SAVITRIBAI PHULE PUNE UNIVERSITY
Bharatiya Jain Sanghatana's
Arts, Science & Commerce College, Wagholi, Pune – 412207
IQAC
PERFORMANCE APPRAISAL

SECTION – A : GENERAL **ACADEMIC YEAR: 2023-24**

1.	Name	:	Dr. Madhuri Deshmukh
2.	Designation	:	Assistant Professor
3.	Name of the College	:	**Bharatiya Jain Sanghatana's** Arts, Science and Commerce College, Wagholi, Pune
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SECTION - B:

CATEGORY I: TEACHING, LEARNING AND EVALUATION RELATED ACTIVITIES

Sr. No.	Nature of Activity ESSENTIAL	Maximum Score		
		Max. API Score allotted (AP/Asso. P/P)	Self-appraisal Score	Verified API Score
a.	Direct Teaching (Classroom, Online, Practical, Participative, Experiential Co-operative, Problem solving, Project, Field work etc).	70/70/60	70	
b.	Examination Duties (Question paper setting, Invigilation, CIE, Open book test, Tutorials, Evaluation) as per allotment.	20/20/10	20.65	
c.	Innovative Teaching – learning methodologies, New pedagogy, Up-dating of subject contents / courses, mentoring etc.	10/15/20	20	
	Total Score	**100/105/90**	**110.65**	

a. Actual hours spent per academic year *7.5

b. Actual hours spent per academic year *10.

c. Actual hours spent per academic year *10.

Direct Teaching 16/14/14 hours per week include the Lectures / Tutorials / Practical / Project Supervision / Field Work.

CATEGORY II:

PROFESSIONAL, DEVELOPMENT, CO-CURRICULAR AND EXTENSION ACTIVITIES

Sr. No.	Nature of Activity CO-CURRICULAR AND EXTENSION ACTIVITES	Maximum Score API Score allotted	Self-appraisal Score	Verified API Score
A	Student related co-curricular, extension and field based activities. (i) Discipline related co-curricular activities (e.g. remedial classes, career counseling, study visit, student seminar and other events.) (ii) Other co-curricular activities (Cultural, Sports, NSS, NCC etc.) (iii) Extension and dissemination activities (public / popular lectures / talks / seminars etc.)	15	15	
B	Contribution to Corporate life and management of the department and institution through participation in academic and administrative committees and responsibilities. i) Administrative responsibility (including as Dean / Principal / Chairperson / Convener / Teacher-in-charge/similar other duties that require regular office hrs. for its discharge. ii) Participation in Board of Studies, Academic and Administrative Committees.	15	15	
C	Professional Development activities (such as participation in seminars, conferences, short term, training courses, industrial experience, talks, lectures in refresher / faculty development courses, dissemination and general articles, and any other contribution)	15	15	
	Total Score of (II)	45	45	

a. Actual hours spent per academic year *10

b. Actual hours spent per academic year *10.

c. Actual hours spent per academic year *10.

Table 2

Methodology for University and College Teachers for calculating Academic/Research Score

(Assessment must be based on evidence produced by the teacher such as: copy of publications, project sanction letter, utilization and completion certificates issued by the University and acknowledgements for patent filing and approval letters, students' Ph.D. award letter, etc,.)

Criteria III

S.N.	Academic/Research Activity	Faculty of Sciences / Engineering / Agriculture /Medical/ Veterinary Sciences	Faculty of languages / Humanities / Arts / Social Sciences / Library /Education/ Physical Education / Commerce/ Management & other related disciplines	Academic/ Research Score	Verified Academic/ Research Score
1.	**Research Papers in Peer-Reviewed or UGC listed Journals**	08 per paper	10*1 per paper	**08*2**	39.1
2.	**Publications (other than Research papers)**				
	(a) Books authored which are published by ;				
	International publishers	12*1	12	12	12
	National Publishers	10	10	-	
	Chapter in Edited Book	05	05		
	Editor of Book by International Publisher	10*1	10*1=10/4=	**10**	10
	Editor of Book by National Publisher	08	08	-	
	(b) Translation works in Indian and Foreign Languages by qualified faculties				
	Chapter or Research paper	03	03	-	
	Book	08	08	-	
3.	**Creation of ICT mediated Teaching Learning pedagogy and content and development of new and innovative courses and curricula**				
	(a) Development of Innovative pedagogy	05	05	-	
	(b) Design of new curricula and courses	02 per curricula/course	02 per curricula/course	-	06
	(c) MOOCs				

	Development of complete MOOCs in 4 quadrants (4 credit course)(In case of MOOCs of lesser credits 05 marks/credit)	20	20	-	
	MOOCs (developed in 4 quadrant) per module/lecture	05	05	-	
	Content writer/subject matter expert for each module of MOOCs (at least one quadrant)	02	02	00	
	Course Coordinator for MOOCs (4 credit course)(In case of MOOCs of lesser credits 02 marks/credit)	08	08	-	
	(d) E-Content Development of e-Content quadrants complete course/e-book	12	12		12
	e-Content (developed in 4 quadrants) per module	05	05	-	
	Contribution to development of e-content module in complete course/paper/e-book (at least one quadrant)	02	02	08	08
	Editor of e-content for complete course/ paper /e-book	10	10	-	-
4	**(a) Research guidance**			00	-
	Ph.D.	10 per degree awarded 05 per thesis submitted	10 per degree awarded 05 per thesis submitted		-
	M.Phil./P.G dissertation	02 per degree awarded	02 per degree awarded	02	
.	**(b) Research Projects Completed**			00	00
	More than 10 lakhs	10	10	-	
	Less than 10 lakhs	05	05	-	
	(c) Research Projects Ongoing :			00	
	More than 10 lakhs	05	05	-	
	Less than 10 lakhs	02	02	-	
	(d) Consultancy	03	03	-	

5	**(a) Patents**			00	
	International	10	10	-	
	National	07	07	-	
	(b) *Policy Document (Submitted to an International body/organisation like UNO/ UNESCO/World Bank/ International Monetary Fund etc. or Central Government or State Government)			00	
	International	10	10	-	
	National	07	07	-	
	State	04	04	-	
	(c) Awards/Fellowship				
	International	07	07	-	
	National	05	05	-	
.					
6.	***Invited lectures / Resource Person/ paper presentation in Seminars/ Conferences/full paper in Conference Proceedings (Paper presented in Seminars/Conferences and also published as full paper in Conference Proceedings will be counted only once)**			00	
	International (Abroad)	07	07	-	
	International (within country)	05	05	-	
	National	03	03	-	
	State/University	02	02	-	**02**
				20.5	89.1

Research	Verified API
1	**39.1**
2	22
3	26
4	**00**

5	00
6	02
Total	**89.1**

Total of – III (1+2+3+4+5+6)	39.1+22+26+00+00+02	**89.1**
Grand Total of Category (I + II + III)	100+45+89.5	**234.1**

Madhusi

(Head of the Department)

Madhusi

Signature of the teacher

Madhusi

IQAC Coordinator

IQAC Co-ordinator
Bharatiya Jain Sanghatana's
Arts, Science & Commerce College,
Wagholi, Pune- 412207.

Signature
(Principal)

I/C Principal
B.J.S. A.S.C. College
Wagholi, Pune- 412207.

Category – I

a) Direct Teaching (Attach curricula completion report)

Teaching Workload				**2023-24**				
Sr. No.	**Course/ Paper**	**SEM**	**Mode of Teaching***	**No. of periods / Hours allotted**		**No. of periods / Hours engaged per annum/ semester**	**% of classes taught**	**Grade**
				Per Week	**Per annum/ semester**			
1	SYBSC III	III	L, T	03	19	19	100	Good
2	SYBSC IV	IV	L, T	03	10	10	100	Good
3	SYBSC Practical III	III	P	04	14 Practical x 4 = 56 * 4= 224	14 Practical x 4 = 56 * 4= 224	100	Good
4	SYBSC Practical IV	IV	P	04	14 Practical x 4 = 56 * 4= 224+12 (2Tours) = 236	14 Practical x 4 = 56 * 4= 224+12 (2Tours) = 236	100	Good
5					489	489	100	Good
* Lecture (L), Seminar (S), Tutorial (T), Practical (P) # Contact Hours (C) 80% & above – Good Below 80% but 70% & above-Satisfactory Less than 70% - Not satisfactory								

Actual hours spent per academic year * 7.5 = 489*7.5= 3667.5

b) Examination duties

Sr. No	Nature	Hr.
1	Exam Controller	00
2	Supervision (Senior & Junior)	Junior Supervision : 8 Days (26.4 Hrs)
3	Practical Examination	10 Days (100 hrs)
2	Question Paper setting (Internal & University)	20

3	Assessment Tutorial, Open book test, Internal Tests, Continuous Internal Evaluation etc.	10
4	Assessment CAP	10 days (50Hrs)
Total		206.4
Total/10		206/10=20.64

- **Actual hours spent per academic year ÷10 = 206/10= 20.64**

c) Innovative Teaching – (Attach report)

Sr. No	Innovative Teaching Methods	Hr.
1	LMS	120 hrs
2	New pedagogy	10 hrs
3	Up-dating of subject contents / courses	40 hrs
4	Mentoring	30 hrs
	Total	200hrs

- **Actual hours spent per academic year ÷10 = 200hrs/10= 20**

Category II

A) Student related co-curricular, extension and field based activities. Attach List and Program activity report

As a coordinator of IQAC I have organised or helped in organization almost all programs and encouraged students for their participation in different intercollegiate activities. Total Hrs: 400hrs

B) Administrative responsibility (Participation in Board of Studies, Academic and Administrative Committees)

: Attach List and Program activity report

As a coordinator of IQAC and Head of Zoology department, I have done administrator work and organised University level workshops for teachers and students. Total hours: 200 hrs

C) Professional Development activities: Attach List and Program activity report

I have worked as a resource persons and Judge for the intra and inter college competitions in our and JSPM college : Total Hrs: 30 hrs.

- **Actual hours spent per academic year ÷10= 630hrs/10= 63.0 hours**

Criteria - III

3.1. Research Papers: (Attach list and Papers)

3.2. Publications (other than Research papers) / Books authored; Attach List and publications

3.3 a) Creation of ICT mediated Teaching Learning pedagogy: Attach List and report
b) Content and development of new and innovative courses and curricula: Attach List and report

c) MOOCs Development of complete MOOCs in 4 quadrants (4 credit course)

d) E-Content/ Innovative Pedagogy: Attach List and report

3.4. a) Research guidance: Nil
b) Research Projects Completed: 02

c) Research Projects Ongoing : Nil

d) Consultancy: Nil

3.5. a) Patents: Attach Documents: Nil

b) Policy Document (Submitted to an International body/organization like UNO/UNESCO/World Bank/International Monetary Fund etc. or Central Government or State Government: Attach Documents

(c) Awards/Fellowship: Attach Documents

3.6. Invited lectures / Resource Person/ paper presentation in Seminars/ Conferences/full paper in Conference Proceedings (Paper presented in Seminars/Conferences and also published as full paper in Conference Proceedings will be counted only once): Attach List and report.

