquatic organisms have the capability of concentrating metals by

# FISH DIVERSITY INDICES OF THE STREAMS OF DOON VALLEY, DEHRADUN, UTTARAKHAND

Deepali Rana<sup>1\*</sup>, S. K. Gupta<sup>2</sup> and Rahul Rana<sup>2</sup>

<sup>1</sup>Department of Zoology, Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand.

<sup>2</sup>D. B. S. (PG) College, Dehradun-248001 UTTARAKHAND, India.

## ABSTRACT

Fish diversity in relation to water quality of Doon valley was examined for a period of two years at 20 sampling stations set of 5 Rivers (Baldi, Song, Suswa, Tons and Asan) in Eastern and Western Doon valley. A total of 56 species, belonging to 5 Orders, 13 Families and 30 Genera were recorded during the present investigation. The Cyprinid family was dominant in the present study. The status of fish diversity, on the basis of the number of species present in a sample, has been evaluated in terms of richness (the number of species), the abundance (dominance) of each species (number of individuals) and lastly the relative abundance of different species by subjecting the data to the fundamentals of different indices like Margalef, Simpson, Shannon - Weiner and Pielou Index, respectively for the streams of Doon valley. The results of all these indices have invariably demonstrated that the richness, dominance, diversity and evenness patterns exhibit typical increasing trend in values of indices from upstream to downstream sections.

**Keywords:** Diversity indices, Doon valley, Fish fauna, Dominance, Richness.

## Introduction

Species richness and relative species abundance are the key elements of biodiversity. Waters (1992) reviewed the fish diversity of freshwater fishes' relative to habitat. Kottelat and Whitten (1996) have reviewed many aspects of freshwater biodiversity in Asia. The species diversity increases with decreasing latitude has been given by Guegan (1998). Studies that attempt to relate fish-assemblage characteristics to habitat characteristics have found that substrate diversity and diversity of water depths (Gorman and Karr, 1978; Angermeier and Schlosser, 1989) and habitat size (Winemiller, 1983; Angermeier and Schlosser, 1989) are important correlates to fish assemblage attributes. Angermeier and Karr (1983) have shown that fish richness and trophic function shift relative to stream size and canopy openness along a longitudinal gradient. A comparison of physico - chemical conditions and fish assemblages in streams flowing through different geological types has been done by Esselman *et al.*



United States Department of Agriculture

## Proceedings

# 21st International Nondestructive Testing and Evaluation of Wood Symposium

Freiburg, Germany  
2019



Forest Service, Forest Products Laboratory  
Forest Research Institute Baden-Württemberg  
Forest Products Society  
International Union of Forest Research Organizations

General Technical Report  
FPL-GTR-272

September  
2019



## Proceedings

# 21st International Nondestructive Testing and Evaluation of Wood Symposium

Freiburg, Germany  
2019

### Edited by

**Xiping Wang**, Research Forest Products Technologist  
Forest Products Laboratory, Madison, Wisconsin

**Udo H. Sauter**, Head of Department of Forest Utilisation  
Forest Research Institute Baden-Württemberg, Freiburg, Germany

**Robert J. Ross**, Supervisory Research General Engineer and Research Professor  
Forest Products Laboratory, Madison, Wisconsin and Michigan Technological University, Houghton, Michigan

### Preface

The International Nondestructive Testing and Evaluation of Wood Symposium Series started in Madison, Wisconsin, USA, in 1963. Since its inception, 20 symposia have been held in various countries around the world, including Brazil, China, Germany, Hungary, Switzerland, and the United States.

The 21st International Nondestructive Testing and Evaluation of Wood Symposium was hosted by the Forest Research Institute Baden-Württemberg (FVA). It was held in Freiburg, Baden-Württemberg, Germany, September 24–27, 2019. This symposium was a forum for those involved in nondestructive testing and evaluation (NDT/NDE) of wood and brought together many international researchers, NDT/NDE users, suppliers, representatives from various government agencies, and other groups to share research results, products, and technology for evaluating a wide range of wood products, including standing trees, logs, structural lumber, engineered wood products, and wood structures. Networking among participants encouraged international collaborative efforts and fostered the implementation of NDT/NDE technologies around the world.

After opening comments from the International Nondestructive Testing and Evaluation of Wood Symposium Organizing Committee, participants were welcomed by the Ministry of Rural Affairs and Consumer Protection Baden-Württemberg and from the State Forest Service Baden-Württemberg ForstBW, Mr. Max Reger. A warm welcome to the University was delivered by Prof. Thomas Seifert.

