

EFFECT OF NAA AND BORON LEVELS ON PLANT AND CURD VIGOUR OF CAULIFLOWER (BRASSICA OLERACEA L. VAR. BOTRYTIS) CV. KASHI GOBHI - 25

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ABSTRACT

Data regarding the effect of NAA and Boron on the plant and curd vigour of Cauliflower has been presented in Table 2to 4. The maximum plant height (59.67 cm.) was recorded with NAA @ 300 ppm (N3) at harvest which was found significantly higher over rest treatments. The data further, reveals that the maximum curd weight (557.50g) and curd volume (127.45cc) was also recorded with the N3 treatment that is NAA @ 300 ppm . Minimum values were recorded in control. The data presented in Table 2 to 4 explicit that plant height, curd weight and volume was significantly influenced by different NAA and boron levels. All the treatments were significantly superior over control.

Keywords : Curd, cauliflower, Growth, Naa, Boron, Nutrition.

INTRODUCTION

The optimum use of manures and fertilizers is one of the essentials for increasing the yield of vegetable crops. The Micronutrients and hormones play very important role in plant nutrition.NAA is found to affect growth and development of plants. Bud formation and flowering is directly influenced by NAA hormones Boron is a micronutrient. Ti directly involved in sugar assimilation. Apical as well as side bud development is directly influenced by boron element. In fact, for high productivity and good quality of vegetables, Boron is a prerequisite. U Several symptoms of boron deficiency can be observed on cauliflower plant when soil is deficient. Both Boron and NAA were tried to assess the impact on Cauliflower plant and curd development.

MATERIALSAND METHODS

A field experiment entitled “Effect of NAA and Boron Levels on plant and curd vigour of Cauliflower (*Brassica oleracea* Var. *botrytis* L) Kshi

Gobhi-25” was conducted at Horticulture Farm, Kulbhaskar Ashram Post Graduate College, Prayagraj during *rabi* season, 2019-20. The experiment was laid out in randomized block design (RBD) with 3 replications. Number of Treatments were 16.

(A) NAA levels Notations **1.** Control (N0) **2.** 100 ppm (N1) **3.** 200 ppm (N2) **4.** 300 ppm (N3)
(B) Boron levels**1.**Control : (B0) **2.** 0.75 kg/ha : (B1) **3.** 1.50 kg/ha : (B2) **4.** 2.25 kg/ha : (B3)

Table - 1 : Details of the treatments along with combinations.

Treatment	Combination	Treatment	Combination
	N ₀ B ₀	T ₉	N ₂ B ₀
T ₁	N ₀ B ₁	T ₁₀	N ₂ B ₁
T ₂	N ₀ B ₂	T ₁₁	N ₂ B ₂
T ₃	N ₀ B ₃	T ₁₂	N ₂ B ₃
T ₄	N ₁ B ₀	T ₁₃	N ₃ B ₀
T ₅	N ₁ B ₁	T ₁₄	N ₃ B ₁
T ₆	N ₁ B ₂	T ₁₅	N ₃ B ₂
T ₈	N ₁ B ₃	T ₁₆	N ₃ B ₃

FINDINGS AND DISCUSSION:

1. GROWTH ATTRIBUTES

Plant height

Effect of NAA levels: Data regarding the effect of NAA and Boron on the plant height of Cauliflower at 30, 60 DAT and at harvest has been presented in Table -2 The maximum plant height (21.98, 45.01 and 59.67cm) were recorded with NAA @ 300 ppm (N3) at 30, 60 DAT and at harvest respectively which was found significantly higher over rest treatments but it was statistically at par with N2. The increase in plant height 56.66, 49.48 and 38.64 per cent higher at 30, 60 DAT and at harvest respectively over control. Minimum height (14.03, 30.11 and 43.04 cm) were recorded in control at 30, 60 DAT and at harvest stage respectively.

Effect of Boron levels: The data further, reveals that the maximum plant height was recorded with the treatment B3 *i.e.* 2.25 kg/ha Boron. While minimum was under control (14.83, 31.00 and 42.62 cm) at 30, 60 DAT and at harvest respectively. The treatment B3 was found significantly superior over control, B1(0.75kg Boron) and B2 (1.50 kg boron). The increase in plant height under B3 was increased by 46.80 and 25.55 percent at 30 DAT; 46.77 and 25.55 per cent at 60 DAT and 46.76 and 25.53 per cent at harvest as compared to control respectively. Findings are in conformity with the findings of Ghosh SK, & Hasan MA (1997) and Kaur P and Mal D. (2018).

Table - 2 : Effect of NAA and Boron levels on plant height of Cauliflower

Treatment	Plant height (cm)		
	30 DAT	60 DAT	At harvest
NAA Levels			
N0 - Control	14.03	30.11	43.04
N1 - 100ppm	17.67	36.45	51.33
N2 - 200ppm	20.11	42.66	58.01
N3 - 300ppm	21.98	45.01	59.67
SE _m +	0.52	1.10	1.51
CD (P = 0.05)	1.51	3.18	4.35
Boron Levels			
B0 - Control	14.83	31.00	42.62
B1- 0.75 kg/ha	17.34	36.24	49.83
B2- 1.5 kg/ha	19.85	41.49	57.04
B3- 2.25 kg/ha	21.77	45.50	62.55
SE _m +	0.52	1.10	1.51
CD (P = 0.05)	1.51	3.18	4.35

2. CURD ATTRIBUTES

Weight of curd (g)

Effect of NAA levels: The data presented in (Table 3.) clearly indicate that different NAA levels significantly influenced weight of curd of Cauliflower. The maximum weight of curd 557.50g was recorded in treatment N3 (NAA @ 300 ppm), which was significantly superior over rest of the treatments except treatment N2 (NAA @ 200 ppm) which was statistically at par. The minimum weight of curd (277.50 g) was recorded under N0 (control).

Effect of Boron levels: Data given in same table further revealed that different boron levels had significant effect on weight of curd of Cauliflower. The maximum weight of curd of 519.49 g was recorded in treatment B3 (boron @ 2.25 kg/ ha) that was significantly superior over rest of the treatments except B2 (boron @ 1.5 kg/ha), which was statistically at par. The increase in weight of curd in treatment B3 was registered 38.00 per cent over control. Findings are in conformity with the findings of Khadka *et.al.* (2005); Mukhopadhyay T P and Chattopadhyay SB (1999); Kumar *et al* 2015, and Negi *et. al.* (2017)

Table - 3 : Effect of NAA and Boron levels on weight of curd of Cauliflower

Treatment	Weight of curd (g)
NAA Levels	
- - -	277.50
N1 - 100ppm	477.50
N2 - 200ppm	539.83
N3 - 300ppm	557.50
SE _m +	10.49
CD (P = 0.05)	30.30
Boron Levels	
B0 – Control	375.74
B1- 0.75 kg/ha	436.85
B2- 1.5 kg/ha	512.75
B3- 2.25 kg/ha	519.49
SE _m +	10.49
CD (P = 0.05)	30.30

Volume of curd (cc)

Effect of NAA Levels: A perusal of data (table 4.)

explicit that volume of curd was significantly influenced by different NAA levels. The maximum volume of curd (127.45 cc) was recorded in NAA @ 300 ppm (N3) treatment which was found significantly higher over N0 and N1 but statistically at par with N2 treatment. The increase in volume of curd was 63.38 and 18.61 per cent superior over N0 and N1 treatments respectively.

Effect of Boron levels: The volume of curd was also affected significantly by different boron levels. The maximum volume of curd (125.95 cc) was found in 2.25 kg boron/ha (B3) treatment which was significantly superior over B0 and B1 but was statistically at par with B2. The maximum volume of curd recorded under the treatment B3 which was found to be 44.64 per cent higher as compared to B0 treatment. The minimum volume of curd (87.08 cc) was recorded under control. Similar results were also recorded by Khadka *et.al.* (2005); Mukhopadhyay T P and Chattopadhyay SB (1999).

Table - 4 : Effect of NAA and Boron levels on volume of Cauliflower curd .