G. E. Society's

S.M.R.K.-B.K.-A.K. Mahila Mahavidyalaya, Nashik, Maharashtra, India

ESTD - 28th June 1985

(Permanently affiliated to SNDT Women's University, Mumbai)

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Edited by

Prin. Dr. Mrs. Deepti Deshpande

&

Prof. Dr. Kavita Patil

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NEP 2020 : Roadmap for Students

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Assistant Professor, BJS College of Arts, Sci. & Comm., Wagholi

Abstract-

National Education Policy was created keeping in mind the rich tradition of ancient Asian Santana Indian knowledge. In Indian philosophy, the pursuit of knowledge, wisdom and time is always considered as the highest goal of human beings. Today we have gone through three national education policies and now planning to implement NEP 2020 policy. In 1968 the National Education Policy, which was implemented by the government, was based on the Kothari Commission recommendations. That policy had free and compulsory education to all the students up to the age of 14, In that importance was given to teacher training and qualification, three language formula, equal opportunity for education for all as well as 10+2+3 structure. In 1986 Rajiv Gandhi implemented new education policy. It provided equal educational opportunities to all the students. First time in this education policy women, Scheduled Castes and Tribes were also taken into consideration. It Established district education and training institutes, and implementation of 10+2+3 pattern across the country, it ensured enough availability of food as well as healthy environment in schools. First time in India most of the open universities and distance learning institutes were opened. In 1992 when P.V. Narasimha Rao was the Prime Minister of India, once again education policy was updated. In 1992 Provision was made to open at least one Open University in every state. It was decided that Common Entrance Tests must be conducted for admission of professional and technical courses throughout India. The 'National Education Policy 2020' focus mainly on mainstreaming of out of school children through open school system It targets to give education to the students as per their interest.

Key Words : Education policies, Format, knowledge, Language formula, stream of education.

NEP 2020-

Union Cabinet approved the new education policy (National Education Policy 2020). Many changes have been made in this from school education to higher education. Central committee under the chairmanship of Prime Minister Narendra Modi have finalized this. This new education policy 2020 emphasizes on providing equal education for all from pre-school to secondary level. Also, efforts will be made through this new education policy to bring the children back into the stream of education, who are away from education.

10+2 pattern has been cancelled in the new education policy. Till now the school curriculum in our country was following 10+2 pattern. But now the method of education has been changed. Now the syllabus will be as per the pattern 5+3+3+4. It means first part will be from primary to fifth class. Second part from sixth to eighth class and fourth part from ninth to twelfth class. If we will learn this pattern i.e. 5+3+3+4, we will come to know that education is divided in various stages.

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Foundation Stage:

The children below three years will study in Anganwadi's. After that for the next two years the children will be in Foundation Stage. Then for the next two years the children will study in primary and secondary school. A new syllabus will be prepared for these five years. It will have more emphasis on activity-based learning. It will include children between the ages of three and eight years. In this way the first stage of education will be get completed by the child.

Second Stage:

In this phase education will be given to third to fifth standard students. During this stage, children will get education of science, mathematics, art etc. It will include children between the ages of eight and 11 years.

Third Stage:

It will cover studies of class six to eight standard. This will include children between the ages 11 to 14 years. The priority will be given to Skill development especially in this stage.

Fourth Stage:

The study from class 9th to 12th will be divided in two stages in NEP. There will also be a facility to choose the subject as per child's interest. This system was popular in the past education patterns also.

Initially there was no form of pre-schooling in government schools. The syllabus from 1st to 10th was normal. But now this has been changed. After 11th we were allowed to choose any subject, we wanted. Government thinks that this will help the students to learn those subjects, in which they have interest. But if we think about it from a teacher's perspective, it is not that much fruitful. The institutions may not arrange different faculties for different subjects. It will create lots of chaos in the mind of student as well as parents.

Vocational education imparting professional knowledge from 6th standard onwards

Dr. Kasthurirangan who headed the committee that made the new educational policy said, now children will be given professional education from sixth standard. Internships will also be offered at the local level. It will impart vocational and skill development education. This new education policy will not create unemployed people. The children will be given the professional education required for employment in the school itself.

Currently there are different regulatory bodies for different courses in higher education, instead (except for law and medical disciplines) there will be a single regulatory body. Like America, a National Research Institute will be established in India to give importance to researchers and improve their quality not only science but also research in sociology will be financially supported. The standard of higher education in the country will be taken to international level. It will increase communication with students from foreign quality educational institutions and educational exchange can also take place.

In the new education policy, though 10th and 12th board exams will be conducted, its importance will be reduced. These exams can be conducted twice in a year Instead

of memorizing and writing answers, the exam will be based on daily useful knowledge. Subjects from different branches like science and art can be studied together. Thus, interdisciplinary education will begin. Flexibility has also been introduced in higher education and interdisciplinary subjects can be studied together in colleges and universities. Education can be stopped at any stage. The marks of that education will be retained and further education can be taken after some time. For students who want to do research, there will be a 5-year course. After that there will be no need to do M.Phil. One can directly take admission for PhD.

Conclusion-

The Union Ministry of Education has set a target of starting at least one multidisciplinary interdisciplinary college in every district by 2030. Until now, the degree was taken from a single subject, now the degree will be completed by taking subjects from multiple disciplines simultaneously. Not only universities but also colleges will have multi-disciplinary courses so the fees will be fixed accordingly. Similar conditions are to be fixed for charging fees of government as well as private educational institutions. Fees will be fixed within that framework and a maximum limit will also be placed on the levy. The progress book is to be evaluated by students, fellow students and teachers themselves without just giving marks and teacher's comments. Based on that, it can be decided that the life skills of the students can be developed.

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Biometric Length Weight Relationships of the Pool Barb *Puntius sophore* (Hamilton 1822) (Cyprinidae) from Ujani Wetland of Maharashtra, India

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The present study explains biometric Length weight relationships (LWRs) of *Puntius sophore* (Hamilton 1822) from the Ujani wetland of Maharashtra, India. A total 213 specimens collected from local fish market of Bhigwan during February 2022 to January 2023. Individual fish measurements of the total length (TL, cm), standard length (SL, cm) and fresh total body weight (Wt. g) were measured using a digital caliper and a weighing machine respectively. Puntius sophore, scientifically classified as an ornamental fish belonging to the Cyprinidae family, is renowned for its striking chromatic attributes, diminutive dimensions, and adaptability to constrained aquatic habitats. Despite its modest size and ossified structure, this species possesses nutritional significance. Puntius sophore boasts a wide geographic distribution encompassing India, Pakistan, China, and select regions within Southeast Asia. Due to limited manpower, we sourced specimens from the market. In the study area, the species was collected using traditional fishing methods,

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such as the "jhaki jal" (cast net) and "tar jal" (square lift net). The slope of the log-transformed linear regression (b) values are 2.8085, The b value exponent for study species is significantly lying within the recommended value of 2.5 – 3.5, while the coefficient of determination (R^2) is 0.82 indicated the proper fitness of the fish in concern of growth and health of the study species. Fulton's condition factor (K) value for present study is greater than 1, indicates fish in healthy environment. The result provides baseline information for the sustainable management and conservation of the studied species.

Keywords: Morphometry; length weight; wetland; conservation; Bhima river

1. INTRODUCTION

"The Western Ghat of India is rich in fish diversity and most of the species recorded are endemic to the Western ghat" [1,2]. "There are about 1047 Indian freshwater fish species has been reported so far from Indian waters, which have been reported so far, with 216 fish species found in the state of Maharashtra" [3,4]. "In Pune district 80 species of fishes belonging to 10 orders, 16 families" reported by [5]. "Bhima river, the tributary of river Krishna is one of the important river of Maharashtra. The Ujani dam is terminal dam on Bhima river situated at Village Ujani. Ujani is the largest freshwater fishing co-operative in state Maharashtra" [6]. "The Bhima river consists of 60 fish species belonging to 6 orders, 15 families and 36 genera" [7]. "The species *Cyprinus carpio, Oreochromis mossambica, Hyporhamphus limbatus, puntius ticto, Labeo rohita, Catla catla, Cirrhinus mrigala* etc. are found to be common while fishing" [4]. "Pool barb *Puntius sophore* (Hamilton 1822) is a small indigenous fish (SIF) member of the family Cyprinidae" [8]. "This species *Puntius sophore* is widely distributed throughout the Indian sub-continent including India, Nepal, Bhutan, Bangladesh and Pakistan" [9]. "This is important target species of fisherman's, having different variety of fishing gears. Due to the fishing pressure this species is declining rapidly. *Puntius sophore* (Hamilton 1822) is the major source of the micronutrients and protein, they eat whole. It is very popular food item and it is also used in aquarium" [9–11].

"In fish biology, the morphological parameters like length and weight are the important primary trait in every individual" [12]. "For examining the health of the fish, the relationship between length and weight is a useful parameter" [13]. "In the length weight relationship (LWR), Convert length data from field studies into weight data because weight data measurement in the field is time-consuming and difficult. Moreover, LWRs and Conditional factor also important to study the fisheries and relationship between length and weight, these are important for study of the biomass production in fishes, useful for comparing life history and morphological aspects of populations inhabiting different regions" [6,14–17].

Due to insufficient knowledge about basic biology of fishes from Ujani reservoir, it is decided to carry out at least some studies on basic biology of *Puntius sophor Length-Weight Relationship (LWR), Growth estimation and Length at maturity of Eleutheronema tetradactylus in the Chilika Lagoon, Indiae*. Therefore, the present study is carried out to prepare basic database on length weight relationship and condition factors of *Puntius sophore,* which has never been attempted earlier from this ecosystem.

2. METHODOLOGY

In total 213 specimens of *Puntius sophore* (Fig. 3) were collected from February 2022 to January 2023 from fish market of Bhigwan. The fish market located at Village Bhigwan, Pune, Maharashtra and is well connected by national highway, which receives the fish supply from Bhima river. After collection, specimens were preserved in 10% formalin solution and brought to the research laboratory for identification and measurements. Fishes were identified based on [18,19]. Measurements of total length (TL), and standard length (SL) were done by using digital caliper (Mitutoyo, Japan) to the nearest 0.1cm accuracy and Weight (W) were measured using weighing machine closest 0.1 gm correctness (CONTECH – CB Series) (Table 1). Length weight relationships was estimated by the common formula: $W = aLb$ [20], where, 'L' is the total length (cm), 'W' is the body weight (g), 'a' is the intercept and 'b' is the slope of the log-transformed linear regression, r^2 is the coefficient of determination to estimate the goodness of fit. Calculation of Fulton's condition factor (K) by $K = 100\ W / L^b$, Where, 'K' is condition factor 'W' is weight of fish 'L' is length of fish And, 'b' is exponent from LWR [21].

3. RESULTS AND DISCUSSION

The sample size (n), Range of total length (TL), standard length (SL), Weight range, intercept (a value), slope (b value) and r^2 the coefficient of determination of *Puntius sophore* were estimated and expressed in the Table 1. Maximum standard length and weight for the *Puntius sophore* were 8.4 cm and 14.9 g respectively. The intercept (a value) and the slope (b value) was found to be 0.0389 and 2.8085 respectively (Fig. 1). The b value exponent for both species is significantly lying within the recommended value of 2.5 – 3.5 [20,22].