The Symposium's general session included speakers from China, Germany, Italy, and the United States on topics including inspection of historic structures, use of NDE in industrial environments, and application of NDE around the world.

During the symposium's banquet, special recognition awards were presented to the Forest Research Institute Baden-Württemberg for its outstanding efforts in hosting the 21st symposium and to Dr. Udo H. Sauter for his leadership as a co-chair in organizing the event. Special recognition awards were also presented to Dr. Raquel Gonçalves for her distinguished service in the symposium series and to Mr. Peter Carter for his outstanding technology transfer efforts in the field of nondestructive evaluation of wood.

Prior to the Symposium, a technical workshop, "Nondestructive Testing and Evaluation Opportunities in a Historic European City," was held. It included coursework on the state-of-the-art in NDE as applied to historic structures, and a tour of the historic Freiburg Cathedral.

A post-symposium tour of the Black Forest was organized and led by the Forest Research Institute Baden-Württemberg.

The technical content of the 21st symposium is captured in the following proceedings. Full-length, in-depth technical papers for the oral presentations and several of the poster presentations are published herein. The papers were not peer reviewed and are reproduced here as they were submitted by the authors.

# FT-NIR Spectroscopic Assessment of Compressive Strength of Wood of *Eucalyptus tereticornis*

Aasheesh Raturi\*

Department of Physics, Dolphin(PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India, [quark6ashu@gmail.com](mailto:quark6ashu@gmail.com).

Vimal Kothiyal

Research and Planning Division, Indian Council of Forestry Research and Education, Dehradun, Uttarakhand, India, [vimal\\_kothiyal@yahoo.com](mailto:vimal_kothiyal@yahoo.com).

P.D.Semalty

Department of Physics, SRT campus HNB Garhwal University, Tehri, Uttarakhand, India [semaltypd@gmail.com](mailto:semaltypd@gmail.com)

\* Corresponding author

## Abstract

In this study, Near infrared spectroscopy (NIRS) coupled with multivariate data analysis has been used to predict Maximum cursing strength (MCS) and compressive strength at limit of proportionality (CS at LP) in compressive strength test on radial and tangential strip wood samples obtained from dry wood specimen of *Eucalyptus tereticornis*. Partial least squares regression (PLSR) calibrations were developed for each wood property. Calibrations had good relationships between values measured in laboratory and NIRS predicted values obtained from small clear samples. The coefficient of determination of cross validation ( $R^2_{cv}$ ) for MCS of wood varies from 0.55 to 0.80. Calibration equations when applied to test set resulted in coefficient of determination ( $R^2_{TS}$ ) that varies from 0.66 to 0.77. The RPD varies from 1.7 to 2.1 and RER values for MCS were found in the range of 6.6 to 9.9. The wave number regions 7502 to 6098 $\text{cm}^{-1}$ , 5450 to 4597  $\text{cm}^{-1}$ , 6102 to 5446  $\text{cm}^{-1}$  and 4601 to 4246  $\text{cm}^{-1}$  were found suitable for radial and tangential face. The  $R^2_{cv}$  for CS at LP of dry wood varies from 0.73 to 0.91. However,  $R^2_{TS}$  varies from 0.77 to 0.85. The value of RPD and RER varies from 2.1 to 2.6 and 7.4 to 9.0 respectively. The models with MSC and second derivative preprocessing method have acceptable PLS statistics for radial and tangential face of wood.

**Keywords:** NIRS, PLS, wood properties

# Natural Polysaccharides in Drug Delivery and Biomedical Applications

2019, Pages 513-530

## Chapter 22 - Marine polysaccharides for drug delivery in tissue engineering

Manoj Kumar Sarangi<sup>1</sup>, M.E. Bhanoji Rao<sup>2</sup>, Versha Parcha<sup>3</sup>, Dong Kee Yi<sup>4</sup>, Sitansu Sekhar Nanda<sup>4</sup>

- <sup>1</sup> School of Pharmaceutical Sciences & Technology, Sardar Bhagwan Singh University, Dehradun, Uttarakhand, India
- <sup>2</sup> Calcutta Institute of Pharmaceutical Technology & Allied Health Sciences, Kolkata, West Bengal, India
- <sup>3</sup> Dolphin (PG) Institute of Biomedical & Natural Sciences, Dehradun, Uttarakhand, India
- <sup>4</sup> Department of Chemistry, Myongji University, Yongin, South Korea

