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Mr. V. S. Jedhe   Mr. A. K. Karhale

Editor

Mr. A. B. Patil

- About Authors and Editor -

Mr. Sanjiv M. Patil

M.Sc. Biochemistry, SET.
Assistant Professor,
Department of Biochemistry,
Shri Shivaji College of Arts Commerce and Science Akola.
Teaching Experience : 15 Years
UG : 11 Years, PG :- 7 Years
Research Experience : 07 Years, Industrial Experience : 05 Years

Mr. Ajit B. Patil

M.Sc. Biochemistry, NET, SET.
Assistant Professor AND Head
Department of Biochemistry
Gulamnabi Aazad College of Arts
Commerce and Science, Barshitakli
Teaching Experience : 16 Years
UG : 11 Years, PG : 05 Years
Research Experience : 03 Years

Mr Vivek S. Jedhe

M.Sc. Biochemistry, NET- JRF, SET
Head & Assistant Professor,
Department of Biochemistry,
Arts and Science College, Pulgaon
Teaching Experience : 12 Years

Mr. Aagosh K. Karhale

M.Sc. Biochemistry, DBT JRF and ICAR NET
from Banaras Hindu University, Banaras.
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Dr. R. R. Pachori (Sharma)
Dr. S. N. Zodpe
Dr. H. S. Malpani
Mr. G. G. Dhage
Dr. N. K. Agrawal
Dr. D. L. Barate

Editors

Dr. V. D. Nanoty
Dr. A. R. Deshpande
Dr. D. D. Bhokare
Dr. R. R. Pachori (Sharma)

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B.Sc. Second year, Semester - III

- EDITORS -

Dr. V. D. Nanoty

Principal
Shri. R.L.T. College
of Science, Akola

Dr. A. R. Deshpande

Professor and Head
Shankarlal Khandelwal Arts,
Science and Commerce College, Akola

Dr. D. D. Bhokare

Professor
Department of Microbiology
Shankarlal Khandelwal college, Akola

Dr. R. R. Pachori (Sharma)

Associate professor and
Head, Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

- AUTHORS -

Dr. R. R. Pachori (Sharma)

Associate professor and
Head, Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

Dr. S. N. Zodpe

Assistant Professor and Head
Shri Shivaji College of Arts,
Commerce and Science, Akola

Dr. H. S. Malpani

Assistant Professor and Head
Shri Radhakishan Laxminarayan
Toshniwal College of Science, Akola

Mr. Govind Dhage

Assistant professor
Shri Vyankatesh Art's, Commerce and
Science College, Deulgaon Raja.

Dr. Nikhil Agrawal

Assistant Professor & Head
Bapumiya Sirajoddin Patel Arts Commerce and
Science College Pimpalgaon Kale

Dr. Dipali Barate

Assistant Professor
Shri Shivaji College of Arts, Commerce
and Science, Akola.

: 180/-

- About Editors -

Dr. V. D. Nanoty
M.Sc., Ph.D
Principal,
Shri. R.L.T. College of Science,
Akola

Dr. A. R. Deshpande
M.Sc. M.Phil., JRF, Ph.D
Professor and Head
Shankarlal Khandelwal Arts,
Science and Commerce College, Akola

Dr. D. D. Bhokare
M.Sc., MBA, Ph.D
Professor,
Department of Microbiology
Shankarlal Khandelwal college, Akola

Dr. R. R. Pachori (Sharma)
M.Sc., SET, Ph.D
Associate professor and
Head, Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

- About Authors -

Dr. R. R. Pachori (Sharma)
M.Sc., SET, Ph.D
Associate professor and
Head, Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

Dr. S. N. Zodpe
M.Sc., Ph.D.
Assistant Professor and Head
Shri Shivaji College of Arts, Commerce
and Science, Akola

Dr. H. S. Malpani
M.Sc., Ph.D.
Assistant professor and Head
Shri Radhakishan Laxminarayan
Toshniwal College of Science, Akola

Mr. G. G. Dhage
M.Sc. CSIR-NET, SET.
Assistant professor
Department of Microbiology
Shri Vyankatesh Art's, Commerce and
Science College, Deulgaon Raja.

Dr. N. K. Agrawal
M.Sc P.hD, D.M.L.T
Assistant Professor & Head
Department of Microbiology
Bapumiya Sirajoddin Patel Arts Commerce and
Science College Pimpalgaon Kale

Dr. D. L. Barate
M.Sc., Ph.D., NET
Assistant Professor, Department of Microbiology
Shri Shivaji College of Arts, Commerce
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Mr. S. M. Patil   Mr. A. B. Patil

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- AUTHORS -

Mr. S. M. Patil

Assistant Professor
Department of Biochemistry
Shri Shivaji College of Arts,
Commerce and Science,
Akola.

Mr. A. B. Patil

Assistant Professor & Head
Department of Biochemistry
Gulamnabi Aazad College of Arts,
Commerce and Science,
Barshitakli.

Dr. B. V. Jaiwal

Assistant Professor
Department of Biochemistry
Ghulam Nabi Azad Arts, Commerce &
Science College, Barshitakli.

Mr. A. K. Karhale

Assistant Professor
Department of Biochemistry
Indian Institute of Science,
Amravati.

- EDITORS -

Mr. S. M. Patil

Assistant Professor
Department of Biochemistry
Shri Shivaji College of Arts,
Commerce and Science,
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Examining the Phylogenetic Implications of a few Wild Fabaceae species, with a focus on Phytochemistry

Nikhil B. Choukhande

Department of Botany,

Shri Shivaji College of Arts, Commerce and Science Akola (MS) India 444003.

Email: nikhilchoukhande91@gmail.com

Summary

Nature shows many variabilities of living components of the environment which possess many useful as well as harmful and inactive chemical constituents. The classification which is based on these chemical constituents is known as chemotaxonomy. All the plants produce secondary metabolites that are derived from primary metabolites. The chemical structure of the secondary metabolites is often specific and restricted to taxonomically related organisms. The classification of plants on the basis of these specific classes of secondary metabolites and their biosynthetic pathways constitutes a chemotaxonomy study. Therefore, the chemotaxonomy study is used directly to generate a Phylogeny tree or cladistics or a cladogram. Its study is helpful to taxonomists, Phyto-chemists, and pharmacologists to solve selected taxonomical problems and for the elucidation of phylogenetic relationships.

Keywords : Chemotaxonomy, Cladogram, primary metabolites, Phylogeny, secondary metabolites.

Introduction :

The science of chemotaxonomy or chemical taxonomy is used for the classification of plants on the basis of their chemical constituents. All living organisms produce secondary metabolites that are derived from primary metabolites. The chemical structure of the secondary metabolites and their biosynthetic pathways is often specific and restricted to taxonomically related organisms and hence useful in classification. This method of classification is considered better in comparison to the traditional method due to the ease of working methodology. In this method of classification, the materials to be analyzed can be dried or crushed. The fresh or complete materials are not the compulsory requirements (Ankanna *et al.,*2012).

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The concept of chemotaxonomy has been elaborated in the past century. According to De Candolle (1816).

1) Plant taxonomy will be the most useful guide to man in his search for new industrial and medicinal plants; and

2) Chemical characteristics of plants will be most valuable to plant taxonomy in the future.

Many species of plants belonging to multiple families are cataloged as medicinal plants on the basis of the presence of specific chemical constituents and their effects on the biological systems (Herrera *et al.,* 2016). Natural Products are produced by all organisms but are mostly known from plants, insects, fungi, algae and prokaryotes. All of these organisms coexist in ecosystems and interact with each other in various ways in which chemistry plays a major role (Reynolds *et al*., 2007; Larsen *et al*., 2007).

The rise of chemotaxonomy is mainly due to the advancement in analytical techniques for chemical analysis that can detect even trace amounts of chemical compounds (Bhargava *et al*., 2013). The phenolics, alkaloids, terpenoids, and non-protein amino acids, are the four important and widely exploited groups of compounds utilized for chemotaxonomic classification (Smith *et al.,*1976).

Material And Method:

Collection Of Plants from Study Area

Two seasonal surveys were conducted to collect the plants from their natural habitats. it was collected from different natural habitats from Washim and Akola districts of Vidarbha region (MS) India. The collected plant species were identified taxonomically by using flora of Vidarbha (Naik, 1998) and flora of Maharashtra (Karthikeyan and Singh, 2001). After correct identification, The taxonomical discription of each plant was done with the help of same floras. one specimen of each selected plant species was deposited in the herbaria of Department of Botany, Shri Shivaji College, Akola (MS).

In the present work following plants were undertaken.

List of plants

1) *Psoralea corylifolia* L.
2) *Rhynchosia minima* (L.)DC.

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3) Crotalaria junicea L.

Protocol for GC- HRMS : Carried out by **SAIF** (Sophisticated Analytical Instrument Facility) - IIT Bombay, Powai, Mumbai.

Observation and Results:

The observations and results of the present study are given in table-1, table-2 and table-3.

Table- 1: GC-HRMS Of Methanolic Extract of *Psoralea corylifolia* L.

Peaks No.	Retention Time (Min.)	m/z Top Peaks	Area [Intens. * Sec]	Compounds	Mol. Formula/	Mol. Wt.
1	25.30	71	152349.67	Phytol	$C_{20}H_{40}O$	296
		57		Isooctane, (ethenyloxy)	$C_{10}H_{20}O$	156
		71		Isophytol	$C_{20}H_{40}O$	296
		43		2-Piperidinone, N-[4-bromo-n-butyl]-	$C_9H_{16}BrNO$	234
		71		1-Hexanol, 5-methyl-2-(1-methylethyl)-	$C_{10}H_{22}O$	158
		71		Sulfurous acid, octadecyl 2-pentyl ester	$C_{23}H_{48}O_3S$	404
		43		1-Nonene, 4,6,8-trimethyl	$C_{12}H_{24}$	168
		71		Sulfurous acid, nonyl pentyl ester	$C_{14}H_{30}O_3S$	278
		57		Heptane, 3-[(ethenyloxy)methyl]-	$C_{10}H_{20}O$	156
		71		1-Hexadecen-3-ol, 3,5,11,15-tetramethyl	$C_{20}H_{40}O$	296
2	25.42	173	7899620.64	Unknown	--	
		173		Phenol, 4-(3,7-dimethyl-3-ethenylocta-1,6-dienyl)	$C_{18}H_{24}O$	256
		173		1-tert-Butyl-3-(3-methoxyphenyl)-bicyclo[1.1.1]pentan	$C_{16}H_{22}O$	230
		173		1-Ethynyl-3,5-dimethyladamantane	$C_{14}H_{20}$	188
		173		Acetic acid, 3-(6,6-dimethyl-2-methylenecyclohex-3-enylidene)-1-methylbutyl ester	$C_{16}H_{24}O_2$	248
		41		Retinoic acid	$C_{20}H_{28}O_2$	300
		43		Retinol, acetate	$C_{22}H_{32}O_2$	328
		81		3-Isopropyltricyclo[4.3.1.1(2,5)]undec-3-en-10-o	$C_{14}H_{22}O$	206

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Peaks No.	Retention Time (Min.)	m/z Top Peaks	Area [Intens. * Sec]	Compounds	Mol. Formula/	Mol. Wt.
		55		Stigmastan-6,22-dien, 3,5-dedihydro	$C_{29}H_{46}$	394
		55		Cholesta-6,22,24-triene, 4,4-dimethyl	$C_{29}H_{46}$	394
		159		7-Tetracyclo[6.2.1.0(3.8)0(3.9)]unde canol, 4,4,11,11-tetramethyl	$C_{15}H_{24}O$	220

Table-2: GC-HRMS Of Methanolic Extract of *Rhynchosia minima* (L.)DC.

Peaks No.	Retention Time (Min.)	m/z Top Peaks	Area [Intens. * Sec]	Compounds	Mol. Formula/	Mol. Wt.
1	32.45	165	54952.41	dl-α-Tocopherol (vitamin E)	$C_{29}H_{50}O_2$	430
		165		Vitamin E	$C_{29}H_{50}O_2$	430
		149		3-Methyl-4-(3,7,7-trimethyl-2-oxa-bicyclo[3.2.0]hept-3-en-1-yl)-but-3-en-2-one	$C_{14}H_{20}O_2$	220
		165		2H-1-Benzopyran-6-ol, 3,4-dihydro-2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)-, acetate. (vitamin E)	$C_{31}H_{52}O_3$	472
		165		3-[(5-Isobutyl-2-methyl-furan-3-carbonyl)-amino]-benzoic acid	$C_{17}H_{19}NO_4$	301
		165		2-Benzofuranmethanol, 2,4,5,6,7,7a-hexahydro-4,4,7a-trimethyl	$C_{12}H_{20}O_2$	196
		430		(+)-α-Tocopherol acetate (Vitamin – E acetate)	$C_{31}H_{52}O_3$	472
		165		2-Benzofurancarboxylic acid, 2,4,5,6,7,7a-hexahydro-4,4,7a-trimethyl-, methyl ester	$C_{13}H_{20}O_3$	224
		121		1-[4-(2'-Ethylhexoxyphenyl)butanophenone	$C_{18}H_{28}O_2$	276
		165		2-Amino-6-hydroxy-9-methylpurine	$C_6H_7N_5O$	165

Table-3 GC-HRMS Of Methanolic Extract of *Crotalaria junicea* L.

Peaks No.	Retention Time (Min.)	m/z Top Peak	Area [Intens. * Sec]	Compounds	Mol. Formula/	Mol. Wt.
1	34.04	229	178062.35	Phenol, 2,4,6-trinitro(Picric acid)	$C_6H_3N_3O_7$	229
		91		N-Ethyl-N-(4-methylpenta-2,4-dienoyl)benzylamine	$C_{15}H_{19}NO$	229
		229		1-Ethanone, 1-[7-methyl-2-(trifluoromethyl)[1,2,4]triazolo[1,5-a]pyrimidin-6-yl]-	$C_9H_7F_3N_4$	244

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		229		6-Isopropyl-9-methyl-1,4-dioxa-spiro[4.5]decane-2,3-dicarboxylic acid, dimethyl ester	$C_{16}H_{26}O_6$	314
		91		Isoquinoline, decahydro-3-(2-chloroethyl)-2-phenylmethyl	$C_{18}H_{26}ClN$	291
		229		Threo-1,2,4-tribromopentane	$C_5H_9Br_3$	306
		229		Erythro-1,2,4-tribromopentane	$C_5H_9Br_3$	306
		91		[1,2,3]Triazolo[4,5-e][1,4]diazepine-5,8-dione, 1-benzyl-1,4,6,7-tetrahydro	$C_{12}H_{11}N_5O_2$	257
		91		9,12-Octadecadienoic acid (Z,Z)-, phenylmethyl ester	$C_{25}H_{38}O_2$	370
		228		2-(2-Benzyldecahydroisoquinolin-3-yl)ethanol	$C_{18}H_{27}NO$	273

Discussion:

As per GC-HRMS analysis, In *Psoralea corylifolia* L. total 20 phytoconstituents; in *Rhynchosia minima* (L.) DC. 10 phytoconstituents and in Crotalaria *junicea* L. total of 10 phytoconstituents were reported. The phenolics, alkaloids, terpenoids and non-protein amino acids, are the four groups of important phytoconstituents and are widely utilized for chemotaxonomic classification (Smith *et al.,*1976).

Conclusion :

As per chemotaxonomy, the presence of various chemical constituents illustrates their inter-relationship. In the present study, the three genera *Psoralea, Rhynchosia* and *Crotalaria* from the Fabaceae family are taken for qualitative and quantitative analysis. After the GC-HRMS study, it is observed that the chemical constituents found are varying. This might suggest that three genera belong to the same family but having varied Phytoconstituents might be due to different evolutionary history.

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Plant-Based Functional Food: A Conceptual Overview

Dipak K. Koche

Department of Botany,

Shri Shivaji College of Arts, Commerce and Science, Akola (MS) 444003

Email-kochedeepak77@gmail.com

Summary

Functional food is a whole food or ingredient or a part of food that is used for specific therapeutic purposes or health promotion. It is divided into two wide categories: Conventional functional foods and modified functional foods. Conventional functional foods are composed of natural or whole-food ingredients that provide functional substances while modified/ fortified functional foods are those which have additional ingredients for specific health purposes. Plant-based food such as fruits, vegetables, herbs, cereals, nuts, and beans contain vitamins, minerals, fiber, omega-3 fatty acids, antioxidants, and phenolic compounds that play a vital role as general immunity boosters and also against chronic diseases including cancer, cardiovascular, and other lifestyle diseases.

Keywords: Functional food, health promotion, vitamins, minerals, fibers, antioxidants.

Introduction:

Functional foods are health-promoting foods that also prevent the severity of chronic diseases. The word functional food is being used to describe traits that have been purposefully bred into established edible plants, such as purple or gold potatoes with lower anthocyanin or carotenoid content. These foods have specific functional benefits and aid in reducing the risk of long-term diseases beyond basic nutritional functions and can look like traditional food and be eaten as part of a daily diet (Kaur and Das, 2011; Datt et al., 2019 and Gupta and Mishra, 2021). The

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functional food sector, including the food, beverage, and food supplement industries, is one of the fastest-growing markets in recent years. The global demand for functional foods is increased drastically in the last decades (Roberts, 2009 and Gupta and Mishra, 2021).

Functional foods are rich in bioactive components. When these components are used in reliable, non-toxic, and defined quantities, they provide a scientifically validated and recorded health benefit for the prevention, control, or treatment of chronic diseases (Martirosyan, and Singharaj, 2016). The inclusion of bioactive compounds, which are biochemical molecules that promote health by physiological processes, overall improves the aura of functional foods. Functional Food Center (FFC) has advanced the functional food concept to provide clarification and a more detailed understanding of its context (Martirosyan, and Singh, 2015). Thus, it could be stated that functional foods not only have health benefits but act positively for physical performance, psychological performance, emotional health, mental health, and chronic illnesses (Granado-Lorencio and Hernandez, 2016).

The term and idea of functional food was first put forth by a Japanese Scholarly Society, during early 1980s. Later, it was converted to a related law for Foods for specified Health use (FOSHU) in Japan. Basically, functional foods were recognized as foods that can modulate body functions and help disease prevention (Shimizu, 2003).

A functional food should be a natural one or at least a portion of food to which an ingredient has been added or extracted using technical or biotechnological methods, and it must represent the effects in significant amounts that can be fairly believed to be consumed in the food (Castillo et al., 2018). As per Functional Food Center (FFC) Natural or processed foods containing known or unknown biologically active compounds that provide a scientifically supported and established health benefit for the prevention, management, or treatment of chronic diseases is prescribed, appropriate, and non-toxic amounts (Martirosyan, and Pisarski,

2017). European Food Safety Authority (EFSA) suggested that functional foods are "A food, which beneficially affects one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either an improved state of health and well-being and/or reduction of risk of disease. A functional food can be a natural food or a food to which a component has been added or removed by technological or biotechnological means, and it must demonstrate their effects in amounts that can normally be expected to be consumed in the diet (Martirosyan and Singharaj, 2016).

Plant based foods contain a variety of functional components such as different vitamins, minerals, phenolic compounds, antioxidants and other bioactive phytochemicals. These Secondary metabolites are physiologically active biomolecules that are helpful for the human body either to improve overall immunity or to counter specific ailments (Cartea et al., 2011, Upadhay and Dixit, 2015 and Sharma et al., 2019).

Major Categories of Functional Foods:

Considering the wide range of functional food, their demand in various forms and self life, the functional foods are categorized into two: i. Conventional food and ii. Fortified food.

    i.   Conventional food:

        All the foods that are composed of natural whole-food ingredients that provide functional substances such as heart-healthy fatty acids, antioxidants, vitamins and minerals are called conventional functional food. It is considered that a safe and organic diet includes more bioactive compounds and less harmful substances including persistent toxins, their metabolites, pesticides, and fertilizers. Such food helps to maintain a balanced diet, healthy lifestyle reducing the risk of developing chronic ailments. These foods also aid to in ensuring the nutritional quality of particular foods or products (Di et al., 2020). Fruits (dry and fresh), vegetables

(leafy green and non-leafy), nuts, seeds, legumes, herbs and spices are the conventional functional foods, that are traditionally providing us nutrition and good health.

ii. Fortified food:

"Fortification of food" refers to the addition of nutrients at levels greater than those found in the original food. Enrichment is associated with fortification. The term "restoration" refers to the addition of nutrients to food to compensate for the nutrients lost during processing. Food fortification is usually done at the industrial level, but it can also be done at the household level (Das et al., 2013).

Food or food products in which there is addition of more ingredients (vitamins, minerals, probiotics and fiber) for specific health purposes done are called fortified/ modified foods. Fortified food products such as fortified juices, dairy products (milk and yogurt), fortified milk alternatives (almond, rice, coconut, and cashew milk), fortified grains (bread and pasta), fortified cereal and granola and fortified eggs are modified functional food products currently available in the market.

Major Components of Functional Foods:

Vitamins:

Vitamins are compounds that cannot be synthesized by humans themselves and thus need to be taken up in the diet for their proper growth and development. Vitamins have a complex biochemistry and play an essential role in human nutrition and health. Vitamin deficiencies cause diseases that can be severe and even lethal in some cases. For example, vitamin A deficiency is a major health issue in developing countries, and estimated that over 130 million children are at increased risk of morbidity and mortality from infectious diseases (Linster et al., 2008). Essential micronutrients including vitamins are important for balanced human health

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and healthy survival. Sometimes, their inadequate absorption of vitamins also causes health issues. Some vitamins like A, C and E acts as antioxidants. Eating food rich in these vitamins helps to prevent various chronic diseases (Ozturk, 2017 and Xiao and Li, 2020).

Over 2 billion people across the globe are believed to be deficient in one or more vitamins, placing them at risk of chronic illness or death. Food fortification and supplementation are both effective methods for ensuring adequate daily intake of these vitamins (Knijnenburg et al., 2019).

Minerals:

Plant-based foods are a great source of minerals that are essential for human health. Plants require at least 14 mineral elements for their nutrition, including macronutrients such as nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur, and micronutrients such as chlorine, boron, iron, manganese, copper, zinc, nickel, and molybdenum. Calcium is essential for bone health and can be found in green vegetables such as broccoli, kale, and cabbage. Leafy vegetables like spinach are also rich in calcium. Fruits like oranges and grapes are also good sources of calcium. Magnesium is another important mineral that can be found in seeds like pumpkin seeds and almonds. Green leafy vegetables are also a good source of magnesium (Gomez-Galara et al., 2010 and Bhowmik et al., 2010)

Iron is important for blood health and can be found in plant-based foods like beans and peas. Spinach is another great source of iron. Iodine is essential for thyroid function and can be found in seaweed and iodized salt. Potassium is important for heart health and can be found in bananas, sweet potatoes, and spinach. Sodium is important for fluid balance in the body and can be found in plant-based foods like celery and tomatoes. It's important to note that environmental stresses such as salinity, drought, extreme temperatures, and light conditions can affect the mineral content of plants. The effect of these factors depends on the species or cultivar of the plant as well as the intensity and duration of the stress (Hoffman et al., 2008 and Bhowmik et al., 2010).

Antioxidants:

Antioxidants are substances that inhibit or prevent additional cellular oxidation. Fruits, vegetables, nuts, cereals, and beans contain different types of antioxidants. These substances are used as functional ingredients in many foods and food products (Das et al., 2020). As a functional ingredient, antioxidants help to protect the human body from many chronic diseases like cardiovascular diseases and cancer (Zeng et al., 2018).

To prevent oxidative damage, plants possess an array of an extensive antioxidant defense system consisting of various enzymes and secondary metabolites. Ascorbate (as vitamin C) and glutathione (GSH) are the major water-soluble antioxidant metabolites; some other secondary metabolites, such as polyphenols, flavonoids and terpenoids also participate in the detoxification and scavenging of reactive oxygen species (ROS) under different environmental stresses (Du et al., 2018; Berni et al., 2019; Sharma et al., 2019 and Hashim et al., 2020). Many of these plant secondary metabolites also display biological activity against insects, pathogenic fungi and other microorganisms (Schnider et al., 2019). These antioxidants play major role in the prevention as well as in the complementary treatment of non-infectious chronic diseases, such as cardiovascular, inflammatory and neurodegenerative disorders, metabolic syndrome and cancer (Unofin et al., 2020 and Swallah et al., 2020).

Dietary Fibers:

The dietary fibers are not the nutritional component but are the essential substances of our balanced foods. Fibers are beneficial because they move through the body without being digested. Dietary fibers are made up of polysaccharides. They are present in soluble or insoluble form in different foods. Pectin, mucilages and beta-glucan are soluble whereas lignin, cellulose, and hemicellulose are insoluble fibers (Chawla et al., 2010). These components are not digested or absorbed in the small intestine and pass into the large intestine in an intact form and is immune to enzymatic digestion. Fiber fortification also helps dairy foods enhance their

sensory qualities, shelf life, and structural properties (Ambuja and Rajkumar, 2018). The dietary fibers play a functional role in the human body against various diseases. Because fiber non- digestible that passes through the small intestine to the large intestine without absorption. In the small intestine nutrients like fat and glucose are absorbed, however, fiber attracts extra fat and glucose, and pushes them to the large intestine, where stool is prepared. Moreover, extra fat and glucose are made part of the stool. Thus, fibers prevents extra glucose and fat into the blood that's aids in inhibiting the chances of various diseases (He et al., 2010 and Ambuja and Rajkumar, 2018).

Conclusion:

Sometimes the terms functional foods and neutraceuticals are being used synonymously and there is no general agreement about what they mean. A functional food resembles or is related to a traditional food, is eaten as part of a daily diet, and has been found to have metabolic advantages and/or lower the risk of developing chronic diseases beyond specific dietary functions. From the above revision of available literature it is concluded that functional food prepared by a conventional or modified procedure, has a functional role in human health. Some natural foods like plant-based food including fruits, vegetable, nuts, herbs, cereals, beans and seafood are rich sources of vitamins, minerals, antioxidants, fiber, phenolic compound and omega-3 fatty acid. All these components have a specific functional role in human health against different ailments. Finally, it could be stated that functional foods have the ability to improve health in general and boost immunity against chronic diseases.

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Potential of an Underutilized Legume Sword bean *Canavalia gladiata* (Jacq.) DC. : A Review

S. A. Rathod[1]*, N. S. Dahibhat[2], P. G. Sawsakade[3] and S. G. Ikhare[4]

[1, 2, 3] Department of Botany, Shri Shivaji College of Arts Commerce & Science, Akola (MS)
[4]Late Annasaheb R.D. Deore Arts & Science College, Mhasadi Tal Sakri, Dist. Dhule

Email- shubhamarathod95@gmail.com

Summary

The Fabaceae family is the third largest plant family among the angiosperms, with high economic and nutraceutical values. Sword bean *Canavalia gladiata* (Jacq.) DC. is one of the underutilized members of this family and was selected for the reviewed study. Selectively researched articles corresponding to its nutritional, pharmaceutical, and biological account had been studied. Reviewed analysis revealed that seeds of plants carry high protein and carbohydrates along with biologically important phytochemicals performing anti-inflammatory antiulcer, antioxidants, hyaluronidase inhibition activity, and a-amylase inhibition activity. Some anti-nutritional properties are also reported due to the presence of the amino acid Canavanine. It was also mentioned that anti-nutritional properties can be easily removed by various traditional methods like Soaking, toasting and fermentation etc.

Keywords: Sword bean *Canavalia gladiata* (Jacq.) DC., nutritional, pharmaceutical, biological, and anti-nutritional properties.

Introduction:

Nature itself is a sustainable treasure, which is diversified with a huge number of plants. This diversity of plants was distributed under different habits such as herb, shrub, trees, and climbers that play an important role in the fulfillment of all primary requirements of mankind. In India, there are diverse climatic conditions that create a huge diversity of plants. Researchers trying to explore such plants to know the nutritional, phytochemical, and pharmaceutical properties of plants which are less known and less popular among the people such plants were referred as underutilized plants. Edible parts of these plants, like root tubers, leaves, flowers, fruits, and seeds may be utilized as dietary supplements, it could be important for their nutritional, and medicinal value or may become the best alternative to some traditionally used plants etc.

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The Fabaceae family is the third largest plant family after the Asteraceae and Orchidaceae in terms of number of plant species that is distributed in around 800 genera and 20000 species. Plants of the Fabaceae family are economically valuable, most of them serve as food, and fodder and have bioactive compounds and pharmaceuticals (Hasanuzzaman *et. al.* 2020).

In this study, the sword bean *Canavalia gladiata* commonly called as sword bean was selected for the review-based study. Profuse literature is available about this plant, vernacular names of this plant in regional languages are Abai, Pathadi, Abey vel in Marathi, Badisem in Hindi, and Mahasimbi in Sanskrit. This plant is a perennial or biennial twinner type of plant with a glabrous stem. Stem stout, glabrous, twining, annual herbs with trifoliate leaves having 10-15 cm long petioles, striate, glabrous; stipule triangular, deciduous. Leaflets membranous, ovate-elliptic in shape, Flowers are pedicellate, pale lilac in colour. The flowering and fruiting period of this plant is reported from September to December. Its fruits are dry, dehiscent pods (legumes), linear-oblong, 6-15 by 15-3 cm, and contain many dark brown seeds (Naik, 1998). Some morphological features of the same plant were revealed in **Image-I** given below.
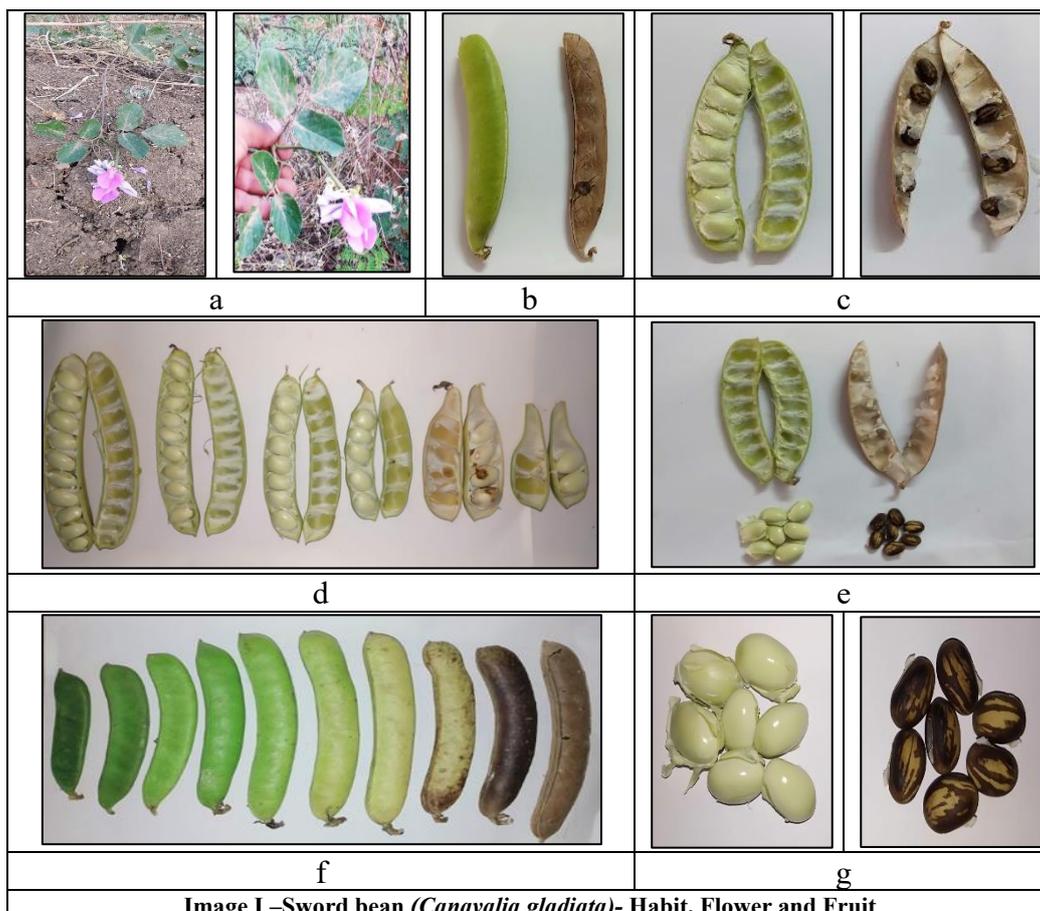

Image I –Sword bean *(Canavalia gladiata)*- Habit, Flower and Fruit
Flowering twig

a-   fresh and dry pod of fresh and dry open pod
b-   Pod variation

c- Seed difference in fresh and dry open pod
d- Maturation stages of pod
e- Seed texture variation
f- Fresh and dry seed

This plant was reviewed by analysis of available literature relevant to nutritional, pharmaceuticals and biological profile of plant *C. gladiata*. The various aspects like cultivation, nutritional properties, feeding properties, biological phyto-constituents and anti-nutritional chemicals and its processing were discussed in this reviewed article.

A] Cultivation of Sword Bean

This plant grows as a twiner and most of the time it grows in support of another tree. It is reported that this plant is distributed in the Eastern and Western Ghats of South India and also cultivated as a fodder crop in Northern and Peninsular India. In India, the sword bean seeds are consumed by certain ethnic groups and poor village people. In Asia, the young pods and seeds of sword bean are used as a green vegetables **(Vadivel *et. al.*, 2019).** Sword Bean (*C. gladiata)* is a vegetable crop propagated through seeds. The pods and seeds attained physiological maturity in 80 days. This plant is cultivated on a limited scale in Asia, West Indies, Africa, and South America (Kumarasamy, *et. al.,* 2020).

The Seeds of *C. gladiata* become tough and thicken after maturity and that creates a barrier in imbibition and eventually to seed germination. In the study, it has been found that seed without any treatment does not germinate even after a week. But it was mentioned that the mechanical scarification of seeds helps in germination. Mechanically treated seed shows 90% uptake of water in 7 hours while untreated seed shows only 10% in the same time period. After the 7 hours scarified seed becomes fully imbibed and swells up to 1.5 times. Researchers reported that treatment of warm water to scarified seed shows a high germination rate as compared to normal water (Doo, *et. al.,* 2001). These recommended methods should be used during cultivation to improve the rate of seed germination.

Cultivation of this plant may involve certain ecological phenomena and balance the relation of the plant with other living individuals. The reproductive ecology of the plant *C. gladiata* were studied by the Rani *et. al.,* (2020). This plant is a fast-growing, evergreen, perennial climber, which exhibits the intense flowering and fruiting that leads to the establishment of reproductive ecology and its correlation with other biological factors of plants. Flowering twigs of the plants possessed button-shaped extra floral nectaries containing low sugar nector in it, present at the base of the leaf petiole and flower pedicel. Ants feed on these nectaries, presence of ants on

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this plant, protects it from herbivores during flower development. Actual pollination in these plants is dependent on the pollinator, pollination was done by the nectar-seeking Carpenter Bees; they proceed the pollen germination by rupturing the stigmatic surface of the flower. Seed dispersal occurs by explosive pod dehiscence and the dry season is ideal for that event, while in the rainy season, seed germination and new plant production take place.

B] Nutritional Profile of Sword Bean:

Nutritional properties of this plant were discovered and discussed by researchers, it was concluded that plants are rich in protein and carbohydrate contents. Cho *et. al.,* (1999) studied the phytochemical analysis of different parts of the plant *Canavalia gladiata* such as leaf, stem, roots, seeds, hulls, pods, and cotyledons. He mentioned that the cotyledons of the sword bean contain higher levels of carbohydrates and protein as compared to other parts of plants.

Protein and carbohydrate estimation of mature seed of *C. gladiata* were done by Eknayake *et. al.,* (1999). Whole seed flour and cotyledon flour were tested separately for estimation, it was found that cotyledon flour has a high content of crude protein, carbohydrates and fats as compared to whole seed flour but it carries higher fiber than cotyledon flour. The nutritional profile of the raw mature seeds of *C. gladiata* can be utilized as a supplement to cereal-based diets. The mature seeds of the plant were originally consumed by people of ancient India. Sword beans are reported the same as other traditional edible legumes for their protein content (Ekanayake, et al.*,* 2001).

Choudhury *et. al.,* (2010) reported to have some wild edible plants utilized by the tribal people of the Tripura region. Out of that, *C. gladiata* is the one that is used as a vegetable by local people. He mentioned that the pods of the same plant were cooked along with the dry fish. It was also stated that the consumption of this plant is a rich source of protein and dietary fibre. *C. gladiata* the underutilized plant has different pharmaceutical and nutritional activity. Assessment of the consequence of processing methods on the nutritional value, biological value and protein quality, sword beans is done by researchers. The matured raw seed of the plant contained 28.39% of protein, 7.84% of lipid, 8.23% of fiber, 5.63% of ash and 49.91% of carbohydrates in it. Among the differentially processed sword bean seed samples, the autoclaved SB sample possessed higher levels of nutrient profiles (Vadivel *et. al.,* 2010).

In the nutritional lipid content study of *C. gladiata* plant, it is estimated, that revealed that percentage of TAG -Triacylglycerol and PL-phospholipids is about 45.7% and 47.0%

respectively Classification of lipids is carried by thin-layer chromatography (TLC), Eighteen TAG-Triacylglycerol molecular species were detected in the sword beans (Yoshida *et. al.,* 2012). Gelling properties of seeds of *C. gladiata* had been reported by Nishizawa *et. al.,* (2018). Grinding of distilled water-soaked seed was done and then boiled and filtered through cotton cloth. Boiled extract of sword bean seeds can be gelated by cooling it up to 10 °C, after that, it remains gelled at room temperature. The melting point of the gelled extract were reported is about 65∘ C. It was suggested that gelling agents can be isolated from the seed and can be used to process the food material.

C] Feeding Properties of Sword Bean:

Most of the researchers reported *Canavalia* species from India as well as abroad. Assessment of variously processed sword bean (toasted, cooked and akanwu-cooked) meals in place of soybean meal was carried out using 120-day-old broiler chicks. In this study prominently Feed-intake values and weight gain values were studied. It is found that broiler chicks fed with cooked sword beans show nearly the same result as the chicks fed with soybeans (Akinmutimi *et. al.,* 2008).

C. ensifromis and *C. gladiata* can be cultivated and used to feed livestock. In both species shows similarities in terms of nutrition but starch and protein content were found to be highest in the *C. gladiate* (Dada *et. al.,* 2013). Bake *et. al.,* (2019) investigated the effect of fermented *Canavalia gladiata* seed meal (FCGSM) in catfish. Five diet plans were formulated with the diverse inclusion of FCGSM. It means D1 has 0% of inclusion of FCGSM and D2, D3, D4, D5 has 15%, 25%, 35%, and 45% of inclusion of FCGSM. Various growth parameters were studied in five different batches of catfish. It was concluded that 35% fermented *Canavalia gladiata* seeds meal is found to be effective for an enhancement of growth in catfish.

Similarly Bake *et. al.,* (2020) carried out a similar type of experiment in catfish along with toasted sword beans (*Canavalia gladiata*) meal (TSBM) . The five diet supplements were prepared such as D1, d2, D3, D4, and D5 with different levels of TSBM. D1 has 0% of TSBM while D2,D3, D4, and D5 comprises 10%, 20%, 30% and 40% of TSBM. On the basis of the above research it was demonstrated that toasted sword bean meal has an operational effect in enhancing growth parameters. Moderately 30% inclusion of TSBM can be included in the diet of catfish.

D] Biological Phyto-constituents of Sword Bean:

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Canavaliside is ent-karate type of glycoside and 8 acylated flavonol glycosides i.e., gladiatoside were identified firstly from *C. gladiata* on the basis of chemical and physiochemical pieces of evidence (Murakami *et. al.,* 2000).

Evaluation of plasma triglyceride, cholesterol, low-density lipoprotein (LDL), Hepatic lipid levels and hepatic thio-barbituric acid reactive substances levels were done by Byun *et. al.,* (2010) in ovariectomized rats on different beans based diet. In this research sword bean-based diets were reported to reduce hepatic lipid, triglyceride and cholesterol level in rats. In this research, it has been concluded that the utilization of sword bean may help to reduce oxidative stress by increasing the antioxidant activity and balancing the lipid ratio in the blood.

The seeds of *Canavalia gladiata* along with seven legume seeds were tested for phytochemicals like phenolics, L-Dopa, and phytic acid as well as their antioxidants and a-amylase enzyme inhibition activity by Gautam *et. al.,* (2012). The concentration of phenolics, L-Dopa and phytic acid in sword bean was found to be 128.6 μg/mg, 422.4 μg/mg, 14 μg/mg respectively. The anti-oxidant activity was analysed by DPPH (2,2-diphenyl-1-picrylhydrazyl) assay, result revealed antioxidant activity of Sword bean seed was 49 %. a-amylase enzyme inhibition activity was found at about 31 %.

The Effects of the hot water and alcoholic extract of the *Canavalia gladiata* plant were tested on the mice to evaluate its exercise ability. In both extract shows the concluding effect of mice swimming capacity. Some organic solvents and water-soluble compounds might be responsible for exercise improving effect (Kim *et. al.,* 2014). Chung *et. al.,* (2014) investigate the antimicrobial effect of various extracts of *Canavalia gladiata* by using different solvents like chloroform, hexane, ethyl acetate, ethanol, methanol, and hot water on 12 different food poisoning bacteria. From that, he concluded that the methanolic extract has been found to suppress the growth of food-poisoning bacteria. Suresh *et. al.,* (2015) found in the presence of trigonelline, cytotoxic amino acid canavanine, antiviral lectin and concanavalin, it was also mentioned that this phytochemical possesses certain anticancer activity.

Pharmaceutical activities of various parts of this sword bean are investigated on various diseases. The Effects of alcoholic extract pods of sword bean were investigated on pectic ulcers in mice. The treatment of *C. gladiata* pod extract is found to be a very effective reduction of ulcer score index numbers, it was concluded pod extract of this plant has potent antiulcer activity (Uppuluri S. *et. al.,* 2015).

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Levodopa and β-sitosterol are phytochemicals reported in the Canavalia *gladiata* plant by Kulkarni *et. al.,* (2016). β-sitosterol was reported to have antipyretic, immune-modulatory, anti-inflammatory hepatoprotective and antioxidant activity used to treat inflammatory disorders, rheumatoid arthritis, colon cancer, benign prostatic hypertrophy and breast cancer while Levodopa is a chemical precursor of the dopamine very helpful for the parkinson diseases. Evaluation of the antimicrobial potential of *Canavalia gladiata* leaf and seeds extract was demonstrated against the *Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa* and *Bacillus subtilis* through the disc diffusion method. In this investigation, it was found that different organic solvent extract of leaf and seed of plant shows significant antimicrobial activity (Tayade *et. al.,* 2020).

Starch is one of the claimed components responsible for gelling properties. The effect of annealing and heat-moisture treatment was demonstrated on the gelatinization parameters of starch, isolated from the seed of *Canavalia gladiata.* It was stated that annealed and heat-moisture treated modification of starch caused the gelatinization because it tends to rearrangement in the structure of the amylopectin and amylose molecules after modifications (Olu-Owolabi *et. al.,* 2011). Hyaluronidase is an enzyme that catalyzes the degradation of, limited activity of this enzyme has a positive impact but excessive degradation of Hyaluronic acid by this enzyme may have certain inflammatory effect that results in allergic symptoms. Hyaluronidase inhibition activity was demonstrated by Scotti *et. al.,* (2016) by using the fermented and non-fermented seed extract of the *Canavalia gladiata***.** It was concluded on the basis of the obtained result that the seed extract shows significant anti-inflammatory activity by inhibiting the Hyaluronidase.

Heat resistant *α*-amylase was isolated from the germinating seeds of sword bean by Posoongnoen *et. al.* (2020) conformation of the isolated enzyme was done by LCMS/MS (Liquid Chromatography with tandem mass spectrometry) analysis activity of the enzyme was tested. The enzyme shows optimal activity at 70° C at a slightly acidic pH. This enzyme was revealed to show stability at 50.0–70.0°C as well as at 5pH to 8pH.

E] Process for removal of the Antinutrients:

Canavanine is a toxic amino acid found in legumes of seeds. Ekanayake *et. al.,* (2007) evaluated the various processing methods to remove the Canavanine from the raw seeds. Overnight soaking and boiling methods can remove about 80% of Canavanine. It

involves discarding of the remaining water after the overnight soaking followed by the consequent boiling with fresh water and draining excess water can reduce the remaining canavanine.

It was also reported that this chemical does not show any adverse effect if they are processed properly. Akande *et. al.,* (2010) discussed certain methods to remove chemicals from food-yielding plants such as the heating method, cooking (boiling), two-stage cooking, pressure cooking, and toasting method. These all methods are simple, and economically feasible and it was recommended that at least two methods should be followed to remove the anti-nutritional elements. *C. gladiata* were also reported for their some anti-nutritional properties because of some phytoconstituents like phenolics, tannins, L-DOPA, phytic acid, hydrogen cyanide, trypsin inhibitor, oligosaccharides and phytohemagglutinin (Tresina *et. al.,* 2012). To increase the biological benefits of sword beans were studied to reduce the anti-nutrient compounds, some traditional procedures such as heating, soaking fermentation, and roasting were reported to be used (Soetan *et. al.,* 2018).

Conclusion:

Available literature covers the broad idea about the *C. gladiata* plant and its nutritional, and pharmaceutical properties along with their biological role in various research fields. All the nutritional properties revealed that, the edible seed of this plant may become a rich source of protein, carbohydrates, and lipid. Utilization of this plant could be proven a good dietary supplement for humans as well as livestock. Differently processed sword bean seed can be directly used in poultry farms, fisheries, and different livestock. The use of sword bean seed may be considered as a substitute for soybean. Reviewing the plant clarifies that, the plant possesses certain antinutritional factors such as canavanine, alkaloids, phenolics, tannins, phytic acid, hydrogen cyanide, trypsin inhibitor, α-amylase inhibitor. The presence of this antinutritional factor in the body may trigger the pathological responses. But in this review-based investigation, it is also proven that this anti-nutritional factor can be easily removable by means of common traditional processing methods such as heating, soaking and fermentation, roasting etc.

C. gladiata plant parts like leaves, stem, pod coat, and seed are rich in pharmaceutical components that play many medicinal roles. In this study, it is evaluated that *C. gladiata* shows antiulcer, anti-inflammatory, antimicrobial, oxidant scavenging, hepatoprotective, and

antipyretic activities. Utilization of this plant as nutritionally or medicinally may be used effectively in the treatment of diseases like peptic ulcer, allergic diseases, skin diseases.

In order to exploration of sword bean *C. gladiata* research is going on in abroad as well as in India also. More research could be done with various perspectives in various fields of science. Qualitative and quantitative analysis and isolation of pharmaceutical components should be done. *C. gladiata* is an underutilized plant that could become and alternative to some traditional and conventional vegetable plants and may good source of nutrition. This plant of *C. gladiata* could be considered a potential nutraceutical plant because it has both nutritional and medicinal value.

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Phytochemical Composition of Few Members of Family Bignoniaceae: A Review

Anand V. Oke

Department of Botany,

Shri Shivaji College of Arts, Commerce, and Science, Akola (MS) 444003 India

Email- okeanand1984@gmail.com

Summary

The species belonging to the family Bignoniaceae are having a diversified range of phytochemicals. The presence of Alkaloids, Anthraquinone, Flavanoids, Phenolics, Triterpenes, Lignin, Coumarin, Xanthone etc. made it a huge treasure of phytochemicals. Members are having various bioactivities ranging from antiviral, antioxidant, anti-inflammatory, vasorelaxant etc. while, few are used as antidotes. The presence of a wide spectrum of phytochemicals and bioactivities made it a future source of medicines.

Keywords: Bignoniaceae, Phytochemicals, Bioactivities.

Introduction:

The plants have been used for diverse purposes since very long. Various organisms use plant products to fulfill their respective needs. The use of plants ranged from Shelter to Food and extended up to the Medicines. One of the larger families of the plant world is Bignoniaceae comprising 110 genera and over 800 species (Parente et. al., 2017). It is an angiospermic family commonly known as the Jacaranda family, Trumpet Creeper family, Bignonia family, or Catalpa family. The members are distributed worldwide, but most of them occur in tropical and sub-tropical countries. The member species of the family are reported for bio-active constituents and pharmacological activities and are also widely used in traditional medicinal systems of a number of countries (Rahmatullah et.al., 2010). Bignoniaceae plants have various bioactive secondary metabolites with diverse pharmacological activities. They are widely used in traditional medicinal systems of a number of countries for the treatment of ailments like hepatic disorders, epilepsy, skin disorders, gastrointestinal disorders, cancer, snake bite,

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respiratory tract disorders, cholera, pain, urinary problems, malaria, sexually transmitted diseases and heart problems (Rahmatullah et.al., 2010).