The b value observed in this study is 2.80, it was found lower than the previous study [9,23]. Factors like mesh size, sampling gear, fishing pressure, gonadal maturity, sex, geographical an environmental factor, sampling season, length range used, diet, stomach fullness might be responsible for variations in the "b" value of fishes [24–26]. However, because these factors were not taken into account in the preliminary investigation, it is possible that the observed variances in LWRs characteristics are the results of a single factor or the combined effects of many factors. As per the previous studies, the value of the parameter b of *Puntius sophore* in present investigation is within the expected range of 2.5–3.5 [20]. Similarly, a value of the present investigation was higher than the all discussed two reports [9,23].

The R^2 value in the present study was found to be greater than 0.80, This shows that the model is properly adapted for Ujani dam water, showed good growth of the fish and revealed that the fish is living in excellent condition [6,27]. The Fulton's condition factor (K) value recorded for present study was 1.424±0.176 (Table 2). K value greater than 1 showed that Fishes in their environment were healthy and in good shape. The condition factor (K) provides information on the physical and biological conditions, as well as alterations brought on by feeding practices and parasite illnesses etc. [28] (Fig. 2).

Table 1. Length weight relationship parameter of *Puntius sophore*

Parameter	Puntius sophore
N	213
TL range (cm)	6.4 - 10.3
TL (Mean±SD)	8.21 ±0.79
SL range (cm)	5.3 - 8.4
SL (Mean±SD)	6.61 ±0.65
W (g)	3.97 - 14.9
W (Mean±SD)	8.07 ±2.47
a value	0.0389
b value	2.8085
R^2	0.82

(N: Number of samples, TL: Total Length, SL: Standard Length, W: Body weight, SD: Standard deviation, a: Intercept, b: Slope, R^2: coefficient of determination)

Table 2. Fulton's condition factor (K) calculated for *Puntius sophore*

Period	CF	SD
Jan	1.406	0.181
Feb	1.478	0.139
Mar	1.456	0.152
Apr	1.344	0.139
May	1.487	0.317
Jun	1.370	0.185
Jul	1.442	0.140
Aug	1.418	0.147
Sept	1.420	0.200
Oct	1.367	0.131
Nov	1.462	0.161
Dec	1.436	0.130
Overall	1.424	0.176

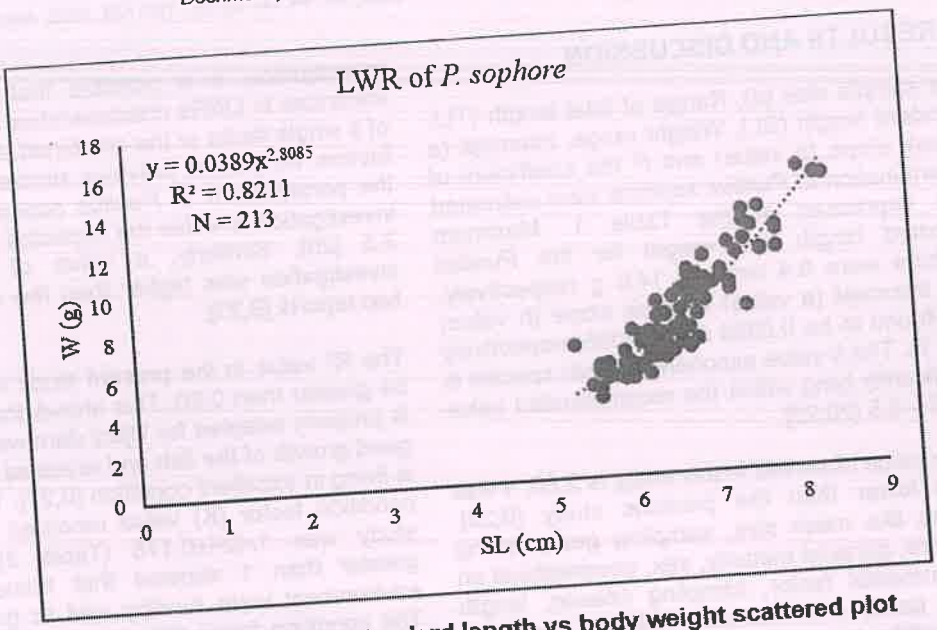

Fig. 1. Graph showing standard length vs body weight scattered plot

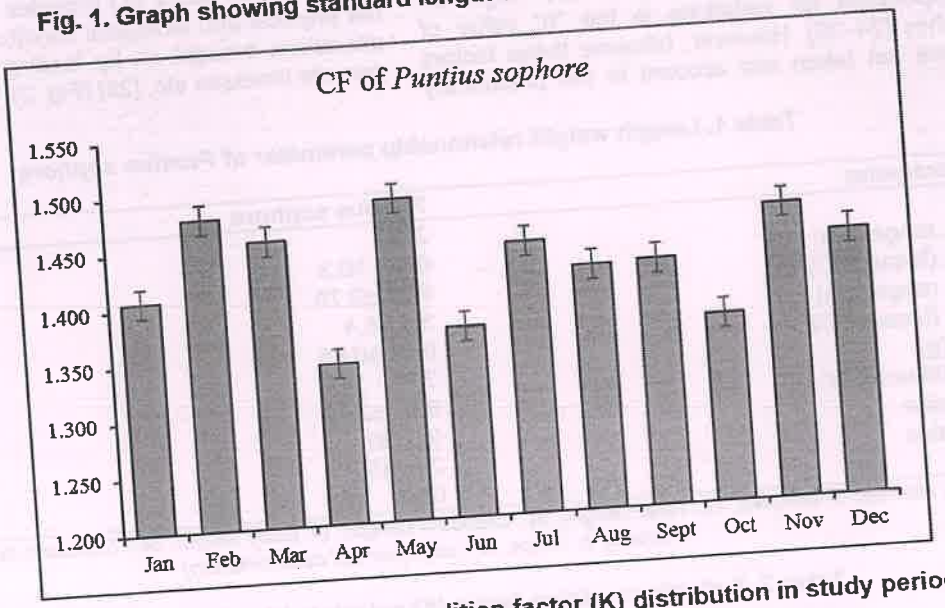

Fig. 2. Graph showing Fulton's condition factor (K) distribution in study period

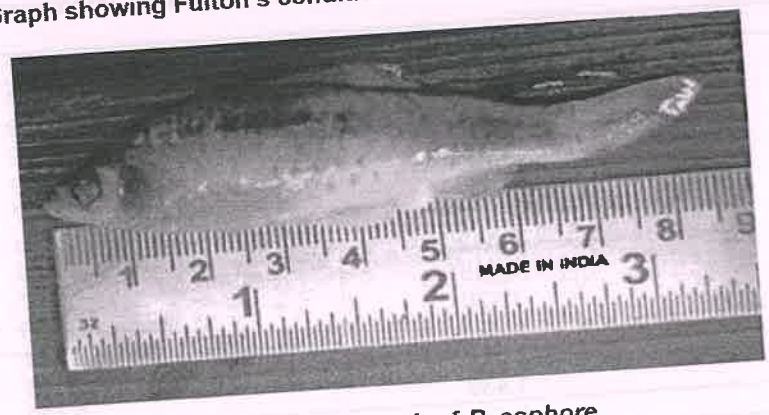

Fig. 3. Photograph of *P. sophore*

4. CONCLUSION

The present investigation provides the baseline information on the length –weight relationships in *Puntius sophore* from Ujani Dam. These freshwater fish species would be important for monitoring their populations and operative implementation of protection of species and other conservation policies.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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Role of Herbal Medicine in Cardiovascular Activities

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Abstract

Herbal medicine has gained substantial attention for its potential role in supporting cardiovascular health. This chapter explores the intricate interplay between herbal compounds and cardiovascular activities, shedding light on their mechanisms of action and therapeutic applications. With a historical backdrop of traditional herbal medicine, the prevalence of cardiovascular diseases serves as a compelling backdrop for the investigation. The chapter delves into the multifaceted mechanisms by which herbal compounds influence the cardiovascular system. Notably, herbs exhibit vasodilatory effects, contributing to blood pressure regulation, and harbor potent antioxidant and anti-inflammatory properties that collectively mitigate oxidative stress and inflammation within the cardiovascular milieu. Furthermore, certain herbs intricately modulate lipid metabolism, holding promise in the management of dyslipidemia. A thorough analysis of well-known herbal treatments clarifies each one's unique contributions to cardiovascular health. Hawthorn is revealed to be the champion of heart health, and garlic demonstrates its mastery of cholesterol reduction. Ginkgo Biloba is notable for its capacity to improve circulation, and turmeric demonstrates powerful anti-inflammatory properties. The chapter also looks at herbal medicine's potential as an intervention for regulating fluid balance, arrhythmias, and hypertension. Examined is the potential for resveratrol-rich plants and green tea to protect against heart disease. Along with considerations for safety, interactions, and future study, the symbiotic relationship between stress reduction, adaptogenic herbs, and heart health is also discussed in this article. This chapter concludes with a thorough examination of the crucial part herbal medicine plays in cardiovascular health. The complex interaction between herbal substances and circulatory functions, from mechanisms of action to clinical applications, shows promise for a more integrative and holistic approach to cardiovascular care.

Keywords: *Herbal medicine, cardiovascular health, mechanisms of action, vasodilation, blood pressure regulation, antioxidant, anti-inflammatory, lipid metabolism.*

Introduction

Herbal Medicine and Cardiovascular Health

Historical Context of Herbal Medicine:

Herbal therapy has played a vital role in managing a variety of medical disorders throughout history, including cardiovascular diseases (CVDs). Herbal medicine has its roots in ancient civilizations when indigenous people gained a profound awareness of plant characteristics and possible advantages. Herbal treatments were frequently used to treat symptoms and improve general health. Traditional healers in many communities passed down their understanding of herbal remedies from generation to generation, weaving a rich tapestry of herbal knowledge. For instance, herbs have long been a crucial part of therapeutic regimens in Traditional Chinese Medicine (TCM) and Ayurveda, providing insights into the treatment of cardiovascular diseases.

Prevalence of Cardiovascular Diseases:

With cardiovascular diseases responsible for a significant portion of morbidity and mortality, they pose a serious threat to global health. Heart failure, stroke, coronary artery disease, and hypertension are a few of the conditions that jointly contribute to the rising prevalence of CVDs. The World Health Organization (WHO) reports that CVDs are the largest cause of death globally, accounting for a projected 17.9 million deaths per year (WHO, 2021). Researchers, medical professionals, and patients are all looking for complementary and alternative treatments as a result of the growing health issue.

Mechanisms of Action of Herbal Compounds on the Cardiovascular System

Vasodilation and Blood Pressure Regulation: It is known that herbal components have vasodilatory properties, which help to control blood pressure and promote cardiovascular health in general. Hawthorn ***(Crataegus spp.)*** has proven vasorelaxant characteristics through influencing endothelial nitric oxide generation, which results in better vascular tone. The synthesis and bioavailability of endothelial nitric oxide are both increased by ginkgo biloba extract, which has also been found to improve vasodilation.