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### Abstract

Natural compounds have been obtained from ocean with a variety of applications in biomedical and biotechnology fields. These natural compounds serve as a renewable source for biomedical applications. A positive impact has been found in device fabrication with its suitable system development. Marine polysaccharides that originate from the ocean have low extraction cost, interact strongly with other biocompounds, and are soluble in aqueous solvents and extraction media. Marine polysaccharides are extracted from algae such as carrageenan, alginate, and fucoidan. Hyaluronan and chitosan are obtained from animal sources. Biocompatibility, biodegradability, antimicrobial action, adhesive action, and antiinflammatory activity are common properties of marine polysaccharides. Owing to these properties, marine polysaccharides are used in drug delivery devices, capsules, particles, and hydrogels. Controlled release of therapeutic agents is achieved by using marine polysaccharides in regenerative medicine and gene delivery, to fight against serious diseases.

[Previous](#)

[Next](#)

### Keywords

Biomaterials; Drug delivery; Marine excipients; Polysaccharides

## Chapter 12

# Different Cell Disruption and Lipid Extraction Methods from Microalgae for Biodiesel Production



Vinod Kumar, Neha Arora, Manisha Nanda, and Vikas Pruthi

**Abstract** The global energy demand is increasing at an exponential rate, and available petroleum sources are rapidly decreasing. In this context, microalgae regained attention for biodiesel production due to its high growth rate and high lipid content. One of the major obstacles for large-scale production of biodiesel from microalgae is extracting intracellular lipids which are present inside the cell wall and membrane. Therefore, there is a substantial necessity to develop a cost-effective, safe, environment-friendly, and efficient extraction method of microalgae lipids. In downstream processing, algal cell disruption and lipid extraction techniques are important for biodiesel production due to high energy consumption and high costs involved. Several techniques for lipids extraction from microalgae have been reported by various researchers. This chapter provides an overview on latest advancements that have been made on the different cell disruption methods including mechanical, chemical, and biological cell disruption methods and different lipid extraction methods including conventional extraction lipid methods, green solvent-based extraction methods, and solvent-free extraction methods.

**Keywords** Microalgae · Lipids · Biodiesel · Cell disruption · Extraction

## 1 Introduction

Escalated energy demands due to industrialization and population growth have led to depletion of fossil fuel reserves. Currently, the consumption of existing petroleum sources is reported to be  $10^5$  times higher than its rate of formation with estimated

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V. Kumar (✉)  
Department of Chemistry, Uttarakhand University, Dehradun, India

N. Arora · V. Pruthi  
Department of Biotechnology, Indian Institute of Technology Roorkee, Roorkee, Uttarakhand, India

M. Nanda  
Department of Biotechnology, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, India

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vinodkhatwalia@gmail.com

## CHAPTER 7

# Regional impact of psychrophilic bacteria on bioremediation

Rishendra Kumar<sup>1</sup>, Pankaj Kumar<sup>2</sup> and Anchal Giri<sup>1</sup>

<sup>1</sup>Department of Biotechnology, Bhiimtal Campus Kumaun University, Nainital, India

<sup>2</sup>Department of Microbiology, Dolphin (P.G) Institute of Biomedical and Natural Sciences, Dehradun, India

