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Nutritional Quality Assessment of Some Cereals and Legumes Grown From Sakri Tahsil Dist-Dhule (M.S.), India.

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Abstract

Nutritional quality viz., protein content, fat content and percentage of moisture were assessed after six month of harvesting of some cereals and legumes commonly grown and utilized as staple food in Sakri tahsil, Dist- Dhule (M.S.). The food grains were treated with powder of *Acorus calamus* Linn @ 10 g kg^{-1} as a post harvest protectant during storage period. There was significant decrease in protein content in seeds of *Triticum aestivum* L (-11.8 %), *Pennisetum glaucum* L (-20.7 %), *Oryza sativa* L (-11.78 %), *Lens culinaris* M (-11.55 %), *Vigna mungo* L (-11.67 %) and *Metyloma uniflorum* V (-14.85 %). Similarly, significant decreased in fat content was also observed in *Sorghum vulgare* Pers (-36.8 %), *Pennisetum glaucum* L (-28 %), *Oryza sativa* L (- 20 %), *Cajanus cajanus* L (-29.41), *Vigna aconitifolia* Namn (-27.30), *Lens culinaris* M (- 28.57 %), *Vigna radiate* L (-23.07 %) and *Metyloma uniflorum* V (- 25.00 %). Whereas significant increased in moisture content of *Eluvine coracana* Gertn (17.85 %), *Cicer arietinum* L (14.30 %), *Glycine max* L (23.45 %), *Lens culinaris* M (20.96 %), *Vigna radiate* L (15.38 %) and *Metyloma uniflorum* V (16.67 %) etc. All the nutritional values of food stuffs were compared with the standard food values prescribed by ICMR. The variation in food stuff content after storage may be due to several reasons like crop grown in infertile or hilly areas, less irrigated, universally selected for experiment and may be due to food grains were not properly dried or over dried.

Key words: *Nutritional quality, moisture content, food stuffs, post harvest protectant.*

Introduction

Wheat and rice form the staple food in North and South India respectively. Apart from these jowar, maize, barley, bajra, ragi etc., are also used to some extent. Cereals are source of

energy in poor population. Cereals have about 75 % and 12.5 % carbohydrates and protein respectively by weight. They also contain 0.5 to 4.0 % fat and 0.4 to 4.0 % minerals (Vidya and Rao, 2010). Pulses had a place in history since 5000 BC. Pulses are prominently grown in South East Asia and Middle East India. Some pulses like Bengal gram, peas and green grams are consumed with or without splitting and removing the outer seed coat. Pulses are rich in proteins when compared to cereals (Mudambi and Rajagopal, 1990). On an average pulses have 20 % proteins on dry weight basis with an exception to Soyabean which has about 40 g/ 100 grams. These are also rich source of another food stuff the carbohydrates and minerals like phosphorus and iron. Vegetarian in India include 30-50 g of pulses in their daily menu (Srivastava and Srivastava, 2003).

High awareness of the people for longevity and good health is making the pulses more useful for the mankind. Pulses are not only important because of their high protein content but also important for their hypocholesterolemic properties as it reduces the body cholesterol and protect cardiovascular system (Srivastava and Srivastava, 2003). In a country like India where a large population is vegetarian, the cheap and best source of protein, lipid, carbohydrates and other essential nutrients are still the pulses. Pulses are often referred to as 'poor man's meat' in developing and underdeveloped countries of the world (Chaturvedi and Ali, 2002; Rout and Senapati, 2006). India is the largest producer of pulses in the world because of vegetarian dietary habits of its large population, accounting for 27-28 % of global production (Anonymous, 1998). In India, Pulses are grown in an area of 22.5 million hectares with annual production of 13-14 million tonnes (Asthana, 1999). It is the leading country for high consumption of pulses with an average consumption of 34g/person/day, but there are wide variations among states. Intake per day ranged from 16 g in Tamilnadu to 55 g in Madhya Pradesh (Chauhan *et al.*, 1997). However, India imports pulses to feed the ever-increasing population. Marginal increase in production in the last few decades and remarkable quantities of stored pulses become unsuitable for consumption due to attack of the most notorious pest, *Callosobruchus chinensis* L. are other important reasons for importing pulses (Mendki *et al.*, 1999; 2001; Ghosal *et al.*, 2005).

The main objective of present investigation is to find out nutritive values like protein, lipid and moisture content of locally grown cereals and legumes; compare these values with standard values prescribed by ICMR. Secondly whether there is loss or gain in their contents when these are

stored for minimum period of six month while using plant based post harvest protectant like power of *Acorus calamus*.

Material and Methods

Plant material: Post harvest protectant such as *Acorus calamus* Linn is purchased from a ayurvedic shop. It was properly dried, grind, sieved and stored in air tight plastic jar.

Food grains or seeds: Non-infested food grains of required cereals and pulses seeds were procured from local farmers immediately after harvesting. The seeds were then thoroughly washed, dried in bright sunlight for 3 days having 6 to 7 % moisture content. For experimental purpose weighed 1 kg food grains and mix with 10 g powder of *Acorus calamus* and stored for six month in airtight pearl pet containers.

Nutritional quality of cereals and pulses were assessed by analyzing various biochemical parameters, viz., total proteins (Lowry *et al.*; 1951), total lipids (Bligh and Dyer; 1959) and percentage of moisture content (Anonymous, 1996). Further, statistical analysis of data was done by Randomized Block Design (RBD) ANOVA- method. Whereas Critical Difference (CD) at 5 % level of significance was calculated.

Results and Discussion

The present investigation is based on finding out proximate components viz., percentage of total proteins, lipid and moisture content of cereals and legumes commonly grown in Sakri tahsil region and used in our daily diet. The nutritive values of assessed samples of cereals and legumes with prescribed values by ICMR are presented in table -1.

Total Proteins: As per ICMR, the protein content in cereals and pulses varies from 7 to 8 % and 18 to 43 % respectively (table-1). The proteins are located in the endosperm or cotyledons and the embryonic axis of seed with only a small amount present in the seed coat. There is wide variability in seed proteins of all cultivated species of cereals and pulses (Srivastava and Ali, 2004). Secondly, protein quality of a crop depends on its amino acids composition and these limiting acids also determine the nutritive value (Srivastava and Srivastava, 2003). In present investigation it was found that the protein content decreased in most of cereals and pulses. But significant

decrease in protein content is found in seeds of *Triticum aestivum* L. (-11.8 %), *Pennisetum glaucum* L (- 20.7 %), *Oryza sativa* L (-11.78 %), *Lens culinaris* M (-11.55 %), *Vigna mungo* L. (-11.67 %) and *Metyloma uniflorum* V (-14.85 %). Non significant decrease was observed only in grains of *Elusine coracana* Gertn.

Total Lipids: Lipids are a group of heterogeneous components consisting of free fatty acids, momo, di and triacyl glycerol, phospholipids, sterols, sterol esters, glycolipids and lipoproteins. The total lipid content of cereals and pulses varies from 1.0 to 5.0 % except soyabean. Their content varies with variety, environmental condition and type of soil on which they are grown. However, as compare to cereals most of pulses are low in total lipid content (Salunkhe and Kadam, 1989). In present study, it is observed that, the amount of fat content in both cereals and pulses were decreased significantly during storage period. But, as compared to standard values of ICMR, there was most significant decreased observed in *Sorghum vulgare* Pers (-36.8 %), *Pennisetum glaucum* L (-28 %), *Oryza sativa* L (- 20 %), *Cajanus cajanus* Linn. (-29.41), *Vigna aconitifolia* N. (-27.30), *Lens culinaris* M (- 28.57 %), *Vigna radiate* L (-23.07 %) and *Metyloma uniflorum* V (-25.00 %).

Moisture content: Percentage of moisture content were found to be inversely related to protein and lipid content. Upon storage, there was an increase in moisture content in the pulses (Multon, 1989). It might be due to promotion of microbial load, which attacks on protease of seeds. Haines (1991) reported that all stored products especially seeds are hygroscopic and can therefore absorb moisture from the surroundings. Rout and Senapati (2006); Patole and Mahajan (2008) noticed that an increase in moisture content of pulse seeds which was attributed respiration gradient of insect and or increase in microbial load, which in turn made pulses more susceptible to insect pest attack. In present studies, we find that significant increased in moisture content of *Elusine coracana* Gertn (17.85 %), *Cicer arietinum* L (14.30 %), *Glycine max* L (23.45 %), *Lens culinaris* M (20.96 %), *Vigna radiate* L (15.38 %) and *Metyloma uniflorum* V (16.67 %) etc. whereas, non significant increase is observed in grains *of Zea mays* L., *Sorghum vulgare* Pers, *Oryza sativa* L. *Cajanus cajanus* L and *Vigna unfuiculata* Walp.

Conclusion

Nutritive values of cereals and legumes have indicated quality of food. They increase palatability of food. Based on present results i. e. decrease in protein and lipid content whereas increase in percentage of moisture were found to be vital index for insect infestation i.e. the seed might be infested by stored grain pest like pulse beetle, *Callosobruchus* Spp and rice weevil, *Sitophilus* Spp. etc. The plant powder like, *Acorus calamus* may protect the seed for considerable period of time and thereafter they may prone to insect infestation. There are several reasons for decrease in protein and lipid content and increase in percentage of moisture. These may include;

- Crop grown in infertile or barren soil.
- Crop grown from less irrigated area or scarcity of water or less rainfall
- Seeds taken for experiment are of variable size
- Storage duration increases may leads to decrease in food stuff contents.
- Grains were not properly dried i.e. under dried or over dried etc.

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References

- ✓ Anonymous; 1996. *Loss on drying*. In: Indian Pharmacopia New Delhi: Controller of publications.
- ✓ Anonymous; 1998. India major importer of pulses due to keen domestic demand. In: Monthly Commentary of Indian Economic Condition. Vol. 468, Indian Institute of Public opinion, New Delhi, pp. 27-29.

- ✓ Bligh, E. G. and W. J. Dyer.; 1959. *Can. J. Biochem and Physiol.*, 37: 911.
- ✓ Chauhan, B. M., Kwatra, A. and Fenwick, G. R., 1997. In: Recent Advances in pulses Research (Asthana A. N. and Ali, M. Editors), II PR Pub, Kanpur, India. Pp. 695-714.
- ✓ Chaturvedi, S. K. and Ali, M., 2002. Poor man's meat needs fresh fillip. *The Hindu Survey of Indian Agri.*, 63-69.
- ✓ Ghosal, T. K., Senapati, S. K. and Deb, D. C.; 2005. Pesticidal effect of edible and non-edible oils on pulse beetle, *Callosobruchus chinensis* (Coleoptera: Bruchidae). *J. Ecobiol.*, 17(4): 321-327.
- ✓ Haines, C. P., 1991. Insects and Arachnids of tropical stored products: their biology and identification. A Training Manual. 2nd eds., *Nat. Reso. Institute*, Africa.
- ✓ Lowry, O. H., Rosebrough, N. J., Far, A. L. and Randall, R. J., 1951. Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193: 265-275.
- ✓ Mendki, P. S., Maheshwari, V. L. and Kothari, R. M., 1999. Pesticidal activity of certain plant extracts to control stored grain pest *Callosobruchus chinensis*. *Pestology*. 12: 64-68.
- ✓ Mendki, P. S., V. L. Maheshwari and R. M. Kothari., 2001. Flyash as a post harvest preservative for five commonly utilized pulses. *Crop protection* 20: 241-245.
- ✓ Mudambi, S. R. and Rajagopal, M. V., 1990. *Fundamentals of Foods and Nutrition* (Third edition). New Age International (P) Limited, Publishers, New Delhi.
- ✓ Multon, J. L., 1989. Spoilage mechanism of grains and seeds in the post harvest ecosystem, the resulting losses and strategies for the defense of stocks. In : Preservation and storage of grains, seeds and their by-products cereals, oil-seeds, pulses and animal feed. CBS Publishers, New Delhi. Pp. 3-11.
- ✓ Patole, S. S. and Mahajan, R. T., 2008. Efficacy of some indigenous plant powders as post harvest protectants of greengram seed against pulse beetle, *Callosobruchus chinensis* Linn (Coleoptera:BRuchidae). *J. Ecofriendly Agric.* 3(2): 138-141.
- ✓ Rout, B. and Senapati, P. K.; 2006. Traditionalizing non-traditional pulses: A case study in a tribal village of southern Orissa. *Everyman's Science* XLI (3) 183-188.
- ✓ Salunkhe, D. K. and Kadam, S. S., 1989. *Handbokk of world food legumes*: Nutritional chemistry, processing technology and utilization. Vol- I-III, CRC Press, Boca Raton, Florida.

✓ Srivastava, R. P. and Ali, M., 2004. Nutritional quality of common pulses. *Bull.*# IIPR/ 2004/07, II PR Publication, Kanpur (India).

✓ Srivastava, R. P. and Srivastava, G. K.; 2003. Review: Nutritional value of pulses. *Indian J. Agri. Biochem.*, 16(2): 57-65.

✓ Vidya, C. and Rao, D. B.; 1999. *A text book of Nutrition*. Discovery Publsihers house, New Delhi- 110 002.

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Original Research Paper Zoology

REVIEW ON THE BEETLE WORLD AND HUMAN RELATIONSHIP

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ABSTRACT The present review deals with relationship of beetles with human being. The beetles has hard sheathed fore winged insects belongs to the Coleoptera order. It is largest order in animal kingdom, constitute about one per cent life forms. Beetles have different habitations except sea and Polar Regions. Besides the pests, most of beetle acts as beneficial insects e.g. they acts as predator (Lady bugs), improving soil fertility and protect livestock health (Dung beetle), used as human food (Meal worm), in art and jewelry (wings of genus- Ivie), in ancient culture (a scarab beetle of Karnak temple and Tomb etc) and many of them used in chemical warfare i.e. they defend themselves by discharging poison, foul testing fluids e.g. True beetle, Leaf beetle, Violin beetle, Bombardier beetle, Blister beetle and Stink beetle etc.

KEYWORDS : Beetle, Coleoptera, Predator, poultry, Culture, Chemical warfare

INTRODUCTION

Beetles are a group of insects that form the order Coleoptera. The word "coleoptera" is from the Greek 'koleos, meaning "sheath"; and pteron, meaning "wing", thus "sheathed wing". This name was given to the group by Aristotle for their elytra, hardened shield-like forewings. The order contains more species than any other order, constituting almost 25% of all known life-forms. About 40% of all described insect species are beetles. The diversity of beetles is very wide-ranging. They are found in almost all types of habitats, but are not known to occur in the sea or in the Polar Regions. They interact with their ecosystems in several ways. They often feed on plants and fungi, break down animal and plant debris, and eat other invertebrates. Some species are prey of various animals including birds and mammals. Certain species are agricultural pests, such as the Colorado potato beetle (Leptinotarsa decemlineata), the boll weevil (Anthonomus grandis), the red flour beetle (Tribolium castaneum) and the mungbean or cowpea beetle (Callosobruchus maculatus) while other species of beetles are important controls of agricultural pests. For example, beetles in the family Coccinellidae ("ladybirds" or "ladybugs") consume aphids, scale insects, thrips, and other plant-sucking insects that damage crops.

Aims and objectives

- Aim is to initiate and encourage the conservation movement among teachers, farmers and society.
- To popularize importance of beetle for mankind as they play an important role as nutrient recyclers returning organic matter through multitrophic interactions, which contribute to soil fertility.
- The beetles are the important components of ecosystem. These are highly important from economical point of view. Today conservation of the species biodiversity is one of the most pressing environmental issues. Many factors threaten the world biological heritage. The change is far nations, government agencies, organizations and individuals to protect and enhance bio-diversity while continuing to meet people's need for natural resources. This challenge exists from local to global scale.

What is beetle?

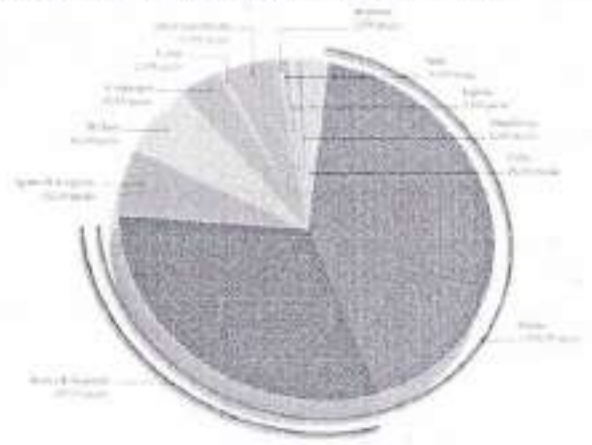
- Beetles are insects. Like all insects, they have a pair of antennae, six legs and three main body parts (fig. 1).
- More than 3, 50, 000 different kinds of beetle have been named. Thousands more are discovered every year. Altogether there are probably more than a million beetle species (Steve Jenkins, 1952).
- A beetle body is enclosed in a rigid shell called an exoskeleton. This hard casing provides support and protection
- Except for oceans and Polar Regions, beetles are found in almost every habitat; grasslands, forests, jungles, deserts, lakes and rivers.
- Beetle sense their surrounding with eyes, ears, and antennae. Tiny hairs on the legs and body of many beetles can also detect sound and odors.
- Beetles don't have a lung or gills. Instead they breathe through small openings on their body.
- Beetles evolved about 230 million years ago around the same time as the dinosaurs.

Taxonomy

The Coleopterans include more species than any other order, constituting almost 25% of all known types of animal life forms (Rosenzweig, 1995; Hunt et., 2007). About 3, 87,100 species of beetles occur – representing about 38.71 % of all known insects (Hammond, 1992). Overall, beetle species and their genera are currently placed in 1,663 tribes, within 541 subfamilies, nested in 211 families grouped into four suborders i. e. Adephaga, Archostemata, Myxophaga, and Polyphaga (Patrice, 2014). Polyphaga is the largest suborder, containing more than 300,000 described species in more than 170 families, including rove beetles (Staphylinidae), scarab beetles (Scarabaeidae), blister beetles (Meloidae), stag beetles (Lucanidae) and true weevils (Curculionidae). (Hunt et al., 2007). These beetles can be identified by the presence of cervical sclerites (hardened parts of the head used as points of attachment for muscles) absent in the other suborders (Atwal and Dhaliwal, 2003). The suborder Adephaga contains about 10 families of largely predatory beetles, includes ground beetles (Carabidae), Dytiscidae and whirligig beetles (Gyrinidae). Archostemata contains four families of mainly wood-eating beetles, including reticulated beetles (Cupedidae) and the telephone-pole beetle. Myxophaga contains about 100 described species in four families, mostly very small, including Hydroscaphidae and the genus Sphaerius.

Table-1. Animal diversity in relation to insects (Beetle)

Sr. No.	Animal group	Total Species	% Contribution
01	Fishes	31,300	2.27
02	Amphibian	6,450	0.47
03	Reptiles	9,100	0.66
04	Birds	10,000	0.72
05	Mammals	5,490	0.40
I	Chordates	62,340	4.52
06	Corals	2,175	0.16
07	Mollusks	85,000	6.17
08	Other invertebrates	69,000	5.0
II	Invertebrates other than Arthropods	79,675	11.3
09	Spider and Scorpion	1,12,201	8.14
10	Crustaceans	47,000	3.4
11	Insects	10,00,000	72.58
III	Arthropods	11,59,201	84.12
IV	Non-Chordates	13,15,376	95.48
	Total	13,77,716	100



Animal diversity

Relationship to human

a) As beneficial resources

Beetles are not only pests, but can also be beneficial, usually by controlling the populations of pests. One of the best, and widely known, examples is;

i) The ladybugs or ladybirds (family Coccinellidae, Fig. 2). Both the larvae and adults are found feeding on aphid colonies. Other ladybugs feed on scale insects and mealybugs. If normal food sources are scarce, they may feed on small caterpillars, young plant bugs, or honeydew and nectar. Ground beetles (family Carabidae) are common predators of many different insects and other arthropods, including fly eggs, caterpillars, wireworms, and others (Kromp, 1999).

ii) Dung beetles (Scarabidae, Fig. 3) have been successfully used to reduce the populations of pestilent flies and parasitic worms that breed in cattle dung. The beetles make the dung unavailable to breeding pests by quickly rolling and burying it in the soil, with the added effect of improving soil fertility, tilth, and nutrient cycling (Brown et al., 2010).

iii) They also protect livestock, such as cattle, by removing dung, which, if left, could provide habitat for pests such as flies. In developing countries, the beetle is especially important as an adjunct for improving standards of hygiene. **The American Institute of Biological Sciences** reports that dung beetles save the United States cattle industry an estimated US$380 million annually through burying above-ground livestock feces (John and Mace, 2006).

iv) Some beetles' help in a professional setting, doing things that people cannot; those of the family Dermestidae are often used in taxidermy and preparation of scientific specimens to clean bones of remaining soft tissue. Using the beetle larvae means that all cartilage is removed along with the flesh, leaving the bones spotless (Tomberlin and Sanford, 2012).

b) As food

Insects are used as human food in 80% of the world's nations (Carrington, 2010). Beetles are the most widely eaten insects. About 344 species are known to be used as food, usually eaten in the larval stage (Ramos and Menzel, 1998). The mealworm (fig. 4) is the most commonly eaten beetle species. The larvae of the darkling beetle and the rhinoceros beetle are also commonly eaten.

c) In art

Many beetles have beautiful and durable elytra that have been used as material in arts, with beetlewing the best example. Sometimes, they are also incorporated into ritual objects for their religious significance. Whole beetles, either as-is or encased in clear plastic, are also made into objects varying from cheap souvenirs such as key chains to expensive fine-art jewelry. In parts of Mexico, beetles of the genus Zopherus (fig. 5) are made into living brooches by attaching costume jewelry and golden chains, which is made possible by the incredibly hard elytra and sedentary habits of the genus (Ivie, 2002).

d) In ancient cultures

Some beetles were prominent in ancient cultures, the most prominent being the dung beetle in Ancient Egypt. Several species of dung beetle, especially the "sacred scarab" Scarabaeus sacer, were revered by the ancient Egyptians (Zabludoff, 2008). The hieroglyphic image of the beetle may have had existential, fictional, or ontologic significance. Images of the scarab in bone, ivory, stone, Egyptian faience, and precious metals are known from the Sixth Dynasty and up to the period of Roman rule. The scarab was of prime significance in the funerary cult of ancient Egypt. Example A Scarab Statue of Karnak temple (fig. 6) and a Scarab on wall of Tomb (fig.7).

e) In modern cultures

Beetles still play roles in culture e.g. the insect fighting for entertainment and gambling. This sport exploits the territorial behavior and mating competition of certain species of large beetles. In the Chiang Mai district of northern Thailand, male Xylotrupes rhinoceros beetles are caught in the wild and trained for fighting. Females are held inside a log to stimulate the fighting males with their pheromones.

f) Beetle as chemical warfare

Beetles have developed quite an arsenal of chemical weapons. They defend themselves with poison, foul tasting fluids, or jets of boiling hot liquid. The bright colors of many of these beetles warn predators that they are not good to it.

i. **True weevil:** The brilliant color of this true weevil is saying "**I taste terrible**" (fig. 8).
ii. **Leaf beetle:** The body of this beetle is poisonous. But it has another trick up its sleeve. It produces a substance that is extremely sticky. If an ant tries to eat one these beetle, it will discover that its jaws are glued together (fig.9).
iii. **Violin beetle:** It repels predators by squirting acid from a gland in its abdomen. Those who handle this insect risk getting a painful burn on their fingers (fig.10).
iv. **Bombardier beetle:** The beetle has one of the most impressive beetle defenses. It squirts a blinding, boiling hot liquid into the face of an attacker. The chemical explosion powering this spray makes a loud popping sound (fig.11).
v. **Iron cross blister beetle:** The toxin from this beetle produce painful blisters on human skin. These beetles are dangerous – a horse can die from accidentally swallowing a few with its feed (fig.12).
vi. **Stink beetle:** It defends itself with a discharge of foul smelling liquid (fig.13).

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Fig. 1. The Beetle

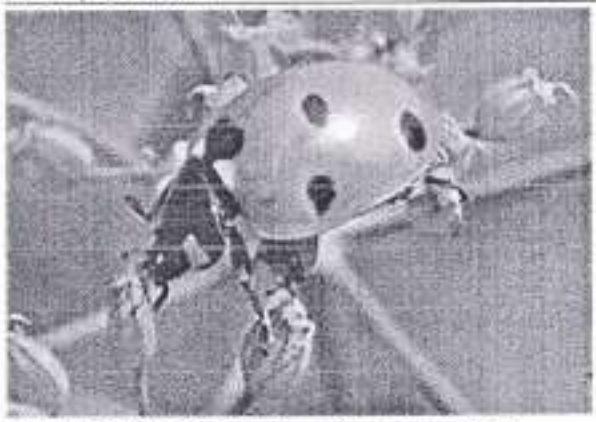

Fig. 2. Coccinella septempunctata (A beneficial beetle).

Fig. 3. A dung beetle rolling dung.

Fig. 4. Mealworms presented in a Bowl for Human consumption.

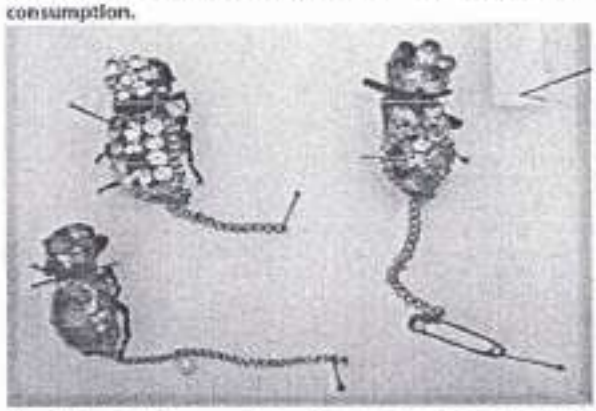

Fig. 5. Zopheridae examples of jewelry temple.taken at the Texas (A&M University Insect Collection in College Station, Texas).

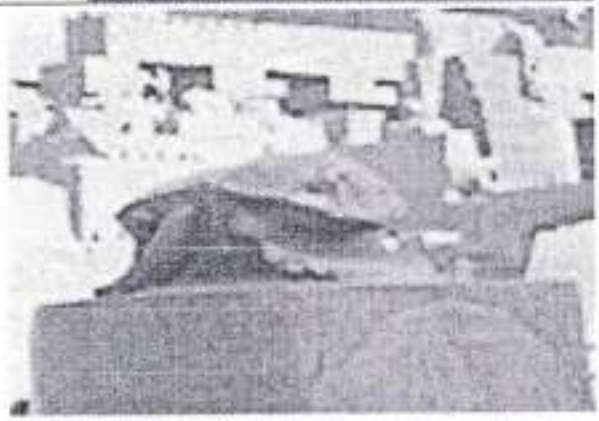

Fig. 6. A Scarab statue in the Karnak.

Fig. 7. . A scarab on a wall of Tomb KV6 in the Valley of the Kings.

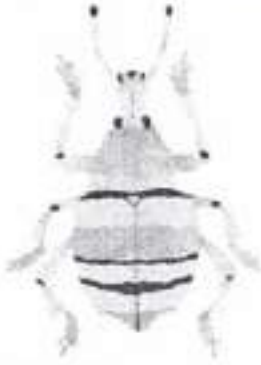

Fig. 8. True weevil

Fig. 9. Leaf beetle

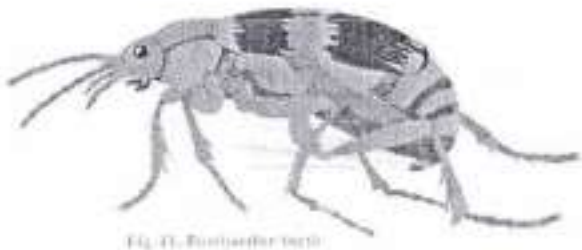

Fig. 12. Iron cross blister beetle

Fig. 13. Stink beetle

References

1. Atwal, A. S. and Dhaliwal, G. S. (2005). Agricultural pests of South Asia and their management. Kalyani publishers, Ludhiana. ISBN 81-272-0226-6.
2. Brown, J., Scholtz, C. H., Janeau, J. L., Grellier, S. and Pascal P. (2010). Dung beetle (Coleoptera: Scarabaeidae) can improve soil hydrological properties. Appl. Soil Eco. 46(1): 9-16.
3. Carrington, Damian (2013). Insects could be the key to meeting food needs of growing global population. The Guardian.
4. Hammond, P. M. (1992). "Species Inventory". Global Biodiversity. Status of the Earth's Living Resources: A Report (1st ed.). London: Chapman and Hall. Pp. 17-39. ISBN 978-0-412-47249-4.
5. Hunt, T., Bergsten, J., Levkanicova, Z., Papadopoulou, A., John, O. S., Wild, R., Hammond, P. M., Ahrens, D., Balke, M., Caterino, M. S., Gomez-Zurita, J., Ribera, I., Barraclough, T. G., Bocakova, M., Bocak, L. and Vogler, A. P. (2007). A Comprehensive phylogeny of beetles reveals the evolutionary origins of a Superradiation. Science 318 (5858): 1913-1916.
6. Ivie, Michael A. (2002). 105, Zopheridae. In Ross H. Arnett, Michael Charles Thomas. American beetles: Polyphaga: Scarabaeoidea through Curculionoidea. Vol. 2 of American beetles. CRC Press. PP 457-462. ISBN 978-0-8493-0954-6.
7. John, E. Losey and Mace Vaughan (2006). The economic value of ecological services provided by insects. Bioscience 56 (4): 311-323.
8. Kromp, B. (1999). "Carabid beetles in sustainable agriculture: A review on pest control efficacy, cultivation aspects and enhancement". Agric. Ecosys and Environ. 74 (1-3): 187-228.
9. Patrice Bouchard. (2014). "The Book of Beetles". The University of Chicago Press, Chicago-60637. ISBN 13:978-0-226-08275-2.
10. Ramos-Elorduy, J. and Menzel, P. (1998). Creepy crawly cuisine: the gourmet guide to edible insects. Inner Traditions/Bear and Company. P.S. ISBN 978-089281-747-8.
11. Rennesson, S., Couard, N. and Grimaud, E. (2008). Duels en miniature: La délicate mise en scène des combats de scarabées au nord de la Thaïlande. Insects (In French) (INRA) 3 (151).
12. Rosenzweig, M. L. (1995). Species diversity in space and time. Cambridge: Cambridge University Press. P.2. ISBN 978-0-521-48952-1.
13. Steve Jenkins (1952). The beetle book. Houghton Mifflin Harcourt, Park Avenue, New York. ISBN 978-0-547-68084-2.
14. Tomberlin, Jeffery K. and Sanford, Michelle R. (2012). Forensic entomology and wildlife. In: Wildlife forensics: Methods and Applications. Edited by Huffman, Jane E. and Wallace, John R. Development in forensic Science 6 (2nd ed.). John Wiley and Sons. Pp. 81-107.
15. Zabludoff, Marc (2008). Beetles. Malaysia: Michelle Bison. Pp. 14-17. ISBN 978-0-7614-2533-8.

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Age and sex specific Body Mass Index of different age group Students of Sakri, Dist. - Dhulia (M.S.), India.

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Abstract: In present work is carried out the survey was made from 500 (300 boys + 200 girls) secondary school students belonging to 10 to 16 years age group, 400 (150 boys + 250 girls) higher secondary students belonging to 16 to 18 year age group and 500 (252 boys + 248 girls) college students belonging to 18 to 21 year age group. The category wise Body mass index (BMI) of secondary school students in boys and girls shows very severe underweight (37 % & 51%), severely underweight (29.3 % & 26 %), underweight (14 % & 8. 5 %), normal weight (15 % & 11.5 %), overweight (3. 7 % & 0 %) and obese (1 % & 3 %) respectively. This percentile in higher secondary school was very severely underweight (18.7 % & 22 %), severely underweight (25.3 % & 27.6 %), underweight (10.7 % & 11.2 %), normal weight (36.7 % & 37.2 %), overweight (6.7 % & 1.6 %) whereas obese (2 % & 0.4 %) respectively. Similarly, in third group this percentile shows very severely underweight (2.35 % & 8.9 %), severely underweight (6.4 % & 8.9 %), underweight (27.8 % & 43.55 %), healthy weight (58.7 % & 30.6 %), overweight (3.15 % & 4.8 %) and obese was (1.6 % & 3.2 %) respectively. From this study, it is found that very large percentage i.e. 82.4, 58.8 and 48.80 respectively in secondary school, higher secondary school and college student were found to be underweight while 13.6, 37 and 44.8 % were normal healthy weight. The percentage of overweight and obese in all three groups was comparatively less with underweight and normal weight category. Therefore, it is advised that there is urgent need of supplementary diet with proper physical exercise to both groups.
Key words: Body mass index, underweight, overweight, obese, physical exercise etc.

Aims and Objectives of the study

- This study aims to develop the age and sex specific BMI to identify the underweight, normal weight, normal weight and obesity among the school and college students of study area.
- To determine the prevalence of underweight, overweight and obesity among students.
- To understand BMI more simply by using standard charts of WHO and CDC.

Introduction: This study explored relationship between physical personality and body mass index (BMI) of secondary school, higher secondary school and college students. The BMI is the ratio of human body weight (kg) to squared height (m^2). The body mass index or Quetelet index is a value derived from the mass (weight) and height of an individual. It is universally expressed in units of kg/m^2, resulting from mass in kilograms and height in meters. The BMI is an attempt to quantify the amount of tissue mass (muscle, fat, and bone) in an individual, and then categorize that person as *underweight*, *normal weight*, *overweight*, or *obese* based on that value. Commonly accepted BMI ranges are underweight: under 18.5 kg/m^2, normal weight: 18.5 to 25, overweight: 25 to 30, obese: over 30 (Eknoyan, 2007; Malcom, 2015). BMI also

provides a simple numeric measure of a person's *thickness* or *thinness*, allowing health professionals to discuss weight problems more objectively with their patients. BMI was designed to be used as a simple means of classifying average sedentary (physically inactive) populations, with an average body composition (WHO, 1995). The BMI For children and teens is calculated based on age and sex and is often called BMI-for-age. After BMI is calculated for children and teens, the BMI number is plotted on the Centers for Disease Control (CDC) BMI-for-age growth charts (for either girls or boys) to obtain a percentile ranking (Fig-1). Percentiles are the most commonly used indicator to assess the size and growth patterns of individual children in the United States. The percentile shows the relative position of the child's BMI number among children of the same sex and age. The growth charts show the weight status categories viz., underweight, healthy weight, overweight, and obese etc used with children and teens (Mackay, 2010). The WHO regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or other health problems, while a BMI equal to or greater than 25 is considered overweight and above 30 is considered obese (WHO, 2006). BMI for age weight status categories and the corresponding percentiles are shown in table-1. Here attempt has been made to determine the BMI related health status of different age group students with studies on causes of underweight and remedial suggestions.

Table-1: Body Mass Index status with the corresponding percentile.

Weight status category	BMI (Kg/m^2)		Percentile range
	From	To	
Very severe underweight	Below	15	Less than the 5th percentile
Severe underweight	15	16	
Underweight	16	18.5	
Normal (Healthy) weight	18.5	24.9	5th percentile to less than the 85th percentile
Overweigth	25	29.9	85th to less than the 95th percentile
Obese	30 and up		Equal to or greater than the 95th percentile

Materials and methods

Present work is based on the measurement of quality and quantity. It is applicable to phenomenon that can be expressed in terms of quantity. Therefore it is of quantitative type of research.

Methods of data collection: For present piece of research work, we collect primary data by using method as described by Kothari, 1988. The study was conducted from secondary school, higher secondary school and college students of Sakri town. Total 1400 (500 +400+500) having different age groups were selected. Personnel were specifically trained for different anthropometric measurements in this study. Height was measured by the anthropometric rod and weight measurement was made by

standard digital weighing scale. Both the equipments were calibrated at regular intervals. Body mass index (BMI) was calculated using the formula.

$$BMI = \frac{\text{Weight (Kg)}}{\text{Height } (M^2)}$$

Results and Discussions

Results of present study explore the BMI values of different age group students. The category wise percentile values of both sexes i.e. boys and girls are presented in table-2, graph-1, graph-2 and graph-3. It is seen that among secondary school students, both i.e. Boys and girls showed very severely underweight (37 % & 51%), severely underweight (29.3 % & 26 %), underweight (14 % & 8. 5 %), normal weight (15 % & 11.5 %), overweight (3. 7 % & 0 %) and obese (1 % & 3 %) respectively. This percentile in higher secondary school was very severely underweight (18.7 % & 22 %), severely underweight (25.3 % & 27.6 %), underweight (10.7 % & 11.2 %), normal weight (36.7 % & 37.2 %), overweight (6.7 % & 1.6 %) whereas obese (2 % & 0.4 %) respectively. In case of college student, the boys and girls showed very severely underweight (2.35 % & 8.9 %), severely underweight (6.4 % & 8.9 %), underweight (27.8 % & 43.55 %), healthy weight (58.7 % & 30.6 %), overweight (3.15 % & 4.8 %) and obese was (1.6 % & 3.2 %) respectively. From these observations it is found that very large percentage i.e. 82.4, 58.8 and 48.80 respectively in secondary school, higher secondary school and college student were found to be underweight while 13.6, 37 and 44.8 % were normal healthy weight. The percentage of overweight and obese in all three groups was comparatively less significant with underweight and normal weight category. This indicates the college student age group is more conscious regarding their health than school students. The category wise total percentage of all three age groups is presented in graph-4. This graph shows that very severe underweight (42.6 %; 20.75 % & 5.6 %), severely underweight (28 %; 26.75 % & 7.6 %); underweight (11.8 %; 11 % & 35.60 %), healthy weight (13.6 %; 37 % & 44.8 %); overweight (2.2 %; 3.5 % & 4.0 %) and obese (1. 8 %; 1.0 % & 2.40 %) respectively.

The prevalence of children and adolescent underweight as well as obesity has risen substantially over the past 30- 40 years. In developed countries, 23. 8 % of boys and 22.6 % girls were overweight or obese (Ng et al., 2014). It is wide range of serious complications that included risk of premature mortality and physical morbidity in later life (Reilly and Kelly, 2011; Park et al., 2012). Several factors that relate to diet, physical activity and sedentary behavior have been found to predict the accumulation of body fat in childhood and adolescence. These include a lack of awareness and false beliefs about nutrition, residence in metropolitan cities, and accessibility to convenience stores and recreational physical activity facilities (Gupta et al., 2012; Casey et al., 2014). It is also noted that in school-age children, high levels of introversion, neuroticism and emotionality, and low levels of conscientiousness, relate to a higher BMI (Vollrath et al, 2012). These findings demonstrate that personality is important for BMI across the lifespan. Few studies have directly explored the mediating role of health-related behaviors in the association between personality and BMI. In young adults, one study found that physical activity, diet, and eating habits mediated associations between personality and BMI (Sutin and Terracciano, 2016).

On other hand there are several causes and problems of underweight i.e. a person may be underweight due to genetics, metabolism, drug use, lack of food (frequently due to poverty), eating disorder, or illness (both physical and mental). Being underweight is associated with certain medical conditions, including diabetes, hyperthyroidism, cancer,https://en.wikipedia.org/wiki/Underweight_-cite_note-7 or tuberculosis (Milas, 2012). People with gastrointestinal or liver problems may be unable to absorb nutrients adequately. People with certain eating disorders can also be underweight due to lack of nutrients and over exercise. The problem of Underweight might be secondary to or symptomatic of an underlying disease. Unexplained weight loss may require professional medical diagnosis. Underweight can also be a primary causative condition. Severely underweight individuals may have poor physical stamina and a weak immune system, leaving them open to infection (Black et al., 2003).

On remedial measures the underweight individuals may be advised to gain weight by increasing calorie intake. This can be done by eating a sufficient volume of sufficiently calorie-dense foods (Zeratsky, 2012). Another way for underweight people to gain weight is by exercising. It can help stimulate a person's appetite if they are not inclined to eat. Certain drugs may increase appetite and acts as appetite stimulant.

Conclusion

From above findings in nutshell it is conclude that;

- The percentage of underweight was found to be more in secondary school students than higher secondary school and college students.
- School girls suffer very severe underweight (i.e. 50.1 %) than boys (37 %).
- The college student is healthier (44.8 %) than secondary school (13.6 %) and higher secondary (37 %) students.
- It is observed that comparatively girls showed higher percentage of underweight than boys in all age groups.
- The percentage of overweight and obese in all age groups is comparatively very less.
- Underweight subject may be advised to increase body weight by taking regular consumption of balanced diet, exercising and take some appetite stimulant drugs.

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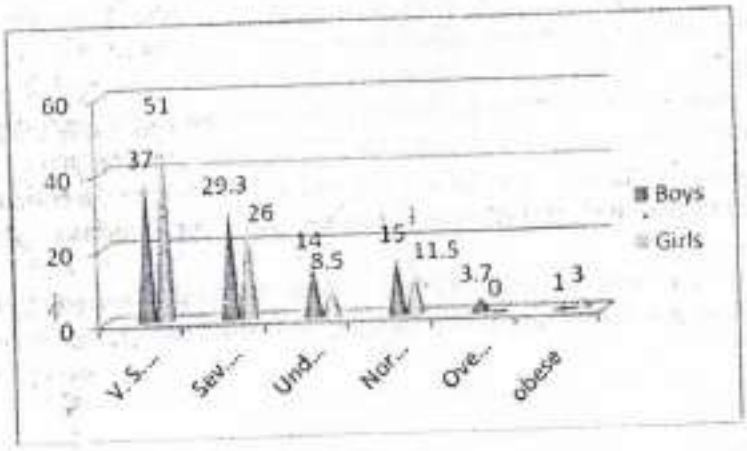

Graph-1: Gender wise category percentile of Secondary school students.

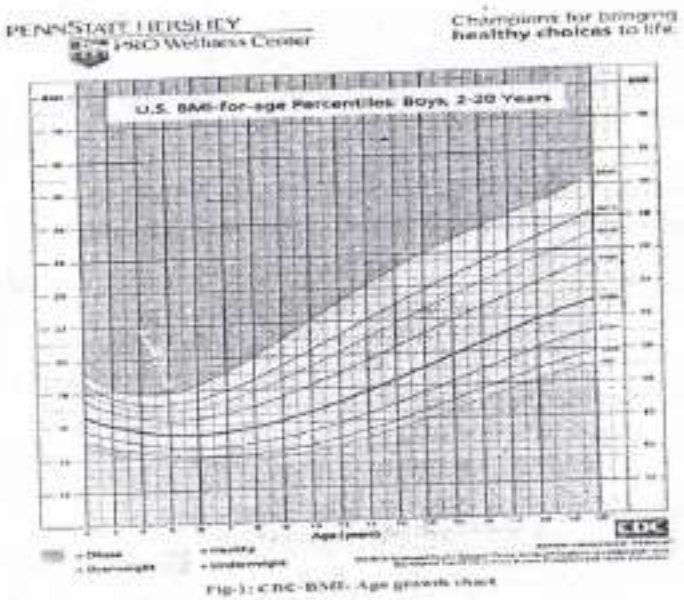

Fig-1: CDC-BMI- Age growth chart

References

1. Black, Robert E., Morris, Saul S., Bryce, J. Where and why are 10 million children Dying every year. *The Lancet*. 361: 2226-34, 2003.
2. Casey, R., Oppert, J. M., Weber, C., Charreire, H., Salze, P. and Badariotti, D. Determinants of childhood obesity: what can we learn from built environment studies? *Food Qual Prefer*. 31: 164–172, 2014.
3. Eknoyan, Garabed. "Adolphe Quetelet (1796–1874)—the average man and indices of obesity". Nephrology Dialysis. *Transplantation*. 23 (1): 47–51. 2007.
4. Gupta, N., Goel, K., Shah, P. and Misra, A. Childhood obesity in developing countries: epidemiology, determinants, and prevention. *Endocr Rev*. 33: 48–70, 2012.
5. Kothari, C. R. *Research Methodology*: Methods and techniques. Wiley Eastern Limited, New Delhi. 1988.
6. Malcolm Kendrick. "Why being 'overweight' means you live longer: The way scientists twist the facts". https://www.independent.co.uk. Archived from the original on 12 April 2015.
7. MacKay, N.J. Scaling of human body mass with height: The body mass index revisited. *J. Biomechanics*. 43 (4): 764–66, 2010.
8. Milas, K. Hyperthyroidism symptoms – sign and symptoms caused by excessive amount of thyroid hormones. *Endocrine web. Retrived* 24 September 2012.
9. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 384: 766–781, 2014.
10. Park, M. H., Falconer, C., Viner, R. M. and Kinra, S. The impact of childhood obesity on morbidity and mortality in adulthood: A systematic review. *Obes Rev*. 13: 985–1000, 2012.
11. Reilly, J. J. and Kelly, J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *Int. J. Obes*. 35: 891–898, 2011.
12. Sutin, A. R. and Terracciano, A. Personality traits and body mass index: modifiers and mechanisms. *Psychol Health*. 31: 259–275, 2016.
13. Vollrath, M. E., Hampson, S. E. and Júlíusson, P. B. Children and eating: personality and gender are associated with obesogenic food consumption and overweight in 6-to 12-year-olds. *Appetite*. 58: 1113–1117, 2012.
14. WHO. "Physical Status: The Use and Interpretation of Anthropometry" (PDF). WHO Technical Report Series. Geneva, Switzerland: *World Health Organization*. 854: 9. 1995.
15. WHO. *"BMI Classification". Global Database on Body Mass Index*. World Health Organization. 2006.
16. Zeratsky, K. "Underweight ? See how to add pounds healthfully". Nutrition and healthy eating. Mayo Clinic. Retrived 19 March 2012.

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Effects of sub lethal concentrations of Fenvalerate on histopathological changes in the gill of fresh water fish species Channa marulius (Ham Buch).

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ABSTRACT: The present study deal with the toxic effects of Fenvalerate pesticide on the gill histology of fresh water fish, *Channa marulius*. The fishes were exposed to $1/4^{th}$ and $3/4^{th}$ sub lethal concentrations i. e. 0.85 ppm and 0.25 ppm of Fenvalerate respectively for 96 h exposure period. Our result showed marked histopathological changes characterized by swelling and degeneration in respiratory epithelial cells and connective tissue cells. Connective tissue cells become degenerative changes and lost their normal cellular structure.

Key words: Sub lethal concentration, gill histology, Fenvalerate Pesticide

INTRODUCTION:

At present, it seems that the problem is more conspicuous in developing countries, where lately there has been an increase in the use of insecticides as a means of increasing agricultural productivity, without much concern to the consequences of indiscriminate application. There are many pathways by which insecticides leave their sites of application and distribute throughout the environments enter the aquatic ecosystem. The major route of insecticides to water ecosystems in urban areas is through rainfall runoff and atmospheric deposition. Frequently and intensity of tissue lesion depend on the concentration of insecticides cause specific or nonspecific histopathological changes in liver tissue of *Heteropneustes fossilis* exposed Chloripyriphos (20% Ec) (Hassina and Mithra, 2014). For example, histopathological lesion in the liver tissue of Fresh water fish, *Cirrinus mrigala* were observed (Velmurugan *et al.*, 2009) after 10 and 30 days exposure to sub lethal concentration of dichlorfos and diazon insecticides respectively. Other researchers reported the same histopathological alteration in different tissue of fish treated with diazon (Banaee *et al.*, 2011), Malathion (Sanjoy and Rita Mahanta, 2012), Cypermethrin (Thayappan *et al.*, 2014), Tannery Effluents (Mohanta *et al.*, 2010), Fenitrothion (Benli and Ozkul, 2010). Lindane changes in histopathological architecture of pituitary gland in fresh water teleost fish, *Mystus vittatus* (Pushpa and Jyotsna, 2016). The present study deal with effects of Fenvalerate on gill histopathology of fresh water fish *Channa marulius*.

MATERIAL AND METHODS:

The fresh water fish *Channa marulius* weighing (15±5 g) and length (10±2 cm) were collected from Kan and Panzara river of Sakri Taluka (Dhule). Live fishes were brought to the laboratory in wide mouthed plastic containers. After thoroughly washed under tab water and acclimated to laboratory conditions for 15 days. They were fed with standard fish diet (Tokyu). Water in the tank was changes after 2 days of interval. Technical grade Fenvalerate was taken from Sushil Agricultural pesticide and fertilizer Agency, Sakri. The fishes were divided into five groups; each group contains ten healthy fishes. They were transferred to plastic tough having capacity of 10 litres and

exposed to 1/4th (0.085 ppm) and 3/4th sub lethal concentration (0.25ppm) of Fenvalerate.

At the end of exposure period, fish were randomly selected for histopathological examination. Tissues like gill were isolated from control and experimental fish. Physiological saline solution (0.85% NaCl) was used to rinse and clean the tissues. They were fixed in aqueous Bouin's solution for 48 h, processed though graded series of alcohols, cleared in xylene and embedded in paraffin wax. Section were cut at 5µ thickness, stained with double stains like Haematoxylene and Eosin (Humson, 1992) and mounted in DPX. The photograph was taken with computer aided microscope.

RESULTS AND OBSERVATIONS:

Histology of Control Fish Gill:

Normal Histological architecture of gills lamellae showed intact and straight lamellae having uniform length with normal epithelial cells and intact secondary lamellae without any damage. No any pathological changes were takes place (Fig. 1).

Histopathology of Experimental fish gill

In the 24 h Fenvalerate treated gills of the fish *Channa marulius* had showed marked histopathological changes characterized by swelling and degradation in respiratory epithelial cells and connective tissue cells. Connective tissue cells become degenerative changes and lost their normal cellular structure. The secondary gill lamellar cell walls are disappeared, gill lamellae are shortened and loss of epithelial tissue with focal congestion of blood vessels (Fig. 2 and 3).

In the 48 h treated gills, the gill lamellae appeared extremely elongated. Epithelial lining was degenerated, damaged lamellae with break in length with distorted supporting tissue (Fig. 4 and 5).

In the 72 h treated gill, lamellae get reduced. Interlamellar tissue shows vacuolation most of the gill structure appeared degenerated, loss of epithelial cells from multiple lamellae and distorted lamellae at multiple foci were seen (Fig. 6 and 7).

In the 96 h treated gill, interlamllar region gets degenerated. Swelling in the respiratory lamellae was pronounced. Cytoplasm showed disintegration at greater degree because of hyperplasia of respiratory epithelial cells and reduced interlamellar space. Severity of damage in the gills was found to be dose dependent (Fig. 8 and 9).

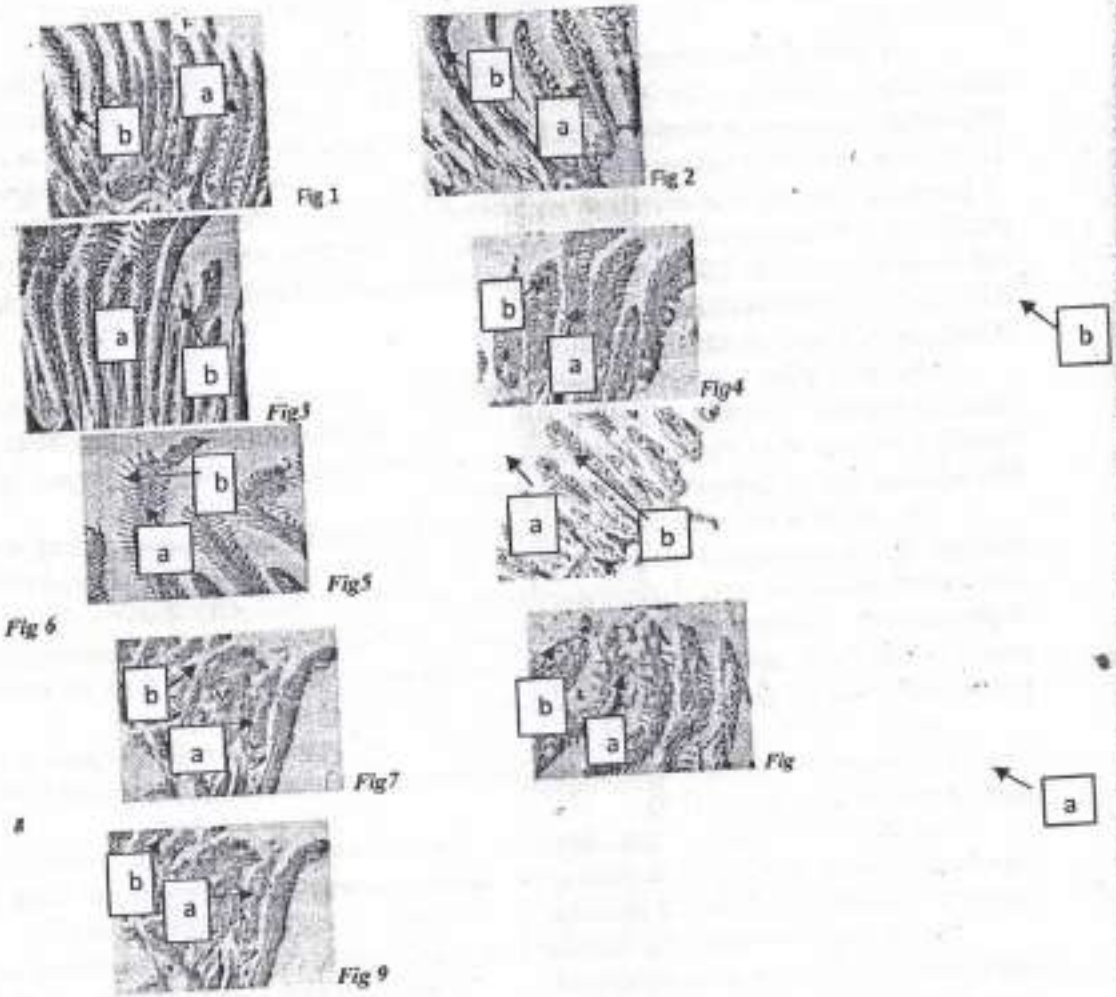

Fig-1.Channa marulius, ***Gill Control, a) Normal Histological architecture of gills epithelium (b) secondary lamellae intact, straight, uniform length pattern with normal epithelial cells and without any damage. Haematoxylin and Eosin, 100 X.***

Fig-2 Chann marulius, Gill exposed to 1/4th Fenvalerate at 24 h. a) Normal histological architecture of gills epithelium with primary gill lamellae (b) Secondary lamellae was damaged slightly. Haematoxylin and Eosin 100 X.