Effects on Inflammation and Oxidative Stress: Herbal substances' anti-oxidant and anti-inflammatory effects are essential in reducing inflammation and oxidative stress in the cardiovascular system. Allicin, a sulfur component found in garlic ***(Allium sativum),*** has been linked to antioxidant activity and a decrease in vascular inflammation (Gorinstein et al., 2007). Turmeric ***(Curcuma longa)*** contains a compound called curcumin, which has been shown to have strong anti-inflammatory effects by inhibiting pro-inflammatory cytokines and modifying intracellular signaling pathways (Jurenka et al., 2009).

Modulation of Lipid Metabolism: Herbal therapies have also shown the ability to modify lipid metabolism, which may be advantageous for treating dyslipidemia. By preventing intestinal cholesterol absorption, plant sterols and stanols, which are frequently found in herbal sources, have been proven to lower low-density lipoprotein cholesterol levels (Demonty et al., 2009). Due to their high soluble fiber content and potential impact on cholesterol production, fenugreek (Trigonella foenum-graecum) seeds have also been investigated for their lipid-lowering benefits (Chevassus et al., 2010).

High blood pressure, often known as hypertension, is a significant risk factor for cardiovascular illnesses. Herbal medicines have been investigated as potential blood pressure management therapies, providing a more comprehensive approach to controlling this common illness.

Herbal Treatments for Blood Pressure Control: Some herbs have demonstrated potential for regulating blood pressure. Attention has been drawn to garlic ***(Allium sativum)*** because of its conceivable antihypertensive properties. Garlic contains a bioactive substance called allicin, which may help lower blood pressure by relaxing and dilating blood vessels (Ried et al., 2013). Another herb that has been linked to blood pressure-lowering benefits is hibiscus ***(Hibiscus sabdariffa)***, probably because of its diuretic effects and capacity to inhibit angiotensin-converting enzyme (Haji et al., 1999).

Clinical Research and Support: Clinical research has examined the effectiveness of herbal therapies in the treatment of hypertension. Garlic supplementation was linked to small drops in both systolic and diastolic blood pressure, according to a meta-analysis of randomized controlled studies (Ried et al., 2018). Furthermore, hibiscus tea has been shown in studies to significantly lower both systolic and diastolic blood pressure (Serban et al., 2015). While these results are encouraging, more investigation is required to determine the long-term efficacy and safety of herbal treatments for hypertension.

Cardiovascular Activity	Role of Herbal Medicine	Examples of Medicinal Plants	Effects
Blood Pressure Regulation	Herbal remedies can help regulate blood pressure by promoting vasodilation, reducing arterial stiffness, and modulating the renin-angiotensin-aldosterone system.	*Hawthorn (Crataegus spp.)*	Vasodilation, improved blood flow.
		Garlic (Allium sativum)	Blood pressure reduction, vasodilation.
Cholesterol Management	Certain herbs possess lipid-lowering properties, aiding in the reduction of LDL cholesterol levels and improving lipid profile.	*Red Yeast Rice (Monascus purpureus)*	LDL cholesterol reduction.
		Fenugreek (Trigonella foenum-graecum)	Cholesterol-lowering effects.
Antioxidant Support	Herbal antioxidants combat oxidative stress, reducing damage to blood vessels and heart tissue.	*Green Tea (Camellia sinensis)*	Antioxidant protection, improved endothelial function.
		Turmeric (Curcuma longa)	Anti-inflammatory, antioxidant effects.
Antiplatelet Activity	Some herbs possess antiplatelet effects, reducing the risk of blood clot formation.	*Ginger (Zingiber officinale)*	Antiplatelet properties.
		Ginkgo (Ginkgo biloba)	Inhibition of platelet aggregation.
Cardiac Function	Herbal remedies may support cardiac muscle function and enhance cardiovascular performance.	*Hawthorn (Crataegus spp.)*	Improved cardiac contractility.
		Danshen (Salvia miltiorrhiza)	Cardiovascular protection, improved circulation.
Endothelial Health	Certain herbs promote endothelial health, enhancing blood vessel function and reducing endothelial dysfunction.	*Grapeseed Extract (Vitis vinifera)*	Endothelial protection, improved nitric oxide production.
		Garlic (Allium sativum)	Endothelial function improvement.

Table: Role of Herbal Medicine in Cardiovascular Activities

This table highlights the diverse contributions of herbal medicine to various cardiovascular activities. Herbal remedies have been recognized for their potential in regulating blood pressure, managing cholesterol levels, providing antioxidant support, influencing platelet activity, enhancing cardiac function, and promoting endothelial health

Herbal Approaches to Cholesterol Management

Elevated cholesterol levels contribute to atherosclerosis and cardiovascular risk. Herbal approaches targeting cholesterol reduction have gained attention as potential adjuncts to traditional therapies.

Cholesterol Reduction with Plant Sterols and Stanols: Studies have been done on the cholesterol-lowering potential of plant sterols and stanols, which are naturally occurring chemicals found in plants. These substances compete with cholesterol for intestinal absorption because of their structural resemblance. Plant sterols and stanols help reduce blood cholesterol levels by decreasing cholesterol absorption (Demonty et al., 2009). Some herbal extracts have showed potential in modifying lipid metabolism. These extracts also have lipid-lowering effects. The naturally occurring statins found in red yeast rice ***(Monascus purpureus)*** extract are known for their ability to reduce cholesterol. Red yeast rice extract has been shown to be effective in lowering levels of both total cholesterol and low-density lipoprotein cholesterol in clinical trials (Halbert et al., 2010).

Fluid balance management using natural diuretics

Cardiovascular health depends on efficient fluid balance control. The potential of some herbal medicines, also referred to as natural diuretics, to reduce fluid retention and encourage a healthy fluid balance has been investigated.

Dandelion *(Taraxacum officinale)* and Fluid Retention: Dandelion has historically been used as a natural diuretic. Dandelion extract, according to studies, may increase salt and urine output, which would help to lessen fluid retention (Clare et al., 2009).

Nettle *(Urtica dioica)*, which has diuretic qualities, may improve fluid elimination and help maintain healthy kidney function. According to (Caesarone et al. 2010), it is thought to stimulate urine production without altering electrolyte balance.

Antioxidants from plants and heart protection

As oxidative stress plays a part in the development of cardiovascular disease, interest in the role of herbal antioxidants in cardioprotection is developing.

Heart health and green tea *(Camellia sinensis)*: Green tea includes catechins, strong antioxidants that may have positive effects on the heart. Major catechin epigallocatechin gallate (EGCG), which has been demonstrated to enhance endothelial function and lessen oxidative stress, supports heart health (Chacko et al., 2010).

Resveratrol-Rich Herbs and Endothelial Function: Resveratrol, which is present in a number of plants, including berries and grapes, has drawn interest for its anti-inflammatory and antioxidant properties. According to (Sahebkar et al.,2013), it could improve endothelial function, consequently enhancing cardiovascular health.

Herbal Medicine for Stress Reduction and Cardiovascular Health

Stress plays a significant role in cardiovascular health, and herbal medicine offers potential avenues for stress reduction, ultimately benefiting the cardiovascular system.

Adaptogenic Herbs and Cortisol Management: A group of herbs known as "adaptogens" aid the body in coping with stress and preserving physiological homeostasis. For instance, Rhodiola rosea has been investigated for its capacity to influence cortisol levels and improve stress resistance in order to modify the stress response (Olsson et al., 2009). According to (Chandrashekhar et al.,2012), ashwagandha *(Withania somnifera)* has also shown stress-relieving properties, possibly through cortisol regulation and neurotransmitter modulation.

Mind-Body Approaches and Their Impact on Heart Health: Mind-body practices, including meditation, yoga, and deep breathing exercises, have been associated with stress reduction and improvements in cardiovascular health.

Mindfulness Meditation and Stress Reduction: The practice of mindfulness meditation encourages present-moment awareness, which might help people feel less stressed. According to studies, therapies focused on mindfulness can lower blood pressure and enhance heart rate variability (Jain et al., 2007).

Yoga offers a holistic approach to stress reduction and cardiovascular health by fusing physical postures, breath awareness, and meditation. According to (Cramer et al., 2018), regular yoga practice has been associated to lower blood pressure, lowered stress hormone levels, and enhanced endothelium function.

Heart rate variability is a sign of cardiovascular health and stress resistance. Deep breathing techniques, such as the practice of coherent breathing, can increase heart rate variability. It has been demonstrated that coherent breathing, which uses slow, rhythmic breathing patterns, lowers tension and anxiety (Lehrer et al., 2000).

Case Studies and Clinical Applications

Case studies and clinical applications provide valuable insights into the real-world effectiveness of herbal interventions for cardiovascular health, showcasing patient experiences and outcomes.

Real-World Examples of Herbal Interventions:

Hawthorn for Heart Health: A case study involving a middle-aged individual with mild heart failure who incorporated hawthorn extract as an adjunct to conventional treatment. The study explores improvements in symptoms, exercise tolerance, and echocardiographic parameters (Pittler et al., 2003).

Garlic and Blood Pressure Management: A clinical application detailing a patient with hypertension who integrated garlic supplementation into their regimen. Blood pressure measurements, before and after the intervention, demonstrate the potential antihypertensive effects of garlic (Ried et al., 2013).

Patient Experiences and Outcomes:

Personal Accounts of Stress Reduction: Patients share their experiences with mindfulness meditation and its impact on stress and overall well-being. Narratives describe reduced anxiety, improved sleep quality, and enhanced emotional resilience.

A Holistic Approach to Cholesterol Control: Individuals discuss their journey using herbal remedies like plant sterols and stanols in conjunction with lifestyle changes to manage cholesterol levels. Changes in lipid profiles and overall cardiovascular health are highlighted.

Incorporating Adaptogens for Stress Resilience: Patient testimonials explore the integration of adaptogenic herbs, such as ashwagandha, into daily routines. Improved stress management, increased energy levels, and enhanced mood are commonly reported outcomes.

Yoga and Heart Health: Patients share their progress in practicing yoga for stress reduction and cardiovascular well-being. Anecdotes reveal lowered blood pressure, enhanced flexibility, and a sense of calm and balance.

These case studies and patient narratives emphasize the multifaceted impact of herbal interventions on cardiovascular health. They illustrate the potential of herbal medicine to complement conventional treatments and enhance overall patient outcomes.

Conclusion

The exploration of herbal medicine's role in cardiovascular health unveils a captivating landscape of natural interventions that can complement conventional approaches. From historical roots to contemporary research, the chapters have delved into diverse aspects of herbal medicine's impact on the cardiovascular system.Herbal remedies offer a unique set of mechanisms to support cardiovascular health. Through vasodilation and blood pressure regulation, herbs like hawthorn, garlic, and Ginkgo Biloba exhibit their potential to promote optimal circulatory function. The antioxidant and anti-inflammatory effects of herbs such as green tea and turmeric contribute to reducing oxidative stress and inflammation, key factors in cardiovascular diseases. Moreover, herbal interventions extend to lipid metabolism modulation. Plant sterols, stanols, and extracts like red yeast rice emerge as promising tools for managing cholesterol levels, addressing a critical aspect of cardiovascular risk.In the realm of heart rhythm disorders, herbs like hawthorn and motherwort offer alternative pathways for arrhythmia management, while adaptogenic herbs and mind-body approaches present strategies for stress reduction. Patient experiences and case studies underscore the tangible impact of herbal interventions, offering real-world examples of improved cardiovascular outcomes and enhanced well-being. As the chapters have illuminated, the integration of herbal medicine into cardiovascular care is a dynamic and evolving field. While promising, it's essential to approach herbal interventions with a nuanced understanding, considering safety, interactions, and individual patient needs. By embracing the synergy between traditional herbal wisdom and modern scientific inquiry, healthcare practitioners can harness the potential of herbal medicine to provide holistic and personalized cardiovascular care.