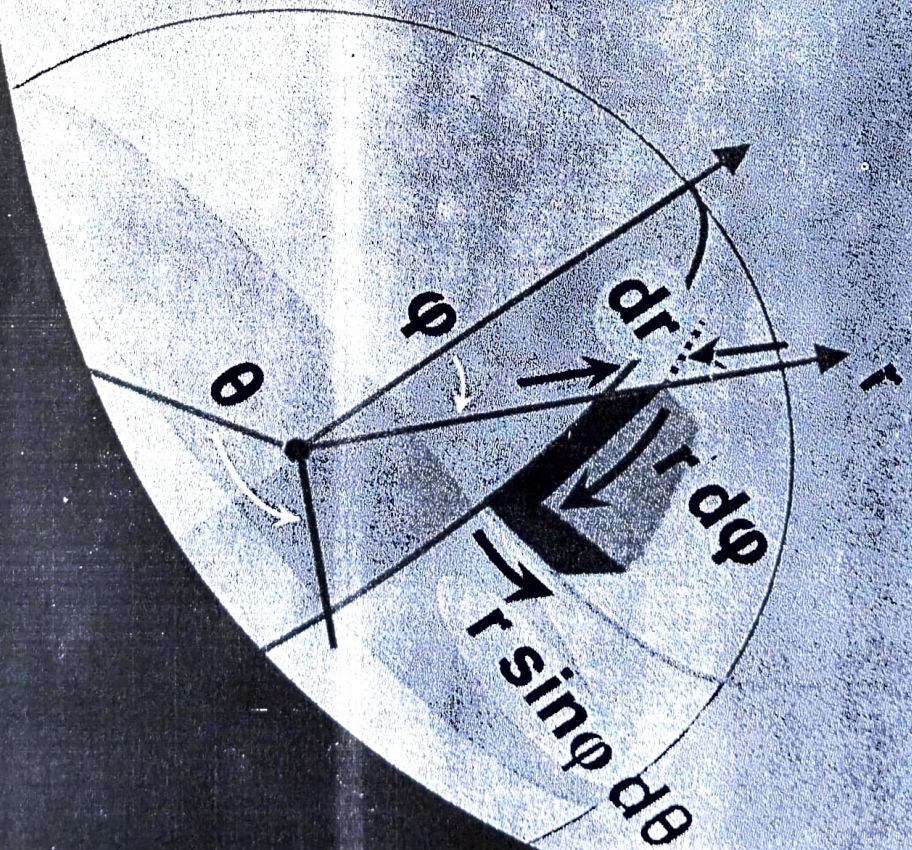
### 7.1 Introduction

There are several low-temperature environments on Earth which support the growth of several organisms (like bacteria, archaea, algae, and yeasts); these organisms are called psychrophiles. Psychrophiles carry several characteristics features; one of these is bioremediation of polluted cold soils and wastewaters. Furthermore, their biomolecules, mainly proteins and enzymes which show high catalytic activity and distinct heat-labile properties, are useful in various domains such as molecular biology, medical research, industrial food or feed technologies, detergents, and cosmetics.

We know that several types of organisms ranging from prokaryotes to eukaryotes flourish in extreme environments such as high and low temperatures, but psychrophiles are plentiful in terms of biomass, diversity, and distribution. Previous research suggests that these types of biodiversity affect the cellular structure of psychrophiles much less than other organisms. Earth's biotopes are cold and have been successfully colonized by miscellaneous organisms (Margesin & Schinner, 1999; Margesin, Schinner, Marx, & Gerday, 2008). Several extreme psychrophiles have been successfully isolated from the Antarctic and Arctic polar regions, indicating that low temperatures spread over a geological time-scale have promoted deep and efficient adaptations to freezing conditions (Fig. 7.1). More than 20% of terrestrial soil is subject to permafrost, which reveals an unsuspected biodiversity in cryopegs, which are salty water pockets that have remained liquid for many years at  $-10^{\circ}\text{C}$  (Gilichinsky et al., 2008). Besides these cold-adapted areas, high-altitude mountains, glaciers, and natural caves also are good sources of psychrophiles. However, the largest psychrophile reservoir is the oceans covering 70% of our planet that have a

A TEXT BOOK OF

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## *About the author....*

Dr. Sanjay Kumar Agarwal is in profession of teaching for the last twenty years to undergraduate and post graduate students. Presently he is working as head of Department of mathematics at Dolphin (PG) institute, Dehradun. He already wrote five best seller books. Published & presented 28 Research papers in journals and national and international conferences. He is also associated with universities in the capacity of member board of studies and research development committee of mathematics.

Dr. Sanjay Kumar Agarwal  
Head of Department (Mathematics)  
Dolphin Institute, Dehradun

## *About the book....*

This book is a outcome of more than 20 years teaching and research experience of the author. This book is written in easy to understand language, start with the introduction of contribution mathematician while leading the book. you will feel yourself inside the classroom, and the content are explained in a systematic way with number of examples. Most of the leaders of calculus hopefully aware that the limit and continuity in the foundation of calculus. This chapter is discussed in detail in this book. we are confidant that this work will fulfill all your needs.



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# Textbook of FOREST STATISTICS

Dr. Sanjay Kr. Agarwal

Foreword by:  
R.C. Srivastava  
Director  
Government of Uttarakhand

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## Forew

R.C. Srivastava  
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The present book is an attempt in the direction to give students, a feeling of classroom lectures on statistics. With a view to cover all necessary information prescribed in the syllabus of under graduate students of Forestry and Horticulture. It's a outcome of more than twenty years of teaching and research experience of the author.