Fig-3.*Channa marulius,* Gill exposed to 3/4th Fenvalerate at 24 h. a) Normal histological architecture of gills epithelium with primary gill lamellae (b) Secondary lamellae slightly damaged. Haematoxylin and Eosin 100 X.

Fig-4. Channa marulius, Gill exposed to 1/4th Fenvalerate at 48 h, a) Mild to moderate changes in length of epithelium (b) damaged degenerated secondary lamellae. Haematoxylin Eosin 100 X.

Fig-5.Channa marulius, Gill exposed to 3/4th Fenvalerate at 48 h, a)Mild to moderate changes in length of epithelium (b) damaged degenerated secondary lamellae. Haematoxylin Eosin 100X.

Fig-6. *Channa marulius,* Gill exposed to 1/4th Fenvalerate at 72 h, a)Mild to moderate changes in length of epithelium & loss of chloride cell population (b) degenerated secondary lamellae. Haematoxylin Eosin 100X.

Fig-7. *Channa marulius,* Gill exposed to 3/4th Fenvalerate at 72 h. a) Mild to moderate changes in length of epithelium & loss of chloride cell population (b) degenerated secondary lamellae. Haematoxylin Eosin 100X.

Fig-8. *Channa marulius* Gill exposed to1/4th Fenvalerate at 96 h a) Mild to moderate changes in length of epithelium & loss of chloride cell population (b) damaged degenerated and ruptured secondary lamellae. Haematoxylin Eosin 100X.

Fig-9. Channa marulius, ***Gill exposed to 3/th Fenvalerate at 96 h, a) Mild to moderate changes in length of epithelium & loss of chloride cell population (b) damaged degenerated and ruptured secondary lamellae. Haematoxylin Eosin 100X.***

DISCUSSION

Histopathological study of gills showed variable and degenerative changes in length of lamellae with loss of epithelial tissue with focal congestion of blood vessels. Similar observation of the lamella and hyperplasia in this work is quite similar to the work of Boyle *et al* (2013). Rathod and Shembekar (2011) reported that the stressful behavior of respiratory impairment due to toxic effects of Dimethoate on gill of fish, *Arias dussumieri*. Vidhya and Radhakrishnan (2016) found lesion formation in villi of *Etroplus suratensis* after exposure to lambda-cyhalothrin. One of the main components of the tannery waste water on *Channa punctatus* was reported by Hemlata and Srivastava, (2008) and (Deepasree and Nair, 2013). According to Subashkumar and Selvanayagam (2015), leaving altered lesion, greater damage in the gill of *Cyprinus carpio* exposed to Zinc oxide. Japamalai (2017) observed induced changes in primary and secondary gill filament of *Labeo rohita* exposed to pesticide dichlorovas. The infiltration of Fenvalerate through the gills might have caused these abnormalities.

CONCLUSSION

The Fenvalerate affect the histopathology of gill of *Channa marulius* indicating their high toxicity. It is concluded that histopathological changes, could serve as valuable biomarkers for Fenvalerate. Therefore, this study revealed the toxicity of Fenvalerate on vital organs and further suggests that Fenvalerate is toxic to aquatic habitat of fresh water fishes.

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REFERENCES

1. Banaee, M., Mirvagheli, A. R., Ahmadi. K. and Ashort, R. (2011). The effect of diazinon on histopathological changes of testis and ovaries of common carp (*Cyprinus carpio*). *Sci. J. Mar. Biol.* 1 (2):25-35.
2. Benli, A. C. K. and Ozkul, A. (2010). Acute toxicity and histopathological effects of sub lethal Fenitrothion on Nile tilapia *Oreochromis niloticus*. Pesticide Biochemistry and Physiology: 32-35.
3. Boyle, D., Al-Bairuty, G. A., Ramsden, C. S., Sloman, K. A., Henry, T. B. and Handy, R. D. (2013). Subtle alterations in swimming speed distributions of rainbow trout exposed to titanium dioxide nanoparticles are associated with gill rather than brain injury. *Aqua. Toxicol.* 126 (15): 116–127.
4. Hassina and Mithra (2014). Histopathological changes in liver tissue of *Heteropneustes fossilis* exposed Chloripyriphos (20% Ec) *Ind. J. of App. Res.* 4(7): 237-140.
5. Hemlata, V. and Srivastava, N. (2008). Zinc induced architectural alteration and accumulation in the ovary of fresh water teleost, *Channa punctatus*. *Electron. J. Ichthyol.* 2:85P-91.
6. Humason, G. L. (1972). Animal technique III ed. W. H. Freeman and Co. San. Franancisco.
7. Japamalai, P. (2017). Histopathological changes in gill of the fish *Labeo rohita* exposed to Dichlorvos 76% EC. *Int. J. Mult. Adv. Res.* 1(3):331-343.
8. Mohanta, M. K., Salam, M. A., Saha, A. K., Hasan, A. and Roy, A. K. (2010). Effects of tannery effluents on survival and histopathological changes in different organs of *Channa punctatus*. *Asian J. Exp. Biol. Sci.* 1 (2): 294 – 302.
9. Pushpa, K. and Jyotsna, K. (2016). Impairment induced by Lindane on changes in histopathological architecture in the pituitary gland of fresh water teleost fish, *Mystus vittatus* (Bloch), *Proc. Zool. Soc. India*. 15(2): 33-36.
10. Rathod, D. S. and Shembekar, V. S. (2011). Histopathological and oxygen consumption alteration induced by toxicity of Dimethoate on gills of fish, *Arias dussumieri*. *Int. Res. J. Jaip.* 2(20):19-20.
11. Sanjoy, D. and Rita, M. (2012). A study on the effect of organophosphorus pesticide Malathion on hepato-renal and reproductive organs of *Heteropneustes fossilis* (Bloch). *The Science Probe* 1 (1): 1-13.
12. Subashkumar, S. and Selvanayagam, M. (2015). Acute toxicity on liver and gill histopathology of fresh water fish, *Cyprinus carpio* exposed to Zinc oxide (ZnO) Nano particles. *Int. J. Scienti. and Res. Pub.*, 4 (3): 1-4.
13. Thayappan, K., Maghil, D., Annadurai, R., Andrew, R. and Narayanasamy, S. (2014). Histological study of the intestine and liver tissues in the fish *Oreochromis mossambicus* exposed to Cypermethrin. *J. Mod. Biotech.* 3 (4): 48–54.
14. Velmurgan, B., Selvanayagam, M., Cengiz, E. I. and Unlu, E. (2009). Histopathological changes in the gill and liver tissue of freshwater Fish *Cirrhinus mrigala* exposed to Dichorvos. *An Int. J. Braz. Arch. of Biol. and Tech.*, 52(5): 1291-1296.

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LimnologicalSurvey on Plankton Diversity from Nakana, Dedorgaon and Sulwade Dams of Dhulia district (M.S.) India.

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Abstract:

The present study was carried out on phytoplankton and zooplankton diversity from Nakana, Dedorgaon and Sulwade dams of Dhulia district of Maharashtra State, India. The survey was undertaken from January 2014 to December 2014. The phytoplankton constitutes the basic food sources of any aquatic ecosystem, which supports fish and other aquatic animals. Zooplankton diversity is one of the most important ecological parameters in water quality assessment. These are also acts as good indicators of the changes in water quality because they are strongly affected by environmental conditions and respond quickly to changes occurs in the surrounding water quality.Zooplankton is the main intermediate link between phytoplankton and fishes. Hence quantitative studies of planktons are of great importance in limnological survey. The study was carried out using microscopic examination of planktons. This investigation revealed that the group wise plankton populations during tenure of study period from study area were found to be as among phytoplankton groups, Chlorophyceae was dominant group with 10 species (45 %) followed by Cyanophyceae with 9 species (29 %), Bacillariphyceae with 6 species (19 %) and Euglenophyceae has only 2 species (6.5 %). While in zooplankton groups, Cladocera was dominant with 12 species (36.3 %) followed by Copepoda with 9 species (27.3 %), Rotifera 7 species (21.2 %), Ostracoda 3 species (9.9 %) and Protozoa has only two species (6 %).

Key words: Phytoplankton, Zooplankton, Limnological survey, Chlorophyceae, Copepoda, Rotifera, Cladocera, Ostracoda, Protozoa.

Introduction:

Plankton is part of aquatic life, which is composed of minute organisms living and wandering in the way of water current. It acts as the chief source of food for furthermost fauna, both in lotic and lentic water ecosystems.Planktons are most sensitive floating community which suddenly target of water pollution (Devassy and Goes, 1988). The planktonic population may fluctuate qualitative and quantitatively depending on complexity of water bodies, site, time, season, source of water, its organic and inorganic matters, geological, biological and climatic aspects respectively (Joshi, 2011 a).Their sensitivity and large variations in species composition are often a reflection of significant alteration in ambient condition within an ecosystem; hence for any scientific utilization of water resources plankton study is of primary interest (Laskar and Gupta 2009). The plankton diversity in the water body shows a correlation with their occurrence and physical, chemical and biological factors (Joshi, 2011 b). Ponds and lakes are important natural or manmade reservoirs which provide habitat and food for many organisms. These reservoirs are unsystematically used for domestic

purpose which makes the water body unsuitable for human consumption, fisheries and drinking purpose. The fresh water ecosystem has been used for the study of factors controlling the abundance and distribution of aquatic organisms (Esenowo and Ugwumba,2010). Planktons respond rapidly to environmental fluctuations because of their short life cycle, hence, their species composition are more likely to indicate the quality of the water which they are found (Jayabhaye, 2010).

The phytoplanktonpopulation has a direct link with the fluctuations of water quality in any aquatic medium because of their basic association in the aquatic ecosystem. Phytoplanktons are important primary producers in the base of food chain which constitutes a vital link and an important biological indicator of quality of the water (Laskar and Gupta, 2013). Some notable work on phytoplankton and zooplankton diversity was carried out by Rao and Choubey, 1990;Ariyadej et al., 2004; Waghmare and Lokhande, 2010; Mishra et al., 2010;Kather Bee et al., 2015). Some phytoplankton species have attended as a bioindicators (Vareethiah and Haniffa, 1998; Bianchi et al., 2003; Tivari and Chauhan, 2006; Hoch et al., 2008) and it is a well suitable tool for understanding water pollution studies (Devi et al., 2016).

Zooplankton is a good indicator of variations in water quality because it is greatly affected by environmental conditions and replies quickly to variations in environmental quality. The main zooplankton groups vary in their relative abundance and they belong to different groups. Naturally, zooplankton is one of the most significant biotic constituents inducing all the efficient aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter (Sinha and Islam, 2002; Joshi, 2011 b). In this investigation an attempt has been made to study the planktondiversity from three water reservoirs like Nakana, Dobhagaon and Sulwade dams of Dhulia districts; the data was collected for one year from January to December, 2014 inclusive from selected sites. There is no earlier record on the diversity of plankton from these lentic water reservoirs and that is why present study was planned.

Materials and methods:

Collection and preservation of sample: The sample was collected from water reservoir dams in the morning hours between 8:00 to 10.00 am. Approximately 10 litre of water is collected by wide mouthed bottle; it was filtered by using specific plankton net No.25 made up of bolting silk, mesh size 55 µm. The samples were allowed to settle by adding Lugol;s iodine, centrifuged and preserved in 4 % formalin for further study. The quantitative analysis of phyto and zooplankton was carried out by taking a drop of preserved solution on slide and observe under microscope

Identification and documentation of plankton: IndividualPlankton is observed carefully under 4x, 10X or 45 X objective lens wherever required. Then with the help of digital camera attached with microscope is being used to capture images of plankton. Identification of plankton species was performed by using standard key and monographs of standard reference books and other literature like Adoni (1985),Kodarkar (1998) and Tonapi (1980).

Study area: Dhulia district is North Western part of Maharashtra State. It is formerly known as West Khandesh. Geographically it is located in North-West corner of Maharashtra state, spread between Latitude 20^0 38' to 21^0 61' N and Longitude 73^0 50' to 75^0 11' E. The district is bounded by Gujarat and Madhya Pradesh States in the

North, by Nasik district in the West and by Jalgaon district in the East. The Nakane dam is located at the 5 km away from the Dhule city. It is major reservoir; which provides 50 % of drinking water to the city. The Sulwade dam is at the 45 km away from the city; which covers 32% area of the city. It constructed on Tapi River at near Sukhwad, Tal- SindkhedaDist- Dhule (M.S.). The Dedorgaon dam is comparatively small reservoir; it covers 18 % of city area and it is 15 km away from the city.

Sulvade DamNakane Dam

Dedargaon DamCollection of samples

Res ults and Disc ussi on

A)

n

kton Diversity

The phytoplankton diversity of different water reservoirs of Dhulia district are presented in table – 1 A. The table shows that there is varied number of phyplankton representing total 31 species belonging to four groupsviz; Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. The Chlorophyceae is

dominant group over the other three groups. Throughout the study period 14 (45 %) species of Chlorophyceae, 09 (29 %)species of Cyanophyceae, 06(19% a) species ofBacillariophyceaeand only 2 (6.5%) species of Euglenophyceae were recorded.

List of phytoplankton species

I. **Chlorophyceae (It includes 14 species):**In the precent investigation the members of Chlorophyceae were dominant during the period of investigation. The maximum and minimum number of chlorophyceae is due to higher transparency and low temperature. The following genera of chlorophyceaewere identified during the investigation viz.,*Ankistrodesmus,Chara, Chlamydomonas, Chlorella, Cosmarium, Micrasterias, Nitrela, OedogoniumPediastrum, Scendesmus, Spirogyra, Ulothrix,Volvox and Zygnema*sp. Among these *Cosmarium*and*Micrasteria* are very less in number except Sulwade dam water.

II. **Bacillariophyceae (It includes 06 species):**Bacillariophyceae are characterized by silicified cell walls and all are colonial and unicellular. Reproduces sexual when the cells reach a minimum critical size and exact environmental conditions, which may include combinations of light, temperature, trace metals, nutrients, organic growth factors etc. The water quality in terms levels of organic matter, dissolved oxygen, pH and other physical factors play a significant role in the ecological distribution of Bacillariophyceae (Sabata and Nayar, 1987). The following genera of Bacillariophyceae were identified during the investigation. These include, *Bacillaria, Diatom, Navicula, Nitzschia, Pinnularia*and *Synedra*sp. Among these *Nitzschia*and *Bacillaria*wereless in number.

III. **Cyanophyceae (It includes 09species):**The Cyanophyceaeis extensively spread in the aquatic environment. The species exist either as a unicellular individual or green algae which also called as chains or filaments the. The species are commonly found on rocks or soil forming a blackish crust when dried out.The following genera of cyanophyceae were identified during the investigation viz., *Anabaena, Anacysitis, Aphanothee, Lyngbya, Merismopedia, Microcystis, Nostoc, Oscillatoria*, and*Phormidium*sp.

IV. **Euglenophyceae(It includes 02 species):**Euglenophyceae or Englenoid algae are relatively large and diverse. Some species are truly planktonic. Near about all euglenoids are unicellular. Nutrition is accompanied by the uptake of dissolved organic compounds hence; Ammonia and dissolved organic nitrogen compounds are the dominant sources of nitrogen amongst most euglenoid algae. Their growth occurs mostly in season and lake systems in which concentrations of ammonia and especially dissolved organic matter is high.The following members of genera were identified during the investigation i.e. *Euglena*and*Phacus*sp.

B) Zooplankton Diversity

The zooplankton diversity of different water reservoirs of Dhulia district are presented in table – 1 B. The table shows that there is varied number of zooplankton representing total 33 species belonging to five groups viz; Cladocera, Copepoda, Rotifera, Ostracoda and Protozoa. Out of which 12(36.3 %) species belongs to Cladocera, 09 (27.3 %) species belongs to Copepoda, 07 (21.2 %) species belong to Rotifera, 03 (9.9 %) species form Ostracoda and 02 (6 %) species belongs to protozoa group.

The diversity and population of zooplanktons is affected by mainly dissolved oxygen, pH alkalinity, temperature and light.The increase and decrease in the population of the zooplankton is also due to water temperature and availability of food in the water

bodies.The highest record of total zooplankton appeared in summer and its Lowest was noted in monsoon.

List of Zooplankton species

I. **Cladocera (It includes 12 species):** In the present investigation Cladocera group represented by highest number (12) of species*viz., Daphnia, Daphanosoma, Chydorus, Bosmonia, Cypris, Eucylope, Moina, Monoclaphnia, Pleuroxus, Simocephalus, Alona*and*Ceriodaphnia*species.

II. **Copepoda (It includes 09 species):** This group is represented by 9 genera (species)*viz.Mesocyclops,Cyclocypria,Clanoid, Cyclops, Cyclopoid, Heliodiaptomus, Daptomu, Paracyclops,* and, *Zoaea Larva* etc.

III. **Rotifera (It includes 07 species):**The most dominant genera of this group is *Asplancha, Philodina, Keratella, LApadella, Lecane, Brchionus*and*Trichocera* species.

IV. **Ostracoda (It includes 03 species)**:Ostracoda occupied fourth position of zooplankton and represented low population diversity compared to above groups. This group represented by three species viz.,*Cyclocyprus, Stenocypris*and *Srandesia species.*

V. **Protozoa(It includes 02 species):**These include*Arcella*and*Euglypha.*

Conclusion

The observation of different groups of phytoplankton and zooplankton with respect to their seasonal variation and diversity was carried out in the study period. There is variation in the number of species of both planktonic populations, it might be due some notable reasons like seasonal fluctuation in temperature, and water level and human interfere for their anthropogenic activities. We also report that as compare to Dedorgaon dam the population of phytoplankton and zooplankton were found to be higher in Nakana and Sulwade dams. The planktons are important organism in food web which in turn increases the fish and crustacean production. To ensure the study area is important as far as aquatic system. More intense studies on aquatic fauna along with ecological parameters should also be under taken to make conservation measures effectively.

References

1. Adoni, A. D. *Workbook on limnology*, Indian Map Committee, Department of Environment, India. (1985).
2. Ariyadej, C., Tansakul, R., Tansakul, P. and Angsupanich, S.Phytoplankton diversity and its relationships to the physic-chemical environmentin the Banglang Reservoir, Yala Province Songklanakarin. *J. Sci. Technol.*, 26: 595-607 (2004).
3. Bianchi, F., F. Acri, F.B. Aubry, A. Berton, A. Boldrin, E. Camatti, D. Cassin and A. Comaschi. Can plankton communities be considered as bioindicators of water quality in the laggon of Venice? *Mar. Pollut. Bull* 46: 964-971 (2003).
4. Devassy, V.P. and Goes, J. I. Phytoplankton community structure and succession in a tropical estuarine complex (central west coast of India). *Estuarine, Coastal Shelf. Sci.*, 27: 671-685 (1988).
5. Devi, M. B., Gupta, S. and Das, T. Phytoplankton community of lake Baskandianua, Cachar District, Assam, North East India- An Ecological study. *Knowl. and Manage. of Aqua. Eco.* 2 (417): 1-9 (2016).
6. Esenowo, I.K. and Ugwumba, A.A. Composition and abundance of microbenthes in Majidum River Ikorodu Lagos State, Niger, *Res. J. Biol. Sci.*, 5(8): 556-560 (2010).

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7. Hoch, M.P., K.S. Dillon, R.B. Coffin and L. A. Cifuentes. Sensitivity of bacterioplankton nitrogen metabolism to eutrophication in sub-tropical coastal water of Key West. Florida. *Mar. Pollut. Bull.*, 56: 913-926 (2008).
8. Jayabhaye, U. M. Studies on phytoplankton diversity in Sawana dam, Maharashtra, India. *Shodh, Samiksha and Mulyankan.* 2 (11-12): 1-3 (2010).
9. Joshi, P. S. Studies on zooplanktons of Dhanora (Hatnapal) Lake of Buldhanadistrict, Maharashtra. *Ind. Sci. Res. J.* 1(11): 1-4 (2011 a).
10. Joshi, P. S. Studies on zooplanktons of Rajura lake of Buldhana district, Maharashtra, India. *Sci. Res. Reporter*. 1(3): 132-137 (2011 b).
11. Kathe Bee, S., Chitra, J. and Malini, E. Studies on plankton diversity and water quality of Ambattur Lake, Tamil Nadu. *Int. J. Pure and Appl. Zool.* 3(1): 31-36 (2015).
12. Kodarkar, M. S. *Methodology for water analysis* (Physico- Chemical, biological and microbial). IAAB, Publication, Hyderabad, India. (1998).
13. Laskar, H.S. and Gupta, S. Phytoplankton community and limnology of Chatla floodplain wetland of Barak valley, Assam, North East India. *Know. Manag. Aquat. Ecosys.*, 411, 06, (2013).
14. Laskar, H.S. and Gupta, S. Phytoplankton diversity and dynamics of Chatlafloodplainlake, Barak valley, Assam, North East India: A seasonal study. *J. Environ. Biol.*, 30:1007- 1012 (2009).
15. Sinha, B. and Islam, M. R. Seasonal variation in zooplankton population of two lentic bodies and Assam State Zoo cum Botanical garden, Guwahati, Assam. *Ecol. Environ. Conser.*, 8: 273-278 (2002).
16. Tiwari A. and Chauhan S.V. S. Seasonal phytoplanktonic diversity of Khithamlake, Agra. *J. Environ. Biol.*, 27: 35-38 (2006).

SURVEY ON SOME HUMAN GENETIC TRAITS OF HIGH SCHOOL AND COLLEGE STUDENTS FROM SAKRI, DIST.- DHULIA (M.S.), INDIA

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ABSTRACT:

In the present piece of work, survey was made for some human genetic traits like appearance of cheeks, ear lobe, hair pattern, hair form and tongue characteristics etc from 500 (250 boys + 250 girls) students each from high school and college students. We find very interesting results for dominant traits of school boys and girls students, the percentage of dimple cheek was (12.8 & 16.4), free ear lobe (60.8 & 75.2), widow's peak (30 & 27.2), curly hair (2.8 & 6.0), Rolling tongue (9.2 & 6.8) and folding tongue was (4.0 & 2.8) per cent respectively in boys and girls. Similar data obtained from college students is for dimple cheek was (6.8 & 11.6), free ear lobe (66.8 & 58.0), widow's peak (35.2 & 29.2), curly hair (1.2 & 2.0), Rolling tongue (11.2 & 8.4) and folding tongue was (5.6 & 4.4) per cent respectively in boys and girls. From this survey, it was found that genetic traits are randomly transmitted from parental to offspring generation and there is no permanent bonding between two genes for different traits. It also observed that except free attached lobe, other dominant traits percentage was less than recessive trait percentage.

Keywords: Human genetic traits, Dimple cheeks, Ear lobe, Curly hair, Rolling tongue, Widow's peak etc.

INTRODUCTION:

The different heritable characteristics in human being have been classified first, on the basis of their appearance and secondly on the basis of their occurrence. According to their visibility, the traits are grouped as dominant, autosomal and sex linked recessives (Arora and Sandhu, 1989). Heredity affects a variety of human traits. They may involve physical appearance such as height, facial features, eye color, skin color, baldness, hair color and form. According to McKusick (1987); in man there are approximately 1,00,000 genes, however, definite position of few genes on the chromosomes have been worked out. Thus, 1300 genes are found to be located on the autosomes, 107 on X- chromosomes and only one on the Y-chromosomes. More than 500 human genetic diseases are known to be caused by single-gene defects (Albert et al., 1989; Verma and Agrawal, 1998).

There are a significant number of traits that have little or no effect on our success as individuals or as a species. The traits we will be looking at today belong to this group; they have little significance in making us better or worse individuals but they to make us more interesting by making us more diverse. One can look at these traits in themselves and trying to determine their genotype for each trait, generally in terms of dominant or recessive.

Here attempt has been made to study various phenotypic traits like cheeks, ear lobes, hair pattern, hair form and tongue characteristic like rolling and folding of 500 school and 500 college students.

MATERIAL AND METHODS:

In present work, the data is collected by direct personal observation method. The data obtained by this method is original, reliable, authentic and accurate but no doubt it is time

consuming. It is applicable to phenomenon that can be expressed in terms of quantity. Therefore it is of quantitative type of research.

Methods of data collection: For present piece of research project, we collect primary data which are collected a fresh and for first time as well as original in character. This data is collected during the course of doing experiment by using observation method as described by Kothari (1988). For collection of data, students was invited in the our departmental laboratory were we observe and record different traits like cheeks (dimple or non-dimple), ear lobes (free or attached), hair form (curved or straight), hair pattern (Widow's peak and straight hair line), tongue character like rolling and non-rolling; folding and non-folding etc. This data was taken from 500 school and 500 college students. After collection of data, it was processed and analyzed as per need of problem, e. g. Tabulation and use of graphical representation by multiple bar diagram.

RESULT AND DISCUSSION:

In present investigation of studies on some human genetic traits viz., cheeks, ear lobes, hair pattern, hair form , rolling and non-rolling and folding and non-folding tongue etc are discussed as bellows;

1. Cheeks – Dimple and non-dimple

The cheek bones may be high, low or intermediate. Many races, such as the American, Indians are characterized by high cheek bones. The gene complex for high cheek bones seems to be dominant. There is quantitative variation in the extent of the fat pads of the cheeks, both as to thickness and placement. In some persons the pads are so low as to result in pendulant cheeks which hang downward. Dimples in the cheeks are inherited also, apparently as a dominant, but with some variation in expressivity. They may occur on one cheek or both, and in rather rare cases there may be two on one cheek (Winchester, 1979).

The tiny, natural indentations seen on the cheeks are mostly heritable. It is dominant phenotype. The smile, dimples are very cute facial muscles deformity that results in an indentation in the cheek. This means people with dimples normally have children with dimples. Therefore, people who have dimples express a dominant gene for dimples and those without dimples have a recessive dimple gene.The data collected from school and college students for cheek trait is presented in table -1. From this table it is seen that out of 500 school students the percentage of dimple cheeks in boys and girls was 12.8 % and 16.4 % respectively. Whereas from college students this percentage was found to be 6.8 and 11.6 % respectively.

2. Ear lobes – Free and attached

Many continuous variations in the size and form of the ears as well as their position on the head indicate multiple gene inheritance of ear characteristics. A few of these seem to correspond primarily to variations in a single gene. **Free ear lobes seem to be dominant over attached ear lobes**, but there is variation in the degree of freedom of those which are attached. From collected for free ear lobes from school and college students is presented in table-1. In school boys and girls this percentage is 60.8 % and 75.2 respectively. Similarly in college students it is 66.8 % and 58 % respectively in boys and girls.

3. Hair pattern- Widow's peak and straight hair line

Widow's peak represents arrangement of hair on the forehead. It is also known as mid-digital; hairline is a result of expression of the hairline gene which is recessive and the other for widow's peak, which is dominant. A widow's peak is a V-shaped point in the hairline in the center of the forehead. Hair growth on the forehead is suppressed in a bilateral pair of peri-orbital fields. Without a widow's peak, these fields join in the middle of the forehead so as to give a hairline that runs

straight across. Widow's peak is a dominant trait controlled by one gene. The data regarding widow's peak is presented in table-1. In school boys and girls this percentage is 30 % and 27.2 % respectively. Similarly in college students this percentage was 35.2 % and 29.2 % respectively in boys and girls.

4. Hair forms – Curly and straight

The form of hair is dependent primarily upon its shape in cross section. Straight hair is rounded, while wavy, curly and kinky hair shows progressive degrees of flattening. The kinky hair of the Negro race generally dominates over the hair form of the white race, although there may be some degree of intermediate expression. Curly hair is mostly determined by genes and less by environment. Parents with curly hair tend to have children with curly hair. Therefore, the curly hair gene is dominant, and straight hair gene is recessive.The observed data for curly hair form is presented in table-1. It shows that the percentage were found to be 2.8 % and 6.0 % respectively in school and 1.2 % and 2.0 % respectively in college students.

5. Tongue- Rolling and Non-rolling

As with most other body characteristics the shape and size of the tongue respond to so many different genes that it is not possible to isolate many effects of individual genes. Some people have the distinctive ability to roll their tongue into a 'U' shape when they extend it from the mouth. This ability seems to depend upon a dominant gene. Some people can roll their tongue into a tube and some people can't. The observed data for rolling and non-rolling tongue is presented in table-. It shows that 9.2 % boys and 6.8 % girl's students from school and 11.2 % boys and 8.4 % girl's students from college has ability to role their tongue. This indicates boys have more ability to roll their tongue than the girls.

6. Tongue- Folding and Non-folding

This is another characteristic of tongue i.e. folding and non-folding tongue. In some persons much rare gene gives the ability to fold the tongue to from front to back. This is also dominant trait. While most of persons are recessive for this trait and they are unable to fold tongue back. The data to show folding (dominant) and non-folding (recessive) tongue is presented in table-1. This shows that 4.0 % and 5.6 % boys and 2.8 % and 4.4 % girl's students respectively from school and college were able to fold back their tongue.

Genetic trait, gender wise average percentage of school and college data is shown in table-2 and their comparative trait percentage is shown in graph-1. From this graph, it is seen that Dimple cheeks (14.6 & 9.2), Free ear lobe (68 & 62.4), Widow' peak (28.6 & 32.2), Curly hair (4.4 & 1.6), Roller tongue (8.0 & 9.8) and folding tongue (3.4 & 5.0) per cent respectively in school and college students. The comparative percentage of total boys and girls students of school and college is presented in table-2 and graph-2; it shows Dimple cheeks (9.8 & 14), Free ear lobe (63.8 & 66.6), Widow' peak (32.6 & 28.2), Curly hair (2.0 & 4.0), Roller tongue (10.2 & 7.6) and folding tongue was (4.8 & 3.6.0) per cent.

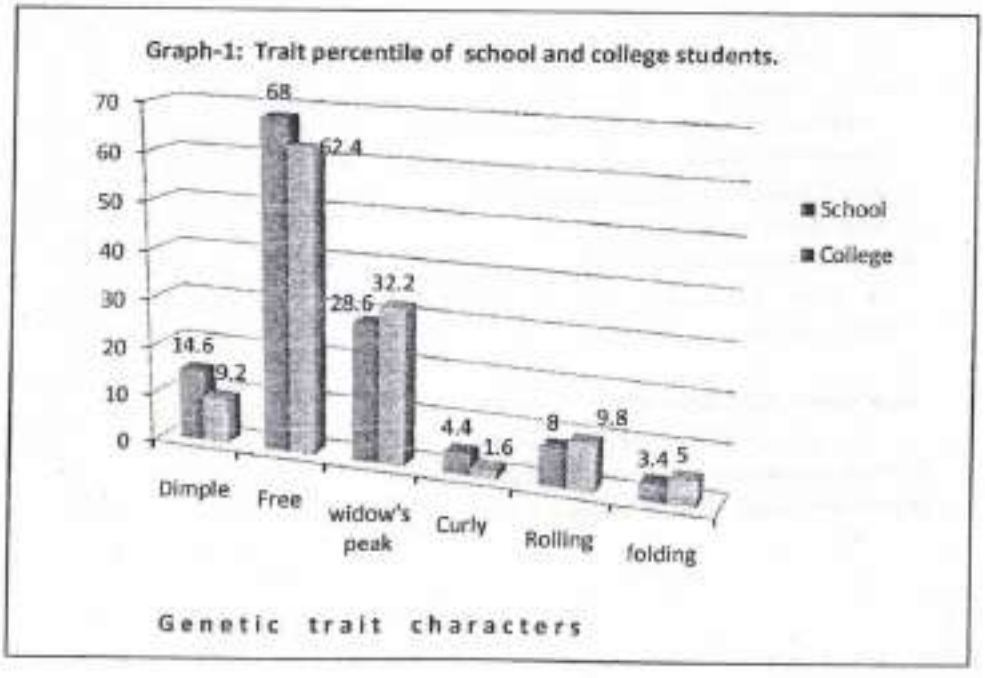
Table- 1: Genetic trait percentile of School and College students.

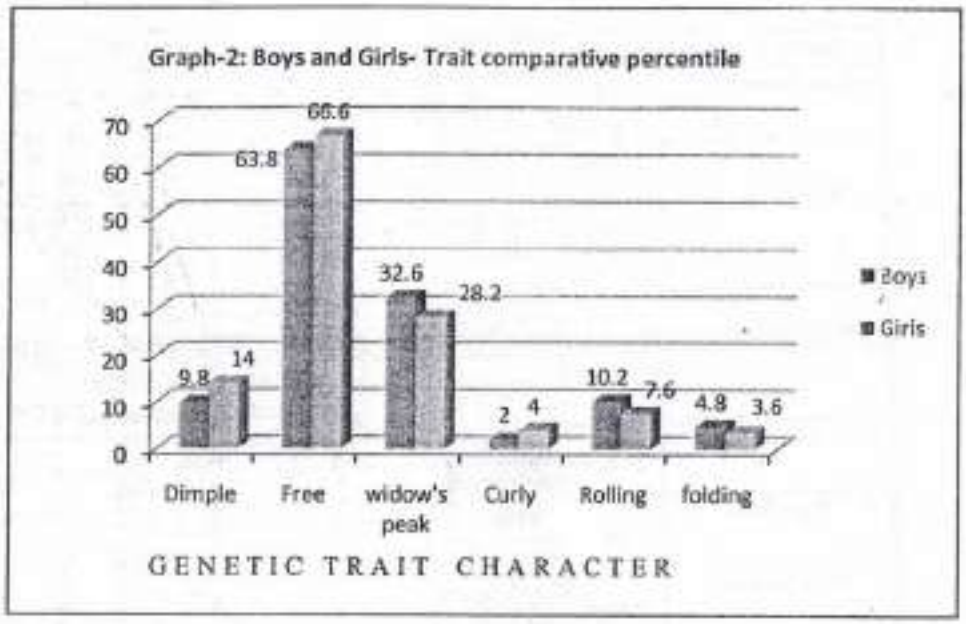
Genetic trait	Trait character	High School student				College student			
		Boys		Girls		Boys		Girls	
		Nos	%	Nos	%	Nos	%	Nos	%
Cheeks	Dimple	32	12.8	41	16.4	17	6.8	29	11.6
	Non-Dimple	218	87.2	209	83.6	233	93.2	221	88.4
Ear lobe	Free	152	60.8	188	75.2	167	66.8	145	58
	Attached	98	39.2	62	24.8	83	33.2	105	42
Hair	Widow's peak	75	30	68	27.2	88	35.2	73	29.2

pattern	Straight hair line	175	70	182	72.8	162	64.8	177	70.8
Hair form	Curly	07	2.8	15	6.0	03	1.2	05	2.0
	Straight	243	97.2	235	94	247	98.8	245	98
Tongue	Roller	23	9.2	17	6.8	28	11.2	21	8.4
	Non-Roller	227	90.8	233	93.2	222	88.8	229	91.6
	Folding	10	4.0	07	2.8	14	5.6	11	4.4
	Non-Folding	240	96	243	97.2	236	94.4	239	95.6

Table-2: Genetic trait: Gender wise average percentage of school and college

Genetic trait		School students	College students	Total	Total
Cheeks	Dimple	14.6	9.2	9.8	14
	Non-Dimple	85.4	90.8	90.2	86
Ear- lobe	Free	68	62.4	63.8	66.6
	Attached	32	37.6	36.2	33.4
Hair pattern	Widow's peak	28.6	32.2	32.6	28.2
	Straight hair line	71.4	67.8	67.4	71.8
Hair form	Curly	4.4	1.6	2.0	4.0
	Straight	95.6	98.4	98	96
Tongue	Roller	8.0	9.8	10.2	7.6
	Non-Roller	92	90.2	89.8	92.4
	Folding	3.4	5.0	4.8	3.6
	Non-Folding	96.6	95	95.2	96.4





CONCLUSION:

From above study, it is concluded that;

- The traits like dimple cheeks and curly hairs are more common in girls than boys.
- The percentage of tongue characteristics like rolling and folding and widow's peak hair pattern is slightly higher in boys than girls.
- Dimple cheeks are more in school students than college student.
- The percentage of curly hair is comparatively less than straight hair in both school and college students and gender. It is also found that girls are having more curly hairs than the boys.
- Except the free ear lobe trait, the percentage of other dominant traits is less than recessive traits.

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REFERENCES:

1. Arora, M. P. and Santhu, G. S. (1989). *Genetics*. 2nd edition. Himalaya Publishing House, Delhi.
2. Kothari, C. R. (1988). *Research Methodology*: Methods and techniques. Wiley Eastern Limited, New Delhi.
3. Meyyan, R. P. and Arumugam, N. (2011). Genetics and Biostatistics. Saras publication, Nagarcoil, Tamilnadu.
4. Verma, P. S. and Agrawal, V. K. (1998). Concepts of Genetics, Human genetics and eugenics. S. Chand and Company Ltd. Ram Nagar, New Delhi- 110 055.
5. Winchester, A. M. (1979). Genetics: A survey of the principles of heredity. Third edition. Oxford and IBH Publishing Co. New Delhi.

ORIGINAL RESEARCH PAPER

Zoology

KEY WORDS: Cyprinidae, Conservation, Asian fishes, Fish fauna, Shannon-Wiener Diversity Index.

A CHECKLIST OF FRESHWATER ICHTHYOFAUNA OF NAKANA LAKE, DISTRICT- DHULE (M.S.) INDIA.

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ABSTRACT

Fishes are aquatic creatures, perfectly adopted for aquatic life. Freshwater bodies comprise variety of fishes and maintain the balanced ecosystem. Present study reveals total 20 species belonging to 5 orders, 12 families and 18 genera. The family Cyprinidae was found to be dominant form major bulk (30%). Followed by Siluridae, Bagridae and Ambassidae each with (10%). Whereas family Clupiedae, Mastacembalidae, Channidae, Cichdae, Gobidae, Claridae, Heteropneustidae and Cobitidae including single species of each contribute (5%). Authors documented the record of fish diversity by calculating the various diversity indices such as Shannon-Wiener diversity index (H), Simpson's Dominance index (D), Simpson's index of diversity (1-D), Simpson's Reciprocal index (1/D), Margalef's Richness index (MD) and Pielou's Evenness index (J).

Introduction

Water is life, It is utmost important for survival. The freshwater bodies i.e. lakes, ponds and reservoirs etc. are vital resources for developing countries, although the amount of water in them constitutes only a minute fraction i.e. less than 1% of the total freshwater recourses on the earth. In India these are mostly manmade, having great economic importance. Indian history is full of events prompting construction of water bodies for power generation, irrigation, drinking and flood control etc. but now a day these are also utilized for fisheries. These are important from socio-economic point of view, as it has potential of providing employment (Khan et al., 1991).

Fishes constitutes half of the total number of vertebrates in the world and lives in all types of aquatic habitats. Around the world approximately 22,000 fish species have been recorded out of which 2500 (11%) are found in India among these 930 species are freshwater and 1,570 are marine (Umbarkhande et al., 2011). Fish is valuable source of protein, in addition to being an important palatable food item, for human consumption. They are part of aquatic food chain, nutrient cycling and ecosystem services. Fish also used as a genetic library for possible future use in medicine and aquaculture, stimulate human interest in nature (Rao et al., 2013). Nakana Lake is a manmade lake, selected as freshwater reservoir for the present study. The aim of this study was to reveal the faunistic diversity of freshwater fish species from Nakana Lake, during June 2013 to May 2014. Many edible fish species are occur and fishing is done regularly. It is also used for aquaculture.

Material and Methods

Study area

The present study was conducted at Nakana Lake. It was built over the Panzara River, near Morane Village, Tah. and Dist. - Dhule (MS) India. The geographical location of the lake has (20° 52' 56.27" N and 74° 43' 31.82" E). This is earthen lake having catchment area is of 945 m, maximum height is 18.41 m. Main purpose behind construction of the lake is for drinking water supply, irrigation and aquaculture.

Collection, identification and preservation of fish

To study the ichthyofaunal diversity, relative species and abundance of Nakana Lake was selected as a case study. The fresh fish specimens were purchased from fisherman at the sight of fishing, brought them to laboratory and wash them with tap water. For identification and taxonomic study the photographs were snapped. For advanced study morphological characters, fin and scale formula were noted. Small specimens were directly placed in 4 % formalin where as large fishes were given an incision in their abdomen and preserved. The fishes were identified by using different literature viz., Day (1994), Talwar and Jhingran (1991) and Jayaram (2002). Those which are not properly identified were sent to the Western Regional Station (WRS, ZSI, Akurdi, Pune (MS).

For quantitative way of water assessment, species diversity indices of diverse water bodies were computed in recent years (Kawade and Pandhakar, 2016). With help of following formulae, we determine the diversity indices to assess how diverse the lake about fish species.

Data analysis

1. Shannon – Weiner Index, (1963): (H): $H = -\sum P_i (\ln P_i)$
2. Simpson's Dominance Index, (1949): (D): $D = \sum n(n-1)/N(N-1)$,
3. Simpson's Index of Diversity = 1-D,
4. Simpson's reciprocal Index = 1/D,
5. Margalef's Index, (1958): (MD): $MD = R-S-1/\ln(n)$
6. Pielou's evenness Index, (1966): (J): $J = H/\ln^*S$

Results and Discussion

During the entire study different fish variety had been observed, total 20 species were collected from Nakana Lake, during study period. The scientific name, local name of the fish species along with Order, Family and status were illustrated in Tabel-1.

The study findings showed that recorded species belonging to 5 Orders, 12 Families, 18 genera and 20 species. Our findings are corroborated with earlier researchers viz. Sarwade and Khillare (2010) reported the 60 species of fishes belonging to 15 families and 36 genera during their study on Ujani wetland (M.S.). Kharat et al (2012) had reported 51 species of fishes belonging to the 14 families and 35genera during their study on Krishna River at Wai (M.S.). Jayabhaye and Lahane (2013) were observed 21 species of fishes belonging to 6 families and 13 genera during their study period on Pimpaldari tank, Dist. Hingoli (M.S.). Recently Sharma et al (2017) recorded 143 fish species including 4 orders, 22 families and 45 genera from River Yamuna.

Due to more fecundity of major carp; density of Cypriniformes was evident in the Lake and suitable environmental condition relatively higher population. Dominance of fish species belonging to order Cypriniformes, those were also reported by other authors from different freshwater reservoirs. Sakhre and Joshi (2002) reported the ichthyofauna of Palas-Nilegaon reservoir in Osmanabad District, Maharashtra. They revealed 21 species of fishes belonging to 14 genera falling under 4 Orders (Cypriniformes, Perciformes, Siluriformes and Osteoglossiformes). Patole and Patil (2009) recorded 22 fish species from Panzara River, Tahsil Sakri, Dist. - Dhule. These belong to 5 orders, 12 families and 22 genera. The member of order Cypriniformes were dominated from major bulk (60%) Patole (2014) again recorded 32 fish species from Tapi River with 6 stations through Dhule and Nandurbar district in Maharashtra. These belong to 6 orders, 12 families and 23 genera. Recently, Dwivedi et al (2017) revealed that 58 fish species belonging to 5 orders, 18 families and 43 genera from the Paisuni River. Cypriniformes order was shared 27 species (46.55%). Sonawane and Patole (2017) reported 20 fish species belonging to 16 genera, 11 families and 6 orders from Nakane, Sulwade and

Dedergaon dams of Dhule District. Very recently Bharman *et al* (2018) recorded 49 fish species from 4 orders, 11 families and 28 genera from Kaladan River and its four major tributaries of Kaladan River, Indo-Myanmar biodiversity hotspot, Mizoram state of India.

In present investigation family wise percentage of fishes is shown in fig.-2, in which Family Cyprinidae is dominant with 6 species (30%) over all the reported families. Ambassidae, Bagridae and Siluridae were having 2 species (10%). Family Clupeidae, Mastacembalidae, Channidae, Cichlidae, Gobidae, Claridae, Heteropneustidae and Cobitidae including single species of each contribute (5%).

Every natural ecosystem doesn't have equal abundance, it shows variety of species which differ in their relative abundance and richness. During tenure of this research work total 252 catches of 20 fish species represented by 12 families.

- Family Cyprinidae found to be dominant group with 6 species in the assemblage composition in which Cirrhinus reba was less abundant, Puntius sophore, Barbora doniconius and Labeo boggut were found to be abundant as well as Cyprinus carpio and Labeo rohita were moderately abundant.
- Family Siluridae shown 2 species Ompok bimaculatus was found to be less abundant and Wallago attu was rear.
- Family Bagridae represents 2 species Mystus bleeker and Mystus vittatus were less abundant and moderately abundant respectively.
- Family Ambassidae shown 2 species Chanda nama and Parambasis ranga was abundant and less abundant respectively.
- Family Heteropneustidae had shown Heteropneustes fossilis species was rare.
- Claridae family includes Clarias batrachus was moderately abundant.
- Cichlidae family represents exotic species Oreochromis mossambicus was found to be abundant.
- Family Gobidae includes Glossogobius giuris was rare.
- Channidae family conveys Channa punctata was less abundant.
- Family Mastacembalidae includes Mastacembelus armatus was found to be rare.
- Family Clupeidae represents species Tenulosa ilisha was abundant.

Rao, *et al* (2013) recorded 63 fish species from river Champawathi (Vizianagaram, A.P., India). They showed 13 species were abundant, 15 moderate, 23 species common and 12 were rare. In the Present Investigation Chanda nama and Oreochromis mossambicus species were found to be abundant and Heteropneustes fossilis showed least count. Thirumala, *et al* (2011) reported the exotic fish species Oreochromis mossambicus established rapidly and widely. As per local fisherman's information catching of tilapia is increasing over the years. During past monsoon season it dominates the indigenous fish species. There is no demand hence fishermen treat this unwanted fish.

Biological Indices

Biological diversity can be measured by many different ways i.e. Richness and Evenness. Different kinds of organisms are present in a particular area is called richness while evenness compares the similarity of population of each species. Diversity depends on those, both things are increases, diversity automatically increases. Shannon and Wiener index is also important tool for quantifying diversity of particular habitat. By using different formulas we calculated values of some indices given in table - 2.

Table:-2, Fish species richness, abundance, dominance and diversity indices of Nakana Lake, Dhule

Sr. No.	Index	Value
1	Species Richness (S)	20
2	Species abundance (N)	252
3	Shannon-Weiner Index (H) (Shannon and Wiener, 1963)	1.7550
4	Simpson's Dominance Index (D) (Simpson, 1949)	0.0713
5	Simpson's Index of Diversity (1-D)	0.9291
6	Simpson's Reciprocal Index (1/D)	14.0469
7	Margalef's Index (MD) (Marglef, 1958)	7.1315
8	Pielou's Evenness Index (J) (Pielou, 1966)	0.6073

The present investigation focused richness, abundance and different diversity indices of freshwater body Nakana Lake. The lake represents richer value about fish species i.e. 20 and abundance is 252. The value of the Shannon-Weiner index was (1.7550) shows greater diversity. The index of dominance is useful for determining particular fish species dominating by that habitat. In Simpson's Dominance Index quantify the probability that two individuals randomly selected from a sample will belongs to the same species. The value of this index was (0.0713), which ranges between 0 and 1. If a value of this index was 0 stands for infinite diversity and 1 indicates no diversity. When value of lake is low, the implication is that "Dominance is shared by all the species of that community" Cummins (2002). To get over this problem 'D' is subtracted from 1 to give the Simpson's index of diversity (1-D) which was (0.9291) and Simpson's reciprocal index (1/D) was (14.0469). These three are the closely related indices shows the same diversity. The species richness is calculated by Margalef's Index (MD) was (7. 315) and evenness is by Pielou's index (J) was (0.6073). Our findings are supported by earlier studies like Mandal, *et al* (2014); Shukla and Sing (2013) are calculated the values of diversity of two floodplain lakes Gopalnagar and Damur of West Bengal and Amu river respectively.

Conclusion

Freshwater resources are precious but the life supporting system, if they exploited economically, there are not beneficial for human society. Aquatic environment and its biota necessary to save and kept the ecosystem undisturbed. Nakana Lake is manmade water reservoir away from discharge of industrial effluents, and drainage of city and garbage. It is dynamic wetland ecosystem but the biodiversity of this lake being disturbed due to some anthropogenic activities including over fishing with fingerlings and juveniles. At the time of religious festivals huge idols of Lord Ganesha and Durga were disposed into the lake. Every year this type of activity reduced the capacity of water body. On the other hand presence of exotic fish species like the reservoir directly affects on economically important native carps. The diversity of fish fauna of Nakana Lake is richer hence there is urgent need to create awareness among fishermen and local peoples about the importance of lake. Government fishery department and NGO's has to take initiative and conserve them for future generation.

Acknowledgement

Authors are thankful to the Director, Western Regional Station, Zoological Survey of India, Pune for keen interest in identification of fishes. We are also thankful to the Principal, S. G. Patil College, Sakri Dist-Dhule for providing Central Library facility for fish literature.

Table-1, Ichthyofaunal diversity of Nakana Lake during June, 2013 to May, 2014.

Order	Family	Scientific Name	Local Name	Status
CYPRINIFORMES	Cyprinidae	1. Cirrhinus reba (Hamilton)	Reba	R
		2. Cyprinus carpio (Linnaeus)	Carpio	MA
		3. Puntius sophore (Hamilton)	Sofor	A
		4. Barbora doniconius (Hamilton)	Dev	A
		5. Labeo rohita (Hamilton)	Rav	MA
		6. Labeo boggut (Sykes)	Ger	A
	Cobitidae	7. Lepidocephalichthys thermalis (Val)	Zirmiti	R
SILURIFORMES	Siluridae	8. Ompok bimaculatus (Bloch)	Raigdi	LA

		9. *Wallago attu* (Schneider)	Papada	R
	Bagridae	10.*Mystus bleekeri* (Day)	Chichva	LA
		11.*Mystus vittatus* (Hamilton)	Chichva	MA
	Heteropneustidae	12.*Heteropneustes fossilis* (Bloch)	Tochya	R
		13. *Clarius batrachus* (Linn.)	Mangur	M
PERCIFORMES	Ambassidae	14. *Chanda nama* (Ham- Buch)	Kach masa	A
		15. *Parambasis ranga* (Hamilton)	Zangara	LA
	Cichlidae	16.*Oreochromis mossambicus* (Peters)	Shilpi	R
	Gobidae	17.*Glossogobius giuris* (Hamilton)	Khavlya	R
	Channidae	18. *Channa punctata* (Bloch)	Dok	LA
SYNBRANCHIFORMES	Mastacembalidae	19. *Mastacembelus armatus* (Lacepede)	Eel	R
CLUPEIFORMES	Clupeidae	20. *Tenulosa ilisha* (Hamilton)	Bhat masa	A

A-Abundant, LA=Less Abundant, MA- Moderately Abundant, R-Rare

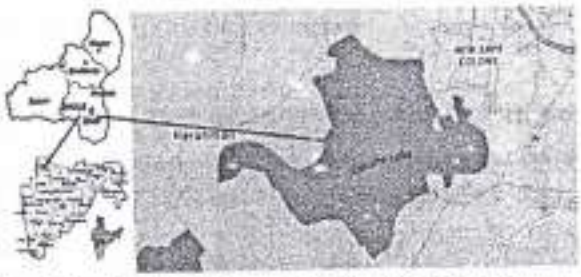

Fig.:-1, Map Showing Study area, Nakana Lake, Dhule (MS) India.

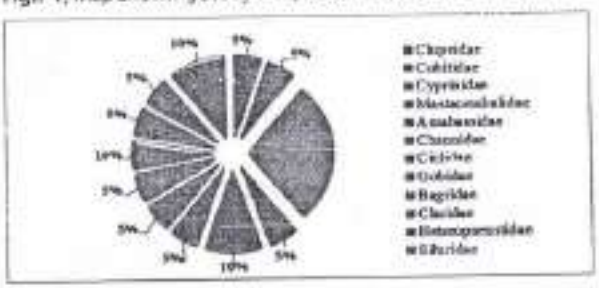

Fig.:-2, Percentage occurrence of fish families of Nakana Lake, Dhule (MS), India.