In a world where cardiovascular diseases continue to pose significant challenges, the exploration of herbal medicine offers a beacon of hope, showcasing nature's intricate contributions to a healthier heart and a more vibrant life.

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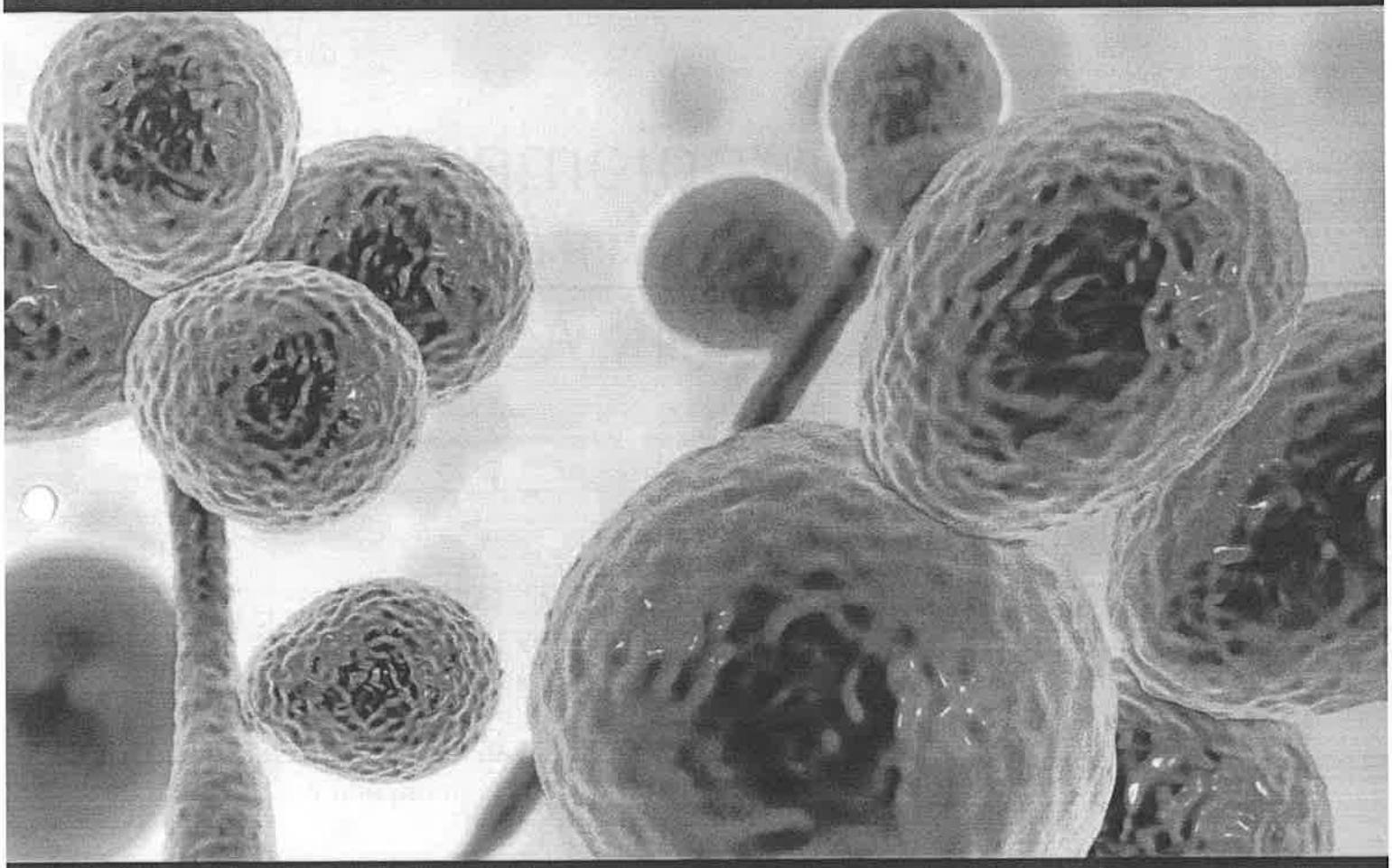
MICROBIOME RESEARCH IN PLANTS AND SOIL



MICROBIOME-ASSISTED BIOREMEDIATION

Rehabilitating Agricultural Soils

Edited by
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Microbiome-Assisted Bioremediation

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CHAPTER

Potential use of microalgal metallothioneins and phytochelatins in bioremediation

17

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1. Bioremediation

The advancement in technology and improved living standard of human beings creates a need of large quantity of new materials as well as energies. These are responsible for the production of waste, results into environmental degradation and destruction of natural environmental components (Mani & Kumar, 2014; Saha et al., 2021). Rapid growth in industrialization, urbanization, mining, and use of pesticides and fertilizers for a prolong time are the primary sources of harmful and toxic pollutants such as heavy metals (HMs), pesticides, microplastics, hydrocarbons, etc. (Emenike et al., 2018; Guo et al., 2020; Rajendran et al., 2021; Xu et al., 2018). Bioaccumulation of these contaminants in food chain causes serious damage to the ecosystem (Zerizghi et al., 2020) and having harmful effects on human body, may lead to cancer, kidney diseases, atherosclerosis, hypertension, Alzheimer's diseases, cardiovascular diseases, etc. (Ahern et al., 2011; Bernhoft, 2012; Flora et al., 2012; Lee et al., 2017; Muszynska et al., 2015; Nawrot et al., 2006). The utilization of microbial source acting as an effective tool for remediation of environment contaminated with toxic organic pollutants and heavy metals (Liu et al., 2020). The bioremediation technique involves the use of microorganisms like microalgae and bacteria to detoxify, transform, or remove HMs and toxic pollutants from environment (Cepoi et al., 2022; Hadiani et al., 2018; Khan et al., 2019; Lopes et al., 2021). Nowadays, more preference is given to these biological-based strategies over other physicochemical approaches, because its implementation is easy and simple, applicable to large areas, more economic, reliable, and ecofriendly (Ashraf et al., 2019). According to the study, cleaning of metal-polluted soils and chemical treatment costs around 100–500 USD per ton, whereas for bioremediation, it costs around 15–200 USD per ton (Meier et al., 2012). Basically, bioremediation process is divided into "*in-situ*" and "*ex-situ*" strategies (Lombi & Hamon, 2005). In "*in-situ*" process, bioremediation takes place at the contamination site, whereas in case of "*ex-situ*," the excavation of these contaminants is performed from its original site and treated elsewhere (Das & Mukherjee, 2007). The "*in-situ*" bioremediation process includes bioventing, bio-

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sparging, bioaugmentation as well as biostimulation (Atlas & Phillip, 2005; Crivelaro et al., 2010; Sharma et al., 2012; Thapa et al., 2012). The "*ex-situ*" process includes the techniques like land farming, composting, biopiles, and use of bioreactors (Chatterjee et al., 2008; Chikere et al., 2011; Soccol et al., 2003; Wu & Crapper, 2009). Both the processes are based on the principles biodegradation, immobilization, biotransformation, removal, or decontamination of various environmental pollutants by using microorganism and plant sources (Abatenh et al., 2017). The chemical contaminants are used by microbes as an energy source and are metabolized into useable energy via redox reactions. The resulting metabolites and by-products are less harmful than original pollutants which are releasing back to the environment (Nester et al., 2001).

2. Heavy metals and their hazardous effects

Heavy metals are considered as most threatening environmental contaminants (Gustin et al., 2021). HMs are the elements with atomic number and density greater than 20 and 5 g/cm^3, respectively (Ali & Khan, 2018). These are categorized into three classes like toxic (a) HMs (e.g., Pb, Hg, Zn, Cu, As), (b) precious metals (e.g., Ag, Pt, Pd, Au), and (c) radionuclide HMs (Th, U, Ra, and Am) (Wang & Chen, 2009). HMs are also classified based on biological perspectives into essential as well as harmful elements. Essential metals or metalloids are micronutrients obtained from plant and animals such as Cu, Zn, Ni as well as Fe, but they can prove toxic above certain thresholds (Garcia-Garcia et al., 2016). On the other hand, toxic elements are nonessential metals, considered to be toxic even at low concentrations (Asad et al., 2019; Ashraf et al., 2019). Nonessential HMs are having serious toxicities toward microorganisms, plants, animals as well as human beings even at very less concentrations (Ali et al., 2019). HMs are not biodegradable, and its toxicity and accumulation in soil and environment attracted much attention worldwide (Kandziora-Ciupa et al., 2021). These can cause direct and indirect effect on the growth of plant like injury to the root, decrease in concentration of carotenoid, necrosis, chlorosis, inhibition of enzymatic activities, decrease in activities related to photosynthesis, and nutrient imbalance (Hasan et al., 2017; Lewis et al., 2001; Mascher et al., 2002; Sachan & Lal, 2017; Shaibur et al., 2009; Yadav, 2010). The bioaccumulation of HMs results into pass the food chains to human beings causing serious and adverse effects on health. HMs can enter the human body by ingestion, through food chain, drinking contaminated water, and contact with environmental contaminants. Its exposure for several years leads to the dangerous effect on the health of human beings (Kumar et al., 2019; Njoga et al., 2021). However, exposure to HM continues and arising in some regions (Järup, 2003). The industrial and domestic waste disposal containing HM threatens the aquatic organism and damage to aquatic ecosystem (De Filippis & Pallaghy, 1994). Hence, the treatment of water contaminated with HMs becomes a global issue and research area of interest for scientists and environmentalists. It becomes necessary to remove these contaminants from aquatic ecosystem as well as industrial wastewater in order to protect environmental as well as human health (Denouche et al., 2021). The use of traditional technologies (e.g., lime precipitation and ion exchange) to remove the HM is often expensive and ineffective (Wilde & Benemann, 1993). So, it becomes essential for searching the newer technologies for the remediation of HMs, which should be economic, effective, and consistent, shall reduce the heavy metal concentration up to significant, and promising approach to remove the HM contaminants (Fu & Wang, 2011; Sheng et al., 2004).