Treatment	Volume of curd (cc)
NAA Levels	
N0 – Control	78.01
N1 - 100ppm	107.45
N2 - 200ppm	120.33
N3 - 300ppm	127.45
SEm+ 3.13	3.13
CD (P = 0.05)	9.03
Boron Levels	
B0 – Control	87.08
B1- 0.75 kg/ha	101.81
B2- 1.5 kg/ha	118.40
B3- 2.25 kg/ha	125.95
SEm+	3.13
CD (P = 0.05)	9.03

CONCLUSION

Plant and curd vigour was significantly influenced with the application of NAA and Boron . NAA was better over Boron. Plant height, curd weight and curd volume may be significantly increased with 300ppm NAA and or 2.25kg/ ha. Boron application. Farmers may be advocated for commercial cultivation of cv. Kasi Gobhi-25 in Allahabad condition..

REFERENCE

1. Ghosh SK, and Hasan MA (1997) : Effect of Boron on growth and yield of Cauliflower. *Annals of Agricultural Science*:18(3):391-392.
3. Kaur P and Mal D. (2018): Effect of foliar spray of NAA and GA3 on the growth, curd formation and yield of Cauliflower. *Journal of Pharmacognosy and Phytochemistry*. 7(3):2805-2807
4. Khadka YG, Rai SK, Raut S. (2005): Effect of Boron in Cauliflower production. *Nepal J. of Science and technology*. 6:103-108.
5. Kumar, J.; Phookan, D.B.; Lal, N.; Kumar, H.; Sinha, K. and Hazarika (2015). Effect of organic manures and biofertilizers on nutritional quality of cabbage (*Brassica oleracea* var. *capitata*) J. Eco- friendly Agri. 10(2): 114-119
6. Mukhopadhyay T P , Chattopadhyay SB (1999); Boron and Molybdenum in growth and yield of Cauliflower grown in Terai region in West Bengha. *Horticultural Journal* 12 (2): 71-76.
7. Negi, E.; Punetha, S.; Kumar S.; Bahuguna, P.; Mekap, B. and Nautiyal, B.P. (2017) Effect of organic manures and bio-fertilizers on growth, yield, quality and economics of broccoli (*Brassica oleracea* L. var. *italic* Plenck) cv. Green head. *IJABR*, Vol. 7n (1) 2017: 96-100

ESSENTIAL OIL: ITS EXTRACTION TECHNIQUES AND MEDICINAL PROPERTIES

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ABSTRACT

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Essential oils, which are obtained through different methods used for extraction like; mechanical pressing or distillation, are concentrated plant extracts that retain the natural smell and flavours of their source. Each essential oil has a unique composition of chemicals, and this variation affects the smell, absorption, and effects on the body. The chemical composition of an essential oil may vary within the same plant species, or from plant to plant. It have been used for thousands of years in various Cultures for medicinal and health purposes. They are concentrated liquid containing volatile (easily evaporated at room temperatures) chemical compounds from plants. Because of their antidepressant, stimulating, detoxifying, antibacterial, antiviral and calming properties, they are recently gaining popularity as a natural, safe and cost-effective therapy for a number of health concerns. Essential oils are aromatic compounds found in great quantities in oil sacs or oil glands present at different depths in the fruit peel, mainly flavoured part and cuticles. In addition, essential oils are aromatic oily liquids extracted from different parts of plants for instance, leaves, barks, seeds, flowers and peels. These oils are very useful for various purposes.

Keywords : *Essential oils, extraction, chemical compound, properties*

INTRODUCTION

Essential oils are valuable plant products, generally of complex composition comprising the volatile principles contained in the plant and the more or less modified during the preparation process. (Bruneton et al.,1995) Essential oils have been isolated in many forms which in one way or the other enhances its bioactive and therapeutic

activities. Freeze Drying, rotary evaporation, steam distillation, hydrolyzation and GC chromatography assays among others are the most effective processes which are employed in these extraction process. Karen et al., indicated the effectiveness of employing GC in extracting the essential oils from leaves of edible (*Arachis hypogaeal.*) and Perennial

(*Arachis glabrata* Benth.) Peanut Plants
(Constanza Karen et al., 2015)

MATERIALS AND METHODS

Some Other Common techniques used for the extraction of essential oils are;

1) Hydrodistillation, 2) Hydrodiffusion, 3) Enfleurage. 4) Cold pressing, 5) Steam distillation, 6) Solvent extraction, 7) Microwave Assisted Process (MAP), 8) Carbondioxide extraction.

Hydrodistillation: The technique involves distillation of water that is in direct contact with fresh or sometimes dried Macerated plant materials. Plant material is grinded and weighed, then transferred into the Clevenger set up. Plant material is heated in two to three times its weight of water with direct steam. The Distillation vessel is heated over heating mantle and the water vapour and oil are removed through a water cool condenser.

Hydrodiffusion: Hydrodiffusion is a method of extracting essential oils in which steam at atmospheric pressure (low-pressure steam <0.1 bar) is passed through the plant material from the top of the extraction chamber, thus resulting in the oils that retain the original aroma of the plants. ((Buchbauer et al., 2000)

Enfleurage: This process is applicable to flowers such as Jasmine or tuberose, that have low content of essential oil and so delicate that heating would destroy the blossoms before releasing the essential oils. Flower petals are placed on trays of odourless vegetable or animal fat which will absorb the flowers essential oil. Every day or every few hours after the vegetable or fat has absorbed as much essential oil as possible; the depleted petals are removed and replaced with fresh ones. This procedure continues until the fat or oil becomes saturated with the essential oil. This is called Enfleurage mixture. Addition of alcohol helps to separate the essential oil from the fatty substances. The alcohol then evaporates leaving behind only the essential oil, hence enfleurage method is the best method when the source from the oil is to be extracted from flower or petals.

Cold pressing: Another method of extracting essential oil that has not found high application in scientific research is cold pressing. It is used to obtain citrus fruits oils such as bergamot, grape fruit, lemon, lime, etc. The fruits to be extracted are rolled over a trough with sharp projections that penetrate the peels, this pierce the tiny pouches containing the essential oil. The whole fruit is pressed to squeeze the juice and is separated from the juice by centrifugation.

Steam Distillation: This is the most common method of extracting oils and is the oldest form of essential oils extraction. In this technique, the desired plant (fresh or sometimes dried) is first placed into the vessel. Next steam is added and passed through the plant that contains the plants aromatic molecules or oils. Once upon, the plant releases these aromatic molecules and in the state, the fragrant molecules travel within a closed system towards the cooling device. Cold water is used to cool vapours. As they cool, they condense and transform into a liquid state.

Solvent extraction: This method involves the extraction of the oils from the oil bearing materials with the use of solvent. Solvent used depends on the part of the plant to be used for extraction. For instance, leaves, roots, fruits are extracted with benzene with or without mixture of acetone or petroleum ether, in the cold or at boiling point while flowers are extracted with ethers. The solvent enters the plant to dissolve the oil waxes and colour. After the extraction, the solvent is removed by distillation under reduced pressure leaving behind the semisolid concentrate, this concentrate are extracted with absolute ethanol. The second extract is cooled to precipitate the waxes and then filtered. This wax free alcoholic solution is distilled under reduced pressure to remove alcohol and finally the essential oil.

Microwave assisted process (MAP): The MAP process uses microwave to excite water molecules in plant tissue causing the cells to rupture and release the essential oil trapped in the extra cellular tissue of

the plants (Belanger et al., 1995). This technique has been developed and reported by many authors as a technique for extraction of essential oils in order to obtain a good yield of the essence and to reduce the time of extraction (Collin et al., 1991, Bouzid et al., 1997, Chiasson et al., 2001, Ghoulami et al., 2001). This technique has also been applied for the extraction of saponins from some medicinal plants

Carbon dioxide extraction: In this technique, plant material is placed in a high pressure vessel and carbon dioxide is passed through the vessel. The carbon dioxide turns into liquid and acts as a solvent to extract the essential oil from the plant material. When the pressure is decreased, the carbon dioxide returns to a gaseous state leaving no residue behind. Qualities of essential oil extracted with any of the techniques described above depend on the chemical composition of the oil.