Phytochemicals of Bignoniaceae:

Many members of the family are reported to have different classes of bioactive secondary metabolites including; phenolics, phenylethanoids, flavonoids, coumarins, lignans, and xanthones (Martin et.al., 2007; da Rocha, 2017; Martin et.al., 2008). It is a huge reservoir of variety of secondary metabolites like saponins, tannins, flavonoids, quinines, alkaloids, reducing sugars, glycosides, quercetin, kaempferol, b-sitosterol, iridoids, terpenes, steroids, coumarins (Choudhury et. al., 2011).

Bignonia L. is the fifth largest genus in the tribe Bignonieae, with 31 lianas species. *Bignonia* plants are widely used in traditional medicine for skin ailments like postpartum hemorrhage, malaria, diabetes, fungal infections, and pneumonia. Much literature reported that *Bignonia* species contained different classes of active constituents such as flavonoids, coumarins, phenylethanoids, phenolics, lignans, and xanthones (Mahmoud et.al., 2019).

The presence of 160 compounds of different classes like iridoids, flavonoids, and quinines are most abundant among the species of *Bignonia,* followed by triterpenes, phenolic acid derivatives, alkaloids, limonoids, xanthones, and phenylethanoids. Furthermore, compounds belong to different classes of secondary metabolites e.g., coumarins, sterols, unsaturated fatty acids, saturated fatty acids, and diterpenes (Mahmoud et.al., 2019).

The *Crescentia cujete* fruits contain flavonoids (flavones and flavanones), saponins, tannins, alkaloids, phenols, hydrogen cyanide, and cardenolides (Ejelonu, 2011; Rivera,2019). Phytosterols, Cardiac glycosides, Terpenoids (Rahmaningsih et.al., 2017; Billacura and Laciapag, 2017). Glycosides, terpenes, and flavonoids in the stem-bark and leaves (Das et.al.,2014).

Saponins, reducing sugar, glycosides, polyphenolics, alkaloids, tannins, flavonoids, phytosterol, and volatile oils (such as hexadecanal, (Z)-9,17- octadecadienal, phytol, kaur-16-ene, neophytadiene, trans-pinane) reported in the leaves of *Crescentia cujete* **(**Uhon and Billacura, 2018; Dawodu et.al.,2016; Anitha et.al.,2019; Aboaba and Fasimoye, 2018). Crescentic acid, tartaric acid, and citric and tannic acids (Godofredo, 2020).

Volatile oils - methyl ester, n-hexadecanoic acid, benzenepropanoic acid, phenol, 3,5- bis(1,1-dimethyl ethyl)-4-hydroxy-, and 2,4-bis(1,1-dimethyl ethyl)- from the methanolic extract of

the fruit of *Crescentia cujete* (Jose et.al., 2020). *Radermachera xylocarpa* (Roxb.) K. Schum is a well-known species from the family. It has Alkaloids, Steroids, Flavonoids, Glycosides, Terpenoids, and Reducing sugars in the bark extract (Oke and Khedkar 2012).

Tecoma stans flowers methanolic extract revealed the presence of carbohydrates, cardiac glycosides, flavonoids, proteins, sterols, and Anthraquinone (Gobika and Suganthi 2023). Glycosides, phenols, phytosterol, triterpene, flavonoids, saponins, and tannins (Das et. al., 2010). Alkaloids, steroids, saponins, anthraquinones, flavonoids, tannins, terpenes, phytosterols, phenols, and glycosides (Anburaj et.al., 2016).

Preliminary phytochemical screening of leaf extract of *Stereospermum kunthianum* revealed the presence of sterols, coumarins and higher fatty acids (Aliyu et. al., 2009).The methanol extract of the flowers of *Mansoa alliacea* (collected in India) yielded β-amyrin ; and β-sitosterol; ursolic acid; β-sitosteryld-glucoside; the flavones apigenin; luteolin; and 7-O-methylscutellarein; the flavone glucoside apigenin-7-glucoside; and the flavones glucuronides apigenin-7-glucuronide; scutellarein-7-glucuronide; apigenin-7-glucuronyl glucuronide; and apigenin-7-O-methylglucuronide (Rao and Rao, 1980) Alkanes, alkanols, triterpenoids, flavonoids, lapachol derivatives and organosulfur compound allin (Maria et. al., 2008).

The principal chemical compounds known in the Bignoniaceae family are alkaloids, polyphenols, flavones, tannins, triterpenes, naphthoquinones, iridoid glucosides, and seed oils (Mostafa et.al., 2013). The flavonoids in the leaf and petal of Bignoniaceae exposed that many flavonoids are flavones subgroup and a little flavonols subgroup (Harborne, 1967). Triterpenes, flavonoids, carbohydrates (meso-inositol), nitrogenous compounds (allantoin), n-alkanes (nhentriacontane), choline chloride, fatty acids, and sterols (Mostafa et.al., 2013). Some of the more common but pharmacologically important compounds in the family Bignoniaceae are ursolic acid, oleanolic acid, a- and b-lapachone, lapachol, verbascoside, corymboside, lupeol, quercitrin, apigenin, pomolic acid, and isoacteoside (Rahmatullah et.al., 2010).

Pyrostegia venusta contains phytochemical compounds like triterpenes, polyphenols, flavones, acacetin-7-O-βglucopyranoside, iridoid glucosides, bellericanin glycosides, alkaloids, naphthoquinones, tannins, allo-tannic acids, oleanolic acid, seed oils, and β-sitosterol (Zari and Zari, 2015) Rutin in leaf (Blatt et.al.,1988) Phenolic compounds, flavonoids like quercetin, catechin, biochanin, syringyl groups, and sterols (cholesterol, β-sitosterol, stigmasterol) (Roy et.al., 2011; Loredo et.al., 2013; Ferreira et.al., 2019; Blatt et.al.,1998).

Pyrostegia genus has shown the presence of flavonoids, phenolic compounds, phenylpropanoids, phenylethanoid glycosides, triterpenes, and sterols (Kusmardiyani et.al., 2020). Flavonoids, phenolic compounds, phenylpropanoids, phenylethanoid glycosides, triterpenes, and sterols (Kusmardiyani et.al., 2020).

The stem bark of *Pyrostegia venusta* contains lupeol, betulin, betulinic acid, and choline chloride (Mostafa et.al., 2013). Methanolic extracts of the roots of *P. venusta* were found to have flavonone hesperidin, 3-b-b-D-glycopyranosyl sitosterol, steroids, and allantoin (Roy et.al., 2011). In roots β-sitosterol (Loredo et.al., 2013). The ethanol extract of the roots of *P. venusta* had allantoin, βsitosterol, 3β-O-β-D-glupyranosylsitosterol, and hesperidin (Ferreira et. al., 2000).

Spathodea campanulata showed the presence of carbohydrates, alkaloids, tannins, and glycosides in extracts of flowers and the presence of steroids, carbohydrates proteins, tannins glycosides, and alkaloids in bark (Zaheer et.al., 2011). *Newbouldia laevis* (P. Beauv.) Seem. contains glycosides, anthraquinones, volatile oils, tannins, steroids, alkaloids, flavonoids, terpenoids and sterols (Okagu et.al., 2021).The dichloromethane extract of the roots of *Newbouldia laevis* Seem. (Bignoniaceae) afforded five new naphthoquinones characterized as 7-hydroxydehydroiso-α-lapachone (29), 6-hydroxy-dehydroiso-α-lapachone (30), 5,7-dihydroxydehydro-iso-α-lapachone (31), 3-hydroxy5-methoxy-dehydroiso-α-lapachone (32) and 5- hydroxy-7-methoxydehydroiso-α-lapachone (Gafner et.al., 1996; Gafner et.al., 1998). Three phenylpropanoid glycosides were isolated from the methanol extract of the roots of *Newbouldia laevis* Seem (Bignoniaceae) (Gafner et.al., 1997).

The leaf and stem bark of *Kigelia africana* were reported to contain tannins in varying amounts, steroids, saponins, glycosides, and carbohydrates. Leaves were also shown to contain flavonoids (Agyare et al., 2013). Fatty acids including elaidic acid, elaidoic acid, stearic acid, palmitic (cetylic) acid, trans-phytol, and b-tocopherol (Atolani et al., 2013). Leaf extracts of *Kigelia africana* yielded significant amounts of vitamins C, B_1, B_3, calcium and potassium (Njogu et al., 2018). *Dolichandrone falcata* Seem. contains alkaloids, flavonoids, sugars, saponins, phenolic, terpenoids, cardiac glycosides, steroids, and amino acids (Patil et.al., 2021).

Conclusion:

The Present study concludes that the family Bignoniaceae holds a big treasure of phytochemicals distributed across a large number of genera. The members of Bignoniaceae

will definitely serve mankind with novel biomolecules having a range of utilities in medicine near future.

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Dr. Prashant A. Gawande (M. Sc. Ph. D. SET)

Dr. Prashant A. Gawande is currently working as a Professor, at the Department of Botany, Sant Gadge Baba Amravati University, Amravati. He has more than 25 years of teaching experience at UG and PG levels in Botany with specialization in Molecular Biology, Biotechnology and Plant Systematics. He has worked as a Principal Investigator on several research projects funded by various agencies like UGC, DST, RGSTC, etc. He has published more than 40 research papers in various journals of National and International repute. Under his able guidance, 04 students were awarded Ph. D. Degrees and 05 students are working. He also authored 03 books, edited 01 volume, and published over 5 book chapters for publications of National and International Levels. He is also working as a Chairman of BOS in botany and on various committees of SGBAU Amravati and a few other Universities and Autonomous colleges. He has also submitted more than 30 genome sequences to various National Databases.

Dr. Dipak K. Koche (M. Sc. Ph. D. NET)

Dr. Dipak K. Koche is currently working as a Professor, at the Department of Botany, Shri Shivaji College of Arts, Commerce and Science, Akola. He has more than 20 years of teaching experience at UG and PG level in Botany and Biotechnology. He has worked as Principal Investigator of 03 Manor and 02 major research projects funded by various agencies like UGC, DST, BRNS- DAE etc. He has one patent to his credit. He has published more than 50 research papers in various journals of National and International repute. Under his able guidance, 02 students were awarded Ph. D. Degrees and 06 students are working. He also authored 03 books, edited 02 volumes, and published over 10 book chapters for publications of National and International Levels. He is also working as a member of BOS in botany for SGBAU Amravati and a few other Universities and Autonomous colleges.

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Effect of Eco-friendly Seed Paper on Growth and Development of some Plant Species

Vaishali S. Patil and **Sanskruti A. Bajare**

Department of Botany, Shri Shivaji College of Arts Commerce and Science Akola (MS) 444003 India

Summary

Seed papers' are biodegradable, eco-friendly paper, acts as a carrier, contain seeds. The seed paper is unrolled paper & can be useful for plantation so that all seeds can planted at even intervals. Many small seeds cannot germinate in soil because they can easily drift away in a high flow of water and if it is deeply penetrated inside the soil, decomposition of seeds may take place. However, little is known about the principal component that affects the plant size produced by seed paper, the carrier material, and its influential properties. Now a day use of plastics is very common in the agriculture industry. Plastic debris can impede plant growth and impair how well they absorb nutrients. So alternative approaches are also being investigated to reduce plastic waste in agriculture, in addition to sustainable packaging. The experiments analyzed six different types of seeds. The output from this research will stimulate innovation in the seed paper industry.

Keywords: Seed papers, eco-friendly, pollutant

Introduction:

The rise in global environmental issue such as air and water pollution, climate change, overflowing land pills and clear-cutting have all led to increased government regulations. Due to this many diseases such as cancer, Arsenicosis, and Skeletal Fluorosis can be seen in many people. Pollutants that may adversely affect agricultural operations include sediment, plant nutrients, inorganic salts and minerals, organic wastes, infectious agents, industrial and agricultural chemicals, and heat.

The use of plastics in agriculture has increased significantly in recent decades. Plastic is also used for seed storage and fertilizer bags, pesticide containers, seedling trays and pots. Many of these products are for single used in agriculture; mulching films represent the greatest potential for soil pollution due to their intimate contact with the soil and the risk of their incorporation into

the soil as they degrade or during post-harvest management. Plastic mulch is used to increase yield by protecting the seedlings by providing insulation, limiting evaporation and to reduce weed and pest pressure. Its attractiveness is due to its durability and flexibility; however, it is non-biodegradable and recovery from the fields and recycling is complex and costly (Gionfra, 2018; Kasirajan and Ngouajio, 2012). Plastic mulch pollution negatively affects plant growth by altering the activity and community of microorganisms; soil structure; seed germination; root development.

The size of a seed is known to affect the fitness of the plant growing from it; larger seeds often have higher finesses. Plant development is thought to be related to seed size. Plants have evolved different adaptations to their sprouting environments, helping some smaller seeds thrive in drier, less nutritious soils, while larger seeds often are able to take advantage of richer soils that hold water better. The increased mass of seeds leads to a higher emergence rate, better plant growth, and higher yield (Singn 1988). **Small seeds require shorter germination time** because they have a thinner seed coat and a larger surface to absorb water to break seed dormancy. All small seeds cannot germinate in soil because they can easily drift away in high flow of water and if it is deeply penetrated inside the soil, decomposition of seeds may take place.

Paper is the cellulose fibers that are extracted from a variety of plant sources and can be converted to pulp. Pulp is combined with water and placed on a machine where it is flattened, dried, and cut into sheets and rolls. There are three main components such as bark, fiber, and lignin which are separated to make pulp. Trees from all over the world feed global demand for paper-based materials. 8 billion trees are cut down each year for paper. The global consumption of paper and paperboard totaled 408 million tons in 2021. Consumption is projected to continue rising over the coming decade to reach 476 million tons by 2032. Forests are under pressure from human activity which results in forest loss and degradation. "According to the United Nations Food and Agriculture Organization" (FAO), we are losing around 33 million acres of forestland annually around the globe. Recycled content is an important component of the pulp and paper industry and is one way to meet growing demand without increasing pressures on forests.

Cellulose provides plant cells with their rigidity and structure, determining the plant's shape and allowing it to grow erect. It also acts as a connective tissue. A paper-based product typically contains 90–99% cellulose fibers. Paper waste improves soil health, increases the growth of grasses, and provides a solution for disposing of classified paper waste. In recent years there

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has been considerable interest in waste paper recycling in the interest of ecology. Paper is one of the many products that have the potential to be reused and recycled before it is completely discarded.

Plantable paper is a seed paper that grows. It is made of recyclable paper embedded with any kind of seed. It can be planted into the soil to germinate and grow well until it turns into a plant. Hence the problem of solid waste disposal is minimized. Waste papers also add organic matter to the soil, provide a form of weed control, utilize a recyclable material, and retain moisture in the soil. If seeds can be incorporated into recycled paper this could reduce carbon emissions and deforestation, and even build new bonds and connections between humans and nature.

Eco-friendly plantable paper is a type of handmade paper that includes any number of different plant seeds. The seeds themselves can still germinate and they can sprout when the paper is planted in soil. This plantable seed paper can be used for stationery, cards, invitations, and for decorative wraps. A wide variety of flower, vegetable, and tree seeds can also be used in seed paper for decorative effects. The seeds and flowers in the paper can create decorative effects and colors. In addition, plantable goods have both social and environmental value.

Humans create an enormous amount of trash, and for this honours, this project is taken into consideration that emphasizes the importance of being environmentally conscious with paper. The main focus of this project was to create plantable seed paper that people can use and then grow things with after they are finished.

Material and Method:

The best papers to use are old newspapers, paper bags, and phone book pages. These recycling papers were taken and cut into small pieces. The paper pieces were soaked in the water for 24 hours. The amount of time the paper is soaked will determine the flexibility of the fibers inside and the way that the paper gets blended into a pulp. The longer the paper soaks, the softer it becomes and the easier it is to blend it into a pulp. Blend the paper until the desired texture is achieved. The paper pulp was taken with a water mixture and strained it to remove excess water. Excess of water comes out. When the paper is strained, the mixture was taken to the table, and small-sized seeds were added to it. 20 seeds of *Trigonella foenum-graecum, Ocimum sanctum, Cuminum cyminum, Brassica nigra, Sesamum indicum, and Capsicum annuum.* were taken. These are all faster-growing plants. Pressing of the paper was done by hand flattening, using a rolling stick, and pressing with sheet pans. The papers (12x12 cm.) were completely flattened and then sat out in the sun (or inside) to completely dry out before use. All of the plants were given the same soil and organic fertilizer, all given half a cup of water every other

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day, as were as being housed in the same sized pots. In all 12 pots were prepared for comparison in which 6 pots had different with seed papers & 6 pots were without seed papers (Photoplate-I). After 3rd, 6th & 9th day length of root & shoot, the numbers of germinating seeds as well as the weight of each plant were calculated. Average length, weight of root & shoot of all the plants were taken into consideration. The percentage of seed germination was done by using the formula-

$$\frac{\text{Number of seed germinates}}{\text{Number of seeds of each plant}} \times 100$$

Morphology of plants:

1. *Trigonella foenum-graecum* **L.**

Common name- Fenugreek, Methi

Family- Fabaceae

An erect, smooth, herbaceous plant, tap-rooted. Its stems are erect, sometimes branched. The leaves are alternate, compound, trifoliolate, and light green in color. The leaflets are oval, and hairy on their lower face. The flowers are papilionaceous, born in leaf axils, white, lemon-yellow or purplish blue in color. The fruits occur as straight or sickle-like pods thin and pointed, and contain 10-20 seeds. The seeds are oblong or square, green-olive or brownish in color, with a very strong and spicy odor.

Uses: It is mainly used as fodder in the Mediterranean Basin. Green parts are highly aromatic and are used as a pot herb and spice. Seeds are edible and used as condiments. They yield oil that is used to flavor butterscotch, cheese, licorice, pickles, rum, syrup, and vanilla. The oil is used in the perfume and cosmetic industries. The seeds are used as flavoring agents for maple syrup, cheese and curries. They contain diospenin, a drug used in the synthesis of hormones. Seed husks are a source of mucilage, oil, sapogenin, and protein. Plant residues or whole plants may be used as green manure and fuel.

2.*Ocimum sanctum* **Linn**

Common name- Holy Basil, Tulasi

Family- Lamiaceae

An erect, many-branched subshrub, with hairy stems, leaves that are green or purple; they are simple**, petioled**, with an **ovate** blade which usually has a slightly toothed margin; strongly

scented and have a **decussate phyllotaxy**, petiolate, ovate, green. The purplish flowers are placed in close whorls on elongated **racemes**. There are more than 3 numbers of flowers, bractiate, calyx 5 greenish, corolla 5, bilabiate covered with scattered hairs, white, Stamens 4 white, style single, white, seed small, white.

Uses- It is used in the treatment of respiratory, digestive, and skin diseases. It is a highly promising immunomodulator, cytoprotective and anticancer agent**. It promotes healthy heart. It is also used in anti-aging, treats kidney stones, relieves headaches, fights acne, relives fever, eye health, oral health** and also **cures respiratory disorders** like bronchitis & tuberculosis. It is a **rich source of vitamin K.**

 3.*Cuminum cyminum* **L.**

 Common name- Cumin, Jeere

Family- Apiaceae

It is an annual herbaceous plant, with a slender, glabrous, branched stem. The stem is colored grey or dark green. The leaves are pinnate or bipinnate, with thread-like leaflets. The flowers are small, white or pink, and borne in umbels. Each umbel has five to seven umbellets. The fruit is a lateral fusiform or ovoid achene containing two mericarps with a single seed. Cumin seeds have eight ridges with oil canals. They resemble caraway seeds, being oblong in shape, longitudinally ridged, and yellow-brown in color.

Uses- Its fruit, known as cumin seed, is most widely used for culinary and medicinal purposes. It is generally used as a food additive, popular spice, and flavoring agent in many cuisines. Cumin has also been widely used in traditional medicine to treat a variety of diseases, including hypolipidemia, cancer, and diabetes.

4. *Brassica nigra* L.

Common name- Black Mustard, Kali Mohari

 Family- Brassicaceae

Annual herb; root taproot; stems glabrous and glaucous; sometimes they have scattered stiff hairs toward the base. The alternate leaves are smaller as they ascend the stems. The lower leaves are pinnately lobed and obovate in outline, tapering to a long and rather stout petiole. The terminal lobe is much larger than the lateral lobes. The upper surface of a lower leaf is often bristly with scattered hairs that are stiff, short, and white. The lower surface is usually glabrous, except for a few hairs along the central vein. The upper leaves are often lanceolate, broadly elliptic, or some other odd shape; they have 1-2 lobes or none. The upper stems

terminate in narrow racemes of yellow flowers. Each flower consists of 4 yellow petals, 4 sepals, several stamens, and a pistil. The sepals are initially green, but become yellow while the flower blooms. The petals are well-rounded toward their tips. Each flower is replaced by a slender silique that becomes appressed against the stalk of the raceme as it matures. This silique is long, tapering to a conical beak. The seeds within this silique are dark brown or black.

Uses: Seed is often used in herbal medicine, especially as a rubefacient poultice, applied to the skin in the treatment of rheumatism, as a means of reducing congestion in internal organs. Applied externally, mustard relieves congestion by drawing the blood to the surface as in head afflictions, neuralgia and spasms. Hot water poured on bruised seeds makes a stimulant foot bath, good for colds and headaches. It is used for treating alopecia, epilepsy, snakebite, and toothache. It is also used in appetizer, digestive, diuretic, emetic and for liver and spleen treatment. It is also used to treat carcinoma, throat tumours, and imposthumes.

5. *Sesamum indicum* **L.**

 Common name- Sesame, Til

 Family- Pedaliaceae

An annual, or occasionally perennial, branched or unbranched; leaves alternate or opposite. At maturity, leaves and stems turn yellow to red in colour. The stems are green, erect, quadrangular, longitudinally furrowed and densely hairy. The leaves are hairy, ovate, dull green; white to pale pink bell-shaped flowers develop at the leaf axils along the stems. The fruit is a deeply grooved capsule, parallel epipedic in shape and containing 8 rows of seeds. The seeds are variable in colour, small and flat with a point at one end.

Uses: Sesame contains chemicals that might help reduce swelling, increase wound healing, and slow how fast sugar is absorbed from food. Sesame seeds are also rich sources of protein, vitamins, and antioxidants. It is also used for high blood pressure, cough, diabetes, high cholesterol, heart disease, lipid metabolism regulation and anti-tumour effects.

6. *Capsicum annuum* **L.**

 Common name- Bell pepper, Mirchi,

 Family- Solanaceae

Annual bushy herb; Leaves-green, simple, alternate, smooth, elliptic; Flowers White, star-shaped occur singly in the leaf axil (the junction between the leaf petiole and stem). Each flower contains about 5 stamens (male flower part) which bear black, oval anthers. A yellow stigma is about the same length as the stamens; fruit- a berry, round, elongated, or block-shaped, green, yellow, orange, red, purple, black, and white.

Uses- To treat pain associated with osteoarthritis, shingles, rheumatoid arthritis, post-herpetic neuralgia, trigeminal neuralgia, diabetic neuropathy, fibromyalgia, and back pain. Others have used capsicum for relief of muscle spasms and even as a gargle for laryngitis.

Observation and Result:

Recycled seed papers have the opportunity to help save our world, one seed at a time. Maximum plants were flourished. When the paper was planted in a pot of soil, the seeds grow and the paper composts away. The seed paper plant development was documented after 3rd, 6th & 9th day of germination in the month of February 2023. The first sprouts came up about three days after they were planted, which was much faster than expected. Fifteen days after this, all the plants had pretty much completely developed and were thriving. Seeds without paper take longer time for germination. It also showed that many seeds were not germinated due to small size as well as they may be drift away in high flow of water or goes deep inside the soil. Decomposition of seeds may take place inside the soil.

Table 1: Comparative Studies on Growth and Development of Plant species

S. No.	Name of plants	Texture of paper	Average Root length (cm)	Average Shoot length (cm)	Weight (gm)	Time of germination	Seed germination	% of seed germination
1	*Trigonella foenum-graecum*	With seed paper	2.24	6.31	6.77	9 days	19	95%
		Without seed paper	1.42	5.21	3.52	9 days	13	65%
2	*Ocimum sanctum*	With seed paper	2.10	4.09	2.22	9days	8	40%
		Without seed paper	1.09	2.30	1.50	9 days	4	15%
3	*Cuminum cyminum*	With seed paper	2.20	4.42	2.54	9 days	18	90%
		Without seed paper	1.50	2.06	1.22	9 days	9	30%
4	*Brassica nigra*	With seed paper	1.28	4.36	7.68	9 days	19	95%
		Without seed paper	1.10	3.54	3.16	9 days	8	20%
5	*Sesamum indicum*	With seed paper	2.15	6.26	3.89	9 days	18	90%

		Without seed paper	1.56	3.79	1.84	9 days	13	70%
6	*Capsicum annuum*	With seed paper	2.31	4.29	3.94	9 days	19	95%
		Without seed paper	1.17	3.12	2.30	9 days	14	70%

Fig. 1. A. Gathering of used papers, B. Cutting and keeping the used papers into small basin with water, C. Blending of wet papers, D. Wet crushed paper, E. Shaping of wet crushed paper, F. Addition of various seeds on wet paper, G. Pots without seed papers, H. Pots with seeded paper
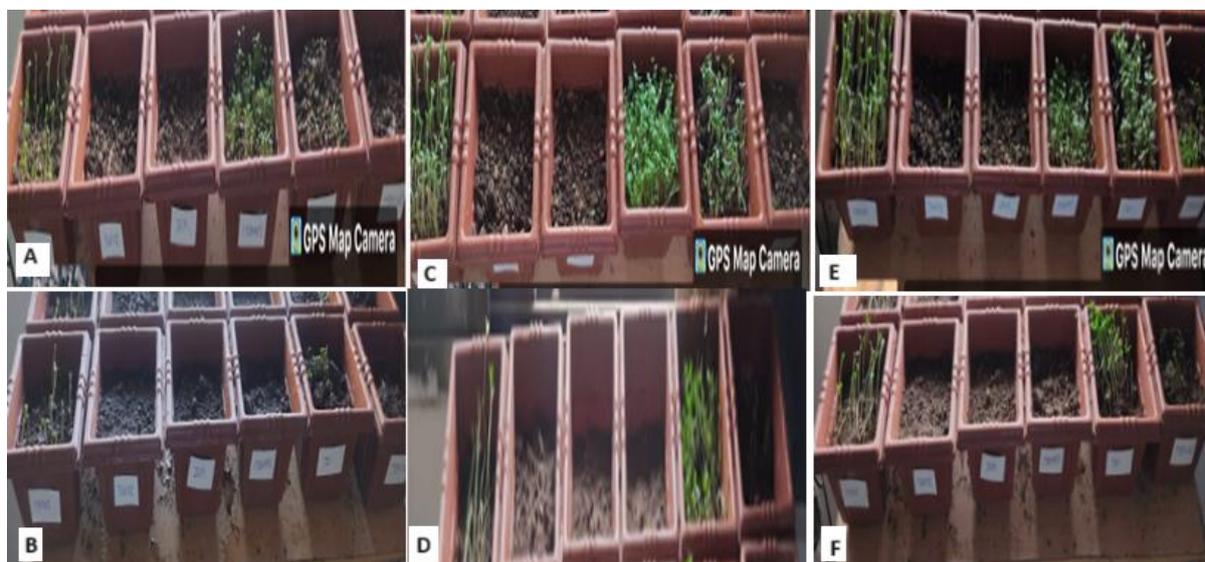
Fig. 2. A. Day 3 of plant development with seed paper, B. Day 3 of plant development without seed paper, C. Day 6 of plant development with seed paper, D. Day 6 of plant development without seed paper, E. Day 9 of plant development with seed paper, F. Day 9 of plant development without seed paper

Graph No 1: Comparative average Root length of Plant Species in with seed paper & without seed paper.
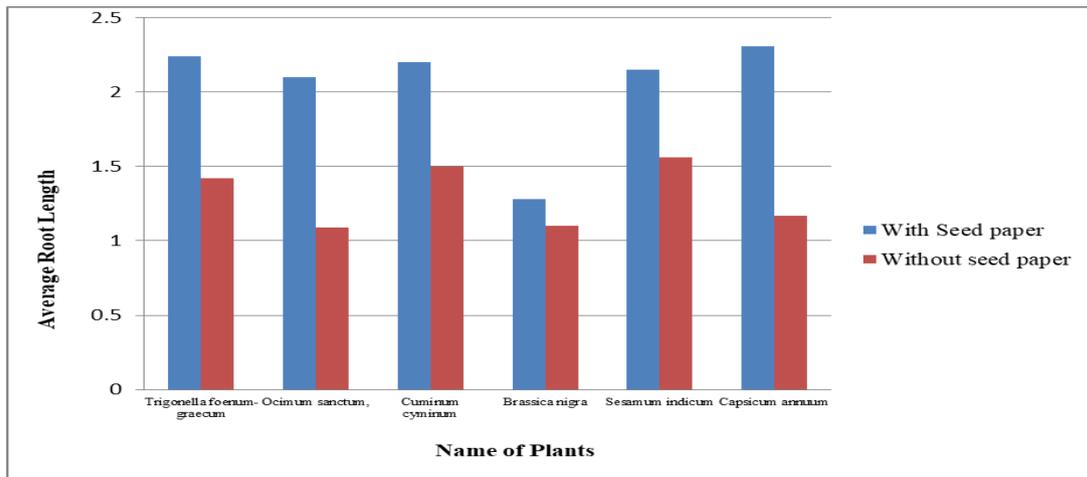
Graph No 2: Comparative average Shoot length of Plant species in with seed paper & without seed paper.
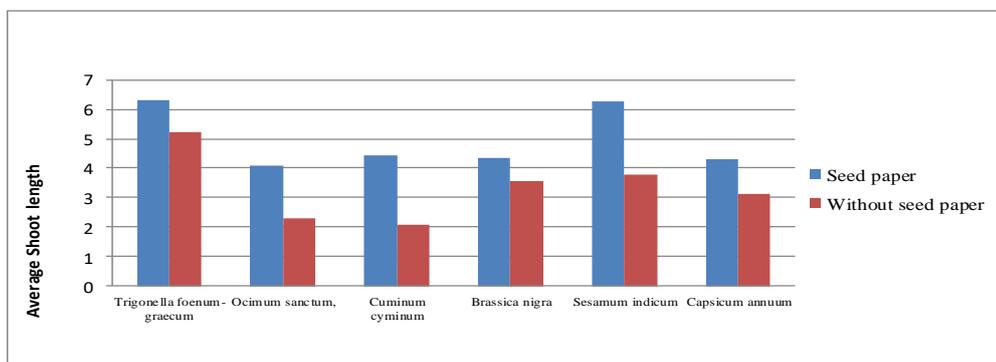
Graph No 3: Comparative studies of Weight of plants with seed paper & without seed paper.
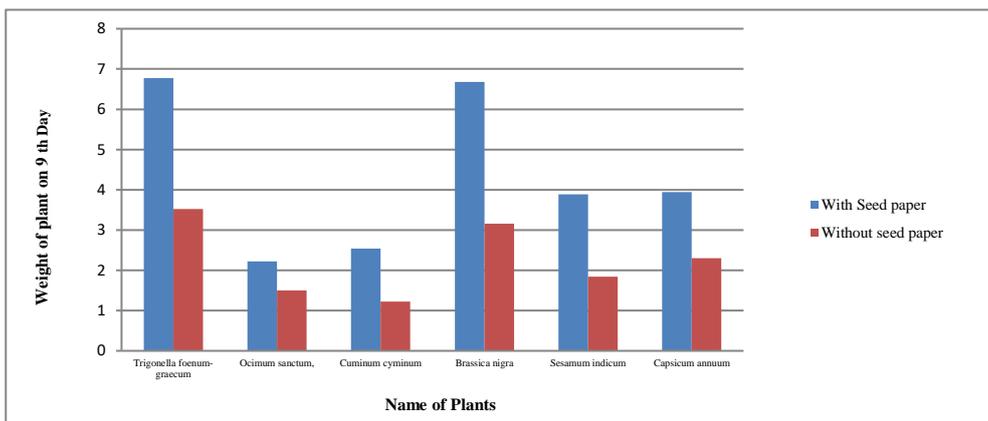
Graph No 4: Comparative Percentage of Seed Germination with seed paper & without seed paper.

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Discussion:

The paper has been thrown away or discarded after being it is primarily used by consumer which may in majority consist of daily news papers, magazine etc. At the same time there are some papers are printed but disposed before its use. For the preparation of papers million trees are cut down causing deforestation and also causes air pollution are creates solid waste too. So recycling of paper is necessary to produce various products like tissue paper, facial papers egg cartons, napkins etc. Paperboards are also used to make book covers and variety of product etc. On the other hand in agriculture field from last 50 years, use of plastic has been increasing which is creating hazardous effect of soil texture and ultimately on seed germination of crops. To minimize use of plastic, the waste papers are good alternatives.

So keeping in mind this thought in the present study we have planned the use of waste paper to prepare seed paper. The seed papers are handmade paper. The seed can germinate on this paper easily as it consist cellulose material. We have studied the comparison with and without seed paper on growth and development of plant.

These seeds papers are considered as eco-friendly and may help the fertility taken total 6 plants for study in the present study. The observation are showing positive results in growth and development of plant in case of using seed paper as compared to the without seed papers. It might be due to the small seeds cannot germinate in soil as they get easily moved away due to flow of water and sometimes might get decomposed. The use of seed paper for seeds having small sizes might be beneficial.

Conclusion:

In the present study it can be concluded that the plantable seed papers can be easily prepared. These papers may be helpful to reduce the paper waste created in various ways. This method might be useful to save environment by reducing use of plastic. These seed papers might be further used as germination paper specially in case of plants whose seed size is very small. The present study might be focusing good growth and development of plants with seed papers than without use of seed papers. So this method is eco-friendly and beneficial for plant growth and development.

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Dr. Prashant A. Gawande (M. Sc. Ph. D. SET)

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Induced Morphological Variation in Mutagen-treated Mungbean [*Vigna radiata* (L.) Wilczek] Cultivars in M$_2$ Generation.

Akshay G. Deshmukh and Dipak K. Koche

Department of Botany, Shri Shivaji College of Arts, Commerce and Science Akola (M.S.), India.

Email: deshmukhakshay489@gmail.com

Summary

The Mungbean [*Vigna radiata* (L.) Welczek] is one of the most important pulse grain crops of the Indian subcontinent having a high amount of protein. In the present study seeds of two varieties of mungbean (AKM-4 and AKM-8802) were treated with gamma rays (100Gy, 200 Gy, 300Gy and 400Gy), EMS, and SA (0.1%, 0.2%, 0.3%, and 0.4%). In the M$_1$ generation, it was noted that physical mutagen gamma rays and chemical mutagen showed a morphological variation in both varieties of mungbean AKM-8802 and AKM-4.

The M$_2$ sowing was done as per a plant-to-row scheme and observed for morphological variations. The variety AKM-8802 shows a large leaf size, hairy and rough leaf surface, different branching pattern, increase in number of pods, tough coating of pods, bold seed, and high yield. And the variety of AKM-4 mutant plant types showed variation in a branching pattern, plant height, pod position mostly upwards, increased number of pods, and high yielding. Especially chemical mutagen sodium azide of the variety AKM-4 shows high yielding.

Keywords: Mungbean, gamma rays, EMS, SA, M$_2$ generation, morphological variation.

Introduction:

The Mungbean[*Vigna radiata* (L.) Welczek] is a member of the fabaceae plant family, which is widespread and rand third among all flowering plant families with over 650 genera and more than 20,000 species (Doyle, 1944). Mungbean is a significant pulse crop that is a global source of high plant protein. It is extensively cultivated as a transient crop between two major crops on the Indian subcontinent. Amount of protein range from, 24-26%, 4% mineral, 51% carbohydrates and 3% vitamins are all present in mungbean (Afzal et. al., 2008). Mungbean is

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wonderful food not only adds protein to the diet but also aids the symbiotic root rhizobia in fixing atmospheric nitrogen, and improving soil fertility (Anjum et. al., 2006).

One of the earliest breeding techniques is mutation breeding. It is utilized in several domains, including molecular biology, cytogenetics, and biotechnology. It is a powerful instrument for increasing crop productivity (Acharya et. al., 2007). Mutation has a practical role in plant breeding more than 2252 mutant types have been created over than past seven decades (Maluszynski et. al., 2000).

In addition to normal plant breeding, mutation breeding serve as a source of growing variety and may confirm a particular improvement without materially changing the phenotypes that are considered acceptable (Konzak et. al., 1996, Koche and Joshi-Saha, 2018). It is possible to produce genetic variability and new variation with improved character by mutation brought on by a variety of physical and chemical mutagens (Wongpiyasatid, 2000). Because of the low genetic variability in mungbeans, common breeding techniques are ineffective in enhancing production; however, by modifying the available genotypes through mutation or by using other advanced breeding techniques, the yield can be increased while also introducing resistance to environmental stresses (Write, 1935).

Improvements are being made to this crop's qualitative and quantitative features on a global scale. A narrow genetic base also makes this crop more susceptible to various biotic and abiotic stress, which is reportedly the main cause of concern for breeding programs for mungbean improvement as well as for crop production and productivity in the context of climate change (Datta et. al., 2012).

Physical mutagens like gamma rays modify the morphological, physiological, biochemical, and genetic characteristics at the cellular level to affect plant growth (Gunckel et. al., 1961) gamma rays and EMS can produce high-yielding new varieties (Khatri et. al., 2005; Jagadeesan and Ponniyamoorthy, 2023). The effectiveness and efficiency of the mutagen are the major factors that affect mutation breeding. The choice of an effective and efficient mutagenic agent determines the required mutation. (Solanki et. al., 1994). The current study is an attempt to induce the mutation in two mungbean cultivars, AKM-8802 and AKM-4 by gamma rays, EMS, and SA, and its M2 generation observations are presented in this article.

Material and Methods:

Germplasm of Mungbean variety AKM-8802 and AKM-4 variety was procured from Dr. Panjabrao Deshmukh Agriculture University, Akola (MS) respectively. The dried, healthy seeds with 10-12% moisture content were irradiated with gamma rays with dose of 100, 200, 300 and 400Gy for AKM-, 8802 and AKM-4 for each dose about 300 seeds of each variety were taken. The gamma ray (GR) irradiation facility (Co^{60} source) was made available from RTMN University, Nagpur. For EMS and SA treatment about 300 seeds of each variety were presoaked in distilled water and then subjected to different concentrations of EMS and SA ranging from 0.1% to 0.4%. The treated seeds were sown in July 2021under field conditions at Departmental field of Shri Shivaji College, Akola (MS) with spacing 15 cm Within row and 30 cm between rows to raise M1 plants.

The M_1 plants were harvested individually and sown in June 2022 to raise M_2 plant to row progenies. The untreated control was sown on either side of each plot. The M_2 population was screened for chlorophyll and other morphological mutations 10 days after germination (Khan et al., 2005). The morphological mutants observed throughout the crop span were tagged and harvested individually. The frequency of mutation was calculated as described by Kharkwal (1998).

Observations and Results:

From M_2 generation of the Mungbean variety, 743 different plant types of morphological mutants were isolated. The variety AKM-8802 shows a large leaf size, hairy and rough leaf surface, different branching pattern, increase in number of pods, tough coating of pods, bold seed, and high yield. And the variety of AKM-4 mutant plant types showed variation in a branching pattern, plant height, pod position mostly upwards, increased number of pods, and high yielding. Especially chemical mutagen sodium azide of the variety AKM-4 shows high yielding. The recorded highest frequency of mutant was in 100 Gy, 200 Gy gamma rayes and 0.1% , 0.2% EMS in AKM-8802 and 100 Gy gamma rays, 0.1% Sodium azide and 0.1% , 0.3 %, 0.4% EMS in AKM-4. Apart from that variation, other morphological variations like dwarf and early flowering. The frequency of above mutant isolated from M_2 population is given in Tables 1 and 2.

In the case of EMS 0.3% and 0.4% concentration was found to induce highest dwarfism in AKM-8802. Leaf variation is one of the most common phenotypic changes that could be induced by mutagens. In the variety of AKM-8802 the highest frequency of induced leaf variation was shown by 100 Gy, 200 Gy, and 400 Gy gamma rays. In gamma gamma-induced

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population the mutation frequency for leaf mutations was highest in 100 Gy i.e. the lowest dose used in the present study, while in EMS induced population, EMS concentration did not induce leaf variations. In AKM-4, EMS 0.2% and 0.4% concentration induce the leaf variation followed by gamma radiation. A similar trend in rough leaf surface mutation.

In the case of branching pattern mutant, 100 Gy and 200 Gy gamma rays respectively produce higher mutation frequency in AKM-8802, while 100 Gy gamma rays, 0.1% Sodium azide, and 0.1% and 0.4% EMS respectively produce higher mutation frequency in AKM-4. A similar trend in early flowering mutants. In the case of Plant Hight mutant, 100 Gy and 200 Gy gamma rays respectively produce higher mutation frequency in AKM-8802, while 100 Gy, 200 Gy gamma rays, and 0.1% Sodium azide and 0.1% EMS respectively produce higher mutation frequency in AKM-4. In the case of the High yield mutant, the 0.1% sodium azide produces a higher mutation frequency in AKM-4. Also, the pod position is mostly upward mutant observed in AKM-4. The gamma rays induce the increasing number in a pod, tough coating of the pod, and bold seed in AKM-8802 variety.

Table 1. Frequency of different morphological mutants isolated from M2 progeny of AKM-8802 variety.

Dose	Treatment	No. of M1 plants	No. of M2 plants	Frequency of Morphological mutants							Mutation per 1000 M2 progeny
				Br	L V	Ht	Dw	I N P	TCP	Bold seed	
Gamma Radiation	100 Gy	210	3150	0.571	0.634	0.730	00	1.174	1.333	0.095	45.666
	200 Gy	196	2940	0.408	0.238	0.840	00	0.714	0.442	0.068	26.000
	300 Gy	208	3120	0.224	0.160	0.224	00	0.033	0.064	00	7.333
	400 Gy	200	3003	0.099	0.199	0.133	00	00	00	00	4.333
EMS	0.1 %	186	2790	0.107	00	00	3.22	00	00	00	31.000
	0.2 %	91	1365	0.146	0.073	00	3.66	00	00	00	35.750
	0.3 %	102	1530	00	00	00	3.33	00	00	00	22.100

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| | 0.4 % | 84 | 1260 | 00 | 00 | 00 | 2.14 | 00 | 00 | 00 | 20.250 |

Br- Branching pattern, L V – leaf variation / increase the leaf size, Ht – mutant, I N P – increase in no. of pods mutant, T C P – Tough coating of pods mutant.

Table 2. Frequency of different morphological mutants isolated from M2 progeny of AKM-4 variety.

Doses	Treatment	No. of M_1 plants	No. of M_2 plants	Frequency of Morphological mutants					Mutation per 1000 M_2 progeny
				Br	L V	Ht	Dw	I N P	
Gamma Radiation	100 Gy	198	2970	0.101	0.067	2.109	00	0.505	27.666
	200 Gy	156	2340	0.085	0.042	1.282	00	0.427	19.108
	300 Gy	180	2700	0.037	0.037	0.444	00	0.407	9.090
	400 Gy	175	2625	0.038	0.076	1.333	00	0.495	19.651
EMS	0.1 %	30	450	0.222	00	3.333	00	1.111	46.666
	0.2 %	36	540	0.185	0.370	1.850	00	0.740	30.909
	0.3 %	34	510	0.784	0.980	4.900	00	2.150	90.000
	0.4 %	29	435	1.839	0.689	9.190	00	4.825	160.000
SA	0.1 %	29	371	3.234	0.269	6.738	00	13.477	488.888

Br- Branching pattern, L V – leaf variation / increase the leaf size, Ht – mutant, I N P – increase in no. of pods mutant, T C P – Tough coating of pods mutant.

Fig. 1: Various mutant types of Mungbean variety AKM 8802

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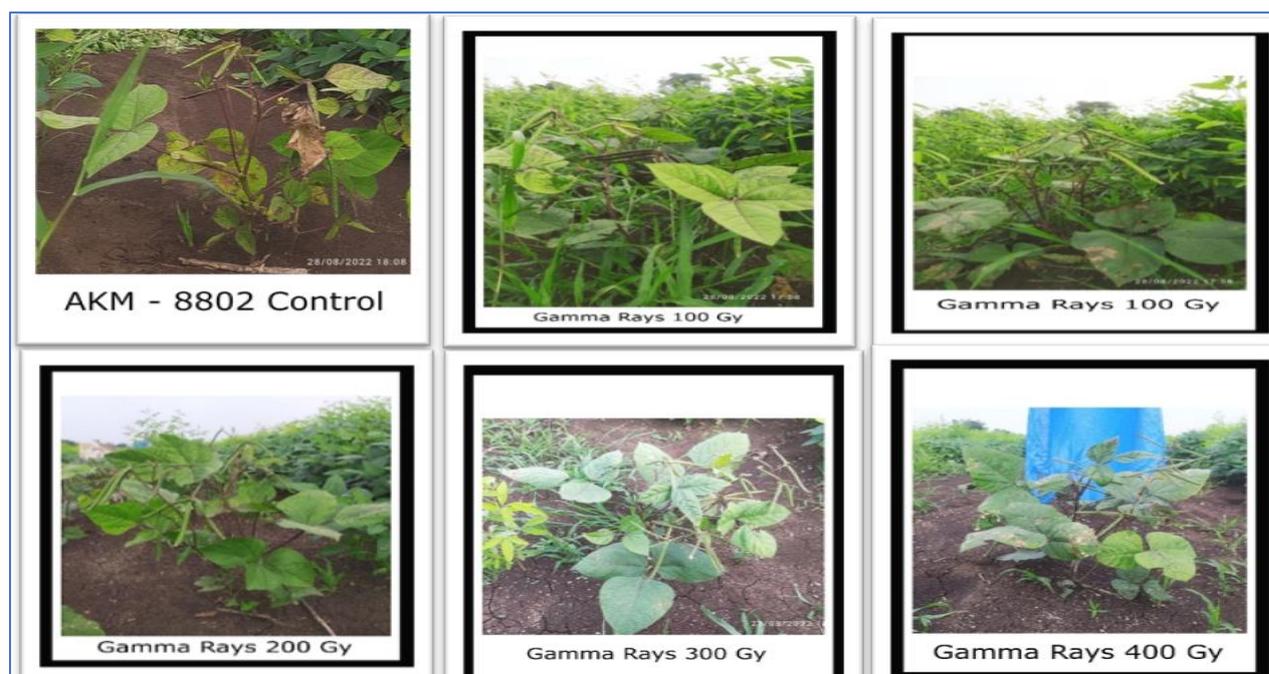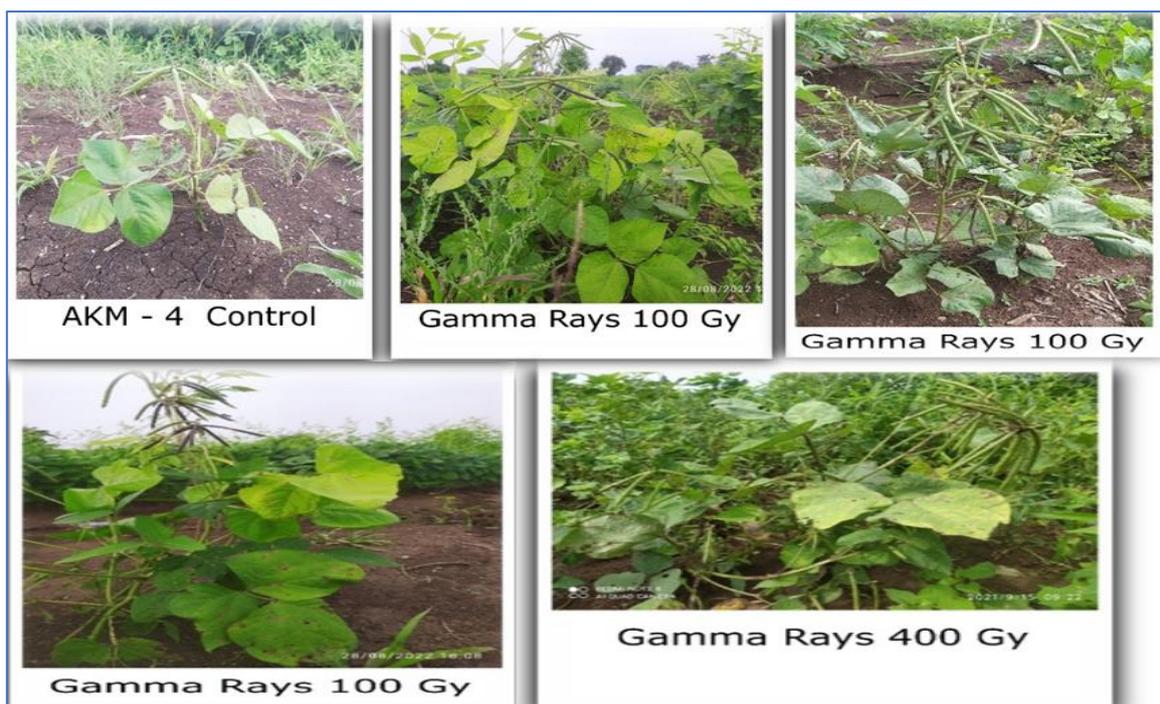
Fig. 1: Various mutant types of Mungbean variety AKM 04

Discussion and Conclusion:

Our study indicated that both physical and chemical mutagens have an impact on the morphology of crops with different doses of physical and chemical mutagens. From the study, it could be concluded that Physical and chemical mutagens like gamma rays, EMS, and SA have a significant impact on plants morphology, biochemistry, and genetics and there by effect on leaf, branches, pods, height of plants, and yield. These mutagens could be used to alter the genetic composition of of Mungbean for certain trait improvements.