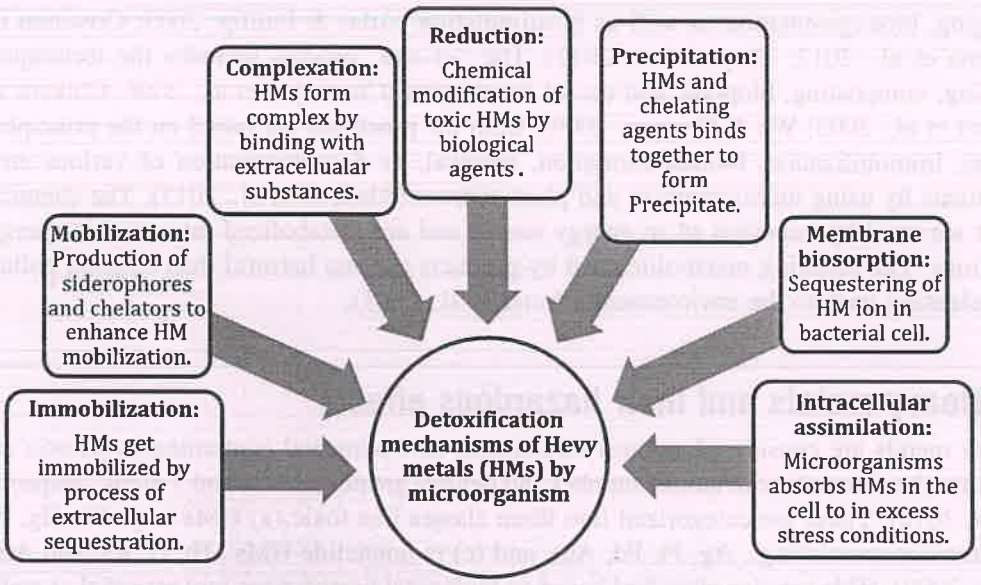

FIGURE 17.1

The mechanisms for detoxifications of heavy metals (HMs) from the soil using microorganisms.

3. Heavy metals detoxification mechanism

The HM accumulation in the cell leads to cell homeostasis disorders, causes damage to chloroplast and pigments, affects the structure and function of DNA, and finally the cell destruction takes place by the formation of reactive oxygen species (ROS) (Kumar et al., 2016). Microorganisms are playing important role in detoxification process which can precipitate, sequester, biosorb with change in oxidation states of different metals (Rizvi et al., 2020). The fundamental mechanism of detoxification of HM involves their chelation in the cytosol by certain ligands like metallothioneins (MTs), phytochelatins (PCs), organic acids, and amino acids which reduce the intracellular contents of HMs and their phytotoxicity (Haydon & Cobbett, 2007). The microbial conversion of toxic metals into less toxic takes place by using the microbial enzymes such as oxidoreductases, dioxygenases, and peroxidases (Saha et al., 2021). The mechanisms involving utilization of microorganism for detoxification of the HM from polluted soil is represented in Fig. 17.1.

4. Metallothioneins

MTs are metal-binding proteins characterized by Vallee et al. in the year of 1950. It is a product of mRNA translation, characterized as cysteine-rich protein with molecular weight (6–7 kDa). The induction of MTs in aquatic organism plays a role of significant biomarker for heavy metal toxicity as well as bioaccumulation (Stillmann, 1995; Won et al., 2008). MTs play a significant role in essential metal supply to the cells and carrying out the transport of harmful metals to other cell organelles (Capdevila & Atrian, 2011). Basically, MTs are small proteins ($\leq$300 amino acids) consisting of some aromatic residues (<10%) and high amount (15%–35%) of cysteine, which coordinate metal ions

(Ziller & Fraissinet-Tachet, 2018). MTs are classified into four types, having tertiary type of structure with metal-binding property is explained for type 4 plant MTs. Structurally type 4 plant MTs consist of cysteine-rich shorter N-terminal acting as domain for metal-binding and long C-terminal domain containing MTs (Leszczyszyn et al., 2013) along with shape having HM-MT complex varies as per total numbers of cations present in bound form (Bell & Vallee, 2009). MTs consist of 15 distinct families, and each family comprises evolutionary respective proteins present in organisms of similar taxonomic groups. The nine conserved motifs which are cysteine rich are present across various MT families like CCXCC, CXCXCXC, CCC, CCXC, CXCC, CXCXC, XCCX, CXC, and XXCXX. The eukaryotic MTs are identified majorly in plants, ciliates, fungi, and metazoan (Ziller & Fraissinet-Tachet, 2018). Most of the MTs obtained from eukaryotes of microorganisms are associated with ciliates (e.g., Paramecium, Tetrahymena), Apusozoa (Thecamonas), and parasitic Apicomplexa (e.g., Theileria, Babesia) or Amebae (Entameba), as well as six types of microalgal genera (Thalassiosira, Symbiodinium, Chlorella, and Aureococcus) include marine type of representatives (Balzano et al., 2020). MTs are the molecules that chelate the toxic metals like Cd, and thus reduce the cytotoxic, free metal ions concentration. Some of the MTs are involving in Zn as well as Cu homeostasis. The heavy metals like Pb, Cu, Zn, As, Cd, Au, and Ag are responsible for inducing the class III MT biosynthesis within several microalgae like *Stichococcus bacillaris*, *Stichococcus tenue*, and *Stichococcus subspicatus* (Perales-Vela et al., 2006; Robinson, 1989).

5. Phytochelatins

PCs are cysteine-rich peptides with metal-binding properties consisting three amino acids: glutamate, cysteine, and glycine, as well as sulfhydryl group of cysteine involves in metal sequestration (Danouche et al., 2021). PCs are also referred as class III MTs identified primarily in higher plants (Cobbett & Goldsbrough, 2002). PCs are synthesized from γ-glutamylcysteine and the synthesis is catalyzed by transpeptidase enzyme, PCs synthase, which needs posttranslational activation by heavy metals (Chen et al., 1997; Grill et al., 1989; Hayashi et al., 1991; Torres et al., 2008). The biosynthesis of glutathione (GSH) includes two reactions: γ-glutamylcysteine formation from cysteine and glutamic acid, the reaction catalyzes by enzyme glutamate-cysteine ligase (GCL) and glutamylcysteine ligation with glycine to form GSH, the reaction is catalyzed by GSH synthetase (GSHS) (Musgrave et al., 2013). In the final step, GSH binds to other glutamylcysteine units to form PCs. PCs are able to form a complex or chelates through thiol group present in cysteine residues side chain. HM cations can coordinate up to four sulfide groups from one or more PCs within HM-PC chelates (Hirata et al., 2005). Most of the metals and metalloids like Cu, Zn, As, Pb, and Cd can be helpful for the PC synthase activation both in vivo as well as in vitro. Earlier PC production is reported within freshwater algae as a response to heavy metals present in the mining water (Pawlik-Skowronska, 2001).

6. Use of microalgal metallothioneins and phytochelatins in bioremediation

MTs are known as a superrich cysteine family present in cytosol, which is characterized by low molecular weight gene-encoded proteins. These are metal-binding proteins having significant role for controlling the intracellular concentration of metals with regular level. The majorly known MTs from

microalgae belongs to Chlorella Symbiodinium, Aureococcus, Thalassiosira, Nannochloropsis, and Ostreococcus genera (Balzano et al., 2020; Gaur & Rai, 2001). The microalgae that synthesize enzymatically PCs rather than MTs in response to metal exposure. The synthesis of PCs in microalgae strains is primarily identified in *C. fusca* on exposure to Cd(II) ions (Gekelar et al., 1988). From the research, Hg—PCs are identified in *C. sorokiniana* with mercury exposure, and synthesis of PCs is also found in Cu(II)-treated *Scenedesmus bijugatus* and Pb(II)-treated *S. bacillaris* (Gomez-Jacinto et al., 2015; Nagalakshmi & Prasad, 2001; Pawlik-skowron, 2002). Cd(II) is found to be a significant stimulator of PC synthase in Chlamydomonas species. PC synthesis is majorly induced by Zn present in Dunaliella species. The electron-dense material is found in vacuoles of green alga *Tetraselmis suecica* which is exposed to Cd(II) as well as diatom *Skeletonema costatum* that accumulated Cu(II) and Cd(II) (Abboud & Wilkinson, 2013; Nassiri et al., 1997; Perales-Vela et al., 2006; Wang et al., 2017). In other study, three microalgae isolated from *P. ambiguum*, *P. typicum*, and *S. quadricauda*, evaluated for the removal and tolerance of mercury, lead, and cadmium present in aqueous solutions. It is reported that cytoplasmic metal concentration is minimized by the formation of complex of metal ion with PCs in the form of metallo-iron, metallo-sulfur, or metallo-phosphate chelates in the cytosol. These are carried into the vacuoles, where acidic pH displaces the metals and allows peptides to return to the cytosol. This mechanism is referred as cellular protection or detoxification mechanism (Shanab et al., 2012).

7. Factors responsible for affecting bioremediation

The prime factor responsible for affecting bioremediation is site characteristic, and other factors viz. pollutant bioavailability, amount of moisture, nutrient availability, pH, temperature, and amount of water also affect the bioremediation efficiency (Leong & Chang, 2020). The type of contaminants and the extent at which it is present in the location or site affect bioremediation. It can be managed by sufficient prior investigation (Abatenh et al., 2017). The high temperature is responsible for the destruction of bacterial cell metabolic activities and can affect the bioaccumulation process. However, pH 6.5—8.5 is considered maximum potential bioremediation (Abatenh et al., 2017; Javanbakht et al., 2014). Within cold environment, nutrient supply in required quantity increases the microbial metabolic activities that results into rise in the rate of bioremediation. Moisture is also responsible for affecting pollutant metabolism rate by influencing osmotic pressure of aquatic sites (Couto et al., 2014). In case of plant-based bioremediation, the factors for the selection of suitable plant include the root system, above-ground biomass, and plant growth. For the growth and metabolism of microorganisms, the water activity values should be 0.9—1.0, and most number of bacteria can grow with upper limit values of water activity (Azubuike et al., 2016; Sharma, 2019). The bioavailability of contaminant is controlled by different process like diffusion, desorption, sorption, dissolution, etc. It can be managed by the application of complexing agents like ethylene diamine tetraacetic acid (EDTA), citric, acetic, and malic acid that form chelates with HMs with increase in bioavailability (Sarwar et al., 2017).

8. Strategic approaches in remediation

The first strategic approach in bioremediation is the use of immobilized microalgae and metals. It is one of the significant approaches in detoxification and metal recovery process. It is reported that

the total removal of Cu(II) by calcium alginate gel immobilized *C. vulgaris* is higher than that of agarose *C. vulgaris* system (Aksu, 1998; Hameed & Ebrahim, 2007). In order to increase the specificity toward HM and microalgal metal-binding capacity, the transgenic approach is developed for the use of microalgae for the treatment of heavy metals in wastewater as well as sediments. It is characterized by enzymatic overexpression of which metabolic residues or products enhance the effect of heavy metal-associated stress, heavy metal-binding proteins on the surface as well as in the transgenic cells cytoplasm (Rajamani et al., 2007). Another approach in remediation is metal desorption; algae are used as characteristic biological adsorbents in different restoration processes. The metal that is sorbed on microalgal biomass is desorbed by using solution used for desorption and by which allowing the reuse of biomass in multiple cycles of sorption–desorption (Lu et al., 2006). Recycling of microalgal biomass is also a strategic approach in remediation in which flocculating agent chitosan is used for microalgal recovery. The gel entrapment by the use of synthetic polymers like polyacrylamides, polyurethanes, or natural polysaccharides like agar, alginate is also recommended (Monteiro et al., 2012).