TYPES OF ESSENTIAL OILS – (Based on Aroma)

1. **Citrus Oils:** Essential oils that have a distinct citrus flavor fall into this category. Bergamot, Grapefruit, Lemon, Lime, orange and Tangerine are some of the plants that produce citrus oils.(Viuda- Martos et al.,2008)
2. **Herbaceous Oils:** Oils that are extracted from plants, which are otherwise most useful herbs. These oils can be extracted from plants such as Basil, Chamomile, Melissa, Clary Sage, Hyssop, Marjoram, Peppermint and Rosemary are some of this kind. (Yepez et al.,2002)
3. **Camphoraceous Oils:** These are essential oils with a particular healing property. Some of these essential oils are obtained from Cajeput, Tea Tree, borneol-like, earthy and mugwort-like and Rosemary- like, with a fruity, dried plum-like background. (Weyerstahl et al.,1993)
4. **Floral Oils:** Oils made from floral parts or which carry the floral essence of plants fall under this group. Geranium, Jasmine,

Lavender, Rose, Neroli, Chamomile, Ylang-Ylang etc. are some of the plants that produce these oils.

(Simpson et al., 1990 , Paulo et al., 1998)

5. **Woody Oils:** Essential oils that are woody in aromas or extracted from the barks and other woody parts of plants. Cedar wood, Cinnamon, Cypress, Juniper Berry, Pine and Sandalwood etc. Produce such oils. (Junming et al,2010 , Li et al.,2002)
6. **Earthy Oils:** Essential oils that have a distinct earthy aroma or are extracted from plants' roots and other earthy parts. Angelica, Patchouli, Vetiver and Valerian produce some of these oils.(Priestap et al.,1990 , Jirovetz et al.,2002)
7. **Spicy Oils:** Oils extracted from spices or spicy plants such as thyme, cloves, Aniseed, Black Pepper, Cardamom, Cinnamon, Coriander, Cumin, Ginger and Nutmeg. (Lopez-Cortes et al.,2013)

MEDICINAL USE OF ESSENTIAL OILS

Essential oils as antibacterial agents

Essential oils can act as anti-bacterial agents against many pathogenic bacterial strains like *Listeria monocytogenes*, *L. innocua*, *Salmonella typhimurium*. (Schmidt et al., 2005). The presence of a phenolic hydroxyl group, in carvacrol is credited with its activity against pathogens like *Bacillus cereus*. Alcohols possess bactericidal rather than bacteriostatic activity against vegetative cells. (Dorman et al., 2000). Bactericidal activities are also shown by essential oil against oral and dental pathogenic microorganism and therefore are used into rinses or mouth washes for pre-procedural mouth control. (Yengopal, 2004a). Mouth washes containing essential oils could be used to control plaque since they can penetrate the plaque bio film where they kill pathogenic wall and inhibit their enzymatic activity (Hamid et al.,2011).

Antioxidant activity of Essential Oils

Essential oils have great potential in the nutrition industry in view of their antioxidant properties, they

are used as feed additives for farm animals, for example, and that may be fundamental to the quality of food products from these animals, since essential oils can improve nutritional value, oxidative stability and increase the shelf life of these products such as meats and eggs. In addition, they are often treated as foods to enhance the taste and organoleptic properties, and even have the function of decreasing the process of deterioration of food. The latter is mainly due to its antimicrobial and antioxidant activities. (Perez-Roses et al., 2016, Wang et al., 2017, Dukić et al., 2016). The interest in extracts rich in natural antioxidants has recently increased, especially the antioxidant activity of essential oils. Most of them confirm the assumption that essential oils are promising as natural antioxidants, which can replace synthetic additives such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) that are potentially harmful to human health. (Rashid et al., 2013, Miri et al., 2012, Taghvaei et al., 2015)

As an Antidiabetic Agent

Diabetes is a hormonal disease in which either the production of insulin is inhibited or the body does not use it properly. Many researches have been conducted to explore the anti-diabetic activity of essential oils, like rosemary essential oil showed hyperglycaemic and insulin release inhibitory effect in diabetic rabbits. Studies show that lipophilic fraction of aromatic plants are not only responsible for this activity but also indicated that oral administration of a combination of essential oils like cumin, cinnamon, oregano, fennel, myrtle etc. was able to enhance insulin sensitivity in type II diabetes. (Hader et al., 1994)

Anti-cancer Activity

Essential oils from aromatic plants have been treated as a product containing anticancer properties because they have the ability to inhibit cell proliferation and decrease the spread of cancer, improving the quality of life of cancer patients and reducing the level of their agony. Mediated therapy with essential oils can be used in combination with

conventional therapies in the treatment of cancer (chemioterapia e radioterapia). (Bayala et al., 2014, Gautam et al., 2014, Yang et al., 2017). It is generally said that components that induce phase I or II drug metabolizing enzymes can protect against chemical damage during the initiation phase. A number of dietary monoterpenes exhibit not only anti-tumor activity but also prevent progression of cancer. D-limonene in orange peel oil inhibits the development of chemically induced rodent mammary skin, liver, lung and fore stomach cancers. (Crowell et al., 1999). The essential oil of *Tetradlea articulata* showed the hallmark of apoptosis when tested on a number of human cancer cell lines like melanoma, breast and ovarian cancer in addition to blood lymphocytes. (Hamid et al., 2011)

Antiparasitic Activity

Due to the hydrophobic and bioactivities nature of its components, essential oils (EO) can be considered important sources of development of agents against intracellular pathogens such as protozoa, which cause parasitic diseases. (Gracia et al., 2017). The essential oil of leaves of *Artemisia indica* showed antimalarial activity in vitro, being a prophylactic potential of malaria, which is a disease caused by the protozoan of the genus *Plasmodium*. The oil inhibited at least two recombinant enzymes from the biosynthesis of plasmid fatty acids and showed low cytotoxicity in mammals. (Tasdemir et al., 2015) Another Essential Oil that presents the antimalarial effect is that obtained from *Piper aduncum* leaves, with camphor (17.1%), viridiflorol (14.5%) and piperitone (23.7%) being the main components found in this oil. (Monzote et al., 2017)

Anti-inflammatory activity

Essential oils have complex mixtures of chemicals that are present in different concentrations, these oils are used in medicine to treat a myriad of diseases because they present potential for anti-inflammatory activity. (Cassia et al., 2014, Lima et al., 2014). In recent years the anti-inflammatory potential of essential oils and their

chemical position has become the object of study of several researchers in the search for new drugs of natural origin. , (Chou et al.,2012 , Branquinho et al.,2017) as well as a study of the synergistic anti-inflammatory effect of the chemical constituents of essential oils and synthetic drugs, showing a possible association between clinical remedies with natural products as a pharmacological alternative and avoiding adverse reactions caused by synthetic products. (Macedo et al.,2016)

Aromatherapy

Aromatherapy is the therapeutic use of fragrances or at least mere volatiles to cure or mitigate or prevent diseases, infection and indisposition by means of inhalation (Buchbauer et al., 1993a). Inhalation of essential oils or their individual, volatile terpenes has a significant role in controlling the central nervous system. For instance, aroma inhibit of storax pill essential oil and pre inhalation of *Aconus gramineus* rhizome. Essential oils are used in Chinese folk medicine in the treatment of epilepsy (Koo et al.,2003)

CONCLUSION

The use of essential oils and their useful properties have spread widely throughout the world, which has greatly increased the quantity and quality of essential oil production. Additionally, there is many applications regarding medication, aromatherapy, anti-inflammatory activities and anti-parasitic and bug repellent, all of which are used directly or indirectly on people to meet their needs and wants.