Acknowledgement:

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Phytochemical Profiling of *Ruellia brittoniana*: A lesser known ethnomedicinal Plant

Tripty D. Jagtap and **Dipak K. Koche**

Department of Botany, Shri Shivaji College of Art's, Commerce and Science, Akola (MS) India 444003

Email: triptyjagtap441@gmail.com

Summary

The members of genus *Ruellia* are commonly known as wild Petunias which belong to the family Acanthaceae. *Ruellia brittoniana* is a common species but lesser known for its ethnomedicinal values. The plant is used ethnomedicinally to cure asthma and other bronchial disorders, as an antidote for snake bites, wound healer and to recover bone fractures.

The qualitative phytochemical analysis showed the richness of plants with the availability of alkaloids, glycosides, phenolics and flavonoids, terpenoids, and saponins. The quantitative phytochemistry showed that the plant has a significant number of major phytochemicals like alkaloids, phenolics, flavonoids, and saponins. HPTLC fingerprinting of methanolic extracts of the leaf, stem, and root of *R. brittoniana*. HPTLC fingerprint revealed several peaks of phytochemical compounds with respective Rf, retention time, and peak area. Off these, the identified compounds include phenolic compounds (ferulic acid, p-coumaric acid), flavonoids (quercetin, rutin, naringenin, apigenin), saponins, and cardiac glycoside (peruvoside). The identified compounds are medicinally important and probably impart medicinal value to *R. brittoniana*.

Keywords: *Ruellia brittoniana*, Acanthaceae, Ethnomedicine, Qualitative phytochemistry, Quantitative phytochemistry, HPTLC.

Introduction:

Ruellia is a genus of flowering plants commonly known as wild Petunias which belongs to the family Acanthaceae. Most of these are shrubs or twining vines; some are epiphytes. Some of these are used as medicinal plants. The genus has been traditionally claimed to be used for treating flu, asthma, fever, bronchitis, high blood pressure, eczema, diabetes., respiratory diseases, toothache, joint pains, and a variety of other ailments, and it has several cosmetic

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uses. Especially *R. brittoniana* is being used to cure Asthma, and bronchial disorders, antidote against snakebite, and as would healer (Jagtap et al., 2023).

The current era is the era of herbal medicine, as it has fewer side effects. But the ethnomedicinal plants and administration should be validated and the active principles must have to isolated to formulate a drug against a specific disease or disorder (Shirsat and Koche, 2020). *R. brittoniana* is a wild ethnomedicinal plant with lesser known for its ethnomedicinal potential (Khan et al., 2017). The present study is an attempt to screen out major phytochemical compounds present in the plant, quantitative analysis of these phytochemicals, and HPTLC analysis to identify some bioactive compounds in the plant.

Fig: 1. *Ruellia brittoniana* Habitate

Material And Methods:

Collection and Identification of Plant

The plant was collected from various places of the Western Vidarbha region and authenticated in the Department of Botany using the flora of Marathwada (Naik, 1998) and the flora of Maharashtra (Singh and Karthikeyan, 2000). The collected plant material after identification, was dried under shade for about 7- 10 days and then ground into fine powder with the help of a blender. The powdered material is kept in airtight polythene bags until further use.

Preparation of Extract

The fresh powder material of the leaf, stem, and root was used for extraction 10gm of coarse powder of leaf, stem, and root was extracted with 100ml of methanol in the Soxhlet apparatus separately. The procedure was carried out for 10 cycles for each sample extract and the temperature was adjusted just below the melting point of solvent. The collected extract was

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used for qualitative phytochemical analysis, quantitative phytochemical analysis, and HPTLC fingerprinting.

Qualitative Phytochemical Analysis:

For qualitative phytochemical analysis, standard protocols were followed (Harborne, 1998; Krishnaiah *et al,* 2009; Koche *et al,* 2010). The reagents and chemicals used were of SD Fine and QualiChem make.

Quantitative Phytochemical Analysis:

For quantitative phytochemical analysis, the standard protocol was followed by Sofowara (1993) and Kokate et al. (2003). The leaf, stem, and root extracts were assayed for the presence of phenolics, flavonoids, alkaloids, saponins, and reducing sugar. (Harborne, 1998; Krishnaiah *et al,* 2009; Koche *et al,* 2010).

HPTLC Fingerprinting:

The methanolic extract of the leaf, stem, and root of *R. brittoniana* was subjected to HPTLC fingerprinting analysis. CAMAG HPTLC system equipped with Linomat 5 sample applicator TLC autosampler 4 with win CATS software, was the instrument employed. 10µl, 10µl, and 20µl volume of each extract was applied on three tracks. The solvent system, Toluene: ethyl acetate: methanol: ammonia 25% (30:30:15:1) in a twig through the chamber was used for developing the plate (20×10cm). The plate was developed up to 7 cm, removed from the chamber, and allowed to dry, later it was scanned using CAMAG TLC Scanner and analyzed with Win CATS software version at λmax 254 nm using deuterium light source, at λmax 366 nm with mercury light source and the slit dimensions were 4.00×0.30 mm. After densitometric documentation, the plate was observed under 254 nm and 366 nm and TLC chromatograms were recorded. Then the plate was derivatized in vanillin-sulfuric acid reagent and dried at 105 °C on a hot plate till the bands appears. The plate was visualized under white light and scanned at 254 nm and 366 nm TLC chromatograms, Rf values, and fingerprint data were recorded by Win CATS software.

Results and Discussion:

The detailed observations on qualitative phytochemical analysis, quantitative phytochemical analysis, and HPTLC analysis of methanolic extracts of *Ruellia brittoniana* are presented in the following paragraphs.

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Qualitative Phytochemical Analysis

The qualitative phytochemical analysis of *Ruellia brittoniana* leaf, stem, and root extract showed that it is rich in phytoconstituents. The qualitative tests were done in three solvents i.e., methanol, acetone, and petroleum ether. Methanol was observed to be more useful the for extraction of phytochemicals than the rest of the solvents. The methanol extract showed the presence of alkaloids, glycosides, carbohydrates, flavonoids, phenolics, tannins, terpenes, steroids, reducing sugar, and saponins. (Table-1). In Acetone extract carbohydrates, terpenes, steroids, and, reducing sugar were absent. While petroleum ether extract showed positive tests for alkaloids, carbohydrates, terpenes, steroids, reducing sugar saponins, and flavonoids, phenolics, were absent (Table-1). Further, the qualitative tests for most of the phytochemicals are found positive in roots powder followed by leaf powder and stem powder respectively. The tests for alkaloids, glycosides, saponins, reducing sugar and carbohydrates are positive in all powder samples. Phenolics, flavonoids, steroids, and terpenes are found absent in acetone and petroleum ether extracts of leaves, stem, and root powder of *R. brittoniana*. The results of the qualitative analysis of powder material are presented in table-1.

Table 1. Qualitative Phytochemical analysis of *Ruellia brittoniana* Leaf, stem, and root extracts

Material/ Powder	Solvents or Extracts	Alkaloids	Glycosides	Phenolics	Flavonoids	Tannins	Terpenes	Steroids	Saponins	Red. Sugar	Carbohydrates	Proteins
Ruellia brittoniana Leaf	Me	+	+	+	+	+	+	+	+	+	+	-
	Ac	+	+	+	+	+	-	-	+	+	+	+
	PE	+	+	-	-	-	+	+	+	+	+	+
Ruellia brittoniana Stem	Me	+	+	+	+	+	+	+	+	+	+	-
	Ac	+	+	+	+	-	-	-	+	+	+	-
	PE	+	+	-	-	-	-	-	+	+	+	-
Ruellia brittoniana Root	Me	+	+	+	+	+	+	+	+	+	+	-
	Ac	+	+	+	+	+	+	+	+	+	+	-
	PE	+	+	-	-	-	-	-	+	+	+	-

NOTE: Me= Methanol extract; Ac= Acetone extract; PE = Petroleum ether extract

Quantitative phytochemical analysis:

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The crude content of major phytochemicals compounds in *Ruellia brittoniana* Leonard was determined using different methods. It has been found that among all five tested phytochemicals, the plant showed higher levels of phenolics followed by reducing sugar, flavonoids, and then alkaloids. Saponins content was also present in the plant. The content of phenolics present in *Ruellia brittoniana* is leaf 14.57±9.87, stem 16.36±3.30, and root 57.01±20.27). The flavonoid contents are (leaf 1.69±0.28, stem 0.81±0.13, and root 0.87±0.20), reducing sugar contents (leaf 12.71±5.75, stem 5.56±0.84, and root 5.08±0.45). The alkaloids are in *Ruellia brittoniana* (leaf 0.87±0.21, stem 0.55±0.13, and root 0.68±0.12), saponins are in *Ruellia brittoniana* (leaf 7.25%±0.74%, stem 4.84%±1.41%, and root 2.37%±0.57%) The account of quantitative analysis of *Ruellia brittoniana* plants is presented in table 2.

Table 2. Quantitative phytochemical analysis (crude content in mg/g of dry sample) of *Ruellia brittoniana*

Sr. No.	Phytochemicals	*Ruellia brittoniana*		
		Leaf	Stem	Root
1	Alkaloids	0.87±0.21	0.55±0.13	0.68±0.12
2	Phenolics	14.57±9.87	16.36±3.30	57.01±20.27
3	Flavinoids	1.69±0.28	0.81±0.13	0.87±0.20
4	Saponins	7.25%±0.74%	4.84%±1.41%	2.37%±0.57%
5	Reducing sugar	12.71±5.75	5.56±0.84	5.08±0.45

HPTLC analysis:

HPTLC analysis produces fingerprints that consist of a sequence of zones that have specific Rf values, colors, and intensity. In the present study, the various patterns of phytochemical constituents were identified based on the color zones in the chromatogram and R_f values obtained during the HPTLC analysis under 254nm and 366nm wavelengths of light. HPTLC chromatogram of *R. brittoniana* leaf **A) &B)**, stem **C) & D)** and root **E) & F)** are shown in **Fig.1**. HPTLC fingerprinting profile, Rf values and their corresponding densitograms of leaf **A) I & ii**, stem **B) I &ii** and root **C) I & ii** are given in **Fig.2**. The *HPTLC* fingerprinting results

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showed several peaks with different *Rf values*. Toluene: ethyl acetate: methanol: ammonia25% (30:30:15:1) was the suitable solvent system that resolved various bands on the chromatogram and it indicates various phytochemicals present in the plants which are given in **Table.3** below.

HPTLC fingerprinting of methanolic extracts of the leaf, stem, and root of *R. brittoniana*. HPTLC fingerprint revealed several peaks of phytochemical compounds with respective Rf, retention time, and peak area. Off these, the identified compounds include phenolic compounds (ferulic acid, p-coumaric acid), flavonoids (quercetin, rutin, naringenin, apigenin), saponins, and cardiac glycoside (peruvoside) (table-3).
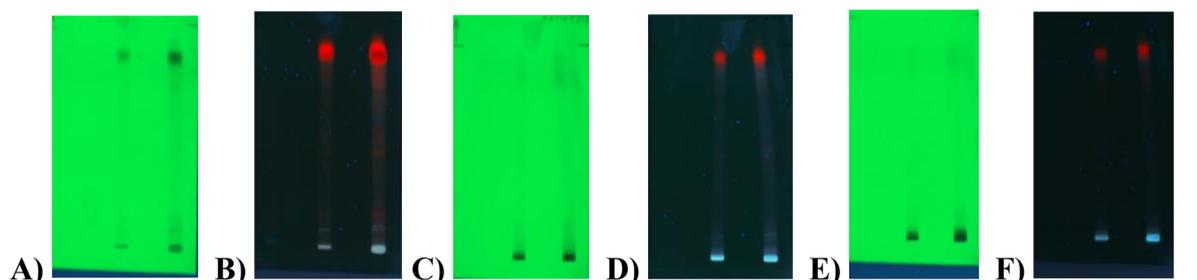
Fig. 2. HPTLC profile of Methanolic Extract of Leaf A &B, Stem C&D, and Root E&F of *R. brittoniana* viewed in UVshort and long wavelengths.

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Table 3. Showing R_f values and Identified compounds at different peaks of *R. brittoniana* leaf, stem, and root

	Sr. No.	R_f values	Max Height	Area	Identified Compounds
Leaves					
	1	0.96	16.7	424.9	Quercetin
	2	0.14	180.1	3071.5	Rutin
	3	0.58	15.0	324.8	Ferulic acid
	4	0.97	61.5	1623.2	Quercetin
	5	0.89	13.2	284.6	Naringenin
	6	0.03	597.8	7618.5	Saponin
Stem					
	1	0.55	18.2	396.6	P-coumaric (Phenolics)
	2	0.14	51.2	727.4	Rutin
	3	0.17	82.9	1520.0	Saponin
Root					
	1	0.65	13.6	233.0	Apigenin
	2	0.03	615.3	16148.1	Saponin
	3	0.17	85.2	2885.1	Saponin
	4	0.54	11.8	57.8	Peruvoside
	5	0.65	42.2	201.7	Apigenin

Table showing HPTLC fingerprinting profile of all three tracks Table Showing R_f values, Area of%, and identified compounds of leaf, stem, and root of *R. brittoniana* at different peaks

Conclusion:

The present study revealed the fundamental phytochemicals present in *R. brittoniana* leaf, stem, and roots. The study showed that the plant *Ruellia brittoniana* is rich in phytochemical constituents especially Phenolics, Flavonoids, alkaloids, glycosides, saponins, and carbohydrates, reducing sugar. The availability of these groups of phyto-components indicates that the plant could prove an alternative remedy to cure asthma, fever, bronchitis, high

blood pressure, eczema, and diabetes. HPTLC fingerprint profile can be used as an important diagnostic method to identify the intensity/availability of the herbal drug, *R. brittoniana*.

From the HPTLC fingerprinting of methanolic extracts, the identified compounds include phenolic compounds (ferulic acid, p-coumaric acid), flavonoids (quercetin, rutin, naringenin, apigenin), saponins, and cardiac glycoside (peruvoside). These results could serve as baseline data to isolate the bioactive principles and their pharmacological validation. It could be stated that the plant has promising availability of medicinally active principles.

Acknowledgment:

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Dr. Prashant A. Gawande (M. Sc. Ph. D. SET)

Dr. Prashant A. Gawande is currently working as a Professor, at the Department of Botany, Sant Gadge Baba Amravati University, Amravati. He has more than 25 years of teaching experience at UG and PG levels in Botany with specialization in Molecular Biology, Biotechnology and Plant Systematics. He has worked as a Principal Investigator on several research projects funded by various agencies like UGC, DST, RGSTC, etc. He has published more than 40 research papers in various journals of National and International repute. Under his able guidance, 04 students were awarded Ph. D. Degrees and 05 students are working. He also authored 03 books, edited 01 volume, and published over 5 book chapters for publications of National and International Levels. He is also working as a Chairman of BOS in botany and on various committees of SGBAU Amravati and a few other Universities and Autonomous colleges. He has also submitted more than 30 genome sequences to various National Databases.

Dr. Dipak K. Koche (M. Sc. Ph. D. NET)

Dr. Dipak K. Koche is currently working as a Professor, at the Department of Botany, Shri Shivaji College of Arts, Commerce and Science, Akola. He has more than 20 years of teaching experience at UG and PG level in Botany and Biotechnology. He has worked as Principal Investigator of 03 Manor and 02 major research projects funded by various agencies like UGC, DST, BRNS- DAE etc. He has one patent to his credit. He has published more than 50 research papers in various journals of National and International repute. Under his able guidance, 02 students were awarded Ph. D. Degrees and 06 students are working. He also authored 03 books, edited 02 volumes, and published over 10 book chapters for publications of National and International Levels. He is also working as a member of BOS in botany for SGBAU Amravati and a few other Universities and Autonomous colleges.

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Dr. K. S. Kumbhar (NET, SET)

Assistant Professor
Department of Geology
Nowrosjee Wadia College (Autonomous)
Pune, Maharshtra, Bharat.

S. P. Kokate (SET)

Assistant Professor
Department of Geology
Fergusson College (Autonomous)
Pune, Maharshtra, Bharat.

Dr. G. D. Gaikwad (SET)

Assistant Professor
Department of Geology and Geo-informatics
Shri Shivaji College of Art's, Commerce, and Science
Akola, Maharshtra, Bharat.

Authors Details

Mayur Shinde is a research scholar in the Department of Science, Technology, Environment, and Maths at National Chung Cheng University located in the Republic of China (Taiwan). He has a strong educational background, having earned his M.Sc. in Geology from SPPU (formerly known as the University of Pune) in 2014 and his B.Sc. in Geology from Fergusson College Pune in 2012. Mayur has extensive experience as an Assistant Professor in various institutions in Bharat, including D.Y. Patil Institute of Engineering, Management and Research in Akurdi, Pune, where he worked from June 2016 to May 2022, Nowrosjee Wadia College from July 2015 to April 2016, and All India Shri Shivaji Memorial Society's College of Engineering in Pune from December 2014 to April 2015.

Mayur has made significant contributions to the field of education, having mentored 20 students pursuing their bachelor's in Civil Engineering for their dissertations. He has also been actively engaged in research, publishing 3 research articles and 2 books, one of which is a copyrighted textbook on Engineering Geology and Geosynthetic Engineering. He is a life member of the Indian Society for Technical Education, demonstrating his commitment to continuous learning and professional development.

In addition to his technical work, Mayur is also dedicated to environmental causes. He is involved with an N.G.O. that focuses on cleaning rivers, showcasing his passion for positively impacting society.

Dr. Kiran Sharad Kumbhar is a well-respected geologist, currently working as an Assistant Professor in the Department of Geology at Nowrosjee Wadia College in Pune, Bharat. He has been in this role since 2014 and has built a strong reputation in the field. Dr. Kiran completed his Bachelor of Science in Geology from Rajaram College in Kolhapur, Maharashtra, in 2001 and received his Master of Science in Geology from the then-University of Pune in 2003.

After completing his M.Sc, Dr. Kiran began his teaching career as a lecturer at Rajaram College in Kolhapur. He later joined Jai-hind College in Dhule, Maharashtra as a lecturer in geology after successfully passing the S.E.T. examination in 2004. In 2005, he was selected for the position of Jr. Geologist at the Groundwater Surveys and Development Agency through the Maharashtra Public Service Commission.

Dr. Kiran's dedication and expertise in the field were recognized when he successfully passed the NET-JRF examination in 2009. He completed his PhD in 2018 with a specialization in groundwater and watershed management under Dr. M.V. Baride, a former Registrar of North Maharashtra University in Jalgaon.

With a wealth of knowledge and experience, Dr. Kiran has made significant contributions to the geoscience community. He has published 10 national and international research papers and authored 02 books on Engineering Geology and Geosynthetic Engineering. He has also participated in several national and international conferences, presenting his research outputs to the broader scientific community. He is also a Member of B.O.S. in Geology, SPPU, Pune. With his strong research background, he works as a reviewer in many national and international journals.

Mr. Shivaji Pundlik Kokate is a highly knowledgeable and skilled Assistant Professor in the Department of Geology at Fergusson College (Autonomous), Pune, Maharashtra. He has been working at the college since June 2017 and has been instrumental in shaping the future geologists of the country. He completed his B.Sc. in Geology in 2011 and M.Sc. in Geology in 2013 from the same institution, showcasing his dedication to the field. In 2014, he completed his Post Graduate Diploma in Disaster Management from IGNOU. Mr. Shivaji Pundlik Kokate's commitment and expertise in the field were

recognized when he successfully passed the S.E.T. examination in 2016.

Mr. Kokate has a passion for teaching and research. He has a track record of mentoring and guiding students, he has guided three Master's students for their dissertations. He is also a Life Member of The Indian Science Congress Association and a Programme Officer of the N.S.S. unit at Fergusson College, Pune. He is a strong believer in lifelong learning and professional development. He has participated in several national and international conferences to present his research outputs and authored one book on Engineering Geology and Geosynthetic Engineering. He is also a Member of B.O.S. in Geology Fergusson College (Autonomous), Pune-4.

In addition to his professional accomplishments, Mr. Kokate is also pursuing his Ph.D. from the Department of Geology at Fergusson College (Autonomous), Pune, further solidifying his commitment to his field.

Mr. Ganesh Dnyaneshwar Gaikwad is an accomplished professional in the field of Geology and Geo-informatics. He holds the position of Assistant Professor and Head, Department of Geology and Geo-informatics at Shri Shivaji College of Arts, Commerce, and Science in Akola, Maharashtra, Bharat.

With eleven years of teaching and research experience, Dr. Gaikwad is well-versed in the subject. He earned his academic credentials, including a Master of Science (M.Sc.) in Geology, from the Government Institute of Science, Aurangabad, under Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. His academic journey continued with a successful completion of the State Eligibility Test for Assistant Professor (SET) in Earth, Atmospheric, Ocean Planetary Science, accredited by the U.G.C. and conducted by Savitribai Phule Pune University.

Dr. Gaikwad's completed his Ph.D research work under the supervision of Prof. D. B. Panaskar from School of Earth Sciences, SRTM University, Nanded and under the mentorship of Professor S.M. Deshpande, Government Institute of Science, Aurangabad. He focuses his research on hydrogeochemistry, groundwater quality assessment, an environmental issues due to geogenic contamination . He has an impressive record of ten research papers published in international journals and two more communicated to international journals. Additionally, he has presented his research findings through six paper presented at international conferences and Nine papers presented in national conferences, making a significant impact on the scientific community.

Preface

Welcome to the first edition of **Crux of Geology**, a meticulously crafted textbook tailored for freshmen embarking on their journey in geology. This comprehensive book has been thoughtfully designed to cater to undergraduate geology students, aligning seamlessly with the criteria stipulated by the National Education Policy 2019, as mandated by the esteemed Government of Bharat.

Geology, as the study of Earth's structure, composition, and processes, plays a vital role in unravelling the mysteries of our planet's past, present, and future. It provides essential insights into how the Earth has evolved over millions of years, shaping its landscapes, forming valuable mineral resources, and influencing natural phenomena such as earthquakes, volcanoes, and climate change.

In Crux of Geology, we recognize the immense importance of geology as a fundamental subject within the broader field of earth sciences. Our goal is to elevate the significance of geology and emphasize its relevance in understanding not only the Earth but also its interconnected systems and their impact on society.

This book has been meticulously designed to cater to the needs of aspiring geologists, whether they are pursuing a geology degree or simply seeking a deeper understanding of our planet's geological processes. We have structured the content logically and comprehensively, guiding readers through the fundamental concepts and principles of geology.

We have carefully examined the language used throughout the book to facilitate learning and comprehension. We have strived to balance scientific accuracy and accessibility, ensuring that complex geological concepts are presented clearly and understandably. Additionally, we have incorporated a variety of well-prepared figures, diagrams, and sketches to enhance visual learning and aid in the interpretation of geological phenomena.

Crux of Geology is a valuable resource on your educational journey, providing a solid foundation for understanding the core principles of Physical Geology and Mineralogy. Whether you embark on a geology degree, pursue a career in earth sciences, or nurture a passion for the natural world, this book will guide you through the intricate world of Geology. We hope that Crux of Geology will ignite your curiosity, inspire your exploration, and equip you with the knowledge and tools to unravel the fascinating stories hidden within the Earth's geological history.

We extend our sincere appreciation to the following individuals for their invaluable contributions and collaboration throughout the advancement of this book: Shri Harshwardhanji Deshmukh (Hon. President, Shri Shivaji Education Society, Amravati), Prof. Sachin Sanap (Hon. Trustee, The Modern Education Society, Pune), Dr. V. V. Chabukswar (Principal, Nowrosjee Wadia College, Pune), Dr. Nitin Kulkarni (Acting Principal, Fergusson College, Pune), Dr. A. L. Kulat (Principal, Shri Shivaji College of Arts, Commerce, and Science, Akola), and Dr. Chien-Yen Chen (Professor and Dean of the College of Science, National Chung Cheng University, Republic of China (Taiwan)), and Prof. Yuan-Hsi Lee (Professor, Department of Earth and Environmental Science, National Chung Cheng University, Republic of China (Taiwan)). Their expertise and guidance have significantly enriched the content of this book, and we are deeply grateful for their support.

We wish to express our profound gratitude to a remarkable assembly of experts and educators in the field of geology who have made invaluable contributions to this book. Their collective knowledge and dedication have significantly enriched the content and context of our work. Among these esteemed individuals are Prof. Dr. S.M. Deshpande, whose membership in the Maharashtra Public Service Com-

mission in Mumbai reflects his substantial expertise. Dr. I. A. Khan, the former Head of the Department of Geology at Nowrosjee Wadia College, Pune, has lent his extensive experience to our book. Additionally, Dr. Shyam Vadetwar, a retired Professor from the Department of Geology at Nowrosjee Wadia College, Pune, has generously shared his insights.

Dr. U. D. Kulkarni, former Principal of M. J. College in Dhule, Dr. S. V. Pathare, Head of the Department of Geology at Rajaram College in Kolhapur, and Dr. Satish Sangode, Head of the Department of Geology at SPPU, Pune, have all made valuable contributions. Prof. Irfan Shaikh, leading the Department of Geology at Poona College in Pune, and Prof. Dr. S.V. Kulkarni, who oversees the Department of Geology at Bhartiya Mahavidyalay in Amravati, have provided significant support. Dr. Shyam Mude, the Head of the Department of Geology at Fergusson College, Pune, and Dr. Sanjida Khan, Head of the Department of Geology at Nowrosjee Wadia College, Pune, have played crucial roles in shaping our work. Prof. Mrs. Madhura Kanetkar, who leads the Department of Geology at Sinhgad College of Science in Pune, Prof. Khanapurkar J V, Head of the Department of Geology at Gopal Krishna Gokhale College in Kolhapur, and Dr. Hrishikesh Samant, Head of the Department of Geology at Xavier's College, Mumbai, have also contributed significantly.

Furthermore, we extend our gratitude to Dr. S.N. Patil, who heads the Department of Geology at NMU in Jalgaon, Prof Dr. Arti Baride, who leads the Department of Geology at Z.B. Patil College in Dhule, Dr. P. B. Pathrikar, Head of the Department of Geology at Rajarshi Shahu College in Pathri, and Dr. P. U. Terkar, Head of the Department of Geology at Kohinoor College in Khultabad. Prof. Dr. A. V. Tejankar, Head of the Department of Geology at Deogiri College in Ch. Sambhajinagar, Prof. Dr. Rajesh Jaipurkar, who oversees the Department of Geology at Sipna College in Chikhaldara, and Prof. Dr. Y.K. Mawale, Head of the PG Department of Geology at SGBAU in Amravati, have all made significant contributions.

Additionally, we acknowledge the contributions of Prof. Yogesh Murkute and Dr. Yogesh Manjare from RTMNU, Nagpur, Dr. K. M. Wanjarwadkar, Head of the PG Department of Geology at GISA in Chatrapati Sambhajinagar, Dr. C.P. Dorlikar, Head of the PG Department of Geology at MG College in Armori, Dr. P.S. Parimal, Head of the Department of Geology at G.S. Tompe College in Chandurbazar, Dr. S.S. Deshmukh, Head of the Department of Geology at GNA College in Barshitakli, Dr. P.D. Shinde, Head of the PG Department of Applied Geology at MGM University in Chatrapati Sambhajinagar, and Dr. M.M. Deshmukh, Head of the Department of Geology at Shri Shivaji Science College in Amravati. Finally, we extend our gratitude to Mr. M.D. Phalke, Head of the Department of Geology at Shri Shivaji Science College in Nagpur, Mr. P. M. Giri from the Department of Geology at Shri Shivaji College in Akola, Dr. G. G. Wadpalliwar, Head of the Department of Geology at SGM College in Kurkheda, Gadchiroli, Mr. Ajit Lole, Head, Department of Geology, Y. C. College, Karad and Mrs. Shweta Patil, Head of the Department of Geology at KTHM College in Nasik. Your collective wisdom and support have been instrumental in making this book a reality, and we deeply appreciate your invaluable contributions to the field of geology.

To all those mentioned above, we are forever grateful for your contributions, guidance, and unwavering support. Your belief in us and your dedication to geology has played a significant role in the creation of this book. Without your involvement and encouragement, this book would not have been possible. We express our deepest gratitude and appreciation for your contributions to Crux of Geology.

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Recent Trends In Commerce Management And Economics

(1)

Dr. Savita V. Nichit,
Department of Commerce
Shri Shivaji College of Arts, Commerce & Science, Akola.
Mob No. – 94045349709

सारांश :

सध्याच्या व्यवसायाच्या परिस्थितीत पर्यावरणीय समस्या व्यवसायात महत्त्वाची भूमिका बजावतात. बहुतेक देशांमध्ये, सरकार पर्यावरणीय समस्यांबद्दल चिंतित आहे. आजच्या व्यवसायात पर्यावरणीयदृष्ट्या शाश्वत विकास हा कळीचा मुद्दा बनला आहे. अशा प्रकारे, ग्रीन मार्केटिंग हे साध्य करण्यासाठी फर्म स्वीकारू शकते अशा धोरणांपैकी एक आहे.

ग्रीन मार्केटिंग म्हणजे त्यांच्या पर्यावरणीय फायद्यांवर आधारित उत्पादने आणि/किंवा सेवा विकण्याची प्रक्रिया. असे उत्पादन किंवा सेवा स्वतः पर्यावरणपूरक असली पाहिजे किंवा पर्यावरणपूरक पद्धतीने उत्पादित केली पाहिजे. आजच्या पर्यावरणाबाबत जागरूक जगात 'ग्रीन' हा शब्द एक गूढ शब्द बनला आहे. सार्वजनिक संबंध आणि विक्रीसाठी ग्रीन मार्केटिंग चांगले बनवल्यामुळे ग्रीन कारणे अधिक लोकप्रिय होत आहेत.

अचअ द्वारे ग्रीन मार्केटिंगची व्याख्या 'प्रदूषण, उर्जा कमी होणे आणि गैर-ऊर्जा संसाधने कमी होण्यावरील विपणन क्रियाकलापांच्या सकारात्मक आणि नकारात्मक पैलूंचा अभ्यास' अशी केली आहे.

तथापि, ग्रीन मार्केटिंगच्या मूलभूत गृहीतकांपैकी एक म्हणजे संभाव्य ग्राहक हिरव्या उत्पादनासाठी अधिक पैसे देण्यास तयार असतील. प्रस्तुत पेपरमध्ये हिरवी उत्पादने खरेदी करण्याची ग्राहकांची जागरूकता आणि इच्छेचे विश्लेषण करण्याचा प्रयत्न केला आहे.

कि वर्ड – ग्रीन मार्केटिंग, ग्रीन मार्केटिंगचे फ्फायदे आणि तोटे

प्रस्तावना :

ग्लोबल वॉर्मिंग, कार्बन क्रेडिट्स, ओझोन कमी होणे, पर्यावरणीय धोके, पर्यावरण प्रभाव मूल्यांकन या सर्व २१ व्या शतकात सामान्य शब्दावली बनली आहे आणि हे पर्यावरणाबाबत जागरूक समाजाचे लक्षण आहे. जेव्हा पर्यावरणाच्या न्हासाचे दुष्परिणाम

समाजाने अनुभवले तेव्हा समाज नैसर्गिक पर्यावरणाबद्दल अधिक चिंतित होतांना दिसते. या अधोगतीचे एक कारण म्हणजे मोठ्या प्रमाणावर उत्पादन, मोठ्या प्रमाणात वापर आणि पर्यावरणाच्या दृष्टीने बेजबाबदार उत्पादनांचे मोठ्या प्रमाणावर विपणन यांमुळे उद्भवणाऱ्या समस्या. परिणामी समाजाच्या अशा प्रकारच्या 'नवीन' चिंता दूर करण्याच्या प्रयत्नात व्यापारी घराण्यांनी त्यांच्या वर्तनात बदल करण्यास सुरुवात केली आहे. पारंपरिक विपणनामध्ये ग्राहकांच्या गरजा पूर्ण करणाऱ्या उत्पादनांची आणि सेवांची परवडणाऱ्या किमतीत विक्री करणे समाविष्ट असते परंतु ग्रीन मार्केटिंगमध्ये हिरवे म्हणजे काय हे परिभाषित करणे आणि ग्राहकांना आवडेल अशी उत्पादने विकसित करणे आणि विकणे हे अतिरिक्त आव्हान आहे.

पर्यावरणीय विपणन म्हणून ओळखल्या जाणाऱ्या ग्रीन मार्केटिंगमध्ये उत्पादन प्रक्रियेतील उत्पादन बदल, पॅकेजिंगमधील बदल आणि बदल तसेच जाहिरातींमध्ये बदल करणे यासह अनेक क्रियाकलापांचा समावेश होतो. तपन के. पांडा यांनी परिभाषित केल्याप्रमाणे 'हरित किंवा पर्यावरणीय विपणनामध्ये मानवी गरजा किंवा इच्छा पूर्ण करण्याच्या हेतूने कोणत्याही एक्सचेंजची निर्मिती आणि सुलभता करण्यासाठी डिझाइन केलेल्या सर्व क्रियाकलापांचा समावेश आहे ज्यायोगे या गरजा आणि इच्छांची पूर्तता नैसर्गिक वातावरणावर कमीत कमी हानिकारक प्रभावाने होते'.

जेव्हा आपण हिरव्या उत्पादनांबद्दल बोलतो आणि विचार करतो तेव्हा हे अत्यावश्यक आहे; खरोखर हिरवे होण्यासाठी त्यांनी दावा केला पाहिजे की ते पर्यावरणास अनुकूल नसून कमी पर्यावरणास हानिकारक आहेत. अशा प्रकारे पर्यावरणीय विपणनाने पर्यावरणावरील परिणाम कमी करण्याकडे लक्ष दिले पाहिजे. पर्यावरणास अनुकूल उत्पादने कार्यप्रदर्शन, परवडणारीता आणि सोयीसह पर्यावरणीय सुसंगतता संतुलित करतात. ते सामान्यत: टिकाऊ, पुनर्वापर करण्यायोग्य, गैर-विषारी असतात आणि ते विघटनशील किंवा पुनर्वापर करण्यायोग्य अशा सामग्रीपासून बनविलेले असावे. या उत्पादनांमध्ये किमान पॅकेजिंग असणे आवश्यक आहे आणि कमी पर्यावरणीय ऊर्जेवर प्रभाव टाकणे आवश्यक आहे.

आपल्या सर्वांना माहित आहे की या पृथ्वीवरील संसाधने मर्यादित आहेत आणि मानवी इच्छा अमर्याद आहेत. त्यामुळे विपणकांनी संसाधनांचा अपव्यय न करता कार्यक्षमतेने वापर करणे तसेच संस्थेची उद्दिष्टे साध्य करणे महत्त्वाचे आहे. जगभरातील ग्राहकांमध्ये पर्यावरणाच्या संरक्षणाबाबत उत्सुकता वाढत आहे. जगभरातील पुरावे सूचित करतात की लोक पर्यावरणाबद्दल चिंतित आहेत आणि त्यानुसार त्यांचे वर्तन बदलत आहेत. याचा परिणाम म्हणून हरित विपणन उदयास आले आहे आणि ते शाश्वत आणि सामाजिकदृष्ट्या जबाबदार उत्पादने आणि सेवांसाठी वाढत्या बाजारपेठेबद्दल बोलतांना दिसते.

राजकीय वर्तुळात वर्चस्व असलेल्या ग्लोबल वॉर्मिंगच्या चर्चेसारख्या पर्यावरणावरील मानवी क्रियाकलापांच्या प्रभावाचा सामना कसा करायचा यावरील वादविवाद पूर्ण ताकदीने चालू असताना, व्यवसायाने 'ग्रीन मार्केट'मध्ये प्रवेश केला आहे. कंपन्या सामान्यत: ग्राहकांना इको-उत्पादने देतात किंवा हिरव्या पद्धतींचा अवलंब करतात आणि काही कंपन्या एकाच वेळी इको-उत्पादन आणि/किंवा पर्यावरण परोपकारासाठी वचनबद्ध असताना इको- किंवा ग्रीन उत्पादने देतात. ग्रीन बिझनेस स्ट्रटेजी विविध प्रकारच्या उद्योगांमध्ये दिसून आल्या आहेत आणि विविध इको समस्यांचे निराकरण करतात. हिरव्या उत्पादनांची काही उदाहरणे म्हणजे हायब्रीड ऑटोमोबाईल्स, इकोफ्रेंडली पेंट, ऑरगॅनिक फूड, रिसायकल कॉपी पेपर आणि पर्यावरणास अनुकूल स्वच्छता उत्पादने. व्यवसाय त्यांच्या पुनर्वापराच्या प्रयत्नांना, पवन उर्जेचा वापर किंवा त्यांच्या कृतींचा पर्यावरणीय प्रभाव कमी करण्याच्या उद्देशाने इतर पद्धतींचा प्रचार करतात.

बाजारातील अर्थव्यवस्थेतील कंपन्या त्यांचे उत्पादन आणि विपणन निर्णय सरकारी नियम आणि ग्राहकांसह अनेक घटकांवर आधारित घेतात, जे ग्राहक उत्पादने उद्योगाला आकार देणारी प्राथमिक शक्ती आहेत. पर्यावरणपूरक उत्पादने आणि सरकारी नियमांबाबत ग्राहकांची प्राधान्ये फर्मच्या नफा वाढविण्याच्या निर्णयामध्ये पर्यावरण आणि इतर हरित उद्दिष्टे समाविष्ट करण्यासाठी प्रोत्साहन देतात. काही कंपन्या त्यांच्या उत्पादनांच्या हिरवळीच्या संदर्भात सक्रिय असतात तर काही कंपन्यांसाठी इको-फ्रेंडली पद्धती कास्ट मिनिमायझेशन धोरणाचे उप-उत्पादन असतात.

ग्रीन मार्केटिंगचा एक महत्त्वाचा पैलू म्हणजे हिरवी उत्पादने खरेदी करण्याची आणि त्यासाठी अधिक पैसे देण्याची ग्राहकांची इच्छा आणि क्षमता. उदाहरणार्थ यूएस मार्केटमध्ये ३.५ दशलक्ष पुष्टी केलेले हरित ग्राहक आहेत तर युरोपियन बाजारपेठेत ग्रीन उत्पादनांसाठी ग्राहक आधार आहे.

तथापि, भारतातील ग्राहक आधार किंवा हिरव्या उत्पादनांसाठी अतिरिक्त पैसे देण्याची ग्राहकांची इच्छा आणि क्षमता यावर फारच कमी डेटा उपलब्ध आहे. प्रस्तुत शोधनिधात ग्रीन मार्केटींग बाबत ग्राहकांची जागरूकता आणि सध्याच्या युगात त्याचे फायदे यांचा अभ्यास करण्याचा प्रयत्न आहे.

शोधनिबंधाची उद्दीष्ट्ये

- ग्रीन मार्केटिंग ही संकल्पना अभ्यासणे.

- ग्रीन मार्केटींग चे फायदे आणि तोटे अभ्यासणे.

संशोधन पद्धती

प्रस्तुत शोधनिबंधासाठी द्वीतीय संशोधन संसाधने उपयोगात आणली आहेत.

यामध्ये प्रामुख्याने ग्रीन मार्केटींग विषयावरील वर्तमानपत्रातील लेख, शोधनिबंध, संकेतस्थळावरील माहितीचा आधार घेतला आहे.

ग्रीन मार्केटिंगचे फायदे

ग्रीन मार्केटिंगचे विविध फायदे खालीलप्रमाणे आहेत: –

नवीन मार्केटला आवाहन

हिरव्या विपणन धोरणांचा वापर करणाऱ्या कंपन्या वेगळ्या लोकसंख्येला सहज आकर्षित करू शकतात. आजकाल, ग्राहक जागरूक होत आहेत आणि मोठ्या कंपन्या पर्यावरणावर कसा परिणाम करत आहेत याकडे लक्ष देत आहेत. त्यांना हे जाणून घ्यायचे आहे की एखादे उत्पादन कसे बनवले जाते आणि त्याचा वापर करताना ते राहत असलेल्या जगावर त्याचा काय परिणाम होतो. म्हणून, ग्रीन मार्केटिंग कंपन्यांना अशा जागरूक ग्राहकांना आकर्षित करण्यात मदत करते. तसेच, ते त्यांना बाजारातील इतर प्रतिस्पर्ध्यांशी स्पर्धा करण्यास सक्षम करते ज्यांनी पर्यावरणास अनुकूल पद्धती लागू केल्या नसतील.

ओव्हरहेड खर्च कमी करते

शाश्वत सामग्रीचा वापर किंवा पर्यावरणाच्या दृष्टीने जागरूक उत्पादन प्रक्रियेत संक्रमण केल्याने कंपन्यांना त्यांचे ओव्हरहेड खर्च कमी करण्यात मदत होऊ शकते. ऊर्जा आणि जल-कार्यक्षम तंत्रांचा अवलंब करून ते त्यांचे मासिक परिचालन खर्च लक्षणीयरीत्या कमी करू शकतात. शाश्वत कच्चा माल वापरल्याने कचरा विल्हेवाटीचा खर्चही कमी होऊ शकतो. कार्यालये, गोदामे आणि उत्पादन स्थळांच्या बांधकामातही पर्यावरणपूरक साहित्याचा वापर केल्यास दीर्घकाळात कंपन्यांचे मोठे पैसे वाचू शकतात, कारण त्यांना कमी देखभाल आणि देखभालीची आवश्यकता असेल.

नफा आणि ब्रँड निष्ठा वाढवते

ज्या कंपन्या बाजारात हिरवी उत्पादने किंवा सेवा प्रथम ऑफर करतात त्यांना या दृष्टिकोनातून मोठा फायदा होऊ शकतो. हे कंपन्यांना त्यांच्या प्रतिस्पर्ध्यांपासून वेगळे होण्यास मदत करू शकते, कारण पर्यावरणाबाबत जागरूक असलेले ग्राहक इतरांपेक्षा शाश्वत आश्वासने असलेल्या ब्रँडला प्राधान्य देतात. म्हणून, ग्रीन मार्केटिंगची संकल्पना व्यावसायिक उपक्रमांना नफा आणि ब्रँड निष्ठा वाढवण्यासाठी त्यांच्या उत्पादनांचे प्रभावीपणे पुनर्ब्रँडिंग करण्यात मदत करते.

पर्यावरणाला मदत करते

ग्रीन मार्केटिंग केवळ कंपन्यांना अधिक नफा मिळविण्यात आणि अधिक निष्ठावान ग्राहक मिळविण्यात मदत करत नाही तर ग्रहाला देखील मदत करते. कंपन्यांनी

त्यांच्या शाश्वत आश्वासनांचे कसून पालन केल्याने हवामान बदल कमी करण्यात आणि पर्यावरणाचे रक्षण करण्यात मोठी मदत होऊ शकते. उत्पादनाच्या टप्प्यापासून ते अंतिम उपभोगाच्या टप्प्यापर्यंत, ते त्यांच्या उत्पादनांचा पर्यावरणीय प्रभाव मनापासून विचारात घेतात ज्यामुळे भरपूर उत्सर्जन टाळण्यास मदत होते.

ग्रीन मार्केटिंगचे तोटे

ग्रीन मार्केटिंगचे तोटे खाली सूचीबद्ध आहेत: –

बदलाची (changes) किंमत मोजावी लागते.

विपणन रणनीती बदलण्यासाठी बराच वेळ लागतो आणि नवीन धोरणाचा विकास व्यवसायांसाठी वाढीव खर्चात अनुवादित होतो. जरी शाश्वत प्रयत्न आणि पद्धती पैशांची बचत करण्यासाठी डिझाइन केल्या गेल्या असल्या तरी, जेव्हा कंपन्या त्यांच्या ब्रँडला अधिक पर्यावरण-अनुकूल पद्धतींकडे वळवण्याचा प्रयत्न करतात तेव्हा त्या बदलांना मोठा खर्च येऊ शकतो.

तुलनेने नवीन संकल्पना

ग्रीन मार्केटिंग ही तुलनेने नवीन संकल्पना आहे आणि तसेच, अत्यंत हिरवे असणे हा नेहमीच फायदेशीर उपाय असू शकत नाही. फायद्याच्या दृष्टिकोनातून हे नेहमीच यशस्वी होऊ शकत नाही कारण सकारात्मक पर्यावरणीय आणि सामाजिक दोन्ही प्रभाव दीर्घकाळ टिकू शकतात. तथापि, जर व्यवसाय दिवाळखोर झाला तर असे इंप्रेशन फारसे काही करत नाहीत.

महागडी हिरवी प्रमाणपत्रे

उत्पादनांचे हिरवे म्हणून व्यावसायिकीकरण करणे हे व्यवसाय ज्या उद्योगात आहे त्यावर अवलंबून असते आणि त्यांना पर्यावरणीय प्रमाणपत्रे मिळविण्यासाठी दीर्घ आणि खर्चिक प्रक्रियेतून जावे लागेल. अशी प्रमाणपत्रे जी सरकारी संस्था, उद्योग संघटना, व्यावसायिक संघटना आणि ग्राहक हक्क गटांद्वारे जारी केली जातात, पर्यावरणीय मानकांची पूर्तता करण्यासाठी विशिष्ट प्रकारची प्रमाणपत्रे वापरतात. हे विशेषतः ऊर्जा वापर आणि पुनर्वापर कचरा व्यवस्थापन क्षेत्रात काम करणाऱ्या कंपन्यांसाठी खरे आहे. अशा सर्व मानकांचा आदर करणे कठीण आणि खर्चिक दोन्ही असू शकते आणि हा ग्रीन मार्केटिंगचा मोठा तोटा आहे.

ग्रीनवॉशिंग

ग्रीन मार्केटिंगमुळे व्यवसायासाठी बरेच फायदे मिळतात आणि म्हणूनच अनेक मोठ्या संस्था 'हिरव्या' दिसण्याचा प्रयत्न करतात परंतु त्यापैकी बहुतेक फक्त ग्रीन वॉशिंग आहेत. केवळ प्रमोशनसाठी, ब्रँड स्वतःला हिरवे दाखवतात पण प्रत्यक्षात ते असे काही

करत नाहीत. याला ग्रीनवॉशिंग असे म्हणतात. याचा अर्थ कंपन्या असे काहीतरी बनवतील जे निसर्गाने टिकाऊ नाही परंतु सर्व लक्ष थोड्या तपशीलावर ठेवून त्यांना हिरवे दाखवतं. उदाहरणार्थ, डिस्पोजेबल वॉटर कंपन्या पर्यावरणासाठी खूप हानिकारक आहेत. तरीही, ते दावा करतात की त्यांचे पॅकेजिंग १००% पुनर्वापर करण्यायोग्य आहे परंतु तरीही त्यांची संपूर्ण उत्पादन प्रक्रिया इतकी प्रदूषित आहे की ते टिकाऊ व्यवसाय होऊ शकत नाहीत.