References

1. Barman, A. S., Sing, M. and Ponde, P.K. (2018). DNA barcoding and genetic diversity analyses of fishes of Kaladhan River of Indo-Myanmar biodiversity hotspot I. Mitochondrial DNA part A:> DNA mapping, Sequencing and Analysis. 29(3): 367-378.
2. Cummins, Hays. (2002). Paleoecology Problem Set.
3. Day, F. (1994). The Fishes of India, Burma Ceylon, fourth Indian reprint, Vol. I and II Lagmandar book agency, New Delhi.
4. Dwivedi, A. C., Mayank, P., Tripathi, S. and Tiwari, A. (2017). Biodiversity: The Non-natives species versus the Natives species and Ecosystem Functioning. J. Biodivers. Bioprospec. Dev., 4:164. Doi:10.4172/2214.1000164.
5. Jayadhaye, U. M. and Lahane, L.D. (2013). Studies on ichthyofaunal Diversity of Pimpalgaon Tank, Hingoli, Maharashtra, India. S.S.M. R.J.E., Jaipur, (8), 54-55.
6. Jayaram, K.C. (2002). The freshwater fishes of the Indian region. Narendra Publication House, Delhi, pp., 551.
7. Kawade, S.A. and Pandhalkar, A. K. (2016). Study of diversity indices fish heterogeneity of Kaka dam, Ahmednagar, Int. J. Adv. Biol. Res., 6(1): 75-78.
8. Khan, A. A., Kartha, K. N., Pely Davison and Gorge (1991). Fish harvesting system in Indian reservoir, Proc. of Nat... Workshop on 1000 energy fishing, 8-9 August (84).
9. Kharat, S.S., Raingankar, M. and Dahanukar, N. (2012). Freshwater fish Fauna Krishna River at Wai, Northern Western Ghats, India. J. Threatened Taxa, 4(6): 2644-2652.
10. Margalef, R., (1958). Perspective in ecological theory. Univ. Chicago Press, Chicago, USA:S-111.
11. Mondal, D.K., Kaviraj, A. and Saha, S. (2010). Water Quality Parameters and Fish Biodiversity Indices as Measures of Ecological Degradation: A Case Study of Two Floodplain Lakes of India. J. Wat. Res and Prot., 2: 85-92.
12. Patole, S. S., and Patil, Manisha (2009). A note on Ichthyofauna of Panzara River (Tah. Sakri Dist.-Dhule, Maharashtra. J. Aqua. Biol, 24 (2): 81-86.
13. Patole, S.S. (2014). Ichthyofaunal diversity of Nandurbar districts (Northwest Khandesh Region) of Maharashtra (India). Int. of Fisheries and Aqua. Studies, 2(2): 167-172.
14. Pielou, E.C. (1966). The measurement of diversity in different types of biological collections. J. Theor. Bio. 13: 131-144.
15. Rao, Chadra Sekhara, J., Simhachalam, G. and Sebastian Raju, Ch. (2013). A study on ichthyofaunal diversity, conservation status and anthropogenic stress of river Champavathi, Vizianagaram District (AP) India. IOSR-JESTFT, Apan J. Biol. Sci., 4(3): 418-425.
16. Sakhare, V.B. and Joshi, P.K. (2002). Ecology of Ralis-Nilegaon reservoir in Osmanabad District, Maharashtra. J. Aqua. Biol. 17(1): 28-31.
17. Sarwade, J.P. and Khillare, Y.K. (2010). Fish Diversity of Ujani Wetland, Maharashtra, India. Biolcan Spl. Issue 1: 173-179.
18. Shannon, C. E., and Wiener, W. (1963). The Mathematical theory of communication, University of Illinois Press Urbana, IL, PP., 125.
19. Sharma, A.P., Dar, M. K., Vass, K.K. and Tyagi, R.K. (2017). Patterns of fish diversity, community structure and ecological integrity of River Yamuna, India. J. Aqua. Eco. Health and Manag. 20(1-2): 30-42.
20. Shukla, P., and Singh, A. (2013). Distribution and Diversity of Freshwater Fishes in Ajan River, Gorakhpur, India. Advances in Biol. Res., 7(2):26-31.
21. Simpson, E. H. (1949). Measurement of diversity, Nature, Lond. 163, (4148) 688.
22. Sonawane, Deepali and Patole, S.S. (2017). Studies on ichthyofaunal diversity of Nakane, Sulwade and Dedargaon Dams of Dhule District (M.S.) Golden Research Thoughts, 6(9):1-9.
23. Talwar, P.K. and Jhingran, A.G. (1991). Inland fishes of India and adjacent countries. Oxford and IBH Publishers, New Delhi.
24. Thirumala, S., Kiran, B. R. and Kantaj, G. S. (2011). Fish diversity in relation to physico-chemical characteristics of Bhadra reservoir of Karnataka, India. Adv.in Applied Sci. Res., 2(5): 58-67.
25. Umrikar, S.B., Jagtap, J.T. and Sonawane, S.R. (2011). Ichthyofaunal diversity from Ambadi Dam, Taluka Kannad, District Aurangabad(MS). Rec.Res.in Sci. and Tech., 3(6):34-37.

Fresh water fish fauna of Panzara and Kan rivers of Sakri Tahsil, Maharashtra (India).

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Abstract

The present study has shown that Panzara and Kan rivers supported 41 fish species belonging to 7 orders, 13 families and 29 genera. The order Cypriniformes was dominant with 23 (56%) species followed by Perciformes with 7 (17%) species, order Suliformes with 5 (12%) species, Synbranchiformes 3 (7%) species and Osteoglossiformes, Clupeiformes and Beloniformes with single species each. Fish diversity was assessed by calculating the various indices such as Shannon-Weiner index (H), Simpson's Dominance Index (D), Simpson's index of diversity (1-D) and Pielou's Evenness index of species richness. It can be concluded that Panzara and Kan rivers flourish with rich fish fauna. It requires proper management and conserves this fish health.

Key Words: Biodiversity indices, Fish fauna, Simpson's index, Conservation etc.

Introduction

Panzara Kan (Panzara + Kan) rivers are life line of Sakri tahasil, these acts as important fish reserves (Patole and Patil, 2009). Fish is sensitive to changes in water chemistry due to different anthropogenic activities from their catchments. Fish responses to environmental disturbances, including hydro-morphological factors are different in time and space in comparison to simpler organisms, as they tend to be integrated over larger intervals. Fish has been identified as suitable for biological assessment due to its easy identification and economic value (Goswami and Mankodi, 2010). Fish assemblages have widely been used as ecological indicators to assess and evaluate the level of degradation and health of water bodies at various spatial scales (Mandal, 2010). Earlier workers like Madhusudan et al. (2011) studies on diversity of fish in Gondoor and Nakane lakes in Dhulia (M. S.). Jaiswal and Ahirrao (2012) studied on ichthyofaunal diversity of Rangavali dam, Navapur district Nandurbar (M.S.).

Fish diversity comprises of species richness (number of species in a defined area), species abundance (relative number of species) and phylogenetic diversity i. e. relationships between different groups of species (Kharat, *et al.*, 2012). Narsimha and Banergee, (2013) observed that there are many advantages of using fish assemblage as biological indicator. Therefore, it is essential to conserve the diversity of fish from freshwater reservoirs and tanks (Khodake *et al.*, 2014). Patole (2014) reported ichthyofaunal diversity of Nandurbar district (Northwest Khandesh region) of Maharashtra (India). Fish diversity is also a good bioindicators of water quality like zooplankton and phytoplankton species considered as biological tool for further bio-monitoring and assessing trophic status of water bodies (Kawade and Pandarkar, 2015). Recently Patole (2015) noted ichthyofaunal diversity of Tapi River flows through Dhule and Nandurbar district of Northwest Khandesh (Maharashtra). Aquatic ecosystems consist of a biotic and biotic component which directly affects the diversity of flora and fauna of water bodies (Borane, 2015). Very recently, Kawade and Pandarkar (2016) studies diversity indices of fish Heterogenesity of Kalu dam, Ahmednagar, Maharashtra. Fishes are one of the good and cheapest sources of protein food for all classes of people. Fishes are the important vertebrate group of animal's world contributing to the biodiversity of animals (Rawal and Deshmukh, 2016; Deepali Sonawane and Patole, 2017).

In the present investigation fish diversity were studied in Kan and Panzara River located at Sakri Tahsil of Dhule District in Maharashtra state, India. We also studied different indices of fish diversity.

Material and methods

For the study of fish diversity, fishes were purchased from fisherman they were collected in Panzara and Kan rivers of Sakri tahsil. Fishes brought to laboratory and preserved in 4% formalin solution in separate specimen jar according to the size of species. Then photographs were taken with the help of digital camera. The fishes were identified by local name named by local fisherman. The scientific identification and classification of fish species were made by using standard book and keys. Specimens with doubtful identifying characters were identified from zoological survey of India (ZSI) Pune.

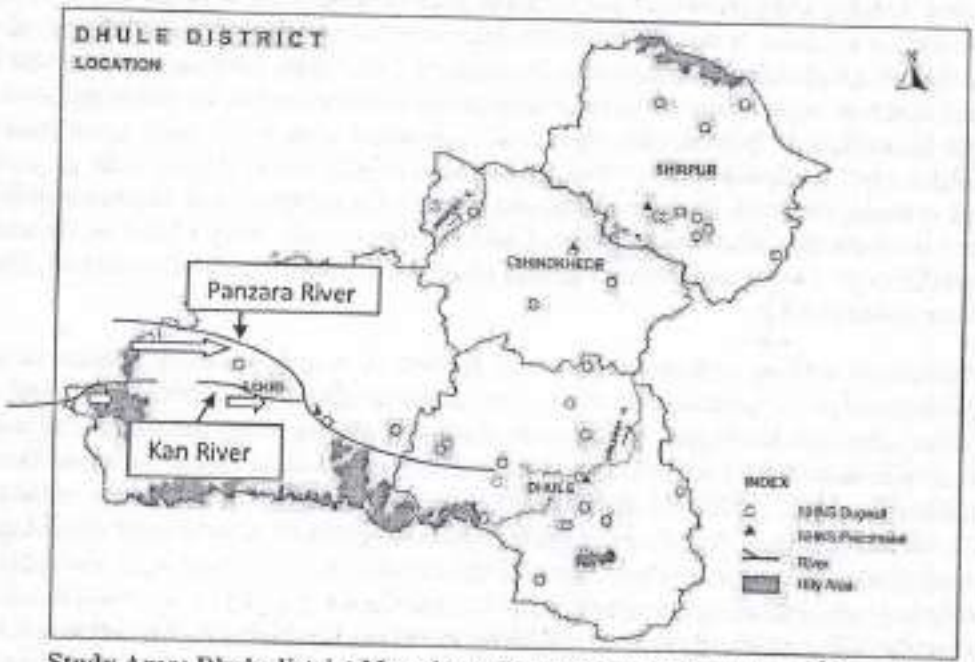
Study Area

Panzara River

The Panzara is the largest river in length of Sakri Tahasil (Dhule). It is life line of Dhule district and one of the tributaries of interstate river Tapi that flow eastward in to Arabian Sea. It lies between 20^0 to 52^0 North latitude and 73^0 to 55^0 North longitudes in North west side of Maharashtra. It originates at Hanuman near Pimpalner, Tal. Sakri Dist. Dhule (M. S.) and meet to Tapi River near Mudavad Tal. Shindkheda, Dist. Dhule (M. S.). Its total length is about 136 km.

Kan River

Kan River flows through the Dhule district and its confluence with Panzara River is near the Sakri Taluka. It is the tributary of Panzara. It lies between 21^0-3' North latitude and 730-59^0 East longitude in North West. It originates near Dhaner Tal. Sakri Dist. Dhule (MS) meet to Panzara at Datarti (Sakri), Dist. Dhule (MS). Total length of Kan River is about 54 km. These rivers are only one main source for water in Dhule dist. of Maharashtra. The water of these rivers is used for drinking, irrigation and aquaculture.



Study Area: Dhule district Map shows Sakri Tahasil (Panzara and Kan rivers).

For determination of diversity indices, total number of species, total number of individuals in a sample and total number of individuals of a species were determined. From these data Shannon - Weiner Index (H), Simpson's Dominance Index (D) and Simpson's Index of Diversity (1-D) and Pielou's evenness Index (J) were determined using the following equations.

1. **Shannon - Weiner Index (H).** It depends on both the number of species present and the abundance of each species. $H = -\Sigma Pi\ (lnPi)$, where Pi is the proportion of each species

Pi = A/T where A is number of each species in the sample, and T is the total number of individuals of all species in the sample.

2. **Simpson's Dominance Index (D)** is determined using the following equations.

$$D = \frac{n_1 (n_1 - 1) + n_2 (n_2 - 2) + \text{--------} + n_{20} (n_{20} - 1)}{N (N - 1)}$$

Where n is the total number of individual of a particular species and N is the total number of Individuals of all species.

3. **Simpson's Index of Diversity** = 1- D

4. **Pielou's evenness Index (J):** $\frac{H}{Ln^* S}$

Where H is the Shannon - Weiner Index and S is the number of species.

Results and Discussion

The fresh water fish diversity of Panzara and Kan rivers of Sakri Tahasil and their abundance is shown in table-I. This showed that most of the fish species recorded were widely distributed in the water bodies of Sakri Tahsil. In the present investigation the fish collected from Panzara and Kan Rivers by making two collection stations centre. We collected 41 species (29 genera) belong to 7 different orders and 12 families.

Similar types of work were carried out by earlier workers like Patole and More (2010). They have been studied biodiversity of fresh water fishes from Sakri, Tahasil. They examined 221 specimens, among them 31 species (25 genera's) of 05 orders, also recorded 17 new species. Ubarhande et al (2011) observed 08 orders, 11 families, 22 genera and 27 species. Madhusudan et al (2011) have showed18 fish species in Gondoor and Nakana lakes where Cyprinidae was dominance over other families. Abu Hanif *et al.*, (2015) reported 26 species belonging to 5 orders from Sandha Rivers of South West Bangladesh. Sakhare (2001) noticed the occurrence of 23 fish species belonging to 7 orders in Jawalgaon reservoir in Solapur district of Maharashtra. Patole (2014) studied ichthyofaunal diversity of Nandurbar district of Maharashtra State; he reported 32 species from 24 genera. Where order Cypriniformes dominate over the other orders. Patole (2015) mentioned ichthyofaunal diversity of tapi river flows through Nandurbar and Dhule district. He reported 32 fish species belonging to 23 genera. He finds similar results i.e. order Cypriniformes where dominance. Deepali Sonawane and Patole (2017) observed 20 fish species belonging to 16 genera, 11 families and 06 orders in Nakane, Sulwade and Dedorgaon dams of Dhule district (M. S.) where Cypriniformes was dominant over other orders. Kawade and Pandarkar (2016) studied on diversity indices, Ahmednagar (M. S.). They reported 27 fish species where order Cypriniformes was dominated over other orders. Our work is corroborated with these earlier workers.

In the present study occurrence of 41 fish species from Panzara-Kan River showed that good fish diversity and their production. It might be suitable water quality of rivers that support proper breeding places for fish. The fishes belonging to order Cypriniformes was dominant.

Table- 2 shows fish species richness and various diversity indices. It is observed that, in present study species abundance was 2478, Shannon- Weiner Index (H) recorded 3.264. The Simpson's Dominance Index (D) was recorded 0.037 and Simpson's Index of Diversity (1-D) was recorded 0.963. The Pielou's evenness (J) value was recorded 0.879.

Conclussion

This ichthyofaunal study suggests the study area water body is rich in fish fauna. Therefore a sustainable strategies needs to raising awareness among the fishermen for conservation of fish diversity in the Panzara and Kan rivers of Sakri Tahsil.

Acknolwedgement

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References

1. Abu Hanif, A., Muhammad, B. S., Reaz, C., Sultan M., Ashfaqun, S. H. and Sukham, M. 2015. Biodiversity and Conservation of Threatened Freshwater Fishes in Sandha River, South West Bangladesh, *World Appl. Sci. J.*, 33 (9): 1497-1510.
2. Borane, V. R. 2015. Study of ichthyofaunal diversity in relation to physico-chemical characteristics of Londhare dam water, Shahada taluka, Maharashtra, India, *J. Environ. Res. Develop.* 10(01), 59-64.
3. Deepali Sonawane and Patole, S. S. 2017. Studies on ichthyofaunal diversity of Nakane, Sulwade and Dedorgaon dam of Dhule Dist. (M. S.). *Gol. Res. Thots.* 6 (9): 1-9.
4. Goswami, A. P. and Mankodi, P. C. 2010. Diversity of fishes from fresh water reservoir Nyari - II Rajkot district, Gujarat, India. *Elect. J. Environ. Sci.*, Vol. (3) 23-26.
5. Jaiswal, D. P. and Ahirrao, K. D. 2012. Ichthyodiversity of the rangavali dam, Navapur distirct Nandurbar, Maharashtra state, *J. Res. Biol.* 3(1), 241-245.
6. Kawade, S. A. and Pandarkar, A. K. 2015. Study of Zooplankton diversity of Dnyaneshwar Sagar in relation to trophic status. *J. Exp. Zool. India*, 18(2): 807-810.
7. Kawade, S. A. and Pandarkar, A. K. 2016. Study of diversity indices fish Heterogeneity of Kalu dam, Ahmednagar, Maharashtra. *Int. J. Adv. Biol. Res.* 6(1): 75-78.
8. Kharat, S. S., Paingankar, M. and Dahanukar, N. 2012. Freshwater fish fauna of Krishna River at Wai, northern Western Ghats, India. *J. of Threat. Taxa*, 4(6): 2644-2652.
9. Khodake, S. P., Borale, P. R and Petare, R. K. 2014. Ichthyofaunal diversity in Jamkhedi reservoir in Dhule district of Maharashtra, India, *J. Environ. Res. Develop.* 9(1): 177-183.
10. Madhusudan, V. Amrutsagar, V. and Lohar, P. S. 2011. Diversity of Mollusca and Fish in Gondoor and Nakane Lakes in Dhulia, Northwest Maharashtra, India. *J. Ecobiotechnol.*, 3(6): 16-2.
11. Mandal, D. K. 2010. Water quality parameters and fish biodiversity Indices as measures of ecological degradation: A case study in two floodplain lakes of India. 2 (1): 85-92.
12. Narasimha, R. K. and Benrgee, 2013. Fish species diversity of Nagaram Tank of Warangal Andhara Pradesh. *IOSR-JESTFT* Vol.3: 14-18.
13. Pandarkar, A. K, Pawar, B. A. and Shendge, A. N. 2014. Ichthyofaunal studies of Visapur reservoir in relation to fish culture, Ahmednagar district, Maharashtra. Flora and fauna. 20(2): 247-250.
14. Patole, S. S. and Patil, M. U. 2009. A note on ichthyofauna of Panzara River (Tah. Sakri), dist. Dhule, Maharashtra. *J. Aqua. Biol.* 24(2):61-66.
15. Patole, S. S. and More, B. C. 2010. Biodiversity of fresh water fishes from Sakri-Tahsil (Dist-Dhulia) of Maharashtra. Research Link, 75, (IX-4): 15-17.
16. Patole, S. S. 2014. Ichthyofaunal diversity of Nandurbar district (Northwest Khandesh region) of Maharashtra (India). *Int. J. Fisheries and Aqua. Studies.* 2(2):167-172.
17. Patole, S. S. 2015. Ichthyofaunal diversity of Tapi River flows through Dhule and Nandurbar district of Northwest Khandesh (Maharashtra), India. *Proc. Zool. Soc. India.* 14(1):43-50.

18. Rawal, R. and Deshmukh, P. S. 2016. Biodiversity of fish fauna in Lakhapura Reservoir, Bhikagaon Tehsil, Khargone District, M. P. *Int. J. of Inno. Res. and Adv. Stud.* 3(4):75-77.
19. Sakhare, V. B. 2001. Ichthyofauna of Jawalgaon reservoir in Solapur district of Maharashtra, *J. Aqua. Biol.*, 16 (1 and2): 31-33.
20. Ubarhande, S. B., Jagtap, J. T. and Sonawane, S. R. 2011. Ichthyofaunal diversity from Ambadi dam, Taluka Kannad, district Aurangabad (M.S.) *Rec. Res. In. Sci. Tech.*, 3(6), 34- 37.

Table1: Fish abundance and diversity in Panzara and Kan rivers, Sakri (India).

Sr. No.	Species	Order	Family	Common name	Abundance
1.	*Xenentodon cacila*	Beloniformes	Belonidae	Vam	13
2.	*Tenualosa ilisha*	Clupeiformes	Clupeidae	Bhat-masa	148
3.	*Acanthocobitis botea*	Cypriniformes	Balitoridae	Mooree	112
4.	*Acanthocobitis moreh*			Mooree	107
5.	*Oreonectus evezardi*			Mooree	35
6.	*Schistura denisoni*			Mooree	23
	Barilius bendelisis		Cprinidae	Zora	142
8.	*Crossocheilus latius*			Regadi	42
	Danio aequipinnatus			Ger	37
10.	*Garra mullya*			Mhya	105
11.	*Hypophthalmichthys nobilis*			Silver	25
12.	*Labeo boggut*			Ger	23
13.	*Lepidocephalichthys guntea*			Mooree	98
14.	*Lepidocephalichthys themalis*			Mooree	88
15.	*Oteobrama cotio cotio*			Ger	26
16.	*Punctius amphibious*			Kanvar	68
17.	*Puntius conchonius*			Chhoti-Debri	73
18.	*Puntius sarana sarana*			Kunder	62
19.	*Puntius sophore*			Lal Dhebri	68
20.	*Puntius ticto*			Dhebri	80
21.	*Rosbora daniconius*			Zora	69
22.	*Salmostoma bacaila*			Mavala	32
23.	*Salmostoma clupioides*			Chal	27
24.	*Salmostoma phulo phulo*			Chal	38
25.	*Tor khudree*			Khavalya	26
	Notopterus notopterus	Osteoglossiformes	Notopteridae	Patoda	21
27.	*Chanda nama*	Perciformes	Ambassidae	Kach-Masa	89
28.	*Parambasis ranga*			Dhebri	18
29.	*Channa gachua*		Channidae	Dok	139
30.	*Channa punctata*			Dok	142
31.	*Channa orientalis*			Dok	135
32.	Channa *marulius*			Dok	149
33.	*Glossogobius giuris*		Gobidae	Khavalya	42
34.	*Mystus bleekeri*	Siluriformes	Bagridae	Chichva	13
35.	*Rita pavimentata*			Sisava	09
36.	*Heteropneusta fossilis*		Clariidae	Tochya	15
37.	*Clupisoma garua*		Schilbidae	Vavadi	79
38.	*Ompok bimaculatus*		Sillrudae	Papada	18
39.	*Macrognathus panicalus*	Synbranchiformes	Metacembelidae	Vam	18
40.	*Mastacembelus armatus*			Vam	09
41.	*Mastacembelus pancalus*			Vam	15

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Table 2: The fish species richness and diversity indices

Sr. No.	Index	Value
01	Species Richness	41
02	Species abundance (N)	2478
03	Shannon- Weiner Index (H)	3.264
04	Simpson's Dominance Index (D)	0.037
05	Simpson's Index of Diversity (1-D)	0.963
06	Pielou's evenness (J)	0.879

Preliminary studies on diversity and relative abundance of Coleopteran beetles of family Carabidae, Meloidae and Tenebrionidae, from Sakri tahsil, District - Dhulia (M.S.).

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Abstract

Present piece of work represents preliminary studies on diversity and relative abundance of Coleopteran beetles of family Carabidae, Meloidae and Tenebrionidae, from study area. The beetles were collected through extensive survey from in and around Sakri tahsil, district- Dhulia (MS). The study revealed total 13 species from 3 families viz., Carabidae, Meloidae and Tenebrionidae of 7 subfamilies and 12 genera. Of these Tenebrionidae were found to be dominant (46.1 %) with respect to Carabidae (30.8 %) and Meloidae (23.1 %). Beetles of these families are commonly called ground, blister and darkling beetles respectively. Most of them are acts as pest of various commercial crops and stored grain pest. Our observations indicate relative abundance of beetles in monsoon than in winter and summer.

Key words: Relative abundance, Coleopteran, Carabidae, Meloidae, Tenebrionidae.

Introduction

The coleopteran beetles belonging to the dominant order of class insecta. They are distributed worldwide and are adapted every possible habitat. These habitats make them ecologically and economically significant as indicator species and pests respectively (Hon, 2018). Several beetles are treated as serious pests of agricultural plants, stored products and plantation. They also play important role in decomposition and recycling of organic nutrients (Bhawane et al., 2012). The world record of identified species is 3,50,000 whereas 17,431 species have been reported from India (Bharmal et al., 2014).

Family Carabidae

Carabidae beetles are commonly called ground beetles are a large cosmopolitan family of beetle with more than 40,000 species worldwide, around 2,000 of which are found in North America and 2,700 in Europe. It is one of the ten largest animal families, as of 2015. Tribe HARPALINI is one of the largest groups of the family Carabidae. Both the genera and species are numerous and diversified. Some more than one thousand species under numerous genera are distributed throughout the word. Harpalini is well represented in India largely by such palaeartic genera as *Harpalus* Latreille, *Hypolithus* Dejean, *Stenolophus* Stephens and *Acupalpus* Latreille. Of these genera *Harpalus* is mostly confined to the Himalayan tract. The genus *Anisodactylus* Dejean, is the palaeartic representative of the subtribe Anisodactylina is replaced in South East Asia by the genus *Gnathophanus* MacLeay. A good number of the Indian genera of the subtribe Harpalina are spread over South East Asia but do not occur elsewhere. So far 115 species under 38 genera are known from India of which 30 species under 18 genera are recorded from the state of West Bengal. Like carabids in general the members of this group are primarily carnivorous in habit but some, particularly the *Harpalus* species are found to feed on foliage and other vegetable matters in addition to their carnivorous habit and should rather be termed 'Omnivorous' (State Fauna Series, Part- 6-A, 1995). The work of 20th century of the Oriental Carabidae by his series of publications as 'Papers on Oriental Carabidae' (1919-1947), these literatures are given in the work of Habu (1973).

Family Meloidae

The family Meloidae, popularly known as blister beetles; is important group of insects in having commercial, medicinal and biological importances. In 1894, Fairmaire described two species namely, *Lytta cardoni* and *Cylilldrothorax braefii* from 'Bengal' Unfortunately, this group was very poorly known not only from West Bengal but also from all over India and its adjacent countries due to lack of worker from this subcontinent. Saha (1972 (a), 1972(b), and 1981) published several papers and a monograph on Meloidae fauna of India and its adjacent countries. So far about 10 species belonging to 17 genera and three subfamilies have been recorded from India and its adjacent countries. In the present paper, 12 species and one new species belonging to 7 genera are reported and it would be the first consolidated account of Meloidae fauna from West Bengal (State Fauna Series, Part- 6 B, 1996). Blister beetles are beetles of the family Meloidae, so called for their defensive secretion of a blistering agent, cantharidin. About 7, 500 species are known worldwide. Many are conspicuous and some are aposematically colored, announcing their toxicity to would-be predators. Cantharidin, a poisonous chemical that causes blistering of the skin, is used medically to remove warts (Bhattacharjee and Brodell, 2003) and is collected for this purpose from species of the genera *Mylabris* and *Lytta*, especially *Lytta vesicatoria*, better known as "Spanish fly". Blister beetles are hypermetamorphic, going through several larval stages.

The larvae are insectivorous, mainly attacking bees, though a few feed on grasshopper eggs. While sometimes considered parasitoids, in general, the meloid larva apparently consumes the immature host along with its provisions, and can often survive on the provisions alone; thus it is not an obligatory parasitoid, but rather a facultative parasitoid, or simply a predator. The adults sometimes feed on flowers and leaves of plants of such diverse families as the Amaranthaceae, Asteraceae, Fabaceae, and Solanaceae. The adults are mostly phytophagous, but often also destroy the eggs of grasshoppers. The meloid beetles yield the cantharidin, a crystalline solid from dried beetles, used medicinally as vesicant and diuretic and in the manufacture of hair oils. Genus *Mylabris pustulata* is large black and red stripped species, common throughout the old world, particularly on yellow-coloured flowers (Mani, 1982).

Family Tenebrionidae

The family Tenebrionidae, members of which are popularly known as darkling beetles. These are versatile group in having unique power of adaptation in almost all habitats either favorable or adverse, including extreme hot deserts and snow capped nl0untains. "Among stored products pests, Tenebrionidae form maximum number of pest insects which cause enormous danger to stored products. It shows extreme organic diversities and adaptive radiations in different ecological niches. The family Tenebrionid is one of the largest families of Coleoptera, comprising about 18,000 described species from all over the world. It consists of 2558 species belonging to 370 genera, 36 tribes and 3 sub-families from Indian subcontinent and its adjacent countries. The Tenebrionidae fauna of West Bengal as well as India as a whole is very poorly known. So, the status of knowledge on the group stands at alpha stage due to the following facts; firstly all the stray publications on the group are scattered and were published in different obscure foreign journals and are not available in India; secondly, due to its vastness and organic diversities, it is very difficult to study the group as because there' is no dependable literature on Indian fauna of this family (State Fauna Series, Part- 6 B, 1996). Earlier Tenebrionid fauna of India and its adjacent countries may be seen in Kaszab (1975, 1979) and Saha (1977, 1990). Tenebrionids are Small or larged, somewhat flat, elongated, hard, often sculptured, mostly black, sometimes reddish-brown. Antennae simple, clavate, moniliform, short, with 11 segments. Eyes prominent. Tarsi heteromerous, with 5-5-4 segments. Claws simple. Wings usually vestigial or absent. Elytra often immovably soldered together along the middle. Usually nocturnal beetles, phytophagous scavengers or feeding on dead and decaying vegetable matter, dung, dried seeds, cereals and other stored products. Few species are pest of flour, cereals and cereal products (Mani, 1982). Present study deal with diversity and relative abundance of beetles from three coleopteran families viz., Carabidae, Meloidae and Tenebrionidae from Sakri tahsil of Dhulia district.

Materials and methods

Study area – Geographical location of Sakri tahsil is in between 21° 087 North latitude and 74°36 East longitude. It is a largest tahsil in Dhule district of Maharashtra State, belongs to Khandesh and Northern Maharashtra region of Nashik division. It is located 70 Km towards west from District head quarters Dhule and 307 Km from State capital Mumbai towards South. Sakri taluka is bounded by by Baglan

taluka towards South, Navapur taluka towards west, Nandurbar taluka towards North, Uchchhal taluka towards west.

Both extensive and intensive surveys were conducted during 2015-2017 in different villages of study area. Field visits were made on holiday during the period of survey. For collection of beetles, sweep nets, bush beating and collection in inverted umbrella and hand picking techniques were used. Sample after collection were killed in chloroform and preserved in 70 % ethyl alcohol in glass vials. They were then brought to the laboratory, where stretching, pinning, labeling, and drying and photograph is done as per the guidelines laid by Zoological Survey of India. For authetification, the preserved samples where periodically send to Zoological Survey of India, Western Regional Station, Akurdi, Pune (M.S.), India.

Results and Discussion

In first attempt, beetles were collected through extensive survey from in and around Sakri tahsil, district- Dhulia (MS). The study revealed total 13 species from 3 families viz., Carabidae, Meloidae and Tenebrionidae of 7 subfamilies and 12 genera. Of these Tenebrionidae were found to be dominant (46.1 %) followed by Carabidae (30.8 %) and Meloidae (23.1 %). Beetles of these families are commonly called ground, blister and darkling beetles respectively. Most of them are acts as pest of various commercial crops and stored grain pest. The detail account on these beetles regarding their generic name, families, subfamilies, diagnostic features and distribution etc is presented in table-1.

Some recent researchers reported diversity of beetles from different regions of Maharashtra State. Their literature survey indicates, Thakur et al (2012) reported 8 species of darkling beetles belonging to family Tenebrionidae from the Melghat Tiger Reserve. They further mentioned that it was dominant family with respect to species diversity. Bhawane et al (2012) provided information of 29 species of white grub beetles and their host range from western ghats, Kolhapur district (MS). Pawara et al (2014) revealed a record of 35 coleopteran species of different families from Jalgaon district. Bharmal et al (2014) enlisted coleopteran (dung beetle) fauna of Sindhudurg district. During their survey they collected 26 species from 6 subfamilies of dung beetle. Patole (2017) represent review on the beetle world and human relationship. He reported besides the pests, most of beetle's acts as beneficial insect, predator, improve soil fertility, protect livestock as well as used as human food etc. Hon (2018) present communication report on diversity of beetles from Kopargaon tahsil, Dist- Ahmednagar (MS). He reported 29 species belonging to 8 families. Kalawate and Patole (2018) reported first record of a trogid beetle (Coleoptera: Scarabaeoidea: Trogidae) from the western ghats, India.

Conclusion

From study area, first time author reporting diversity and relative abundance of beetles of three family's viz., Carabidae (ground beetle), Meloidae (blister beetle) and Tenebrionidae (darkling beetle) through extensive survey. The study revealed total 13 species of beetles belonging to 12 genera scattered in 7 subfamilies viz., Brachininae, Harpalinae, Meloinae, Tenebrioninae, Pimeliinae, Platynontini and Tenebriominae. Among these Darkling beetles was found to be dominant in number (46.1 %) followed by ground beetles (30.8 %) and blister beetles (23.1 %). In general observation it is observed that the density of beetles was going to be decreased due to increased human interference as well as altered environmental conditions.

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References

1. Bharmal, D. L., Koli, Y. J. and Bhawane, G. P. 2014. An inventory of the Coleopteran fauna of Sindhudurg district, Maharashtra, India. *Int. J. Curr. Micro. And Appl. Sci.* 3(12): 189-19.
2. Bhattacharjee, Pradip; Brodell, Robert T. 2003. "Cantharidin". In Robert T. Brodell and Sandra Marchese Johnson, eds. Warts: Diagnosis and anagement—an Evidence-Based Approach. London: Martin Dunitz. pp. 151–160. ISBN 1-84184-240-0.
3. Bhawane, G. P., Mamlayya, A. B., Wagh, S. R. and Chaugule, A. K. 2012. Diversity of white grub beetles and their host range from northern western ghats, Kolhapur district (MS), India. *The Bioscan* 7(4): 589-596.
4. Habu, A. 1973. *Fauna Japonica,* Carabidae : Harpalini (Insecta: Coleoptera) i-xiii-430.
5. Hon, S. T. 2018. Preliminary study on diversity of coleopteran fauna from Kopargaon tahsil District Ahmednagar, Maharashtra, India. *Int. Res. J. Biol. Sci.* 7(6):23-25.
6. Kaszab, Z. 1975. Tenebrioniden aus Indien (Coleoptera) *Acta Zool. Acad. Sciel1. Hung.,* 25(2-3).
7. Kaszab. Z. 1979. Tenebrioniden aus Sudindien (Coleoptera) *Acta zool. Acad. Sciell. Hllllg* 25(3-4) : 285-275.
8. Patole, S. S. 2017. Review on the beetle world and human relationship. *Glo. J. Res. Anal* (GJRA) 6(10): 441-444.
9. Kalawate, A. S. and Patole, S. S. 2018. First record of a trogid beetle (Coleoptera: Scarabaeonidea: Trogidae) from the western ghats, India. *J. Threat Taxa.* 10(7): 11988-11991.
10. Pawara, R. H., Patel, N. G., Pawara, J. V., Gavit, P. J. and Ishi, S. S. 2014. Beetles of Jalgaon district of Maharashtra, India. *Biolife.* 2(3): 970-973.
11. Saha, G. N. 1972 (a). Studies on Blister Beetles (Coleoptera: Meloidae) from India: Two new species of the genus *Eletica* Lacordaire. *Zool. Anz. Leipzig,* 189 : 98-101.
12. Saha, G. N. 1972 (b). Observation on a collection of blister beetles, *Mylabris* Fab. (Coleoptera: Meloidae), from Pakistan, with description of a new species and a new subspecies. *Proc. Zool. Soc.,* Calcutta, 25 : 19-23.
13. Saha. G. N. 1977. The Darkling Beetles (Tenebrionidae: Coleoptera) from Rajasthan. *NeB's/. Zool. Surv.Illdia,* 3 (2) : 89-91.
14. Saha, G. N. 1981. A new genus of Meloidae (Coleoptera) from India. *Oriental Insects.* Delhi 15 (3): 63-65.
15. Saha, G. N. 1990. Ethological and Ecological Adaptations in Taxonomy (In Environment and Biology. Edited by Director, Z.S.I.), 317-321.
16. State Fauna Series-3. 1995. Fauna of West Bengal, Part- 6 A (Insecta: coleoptera). Zoological Survey of India.
17. State Fauna Series-3. 1996. Fauna of West Bengal, Part- 6 B (Insecta: coleoptera). Zoological Survey of India.
18. Thakare, V. G., Zade, V. S. and Hegde, V. D. 2012. Darkling beetle (Coleoptera: Tenebrionidae) of Melghat Tiger Reserve, Central India. *J. New Biol. Reports* 1(1): 29-32.

Table -1: Beetles with diagnostic features and distribution of Carabidae, Meloidae and Tenebrioinidae families.

Family and subfamily and generic name	Diagnostic features	Distribution
I. Carabidae a) Brachininae 1. *Brachinus hexagrammus* Chaudoir	Bombardier beetles are ground beetles, which are most notable for the defense mechanism that gives them their name: when disturbed, hey eject a hot noxious chemical spray from the tip of the abdomen with a popping sound. The damage caused can be fatal to attacking insects. Some bombardier beetles can direct the spray in a wide range of directions.	*Brachinus* is a genus of ground beetle native to the Nearctic, Palearctic, the Near East and North Africa. Beetles in this genus are commonly referred to as bombardier beetles. Found in tropical region of India.
b) Harpalinae 2. *Anthia sexguttata* Fabricus 1775	Pattern of spots on the elytra and thorax. Adults measure approximately 4 cm (1.5 inches), are black with six relatively large, white, dorsal spots (four over the elytra and two on the thorax). Other patterns are possible although the pattern is always symmetrical. The larva has a flattened form, a large head capsule, and prominent mandibles. Species of *Anthia* can spray a jet of formic acid up to 30 centimetres (12 in), which if not treated, can cause blindness in animals which harass the beetles. In general the beetles are large, armored, fast-moving, with prominent, powerful, sharp mandibles. Some are diurnal predators in semi-arid habitats, some are nocturnal.	The species occurs in the drier parts of South Asia. It is common in the scrub forests of southern India.
3. *Chlaenius ruffemortus* M. 4. Chlaenius Sp.	Bright metallic green, sometimes tinged with bluish. Characters, head shiny, pronotum and elytra more dull ventral surface black all appendages orange/brown except antennomeres 1-3, which are often paler front angle of pronotum prominent, with inconspicuous pubescence basal impressions of pronotum small, but distinct, rather shallow elytra dull, with fine yellowish pubescence elytral striations fine, basically rows of small punctures mandibles short, curved, left mandible no more than slightly longer than eye; scrobe extended more than half length of mandible.	*Chlaenius* is a large and diverse genus of ground beetle. It is native to the Palearctic, the Near East, North -Africa, Afrotropical region, and the Nearctic. The genus *Chlaenius* Bonelli, 1810 reported from four agro-climatic zones of Rajasthan.

II. Meloidae c) Meloinae 5. *Mylabris pustulata* Fabricius, 1775.	Blister beetles are beetles of the family Meloidae, so called for their defensive secretion of a blistering agent, cantharidin. About 7,500 species are known worldwide. Many are conspicuous and some are aposematically colored, announcing their toxicity to would-be predators. Cantharidian, a poisonous chemical that causes blistering of the skin, is used medically to remove water and is collected for this purpose from species of the genera Mylabris. The adults feed on flowers and leaves of plants of such diverse families.	Several species are distributed worldwide.
6. *Meloe proscarabaeus* Linnaeus, 1758.	The blister beetle genus *Meloe* is a large, widespread group commonly referred to as oil beetles. They are known as "oil beetles" because they release oily droplets of hemolymph from their joints when disturbed; this contains cantharidin, a poisonous chemical causing blistering of the skin and painful swelling. Members of this genus are typically flightless, without functional wings, and shortened elytra.	Reported from several states of India.
7. *Psalydolytta* Sp. Peringuey, 1909.	This species belongs to the group of P. atripes and is phenotypic ally similar to P. be quaertic. It differs from this central African species because of male antennomeres more robust and less slender, antennomere III not twice but 1.5 times as long as IV, male temples converging posteriad and not parallel, elytral chestnut ground colour clearer and setation with less evident longitudinal stripe.	Worldwide distribution
III. Tenebrionidae d) Tenebrioninae 8. *Platinotus punctitipen* Mulsant and Roy, 1853	Body elongate, oblong, robust strongly convex, glabrous and brownish, length 17-20 mm, head emarginated apically and fringed with short spines. Clypeus broadly emarginated apically. Eyes small and finely flattened. Antenna longer than head with segments 7 to 11unequally projected on one side. Elytra almost twice as long as wide broader line ; apices narrowed and deflexed apically.	ZSI Akurdi Pune Research team recorded this beetle from Maharashtra (Melghat Tiger Reserve). India: West Bengal (Haora). North India (State India series, 1996).

9. *Gonocephalum byline* Walker, 1858	*Gonocephalum* is a genus of darkling beetles, common name false wireworm in the family Tenebrionidae. In the species of this genus the body is quite elongated, the base of pronotum is usually slightly narrower than the base of elytra. The hind wings are developed. Adult *Gonocephalum* are active on the soil surface, and tend to damage dicotyledonous crops more severely than monocots.	India (Andaman island, Sikkim, Uttarakhand, Uttarpradesh and west Bengal, Karnataka), Borneo, Indonesia, Malasia, Philippines, Sri Lanka, Bhutan, Nepal, Japan, Korea, Russia, Yunnan, China, Vietnam, Fiji, Hawaii.
e) Pimeliinae 10. *Adesmia monilis* Klug, 1830.	Darkling beetle. Length variable about 1.2 to 1.8 cm. elongated, sub parallel apex narrow and rounded, posterior end convex, ash colored, moderately shining, head densely punctate, vertical ridges on wings.	Distribution - Not reported earlier.
f) Platynontini 11. *Notocorax minimus*	Small body, body dark brown to black, shiny, moderately convex, densely and distinctly punctate. Body length 9-11 mm. Head dense, antennae moderately long and wide. Pronotum rounded, puncuration large and dense. Elytra composed of 9 rows connected at apex. Wings entirely reduced.	Burma, India.
12. *Rhytinota indica* Schaufuss, 1872.	Darkling beetle, grey-blackish colored. Measured about 1.0 to 1.5 cm in length. Elytra well developed.	Bombay, Maharashtra- Melghat Tiger Reserve.
g) Tenebriominae 13. *Tribolium castanum* Herbst, 1825.	Body oblong-parallel, depressed and reddish brown. Head without rontoc1ypeal suture and genae widened moderately, eyes enlarge, ; antenna with last 3 segments forming a distinct club and segment 9 nearly as wide as segment 8 pronotum widest at middle, sides evenly curved, anterior n1m'gin nearly straight and posterior margin bisinuate; Elytra 2 times as long as wide, broadest basally, narrowing uniform11y to apex, surface coarsely punctured. Species usually smaller, 3-4 mm long.	India: West Bengal (Haora, Calcutta, North 24-Parganas) throughout India and Cosmopolitan.

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Assessment of physical parameters of Dedargaon Dam, Dist- Dhule, Maharashtra, India

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ABSTRACT

The present study is carried out during the study period Jan 2014 to Dec 2015. It deals with the assessment of water quality in terms of physical parameters. The water samples were collected from three sites of Dedargaon dam which supplies water to Dhule city of Maharashtra state, India. Certain physical parameters like colour, odour, temperature, pH, turbidity, total dissolved solids (TDS), etc. were assessed. The results were compared with the standards prescribed by National and International agencies like World Health Organization (WHO), International Standard Institute (ISI) and Bureau of Indian Standards (BIS). The results reveal that the values of physical parameters tasted were found to be in the prescribed permissible limit. Thus, the water is suitable for human use.

Key words:- Dedargaon dam, WHO, ISI, BSI, Water quality, Physico-chemical parameters.

INTRODUCTION

"Water is a liquid of life", as there can be no life possible without water. Water is the key compound and indispensable for life. The superiority of water requires for all living organisms which includes plants and animals. Man consumes water for various purposes like cooking, drinking, washing, etc. Every aquatic body is able to absorb some amount of contamination without any serious impact attributable to dilution and self purification factors. The water resources are supportive or potentially helpful for human being (Patil *et al.*, 2012).

Water is God's creation and Pollution is man's contribution

Pollution makes changes in physical, chemical, radiological and biological factors of the resources. It happens due to various activities of human beings. As a result of these various anthropogenic performances, the water quite often becomes in poor condition for various uses like domestic, drinking purposes, industrial, irrigation purposes etc. the water bodies are also polluted by the release of sewage or industrial wastes. Mostly pollution begins from the removal of wastewater following the use of water for a wide variety of purposes. India is still rendering polluted water day by day and the circumstances are declining gradually due to careless performance of its

society (Sivalingam, 2018). The increased use of metal-based fertilizer in agricultural revolution of the government could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also faucal pollution of drinking water causes water born disease which has led to the death of millions of people. (Adefemi and Awokunmi, 2010).

Description of study Area:

India is a vast country; it measures the area of about 806 million acres. The area which was undertaken for investigation is rural districts of Maharashtra (India). The Dhule district is also known as West Khandesh and categorized as district head quarters since 1960. Dhule district was Situated between 73°47' and 75°11' East of longitude and 20°38' and 22°3' North latitude, is the westernmost of the districts of Northern border area of Maharashtra State.

Dedargaon Storage Dam

The Dedorgaon dam was situated on Anwar nala which was joined by River of Panzara. The construction of the dam was completed in 1885. The basement of dam water storage capacity elevation extended on 350 meters. The live water srorage capacity of the dam is 152.37. The overflow (maximum) water storage capacity of the dam is 346.70 meters. As well as the minimum water storage capacity of the dam is 338.10 meters. But intake capacity is 342.30 meters. The Dedorgaon dam is comparatively small reservoir; it supplies water to dhule city. It covers 18 % of city area and it is 15 km away from the city. From this source, water supplied at the rate of 5 MLD. The capacity of Dedargaon water works after increasing the capacity of Dedargaon tank. The pure water is stored at Malegaon GSR and from this storage tank the water is supplied to various regions i.e. Malegaon Naka, Mohadi, Mahada wasti, Dedargaon.

MATERIAL AND METHODS

For the collection of water samples three sites were selected from the dam site. Monthly collection of samples was taken in morning time. The water samples were collected in sterilized glass bottle with screw cap. After the collection, the samples were labelled as per date of collection, site number, timing of collection etc. Temperature was recorded immediately on site after collection of samples.

After collection, the sample were immediately transferred to laboratory for analysis of EC Turbidity, TDS etc. These parameters were measured in laboratory by different methods are shown in table-1A. The analytical methods were followed are described by NEERI (1981), Trivedi and Goel (1986) and Kodarkar (2006).

RESULTS & DISCUSSION

The statistical analysis of variation in physical parameters during study period i.e. Jan 2014-Dec 15 is presented in table-1; likewise seasonal variation also shown in graphs. From table and graphs, it is observed that the fluctuation of all these parameters was due to seasonal and environmental changes.

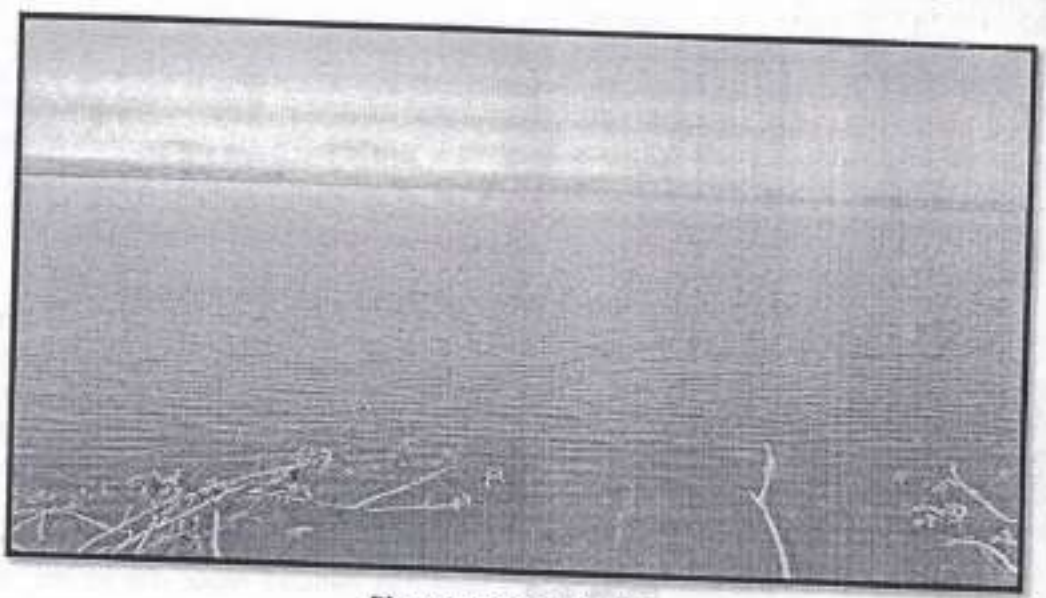


Plate-1: Dedargaon dam

Colour:

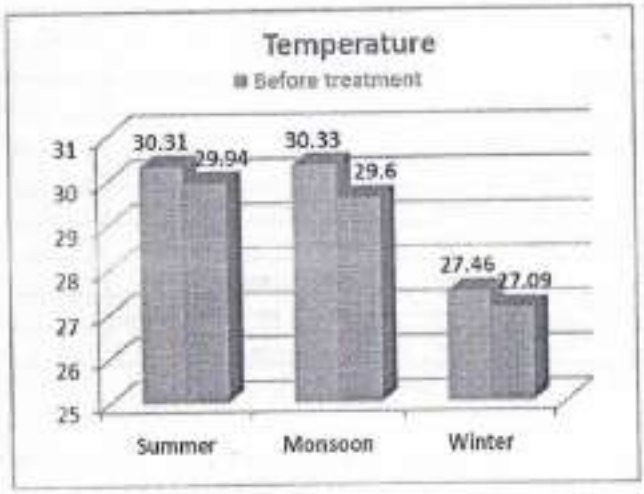
The pure water has no colour. Throughout the study period the before treatment colour of water body i.e Dedargaon dam seen greenish in the winter season, in summer it appear a yellowish colour and in the monsoon season it has muddy to brownish colour. Whereas the after treatment water is colourless during the study period.

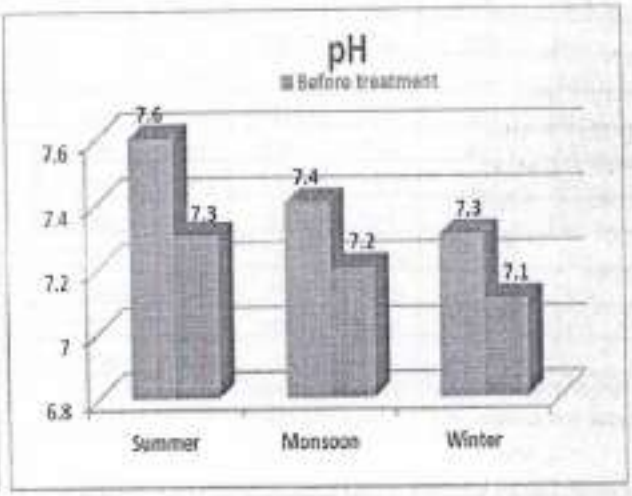
Odour:

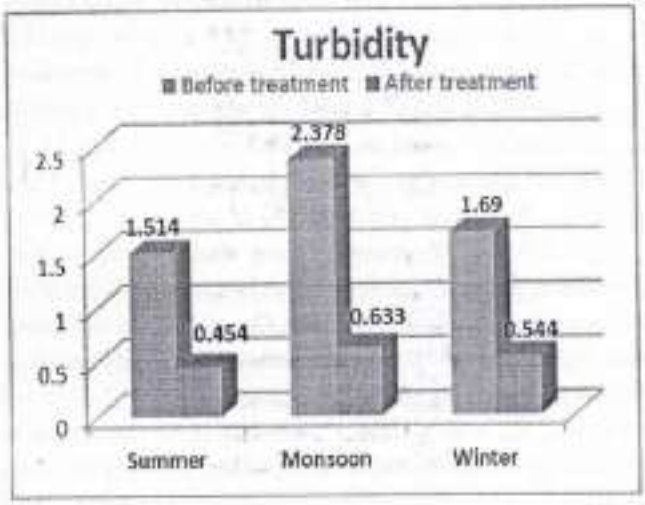
In the present study the Dedargaon dam before treatment water has odour free in the winter season. In the summer season the odour of the water body has fishy and obnoxious smell while in the monsoon it gives muddy and soapy smell. The after treatment water which Supplied by municipal corporation is odourless and somewhat chlorinous smell throughout the study period.