REFERENCES

1. Bayala B, Bassole IH, Scifo R, Gnoula C, Morel L, Lobaccaro J-MA, Simpure J. (2014) Anticancer activity of essential oils and their chemical components—A review. American Journal of Cancer Research. 4(6):591-607.
2. Branquinho LS, Santos JA, Cardoso CAL, Mota J da S, Junior UL, Kassuya CAL, Arena AC. (2017) Anti-inflammatory and toxicological evaluation of essential oil from *Piper glabratum* leaves. Journal of Ethnopharmacology. 198:372-378.
3. Buchbauer G. (2000). The detailed analysis of essential oils leads to the understanding of their properties. Perfumer and flavourist. 25:64-67.
4. Buchbauer G, Ngassoum MB, Geissler M (2002) Aroma compound analysis of *Piper nigrum* and *Piper guineense* essential oils from Cameroon using solid-phase microextraction–gas chromatography, solid-phase microextraction–gas Chromatography–mass spectrometry and olfactometry. Journal of Chromatography A 976: 265-275.
5. Constanza K, Tallury S, Whaley J, Sanders T, Dean L (2015) Chemical composition of the essential oils from leaves of edible (*Arachis hypogaea* L.) and perennial (*Arachis glabrata* Benth.) peanut plants. Journal of essential Oil Bearing Plants 18: 605-612.
6. García M, Scull R, Satyal P, Setzer WN, Monzote L. (2017) Chemical characterization, antileishmanial activity, and cytotoxicity effects of the essential oil from leaves of *Pluchea carolinensis* (Jacq.) G. Don. (Asteraceae). Phytotherapy Research: PTR.31(9):1419-1426.
7. Jafari SM. (2015) Application and stability of natural antioxidants in edible oils in order to substitute synthetic additives. Journal of Food Science and Technology. 52(3):1272-1282
8. Jirovetz L, Jager W (1993). Fragrance compounds and essential oils with sedative effects upon inhalation. J. pharm Sc:82: 660-664.
9. Junming X, Jianchun J, Jie C, Yunjuan S (2010). Biofuel production from catalytic cracking of woody oils. Bioresource technology 101: 5586-5591.
10. Koo B, Lee S, Ha J, et al. (2003). Inhibitory

effects of essential oil for SuHeXiang Wan on central nervous system. *Bio Pharm Bull* . 27: 515-519

11. Li C, Jiang L and Cheng S (2006) Study on preparation of bio-diesel with four woody plant oils. *Biomass chemical engineering* 40: 51-55.

12. Lima VT, Vieira MC, Kassuya CAL, Cardoso CAL, Alves JM, Foglio MA, De Carvalho JE, Formagio ASN. Chemical composition and free radical-scavenging, anticancer and anti-inflammatory activities of the essential oil from *Ocimum kilimandscharicum*. *Phytomedicine*. 2014;21(11):1298-1302

13. López-Cortés I, DC Salazar-García, B Velázquez-Martí, DM Salazar (2013) Chemical characterization of traditional varietal olive oils in East of Spain. *Food research international* 54:1934-1940.

14. Mahato N, Sharma K, Koteswararao R, Sinha M, Baral E, (2019) Citrus essential oils: Extraction, authentication and application in food preservation. *Crit Rev Food Sci Nutr* 59: 611-625

15. Monsef-Esfahani HR, Amini M, Amanzadeh Y, Hadjiakhoondi A, Hajiaghvae R, Ebrahimi A.(2012) Comparative chemical composition and antioxidant properties of the essential oils and aromatic water from *Teucrium persicum* Boiss. *Iranian Journal of Pharmaceutical Research*. 11(2):573-581

16. MartosM V, Navajas R, Fernández-López R, Álvarez P (2008) Antifungal activity of lemon (*Citrus lemon* L.), Mandarin (*Citrus reticulata* L.), grapefruit (*Citrus paradisi* L.) and orange (*Citrus sinensis* L.) essential oils. *Food control* 19:1130-1138.

17. Maurya S, Kushwaha A K and Singh G (2013) Biological significance of spicy essential oils. *Advances in Natural Science* 6: 84-95.

18. Mimica-DukićN, OrčićD, LesjakM, ŠibulF. Essential oils as powerful antioxidants: Misconception or scientific fact? In: *ACS Symposium Series* [Internet]. 1st ed. Washington, DC; 2016. P. 187-208.

19. Monzote L, Scull R, Cos P, Setzer W. Essential oil from *Piper aduncum*: Chemical analysis, antimicrobial assessment, and literature review. *Medicines*. 2017;4(3):49. 39)De Cássia da Silveira e Sá R, Andrade L, dos Reis Barreto de Oliveira R, de Sousa D. A review on anti-inflammatory activity of phenylpropanoids found in essential oils. *Molecules*. 2014;19(2):1459-80.

20. Paulo C de L Nogueira, Anita J Marsaioli, Maria do Carmo E Amaral, Volker Bittrich (1998) The fragrant floral oils of *Tovomita* species. *Phytochemistry* 49: 1009-1012.

21. Pérez-Rosés R, Risco E, Vila R, Peñalver P, Cañigüeral S. Biological and nonbiological antioxidant activity of some essential oils. *Journal of Agricultural and Food Chemistry*.2016;64(23):4716-4724

22. Priestap H, G Rücker, M Neugebauer, AL Bandoni (1990) Investigation of the essential oils from *Aristolochia triangularis*. *Journal of Essential Oil Research* 2: 95-98

23. Rashid S, Rather MA, Shah WA, Bhat BA.(2013) Chemical composition, antimicrobial, cytotoxic and antioxidant activities of the essential oil of *Artemisia indica* Willd. *Food Chemistry*. 138(1):693-700.

24. Santos WC, Sousa Neto BP, Lopes EM, Piauilino CA, Cunha FVM, Sousa DP, Oliveira FA, Almeida FRC. (2016) Association of terpinolene and diclofenac presents antinociceptive and anti-inflammatory synergistic effects in a model of chronic inflammation. *Brazilian Journal of Medical and Biological Research*. 49(7):1-10

25. Silveira e Sá R, Andrade L, dos Reis Barreto de Oliveira R, de Sousa D. A review on anti-inflammatory activity of phenylpropanoids found in essential oils. *Molecules*. 2014;19(2):1459-80.
26. Simpson BB, JL Neff and G Dieringer (1990) The production of floral oils by *Monttea* (Scrophulariaceae) and the function of tarsal pads in *Centris* bees. *Plant Systematics and Evolution* 173: 209-222.
27. Tasdemir D, Tierney M, Sen R, Bergonzi M, Demirci B, Bilia A, Baser K, Brun R, Chatterjee M (2015). Antiprotozoal Effect of *Artemisia indica* Extracts and Essential Oil. *Planta Med* [Internet]. 17;81(12/13):1029-1037.
28. Tongnuanchan P and S Benjakul (2014) Essential oils: extraction, bioactivities, and their uses for food preservation. *Journal of food science* 79: R1231-R1249
29. Weyerstahl P, Schneider S, Marschall H, Rustaiyan A (1993) The essential oil of *Artemisia Sieberi* Bess. *Flavour and fragrance journal* 8: 139-145.
30. Yang C, Chen H, Chen H, Zhong B, Luo X, Chun J. Antioxidant and anticancer activities of essential oil from gannan navel orange peel. *Molecules*. 2017;22(8):1-10
31. Yepez, M Espinosa, S López, G Bolaños (2002) Producing Antioxidant fractions from herbaceous matrices by supercritical fluid extraction. *Fluid Phase Equilibria* 194: 879-884.
32. Yih KH, Yang CH, Huang KF. Anti-oxidant activity and major chemical component analyses of twenty-six commercially available essential oils. *Journal of Food and Drug Analysis*. 2017;25(4):881-889.

FISH FAUNA OF JABALPUR DISTRICT OF MADHYA PRADESH

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ABSTRACT

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Jabalpur, formerly Jubbulpore, is a city situated on the banks of Narmada River in the state of Madhya Pradesh. Some small river also flows from the region, but the piscine community is yet to be explored and have limited existing literature. The present study includes 101 fish species belongs to 46 genera, 21 families and 9 orders from rivers, ponds and reservoirs of Jabalpur. The order Cypriniformes are most dominant, followed by Siluriformes, Perciformes and other orders. Fishes are assigned with their IUCN status list; most of them are Least Concerned, some fishes are Endangered and Vulnerable. Some fishes are still not evaluated and data deficient.

Keywords : Jabalpur, fish, fauna

INTRODCUTION

India occupies the ninth position in having largest and richest biodiversity, about 450 families of fresh water fishes are present globally and roughly 40 are present in India (Talwar and Jhingaran, 1991). The state of Madhya Pradesh is the central state of India & one of the important aquatic biodiversity hotspots of the country, having bestowed with a large number of water bodies both lotic and lentic, the state boasts of rich fish biodiversity. The State of Madhya Pradesh with six major river basins, viz., Ganga, Narmada, Tapti, Mahanadi, Mahi and Godavari is one of the finest watersheds in the country. The richness of fish species has attracted the attention of eminent researchers and the state has a good contribution in enriching the data bank on the aquatic biodiversity of the nation.