सारांश

थोडक्यात, ग्रीन मार्केटींग आजच्या युगातील विपणन व्यवस्थेतीतील एक मोठा पर्यावरण पूरक बदल आहे. दैनंदीन जीवनातील उपभोगाच्या वस्तू, शालेय संसाधने (हिरव्या रंगाची नोटबुक्स), प्लॅटीकचा वापर टाळून कमी वजनाच्या तयार होणाऱ्या पिशव्या, प्लॉस्टीक चा थिकनेस लक्षात घेऊन तयार केलेली उत्पादने आज सुशिक्षित ग्राहक वर्गासाठी तयार होतांना दिसत आहे. पर्यायांची उपलब्धता विचारात घेता आणि ग्राहकांची जागरुकता अभ्यासता ग्रीन मार्केटींग हा एक नवीन मार्केटींग बाजारात आपली पायेमुळे घट्ट करतांना दिसत आहे.

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संगिता महादेव शेगोकार,
सहाय्यक प्राध्यापक
वाणिज्य व व्यवस्थापन विद्याशाखा
श्री शिवाजी कॉलेज ऑफ आर्टस्,
कॉमर्स अँड सायन्स, अकोला

देशाच्या अर्थव्यवस्थेत शेतीचे असणारे महत्व लक्षात घेता शेतीपिकांना संरक्षण देणे गरजेचे ठरते. भारतीय शेती मध्ये असणारी कमालीची अनिश्चिततेमुळे तर संरक्षण अधिकच महत्वाचे ठरते. नैसर्गिक संकटामुळे जसे की - नैसर्गिक आग आणि वीज, वादळ, गारपीट, चक्रीवादळ, टायफून, चक्रीवादळ, पूर आणि भूस्खलन, दुष्काळ, कीटक/रोग इ. शेती पिकांचे अतोनात नुकसान होत असते. त्यामुळे सरकारने वेळोवेळी पीक विमा योजना विविध स्वरूपात प्रस्तुत केल्या आहेत. त्यांचा आढावा येथे घेण्यात आला आहे.

वैयक्तिक दृष्टिकोन आधार (१९७२-१९८४)

भारतीय आयुर्विमा महामंडळाच्या सामान्य विमा विभागाने सन १९७२-७३ मध्ये पहिला पीक विमा कार्यक्रम गुजरातमधील एच-४ कापसावर सुरू केला होता. नंतर भारतीय जनरल इन्शुरन्स कॉर्पोरेशनने वैयक्तिक दृष्टीकोनावर आधारीत एक प्रायोगिक योजना घेतली. या पीक विमा योजनेत शेंगदाणा, गहू आणि बटाटा यांचा समावेश केला गेला आणि हि योजना गुजरात, महाराष्ट्र, तामिळनाडू, आंध्र प्रदेश, कर्नाटक आणि पश्चिम बंगाल या राज्यांमध्ये लागू केली गेली. हि योजना सन १९७८-७९ पर्यंत चालू राहिली आणि हि सर्वात पहिली पीक विमा योजना होती. त्यात केवळ ३११० शेतकयांचा समावेश होता ३७.८८ लाखांच्या दाव्यांच्या तुलनेत केवळ ३११० शेतक-यांना ४.५४ लाखांच्या प्रीमियमसाठी पीक विमा संरक्षण उपलब्ध केले गेले.

पायलट पीक विमा योजना– (१९७९-१९८४)

ज्या व्यक्तीने पीक विम्याचे मूळ मॉडेल तयार केले, ते प्रा. विनायक महादेव दांडेकर यांनी सत्तर च्या दशकाच्या मध्यात पीक विम्यासाठी पर्यायी 'सजातीय क्षेत्राचा दृष्टिकोन'सुचवला. या दृष्टिकोनावर आधारित भारतीय जनरल इन्शुरन्स कॉर्पोरेशन ने १९७९ पासून प्रायोगिक पीक विमा योजना सुरू केली. या योजनेत तृणधान्ये, बाजरी, तेलबिया, बटाटा, हरभरा आणि बार्ली समाविष्ट होते. हा विमा हप्ता विम्याच्या रकमेच्या ५ ते १० टक्के इतका होता. ही योजना १९८४-८५ पर्यंत चालली आणि एकूण १३ राज्यांनी भाग घेतला. यात १.५७ कोटी रुपयाच्या दाव्यांच्या विरूद्ध १.९७ कोटी रुपयाच्या प्रीमियमसाठी ६.२७

लाख शेतक-यांना पीक विमा संरक्षण उपलब्ध केले गेले. भारतीय जनरल इन्शुरन्स कॉर्पोरेशन आणि संबंधित राज्य सरकारने जोखीम २:१ च्या प्रमाणात वाटून घेतली होती.

सर्वसमावेशक पीक विमा योजना- (१९८५-१९९९)

पायलट पीक विमा योजना कडून मिळालेल्या माहितीवर आधारित, १ एप्रिल १९८५ रोजी भारत सरकारने सर्वसमावेशक पीक विमा योजना राज्य सरकारांच्या सक्रिय सहभागाने सुरू केली.या योजनेची अंमलबजावणी एकसंध क्षेत्र दृष्टिकोनावर करण्यात आली होती तसेच ती अल्पकालीन पीक कर्जाशी जोडलेली होती. म्हणजेच अधिसूचित क्षेत्रातील अधिसूचित पिकांसाठी दिलेली सर्व पीक कर्जे अनिवार्यपणे या योजने अंतर्गत दीली जात होती. खरीप १९८५ ते खरीप १९९९ या कालावधीत या योजनेमध्ये १५ राज्ये आणि २ केंद्रशासित प्रदेश सहभागी झाले होते. या योजनेत आंध्र प्रदेश, आसाम, बिहार, गोवा, गुजरात, हिमाचल प्रदेश, कर्नाटक, केरळ, मध्य प्रदेश, महाराष्ट्र, मेघालय, ओरिसा, तमिळनाडू, त्रिपुरा, पश्चिम बंगाल, अंदमान व निकोबार बेटे आणि पाँडिचेरी सहभागी झाली होती.

या योजनेमध्ये अन्न पिके आणि तेलबिया पिकवण्यासाठी वित्तीय संस्थांकडून पीक कर्ज घेणारे शेतकरी अनिवार्यपणे समाविष्ट होते. याचे कव्हरेज पीक कर्जाच्या १००टक्के तसेच कमाल रू १०,००० प्रति शेतकरी पर्यंत मर्यादित होते. कमाल विम्याची रक्कम पीक कर्जाच्या १०० टक्के होती, जी नंतर १५० टक्के पर्यंत वाढवली गेली. तृणधान्ये आणि बाजरीसाठी प्रीमियम दर २ टक्के आणि कडधान्ये आणि तेल बियांसाठी १ टक्के होते. लहान आणि अल्पभूधारक शेतक-यांकडून देय असलेल्या विमा हप्त्याच्या ५० टक्के राषीसाडी केंद्र आणि राज्य सरकारांनी समान प्रमाणात अनुदान दिले होते. ही योजना राज्य सरकारांसाठी ऐच्छिक होती. परंतु या योजनेत भारत सरकार, राज्य सरकारांचे विभाग, बँकिंग संस्था आणि भारतीय जनरल इन्शुरन्स कॉर्पोरेशन यांचा समावेश होता. केंद्र आणि राज्य सरकारने प्रीमियम आणि दावे २:१ च्या प्रमाणात वाटून घेतली होती.

या संपूर्ण कालावधीत, योजनेमध्ये १२.७६ कोटी हेक्टर क्षेत्राचा पीक विमा काढला गेला. ७.६३ कोटी शेतक-यांनी २४,९४९ कोटी रकमेच्या विम्यासाठी ४०३.५६ कोटी रकमेचा विमा हप्त्याचा भरला होता. त्या अनुषंगाने, एकूण दाव्यांची पूर्तता २३०३.४५ कोटी होती, अशा प्रकारे दाव्याचे प्रमाण १: ५.७१ होते. ७.६३ कोटी शेतक- यांपैकी सुमारे ५९.७८ लाख शेतक-यांना फायदा झाला. मात्र एकूण दावा पूर्तता रक्कम प्रमाणाच्या तुलनेत फारच थोड्या शेतक-यांना या योजनेचा फायदा झाला.या योजनेमध्ये सहभागी १५ राज्ये आणि २ केंद्रशासित प्रदेशापैकी बहुतांश दावा रक्कम ही गुजरात १०८६ कोटी (४७ टक्के) आंध्र प्रदेश ४८२ कोटी (२१टक्के) महाराष्ट्र - २१३ कोटी (९ टक्के) आणि ओरिसा - १८१ कोटी (८ टक्के) वितरीत करण्यात आली होती. हि योजना खरीप १९९९ नंतर बंद करण्यात आली, ज्याची जागा सुधारित आणि विस्तारित राष्ट्रीय कृषी

विमा योजना ने घेतली.

प्रायोगिक पीक विमा योजना– (१९९७–१९९८)

ही योजना रबी १९९७ मध्ये सुरू करण्यात आली होती. ५ राज्यांतील एकूण १४ जिल्हे या योजनेअंतर्गत आहेत. ही योजना सर्वसमावेशक पीक विमा योजने सारखीच होती. केंद्र आणि राज्य सरकारने प्रीमियम अनुदान आणि दावे ४ : १ च्या प्रमाणात वाटून घेतली होती. ही योजना प्रीमियमवर १०० टक्के सबसिडी देत होती आणि मात्र अनेक प्रशासकीय आणि आर्थिक अडचणीमुळे एका हंगामानंतर बंद करण्यात आले. प्रायोगिक पीक विमा योजना अंतर्गत ४,५४,५५५ शेतक-यांना १६८.११ कोटी विम्याच्या रकमेचे संरक्षण देण्यासाठी शेतकऱ्यांनी २.४८ कोटी भरलेल्या विमा हप्ता भरला होता. तसेच या योजने अंतर्गत रु. ३७.८० कोटी दाव्यांची रक्कम शेतकऱ्यांना दीली गेली होती.

बियाणे पीक विम्यावरील पथदर्शी योजना (२०००)

ही योजना खरीप २००० मध्ये ११ राज्यांमध्ये सुरू करण्यात आली होती. बियाणे महामंडळे आणि बियाणे फ्फार्म यांच्या मालकीच्या पायाभूत सुविधांना स्थिरीकरण प्रदान करणे हे तिचे मुख्य उद्दिष्ट आहे. हे बियाणे पिके अपयशी झाल्यास शेतकर्यांना आर्थिक सुरक्षा आणि उत्पन्न स्थिरता प्रदान करते. शास्त्रोक्त पद्धतीने आधुनिक बियाणे उद्योगाला चालना देण्यासाठी राज्य बियाणे महामंडळाने त्याची स्थापना केली. या योजनेत सहभागी होण्यासाठी सरकारच्या अंतर्गत किंवा खाजगी नियंत्रण असलेल्या सर्व बियाणे उत्पादक संस्था, ज्या अधिसुचित पिकांसाठी किंवा राज्ये किंवा क्षेत्रांसाठी विशिष्ट वर्गाचे बियाणे तयार करु षकतात त्या पात्र असत. मुलभूत व प्रमाणित बियाणे पिकांची लागवड करणारे अधिसुचित राज्ये किंवा क्षेत्रांमधील सर्व शेतकरी, ज्यांनी बियाणे पीक प्रमाणपत्रासाठी ऑफ्फर केले होते आणि संबंधित प्रमाणन एजन्सीकडे नोंदणी केली होती ते कव्हरेजसाठी पात्र होते. या योजनेमध्ये आंध्र प्रदेश, ओरिसा, गुजरात, हरियाणा, कर्नाटक, मध्य प्रदेश, पंजाब, राजस्थान, यूपी, महाराष्ट्र, छत्तीसगड आणि उत्तरांचल यांचा समावेश होता.

राष्ट्रीय कृषी विमा योजना– (१९९९–२०००)

वर्ष १९९९–२००० च्या रब्बी हंगामापासून देशात राष्ट्रीय कृषी विमा योजना ची सुरुवात झाली. राष्ट्रीय कृषी विमा योजनेची अंमलबजावणी करण्यासाठी भारतीय कृषी विमा कंपनीचा समावेश करण्यात आला. या योजनेत फक्त ९ राज्ये व केंद्रशासित प्रदेशांनी सहभाग घेतला. ऊस, बटाटा, कापूस, आले, कांदा, हळद, मिरची, धणे ताग, केळी आणि अननस ही पिके या विम्यांतर्गत होती. ॲग्रिकल्चरल इन्शुरन्स कंपनी ऑफ इंडिया लि. जी डिसेंबर २००२ मध्ये स्थापन झाली आणि एप्रिल २००३ पासून कार्यरत झाली, योजनेच्या अंमलबजावणीची जबाबदारी घेतली.

नैसर्गिक आपत्ती, कीटक आणि रोगांचा परिणाम म्हणून अधिसूचित पिकांपैकी

कोणत्याही पीक उत्पादन अयशस्वी झाल्यास आगामी हंगामासाठी शेतकर्‍यांना विमा संरक्षण आणि आर्थिक सहाय्य प्रदान करणे, शेतक-यांना कृषी क्षेत्रातील उच्च तंत्रज्ञान, प्रगतीशील शेती पद्धती व उच्च मूल्याच्या निविष्ठांचा अवलंब करण्यास प्रोत्साहित करणे, विशेषतः आपत्तीच्या वर्षात शेतीचे उत्पन्न स्थिर करणे हे या योजनेचे मुख्य उद्देश होते. या योजनेंतर्गत येणारी पिके आहेत सर्व अन्नधान्य, तेलबिया आणि वार्षिक बागायती व व्यावसायिक पिके जी ऊस, बटाटा, कापूस, आले, कांदा, हळद, मिरची, धणे, जिरे, ताग, टॅपिओका, केळी आणि अननस इ. ही योजना कर्जदार आणि बिगर कर्जदार अशा दोन्ही शेतकऱ्यांसाठी उपलब्ध होती. ही योजना व्यापक आपत्तीसाठी क्षेत्रीय दृष्टिकोन आणि गारपीट, भूस्खलन, चक्रीवादळ, पूर इत्यादी स्थानिक आपत्तीसाठी वैयक्तिक दृष्टिकोन आहे. या योजनेमध्ये बाजरी आणि तेलबियांसाठी ३.५ टक्के (विमा रकमेच्या) विमा हप्त्या दर, इतर खरीप पिकांसाठी २.५ टक्के, गव्हासाठी १.५ टक्के आणि इतर रब्बी पिकांसाठी २ टक्के तसेच खरीप व रब्बी हंगामातील वार्षिक व्यावसायिक व बागायती पिकांच्या बाबतीत वास्तविक दर इत्यादी प्रमाणे विमा हप्ता दर ठरविल्या गेले होते. केंद्र सरकार आणि राज्य सरकार यांच्यात समान (५०:५०) अषारीतीने वाटून घेतलेल्या प्रीमियमच्या ५० टक्के सबसिडीसाठी लहान आणि सीमांत शेतकरी उपलब्ध होती. वर्ष १९९९-२००० ते २०१५-२०१६ उपलब्ध आकडेवारी नुसार तेहतीस पीक हंगामात सुमारे २७१२५४४२० शेतक-यांना योजनेत समाविष्ट करण्यात आले ४६७५०४.७६ कोटी रुपयाच्या विम्यासाठी १४११६.९२ कोटी रुपये विम्या हप्त्यापोटी भरण्यात आले आणि ५६३५२.१८ इतक्या कोटी रुपयाचे दावे मंजूर करण्यात आले.

सुधारित राष्ट्रीय राष्ट्रीय कृषी विमा योजना– (२०१०)

वर्ष २०१० मध्ये सुधारित राष्ट्रीय कृषी विमा योजना लागू करण्यात आली. हि योजना राष्ट्रीय कृषी विमा योजना अधिक सुलभ आणि सुकर बनविण्यासाठी सुचविली गेली. या योजनेमध्ये राज्यांशी सल्लामसलत करून उणीवा दूर करण्यासाठी आणि ते अधिक व्यापक आणि शेतकरी अनुकूल करण्यासाठी आवश्यक सुधारणा समाविष्ट केल्या आहेत. या योजनेमध्ये कर्जदार शेतकऱ्यांचा 'अनिवार्य श्रेणी' अंतर्गत विमा उतरवला जात होता तर बिगर कर्जदार शेतकऱ्यांचा 'स्वैच्छिक श्रेणी' अंतर्गत विमा उतरवला जात होता. लागवडीच्या जोखमीसाठी आणि चक्रीवादळामुळे कापणीनंतर झालेल्या नुकसानासाठी नुकसानभरपाईची रक्कम देय असेल. प्रिमियमचे दर एक्च्युअरी आधारावर ठरवले जात होते. विमा हप्ता २ टक्क्यापर्यंत कोणत्याही प्रकारचे अनुदान दिल्या जात नव्हते. तर २ टक्के ते १५ टक्के किंवा १५ टक्क्यापेक्षा जास्त विमा हप्त्यासाठी शेतकर्‍यांसाठी अनुदान दिल्या जात होते. २ टक्के ते ५ टक्के किंवा ५टक्क्यापेक्षा जास्त विमा हप्त्यासाठी ४० टक्के, ५ टक्के ते १० टक्के किंवा १० टक्क्यापेक्षा जास्त विमा हप्त्यासाठी ५० टक्के, १० टक्के ते १५ टक्के किंवा १५ टक्क्यापेक्षा जास्त विमा हप्त्यासाठी ६० टक्के, १५ टक्क्यापेक्षा जास्त विमा हप्त्यासाठी ७० टक्के शेतकर्‍यांसाठी अनुदान दिल्या जात होते. उंबरठा उत्पन्नाची गणना करण्यासाठी ६०

टक्क्याऐवजी ७० टक्क्याची किमान नुकसानभरपाई पातळी ठरविल्या गेली होती. प्रमुख पिकांसाठी विम्याचे एकक क्षेत्र ग्रामपंचायत असेल. खाजगी क्षेत्रातील विमा कंपन्यांना च्या अंमलबजावणी करण्याची परवानगी दीली गेली. या योजनेत एकूण १,२१,२७,७७६ लाख शेतकरी या योजनेत सहभागी झाले. तसेच हि योजना २१ राज्यामध्ये राबविण्यात आली. वर्ष २०१५-१६ पर्यंत २५६९.०७ करोड रुपये शेतक-यांना वाटप करण्यात आले.

हवामान आधारित कृषी विमा योजना – (२००७)

एग्रीकल्चर इन्शुरन्स कंपनी ऑफ इंडिया लिमिटेड ने प्रायोगिक तत्त्वावर हवामान आधारित पीक विमा योजना वर्ष २००७ मध्ये २० राज्यात राबविली. हवामानावर आधारित पीक विम्याचे उद्दिष्ट विमाधारक शेतकऱ्यांच्या अपेक्षेने पिकाच्या नुकसानीमुळे होणाऱ्या आर्थिक नुकसानीच्या संभाव्यतेविरुद्ध पाऊस, तापमान, दंव, आर्द्रता इत्यादी हवामान घटकांच्या प्रतिकूल परिस्थितीमुळे होणारे त्रास कमी करणे हे होते.

एग्रीकल्चर इन्शुरन्स कंपनी ऑफ इंडिया लिमिटेडने प्रायोगिक तत्त्वावर हवामान आधारित पीक विमा योजना लागू केली होती. खरीप २००७ मध्ये कर्नाटकमध्ये आधारावर आणि कोरडवाहू आठ पिकांचा समावेश करून जवळपास ५०,००० हेक्टर क्षेत्रफळासाठी ५० कोटी रुपयांच्या विम्याच्या रक्कमेचा विमा काढण्यात आला. वर्ष २००७-०८ आर्थिक सर्वेक्षणानुसार रब्बी २००७-०८ हंगामासाठी बारा राज्यांतील निवडक भागात या योजनेची मोठ्या प्रमाणावर अंमलबजावणी करण्यात आली. या योजनेत एआयसी बरोबरच इफको टोकियो व आय सी आय सी आय लोंबार्ड सारख्या खाजगी विमा कंपन्यानी सहभाग घेतला होता.

पुनर्रचित हवामान आधारित पीक विमा योजना–(२०१६)

पुनर्रचित हवामान आधारित पीक विमा योजनेची सुरुवात १८ फेबुवारी २०१६ रोजी माननीय पंतप्रधानांनी केली होती १२ राज्यांनी ही योजना खरीप २०१६ मध्ये लागू केली तर ९ राज्यांनी रब्बी २०१६-१७ मध्ये ही योजना लागू केली आहे. हवामान आधारित पीक विमा योजनाही विमाधारक शेतक-यांचा पाऊस, तापमान, वारा, आर्द्रता इत्यादींशी संबंधित प्रतिकूल हवामान परिस्थितीमुळे अपेक्षित पिकाच्या नुकसानीमुळे होणा-या आर्थिक नुकसानीच्या संभाव्यतेविरुद्ध होणारा त्रास कमी करण्याच्या उद्देषाने राबविल्या जात आहे. ही योजना हवामान मापदंडांचा वापर करते. हवामान स्टेशनकिंवा बॅकअप वेदर स्टेशन कडून हवामान डेटा प्राप्त झाल्यानंतर दाव्यांची प्रक्रिया सुरू होते. दाव्यांची प्रक्रिया विमा मुदत पत्रके, पेआउट संरचना आणि योजनेतील तरतुदींनुसार काटेकोरपणे केली जाते. सर्व मानक दाव्यांवर प्रक्रिया केली जाते आणि जोखीम कालावधी संपल्यापासून ४५ दिवसांच्या आत पैसे दिले जातात. ही योजना कृषी मंत्रालयाद्वारे प्रशासित केली जाते. वर्ष २०१५-२०१६ ते खरीप २०२२ उपलब्ध आकडेवारी नुसार तेरा पीक हंगामात सुमारे ३०१७९४३ शेतक-यांना योजनेत समाविष्ट करण्यात आले

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नारळ पाम विमा योजना- (२००९)

हि योजना वर्ष २००९ - २०१० पासून केरळ, तामिळनाडू, आध्रप्रदेश, गोवा, पश्चिम बंगाल, महाराष्ट्र व ओरिसा या सात राज्यातील सात क्षेत्राच्या निवडक क्षेत्रात प्रायोगिक तत्वावर राबविण्यात आली. हि योजना नारळ विकास मंडळाव्दारे प्रशासीत केली जाते. एकूण विमा हप्त्यांमध्ये ५० टक्के भारत सरकार तर २५ टक्के राज्य सरकार आणि उर्वरित २५ टक्के राशी शेतकरी भरत असतात. कृषी विमा कंपनी ऑफ इंडिया ही योजना राबवत आहे आणि सर्व दाव्यांचे देय देण्यास जबाबदार आहे. प्रिमियम दर प्रति पाम रु. ९.०० (४ ते १५ वर्षे वयोगटातील रोपट्यांसाठी) ते रु. १४.०० (१६-६० वर्षे वयोगटातील रोपट्यांसाठी) आकारले जाते. सर्व प्रकारच्या शेतकऱ्यांना प्रिमियमचे ५० ते ७५ टक्के अनुदान दिले जाते. या योजनेअंतर्गत जेव्हा पामचे नुकसान होते, तेव्हा अधिसूचित क्षेत्रामध्ये विमाधारकास इनपुट खर्चाच्या नुकसानीइतकेच दाव्याचे पेमेंट दिले जाते. वर्ष २०१२-२०१३ ते २०२०-२०२१ उपलब्ध आकडेवारी नुसार सुमारे ३३२३४ शेतक-यांना योजनेत समाविष्ट करण्यात आले

प्रधानमंत्री फसल विमा योजना (२०१६)

पी एम एफ बी आय च्या आधीच्या विमा योजनांच्या विम्या हप्त्यातील वृद्धी आणि प्रीमियममधील शेतक-यांचा वाटा, प्रीमियम दरांची मर्यादा आणि विम्याच्या रकमेतील कपात इ., घटकावर पुनरावलोकन केले गेले. हि योजना १८ फेब्रुवारी २०१६ रोजी सादर केली गेली. ही राज्य आणि केंद्र सरकारची संयुक्त योजना होती. हे खरीप पिकांसाठी २ टक्के, रब्बी पिकांसाठी १.५ टक्के आणि वार्षिक व्यावसायिक आणि फळोत्पादन पिकांसाठी ५ टक्के विमा हप्ता द्यावा लागतो. योजनेची अंमलबजावणी २३ राज्यांनी खरीप २०१६ हंगामात केली आहे. ही योजना पीक अपयशी झाल्यास सर्वसमावेशक विमा संरक्षण प्रदान करते तसेच शेतक-यांचे उत्पन्न स्थिर ठेवण्यास मदत करते आणि त्यांना नाविन्यपूर्ण पद्धती दत्तक घेण्यासाठी प्रोत्साहित करते.

या योजनेमध्ये सर्व अन्न पिके आणि तेलबिया पिके आणि वार्षिक व्यावसायिक व बागायती यांचा समावेश आहे. अधिसूचित पिकावर कर्ज घेणा-या कर्जदार शेतक-यांसाठी ही योजना अनिवार्य आहे. तथापि, इतर व कर्जदार नसलेल्या शेतक-यांसाठी हे ऐच्छिक आहे. प्रीमियम आणि देय विमा शुल्काच्या दरांमधील फरक केंद्र आणि राज्याने समान वाटून घेतला आहे. ही योजना पॅनेल केलेल्या जनरल विमा कंपन्या द्वारे लागू केली आहे. योजनेची अंमलबजावणी क्षेत्र दृष्टीकोन आधारावर केली जाईल. एकक मुख्य पिकांसाठी आणि इतर पिकांसाठी विमा हा गाव ग्रामपंचायत स्तरावर असेल. गाव व ग्रामपंचायतीच्या पातळीपेक्षा आकाराचे एकक असू शकते. अधिसूचित क्षेत्रातील बहुसंख्य शेतक-यांना पेरणी व लागवड करण्यापासून प्रतिबंधित झाल्यास प्रतिकूल हवामानामुळे पिकांचा विमा उतरवला तर विमा उतरवलेले शेतकरी विम्याच्या रकमेच्या २५टक्के पर्यंत

नुकसानभरपाईच्या दाव्यांसाठी पात्र असतील. विस्तृत पसरलेल्या आपत्तींचे दावे क्षेत्राच्या दृष्टिकोनावर मोजले जात आहेत. तथापि स्थानिक संकटांमुळे होणारे नुकसान (गारपीट, भूस्खलन आणि पूर) आणि काढणीनंतर निर्दिष्ट संकटांमुळे होणारे नुकसान, (चक्रीवादळ व चक्रीवादळ पाऊस आणि अवकाळी पाऊस) वैयक्तिक विमाधारक शेतकऱ्याच्या प्रभावित विमा उतरलेल्या शेतात मूल्यांकन केले जाते. नुकसानभरपाईचे तीन स्तर, उदा., ७० टक्के ८० टक्के ९० टक्के पीक जोखमीशी संबंधित क्षेत्र सर्व पिकांसाठी उपलब्ध असेल. उंबरठा उत्पन्न आधारावर विमा युनिटमधील सर्व विमाधारक शेतकऱ्यांना संरक्षण दिले जाईल. उंबरठा अधिसूचित पिकाचे उत्पन्न हे मागील सात वर्षांच्या उत्पन्नाची सरासरी, दोन अधिसूचित आपत्ती वर्षांपर्यंतचे उत्पन्न वगळून नुकसानभरपाई पातळीने गुणाकार केला जातो. वर्ष खरीप २०१६ ते रब्बी २०२१पर्यंत उपलब्ध आकडेवारी नुसार बारा पीक हंगामात एकूण सुमारे १४१३८५२२२ अर्जदारांचा योजनेत समावेष आहे. ४५१२२७३५ लाख रुपयाच्या विम्यासाठी ६३६१०९१ लाख रुपये विम्या हप्त्यापोटी भरण्यात आले आणि ४८४६२८६ इतक्या लाख रुपयाचे दावे मंजूर करण्यात आले.

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A Brief Overview of Anti-Cancer Activity of 3, 4-Dihydropyrimidinone / Thione

Santosh B. Gaikwad[1,5], Sagar D. Bhakare[2], Jagannath S. Godse[3], Abhimanyu P. Pawar[4], Kishore Puri[5*]

[1]Department of Chemistry, Late Pundalikrao Gawali Arts and Science Mahavidyalaya, Shirpur (Jain) Dist. Washim – 444 504, Maharashtra, India

[2]Department of Chemistry, Dahiwadi College, Dahiwadi Dist. Satara – 415 508, Maharashtra, India

[3]Department of Engineering Science, Hi-Tech Institute of Technology, MIDC Waluj, Aurangabad - 431 136, Maharashtra, India

[4]Department of Chemistry, Nevjabai Hitkarini College, Bramhapuri, Maharashtra 441 206, India

[5*]Department of Chemistry, Shri Shivaji College of Arts, Commerce and Science, Akola – 444 003, Maharashtra, India

ABSTRACT

The Biginelli reaction, discovered by chemist Pietro Biginelli, has shown potential for the development of compounds with various biological activities, particularly the functionalized 3, 4-dihydropyrimidin-2(1H)-ones/thiones (DHPMs). To investigate the potential anti-cancer activity of dihydropyrimidinone derivatives containing heteroaryl moieties, we conducted a brief study that involved designing, synthesizing, and evaluating a series of compounds. This quick overview will discuss recent new and novel synthesis and the anti-cancer activity of 3, 4-dihydropyrimidinone/thione.

Keywords: 3, 4-dihydropyrimidinone/thione, anti-cancer activity, Biginelli adducts, heterocycle molecules.

I. INTRODUCTION

The year 1891 marked the discovery of a new class of heterocycle molecules called Biginelli adducts. The chemist Pietro Biginelli first reported the simple process that synthesizes organic compounds of this kind [1]. The Biginelli reaction involves the reaction of 1, 3-dicarbonyl compounds with aldehydes and (thio) urea to produce 3,4-dihydropyrimidin-2(1H)-ones/thiones (DHPMs) (**fig. 1**) [2]. Over the past decade, 3, 4-dihydropyrimidin-2-(1H)-one/thione and their derivatives have attracted significant attention in organic and medicinal chemistry as pharmacophores displaying diverse pharmacological and therapeutic properties [3-5]. Their pharmaceutical and biological activities include anti-viral [6], potent-HIV pg-120-CD4 inhibitors [7, 8], anti-cancer [9, 10], anti-inflammatory [11, 12], potent calcium channel blockers [4, 13, 14], antihypertensive [4], anti-bacterial [15, 16] and antifungal agents [16, 17].

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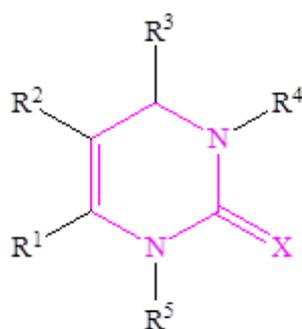
$X = O$ or S.

$R^{1-5} = H$, Alky, Aryl, amide, ester,
acyl, (thio) urea or heterocycles

Fig. 1 Basic Molecule of Biginelli Reaction

Monostrol and its analogues are a group of antihuman kinesin Eg5 inhibitors that are highly effective. They are characterised by a dihydropyrimidine nucleus [9, 18]. Monostrol, flourastrol, and Piperastrol are significant biologically active representatives of dihydropyrimidin-2-(1H)-one/thione (**Fig. 2**), used as Eg5 inhibitors and anti-cancer agents.

| Monostrol | Flourastrol | Piperastrol |
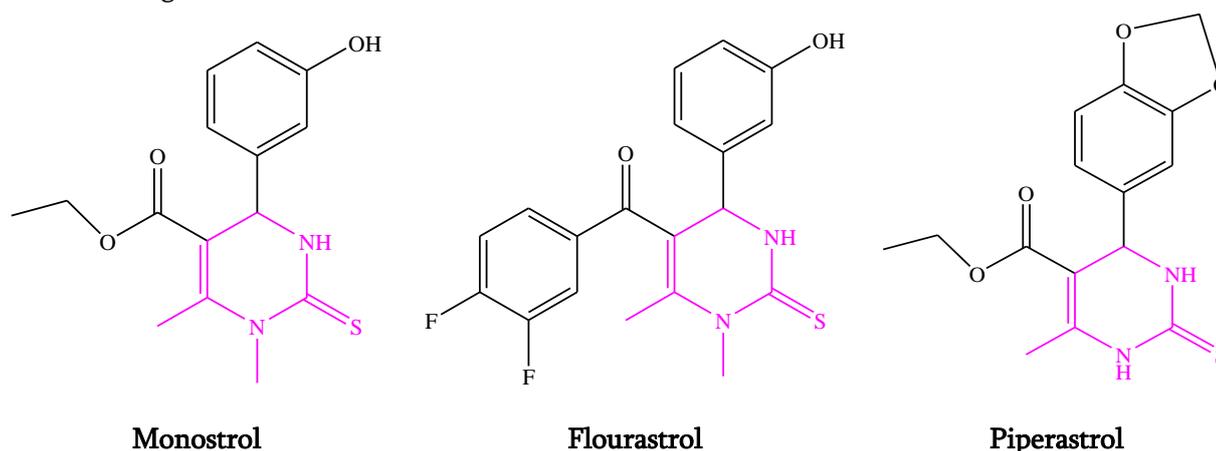
Fig. 2 Significant biologically active representatives of dihydropyrimidin-2-(1H)-one/thione

Out of the eleven synthesised monastrol analogues, Piperastrol was identified as a potent anti-cancer agent. This was based on the concentration of the adduct required to inhibit cell growth by 50% (EC_{50}, IC_{50} or GI_{50}) in various cancer cells as listed below: MCF-7 breast cancer: 1.9 μg/mL, 786-0, kidney cancer: 2.0 μg/mL, HT-29 colon cancer: 2.5 μg/mL, UACC.62 melanoma: 6.0 μg/mL, OVCAR03 ovarian cancer: 6.6 μg/mL [19-20].

The fundamental reagents used in the Biginelli reaction remain unchanged. However, the reaction conditions, reagent derivatives, and specific catalysts have been modified. Recent studies have demonstrated that these modified protocols result in higher product yields and shorter reaction times than the traditional Biginelli reaction.

DIFFERENT NOVEL REACTION FOR THE SYNTHESIS OF 3, 4-DIHYDROPYRIMIDINONE VIA THREE-COMPONENT BIGINELLI CONDENSATION WITH THEIR EFFICIENT ANTICANCER ACTIVITY

SCHEME: - 1

Synthesis of 3, 4-Dihydropyrimidinone using DMF-DMA:

In their study, Bhat *et al.* [21] successfully synthesised nine new derivatives of dihydropyrimidinone 9 with good yields. To begin the synthesis process, they obtained enaminone (II) without using any solvents by reacting 3, 4, 5-trimethoxy acetophenone (I) with dimethylformamide dimethylacetal (DMF-DMA). The final derivatives of dihydropyrimidinone were then produced by reacting the enaminone with substituted benzaldehydes, urea, and glacial acetic acid. Only compounds with 3,4,5-trimethoxy benzaldehydes displayed significant anti-cancer activity. During the apoptotic assay, necrosis was considerably increased from 1.97% to 12.18% compared to the control. Only the given compound (**Fig. 3**) showed crucial anti-cancer activity. During the apoptotic assay, necrosis was substantially increased from 1.97% to 12.18% compared to the control.
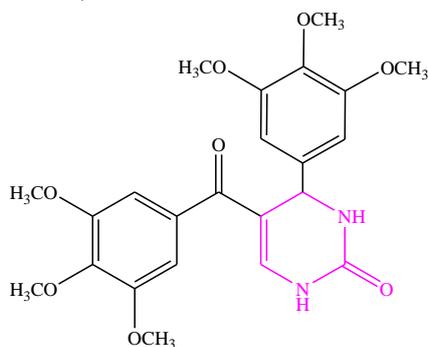
Fig. 3 Compound showing Anti-cancer activity

SCHEME: - 2

Synthesis of 3, 4-Dihydropyrimidinone using tetrabutylammonium hydroxide:

Liu and colleagues [22] showed selectivity towards gliomas. The introduction of aryl/alkyl chains in R3 and low electron-donating groups in R1 of DHPMs resulted in potent anti-proliferative activity. The in vivo efficacy study demonstrated that the compound illustrated in **Fig. 4** has potential as a lead compound in developing novel anti-tumor drugs for glioma treatment. This study can lay a foundation for the future development of DHPMs as a new anti-tumor drug.
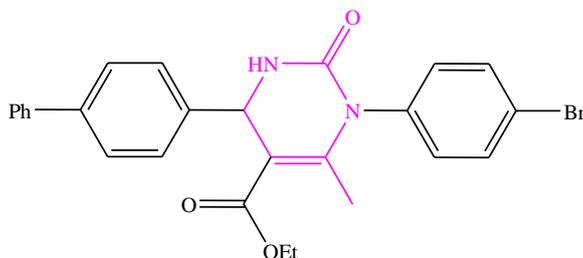
Fig. 4 The novel anti-tumour drugs to treat glioma

SCHEME: - 3

Synthesis of Acetophenone-Based 3, 4-Dihydropyrimidinone:

In a study by Saeed and colleagues [23], an Acetophenone-Based 3, 4-dihydropyrimidinone was prepared using acetone as the solvent and reagent. The self-condensation of acetone resulted in the intermediate 4-methylpent-3-en-2-one, which reacted with KSCN and 4-acetyl aniline to produce the final molecule (as shown in **Figure 5**) in a high yield of 95%. The following compound has the potential to act as a multi-target inhibitor. It has promising DNA groove-binding properties that can efficiently block DNA proliferation and cell growth.
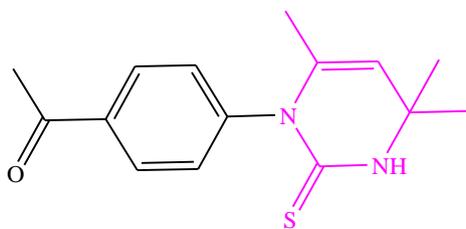
Fig. 5 Efficient block for DNA proliferation and cell growth

SCHEME: - 4

Synthesis of new 3, 4-Dihydropyrimidinone:

A new anti-cancer 3, 4-dihydropyrimidinone series bearing various heteroaryl moieties was synthesised and evaluated for activity by Amany and Khalid [24]. The following compound (**Fig. 6)** possessed the most significant activity against NCI-H460, SK-MEL-5 and HL-60 (TB) cell lines. It proved to have a dual inhibitory effect against VEGFR-2 and m TOR.
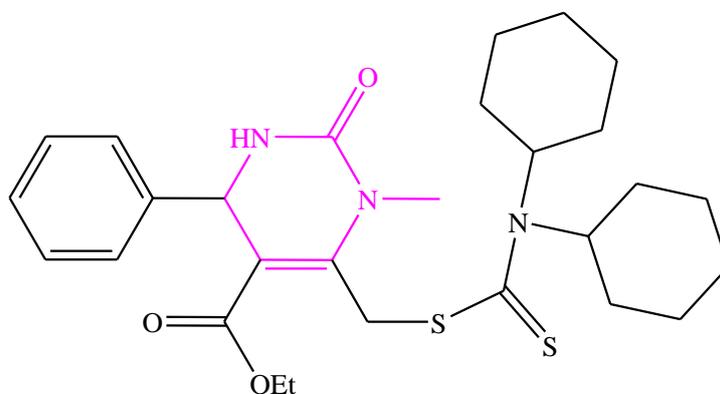
Fig. 6 Most significant activity against NCI-H460, SK-MEL-5 and HL-60 (TB) cell lines.

SCHEME: - 5

Synthesis of new 3, 4-dihydropyrimidines using β-aroylpyruvates as synthons:

A new synthesis of 3, 4-dihydropyrimidines was reported by Afaf El-Malah *et al.* [25]. The synthesis was achieved through a multicomponent one-pot reaction of β-aroyl pyruvates, substituted benzaldehyde and thiourea to form β-aroylpyruvates as synthons (**Fig. 7**). Most of the colon cancer and leukaemia cell lines were found to be highly responsive to the anti-tumour properties of compound 7(a). The growth-inhibiting effect of the compound was found to exceed 50% in these cell lines. Among them, the colon cancer HT29 cell line showed 53.16% growth inhibition, while the leukaemia cell lines K-562 and SR exhibited growth inhibition rates of 64.97% and 71.68%, respectively. Compound **7(a)** showed enough anti-cancer activity against colon cancer cell lines, including HCT-15, KM12, HCT-116 and SW-620, with cell growth inhibition of 49.22%, 48.55%, 38.75% and 33.42%, respectively. Compounds **7(a)** and **7(b)** displayed an extreme anti-tumour influence against UO-31, with growth inhibition of 35.64% and 24.15%, respectively.

7(a)   7(b)
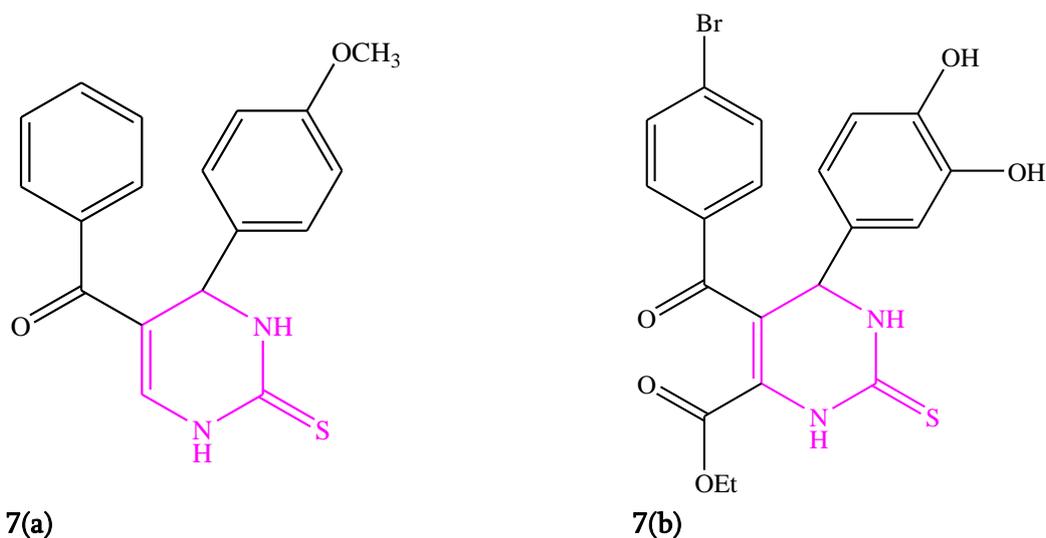
Fig. 7 The *in vitro* anti-cancer activity of new 3, 4-dihydropyrimidines using β-aroylpyruvates.

II. CONCLUSION

Dihydropyrimidinones are a class of compounds that exhibit a range of beneficial biological activities, such as anti-cancer, anti-bacterial, anti-oxidant, and anti-viral effects. Here, we discussed the anti-cancer activity of the 3, 4-Dihydropyrimidinones compounds. There is a scaffold for developing a variety of novel drugs, those used for cancer treatment. The newer modified synthesis methods have significantly transformed the study and design of novel drugs from Dihydropyrimidinone derivatives. The studies that have been reported indicate that Dihydropyrimidinone derivatives are exhibiting promising activity. Hence, the optimization of Dihydropyrimidinones is paving new paths in medicinal chemistry.

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- AUTHORS -

Dr. A. A. Patokar
Asst. Professor
Shri Shivaji College of Arts,
Commerce & Science, Akola

Prof. V. N. Mohod
Asst. Professor
Vidyabharati Mahavidyalaya
Amravati

Prof. R. B. Ghayalkar
Asst. Professor
Shri R.L.T. College of Science,
Akola

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Asst. Professor
Shri Shivaji Science College
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Asst. Professor
Shri Shivaji College of Arts,
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Dr. P. E. Ajmire
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G. S. Science, Arts &
Commerce College,
Khamgaon

Prof. N. M. Jathe
Asst. Professor
Smt. Narsamma Arts,
Commerce & Science College,
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Shri Shivaji College of Arts,
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Mr. R. N. Ganbas

Dr. P. M. Deshmukh

Dr. Y. S. Mohite

Editors

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Dr. A. R. Deshpande

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Principal
Shri. R.L.T. College
of Science, Akola

Dr. A. R. Deshpande
Professor and Head
Shankarlal Khandelwal Arts,
Science and Commerce College, Akola

Dr. R. R. Pachori (Sharma)
Associate professor and Head
Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

Dr. S. N. Zodpe
Assistant Professor and Head
Shri Shivaji College of Arts, Commerce
and Science, Akola

- AUTHORS -

Dr. Y. S. Patil
Associate Professor & Head
Shri Dnyaneshwar Maskuji Burungale
Science and Arts College, Shegaon

Dr. H. S. Malpani
Assistant professor and Head
Shri Radhakishan Laxminarayan
Toshniwal College of Science, Akola

Dr. N. A. Sonune
Assistant Professor and Head
Adarsha Science, J.B. Arts and Birla
Commerce Mahavidyalaya, Dhamangaon Rly.

Mr. R. N. Ganbas
Assistant professor
Shri Vyankatesh Art's Commerce and
Science College, Deulgaon Raja

Dr. P. M. Deshmukh
Assistant Professor
Shri. Dnyaneshwar Maskuji Burungale
Science and Arts College, Shegaon

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Assistant professor and Head
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Dr. V. D. Nanoty
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Shri. R.L.T. College of Science,
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Dr. A. R. Deshpande
M.Sc. M.Phil., JRF, Ph.D
Professor and Head
Shankarlal Khandelwal Arts,
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Dr. R. R. Pachori (Sharma)
M.Sc., SET, Ph.D
Associate professor and Head
Department of Microbiology
Rajasthan Aryans Mahavidyalaya, Washim

Dr. S. N. Zodpe
M.Sc., Ph.D.
Assistant Professor and Head
Shri Shivaji College of Arts, Commerce
and Science, Akola

- About Authors -

Dr. Y. S. Patil
M.Sc., Ph.D.
Associate Professor & Head
Shri Dnyaneshwar Maskuji Burungale
Science and Arts College, Shegaon

Dr. H. S. Malpani
M.Sc., Ph.D.
Assistant professor and Head
Shri Radhakishan Laxminarayan
Toshniwal College of Science, Akola

Dr. N. A. Sonune
M.Sc., NET, SET, Ph.D.
Assistant Professor and Head
Adarsha Science, J.B. Arts and Birla Commerce
Mahavidyalaya Dhamangaon Rly

Mr. R. N. Ganbas
M.Sc., CSIR, NET, SET
Assistant professor
Shri Vyankatesh Art's Commerce and
Science College, Deulgaon Raja

Dr. P. M. Deshmukh
M.Sc., Ph.D.
Assistant Professor
Shri. Dnyaneshwar Maskuji Burungale
Science and Arts College, Shegaon

Dr. Y. S. Mohite
M.Sc., Ph.D.
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Asst. Professor
Shri R.L.T. College of Science,
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Dr. U. S. Junghare
Asst. Professor
Shri Shivaji Science College
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Dr. S. M. Chavan
Asst. Professor
Shri Shivaji College of Arts,
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Professor
G. S. Science, Arts &
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Asst. Professor
Smt. Narsamma Arts,
Commerce & Science College,
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Prof. A. B. Dube
Asst. Professor
Shri Shivaji College of Arts,
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Awareness and Usability of SWAYAM Courses by Library and Information Science Professionals of Mumbai and Thane District Region

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Nitin M. Chaware
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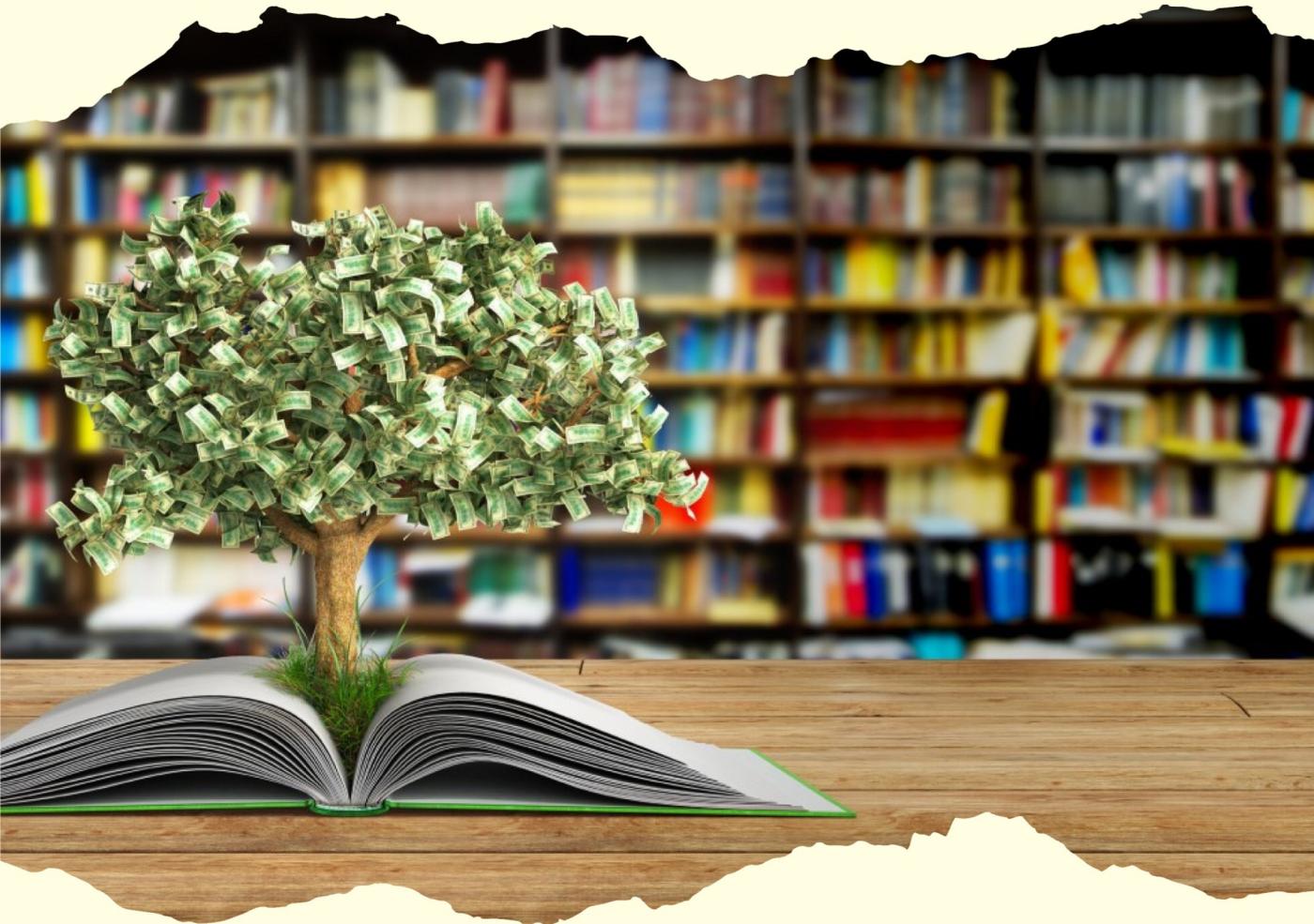
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"Awareness and Usability of SWAYAM Courses by Library and Information Science Professionals of Mumbai and Thane District Region"

Nitin M Chaware

Librarian, Arts, Commerce and Science College Kinhavali, Tal-Shahapur, Dist-Thane.