Temperature:

The before and after treatment values of water temperature was recorded in summer i.e. (30.31 ± 0.89 °C) and (29.94 ± 0.84 °C) respectively. It was slightly decreased in monsoon (30.33 ± 0.53 °C) and (29.6 ± 0.45 °C) whereas during winter season, it was (27.46 ± 0.81 °C) and (27.09 ± 0.76 °C) with significant seasonal variations ($P< 0.05$, $F_{2,21}$ 4.789 before and 4.968 after treatment) during study period. The water temperature shows significant positive correlation with alkalinity, BOD, Chloride, CO_2 at $P< 0.05$ level while at $P< 0.01$ level with hardness, pH and TDS. It showed negative significant correlation with COD, turbidity at $P< 0.05$ level while at $P< 0.01$ level with DO and nitrates before treatment. Whereas after treatment it shows positively significant correlation at $P< 0.05$ level with alkalinity, BOD, Chloride, and hardness while at $P< 0.01$ level with CO_2, pH, TDS. Negative significant correlation at $P< 0.05$ level with EC and turbidity while at $P< 0.01$ level with COD, DO, nitrates.







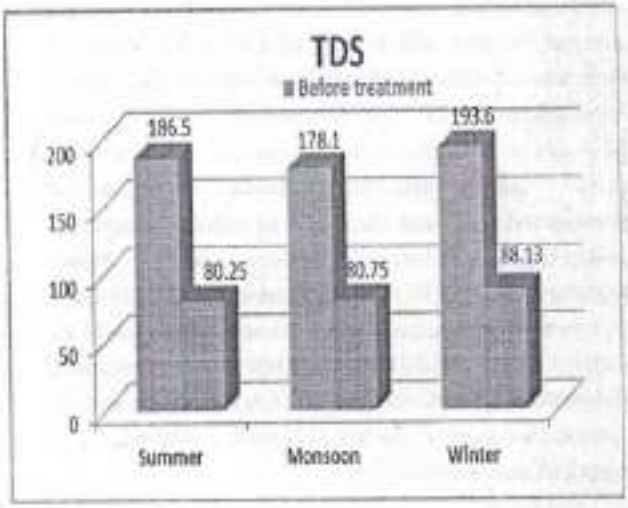


Table-2: Pearson co-relation table of Dedargaon dam (Before treatment)

	AL	BOD	Cl	CO_2	COD	DO	EC	HARD	NO	pH	TDS	TEMP	TURBID
AL	1.000												
BOD	.008	1.000											
Cl	.468*	.239	1.000										
CO_2	.181	-.005	.472*	1.000									
COD	-.145	.534**	.138	.016	1.000								
DO	-.601**	-.175	-.317*	-.646*	.109	1.000							
EC	-.332*	-.494*	-.648*	-.288	.472*	.484*	1.000						
HARD	.265	.443*	.484*	.365*	-.606*	-.416*	-.140	1.000					
NO	.851**	-.390*	-.319*	-.012	-.038	.592**	.478*	-.480*	1.000				
pH	.692**	.466*	.395*	.616**	.028	-.666**	-.318*	.417*	-.703**	1.000			
TDS	.178	-.229	.601*	.439*	-.025	-.410*	-.446*	.450*	.059	.431*	1.000		
TEMP	.425*	.345*	.364*	.695*	-.651*	-.731**	-.091	.360**	-.546**	.436**	.583**	1.000	
TURBID	-.297	-.488*	-.875**	-.471*	-.041	.415*	.419*	-.107	.676**	-.114	-.234	-.336*	1.000

Table- 3: Pearson co-relation table of Dedargaon dam (After treatment)

	AL	BOD	Cl	CO_2	COD	DO	EC	HARD	NO	pH	TDS	TEMP	TURBID
AL	1.000												
BOD	.238	1.000											
Cl	.376*	.122	1.000										
CO_2	.368*	.337*	.395*	1.000									
COD	-.168	-.610**	-.125	-.487*	1.000								
DO	-.319*	.170	-.395*	-.698**	.691**	1.000							
EC	-.204	-.436*	-.423*	-.480*	.345*	.482*	1.000						
HARD	.610**	.372*	.478*	.348*	-.344*	-.442*	-.367*	1.000					
NO	-.345*	-.688**	-.349*	-.351*	.444*	.359*	.350*	-.375*	1.000				
pH	.472*	.648*	.529**	.351*	-.556**	-.680**	-.425*	.601*	-.405*	1.000			
TDS	.426*	.049	.264	.367*	-.396*	-.617**	-.334*	.666**	-.085	.323*	1.000		
TEMP	.952*	.485*	.444*	.778**	-.740**	-.847**	-.498*	.633*	-.806**	.739**	.540**	1.000	
TURBID	-.553**	-.433*	-.394*	-.182	.423*	.451*	.425*	-.398*	.365*	-.313*	-.051	-.383*	1.000

**Correlation is significant at 0.01 level (2-tailed)
*Correlation is significant at 0.05 level (2-tailed)

Bhagde *et al* (2016 a) measured temperature 25 °C to 34 °C at two sampling stations from Aadhala River in Ahmednagar District. Bhagde *et al* (2016 b) recorded minimum temperature 30 °C in the month of December, 32 °C in August and 37 °C in the month of March from Devtale Lake in Sangamner Taluka of Ahmednager District of Maharashtra State, India. Dahegaonkar (2016) reported seasonal variation in physico-chemical parameters like water temperature the maximum water temperature (35.1 °C) in summer season and minimum (24.4 °C) in winter season, for a period of June, 2005 to May, 2007. Fule *et al* (2017) recorded the temperature range between 22.00 °C to 36.50 °C i.e. lowest in winter and highest in summer during the year 2008-09, from Sarangpuri Lake, Dist-Wardha.

pH:

The maximum before and after treatment mean values of pH was recorded in summer i.e. (7.4 ± 0.054) and (7.3 ± 0.032) respectively. It slightly decreased in monsoon i.e. (7.4 ± 0.057) and (7.1 ± 0.042) respectively, whereas during winter season it was (7.3 ± 0.043) and (7.1± 0.046) respectively, with significantly significant seasonal variations ($P< 0.05$, $F_{2\ 21}$ 0.9545 and 4.019) before and after treatment during study period. Before treatment it shows positive correlation significant level at $P< 0.05$ with alkalinity, BOD, Chloride, CO_2, hardness and TDS and at $P< 0.01$ with temperature only while it shows negative significant correlation at $P< 0.05$ level with DO, EC and nitrates. Whereas after treatment it shows significant positive correlation at $P< 0.05$ with alkalinity, Chloride, CO_2, hardness and TDS and

correlation at P< 0.01 level with temperature. While it shows negative significant correlation at P< 0.05 level with EC and nitrates and at P< 0.01 with DO.

Prasad *et al* (2014) observed the maximum pH (8.8) at site Kadiyampalli and the minimum (7.7) at Voddipalli village. Tandale and Mujawar (2014) reported that lowest pH value was noticed in the september (6.68) and high in November (7.36). They noticed that the values of pH are within the range of permissible limit of drinking water quality standards (WHO). Bhagde *et al* (2016 a) studied physico-chemical parameters of Aadhala River. They observed that the changes occur in pH and recorded pH 6.2 to 7.5. Bhagde *et al* (2016 b) observed minimum pH 7.67 in the month of August, 7.3 in December and maximum pH was noticed in the month of March i.e. 8.1. Dahegaonkar (2016) recorded maximum pH (8.15) in the month of August, 06 and minimum (7.62) in October, 2005.

Turbidity:

The maximum before and after treatment values of turbidity was recorded in monsoon i.e. (2.378 ± 0.16) and (0.633 ± 0.067) respectively. It was slightly decreased in winter i.e. (1.69 ± 0.092) and (0.544 ± 0.022) respectively, whereas it recorded minimum in summer i.e. (1.514 ± 0.17) and (0.454 ± 0.039) respectively. It was noticed with significantly significant seasonal variations (P< 0.01 and P< 0.05) $F_{2,21}$ 10.66 before treatment and 3.731 after treatment during study period. Before treatment it shows significant positive correlation with DO and EC at P< 0.05 level and with nitrates at P< 0.01 level. It shows negative significant correlation with BOD, CO_2, Temperature at P< 0.05 level and at P< 0.01 level with Chloride. While after treatment it shows significant positive correlation with COD, DO, EC and Nitrates at P< 0.05 level whereas negative significant correlation at P< 0.01 with alkalinity and correlation at P< 0.05 with BOD, Chloride, hardness, pH and temperature etc.

Table – 4: Statistical Analysis of physical parameters during (2014/15)

	Season	Mean	Std. Dev.	Std. Error	F-Value	P-Value	R-Square	P value summary	Significant difference Among means (p<0.05)
Temperature									
Before Treatment	Summer	30.31	2.492	0.881	4.789	0.0193	0.3132	*	Yes
	Monsoon	30.33	1.498	0.5297					
	Winter	27.46	2.275	0.805					
After Treatment	Summer	29.94	2.361	0.8347	4.968	0.0171	0.3212	*	Yes
	Monsoon	29.6	1.266	0.4476					
	Winter	27.09	2.13	0.753					
pH									
Before Treatment	Summer	7.6	0.1808	0.0639	11.52	0.0004	0.5231	***	Yes
	Monsoon	7.4	0.1309	0.0463					
	Winter	7.3	0.119	0.042					
After Treatment	Summer	7.3	0.1195	0.0423	10.23	0.0008	0.4935	***	Yes
	Monsoon	7.2	0.0535	0.0189					
	Winter	7.1	0.141	0.05					
Turbidity									
Before Treatment	Summer	1.514	0.4693	0.1659	10.66	0.0006	0.5038	***	Yes
	Monsoon	2.378	0.4261	0.1506					
	Winter	1.69	0.259	0.0916					
After Treatment	Summer	0.4538	0.1112	0.0394	3.731	0.0411	0.2622	*	Yes
	Monsoon	0.6325	0.1881	0.06651					
	Winter	0.544	0.06	0.0216					
TDS									
Before Treatment	Summer	186.5	23.9	8.449	1.134	0.3407	0.09746	ns	No
	Monsoon	178.1	14.41	5.094					
	Winter	193.6	22.26	7.869					
After Treatment	Summer	80.25	24.05	8.504	0.5422	0.5894	0.04911	ns	No
	Monsoon	80.75	6.649	2.351					
	Winter	88.13	15.42	5.453					

Tali *et al* (2012) studied the alterations of turbidity within Aug-2010 to Jul-2011 the values of turbidity ranges from 3.9 NTU and 22.8 NTU at sitte I and from 3.5 NTU and 23.8 NTU at site II, which was lowest in summer 2011 at site II and highest in the monsoon at site II of the River Narmada at Madhya Pradesh India. Dhale and Pachkore (2012) recorded the values of turbidity ranges from 0.1 to 0.4 NTU which fall under the desirable limits prescribed by WHO. Sahu *et al* (2015) showed the lower turbidity i.e. 3 NTU at station S1 and higher turbidity i.e. 21 NTU at station S2. It was noticed due to the disturbance by anthropogenic activity.

TDS:

The maximum before and after treatment values of water TDS was recorded in winter i.e. (193.6 ± 7.87) and (88.13 ± 5.46) respectively. It was slightly decrease in summer i.e. (186.5 ± 8.45) and (80.25 ± 8.51) respectively, while it was recorded in monsoon i.e. (178.1 ± 5.094) and (80.75 ± 2.356) respectively, with significantly significant seasonal variations ($P< 0.01$ and $P< 0.05$) $F_{2\ 21}$ 1.134 before treatment and 0.542 after treatment during study period. Before treatment it shows significant positive correlation at $P< 0.05$ with Chloride, CO_2, hardness and pH whereas correlation at $P< 0.01$ with temperature. It shows negative significant correlation with DO and EC at $P< 0.05$ level. While after treatment it shows significant positive correlation at $P< 0.01$ with hardness as well as temperature and at $P< 0.05$ level with alkalinity CO_2 and pH. It shows negative significant correlation at $P< 0.01$ with DO and at $P< 0.05$ level with COD and EC.

Lubal *et al* (2012) recorded the fluctuation of TDS values in the range of 178 mg/ L to 290 mg/ L. They noticed the maximum values of TDS in May and minimum in December from at Mhaswad water reservoir of Satara. According to Aggarwal and Arora (2012) of Kaushalya River TDS values ranged between 152mg/ L to 252 mg/ L and stated that the water with TDS can be considered to be good. Dhale and Pachkore (2012) recorded Total Dissolved Solid (TDS) noted from 552.00 mg/ L to 1183.00 mg/ L. Tali *et al* (2012) recorded the TDS values ranged as 230 mg/ L to 345 mg/ L from site I and 190 mg/ L to 360 mg/ L at site II, Which was minimum in January, 2011 and maximum in the month of July, 2011.

CONCLUSION

According to observations, considering the physical analysis the water samples were found to permissible limit. Related recommended standards assessment of the dam water quality parameters values, it was observed that 06 parameters i.e. Color, Odor, Temperature, pH, Turbidity, TDS during study period all the samples were found within desirable limit for domestic as well as drinking water. It was observed that the maximum possible concentration of Turbidity in the rainy season. As compare to after treatment water samples, before treatment water samples found unpleasant, that may be polluted due to flooding, agricultural runoff, anthropogenic activities etc.

Conflicts of interest: The authors stated that no conflicts of interest.

REFERENCES

Adefemi SO and Awokunmi EE (2010) Determination of physico-chemical parameters and heavy metals in water samples from Itaogbolu area of Ondo-State, Nigeria, African J. Environ. Sci. Technol., 4(3), 145-148.

Aggarwal R and Arora S (2012) A study of water quality of Kaushalya River in the submountaneous Shivalik region. International Journal of Scientific and Technology Rerearch,1(8): pp.52-68.

Bhagde R, Suryavanshi A, Karpe D and Dama LB (2016a) Hydrobiological study of Devtale Lake in Sangamner Taluka of Ahmednager District of Maharashtra State, India. *Trends in Life Sci. DAMA Int. J.*, 5(2): pp.1-5.

Bhagde R, Suryavanshi A, Khan S and Dama LB (2016b) Study of physico-chemical parameters and faunal diversity of Aadhala River in Ahmednagar District of Maharashtra State India. *Trends in Life Sci. DAMA Int. J.*, 5(2): pp.6-11.

Dahegaonkar NR (2016) Studies on pollutional status of Lohara Nullah in Chandrapur (Maharashtra), India. *Int. J. Res. Biosci. Agri. Tech.* (Special Issue): pp.13-18.

Dhale DA and Pachkore GL (2012) Assessment of physico-chemical status of ground water samples of Parbhani District (M.S., India). Int. J. Pharma. Sci. Res., 3(5): pp.1367-1370.

Fule UW, Nimgare SS and Telkhade PM (2017) Study of physico-chemical characteristics of Sarangpuri Lake, Dist-Wardha (M.S.). Int. J. Res. Biosci. Agri. Technol., 5(1): pp.1-5.

Lubal MJ, Sutar AU and Pawar KW (2012) Studies on physico-chemical aspects of Mhaswad water reservoir of Satara District (Maharashtra) India.*Int. J. Plant, Animal Environ. Sci.* 2(3): pp.12-15.

Patil PN, Sawant DV and Deshmukh RN (2012) Physic chemical parameters for testin of water-A review. Int. J. Environ. Sci. 3(3): 1194-1207.

Prasad M, Reddy B, Reddy Muralidhara, Ramakrishna M and Sunitha V (2014) Studies on physicochemical parameters to assess the water quality in Obulavaripalli Mandal of YSR (Kadapa) District, Andhra Pradesh, India.*Int. J. Curr. Res. Academic Review*, 2(12): pp.31-41.

Sahu P, Karad S, Chavan S and Khandelwal S (2015) Physicochemical analysis of Mula Mutha River Pune. Civil Engineering and Urban Planning: *An Int. J.* 2(2): pp.37-46.

Sivalingam P (2018) Physico-Chemical Parameters and Plankton Diversity of Manchiryal Town Lake Adilabad District, Andra Pradesh, India.*J. Biotech. Biores.*, 1(2): pp.1-3.

Tali I, Pir Z, Sharma S, Mudgal LK and Siddique A (2012).Physico chemical properties of water of river Narmada at Madhya Pradesh, India.*Researcher*, 4(6): pp.5-9.

Tandale SM and Mujawar HA (2014) Assessment of surface water quality in the vicinity of an industrial area near village Datav of Raigad, Maharashtra. *J. Res. Enginee. Technol.*, 3(4): pp.31-35.

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Biochemical changes of fresh water fish, *Channa marulius* (Ham Buch) exposed to 3/4th Sub lethal Concentration of Cypermethrin and Fenvalerate.

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ABSTRACT

The present study is aimed to evaluate the changes in total protein, total cholesterol content and the glucose in muscle of *Channa marulius* after exposure to 3/4th sub lethal concentration of Cypermethrin and Fenvalerate. It was found that as compared to control the total proteins were reduced on other hand total cholesterol and glucose was increased with increased period of exposure to both pesticides. This study will reflect the role of these biochemical parameters for assessment of aquatic pollution as far as the natural pesticides are concerned.

Keywords: *Channa marulius*, Cypermethrin, Fenvalerate, Biochemical, Protein.

INTRODUCTION

Cypermethrin and Fenvalerate are widely used as pesticide all over the world to increase the production of food grains and other agricultural-products (Bhoi *et al.*, 2016) and there is increased risk of food being contaminated with the insecticide, which may harm humans and domesticated animals. Cypermethrin and Fenvalerate produce drastic effects in fishes (Patole *et al.*, 2016). Biochemical and physiological biomarkers are frequently used for detecting or diagnosing sub lethal effects in fish exposed to different toxic substances (Monali and Deepronil, 2017). The pesticides can severely affects the physiological and health status of the fish (Bhoi and Patole, 2018). The most toxicants exert their effects at basic level of the organism by reacting with enzymes or metabolites and other functional components of the cell. The present study aimed to determine the sub lethal effects of Cypermethrin and Fenvalerate on some selected biochemical parameters of *Channa marulius*.

MATERIAL AND METHODS

The fresh water fish *Channa marulius* weighing (15±5 g) and length (10±3 cm) were collected from Kan and Panzara river of Sakri Tahsil (Dhule). Live fishes were brought to the laboratory and thoroughly washed under tap water and acclimatized in laboratory conditions for 15 days. They were fed

with standard fish diet (Tokyu grow certified company). Water in the tank was changes after 2 days of interval. Technical grade Cypermethrin (25%) and Fenvalerate (ISAGRO ASIA), 20% (EC) were purchased from Sushil Agricultural pesticide and fertilizer Agency.

The fishes were divided into a 4 group, each group of 10 healthy fishes were transferred to plastic tough having capacity of 10 litres and they exposed separately to 3/4th sub lethal concentrations of Cypermethrin (0.18 ppm) and Fenvalerate (0.25 ppm). One group was kept as control. At the end of exposure period, fish were randomly selected for biochemical study. Tissue like muscles was dissected out from control and experimental fishes. Estimation of total glucose was done by Phenol-Sulphuric acid method (Barham and Trinder, 1972), total cholesterol (%) with the method (Zlatkis, 1953) and total proteins (g/100g) was estimated by Lowry *et al.* (1951).

RESULTS & DISCUSSION

Glucose, Cholesterol and Protein of fresh water fish *Channa marulius* exposed to 3/4th sub lethal concentrations of Cypermethrin and Fenvalerate shown in table 1 and 2 as well as figure 1 and 2 respectively.

Table- 1: Glucose, cholesterol and protein of fish *Channa marulius* exposed to sub lethal concentrations 3/4th (0.18ppm) of Cypermethrin.

Parameters	Control	3/4th dose concentration of Cypermethrin			
		24 h	48 h	72 h	96 h
Glucose (mg/dL) (Muscle)	42.33±1.8	50.53±1.1 (8.96) *	53.34±1.6 (13.76)**	56.86±1.4 (19.09)**	59.90±1.8 (23.20)**
Cholesterol (mg/dL) (Muscle)	123.00±2.7	133.03±2.5 (7.31)*	140.7±3.0 (12.36)**	143.73±3.2 (14.21)**	152.42±3.6 (19.10)**
Protein(mg/dL) (Muscle)	10.37±0.57	8.34±0.45 (-24.34)**	7.50± 0.41 (-38.26) ***	7.27±0.10 (-42.64) ***	6.56± 0.30 (-58.07) ***

Table- 2: Glucose, cholesterol and protein of fish *Channa marulius* exposed to sub lethal concentrations 3/4th (0.25 ppm) of Fenvalerate.

Parameters	Control	3/4th dose concentration of Fenvalerate			
		24 h	48 h	72 h	96 h
Glucose mg/dL) (Muscle)	42.33±1.8	46.50±1.5 (8.96) *	49.34±1.2 (14.20) **	58.86±1.6 (28.08)**	61.90±1.5 (31.61)**
Cholesterol (mg/dL) (Muscle)	146.00±2.7	149.03±2.4 (0.020) NS	150.7±2.3 (1.12) NS	152.43±3.6 (2.25)*	154.73±3.1 (3.70)*
Protein (mg/dL) (Muscle)	10.36±0.57	10.03±0.46 (-3.29) NS	8.09± 0.42 (-28.05) **	8.01±0.10 (-29.33)**	7.53± 0.31 (-37.58) ***

Mean ± S.D. values differ significantly (p<0.05) within same column.*Significant value: p<0.05, ** p<0.01, *** p<0.001. NS = Non-Significant (p>0.05). Values in the parenthesis are percentage change over control treated as 100 per cent.

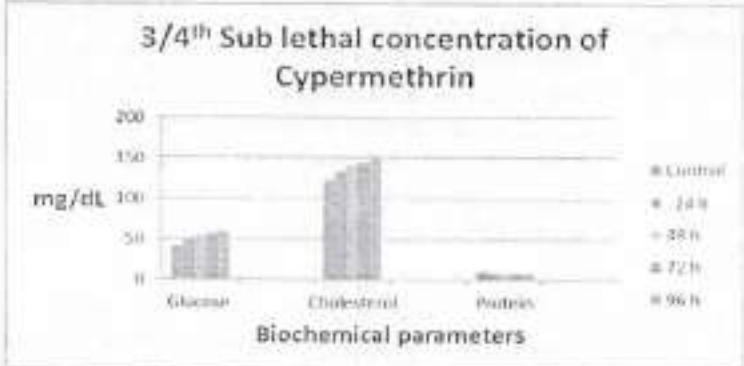

Figure 1: Glucose, cholesterol and protein content of fish *Channa marulius* exposed to sub lethal concentrations 3/4th (0.18 ppm) of Cypermethrin.

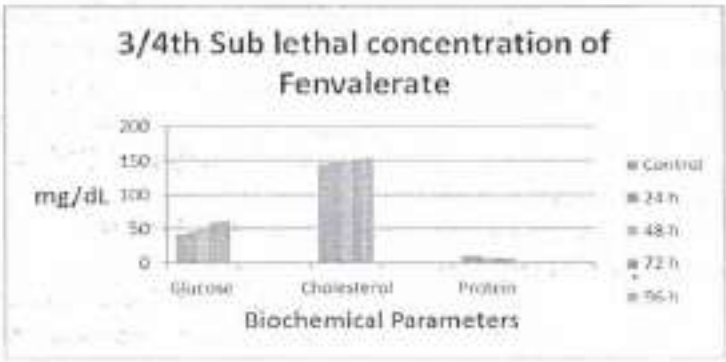

Figure 2: Glucose, cholesterol and protein content of fish *Channa marulius* exposed to sub lethal concentrations 3/4th (0.25 ppm) of Fenvalerate.

Cypermethrin

The amount of glucose in the fish exposed to 3/4th sub lethal concentration of Cypermethrin recorded as 42.33, 50.53, 53.34, 56.86 and 59.90 mg/dL in control, 24 h, 48 h, 72 h and 96 h of exposure respectively. It was found that the glucose levels were increased significantly as compared to control groups. Similarly the amount of cholesterol for control, 24 h, 48 h, 72 h and 96 h was found to contai123.0, 133.03, 140.7, 143.73, and 152.42. These figures show the level of cholesterol was found to be increased. On other hand, the protein content in the fish after exposed to 3/4th Cypermethrin was found to contain 10.37, 8.34, 7.50, 7.27 and 6.56 mg/dL of protein in control, 24 h, 48 h, 72 h and 96 h respectively. Protein content was decreased significantly than control groups.

Fenvalerate

The glucose level in 24 h, 48 h, 72 h and 96 h exposure was found to contain 46.50, 49.34, 58.86, 61.90 mg/dL and in control it was found to be 42.33 mg/dL.

Glucose content was increased significantly when compared to control groups. Whereas the amount of cholesterol in the fish after exposed to 3/4th Fenvalerate was found to contain 149.03, 150.7, 152.43 and 154.73 and mean control was 146.00 mg/dL for 24 h, 48 h, 72 h 96 h and control respectively. The Cholesterol was found to be slightly increased. The amounts of total protein were found to be as 10.36, 10.03, 8.09, 8.01 and 7.53 mg/dL in control, 24 h, 48 h, 72 h and 96 h respectively. It means the values of total protein were decreased significantly.

Biochemical parameters are sensitive index to change due to pesticide toxicity and can constitute important tools in toxicological studies (Balarko *et al*., 2012). Hence, the purpose of this work is to evaluate the 3/4th sub lethal effect of Cypermethrin and Fenvalerate on some selected biochemical parameters. Result showed that glucose and cholesterol increased significantly as the concentration of the toxicant increases. Similar result was recorded by Ojutiku *et al* (2013). They revealed that a significant increase in glucose and cholesterol level in the *Channa marulius* exposed to 3/4th sub lethal concentration of Cypermethrin and Fenvalerate insecticide. This result was also corroborated by the findings of Vishal (2012); Pallavi *et al* (2016); Sharmila and Kavitha, (2017). The decrease in protein during Cadmium chloride and Rogar exposure may be due to increased catabolism and decreased anabolism of proteins in *Oreochromis niloticus* and *Channa striatus* (Al-asgah *et al*., 2015; Bhandare *et al*., 2016)). Mohamad *et al* (2016) reported that cholesterol and glucose were increased significantly and total protein were decline in common carp, *Cyprinus carpio* exposed to Cadmium and Lead. The decreased of protein under the Cypermethrin and Fenvalerate stress noticed in the present study may be due to the utilization of amino acids in the various catabolic reactions. Decrease in protein content may be due to increased proteolysis (Chandra *et al* 2017; Subburaj *et al*., 2018)) or it may be due to metabolic utilization of the ketoacids to glucogenesis pathway for synthesis of glucose (Mehra and Singh, 2018 and Naji *et al*., 2011f). Alaa *et al* (2018) found that the levels of glucose and cholesterol were increased in Nile tilapia, *Oreochromis niloticus* and African fish *Clarias gariepinus*. Al-Otaibi *et al* (2019) showed that elevated level of glucose in cat fish, *Clarias gariepinus* exposed to diazinon. The level of blood glucose and cholesterol were significantly increased while proteins were decreased significantly observed by earlier workers viz; Sehzad *et al* (2019); Mari *et al* (2019) and Okey, (2019).

CONCLUSION

Cypermethrin and Fenvalerate are important insecticides in agriculture; their toxicity to aquatic fish has been ascertained as a result of flow from agricultural land near aquatic rivers or lake because of irrigational farming. The evidence of effect on some biochemical parameter in the blood and organs of the fish should make us reduce it incidences into aquatic bodies.

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REFERENCES

Alaa, GM, Osman, KY, Abouel, F, Abdel, BM, Abdel, R, Usama, M, Mahmoud, WK and Mohsen, AM (2018).Blood Biomarkers in Nile tilapia *Oreochromis niloticus* and African Catfish *Clarias gariepinus* to Evaluate Water Quality of the River Nile. *J. Fisher. Sci.com.* 12(1): 001-015.

Al-asgah, NA, Abdel-Warith, AWA, Younis, EM and Allam, HY (2015) Haematological and biochemical parameters and tissue accumulations of Cadmium in *Oreochromis niloticus* exposed to various concentrations of Cadmium chloride. *Saudi J. Biol. Sci.* 22(5) 543-550.

Al-Otaibia, AM, Al-Balawia, HFA, Ahmada, Z and Sulimana, EM (2019) Toxicity bioassay and sub-lethal effects of diazinon on blood profile and histology of liver, gills and kidney of catfish, *Clarias gariepinus*. *Braz. J. Biol.* 79(2):326-336.

Balarbo, C, Rakhi, D, Manisha, K and Ranu, N (2012) Primary and secondary stress response of *Channa punctatus* exposed to sub lethal Aluminum toxicity. *J. Appl. Sci. Environ. Sanita.* 7 (2): 125-130.

Barham, D and Trinder, P (1972) An improved colour reagent for the determination of blood glucose by the oxidase system. Analyst. 97:142-145.

Bhoi, SS, Patil, MU and Patole, SS (2016) Impact of 3/4th sub lethal concentration of Cypermethrin on haematological parameters of fish, *Channa marulius* (Ham Buch). *Uttar Pradesh J. Zool.* 36(2): 155-160.

Bhoi, SS and Patole, SS (2018) Effect of sub lethal concentrations of Fenvalerate on histopathological changes in the gill of fresh water fish species *Channa marulius* (Ham Buch). *J. Res. and Dev.* 08(03): 170-174.

Ojutiku, RO, Asuwaju, FP, Ayanda, IO, Obande, RA and Agbelege, OO (2013) Effect of acute toxicity of Cypermethrin on some biochemical parameters of juveniles of *Clorio gariepinus* (Burchell, 1822). *Int. J. Engi. Sci. Inven.* 2(3): 1-7.

Bhandare, RY, Sonawane, DL, More, PR. and Paikro, SM (2016) Effect of Organophosphate insecticide (Rogar) on protein content of *Channa striatus* from Sukhana River, Aurangabad (M. S.) Abst. Proc. 103rd Ind. Sci. Cong. Asso. Mysore.

Chandra JS, Neelima, P and Govinda, K (2017) A review on the toxicity and other effects of Dichlorvos, an organophosphate pesticide to the freshwater fish. *Biosci Discov.* 8(3): 402-415.

Lowry, OH, Rosebrough, NJ, Farr, AL and Randall, RJ (1951). Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193: 265-275.

Mari, SM, Parvathibai, C, Ramesh, U, Sudhakaran, MR, Raju, G, Parvathiraj, P and Sevakumar, S (2019) Effect of pH on plasma cholesterol and glucose levels of fresh water fish, *Cyprinus carpio*. *Res. J. Life Sci. Bioinform. Pharmaceut. And Chem. Sci.* 5(1):332-340.

Mehra, J and Singh, SK (2018) Furadan induced histopathological and histochemical changes in the stomach of *Macrognathus aculeatus* (Bloch). *Proc. Zool. Soc. India.* 17(1): 57-60.

Mohammad M, Soledeh, SB, Fatemeh, M, Nahid, M, Mahbubeh, M and Nurish M (2016) Biochemical alteration induced by Cadmium and Lead in common carp via an experimental food chain. *Iran. J. Toxicol.* 10(4):25-32.

Monal, C and Deepronil R (2017) Genomic and biochemical changes in fishes due to pesticide pollution. *J. Environ. Sci. Toxicol. and Food Techn.* 11(5) 06-11. www.iosrjournals.org

Naji M, Yousef JY and Hosseinzadesh, SH (2018) Impact of Atrazine on some blood and biochemical indices in farmed *Acipenser nudiventris*. *Int. J. Ornament. Aqua. Res.* 1(1): 33-39.

Okey, IB (2019) Effect of Clove (*Eugenia caryophyta*) powder anaesthetic on some haematological and biochemical parameters of *Heterobranchus bidorsalis juveniles*. *J. Agri. And Aqua.* 1(1)

Pallavi, S, Ajay, S and Pandey, AK (2016) Pesticides Toxicity in fishes: Biochemical, Physiological and Genotoxic aspects. *Biochem. Cell. Arch.* 16 (2):199-218.

Patole, SS, Patil, MU and Bhoi, SS (2016) Effect of Fenvalerate Synthetic pyrethroid on a certain haematological parameters of fresh water fish, *Channa marulius*. *Int. J. Life. Sci. Scienti. Res.* 2(3):269-272.

Sharmila, G and Kavitha, AV (2017) Alterations in biochemical parameters of *Cyprinus carpio* (Linn. 1758) induced by chronic exposure to organophosphorus pesticide, monocrotophos. *Int. J. Appl. Res.* 3(9):399-403.

Shehzad, G, Sadia, T, Munawar, SA, Naveed, A and Muhammad, FK (2019) Effect of Chlorpyrifos on haematological and xeral biochemical components of fish *Oreochromis mossambicus*. *Pakistan J. Zool.* 51(3): 1047-1052.

Subburaj, A, Jawahar, P, Jayakumar, N, Srinivasan, A and Ahilan, B. (2018) Acute toxicity of bioassay of Malathion (EC 50%) on fish, *Oreochromis mossambicus* (Tilapia) an associated histological alteration in gills. *J. Entm. Zool. Stud.* 6(1): 103-107.

Vishal R, Santosh KS, Arpita, Kirti and Abhishek (2012) Comparative toxicity of Butachlor, Imidacloprid and Sodium fluoride on protein profile of the walking catfish *Clarias batrachus*. *J. Appl. Pharm. Sci.* 02 (05): 121-124.

Zlatkis, A and Boyle, AJ (1953) A new method for direct determination of serum cholesterol. *J. Lab. Clin. Med.* 41:483-492.

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Effect of Yoga practices with suryanamaskar on flexibility, BMI, Hb level in underweight anemic college students

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ABSTRACT

The main aim of this study is to find out the effect of Yoga suryanamaskara on flexibility, BMI and anemia in underweight anemic college students. Anemia hampered the strength, efficiency and health.Yoga has become part and partial of our healthy life and empowerment. For this study, 50 underweight (BMI < 18.50) and anemic students aged between 18-22 years who were willingly to participate in the program were selected randomly as subjects from Senior College , Pimpalner, Dhule(MS) for 60 days program from 1st Nov. to 30th Dec.2018. They were divided into an experimental group and a control group. Yogic practices were progressively introduced to the experimental group on six day in a week for nearly 60 to 70 minutes.The therapy was carried out in the evening from 5.30 pm to 6.45 pm.in Maratha mangal Karyalaya, Pimpalner, Dist. Dhule. The control group was not exposed to any yogic practices. Assesment has been done before and after study for the parameters like flexibility, height, weight andHb% for both groups. After the Yoga therapy every student showed significant positive improvement in flexibility, weight gaining and Hb level among experimental group when compared to control group. Flexibility, BMI and Hb level showed a significant improvement.

Key words: Yoga, suryanamaskar, BMI, Flexibility, underweight, Hb etc.

INTRODUCTION

Flexibility is an important ability for health related fitness. Lack of flexibility in back can be cause for bad posture, back pain and many more may be due to compression of peripheral nerves. With good flexibility an individual have great ease movements, less chance of injury during movements (Miller 2006). The practice of asanas is one of the best ways to improve flexibility. There are plenty of studies have been done to see the effect of yogic asanas on flexibility and suryanamaskar is itself combination of six asanas(Bhavanani 2011).What happens when you are underweight?Some people might be underweight genetically, others are probably under the mark because they don't get required nutrients to remain in the pink of health.

These nutrients are not reaching where they should because of lack of consumption or improper absorption. In such condition immune system takes a hit, difficult to fight infections and illness, individual will also be more prone to flu and pneumonia.Being anemic and extremely slender could also affect menstrual cycle in females; MC will be irregular or completely stop due to lesser estrogen. There may be lethargic, fatigued and lower stamina (Google-by Shrishti walia).

How does yoga help you gain weight? Yogic asana alone may elicit a positive improvement in the body mass index (Aloke 2016). Yoga is such an incredible workout that it has solutions to almost all health-related problems. Yoga is a mind body therapy it addresses problems like poor metabolism, stress, lack of appetite and digestive issues. While it helps overcome these problems, it also stabilizes flexibility, weight and ensures the right weight goals. Yoga enhances the circulation of oxygen and blood and this helps improve the nutrients absorption. It also induces the proper secretion of enzymes and hormones needed for proper health. It strengthens the muscles and allows becoming strong and flexible. It also improves stamina of individuals. Essentially yoga works mainly towards regulating metabolism (Google-by Shrishti walia). In India, a great need of yoga and yogic practices to be taught and also to practice yoga, to overcome physical, mental, and physiological problems, as it is the current need.A lot of research is conducted in Yoga for the prevention anemia (Ramanath 2013),BMI and Cholesterol level (Seema Patel and Kamakhya Kumar 2016), Obesity (Dhara *et al*, 2012).

Anemia is the most common ailments in developing countries, especially in women and children, mostly it encountered in general practice is iron deficiency anemia and it affect up to 10% world population (Petry *et al*, 2016, Hasan *et al*, *2016* and Zsaku *et al*, 2016). Anemia is a medical condition in which decrease in number of red blood cells or less than the normal quantity of hemoglobin in the blood. Anemic patients have feeling of weakness or fatigue and poor concentration (Medicine net.com 2000, Merran 2009). Yoga as a therapy works on the body as a whole: Increases the RBCs production as well as purifies the blood. Helps to manage symptoms of anemia.Helps to improve vital energy in the body. Improves mental health, blood circulation appetite and maintain good health (Seshadri, 2013).

Yoga practices can make them emotionally stable and make them free from psychological disturbances. It helps to control and check emotions. It gives balance of mind, physically fit and healthy and their approach the future life without any disturbances (Sharma *et al*, 2014). Yoga is a self discipline method of the integrating the body, breath and mind and attaining one's full potential. The antistress and antioxidant effect of yoga is beneficial in the improvement of hematological parameters in anemic patients. Yoga increases the circulation of the blood and improves the functioning of entire circulatory system (Neena Sharma and Ritu Gupta 2016 and Purohit *et al* 2013).

The Pranayama which is systematic and rhythmic respiration helps to relax the physical and mental organs of the body and keeps every cell oxygenated which helps in metabolism. Psychological benefits: Regular Yoga practice creates mental clarity and calmness, increases body awareness, relieves chronic stress patterns, relaxes attention and sharpens conceatration (Sharma Preeti and Pradeep Kumar 2016). Haemoglobin is the iron-containing oxygen-transport agent in the red blood cells of all vertebrates which carries oxygen from the respiratory organs to the rest of the body (i.e. the tissues) where it releases the oxygen to burn nutrients to provide energy to power the functions of the organism and collects the resultant Co2 to bring it back to the respiratory organs to be dispensed from the organism.

Blood Hb level is the weight and quantity of Hb in the blood measured in gms/100ml. The quantity of Hb/deciliter or 100ml of blood is determined by Hemoglobinometer. The normal value of Hb for men is 13-18g/dl and for women is 11.5-16.5g/dl.Therefore this study undertaken to test the effectiveness of yogic practices with suryanamaskar in the management of flexibility, low BMI and anemic condition.

Objectives of the Study:

1. To help students to build their capacity and quality.
2. To provide opportunities for students to be physically, mentally, emotionally and spiritually empowered.
3. To make them aware about old Indian culture and social behaviour with in the society.
4. To create the awareness in society about this new field of treatment of diseases by Yoga.

MATERIAL METHODS

Study setting: The place of work was Karm. A. M. Patil and Kai. N. K. Patil Sr. College, Pimpalner, Dhule (M.S.) India.

Selection criteria: Selection was based on inclusion and exclusion criteria as fallows.

Inclusion Criteria:

1) Age group of 18 to 22 years
2) Subjects of both genders.
3) Willingness towards participation
4) Anemic and underweight (low BMI) students.

Exclusion Criteria:

1) Students who are below 18 years and above 22 years.
2) Students with cardiac abnormalities/disease.
3) Female students who are pregnant.
4) Any congenital anomaly and auto immune disease.
5) Students suffering from any kind of diagnosed / clinically seems to be neurologically/orthopedic disorders.
6) Body mass index more than 18.5.
7) Studentswho underwent major surgery.
8) Visual problems.

Parameters used in study:

i. **Flexibility:** Extensibility of lower back and hamstring muscles was taken for flexibility of the body.
ii. **Body Mass Index:** the ratio of weight and hight.
iii. **Blood hemoglobin** level by *Hemoglobinmeter.*

Tools used in study:

i. **Modified sit and reach assessment score chart and sit-and-reach test box** : used for measurement of flexibility of lower back and hamstring muscles.
ii. **Height frame and weighing machine:** to measure height and weight for calculation of body mass index.
iii. **Hemoglobinometer:** for Hb estimation.

Duration of study: The total study period was of two months (8 weeks).

Procedure: Subjects were selected based on inclusion and exclusion criteria with a written consent signed by them for participation in the study.

Flexibility of lower back and hamstring muscles was assessed by modified sit and reach test score (Tsang and Mak 2004) using a sit-and-reach test box and the score was taken for the consideration. The sit and reach test box (Base: 18" Length X 12" Width X 13-3/4" Height and Top: 27 ½" Length X 12" Width, as per Lafayette adjustable Sit and Reach Flexibility Tester 2003) has been tested and .found good test-retest reliability (0.994). The sit and reach test scores (Davis 2000) are considered in 7 grades; Very poor (1), Poor (2), Fair (3), Average (4) and Good (5), Excellent (6), Super (7). The very poor (grade 1) consist of <-20 score for men and <-15 foe women, poor (grade 2) consist of -19 to -9 for men and -14 to -8 for women, fair (grade 3) consist of -8 to -1 for men and -7 to 0 for women, average (grade 4) consist of 0 to +5 for men and +1 to +10 for women, good (grade 5) consist of +6 to +16 for men and +11 to +20 for women, excellent (grade 6) consist of +17 to +27 for men and +21 to +30 for women.

The test involves sitting on the floor with the back and head against a wall, legs fully extended with the bottom of the feet against the sir-and-reach box. Later on placing the hands on top of each other, stretching the arms forward while keeping the head and back against the wall. The distance has been measured from the fingertips to the box edge with a ruler. This becomes zero or starting point. Later slowly bending and reaching forward as for as possible sliding the fingers along the ruler, holding the final position for two seconds and the distance reached was recorded. The test was repeated three times, and the best distance was noted for the score. In this study grade has been taken for consideration.

Standard height and weighing machine have been used for the measurement of height and weight. BMI (WHO 1997) was calculated by taking the ratio of the subject's height (in meter) and weight (in kilogram) i.e.(weight/height2). BMI has been divided in to three groups; Low BMI (<18.5), Medium BMI (18.5-24.9), and High BMI (>25).

Blood hemoglobin level is the weight and quantity of Hemoglobin in the blood measured in gms /100ml. The quantity of Hb/deciliter or 100ml of blood is determined by *Hemoglobinmeter.* The normal value of hemoglobin for men is 13-18g/dl and for women is 11.5-16.5g/dl.

The present study was conducted to assess the effect of Yogic practices with suryanamaskar among young

students who were underweight (low BMI) and less in Hb content. The study was undertaken at Maratha Mangal Karyalaya,Pimpalner, Dist-Dhule (MS). All the subjects of the study were of the age group of 18 to 22 years. The practices were taught six days in a week for nearly 60 to 70 minutes. Every day the therapy was carried out in the evening from 5.30 pm to 6.45 pm. The 50 subjects were divided randomly into two groups. Experimental group containing 25 subjects and Control group containing 25 subjects. The control group was not exposed to any yogic practices. Yoga therapy was introduced to the experimental group.

The set of Asanas and Pranayama included in the course (10)

I. **Humming in meditative postures-** Sukhasana (Easy pose)/ Padmasana (Lotus pose) / Vajrasana (Thunderbolt)

II. **Loosening Exercises-**Warm ups : starting from head, working towards the toes.

1. Neck roll, 2.Shoulder rotation, 3. Arm rotation, 4. Elbow movement, 5. Wrist movements, 6. Finger movements, 7. Waist movements, 8. Knee rotation, 9. Ankle rotation, 10. Toe movements

III. **Suryanamaskar (One avartan daily i.e. 11 times)**

IV. **Asanas-(A) Standing**

1. Konasan (Side bend pose), 2.Tadasana and 3. Vrikshasana (Tree pose)

(B) Sitting

1. Vajrasana or Shashankasana (Forward bending)
2. Ustrasana/Ardhachandrasana(Backward pose)
3. Vakrasana (Twist pose)/Ardhamatsyendra -sana (Half-spine twist pose)
4. Paschimotanasana (Back stretch pose)

(C) Lying on stomach (prone)

1. Bhujangasana (Cobra pose), 2. Shalbhasana (Leg back bend), 3. Dhanurasana (Bow pose)

(D) Lying on back (Supine)

1. Markatasana (Twisting pose), 2.Pavanmuktasana (Wind relieving pose)
3. Setubandhasana (Bridge pose), 4.Sarvangasana (Shoulder pose), 5.Matsysana (Fish pose)

V. **Deep Relaxation in Shavasana pose (Corpse pose)**

VI. **Pranayama (Breathing practices)**

1. Bhastrika
2. Kapalbhati (Short and strong forceful exhalation and inhalation happens automatically)
3. Anuloma-viloma(Alternate nostrilbreathing)
4. Ujjai
5. Bhramari (Om Chating/ Honybee sound during expiration)
6. Udgeeth (Chating of Om mantra)

VII. **Deep Relaxation In Shavasana pose**

VIII. **Humming in meditative postures-** Sukhasana (Easy pose)/ Padmasana (Lotus pose) / Vajrasana (Thunderbolt)

RESULTS & DISCUSSION

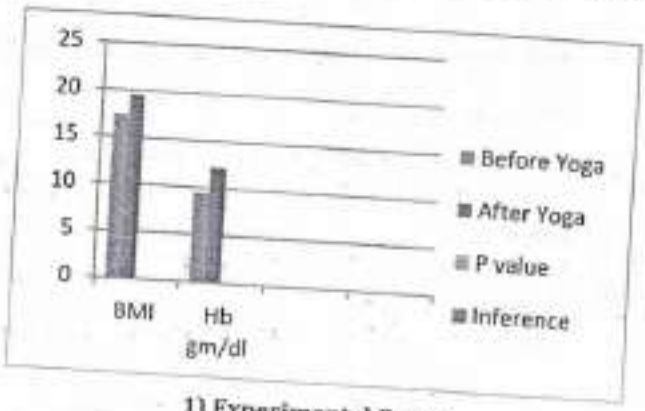
Results are displayed on table 1, we found significant changes between experimental and control groups in flexibility, BMI and hemoglobin.

Experimental group –depicts significant improvement in flexibility poor (Grade 2: -19 to -9) to Average (GRADE 4: +1 to +5) [*], Weight 45.33 to 48.20 [*], BMI 17.40+-0.4 to 19.50+-0.3 [*] and Hb 9.5+-0.3 to 12. 2+-0.2 [**].

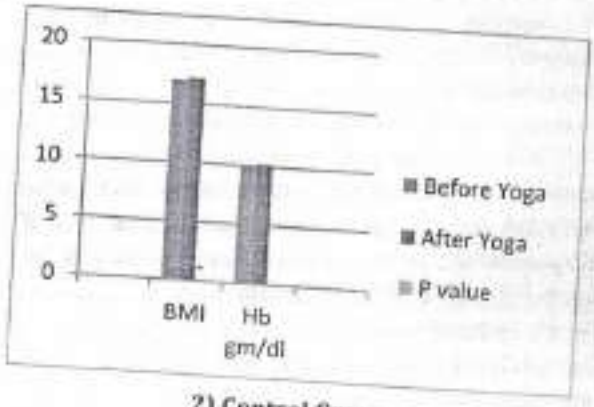
Control group –depicts no significant improvement in flexibility poor (Grade 2: -18 to -9) to Average (GRADE 4: -17 to -8) [NS] ,Weight 45.60 to 45.65 [NS], BMI 17.00 to 17.20 [NS] and Hb 10.00 to 10. 2 [NS].

Table 1

Variables	Experimental Group		Control Group	
	Before Yoga Mean Score	After Yoga Mean Score	Before Yoga Mean Score	After Yoga Mean Score
Flexibility (cm) mean	Poor (Grade 2) -19 to -9	Average (Grade 4) 0 to +5	Poor (Grade 2) -18 to -9	Average (Grade 4) -17 to -8
BMI	17.40 +- 0.4	19.50 +- 0.3*	17.00	17.20 (NS)
Hb gm/dl	9.5 +- 0.3	12.2 +- 0.2**	10.00	10.2 (NS)



1) Experimental Group



2) Control Group

DISCUSSION

From the results it is evident that the eight week of yoga with suryanamaskar programme showed significant improvement in flexibility level. The finding is supported by the study conducted by (Shankar and Pancholi, 2011, Galantino ML et al; 2004 and Bal B. S. and Kaur P. J. 2009).The finding of Sisodia A Singh 2017 also revealed that a significant improvement found in flexibility due to regular practice of suryanamaskar. It may be due to regular stretching exercise increase extensibility of muscles, ligaments and tendons.

From the results it is also evident that the eight week of yoga with suryanamaskar programme showed significant improvement also in BMI level of underweight students. The increase of body weight may be due to the decrease of body fat and increase of body mass. Similar finding also reported by Aloksen Sen Borman 20016.

The present work was also carried out to investigate Hb % by yoga with suryanamaskar in anemic students. As shown in above table among 24 students the Hb % was increased in 90 % students., the reason for increased red blood cell count can be explained by two different mechanisms; it may be due to hypoxia that release more erythropoietin during yoga practices and second is that yoga practices increased release of iron stores from reticulo endothelial cells and splenic concentration enhance the release of reserved RBCs. Very similar results was found by other researchers Verma Rahul et al; 2017, Karpoor Chandrashekher, Vikash K Tiwari et al; 2017 and Ramnath B. et al; 2013.

The practices of asanas and pranayama have proved very valuable for the production of hemoglobin and necessary element in the blood in the pure form (6). Trikonasana (Budilovsky Joan and Adamson Eve 2000 and Swami Muktibodhanand Saraswati 2006) and its variations, Sarvangasana (Francina 2003), Surya namaskara, Yoga mudras (kongtrul 2005) are useful for purification of blood and increases of blood cells.*Yoga practices hold great* promise and potential in the field of medical science. Yoga therapy will definitely emerge as a major branch of medical treatment and eventually become a standard of care and practice in coming few years. India has made great progress in yogic science research as evidenced by a number of scientific and clinical papers in various journals.

Although Yoga as a therapy is still at the stage of clinical research, advances have been made in understanding how to use these practices for treating various diseases via correlating its biochemical, hematological spectrum (Preeti Sharma and Pradeep Kumar 2016). Krishna Sharma et.al 2014 also demonstrated that short-term yoga practice increase Hb, Hematocrite, White Blood Cell count and Peck Expiratory Flow rate dut to 1 month regular practice of yoga. Yoga can help in incresing RBC count in two ways. One is by making use of breathing exercses and the other is by doing special asanas. Breathing exercises like Ujjayi, Suryabhedana, AnulomViloma and Kapalbhatti increases circulation of blood and improre functioning of the entire circulatory system. According to various Yoga gurus anaemic patients should start their Yoga session with Pranayama followed by Trikonasan. Other Yoga poses for anaemia are Sarvangasana, Paschomittanasana,Uttanpadasana, learit-Karani-mudra and various shavasans.(30). For Anaemia the practice of asanas and Pranayama have proved very valuable for prduction of hemoglobin and necessary elements in the blood in the pure form. The practices of asana are useful for purification of blood

and increase of blood cells.ThePranayams like Sivanands, Shitali, Sitkari and AnulomVilom are recommended for anaemia (30).By doing Sivananda Pranayama, may get maximum oxygen by inhaling. The air (Containing oxygen) that we breathe into our lungs is transfered into our blood, which travels around our body delivering oxygen to our brain, organs and all other parts of our body. It helps the nervous system, the heart, the digestive system, muscles, sleep, energy levels, mental soundness, concentration and memory and much more, when we exhale properly, we also get rid of the waste products like carbon dioxide, toxins etc.(30). Shitali and Sitkari Pranayamas are performed in the early morning before sunrise, a very good digestive power is observed, hunger increases, blood gets pured. Anulom - VilomPranayam increase of working capacity of intestines creates a new process of sending the iron that is produced additionally, in the various organs of the body. KapalBhatti / KapalBharti controls breathing and increases oxygen level in the blood, thus increasing body capacity and the lung capacity. It also detoxifies the body of toxins (31).

CONCLUSION

The present study reveals that yoga with suryanamaskar helps efficiently in enhancing flexibility; enhance BMI of underweight and reducing the symptoms of anemia with minimum effort. Based on above results and discussion, we can come to the following conclusion -

1. This short-term study has showed very significant results in Hb level.
2. The yogic practices can be used efficiently to improve flexibility and BMI.
3. The yoga therapy would yield more result if it is carried out for longer duration unlike present study.