The Jabalpur district (23°10' N, 79°57' E) lies in the eastern half of Madhya Pradesh in the

central region of India with geographic area of 5211 sq km. It is situated on the Deccan Plateau at an altitude of 402 m. above msl and surrounded on all sides by ancient basalt rocks and forests. Jabalpur is one of the most important district of Madhya Pradesh states. It lies in the catchment of the longest river of Central India, the Narmada, along with its tributaries viz. Hiran, Gour, Ken and Sone. The Jabalpur city is surrounded by low, rocky and barren hillocks, which include Kariapathar hillock to the northeast, Sita Pahad and Kandhari hills to the east and Madan Mahal hills to the southwest. Khandari and Pariyat, these two main water reservoirs are located in the northeast direction in Jabalpur district. The Jabalpur district enjoys typical monsoon climate with three seasons, summer from March to June, rainy season from June to September and winter from November to February. The period from mid-September to October is the post-monsoon period (Editor-Director, 2008).

Fishes are the important element in the economy of many nations as they have been a staple in the diet of many people (Day, 1878; Datta Munshi and Srivastava, 1988; Sharma, 2007; Paunikar *et al.*, 2012). Ichthyofaunal documentation is important to analyze status of fish species and also helps us for future planning to improve and conserve the biodiversity (Myers *et al.*, 2000; Lakra *et al.*, 2007; Bose, *et al.* 2013). In India potential of fish culture is yet to be fully exploited. Fishes being rich source of proteins and have high nutritive value (Remadevi, 2003). Extensive development of aquaculture needs to be given priority after green revolution to feed ever growing population (Lakra *et al.*, 2010). Success of fish culture depends apart from other factors, on selection of suitable species. Secondly the country is rich in diversity of such important group of animals Thakur, *et al.*, 2021). Further, there is a need of a survey of diversity of fishes in different types of habitats of river all over the country (Menon, 1999; Daniels, 2002; Gopi *et al.*, 2017; Paunikar, 2021).

Several renowned workers studied the fresh water fishes of rivers, ponds, lakes, dams and reservoir of Madhya Pradesh including Jabalpur district. A very few reports are available of fishes from Jabalpur districts. The freshwater fishes of Jabalpur districts from different rivers, ponds and reservoirs studied by Malviya (1961); Mathur and Mishra, (1976); Sharma (2008); Chandra *et al.* (2010); Paunikar *et al.* (2012); Saini and Dube (2017) and Chanchala *et al.* (2017).

MATERIALS AND METHODS

Fishes species distributed along the river Narmada, Gour, Periyat, Temar and several Ponds and Reservoirs of Jabalpur, Madhya Pradesh state are presented in this paper. The checklist was prepared by taking previous publication as a baseline but categorised into their current status list, their habitat using an online version of biodiversity of India. The biodiversity status is criteria according to the IUCN, 1994 and Molar and Worker, 1998.

RESULTS AND DISCUSSION

The present study includes 101 fish species belongs to 46 genera, 21 families and 9 orders from rivers, ponds and reservoirs of Jabalpur. The order Cypriniformes are most dominant, followed by Siluriformes, Perciform. Fishes are assigned with their IUCN status list; most of them are Least Concerned, some fishes are Endangered and Vulnerable. Some fishes are still not evaluated and data deficient (Table-1).

The members of Order Cypriniformes were dominated by 61 species followed by Siluriformes 20 species, Perciformes 12 species, Mastacembeliformes 3 species and Osteoglossiformes, Beloniformes 2 species each and Chichliformes, Mugiliformes, Synbranchiformes 1 each. The 21 fish families represented by 54 fish species, Family Cyprinidae was dominant group with 13 species in the assemblage composition in which *Garra Lamta*, *Rasbora daniconius* and *Puntius ticto* were found most abundant. *Catla-caltla*, *Puntius punctius*, *Puntius sarana*, *Puntius sophore*, *Lebeo rohita*, *Cyprinus carpio*, *Hypothalmichthys molitrix*, *Chela bacaila*, *Cirrhinus mrigala* found abundant. *Cirrhinus reba* and *Labeo calbasu* were found less abundant. Followed by Family Bagridae in which *Mystus cavasius* was found abundant. *Mystus aor* (*Aorichthys*), and *Mystus seenghala* were found less abundant.

Among Family Channidae *Channa striatus* was found less abundant while *Channa punctatus* and *Channa gaucha* were found abundant. Followed by Family Notopteridae in which *Notopterus Notopterus* was found abundant. *Notopterus chitala* was found rare. Family Siluridae in which *Wallago attu* was found abundant. Family *Ompok bimaculatus* was found rare. The family Mastacembelidae in which *Mastacembelus armatus* and *Mastacembelus pancalus* were found less abundant. Followed by family Nandidae in which *Nandus* where found less abundant. Family Ambassidae in which *Chanda nama* and *Chanda ranga* are found less abundant. The family Claridae

in which *Claris batrachus* found abundant.

The family Mugilidae in which *Mugil cephalus* was found rare. Family Belonidae in which *Xenentodon cancila* was found rare. Family Cichlidae in which *Oreochromis mossambica* were found abundant. The family Anabantidae in which *Anabas testudineus* were found abundant. Family Gobiidae in which *Glassogobius giuris* were found rare.

Some reports available on fishes of different rivers of Jabalpur. Sharma (2008) reported 93 species of fishes different rivers, ponds and reservoirs of Jabalpur district. Paunikar *et al.* (2012) recorded 33 species of fishes from Gour river, Jabalpur. Saini and Dube (2017) reported 29 species of fishes from Narmada rivers of Jabalpur. Chanchala *et al.* (2017) recorded 34 species of fishes from Temar rivers of Jabalpur.

Desai (1994) studied the status of endangered, vulnerable and rare fishes of river systems (Western and Central) of Madhya Pradesh.

CONCLUSION

The above list regarding Fish diversity of the Jabalpur district of Madhya Pradesh state are aiming to contribute a better knowledge of the fish diversity planning of aquatic environments in this region. To maintain fish biodiversity has an immense importance as it is not always possible to identify individual species critically to sustain aquatic ecosystem.

Table - 1 : List of fish species from Jabalpur district, Madhya Pradesh

Sr. No	Order/ Family	Scientific Name	Common Name	Threat Status
1	Order: Cypriniformes Cyprinidae	<i>Catla catla</i> (Hamilton)	Indian Major Carp	LC
2		<i>Chela (Chela) cachius</i> (Hamilton)	Chela	LC
3		<i>Chela (Chela) laubuca</i> (Hamilton)	Winged Rasbora	LC
4		<i>Salmostoma bacaila</i> (Hamilton)		LC
5		<i>Salmostoma clupeoides</i> (Bloch)		LC
6		<i>Salmostoma phulo phulo</i> (Hamilton)		LC
7		<i>Cirrhinus mrigala</i> (Hamilton)	Mrigal	LC
8		<i>Cirrhinus reba</i> (Hamilton)	Reba carp	LC
9		<i>Cirrhinus cirrhosa</i> (Bloch)		LC
10		<i>Ctenopharyngodon idellus</i> (Valenciennes)	Grass carp	NE
11		<i>Cyprinus carpio</i> (Linnaeus)	Common carp	EN
12		<i>Hypophthalmichthys molitrix</i> (Valenciennes)	Silver carp	NT
13		<i>Labeo bata</i> (Hamilton)	Bata	LC
14		<i>Labeo boga</i> (Hamilton)	Burmese Fish	LC
15		<i>Labeo boggut</i> (Sykes)		LC
16		<i>Labeo calbasu</i> (Hamilton)		LC
17		<i>Labeo gonius</i> (Hamilton)		LC
18		<i>Labeo rohita</i> (Hamilton)	Rohu	LC
19		<i>Labeo dero</i> (Hamilton)		LC
20		<i>Labeo fimbriatus</i> (Bloch)	Fringed-lipped peninsula carp	LC
21		<i>Osteobrama cotio</i> (Hamilton)		LC
22		<i>Osteobrama vigorsii</i> (Sykes)		LC