Dr. Ashish S Raut

Librarian, Shri Shivaji College of Arts, Commerce and Science Akola.

ABSTRACT

The present study was carried out to examine the awareness of SWAYAM among library and information science professionals. Data collected form colleges of thane districts library and information science professionals. Awareness of MOOCs-SWAYAM Inventory was developed and validated by the researcher. 104 library and information science professionals have responded to the questionnaire. The data collected were put into appropriate statistical analysis. The result revealed that awareness and usability of MOOCs- SWAYAM by library and information science professionals is not adequate.

Introduction

With the advent of advance technology there have been great revolution in the delivery of teaching & learning process. With this education has grown from traditional to distance, open and now an online. As a mode of education reaching more patrons in a effective and efficient manner. Today there are many sources of education but most recent & current one those who receive immense attention worldwide that is MOOC-SWAYAM courses. MOOC-SWAYAM courses are the future of the lifelong learning. It is relatively new trend in the pedagogy of education. It is only way to keep up to date that are taking place in every walk of the life due to the advent of ICT. MOOC-SWAYAM provide massive participation and open access via online mode. An only condition is you have a smart phone or Computer system with Internet connections. In 2012 MOOCs famous in education field but it was introduced by Dave Cornier in 2008. An Indian MOOC platform that is "Study Webs of Active-Learning for Young Aspiring minds" (SWAYAM) launched in 2016 and famous in Indian Scenario. Many universities adopt the method of SWAYAM and gives credits to the learners who complete the syllabus related courses on SWAYAM plat form. SWAYAM based on four quadrants of MOOCs Video lecture, PDF Documents, Assessments and Discussion Forum. SWAYAM is an online platform where 'n' number of participants can register themselves from any corner of the India and World. They can also deliver and access via the web. All contents of the platform are free to use where as some of the developers charged fee for certificates. It is Open to all without any restriction like gender bias, qualification, age, place etc.

Relevance

Many MOOC courses platform available before the Indigenous platform like Courseware, Khan Academy, edx, Udacity offering free online courses but Indian learners hard to adopt the language and content of the platform. Under the Digital India initiative government of India create a basic structure platform for the citizens of the country that is SWAYAM. Government makes available the courses in regional languages also. This study indicates the awareness, perception and the reasons of professionals why they are enrolling on the SWAYAM platform.

MOOCs in Indian Scenario

In Indian scenario the first steps on the way of MOOCs by IGNOU to initiating the National Digital Repository i.e., **"eGyankosh"** in Oct 2005 and publicly launched on June 9 2008, to store, index,

distribute, share and preserve the digital learning resources developed by Open and Distance learning Institutions of the Country. It is developed by IGNOU. https://egyankosh.ac.in/.

Another platform was introduced in Oct 2006 by Ministry of Human Resource Development, Government of India is **"SAKSHAT"** as a part of National Mission on education through ICT. The portal inaugurated by former president Dr. A.P.L. Abdul Kalam with the vision of "lifelong learning for students, teachers and those in employment or in pursuit of knowledge free of cost to them and accessing the electronic contends in the form of e-books, e-journals, digital repository and digital library, interact with the faculties via blogging, online chat, and discussion forum. https://www.education.gov.in/technology-enabled-learning-1

In 2013 MHRD launched **"e-PGPathshala"** which provide e-learning platform and maintained by INFLIBNET. On this platform PG courses curricula E-contents available inthe form of Audio and Video. Its aim to updating the knowledge of the learners and given education to all who were not able to enter the formal education. https://epgp.inflibnet.ac.in/

Teach anything to any one at anywhere, IIT Kanpur developed the "**mooKIT"** platform for their students in 2012. mooKITis an easy for developing and including the content for the students and by the students. It is MOOC Management system targeted to the learners.

The revolutionary design comes in to action that is digital India in 2016 the MHRD, Government of India announces a portal for MOOCs called **"SWAYAM"** (Study webs of Active-Learning for Young Aspiring Minds). UGC also announced that all Universities in India to make necessary amendments in the examination reform so that learners may deposit 20% credits undergoing through SWAYAM.

Aims of the Study

This study aims to calculate the awareness and usability of SWAYAM courses by Library professionals.

Statement of Problems /Objectives of the Study

- To find out the awareness of SWAYAM among library and information science professionals.
- To find out the enrollment on SWAYAM by LIS Professionals
- To Study the usability of SWAYAM Courses by LIS professionals. To find out the problem faced by the LIS professionals.

Operational Definitions

MOOC: Massive Open Online Courses (MOOCs) are such online courses which are developed as per the pedagogy stated herein and following the four-quadrant approach.

SWAYAM: "SWAYAM platform" means an Information Technology platform developed and made functional by the Government of India in the Ministry of Education, for the purpose of offering online learning courses.

'SWAYAM platform' is an IT platform developed and made functional by the Ministry of Human Resource Development of Government of India for the purpose of offering online learning courses on the MOOCs pattern.

Awareness: Awareness means "knowledge or perception of a situation or fact"

Usability: Usability means "the degree to which something is able or fit to be used"

Scope of the study

Study was conducted on library professionals of Thane districts who had enrolled on yet to enrolled on the SWAYAM indigenous MOOC portal. Nearly 150 questionnaires circulated for the study.

Methodology

For the study researcher used online survey method for collecting the data. For collecting the data structured base questionnaire used and distributed among the library and information science professionals

of the Thane districts. Questionnaire was created using google form and link of it distributed by social media like what's apps because LIS professionals are well connected to each other through this and gives response in less time. Total 104questionnaires received from LIS professionals. Data collected for the year of Jan- Dec 2022. MS-Excel for the analysis of data to present the statistics including tables, percentages, and graphical representation to provide the picture of awareness and usability of SWAYAM Courses among the Library and Information Science Professionals.

Related Review of Literature

(Bhagat, Supriya and Raju, Rohan2017). (Panda, Siba Prasad; Mahapatra, R.K. and Saibabu, K. 2019). Authors of this papers explore the SWAYAM Indian MOOC Platform. It has become a valuable and cost-free platform. Authors explore the SWAYAM platform its features, policies, procedures, programmes, associated institutions. It explores to new fields or training in specified skill. It will be improving acceptability and creditability of Indian MOOC platform.

(Shaikh, Shahin Altaf 2017) and (Sivakumar, R. 2019). These papers said that MOOC-SWAYAM is a new trend of lifelong learning and examine the status of it among the students and teacher, students and teacher are less aware about MOOC. Students and Teachers use blogging, YouTube, what's apps platform groups for sharing the learning things and clarify it. Study shows that MOOC is less popular among them and perception about MOOC was negative. If guided properly about the MOOC Courses and their advantages they must be starting to use MOOC.

(Samanta, Anuva 2018). Comparative study done by the author between Education andLIScoursesavailableonSWAYAMplatformfrom2016toJune2018.Paperalsoshows that the Courses and their enrolment increases year by year. Platform have Certificate, Diploma and Degree type of courses. Study helps to making a policy in the platform for the availability of the best contend.

(Kumar, Vinodh B; Dhanpal, A and Tharmar, K. 2019). In this paper comparative studydonebytheauthorsbetween10 top major subjects, top5institutionsthoselaunchmore courses and top five faculty members who created and delivered the courses on the platform. It is found that 15 major subjects contributed 1556 online courses in between them most of the courses contributed by Engineering subjects. Study also suggest that more and more students should enroll the SWAYAM platform and get benefited from it.

(Basnsode, Sadanand 2019) and (Majumder, Chiranjit 2019). Paper deal with the Government of Indian MOOC Initiative, SWAYAM. Paper studied the challenges arises in the LIS field. It also identified the barriers when it used like, language, free or paid, personal attention, time, government policy etc. Paper also gives the opportunities from it. Paper recommended that use the other languages for the courses along with English.

(Bhagyalakshmi, R. and Karthika, P. 2020), (Jeyakumari, K.; Balu, A. 2020) and (Shewale, Rahul 2021). The analysis of the studies revealed that the awareness and impact of the MOOC-SWAYAM platform on the students and teachers. There is need for improvement in the awareness of the MOOC-SWAYAM platform among the students and teachers. How-to use it benefits of it, requirement of it, cost, time and place free etc.

Data Analysis

Table 1 -Gender Wise Distribution

Sr. No.	Gender	Registration No.	Percentage
1	Male	43	41.34%
2	Female	61	58.65 %
	Total	104	100%

Table 1 describe the gender wise distribution of registration in SWAYAM platform. Female percentage was quite higher than the male that is 58.65% and Male is 41.34%. Female professionals are more egger to know something new.

Table 2 -Age Group Wise Distribution

Sr. No.	Age Group	Registration	Percentage
1	24-30	04	3.84%
2	30-40	25	25.03%
3	40-50	47	45.19%
4	50-60	27	25.96%
5	60+	01	0.96%
	Total	104	100%

From the above table 2 it shows that 40-50 age group professionals have 45.19% registration below 50-60 age groups have nearly 26% and 30-40 age groups have 25.03%. It clear that more experience professionals ready to learn new methods and techniques to update the knowledge.

Table3 - Designation Wise Registration

Sr. No.	Designation	Registration	Percentage
1	Librarian/College Librarian	74	71.15%
2	Library Attendant	09	8.65%
3	Assistant Librarian	07	6.73%
4	Library Assistant	06	5.76%
5	Library Clerk	04	3.84%
6	Asso. Prof .In LIS	02	1.92%
7	Prof. In LIS	01	0.96%
8	Dy. Librarian	01	0.96%
	Total	104	100%

From the collected data 71.15% professionals was librarian and 4% are in Teaching profession, other 25% are other supporting staff of the library and library profession. Librarians are more interested to know the new technique of education and get benefited from it.

Table4 –District wise registration

Sr. No.	District	Registration	Percentage
1	Mumbai	54	51.92%
2	Mumbai Suburban	28	28.92%
3	Thane	22	21.15%
	Total	104	100%

Data collected from the Mumbai region, Total 104 responses collated by the researcher out of it 51.92% responses from Mumbai district, 28.92% from Suburban of Mumbai and 21.15% from Thane district. Mumbai district professionals more restoration than other district of the study.

Table5–Awareness of SWAYAM

Sr. No.	Awareness	No. of participation	Percentage
1	Yes	88	84.62%
2	No	16	15.38%
	Total	104	100%

Table 5 reveled that out of 104 total 88 (84.62%) professionals aware about SWAYAM and its culture and it is positive sign for the study.

Table 6 - Registration on the SWAYAM platform

Sr. No.	Registration	No. of respondent	Percentage
1	Yes	57	54.80%
2	No	31	29.80%
3	Blank	16	15.38%
	Total	104	100%

As mention in table 5 total 88 professionals aware but only 57 (54.80%) professionals register themselves on SWAYAM platform and 31 was not interested to register himself and 16 professionals are already not aware about the SWAYAM platform.

Table 7 Sources use for access the SWAYAM platform

Sr.No.	Sources use for use	No. of. Respondent	Percentage
1	Mobile App of SWAYAM Platform	13	12.5%
2	Website of SWAYAM plat form	54	51.92%
3	Blank	37	35.57%
	Total	104	100%

From table 7 total 54 professionals use SWAYAM platforms website for accessing the courses and 13 from mobile app and other 37 not interested to answer the question.

Table8 -Reason for enroll in the SWAYAM platform

Sr. No.	Enrolment reason	No. of Respondent	Percentage
1	Update the current knowledge on the topic	39	37.50%
2	Development in professional knowledge.	39	37.50%
3	Various Interestedtopics for learning	28	26.92%
4	Free for learning	25	24.03%
5	Learning to digital Mode	25	24.03%
6	Reach geographical boundaries	08	07.69%
7	For a certificate of a course	07	06.73%
8	Pay a nominal exam fee and qualify for the Exam and get the certificate of related course	07	06.73%
9	Could not be afforded to pursue a formal education.	02	01.92%
10	Blank	32	30.76%
	Total		100%

From the table 8 library professionals gives their opinion why they enroll the SWAYAM courses. 37.50% professionals enroll for "Update the current knowledge on the topic" and "Development in professional knowledge" respectively. Below that 26.92% for "various interested topics for learning." Next of it "Free for learning" and "Learning to digital Mode" is 24.03% respectively. From the data we can say that library professionals interested to update their knowledge and also develop the professional knowledge of them.

Table 9 Enrolled or completed on the SWAYAM platform

Sr. No.	Enrolment of Courses	No. of Respondent	Percentage
1	1 Courses	27	25.96%
2	2 Courses	12	11.53%
3	3 Courses	09	08.65%
4	4 Courses	05	04.80%
5	5 Courses	01	00.96%
6	6 Courses	03	02.88%
7	7 Courses	01	00.96%

8	8 Courses	02	01.92%
9	9 Courses	00	00.00%
10	10 Courses	**02**	**01.92%**
	Blank	**42**	**40.38%**
	Total	**104**	**100%**

From the table no 9 it described that 27 professional's enroller completed01 course. Followed them 12 respondents enroll or complete 02 courses. 8 and 9 courses done by 2 respondents respectively. Whereas 09 professionals done 03 courses from the platform. There is no response for 9 courses done by anyone. 42 professionals not showing the interest to give the response to respective question or they are not interested to complete the courses from the SWAYAM platform.

Table 10 Categoriesof SWAYAM users

Sr. No.	User Category	No. of Respondent	Percentage
1	Active Participants=Regular and also participate in all activity of course.	26	25%
2	Drop In=Only enrolled in SWAYAM	17	16.34%
3	Passive Participants=Regular but does not Participate in assignment	13	12.50%
4	Observer=Irregular in course	06	05.76%
5	Blank	42	40.38%
	Total	104	100%

As study the usability of professionals, in table 10 which type of users they are described, 25% of professionals are Active participants they are regular accessing the platform and courses and done all the activity of it. 12.50% respondent professionals are Passive participants which are regular but do not participate in assignment. 05.76% respondent professionals are only observer they are regulating courses and 16.34% respondents are drop in category they can't show interest in the activity of courses.

Table 11 Attitude of Library Professionals on the usage of SWAYAM

Attitude of LIS professional	Strongly Agree	Agree	Neither Agree nor disagree	Disagree	Strongly disagree	Overall Responce
Prefer to use Professional Development	31	34	3	1	0	Agree
Prefer to use Personal up- gradation	31	31	6	2	0	Strongly agree and agree both
Using SWAYAM to enhance efficiency	33	29	6	1	0	Strongly agree
To attend as an option for Refresher / Short term Courses.	25	31	10	1	0	agree
Using SWAYAM to Improve work	23	34	6	4	1	agree
User friendly	25	35	4	3	0	agree
To get certificate	19	32	10	3	3	agree

Table no 11 explore the attitude of professionals from strongly agree to strongly disagree. It provides consolidates the information about the attitudes of library professionals regarding the usage of SWAYAM, categorized into different aspects attitudes toward using SWAYAM is considered such as using it for professional development, personal up-gradation, enhancing efficiency, attending as an option for refresher/short-term courses, improving work, finding it user-friendly, and aiming to get certificates. It clears that professionals are agreed and strongly agree to the overall attitudes which are stated by the researcher.

Table 12-perceptions of use fulness of SWAYAM

Sr. No.	Perception of Use fulness	No. of Participation	Percentage
1	The course is useful for developing an Understanding of the profession	20	19.23%
2	SWAYAM courses enable to develop professional skill	19	18.26%
3	The language used in the text is simple	12	15.53%
4	Professional scan learns their own time and place Through SWAYAM Portal	10	09.61%
5	You will wish to join more MOOC Courses available on SWAYAM Portal	08	07.69%
6	An activity like assignment one comodule is Use full o reactive learning	04	03.84%
7	Abended learning approach of written text, video, lessons and learning exercises was Effective means for self-study	03	02.88%
8	Blank	31	29.80%
	Total		100%

Above table no 12 gives idea about the perception of usefulness of SWAYAM courses. 19% respondents said that it is useful for developing and understanding of the profession knowledge, belowthat18%saidthat SWAYAM courses enable to develop professional skill, 15% said that language used in is so simple and understanding to everyone, nearly 10% professional say that it is use on anytime and anywhere other perceptions like wish to join, blended learning and assignment have quite low responses. 30% of respondent not interested to give the answers of these particular questions.

Table 13 Beforecompleting SWAYAM course knowledge of subject

Sr. No.	Before Subject Knowledge	No. of. Respondent	Percentage
1	More than Basic	26	25%
2	Basic	24	23.07%
3	Just heard about the topic	14	13.46%
4	None	05	04.80%
5	Blank	35	33.65%
	Total	104	100%

Table14-AftercompletingSWAYAMcourse knowledge of subject

Sr.No.	After subject Knowledge	No. of Respondent	Percentage
1	Better understand the subject.	23	22.11%
2	Know more about the subject.	21	20.19%
3	Know a deep knowledge of the subject.	14	13.46%
4	Getting the best knowledge & Practice of the subject.	09	08.65 %
5	Blank	37	35.57%
	Total	104	100%

From the table no 13 and 14 it is clear that 65 % of respondent before the knowledge of the respective course subject was basic (23%), heard about the subject (13%) etc but after the completion of courses 65% of professionals know about the subject more than (20%) they have before like better (22%) and deep (13%), best(10%)understanding of the subject.

Table15-Satisfaction level of SWAYAM Courses

Sr. No.	Satisfaction of SWAYAM Materials	No. of Respondent	Percentage
1	Best	28	26.92%
2	More than best	18	17.30%
3	Good	14	13.46%
4	Moderate	07	6.73%
5	Low	01	00.96%
	Blank	35	33.65%
	Total	104	100%

From the data of table, no 15 shows that the usability of SWAYAM courses and its satisfaction level. 27% of respondents gives "best" satisfaction level 17% professionals gives "More than best" satisfaction level, 13% gives "good" satisfaction level, whereas 7% gives Moderate and only a 1%respondent not satisfied from it and 33% respondent not shoe interest to give ssatisfaction level of SWAYAM courses. It clearly shows that the Usabilityof SWAYAM Courses satisfied the respondent's expectations highly.

Table16 -Reason for not enroll

Sr. No.	Reason for not enroll	No. of Respondent	Percentage
1	I don't know how to enroll	23	22.11%
2	Not Techno-savvy	10	9.61%
3	It stakes so long time for complete of course	16	15.38%
4	Not interested in online learning	08	07.69%
5	Health Issue (Special Retina)	04	03.84%
6	Any other	05	04.80%
		66	63.46%

From the above table 16 it shoes that 60% or more than those respondents not enroll themselves on the platform because of some reasons that is 22% not know to how to enroll, 9% not techno-savvy, 15% due to long period of courses, 7% not interested in online learning, 4% have health issue and some have time and other platform using.

Finding

1. Most of the female library science professional of Mumbai region use the SWAYAM platform for the betterment of the profession.
2. Mumbai was the highest SWAYAM plat form using professionals.
3. The highest number of47 (45.19%) professionals are in age group of 40-50 years.
4. Out of 104 responses 88 professionals heard about the SWAYAM but only 57 (64%) out of 88 registered or enroll themselves on the portal.
5. Out of 88 professionals 52% professionals use Website portal of SWAYAM to access the courses.
6. Most popular reason to enroll in SWAYAM is "Update the current knowledge on the topic" and "Development in professional knowledge" respectively.
7. 25%ofprofessionalsareactivelyparticipatedinSWAYAMCoursestheyare regularly attending the courses and solve the all assignments of courses.
8. Professionals are strongly agreeing to "Prefer to use Personal up-gradation" and "Using SWAYAM to enhance efficiency" attitudes.
9. Most popular perception among the professionals is "useful for developing and understanding of the profession"
10. 65% of professionals agree to they have increase in their knowledge after the completion of courses as compare to previous knowledge they had.

11. SWAYAM Courses average satisfaction level among professionals is "Best".
12. 63% of professionals not enrol themselves on the SWAYAM platform.

Conclusion

SWAYAM is based on MOOC system. It is developed for the welfare for young and aspiring minds of the nation. The study found that professionals are egger to acquiring the knowledge through online courses platform like SWAYAM and develop their professional skill and use these skills in the profession for the development of profession. Need to have plan for more awareness programs for enrolment in SWAYAM platform.

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Exploring the Unexplored Dimensions of Research: A Journey into Altmetrics

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Dr. Subhash Chavan
Dr. Jyoti Bhabal
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Mrs. Prajakta Mhaprolkar

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EDITORS

Dr. Subhash Chavan
Dr. Jyoti Bhabal
Dr. Vrushali Rane

Dr. Nandkishor Motewar
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Dr. Anjali Kale

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Challenges and Opportunities in Adapting Digital Technologies in Libraries

Exploring the Unexplored Dimensions of Research:
A Journey into Altmetrics

Mr. Sagar B. Khatale
Librarian
K.J. Somaiya Institute of Dharma Studies,
SomaiyaVidyavihar University, Mumbai

Prof. (Dr) Ashish S. Raut
Librarian
ShriShivaji College of Arts,
Commerce and Science, Akola

ABSTRACT:

Conventional metrics, such as journal impact factor and citation counts, offer limited perspectives on research impact. Altmetrics, a web-based metric study, has emerged to supplement traditional measurements by providing real-time information on scholarly research's digital platform impact. The reviewed literature traces evolution of altmetrics, highlighting its applications and limitations. The historical development of altmetrics identifies key milestones, from initial signs on social media to standardization efforts and acceptance by publishers. Altmetrics comprise various components, including social media, news coverage, citations, online peer review and multimedia platforms. Data aggregators, such as Altmetric.com, ImpactStory, Plum Analytics and Crossref Event Data, play a vital role in tracking and accumulating altmetrics data. Despite its advantages, altmetrics faces criticisms and challenges, including data reliability, gaming, lack of standardization, and discipline-specific differences. In conclusion, altmetrics offer a valuable tool for understanding research impact in the digital age, however awareness of limitations and continuous improvement efforts are essential for the effective use of these metrics in scholarly and societal communication.

Keywords: Altmetrics, Research, Metrics, Scholarly

1. INTRODUCTION:

Conventional metrics such as journal impact factor and article citation counts play a crucial role in evaluating and assessing research. However, these metrics constitute only a part of the scholarly ecosystem, capturing just one aspect of impact. The influence of research in the academic community is not well represented by these traditional citation metrics, particularly when it comes to scientific communication. The landscape of scholarly research goes beyond traditional metrics as a majority of research outputs are now accessible in electronic formats with user-friendly mechanisms. Monitoring their accessibility, usage and sharing on digital platforms provides a more comprehensive understanding of the reach and impact of scholarly research, extending beyond traditional measures. In recent times, alongside traditional metrics, a new web-based metric study, known as altmetrics, has been developed to evaluate research quality by tracking and measuring the impact that scholarly research gathers on digital platforms.

Altmetrics offer fast and real-time information about an article's distribution across several media outlets, while standard metrics like citation counts and impact factors can only be obtained years after publication. Altmetrics is still intended to supplement conventional measurements, not to completely replace them. Altmetrics are just metrics that go beyond conventional citations. Priem (2014)defined altmetrics as the "study and use of scholarly impact measures based on activity in online tools and environments."NISO(2016) defined"altmetric as a broad term that encapsulates the digital collection, creation, and use of multiple forms of assessment that are derived from activity and engagement among diverse stakeholders and scholarly outputs in the research ecosystem." Bornmann (2014) stated that "altmetric is a term to describe web-based metrics for the impact of publications and other scholarly material by using data from social media platforms." With the aid of persistent identifiers, altmetrics maps the scholarly influence of web-based digital tools and monitors qualitative data that is a supplement to citation-based, traditional metrics.

2. SIGNIFICANCE OF THE STUDY:

Conventional measures such as article citation counts and journal impact factor are typically time-consuming and offer a limited perspective on research impact, focusing on just one aspect. In contrast, altmetrics offer real-time information, presenting a more comprehensive view of article impact. This study aims to review the concept of altmetrics as a method to evaluate the impact of research.

3. REVIEW OF RELATED LITERATURE:

Priem et al.(2010) proposed adopting the term "Altmetrics" in the altmetrics manifesto. The authors claim that in order to choose the most important source from the scholarly literature, the academic community uses filters. Even though the conventional filters are becoming overloaded, the academic community is able to create new filters because of the development of new web tools. These filters are altmetrics, which show how quickly and widely scholarship has an impact. Priem, Groth&Taraborelli (2012) outlined in their paper "The Altmetric Collection" the necessity and significance of citation-based filters in assessing the impact of research. Researchers have indicated that in order to collect data on wider effects and offer more specific information on the scientific system, new procedures and approaches are required. The study and application of scholarly impact metrics based on activity in online tools and environments is known as altmetrics. Most of the time, altmetrics is a subset of webometrics and scientometrics. Alperin (2013) in his insightful study discussed the advantages that both ordinary researchers and emerging nations could benefit from the use of altmetrics. A few creative minds have tried to reinvent scholarly communication by introducing novel metrics called altmetrics. Altmetrics is a useful instrument that gives these alternative scholars an advantage by assessing research that transcends national borders. Cave (2013) reviewed altmetrics and its application and predicted that they will be utilized soon to determine the impact of research on a wider scale. Altmetrics have been made available by publishers and open-source platforms to track the impact of scientific research. There are also a number of subscription-based platforms available that provide altmetrics data. Torres, Cabezas& Jimenez (2013) examined the idea of altmetrics, or alternative metrics, which were brought up by the creation of new Web 2.0 based indicators for the assessment of scholarly work and study. The findings demonstrate that, based on altmetrics, the most cited papers also have the greatest impact. Bornmann (2014) pointed out that while bibliometrics and peer review have become the accepted methods for assessing the impact of research in Science, there is currently no accepted framework for assessing the societal impact of research. Altmetrics is a thought-provoking alternative for evaluating the social impact of research. The definition, categorization, advantages, and downsides of altmetrics for impact measurement were covered by the author. Brigham (2014) explained about the fundamentals of altmetrics and its tools and how libraries can use them. To assess the research or academic influence, conventional assessment techniques like journal impact factor or citation counts have been employed. These are not, however, all-inclusive and accurate research measurement instruments. By monitoring research products such as datasets and software when they are mentioned online, altmetrics are paving the way for a new method of measuring the impact of these tools in addition to article-level metrics. Priem (2014) explored altmetrics, a method for analyzing activity in internet tools and systems to find previously undetectable signs of scholarly impact. A growing number of academics are using internet resources like Mendeley, Twitter, and blogs, which may help us assess the hidden effects that traditional citations ignored. The researcher has defined altmetrics, talked about studies on altmetric sources, and described the applications, limitations and suggested directions for further study. Roemer and Borchardt (2015) discussed a number of crucial topics, such as conflicts and possibilities of altmetrics. Without question, the collection of online data which could contain interactions between the scholarly impact and academic impact is the foundation of altmetrics. The two main points of controversy in the development of

altmetrics are gaming and correlation with bibliometrics. Even with all of the debates and criticism, altmetrics still offer a significant and special chance to close gaps in the scholarly impact. Kumar et al. (2016) examined altmetrics, a new category of alternative metrics for study of web research. The result of increased social media use demands the use of altmetrics, which measures academic content found on web 2.0 social media platforms online. Williams (2017) examined the overview and assessment of altmetrics. This study's main goals were to give a thorough overview and analysis of altmetrics and investigate their significance for researchers, academics and scholars. The concept of altmetrics, how it operates, its typologies, its technological capabilities, its critical evaluation and some prospects for current and future research are all covered in the six sections that make up this study. Nuzzolese et al. (2018) carried out research to investigate the efficacy of altmetrics in evaluating the quality of research. The primary goal of this study was to thoroughly examine whether any correlations exist between traditional (such as citation count and h-index) and alternative (such as altmetrics) indicators, and which of them might be useful for assessing academics. Banshal, Singh & Muhuri (2020) evaluated the efficacy of altmetric mentions' ability to forecast future citations of academic papers using data from ResearchGate and three more social media networks. The study's main goal was to investigate the kind and strength of the relationship between altmetrics and citations utilizing three social media platforms and ResearchGate. Thelwall (2020) examined the benefits and drawbacks of using altmetrics in research evaluation. Altmetrics have the potential to be beneficial for evaluating research since they can show significant non-academic consequences and show impact earlier than citations after an item is released. Frequently, these drawbacks include gaming and their inability to interpret the facts in ways that will have a particular impact. Nuredini (2021) carried out research on altmetrics for digital libraries, looking at its theory, uses, assessment, and suggestions. Researchers investigated altmetrics as a novel way to find relevant articles in the field of economic and business studies literature from a variety of library portals. Khatale and Raut (2024) studied the influence of Indian Library and Information Science journals through altmetric analysis. Web of Science and Altmetric explorer were used to collect the data. Altmetric Attention Score and Citations of scholarly journals are weakly correlated across all studied Indian LIS journals.

4. HISTORICAL DEVELOPMENT OF ALTMETRICS:

Since its conception in early 2010, altmetrics, a relatively new method of assessing the influence and visibility of scholarly work, has gained a lot of interest from the scholarly communication community. Several significant turning points in the history of altmetrics can be identified:

4.1 Initial Signs : The origins of altmetrics in the dissemination of scientific knowledge can be traced from the rise of social media tools like Facebook and Twitter. Scholars started utilizing these platforms for sharing research outputs.

4.2 Altmetrics Manifesto : The term "altmetrics" was first used in 2010 by a group of academics that included Jason Priem, Dario Taraborelli, Paul Groth and Cameron Neylon. Their work, Altmetrics Manifesto, outlined the objectives and guiding principles of altmetrics. (Priem et al., 2010)

4.3 Launch of Altmetric.com : Euan Adie in 2011 launched Altmetric.com, one of the pioneering companies in the field.

4.4 Integration with Research Platforms : As altmetrics gained popularity, more and more research platforms and tools began to include altmetric indicators. In 2011, for instance, the Public Library of Science (PLOS) started using altmetrics.

4.5 Standardization Efforts : A number of standardization projects were launched in order to establish best practices and guarantee the validity of altmetric data. In 2013, the Altmetric Data Quality Code of Conduct was introduced followed by the release of the Altmetrics API.

4.6 Acceptance by Publishers and Institutions : After realizing the value of altmetrics in

assessing the influence of research, academic institutions and publishers began including altmetrics indicators into their assessment procedures.

4.7 Transforming Indicators and Metrics : New metrics and indicators are constantly being added to altmetrics in order to capture all facets of research effect. Data on citations, article downloads, media attention, policy document attention, views and more may be included in these metrics.

Overall, the history of altmetrics illustrates how the subject keeps growing as more people become aware of the shortcomings of traditional citation-based metrics and seek alternate ways to measure the influence of research in the digital age.

5. COMPONENTS OF ALTMETRICS:

Altmetrics create metrics of research output using a variety of data sources. It consists of several elements that provide an exhaustive evaluation of the impact of the research. These components are:

5.1 Social Media Platforms : Altmetrics monitors how research output is shared, mentioned, and discussed on a variety of social media sites, including Pinterest, Google+, Facebook, Twitter, Reddit, and SinaWeibo.

5.2 Coverage of News and Media : Altmetrics take into account the amount of media coverage academic work receives in blogs, online news sources, press releases, publications, and news pieces.

5.3 Bookmarking and Saving tools : Altmetrics count the number of times a scientific publication is bookmarked or saved by users in Mendeley or other social bookmarking apps.

5.4 Citations and Policy Documents : Although they go beyond traditional citations, citation counts are still a part of altmetrics as altmetrics monitor citations from academic databases such as Dimensions and the Web of Science. Altmetrics also track policy documents, wikipedia, patents, clinical guidelines, government reports, etc.

5.5 Online Peer Review and Recommendations : Altmetrics monitors how many reviews or ratings scholarly works obtain on platforms such as Publons, Syllabi, and Faculty Opinions. Positive comments and suggestions could be an indication of the research's influence and impact.

5.6 Multimedia Platforms : Altmetrics also covers non-conventional video-uploading platforms like YouTube. These video-uploading platforms assist scientists, researchers or institutions to disseminate their research in various forms like video lectures, demonstrations, interviews and presentations.

6. ALTMETRICS DATA AGGREGATORS:

According to Karmakar, Banshal& Singh(2021)"An altmetrics aggregator is typically a platform which tracks and accumulates various types of events from different social media, academic social networks and other platforms for scholarly articles." The major data aggregators are represented in Figure 1. KNAW Pure Blog (n.d.)

Figure 1: Altmetrics Data Aggregators

6.1 Altmetric.com : One of the first altmetric data aggregator platforms, altmetric.com was founded in 2011 by Euan Adie and is based in London, United Kingdom. It is a member of the digital science product family and analyzes and tracks online activity and conversations surrounding scholarly outputs. It is a widely used data aggregator tool that tracks and supplies altmetric data of scholarly research outputs.

6.2 ImpactStory : Accoring to ImpactStory (2024)"Impactstory is an open-source website that helps researchers explore and share the online impact of their research." It was originally started as "total-impact", a hackathon project at the Beyond Impact workshop in 2011.

6.3 Plum Analytics : In 2011, Mike Buschman, a former Microsoft librarian, and Andrea Michalek, an entrepreneur, established Plum Analytics. They created PlumX, an analytical tool. (Brigham, 2014)Plum Analytics tracked 67 different types of research outputs which are named as 'artifacts'.

6.4 PLOS Article-Level Metrics : One of the first publishers to implement Article Level Metrics (ALM) for open-access journals was the Public Library of Science (PLOS). Since 2009, PLOS has gathered and presented a variety of metrics for publications; however, as of August 2013, PLOS was using and providing a collection of differently categorized ALM. (Fenner, 2013) In order to track and show article-level metrics for scientific papers, the Open Access publisher Public Library of Science (PLOS) launched Lagotto, an Open Source program, in March 2009.

6.5 Crossref Event Data : The non-profit organization Crossref offers the Crossref Event Data service, which is primarily concerned with making scholarly content discovery and linking possible. A mention in a news article, wikipedia page, blog post, conversation, or comment on social media can all be considered as event. Citations in datasets and patents are another type of event.

6.6 Scholarometer : According toKaur, Radicchi&Menczer(2013)"Scholarometer is a social tool for scholarly services developed at Indiana University, with the goal of exploring the crowdsourcing approach for disciplinary annotations and cross-disciplinary impact metrics. The data collected by Scholarometer is available via an open API."

Most of these altmetric data aggregators are based on a similar philosophy to capture online events around scholarly objects. The researcher must be aware of the scope of the altmetrics data aggregator when choosing one, particularly the research outputs it tracks, the scholarly identifiers it uses, the data collection methodology it employs, and the metrics reporting procedure.

7. BENEFITS OF ALTMETRICS:

Erfanmanesh(2017)Stated "Many advantages of altmetrics over traditional citation-based metrics are there including providing real-time data, broader and more diverse audiences, speed, transparency, greater level of openness and ease of data collection using APIs."Some of the key benefits of altmetrics include:

7.1 Wider Impact Assessment : Altmetrics can measure a more diverse impact of research by considering a wide range of indicators beyond citations. They provide a more thorough assessment of the impact of research by taking into account a range of factors, including downloads, views, social media mentions, saves, and discussions. (Kumar et al., 2016)

7.2 Diversified Involvement : Altmetrics monitors a range of sources, such as online reference managers, blogs, policy documents, news sources, and social media platforms. This enables researchers to be aware of how their work is viewed and disseminated to various audiences, including members of the public, decision-makers, and practitioners.

7.3 Timeliness : Altmetrics can produce real-time data on how research is being received and discussed. Altmetrics provide data that is more up-to-date, indicating influence in days instead of years. (Piwowar, 2013)

7.4 Accessibility and Openness : The majority of the time, altmetrics data is publicly available, encouraging transparency and repeatability. According to Piwowar (2013) "Altmetrics offers a potential impact on diverse audiences including scholars, practitioners, clinicians, educators and the general public" which displays the openness of these metrics.

7.5 Societal Impact : By offering a way to assess the research's wider societal impact and relevance and by helping researchers understand how their work is being accessible and discussed outside of academia, altmetrics increase the reach and influence of research beyond academic

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bounds.

Overall, altmetrics supplement conventional citation-based metrics by offering a quick comprehensive, and varied knowledge of the effect of research.

8. CRITICISMS AND CHALLENGES:

Like any emerging field, altmetrics also face several challenges and criticisms. Commonly observed problems include poor data quality and dependability, the possibility of manipulation of gaming, and the absence of established procedures for analyzing and disclosing altmetrics.

8.1 Data Reliability and Quality : The quality and reliability of altmetrics data range significantly throughout data sources. Data security, privacy and quality are all at risk since some data sources are open to spam, manipulation and inaccurate data.

8.2 Gaming and Bias : Gaming can have an impact on altmetrics since it can artificially increase mentions and engagements in online digital media. Altmetrics could be biased if some research outputs are more likely to be shared, discussed and given more attention than others because they are more relevant, accessible or controversial.

8.3 Lack of Standardization : There is no commonly acknowledged methodology for gathering and analyzing altmetrics data from various sources of information. Setting up standardized metrics is difficult due to the diversity of data, including social media mentions, views, bookmarks and downloads.

8.4 Significant Differences by Discipline : It can be challenging to create inclusive altmetrics that accurately reflect the research impact across all disciplines since different fields have distinct communication and publication strategies. As a result, altmetrics may not capture influence across disciplines in the same way.

There is continuous research and development being done in the altmetrics sector to address these problems and improve the data excellence, dependability, unbiasedness, standardization, and interpretation of altmetrics.

9. CONCLUSION:

As a relatively new technique in metric studies, altmetrics aims to address the drawbacks of traditional citation-based indicators by giving funding agencies, academic institutions, publishers, pharmaceutical companies and corporate R&D departments a comprehensive understanding of the impact and reach of the scholarly works they produce. Over the past decade, altmetrics gained a lot of interest as a way to measure the impact of academic outputs on society in the digital age as well as their wider reach. Altmetrics offer a more comprehensive knowledge of research impact and provide a multidimensional evaluation of research influence by integrating many data sources and capturing attention, engagement and dissemination. However it is essential to be aware of the drawbacks and restrictions that come with altmetrics, such as the possibility for gaming or biases present in online forums. To ensure reliability, it is crucial to develop best practices and improve procedures. In the digital age, altmetrics provide a great way to investigate and understand the shifting dynamics of how research affects scholarly and societal communication.

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Beyond Citations: Unveiling The Influence of Indian Library and Information Science Journals Through Altmetric Analysis

2 authors:

Sagar Khatale
Somaiya Vidyavihar
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Ashish Raut
Shri Shivaji College of Arts, Commerce and Science
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INNOVATIVE TECHNOLOGY AND APPLICATIONS

FOR

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Innovative Technology and Applications for Sustainable Library Services I-KOAL 24

Dr Salek Chand, Dr. Anand A. Jha, Dr Nitin Joshi and Dr Dharmendra Mehta

DISCLAIMER:

Beyond Citations: Unveiling The Influence of Indian Library and Information Science Journals Through Altmetric Analysis

Mr. Sagar Khatale

Librarian, K.J. Somaiya Institute of Dharma Studies, Somaiya Vidyavihar University, Mumbai

Prof. (Dr) Ashish Raut

Librarian, Shri Shivaji College of Arts, Commerce and Science, Akola

ABSTRACT

This study investigates the altmetric visibility of Indian journals within the field of Library and Information Science (LIS). The research focuses on scholarly articles published in Indian LIS journals indexed on the Web of Science. The Web of Science database was used to retrieve the citations of scholarly articles and Altmetric Explorer was used to get the Altmetric Attention Score. Four Indian LIS journals were currently indexed on the Web of Science with the aggregate total of 1602 scholarly articles having Digital Object Identifier. Out of 1602 scholarly articles, 206 (12.86 %) had an Altmetric Attention Score. The findings of this study revealed that the year-wise growth of altmetric attentions to Indian LIS journals was not constant. X previously known as Twitter (92.64 %) was the popular altmetric data source where scholarly articles from Indian LIS journals were mentioned. 'Journal of Scientometric Research' received highest 382 (67.73 %) Altmetric Attention Score with the highest number of 139 (67.47 %) mentioned outputs as scholarly articles. Altmetric Attention Score and citations of scholarly articles have a weakly positive correlation (< 0.2) across all four Indian LIS journals. 'Journal of Scientometric Research' got the highest number 2439 (50.52 %) of Mendeley readers and has received the highest 570 (47.62 %) dimensions citations.

Keywords: Altmetrics, Indian LIS Journals, Scholarly Articles, Web of Science

Introduction

In the contemporary digital era, scholarly communication has undergone rapid and substantial changes. Traditional metrics used to assess the impact of academic research, such as citation counts and journal impact factors, have become inadequate. The proliferation of online platforms and increased accessibility to diverse research outputs has expanded the landscape of scholarly communication. This expansion necessitates alternative methods for evaluating the visibility and influence of scholarly products. In response to this evolution, alternative metrics, commonly referred to as altmetrics, have emerged as a new and complementary approach to assess the broader influence and impact of scholarly work in a more dynamic and comprehensive manner. Altmetrics take into account various social media engagements and online activities within the scholarly community.

Altmetrics encompass a range of metrics designed to gauge and analyze both the societal and academic impact of online attention received by research outputs. In contrast to traditional citation-based metrics, which primarily focus on the academic research impact of scholarly publications, altmetrics provide a broader perspective by incorporating the societal impact as well. "Many advantages of altmetrics over traditional citation-based metrics are there including providing real-time data, broader and more diverse audiences, speed, transparency, greater level of openness and ease of data collection using APIs" (Erfanmanesh, 2017)[1]. Altmetrics track and measure the range of activities which includes downloads, saves, discussions, mentions, bookmarks, media coverage, etc. "Altmetrics offers a potential impact on diverse audiences including scholars, practitioners, clinicians, educators and the general public" (Piwowar, 2013)[2]. Priem (2014)[3] defined altmetric as the "study and use of scholarly impact measures based on activity in online tools and environments." Bornmann (2014)[4] stated, "altmetric is a term to describe web-based metrics for the impact of publications and other scholarly material by using data from social media platforms."

Review of Related Literature

Priem, Groth & Taraborelli (2012)[5] explained the need and importance of citation based filters in measuring research impact in their article 'The Altmetric Collection'. Alperin (2013)[6] in his informative paper mentioned the benefits of using altmetrics by developing countries as well as the common researcher. Traditional citation counting mechanism of counting scholarly impact unfairly and undoubtedly supports those from North America and Europe and ignores the developing world. Roemer and Borchardt (2015)[7] elaborated some important issues, including controversies and opportunities for altmetrics. The foundation of altmetrics is undoubtedly the gathering of online data, which may involve interactions between the scholarly impact and academic impact. Tattersall (2017)[8] explored the opportunities altmetrics offer to library and information professionals as part of their research support provision. This paper examined what altmetrics are and how they can offer another useful metric to help academics engage with a variety of interested parties over the web. Ezema & Ugwu (2019)[9] studied the research impact of Library and Information Science (LIS) journals using Web of Science (WoS), Scopus and Google Scholar (GS) and then examined whether there is a correlation between their citations and altmetric attention. Sankar and Sarangapani (2020)[10] explored the coverage of LIS literature published in 2019. Altmetrics Technique is used to identify the trends in the subject with the primary objective as to know the scholarly communication of LIS Literature on social media and to evaluate the Altmetric Attention Score.

Objectives

1. To analyze year-wise growth of the altmetric attentions that Indian LIS journals received.
2. To identify the highly used altmetric data sources to share research published in Indian LIS Journals.
3. To find out the number of Mendeley readers and number of Dimentions citations that Indian LIS journals received.
4. To examine the correlation between Altmetric Attention Score (AAS) and Citations of scholarly articles published in Indian LIS Journals.

Scope and Limitations of The Study:

The study's focus was confined to journals within the field of Library and Information Science originating from India, specifically those indexed in the Web of Science (WoS) core collection within the Emerging Sources Citation Index (ESCI). Within the Web of Science, the search query was constrained to articles published between 2005 and 2023, each equipped with a Digital Object Identifier (DOI)

Materials and Methods:

1. Data Sources:

"Web of Science (WoS) is the world's most trusted publisher-independent global citation database. Guided by the legacy of Dr. Eugene Garfield, inventor of the world's first citation index, the Web of Science is the most powerful research engine, delivering best-in-class publication and citation data for confident discovery, access and assessment". [11]

"Altmetric.com is a London-based digital science company with a vision to track and analyze the online activity around scholarly research outputs". [12]

2 Data Collection:

Data were collected in two types i.e. primary data and secondary data.

2.1 Primary Data:

The primary bibliographic data of scholarly articles published in the field of Library and Information Science particularly from India were retrieved from Web of Science core collection by using Emerging Sources Citation Index (ESCI) as the related journals are indexed in ESCI. To retrieve the primary data, a structured query was run in Web of Science with the following fields with tags:

- DOI (DO):   10.*
- Document Type (DT):   Article

- Date of Publication (DOP): 01-01-2005 to 25-12-2023
- Publication Title (SO): Collnet Journal of Scientometrics and Information Management or DESIDOC Journal of Library and Information Technology or Journal of Scientometric Research or Annals of Library and Information Studies

Web of Science database was thoroughly searched and found four journals which are originally published from India and are currently indexed in Web of Science have taken into account for this research.

((DO=(10.*)) AND DT=(Article)) AND DOP=(2005-01-01/2023-12-25) AND (SO==("COLLNET JOURNAL OF SCIENTOMETRICS AND INFORMATION MANAGEMENT" OR "DESIDOC JOURNAL OF LIBRARY INFORMATION TECHNOLOGY" OR "JOURNAL OF SCIENTOMETRIC RESEARCH" OR "ANNALS OF LIBRARY AND INFORMATION STUDIES"))

1602 bibliographic records of scholarly articles were retrieved by executing the above query in the advanced search option of Web of Science. (Image 1) The above query was run on 25th December 2023 and all the data was collected on the same date.