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REFERENCES

Acharya Balkrishna, Pranayam Rahayshya. *Divya Prakashan, Patanjali Yogpeeth, Hardwar.* R & D

Aloke Seb Borman (2016) Effect of yogic asana on body mass index.*Int J of Physiology. Nutrition and Physical Education; 1(1):01-04.*

Anuroadh Singh Sisodia (2017) Effect of Suryanamaskar on flexibility of school girls. *Int. Journal of Phy Education, Sports and Health; 4(20:154-156.*

Available from: Google- by SrishtiWalia - *https://food.ndtv.>health*

Available from: Google-*https://www.stylecroze-com>ef.*

Bal BS and Kaur PJ (2009) Effect of selected asanas in Hatha yoga on Agility and Flexibility level. *Journal of Sport and Health Research, 1(2):75-87.*

Bhavanani B *et al* (2011) A comparative study of slow and fast suryanamaskar on physiological function. *Int. Jour. Of Yoga (IJOY); 4(2):71-76.*

Budilovsky Joan and Adamson Eve (2000). The complete idiot's guide to yoga (2 ed.). *Penguin.p.143.*

Doshi Dhara R and Yogesh A. Jogsan (2012). A Study on Impact of Yoga on Self-Control in Obese Women. *Int J of Sci & Res Publications, Vol 2, Issue 8 ,ISSN 2250-3153.*

Francina Suza (2003) Yoga and the Wisdom of Menopause: A Guid to Physical, Emotional, and Spiritual Health at Midlife and Beyond. *HCL.* P. 233.

Galantino ML et al (2004) The impact of modified Hatha yoga on chronic low back pain: a pilot study. *AlternTher Health Med, 10(2):56-59.*

Hassan TH *et al* (2016) Impact of iron deficiency anemia on the function of the immune system in children. Medicine. 95:47.

Internet - Google, 2009 www.th://indianmirror.com/game/yoga/yog....

Karpoor Chandrashekhar. Effect of six week yogasana training on hematological parameters and lipid profile.*National J. of Basic Medical Sciences; Vol. 3,Issue-2: 119-122.*

Kongtrul, Jamgon. (2005) The Treasury of Knowledge (shesbyakun la khyabpa"Imdzod). Book Six, Part Four: Systems of BiddhistTantra, The Indestructible Way of Secret Mantra. *Bolder, Colorado, USA: Snow Lion Publications.* P.493.

Krishna Sharma K *et al* (2014) A Study on the effect of Yoga Therapy on Anaemia in Woman. *European Scientific Journal,* Edition vol.10, No.21, Pp..283-290.

MedicineNet.com -Definition of Anemia Last Editorial Review: 12/9/2000 8:31:00 AM

Merran. (2009). Webster dictionary-anemia Retrived on May 25,2009.

Miller David K (2006). Measurement by the physical educator why and how. McGraw Hill., 259.

Neena Sharma and Ritu Gupta (2016). A study on yoga in anemic patients.*Int J Med Sci Public Health. 5(3): 399-401.*

Petry N *et al* (2016) The proportion of anemia associated with deficiency in low, medium and high human development index countries: A systematic analysis of national surveys. Nutrients. 8:693.

Preeti Sharma and Pradeep Kumar (2016). Scope of Yoga practices in Hematological and Biochemical alterations. *Asian J of Pharmaceutical and Clinical Research.* Vol 9, Issue 1, pp 73-75.

Purohit G *et al* (2013) Cardioprotectant and antistress effect of Yoga training and its co-relation with haematologicalparamiters: prospective study of 47 young individuals.*Schf AppISci,* 1(8):8526.

Ramanath B *et al* (2013). A randomized control study of Yoga on anemic patients. *Int. J. of Res in Med Sci. 1(3):240-242.*

Seema Patel &Kamakhya Kumar (2016). A study on the effect of Yoga and diet-control on Body Mass Index and Cholesterol level of the Obese Youth. *Int J of Sci andConsciousness. 2(1),13-17.*Savita

Seshadri VR (2013) Controlling Anaemia through Indian System of Medicine. *State Planning Commission, Tamilnadu,Workshop Series : 2/HSW/2013.*

Shankar G and Pancholi B (2011) The effect of Suryanamaskar Yoga practice on the heart rate, blood pressure, flexibility and upper body muscle endurance in healthy adult. *Int. Jour. Of Health Sciences and Research, 1(1):2-6.*

Swami Muktibodhananda Saraswati (2006). Energy: The spark of life & universal goddess, A book about yoga and personal growth for men and women. *Trafford Publishing.* Pp. 63-64.

Verma Rahul *et al* (2017) Hematological modulation in regular practice of Yoga in young healthy medical students. *World J of Pharmacy and Pharmaceutical Sciences; 6(8):1701-1712.*

Vikash K Tiwari *et al* (2017) Yoga enhances bioavailability and assimilation of oral iron on young female patients of iron deficiency anemia. *Int. J. of Contemporary Medical Research;4(7):1475-1477.*

Zsaka U *et al* (2016). Effect of oral iron on markers of oxidative stress and antioxidant status in children with iron deficiency anemia. *J. of Clinical and Diagnostic research. 10:13-19.*

Original Research Paper

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Zoology

STUDIES ON DIVERSITY AND RELATIVE ABUNDANCE OF DUNG BEETLES (COLEOPTERA: SCARABAEIDAE) FROM SAKRI TAHSIL, DIST-DHULIA (M.S.) INDIA

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ABSTRACT An updated checklist of 15 species (14 genera) of Scarabaeoid beetles (Coleoptera: Scarabaeidae) belonging to 5 subfamilies (Scarabaeinae, Rutelinae, Melolonthinae, Dynastinae and Cetoniinae) is provided for the first time. The survey was carried out in 2015-2017, from Sakri tahsil, Dist- Dhulia (MS). Out of total species, the subfamily Scarabaeinae contribute dominant number i.e. 6 species (40 %) followed by Dynastinae 3 species (20 %) while remaining subfamilies having 2 species (13.3 %) each. The subfamily; Scarabaeinae include the beetle which exclusively feed on dung and carrion. Whereas the beetles in the subfamilies; Rutelinae, Melolonthinae, Dynastinae and Cetoniinae are phytophagous in nature and acts as pest of various commercial crops of agricultural and forestry importance. Our observations indicate relative abundance of beetles in monsoon than in winter and summer.

KEYWORDS : Scarabaeoid, Coleoptera, Dung beetle, Carrion, Phytophagous, Crop pest

INTRODUCTION

The family Scarabaeidae is one of the largest families in order Coleoptera; these are world's most fascinating beetles noticeable due to their relatively large size, bright colors, elaborate ornamentation and interesting life histories. The family falls under super family Scarabaeoidea which currently includes approximately more than 37000 species under 2500 genera (Krajcik, 2012). The Scarabaeidae is the richest family in Scarabaeoidea which is composed of about 91 % of all the scarabaeoids and include about 27,800 species worldwide. In India about 1590 species under 203 genera are known. Scarab beetles are generally heavily build and small to large in size. They can easily be recognized by characteristic form of antennae. The group is very important economically and some of the most serious pest of agriculture, forestry and fruit trees belongs to this family. Oryctes rhinoceros is a well known pest of coconut plantation Phyllognathus dionysius feeds on the roots of paddy, rose chafers are known for their damage to forest and fruit trees. Larvae of some of the melolonthid beetles are serious pest ground nut cultivation in some parts of India. The majority of the members of this family is noctural in habit and come out at dusk and hides during day time, but some are diurnal. A large section of the species is foliage feeder or coprophagous in nature; larvae generally develop in soil rich in organic matters; some are root feeders and are found in dung or rotting animal matters. The family Scarabaeidae is further divided into 16 subfamilies, 82 tribes and 94 sub tribes (Smith, 2006). The beetles in the subfamily scarabaeinae are commonly called dung beetles while most species in the subfamilies viz., Rutelinae, Melolonthinae, Dynastinae and Cetoniinae feed on plant products and are agricultural pests of various commercial crops. The dung beetles perform a series of ecological functions such as nutrient cycling, soil aeration (Mittal, 1993), secondary seed dispersal and regulation of enteric parasites and dung breeding dipterans pests (Kailash Chandra et al., 2015).

A perusal of literature on the diversity of Scarabaidae beetles from different state of India were reported by some earlier workers viz.,

- Aland et al (2012) surveyed and collected 59 species of scarabaeid beetles in and around Amba Reserved forest of Western ghat region Kolhapur district, Maharashtra.
- Bhawane et al (2012) reported 29 species of family scarabaeidae. Most of these are polyphagus and serious pest of agricultural, horticultural and silvicultural crops.
- Bhawane et al (2014) made survey on collection of 26 species of dung beetles of Scarabaeinae subfamily from Sindhudurg district, Maharashtra, India.
- Davíd and Petr (2013) reported 29 species of aphodiinae tribes (Coleoptera: Scarabaeidae) from the state of Goa, Maharashtra and Rajasthan (India).
- Deanshu Gupta et al (2014) updated 61 species of scarabaeoid beetles belonging to 30 genera, 19 tribes, 3 families and 7 subfamilies from Pench Tiger Reserve, Madhya Pradesh, India.
- Hon Shashikant Trimbak (2018) a communication report on 29 species of Scarabaeidae family from Kopargaon tahsil, Dist-Maharashtra, India.
- Kailash Chandra and Ahirwar (2005a) made comprehensive survey of Bandhavgarh National Park in Madhya Pradesh revealed 44 species in 24 genera and 8 sub families.
- Kailash Chandra and Ahirwar Gupta (2005 b) made comprehensive list of total 61 species of scarabaeidae beetles pertaining to 27 genera under 8 sub families from Kanha Tiger Reserve, Madhya Pradesh, India.
- Kailash Chandra and Devanshu Gupta (2012 a) reported taxonomic account of 4 species of genus Bolbohamatum and one species of genus Bolbogoniam from Central India (Madhya Pradesh and Chhattisgarh).
- Kailash Chandra and Devanshu Gupta (2012 b)) diversity and relative abundance of Pleurostict scarabaeidae were studied and analyzed in Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh.
- Kailash Chandra and Devanshu Gupta (2012 c) made survey of 52 scarab beetles belonging to 24 genera and 5 sub families of family scarabaeidae from Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh, India.
- Kailash Chnadra et al (2012) reported faunal account of scarab beetles from Govind wildlife sactuary, Uttarakhand, comprising 11 species belonging to 2 families of superfamily Scarabaeoidea.
- Kailash Chandra and Devanshu Gupta (2013) represent taxonomic account of 52 species of dung beetles belonging to 22 genera, 12 tribes and 3 families from Chhattisgarh.
- Kailash Chandra et al (2015) reported scarab beetles belonging to 53 species, 27 genera and 6 sub families from Sidhi district of Madhya Pradesh, India.
- Patole (2018) represent taxonomic account of 33 coleopteran beetles belonging to 8 families from Sakri region, Dist- Dhulia (M.S.).
- Pawara et al (2014) recorded 35 species belonging to 28 genera under 13 families of order Coleoptera from Jalgaon district of Maharashtra, India.
- Sarkar, S. K., Suman Saha and Raychaudhari, D. (2014) reported taxonomic account of 8 dynastinae fauna (coleoptera: Scarabaeidae) of Buxa tiger reserve (West Bengal, India).
- Thakare et al (2012) accounted 32 species of scarab beetles belonging to 22 genera, 8 subfamilies and 3 families under superfamily Scarabaeoidea from Melghat Tiger Reserve, Vidarbha, Maharashtra (India).

Scarabaeid beetles already have attracted attention of researchers in other parts of Maharashtra State, where considerable work has been done on various aspects. However, no research work has been undertaken in this region on any of its aspect. Therefore, attempt has been made for first time to study diversity and relative abundance of dung beetles (Coleoptera: Scarabaeidae) from Sakri tahsil which is the adjoining part of Western Ghat, Maharashtra.

MATERIALS AND METHODS

STUDY AREA -

Sakri is a largest tahsil in Dhule district of Maharashtra State, India. It belongs to Khandesh and Northern Maharashtra region of Nashik division. It is located 70 Km towards west from District head quarters Dhule and 307 Km from State capital Mumbai towards South. Study

area has; altitude: 215 meters above Sea level; Latitude: 21.08715 and Longitude: 74.3601. Sakri taluka is bounded by by Baglan taluka towards South, Navapur taluka towards west, Nandurbar taluka towards North, Uchchhal taluka towards west. Nandurbar City, Satana City, Dhule City, Malegaon City are the nearby Cities to Sakri.

Both extensive and intensive surveys were conducted during 2015-2017 in different villages of study area. Field visits were made on holiday during the period of survey. For collection of beetles, sweep nets, bush beating and collection in inverted umbrella and hand picking techniques were used. Decaying vegetable matter and dung of various animals was also examined to make collection. In evening hours light trap was used to collect nocturnal beetles. Sample after collection were killed in chloroform and preserved in 70 % ethyl alcohol in glass vials. Necessary data regarding locality, date of collection etc noted in notebook. They were then brought to the laboratory, where stretching, pinning, labeling, and drying and photograph is done as per the guidelines laid by zoological survey of India. For authetification, the preserved samples where periodically send to Zoological Survey of India, Western Regional Station, Akurdi, Pune (M.S.), India.

RESULTSAND DISCUSSION

In first attempt, Scarabaeid beetles were collected through extensive survey from in and around Sakri tahsil, district- Dhulia (MS). The study revealed total 15 species of Scarabaeid beetles belonging to 5 subfamilies viz., Scarabaeinae, Dynastinae, Rutelinae, Melolonthinae and Cetoniinae are presented in table-1. Of these Scarabaeinae were found to be dominant (40 %) over the other subfamilies. Beetles of this subfamily exclusively feed on dung and carrion and are commonly called 'dung beetles' whereas the beetles in the subfamilies like Dynastinae, Rutelinae, Melolonthinae and Cetoniinae are pests of various commercial crops and usually called 'Chafers'.

For the process of dung burial and relocation, the dung beetles play significant roles in nutrient cycling, soil aeration, secondary seed dispersal and regulation of enteric parasites as well as dung breeding dipterans pests (Mittal, 2005). They are classified into three categories like tunnellers, dwellers and rollers. The tunnellers species bury brood balls in vertical chambers in close proximity to the original deposition site and the roller species carry the dung balls to some horizontal distance away before burial beneath the soil surface. Whereas the dweller species brood their young ones inside the dung mass itself. The dung beetles reported in present work from Scarabaeinae family, the species Gymnopleurus cyaneus F. and Gymnopleurus gemmata H. were dung rollers while the speices Catharsius pithecius F., Onitis philemon F., Onthophagus hinda Arrow and Heliocopris gigas L. were tunnellers. Earlier researchers estimated that about eighty thousand tons of excrement is daily carried into the soil by these dung beetles in India at different depth in the ground. But this activity going to be decreasing every year might be due to loss of beetle habitat, altered food quality due to pollutants, decrease in amount of dung or number of cattle and increased cattle antibiotics as well as other environmental changes. Some observations were reported from study area.

The scarab beetles collected from study area in subfamilies like Rutelinae, Melolonthinae, Cetoniinae and Dynastinae feed on plant products and are acts as agricultural pests of various commercial crops. Nine species were recorded from the study area with most of them widely distributed. The adults are phytophagous, they feed on foliage of different trees whereas their grubs causes extensive damages to the roots of cereals, legumes and many other small trees cause extensive damage to field crops and fruits particularly growing during rainy season. Hence, they are appeared as serious pests of economically important crops like sugarcane, groundnut, pearl, millet, sorghum, paddy, chilies and number of leguminous plants (Kailash Chandra et al., 2015).

CONCLUSION

From study area, first time author reporting Scarabaeid beetles collected through extensive survey. The study revealed 15 species of beetles belonging to 14 genera scattered in 5 subfamilies viz., Scarabaeinae, Dynastinae, Rutelinae, Melolonthinae and Cetoniinae. Among these Scarabaeinae was dominant in number (40 %) and these are tunnellers or rollers; plays significant role in nutrient cycling. Whereas beetles from other subfamilies are phytophagous and acts as pests of different trees and economically important crops. It is further observed that the density of dung beetles was going to be decreased due to decrease in number of cattle, increased human interference as well as altered environmental conditions.

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Table-1: List of dung beetles (Coleoptera: Scarabacidae) from Sakri tahsil (Dist- Dhulia) Maharashtra.

Sr. No.	Name of Subfamily	Species- Scientific name	Feeding habits
01	Scarabaeinae	Catharsius pithecius Fabricus 1775	Tunnellar
02		Gymnopleurus cyaneus Fabrichus 1798	Roller
03		Gymnopleurus gemmata Harold 1871	Roller
04		Onitis philemon Fabricius 1801	Tunnellar
05		Onthophagus hinda Arrow 1931	Tunnellar
06		Heliocopris gigas Linnaeus	Tunneller
07	Dynastinae	Phyllognathus dionysius Fabricius	Phytophagus
08		Oryctes rhinoceros Linnaeus	Phytophagus
09		Eophileurus platypterus Wood 1823	Phytophagus
10	Rutelinae	Anomala ruficapilla Burmeister 1855	Phytophagus
11		Adoretus lasiopygus Burmeister 1855	Phytophagus
12	Melolonthinae	Maladera amboliensis Ahrens & Silvia 2016	Phytophagus
13		Holotrichia Spp.	Phytophagus
14	Cetoniinae	Chiloloba acuta Wood	Phytophagus
15		Oxycetonia versicolor Fabricius	Phytophagus

1. Phyllognathus Dionysius F

2.Anomalla ruficapilla B.

3. Catharsius pitheecus F.

4. Gymnopleurus cyaneus F

5. Gymnopleurus [illegible]

6. Onitis phileman F

7. Chilolobha acuta V

8. Adoretus lasiopyg[illegible]

9. Oxycetonia versicu[illegible]

10. Onthophagus hin[illegible]

11. Heliocopris gigas L.

12. Oryctes rhinocer[illegible]

13. Eophileurus plat[illegible]

14. Maladera amboliensis

Photo plates of Scarabacidae beetles from Sakri tahsil Dist- Dhulia (M.S.).

REFERENCES

1. Alawl, S. R., Mamlayya, A. B. and Bhawane, G. P. (2012). Diversity of scarabaeid beetles (Coleoptera: Scarabaeidae) in and around Amba reserved forest of western ghat region Kolhapur district, Maharashtra. Indian J. Trop. Biodiv. 20(1): 84-87.
2. Bhawane, G. P., Mamlayya, A. B., Wagh, S. R. and chougule, A. K. (2012). Diversity of white grub beetles and their host range from northern western ghats, Kolhapur district (MS), India. The Bioscan 7(4): 589-596, 2012.
3. Bhawane, G. P., Bharamal, D. L., Koli, Y. J. and Korgaonkar, D. S. (2014). Scarab (Scarabaeidae) fauna of Sindhudurg district, Maharashtra, India. BioInfo. 2(4): 1301-1304.
4. David, K. and Pete, S. (2013). Aphodiinae (Coleoptera: Scarabaeidae) of the Goa, Maharashtra and Rajasthan (India) with description of Aphodius (Gilletinus) rajasthanensis sp. Nov. Acta Entomol. Musei Nat. Pragae. 53(2): 633-648.
5. Devendra Gupta, Kailash Chandra and Salman Khan (2014). An updated checklist of scarabaeid beetles (Coleoptera: Scarabaeoidea) of Pench Tiger Reserve, Madhya Pradesh, India. J. Entomol. Zool. Stud. 2(5): 225-240.
6. Hon Shashikant Trimbak (2018). Preliminary study on diversity of coleoptera fauna from kopargaon taluk, district Ahmednagar, Maharashtra, India. Int. Res. J. of Biol. Sci. 7(6): 23-25.
7. Kailash Chandra and Ahirwar, S. C. (2005 a). Scarabaeid beetles (Coleoptera) of Kanha Tiger Reserve, Madhya Pradesh. Rec. Zool. Surv. India: 103 (1-2): 147-155.
8. Kailash Chandra and Ahirwar, S. C. (2005 b). Scarabaeid beetles of Bandhavgarh national park, Madhya Pradesh. ZOOS' Print Journal. 20(8): 1961-1964.
9. Kailash Chandra and Devendra Gupta (2012 a). Bolboceratine scarabs of genera Bolbohamatum Krikken, 1980 and Bolbogeniatus Balthasar, 1941 (Coleoptera:Geotrupidae) from central India. Taprobanica 4(2): 69-76.
10. Kailash Chandra and Devendra Gupta (2012 b). Diversity and relative abundance of Pleurosticti Scarabaeidae (Coleoptera) in Achanakmar-Amarkantak Biosphere Reserve, Central India. World J. Z. 7(2): 147-154.
11. Kailash Chandra and Devendra Gupta (2012 c). An inventory of scarab beetles (Coleoptera:Scarabaeidae) of Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh, India. I. J. S. N. 3(4): 886-891.
12. Kailash Chandra., Devendra Gupta., Uniyal, V. P., Bhandoraj, M. and Sanyal, A. K. (2012). Studies on scarabaeid beetles (Coleoptera) of Govind Wildlife Sanctuary, Gaurwal, Uttarakhand, India. Biol. Forum – An Int. J. 4(1): 48-54.
13. Kailash Chandra, Devendra Gupta and S. C. Goel (2015). On Scarab beetles (Coleoptera: Scarabaeidae) from Sidhi district of Madhya Pradesh, India. Uttar Pradesh J. Zool. 35(3): 235-243.
14. Krajcik, M. (2012). Check list of the world Scarabaeoidea. Animax. X- Supplement. 5, 278.
15. Mittal, I. C. (1993). Natural manuring and soil conditioning by dung beetles. Trop. Ecol. 34(2): 130-135.
16. Mittal, I. C. (2005). Diversity and conservation status of dung beetle (Lamellicorn: Scarabaeidae: Coleoptera) in North India. Bull. Nat. Inst. Ecol. 15: 43-51.
17. Parde, S. S. A checklist of beetle diversity (Insecta: Coleoptera) from Satpur region, Dist-Dhule (M.S.) India. J. Emer. Technol. & Innov. Res. 5(8): 1-6, 2018.
18. Pawara, R. H., Patel, M. G., Pawara, J. V., Gavit, P. J. and Jaki, S. S. (2014). Beetles of Jalgaon district of Maharashtra, India. BioInfo 2(3): 970-973.
19. Sarkar, S. K., Saha, S. and Bandyopadhyay, D. (2014). Taxonomic account of Dynastinae fauna (Coleoptera: Scarabaeidae) of Buxa Tiger Reserve (West Bengal, India). Rec. Z. Biol.-Zool., 59(2): 89-112.
20. Smith, A. B. T. (2006). A review of the family group names for the super family Scarabaeoidea (Coleoptera) with corrections to nomenclature and a current classification. Col. Soc. Monographs. 5: 144-204.
21. Thakare, V., Zade, V., Kailash Chandra and Devendra Gupta. (2012). Scarab beetles (Coleoptera: Scarabaeoidea) of Melghat Tiger Reserve, Central India. Acta. J. Entomol. 3(2): 73-80.

Seasonal Variation, Diversity Indices and Correlation Of Phytoplanktons from Nakana Lake, District Dhule (MS) India

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Abstract: Present study discovered the incident of 38 phytoplanktonic species during two years. Amid these 17 species of Chlorophyceae, 9 species of Bacillariophyceae, 9 species of Cyanophyceae and 3 species of Euglenophyceae were observed. The total density of phytoplanktons were recorded as (8152/l) and (7656/l) with significantly significant seasonal variation in year 2014-15 and 2015-16 respectively. Total density was decreased in next year as compare to first. Maximum density of phytoplankton found in summer season, moderate in winter and in monsoon it was least in condition. Spirogyra spp, Fragillaria capulina, Lungbya and Euglena pisciformis, were showed dominant position from each phytoplanktonic group. Total 6 diversity indices were estimated among them Shannon-Weiner Index (363.5157) and (344.3082), Simpson's Dominant Index were (0.0775) and (0.0429). Physico-chemical parameters like pH, Turb, TDS, EC and O_2 were positively correlated however Temp, Free CO2, TH, Ca^{++} and Mg^{++} were negatively correlated with phytoplanktons.
Key words: Chlorophyceae, Euglena pisciformis, Simpson's Dominance Index

1. INTRODUCTION:

Phytoplanktons are drifting or floating organisms that live in all aquatic habitats i.e. fresh, Marine as well as estuarine water., (Sharma, 2010). Few are having capability of self-regulation as compare with who those are float with water. First tropic level starts from phytoplankton because they are autotrophs and form the basic link in the food chain of all aquatic animals. They are expansively detained that predominantly significant to the food web of aquatic ecosystem. Phytoplanktonic diversity plays a key role in aquatic habitat, (Devi *et al.* (2016). No systemic analysis has been carried out regarding seasonal fluctuations and diversity and dominance analyzes by diversity indices of phytoplanktons from Nakana Lake. In sort to fill up this lacuna, present investigation had commenced.

2. MATERIAL AND METHODS:

The study area Nakana Lake was visited at monthly intervals during couple of year study between 7.00am to 9.00am, map of study area mention in fig.-1. By using 25mm mesh size plankton net 100 liters of surface water were sieve, net was washed with water by inverting it to collect the phytoplanktons attached to the net. Filtrate was taken in another sterilized bottle, labeled and for preservation 4% formalin was added. For further analysis sample were brought to the laboratory. 10 ml of sample was concentrated by centrifuging at 2000 RMP for 5 to 10 minutes. Quantitative analysis completed with the help of "Sedgwick–Rafter counting cell". The systemic identification of phytoplanktons was made by using standard keys of Edmondson (1959),Tonapi (1980)and Dhanpathi (2000) Determination of plankton density the average of 5 to10 counts was made and the result was expressed as number of organisms per liter (org/l) of sample water.

During study tenure i.e. Feb., 2014 to Jan., 2016, collected data were pooled for four months and three seasons and estimated for seasonal changes. After this, the Mean and standard Error of Mean (SEM) was calculated for each season and One Way ANOVA with various physico-chemical parameters were performed. The Pearson correlation was calculated by keeping plankton as dependant variable and other abiotic and biotic factors as independent variables with the help of SPSS 7.5 for windows.

3. DATA ANALYSIS OF DIVERSITY INDICES

Diversity Indices were estimated by Shannon and Wiener (1963); Simpson (1949); Margalef (1958) and Pielou (1966) methods.

1. Shannon – Weiner Index (H): $H= -\sum Pi (In Pi)$,
2. Simpson's Dominance Index (D): $D= \sum n(n-1)/N(N-1)$,
3. Simpson's Index of Diversity = 1-D,
4. Simpson's reciprocal Index = 1/D,
5. Margalef's Index (R): $R= S-1/Ln (n)$
6. Pielou's evenness Index (J): $J = H/Ln^*S$

Where, S = Number of species
N = Total number of individual of all species.
Pi = A/T where A is number of each species in the sample,
T = Total number of individual of all species in the sample.
n = Total number of individuals of particular species.

TOTAL PHYTOPLANKTONS:

Diversity of Phytoplanktons was recorded with 38 species,ᵗmention in Table-1. They belong to four groups: Chlorophycae, Bacillariophyceae, Cynophyceae and Euglinophyceae. Species wise percentage includes Chlorophyceae (44%), Cynophyceae, (24%), Bacillariophyceae (24%) and Euglenophyceae (8%), shown in fig.-1. Seasonal variation in density of Phytoplanktons was shown in Table- 2. Phytoplanktons as biotic parameters correlated with abiotic parameters i.e. physico-chemical status of water. Estimated values were shown positive and negative correlation with each other, publicized in Table- 3.

The total density of phytoplanktons recorded (8152 / l) ($F_{2,44}$ 12.94) ($p< 0.01$) in year 2014-15 and (7656/l) ($F_{2,44}$ 20.69) ($p< 0.01$) in 2015-16. Seasonal variation ranges in between (2536/l) in year 2014-15 and in year 2015-16 shown (3039/l). The population of phytoplanktons estimated significant seasonal variation, in winter it was minimum (634.00 ± 25.59) (591.25 ± 23.26), moderate in monsoon (646.25 ± 2.52) (586.75 ± 11.43) and maximum in summer (759.75 ± 21.27) (736 ± 19.31) at 2014-15 and 2015-16 respectively.

Total phytoplankton density was positively correlated with pH, Turb, TDS, EC and TA at 0.01 (Two tailed) while free CO_2 at 0.05 (One tailed) and negative correlation shown with Temp, free CO_2 and Mg at 0.01 (Two tailed) TH and Ca^{++} at 0.05 (One tailed) in year 2014-15, same again in year 2015-16 it was positively correlated with Turb, TDS, EC and TA at 0.01 (Two tailed) while pH and DO at 0.05 (One tailed) whereas negative correlation at Temp., DO, TH, Ca^{++} and Mg^{++}, among these DO and Ca^{++} at 0.05 (One tailed), Borics *et al.* (2021)

CHLOROPHYCEAE:

Total 17 species of were identified from group Chlorophyceae. It was found in dominant quantitative composition at both years: (3062/l) (2921/l). The richness of the group Chlorophyceae ranges in between (208/l) to (326/l) observed in month of July and Nov. respectively in year 2014-15 while in year 2015-16 it was (202/l) month of Mar. and (329/l) in Nov. Recorded values express species dominance by species *spirogyra spp.* (94/l) and (96/l) in summer season 2014-15 and 2015-16 respectively on the other hand least count reported by species *Ankistrodesmis falcatus* (30/l) in summer at year 2014-15 and *Zygnema* was (22/l) in winter 2015-16.

The population of Chlorophyceae was recorded in minimum in monsoon (234.0 ± 7.51), moderate in winter (248.25 ± 19.51) and maximum in summer (285.25 ± 17.90). It shown non-significant seasonal variation ($F_{2,44}$ 2.77) ($P> 0.05$) at year 2014-15 while it was in 2015-16 estimated minimum in monsoon (209.50 ± 8.88), moderate in winter (225.50 ± 16.45) and maximum in summer (295.25 ± 16.12), it shown significantly significant seasonal variation ($F_{2,44}$ 10.29) ($P< 0.01$).

When group Chlorophyceae correlated with all water parameters, the observed values given away, pH and CO_2 (One tailed) whereas Turb, TDS, EC, TA, TH and Ca^{++} (Two tailed) were positively correlated as well as Temp, DO and Mg^{++} was negatively correlated (One tailed) at year 2014-15. However pH and CO_2 (One tailed) in addition to Turb, TDS, EC and TA (Two tailed) was positively correlated while Temp (Two tailed) and TH, DO, Ca^{++} and Mg^{++} were negatively correlated (One tailed), Jain *et al.* (2018).

BACILLARIOPHYCEAE:

Total 9 species were recorded during couple of year and pull off second position on level of dominancy. Species richness of this group was (2451/l) and (2288/l) in year 2014-15 and 2015-16 respectively. Range of richness of group Bacillariophyceae in between (174/l) (230/l) in the month of June and Dec. respectively in year 2014-15 whereas (161/l) in month July and Nov. it was (219/l) in year 2015-16. Species dominance from observed values was highest *Fragillaria capurina* (120/l) in summer season and lowest *Synedra affinis* (56/l) in Monsoon season in year 2014-15 even as *Diatom vuloare* highest (125/l) in winter season and lowest (56/l) in monsoon season.

Composition of this group was shown significantly significant seasonal variation ($F_{2,44}$ 24.13) ($P< 0.01$) at year 2014-15 while it was ($F_{2,44}$ 5.94) ($P< 0.01$) in year 2015-16. Recorded values displayed different seasons like, in summer it was maximum (231.75 ± 3.75), moderate in monsoon (190.75 ± 3.19) and minimum in winter (190.25 ± 6.79) at year 2014-15 then again in summer it was maximum (209.50 ± 5.69), moderate in winter (183.25 ± 9.02) and minimum in monsoon (179.25 ± 4.75) at year 2015-16.

Group Bacillariophyceae was shown positive and negative correlations as follows, pH and CO_2 (One tailed) and Turb, TDS, EC and TA (Two tailed) whereas Temp, DO, TH, Ca^{++} and Mg^{++} (Two tailed) in addition to pH, Turb, TDS, EC, DO, CO_2, TA (Two tailed) while Temp, TH, Ca^{++}, Mg^{++} (One tailed) at 2014-15 and 2015-16 respectively, Rawat and Trivedi (2018).

CYNOPHYCEAE:

Total 9 species were reported during tenure of research and it held on third position on level on ascendancy. Richness of species revealed difference in values, like (2087/l) (1943/l) in year 2014-15 and 2015-16. Group Cyanophyceae publicized variable values as reference to richness, highest population in month of January (201/l) and lowest at month of Aug. (149/l) in year 2014-15 whereas in year 2015-16 it was reported highest (189/l) in two months of Jan. as well as Mar. while lowest in month of July (136/l). Species dominance shown by *Nostoc spp.* (123/l) and least count by species *Oscillatoria chlorine* (15/l).

The population of group Cyanophyceae estimated significant seasonal variation ($F_{2\,44}$ 19.92) ($P< 0.01$) in year 2014-15 at the same time it was ($F_{2\,44}$ 12.24) ($P< 0.01$) in year 2015-16. Seasonal variation ranges maximum in summer (193.25 ± 3.00), moderate in monsoon (166.50 ± 3.79) and minimum in winter (162.00 ± 4.41) in year 2014-15 even as it was maximum in summer (184.75 ± 3.32), moderate in winter (152.25 ± 5.76) and minimum in monsoon (148.75 ± 7.12) n year 2015-16.

Cyanophyceaen members positively correlated with pH, Turb, CO_2, TA (One tailed) and TDS, EC, TH (Two tailed) at year 2014-15 as well as pH (One tailed) and Turb, TDS, EC, CO_2, TA (Two tailed) at year 2015-16. Negative correlation shown with parameters Temp, DO, Ca^{++}, Mg^{++} (One tailed) at year 2014-15 and Temp, DO, TH, Ca^{++}, Mg^{++} (One tailed) in year 2015-16. More abundance of Cyanophyceae group in summer season was recorded by Sivalingam (2018).

EUGLENOPHYCEAE:

Total 3 species were identified and detained on last position on level of supremacy. In the present investigation the seasonal numerical density of Euglenophyceae ranges from (552/l) and (504/l) in year 2014-15 and 2015-16 respectively. Richness of group Euglenophyceae given away up and downs in recorded values. Pick population observed in the month of Jan. (59/l) and it occurs least in the month of Nov. (26/l) in the year 2014-15. Just as in year 2015-16 it was pick in the month of July (58/l) and record buck in the month of Nov. (26/l). Species governance made known by species *Euglena pisciformis* was in June (106/l) and lowest in Oct. by *Euglena stellata* (27/l). Scarcity of population of this group was reported by Kathar *et al.* (2015).

In year 2014-15 the inhabitants of Euglenophyceae group exposed significant seasonal variation ($F_{2\,44}$ 12.4) ($P< 0.01$). It was lower in monsoon (33.50 ± 3.52), moderate in winter (49.50 ± 3.77) and higher in summer (55.60 ± 1.87) even as in year 2015-16 it was revealed significant seasonal variation ($F_{2\,44}$ 13.92) ($P< 0.01$). It was minimum in winter (30.25 ± 2.17), moderate in monsoon (46.50 ± 2.66) and maximum in summer (49.25 ± 3.30).

Correlation of Eulenophyceae with pH, Turb TDS, EC, CO_2, TA (one tailed) positive at year 2014-15 while same year they were Temp, DO, TH, Mg^{++} (One tailed) and Ca^{++} (Two tailed) were negative. Positively correlated parameters with Euglenophyceae were Turb, TDS, EC and pH CO_2, TA, TH (One tailed) Mg^{++} (Two tailed) even as Temp, Ca^{++} (One tailed) were negatively correlated at year 2015-16 respectively, Suresh (2015).

In both years, present study sequencing of the phytoplanktons on the basis of density in 4 groups like this, Chlorophyceae > Basillariophyceae > Cynophyceae > Euglenophyceae. The diversity and density point of view, group Chlorophyceae established abundantly. Basillariophyceae and Cynophyceae group were found modestly. Euglenophyceae observed was adequately. The density of phytoplanktons observed minimum in monsoon season due to raining, surface and agricultural runoff causing soil erosion is occurred and to end with turbidity increases, Komala *et al.* (2013). Nakana lake located at subtropical region so maximum sunlight penetrated in summer hence shows higher density in this season. Rest of season winter displayed moderate density because of minimum sunlight and temperature.

Species diversity of Euglenophyceae reported lesser but they found abundantly as compare to other groups. According to (Ghosh *et al.*, 2015) members of Euglenophyceae good biological indicators of organic pollution hence low pollution indicated by them. In present studies five organic pollution tolerant genera were listed out viz., *Oscillatoria, Chlorella, Nitzschia, Navicula* and *Euglena.* But all density of phytoplanktons was decreased at next year than earlier. So many studies have been carried out on the seasonal variations of phytoplanktons (Lokhande and Shembhekar (2009); Dalal and Nisal (2012); Sebastian and Thomas (2016).

DIVERSITY INDICES

No equal abundance and richness in every habitat, they are diverging in their relative occurrence. In particular area different kinds of organisms counting as their richness although resemblance of population of each species comprises evenness. When these above things are increases, automatically diversity increases. Diversity indices were calculated and obtained values were mention in Table- 4.

Species richness of phytoplanktons of Nakana lake was 38 at two year study period and abundance (8152) and (7656) in year 2014-15 and 2015-16 respectively. Shannon- Weiner Index was estimated in year 2014-15 (363.5157) and in year 2015-16 was (344.3082). Simpson's Dominance Index (0.0775) and (0.0429) while Simpson's Index of Diversity (0.9225) and (0.9571) ranges in between 0 to 1 in couple of year indicated that Nakana lake has richer in diversity and density of phytoplanktons. Simpson's Reciprocal Index were (12.9032) and (32.3100) whereas Margalef's Richness Index (4.1083) and (4.1372) in addition to Pielou's Evenness Index (99.9332) and (94.6529) in year 2014-15 and 2015-16 respectively. But point to noted at year 2015-16 all indices were declined except Simpson's Index of

Diversity and Pielou's Evenness Index. Some studies agree with our work Kawade and Pandharkar (2016); Singh *et al.* (2016)

4. CONCLUSION:

In wrapping up, Nakana lake wires excellent diversity and density of planktons because the lake is manmade and built on Panzara River which was originated from hills. It is eternally afar from drainage of city, garbage and industrial effluents. But anthropogenic activities increased day by day hence physico-chemical parameters exposed seasonal fluctuations. Phytoplanktons are good indicators of these changes. They strongly affected and respond rapidly against water pollution. If care is not taken Nakana lake almost immediately suffer and develops into deteriorated habitation.

REFERENCES:

1. Borics, G., Abonyi, A., Salmosa, N. and Ptacnik, R. (2021): Freshwater phytoplankton diversity: models, drivers and implications for ecosystem properties. *Hydrobiologia*, 848: 53-75.
2. Dalal, L.P. and Nisal, R.S. (2012): Diversity of fresh water algae of the Mahakali Dam (Wardha, Maharashtra, India). *Asiatic J. Biotech. Res.*, 03(10): 1479-1482.
3. Devi, M. B., Gupta, S. and Das, T. (2016): Phytoplankton community of Lake Baskandianua, Cachar District, Assam, North East India- An Ecological study. *Knowl. Manage. Aqua. Eco.* 2 (7): 1-9.
4. Dhanapathi, M.V.S.S.S. (2000): Taxonomic notes on the Rotifers from India, *Indian Asso. of Aqua. Biologists* (IAAB).
5. Edmondson, W. T. (1959): Fresh Water Biology. Ward and Whipple, 2nd Ed. John Wiley and Sons. New York. USA, 95-189.
6. Ghosh, S., Barinova, S. and Keshri, J. P. (2015): Diversity and seasonal variation of phytoplankton community in the Santragachi Lake, West Bengal, India. *Q. Sci. Connect 2012*, (3): 8-15.
7. Jain, C. K., Malik, D. S. and Tomar, G. (2018): Seasonal variation in physico-chemical and phytoplankton diversity of Alaknanda River at Garhwal region (Uttarakhand). *Int. J. Fisheries and Aqua. Studies*, 6(2): 353-357.
8. Kather, B., Chitra, J. and Malini, E. (2015): Studies on plankton diversity and water quality of Ambattur Lake, Tamil Nadu. *Int. J. Pure Appl. Zool.* 3(1): 31-36.
9. Kawade, S. and Pandharkar, A. (2016): Study of diversity indices of fish Heterogenesity of Kalu dam, Ahmednagar, Maharashtra. *Int. J. Adv. Biol. Res.* 6(1): 75-78.
10. Komala, H. P., Nanjundaswamy, L. and Devi Prasad, A. G. (2013): An assessment of Plankton diversity and abundance of Arkavathi River with reference to pollution, *Adv. in App. Sci. Res.*, 4: 320-324.
11. Lokhande, M. V. And Shembekar, V. S. (2009): Studies on phytoplankton diversity of Dhanegaon reservior, Dhanegaon, Dist. Osmanabad, Maharashtra. Shodh, *Samiksha aur Mulyankan., Int. Res. J.*, 2(7): 35-39.
12. Margalef, R., (1958): Perspective in ecological theory, Univ. Chicago Press, Chicago, USA IL-111.
13. Pielou, E.C. (1966): The measurement of diversity in different types of biological collections, *J. Theor. Bio.* 13: 131-144.
14. Rawat, R. and Trivedi, S. (2018): Seasonal Diversity of Phytoplankton in Relation to Seasonal Changes in physico-chemical Parameters of Khedi Kalan Station of Dholawad Dam of Ratlam District, M. P., *Int. J. Pure App. Biosci.*, 6 (2): 448-454.
15. Sebastian, S. and Thomas, J. V. (2016): Temporal Variation of Phytoplankton in Idukki Reservoir, Kerala., *Indian J. of Ecol.*, 43 (1): 22-27.
16. Shannon, C E., and Wiener, W. (1963): The Mathematical theory of communication, University of Illinois Press Urbana, IL, pp., 125.
17. Sharma, B. K. (2010): Phytoplankton diversity of two floodplain lakes (pats) of Manipur, North-Eastern India., *J. Threatened Taxa*, 2(11): 1273-1281.
18. Simpson, E. H. (1949). Measurement of diversity, Nature, Lond. 163, (4148) -688.
19. Singh, P. K. and Shrivastava, P. (2016): Assessment of water quality of Upper Lake, Bhopal (M.P), *Int. J. Environ. Sci.*, 7(2): 164-173.
20. Sivalingam, P. (2018): Physico-Chemical Parameters and Plankton Diversity of Manchiryal Town Lake, Adilabad District, Andhra Pradesh, India. *J. Biotech. Biores.*, 1(2): 1-3.
21. Suresh, B. (2015): Multiplicity of phytoplankton diversity in Tungabhadra River near Harihar, Karnataka (India). *Int. J. Curr. Microbiol. Appli. Sci.*, 4(2): 1077-1085.
22. Tonapi, G. T. (1980): Fresh water animals of India (an ecological approach) Oxford and IBH. Publ. Co., New Delhi, pp. 341.

FIG.-1. Map of the Study area, Nakana lake.

FIG.-2. Percent diversity of different groups of Phytoplanktons from Nakana lake

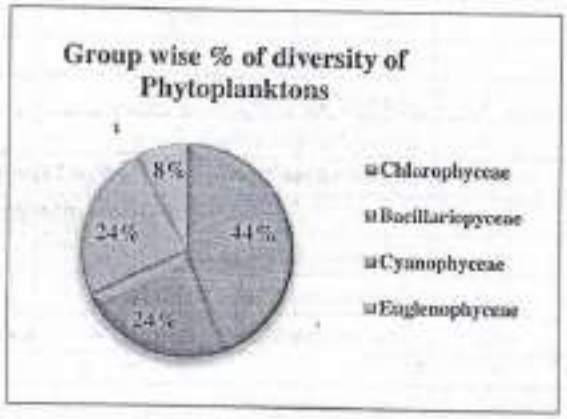

TABLE- 1. Percentage Of Diversity With Density Of Groups Of Phytoplankton.

Sr. No.	Name of Species	2014-15	2015-16
	Chlorophyceae (17)		
1	*Ankistrodesmus falcatus*	4.4	3.8
2	*Chara spp*	6.8	6.6
3	*Chlamydomonas conferta*	5.2	4.8
4	*Chlorella conglamerata*	6.7	6.7
5	*Chlorella valgoris*	5.4	4.9
6	*Cladophora spp*	6.3	5.6
7	*Closterium limneticum*	5.9	5.5
8	*Hydrodictyon spp*	4.7	4.9
9	*Micrasterias spp*	5.1	4.4
10	*Nitrela spp*	6.9	6
11	*Oedogonium patulu*	7.9	7.3
12	*Pediastrum duplex*	6.5	6.9
13	*Pediastrum simplex*	6.3	6.6
14	*Spirogyra spp*	7.3	7.8
15	*Ulothrix zonata*	6.1	6.4
16	*Volvox spp*	4.7	6
17	*Zygnema spp*	3.1	4.8
	Bacillariopyceae (9)		
18	*Bacillaria paradox*	10.1	10.8
19	*Diatom vuloare*	12.9	12.5
20	*Diatom spp*	13.5	13.4
21	*Fragillaria capurina*	13.7	13.9
22	*Navicula gracilis*	11.1	10.6
23	*Navicula viridula*	10.1	10.4
24	*Nitzschia subtilis*	10.5	10.2
25	*Pinnularia species*	9.7	9.7
26	*Synedra affinis*	8.1	8.1
	Cyanophyceae (9)		
27	*Anabaena constrict*	11.5	11.6
28	*Anacysitis spp*	11.5	11.4

29	*Lyngbya spp*	12.8	12.6
30	*Merismopedia punctata*	13.2	12.4
31	*Microcystis aerugenose*	11.8	11.2
32	*Nostoc spp*	12.8	15
33	*Oscillatoria chlorine*	4.7	3.6
34	*Oscillatoria limosa*	10.6	11.1
35	*Phormidium muciola*	10.5	10.7
	Euglenophyceae (3)		
36	*Euglena pisciformis*	49	49.8
37	*Euglena viridis*	32.8	33.5
38	*Euglena stellata*	18.1	16.6

TABLE-2. Seasonal Variations in density (Mean ± SEM) of different groups of Phytoplankton (org /l) at Nakana Lake during Feb. 2014 to Jan. 2016.

Sr. No	Groups	Study tenure	Season wise value (Mean ± SEM)			F Value	P Value
			Summer	Monsoon	Winter		
1	Total Phyto.	2014-15	759.75±21.27	646.25±2.52	634.00±25.59	12.94	**
		2015-16	736.00±19.31	586.75±11.43	591.25±23.26	20.69	*
2	Chloro.	2014-15	285.25±17.90	234.00±7.51	248.25±19.51	2.77	NS
		2015-16	295.25±16	209.50±8.88	225.50±16.45	10.29	**
3	Bacillario.	2014-15	231.75±3.75	190.75±3.19	190.25±6.79	24.13	**
		2015-16	209.50±5.69	179.25±4.75	183.25±9.02	5.94	*
4	Cyano.	2014-15	193.25±3.00	166.50±3.79	162.00±4.41	19.92	**
		2015-16	184.75±3.32	148.75±7.12	152.25±5.76	12.44	**
5	Eugleno.	2014-15	55.60±1.87	33.50±3.52	49.50±3.77	12.4	**
		2015-16	49.25±3.30	46.50±2.66	30.25±2.17	13.92	**

TABLE -3. Pearson Correlations: Phytoplankton density with abiotic parameter in Nakana lake during Feb, 2014 to Jan, 2016.

Sr. No	Para.	T. Phyto.		Chloro.		Bacillario.		Cyano.		Eugleno.	
		2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
1	Temp	-0.29*	-0.244*	-0.255*	-0.274**	-0.089**	-0.244	-0.453	-0.199	-0.124	-0.42
2	pH	0.701**	0.622*	0.650*	0.604*	0.654*	0.692**	0.643*	0.602*	0.545*	0.251*
3	Turb	0.804**	0.746**	0.746**	0.721**	0.892**	0.732**	0.651*	0.735**	0.507*	0.239
4	TDS	0.935**	0.787**	0.905**	0.780**	0.858**	0.826**	0.881**	0.702**	0.551*	0.366
5	EC	0.870**	0.790**	0.849**	0.779**	0.893**	0.815**	0.732**	0.690**	0.517*	0.426
6	DO	-0.600*	-0.580*	-0.581*	-0.564*	-0.697**	0.659**	-0.465	-0.445	-0.411	0.665
7	CO_2	0.646*	0.636*	0.578*	0.559*	0.544*	0.791**	0.636*	0.678**	0.643*	0.187*
8	TA	0.711**	0.735**	0.698**	0.697**	0.723**	0.686**	0.612*	0.680**	0.363	0.375*
9	TH	-0.951**	-0.373	0.954**	-0.407	-0.871**	-0.393	0.892**	-0.441	-0.512*	0.82*
10	Ca^{++}	-0.824**	-0.520*	0.819**	-0.523*	-0.877**	-0.560*	-0.633*	-0.515*	-0.681**	-0.024
11	Mg^{++}	-0.534*	-0.376	-0.498*	-0.361	-0.688**	-0.415	-0.32	-0.416	-0.491	0.142**

The P value for ANOVA is Non-significant if P > 0.05 (ns), significant if P < 0.05 (*), significantly significant (**) if P < 0.01 and highly significant if P < 0.001(***). At (••) Correlation is significant at the 0.01 level (two-tailed), whereas at (•) correlation is significant at 0.05 level (two-tailed).

TABLE-4, phytoplankton species richness, abundance, diversity and dominance indices of Nakana lake.

Sr. No.	Index	2014-15	2015-16
1	Species Richness	38	38
2	Species abundance	8152	7656
3	Shannon-Weiner Index	363.5157	344.3082
4	Simpson's Dominance Index	0.0775	0.0429
5	Simpson's Index of Diversity	0.9225	0.9571
6	Simpson's Reciprocal Index	12.9032	32.3100
7	Margalef's Richness Index	4.1083	4.1372
8	Pielou's Evenness Index	99.9332	94.6529

A Review on Classification of Indian Condiments

Dr. S. S. Patole*

INTRODUCTION

All over the world, India has been recognized as the home of condiments (spices). Being predominant export item spices constitute an important group of horticultural commodities which play a significant role in the national economy (Anonymous, 1988). The term condiment refers to aromatic or pungent vegetable substances used for flavoring foods and have several commercial uses (Edison, 1990). India produces most of tropical and temperate spices from Kerala to Kashmir about 2.0 million tonnes from an area about 2 million hectares and earning Rs 30,00,000 per annum from export (Anonymous, 1990). Kerala enjoys unique position in spices as it leads in black pepper, small cardamom, ginger, clove, nutmeg, vanilla and cinnamon etc. Karnataka, Tamil Nadu, Andhra Pradesh also have significant cultivation in tropical and some of subtropical spices (Pruthi, 1979). Gujarat, Maharashtra, Rajasthan, Madhya Pradesh, Punjab, Haryana, Uttar Pradesh and Bihar are famous for seed and bulb spices like fennel, coriander, cumin, fenugreek, onion and garlic. Kashmir is well known for saffron, Kalazira, celery seed, asafetida and other temperate cultivated and wild spices (Singh, 1990). Odisha shares appreciable amount of turmeric and ginger production. Sikkim and Darjeeling hills are well known for big cardamom. The north eastern state like Meghalaya, Assam and Tripura are famous for ginger and turmeric whereas the warmer valleys of north-eastern hill states are potential areas for black pepper and cardamom (Anonymous, 1989).

There are huge numbers of plants which are used as spices and these could be classified according to different systems of classification as below;

(A) Classification based on part used

This type of spices classification (table-1) facilitates the arranging of crops which may also be helpful in describing their cultivation.

(B) Classification based on climatic requirement

Plants are classified according to her stability of particular climatic zone like tropical, subtropical and temperate etc. This type of classification helps in identifying the spice crop suited to a particular climatic zone. The climatic classification is as follows;

i. **Tropical:** The tropical spices are those which require high temperature and abundant rainfall or moisture and are easily damaged by low temperature. These tropical spice plants continue their growth and production throughout the year through the intensity of production may not be equal throughout the year. Examples- Clove, nutmeg, cinnamon, kokam, galangal, small cardamom, vanilla, black pepper, ginger and turmeric etc.

ii. **Subtropical:** It is the mesothermal temperate area where three distinct seasons mainly occurs i.e. winter, summer and monsoon. Perennial plants have to resist low temperature in winter and high temperature in summer. Most of the seed spices like cumin, dill, fennel, coriander, fenugreek and bulb spices like onion and garlic are commonly grown during winter season and most of them require relatively low temperature during vegetative or early stages of growth and high temperature during

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reproductive or maturity stage. Some of the temperate spices like celery are grown during winter and tropical spices like turmeric and ginger are grown during the summer and rainy seasons.

iii. **Temperate:** These are spices which can resist low temperature or frost conditions but are easily damaged by hot weather. Seed and floral spices are grown during the summer season. Perennial temperate tree spices are mostly grown in wild and cultivated form in the western Himalayas. On limited scale they are also found in the eastern Himalayas and Nilgiri hills. Example- Saffron, kalazira, asafetida, caraway seed, celery seed, savory, caper, balam, origanum, calamus and thyme.