Sr. No	Order/ Family	Scientific Name	Common Name	Threat Status
23		<i>Puntius amphibius</i> (Valenciennes)	Scarlet-banded Barb	NE
24		<i>Puntius (Pethia) conchoni</i> (Hamilton)	Stigma Barb	LC
25		<i>Puntius curmuca</i> (Hamilton)		EN
26		<i>Puntius dorsalis</i> (Jerdon)	Long Snout Barb	NT
27		<i>Puntius chola</i> (Hamilton)	Green Barb	EN
28		<i>Puntius (Pethia)gelius</i> (Hamilton)		NT
29		<i>Puntius melanostigma</i> (Day)		NE
30		<i>Puntius punjabensis</i> (Day)		LC
31		<i>Puntius sarana</i> (Hamilton)	Olive Carp	VU
32		<i>Puntius sophore</i> (Hamilton)	Stigma Barb	LC
33		<i>Puntius ticto</i> (Hamilton)	Fire Fin Barb	LC
34		<i>Puntius waageni</i> (Day)		VU
35		<i>Rasbora daniconius</i> (Hamilton)	Common Rasbora	NE
36		<i>Rasbora rasbora</i> (Hamilton)		LC
37		<i>Aspidopariya morar</i> (Hamilton)	Aspidopariya	LC
38		<i>Tor tor</i> (Hamilton)*		EN
39		<i>Tor putitora</i> (Hamilton)	Golden mahasheer	EN
40		<i>Amblypharyngodon mola</i> (Hamilton)	Indian Carplet	LC
41		<i>Amblypharyngodon melettina</i> (Valenciennes)		LC
42		<i>Esomus danricus</i> (Ham.)	Flying Barb	DD
43		<i>Danio aequipinnatus</i> (McClelland)		
44		<i>Danio devario</i> (Hamilton)	Danio	LC
45		<i>Danio rerio</i> (Hamilton)		LC
46		<i>Barilius barila</i> (Hamilton)		LC
47		<i>Barilius bendelisis bendelisis</i> (Hamilton)	Hill Trout	LC
48		<i>Barilius evezardi</i> (Day)		LC
49		<i>Barilius vagra vagra</i> (Hamilton)		LC
50		<i>Barilius shacra</i> (Hamilton)		LC
51		<i>Crossocheilus latius latius</i> (Hamilton)		LC
52		<i>Garra gotyla gotyla</i> (Gray)	Stone Sucker	LC
53		<i>Garra lamia</i> (Hamilton)	Stone Sucker	LC
54		<i>Garra mullya</i> (Sykes)	Stone Sucker	LC
55	Family: Nemacheilidae	<i>Nemacheilus botia</i> (Hamilton)	Striped Loach	NE
56		<i>Nemacheilus (Schistura) denisoni denisoni</i> (Day)		NE
57		<i>Nemacheilus (Schistura) multifasciatus</i> (Day)		NE
58		<i>Nemacheilus (Schistura) savona</i> (Hamilton)		LC
59		<i>Nemacheilus (Schistura) striatus</i> (Day)		LC

Sr. No	Order/ Family	Scientific Name	Common Name	Threat Status
60	Family: Cobitidae	<i>Lepidocephalus (Lepidocephalichthys) guntea</i> (Hamilton)	Loach	LC
61		<i>Lepidocephalus (Lepidocephalichthys) thermalis</i> (Valenciennes)	Lesser Loach	LC
62	Order: Siluriformes	<i>Rita gogra</i> (Sykes)		LC
63	Family: Bagriidae	<i>Rita rita</i> (Hamilton)	Rita	EN
64		<i>Aorichthys aor</i> (Hamilton)	Long Whiskered Catfish	NE
65		<i>Mystus vittatus</i> (Bloch)	Striped Dwarf Catfish	EN
66		<i>Mystus tengara</i> (Hamilton-Buchanon)		LC
67		<i>Mystus bleekeri</i> (Day)		LC
68		<i>Mystus seenghala</i>	Giant River Catfish	LC
69		<i>Mystus cavasius</i> (Hamilton)	Dwarf Catfish	LC
70	Family: Siluridae	<i>Ompok bimaculatus</i> (Bloch)	Butter Catfish	NE
71		<i>Ompak paba</i>	Butter Catfish	NE
72		<i>Wallago attu</i> (Bloch and Schneider)	Freshwater Shark	VU
73	Family: Schilbeidae	<i>Chupisoma gama</i> (Hamilton)		EN
74		<i>Eutropiichthys vacha</i> (Hamilton)		EN
75	Family: Sisoridae	<i>Bagarius bagarius</i> (Hamilton)	Bagarius	EN
76		<i>Nangra itchkeea</i> (Sykes)		VU
77		<i>Conta elongata</i> (Day)		DD
78		<i>Glyptothorax telchitta telchitta</i> (Hamilton)		LC
79	Family : Clariidae	<i>Clarias batracus</i> (Linnaeus)	Air Breathing Catfish	VU
80	Family: Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch)	Stinging Catfish	VU
81	Order : Mastacembeliformes Family: Mastacembelidae	<i>Macrognathus aculeatus</i> (Bloch)	Lesser Spiny Eel	LC
82		<i>Mastacembelus armatus</i> (Lacepede)	Bam	LC
83		<i>Macrognathus punctalus</i> (Hamilton)		LC
84	Order: Chichliformes Family :Cichlidae	<i>Oreochromis mossambica</i> (Peters)	Telapi	LC
85	Order: Sybranchiformes Family : Synbranchidae	<i>Monopterus cuchia</i> (Hamilton)	Swamp eel	LC
86	Order : Perciformes Family : Channidae	<i>Channa orientalis</i> (Schneider)	Brown Snake-head Murre	LC
87		<i>Channa marulius</i> (Hamilton)	Giant Snake-head Murrel	LC
88		<i>Channa punctatus</i> (Bloch)	Green Snake-head Murre	LC
89		<i>Channa striatus</i> (Bloch)	Striped Snake-head Murrel	LC
90		<i>Channa gachua</i> (Hamilton)		LC

Sr. No	Order/ Family	Scientific Name	Common Name	Threat Status
91	Family: Ambassidae	<i>Chanda baculis</i> (Hamilton)		DD
92		<i>Chanda nama</i> (Hamilton)	Indian Glass Fish	LC
93		<i>Chanda ranga</i> (Hamilton)	Indian Glass Fish	LC
94	Family : Anabantidae	<i>Anabas testudineus</i> (Bloch)		LC
95	Family: Nandidae	<i>Nandus nandus</i> (Hamilton)		LC
96	Family: Badidae	<i>Badis badis</i> (Hamilton)		LC
97	Family : Gobiidae	<i>Glossogobius giuris</i> (Hamilton)	Bar-eyed Goby	NT
98	Order: Mugiliformes Family: Mugilidae	<i>Mugil cephalus</i> (Linnaeus)	Mullet	LC
99	Order: Beloniformes Family: Belonidae	<i>Xenentodon cancila</i> (Hamilton)	Freshwater Garfish	NT
100	Order: Osteoglossiformes	<i>Notopterus notopterus</i> (Pallas)	Feather back	LC
100	Order: Osteoglossiformes	<i>Notopterus notopterus</i> (Pallas)	Feather back	LC
101	Family: Notopteridae	<i>Notopterus chitala</i> (Hamilton)	Moy	NT

Distribution Status IUCN: CR =Critically EN=Endangered VU =Vulnerable, LC= Least Concerned, NE= Not Evaluated, DD= Data Deficient.

* Recently this species declared as state Fish of Madhya Pradesh.