Dr. Sanjay Kumar Agarwal is in the profession of teaching for the last fifteen years to undergraduate and post graduate students of Pharmacy, Nursing, Agriculture, Forestry and Paramedical Sciences. Presently, he is working as Head of the Department of Statistics and Mathematics at Dolphin (PG) Institute of Bio-medical and Natural Sciences, Dehradun, Uttarakhand, India.

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**R.C. Srivastava**

Director

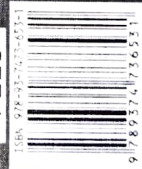
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**Textbook of Forest Statistics**

**Dr. Sanjay Kr. Agarwal**



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# Textbook of Agricultural Statistics

**Dr. Sanjay Kr. Agarwal**

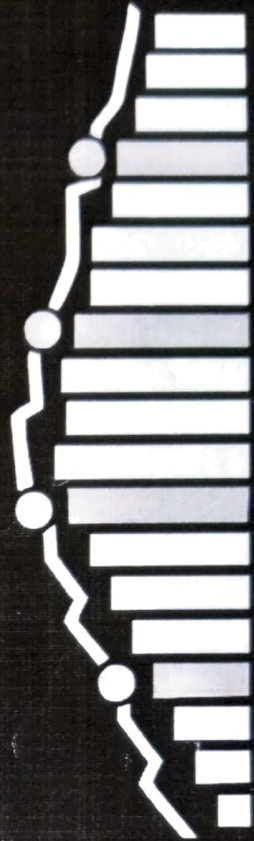
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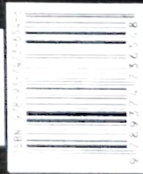