Table-1: Classification of spices based on part used

Part used	Name of plant (Spice)
Flower and floral part	Clove, saffron, caper, cassi bud, savory.
Fruit	Small cardamom, big cardamom, chillies.
Berry	Allspice, black pepper and juniper.
Seed	Aniseed, caraway, celery, fennel, cumin, kalazira, coriander, dill, mustard and fenugreek.
Rhizome	Ginger, turmeric, galangal, calamus.
Root	Angelica, horse-radish, lovage and calamus.
Leaves	Bayleaf, mints, marjoram, origanum, chervil, chives, basil, spearmint, tejpata, sage, savory.
Bark	Cinnamom
Bulb	Garlic, onion.
Kernel	Nutmeg
Aril	Mace
Resins	Asafetida

(C) Classification based on number of seasons required by crops

In this type of classification, the spices are grouped according to their requirement of growing season or years for life cycle or for commercial production viz annuals, biennials and perennials.

i. **Annuals:** Most of seed spices like coriander, fennel, fenugreek, cumin, caraway, dill etc are annuals since they complete their life cycle in one growing season.

ii. **Biennials:** These spices require two years or two growing seasons to complete a growth cycle. Example- onion and parsley.

iii. **Perennials:** The spice plant which normally live for more than two years are called perennials. These include herbaceous perennials - kalazira, creepers-black peppers, bulbus perennials-saffron and woody perennials-nutmeg, clvoe, cinnamon etc.

(D) Classification based on economic importance of spices

In this type of classification, the spices are classified and groups according their economic values in national and international trade. These are;

i. **Major spices:** Black pepper, small cardamom, chillies, ginger, turmeric etc.
ii. **Seed spices:** Coriander, cumin, celery, funnel and fenugreek.
iii. **Tree spices:** Clove, nutmeg, mace, cinnamon, tejpata, kokam and allspice.
iv. **Miscellaneous spices:** Garlic, saffron, vanilla, curryleaf, mint and other minor spices.

(E) Botanical classification

This type of spices classification is of value in showing relationships and gives an idea of the plant families represented as well as the important crops belonging to each of these families. These are further divided into two main sub-division or classes i.e. monocotyledonae and dicotyledonae.

Table-2: Monocotyledon families and spice plant

Family	Vernacular name	Botanical name
Araceae	Calamus	*Acorus calamus*
Iridaceae	Saffron	*Crocus sativus* L
Orchidaceae	Vanilla	*Vanilla fragrans*
Alliaceae	Chives	*Allium schoenoparasum*
	Garlic	*Allium sativum* L
	Onion	*Allium cepa* L
	Stone Leek	*Allium fistulosum* L
	Shallot	*Allium ascalonicum* L
Zingiberaceae	Ganangal	*Alpinia galangal* L
	Ginger	*Zingiber officinale* L
	Large Cardamom	*Amomum subulatum*
	Small cardamom	*Eleltaria cardamomum*
	Turmeric	*Curcuma longa* L

i. **Monocotyledonae (Monocot):** The spices in this class have one cotyledon in the embryo and flower parts, mostly in three of its multiple and parallel leaf veins. It includes the following families of spices (table-2).

ii. **Dicotyledonae (Dicot):** Spices plant of this class has two seed leaves in embryo flower parts mostly in 4, 5 or their multiples and leaves with netted veins. The following families of spice (table-3) come under this class.

Table-3: Dicotyledon families and spice plant

Family	Vernacular name	Botanical name
Capparidaceae	Caper	*Capparis spinosa* L.
Guttuferae	Kokam	*Garacinia indica* Choisy
Lauraceae	Bay leaf	*Laurus nobilis* L.
	Cassia (Cassia china)	*Cinnamomum aromaticum* L.
	Tejpatta (Indian cassia)	*Cinnamomum tamala* Nees
	Cinnamomum	*Cinnamomum zeylanicum* Blume
Leguminosae	Fenugreek	*Trigonella foenum gracum* L.
	Tamarind	*Tamarindus indica* L.
Labiatae	Balm	*Melisso officinalis* L.
	Basil	*Ocimum basilicum* L.
	Hyssop	*Hyssopus officinalis* L.
	Marjoram	*Majorana hortensis* Moench
	Mint	*Mentha arvensis* L.
	Pepper mint	*Mentha pipenta* L.
	Origanum	*Origanum vulgare* L.
	Rosemary	*Rosmarinus officinalis* L.
	Sage	*Salvia officinalis* L.
	Savory	*Satureia hontensis* L.
	Thyme	*Thymus vulgaris* L.
Myristaceae	Nutmeg	*Myristica fragrans* Hout
Myrtaceae	Allspice	*Pimenta officinalis* L.
	Clove	*Eugenia carryophyllus* Spregal
Piperaceae	Black pepper	*Piper nigram* L.
	Long pepper	*Piper longum* L.

Family	Vernacular nam	Botanical name
Rutaceae	Curryleaf	*Murraya koenigii* L
Umbelliferae	Ajowan	*Trachyspermum ammi* L
	Angelica	*Angelica archangelica* L
	Aniseed	*Pimpinella anisum* L
	Asafoetida	*Ferula assafoetida* L
	Caraway	*Carum carvi* L
	Celery	*Apium graveolens* L
	Celeriac	*Apium graveolens* var
	Chervil	*Anthriscus cerefolium* Hoffim
	Coriander	*Coriandrum sativum* L
	Cumin	*Cuminum cyminum* L
	Cumin black	*Nigella sativa* L
	Dill (Indian)	*Anethum sowa* Roxb
	Dill (European)	*Anethum graveolens*
	Fennel	*Foeniculum vulgare* Mill
	Lovage	*Lovistcum officinale* Koth
	Parsely	*Petroselinum crispum* Miller
	Kalazira	*Carum bylbocastanum* Koch
Solanaceae	Chillies	*Capsicum annum* L
	Paprika	*Capsicum annum* L
	Birdchillies	*Capsicum frutesens* L
Cruciferae	Indian brown mustard	*Brassica juncea* L
	Black mustard (True mustard)	*Brassica nigra* Koch
	White mustard (Sufai Rai)	*Brassica alba*
	Horse – radish	*Armoracia rusticana*
Compositae	Tarragon	*Artemisia dracunculus* L

REFERENCES

1. Anonymous (1988). *Status Pappers on Spices*, Spices Board, Calicut, Kerala. Pp. 1-110.
2. Anonymous (1989). *Abstracts of Papers*. International Conference on Recent Advances in Medicinal, Aromatic and spices Crops held at New Delhi, India. January, 28-31.
3. Anonymous (1990). *Recommendations of National Symposium on Onion and Garlic (Production, Marketing and Export)* held at Dr. Y. S. Parmar University of Horticulture and Forestry, Solan, India. June, 2-3.
4. Edison, S. (1990) *Indian Cocoa*, Arecanut and Spices Journal, 13-3: 124-126.
5. Pruthi, J. S. (1979). *Spices and Condiments*. National Book Trust, India, New Delhi. Pp 1-5.
6. Singh, V. B. (1990). *Fruits of North Eastern Region of India*, Wiley Eastern Ltd., New Delhi.

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Studies On Effect Of Yoga Practices On Obesity and Lipid Profile Of Rural People

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Abstract:
Background: *As an Americans In Indians obesity is the burning issue as health problems particularly in urban are About 30-70 % of urban people is either overweight or obese or has abdominal obesity. If BMI of the person is betwe 25 and 29.9 you are considered overweight and if BMI is 30 or over you are considered as obese. Generally body fa accumulated on abdomen, thighs, buttocks and breasts may generate metabolic syndrome, diabetes, hypertensi arthritis and CVD.*
Objectives: *The main aim of this study was to observe the effect of yogic practices like yogic jogging, suryanamask asanas and pranayama help to reduce BMI- obesity and correct the lipid profile with considerable health benefits.*
Method: *In this study 50 subjects between age of 20-60 years, of both sexes having overweight and obese were select by Yoga Committee and Department of Zoology, Pimpalner. These were divided in to two group viz. yoga group a non-yoga group, 25 in each group.*
Time Line- *The yogic intervention consisted of 80-90 minutes daily, 3 months at Maratha Mungal Karyalaya, Pimpaln Dhule (MH). BMI and lipid profile were observed prior to initiation yoga training and after 3 month of yoga training*
Result: *It was found that there was significantly fall in BMI, total cholesterol (TC), low density lipoprotein (LDL), Ve low density lipoprotein(VLDL), triglycerides (TG) and significant rise in high density lipoprotein (HDL) in both m and women.*
Conclusion: *Our finding indicates that yoga practices along with diet restriction is more beneficial in recovery obesity/ BMI and lipid profile.*
Keywords: *Lipid profile, Obesity, Rural people, Asanas, Pranayama, Yoga Practices.*

1. INTRODUCTION:

Presentday is age of competition and speed has increased the stresses and strains. It is resulting chang style and health problems such as obesity, diabetes, hypertension and cardiovascular diseases.

Obesity is the burning issue as an important health problem particularly in urban areas. About 30-7 adult urban is either overweight or obese or has abdominal obesity. If the BMI is between 25 and 29.9 you are con overweight and if BMI is 30 or over are considered obese. Generally body fat is accumulated on abdomen, buttocks and breasts it may generate metabolic syndrome, diabetes, hypertension, arthritis and CVD (Shukla al., 2016). Yoga is the best solution to solve the above problems by free of cost, without any side effects (Bhas Srinivasan 2015). A recent survey has suggested that 15 million Americans have practiced yoga at least one in Yoga is a way of life and an ancient discipline designed to bring parlance and health to the physical, mental, em and spiritual dimension of individual which corroborates well with the WHO definition of health. Yoga comprise aspects as *Yam, Niyama, Asana, Pranayama, Pratyhara, Dharma, Dyane* and *Samadhi* (Daljeet Singh, et al., 20 Meher Arati, et al., 2015). Hence yoga and pranayama has been incorporated in to modern medicine during decades. Yoga is the best life style modification which aims to attain the unity of body mind and spirit through th practices and meditation (Ankad, et al., 2011).

studies reported outcomes of yoga intervention for at least four weeks or more on civil population has got a signif results but some studies which are short term yoga intervention has not got a significant results (Balginder Singh 2

Studies by Jayaram Gadham et al., (2015) and Vijay Tundwala (2012) found that the BMI and lipid p can be managed in the body with the help of yogic life style intervention. In the field of physical fitness the research have recommended that the yogic practices have very positive effects on the physical and physiol variables of layperson. Therefore this study was carried out to find the effects of yoga practices on physical-BM physiological variables-lipid profile of general obese people of rural background.

2. MATERIAL AND METHODS:

STUDY DESIGN:

In this study 50 subjects between the age of 20-60 years, of both sexes having overweight and obese randomly selected by Yoga Committee and Department of Zoology, KNKP Sci. College, Pimpalner, Dhule Consent from subjects and ethical clearance was taken. Subjects were divided into two group viz. Yoga group and Yoga group, 25 in each group.

EXCLUSION CRITERIA:

We excluded the subjects with smoking, alcohol consumption, suffering from any endocrine, hepatic, disease, hypertension, diabetes, lipid metabolism disorders, CVD and heavy exercises.

YOGA TRAINING:

All subjects were asked to practice same yoga and pranayama training for a period of 3 month. The intervention consisted of 80-90 min/day, 5 days in a week in Maratha Mangal Karyala, Pimpalner, Dhule (MH),

YOGA PROTOCOL:

In pranayama they were practicing Bhastrika, Kapalbhati, Bahya, Anulom-vilom, Brahmari, Udgee Ujjayee. Asanas including Suryanamaskar and microexercises. Each class was started with Omkar chanting and mantras for 5 min followed by Yogic jogging, 2-3 standing asanas like Tadasana, Konasana, Vriksh Virbhadrasana, Katichakrasana and Suryanamaskar for 20 min. Again followed by Shavasana for 5 min.

Then all subjects were practicing Pranayama Bhastrika for 5 min, Kapalbhati for 5 min followed by like Shalabhasana. Bhujangasana, Dhanurasana for 5 min.

Again they were practicing Anulom-vilom for 5 min followed by Asanas like Markatasana, Uttanpa Pavanmuktasana, Setubandhasana, Halasana, Servangasana for 10 min.

Again pranayama Bahya 2-3 min, Ujjayee 2-3 min, followed by microexercises and sitting asan Mandukasana, Shasakasana, Ardhachandrasana, Ustrasana for 15 min.

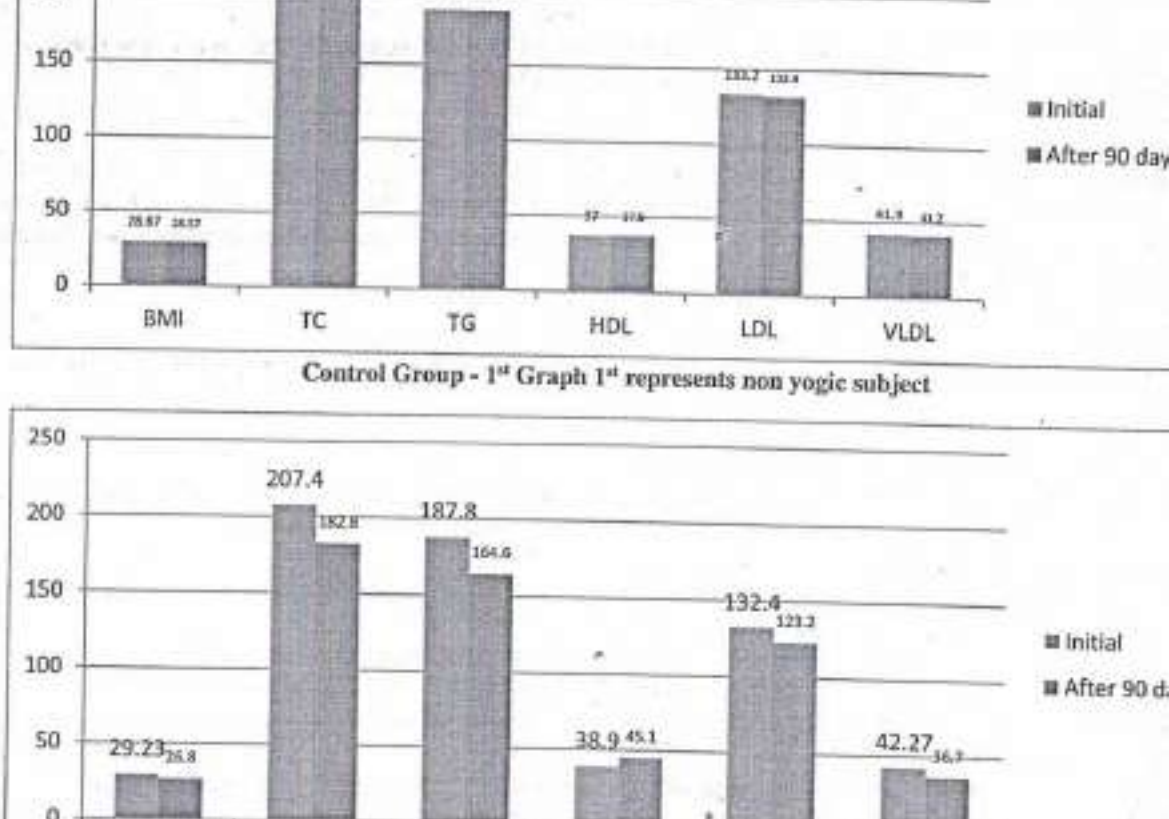
Brahmri 2-3 min, Udgeeth 2-3 min followed by Sihasana, Hashyasana 2-3 min and finally one day cl completed with 5 min Shavasana at the end.

SAMPLE COLLECTION:

Weight and height for BMI and estimation for lipid profile were observed prior to initiation yoga traini after 3 month of yoga training. The fasting venous blood samples were drawn from the study subjects at the be and after 90 days of yoga training for analysis of lipid profile.

Table -I Effect of Yogic practices in Pre-obese and Obese rural subjects on BMI, TC, TG, HDL, LDL and VLDL.

Variables	Mean Values					
	Control Group-1 (n=20)			Yoga (Expt.) Group -2 (n=20)		
	Initial	Final (After 90 days)	% Relief	Initial	Final (After 90 days)	% Relief
BMI	28.67	28.57	0.34 % NS	29.23	26.8	2.83 % *
TC	208.2	208.0	0.1o % NS	207.4	182.8	11.86 % *
TG	186.6	186.2	0.21 % NS	187.8	164.6	12.35 % **
HDL	37.00	37.6	-1.62 % NS	38.9	45.1	15.93 % **
LDL	133.2	132.4	0.60 % NS	132.4	123.2	6.94 % *



Control Group - 1st Graph 1st represents non yogic subject

Yoga (Expt.) Group -2nd Graph 2nd represents effects of yogic practices after yoga

The results of pre-obese and obese rural subjects on BMI, TC, TG, HDL, LDL and VLDL of control and exper groups are represented in Table-1. Their values are represented in Graph-1 (Control Group) and Graph-2 (Experimental g

This study show improvement in BMI in the study group which was at pre yogic treatment 29.23 and after 3 yoga therapy was 26.8 (2.83 % *) it was statistically significant. The results of this study are consistent with Shukla R (2016) they had observed BMI reduction from 31.54 to 30.77 ($p<0.001$) after yogic life style in pre-obese and obese subj

Similarly Nandre Y. M. et al., (2018), Seema Patel and Kamalhya Kumar (2016), Jayaram Gadham et al., (Vijay Tundwala et al., (2018). Studied effect of yoga asanas including pranayama by conducting 6 weeks to 12 weeks yog program and they observed significant reduction in body mass index, reduction in the blood serum level on TC, TG, LDL

In this study lipid profile i.e. total cholesterol decreased from 207.4 mm/dl to 182.2 mm/dl (11.86% *) trig decreased from 187.8 mm/dl to 164.6 mm/dl (12.35% **), HDL increased from 38.9 mg/dl to 45.1 mg/dl (15.93% decreased from 132.4 mg/dl to 123.2 mg/dl (6.94 % *), VLDL decreased from 42.27 mg/dl to 36.7 mg/dl (13.17% **). All results in the study group after 3 months are significantly improved. Pai A et al., (2011) also have observed a significant in BMI ($p<0.04$) after 6 months of yoga intervention and observed the significant decreases in TC, TG, LDL and also Body and DBP.

Result of this study consistent with following studies, Abhishek Chaturvedi et al., (2015) observed the biochemic in perimenopausal in women that significant decreases TC ($p=0.06$), LDL ($p=0.04$), Fasting blood sugar ($p=0.05$) and sig increases TC/HDL ratio ($p=0.002$) and TSH. Similarly BV Surendra (2014) also found statistical significant improvemen profile that was reduction in TC, TG, LDLand VLDL and significant elevation of HDL in 3 months study.

The short term study (30 days) of P. Leela et al., (2013) also showed improvement in lipid profile as TC, T decreased and HDL increased. The long term study (2 Years) of Meher Arati et al., (2015) also found that there was signifi in HDL and significant fall in TC, TG, LDL, and VLDL in both men and women.

REFERENCES:

1. Shukla Ravi, Singh Girish and Gehlot Sangeeta, (2016): How obese individuals respond to paschimottanasa kapalbhati on body fat, visceral fat and lipid profile. *World J. of Pharmacy and Pharmaceutical Sciences,* Issue 1, 595-607.
2. Bhaskar A. and M. V. Srinivasan (2015): Effect of Pranayama and Yogasnas on Apolipoproteins, lipid prof Atherogenic Index in Healthy Subjects. *Int. J.of Recent Research and Applied Studies,* Vol. 2, Issue 8(3), 1
3. Daljeet Singh and Monika Verma, (2014): Effect of yogic life style intervention on lipid profiles o background sportsman. *Int. J. of Education and Sci. Reasearch,* Vol. 1, Issue 3, 13-16.
4. Meher Arati, Priydarshini Arpita and Mohanty Arati, (2015): Effect of Yoga on Serum Lipid Profile in healthy volunteers. *Int. J. of Contemporary Med.Reasearch,* Vol. 2, Issue 5, 1277-1281.
5. Ankad RB, et al., (2011): Effect of short term pranayama and meditation on cardiovascular functions in individuals, *Int. J. of Yoga,* 12 (2), pp.58-62.
6. Archana Mandape, Jyotsana Bharshankar, Mrunal Phatak, (2015): Effect of Raja Yoga Meditation on tha Profile of Healthy Adults in Central India. *JHMS Vol: 01, Issue:01, pp 10-13.*
7. Maini S, Kaur H, Kohli PG, (2014): Effect of Raja Yoga Meditation on Serum Cholesterol and HDL. *IJMD 490-496.*
8. Seema Patel & Kamakhya Kumar, (2016): A study on the effect of yoga and diet control on the BMI and chol level of the obese youth. *Int. J. of Sci. and Conciousness, 2(1), 13-17.*
9. Abhishek Chaturvedi, et al., (2015): Efficacy of yoga in balancing the deranged biochemical profile in perimenopausal women hailing from south Kanara district of Karnataka, India. *Asian J. of Biomedic Pharmaceutical Sci. 5(45), 20-25.*
10. Shete Sanjay Uddhav, Thakur Ghanshyam Singh, Kulkarni D. D., (2012): Residential Yoga and Diet o Profile in Police Officers. *Int. Res. J. of Pharmacy, 3 (9), pp 155-158.*
11. Baljinder Singh Bal, (2015): Short-Term Effects of Kapalbhati Pranayama on Hematological Parame Retrospective Cross-Sectional Study. *Education of Linguistics Research, Vol. 1 No.1, pp 43-53.*
12. Jayaram Gadham, Srikanth Sajja, V. Rooha, (2015): Effect of yoga on obesity, hypertension and lipid prof *J. Res Med Sci. 3(5): 1061-1065.*
13. Vijay Tandwala, R. P. et al., (2012): A study on effect of yoga and various asanas on obesity, hypertensi dyslipidemia. *Int. J. of Basic and Applied Med. Sci. Vol.2(1),pp93-98.*
14. Nandre Y. M. & More B. C. (2018): Efficacy of cow urine and yoga practices to reduce the obesity and sup practice for rural cow keepers. *JRD Vol.08(special Issue06)pp 65-73*
15. Pal A, et al., (2011): Effect of yogic practices on lipid profile and body fat composition in patients of c artery disease. *Complement Ther Med. 19(3):122-7.*
16. BV Surendra (2014): Effect of Pranayana and Yogasanas on Lipid Profile in Normal Healthy Volunteers.*In Clinical Biomedical*
17. P.Leela, C. R. Mallikarjun, M. Prafulla & Swapnali, (2013): Effect of Pranayama and Yoga on Apolipo Lipid profile and Atherogenic index in Healthy subjects.*An Int. Res.J.of Pharmacy and Plant Sci. Vol.1(2),*

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A Review on natural enemies as biological control agents of agricultural importance

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Abstract :

Biological control is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms. It relies on predation, parasitism, herbivory, or other natural mechanisms. It can be an important component of integrated pest management (IPM) programs. There are three basic strategies for biological pest control i.e. classical (importation), where a natural enemy of a pest is introduced in the hope of achieving control; inductive (augmentation), in which a large population of natural enemies are administered for quick pest control; and inoculative (conservation), in which measures are taken to maintain natural enemies through regular reestablishment. Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids and pathogens. Whereas biological control agents of weeds include seed predators, herbivores and plant pathogens.

Keywords: Natural enemies, predation, parasitism, integrated pest management.

Aims and objectives :

- Biological control is the beneficial action of parasites, pathogens, and predators in managing pests and their damage.
- Biocontrol provided by these living organisms, collectively called "natural enemies," is especially important for reducing the numbers of insect pest and mites.

Introduction :

The term "biological control" was first used by Harry Scott Smith at the 1919 meeting of the Pacific Slope Branch of the American Association of Economic Entomologists, in Riverside, California.[1] It was brought into more widespread use by the entomologist Paul H. DeBach (1914–1993) who worked on citrus crop pests throughout his life.[2,3] However, the practice has previously been used for centuries. In 1905 the USDA initiated its first large-scale biological control program, sending entomologists to Europe and Japan to look for natural enemies of the gypsy moth, Lymantria dispar dispar, and brown-tail moth, Euproctis chrysorrhoea, invasive pests of trees and shrubs. As a result, 9 parasitoids of gypsy moth, 7 of brown-tail moth, and 2 predators of both moths became established in the US. Although the gypsy moth was not fully controlled by these natural enemies, the frequency, duration, and severity of its outbreaks were reduced and the program was regarded as successful. This program also led to the development of many concepts, principles, and procedures for the implementation of biological control programs. [4,5,6] Prickly pear cacti were introduced into Queensland, Australia as ornamental plants, starting in 1788. They quickly spread to cover over 25 million hectares of Australia by 1920, increasing by 1 million hectares per year. Digging, burning and crushing all proved ineffective. Two control agents were introduced to help control the spread of the plant, the cactus moth Cactoblastis cactorum, and the scale insect Dactylopius. Between 1926 and 1931, millions of cactus moth eggs were distributed around Queensland with great success, and by 1932, most areas of prickly pear had been destroyed. [7] The first reported case of a classical biological control attempt in Canada involves the parasitoidal wasp Trichogramma minutum. Individuals were caught in New York State and released in Ontario gardens in 1882 by William Saunders, for controlling the invasive currant worm Nematus ribesii. Between 1884 and 1908, the first Dominion Entomologist, James Fletcher, continued introductions of other parasitoids and pathogens for the control of pests in Canada. [8]

Biological control agents :

1. Predators :

Predators are mainly free-living species that directly consume a large number of prey during their whole lifetime. Given that many major crop pests are insects, many of the predators used in biological control are insectivorous species.

- Lady beetle, and in particular their larvae which are active between May and July in the northern hemisphere, are voracious predators of aphids, and also consume mites, scale insects and small caterpillars. The spotted lady beetle (Coleomegilla maculata) is also able to feed on the eggs and larvae of the Colarado potato beetle (Leptinotarsa decemlineata).
- The larvae of many hoverfly species principally feed upon aphids, one larva devouring up to 400 in its lifetime. Their effectiveness in commercial crops has not been studied.
- Several species of entomo-pathogenic nematode are important predators of insect and other invertebrate pests. Entomopathogenic nematodes spread in the soil and infect suitable insect hosts.
- For rodent pest like rats and bandicoots, the Cats are effective biological control. Barn owls are also sometimes used as biological rodent control.

2. Parasitoids :

- Parasitoids lay their eggs on or in the body of an insect host, which is then used as a food for developing larvae. The host is ultimately killed. Most insect parasitoids are wasps or flies, and many have a very narrow host range. The most important groups are the
- Ichneumonid wasps, which mainly use caterpillars as hosts;
- Braconid wasps, which attack caterpillars and a wide range of other insects including aphids;
- Chalcid wasps, which parasitize eggs and larvae of many insect species;
- Tachinid flies, which parasitize a wide range of insects including caterpillars, beetle and larvae, and true bugs.
- Trichogramma is a genus of minute polyphagous wasps that are endoparasitoids of of insect eggs. Trichogramma is one of around 80 genera with over 200 species worldwide

There are a number of recent studies pursuing sustainable methods for controlling urban cockroaches using parasitic wasps. Since most cockroaches remain in the sewer system and sheltered areas which are inaccessible to insecticides, employing active-hunter wasps is a strategy to try and reduce their populations.

3. Pathogens :

Pathogenic micro-organisms include bacteria, fungi and viruses. They kill their host and are relatively host-specific. Various microbial insect diseases occur naturally, but may also be used as biological pesticides. Following are few examples of pathogens.

a) **Bacteria:** Bacteria used for biological control infect insects via their digestive tracts, so they offer only limited options for controlling insects with sucking mouth parts such as aphids and scale insects.

i. Bacillus thuringiensis, a soil-dwelling bacterium, is the most widely applied species of bacteria used for biological control, with at least four sub-species used against Lepidopterans (Moth, butterfly), Coleopteran (beetle) and Dipteran insect pests. The bacterium is available to organic farmers in sachets of dried spores which are mixed with water and sprayed onto vulnerable plants such as brassica and fruit trees like cotton etc.

ii. The bacterium Paenibacillus popilliae which causes milky spore disease has been found useful in the control of Japanese beetle, killing the larvae. It is very specific to its host species and is harmless to vertebrates and other invertebrates.

b) **Fungi:** Green peach aphid a pest in its own right and a vector of plant viruses, killed by the fungus Pandora neoaphidis. Entomopathogenic fungi, which cause disease in insects, include at least 14 species that attack aphids. Beauveria bassiana is mass-produced and used to manage a wide variety of insect pests including whiteflies, thrips, aphids and weevils.

c) **Viruses:** Baculoviruses are specific to individual insect host species and have been shown to be useful in biological pest control. For example, 1) the Lymantria dispar multicapsid nuclear polyhedrosis virus has been used to spray large areas of forest in North America where larvae of the gypsy moth are causing serious defoliation. The moth larvae are killed by the virus they have eaten and die, the disintegrating cadavers leaving virus particles on the foliage to infect other larvae. 2) A mammalian virus, the rabbit haemorrhagic disease virus was introduced to Australia to attempt to control the European rabbit populations.

References :

1. Harry Smith Fund. Biological Control: Archived from the original on 21 April 2017. Retrieved 2 March 2017.
2. Inventory of the Paul H. DeBach Papers, 1921–1989 (bulk 1955–1980)". Online Archive of California. Archived from the original on 8 April 2017. Retrieved 7 April 2017.
3. DeBach P., Hagen K. S. (1964). P. DeBach (ed.). Manipulation of entomophagous species. Biological control of insect pests and weeds. Reinhold. pp. 429–458.
4. Coulson, J. R.; Vail, P. V.; Dix M.E.; Nordlund, D.A.; Kauffman, W.C.; Eds. 2000. 110 years of biological control research and development in the United States Department of Agriculture: 1883–1993. U.S. Department of Agriculture, Agri. Res Serv. 3–11.
5. History and Development of Biological Control (notes) (PDF). University of California Berkeley. Archived (PDF) on 24 November 2015. Retrieved 10 April 2017.
6. Reardon, Richard C. Biological Control of The Gypsy Moth: An Overview". Southern Appalachian Biological Control Initiative Workshop. Archived from the original on 5 September 2016. Retrieved 10 April 2017.
7. The Prickly Pear Story (PDF). Department of Agriculture and Fisheries, Queensland. Archived (PDF) from the original on 10 June 2016. Retrieved 7 June 2016.
8. McLeod J. H., McGugan B. M., Coppel H. C. (1962). A Review of the Biological Control Attempts Against Insects and Weeds in Canada. Technical Communication No. 2. Reading, England: Commonwealth Agricultural Bureau.

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"DIVERSITY OF GASTROPODS IN THE BORI RIVER DAM, AT TAMASWADI, TAL- PAROLA, DISTRICT JALGAON (MS), INDIA".

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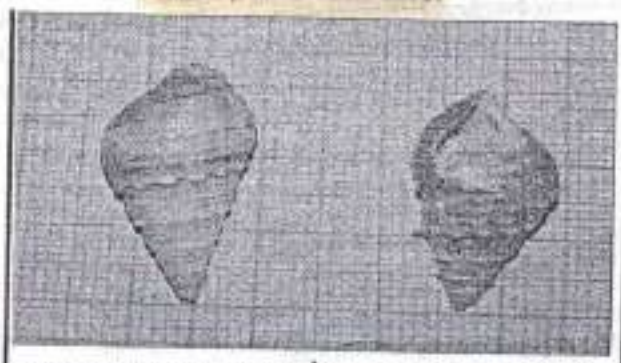
ABSTRACT

Freshwater Gastropods diversity and its abundance status were studied from Bori river dam, Tamaswadi, Tal-Parola, District Jalgaon. The Snails and slugs were collected during the tenure of academic year 2001-2002. The samples were collected at every month from Two different sites of Bori river dam. A total of 10 Gastropod species were recorded throughout the year, which belonged to 4 orders, 7 families and 8 genera. Maximum species were collected in winter season at both sites and the dominant order was found to be Basommatophora.

KEYWORDS: Gastropoda diversity, Bori river dam, Jalgaon.

INTRODUCTION:

Molluscs are extremely important communities among other ecological communities. They constitute the second largest invertebrate and



most successful group next only to insects, (Abbott, 1989; Bouchet, 1992). Basically all molluscs are aquatic but they move on the land and still dependent on a moist ground, in an excess of hot(summer) or cold(winter) dry climate they enter in the state of aestivation and hibernation respectively for about 2 to 3 years without any arousal. The Phylum Mollusca are classified into seven classes viz. Aplacophora, Polyplacophora, Monoplacophora, Gastropoda, Scaphopoda, Pelecypoda, and Cephalopoda. Gastropoda is the largest class having approximately 85,000 to 1,00,000 species are recorded throughout the world (Hyman, 1967; Strong et al., 2008). The molluscan diversity all over the world of molluscan species recorded in the terrestrial ecosystem (24503) and fresh water ecosystem (8765). Out of these only 171 species of Gastropods are recorded (Punithavelu and Raghunathan, 2005). The malacofaunal check list and considerable work has been done from Abroad (Todd and Gary, 1990; Ruano, 1997). The information available on molluscan species diversity in India is not in focused, hence chosen for study.

They are beneficial to man from their ancient time by both way economically and medicinally (Wosu, 2003). Like all animals, the molluscs are not considered by men to be either useful or destructive. Gastropod plays an important role in balancing the nature. The shells were used in Unani and Ayurvedic medicine system and for meditation, in the production of humus, in the control of fungi, algae, lichens and also as predators and parasites; but, in nature the molluscs are hunted and eaten by predators (Ahirrao, 2003).

In scientific studies, molluscs are important in study of drug action on heart, hormones, enzymes and antitoxins-especially in relation to immunological hematology. These are suitable bio-indicators for some radio-active and chemical pollution in the coastal areas of water bodies. The snails and slugs are important to man because of the damage they do in agriculture, horticulture and forestry. Furthermore, they are of

importance in medical and veterinary practice, since they serve as intermediate host for certain parasitic worms of man and domestic animals viz. Schistosome parasites (Ahirrao, 2003).

MATERIALS AND METHODS:

Study area:

Bori river dam is 20 km away from Parola, Tal-Parola, District-Jalgaon(MS) India. It is an earthen dam, having height of the dam above lowest foundation is 66 feet and the length is about 11040 feet. The average rainfall ranges from 77 cm to 80 cm. The major rivers passing from Parola city is the Bori and other tributaries. The average minimum temperature 10° to 12 °C and maximum temperature was 42° to 45 °C of the year. The longitude and the latitudes of Parola are 20.8822 °N 75.1253 °E respectively.

Fig:-1. Map Showing Study area Bori river dam, Tamaswadi, near Parola, Dist-Jalgaon MS, India.

SAMPLING AND PRESERVATION:

The Molluscan species were collected from Bori river dam, Tamaswadi, Tal-Parola District-Jalgaon. All specimens were brought to the laboratory, washed thoroughly and preserved in 4% formalin. The shells were dried at room temperature, and then separated and kept in separate tray. Identification was done (Preston, 1915; Rao, 1989; Tonapi, 1980). The unidentified molluscan shells are identified and classified up to species level by Zoological survey of India, Pune, Maharashtra State, India. Data were collected at every month from April 2001 to Mar 2002.

DATA ANALYSIS:

At every month four quadrate (1 X 1m) were sampled from two different sites and the average of those were considered as abundance/rareness shown in the table no.1:

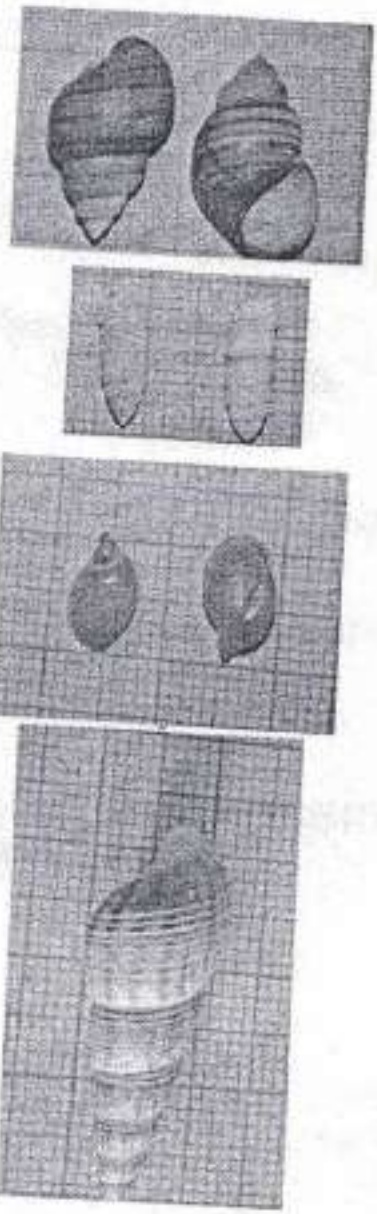


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Table: 1: The Gastropoda specimens found in the Bori river dam, Tamaswadi, Parola, Dist-Jalgaon

Order	Super Family	Family	Sr No	Name of the snail	Freque./ Abund.
Meso-gastropoda	Cerithioidea	Thiaridae	1	*Thiara lineata*	+++
			2	*Thiara tuberculata*	++
		Viviparidae	3	*Bellamya bengalensis*	+++
Basomma-tophora	Planorboidea	Planorbidae	4	*Indoplanorbis exustus*	++
			5	*Gyraulus sp.*	++
	Lymnaeoidea	Lymnaeidae	6	*Lymnea accuminata*	++
			7	*Lymnaea luteola*	+
Stylomma-tophora	Veronicelloidea	Veronicellidae	8	*Leviculis alte alte*	++
		Cerrastidae	9	*Cerrastus mossonianus*	++
Pulmonata	Achatinoidea	Sublinidae	10	*Zootecus insularis*	+

Where, + = Less no. of animals found in the above collection site;
++ = Moderate number of animals;
+++ = Abundant animals are available throughout the year.

RESULTS AND DISCUSSION:

During the study period, total 10 species were recorded from Bori dam, Tamaswadi during April 2001 to Mar 2002, which belongs to 4 orders, 7 families and 8 genera. Class Gastropoda, possesses 4 orders i.e. Basommatophora, Mesogastropoda, Stylommatophora and Pulmonata. Mesogastropoda incudes 2 families, Thiaridae and Viviparidae. Out of which the family Viviparidae has one species and Thalaridae includes 2 species. Basommatophora with 2 families i.e. Lymnaeidae and Planorbidae have two species each. Stylommatophota has two families Veronicellidae and Cerrastidae each with single species while Order Pulmonata has only one family Sublinidae include, Zootecus insularis.

Among all these specimens Thiara lineata and Bellamya bengalensis species were abundanant throughout the year. Because the members of family Thiaridae and Viviparidae are quick colonizers, tolerant to habitat diversity and variability due to a very strong and thick shell. Many forms are parthenogenetic females capable of multiplication in a short time and Thiaridae as the most persistent and abundant macro-invertebrate family, Contreras-Arquieta (1998).

A number of workers have carried out their studies on various species of snails from different part of the country. The existence of molluscs is highly necessary because they constitute food for many aquatic organisms (Subba Rao, 1989 and 2003; Begum and Narayana, 2006). Sharma et. al., (2013) studied bottom sampling for 12 months from the banks of the stream and registered a total of 11 species of mollusca, while Patil et. al.,(2016) Studied, Malacofaunal distribution, abundance and diversity of the Nakane Lake reported 13 species of molluscs, out of which 10 species are Gastropods and 3 species of Pelecypods, belongs to 4 orders and 10 families and 12 genera.

CONCLUSION:

In general, the present study revealed that species abundance and diversity of molluscans species depends upon rich ecosystem of Tamaswadi dam. All recorded molluscan species are indigenous.

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REFERENCES:

1.Abbott, R. T.(1989):Compendium of landshell . American Malacologists, Burlington, M.A.

2.Ahirrao, K. D. (2003): Effects of sevin on some ecophysiological aspects of a Melanoid snail, Melania scabra. Ph. D. Thesis submitted to Dr. BAMU, Aurangabad.

3.Begum and Narayana J. (2006). Animal diversity of four lentic water bodies in and around Davangare city, Karnataka, J. Aqua. Bio. 21(2):13-18.

4.Bouchet, P. (1992). Extinction and preservation of species in the tropical world: What future for Molluscs? American Conchologist: 20; 20-24.

5.Contreras-Arquieta, A. (1998). New record of snail Melanoids tuberculata (Muller, 1774) (Gastropoda: Thiaridae) in the Cuatro Cienegas Basin, and its distribution in the state of Coahuila, Mexico. Southwest Nat. 43(2): 283-286.

6.Hyman, L.H., (1967): The invertebrates Vol.6. Mollusca, 1, McGraw Hill, New York.

7.Patil, M. U., S. S. Patole, S. S. Bhoi and K. D. Ahirrao (2016): Malacofaunal distribution, abundance and diversity of the Nakana Lake, Dhule (MS) India, Journal of research in biology, vol-6(2): 1977-1983.

8.Prestone, H. B.,(1915): The fauna of British India including Ceylon and Burma. Mollusca (Freshwater Gastropoda and Pelecypoda). Taylor and Francis, Landon, pp i-xi+ 244.

9.Punithavelu, V.R. and Raghunathan, M.B. (2005). Taxonomy and diversity of freshwater gastropods (Mollusca) from southern India. Pro. Nat. Conf. on Wetland Biodiversity, Pp.26-27

10.Rao, S. N. V. (1989): Freshwater Mollusca of India. In. Rao K.S. (ED.). Recent advances in freshwater Biology. New Delhi. Anmol Publication. 2: 187-202.

11.Ruano, F.D.L. (1997). Fisheries and farming of important marine bivalves in Portugal. NOAA Tech. Rep. NMFS, 129:191-200.

12.Sharma, K. K., Komal Bangotra and Minakshi Saini(2013): Diversity and distribution of Mollusca in relation to the physic-chemical profile of Gho-Manhasan stream, Jmmu(J & K). Journal of Biodiversity and Conservation Vol5(4), pp 240-249,

13.Strong, E.E., O. Gargominy, W. F. Ponder and P. Bouchet (2008) : Global diversity of Gastropods(Gastropoda; Mollusca) in freshwater. Hydrobiologia 595: 149-166.

14.Subba Rao, N. V. (1989): Handbook: Freshwater molluscs of India, Zoological Survey of India, Calcutta.

15.Subba, Rao, N. V., (2003). Molluscan checklist of Ghodaghodi Tal area, Kailali Distict, Our Nature, 1: 1-2.

16.Todd, A.C., and Gary, D.S. (1990). Factors determining population density and size distribution of a freshwater snail in streams: effect of spatial scale. OIKOS. 59:359-367.

17.Tonapi, G. T., (1980): Freshwater animals ofindia. An Ecological Approach. Oxford and IBH publishing co., New Delhi, Bombay, Calcutta 341pp.

18.Wosu, L.O. (2003) : Commercial snail farming in West Africa- A guide. Ap. Express Publishers, NSukka - Nigeria.

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Effects of Silver Coated Paper Dishes on Growth, Reproduction, Nutrient Content and Bioaccumulation of Earthworm Species, *Eudriluseugeniae*kinberg, 1867.

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ABSTRACT : In hotels, restaurants, birthday parties, marriage ceremony etc. Silver coated thin polythene paper dishes are commonly used. Afterwards they are thrown along with food waste near road side or in the dumping ground. Silver has antibacterial property which may hinder the process of bacterial decomposition. Therefore, efforts are made to find out possible way of decomposition of Silver coated thin polythene paper dishes and food waste along with soil, cow dung earthworm and microbes. Also effect of Ag^{++} on earthworm for 60 days of experiment. The results revealed that silver coated paper dishes do not much affecting the growth and mortality of worms but they decrease the rate of reproduction. Significant increase in macronutrients viz., N, P, andK is observed in all the composting beds as compare to control. The maximum NPK is recorded in composting E_5 bed with biocatalyst, *Aspergillusniger* and earthworms.

In bioaccumulation experiment earthworms are very well adapted for accumulation of silver in their body. Composting bed with biocatalyst (mixture of decomposing bacteria), *A.niger* and earthworm, *Eudriluseugeniae*was found to be polythene degradation potential. Significant decrease in weight of thin polythene was observed in E_5 as compare to E_1, E_2, E_3 and E_4 composting beds

KEYWORDS: Earthworm, Biocatalyst, *Aspergillusniger*, Nutrients, Bioaccumulation, Polythene degradation, etc.

I. INTRODUCTION

Silver is a transition metal element whose medicinal use as antimicrobial agent has been documented since 1000 B.C. It is used as a health additive in traditional Chinese and Ayurvedic medicine et al. [1].Nowadays, the burgeoning nano-technology industry is quickly producing nano-material that is being incorporated into consumer product. A list of more than 500 consumer products that claim to include some form of engineered nano-particles.[2]. Of these, about 20% contain silver nano-particle e.g. socks, paints, bandages and food containers etc are incorporate with nanosilver (n-Ag) to exploit its antimicrobial properties.et al. [3].

Annually around 3 lac kg of silver waste enters in ecosystem worldwide. It is expected that 20 tones ofbiocidal silver will enter terrestrial ecosystem and 20 tons of it will be discarded into European water ways by 2020 A.D. Silver is a known toxin and nanosilver has enhanced human and environmental toxicity. The USEPA (United State of Environmental Pollution Agency) views silver in surface waters as a "Priority pollutant", and after mercury it is the most toxic metal to aquatic organism. It is also toxic to important soil organisms and micro-organisms in sewage treatment plants [4].

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Earthworms are useful to clean up the soil from various pollutants like heavy metals [5].and are able to accumulate heavy metal in their tissues from the surrounding soil and might be reduces toxicity et al. [6]. Adverse effect of Ag-nano particles and Ag-ions on reproduction, growth and mortality on*E. foetida*. They also reported that Silver can readily bioaccumulate in aquatic organisms. Depending on age, size, sex, health and metabolism; the gastropods and arthropods can also bioaccumulate silver in their bodieset al. [7].

Silver has some potential toxic effects on beneficial soil microorganisms, which play a major role in nitrogenfixation microbes like ammonofying bacteria and chemolithotrophic bacteria in soil communities. These organisms deliver many crucial nutrients which are most essential in soil formation [8]. These soil bacteria can play key role in N_2 fixing and the breakdown of organic matter. These bacteria also form symbiotic relationship with legumes plants, which provide a major source of fixed nitrogen for individual as well as other plants. Silver disturbs denitrification processes leading to ecosystem disruption. Environmental denitrification is important because excess nitrates can reduce plant productivity, which results in eutrophication in water bodies' viz., rivers, lakes and marine ecosystem and acts as drinking water pollutants [9].

The treatment centers are typically not properly designed to remove nanoparticles. Therefore, sewage sludge may contain silver NPs. In many countries; sewage sludge is dried and applied as a fertilizer e.g. in Germany, every year about 2 million tones of dry sewage sludge is used as a fertilizer et al. [10]..

Bacteria are the smallest and most abundant microbes in the soil. A gram of soil may contain billions of bacteria. Most live in the top cover of soil up to 10 cm depth where organic matter or leaf litter is present. Among soil bacteria,*Bacillussubtilis*and*Pseudomonas fluorescens* are acts as the decomposers. Whereas *Rhizobium, Azotobacter, Agrobacterium* and*Azospirillum*etcare N_2 fixing bacteriaset al. [11].A fungi species, *Aspergillusniger* has been reported to show biodegradation in plastics and polythene [12]. During the last 2-3 decades, plastic materials have gained widespread use as they have been increasingly used in food, clothing, shelter, transportation, construction, medicine, etc. They are resistant to biodegradation. A general estimate of worldwide plastic waste generation is annually about more than 55 million tons et al. [13]. Kathiresan[14] (2003) has reported that the high diversity of microorganisms in mangrove soil is capable of degrading plastics, at a slower rate.

Currently scanty information is available regarding the effect of silver on growth, reproduction and bioaccumulation of earthworm. Similarly effect of microbial inoculation and *Aspergillusniger*(fungi) on decomposition and degradation of thin polythene of silver coated dishes. Hence, in present study our aim is to find out the effect on growth, nutrient content, bioaccumulation of silver by earthworm and determining the ability of *A. niger* to degrade the thin polythene

II.MATERIAL AND METHODS

Earthworm species, *Eudriluseugeniae* was obtained from State Government agriculture nursery, Sakri, Dist-Dhule (M. S.). In the laboratory, the stock culture was maintained in the plastic container using partially decomposed bio - waste and cow dung as a growth medium. Only healthy adult worm having well developed clitellum were used for the vermicomposting experiment. The silver coated paper dishes were purchased from local market. The natural soil and a month old cow dung (CD) were collected from agriculture field and cow shed respectively.

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Experimental set up

The experiment was performed in small plastic tough having 2 Kg capacities. Each tough contain about 1 kg biowaste including soil. The details of groups were shown in table 1.

Table - 1

Sr. No.	Groups	Composting beds
1	Control	Soil 40% + CD 30% + food waste 20% + 10% Paper
2	Expt 1	Soil 40% + CD 30% + food waste 20% + 10% SCD
3	Expt 2	Soil 40% + CD 30% + food waste 20% + 10% SCD + 2gm Biocatalyst
4	Expt 3	Soil 40% + CD 30% + food waste 20% + 10% SCD + *A. niger*
5	Expt 4	Soil 40% + CD 30% + food waste 20% + 10% SCD + 20 worms
6	Expt 5	Soil 40% + CD 30% + food waste 20% + 10% SCD + Biocatalyst + *A. niger*+ 20 worms

CD = Cow dung, SCD = Silver coated dishes

All the material in each composting bed was mix thoroughly with water and kept for 60 days. To maintain humidity (75 ± 5 %) water was sprinkled at the interval of 3 to 4 days and the bed was covered by gunny bags to prevent evaporation and protect the worms from predators. Small holes were drilled at the bottom of each tough for good drainage. All the beds were kept under shed to avoid the direct sunlight

Worms counting and cast analysis

At the end of experiment period of 60 days, bed were removed from tough and it was sun dried for 1-2 days by making heaps, all worms going at the bottom. On third day the worms were separated and counted. The results are shown in table - 2. The percent increase in the number of earthworms was determined by the formula [15].given below:

$$\% \text{ increase} = \frac{\text{Earthworm counted} - \text{worms introduced}}{\text{Earthworms counted}} \times 100$$

Similarly the worm cast was collected and subjected for nutrient analysis at Shetjamin laboratory, SatanaDist-Nasik (M.S.). The total nitrogen (N %) was estimated by Kjeldahl digestion and distillation method [16]. Diacid of sample was carried out using concentrated HNO_3 and $HClO_4$ mixed in 9:4 ratios. The digested extracts were used to determine total K^+ using Flame photometer [17]. Whereas phosphorus (P) and silver bioaccumulation from soil and earthworm were measured by using atomic adsorption spectrophotometer i.e. AAS [18]. The results were calculated and analyzed statistically and data is presented in the table 2.

III. RESULT AND DISCUSSION

Earthworm counting: Growth, reproduction, nutrient content and bioaccumulation of silver etc are presented in table-2. From this table it was noticed that, the maximum number of worm'si.e 72.22 % was counted in the vermibed E_3 while in the vermibed E_6 the worm number was 65.5 % only. Thus, silver coated dishes along with soil, cow dung and food waste are not significantly affect on growth as well as mortality of earthworms but decrease the reproduction rate. Similarly, worms along with soil and CD shown significant increase in worms; this might be due to microbial inoculation and there must be mutualistic association between earthworms and microbes. Our results are corroborated with early work done by [18,19,20].The combination of three tier systems reduces the time of composting, gives quality biofertilizer and good growth of worms. Suthar and Singh [21].revealedthat when organic waste passesthrough gut of worms some quantity of organic minerals may converted into more exchangeable form. Vermibed containing soil, cow dung and grasses appeared ideal substrate for the growth of earthworm *E. foetida*et al. [22]

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Nutrient content: The data of nutrient content of composting beds are also presented in table 2. In all the composting beds except bed E_1, significant increase in NPK was observed as compare to control, while it was decreased in E_1 bed. This decreased amount might be due to silver coated dishes. No much variation seen in composting bed E_2 and E_3. Maximum NPK seen in the E_5bed containing worms, biocatalyst and *Aspergilluniger*. This might be due to the bioaccumulation of Ag^{++} by earthworm and enhanced microbial growth. Supporting activity of worms, biocatalyst and degradation of thin polythene by *A. niger* probably gives maximum NPK content after 60 days.

Ag bioaccumulation: Earthworm species, *E. eugeniae* found to be good for bioaccumulation of silver in their body. Control bed without silver coated dishes therefore shown Ag^{++} content below detectable level (BDL). In the first experimental bed (E_1) with SCD, the amount of Ag^{++} where found to be maximum (i.e. 0.0202 ppm) than other experimental beds viz., E_2, E_3, $E_4$and E_5. Reduction in Ag contents in the soil of E_4 and E_5 bed and slightlyincreased or bioaccumulation in earthworm probably indicate role of microbial inoculation. We obtained similar results with previous researchers like Vasanthiet al. [23].

Biodegradation of thin plastic: 100 gm of silver coated thin polythene paper dishes were cut into smaller pieces or strips. They were mixed in the composting bed for 60 days. At the end of the experiment, the strips were taken out and washed properly with double distilled water followed by 70% ethanol. The strips were dried and weighed. The final weight loss were calculated and compared.

The experimental bed E_5shows reduction in weight of thin polythene as compare to $E_1E_2$and E_4. This might be due to the inoculation of *A. niger*. Similarly maximum weight loss observed in E_5 composting bed; this might be due to the inoculation of *A. niger*, biocatalyst and worms. Probably the worms might be facilitating the growth of microbes.