Journal Title	Count of Scholarly Articles	Percentage
Annals of Library and Information Studies	252	15.73 %
COLLNET Journal of Scientometrics and Information Management	317	19.78 %
DESIDOC Journal of Library and Information Technology	717	44.76 %
Journal of Scientometric Research	316	19.73 %
Total	1602	100 %

Table 1: Bibliographic Records with Journal Titles
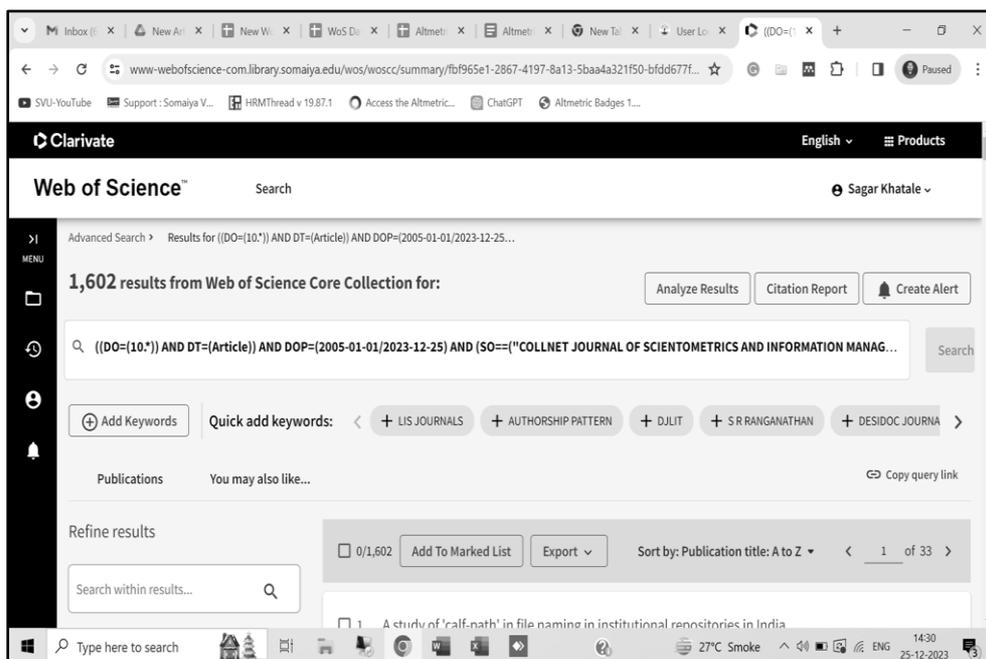
Image 1: Web of Science Search Results

2.2 Secondary Data:

The retrieved primary bibliographic data of 1602 scholarly articles from Web of Science were checked in the Altmetric Explorer. All the DOI's of scholarly articles were added in 'scholarly identifiers' search box available in the 'advanced search' option of altmetric explorer to retrieve the details of scholarly articles tracked by altmetric.com. Out of 1602 scholarly articles retrieved from Web of Science, 246

articles (15.35 %) are tracked by altmetric.com out of those 206 articles (12.86 %) received at least one Altmetric Attention Score. All the details of the 206 articles tracked by altmetric.com were saved in excel file for further analysis.

Scholarly Articles from Web of Science	Scholarly Articles Tracked by Altmetric	Scholarly Articles with Attention
1602	246 (15.35 %)	206 (12.86 %)

Table 2: Altmetric Tracking Details

Data Analysis:

Data retrieved from Web of Science and Altmetric Explorer was further analyzed to get the results of the research.

1 Year-wise Growth of Altmetric Attentions:

From the year 2005 to 2012, there was no significant attentions were received by Indian LIS journals however from the year 2013 the upward trend was seen till 2016. In the year 2017, there was a drastic downward trend was seen. However from the year 2018 till 2021 there was again an upward trend. In 2022 and 2023, Indian LIS journals are getting less altmetric attentions. According to the year-wise data, the growth of altmetric attentions to Indian LIS journals was not constant. (Figure 1)
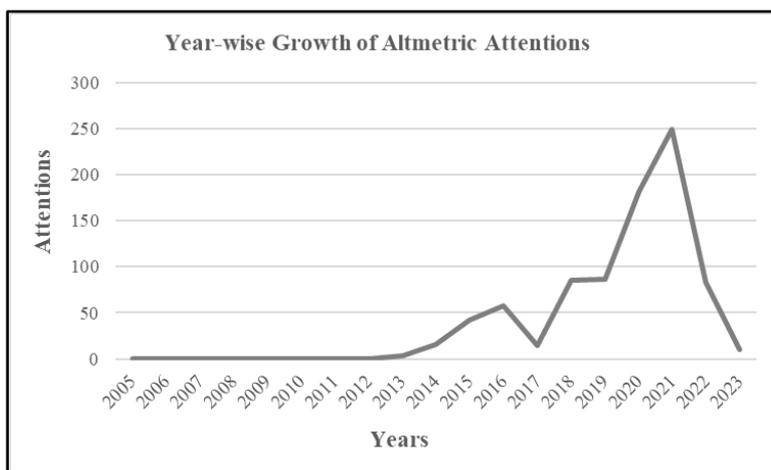
(Source: altmetric.com)
Figure 1: Year-wise growth of Altmetric Attentions

Highly used Altmetric Data Sources:

'Journal of Scientometric Research' has got a decent number of altmetric attentions to its scholarly publications as out of 206 total publications, 139 (67.47 %) are from the same journal and has got 382 (67.73 %) Altmetric Attention Score. Altmetric tracked and got mentions to 33 (16.02 %) scholarly articles from 'COLLNET Journal of Scientometrics and Information Management' with 62 (10.99 %) Altmetric Attention Score. (Table 3)

Journal Title	Annals of Library and Information Studies	COLLNET Journal of Scientometrics & Information Management	DESIDOC Journal of Library & Information Technology	Journal of Scientometric Research	Total
Altmetric Attention Score	7	62	113	382	564
Number of Mentioned Outputs	4	33	30	139	206

Altmetric Data Sources					
News mentions	0	0	0	2	2
Blog mentions	0	1	8	2	11
Policy mentions	0	1	0	0	1
Patent mentions	0	0	4	0	4
X (Twitter) mentions	4	58	47	659	768
Peer review mentions	0	0	1	0	1
Facebook mentions	0	10	0	11	21
Wikipedia mentions	1	1	11	3	16
Google+ mentions	0	1	3	1	5
Weibo mentions	0	0	0	0	0
LinkedIn mentions	0	0	0	0	0
Reddit mentions	0	0	0	0	0
Pinterest mentions	0	0	0	0	0
F1000 mentions	0	0	0	0	0
Q&A mentions	0	0	0	0	0
Video mentions	0	0	0	0	0
Syllabi mentions	0	0	0	0	0
Total Mentions	5	72	74	678	829

Source: altmetric.com

Table 3: Journalwise Altmetric Data Sources

Figure 2 and table 3 shows the highly used altmetric data sources to share the research published in Indian LIS journals. Altmetric tracked 17 different data sources to get the digital footprints of research published. Out of the total data sources, X (Twitter) (92.64 %) was the highly used altmetric data source to share research published in Indian LIS journals. The next highest data source was Facebook (2.53 %) followed by Wikipedia (1.93%), Blog (1.33 %), Google+ (0.60 %), Patent (0.48 %), News (0.24 %), Policy (0.12 %) and Peer review (0.12 %).

(Source: altmetric.com)
Figure 2: Highly used Altmetric Data Sources

Number of Mendeley Readers:

Out of the four Indian LIS journals, 'Journal of Scientometric Research' (50.52 %) got the highest number of mendeley readers. 'DESIDOC Journal of Library and Information Technology' stood second (28.44 %) followed by 'COLLNET Journal of Scientometrics and Information Management' (20.32 %). 'Annals of Library and Information Studies' (0.72 %) got very less readers as compared with other journals.
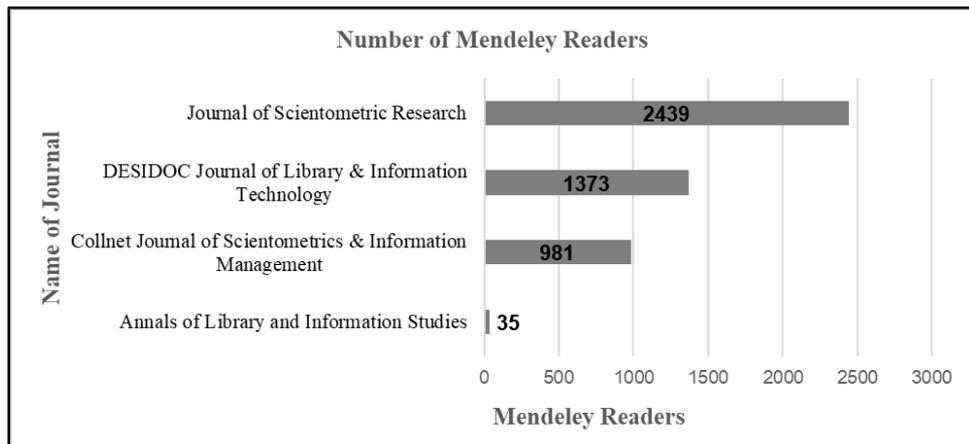
Source: altmetric.com
Figure 3: Number of Mendely Readers

Number of Dimensions Citations:

'Journal of Scientometric Research' (47.62 %) has got the highest number of dimensions citations. 'DESIDOC Journal of Library and Information Technology' stood second (33.00 %) followed by 'COLLNET Journal of Scientometrics and Information Management' (19.30 %). 'Annals of Library and Information Studies' has got only single digit dimensions citation (0.08 %) which was very less as compared with other journals.
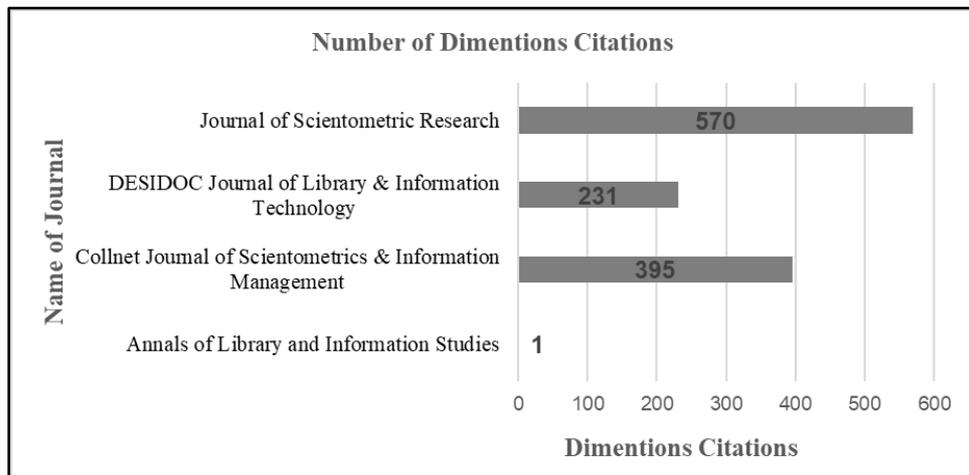
Source: altmetric.com
Figure 4: Number of Dimentions Citations

Correlation between Altmetric Attention Score and Citations of scholarly articles:

Table 4 gives a comparative analysis of four scholarly journals in the field of Library and Information Science in India. The focus is on examining the correlation between the Altmetric Attention Score and citations of articles published in these journals. The correlation values indicate the strength and direction of the relationship of the variables. The Pearson correlation of the two variables i.e. Altmetric Attention Score and citations of scholarly articles was found to be < 0.2 for all four Indian LIS journals. There was a weakly positive correlation between both variables. Researchers and stakeholders in the field of LIS can use this information to assess the impact and attention gathered by scholarly articles in these journals.
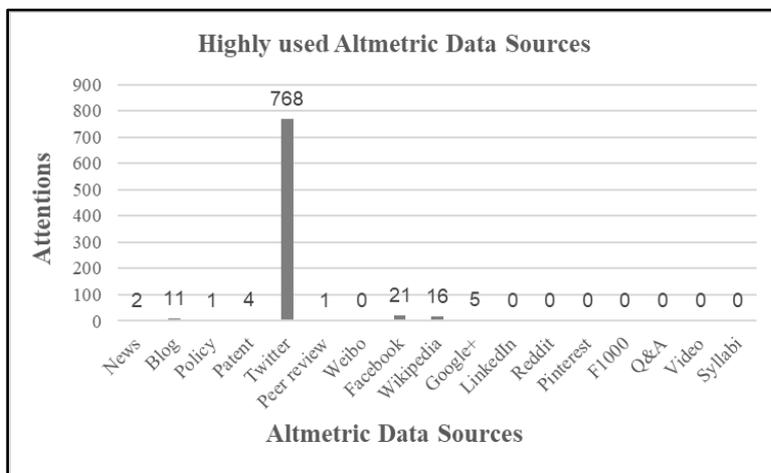
Journal Title	Annals of Library and Information Studies	COLLNET Journal of Scientometrics & Information Management	DESIDOC Journal of Library & Information Technology	Journal of Scientometric Research
Number of Mentioned Scholarly Articles	4	33	30	139
Citations of Scholarly Articles	5	216	128	358
Altmetric Attention Score	7	62	113	382
Correlation	0.169322933	0.281052853	0.273663	0.2682525
P value	0.146429441	1.02687E-05	1.45E-05	2.537E-05

Source: altmetric.com

Table 4: Correlation between Altmetric Attention Score and Citations of Scholarly Articles

Findings

This study investigated the altmetric presence in Library and Information Science journals currently indexed in Web of Science and published from India. Out of the four Indian journals considered in this study, 'DESIDOC Journal of Library and Information Technology' (44.76 %) has got the highest number of scholarly articles indexed in Web of Science followed by 'COLLNET Journal of Scientometrics and Information Management' (19.78 %). 'Journal of Scientometric Research' (67.47 %) followed by 'COLLNET Journal of Scientometrics and Information Management' (16.02 %) has got highest altmetric attentions to their scholarly publications. It was observed that there is no altmetric attention for the scholarly articles before the year 2012 and the year-wise growth in the altmetric attentions was not constant. LIS journals published from India have received attentions from 09 different altmetric data sources. 206 from a total 1602 scholarly articles from all four Indian LIS journals received a minimum one mention on altmetric data sources. X (Twitter) provided the most altmetric data for Indian LIS journals followed by facebook mentions. Except for X (Twitter) 92.64 %, the results showcased the existence of altmetric data on other data sources was very low as all other data sources which includes facebook, Wikipedia, Blog, Google+, Patent, News, Policy and Peer review contributed only remaning 7.36 %. Altmetric data sources like Weibo, LinkedIn, Reddit, Pinterest, F1000, Q&A, Video and Syllabi does not received even one altmetric attention for all the 206 scholarly articles from four Indian LIS journals tracked by altmetric.com.

Mendeley is also an important source of altmetric data. This study examined the Mendeley readership of scholarly articles published in Indian LIS journals. The majority of Mendeley readers referred scholarly publications from the 'Journal of Scientometric Research' as this journal got 50.52 % of the total readership. Dimensions.ai is a platform that provides access to abstracts and citations of a varied range of scholarly research, its data and analytics. Altmetric.com tracks citations data alongwith various data sources however these citations are not a part of Altmetric Attention Score. 'Journal of Scientometric Research' (47.62 %) has got almost half of the dimensions citations selected for the study. All four Indian LIS journals have weakly positive correlation (< 0.2) between Altmetric Attention Score and citations of scholarly articles.

Conclusion

Altmetrics play a crucial role in examining both academic and societal impact on information and knowledge, offering a means to assess the impact of information shared across diverse digital media platforms. Academic scholars should familiarize themselves with the role of altmetrics in research fraternity and incorporate this innovative technique into the research evaluation process. Exploring the Altmetric technique is essential in the current context to analyze the impact of research, not only within the academic community but also in the realm of social engagements.

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Contributors

Mr. Sagar Khatale is a Ph.D. research scholar at Sant Gadge Baba Amravati University, Amravati, Maharashtra, India. He obtained his Master's Degree in Library and Information Science from Savitribai Phule Pune University and also completed Post Graduate Diploma in Library Automation and Networking. Currently, he is working as a Librarian at KJ Somaiya Institute of Dharma Studies, Somaiya Vidyavihar University, Mumbai, Maharashtra, India from the last 10 years. His research interests are Altmetrics, Digital Literacy, etc. He is the first author of this paper and for correspondence he can be contacted at *sagar.khatale@somaiya.edu*

Prof. (Dr) Ashish Raut is currently working as a Librarian (Professor Grade) and IQAC Coordinator at Shri Shivaji College of Arts, Commerce and Science, Akola affiliated to Sant Gadge Baba Amravati University, Amravati, Maharashtra, India. He is a Ph.D. research guide and currently 06 Ph.D. research scholars are registered under his guideship. His area of research interests are Best Practices for NAAC, Cloud Computing, Library Security, Marketing of Library Services, etc. He is the second author and can be contacted at *ashish.satvik@gmail.com*

Empowering Education: An In-Depth Analysis of SWAYAM Initiative in India

2 authors:

Nitin M. Chaware
VPM Kinhavali, Arts, Commerce and Science College kinhavali Tal-Shahapur Dist-...
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Contents

EMPOWERING EDUCATION: AN IN-DEPTH ANALYSIS OF SWAYAM INITIATIVE IN INDIA

NITIN. M. CHAWARE[1] AND ASHISH S. RAUT[2]

1. Research Scholar; 2. Librarian
Shri Shivaji College, Akola, Maharashtra
e-mail: 1. nitvil@gmail.com; 2. ashish.satvik@gmail.com

1. Introduction

In the 21st century, huge developments and high usage of information and communication technology (ICT) in numerous industries. It has brought changes in all the fields of human life. It changes the entire face of the teaching and learning system. Today growing demand for ICT resources in the digital world, the government of India launched the "Digital India" Project in 2016. Most educators, researchers and teachers develop new tools and techniques for the teaching and learning process. New technology has always been of interest to educationalists and students. This Technology is widely used for the betterment of students those who are not admitted to any school or college, those who stay far away or do not attend at a specific time, can listen to their lectures using this technological tool at any place any time. It plays a significant role beyond open and distance learning, academician guidance and teaching the students through these technologies.

"Indian government and its academic agencies have also taken MOOCs seriously and a platform "Study Webs of Active-Learning for Young Aspiring Mind" (SWAYAM) has been launched with ambitious goals by the Government of India, Ministry of Human Resource Development in 2016. Eight National MOOCs Coordinators (NMCs) have been established by MHRD with their prime responsibility being designing, developing, and delivering MOOCs on various disciplines from senior school level to Postgraduate level." (Uppal, Ritu. 2019)

SWAYAM often emphasized open access features, such as open licensing of contents, structure and learning goals to resources. In 2000 changes in online learning, e-learning and distance education, with increasing online presence opened learning opportunities and the development of SWAYAM (MOOC). SWAYAM is based on the principles of Access, Quality, and Equity. It is also based on four quadrants of MOOCs.

2. Aim of the Study

The study aims to conduct a comprehensive analysis of the SWAYAM platform. Through rigorous examination of various aspects of the initiative, its objectives, implementation strategies, accessibility and impact on quality of education. The aim is to contribute to the discourse on digital education in India.

3. Methodology

An online and SWAYAM-learning platform launched by the under the supervision of the Ministry of Human Rights of Government of India. The main objective of the paper is to know the basics of SWAYAM including its functions and features, role and importance. This article is conceptual and covers the basics of SWAYAM, therefore only the official website was used for this study.

4. SWAYAM Platform

SWAYAM stands for "Study Webs of Active-Learning for Young Aspiring Worlds." SWAYAM Platform provides access to quality learning resources across the country. SWAYAM platform provides an integrated and online courses using ICT, for higher education and skill base courses up to high school to enable every student to benefit from learning materials through ICT. The then President of India (Dr. Pranab Mukherjee) launched the SWAYAM portal to provide quality and higher education within the reach of all.

SWAYAM is a....

- One-step interactive e-content accessible via the web and mobile devices for all courses, from higher secondary education to university post graduation level education.
- With the help of multimedia learners have best quality experience on anytime and anywhere.
- Advanced system for easy accessing, monitoring and certification.
- To clear any query peer group interaction and discussion forum established.

A hybrid learning model that improves the quality of teaching in the classroom. **(Gazettes, March 2016)**
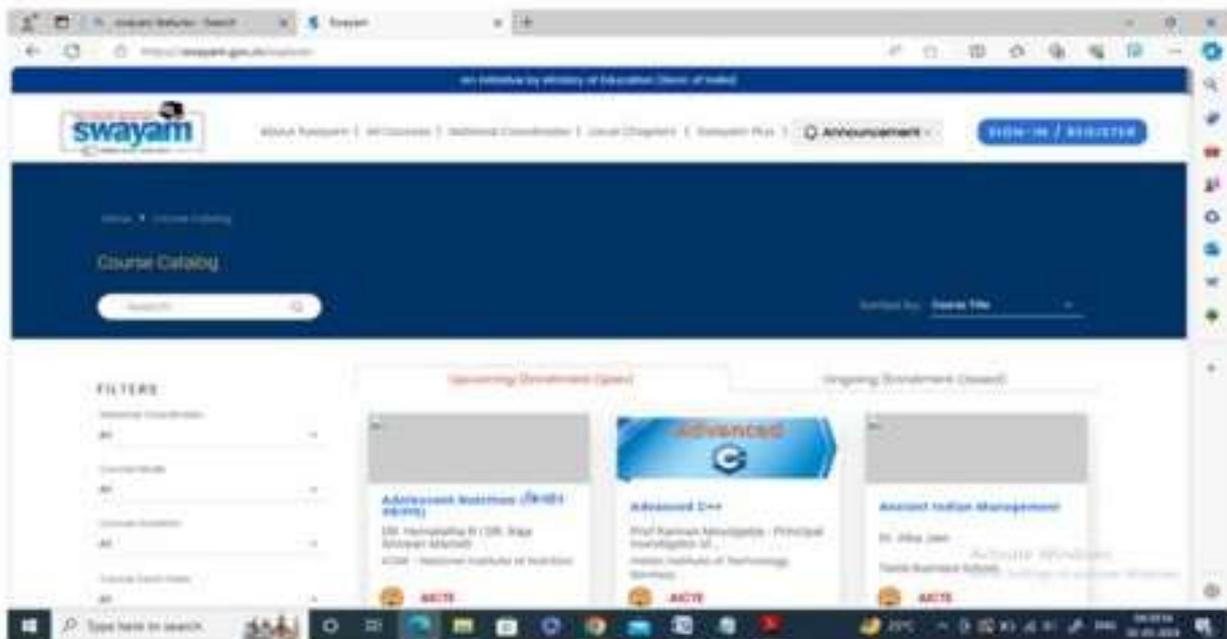
"The Journey of SWAYAM can be traced back to 2003 with the initiation of the NPTEL, (National Program on Technology Enhanced Learning) a joint program on IIT & IIS, this was the first major attempt at E-learning in the country through online web and video courses in Engineering, Science & Humanities streams. The launch of the National Mission on Education through Information and Communication Technology) in Feb 2009." (8th Pan-Commonwealth Forum on Open Learning."(8th Pan-Commonwealth Forum on Open Learning **(PCF8) 27 - 30 November, 2016)**

The Indian government launched the SWAYAM initiative with the goal of achieving the three principles of access, equity and quality in education. SWAYAM is a free and open learning platform for 9th to Postgraduate students. It is based on MOOC guidelines. SWAYAM is an Indian "Massive Open Access Course" (MOOC) for all. SWAYAM developed the program with the help of Microsoft, Ministry of Human Resource Development and AICTE. These efforts aim to make available best teaching resources to all. SWAYAM is a best digital tool for students who have not been touched by the digital revolution and the information economy. https://SWAYAM.gov.in/about.

The UGC has issued rules for universities to grant credit to students who complete courses related to UG or PG degrees on a platform. Students to submit the complete examination marks to the college or university themselves. Every university must ensure that marks obtained by any student are not rejected by any university. Swami starts the course on 1st June and 1st November every year. **(UGC, Circular. 2016).**

4.1) SWAYAM based on 4 quadrants of MOOCs that is...

Government of India issuing the guidelines for the SWAYAM in March 2017, as per the guideline SWAYAM based on 4 quadrants of MOOCS that is shown by the diagram.
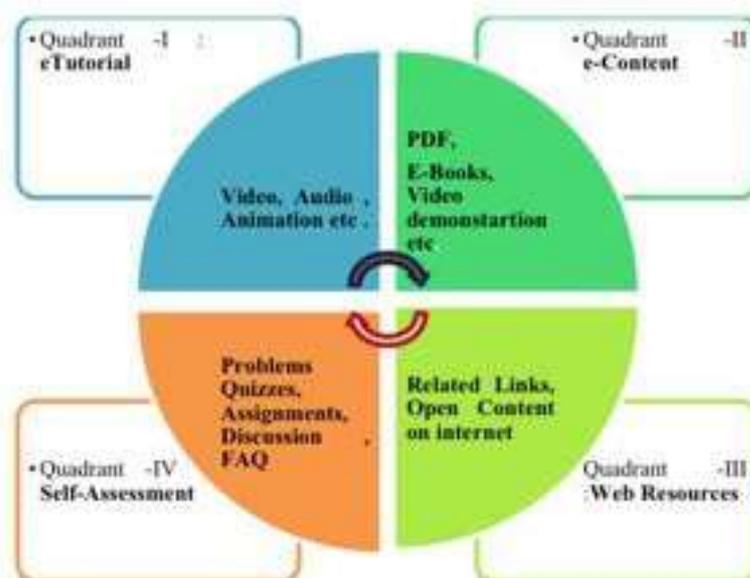
4.2. Nine National Co-ordinatesand distribute its roles and responsibility –

S. N.	National Coordinators	Term	SWAYAM, MOOC Develop for
1.	AICTE	"All India Council for Technical Education"	AICTE take responsibility for international courses
2.	NPTEL	"National Program on Technology Enhanced Learning"	Technical and Engineering courses
3.	UGC	"University Grant Commission"	Related to post-graduation courses
4.	CEC	"Consortium for Educational Communication"	Related to Under-graduate courses
5.	NCERT	"National council of Educational Research and Training"	Secondary School education
6.	NIOS	"National Institute of Open Schooling"	School level courses
7.	IGNOU	"Indira Gandhi National Open University"	Courses develop for non schooling students
8.	IIMB	"Indian Institute of Management, Bangalore"	Management study courses
9.	NITTTR	"National Institute of Technical Teachers' Training & Research"	Professional Teacher Training courses.

From that National Coordinators

➢ "NIOS & NCERT" take responsibility to develop the courses for School Educations
➢ "IGNOU & NITTTR" take responsibility to develop the courses for Out of School Education.
➢ "NPTEL, AICTE, CEC and IIMB" take responsibility to develop the courses for under graduate education.
➢ "NPTEL, AICTE, UGC and IIMB" takes responsibility to develop the courses for Post graduate education. (SWAYAM, 2018).

Students register at SWAYAM to study various courses in different subject areas. Diversity course enrollment reflects student attitudes toward learning in a new open mode of distance learning called SWAYAM (Online Learning System).

5. Why SWAYAM?

The present need of knowledge economy is highly educated people ready to improve their skills through lifelong learning. The advent of ICT connectivity in the form of the internet changed this model significantly, where a teacher can now reach thousands or lakhs of students simultaneously.

5.1) Changing in Technology- Influence of technology in our education

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5.2) Changing in the learner's attitude Learners have ever think quickly their attitude about searching and learning things changes.

5.3) New generation mostly technology savvy- Today learners are more technology savvy they like technological base education.

5.4) For interactive learning- Through technology education process is continuously interactive 24*7

5.5) Changing the approaches- Changing the approaches of government, educators, and learners.

6. Scope of SWAYAM

SWAYAMgives Curriculum and skill based course contents covering 12 disciplines are...

- ❖ ARPIT
- ❖ Architecture and Planning
- ❖ Design
- ❖ Engineering and Technology
- ❖ Health Science
- ❖ Humanities and Arts
- ❖ Law
- ❖ Management and Commerce
- ❖ Math and Science
- ❖ NPTEL Domain
- ❖ School
- ❖ Teacher Education

6.1) Secondary to higher secondary school Education modules for teacher training as well as to help students for understand the subject.

6.2) Skill-based curriculum, which covers both post-high school skills.

6.3) Integrated higher education plans, professional certification programs and advanced courses are offered.

6.4) Courses suitable for students who are lifelong learners.

6.5) Special skills and awareness courses taught, which are not part of any formal education. **(Guideline March 2017)**

7. SWAYAM Outreach as Local Chapter

To take the SWAYAM initiative forward and encourage more students across colleges to participate in this initiative, we are establishing SWAYAM-NPTEL chapters in colleges. With approval from the administration a single faculty from the College who will be our "Single Point of Contact" (SPOC). We will keep the SPOC updated on all the recent NPTEL activities and provide him with data that he can disseminate to the students. He can differentiate between reasonable teachers for different courses, who can ensure that students are dynamic in the course, submit their assignments on time and clarify the questions they have. Students will have a chance to get a certificate from IITs.

8. SWAYAM Outreach as SWAYAM PRABHA 32DTH Channels

Apart from SWAYAM, another platform called SWAYAM PRABHA has also been strengthened to complement the 32 DTH channels; it is dedicated to advanced telecasting and advanced content with free GSAT-15. SWAYAM PRABHA is a program of the Ministry of Education Under government of India. It aims to provide high-quality educational content to students across the country through digital media free of cost. SWAYAM PRABHA runs 24x7 channels dedicated to different topics and broadcasts educational programs and expert talks on various industry topics. These channels include a variety of programs, from school-level programs to higher education, that help students access quality educational resources regardless of their location or socioeconomic status.

9. SWAYAM Outreach as SWAYAM PLUS

In accordance with the Ministry's NEP 2020 education guidelines, SWAYAM must increase the range of courses it now offers in order to find and add courses that improve students' employability and are in line with industry demands. For that on February 27, 2024, SWAYAM Plus" was launched by ministry in partnership with top industry players and ed-tech businesses to provide its students programs that are centered on professional growth and employability.

9.1) Quality learning and certificate programs from the best in industry and academia at affordable prices.

9.2) Employment-focused programs that provide selected future skills in fields.

9.3) Reach a large student body serving learning in different parts of the country with a focus on reaching students in 2nd and 3rd tier cities

9.4) Flexible offerings to meet student needs - across disciplines and opportunities to learn using resources in vernacular languages.

9.5) Access to Indian Knowledge Systems - Systems for Learners Worldwide.

9.6) Access to Indian Knowledge Systems for Learners Worldwide...

Table No 1 - SWAYAM Courses offered from 2016 to 2020.

Sr. No.	National Co coordinator	No of Partnering Institutions	No of Courses Complete	Enroll Students	No of Students register for exam	No of Students qualify for certificate	No of Courses ongoing 10 July 2020	Enroll Students 10 July 2020
1	AICTE	07	132	262041	07	00	70	182053
2	CEC	19	460	822663	13800	8524	127	172672
3	IGNOU	03	73	148027	1485	962	65	50479
4	UGC	133	263	284766	12310	9289	00	00
5	IIMB	03	83	232378	4861	3383	21	44000
6	NCERT	08	80	97547	00	00	31	93469
7	NIOS	01	130	2942319	00	00	44	160623
8	NITTTR	03	49	140574	1561	961	19	17231
9	NPTEL	26	2052	10252010	1187607	631545	418	860342
	TOTAL	203	3322	15182325	1221631	654664	795	1580869

All the nine National coordinators have their Partnering Institutions for developing the courses, No of the Students qualify for certificate-completed courses, enroll students and more table no 1 shows you the full details of it. https://SWAYAM.gov.in/nc_details/

7. INTERPRETATION OF DATA:

From the above table no 1 we clearly know that all the nine national coordinators working well in their respective area and give the open and distance interactive learning to all the learners who wish to learn something with or without admitted in any school or college. The prime Moto of Indians MOOCs, SWAYAM to provide or available various types of courses to everyone at anywhere, in anytime. SWAYAM also provide courses in 8 Language translation facilities through NPTEL.

From the 15 August 2016 to till 10 July 2020 these all Nine National Coordinators creating and developing courses but these all nine coordinators doesn't do bulk work alone there for they have their own partnering institutions. You just see the table above;

SWAYAM in its 04-year journey, it had completed 3322 Courses. National Program on Technology Enhanced Learning (NPTEL) till date (10 July 2020) 2052 Courses Completed successfully it is largest number as compare to other national coordinators, after NPTEL, CEC complete 460, UGC 263, AICTE 132, NIOS 130, IIMB 83, NCERT 80, IGNOU 73 and NITTTR have completed lowest cursed that is 49.More than 1.5 Cr. Students enroll in SWAYAM's various courses offered by national coordinators in this 4 year. NPTEL have largest student enrollment that is 1, 02, 52,010, also largest number of students registered themselves for the examination that is 1187607 and among that 631545 have successfully qualify the certificates of NPTEL.

CEC have 19 partnering institution developed 460 courses second most course developing institution and 2nd most in enrollment of students 822663 for all the courses offered by them, from that 13800 registered for exam and 8524 have got their certificate.

Total 203 Partnering Institution works under in Nine National Coordinators. UGC have largest partnering institution that is 133 because UGC have providing UG & PG level courses therefore they need more helping hands to develop every subject's course for UG and PG students. Thereafter they developed 263 courses which is 3rd rank in nine coordinators and 4th rank in enrollment of student's number 284766. Only 12310 learners register for exam and 9289 qualify for certification.

AICTE have 07 partnering institutions, they developed 132 courses which is 4thplace, 5th rank on total student enrolled 262041, from that only 07 students register for exam and no one got the certificate yet.

NIOScompleted 130 courses which is on 5th place. but third rank in enrollment of students, that is 2942319, but in NIOS no one learner go for registering the exam for certificate because NIOS is for schooling learning e-contend development responsibility.

IIMB on 6th place in Partnering institutions, developed courses and enrollment of students for the courses respectively 03, 83, and 232378. Only 3383 learners qualify for certificate out of 4861 exam registration.

NCERT have 7th place in conducting the courses they had 80 courses completed with 08 partnering institution. 97545 students enroll for the courses but no one registers himSWAYAM for examination for certificate. NCERT is for schooling learning e-contend development responsibility.

IGNOU most recognized distance Education University that also developed the courses for SWAYAM till 73 courses developed by IGNOU, having 3 partnering institutions,which is 8th place among nine coordinators. 148027 student's enrollments for 73 courses, 1485 student's register for exam and 962 qualify for certificates.

NITTTRwhich is last in row for development of courses, NITTR developed 49 courses 140574 learners enroll these courses and only 1561 learners want to give exam and 961 pass this exam and get their certificate.

8. Conclusion

SWAYAM is a platform where we take a part to learn something and teach something to new technological generation. SWAYAM is Indian platform of MOOC. There are so many Courses available free of cost, if you want to get e-certificate you just pay nominal fee and give online exam for it. The Moto of SWAYAM is depending on the success of courses offered by SWAYAM to the learners. As situation we face today, most of the educational institution and educationalist use e-teaching and e-learning platform, on that basis in near future it is compulsory part of our pedagogy system. UGC already implemented in teaching staff's CAS promotion. Now the time is come to make our SWAYAM tech-savvy for the betterment of teaching process. Now the everyone have smart phones they can access SWAYAM on mobile "Anyone who can access Face book, what's apps on their phone can access high-quality SWAYAM courses offered by faculty from CUs, IITs, IIMs, IISERs etc., opening up quality education to the masses". **(Bast, Felix. 2019).**Government of India appoints 9 national Coordinators for inspection and analyzing the courses and material by partnering institution per the norms of 4 quadrants of MOOCs and then permitted to publish the course on SWAYAM platform. SWAYAM definitely change the educational pedagogy in near future. As NEP 2020, Department of Education on 27 February 2024 launch "SWAYAM Plus" for the enhancement of learner's employability.

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Comprehensive Study of E-Waste Hazards and Its Management

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Prof. Dr. Gajanan S. Wajire

Department of Electronics, Shri Shivaji College of Arts, Commerce & Science, Akola - 444003 (M.S.)
e-mail : gsw.741@gmail.com

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Abstract:

Electronic waste, or e-waste, is a rapidly growing environmental concern as technological advancements lead to increased consumption of electronic devices. This research paper aims to provide a comprehensive overview of the hazards associated with e-waste and the various strategies for its effective management. The paper discusses the environmental, social, and health impacts of improper e-waste disposal and highlights the importance of adopting sustainable practices to mitigate these hazards. Also, it focuses on possible remedies to control e-waste.

Now a day, an importance of the new concept 'Work from home' has become a recent hash tag of the world. As a result, the need of all kinds of electronic devices, gadgets and media is consistently growing, which is insisting more burden of e-waste in the world. Thus, e-waste management plays an important role in the process of sustainable development for human as well as environmental issues.

Keywords: E-waste hazards, impacts and strategies, legislations, recycling & disposal.

1) Introduction:

The proliferation of electronic devices in contemporary society has resulted in an alarming surge in electronic waste. E-waste encompasses discarded electronic appliances, gadgets, and equipment, containing hazardous materials that pose significant risks to the environment and human health. This paper addresses the urgent need for a systematic approach to manage e-waste, considering its detrimental effects on ecosystems and public well-being. The concept of e-waste is still new in India, but it is very important and is true need of the hours.

2) Hazards and impacts of E-Waste:

Electronic waste material contents number of toxic and hazardous substances like Tin, Lead, Mercury, Sulphur, Cadmium, Beryllium, Chromium, Americium, plastics and many other oxides. These substances create various environmental problems and damages through emission as well as convention processes. Toxic chemicals from e-waste can pollute the soil, crop and food sources. Also, these are non-biodegradable and causes air & soil contamination as well as pollution. E-waste dumping backyards and nearby places are polluted and causes health hazards to human and animal beings.

Various impacts of e-waste can be listed as below:

i) Environmental Impact of e-waste results in soil contamination, water pollution and air pollution too.

ii) Health Impact on human being due to exposure to toxic substances includes respiratory, reduced fertility, slower growth rate and skin ailments.

iii) Long-term health implications may include liver damage, kidney damage, heart damage, eye and throat irritation.

iv) Social Impact due to informal recycling and its consequences affects the vulnerable communities in various aspects.

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3) E-Waste Management Strategies:

E-waste get generated from various resources and sectors of the society. India is 5th largest E-waste producer country in the world; after China, USA, Japan & Germany. As per the Indian survey of last year, the sector wise percentage of collected e-waste is pictured in following figure-1.
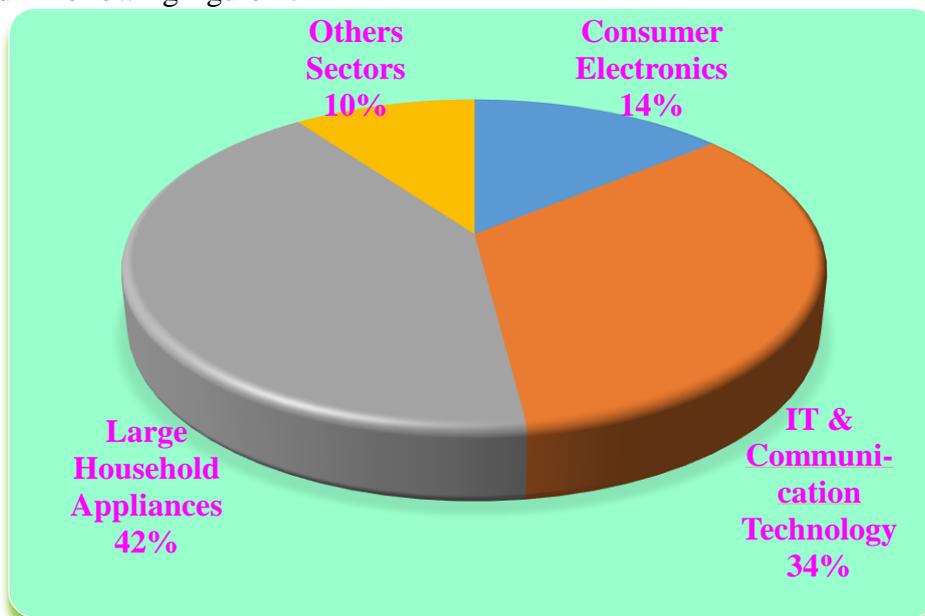
Figure-1: Sector wise percentage of collected e-waste

E-waste management strategy may include following suggested methods:
1) Every manufacturer, dealer & user should adapt proper way of disposal.
2) Collect e-waste & send it to Distributor, Dealer or Manufacturer.
3) E-waste can be send to CSC (Common Services Canters).
4) In India, total 350⁺ CSC are available for such a dedicated purpose.
5) 'Digital India' campaign also adapted 'Digital Cleaning' concept.
6) Recycling tasks should be carried out in eco-friendly manners.
7) Producer should also get-back or by-back used or e-waste products.

4) Legislation and Policies:

As per new e-waste policy producers, dealers and distributers are abide by their mandatory e-waste EPR (Extended Producer Responsibility). There are stipulated international agreements and frameworks for scientific disposal of such materials. Also, the national regulations and enforcement guidelines has to follow at every stage of collection and recycling process.

For reuse and refurbishment of e-waste, the complete chain is promoted by the circular economical distributions. Utmost care and steps are taken for extending the lifespan of electronic appliances and devices. Public awareness, education and outreach programs are to be conducted for promoting responsible consumer behaviour.

5)   Case Studies and Future Perspectives:

Successful E-Waste Management Programs has to be organized and conducted within every country with effective man power and management. Corporate initiatives has to be promoted for responsible recycling and disposal. At every stage, challenges and lessons learned strategies should be identified to avoid barriers to implementation the schemes. Learning from failed initiatives should studied and improvement should be adopted with recurrence.

6

For future perspectives, emerging technologies and innovations in e-waste recycling process should be upgraded with time span. Sustainable, renewable and eco-friendly product materials and designing policy should be implemented. Global collaborations, international cooperations and sharing best practices are needed to avoid the adverse effects of e-waste throughout the world.

6)   Conclusion:
This research paper concludes by emphasizing the critical need for immediate action in addressing e-waste hazards. It advocates for the adoption of sustainable e-waste management practices, including stringent regulations, effective recycling methods, and public awareness campaigns. By comprehensively addressing the challenges associated with e-waste, society can pave the way for a more and more sustainable, eco-friendly and environmentally conscious future.

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Vermicomposting And Its Importance In Improvement Of Soil Nutrients And Agricultural Crops

Dr. Ujwala P. Lande

Assistant Professor, Department of Zoology,
Shri Shivaji College of Arts, Commerce & Science, Akola, (M.S.), India

FULL PAPER

INTRODUCTION

Composting, generally defined as the biological aerobic transformation of an organic byproduct into a different organic product that can be added to the soil without detrimental effects on crop growth [1]. In the process of composting, organic wastes are recycled into stabilized products that can be applied to the soil as an odorless and relatively dry source of organic matter, which would respond more efficiently and safely than the fresh material to soil organic fertility requirements. The conventional and most traditional method of composting consists of an accelerated biooxidation of the organic matter as it passes through a thermophilic stage (45° to 65°C) where microorganisms liberate heat, carbon dioxide and water. However, in recent years, researchers have become progressively interested in using another related biological process for stabilizing organic wastes, which does not include a thermophilic stage, but involves the use of earthworms for breaking down and stabilizing the organic wastes. Composting is a biotechnological process by which different microbial communities convert organic wastes into a stabilized form. During the process, thermophilic temperatures arise because of the heat released due to biological activityThe treatment by composting leads to the development of microbial populations, which causes numerous physicochemical changes within mixture. These changes could influence the metal distribution through release of heavy metals during organic matter mineralization or the metal solubilization by the decrease of pH, metal biosorption by the microbial biomass or metal complexation with the newly formed humic substances (HS) or other factors.

VERMICOMPOSTING

Earthworms are often referred to as farmer's friends and natures ploughmen. Earthworms are extremely important in soil formation, principally through their

activities in consuming organic matter, fragmenting and mixing it intimately with mineral particles to form aggregates. During their feeding, earthworms promote microbial activity greatly, which in turn accelerates the breakdown of organic matter and stabilization of soil aggregates. Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the process of waste conversion and produce a better end product. Vermicomposting differs from composting in several ways. The process is faster than composting because the material passes through the earthworm gut, a significant but not yet fully understood transformation takes place, whereby the resulting earthworm castings (worm manure) are rich in microbial activity and plant growth regulators, and fortified with pest repellence attributes as well in short, earthworms, through a type of biological alchemy are capable of transforming garbage into 'gold'.

Raw materials for vermicomposting

The residues like sugarcane trash, press mud, sugar factory effluent, broiler ash, spent wash, etc, should be bio processed and added to the soil, to complete their natural cycle. Bicycling of these residues through vermiculture biotechnology reduces the use of chemical fertilizers derived from non- renewable sources. "BIOAGRO" compost was produced from the city garbage. By the addition of neem cake, rock phosphate and gypsum in small quantities to this compost "BIOAGRORICH" compost were made. Organic wastes such as poultry manure, cattle dung, pig manure as well as agricultural waste like sugarcane trash were fed to earthworm to hasten the process of decomposition. Karthikeyanet al., reported that the waste consist of decomposable organic matter with high carbon nitrogen ratio. Swati Pattnaik and Vikram Reddy reported that the vegetable market waste is leftover and discarded rotten vegetables fruits and flowers in the market. This urban waste can be converted to a potential plant nutrient enriched resource compost and vermicompost that can be utilized for sustainable land restoration practices.

Microbiology of vermicomposting

Due to inoculation of microorganisms the period of composting was reduced by about 4 weeks. The results also indicate that by utilizing mesophillic cellulolytic fungi, the process of composting a high C/N homogenous material can be accelerated and the quality of the resulting composting can be improved. Various studies also indicated the possibility of augmenting the quality of compost through inoculation with Azotobacter and phosphate solubilizing microorganisms in the presence of rock phosphate.

Edward et al., studies the symbiotic interaction between earthworms and microorganisms in the breakdown and fragment organic matter progressively. The gut isolates included the Actinomycetes, Streptomyces lipmanii and the oxalatedegrading bacterium Pseudomonas oxalaticus and anaerobes have not been enumerated from

the worm gut but several nitrogen fixers (Clostridium butyricum, Clostridium beijerinkii and Clostridium paraputrificum) have been isolated from Eiseniafoetida casts, microbial growth was limited by the amount of available carbon immobilization of phosphate in earthworm casts is probably caused by mainly abiotic processes, carbon mineralization by soil microflora fertilizer with glucose and phosphorous was limited by nitrogen, except in freshly deposited casts.

EFFECT OF VERMICOMPOST MATERIALS IN AGRICULTURE

Vermicomposting is a process of biotransforming and stabilizing organic materials (often waste) into humus by the combined activity of earthworms and microorganisms . Earthworms excrete partially digested materials, known as vermicasts or castings, which are more homogeneous in composition than the source material, have reduced levels of contamination, and contain elevated levels of plant growth regulators or symbiotic microbes and organic acids such as humic and fulvic acids . It also resulted in higher content of phosphorus significantly . The casting by earthworms was seen to improve, the soil organic matter and nutrient status, by recycling available nutrients especially N, P, K, Ca and Mg . Application of coir dust coir pith into soil contributes 20.7 kg N, 10.5 kg, P2O5 and 30.8 kg K2O ha annually. Coir pith being a rich potash source also helps to retain moisture in the soil for a long time.

EFFECT OF VERMICOMPOST ON PHYSICO-CHEMICAL CHARACTERISTICS OF SOIL

The composted organic wastes exert variety of physical, chemical and biochemical influences upon the soil faking the soil a favourable substrate for plant growth. It maintains the soil in a proper homeostaitc state. It also removes excessive amounts of heavy metals such as copper and lead and there by served as a means of detroxification. Kumaresanet al., reported that there was a slight decrease of pH due to the organic acids released during the decomposition of the various farm wastes. The application of organic wastes into soil has considerably increased the available K status also. Application of vermicomposting in combination with NPK fertilizers resulted in higher content of total nitrogen compared to FYM in combination with NPK fertilizers or control. It also resulted in higher content of phosphorus significantly (Kale et al.,).The casting by earthworms was seen to improve, the soil organic matter and nutrients status, by recycling available nutrients especially N, P,

K, Ca and Mg. Application of coir dust coir pith into soil contributes 20.7 kg N, 10.5 kg, P2O5 and 30.8 kg K2O ha annually.