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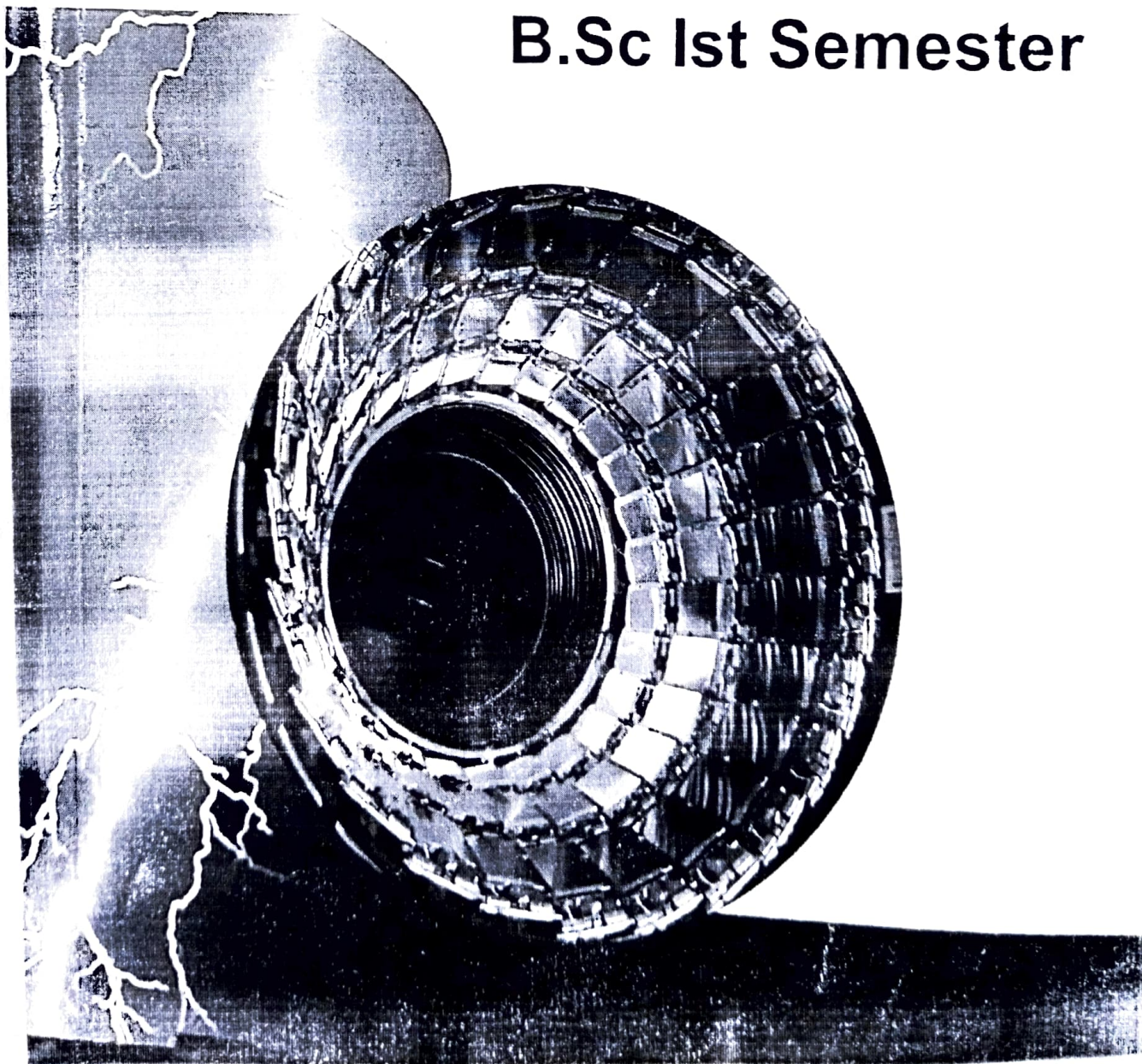
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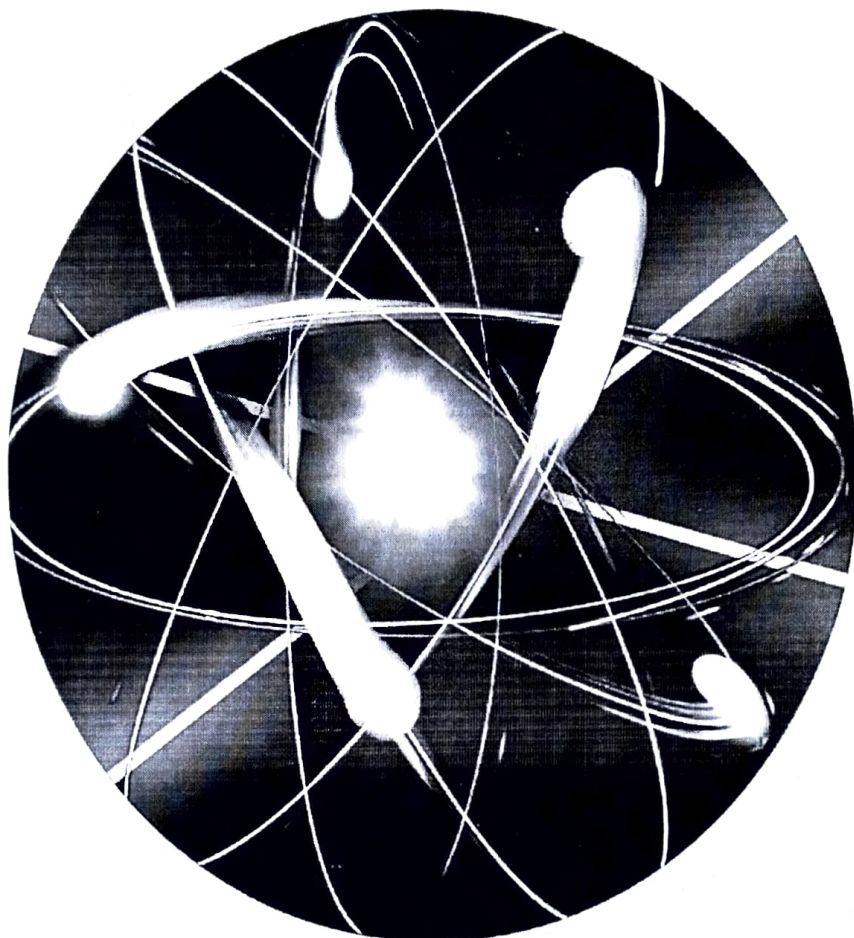
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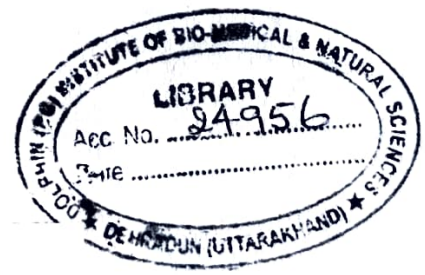
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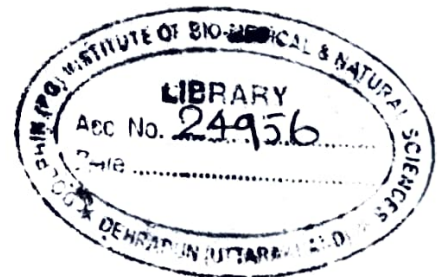
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*Department of Zoology/Entomology*

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HARENDRA KUMAR GAUR and SHALINI ANAND



Biofertilizers and Biopesticides are two important cornerstone needs intensive research to improve the quality primarily to achieve food security for the growing population and restore soil fertility. Nature has provided countless avenues for research in these fields which needs to be explored. The development of new biopesticides with multiple mode of action against pests and biofertilizers with multi-crop growth promoting activities are most important for sustainable global agriculture. These two needs to be prioritized in agricultural research by universities, research organizations, Research and Develop wings of manufacturers for technology development to the farming community. The technologies so developed need to be transferred worldwide to achieve maximum benefits to the society.