Our results are corroborated with *A. niger*attach to the surface of the plastic strips and start growing using the polymer as their only carbon source, degrading them into molecular weight monomer and dimmers. *A. niger* formed a fungal mat over the plastic strips and revealed a properly to engulf them Mukharjee and Chatterjee, [24]. They also reported that the fungi, *Aspergilluniger* degrade the low density polythene(up to 5.8%) withina month.

Table-2: Growth, reproduction, nutrient content and bioaccumulation of Ag^{++}

Vermibed Group	Worms count			Nutrient Content (%)			Ag % Bioaccumulation		Plastic biodegradation In gm%	
	Introduced	Counted	% increase	N%	P%	K%	Soil	Worm	Introduced	Undigested
Control - Soil 40% + CD 30% + food waste 20% + 10% paper	-	-	-	0.42	0.027	360	BDL < 1 ppm	-	100	80
E1 - Soil 40% + CD 30% + food waste 20% + 10% SCD	-	-	-	0.40 (-12.5)*	0.021 (-28.57)**	340 (-5.55)*	0.0202	-	100	36.1
E2 - Soil 40% + CD 30% + food waste 20% + 10% SCD + 2gm Biocatalyst	-	-	-	0.67 (37.83)**	0.035 (28.95)**	509 (27.50)**	0.0156	-	100	28.3
E3 - Soil 40% + CD 30% + food waste 20% + 10% SCD + *A. niger*	-	-	-	0.65 (33.82)**	0.035 (22.86)**	440 (16.14)**	0.0192	-	100	27.2
E4 - Soil 40% + CD 30% + food waste 20% + 10% SCD + 20 worms	20	58 ± 4	65 ± 5	0.86 (47.05)***	0.040 (32.50)**	700 (47.28)***	0.0119	0.0067	100	21.2
E5 - Soil 40% + CD 30% + food waste 20% + 10% SCD + Biocatalyst + *A. niger* + 20 worms	20	71 ± 3	71 ± 2	0.89 (49.44)***	0.050 (46.00)***	808 (53.87)***	0.0112	0.0078	100	16.6

Significant value : *P<0.05, **P<0.01, *** P<0.001. Values in the parenthesis are % change over control. CD (Mean ± SEM, n =4)

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IV. CONCLUSION

- Silver coated dishes not affect on growth and mortality of worms but slight decrease in reproduction.
- Silver coated dishes if composted along with soil, cowdung, biocatalyst, *A. niger* and earthworms gives quality biofertilizer.
- The earthworm *E. eugeniae*was found to good for bioaccumulation of Ag^{++} and can reduce the soil toxicity.
- *Aspergillusniger* has potential to degrade the thin polythene.
- It is feasible technology for hotel / restaurant and lawn owners.

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REFERENCES

1. Singh M., Shinjni, S., Prasad. S and Gambhir, I.S. "Nanotechnology in medicine and antibacterial effect of silver nanoparticle". Dig. J. Nanomater. Biostruct. 3 115-122.2008.
2. Woodrow Wilson, "International center for scholars. Nanotechnology consumer product inventory" (http://www.nanotechproject.org/44) 2007.
3. Duran N., Marcato, P.D., De Souza, G.I.H., Alves O.L., Esposito, E., "Antibacterial effect of silver nanoparticles produced by fungal process on textile fabrics and their effluent treatment." J. Biomed. Nanotechnol. 3(2):203-208,2007.
4. Senjen, Rye., "Nano and biocidal silver": extreme germ killers present a growing threat to public health. FOE Australia and [illegible], FOE U.S.,2009.
5. Pereira, M. G. and Arruda, M. A. Z., "Vermicompost as a natural adsorbent material characterization and potentialities for Cadmium adsorption" J. Braz. Chem. Soc. 14:39-47,2003.
6. Vander, P. M. J., Bonds, R. D., Waalewijn-Kool, P. L., Vanden Berg, J. H., Herrera Rivera, Z. E., Bovenschen, E., Molleman, B., Baccus, J. M., Tromp, P., Peter, R. J., Koopmans, G. F., Rietjens, I. M., Vanden Brink, N. W., "Effect of silver nano particles (NM-300k) on Lumbricusrubellus earthworm and particle characterization in relevant test matrices including soil." Env. Toxicol. Chem. 33(4): 743-52,2014.
7. Wijnhoven, S.W.P., Peijnenburg W.J.G.M., Herberts CA., Hagens W.I., Oomen A.G., Heugens E.H.W., Roszek B., Bisschops J., Gosens I., Van de Meent D., Dekkers S., De Jong W.H., Van Zijverden M., Sips A.J.A.M., and Geertsma R.E., "Nanosilver - A review of available data and knowledge gaps in human and environmental risk assessment." Nanotoxicology. 3(2):109-138,2009.
8. Christina Greulich,a Dieter Braun,b Alexander Peetsch,c JörgDiendorf,c Bernhard Siebers,*b Matthias Epple*c and Manfred Köller*a, The toxic effect of silver ions and silver nanoparticles towards bacteria and human cells occurs in the same concentration range. Vol.(2), 6981-6987,2012.
9. Senjen Rye "Nano silver a threat to Soil, Water and Human health? Friends of the Earth Australia March 2007. Available at : http://nano.foe.org.au/node/189,2007.
10. Schlich, K., Klawonn, T., Terytze, K., Hund-Rinke, K., "Hazard assessment of a Silver NPs in Soil applied via sewage sludge". Environmental Science Europe 25:17 DOI : 10.1186/2190-4715-25-17,2013.
11. Meghalbhatt1, Sejal Patel2, Puja Prajapti2 and Y.T.Jasrai3, "Isolation and Identification of Soil Microflora of National Parks of Gujarat, India". Int. Jr. of Micro. And App. Sci. Vol. 4 (3) pp. 421-429,2015.
12. Nayak, P. and Tiwari, A. "Biodegradability of Polythene and Plastic by the help of Microorganism: A way for Brighter Future". Jour. J Environment Analytic Toxicol. 1(4) 1-4,2011.
13. Shrirll Kumar, K., Hatha, A.A.M. and Christi, K.S. "Diversity and effectiveness of tropical mangrove soil microflora on the degradation of polythene carry bags." Int. J. Trop. Bio. 55: 777-786,2007.
14. Kathiresan, K. "Polythene and plastics-degrading microbes from mangrove soil." Rev. Biol. Trop. 51(3-4,2003.
15. Suthar, S. "Vermicomposting potential of Perionyxsansibaricus(Perrier)in different waste material." Biores. Technol. 98(1): 1231-1237,2007.
16. Simard, R. R., "Ammonium acetate extractable elements". pp 39-43. in: Martin, R. and S. Carter (Eds.). Soil Sampling and Method of Analysis. Lewis Publishers, Florida,1993.
17. Jackson, M. L., "Soil Chemical Analysis," Prentice Hall of India Pvt. Ltd. New Delhi,1973.
18. Yadav, A. and Garg, V. K. "Feasibility of nutrient recovery from industrial sludge by vermicomposting technology". J. Hazard. Mater. 168: 262-268,2009.
19. More B. C. and Patole S. S. "Efforts for quality biofertilizers by using three tier systems." J. Env. Bio Dev. 9(2): 287-292,2014.
20. Patole, S. S. and More, B. C. "Vermicomposting of animal wastes by using biocatalyst and earthworm species, Eudriluseugeniae(Kinberg, 1867" J. Environ. Res Dev. 10(3): 465-468,2016.
21. Suthar, S. and Singh, S. "Vermicomposting of domestic waste by using two epigeic earthworms, Perionyxexcavatus and Perionyxsansibaricus". Int. J. Environ Sci and Technol. 5(1): 99-106,2008.
22. More B. C., Nandre Y. M. and Patole S. S. "Studies on dietary influence on the population of epigeic species of earthworm E. foetida." J. Environ. Biol. Sci. 24(1) 35-37,2010.
23. Vasanthi, K., Chairman, K. and A. J. A. Ranjit Singh., "Vermicomposting of leaf litter ensuing from the trees of Mango (Mangiferaindica) and Guava (Psidiumguajava) leaves" Int. J. Adv. Res. 1(3): 33-38,2013.
24. Mukherjee, S. and Chatterjee, S., "A comparative study of commercially available plastic carry bag biodegradation by microorganisms isolated from hydrocarbon effluent enriched soil." Int. J. Curr. Microbiol. App. Sci. ISSN: 2319-7706, 3(5): 318-325,2014.

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Sub Lethal Effects of Cypermethrin and Oxyfluorfen on Stress Enzyme Activities of Earthworm Species, *Eisenia foetida* Savigny, 1826

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ABSTRACT: Present study aims to assess the effect of Sublethal dose of the commercial formulations of Cypermethrin (insecticide) and Oxyfluorfen (herbicide). Laboratory study was conducted in a natural Soil and Cow Dung in order to measure effect of these chemicals on activities of stress enzymes viz., Glutathione, Catalase (CAT) and LPO/MDA for a period of 90 days. The activity of Glutathione and CAT was significantly decreased whereas LPO/MDA activity significantly increased as compare to control. These results confirm the toxic effect of insecticide and herbicide on earthworm and pollution indicator under long term exposure.

KEY WORDS: Sublethal, Cypermethrin, Oxyfluorfen, Pollution indicator, stress enzymes.

I. INTRODUCTION

Soil pollution has enormously increased during the last 3-4 decades due to the intensive use of pesticides and fertilizers in agriculture, industrial activities, urban waste and atmospheric deposition. It causes decrease in soil fertility, alteration of soil structure, disturbance of the balance between flora and fauna residing in the soil contamination of the crops, groundwater pollution and threat for living organisms [1].

Earthworms are common soil organisms in moist environment and play an important role in improving structure and fertility of soil ecosystems [2]. It has been indicated that earthworms may represents up to 60-80% of the total animal biomass in soil [3]. Unlike many other soil organisms that are protected by thick cuticle on the exterior of their bodies, earthworms are protected by thin cuticle and therefore these are particularly susceptible to soil chemicals [4]. The bioaccumulation of insecticides in earthworms may not lead to significant effects to the animal itself, but may produce serious damages to higher tropic levels [5]. Therefore earthworms are suitable bio indicators of soil contamination and can be used to provide safety thresholds for insecticides applications and also used as key index of eco toxicology diagnosis [6,7].

The earthworm skin is extremely permeable to water [8] and it represents a main route for contaminant uptake [9,10] Secondly, these organisms ingest large amount of soil, therefore they are continuously exposed to contaminants absorbed to solid particles through their alimentary tract [11]. The acute toxicity test for earthworm requires 14 days [12] and it only measures lethality, it may be insufficient for predicting long term effect [13]. Chronic test, based on the inhibition of earthworm reproduction [14] provides a more ecological relevant sublethal end point than lethality but it may requires a longer exposures period (at least 50 days) for accurate assessment [15]. Antioxidant defenses are the most used biomarkers due to their crucial role in cell homeostasis preventing toxic action of chemicals [16]. Therefore, earthworms is receiving increasing attention for its potentially in soil pollution monitoring and assessment. Biomarkers specific to oxidative stress, recommended for biomonitoring the quality of the aquatic environment, including malondialdehyde (MDA) which is derived from lipid peroxidation of polyunsaturated fatty acids in cell membranes

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during oxidative stress [17,18,19]. Reduced glutathione (GSH) involved in the antioxidant defense system [20] and Catalase (CAT) which is the first line of defense against oxidative stress [21].

Cypermethrin is a synthetic pyrethroid insecticide, an analogue of Pyrethrins. It is extensively used for pest control programs in domestic, industrial and agricultural sector [22]. On other hand Oxyfluorfen is a selective pre and post emergent contact herbicide used to control certain annual broad leaf and grassy weeds in vegetables, fruit, cotton, ornamentals and on non-crop areas. In India, both pesticides i.e. Cypermethrin and Oxyfluorfen are very common and extensively used in agriculture [23,24].

Very little information is available regarding effects of insecticide and herbicide on earthworm. It promoted us to undertake this work. Hence, our aims to assess the effect of sublethal dose of a commercial formulation of Cypermethrin and Oxyfluorfen on earthworm, *E.foetida* Savigny, 1826.

II. MATERIALS AND METHODS

BIOLOGICAL METHOD: Earthworm species *Eisenia foetida* were obtained from state Government agriculture nursery, Sakri, Dist- Dhule (M.S). As per guideline (OECD, 1984) they were maintained in the laboratory. Only healthy adult worms having well developed clitella were used for the experiment.

CHEMICAL METHOD: Two chemicals i.e. a commercially available Cypermethrin (10% EC) an insecticide belongs to synthetic pyrethroid and selective herbicide, Oxyfluorfen (23.5% EC) commonly called 'Goal' are used. Both pesticides were purchased from local agro market.

The quality soil and a month old cow dung were collected from agriculture field and cow shed respectively.

EXPERIMENTAL SET-UP

The experiment was performed in plastic tough having 5 litre capacities. A dried quality soil was ground and sieved. In a tough 800 g of fine soil thoroughly mixed with 200 g cow dung (CD) and appropriate amount of water was added to moisten the mixture. On next day 20 mature worms were added to each tough. The tough was covered with perforated lid. The experimental set up was prepared in triplicate for each treatment.

TREATMENT OF THE WORMS

The LC_{50} Values of both the pesticides in earthworm were already estimated in our previous study, which was 0.240 ml/ kg for Cypermethrin and 0.420 ml/ kg for Oxyfluorfen. A higher sublethal ($3/4^{th}$) dose i.e. 0.180 and 0.315 ml/ kg of Cypermethrin and Oxyfluorfen respectively was added in 100 ml of water and that was mixed thoroughly in the experimental groups only. To maintain 75 ± 5 % moisture level water was sprinkled at the interval of 3 to 4 day. The entire tough was kept for 90 days under shade at room temperature.

ENZYMATIC MEASUREMENT

At the end of the experiment, earthworms were fasted for 24 hours so that their digestive tract was completely empty. Prior to biochemical analysis, the worms were cut into pieces and mixed with ice cold 0.86 % invertebrate ringer solution, the mixture was homogenized and centrifuged. The resulting supernatant was used for the determination of activities of enzymes like Glutathione, CAT and MDA. The Glutathione was realized by [25], the activity of CAT was measured according to the method of [26] and lipid peroxidation level (MDA) was assessed by measuring the TBARS formation as described by [27].

III. RESULTS AND DISCUSSION

Antioxidant activities of Glutathione, CAT and MDA are presented in table-I. It shows that the activity of Glutathione was slightly or non significantly decreased whereas it was significantly decreased in CAT. Similarly the MDA activity was found to be significantly increased for both pesticides group over the control.

Earthworms were hardly studied in past and their use was mainly concentrated on the effects of heavy metals [28,29] whereas very few studies in past have included research on the impact and effect of organic pollutants such as

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pesticides on the earthworm. [30,31]. During the exposure to pesticides, earthworms are capable to reduce the toxic effects of the chemical product by adjusting their internal biochemical responses. So the biochemical reactions are rather important to evaluate the potential adverse effects of chemicals on the environment [32]. Our results showed decreased Glutathione and CAT and increased LPO/MDA activities. The inhibition of CAT activity may be the result of increased H_2O_2 in the cell which can be generated directly by divalent reduction of O_2 or indirectly by univalent reduction of O_2 followed by dismutation of oxygen [33].

The decrease of the rate of GSH, is due to the use of the GSH to thwart the installation of the oxidative stress induced by the ROS generated by the exposure to the insecticide used. Our results are corroborated with [34] and [35] who revealed reduction in Glutathione in earthworm treated with insecticide like methonyl.

The increased MDA was a good correlation with the generation of ROS [36,37]. Many studies have indicated that the level of the peroxidation of lipids was an important parameter assessing the level of the oxidant efforts in the living organisms. Induced an increase of the rate of MDA. This agreement with the previous work of [38,39]; suggested that one of the most damaging effect of ROS and their products in cells is the peroxidation of membranes lipids, who can be indicated by the detection of MDA. Our results also corroborated with work done by Zeriri *et al* (2012) on potential toxicity of an insecticide on earthworm, *Octadrilus complanatus* an increase of catalase activity and the rate of MDA after exposure of earthworms to the methonyl insecticide. Similar work i.e. treatment of Malathion to bivalve snail (mollusca) was studied by [40]. They showed that the activity of acetyl cholinesterase was strongly inhibited whereas the activity of catalase increased. Enhanced LPO/MDA levels in fishes indicated development of oxidative stress [41]. Depleted catalase activity can suggest increased oxidative stress and increased MDA activity may be indicative of free radical tissue injury [42].

TABLE-I
Antioxidant activities of stress enzymes (Glutathione, CAT and MDA) in earthworm exposed to Sublethal concentration of Cypermethrin and Oxyfluorfen.

Sr. No.	Pesticide	Group	3/4th Sublethal dose (ml/ kg)	Antioxidant activities		
				Glutathione (mg/ g)	CAT (mg/ g)	MDA (N mole/ g)
1	Cypermethrin	Control	--	19.34 ± 2.20	0.480 ± 0.020	40.56 ± 2.50
		Experimental	0.180	18.16 ± 1.76 (-6.10) NS	0.348 ± 0.020 (-25.5) **	65.52 ± 3.20 (+ 38.09) ***
2	Oxyfluorfen	Experimental	0.315	16.70 ± 1.58 (-13.65)*	0.276 ± 0.020 (-42.50) ***	90.56 ± 3.40 (+55.21) ***

* Significant value: P<0.05, ** P<0.01, *** P<0.001. Values in the parenthesis are per cent change over control. CD (Mean ± SEM, n = 3).

IV. CONCLUSION

In nutshell, earthworms are the sentinel animals in pollution by Cypermethrin and Oxyfluorfen. Similarly, this commercial formulation causes change in MDA, Catalase (CAT) and Glutathion enzyme activity. The increased MDA/LPO activity may be indicative of free radical tissue injury of oxidative stress. Decreased glutathione and CAT activity may be due to the failure of detoxification phenomenon of pesticide and development of oxidative stress. The depleted CAT can also suggest increased oxidative stress.

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REFERENCES

1. Gubi, M. and Gunasekaran, P. "Effect of butachlor herbicide on earthworm *Eisenia foetida* and its histological perspicuity". *Appl. Environ. Soil Science*. (Article ID 850758, doi:1155/2010/850758), 2010.
2. Bartlett, M. D., Briones, M. J. I., Neilson, R., Schmidt, O., Spurgeon, D. and Creamer, R. E. "A critical review of current methods in earthworm ecology: from individuals to populations". *Eur. J. Soi. Biol.* 46: 67-73, 2010.
3. Josquet, P., Plumere, T., Thu, T. D., Rumpel, C., Duc T. T. and Orange, D. "The rehabilitation of tropical soils using compost and vermicompost is affected by the presence of endogeic earthworms". *Appl. Soil. Ecol.* 46: 125-133, 2010.
4. Nahmani, J., Hodson, M. E. and Black, S. "Effect of metal on life cycle parameters of the earthworm *Eisenia fetida* exposed to field-contaminated metal polluted soil". *Environ. Pollute* 149: 44-58, 2007.
5. Van Gestel, C. A. M., Ortiz, M. D., Bergman, E. and Verweij, R. A. "The bioaccumulation of molybdenum in the earthworm *Eisenia Andrei* influence of soil properties and ageing" *Chemosphere*. 82: 1614-1619, 2011.
6. Zhu, J., Lu, Y. T., Chen, W.C. "Single and joint toxic effects of cadmium and phenanthrene on enchytraeid *Fridericia bulbosa*". *Eur. J. Soil. Biol.* 44: 260-265, 2008.
7. Lourenco, J. I., Pereira R. O., Silva, A. C., Morgado, J. M., Carvalho, F. P., Oliveira J. M., Malta, M. P., Palva, A. A., Mendo, S. A., Goncalves, F. J. "Genotoxic end points in the earthworms sub lethal assay to evaluate natural soils contamination by metal and radio nuclides". *J. Hazard. Mater.* 186: 788-795, 2011.
8. Wallwork, J.A. *Annelids: "The first Coelomates, Earthworm Biology"*. Edward Arnold Publisher, ISBN 0713128644, London, United Kingdom, 1983.
9. Jager, T., Fleuren, R.H.L.J., Hogendoorn, E.A. and de Corte, G. "Elucidating the routes of exposure of organic chemicals in the earthworm, *Eisenia Andrei* (Oligochaeta)" *Environmental Sciences and technologies*. Vol.37, No. 15, (August 2003), pp. 3399-3404, ISSN 0013- 936X, 2003.
10. Vijver, M.G., Vink, J.P.M., Marmans, C.J.H. and Van Gestel, C.A.M. "Oral sealing using glue: a new method to distinguish between intestinal and dermal uptake of metals in earthworms", *Soil Biology and Biochemistry*, Vol. 65, No.1, (January 2003), pp. 125-132, ISSN 0038-0717, 2003.
11. Margan, A.J., Sturzenbaum, S.R., Winters, C., Grime, G.W., Aziz, N.A.A. and Kille, P. "Differential metallothionein expression in earthworm (Lumbricus rubellus) tissues". *Ecotoxicology and Environmental safty*, Vol. 57, No.1, (January 2004), pp. 11-19 ISSN 0147-6513, 2004.
12. OECD "Guideline for testing of chemicals: Earthworm acute toxicity test". No. 207, Paris, France, 1984.
13. Whitfield Aslund, M. L., Simpson, A. J. and Simpson, M. J. "1H NMR metabolomics of earthworm responses to polychlorinated biphenyl (PCB) exposure in soil. Ecotoxicology" Vol.20 (4): 836-846, 2011.
14. OECD "Guideline for testing of chemicals. Earthworm reproduction test", No. 222, Paris, France, 2004.
15. Handy, R.D., Galloway, T.S. and Depledge, M.H. "A proposal for the use of biomarkers for the assessment of chronic pollution and in regulatory toxicology. *Ecotoxicology*" Vol.12 (1-4): 331-343, 2003.
16. Novais S. C., Gomes S.I.L., Gravato C., Guilhermino L., De Coen W., Soares A.M.V.M., Amorium M.J.B. "Reproduction and biochemical responses in *Enchytraeus albidus* (Oligochaeta) to zinc or cadmium exposures". *Environmental pollution*. Vol. 159(7): 1836-1843, 2011.
17. Hamza-Chaffai, I., Pellerin, J. Amiard, C. "Health assessment of a marine bivalve Ruditapes decussates from the Gulf of Gab and egraves (Tunisia)". *Environ. International: a journal of environmental science, risk and health*. Vol 28: 609-617, 2003.
18. Dewes, L.J., Sandrine, J.Z., Monserrat, J.M., Yunes, J.S. "Biochemical and physiological responses after exposure to microcystins in the crab *Chasmagnathus granulates* (Decapoda, Brachyura)". *Ecotoxicol Environ. Saf.*, 65: 201-208, 2006.
19. Oruc, E.O., Usta, D. "Evaluation of Oxidative stress Response and Neurotoxicity potential of Diazinon in different tissues of *Cyprinus carpio*". *Environ. Toxicol. Pharmacol.*, 23: 48-55, 2007.
20. Machiek-Ajmi, M., Hamza-Chaffai, A. "Accumulation of cadmium and lead in *Cerastoderma glaucum* originating from the Gulf of Gabes, Tunisia". *Bull. Environ. Contam. Toxicol.* (3): 529-537, 2006.
21. Samaoui-Damak, W., Hamza chaffai, A., Berthet, B., Amiard J. C. "Preliminary study of the clam *Ruditapes decussates* exposed *in vivo* to metal contamination and originating from the Gulf of Gabes, Tunisia". *Bull. Environ. Contam. Toxicol.* 71: 961-970, 2003.
22. Jahanbakshi, A., Shaluei, F. and Baghbiaki, M. "Acute toxicity of Cypermethrin on the great sturgeon (Huso huso) Juveniles". *World Journal of fish and Marine Sciences*. 4(2): 170-174, 2012.
23. Trivedi, P., Sharma, V. P., Shrivastava, L. P. and Malik, S. "Determination of organophosphorus pesticides residues in wheat and rice by QuEchERS method". *J. Environ. Res. Develop.*, 9(1): 1-6, 2014.
24. Urkude, R., Dharvey, V., Marganwar, R. and Dhawas, S. D. "Influence of Endane and endosulfan on earthworm population". *J. Environ. Res. Develop.* 9(1): 184-187, 2014.
25. Moron, M. A. and Mannervick, B. "Level of glutathione s-transferase activities in rat liver". *Biochimica et Biophysica Acta*. 582: 67-78, 1979.
26. Aebi, H. "Catalase *in vitro*. Methods in vitro. Methods in Enzymology" edited by L. Parker. Academic press New York 105, p. 121-126, 1984.
27. Ohkawa, H., Ohishi, M., Yagi, K. "Assay of lipid peroxides in animal tissue by thiobarbituric acid reaction". *Jornal of Biochemistry*. 95: 351, 1779.

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28 Schleiffer, R., Coeurdassier, M., Morilhat, M., Pernard, N., Faivre, B., Flicoteaux, P. "Lead concentrations in feathers and blood of common blackbirds (Turdus merula) and in earthworms inhabiting unpolluted and moderately polluted urban areas". *Sci Total Environ.* 371: 197-205, 2006.

29 Bundy, J. G., Keun, H. C., Sidhu, J. K., Spurgeon, D. J., Svendsen, C., Kille, P. "Metabolic profile biomarkers of metal contamination in a sentinel terrestrial species are applicable across multiple sites". *Environ. Sci. Technol.* 41: 4458-4464, 2007.

30 Capowiez, Y., Rault, M., Rault, C., Mazzia, M., Belzunces, L. "Earthworm behavior as a biomarker- a case study using imidacloprid". *Pesticbiologia*, 47: 542-547, 2003.

31 Gambi, N., Pasteri, A., Fabbri, E. "Acetylcholinesterase activity in the earthworm *Eisenia Andrei* at different conditions of carbaryl exposure". *Comp. Biochem. Physiol.* 145 (4): 678-683, 2007.

32 Gao, Y. H., Sun, Z. J., Sun, X. S., *Rao*, Y. Z. "Toxic effect of oleandox antibiotic on *Eisenia foetida*" *Eur. J. Soil Biol* 43: 252-255, 2007.

33 Fridovich, I. "Oxygen radicals, hydrogen peroxide, and Oxygen toxicity, in: W. A. Pryor (ed.). Free radicals in Biology". Academic Press, London, pp. 239-277, 1976.

34 Garg, D. P., Bansal, A. K., Anshoo Malhotra, Ravi Kiran, Dhawan, D. K. "Methomyl induced haematological and biochemical alterations. Protection by vitamin E". *Pesticide Biochemistry and Physiology*, 93: 127-132, 2009.

35 Zeriri, I., Tedjine Aicha M., Grara Nedjoud., Belhaoucher Nawel., Berrebbah Houria and Djebar Mohamed Reda "Potential toxicity of an insecticide of the family of Carbamates on a bioindicator model of the pollution the earthworm *Octodrilus complanatus*". *Annals of Biological Research*, 3(11): 5367-5373, 2012.

36 Green, R. M., Graham, M., O'Donovan, M. R., Chipman, J. K., Hodges, N. J. "Sub cellular compartmentalization of glutathione: correlation with parameters of oxidative stress related to genotoxicity". *Mutagenesis*, 21: 383-390, 2006.

37 Luo, Y., Su, Y., Lin, R. Z., Wang, X. R. "2-Chlorophenol induced ROS generation in fish *Carassius auratus* based on the EPR method". *Chemosphere*, 65(6): 1064-1073, 2006.

38 Li, Y. N., Zhou, Q. X., Li, F. X., Liu, X. L., Luo, Y. "Effect of tetrabromobisphenol A as an emerging pollutant on wheat (*Triticum aestivum*) at biochemical levels". *Chemosphere*, 74(1): 119-124, 2008.

39 Xue, Y. G., Gu, X. Y., Wang, X. R., Sun, C., Xu, X. H., Sun, J. Zhang, B. G. "The Hydroxyl Radical Generation and Oxidative Stress for the Earthworm *Eisenia foetida* Exposed to Tetrabromobisphenol A". *Ecotoxicology*, 18: 693-699, 2009.

40 Safia Nadji, Amina Amrani, Radia Mebarki and Mohammad El- Hadi Khebbeb "Acetylcholinesterase and catalase activities in several tissues of a bivalve mollusc (*Rudistopes decussatus*) fished from Mellah lagoon (North East of Algeria) after malathion exposure". *Annals of Biological Research*, 1 (4): 138-144, 2010.

41 Samanta, P. Pal, S. Mukherji, A. K., Senapati, T., Ghosh, A. R. "Biochemical effects of almix herbicide in three fresh water teleostean fishes". Volos, Greece. *Hydro Mediv* 13-15, 2014.

42 More, B. C., And Patole, S. S. "Acute toxicity effect of TiO_2 and Cd $(OH)_2$ Nanoparticles (NPs) on earthworm species, *Endrilus eugeniae*". *J. Environ. Res. Develop.* 10(1): 73-78, 2015.

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STUDIES ON ICHTHYOFAUNAL DIVERSITY OF NAKANE, SULWADE AND DEDORGAON DAMS OF DHULE DISTRICT (M.S.).

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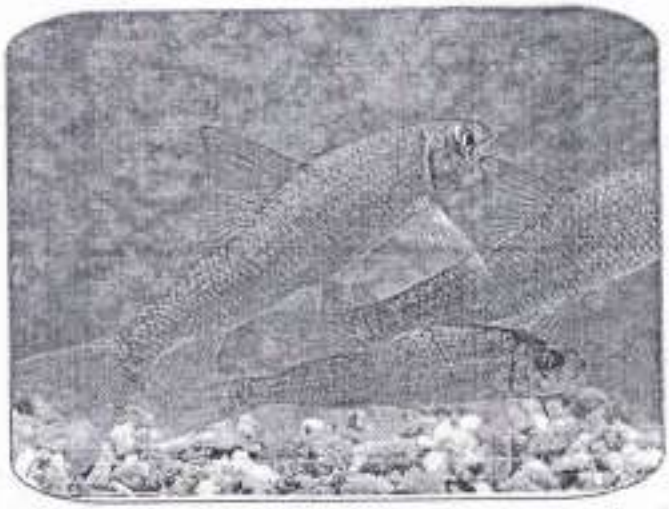
ABSTRACT

The present study deals with fish diversity from three different dams viz; Nakane, Sulwade and Dedorgaon around Dhule city. It was undertaken during the period January, 2014 to October 2015. The results of investigation reveals among collection of 32 fish specimens belonging to 6 orders 11 family, 16 Genera and 20 species. In which 14, 5 and 13 species where obtained from Nakane, Dedorgaon and Sulwade dams respectively. Four species i.e. Punctius sophore, Punctius sarana, Garra mullya, Labeo buggut are commonly found at all sites. The order Cypriniformes was dominant with 07 (35%) species followed by order Siluriformes with 6 species (30%), order Perciformes 04 (20%) species, while the order Osteoglossiformes, Clupeiformes and Synbranchiformes was represented by single species respectively. Fish diversity was assessed by calculating the various diversity indices such as Shannon-Wiener diversity index, Simpson's Dominance index, Simpson's index of diversity and Evenness index etc.



KEY WORD- *Icthyofounal diversity, Cypriniformes, Siluriformes, Perciformes, Osteoglossformes, Clupeiformes, Synbranchiformes, Shannon-Wiener index.*

INTRODUCTION :

Since last two centuries to date various researchers have studied the taxonomy and ichthyofaunal diversity from Maharashtra as well as various states of country. Shinde et al (2009) studied on ichthyofaunal diversity of Harsool Savangi dam, district Aurangabad, Maharashtra. Patole and Patil (2009) reported ichthyofauna of Panzara River (Tah. Sakri) of Dhule district of Maharashtra. Patole and More (2010) reveal biodiversity of fresh water fishes from Sakri- Tahsil (Dist- Dhulia) of Maharashtra. Shaikh et al (2011) worked on the ichthyofaunal diversity of upper Dudhana water reservoir near Somthana in Jalna district, Maharashtra. Rankhamb (2011) studied on ichthyofaunal diversity of Godavari River at Mudgal, district Parbhani. Madhusudan et al (2011) studied on diversity of fish in Gondoor and Nakane lakes in Dhulia (M.S.). Joshi (2012) studies on ichthyofaunal diversity of Buldhana district (M.S.). Jaiswal and Ahirrao (2012) studied on ichthyofaunal diversity of Rangavali dam, Navapur district Nandurbar (M.S.). Ubharhande and Sonawane (2012) worked on study of freshwater fish fauna at Paintakli dam from Buldhana district of Maharashtra. Kharat et al (2012) studied on freshwater fish fauna of Krishna river at Wai, Northwestern Ghats, India. Nagma and Khan (2013) report fish diversity from Bijnor district in western Uttar Pradesh. Kalbande et al (2013) worked on Rawanwadi lake of Bhandara district (M.S.) Sheikh (2014) reports from Pranhita river, Sironcha district Gadchiroli (M.S.) Khodke et al (2014) studied

ichthyofaunal diversity in Jamkhedi reservoir in Dhule district of Maharashtra, Inida. Patole (2014) reported ichthyofunal diversity of Nandurbar district (Northwest Khandesh region) of Maharashtra (India). Recently, Patole (2015) noted ichthyofaunal diversity of Tapi River flows through Dhule and Nandurbar districts of Northwest Khandesh (Maharashtra) and very recently, Kawade and Pandarkar (2016) studies diversity indices of fish Heterogenesity of Kalu dam, Ahmednagar, Maharashtra.

In last few decades much attention is being paid to aquaculture as a source of food to the growing population of the country. Fishes constitute the most conspicuous component of island aquatic fauna and rank very high as a source of proteins. They are one of the important elements in the economy of nation as they have been a stable item in the diet of many people. For sustained exploitation and simultaneous conservation of fisheries resources, basic scientific information on biodiversity is vital (Sone and Malu, 2000: Shendge, 2008; Pawar et al., 2011). Fish diversity is also a good bioindicator of water quality (Madhusudan et al., 2011; Patole, 2014). Fish diversity is declining rapidly each day due to unending anthropogenic stress. This diversity is not only the wealth of our world but it also has some serious implications on fishery (Sakhare, 2001). Thus there is an urgent need for proper investigation and documentation of this fish diversity in order to develop a fresh water fish diversity information system having both bioinformatics and georeferenced databases of fish and fish habitat. Biodiversity is essential for balancing ecosystem and facing varied problems to environment. Nowadays the aquatic ecosystem is adversely affected due to release of wastes in it along with over exploitation, habitat loss, introduction of exotic species and contamination of surface waters by anthropogenic activities that affects and threatened the fish biodiversity.

In present study; Nakane, Sulwade and Dedorgaon dams of Dhule district are selected for ichthyofaunal diversity. Where many edible fish species natively occurred and some are commercially harvested and fishing is done throughout year. There is tremendous scope for enhancing inland fish production by scientific manner. No attempt so far is been made to study fish diversity from these reservoirs. Therefore our main aim is to collect data regarding fish diversity of the dams around Dhule city.

MATERIAL AND METHODS

The fish specimen was collected from above mentioned dams with the help of fishermen during January, 2014 to October 2015. The members of local fishermen were used different types of nets. A photograph of fresh fish was taken with help of digital camera (Sony, DSC-W610). The fishes which were procured from fisherman is brought to the laboratory and immediately preserved in 4% formalin solution and subsequently after 4-8 h fixation and washing with tap water, transferred to 70 % ethanol. The large sized specimen was given incision on belly. The preserved material was send to Western Regional Station, Zoological Survey of India, Akurdi Pune (M.S.) for authentication. The identified fishes and their valid scientific names have incorporated in the present paper.

Study area: Dhule district is North Western part of Maharashtra State. It is formerly known as West Khandesh. Geographically it is located in North-West corner of Maharashtra state, spread between Latitude 200 38' to 210 61' N and Longitude 730 50' to 750 11' E. The district is bounded by Gujarat and Madhya Pradesh States in the North, by Nasik district in the West and by Jalgaon district in the East. The Nakane dam is located at the 5 km away from the Dhule city. It is major reservoir; which provides 50 % of drinking water to the city. The Sulwade dam is at the 45 km away from the city; which covers 32% area of the city. It constructed on Tapi River at near Sukhwad, Tal- Sindkheda Dist- Dhule (M.S.). The Dedorgaon dam is comparatively small reservoir; it covers 18 % of city area and it is 15 km away from the city.

The diversity indices are calculated from the abundance of the organisms and serve as very good indicator of pollution. One widely used measure of diversity that combines species richness with equitability is the Shannon-Weiner index. Simpson's dominance index is also an important index used widely for water quality monitoring. For determination of diversity indices, total number of species, total number of individuals in a sample and total number of individuals of a species were determined. From these data Shannon- Weiner index (H), Simpson's Dominance index (D), Simpson's index of diversity (1-D) and Pielou's evenness index (J) were determined using following equations.

i.Shannon-Weiner Index (H): It depends on both the number of species present and the abundance of each species.

$H = \Sigma Pi (\ln Pi)$,

Where 'Pi' is the proportion of each species.

$Pi = A/T$,

Where 'A' is number of each species in the sample, and T is the total number of individuals of all species in the sample.

ii. Simpson's Dominance Index (D): It is determined using the following equation;

$$D = \frac{n_1(n_1-1) + n_2(n_2-1) + n_3(n_3-1) + \ldots\ldots\ldots n_{20}(n_{20}-1)}{N(N-1)}$$

Where 'n' is the total number of individual of a particular species and 'N' is the total number of individuals of all species.

iii. Simpson's Index of Diversity: 1-D
iv. Pielou's evenness Index (J): H/ Ln (S)
Where 'H' is the Shannon –Weiner Index and 'S' is the number of species.

RESULTS AND DISCUSSION

The result of present study i.e. fish diversity is shown in table-1. This table also shows order, family, Species and their localities in the form of different collection sites. Viz S1 (Nakane dam), S2 (Dedorgaon) and S3 (Sulwade) dams. We collected total 32 fish specimens, among them 20 species belonging to 16 genera, 11 families and 06 orders. The order wise short list is given below;

Order I. Cypriniformes: It includes 07 species.

a)Family- Cyprinidae

1.*Punctius sophore* (Hamilton), 2.*Salmophasia bacaila* (Hamilton), 3.*Punctius sarana* (Val.), 4.*Cirrhinus reba* (Hamilton), 5.*Garra mullya* (Sykes), 6.*Labeo buggut* (Sykes) and 7.*Labeo calabasu* (Hamilton).

Order II. Siluriformes : It include 06 species

a) Family- Siluridae

8.Ompak bimaculatus (Bloch) and 9.Ompak malabaricus(Val.)

b) Family -Bagridae

10. Mystus bleekeri (Day), 11.Mystus sp. And 12. Sperata aor(Hamilton)

c)Family -Claridae

13. Heteropneustes fossilis (Bloch)

Order III. Perciformes: It include 04 species

a)Family -Ambassidae - 14.*Parambassis sarana* (Hamilton).
b)Family- Chilidae - 15. Oreochromis mossambica (Peters)
c)Family -Gobiidae -16.Glossogobius giuris (Hamilton)
d)Family- Channidae - 17.Channa puntus (Bloch)

Order IV. Osteoglossiformes: It include 01 species

Family- Notopteridae, includes 18. Notopterus notopterus (Pallas)

Order V.Clupeiformes : It include 01. Species

Family–Clupeidae , 19. Tenualosa ilisha (hamilton)

Order VI. Synbranchiformes : It include 01 species

Family– Mastacembelidae, 20. Macrognathus pancalus (Hamilton)

Similar types of work were carried out by earlier workers like Patole and More (2010). They have been studied biodiversity of fresh water fishes from Sakri – Tahsil. They examined 221 specimens, among them 31 species (25 genera's) of 05 orders, also recorded 17 new species. Ubarhande et al. (2011) observed 08 orders, 11 families, 22 genera and 27 species. Madhusudan *et al* (2011) have showed 18 fish species in Gondoor and Nakane lakes where Cyprinidae was dominance over other families. Sakhare (2001) noticed the occurrence of 23 fish species belonging to 7 orders in Jawalgaon reservoir in Solapur district of Maharashtra. Patole (2014) studied ichthyofaunal diversity of Nandurbar district of Maharashtra State; he reported 32 species from 24 genera. Where order Cypriniformes dominate over the other orders. Patole (2015) mentioned ichthyofaunal diversity of tapi river flows through Nandurbar and Dhule district. He reported 32 fish species belonging to 23 genera. He finds similar results i.e. order Cypriniformes where dominance. Kawade and Pandarkar (2016) studied on diversity indices of Kalu dam, Ahmednagar (M.S.). They reports 27 fish species where order Cypriniformes was dominated over other orders.

In present study occurrence of 20 fish species from study area indicates good fish diversity and their production. It might be due to the suitable water quality of the dams that provides proper breeding ground for fish. The observation on Nakane, Dedorgaon and Sulwade dams which were selected for a present study that there is rich diversity of fish. In Nakane dam (45%) it is followed by Sulwade (38%) and Dedorgaon (16%). The fishes belonging to the family Cyprinidae was dominant in all reservoirs.

The diversity indices were presented in table-2. This shows that, in present study species abundance was 607, Shannon-Weiner Index (H) recorded 2.365. The Simpson's Dominance Index (D) was recorded 0.056 and the Simpson's Index of Diversity (1-D) was recorded 0.934. The Pielou's evenness value (J) was recorded 0.769.

CONCLUSION

The aquatic ecosystem is an important and having large number of economically important animals specially fish which is important source of protein food. The study of fish fauna of an aquatic body is useful for planning of fish development for fish and other fishery culture. It is concluded that the dams of Dhule district lost some rare species because of some anthropogenic activities like over fishing and recreational activities besides water pollution. It is therefore essential to prevent depletion of fresh water fish resources and illegal method of fish catching.

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REFERENCES

1.Jaiswal, D. P. and Ahirrao, K. D. Ichthyodiversity of Rangavali dam, Navapur dist- Nandurbar, Maharashtra state. J. Res. Biol. 3(1): 241-245 (2012).

2.Joshi, P. S. Ichthyological fauna of Buldhana district, Maharashtra (India). Onl. Int. Interdis. Res. J. 2(2): 111-115 (2012).

3.Kalbande, S., Telkhade, P. and Zade, S. Fish diversity of Rawanwadi lake of Bhandara district Maharashtra, India. Nat. J. Res. Sci. Technol. 2(2): 30-33 (2013).

4.Kawade, S. A. and Pandarkar, A. K. Study of diversity indices of fish Heterogenesity of Kalu dam, Ahmednagar, Maharashtra. Int. J. Adv. Biol. Res. 6(1): 75-78 (2016).

5.Kharat, S. S., Mandar, P. and Nilesh Dahanukar. Freshwater fish fauna of Krishna river at Way, Northern Western

Ghats, India. J. Threat. Taxa. 4(6): 2644-2652 (2012).
6.Khodke, S. P., Borale, R. P. and Petare, R. K. Ichthyofaunal diversity in Jamkhedi reservoir in Dhule district of Maharashtra, India. J. Environ. Res. Dev. 9(1): 177-183 (2014).
7.Madhusudan, V., Amrutsagar, V. and Lohar, P. S. Diversity of Mollusca and Fish in Gondoor and Nakane Lakes in Dhulia, Northwest Maharashtra, India. J. Ecobiotechnol, 3(6): 16-2 (2011).
8.Nagma, M. and Afzal Khan. Studies on fresh water fish fauna of district Bijnor in Western Uttar Pradesh, India. Int. J. Life Sci. Bitec. And Pharm. Res. 2(3): 410-417 (2013).
9.Patole S. S. and Patil, M. U. A note on icthyofaunal diversity of panzara (Tah. Sakri) Dist: Dhule, Maharashtra. J. Aqua. Bio., 24(2):61- 66 (2009).
10.Patole S.S. and More B. C. Biodiversity of fresh water fishes from Sakri-Tahsil (Dist- Dhulia) of Maharashtra. Research Link, 75, (IX- 4):15-17 (2010).
11.Patole, S. S. Ichthyofunal diversity of Nandurbar district (Northwest Khandesh region) of Maharashtra (India). Int. J. Fisheries and Aqua. studies. 2(2):167-172 (2014).
12.Patole, S. S. Ichthyofaunal diversity of Tapi River flows through Dhule and Nandurbar districts of Northwest Khandesh (Maharashtra), India. Proc. Zool. Soc. India. 14(1): 43-50 (2015).
13.Pawar, B. A., Pandarkar, A. K. and Shendge, A. N. Ichthyofauna of Pravara River in relation to Pisciculture, Ahmednagar district, Maharashtra. J. Expt. Zool. India. 14(1): 129-132 (2011).
14.Rankhamb, S. V. Ichthyofaunal diversity of Godavari river at Mudgal tal- Pathri, Dist- Parbhani. Rec. Res. Sci. Tech. 3(12): 11-13 (2011).
15.Sakhare, V. B. Ichthyofauna of Jawalgaon reservoir in Solapur district of Maharashtra. J. Aqua Biol., 16(1 and 2): 31-33 (2001).
16.Shaikh, H. M., Kambale, S. M. and Renge, A. B. The Study of ichthyofaunal diversity in upper dudhana project water reservoir near Somthana in Jalna district, Maharashtra, India. J. Fisher, Aquacul. 2(1): 8-10 (2011).
17.Sheikh, S. R. Studies on ichthyofaunal diversity of Pranhita river, Sironcha, Dist- Gadchiroli, Maharashtra, India. IJFAS. 1(5): 144-147 (2014).
18.Shendge, A. N. Ichthyofaunal diversity of Ujani dam. J. Exp. Zool. India, 11(1): 147-150 (2008).
19.Shinde, S.E., Paithane, R. Y., Bhandare, A. And Sonawane, D. L. Ichthyofaunal diversity of Harsool Savangi dam, district Aurangabad (M.S.), India. Wrold J. Fish Mar. Sci., 1(3):141-143 (2009).
20.Sone, A. A. and Malu, R. A. Fish diversity in relation to aquaculture in Ekbhurgii reservoir, Washim, Maharashtra. J. Aqua. Biol. 15(1&2): 44-46 (2000).
21.Ubarhande, S. B. and Sonawane, S. R. Study of freshwater fish fauna and water quality at Paintakali dam from Buldhana district, M. S., India. J. Expt. Sci., 3(7): 4-8 (2012).

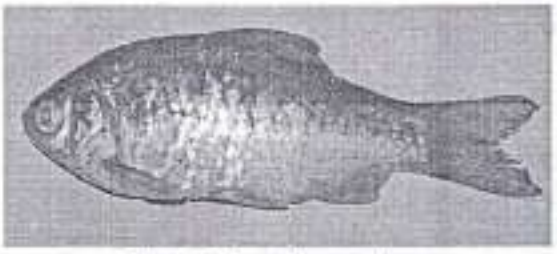

Plate-1: Punctius sophore

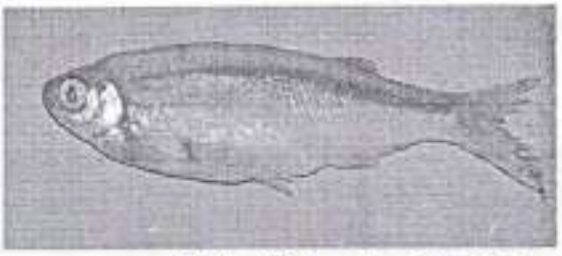

Plate-2: Salmophasia bacaila

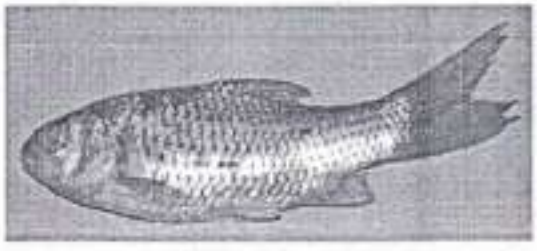

Plate-3: Punctius sarana

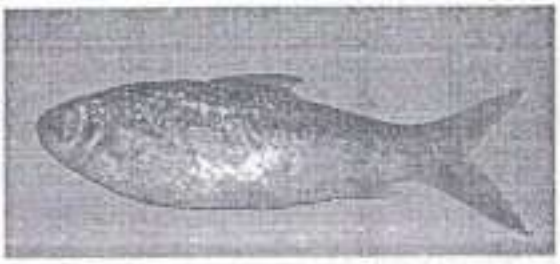

Plate-4: Cirrhinus reba

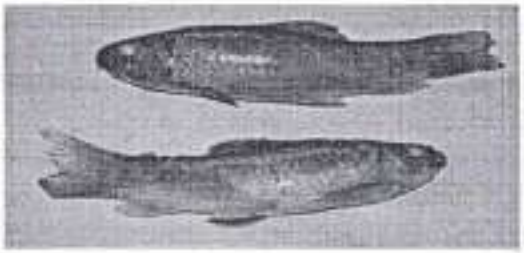

Plate-5: Garra mullya

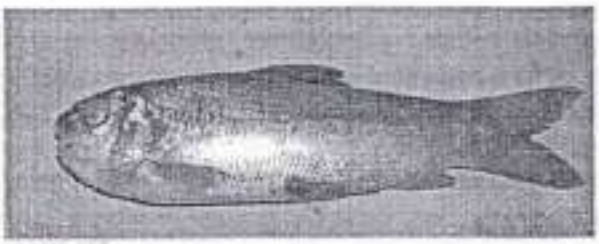

Plate-6: Labeo boggut.