IMPORTANCE OF VERMICOMPOST

Source of plant nutrients Earthworms consume various organic wastes and reduce the volume by 40–60%. Each earthworm weighs about 0.5 to 0.6 g, eats waste equivalent to its body weight and produces cast equivalent to about 50% of the waste

it consumes in a day. These worm castings have been analyzed for chemical and biological properties. Soil available N increased significantly with increasing levels of vermicompost and highest N uptake was obtained at 50% of the recommended fertilizer rate plus 10 t ha -1 vermicompost. Similarly, the uptake of N, phosphorus (P), Potassium (K) and magnesium (Mg) by rice (Oryzasativa) plant was highest when fertilizer was applied in combination with vermicompost.

Improvement of plant growth and yield

Vermicompost plays a major role in improving growth and yield of different field crops, vegetables, and flower and fruit crops. The application of vermicompost gave higher germination (93%) of mung bean (Vignaradiata) compared to the control (84%). Further, the growth and yield of mung bean was also significantly higher with vermicompost application. Likewise, in another pot experiment, the fresh and dry matter yields of cowpea (Vignaunguiculata) were higher when soil was amended with vermicompost than with biodigested slurry.

Role in Nitrogen cycle

Earthworms play an important role in the recycling of N in different agro-ecosystems, especially under jhum (shifting cultivation) where the use of agrochemicals is minimal. Karmegam and Daniel reported that during the fallow period intervening between two crops at the same site in 5- to 15-year jhum system, earthworms participated in N cycle through cast-egestion, mucus production and dead tissue decomposition. Soil N losses were more pronounced over a period of 15-year jhum system. The total soil N made available for plant uptake was higher than the total input of N to the soil through the addition of slashed vegetation, inorganic and organic manure, recycled crop residues and weeds.

Improvement of soil physical, chemical and biological properties.

Limited studies on vermicompost indicate that it increases macropore space ranging from 50 to 500 m, resulting in improved air-water relationship in the soil which favorably affects plant growth. The application of organic matter including vermicompostfavorably affects soil pH, microbial population and soil enzyme activities. It also reduces the proportion of water-soluble chemical species, which cause possible environmental contamination.

CONCLUSION

In recent years, the ecological characteristics and beneficial effects of earthworm have been clearly demonstrated, focused by scientific research. Earthworm's activity influences the rate of soil turnover, mineralization and humification of soil organic matter. Improvement in the consistency of soil texture with a concomitant increase in porosity, infiltration and soilwater retention are other characteristics of worm-worked soils. There are multiple benefits of vermitechnology;

low cost production of biofertilizer, environmental management of solid wastes and agricultural residues, enhanced soil productivity, tastier quality food, among others. Vermitechnology also aids in the reduction of soil salinity, soil erosion with less runoff and wasteland development. From this present review, it is concluded that the organic wastes are effectively recycled by microorganisms followed by earthworms and plays a major role in the development of growth and yield of agricultural crops. The nutritive value of compost material is high and the composting process effectively converts the waste product into useful by-product.

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Optimizing OCR Accuracy for Devanagari Script via improved Preprocessing

Anita B. Dube
Shri Shivaji College of Arts, Commerce and Science,
Akola, MH, India

Abstract :

This paper presents a study on improving the accuracy of OCR systems by using preprocessing techniques to improve the recognition performance of OCR. Devanagari script is one of the most complex scripts in the world. Due to the complexity of the character shapes and the ligatures, OCR systems face a lot of challenges. Different preprocessing techniques are discussed in this paper, such as Binarization, Normalization, and Noise reduction. Phases of Devanagari OCR are also discuss here. It gives an overview of existing preprocessing techniques & their limitations. Also discusses some of the recent techniques for preprocessing of Deep Learning. These techniques are used to improve the OCR accuracy by improving the recognition performance.

The findings of this paper will help to design advanced OCR technology in the field and provide valuable insights to researchers working on natural language processing (NLP) and document analysis.

Keywords:

OCR, Devanagari script, Deep Learning, recognition

1. Introduction :

OCR (Optical character recognition) technology has changed how we process text data. OCR technology is used to convert printed or handwritten text into machine-readable text for processing[1]. The accuracy of OCR largely depends upon the quality of the input text. The input text is affected by many factors like scanner quality, scan resolution, paper quality, font & linguistic qualities[2]. OCR technology has advanced significantly in recent years, especially in its ability to process a wide range of scripts and languages. However, there are still some scripts that pose unique challenges to OCR accuracy. Devanagari is one such script that poses a unique challenge to OCR technology, as it contains a lot of complex characters with ligatures.

The Devanagari script is used for various languages such as Hindi, Marathi, Nepali, Sanskrit language, etc., where characters have various shapes and various connections. The complex structure of the Devanagari script causes problems for OCR systems. It reduces the accuracy and reliability of the text recognition tasks.

To overcome these issues, preprocessing plays an essential role in improving the results of OCR for the Devanagari script. Preprocessing is purifying and standardizing input text data before providing input into OCR engines. There are several steps involved in the preprocessing process, each of which has its specific characteristics.

Some of these steps include: - Normalization-Noise reduction-Segmentation - Feature extraction.

Our research focuses on developing and improving preprocessing methods specifically designed to address the challenges posed by Devanagari scripts. We explore methods for standardizing character representations with the help of Unicode, noise reduction techniques to filter out unnatural elements, segmentation methods to isolate single characters or ligatures, and feature extraction methods to extract pertinent information for recognition.

2. OCR Phases:

Optical character recognition, is the process of converting printed or hand-written text into a machine-readable form. It is essential for the digitization of documents, data entry automation, and text analysis. OCR systems typically consist of a sequence of steps to read and identify characters from input data or documents. The following figure shows the phases of the OCR system.
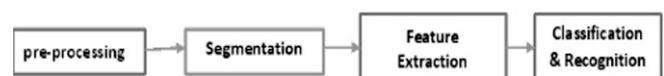
Fig.1 Phases of OCR System

Preprocessing	Preprocessing phases remove noise & unwanted data from image whiteout losing significant information.
Segmentation	The segmentation phase separates text from the image background
Feature Extraction	The process of feature extraction is the process of extracting the relevant features from an object or an alphabet to construct feature vectors.
Classification & Recognition	Image recognition is the process of identifying, classifying, and recognizing an object using different techniques.

3. Preprocessing Techniques

In digital image processing, preprocessing is the process of improving the quality of an image before proceeding to the next task like segmentation, Feature Extraction, and Recognition. The goal of preprocessing is to improve the quality of the image, reduce noise, correct the distortion, and highlight important information so further processing will be simplified. Preprocessing techniques can be applied on color, greyscale, or binary images. As computational cost for processing color images are very high most applications use binary of grey images[3]

Here are some of the most common preprocessing methods:

3.1 Image Binarization:

It is the process of converting grayscale images into binary images. It is also known as thresholding[4]. It is the most fundamental way to separate useful information from the image. Image thresholding can be performed on greyscale images. It can be used to separate foreground from background image. Here each pixel value is compared with the threshold value, if it is less than a threshold then it is considered as zero or a max value of 255.

```
If p (x, y) < Threshold :
P (x, y) = 0
else :
p (x, y) = 0

where
p (x, y) = Pixel Value
```

3.2 Normalization:

Normalization is the process of converting the image into some standard form[5]. Normalization is a technique used to get characters of the same size. This technique drastically reduces the size of data. Character patterns can vary in size. Typically, a fixed size array is used to input data into the recognition system. To make the image suitable for this size, size normalization is necessary. This technique reduces the size of an image without changing its structure[6].It helps to increase the performance of machine learning algorithms as well as improve the efficiency of image processing steps.

3.3 Noise reduction:

The noise in an image can be caused by dirt or random changes in brightness or color information. Noise can also cause the text in the document images to become illegible, which can negatively impact the performance of OCR engines[5].One of the most important preprocessing steps in image processing is noise reduction. Noise reduction is the process of removing or reducing unwanted noise or artifacts (disturbances) from an image. Noise can reduce image quality and interfere with other processing steps such as image segmentation, image feature extraction, or object detection.

3.4 Thinning:

Thinning is the process of reducing the thickness of an object in an image while keeping its shape and connectivity. It is one of the most common morphological operations in image processing. Thinning is often performed as a last step of the preprocessing process[6]. It is used in image segmentation and feature extraction, as well as in pattern recognition. The purpose of thinning is to reduce the number of pixels along the object boundaries of an image.

4. Existing Preprocessing Techniques and Limitations

Binarization	Thresholding[7] Ostu's Method[7] Entropy Based Thresholding[7] Multithresholding Methods[7] Color Based Binarization[8]	If the threshold cannot be selected properly then there may be chances of data loss
Noise Reduction	Median Filtering[9] Gaussian Filtering[9] Mean Filtering[9]	There's a fine line between reducing noise and preserving valuable information. Too much smoothing can blur important details. The filter and parameters can vary from application to application and may need some trial and error.

Normalization	MinMax Normalization[10] Z Score normalization[10] Unit Vector Normalization	Outlier sensitivity can affect normalization, especially with Min-Max scaling.
Thinning	ZS Algorithm[11] Guo & Hall thinning algorithm[12] Hilditch thinning algorithm[12] Rosenfeld algorithm[11]	Thinning algorithms may use over-thinning or under-thinning techniques depending on the characteristics of the image.

5. Challenges for OCR in Devanagari Script[13]

- **Variations in character shapes:** There are variations in Devanagari characters when we consider different fonts[14], styles, shape[15] & handwriting variations.
- **Ligatures & conjunct characters:** Complexity arises in Devanagari script due to ligatures & conjunct characters. These pose difficulty in segmentation & character recognition.
- **Diacritics & Matras:** Diacritics in Devanagari are used to represent the vowel sounds and modifiers in the script. Diacritics are often found near base characters and influence character segmentation & recognition accuracy.
- **Noise & Degraded Text:** OCR in Devanagari suffers from noise, artifacts, and image quality variations, especially in scanned documents and handwritten text [5].
- **Intraclass variability:** Some Devanagari characters have a high intra-class variation where the shape and structure of different instances of the same character may differ.

6. Recent advancement in Preprocessing Techniques:

- **Deep Learning Based Denoising[16]:** Use deep learning denoising techniques like Convolutional Neural Network (CNN) or Autoencoders to denoise Devanagari Text images. CNNs and autoencoders can learn complex noise patterns and denoise images without distorting text.
- **Domain Adaptation[17] :** Use domain adaptation methods to translate OCR models that are trained on scripts or languages from other languages to Devanagari scripts. This can be done by tuning pre-trained OCR models using Devanagari specific data or through techniques such as adversarial training, which aligns feature distributions from source to target domains.

- **Super Resolution Imaging[18]:** Use super-resolution algorithms to improve the resolution of the low-resolution text images. The super-resolution algorithms are based on deep learning architectures, which can predict high-res versions of the low-res images. This can improve the OCR accuracy of the text images by providing more detailed character details.

7. Conclusion and Future Directions

The study shows various preprocessing techniques used in OCR to improve the recognition rates. Also It shows the limitations of existing techniques so there is a need to shift for adapting deep learning approach for better results in recognition.

To sum up, improving OCR precision for Devanagari scripts through better preprocessing involves taking advantage of the latest developments in deep learning and computer vision as well as domain adaptation. The quality of Devanagari texts can be improved before feeding them to OCR models to improve recognition accuracy.

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An Overview of Devanagari Sign Language Using Hand Recognition: Advancement & Challenges

R. S. Kale
Head, Dept. Of Computer Science,
Shri Shivaji College of Arts,
Commerce and Science, Akola, Maharashtra

C. R. Mankar
Research Scholar, Dept. Of Computer Science,
Shri Shivaji College of Arts, Commerce and Science,
Akola, Maharashtra

1. Abstract :

DSL is used for communication between people who have a hearing impairment, with the help of hand gestures and movements they usually communicate, this language of communication is sign language. But when it comes to the communication between these people with others who don't know sign language it becomes problematic. The solution to this problem is to digitalize the Devanagari sign language with the help of the software camera. The hand gestures can be saved in the database, and while communicating the hand gestures can be matched and their meaning can be converted to text for the other persons. This abstract provides an overview of DSL using hand recognition and also highlights the advancements and challenges faced. The findings of this paper will benefit the betterment of such systems.

Keywords :

Sign Language (SL), Sign Language Gesture Recognition (SLGR), Devanagari Sign Language (DSL),

1. Introduction :

Many different sign languages are being used worldwide by specially-abled persons, based on signs and alphabets. There are many SL used in INDIA, in Maharashtra, Devanagari Sign Language (DSL) is one of them.

- Devanagari Sign Language (DSL) : This communication system will help hearing-impaired people to communicate with others who are not aware of DSL. In the Indian region, it helps in conveying messages with the help of hand gestures, expressions, and movements of the body. The recognition of DSL will facilitate communication to be more meaningful between deaf and hearing counterparts. This paper includes literature reviews, Hand Gesture Recognition Techniques recent advancements, and challenges in DSL recognition. The findings of this paper will contribute to the development of DSL Recognition systems to be more accurate and efficient. Some of

the DSL is as shown in the following fig. 1, 2.

fig. 1   fig. 2

1. Literature reviews :

1. The author proposed a framework for SLGR using HamNoSys, its phonetic transcription system for SL, describing the shape of the hand, its position, and movement. According to the author, HamNoSys is useful in designing SLGR because it gives a detailed constant representation of signs. The components of the framework HamNoSys, feature extraction module, and classifier of signs. The evaluation of the framework shows an accuracy of 85% on the Russian Sign Language dataset. It has several limitations as the evaluation was conducted on a small data set and not on other SL.

2. The Author used histogram matching algorithm, for recognizing DSL. It involves steps like capturing the image of a hand with a laptop camera, pre-processing the captured image by morphological operations by extracting the region of the hand, and feature extraction. The obtained histogram is compared with the data set with its similarity. The data set used includes 13 swars i.e. vowels and 33 vyanjans i.e. consonants.

3. Support Vector Machine (SVM) is used for the classification and regression and finds the hyperplane which is a dataset. The author recognizes 15 gestures of the hands, the system shows 94.5% accuracy using the SVM. SSVM is a very effective technique for recognizing the hand gestures used for SL. To improve the accuracy and robustness of the system, variation in hand gestures, background noise, and the limited dataset is needed.

4. The Author used 3DCNN i.e. 3D convolutional neural network, to identify the hand gesture via video recording where ASL for 100 different signs was used. According to the author, the system proposed has achieved 95.5% accuracy, which is promising. There are certain challenges like variation in HG, background noise, and limited size of a dataset which requires addressing.

5. Using MATLAB, image processing is done with a tool box for the tasks like segmentation, extraction of features, and classification. The gesture of hand is recognized from the recorded video. The system will allow communication between the deaf and other people using SL. The results were promising but need improvement when compared to previous studies.

2. Hand Gesture Recognition Techniques :

Some of the commonly used techniques are implemented with hand gestures, kinetic sensors, gloves. The gloves can be classified into wired and wireless one for recognizing the gestures of palm and hand as well. The techniques include region of hand, segmentation,

Sr. no	Method	Parameters	Recognition Method	Accuracy	Remarks
1	Hand Gesture Recognition based on Static Gesture set and HSI and CIELAB colour space	Green Coloured Glove, Skin Colour	Edge Traversal Algorithm		Complex background needed
2	Real Time Hand Gesture Recognition	Skin collector	Scale-Distance	93.8	Real time
3	Hand Gesture Recognition Using Network Space Fitting technique	SGONG network	Likelihood	90.4	Faster with SGONG
4	Finger Earth Mover's Distance with Commodity Depth Camera Technique	Curve of Time series	FEMD	90.6	Scale affiliated

3. Recent Advancements :

- Recognition Techniques : From the study of various researchers, DSL is progressing in techniques like recognizing the gestures with different types and approaches in order to improve the efficiency and accuracy of the system.
- Dataset : The limited dataset is one of the crucial challenges faced, but there is advancement done by increasing size of the dataset to encompass DSL gestures.
- Analysis : Many researchers have performed their research on a specific language, grammar, their syntax and features. The analysis will help in enhancing a unique language system to be developed with more accuracy and efficiency.
- Approaches : Researchers have used different multimodal, but the advancement in integrating the modalities like gestures of hand and their movement, expressions to improve the accuracy of DSL recognition system.

4. Challenges :

1. Variability in Gesture : DSL includes a wide range of gestures that vary from regions, individuals, and contexts. This variety makes it challenging in developing robust and adaptable recognition systems with different signing styles within DSL.

2. Real-time Processing : Real-time recognition of DSL gestures is essential for good communication. Achieving it is a challenge due to its complex nature of gestures, there is a need for efficient processing algorithms with limited resources.

3. Limited Annotated Datasets : Despite the availability of DSL datasets has improved, it lacks in large-scale, annotated datasets. Limited datasets used during training and evaluation of DSL recognition models is a challenge in developing recognition systems with a wide range of DSL gestures.

4. Environmental Factors : DSL recognition systems must be effective in various environmental conditions like lighting conditions, background clutter, and noise. Overcoming these environmental factors and ensuring robust recognition performance in real-world settings is a challenge.

5. User Acceptance and Usability : Developing DSL recognition systems which are user-friendly, accessible is crucial for their world wide acceptance. Overcoming usability challenges, user interfaces and addressing user feedback, is needed for effective deployment and usage of DSL recognition systems.

5. Conclusion :

The research done in the field of DSL in recent years is encountering many challenges like real time processing, limited data set, advancements in developing DSL recognition systems This paper shed light on the current DSL Recognition using hand gesture techniques, from which the new researchers can explore and improve the systems for the communications between the deaf, hearing impaired, and other persons.

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Morphometric Analysis of Pili River Watershed, District Amravati, Maharashtra: A Remote Sensing And Gis Approach

Pratik Nichal
Department of Geology,
Shri Shivaji College of Arts, Commerce and Science, Akola

Pavankumar Giri	**Y. K. Mawale**	**R. S. Jaipurkar**	**G. D. Gaikwad**
Department of Geology, SGB Amravati University, Amravati	Department of Geology, SGB Amravati University, Amravati	Department of Geology, Arts, Commerce and Science College, Chikhaldar	Department of Geology, Shri Shivaji College of Arts, Commerce and Science, Akola

Abstract :

Morphometric analysis was carried out to investigate and control the drainage pattern and characteristics of Pili River Watershed using Remote Sensing and GIS analysis. The study area of Pili River watershed sub-watershed of Sapan River basin in Amravati district of Maharashtra state. The study area has total 341 streams associated with fifth-order of stream sprawling over an area of 121.67 sq. km of which 251 are of 1st order, 66 are of 2nd order, 18 are of 3rd order, 5 are of 4th order, 1 is of 5th order which point out that the highest number of streams are in 1st order and number of stream decreases with increase in stream order. The drainage density of the basin is 2.47 km/km². In the study area value of elongation ratio 0.41 representing that the study area is elongated with moderate relief and steep slopes. Morphometric key parameters like stream order, stream length, bifurcation ratio (4.01), drainage density, stream frequency (2.80), elongation ratio, circularity ratio (0.34), relief ratio (0.04), and compactness constant are calculated. This watershed displays the dendritic to sub-dendritic drainage pattern.

Keywords :

Morphometric analysis, Remote Sensing & GIS tools, Pili river watershed.

Introduction :

Morphometry is defined as the measurement of the shape and mathematical analysis of drainage basin, configuration of the earth surface, shape, and dimension of its landforms (Clarke, 1966). Morphometric studies in the field of hydrology were first initiated by Horton 1940 and Strahler 1950. Geo-spatial technologies, such as Geographic Information Systems (GIS) and Remote Sensing (RS), are efficient tools in delineation of watershed and drainage network for the water resources prognostication and association.

In the current study attempt has been made to investigate the nature and structure of Pili River watershed by put on various morphometric techniques. The morphometric analysis of a watershed affords treasured data about the watershed features, regional topography, drainage pattern, basin geometry, nature of bedrock and groundwater potential zones etc. The drainage basin's morphometric analysis plays a vital role for understanding the hydrological behavior of drainage basin and to analyze flood, geological and geomorphological structure. It is also found to be of enormous value in watershed prioritization and preservation of natural properties at watershed level.

Suggestion of drainage morphometry is very significant in understanding the landform processes, soil physical properties and erosional appearance to be shown. Drainage features of many river basins and sub-basins in different parts of the globe have been studied using conservative methods (Horton, 1945; Strahler, 1957). Geographical Information System (GIS) systems are now-a-days used for evaluating numerous morphometric parameters of the drainage basins and watersheds, as they deliver a flexible environment and a powerful tool for the manipulation and analysis of spatial information.

Significance of the study :

This paper's primary goal is to investigate how the three morphometric parameter qualities aid in the determination of a natural system. The primary goal of the research was to examine the hydrological aspect of the Pili River watershed and how it relates to morphometric analysis. The focus of the investigation has been on identifying the drainage bifurcation systems and their characteristics, as well as on studying all the morphometric parameters of each sub-catchment in relation to the hydrological characteristics of the basin.

Study Area :
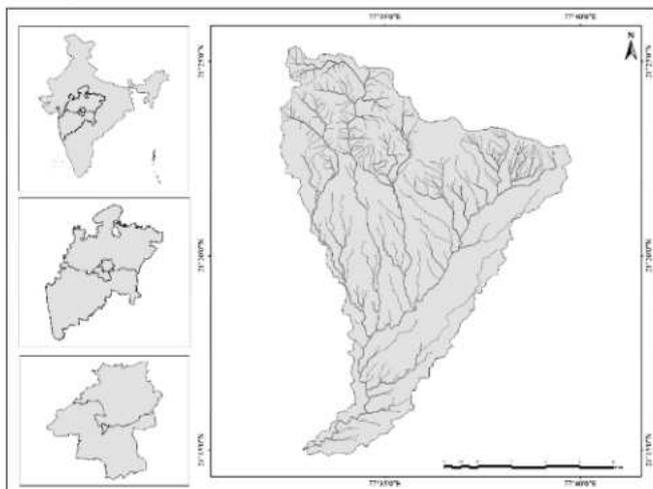
Fig. 1 : Location map of the study area

The study area of Pili river watershed covers between 21^0 15' 00" N to 21^0 25' 00" N Latitude and 77^0 30' 00" E to 77^0 40' 00" E Longitude, falling in part survey of India topographical sheet No. 55 G/11, 55 G/12 on the scale 1:50,000 it covers total area of 121.67 Sq. km includes in Amravati districts of Maharashtra (Figure 1). Geology of the area is mainly covered by basaltic rock at the North Western part and Purna Alluvium at Southern part. The area has suffered a lot by tectonic movement in the past as demonstrated by changing fault and lineament association with hills situated in the North western side of study area.

Database and Methodology :

The area, altitude, volume, slope, profile, and texture of landforms were the major parameters of basin has been analyzed under morphometric study.

The remotely sensed data in the form of SRTM (DEM) satellite imagery having a spatial resolution of 30m and description of the drainage network and conveying the stream order from Survey of India (SOI) topographical map for a large river basin is a tiresome work. Survey of India (SOI) toposheets No. 55G/11, 55G/ 12 on 1:50,000 scale was used as source data. The toposheets are georeferenced and rectified using ArcGIS 10.8.1 software with WGS 1984 datum and digitized the drainage network of the river.

Morphometric Analysis :

Morphometry is the branch of geomorphology. It is defined as the measurement and mathematical analysis of the configuration of the drainage basin. This detailed quantitative method is used to identify the pattern of drainage network, ordering of streams, valuation of drainage length, density, frequency, bifurcation ratio,

etc. These parameters act as a basic tool to establish various statistical relations helpful to explore the basin for its topographical, structural and lithological details.

Good correlations were conventional between the morphometric and the hydrologic characters of the watershed. These were found to be useful for integrated progressive planning of watershed or basin. The use of remote sensing made the task speedier and more reliable. The watershed morphometry of the study area has been worked out to develop relationships between watershed parameters, runoff characteristics, basin shape, sub-soil materials, infiltration and relief characteristics. The morphometric analysis of the watershed was agreed out in terms of the parameters, namely, stream order, stream length, bifurcation ratio, relief ratio, drainage density, stream frequency, drainage texture, form factor, circulatory ratio, elongation ratio is given as follows: The different morphometric parameters have been calculated by using various formulae.

Fig. 2 : Drainage network of study area

Pili River watershed displays very classic drainage texture. Morphometric study of these watershed represents parallel drainage pattern from most of the southern part and some of dendritic to sub-dendritic drainage pattern. However, North-Western area of watershed shows absence of structural controls; rock/sediments of uniform resistance and closely spaced faults; steep topography; non-cohesive sediments.

Linear aspects of the basin :

Linear aspects give the information about one-dimensional parameter like Stream Order (u), Stream Number (Nu), Stream Length (Lu), Mean Stream length (LSM), Stream length ratio (RL), and Bifurcation Ratio (Rb). This specifies channel patterns of the drainage network with the topological characteristics of the stream segments and investigate are based on open links of the stream network. The linear characteristics of the drainage basin are conferred below.

Stream Order (u) :

Classification of streams, based on the number and type of stream intersections is called stream ordering. Arthur Newell Strahler (1918–2002), In 1952 a professor of geoscience at Columbia, allotted an important article entitled "Hypsometric Analysis of Erosional Topography" in Geological Society of America Bulletin 63. Strahler's stream ordering system is based on the stream/tributary relations. The uppermost channels in a drainage network are nominated as first-order streams which is very small and has no tributaries.

When two first-order's stream meet's together a second-order stream is formed, third-order streams are similarly created when two second-order channels join, and so on. But the intersection of a channel with another channel of lower order does not raise the order of the stream below the intersection. e.g., a fourth-order stream intersecting with a second-order stream is still a fourth order stream below the intersection.

The study area has total 341 streams linked with fifth-order of stream of which 251 are of 1st order, 66 are of 2nd order, 18 are of 3rd order, 5 are of 4th order, 1 is of 5th order which specify that the highest number of streams are in 1st order and number of stream diminutions with growth in stream order.

Stream Number (Nu) :

The count of stream network in given order is termed as stream number. The stream number is the number of streams having of numerous orders and it is inversely proportion to the stream order. The number of streams decreases as the stream order increases (Strahler, 1953).

Classification of streams, based on the number and type of tributary junctions is called stream ordering. It is a beneficial indicator of stream size, discharge, and drainage area (Strahler 1964). The stream characteristics authorize Horton's first law (1945), "law of stream numbers", which states that number of streams of dissimilar orders in a given drainage basin tends closely to approximate an opposite geometric ratio. The study area has total stream number is 341.

Stream length (Lu) :

Stream length (Lu) is one of the most significant hydrological features of the basin as it exposes surface runoff characteristics. The stream of comparatively smaller length is characteristics of areas with larger slopes and finer textures. Longer lengths of streams are usually indicative of flatter incline.

The stream length has been calculated on the basis of the Horton's law. In general, the total length of river segment is highest in first order stream since the length is inversely proportional to the stream order. The study area of total stream length is 301 km. The total length of streams segment is maximum in first order stream and decreases as the number of streams of various order in the basin are calculated and their length from mouth to drainage divide are measured with the help of Toposheets and ArcGIS software.

Stream Length Ratio (RL) :

The ratio in between the average lengths of successive orders is stream length ratio (Horton 1945). In the southern semi part of basin large number of small streams are developed where the formations at upstream side and are less pervious stream length ratio of study area (Table 3). Sequence with order number.

Table 3: Stream Order, Number of Stream, and Stream Length

River Basin	Stream order (u)	Number of Stream (Nu)	Total Length of Stream in km (Lu)	Stream Length Ratio (RL)
Pili	I	251	170	3.20
	II	66	53	2.20
	III	18	24	0.70
	IV	5	34	1.70
	V	1	20	
Total		341	301	

Bifurcation Ratio (Rb) :

Bifurcation Ratio (Rb) is defined as ratio of the number of streams of a given order (Nu) to the number of streams of the next higher order (Table 4). Bifurcation ratio characteristically ranges between 3.0 and 5.0 for basins in which the geologic structures is not change the drainage pattern (Strahler, 1964). The bifurcation ratio of Pili River watershed in between 3.80 – 5.00, and the Mean Bifurcation Ratio is 4.01, which designate that the basin is normal and the control of drainage network is mainly definite by geomorphology.

Table 4 : Bifurcation Ratio (Rb)

1st order / 2nd order	3.80
2nd order / 3rd order	3.66
3rd order / 4th order	3.60
4th order / 5th order	5.00
Mean Bifurcation Ratio	4.01

Aerial aspect of drainage basin :

The areal aspect of a drainage basin is the two-dimensional properties of the basin. It includes the clarification of adjustment of areal elements, i.e.,
1) Basin Area (A) 2) Perimeter (P)
3) Drainage density (Dd) 4) Stream frequency (Fs)
5) Constant Of Channel Maintenance (C) 6) Texture ratio (Rt)
7) Elongation Ratio (Re) 8) Circulatory ratio (Rc)
9) Form factor ratio (Rf)

This analysis is very useful for originating the association between stream discharge and area of basin.

Basin area (A) :

Basin area is the direct outcome of the drainage expansion in a particular basin. The area of Pili River Watershed is about 121.67 km. which indicates that rainwater will reach the main channel more rapidly where the water has much further to travel (Table.5).

Drainage density (Dd) :

Drainage density is distinct as a ratio of total length of all streams to whole area of basin (Horton, 1932). It is important factor for sign of landscape separation and peak runoff potential of basin. Pili River Watershed is 2.47 km/sq km (Table.5).

Drainage density is measured to be an important index; it is a measure of the texture of the network, and designates the balance between the erosive power of overland flow and the resistance of surface soils and rocks.

Stream frequency (Fs) :

The stream frequency of the basin is the ratio of the ratio of total number to the basin area (Horton, 1945). It is a good indicator of drainage pattern. Stream frequency has been calculated by the number of streams divided by the total area of basin in sq. km. It is mainly depending on rainfall and physiography of the region. The Stream Frequency of the Pili River Watershed is 2.80 (Table.5).

Constant of channel maintenance (C) :

Drainage density is the inverse of constant channel maintenance (Schumm, 1956). Therefore, the lowers of constant channel maintenance are higher the drainage density and vice versa. Regarding the Pili River Watershed, the average constant of channel maintenance is 0.40 (Table.5).

Texture ratio (Rt) :

The Perimeter of watershed is a ratio of total number of first order streams and The ratio depends on the underlying lithology, infiltration capacity and relief aspect of the terrain. It is the ratio of total stream numbers to the total perimeter of the basin (Horton, 1945). Texture ratio of the Pili River Watershed is 3.78, which indicate fine texture and area under high relied and steep slopes (Table.5).

Elongation ratio (Re) :

Elongation ratio is definite as the ratio of diameters of circle of same area as the basin to the maximum basin length (Schumm, 1956). Strahler (1952) states that elongation ratio runs between 0.6 and 1.0 over a wide variety of climatic and geological types. The Elongation ratio of the Pili River Watershed is 0.41, which indicate basin is highly elongated. (Table 5).

Circulatory ratio (Rc) :

Miller (1953) defined a dimensionless circularity ratio as the ratio of basin area to the area of circle having the same perimeter as the basin. He described the basis of the circularity ratios range 0.4 to 0.5 which indicates strongly elongated and highly permeable homogenous geological materials. The circularity ratio value 0.34 of the Pili River watershed corroborates the Miller's (1960) range, which indicates that the watershed is less elongated in shape, moderate discharge of runoff and permeability of the subsoil condition.

Form factor ratio (Rf) :

Form factor may be delineated as the ratio of basin area to square of the basin length (Horton, 1932). The form factor value would vary between 0 and 1 and may always be less than 0.754 for a perfectly circular watershed. Higher value indicates circular shape while lower value shows elongated shape of the basin. Form Factor of Pili River watershed is 0.42 that's gives some elongated shape.

Table 5 : Aerial aspect of drainage basin

Parameters	Calculated Value
Basin Area (A)	121.67 sq. km
Perimeter (P)	66.39 km
Drainage Density (Dd)	2.47 km
Stream Frequency (fs)	2.80
Constant of Channel Maintenance (C)	0.40
Texture Ratio (Rt)	3.78
Elongation Ratio (Re)	0.41
Circulatory Ratio (Rc)	0.34
From Factor Ratio	0.42

Table 6 : Relief aspects of drainage basin

Morphometric Parameters	Calculated Value
Maximum Elevation in The Area (mts)	1038 m
Minimum Elevation in The Area (mts)	350 m
Basin Relief (mts)	688 m
Relief Ratio (Rh)	0.04
Ruggedness Number (Rn)	1.69

Relief aspects of drainage basin :

The above mentioned Linear and Areal features is measured as dimensional aspects, a river basin mostly deals with the length and width related parameters. Beside these two parameters there are one more important aspect which is related to the height/elevation of the basin. This third dimension is the concept of relief. It plays an vital role in determining basin drainage systems - the effectiveness of erosion, transportation, and deposition, etc.

Relief aspect is represented by following parameters :

- Basin Relief (Bh)
- Relief Ratio (Rh)
- Ruggedness Number (Rn)

Basin relief (H) :

Basin relief is the difference in elevation between the maximum elevation (1038 m.) and minimum elevation (350 m.) of the basin. It controls the slope of basin. Thus, the run-off and sediment transportation rate also depend on it.

Low value of basin relief shows low run-off, low sediment transport, and scattering of water within the basin. Opposite circumstances are found in basin of high relief. The vertical distance modification between point of and is the relief of basin. The basin relief of Pili River Watershed is 688 meters.

Relief ratio (Rh) :

When basin relief (H) is divided by maximum basin length (Lb) gives the relief Ratio of Pili River Watershed is 0.04, which Specifies that the basin has strong relief and sheer slope.

Ruggedness number (Rn) :

Strahler (1968) designates ruggedness number as the product of maximum basin relief and drainage density. It generally combines slope sheerness with its length. Extremely high values of ruggedness number occur when slopes of the basin are not only sharper but long, as well. The ruggedness number of Pili River Watershed is 1.69.

Summery & Conclusion :

This study facilitated me to know the influence of Morphometric, tectonic and erosional control in the progress of landforms by studying the various parameters (linear, areal and relief) of the Pili River Watershed. The order wise stream number and length displayed that the maximum frequency of first order streams decreases as the stream order increases. This is because of the occurrence of structures like fractures, joints, cracks etc. in the higher influences of the study area. The results of bifurcation ratio presented that basin has knowledgeable less structural complexity and differential uplift rates accompanying with tectonic uplift.

The slope of the watershed varies from 0° - 47°. The watershed has a very gentle slope of north-western area. Pili River Watershed illustrations very classic drainage texture. Morphometric study of these watershed signifies Parallel Drainage Pattern of most of the area's southern part and some of dendritic to Sub-Dendritic Drainage Pattern of North-Western area of watershed. The larger number of first order streams points to uniform lithology and noble slope gradient. The bifurcation ratio of the Pili River watershed is 4.01 which specify that the basin is normal and the control of drainage network is mainly noticeable by geomorphology.

Drainage density, quantified as the length of drainage channels per unit area of the basin helps in well interpretation of the hydrological data of Pili River. Pili River watershed possess high drainage density which is suggestive of permeable material. Circularity and elongation ratio shows that the basin has some elongated shaped. The morphometric parameters consequential with the help ASTER or SRTM based DEM data through GIS techniques delivers an identical significant inputs for watershed arrangement and planning.

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"Dynamic LULC Analysis of Dnyanganga Wildlife Sanctuary and Botha Forest Using GIS and Remote Sensing: Implications for Biodiversity Conservation"

G. D. Gaikwad	Zaid Imran Ahmed	Siddhant R. Lahase	P. M. Giri
Shri Shivaji College of Arts, Commerce & Science, Akola (MS), INDIA.	Shri Shivaji College of Arts, Commerce & Science, Akola (MS), INDIA. Zaidimranahmed01@gmail.com	Shri Shivaji College of Arts, Commerce & Science, Akola (MS), INDIA.	Shri Shivaji College of Arts, Commerce & Science, Akola (MS), INDIA.

Abstract :

Land Use and Land Cover (LULC) mapping, influenced by diverse natural and anthropogenic factors, undergoes continual changes over time. In response to the depleting tropical forest resources, there is a growing interest in natural forest management to enhance profitability while conserving biodiversity. This research utilizes remote sensing data, and ArcGIS, Global mapper software's for forest mapping. The study area encompasses the Dnyanganga Wildlife Sanctuary, characterized by diverse flora and fauna. The primary objective is to investigate the entire area, emphasizing wildlife development within the sanctuary. Utilizing a multidisciplinary approach, the research integrates geospatial technologies, including Geographic Information System (GIS), to assess the Land Use and Land Cover patterns.

The study zone, centred around Botha village in Khamgaon tehsil, Buldhana district, Maharashtra, is renowned for its successful implementation of the Joint Forest Management Programme. The village, located at the periphery of the Dnyanganga Wildlife Sanctuary, relies on the forest for livelihood and sustenance. The forest area, classified as a Class A forest, covers various tree species, supporting a tribal population engaged in agriculture and livestock rearing. Ethno botanical surveys were conducted to identify medicinal plants, revealing a rich diversity of flora with potential economic value. Chemical analysis of these plants could further unveil their nutritional and medicinal properties. The research underscores the importance of sustainable forest management, proposing strategies such as supporting secondary forest management, land restoration, and accounting procedures reflecting the true value of natural forests. The Botha Reserve Forest in Maharashtra emerges as a botanical treasure, providing valuable insights into biodiversity. The study concludes by emphasizing the significance of protected areas for environmental sustainability.

Keywords :

LULC, Geographic Information System, Sustainable Forest Management, Hyperspectral Imagery, Protected Areas.

Introduction :

This study focuses on the Dnyanganga Wildlife Sanctuary, a protected area located in the Buldhana district of Maharashtra, India (Read, et al., 2016). Established to conserve the region's unique biodiversity, the sanctuary encompasses diverse flora and fauna, including leopards, sloth bears, and over 150 bird species (Salve et al., 2015). Forests play a crucial role in maintaining ecological balance and supporting global biodiversity (Patil et al., 2017). They act as vital carbon sinks, mitigate climate change, and provide essential ecosystem services for human well-being (Singh et al., 2018). However, anthropogenic pressures such as deforestation and habitat fragmentation pose significant threats to forest ecosystems worldwide (Salve et al., 2023).

This research aims to investigate land use and land cover (LULC) changes within the Dnyanganga Wildlife Sanctuary and surrounding areas (Kazi et al., 2012). By employing remote sensing and Geographic Information Systems (GIS) techniques, the study seeks to quantify and analyze LULC changes over time (Attri et al., 2015), particularly focusing on forest cover dynamics, assessing the potential drivers behind these observed changes, including anthropogenic activities and to evaluate the ethno botanical and hydrological significance of the Botha forest, a crucial resource for local communities (Shrikrushna et al., 2019). This comprehensive approach will provide valuable insights into the ecological status of the Dnyanganga Wildlife Sanctuary and contribute to the development of sustainable management strategies. The findings are expected to be of significant interest to researchers, policymakers, and conservationists committed to preserving the ecological integrity of this vital ecosystem and similar protected areas globally (Das et al., 2016).

Study Area :

The focal point of this research is Botha, a diminutive village situated in the Khamgaon tehsil of the Buldhana district in Maharashtra, India (Shegaokar et al., 2017). Notably, Botha has gained prominence due to its noteworthy accomplishments in the Joint Forest Management Programme in Maharashtra (Saigal et al., 2003), spearheaded by the dynamic Forest Officer, Dr. Mohan Jha. Botha falls within the jurisdiction of the Khamgaon Range in the Buldhana Forest Division and is classified as a Class A forest, spanning an expansive area of 1510 hectares. This village is strategically positioned on the periphery of the Dnyanganga Wildlife Sanctuary, with a substantial portion of the conserved forest area seamlessly integrating with the sanctuary (Ghate et al., 2000).

The vegetation composition within the woodland is characterized by a diverse array of tree species, prominently featuring ain, dhavada, palash, and teak (Gawande et al., 2022). The demographic landscape of Botha encompasses a population of 270 individuals, distributed across 63 households (Kulkarni et al., 1980). The inhabitants predominantly comprise Mahadeo Koli tribals and individuals from scheduled castes (Maske et al., 2011). Covering a total geographical expanse of 1662 hectares, Botha faces a socio-economic fabric where 49% of the populace grapples with landlessness, while the remaining 51% are engaged in marginal farming activities, predominantly cultivating crops such as paddy and nachani (Nagarju et al., 2017). Livestock rearing is an integral component of the local economy, with a total livestock population of 388, encompassing 267 cows, 40 buffaloes, 81 bullocks, and a modest presence of sheep and goats (Mohan et al., 2000).

The symbiotic relationship between the villagers and the forest is evident in their dependence on the woodland for essential resources (Haripiya et al., 2008). Both fuel wood and fodder are extracted from the forest, with the latter not merely serving domestic needs but also contributing significantly to the villagers' economic sustenance. Noteworthy among these forest resources are the leaves of anjan, a high-value fodder, fetching a commendable market price (Raidel et al., 2015). Of paramount importance, a subset of villagers engages in the collection of medicinal plants from the forest, underlining the region's potential as a repository of botanical diversity (Panigrahy et al., 2010). Furthermore, the forest serves as a grazing ground for cattle, further exemplifying its multifaceted role in the local ecosystem.

Despite the ecological significance of Botha, it is noteworthy that the current forest cover, constituting 23% of the total geographical area, falls considerably short of the recommended 33% stipulated by the Indian

National Forest Policy (Joshi et al., 2011). This discrepancy underscores the urgency for meticulous and precise forest mapping (Chuivieco et al., 1996), a gap addressed by national-level initiatives, such as those conducted by the Forest Survey. In summary, Botha stands as a microcosm encapsulating the intricate interplay between human populations and forest ecosystems, accentuating the imperative for comprehensive research endeavors to inform sustainable conservation strategies.
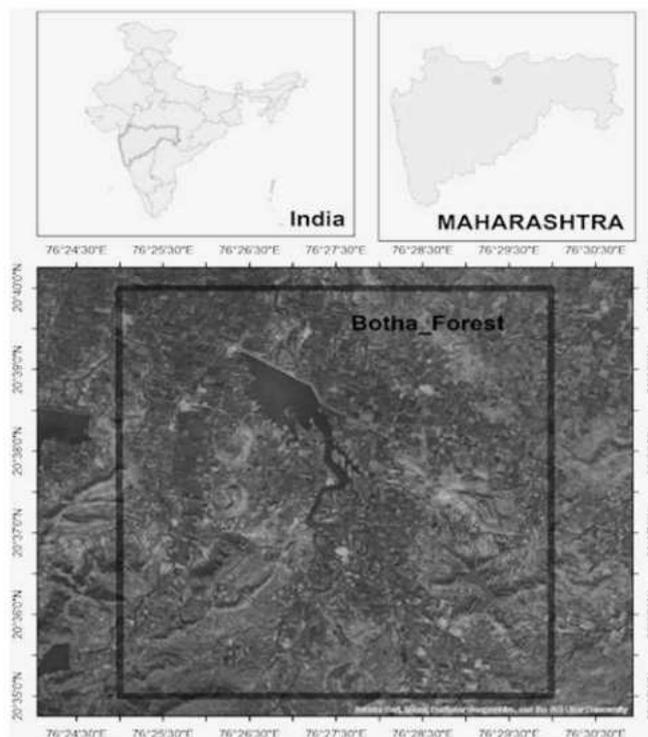
Fig. 1.0 : Study Area

Methodology :

In this study, a comprehensive approach is adopted to assess and manage the forested areas in Buldhana District, Maharashtra, utilizing advanced Remote Sensing (RS) and Geographic Information System (GIS) techniques (Kayet, et al., 2021). The research design follows a systematic framework for data collection, processing, and analysis, with a focus on developing a detailed Forest Management plan (Choudhary, et al., 2020). The study period spans from 2002 to 2021, utilizing Landsat Thematic Mapper (TM) and LISS-III satellite imageries (Nikhl, et al., 2021). Primary and secondary data sources, including fieldwork, satellite imagery, toposheets, maps, census data, and Land Use Land Cover (LULC) data, are incorporated to ensure a holistic understanding of the study area (Dakey et al., 2023).

The data collection process involves extensive field surveys, authentic data gathered through questionnaires, and the utilization of high-resolution satellite

images such as Landsat TM and LISS-III (Shirbhate et al., 2007), along with open-source satellite images and Google Earth imagery for cross-validation (Musavi et al., 2016). Toposheets from Survey of India, DHYAN GANGA FOREST maps, and relevant topographic maps are essential references, while demographic data from census records and LULC data from ESRI contribute to a comprehensive analysis of land changes (Ingale et al., 2020). The digitization process using Arc GIS 10.8 converts raster data into vector format, enabling an accurate representation of geographical features through a step-by-step process, from creating shape files to digitizing features and saving edits (Joshi et al., 1974).

Remote Sensing and GIS techniques play a crucial role in forest management, addressing aspects such as fire prevention, monitoring, biodiversity conservation, and resource assessment (Rogan et al., 2006). GIS is employed for accurate spatial data collection, analysis, and decision-making, while RS devices, satellite imagery, land detecting devices, and aerial photography devices are utilized to create comprehensive databases for forest management. GIS tools are also instrumental in working plan preparation, ensuring sustainable forest management. In conclusion, this research methodology integrates fieldwork, satellite imagery, and GIS techniques, providing a systematic and multi-faceted approach to assess and manage forested areas in Buldhana District. The application of RS and GIS technologies ensures accurate data representation and facilitates informed decision-making for sustainable forest management.

Fig. 1.1 : Road Network

Unsupervised classification map of 1992 :

This section presents a comprehensive land use and land cover (LULC) analysis of the Dnyanganga forest utilizing unsupervised classification techniques applied to remotely sensed imagery acquired in 1992. Unsupervised classification, as a data-driven methodology, facilitates the grouping of pixels with similar spectral characteristics into distinct classes without a priori knowledge of specific land cover types (Oyekola, et al., 2018). This approach proves particularly advantageous in ecological studies where detailed ground truth information may be limited (Lemenkova, et al., 2021). The unsupervised classification procedure for the Dnyan ganga forest identified several key LULC categories, each contributing to a nuanced understanding of the ecosystem's composition. The Vegetation class incorporates diverse plant communities exhibiting similar spectral reflectance, potentially encompassing grasslands, shrubs, and low-lying vegetation. Agriculture, as a distinct class, denotes areas actively cultivated for agricultural purposes, aiding in the delineation of human-induced land use changes within the forest boundary.

Fig. 1.2 : Unsupervised Classification 1992

The Deciduous class signifies areas likely dominated by deciduous trees, revealing distinct spectral signatures that may vary seasonally (Erosmiah et al., 2023). This classification sheds light on the temporal dynamics (Sibato et al., 2018) of vegetation within the forest, contributing crucial information for ecological assessments. The Water Body class encompasses both permanent and temporary water bodies, such as lakes, rivers, and streams (Selva et al., 2023), providing insights

into the spatial distribution of aquatic features within the forest landscape (Rozenstein et al., 2011). The unsupervised classification methodology applied in this analysis contributes valuable insights into the heterogeneity of land cover types within the Dnyanganga forest, serving as a foundation for further studies in biodiversity conservation and ecosystem management (Shekar et al., 2023). The flexibility of unsupervised classification makes it a suitable tool in scenarios where detailed ground truth information is scarce (Ismail et al., 2020), emphasizing its utility in advancing our understanding of complex ecological systems.

Table 1.0 : LULC Classification 1992

LULC Categories	Calculation Area(Sq.M)	Percentage (%)
Vegetation	39539974.22	48%
Agriculture	13773708.76	17%
Deciduous	2265944.91	6%
Water body	15758675.44	19%
Forest	40539777.33	55%
Mangrove	12235654.22	10%

Unsupervised classification of 2021 :

In the examination of change detection using multi-temporal datasets for the year 2021, the unsupervised classification method was employed to discern alterations in land cover over time (Waman et al., 2020). This approach, widely utilized in remote sensing applications, allows for the identification of regions exhibiting shifts in land cover dynamics between different imaging dates (Madariya et al., 2022). The findings reveal significant changes, such as the clearing of vast forested areas, the prevalence of shifting cultivation in specific regions of India, and substantial soil erosion. Deforestation emerges as a prominent concern, with major contributing agents including farmers, ranchers, loggers, and plantation companies. The State forest department actively encourages the engagement of village communities and various stakeholders in plantation activities as a countermeasure. The Dnyanganga forest, host to diverse wildlife including leopards, sloth bears, barking deer, blue bulls, spotted deer, hyenas, jungle cats, and jackals, witnesses a decline in animal populations by 30% compared to 1992.