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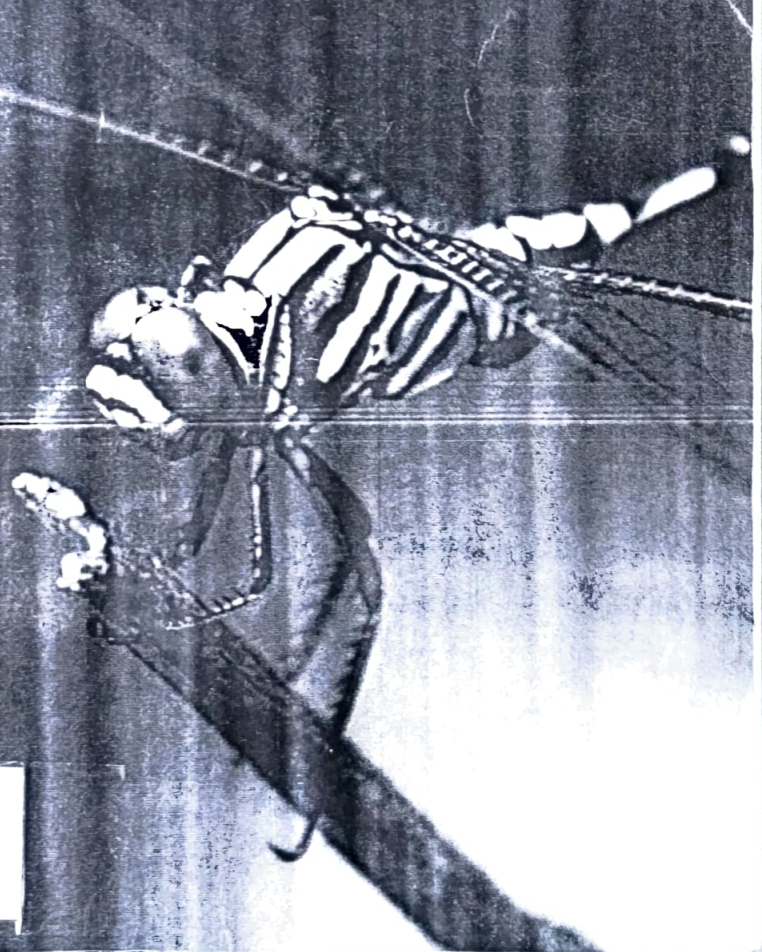
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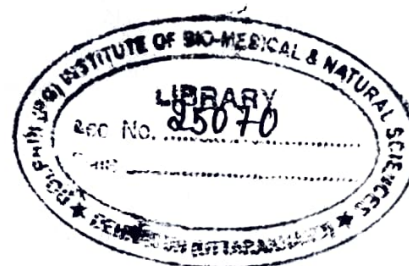
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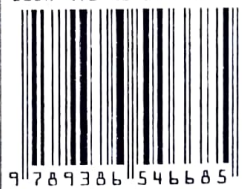
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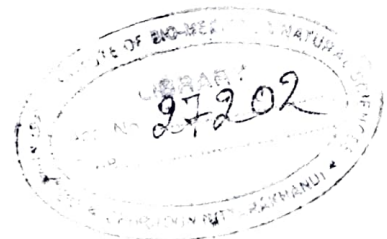
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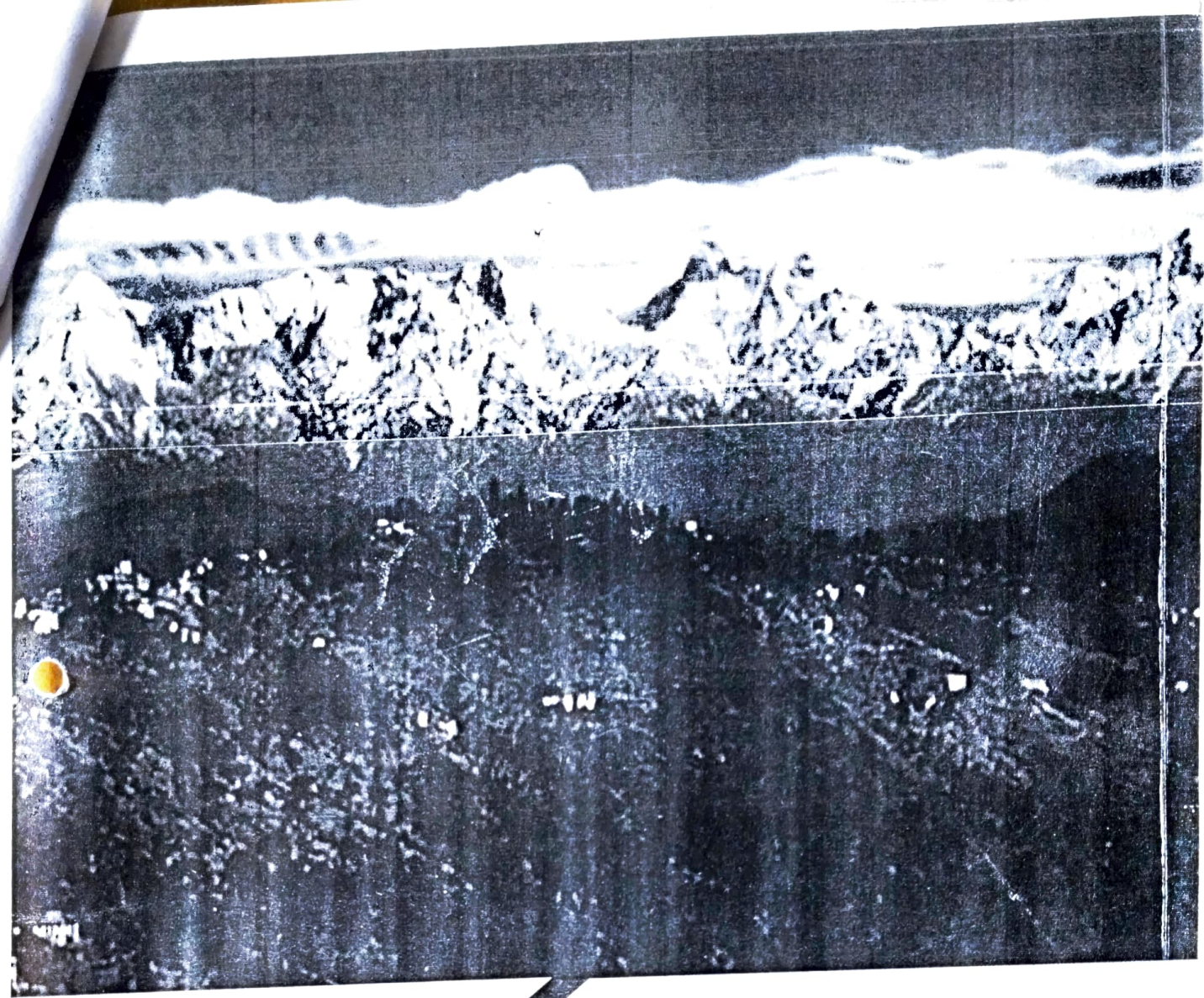
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## Chapter 8

# Microalgae: A Promising Tool for Remediation of Heavy Metals

**Vinod Kumar**

*Uttaranchal University, India*

**Manisha Nanda**

*Dolphin (PG) Institute of Biomedical and Natural Sciences, India*

### **ABSTRACT**

*The primary functions of ecosystems, wherever located, or whatever their constituents on earth, are to sustain life. They provide vital needs, commonly described as "ecological services," for all the living things residing within that particular system, or for those on its fringes. Such services include shelter, food, maintaining soils and hydrology, and providing livelihoods for its dwellers. Water is considered an important resource for mankind and other living organisms. Therefore, maintaining the water to a high quality is crucial. Bioremediation of heavy metals and micro pollutants by microorganisms (algae, bacteria, fungi, and yeast) has been used for the last two decades. All micro-organisms and microalgae are gaining increasing attention because microalgae can easily grow and is cheap to process and able to accumulate high metal content.*

### **INTRODUCTION**

All around the world natural water bodies are contaminated with different type of heavy metals and directly or indirectly discharge of wastewater by industries. These micro pollutants reached to our drinking water supplies, aquatic ecosystems and other

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