9. Metallothioneins and phytochelatins in heavy metal phycoremediation

Phycoremediation is a type of bioremediation, related to the utilization of algae for removing or mitigation of toxic pollutants (John, 2003). In this process, the HMs are removed from polluted water as well as sediments by using microalgal ability to get incorporated into the metal cations from surroundings. HM uptake process is driven with the use of electrochemical affinity which starts with the adsorption of metal. Electrochemical affinity occurs within metal cations and groups of cell wall polymers that are polar in nature. The dead microalgal biomass can also be used which prevents the risk of contamination of ecosystem, particularly suitable for polluted environments in which the inhibition of microalgal growth takes place (Kumar et al., 2015; Arica et al., 2005). The accumulation and intracellular transport of HMs in the particular organelles are regulated with use of MTs, PCs, and different heavy metal-binding molecules like polyphosphates. The biosorption rate of HM can be enhanced by adjusting the physicochemical conditions like pH, temperature to which microalgal substrates as well as HMs exposure takes place; as increase in the bioaccumulation of HMs, the scientist expressed recombinantly import-storage systems that consist of primary active transporters and secondary carriers and channels (Diep et al., 2018).

10. Current developments in bioremediation and other applications

Bioremediation is one of the promising and innovative techniques of waste management which use living organism for the removal or neutralization of contaminants (Mosa et al., 2016). Phytoremediation is the efficient, cost-effective, solar-powered, and green alternative technology which is also called as green remediation, botanoremediation, or agroremediation related to use the plant to transform, reduce, extract or immobilization of contaminants present within soil, sediment as well as groundwater (McGrath et al., 2001; Ullah et al., 2015). Another technology of bioremediation includes phytoextraction, phytostabilization, phytovolatilization, phytotransformation, and phytofiltration. Phytoextraction is also called as phytoaccumulation which is related to the use of hyperaccumulating

plants which are responsible for the uptake of metal from soil with the use of its roots and accumulate them in its aerial part (Oladoye et al., 2022). Phytostabilization is also an emerging technology that refers to use plant to immobilize soil contaminants through adsorption on or precipitation in root zone (DalCorso et al., 2019). Phytovolatilization is related to the uptake of toxic soil contaminants by plants and its transformation into the volatile products, followed by their discharge in environment (Ali et al., 2013). Phytotransformation or phytodegradation is restricted to eliminate the organic contaminants as heavy metals are nonbiodegradable (Singh et al., 2018). Phytofiltration technique consists the process of elimination of organic as well as inorganic pollutants from the water with aid of plant roots (rhizofiltration), plant shoots (caulofiltration), or seedlings (blastofiltration) (Hakeem et al., 2020). The nanoparticles are having special characteristic that includes improved process of catalysis and adsorption with increased reactivity. Recently the microorganisms and its extracts are proved to be promising, ecofriendly catalysts for engineered nanomaterial. The combination of nanotechnology and bioremediation is called as nano-bioremediation which is more ecofriendly, safe, more economic, and green (Hidangmayum et al., 2022).

11. Future technologies in bioremediation

Biotechnological interventions which primarily include the genetic engineering, for example, various steps which are rate limiting in known pathways of metabolism can be altered and genetically manipulated in order to increase the rate of biodegradation or by the introduction of completely newer pathways of metabolism in microorganism for high amount of HMs accumulation. The study related to hologenomics of microorganisms from plant source which assists for the manipulation of microbial niches helps to increase in resistance against the harmful contaminants. Though there are various technologies available for bioremediation, there is need to develop more suitable ecofriendly technology for the treatment of the multistressed and multimetal-contaminated soil (Saha et al., 2021). Metagenomic perspectives shall also be focused on microbial evolution during the process of bioremediation (Raklami et al., 2022).

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Curriculum Completion Report

(2023 - 2024)

Name :- DR. Madhuri Deshmukh Dept. :- Zoology

To,
The Principal
BJS's ASC College
Wagholi, Pune- 412207

Subject :- Syllabus completion report for Semester I and II of the academic year 2023 -24.

Respected Sir,

With reference to the above mentioned subject, I am submitting the syllabus completion report for your kind perusal.

Course code	Course Name	Class	Date of completion	No. of classroom lectures	No. of Online lectures	Total Lectures	Total Teaching Hours
ZO 231	Animal Diversity III	SYBSC	31/08/23	19	-	19	15.83
ZO233	Practical III	SYBSC	18/10/2023	14X4 = 56 (56X4) = 224	-	224	224
ZO 241	Animal Diversity IV	SYBSC	28/04/24	10	-	10	8.33
ZO243	Practical IV	SYBSC	26/03/2023	15X4 = 60*4=240+24= 264Tour	-	264	264

Total Teaching Hours: **512.16**
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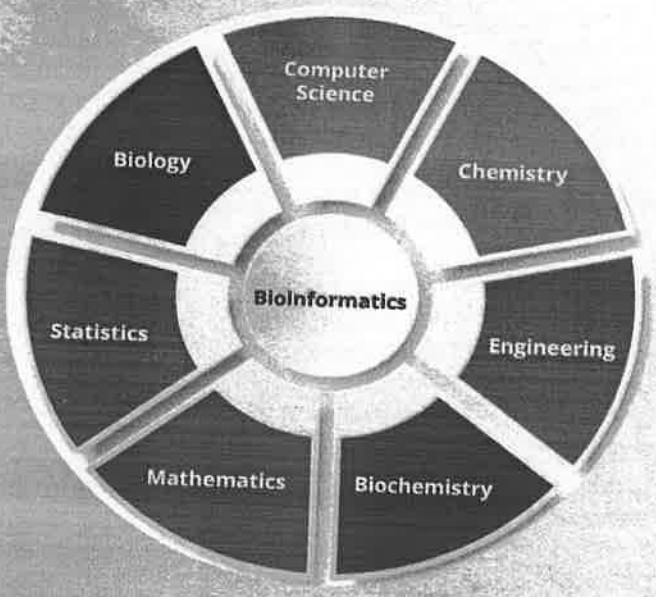

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S.M.R.K.-B.K.-A.K. Mahila Mahavidyalaya, Nashik, Maharashtra, India
(Permanently affiliated to SNDT Women's University, Mumbai)
NAAC Re-Accredited B++ & ISO:9001-2015 Certified

Certificate

This is to certify that **Dr. Deshmukh Madhuri Vishnu** *of* **B.J.S. College of Arts, Sci., & Comm., Wagholi** *has participated in the One day National Seminar on* **'Execution of NEP 2020 in Higher Education'** *organized by Faculty of Home Science in collaboration with Home Science Association of Nashik (HAN) of SMRK-BK-AK Mahila Mahavidyalaya, Nashik on Saturday, 21st October 2023.*

He/She also has presented & published a paper with title

"NEP 2020: Roadmap for Students."

His/her participation is appreciated.

Sangita Kamble
Seminar Convenor
Asst. Prof. & H.O.D. H.D. Dept.

Prof. Dr. Mrs. Kavita Patil
Seminar Co-ordinator
Vice-Principal.

Prin. Dr. Mrs. Deepti Deshpande
Seminar Director
Secretary, Treasurer & H.R Director, G.E. Society. Nashik

JSPM UNIVERSITY PUNE

Recognized by the UGC u/s 2 (f) of UGC Act 1956 and enacted by the
State Government of Maharashtra - JSPM University Act, 2022 (Mah. IV of 2023)

Ref: JSPM Uni/SFS/ Exam/2023-24/04 **Date:** 12/12/2023

To
Dr. Madhuri Deshmukh,
Head, Department of Zoology,
BJS Science College,
Pune.

Subject: Appointment as External Examiner for End Semester Practical Examination, JSPM University, Pune (Nov /Dec 2023).

Ma'am,

It gives me great pleasure to notify you that you have been appointed as External Examiner for the following:

Examination	Paper / Subject	Chairman	External Examiner	Examination Date
First Year. B.Sc. Forensic Science (Sem-I) End Semester Practical	Liberal learning Courses – Human Anatomy and Physiology (Semester – I) **Center for Practical:** School of Forensic Sciences, JSPM University.	**Ms. Megha D. Sapkota** Assistant Professor School of Forensic Sciences, JSPM University Wagholi, Pune.	**Dr. Madhuri Deshmukh,** Head, Department of Zoology, BJS Science College, Pune.	14.12.2023

You are hereby informed to conduct the above said examination as per JSPM University Pune Rules and Regulations.

Dr. Sagar B. Wankhede
I/C Dean, Faculty of Health Sciences
JSPM University, Pune

JSPM UNIVERSITY WAGHOLI 412207 PUNE

JAYAWANT SHIKSHAN PRASARAK MANDAL' S
CHARAK COLLEGE OF PHARMACY AND RESEARCH
Affiliated to Savitribai Phule Pune University, Pune.
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Directorate of Technical Education (DTE), Govt. of Maharashtra.
Approved by All India Council for Technical Education (AICTE), New Delhi.
Accredited by National Assessment and Accreditation Council (NAAC).
ISO 9001:2015 Certified.

rof. Dr. T. J. Sawant
Founder Secretary

Dr. S. B. Wankhede
Principal

Ref: JSPM/CCOPR/Avishkar/2023-24

Date: 28/09/2023

To,

Dr. Madhuri Deshmukh

HOD Department of Zoology

Bharatiy Jain Sanghatana Arts, Science & Commerce College, Wagholi, Pune

Dear Madam,

It gives me immense pleasure to inform you that we are organizing a college level Poster Presentation Competition "Avishkar 2023-24" on 30th September 2023. It is indeed a privilege to invite you as a judge for the above mentioned "Poster Presentation Competition" to be conducted at our college JSPM's Charak College of Pharmacy and Research, Wagholi.

The schedule for the event is as follows,

Date of Competition: 30/09/2023

Time: 10.00am to 3.00 pm.

Venue: JSPM's, Charak College of Pharmacy and Research, Wagholi,

Looking forward to your kind cooperation.

Thanking You.

JSPM's Charak College of Pharmacy & Research Wagholi, Pune

Yours truly,

Dr. S. B. Wankhede
(Principal)

PRINCIPAL
Charak College of Pharmacy & Research
Wagholi, Pune-412207.

Address: Gat No. 720 (1&2), Pune Nagar Road, Wagholi, Pune-412207 (MS)
Phone: 020-67335103 Fa: 020-27051172, Email: principal@jspmccopr.edu.in, Website: jspmccopr.edu.in

JAYAWANT SHIKSHAN PRASARAK MANDAL' S
CHARAK COLLEGE OF PHARMACY AND RESEARCH
Affiliated to Savitribai Phule Pune University, Pune.
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Directorate of Technical Education (DTE), Govt. of Maharashtra.
Approved by All India Council for Technical Education (AICTE), New Delhi.
Accredited by National Assessment and Accreditation Council (NAAC).
ISO 9001:2015 Certified.

of. Dr. T. J. Sawant
ounder Secretary

Dr. S. B. Wankhede
Principal

Date: 30/09/2023

To,

Dr. Madhuri Deshmukh

HOD Department of Zoology

Bharatiy Jain Sanghatana Arts, Science & Commerce College, Wagholi, Pune

Dear Madam,

I am very thankful to you for your kind presence & sparing your valuable time with us at our college on 30/09/23 as judge for Poster Presentation Competition "Avishkar 2023-24". I am confident that your valuable suggestions will help us in our future endeavors.