The forest area distribution in 2021 comprises 25% Vegetation, 30% Agriculture, 10% Deciduous forest, 22% Water Body, 27% Forest, and 7% Mangrove forest. Notably, the economic impact of deforestation is acknowledged, as it provides communities with opportunities for positive changes. However, the adverse consequences outweigh the benefits, including future food prob-

lems, soil exposure to harsh environmental conditions, increased flooding risks, displacement of indigenous communities, and loss of biodiversity. The calculated LULC areas and percentages for 2021 further illustrate the changing landscape: Vegetation covering 30% of the area, Agriculture occupying 30%, Deciduous forest at 10%, Water Body encompassing 22%, Forest accounting for 27%, and Mangrove forest constituting 7%. These findings underscore the dynamic nature of land use and cover, emphasizing the need for sustainable conservation practices to mitigate the adverse effects of ongoing environmental transformations.
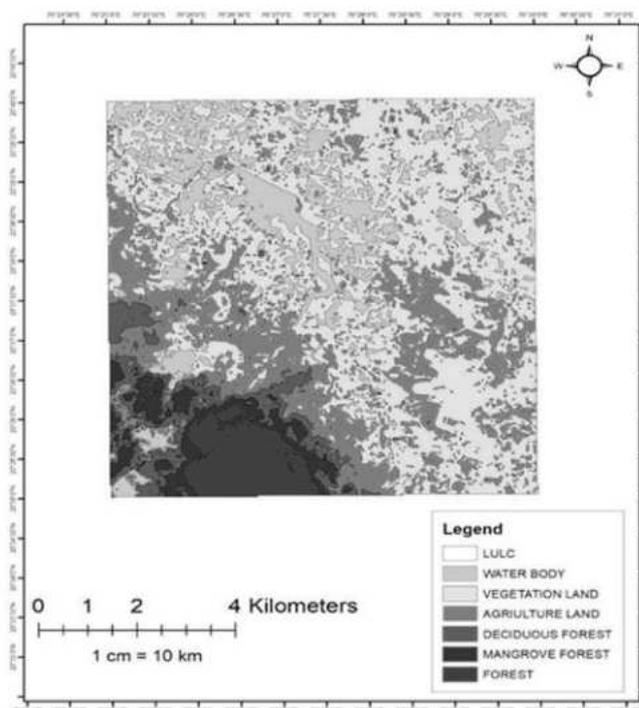

Fig 1.3 : Unsupervised Classification 2021

Table 1.1 : LULC Classification 2021

LULC Categories	Calculation Area(Sq.M)	Percentage (%)
Vegetation	30532974.12	25%
Agriculture	35773532.99	30%
Deciduous	2665944.22	10%
Water body	19758675.52	22%
Forest	22539151.21	27%
Mangrove	11232427.20	7%

Results :

Land Use and Land Cover (LULC) Analysis: The LULC analysis for the years 1992 and 2021 revealed significant changes in the Botha Reserve Forest ecosystem. The table below presents the area and percentage distribution of various land cover categories for both years:

Table 1.2 : LULC Classification 1992-2021

Categories	1992 Area (Sq.m)	1992 %	2021 Area (Sq.m)	2021 %
Vegetation	39,539,974.22	48%	30,532,974.12	25%
Agriculture	13,773,708.76	17%	35,773,532.99	30%
Deciduous	2,265,944.91	6%	2,665,944.22	10%
Water body	15,758,675.44	19%	19,758,675.52	22%
Forest	40,539,777.33	55%	22,539,151.21	27%
Mangrove	12,235,654.22	10%	11,232,427.20	7%

The comprehensive analysis conducted on the Land Use and Land Cover (LULC) dynamics within the Dnyanganga Wildlife Sanctuary and Botha Forest using sophisticated Geographic Information System (GIS) techniques and Remote Sensing methodologies has yielded pivotal insights with profound implications for biodiversity conservation efforts.Our investigation has revealed a discernible shift in LULC patterns over the studied period, characterized by a notable decrease in forest cover and vegetative expanses alongside a corresponding increase in agricultural encroachments and water bodies within the sanctuary and forest regions. These findings underscore the urgent need for targeted conservation strategies to counteract the escalating anthropogenic pressures threatening these ecologically sensitive areas.

Overall, our research underscores the critical importance of proactive conservation measures informed by cutting-edge geospatial technologies and interdisciplinary approaches. By leveraging the analytical capabilities of GIS and Remote Sensing, coupled with traditional ecological knowledge, stakeholders can devise targeted interventions aimed at preserving the biodiversity hotspots encapsulated within the Dnyanganga Wildlife Sanctuary and Botha Forest.In conclusion, our findings serve as a clarion call for concerted action towards the sustainable management and preservation of these invaluable natural heritage sites. It is imperative for policymakers, conservationists, and stakeholders to collaborate closely to develop and implement robust conservation strategies that safeguard the ecological integrity and resilience of these ecosystems for future generations.

Conclusion :

This study leverages the power of remote sensing and Geographic Information Systems (GIS) to investigate Land Use and Land Cover (LULC) dynamics within the Dnyanganga Wildlife Sanctuary. The unsupervised classification approach employed here of-fers a promising technique for efficiently identifying distinct land cover categories. Our analysis revealed concerning trends between 1992 and 2021, with a statistically significant decrease in forest cover and vegetation. Conversely, agricultural land and water bodies exhibited a concerning increase. These findings warrant further investigation, particularly regarding the potential underlying causes for the observed LULC changes. Future research that integrates hydrological modeling could elucidate the potential impact on the sanctuary's water resources. The study emphasizes the significance of geospatial technologies like GIS for monitoring LULC dynamics and informing evidence-based conservation strategies. Moving forward, the utilization of advanced classification algorithms holds promise for achieving even finer-scale and more precise land cover maps. This would provide invaluable data for informed decision-making regarding wildlife habitat preservation, natural resources management, and the overall ecological health of the Dnyanganga Wildlife Sanctuary.
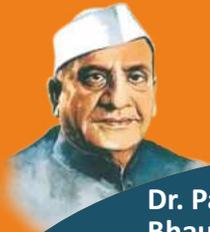
SCOPE FOR FUTURE RESEARCH

- **Long-Term Monitoring :** Conducting continuous LULC analysis using remote sensing and GIS techniques to monitor changes over an extended period, allowing for a more comprehensive understanding of ecosystem dynamics.

- **Impact Assessment :** Investigate the specific impacts of land use changes on wildlife populations, focusing on the habitats of endangered species within the sanctuary.

- **Socio-Economic Studies :** Explore the socio-economic implications of land use changes on local communities, considering the balance between conservation efforts and the livelihoods of residents.

- **Advanced Technologies :** Further research into advanced technologies, such as hyperspectral imagery and ground-penetrating radar, to enhance the accuracy of biodiversity mapping and belowground biomass assessments.

- **Policy Development :** Analyze the effectiveness of existing conservation policies and recommend improvements to ensure the sustainable management of protected areas.

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VOLUME IV : Electronics, Computer Science & Application

CONTENTS

Computer Science & Application

Challenges in Devanagari Script-based CAPTCHA: A Comprehensive Analysis

Anita B. Dube

Shri Shivaji College of Arts, Commerce & Science, Akola, MH, India

Abstract:

As the number of online services continues to grow and the threat of automated bots continues to increase, the need for strong security measures has never been more important. CAPTCHA, which stands for Completely Automatic Public Turing Test to Tell Computers Apart, is one of the most popular ways to distinguish between people and machines. A variety of CAPTCHAs are there, but they are in English. In a multilingual country like India, there is a need to develop Captcha in the native language. Devanagari is a script used to write Sanskrit, Hindi, Marathi, and many other Indian languages. This paper gives a comprehensive analysis of challenges that have been faced in setting up a CAPTCHA system using the Devanagari script. The purpose of this paper is to look at the weaknesses and issues that have been encountered in developing a reliable and robust CAPTCHA system based on this script.

Keywords: Captcha, Bots, Devanagari script

1. INTRODUCTION

In recent years, internet applications such as email, social networks, blogs, and e-government sites have become a necessity for everyone. As the Internet continues to grow, so does the need for Security. CAPTCHA stands for "Completely automated public Turing test to distinguish Computers from Humans". It's a security feature used to distinguish human users from automated bots. CAPTCHA was created in the late 90s as a solution to the growing problem of automated scripts and bot attacks on the Internet. CAPTCHA's main purpose is to prevent unauthorized access to an online system, website, or application from spamming, fraud, and other unauthorized activities. A successful CAPTCHA meets the following criteria: Automatic generation of the test Quick and easy response to the test accepted by all human beings and resistance to attacks with a publicly known protocol. The Devanagari language is one of India's official languages and is spoken by the majority of people. Devnagri script is the base of most Indian languages, which includes Marathi, Hindi, Bengali, Gujranwala, Konkani, and other northern Indian languages[1][2].

1.1 Origin & Purpose

A captcha is a security feature that is used on websites to differentiate between automated bots and humans. While CAPTCHA was first developed by John Lanford at Carnegie Mellon University[3], it was Mori Naor[4] who first introduced the idea of the Turing Test to differentiate between a human and a robot in 1996. The term "Turing test" in CAPTCHA refers to the test proposed by Alan Turing to determine a machine's ability to exhibit intelligent behavior indistinguishable from that of a human. OCR can compromise CAPTCHA security. There are many different types of CAPTCHA, each with its benefits and drawbacks.CAPTCHA is a challenge-response test that is used to identify whether the user is a human being or not. The CAPTCHA is based on the reverse Turing Test. The Turing Test is

a test that can be used to identify whether a computer can understand a text, an image, a video, or an audio. The computer cannot understand a distorted text or a number.

Web services use Captcha for the following purposes:

- **Spam Prevention:** One of CAPTCHA's main goals is to stop automated bots from sending forms on websites. CAPTCHA does this by creating challenges that humans can easily solve but machines can't. This helps reduce the number of automated spam submissions[5].

- **Account Security:** CAPTCHA, is often used during account creation to verify that the new account is created by real human users and not automated scripts, which can be used to create thousands of fake accounts in a short period [6].

- **Security in Online Transactions:** CAPTCHA is used in online transactions and financial transactions as an extra layer of security. CAPTCHA ensures that human users initiate these processes to protect sensitive information and avoid automated attacks[7].
- **Data Protection:** CAPTCHA is used by websites and online platforms to protect against web scraping[7], which is the practice of using automated bots to collect large amounts of information from websites. The CAPTCHA challenges prevent these automated data harvesting attempts.
- **Protecting Website Registration:** It is used to protect several free email services (Yahoo, Gmail, Hotmail) from bot programs that register thousands of email accounts per minute using an automated script[7][8].
- **Bot Protection:** A CAPTCHA prevents automated bots from doing things like creating duplicate accounts, filling out forms, or doing things that could damage a website or an online service[7][8].

1.2 Early Captcha Design

There are four main types of CAPTCHA, which are: Text Based, Image Based, Audio Based & Video Based. Now a variety of Captchas are introduced. CAPTCHAs are AI problems that can't be solved by today's software or bots but can be easily solved by people. A client who gives the right answer to a question is considered a human otherwise, a bot.

The earliest CAPTCHA was based on distorted text that was hard for OCR (Optical Character Recognition) software to read. Users had to manually enter the characters from the distorted image to show they were human. This is the most common type of CAPTCHA. Google, Yahoo, and Microsoft have all had their own text-based CAPTCHA deployed for years. [9][10][11].CAPTCHA based on images has been suggested as an alternative to text media. The users are asked to perform an image recognition task[12][13]. Audio Captcha is based on the user's ability to recognize sound or speech. It was introduced as an accessible option for people who can't use the more popular visual CAPTCHA and for the visually impaired. The video-based CAPTCHA was created primarily to make CAPTCHA sessions engaging and creative [14]. A moving object is presented to the user and the user is asked to complete a task.

2. MOTIVATION OF DEVANAGARI SCRIPT-BASED CAPTCHA

Using the Devanagari script-based Captchas can serve many purposes, each one with its own motivation[15]

Language Specificity: In the captchas of any website or application, the security feature should be based on the language of the target user. The majority of these languages are Hindi language, Marathi language, Sanskrit language, etc. Therefore, if a website or application caters to users who mainly communicate in their local language, then one should use the script in the captchas[16].

Cultural Sensitivity: For web applications that emphasize cultural sensitivity, the use of Devanagari in captchas conveys a sense of respect for and acceptance of the language and culture of the target audience.

Localization: if a website is localized for areas where Devanagari scripts are widely used, including Devanagari in captchas is in line with the localization strategy. This can help users to feel more secure and understand the security features[16].

3. CHALLENGES IN DEVANAGARI SCRIPT-BASED CAPTCHA

As OCR became more advanced, the types of CAPTCHA tasks developed to include image recognition, image selection, mathematical problems, and distorted characters against a complex background.

3.1 Linguistic Complexity: Language complexity is a key design and implementation challenge for CAPTCHA. Language complexity refers to tasks that are simple for humans to solve, but challenging for automated scripts, especially those using machine learning algorithms. When it comes to linguistic complexity, CAPTCHA design challenges often center around using natural language elements. Below are some of the specific aspects of language complexity that challenge CAPTCHA design [17, 18]:

> **3.1.1 Multiple character variations:** Languages often have different types of characters, including uppercase letters, lowercase letters, accents, and letterforms. In Devanagari, each character represents a consonant with an inherent vowel sound, and additional vowel sounds can be added. The use of diacritic marks can result in the addition of additional vowel sounds.

> **3.1.2 Ligatures and conjunct characters:** Complexity is added to some languages, such as Devanagari or Arabic, or to scripts that have ligatures. However, automated systems may not be able to identify and isolate ligatures, making it difficult to create CAPTCHA that contains such language features.

3.2 Font Variability: Devanagari font variability is one of the most important challenges when designing a CAPTCHA based on the script. Devanagari script is a very complex script. It has a lot of different characters, ligatures, and variations. When designing a script-based CAPTCHA, font variability can be a problem for both human users and automatic recognition systems. Here are a few aspects of font variability in Devanagari scripts CAPTCHA:

> **3.2.1 Font styles and shapes:** The Devanagari characters are written in different font styles with different shapes and forms. Using different font styles for CAPTCHA

characters can be a problem for automatic systems that can't generalize across different representations.

3.2.2 Legibility concerns: Some fonts may contain characters with complicated shapes or complex details, which can cause readability problems for both human and automatic systems. It is important to strike a balance between keeping characters legible for human users while introducing complexity for automatic recognition.

3.3 Cultural and Regional Sensitivity: Devanagari scripts are used not only in Hindi but also in several other Indian languages. The usage of the script varies from one region to another. Therefore, it is essential to take into account cultural and regional sensitivities when designing a CAPTCHA based on the script. It is also important to ensure that the CAPTCHA is effective, inclusive, and respectful of the language and cultural diversity of the country. Here are some things to keep in mind when designing a CAPTA based on script. When designing a script-based CAPTCHA, there are some factors to consider.

3.3.1 User familiarity with script: Different regions of the world may have their unique dialects of Devanagari. Therefore, it is important to consider how familiar users are with specific characters, ligatures, and writing styles for a good user experience.

3.3.2 Regional variations in script usage: In addition to Hindi, Devanagari is used for Marathi, Tamil, Telugu, Malayalam, Kannada, and many other languages. It is important to consider the regional variation in the use of Devanagari to develop CAPTCHA that resonates with different linguistic communities.

3.4 Security Concerns: Devinagari Script-Based CAPTCHA Security Concerns Devinagari script-based CAPTCHA security concerns[18,19,20] are very important because CAPTCHA plays an important role in preventing automated attacks on online systems. The use of Devanagari scripts comes with its own set of challenges. However, addressing the security concerns is very important to make sure that the CAPTCHA is effective in preventing automated scripts and bots. Here are some of the security concerns related to Devanagari scripting-based CAPTCHA

3.4.1 Vulnerability to OCR attacks[18]: However, Devanagari characters are prone to OCR attacks if they are not distorted properly. A good CAPTCHA should use distortion techniques that make OCR software difficult to read and interpret.

3.4.2 Machine learning-based attacks[18]: Traditional CAPTCHA can be challenged by advances in machine learning. Devanagari Script-based CAPTCHA can also be challenged by adversaries' machine-learning techniques. As a result, there is a need for continuous innovation in the design of CAPTCHA

3.5 Usability and Accessibility: Devanagari script-based CAPTCHAs require usability and accessibility[16,18]. Usability refers to the ease with which users can interact with the CAPTCHA and complete it. Accessibility refers to the ability of people with disabilities to participate in the CAPTCHA. Let's take a closer look at the following: Usability and Accessibility of Devanagari Script-Based CAPTCHA[21]

3.5.1 User-friendliness: Take into account the fact that users are familiar with various Devanagari scripts and characters. Try to create a design that appeals to a wide range of users.

3.5.2 Avoiding Unnecessary Complexity: Make the CAPTCHA as easy as possible. Avoid making the CAPTCHA more complicated than it needs to be. This can confuse users or discourage them from signing up.

4. PROPOSED SOLUTIONS

Behavioral Analysis Challenges: To add an extra layer of protection, incorporate challenges that include behavioral analysis, for example, based on user behavior.

Continuous Monitoring: Systematically track and analyze CAPTCHA performance. Update CAPTCHA designs regularly based on new threats and user feedback.

Education and Awareness: Educate users about CAPTCHA and how it impacts online security. Increase awareness of security best practices to improve user collaboration.

5. CONCLUSION

Combining these suggestions, developers, and designers will be able to develop CAPTCHAs based on Devanagari scripts that are not only safe from automated attacks but also easy to use, culturally sensitive, and accessible to a wide range of users. With regular updates and ongoing engagement with the user community, these solutions will be able to address the ever-changing security challenges.

This paper provides insights to researchers, developers, and security professionals working with CAPTCHA systems with specific challenges related to the implementation of such mechanisms using the Devanagari script, as well as possible solutions and future direction for improving the efficiency and security of Devanagari-based CAPTCHA systems

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ENGLISH PART - VIII

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19. Physicochemical and Thermodynamic Studies of the Schiff Base Ligands in Binary Polar and Nonpolar Solvent System

Y. S. Thakare
P. G. Department of Chemistry, Shri Shivaji College of Arts, Commerce and Science, Akola.

Abstract

Present work investigate the newly synthesis Schiff base derivatives, characterization, density, viscometric and thermodynamic study in 70% ethanol-water and 70% dioxane-water binary solvent system. Elemental analysis, and spectral interpretation was carried out to characterize the structure of synthesized Schiff base. Various thermodynamic parameters like the change in enthalpy, entropy and Gibbs free energy were evaluated using different concentration at 308K, 318K, and 328K. It gives very important information about change in viscosity with temperature. Solute-solute interactions solute-solvent interactions were interpreted by viscometric study of synthesized ligand at different concentration. Positive value of β - coefficient may attribute to strong solute-solvent interaction on other hand value of A-coefficient is almost negative which indicates weak solute-solute interaction. The results show that the value of specific viscosity varies with concentration and nature of Schiff base.

Keywords: viscosity, thermodynamic parameter, Schiff base ligand, molecular interaction.

Introduction

Schiff bases have been known since 1864 when Hugo Schiff reported the condensation of primary amines with carbonyl compounds. Nowadays, the research field dealing with Schiff base coordination chemistry has expanded enormously because of their wide uses in inorganic, bioinorganic, analytical, material science, and pharmaceutical chemistry. For years, Schiff bases have been greatly inspiring to many chemists and biochemists [1]. Schiff base metal complexes exhibits antibacterial, antifungal, anticancer, anti-inflammatory and antioxidant activities [2-3]. The densities and viscosities of ternary mixtures of N, N′-salicylidenephenylenediamine Schiff base (Salophen) + ionic liquid + N,N-dimethylformamide (DMF) have been determined at 298.15 K [4]. For natural and industrial processes known significant physicochemical properties

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like density, viscosity, surface tension and antimicrobial properties Schiff base ligands metal complexes were studied [5-7]. Concentration and temperature dependence of the thermodynamic properties of novel Schiff based ligand were carried out in different solvent system [8]. Volumetric and viscometric studies were carried out to study solute-solvent molecular interactions study [9-11-12]. 4–527, (2013)

The present study deals with synthesis and viscometric measurement of Schiff base ligand N-methyl 1-phenylmethanimine (C1), 2-methoxy-4((phenylimino)methyl)phenol (C2) and 1-(4-methoxyphenyl)-N-Phenylmethanimine (C3) at 308 K, 318 K and 328 K in binary mixture of 70% dioxane-water and 70% ethanol-water From the data obtained solute-solute, solute-solvent interactions and thermodynamic parameters ΔG, ΔH and ΔS have been calculated.

Materials and Methods

Experimental Procedure

All the chemicals used were of analytical grade reagent from S D Fine-Chem Limited, Mumbai 400 030 and were used without further purification. Aqueous solutions were prepared with doubly distilled water. The binary mixture of 70% dioxane-water and 70% ethanol-water were prepared gravimetrically in Stoppard bottle. The densities and viscosities of pure liquids and their binary mixtures were measured using single capillary pycnometer and Ostwald's viscometer which was calibrated with double distilled water. The flow time was measure with the digital stop watch, each sample allowed to flow three times and then average flow time was calculated. The thermodynamic measurement was carried out in the thermostat. From the observation density, relative and specific viscosity can be calculated for all the Schiff base ligand in both the solvent.

$$\eta\_r = (d\_1 \times t\_1)/(d\_w \times t\_w)$$

ηr-relative viscosity ($\eta r = \eta 1/\eta w$), $\eta 1$, $d1$, $t1$ and ηw, dw, tw were viscosity, density and time required to flow for Schiff base ligand and water respectively. Viscosity data were analyzed in the light of Jones-Dole equation.

$$(\eta r - 1) / \sqrt{C} = A + \beta\sqrt{C}$$

Where A and β are the Falkenhagen and the Jones-Dole coefficients. From the graph of $(\eta r -1) /\sqrt{C}$ verses $\sqrt{C}$, 'A' which is the measure of solute-solute interactions and 'β' which is the measure of solute-solvent interactions has been calculated.

Synthesis of Schiff Base

1. Synthesis of N-methyl 1-phenylmethanimine (C1)

0.01 mole of benzaldehyde is added to the solution of aniline (0.01mole) in ethanol as a solvent. Catalytic amount of nickel nitrate hexahydrate is added to the reaction mixture and stirrer at room temperature. The solid obtained is filter and recrystalised by using ethanol. Yield - 78 %, Colour- Green, M.P -1100 C, Solubility - Hot ethanol, M. F.- C13H11N, M. Wt.- 181.24
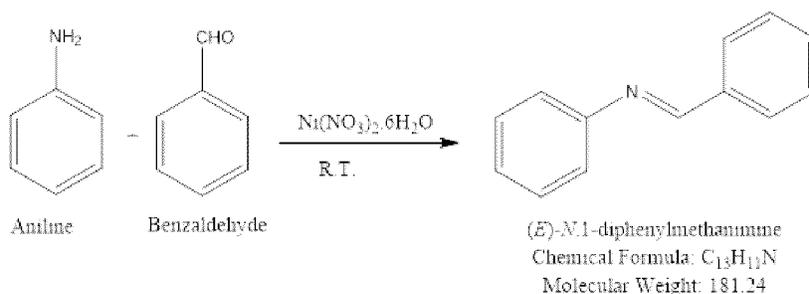
2. Synthesis of 2-methoxy-4((phenylimino) methyl) phenol (C2)

0.01 mole of Aniline is added to the solution of Vaniline (0.01mole) in ethanol as a solvent. Catalytic amount of nickel nitrate hexa -hydrate is added to the reaction mixture and stirrer at room temp the solid obtained is filter and recrystalised by using ethanol. Yield - 75 %, Colour – yellow, M.P -1100 C, Solubility- Hot ethanol, M. F. - C14H13NO2, M Wt.- 227.26
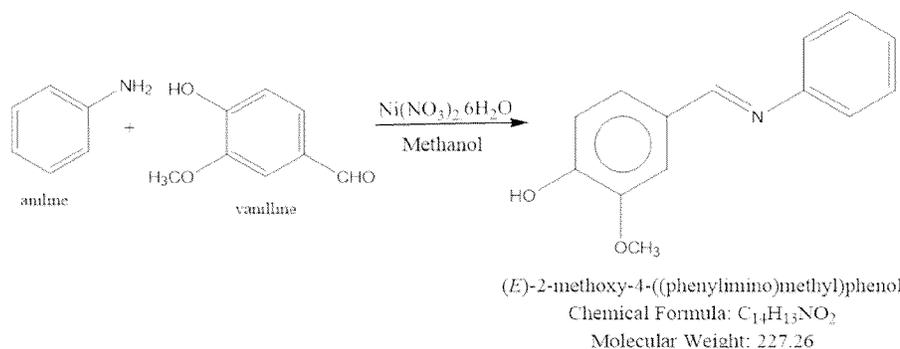
3. Synthesis of 1-(4-methoxyphenyl)-N-Phenylmethanimine (C3)

0.01 mole of Aniline is added to the solution of Anisaldehyde (0.01mole) in ethanol as a solvent. Catalytic amount of nickel nitrate hexa-hydrate is added to the reaction mixture and stirrer at room temp the solid obtained is filter and recrystalised by using ethanol. Yield - 73 %, Colour – green, M. P :-1100 C, Solubility - Hot ethanol, M. F.- C14H13NO, M Wt. - 221.26

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ethanol. Yield - 73 %, Colour – green, M.P.:-110⁰ C, Solubility - Hot ethanol, M. F.- $C_{14}H_{13}NO$, M Wt. - 221.26

(E)-1-(4-methoxyphenyl)-N-phenylmethanimine
Chemical Formula: $C_{14}H_{13}NO$
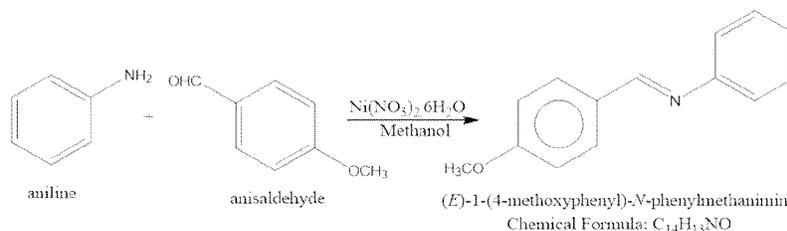
Result and Discussion

Viscometric Study with Variation in Concentration

To explorer the utility of synthesized Schiff base derivatives C1, C2 and C3 its viscosity study was carried out for different concentration in 70% ethanol-water system and 70% dioxane-water system as a solvent. The data obtained were used to calculate the relative viscosity (ηr) and density of Schiff base derivative. It was observed that relative viscosity decreases in both the solvents. The plot between (ηr -1) /$\sqrt{C}$ verses $\sqrt{C}$ shows a linear graph which shows the validity of Jones–Dole equation for all the tested Schiff base derivative. The slope of this graph shows the value of β –coefficient, and intercept give the value of coefficient A.

Table 1 Viscometric Study with Variation in Concentration of Ligand (T=273K)

System	Medium	Conc. (M)	$\sqrt{c}$	Time flow (sec)	Relative viscosity (η_r)	Specific viscosity (η_{sp})	A coefficient	β coefficient
N-methyl1-phenylmethanimine(C_1)	70% Ethanol water system	0.1 0.05 0.001	0.316 0.224 0.032	33 28 25	0.9538 0.7937 0.7116	-0.149 -0.925 -9.303	-0.9.962	34.59488
N-methyl1-phenylmethanimine(C_1)	70% Dioxane water system	0.1 0.05 0.001	0.316 0.224 0.032	22 21 20	0.7583 0.7139 0.6561	-0.7796 -1.2829 -11.0935	-11.77	39.29699
2-methoxy-4((phenylimino)methyl)phenol (C_2)	70% Ethanol water system	0.1 0.05 0.001	0.316 0.224 0.032	47 40 39	1.3561 1.1639 1.1259	1.596 0.564 0.528	0.289	3..227734
2-methoxy-4((phenylimino)methyl)phenol (C_2)	70% Dioxane water system	0.1 0.05 0.001	0.316 0.224 0.032	24 23 21	0.8151 0.7538 0.6860	-0.5964 -1.1040 -10.1290	-10.76	36.29651
1-(4-methoxyphenyl)-N-Phenylmethanimine (C_3)	70% Ethanol water system	0.1 0.05 0.001	0.316 0.224 0.032	59 54 44	1.6710 1.5100 1.2317	3.0089 2.286 1.474	1.261	5.2916668
1-(4-methoxyphenyl)-N-Phenylmethanimine (C_3)	70% Dioxane water system	0.1 0.05 0.001	0.316 0.224 0.032	19 17 16	0.6511 0.5631 0.5278	-1.1254 -2.1031 -15.2322	-0.279	53.49988

To study the pharmacokinetics of synyhesize Schiff base, viascometric study was carried out at different concentration using polar and non polar solvents. Above table shows that with decrease in concentration of ligand there is decrease relative viscosity and specific viscosity in 70% Ethanol water and 70% Dioxane water because decrease in concentration   number of solute particle decreases at the same time solvation effect increases. It was observed from the table that the values of A are almost negative in both the solvent for C1, C2 and C3 shows weak solute-solute interaction which is also supported by decrease in relative viscosity. Again the values of a are more negative in dioxane-water as compare to ethanol-water medium due to different polarity index of binary solvents. On the other hand value of β -coefficient is positive shows strong solute-solvent interaction which indicates the good drug activity.

Viscometric Study with Variation in Temperature

The relationship between of viscosity of liquids and temperature is expressed mathematically as- $\eta = A.e^{(\Delta G/RT)}$

The viscometric study was extended for different concentration of Schiff base ligand in using 70% dioxane-water system and 70% ethanol-water system at 308K, 318K, and 328K. The graph plotted between log ηr and 1/T for each system was found to linear showing the validity of above equation. From the temperature variation data, thermodynamic parameters like change in enthalpy, entropy, and Gibbs free energy have been evaluated using following equation and are listed in table 2.

$\Delta G = -2.303 \times R \times Slope$

$\llbracket \log\eta \rrbracket\_(r\_1) - \llbracket \log\eta \rrbracket\_(r\_2) = \Delta H/2.303 \ [1/T\_1 - 1/T\_2]$

$\Delta S = (\Delta H - \Delta G)/T$

Table 2 - Viscometric Study with Variation in Temperature (Medium – Dioxane-Water)

System	Conc. (M)	Temp (K)	1 / T (K^{-1}) × 10^{-3}	Time flow (sec.)	Relative Viscosity η_r	Log (η_r)
C$_1$	0.1	308	3.24 ×10^{-3}	21	0.7842	-0.1055
		318	3.14 × 10^{-3}	20	0.8638	-0.0635
		328	3.04 × 10^{-3}	19	0.9386	-0.0275
	0.05	308	3.24 ×10^{-3}	20	0.7278	-0.1379
		318	3.14 × 10^{-3}	19	0.7981	-0.0979
		328	3.04 × 10^{-3}	18	0.8600	-0.0655
	0.001	308	3.24 ×10^{-3}	19	0.6665	-0.1761
		318	3.14 × 10^{-3}	18	0.7309	-0.1361
		328	3.04 × 10^{-3}	17	0.7843	-0.1055
C$_2$	0.1	308	3.24 ×10^{-3}	22	0.7972	-0.09843
		318	3.14 × 10^{-3}	21	0.8804	-0.05531
		328	3.04 × 10^{-3}	20	0.9529	-0.0209

System	Conc. (M)	Temp (K)	$1/T$ $(K^{-1}) \times 10^{-3}$	Time flow (sec.)	Relative Viscosity (η_r)	Log (η_r)
	0.05	308	3.24×10^{-3}	21	0.7366	-0.1327
		318	3.14×10^{-3}	20	0.8116	-0.0906
		328	3.04×10^{-3}	19	0.8754	-0.0577
	0.001	308	3.24×10^{-3}	20	0.6942	-0.1585
		318	3.14×10^{-3}	19	0.7646	-0.1165
		328	3.04×10^{-3}	18	0.8212	-0.0855
C_3	0.1	308	3.24×10^{-3}	17	0.6232	-0.2053
		318	3.14×10^{-3}	16	0.6771	-0.1693
		328	3.04×10^{-3}	15	0.7208	-0.1421
	0.05	308	3.24×10^{-3}	16	0.5665	-0.2468
		318	3.14×10^{-3}	15	0.6143	-0.2116
		328	3.04×10^{-3}	14	0.6501	-0.1870
	0.001	308	3.24×10^{-3}	15	0.5252	-0.2796
		318	3.14×10^{-3}	14	0.5684	-0.2453
		328	3.04×10^{-3}	13	0.5986	-0.2228

Table 3 - Viscometric Study with Variation in Temperature (Medium – Ethanol-Water)

System	Conc. (M)	Temp (K)	$1/T$ $(K^{-1}) \times 10^{-3}$	Time flow (sec.)	Relative Viscosity (η_r)	Log (η_r)
C_1	0.1	308	3.24×10^{-3}	32	0.9887	-0.0049
		318	3.14×10^{-3}	29	1.0041	0.0017
		328	3.04×10^{-3}	26	1.0063	0.0027
	0.05	308	3.24×10^{-3}	27	0.8202	-0.0860
		318	3.14×10^{-3}	25	0.8650	-0.06209
		328	3.04×10^{-3}	23	0.8848	-0.05315
	0.001	308	3.24×10^{-3}	23	0.6539	-0.1844
		318	3.14×10^{-3}	21	0.6910	-0.1605
		328	3.04×10^{-3}	19	0.7003	-0.1547
C_2	0.1	308	3.24×10^{-3}	38	1.1306	0.0533
		318	3.14×10^{-3}	35	1.2287	0.0894
		328	3.04×10^{-3}	30	1.0758	0.0317
	0.05	308	3.24×10^{-3}	45	1.333	0.1248
		318	3.14×10^{-3}	42	1.4570	0.1634
		328	3.04×10^{-3}	39	1.4882	0.1726
	0.01	308	3.24×10^{-3}	38	1.167	0.0670
		318	3.14×10^{-3}	36	0.0017	-2.1739
		328	3.04×10^{-3}	33	1.2926	-3.1114
C_3	0.1	308	3.24×10^{-3}	59	1.6933	0.2287
		318	3.14×10^{-3}	52	1.540	0.1875
		328	3.04×10^{-3}	45	1.6987	0.2301
	0.05	308	3.24×10^{-3}	57	1.689	0.2276
		318	3.14×10^{-3}	52	1.800	0.2552
		328	3.04×10^{-3}	48	1.8278	0.2619
	0.01	308	3.24×10^{-3}	42	1.222	0.0870
		318	3.14×10^{-3}	38	1.2915	0.1110
		328	3.04×10^{-3}	35	1.3270	0.1228

Table 4 - Value of Thermodynamic Parameters

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System	70% Dioxane-water				70% Ethanol-water		
	Conc. (M)	ΔG (J mole^{-1})	ΔH (J mole^{-1})	ΔS (J mole^{-1}K^{-1})	ΔG (J mole^{-1})	ΔH (J mole^{-1})	ΔS (J mole^{-1}K^{-1})
C_1	0.1M	-0.7467	-906.11	2.7434	-0.5744	-86.446	0.2787
	0.05M	-0.6892	-845.66	2.9394	-0.3063	-377.03	1.1005
	0.001M	-0.6701	-823.90	4.1161	-0.2680	-339.23	1.2231
C_2	0.1M	-0.7275	-845.99	2.7443	0.1914	289.10	-0.9380
	0.05M	-0.7084	-635.35	2.0933	-0.4403	-551.44	1.7889
	0.001M	-0.6892	-812.015	2.6341	30.4248	3655.29	-11.8242
C_3	0.1M	-0.5935	-691.96	2.2446	-0.2354	-1052.54	3.4173
	0.05M	-0.5552	-699.26	2.2685	-0.3255	-458.87	1.4887
	0.001M	-0.5361	-579.07	1.8783	-0.3255	-458.87	1.4887

From the above table it is shown that the value of change in free energy for different derivative of Schiff base is decreases using ethanol-water and dioxane-water system. The value of entropy is also increases with decreases in concentration of compound in both the solvent system. The negative value of enthalpy indicates that the reaction is exothermic.

Conclusion

In the present study, the relative viscosity of solution of Schiff base derivatives decreases with decrease in concentration of solution. It was observed that the values of A more negative and β -coefficients are more positive in Dioxane-water as compare to ethanol-water medium for all the tested Schiff's bases shows weak solute-solute and strong solute-solvent interaction indicates the good drug activity. The value of thermodynamic parameter increases with increases in temp in both the solvent system. The negative values of ΔH indicated the reaction is exothermic. The values of entropy are positive shows the randomness of solute molecules in the compound it was increase with decreases in concentration of the solvent. It was also observed that the values of entropy are more positive in medium-dioxane-water as compared to medium-ethanol-water. Thermodynamic study shows negative value of Gibbs's free energy. It was observed that the value of ΔG is more negative in 70% dioxane-water indicates the more hydrophobic nature of Schiff base derivative. These different results for all the tested compound may be due to different polarity index of solvent dioxane and ethanol.

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IDEAL

ज्ञान-विज्ञान विमुक्तये

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2. Biodiversity of Moth in the Vicinity of Sonala Dam, Sonala, Dist. Washim, (M.S.)

Dr. Ujwala P. Lande
Assistant Professor, Department of Zoology, Shri Shivaji College of Arts,
Commerce & Science, Akola, (M.S.), India.

Abstract

Moths belong to Order Lepidoptera, characterized by drablycolored scales on the body, epiphysis on the foreleg, phytophagous and predominantly nocturnal nature. They are very sensitive to climate changes and vegetation alterations, making them an important group for monitoring climate and habitat changes.The study of Biodiversity of moth in the vicinity of Sonala dam, Sonala was carried for the period of 6 months that is from August 2022 to January 2023.The specimens were collected from the surrounding area of Sonala dam. A total of 16 species of Lipedoptera were recorded from different habitats and different sites around the Sonala dam, Sonala.The order Lipedoptera consists of 9 families Erebidae is dominant by 4 species were found to be present in various habitat studied like hilly area, grasslands, plus shrubby area and agricultural fields.

Keywords: Biodiversity, Moth, Sonala.

Introduction

Invertebrates diversity plays a vital role in all ecosystem, example: species, population, and individual (Cardinale *et al.,* 2006; Bashir 2019; Shakeel, 2019. Member of phylum Arthropoda play a pivotal role in ecological service (Rathore and Jasrai, 2023; about Shaara, 2021; Karar, 2020). Besides most successful phylum, they dominate all types of habbits excepts for the ocanic benthic zone (Jamal, 2021; Abrol , 2019 . Lepidoptera is one of the most diverse groups, representing 1,57,424 described species globally (van Nieukerken et al., 2011; Sajjad, 2019). According to a recent study, 1, 65,000 moths have been reported globally Khan and Perveen, (2015), among which 12,000 species of moths have been reported from India (Chandra and Nema, 2007).

Moths belong to Order Lepidoptera, characterized by drablycolored scales on the body, epiphysis on the foreleg, phytophagous and predominantly nocturnal nature. They are very

sensitive to climate changes and vegetation alterations, making them an important group for monitoring climate and habitat changes (Thomas, 2005). They are also considered vital for ecosystem services because of various roles such as agricultural pests (Sharma and Bisen, 2013), food for mammals (Vaughan, 1997), birds (Wilson et al., 1999), and night pollinators (Macgregor et al., 2015). According to previous study, India has 12,000 species (Chandra and Nema 2007). Therefore, as an initiative before detailed study, present observation of moths in the vicinity of Sonala dam, Sonala was focused to documents in certain area to plan the future study and helpful to global Lepidoptera checklist assessment. Moths and butterflies belong to order Lepidoptera of class Insecta and is one of the largest order of insects. Many researchers have studied the diversity of moth fauna during their survey in different region of Maharashtra state. Hampson (1891) have reported total 611 species of moths from Maharashtra.

Materials and Methods

Study area

Sonala Dam reservoir was constructed in the year 1981. Agricultural fields surround the reservoir including dense vegetation. The reservoir is mainly used for drinking water supply to nearby villages and for irrigation. The nearby villages also use the water for bathing and washing purposes. The dam is constructed by irrigation department of Maharashtra Govt. The Sonala dam is located at 77^0, 12', 30" Longitude and latitude of 20^0, 19', 00" in Sonala village of Washim district in Maharashtra (India). It is an earthen dam with 19.20 meter maximum height and 446.90 hector submergence with 132.50 square Km. of catchment area. The dam is presently used for irrigation and drinking for regional rural areas. The reservoir is constructed on the River Aran also known as River Adan a tributary of River Godavari. Adan River in its way runs through the Maraldoh village, before draining in the dam.

Collection and Photography of Insects

A field survey was carried out from the month of August 2022 to January 2023. Insects are a remarkable group of animals. They occur virtually everywhere and make up more than half of all living things on earth. Methods used for present study insect net, killing jar, forceps, relaxing jar, spreading board and pinning block, insect pins and labels, storage box. Before proceeding to collecting the moth the equipments used for collection was assembled. The equipment used were simple and inexpensive. The collecting kit include following items. Collecting net, Sweep Net, Forceps, Thermacol sheath, Pins, Notebook, Pencils, Camera, ethyl

acetate, Adhesive solution. The moths observed were identified with the help of research paper and literature available (Sachin A Gurule and Santosh M Nikarm, 2013) and (Sachin A Gurule and Ryan D Brookes 2021). The moths which were not possible to identify at species level were identified at their genus level. The list of moth species sequence [Super families and Families] prepared was according to Nieukerken et.al. (2011).

Observation and Result

　　　Diversity of Moth:- The study of diversity of moth around Sonala dam, Sonala was carried for the period of 6 months that is from August 2022 to January 2023.The specimens were collected from varoious sites surrounding the dam. A total of 16 species of Lipedoptera was recorded from different habitats and different sites around the Sonala dam, Sonala.The order Lipedoptera consists of 9 families Erebidae is dominant by 4 species were found to be present in various habitat studied like hilly area, grasslands, plus shrubby area and agricultural fields. The total species were observed and collected tabulated in Table I

　　　Using an Identification Key

　　　This study reveals that in the morphological identification of moths, keys like strong hind legs for jumping, coloration for defensive function from predators as well as to attract the females when mating is required, size, shape plays an very important role. Following are the key identified varieties of moths from selected area.

Sr.No.	Class	Order	Family	Genus	Species
	Insecta	Lepidoptera	Pyralidae	*Plodia*	*interpunctella*
	Insecta	Lepidoptera	Noctuoidea	*Heliothies*	*peltigera*
	Insecta	Lepidoptera	Erebidae	*Ophiusa*	*tirhaca*
	Insecta	Lepidoptera	Sphingidae	*Daphnis*	*herii*
	Insecta	Lepidoptera	Crambidae	*Duponchelia*	*fovealis*
	Insecta	Lepidoptera	Erebidae	*Syntomoides*	*imaon*
	Insecta	Lepidoptera	Noctuidau	*Mythimna*	*unipunta*
	Insecta	Lepidoptera	Uraniidae	*Mycronia*	*aculeata*
	Insecta	Lepidoptera	Crambidae	*Patania*	*rurania*
	Insecta	Lepidoptera	Sphingidae	*Theretra*	*silhetensis*
	Insecta	Lepidoptera	Geometridea	*Xanthotype*	*urticaria*
	Insecta	Lepidoptera	Saturniidae	*Hemileucinae*	*Lonomia*
	Insecta	Lepidoptera	Geometridae	*Selenia*	*lunularia*
	Insecta	Lepidoptera	Arctiinae	*Cyana*	*perornata*
	Insecta	Lepidoptera	Erebidae	*Lymantria*	*dispar*
	Insecta	Lepidoptera	Adelidae	*Nemophora*	*degeerella*

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Discussion

Over the entire duration of the present study, a total of 16 species of Lipedoptera was recorded in the vicinity of Sonala Dam, Sonala district Washim of Maharashtra.

The order Lipedoptera consists of 9 families Erebidae is dominant by 4 species. Ananya Nayak found Micraloa Sp., Nannoarctia himalayana, Pericallia ricini, Syntomoides imaon. In the present work Ophiusa tirhaca, Handmaiden moth, Cyana peroranata, Lymantria disper this species are found. The Erebidae are a family of moth in the superfamily Noctuodea. The family is among the largest families of moths by species found and contains a wide veriety of well known micromoth groups

The second family Noctuoidea with 2 species, Sunanda Sasmal found Risodinae, Condicinae in their work. In the present work species found are Bordered straw and Armyworm moth. The Noctuidae, commonly known as owlet moths. They are considered the most controversial family. It is the second largest family. The third family Sphingidae with 2 species, Yash Sondhi found Acomeryx anceus, Dophnis hypothous. In the present work species found are Oleander Hawk Moth and Theretra silhetensis. The Sehingidae are the family of moth called Sphinx moths. It is best represented in the tropics, but species are found in every region. The fourth family Crambidae with 2 species, Shashank Rajendra Pathour found Vitessa suradeva, Agathodes ostentalis. In the present work species found are Duponchelia fovealis and Patania ruralis. Crambidae compreses the grass moth. They are variable in apperience. The fifth family Geometridea with 2 species, Sanjay Sondhi found Celenna festivaria, Godonela Ozararia. In the present work the species found are Xanthotype urticaria and Selenia lunularia. This is very large family of nocturnal moths. All geometrias have a uniform shape, which is characteristic and family.The sixth family Pyralidae with 1 species, Lokesh N. Wankhade found Plodia interpumctella.In the present work species found are Indianmeal Moth. The Pyralidae, commonly called Pyralid moths. The seventh family Uraniidae with 1 species, Mayuri N. Kadwe found Micronia aculeata in the present work species found is Mycronia aculeata. Some of the tropical species are known for their bright, butterfly like colours and are called sunset moths. The eighth family Saturniidae with 1 species, Mrunalini Sonne found Actias Selene. In the present work species found is Lomomia electra. The Saturniidae family contain some of the largest species of the moth in the world. The ninth family Adelidae with 1 species i.e Nenochora degeerella.

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Conclusion

Moths are primarily nocturnal creature that occupy a wide variety of habitat and constitute an important component of teristrial ecosystems and serve as food resource for birds, small mammals as well as pollinators and nutrient recycle. The present study concludes the discovery of 16 moths pertaining 9 families. Beside this, the survey was conducted during August 2022 to January 2023in the vicinity of Sonala Dam. In addition to this, the family Erebidae includes the major number of species as compare to Noctuoidea, Sphingidae families. The present study will provide the baseline information to the study of moth diversity from the city and adjoining areas. Further studies with a long term systematic approach are needed to ascertain the entire moth assembling of the city. Moths make up a significant part of our biodiversity and are very important in ecosystems (as herbivorous, pollinators and as prey for othe animals). Butterfly conservation takes action to conserve moth and their habitats, through direct management, research, recording and monitoring adviced, policy development and raising awareness often working with partner organization and individuals.

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3. A Comprehensive Evaluation on Phytochemical and Pharmacological Profiles of *Achyranthes aspera* Linn

Undal V. S.
Department of Botany, Ghulam Nabi Azad College, Barshitakali,
Dist - Akola (MS) India.
Ahir M. R.
Department of Microbiology, Ghulam Nabi Azad College, Barshitakali,
Dist - Akola (MS) India.

Abstract

Plant resources constitute an important natural prosperity of Country. They play a significant role in supplying crucial health care service to rural community in addition huge number of profitable produce. The plant contain secondary metabolites like glycosides, flavonoid, alkaloids, tannins, terpenoid, phenol, volatiles oils and several more compounds with serve as important curative mediators. The *Achyranthes aspera* L (Amaranthaceae) is an important medicinal perennial herb found naturally as a weed throughout India. It is commonly known as Chaff tree, Prickly- chaff flower, rough-chaff tree. Though approximately the entire of its parts are used in conventional systems of medicines, seeds, roots and shoots are the most important parts which are used medicinally. With published data, it found that broad numbers of phytochemical ingredients have been isolated from the plant which possesses number of pharmacological activities like anti-cancer, anti-dandruff, antidiabetic and hypoglycemic, anti-diarrheal, antifungal and more 12 activities focused in current paper. Despite its rich conventional use and rising scientific concern, the safety and toxicity of *A. aspera* entail further exploration. Sufficient toxicological investigations are necessary to resolve secure dosage levels and potential adverse effects.

Keywords: Achyranthes aspera, Alkaloids, phenol, amaranthaceae, antidiabetic, antifungal

Introduction

The awareness of herbs has been handed down from generation to generation for thousands of years (Bown, 1995). Herbal medicines have a strong conventional or conceptual foundation and the prospective to be valuable as drugs in terms of safety and effectiveness leads