REFERENCES

1. Bose A.K., B.C. Jha, V.R. Suresh, A.K. Das, A. Parashar and Ridhi.(2013).Fishes of the middle stretch of river Tawa, Madhya Pradesh, India. Journal of Chemical, Biological and Physical sciences.vol 3(1): 706-716
2. Chanchala S. Shrivastava, R. K., Dube, K. K. (2017). Studies on Ichthyofaunal Diversity of Tamar River, Jabalpur, Madhya Pradesh, India. *International Journal of Science and Research*, 6(1):1408-1410.
3. Chandra, Kailash, Sharma, R.M. and Ojha, P. (2010). A compendium on the faunal resources of Narmada River Basin in Madhya Pradesh. Rec. zool. Surv. India, Occ. Paper No., 310: 1-152 (Published by the: Director, Zool. Surv. India, Kolkata).
4. Daniels, R.J.R. (2002).Freshwater Fishes of Peninsular India. Hyderabad: Universities Press (India).
5. Datta Munshi J. and Srivastava, S. (1988). Natural history of fishes and systematics of freshwater fishes of India. Narendra Publishing House New Delhi-110006,
6. Day F. (1878.). The fish of India, William Dawson's and sons., London, U.K reprint edition, 5. Today and Tomorrow Book Agency, Delhi.
7. Desai, V.R. (1994). Endangered, vulnerable and rare fishes of river systems (Western and Central) of Madhya Pradesh. Threatened fishes of India. Nature conservation Publication, 4: 97-108.
8. Editor-Director (2008). *Faunal Diversity of Jabalpur District, Madhya Pradesh*: 1-417.(Published by the Director, Zool. Surv. India, Kolkata)
9. Gopi, K. C., Mishra, S. S., Kosygin, L. (2017). Pisces. Chapter 33, 527–570p. In: Chandra, K., Gopi, K.C., Rao, D.V., Valarmathi, K. and Alfred, J.R.B.. (Eds.) Current Status of Freshwater Faunal Diversity in India. Director, Zoological

- Survey of India, Kolkata, India, 624.
10. Jayaram K.C. (1981). The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka, zoological survey of India, Calcutta.; xxii + 475.
 11. Lakra, W. S., Mohindra, V., and Lal, K. K. (2007). Fish genetics and conservation research in India: status and perspectives, *Fish Physiol. Biochem.*, 33, 475–487, <https://doi.org/10.1007/s10695-007-9168-z>,
 12. Lakra, W. S., Sarkar, U. K., Kumar, R. S., Pandey, A.; Dubey, V. K. and Gusain, O. P. (2010). Fish diversity, habitat ecology and their conservation and management issues of a tropical River in Ganga basin, India. *Environmentalist.*, 30(4): 306–319.
 13. Malviya, R.B. (1961). A list of fishes from Jabalpur, M.P. *Proc. National Academy of Science India Section B*, 31(3): 349-354.
 14. Mathur, D.S. and Mishra, S.K. (1976). Addition to the fish fauna of Jabalpur district (M.P.). *Newsletter of Zoological Survey of India*, 2 (4): 156-158.
 15. Menon, A. G. K. (1999). Check list – Fresh water fishes of India, *Records of the Zoological Survey of India Occasional Papers*, 175, 366 pp.,
 16. Molur, S. and Walker, S. (1998). Report of the Conservation Assessment and Management Plan. Workshop on freshwater fishes of India. Zoo Outreach Organization/ CBSG, Coimbatore, India, pp: 156.
 17. Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A. da Fonseca and J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
 18. Pathak, S. and Lavudya N. (2021). Diversity of freshwater fish in Narmada River, Madhya Pradesh. *Journal of Entomology and Zoology Studies*, 9(2): 704-709
 19. Paunekar, S., Tiple, T., Jadhav S.S. and Talmale S.S. (2012). Studies on Ichthyofaunal Diversity of Gour River, Jabalpur, Madhya Pradesh, Central India. *World Journal of Fish and Marine Sciences*, 4(4): 356-359.
 20. Paunekar, S.D. (2021). Species diversity, population structure and conservation status of fishes inhabiting in six different wetlands of Uttar Pradesh. *International Journal of Fisheries and Aquatic Studies*, 9(5): 30-38.
 21. Remadevi K. (2003). Freshwater fish biodiversity. In Venkataraman K (Ed) *National Aquatic ecosystem of India*, Zoological survey of India, Chennai, 217-224.
 22. Saini, D. and Dube, K.K. (2017). Fish diversity studies of River Narmada, Jabalpur Region (M.P). *International Journal of Fisheries and Aquatic Studies*, 5(5): 13-16
 23. Sharma. H.S. (2007). Freshwater fish fauna of Madhya Pradesh (including Chhattisgarh), *State Fauna Series*, Zoological Survey of India; 15(1): 147-244.
 24. Sharma, H.S. (2008). “Pisces” Faunal diversity of Jabalpur district (M.P.). *Zoological Survey of India*, pp: 225-274.
 25. Thakur, K., Kumar, R. Bhavna (2021). A Review on Freshwater Fish Diversity of India and Concept of DNA Barcoding in Fish Identification. *Egyptian Journal of Aquatic Biology & Fisheries*. 25(3): 667 – 693.
 26. Talwar, P.K. and Jhingran, A.G. (1991). *Inland Fishes of India and adjacent countries*. Vols. I and II. Oxford and IBH publishing Co. Pvt. Ltd., pp: 1158.

IMPACT OF MASS MEDIA ON RURAL DEVELOPMENT PROGRAMMES IN SIKRARA BLOCK, JAUNPUR, UTTAR PRADESH

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ABSTRACT

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The study aimed to investigate the impact of mass media on rural development programs in Sikrara block, Jaunpur, Uttar Pradesh. The main findings of the study revealed that the majority of the respondents belong to the middle age group, representing 63.34% of the total respondents. Secondary school is the most common educational background for respondents at 26.66%, followed by graduation at 25.84%. Backward caste stratum represents 42.5% of the respondents, while 65% of respondents belong to medium-sized land holdings. The majority of respondents have medium knowledge about rural and agricultural development at 66.66%, while 21.67% have low knowledge and 11.67% have high knowledge. Medium knowledge is also prevalent among respondents when it comes to women and child development, representing 81.66% of the total respondents, while 10% have high knowledge and 8.34% have low knowledge. Most of the respondents have a favorable attitude towards rural and agricultural development, accounting for 69.16% of the total respondents. However, 30.84% of respondents have an unfavorable attitude towards it. For women and child development, 56.67% of respondents have a favorable attitude, while 43.33% have an unfavorable attitude. Lastly, the majority of respondents have medium mass media exposure at 73.34%, while 19.16% have high exposure and 7.5% have low exposure. These findings suggest that there is a need to strengthen mass media exposure to enhance rural development programs in the Sikrara block of Jaunpur, Uttar Pradesh.

Keywords : *Investigate, background, to strengthen mass media exposure etc*

INTRODUCTION

Exactly and from the social, economic and political perspective the declaration is valid even today. Around 65 per cent of the State's population is living in rural area. People in rural areas should have the same quality of life as is enjoyed by people living in sub urban and urban areas. Further there are cascading effects of poverty, employment, poor and inadequate infrastructure in rural areas on urban centers causing slums and consequential social and

economic tensions manifesting in economic deprivation and urban poverty. Hence Rural Development which is concerned with growth and social justice, improvement in the living standard of the rural people by providing adequate and quality social services and minimum basic needs becomes essential. The strategy of rural development mainly focuses on poverty alleviation, better livelihood opportunities, provision of basic amenities and infrastructure facilities through innovative

programs of wage and self-employment. The above goals will be achieved by various programme support being implemented creating partnership with communities, non-governmental organizations, community based organizations, institutions, while the Department of Rural Development will provide logistic support both on technical and administrative side for programme implementation. Other aspects that will ultimately lead to transformation of rural life are also being emphasized simultaneously.

Rural development is important not only for the majority of the population residing in rural areas, but also for the overall economic expansion of the nation. Rural development is considered to be of noticeable importance in the country today than in the olden days in the process of the evolution of the nation. It is a strategy that ties to obtain an improved and productivity, higher socio-economic equality and ambition, and stability in social and economic development. The primary task is to decrease the famine that exists in roughly about 70 per cent of the rural population, and to make sufficient and healthy food available. The secondary task is to ensure the availability of clothing and footwear, a clean environment and house, medical attention,

recreational provision, education transport and communication.