Thanking You,

Regards.

Dr. S. B. Wankhede
Principal

PRINCIPAL
arak College of Pharmacy & Research
Wagholi, Pune-412207.

College of Pharmacy & Research * JSPM's Charak Wagholi, Pune

Address: Gat No. 720 (1&2), Pune Nagar Road, Wagholi, Pune-412207 (MS)
Phone: 020-67335103 Fa: 020-27051172, Email: principal@jspmccopr.edu.in, Website: jspmccopr.edu.in

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IQAC Cluster India
Reg No. MAH/236/2021/PUNE
www.iqacclusterindia.com

CERTIFICATE OF PARTICIPATION

This is to certify that

Dr. Madhuri Deshmukh, Assistant Professor,
Bharatiya Jain Sanghatana's Arts, science and Commerce College, Wagholi, Pune

Has participated and successfully completed the Five Days National Level Faculty Development Programme on "CO-PO Designing, Mapping, Attainment Methods and Continuous Internal Evaluation (CIE) from 11th September to 15th September 2023 organized by IQAC Sao Chang College in association with IQAC Cluster India.

DR. SANTOSH KUMAR SINGH
CO-ORDINATOR, IQAC
SAO CHANG COLLEGE, TUENSANG

PROF. BHARAT KANGUDE
FDP CO-ORDINATOR

PROF. PEEYUSH PAHADE
President, IQAC Cluster India

MR. LONGTICHANG TZUDIR
Principal In-charge
Sao Chang College, Tuensang

BJS
Bharatiya Jain Sanghatana

BHARATIYA JAIN SANGHATANA'S ARTS, SCIENCE & COMMERCE COLLEGE, WAGHOLI, PUNE

THE INTERNAL QUALITY ASSURANCE CELL
ORGANIZES
ONE DAY FACULTY DEVELOPMENT PROGRAM

CERTIFICATE OF PARTICIPATION

This is to certify that Mr. / Ms/Dr. Madhuri V. Deshmukh has participated in the One Day Faculty Development Program on "**Book & Article Writing With International Standards**" organized by The Internal Quality Assurance Cell on 20th April 2024.

Madhuri.

Dr. M.V.Deshmukh
Coordinator IQAC

Dr .S. D. Gaikwad
Principal

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Certificate

This is to certify that

Dr. Madhuri Vishnu Deshmukh

Bharatiya Jain Sanghatana's Arts Science & Commerce College Wagholi Pune

has participated in the **One Week National level Online Faculty Development Program**

on **Outcome Based Education and Application of Generative AI in Teaching and Research,**

organised by the **Internal Quality Assurance Cell (IQAC)** of **Gauhati University, Assam**

in association with **ipsr solutions limited** from **17 April 2024** to **24 April 2024**

and has successfully completed all the tasks, assignments and assessments and secured an **A grade**.

Certificate ID: ssl4ZjnG10

Prof. Bhaben Tanti
Director, IQAC
Gauhati University

Dr. Mendus Jacob
M.D & C.E.O - ipsr solutions limited
Professor & Director, MCA
Marian College, Kuttikkanam (Autonomous)

BJS

भारतीय जैन संघटनेचे कला, विज्ञान व वाणिज्य महाविद्यालय, वाघोली, पुणे – ४१२२०७

गोपनीय मूल्यांकन व स्वयंमूल्यांकन प्रतिवेदन (२०२३-२०२४)

(शिक्षकेत्तर /तांत्रिकेत्तर / तांत्रिक सेवकांसाठी (नियम १२ अनुसार)

कर्मचारी क्रमांक :- .....

नांव :- पाटील विश्वास पुंडलिक

विभाग :- रसायनशास्त्र शाखा : विज्ञान

सध्याचे पद :- प्रयोगशाळा परिचर

भाग १ : स्वयंमूल्यांकन (वैयक्तिक माहिती) संबंधित सेवकाने भरावयाची माहिती

जन्मदिनांक :- 01/06/1972

राष्ट्रीयत्व व धर्म :- भारतीय, हिंदू

अनुसूचित जात/अनुसूचित जमात/भटक्या विमुक्त जाती/इतर मागासवर्गीय : OBC

सध्याचा पत्ता :- 170 गजानन इंदिरापुरी कॉलेज पार्क जवळ बकोरी रोड मोरेवस्ती ता.हवेली जि.पुणे-412206.

कायमचा पत्ता :- मु.पो. आडगांव ता.चोपडा जि.जळगांव पिन 425107

महाविद्यालयीन सेवेत प्रविष्ट झाले त्यावेळेस धारण केलेले पद :- प्रयोगशाळा परिचर

महाविद्यालयात सेवेत प्रविष्ठ झाल्याचा दिनांक : 20/07/1998

महाविद्यालयीन सेवेत प्रथम प्रविष्ठ झाल्यापासून झालेल्या पदोन्नती

अ.क्र.	पद	दिनांक
१	प्रयोगशाळा परिचर	20/07/1998
२		
३		
४		

मातृभाषा :- मराठी

अवगत असलेल्या इतर भाषा :- हिंदी

शैक्षणिक पात्रता :

अ.क्र.	पदवी	विद्यापीठ/बोर्ड	वर्ष
१	12 वी पास	पुणे	1990
२			
३			
४			

शैक्षणिक वर्ष २०२३-२०२४ मध्ये सोपविलेली कामे

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शैक्षणिक वर्ष शैक्षणिक वर्ष २०२३-२०२४ मध्ये केलेली कामे

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शैक्षणिक वर्ष २०२३-२०२४ मध्ये केलेले विशेष उल्लेखनीय कार्ये

.....

.....

शैक्षणिक वर्ष २०२३-२०२४ मध्ये मिळालेली बक्षिसे अथवा झालेल्या शिक्षा

.....

.....

वरील सर्व माहिती खरी असून त्याच्या पुराव्यादाखल आवश्यक पुरावे माझेकडे आहेत.

दिनांक : 17.05.2024

स्वाक्षरी : .....

नांव : पश्चिम विलास पुंडलि

ठिकाण : वाशिमी

पद : प्रयोगशाळा परिचर

सर्वसाधारण समर्थता व चारित्र्य या संबंधातील गोपनीय मूल्यांकन प्रतिवेदन

नांव :- श्री. परीमल व्ही. पी.

प्रतिवेदन काळात धारण केलेले पद :- प्रयोगशाळा परिचर

विभाग / शाखा :- महाविद्यालय प्रयोगशाळा

मूल्यांकनाचा आढावा

(चौकोनात √ अशी खूण करावी)

अ. क्र.	नांव	अति उत्कृष्ठ	उत्कृष्ठ	निश्चित चांगली	चांगला	साधारण	साधारणपेक्षा कमी
		अ+	अ	ब+	ब	क	क-
१	**तांत्रिक समुचितता**						
	उद्योगप्रियता				√		
	कार्यतत्परता				√		
	उपक्रमशिलता				√		
	नीटनेटकेपणा				√		
	अचुकता	—	—	—	√		
	कामातील नियमितपणा	—	—	—	√		
	कामातील व्यवस्थितपणा व पध्दतशिरपणा	—	—	—	√		
	काम उरकण्याची तत्परता	—	—	—	√		
	उपस्थितीमधील वक्तशीरपणा	—	—	—		√	
	वरिष्ठांशी वर्तणूक	—	—	—	√		
	सहकाऱ्यांशी वर्तणूक	—	—	—	√		
	विद्यार्थ्यांशी वर्तणूक	—	—	—	√		
	भरवसा	—	—	—	√		
	काम करवून घेण्याची क्षमता	—	—	—	√		
२	**सर्वसाधारण निरीक्षण**	—	—	—			
	सर्वसाधारण मत व ग्रहणक्षमता	—	—	—	√		
	नेतृत्वाचे गुण	—	—	—	√		
	कामाबाबतची माहिती	—	—	—	√		
	तांत्रिक समर्थता	—	—	—	√		
	कामाव्यतिरिक्त इतर विशेष	—	—	—	√		
	सर्वसाधारण बुध्दिमत्ता	—	—	—	√		
	सचोटी व चारित्र्य	—	—	—	√		

१. प्रशासकीय समर्थता (निर्णयशक्ती, उपक्रमशीलता, कामातील उरक, तत्परता व धडाडी) :- ..... आली .....

२. सध्याच्या पदावर यांपुढे चालू ठेवण्याची पात्रता :- ..... आहे .....

३. पदोन्नतीसाठी योग्यता :- ..... आहे .....

४. वर नमूद केलेल्या बाबीशिवाय काही बाबी/पैलू नमूद करावयाचे असल्यास येथे नमूद करावे :- .....

५. प्रतिवेदन अधिकाऱ्याची शिफारस निरीक्षण :- ..... शिफारस आहे .....

दिनांक : 22/5/2024

स्वाक्षरी : .....

नांव : केशव एस. वही

ठिकाण : वाघोली

पद : कार्यालयीन अधिक्षक

(परिच्छेद १, २ व ३ मधील सर्व बाबी सर्व श्रेणीतील कर्मचाऱ्यांना लागू होतीलच असे नाही. जेथे एखादी बाब लागू होत नसेल तेथे प्रतिवेदन अधिकाऱ्यांनी लागू नाही असे म्हणावे. मूल्यांकन पाच श्रेणींवर आधारलेले असेल उदा. २) अति उत्कृष्ठ (अ+), २) उत्कृष्ठ (अ), ३) निश्चित चांगला (ब+), ४) चांगला (ब), ५) साधारण (क), ६) साधारण पेक्षा कमी (क-))

पुनरावलोकन अधिकाऱ्याचा अहवालावरील अभिप्राय

१. पुनरावलोकन अधिकाऱ्याच्या सेवेतील प्रतिवेदन कालातील कालखंड : .....

२. आपण प्रतिवेदन अधिकाऱ्यांशी सहमत आहात काय, किंवा आपण त्यात काही बदल सुचवू इच्छिता का किंवा अधिक काही म्हणून इच्छिता : .....

३. सवेकासाठी अभिप्रायाचे निरीक्षण आणि प्रतिवेदन अधिकाऱ्यांकडून काही मगावावयाचे झाल्यास स्पष्टीकरण : .....

४. सेवकाला कळवावयाचे अभिप्राय, त्रुटी व प्रतिवेदन अधिकाऱ्यांकडून मागवावयाचे झाल्यास स्पष्टीकरण : .....

दिनांक : ...../...../.....

स्वाक्षरी : .....

नांव : डॉ. गायकवाड एस.

ठिकाण : .....

पद : .....

प्रभारी प्राचार्य
भारतीय जैन संघटनेचे
कला, विज्ञान व वाणिज्य महाविद्यालय
वाघोली, पुणे- ४१२२०७.