MATERIALS AND METHODS

The present study on the impact of mass media on rural development programs was conducted in Jaunpur district, Uttar Pradesh. The district Jaunpur was selected purposively Out of 75 districts in the state and Baksha block was selected based on its connectivity to Tilak Dhari Post Graduate College, Jaunpur. Ten villages were selected from this block, with a focus on those that had a significant impact of mass media on rural development programs. A total of five villages were selected for the study, and 12 respondents were randomly selected from each village, resulting in a total sample size of 120 respondents. The data collected from the respondents were computed through Microsoft Excel software and the Statistical Package for the Social Sciences (SPSS) software was used for the statistical analysis .

RESULTS AND DISCUSSION

Distribution of the respondents according to their age:

Table- 1 represents the age distribution of the head of the farm families as obtained from the sample under study-

Table - 1 : Age distribution of the respondents.

Sr. No.	Age	Frequency	Percentage
1.	Young (up to 37years)	20	16.66
2.	Middle (38 – 63 years)	76	63.34
3.	Old (above 63 years)	24	20
	Total	120	100

The above table 1 shows that majority of respondents (63.33 per cent) belong to the middle age group followed by 16.66 per cent respondents with the young age group, whereas 20 per cent respondents belong to the age group of old age.

It is thus clear from the table that maximum respondents i.e. 63.33 per cent belong to the age

group between (38 to 63 years). The old age groups of above 63 years are mostly family of head therefore, they work less but they supervise, guide and take decision for developmental activities. The work of Natikar (2001) are in line of present findings.

Distribution of the respondents of their education

Table-2 presents the educational status of the respondents.

Table - 2 : Educational background of the respondents.

Sr. No.	Level of education	Frequency	Percentage
1.	Illiterate	5	4.17
2.	Primary school	6	5
3.	Middle school	10	8.34
4.	High school	22	18.33
5.	Secondary	32	26.66
6.	Graduation	31	25.84
7.	PG & Above	14	11.66
	Total	120	100

The table 2. shows that majority (26.84 per cent) of respondents have educational level up to secondary followed by 25.84 per cent of respondents belong to graduate category, 18.33 per cent of respondents belong to high school category, 11.66 per cent of respondents belong to PG & above category, 8.34 per cent of respondents belong to middle school, 5 per cent of respondents belong to primary school category, however only 4.16 per cent respondents were illiterate.

Thus table-2 concludes that 95 per cent respondents were educated while only 4.2 per cent were illiterate. The majority (26.84 per cent) of

respondents have educational level up to secondary level of education. This finding finds support from the work of **Rathore *et al.* (2006)**

Distribution of respondents according to their Caste:

Caste is another important factor which pervades all fields of social action in the rural society. One's position in the caste hierarchy is a huge measure, which determines his behaviour in society. Caste category is divided into three i.e. General, Other Backward and Schedule caste. The relevant information has been presented in the table- 3

Table - 3 : Caste distribution of the respondents

Sr. No	Category	Frequency	Percentage
1.	General caste	50	41.66
2.	Backward caste	51	42.50
3.	Schedule caste	19	15.84
	Total	120	100

The above table indicates that maximum number of respondents belong to backward caste constituting 42.5 per cent, while 41.66 per cent and 15.84 per cent respondents belong to upper caste and schedule caste group respectively. It is clear from the table that the majority of the respondents belong to

backward caste.

Distribution of knowledge about rural and agriculture development programme:

Knowledge level of rural people was recorded on the basis of their responses regarding rural development parameters and presented in table-4

Table - 4 : Distribution of knowledge about rural and agriculture development programme

Sr. No.	Category	Frequency	Percentage
1.	Low (below 10.04)	26	21.67
2.	Medium (10.04-13.06)	80	66.66
3.	High (above to 13.06)	14	11.67
	Total	120	100

Table-4 indicates that majority (66.66 per cent) had medium knowledge about rural and agriculture development followed by 21.67 per cent of respondents who have low knowledge, while 11.67 per cent respondents had high knowledge regarding various rural development programmes.

The majority of respondents (66.66 per cent) had medium knowledge about rural and

agriculture development. This finding finds support from the work of **Adeniji and Ega (2006)**.

Knowledge of respondents about Women and Child Development Programmes: Women and child development programmes have great emphasis on rural women and play a key role in their awareness about accountability in women and child welfare activities. An assessment of their knowledge was observed and presented in table-5

Table - 5 : Knowledge of respondents about Women and Child Development Programmes

Sr. No.	Category	Frequency	Percentage
1.	Low (below to 4.67)	10	08.34
2.	Medium (4.67-8.13)	98	81.66
3.	High (above to 8.13)	12	10.00
	Total	120	100

Table-5 indicates that majority (81.66 per cent) had medium knowledge about women and child development followed by 10 per cent of respondents who have high knowledge, while 8.34 per cent respondents had poor knowledge regarding various women and child development programmes.

Attitude of respondents towards programme: Opinion of respondents about women and child development and rural development programmes was measured and given in table -6.

Table-6 shows that majority (69.16 per cent) of respondents have favourable attitude towards rural and agricultural development, 56.67 per cent of

Table - 6 : Attitude of respondents towards programme

Sr.No.	Particular	Favourable		Unfavourable		Total
		Frq.	(per cent)	Frq.	(per cent)	Frq.(per cent)
1.	Rural and agriculture development	83	69.16	37	30.84	120
2.	Women and child development	68	56.67	52	43.33	120

respondents have favourable attitude toward women and child development and 30.84 per cent have unfavorable attitude toward rural and agricultural development.

The majority of respondent (43.33 per cent) have unfavourable attitude towards women and child development, and majority of respondents (69.16 per cent) have favourable attitude towards rural and agricultural development, 30.84 per cent have unfavourable attitude toward rural and

agricultural development. This finding is supported by Kumar *et al.* (2019).

Communication behaviour of the respondents:

Communication behaviour of a respondent was conceptualized as a composite measure of sources of information through mass media exposure and extension contacts which is given in table-7.

Table -7 indicated that 73.34 per cent of respondents were found to have medium mass media exposures followed by 19.16 per cent of

Table - 7 : Distribution of respondents according to mass media exposure

Sr. No.	Category	Frequency	Percentage
1.	Low (below 1.98)	09	07.50
2.	Medium (1.98-13.60)	88	73.34
3.	High (above 13.60)	23	19.16
	Total	120	100

respondents having high mass media exposure and remaining 7.5 per cent respondent had low level of mass media exposure.

The majority of the respondents were found to have medium mass media exposures. The finding finds support with the work of Galindo (2004).

CONCLUSION

On the basis of findings and observations made, it may be concluded that higher percentage of respondents belong to middle age group, have high school education, belong to backward caste stratum. Majority of respondents have fair knowledge about different rural development programmes. Maximum number of respondents were found to have medium mass media exposure and low extension contact, respectively.

REFERENCES

1. Adeniji, O. B. and Ega, L. A. (2006) Impact of mass media on adoption of agricultural innovations in Kaduna State. *Journal of Agriculture, Forestry and Social Sciences*. 4(1):89-98.
2. Galindo-Gonzalez, G. (2004). The radio: a means to promote rural development in

- Mexico. [Spanish] Radiodifusion: un medio para impulsar el desarrollo rural en Mexico. *Terra*. 22(1):127-132.
3. Kumar, A.; Singh, D.K. and Singh, B.P.(2019). To study the socio-economic status of respondent in relation to awareness of rural development programme in Meerut District in India. *International Journal of Pure and Applied Bioscience*. 7(1): 92-96
4. Kumar, A.; Tomar, M.; Singh, B.P. and Mehta, G.(2019). To study the attitude and contrints of the people toward rural development programme .*International Journal of Chemical Studies*. 7(2): 381-383
5. Natikar, K.V. ; (2001). Attitude and use of form journal by the subscriber farmers and their profiles. *A critical analysis, Ph.D. Thesis (Unpub)UAS, Dharwad*.
6. Rathod, R. and Tarikha, R. N. (2006). Information need and utilization pattern of subscriber of RAU publication. *International journal extension education dec.2006: 95-97*

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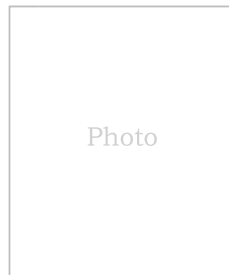
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