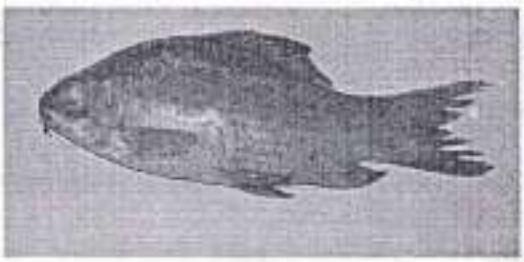

Plate-7: Labeo calabasu

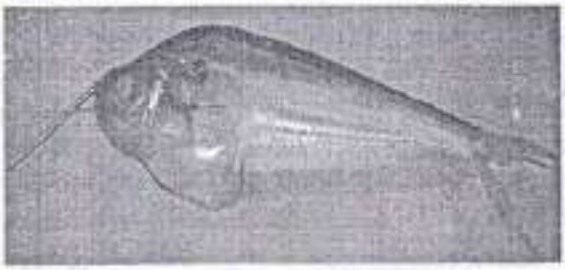

Plate-8: Ompak bimaculatus

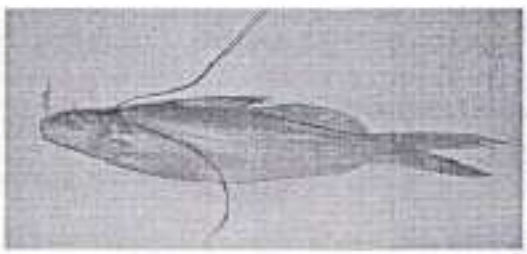

Plate-9: Mystus bleekeri

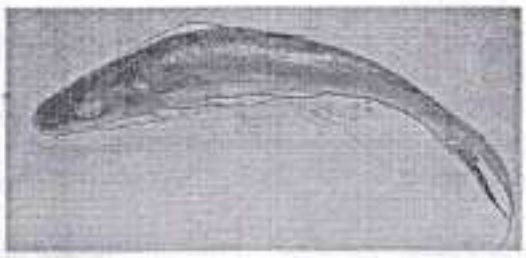

Plate-10: Sperata aor

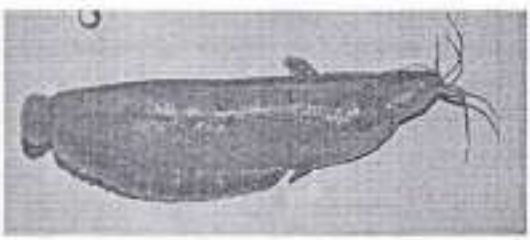

Plate-11: Heteropneustes fossilis

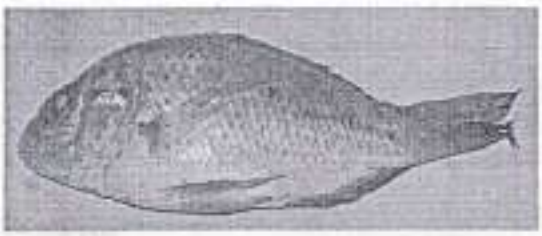

Plate-12: Oreochromis mossambica

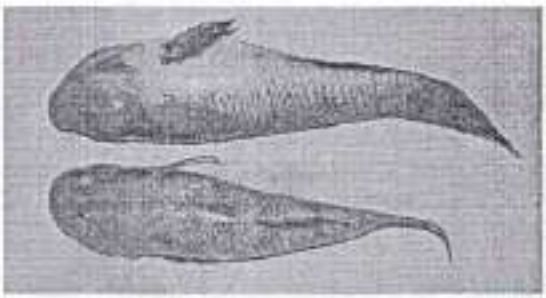

Plate-13: Glossogobius giuris

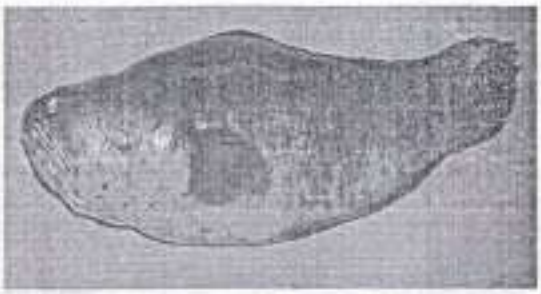

Plate-14: Channa punctatus

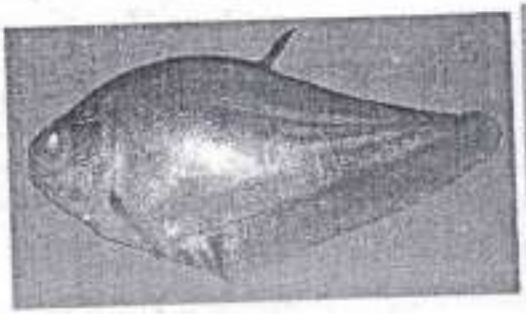

Plate-15: Notopterus notopterus

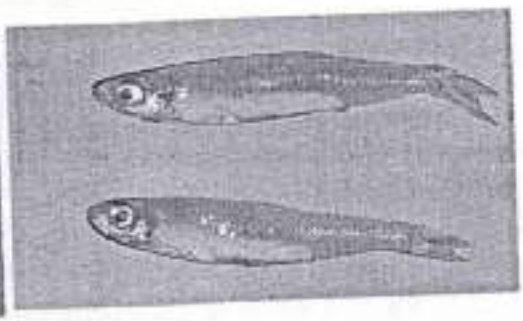

Plate- 16: Tenualosa ilisha

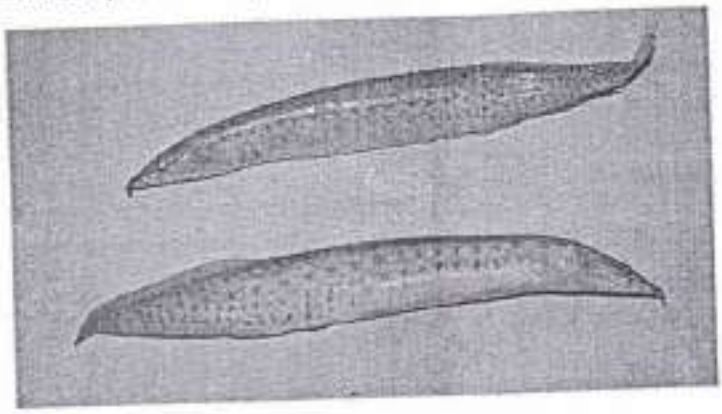

Plate-17: Macrognathus panacalus

Table-1: Ichthyofaunal diversity and Abundance

Sr. No.	Fish- Scientic name	Order	Family	Common name	* Collection sites			Abundance
					S1	S2	S3	
1.	*Puntius sophore* Hamilton.	Cypriniformes	Cyprinidae	Lal-debhari	+	+	+	40
2.	*Salmophasia bacaila* Hamilton			Chal	+	-	+	22
3.	*Puntius sarana* Val			Kunder	+	+	+	62
4.	*Cirrhinus reba*Hamilton			Reba	-	-	+	68
5.	*Garra mullya* Sykes			Mhya	+	+	+	72
6.	*Labeo boggut* Sykes			Ger masa	+	+	+	41
7.	*Labeo calbasu* Hamilton			--	+	-	+	28
8.	*Ompak bimaculatus* Bloch	Siluriformes	Siluridae	Papada	-	-	+	12
9.	*Ompak malabaricus* Val			--	-	+	-	06
10.	*Mystus bleekeri* Day		Bagridae	Chichva	-	-	+	05
11.	*Mystus* Spp.			--	+	-	-	04
12.	*Sperata aor* Hamilton			Ek-Kati	-	-	+	03
13.	*Heteropneutes fossilis* Bloch		Claridae	Tochya	+	-	-	10
14.	*Parambasis ranga* Hamilton	Perciformes	Ambassidae	Debhari	+	-	+	12
15.	*Oreochromis mossambica* Peters		Chilidae	Shilpi	+	-	-	42
16.	*Glossogobius giuris* Hamilton		Gobidae	Khavalya	+	-	+	40
17.	*Channa punctata* Bloch		Channidae	Dok- masa	+	-	-	48
18.	*Notopterus notopterus* Pallas	Osteoglossiformes	Notopteridae	Patoda	+	-	-	22
19.	*Tenualosa ilisha* Hamilton	Clupeiformes	Clupeidae	Bhat-masa	-	-	+	58
20.	*Macrognathus pancalus* Hamilton	Synbranchiformes	Mastacembeladae	Vam-masa	+	-	-	12

* Collection sites : S1 = Nakane dam, S2 = Dedorgaon dam and S3 = Salwade dam.

Table -2: The fish species richness and diversity indices

Sr. No.	Index	Values
01	Species richness	20
02	Species abundance (N)	607
03	Shannon-Weiner Index (H)	2.365
05	Simpson's Dominance Index (D)	0.066
06	Simpson's Index of Diversity (1-D)	0.934
07	Pielou's evenness (J)	0.369

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Quality Assessment of Drinking Water Supplied by Municipal Corporation in Dhule City, MS, India

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ABSTRACT: The present study is carried out during the study period Jan 2015 to Nov 2015. It deals with the assessment of water quality in terms of physico-chemical and microbial parameters. The water samples were collected from nine sites of municipal water supply spread across Dhule city of Maharashtra state, India. Data collection based on the questionnaire and laboratory analysis of water samples. Certain physico-chemical parameters like temperature, pH, alkalinity, turbidity, total hardness (TH), total dissolved solids(TDS), dissolved oxygen (DO), chlorides, nitrates, chemical oxygen demand (COD) and biochemical oxygen demand (BOD) etc.The main objective of the study was to determine suitability of the water for human consumption and other domestic uses.The results were compared with standards prescribed by National and International agencies like World Health Organization (WHO), Indian Standard Institute (ISI) and Bureau of Indian Standards (BIS). The results reveal that the values of physico-chemical and microbial parameters tested were found to be in the prescribed permissible limit. Thus the drinking water sample is suitable for human use.

KEYWORDS: WHO, ISI, BSI, Water quality, Physico-chemical parameters, Drinking water.

I.INTRODUCTION

We are all aware of water thus; there is no need to discuss the importance of water in our life. Water is basic necessity in our life; hence lives cannot survive without water(Khadse et al.,2005). It is being a basic need of human development, health and wellbeing, safe drinking water is an internationally accepted human right (WHO, 2008) which has been enlisted as one of the ten targets in the Millennium Development Goals (MDGs). An adequate supply of safe and potable water assist in preventing the spread of gastrointestinal diseases supports domestic and personal hygiene and improves the standard of living (Ezeribe et al., 2012). Now a day due to increase human population, rapid industrialization and indiscriminate use of chemical fertilizers in agriculture are causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and depletion of aquatic biota. On other hand due to use of contaminated drinking water, the population suffers from a variety of water born disease. In developing countries like India, the drinking water quality is continuously being contaminated and hazardous for human use due to large growth of population, expansion in industries, throwing away of waste water and chemical effluents into canals and other water sources. Secondly increased use of metal based fertilizer in agriculture revolution of the government could result in continued rise in concentration of metal pollution in fresh water reservoir due to the water run-off causes's water born diseases which has led to the death of millions of people. High levels of pollutants mainly organic matter in river water cause an increase in biological oxygen demand, chemical oxygen demand, total dissolved solids, suspended solids and fecal coliform. They make water unsuitable for drinking, irrigation or any other use (Ezeribe 2012). According to recent estimates, the quantity of available water in developing regions of South Asia, Middle East and Africa is decreasing sharply while quality of water is deteriorating rapidly due to fast urbanization, deforestation,

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and land degradation etc (Mohsin et al., 2013). It is therefore necessary that the quality of drinking water should be checked at regular time intervals.

Water is elixir of life, it is essential to all known life forms and is required for hydration to sustain health, sanitation needs, as a solvent to wash everyday items, for industrial applications and as a thermal transfer agent, among others. Inadequate water treatment has a significant and divesting impact on public health. About 1.2 billion people, worldwide, lack access to safe drinking water and twice that many lack adequate sanitation. The World Health Organization (WHO, 1996) estimates that 3.4 million people, mostly children, die every year from water-related diseases. The joint monitoring programme for water supply and sanitation, implemented by the World Health Organization (WHO) and UNICEF (2012), reports that 783 million people in the world (11 % of total population) have no access to safe water, 84 % of whom live in rural areas. The increase of fecal pollution in water resources is a problem in developing as well as in under developed countries (Rout and Sharma, 2011).

There are trends in developing countries to use sewage effluent as fertilizer has gained much importance as it is considered a source of organic matter and plant nutrients and serves as good fertilizer. Farmers are mainly interested in general benefits, like increased agriculture production, low cost water source, effective way of effluent disposal, source of nutrients, organic matter etc, but are not well aware of its harmful effects like heavy metal contamination of soils, crops and quality problems related to health. Research has proven that long term use of this sewage effluent for irrigation contaminates soil and crops to such an extent that it becomes toxic to plants and causes deterioration of soil [illegible], 2010; Patole and Patil, 2012). This contains considerable amount of potentially harmful substances may lead to contamination of food chain, as observed that soil and plants contained many toxic metals, that received irrigation water mixed with industrial effluent (Adnan et al., 2010; Asadullah et al., 2013).

Recent UNESCO report indicates that a vast chunk of population in India has no access to safe drinking water and that about 66 million people still rely on unsafe ground water for consumption (Patole and Patil, 2012). Most diseases and deaths occurring globally are directly linked to lack of adequate water, sanitation and unhygienic conditions. Regarding the quality of drinking water, microbiological contamination is a primary concern of developing countries (Ubharhande and Sonawane, 2012). The quality of water in all more important when it comes for human consumption and also in domestic use as it has a precise bearing on human health. Taps running unpurposefully, leaking water supply pipes, using filtered water for gardens and building construction are few instances of inefficient and misuse of water in daily life (Bhalerao, 2012; Reda, 2016). It is a challenge in itself, to provide a potable water quality to growing population with increasing demand for water. As per the available records no scientific study on the water quality has been conducted here so far. The present work has been undertaken to understand the seasonal fluctuations in water quality as well as the quality aspects of water which supplied by Dhule Municipal Corporation(DMC).

II.MATERIALS AND METHODS

Study area

Dhule city is North Western part of Maharashtra State. It is formerly known as West Khandesh and situated between 21°19'North Latitude and 75°20' East Longitude. The city and its suburbs covering an area of nearly 46.46 Sq. km. The city is situated on the bank of the Panjhra River. The drinking water is supplied to the house hold through [illegible] system from threeimportant reservoirs like, TapiRiver(Sulwade barriage), Nakane dam and Dedorgaon dam [illegible] different sites of city.

To determine physico-chemical and microbial parameters, samples were collected at regular intervals. The water samples were collected from three sampling sites viz. I, II and III from Sulwade (Deopur aren- Navrang tank), Dedorgaon (Panchkandil area- Malegaon road tank) and Nakane (Moglai area- Hanuman tekadi tank) pumping stations respectively. Water samples were collected from different locations, and point of collection was about 50-100 meters away from each other. The potable water samples were collected in one litre capacity cleaned polythene bottle and brought to the laboratory in an ice box jar to avoid unusual change in water quality. The sample bottles were labeled with date and sampling source. Prior to the sampling all the bottles are washed and rinsed thoroughly with distilled

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water. All the precautions were taken as given in APHA, AWWA, WPCF (2003) while sample collection and preservation

Immediately after sample collection various physico-chemical and microbial parameters like water temperature and pH were recorded at collection site as well as DO, TDS, BOD, COD, TH, alkalinity, chloride and nitrates etc were measured in laboratory by different methods are shown in table-1A. The analytical methods were followed are describedby Manivasakam(2009), NEERI (1981), Trivedi and Goel (1986) and Kodarkar (2006).

III.RESULTS AND DISCUSSION

The statuses of physico- chemical parameters are direct or indirect indicesof water quality. Certain limits have been recommended,the values above which required some corrective measures for chemical parameters. The observed values of different parameters and their correlation enables to classify the chemical composition of water, characterize the level of water pollution and the nature and sources of prevalent pollutants. As shown in Table -1 A and B, the values of physico-chemical and microbial parameters found under permissible limits. The drinking water should be free from taste, odor, turbidity, harmful chemicals and microorganisms. The present study stated that the supplied water is free from fecalcoliforms; a clear indication of water quality was supplied to various parts of the city by Dhule Municipal Corporation. Results on various physic-chemical parameters are presented in table-2 as discussed bellows;

1. **Temperature:**It is an important a biotic factor, it has effects on certain chemical and biological activities in the organisms attributing in aquatic media. It is an important parameter for biological and physiological processes in aquatic organisms. For the growth of organisms it is a vital parameter (Patil et al., 2012). The water temperature is fluctuating between 25^{0}C to 33^{0} C in the study period. The maximum temperature (32-33^{0}C) was recorded in the month of May (summer) and minimum (25 ^{0}C) in the month of November (winter). Except in the month of winter season, the atmospheric temperature was found to be higher than the water temperature. The fluctuation in air and water temperature may be due to influence of season and location. High temperature during summer was due to greater heating of water and insolent heat from sun. Onset of monsoon result in fall in temperature of water bodies because clouds acts as a barrier in the process of heating (Edimeh et al., 2011; Sabrina et al., 2013). The values reported in this work are within the permissible range recommended by WHO and others. Bhalerao (2012) reported similar results. Bernard and Ayeni (2012) reported that high water temperature enhances the growth of microorganisms and may increase taste, odor, color and corrosion problems.

2. **pH (Hydrogen ion concentration):** The test for pH of drinking water is carried out to determine whether it is acidic or alkaline in nature. Like temperature, the role of pH is very important in the growth of flora and fauna in the aquatic ecosystem. Thus, the estimation of pH has most important because most of the chemical and biochemical reactions are depend on pH value of water (Ezeribe et al., 2012; Reda, 2016). It is the most significant parameter which indicates the pollution of the water body. The factor that affects on pH is photosynthesis exposure todomestic sewage, disposal of industrial wastes etc. In the present study the pH value ranges from 6.6 to 7.2. The pH range of such type was recorded in the study so the pH of water is suitable for drinking purpose. Although pH usually has no direct impact on consumers, it is one of the most important operational water quality parameter (Bernard and Ayeni, 2012). The higher pH values observed suggest that carbon dioxide, carbonate-bicarbonate equilibrium is highly affected (Patil et al., 2012). In present study, the pH values lies around neutral (pH- 7). This pH fluctuation depends on changes in air temperature that brings influence in biochemical and chemical reactions (Bhalerao, 2012). It is noticed that water with low pH is tend to be toxic and with high degree of pH, it is turned into bitter taste (Mohsin et al., 2013). Extreme pH (pH > 11) results in irritation in eyes, skin and mucus membrane and also cause hair fibres to swell (Asadullah et al., 2013). Our results shows that all the water samples were within permissible limit.

3. **Turbidity:**Turbidity in drinking water is due to presence of inorganic particulate matter in suspended state (Ezeribe et al., 2012). High turbidity can protect microbes from the effect of disinfection thereby can stimulate

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bacterial growth (Bernard and Ayeni, 2012). It is one of the foremost parameter for the acceptability of drinking water quality. As per WHO, ISI and BIS guidelines for turbidity are < 5 NTU. The observed values in studied samples for turbidity were varied from 0.28 to 0.98 NTU. On the ground of turbidity all samples were found within the permissible limits.

4. **Total dissolved solids (TDS):** The higher concentrations of TDS showan unusual taste of water and reduce its portability. The TDS is also very significant parameter for drinking water and water to be used for other purposes (Reda, 2016). In the present study the range of TDS of analyzed sample varied between 56 to 116 mg/ L as shown in table -2. Our observations are in link with the earljer findings of Gonai et al (2010), Asadullah et al (2013). The TDS of water is mainly due to presence of carbonates, calcium, chloride, phosphates and other ions. Increased TDS related to increase in the load of soluble salts, mud, nutrients and other particles (Mohsin et al., 2013). The TDS proportionally increased the electrical conductance in water and ran parallel to each other. All the values of TDS were within the standard limit of WHO and BIS (500 mg/L). Therefore the water is safe for drinking in terms of TDS.

5. **Dissolved oxygen (DO):** The dissolved oxygen in water plays significant role in limnology. It regulates many of the metabolic processes of aquatic organisms. It also indicates the ability of water that support the sustainability of biological life is due to diffusion of oxygen from atmosphere, photosynthetic evolution by aquatic plants. DO is one of the most important parameter. Its correlation with water body gives direct and indirect information e.g. bacterial activity, photosynthesis, availability of nutrients, stratification etc (Premlata, 2009). In the progress of summer, dissolved oxygen decreased due to increase in temperature and also due to increased microbial activity (Kataria et al., 1996). The high DO in summer is due to increase in temperature and duration of bright sunlight has influence on the % of soluble gases. During summer the long days and intense sunlight seem to accelerate photosynthesis by phytoplankton, utilizing CO2 and giving off oxygen. This possibly accounts for the greater qualities of O2 recorded during summer (Patil et al., 2012). In present work higher (6 to 6.4 mg/ L) and lower (4.6 to 4.9 mg/ L) values of DO were observed during the month of May and November respectively. This variation in DO could be due to differences in organic matter that remains as residue in water (Edimeh et al., 2011; Patole and Patil, 2012). These results corroborated with earlier workers viz., Bhalerao (2012) and Ezeribe et al (2012).

6. **BOD:** BOD has been used as a measure of the amount of organic materials contamination in water, specified in mg/L. It indicates the strength of polluted waters,sewage,effluents and provides data on pollution load in natural waters. The increase in values of BOD indicates a higher consumption of oxygen and a higher pollution load.Thus BOD is used as measure of the amount of organic material in an aquatic solution which supports the growth of micro-organisms. In general BOD gives a quantitative index of organic substance, which is degraded rapidly. The high BOD created due to oxidation of organic waste by natural micro-organisms. The observed BOD level in present investigation is ranging from 13 to 20 mg/ L and it is below permissible limit of ISI. Similar results were reported by Patil et al., (2012).

7. **COD:** COD is another measure of organic material contamination in water and specified in mg/ L. It indicates the amount of oxygen required for chemical oxidation of organic matter using a strong chemical oxidant like Potassium dichromate under reflux conditions. The high COD values indicate the presence of chemically oxidizable carbonaceous matter as well as inorganic matter such as sulphides, nitrates and reduced metal ions (Patil et al., 2012). In present report the amount of COD were found to be within permissable limit prescribed by WHO and BIS.

8. **Alkalinity:** The alkalinity is also the most important parameter in which the measurement of the ability of water to resist the acidification for instance, to acid rain alkalinity of water is measure of its capacity to neutralize acids. The high alkalinity values are indicators of the eutrophic nature of the water bodies. Seasonal analysis shows that the higher value in summer months followed by winter and fall in monsoon months. Similar results were reported

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that alkalinity was maximum in summer due to high photosynthetic activity (Hujare, 2008; Bernard and Ayeni, 2012; Reda, 2016). The alkalinity of water may be caused by dissolving strong bases such as Sodium or potassium hydroxide ions (Bernard and Ayeni, 2012). Moderate concentration of alkalinity is desirable in most water supplies to stable the corrosive effect of acidity (Mohsin et al., 2013). The desirable limit according to WHO and BIS is 200 to 600 mg/L. The water of samples varied from 44.00mg/L to 86.00 mg/L. So the alkalinity content in all sampling sites has been found within the desirable limit. The alkalinity is itself are not harmful to the human being. However the taste of water is bitter when there is in large quantities alkalinity.

9. **Total hardness:** The hardness of water is due to presence salts of Ca^{+2}, Mg^{+2} and other heavy metals ions like Al^{+3}, Fe^{+2} and Mn^{+2} which are dissolved in the water (Raut and Sharma, 2011). In the natural water it is a common constituent due to the concentration of salts.The main sources of these ions are sedimentary rocks, seepage and run off from solid(Patole and Patil, 2012). Hard water is characterized with high mineral contents that are usually not harmful for humans (Asadullah et al., 2013). The water is soft which has the hardness below 50 mg/L. On the other hands, the water is to be objectionable for the domestic purpose if the hardness is found more than 150mg/L (Mohsin et al., 2013). Depending on the interaction of other factors, such as pH and alkalinity, water with hardness above approximately 200 mg/L may cause scale deposition in the treatment works, distribution system and pipe work and tanks within buildings. Soft water with hardness below 100 mg/L may have a low buffering capacity and so be more corrosive for water pipes (Bernard and Ayeni, 2012). Maximum permissible limit of total hardness is 500 mg/L prescribed by WHO and others. The values of hardness were recorded between 34.0 to 68.0mg/L in the present study and fall below WHO and BIS standards of drinking water which is soft in nature. Those results clear that hardness of water is according to the WHO (2008) standards and it is not harmful for human consumption.

10. **Nitrates:** Nitrates can reach both surface water and ground water as a consequence of agricultural activity i.e. excess use of inorganic nitrogenous fertilizers and manures as well as nitrogen cycle and industrial waste (Bernard and Ayeni, 2012). Some ground water may also have nitrate contamination as a consequence of leaching from natural vegetation but most of unpolluted sources of water are deficient of nitrates because it exists only in few natural sources (Trivedi and Goel, 1986). Presence of nitrates in water indicates the presence of fully oxidized organic matter. Nitrate is one of the important diseasing causing parameter of water quality particularly excess level can cause Methemoglobinemia as blue baby syndrome in infants (Ezeribe et al., 2012; Mohsin et al., 2013). The WHO allows maximum permissible limit of nitrate in drinking water is 20 mg/L. In study areas, results clear that the concentration of nitrates ranges from 11.0 to 18.0 mg/L. These results indicate that the quality of water is acceptable which was bellowingthe WHO and BSI standards of drinking water permissible limit.

11. **Chlorides**The chlorides are the moststable component in water and its concentration is highly unaffected by most physico-chemical and biochemical processes. Hence value of chloride concentration in water is a useful measure in water sample (Ezeribe et al., 2012). The main source of chlorides in fresh water is the discharge of domestic and industrial sewage. The concentration of chlorides is thus the indicator of pollution (Venkateswara, 2011). Chloride may increase due base exchange phenomena, high temperature, domestic effluents, septic tanks and low rainfall (Reda, 2016). The surface water bodies often have low concentration of chlorides as compare to ground water. It has key importance for metabolism activity in human body and other main physiological processes (Mohsin et al., 2013). The maximum permissible limit of chloride in potable water is 250 mg/L. It produces salty taste at 250 to 500 mg/L (Trivedi and Goel, 1986). In analyzed water samples, the concentration of chloride varies from 74 to 142 mg/ L. The chloride content of the water sample when compared with WHO, ISI and BIS standards then it was found that all samples showed concentration within the permissible limit. The values of chloride content were found to be almost negligible in the water samples. This may be due to absence of any polluting industry in nearby areas.

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IV.CONCLUSION

The present study quality assessment of the physico-chemical parameters of drinking water from nine sites at different (supplied from 3 dams) location in Dhule city was carried out. To assess the quality of drinking water each parameter was compared with the standard desirable limits prescribed by World Health Organization (WHO), Indian Standard Institute (ISI) and Bureau of Indian Standard (BIS). From the study it can be concluded that drinking water supplied by DMC is safe for drinking purposes from the point of view of levels of pH, turbidity, TDS, DO, BOD, COD, alkalinity, TH, nitrates and chlorides. It was also observed that alkalinity, dissolved oxygen and temperature etc are higher in summer season and lower in winter season. This may due to higher photosynthetic rate in summer season. Whereas the pH value is higher in winter season and lower in summer season. It indicates reduction in photosynthetic activities in winter which reduces assimilation of CO_2 and HCO_3^-.

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REFERENCES

1. Adeva, A., Ahmad, T., Malik, E., Muhammad, I., Khatak, M. and Muhammad, A. Khan. Evaluation of industrial and city effluent quality using physic-chemical and biological parameters. *Elec. J. Environ. Agric. And Food Chem.* 9(5): 931-939, 2010.
2. APHA, AWWA, WPCF. *Standard methods for examination of water and wastewater*. 20th edi. American Public Health Association, Washington, DC. 2005.
3. Abdullah, Niza, K. and Khan, S. I. Physico-chemical properties of drinking water available in educational institutes of Karachi city. *Sci. Tech. and Dev.*, 32(1): 28-33, 2013.
4. [illegible]d, E. and Ayeni, N. Physicochemical analysis of ground water samples of Bichi local government area of Kano state of Nigeria. *World* [illegible]*ent.* 2(6): 116-119, 2012.
5. [illegible]ekaran, S. N. Study of fish and water quality at Kasar Sai dam, Haveli, Pune, MS, India. *Int. Res. J. Bio. Sci.* 1(4): 51-55, 2012.
6. Edimeh, P. O., Eneji, I. S., Okeiyede, O. F. and Sha'ato, R. Physico-chemical parameters and some heavy metals content of Rivers Inachalo and Niger in Idah, Kogi State. *J. Che. Soc. Nigeria.* 36 (1): 95-101, 2011.
7. Erenbe, A. I., Ohieke, K. C. and Jauro, A. Physico-chemcial properties of well water samples from some villages in Nigeria with cases of stained and mottle teeth. *Sci. world J.* 7(1): 1-3, 2012.
8. Gorai, A. H., Sakarat, P. and Khan, A. A. Study of some physic-chemical parameters in medical pond, Aligarh. *The Ekol.* 10(1-2): 89-96, 2010.
9. Hujare, M. S. Seasonal variation of physic-chemical parameters in the perennial tank of Talsande, Maharashtra. *Economical, Environ, Monit.* 18(3): 233-242, 2008.
10. ISI (IS 10500-91). *Indian Standard Institute*. Specification for drinking water, New Delhi. 2003.
11. Kataria, H. C., Qureshi, H. A., Iqbal, S. A. and Shandilya, A. K. Assessment of water quality of Kolar reservoir in Bhopal (M.P.) *Pollu. Res.* 15(2): 191-193, 1996.
12. Khadse, G. K., S. P. Andey and M.V. Nanoti. Rural water supply and need for water quality assessment: A case study. *Journal of Environ. Sci. & Engg.* 47(3): 242-249, 2005.
13. Kodarkar, E. D. Methodology for water analysis- Physico-chemical, Biological and Microbiological. *IAAB Publication No.2.3rd Edition. IAAB*, Hyderabad. PP: 1-107, 2006.
14. Manivesakam, N.Physico - chemical examination of water, sewage and industrial effluents.*Pragati Prakashan, Meerut.* 2009.
15. Mohsin, M., Safdar, S., Asghar, F. and Jamal, F. Assessment of drinking water quality and its impact on residents health in Bahawalpur City. *Int. J. Humanities and Soc. Sci.* 3(15): 114-128, 2013.
16. NEERI. A course manual of water and waste water analysis. *National Environmental Engineering and Research Institute, Nagpur.* 1981.
17. Patil, P. N., Sawant, D. V. and Deshmukh, R. N. Physico-Chemical parameters for testing of water- A review. *Int. J. Environ Sci.* 3(3): 1194-1207, 2012.
18. Patole, S. S. and Maniha Patil. Studies on physico-chemical qualities of drinking water from Wadibhokar village of Dhulia District (M.S.) *Int. Biannual J. Eco. Environ. Sci.* 4(2): 169-172, 2012.
19. Premlata, V. Multivariant analysis of drinking water quality parameters of Lake Pichhola in Udaipur, India. *Biological Forum- Bio. Forum- An Int. J.* 1(2): 97-102, 2009.
20. Rani, C. and Sharma, A. Assessment of drinking water quality: A case study of Ambala cantonment area, Haryana, India. *Int. J. of Env. Sci.* 2(2): 933-944, 2011.

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21. Reda. A. H. Physico-chemical analysis of drinking water quality of Arbaminch Town. *J. of Env. Anal. Toxicol.* 6(2): 1-5, 2016.
22. Trivedi, R. K. and P.K. Goel. Chemical and biological methods for water pollution studies. *Environ. Publications*, Karad(India), 1986.
23. Ubarhande, S. B. and Sonawane, S. R. Study of freshwater fish fauna and water quality at Paintakli dam from Buldhana district, (M.S.), India. *J. Expr. Sci.* 3(7): 4-8, 2012.
24. Venkateswara, B. R. Physico-chemical analysis of selected ground water samples of Vijayawada rural and urban in Krishna district, Andhra Pradesh, India. *Int. J. Environ. Sci.* 2: 710-714, 2011.
25. WHO (World Health Organization). Guidcline for drinking water quality, Recommendation. 1, 16-17, 1996.
26. WHO Geneva. *Guidelines for drinking water quality*. 3rd edi. 1: 438, 2008.
27. WHO and UNICEF. Progress on Sanitation and drinking water: 2102 Update; WHO/UNICEF: Geneva, Switzerland, 2012.

Table-1: Water quality parameters with their analytical techniques and standard permissible limit.

Parameters	Techniques used	* Standard permissible limit		
		WHO	ISI	BSI
Temperature (^{0}C)	Thermometer	--	--	--
pH	pH meter	7.0 – 8.5	7.0 – 8.5	6.0 – 8.5
Turbidity (NTU)	Turbido meter	5.0	10.0	10.0
Total dissolved solid (ppm)	Evaporation method	500	5000-1000	300
Dissolved Oxygen (mg/ L)	Winkler's method	4.0	3.0-7.0	4 - 6
Biological Oxygen Demand(mg/ L)	Incubation followed by titration	6.0	30.0	--
Chemical Oxygen Demand (mg/ L)	C.O.D. digester	10.0	--	40.0
Alkalinity (mg/ L)	Acid-base titration	200 - 600	200	200 - 600
Total Hardness (mg/ L)	EDTA- titration method	200	300	200
Nitrates (mg/ L)	UV visible spectrophotometer	10-20	10-20	10-30
Chlorides (mg/ L)	Mohr's method	200	200	250

Sources: WHO (2008); ISI (2003); BSI (1991).

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Studies on Sub Lethal Effect of Cypermethrin and Oxyfluorfen on Biochemical Parameters of Earthworm Species, *Eisenia foetida* Savigny, 1826

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ABSTRACT: Present piece of work deals with sub lethal effect of pesticides viz., Cypermethrin and Oxyfluorfen on biochemical parameters of earthworm species, *Eisenia foetida*. The results revealed that the sub lethal concentration of both pesticides significantly reduce the biochemical content of experimental worms over the control. Decreased values of protein, triglyceride and glycogen were dose dependent and found to be 11.1 % & 4.9 %; 35.8 % & 22.4 % and 13.6 % & 22.7 % in worm exposed to $3/4^{th}$ sub lethal concentration of Cypermethrin and Oxyfluorfen respectively.

KEY WORDS: Pesticides, Cypermethrin, Oxyfluorfen, Protein, triglyceride and glycogen etc.

I. INTRODUCTION

Herbicides and insecticides have become inseparable part of modern agricultural production and technology. But it can adversely affect on beneficial soil organisms and there by contribute to environmental concern. This necessities permanent monitoring of their use and effects on the growth and development of the soil macro and micro flora and fauna. Particularly earthworms. Earthworms are highly susceptible to changes of ecological factors [1]. Globally, Cypermethrin is one of the most widely used synthetic pyrethroid for agricultural and domestic purposes. Most of the pesticides used in the agriculture end up as residues in the soil, making soil dwelling organisms, especially earthworms more susceptible to pesticides intoxication. Cypermethrin is known to be a neurotoxicant to many model organisms, including mammals and insects, but such type of toxicity evidence is not available for invertebrate system like earthworms [2]. The use of Cypermethrin occupies 4^{th} position globally in pest application. The usage is more than one million pounds per year in the US only as an active ingredient for agriculture necessities [3]. However, despite its usage and knowledge on the toxicity of Cypermethrin, Surprisingly very less work have been carried out on earthworm to evaluate the effects of this insecticide [4].

Earthworms have been shown to be affected by the fate of herbicides in soil. Earthworms directly influence the persistence of herbicides in soil by metabolizing a parent compound in their gut, by transporting herbicides to depth and increasing the soil bound (non extractable herbicide) fraction in soil or by absorbing herbicide residues in their tissues. [5]. *Eisenia fetida* is an earthworm of high abundance in compost upper layer of soil. It has been used as a biomonitor for heavy metal and insecticide ecotoxicology and potential spin-off for the use of earthworm data in ecotoxicological study risk assessment [6]. Earthworm have been exposed the soil spicked with the herbicide precursor, Chloroacetamide, which was lethal to the animals [7]. Butachlor herbicide causes histological changes [8].

The abundance use of herbicides does not affect only selected weeds, but also destroy non-target species in the agricultural fields as well as and also affect the texture and physiochemical properties of soils [9]. The use of specific herbicide, fungicides, and insecticides in the agricultural field can be highly toxic to earthworm population [10]. Correira and Moreira [11] reported the effect of herbicide on growth, survival and reproduction rate of earthworm

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species, *Eutyphoeus waltoni*. Sublethal concentration of Cypermethrin shown significant responses on fatty acid, sugars and amino acids in worm species, *Metaphire posthuma* [2]. Earthworms have been studied as a readily available, easily maintainable and cheap test species for assessing chemical pollution. The present piece of investigation aims to find out the 1/4th and 3/4th sub lethal effect of Cypermethrin and Oxyfluorfen on biochemical parameters viz., protein, triglyceride and glycogen content of the worm, *Eisenia foetida*.

II. MATERIAL AND METHODS

BIOLOGICAL MATERIAL: Earthworm species *Eisenia foetida* were obtained from state Government agricultural nursery, Sakri (Dhule) M.S. They were maintained in the laboratory as per OECD [12] guidelines. Only healthy adult worms having well developed clitella were used for the experiment.

CHEMICAL MATERIAL: Two chemicals i.e. commercially available Cypermethrin (10% EC) an insecticide belongs to synthetic pyrethroid and selective herbicide Oxyfluorfen (23.5% EC) commonly called "Goal" were purchased from local pesticide shop. The quality soil and a month old cow dung were collected from agriculture field and cow shed respectively.

EXPERIMENTAL SET-UP: The experiment was performed in plastic tough having five kg capacities. A dried quality soil was ground and sieved. In a tough 800 g of fine soil thoroughly mixed with 200 g Cow dung and appropriate amount of water was added to moisten the mixture.

TREATMENT: The LC_{50} values of both the pesticide in earthworms were already estimated in our previous study, which was 2.240 ml/kg for Cypermethrin and 0.420 ml/kg for Oxyfluorfen. The sub lethal concentrations i.e. 1/4th and 3/4th doses of Cypermethrin is 0.56 and 1.68 ml/kg respectively. While the sub lethal doses (i.e. 1/4th and 3/4th) of Oxyfluorfen is 0.105 and 0.315 ml/kg respectively. The dose concentrations of both pesticides were separately added in 100 ml of distilled water that was mixed in the experimental groups only. On next day, 20 mature worms were added to each tough. The tough was covered with perforated lid and kept for 45 days. The experimental set up was prepared in triplicate for each treatment.

BIOCHEMICAL MEASUREMENT:

ESTIMATION OF PROTEINS: At the end of the experiment of about 45 days, earthworms were removed from vermibed and fasted for 24 h, so that their digestive tract was completely empty. For biochemical analysis, the worms were cut into pieces and mixed with ice cold 0.86% invertebrate ringer solution, the mixture was homogenized and centrifuged. The resulting supernatant was used for the determination of protein. It was estimated according to the method suggested by Lowry [13]. Triglycerides were estimated from the earthworm homogenate by GPO/PAP method [14] and glycogen was estimated by method suggested by Gael [15]. Results were tabulated and statistically analyzed.

The per cent change in biochemical contents were determined by applying following formula i.e.

$$\% \text{ change} = \frac{\text{Control} - \text{Experimental}}{\text{Control}} \times 100$$

III. RESULTS AND DISCUSSION

The biochemical contents of control and experimental worms exposed to sublethal concentration of both pesticides is presented in table-1. This table shows that there is significant and dose dependent decline in biochemical contents like protein of the worm exposed to 1/4th and 3/4th sub lethal concentration of Cypermethrin and Oxyfluorfen is 7.4 % & 11.1 % and 1.2 % & 4.9 % respectively. In case of triglyceride content, the values are 28.4 % & 35.8 % and 13.4 % & 22.4 % respectively. Whereas glycogen content were found to be 4.5 % & 13.6 % and 18.2 % & 22.7 % respectively under both pesticide stresses.

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IV. CONCLUSION

The present study indicates that both pesticides i.e. Cypermethrin and Oxyfluorfen cause alterations in all the biochemical parameters of earthworm, *Eisenia foetida*. The significant reduction in levels of protein, triglyceride and glycogen contents were found to be dose dependent over the control worm. It might be caused by intoxication of pesticidal stress in the intermediary metabolism of the earthworm.

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REFERENCES

1. Mirjana, R., Spasenija, R. and Tanja, M. Herbicide and pesticide effect on the Earthworm species *Eisenia foetida* (Savigny, 1826) (Oligochaeta, lumbricidae). *Arch. Biol. Sci. Belgrade.* 59(2): 23-24, 2007.
2. Ch, R., Amit Kumar Singh, Pathya Pandey, P.N. Saxena and M.K. Reddy Mudiam. Identifying the metabolic perturbations in earthworm induced by Cypermethrin using gas chromatography-mass spectrometry based metabolomics. *Scientific Reports*, 5: 15674, DOI: 10.1038, 2015.
3. Gijare, S., Raju, V.T., Tantarpale and Kulkarni, K. M. Influence of Cypermethrin on liver of the freshwater fish *Ophiocephalus punctatus*. *Pollu. Res.* 31(1): 35-40, 2011.
4. Mudiam, M. K., Ch, R. and Saxena, P. N. Gas chromatography-mass spectrometry based metabolomic approach for optimization and toxicity evaluation of earthworm sub-lethal responses to carbofuran. *PLOS One.* 8, e81077, 2013.
5. Gilman, A. P. and Vardanis, A. Carbofuran: Comparative toxicity and Metabolism in the worms *Lumbricus terrestris* and *Eisenia foetida*. *J. of Agri and Food Chem.* 22(4): 625-628, 1974.
6. Van Gestel CAM and Weeks, J. M. Ecological, physiology and physicochemical factors in earthworm ecotoxicology. 3rd International workshop on Earthworm Ecotoxicology. *Ecotoxicol. Environ. Safety* 57(1):100-105, 2004.
7. Hund-Rinke K., Achazi, R., Rombke, J. and Warnecke, D. Avoidance test with *Eisenia foetida* as indicator for the habitat function of soils: Results of a laboratory comparison test. *J. Soils Sediments* 3(1): 7-12, 2003.
8. Muthukaruppan, G., Janardhanan, S. and Vijayalakshmi, G. S. Sublethal toxicity of herbicide butachlor on the earthworm *Perionyx sansibaricus* and its histological changes. *J. Soil Sediments* 5(2): 82-86, 2005.
9. Robidoux, P. Y., Hawari, J., Thiboutot, S., Ampleman, G. and Sunahara, G. I. Acute toxicity of 2,4,6-trinitrotoluene in earthworm (*Eisenia andrei*). *Ecotoxicol. Environ. Saf.* 44(3): 11-21, 1999.
10. Zhou, S. P., Duan, C. P., Fu, H., Chen, Y. H. and Yu, Z. F. Toxicity assessment for chlorpyrifos contaminated soil with three different earthworm test methods. *J. Environ Sci.* 19(7): 854-858, 2007.
11. Correia, F. V. and Moreira, J. C. Effects of glyphosate and 2,4-D on earthworms (*E.foetida*) in laboratory tests. *Bull. Environ. Contam. Toxicol* 85: 264-268, 2010.
12. OECD: *Organization for Economic cooperation and Development Guideline for testing of chemicals: Earthworm Acute Toxicity test*, OECD Guidelines No. 207, Paris, France, 1984.
13. Lowry, O. H. Rosebrough, N. J., Farr, A. L. and Randall, R. J. Protein measurement with Folin-phenol reagent. *J Biol Che.* 193:265, 1951.
14. Trinder, P. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor, *Ann. Clin. Biochem* 6: 24-27, 1969.
15. Goel, R. K. Evaluation of anti-hyperglycemic activity of some novel monocyclic beta lactams. *J. Pharm Pharmaceut Sci.* 7(1): 80-83, 2004.
16. Jha, B. S. and Verma, B. P. Effect of pesticidal mixture on protein content in the freshwater fish *Clarias batrachus*. *J. Ecotoxicol. Environ. Monitr.* 12(3): 177-180, 2002.
17. Baruah, K., Sahu, N.P., Pal, A.K., Debnath, D., Dietary phytase: an ideal approach for a cost effective and low polluting aqua feed. NAGA world fish centre Quarterly, 27, 15-19, 2004.
18. Abdul Naseem, Yousefi, S., Ayoub, Y. and Mohammad, A. Effect of Atrazine (Herbicide) on blood biochemical indices of grass carp (*Ctenopharyngodon idella*). *J. of the Persian Gulf (Marine science).* 2(5): 51-56, 2011.
19. Somaiah, K., Satish, P. V. V., Sunita, K. and Jyothi, N. B. Studies on the biochemical responses in the tissues of freshwater fish *Labeo rohita* exposed to the organophosphate, Profenos. *Int. J. Pharm. Sci. Rev. Res.* 32(2): 106-115, 2015.
20. Sarmini, T. A., Chandrasekhar, R. and Awang Mohammad M. Endosulfan induced changes in the liver and ovary of freshwater fish, *Oreochromis mossambicus* (Trewavas). *Malaysian J. Sci.* 22: 29-34, 2002.
21. Jee, L. H., Masroor, F. and Kang, J. Responses of Cypermethrin induced stress in haematological parameters of Korean rock fish, *Sebastes schlegeli* (Hilgendorf). *Aquacult. Res.* 36: 898-905, 2005.
22. Mahalakshmi, K. and [illegible] A. Blood glucose level and hepatic glycogen [illegible] in *Labeo rohita* exposed to heavy metal chromium. *J. Ecobio.* 25(4): 307-310, 2009.
23. [illegible], R. and [illegible], B. Spirotetramat an insecticide inhibitor of lipid synthesis affects the amount of carbohydrates, glycogen and the activity of lactate dehydrogenase in *Drosophila melanogaster*. *J. Entomol and Zool Studies* 4(1): 452-456, 2016.
24. Nagaraju, B., Vakita, V. R. and [illegible], K. Effect of Chlorantraniliprole on biochemical and carbon [illegible] in various tissues of freshwater fish *Labeo rohita* (Hamilton). *Environ and Ecol. Res.* 1(4): 208-215, 2013.
25. Pelosi, C., Bertrand, M., Thenard, J. and Mougin, C. Earthworms in a 15 year agricultural trial. *Appl. Soil. Ecol.* 88:1-8, 2015.

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PROTEINS: Proteins are very important organic substance. In present study, the results show maximum reduction (11.1 %) in protein content was found in worm exposed to 3/4th dose concentration of Cypermethrin than Oxyfluorfen exposed worms. The decrease in protein content could also be attributed to spontaneous utilization of amino acids inside the organism by various catabolic reactions in order to combat the stress condition. Similar results were reported by Jha and Verma [16] in fish species, *Clarias batrachus* exposed to pesticide mixture. Barnab [17] reveal study on effect of paper mill effects of muscle proteins in fish, *Heteropneustus fossilis*. In chronic toxicity, fish were exposed to atrazine herbicide for 30 days. The results showed significant decrease in plasma total protein, albumin, glucose, cholesterol and triglycerides [18]. Somaiah [19] reported significant decline in total glycogen, protein, lipids, carbohydrates and free amino acids etc were observed in freshwater fish, *Labeo rohita* exposed to sublethal concentration of organophosphate pesticides, Phenthoate.

TRIGLYCIRIDES: Triglyceride content has decreased in the present report. It is observed that maximum (35.8 %) decreased was found in worm exposed to 3/4th sub lethal concentration of Cypermethrin than Oxythuorfen (22.4 %). During the time of low availability of carbohydrates, lipids serve as a source of energy for supporting the physiological functions of the body. Hence, the decline in triglyceride content was due to the utilization of lipids for meeting the energy demand under the pesticide stress. Similar results [19, 20] support the present work that the triglyceride level was changed when worm exposed to toxicants like Cypermethrin and Oxyfluorfen.

GLYCOGEN: The Carbohydrates (Glycogen) are the main source of energy in the cells and play a vital role in cellular metabolism by acting as fuel and providing energy to the body cells. In present study maximum glycogen depletion was observed in worm exposed to the higher sub lethal concentration of herbicide, Oxyfluorfen (i. e. 22.7 %) than insecticide, Cypermethrin (i. e. 13.6 %). The change in carbohydrate metabolism that would mean the changing energy demand may be subjected to stress. These alterations supports that carbohydrate metabolism in animals is effected by the toxicants [19, 21, 22]. Neelima and Sobani [23] revealed reduction in the amount of glycogen content in pupae of *Drosophila melanogaster* exposed to sub lethal concentration of an insecticide, Spiromesifen. Our work is corroborating with Nagaraja [24], they studied oxidative stress in freshwater fish, *Labeo rohita* exposed to sublethal concentration of Chlorantraniliprole (Coragen). They revealed that protein as well as glycogen and total lipid content of various organs were decreased significantly. Epoxiconazole a persistent widely used pesticide affect on lipid and glycogen content after 28 days of exposure [25].

Table-1: Biochemical content of *Eisenia foetida* treated with pesticides

Treatment	Dose concentration	Biochemical parameters (mg/ dl)		
		Protein	Triglyceride	Glycogen
Control	–	40.50 ± 2.0	33.50 ± 1.50	11.00 ± 0.5
Cypermethrin	1/4th	37.50 ± 1.0 (7.4) *	24.0 ± 2.0 (28.4) **	10.5 ± 0.5 (4.5) NS
	3/4th	36.00 ± 1.5 (11.0) *	21.50 ± 1.5 (35.8) ***	09.50 ± 0.5 (13.6) *
Oxyfluorfen	1/4th	40.0 ± 1.0 (1.2) NS	29.0 ± 1.5 (13.4) *	9.0 ± 0.5 (18.2) **
	3/4th	38.50 ± 1.5 (4.9) NS	26.50 ± 1.5 (22.4) **	08.50 ± 1.0 (22.7) **

Significant values: *P<0.05, **P<0.01, *** P<0.001.
Values in the parenthesis are % change over control. CD (Mean ± SEM, n = 5)

A checklist of beetle diversity (Insecta: Coleoptera) from Sakri region, Dist- Dhulia (M.S.) India.

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Abstract

The study presents taxonomic account of 33 coleopteran beetles belonging to 8 families viz., Buprestidae, Carabidae, Cerambycidae, Chrysomelidae, Hybosoridae, Meloidae, Scarabaeidae and Tenebrionidae from Sakri region, District - Dhulia (M.S.) is provided for the first time. Interactive identification keys of species were prepared by studying thoroughly the morphological characters of all collected beetle specimen. Based on collection data, the highest number of specimen were recorded from scarabaeidae family.

Key words: Coleopteran beetle, Bupresitidae, Carabidae, Cerambycidae, Scarabaeidae.

Introduction

Coleopteran beetles are a globally distributed insect group, with their high diversity in tropical forest and are member of largest order coleoptera. Mostly beetles feed on the microorganism rich liquid component of mammalian dung and other decaying material (Kailash Chandra and Devanshu Gupta, 2013).

A perusal of literature on the diversity of beetles from different state of India were reported by some earlier workers viz.,

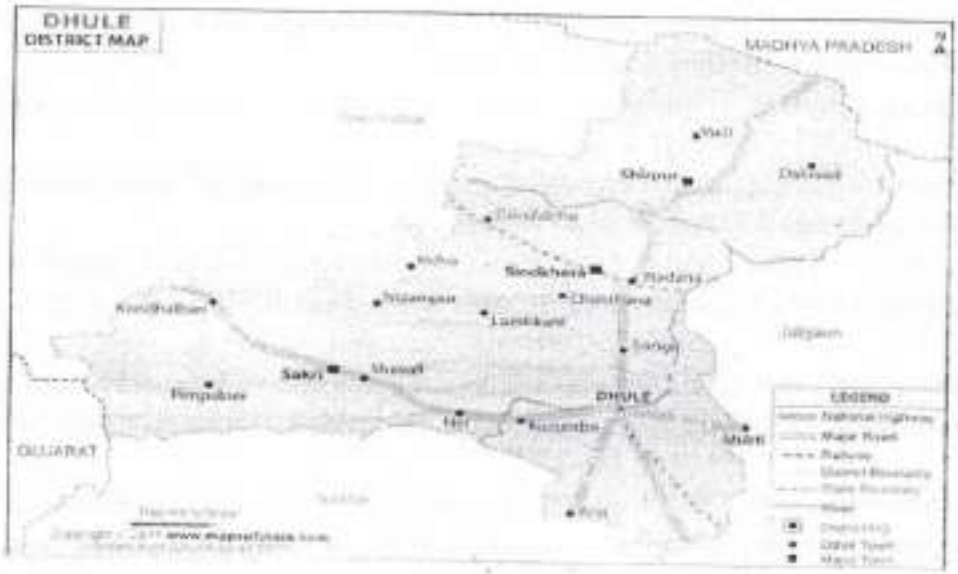
- Bhawane et al (2012) reported 29 species of family scarabaeidae. Most of these are polyphagus and serious pest of agricultural, horticultural and silvicultural crops.
- Deanshu Gupta et al (2014) updated 61 species of scarabaeoid beetles belonging to 30 genera, 19 tribes, 3 families and 7 subfamilies from Pench Tiger Reserve, Madhya Pradesh, India.
- Hegde and Lal (2014) studied 20 species under 10 genera of 8 tribes belonging t o 4 sub families of darkling beetles of family Tenebrionidae from Andaman Islands.
- Hegde and Vasanthakumar (2017) reported rediscovery of darkling beetle (Penthocoides seriatoporus F)
- Kailash Chandra and Ahirwar (2005a) made comprehensive survey of Bandhavgarh National Park in Madhya Pradesh revealed 44 species in 24 genera and 8 sub families.
- Kailash Chandra and Ahirwar Gupta (2005 b) made comprehensive list of total 61 species of scarabaeidae beetles pertaining to 27 genera under 8 sub families from Kanha Tiger Reserve, Madhya Pradesh, India.
- Kailash Chandra and Devanshu Gupta (2012 a) reported taxonomic account of 4 species of genus *Bolbohamatum* and one species of genus *Bolbogonium* from Central India (Madhya Pradesh and Chhattisgarh).
- Kailash Chandra and Devanshu Gupta (2012 b)) diversity and relative abundance of Pleurostict scarabaeidae were studied and analyzed in Achanakmar-Amarkantak Biosphere Reserve, Chhatisgarh.

- Kailash Chandra and Devanshu Gupta (2012 c) made survey of 52 scarab beetles belonging to 24 genera and 5 sub families of family scarabaeidae from Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh, India.
- Kailash Chandra and Devanshu Gupta (2013) represent taxonomic account of 52 species of dung beetles belonging to 22 genera, 12 tribes and 3 families from Chhattisgarh.
- Kailash Chandra et al (2015) reported scarab beetles belonging to 53 species, 27 genera and 6 sub families from Sidhi district of Madhya Pradesh, India.
- Sarkar et al (2014) recorded 8 genera from Buxa Tiger Reserve, West Bengal, India.
- Kalawate and Patole (2018) recorded a trogid beetle from the weatern ghats, India.
- Patole (2017 a) reviewed on the beetle world and their relationship with human.
- Patole (2017 b) reported review on coleopteran beetles an agricultural major crops pests of the world.
- Sarkar et al (2014) reported systematics of Dynastinae fauna under 8 genera from Buxa tiger reserve, West Bengal.
- Thakare et al (2012) studied diversity of darkling beetles at different sites in Melghat Tiger Reserve during 2009-2010. They were recorded 8 new species of darkling beetles belonging to family tebebrionidae from study area.
- Vaibhao et al (2012) reported the diversity of darkling beetles at different sites in Melghat tiger reserve, from Satpuda hill ranges in Central India. They were reported 8 species of darkling beetles belonging to family Tenebrionidae.

A perusal of literature on the diversity of coleopteran beetles revealed that there are scanty reports on the taxonomic studies and distribution of beetles of the Maharashtra State. Keeping in view, the present work is aimed to prepare the identification keys and reports on the distribution and diversity of these beetles from study area.

Materials and method

Study area - Sakri is a largest tahsil in Dhule district of Maharashtra State, India. It belongs to Khandesh and Northern Maharashtra region of Nashik division. It is located 70 Km towards west from District head quarters Dhule and 307 KM from State capital Mumbai towards South.



Altitude/Latitude and Longitude: Altitude: 215 meters above Sea level; Latitude: 21.08715 and Longitude: 74.3601.

Sakri taluka is bounded by by Baglan taluka towards South, Navapur taluka towards west, Nandurbar taluka towards North, Uchchhal taluka towards west. Nandurbar City, Satana City, Dhule City, Malegaon City are the nearby Cities to Sakri.

Both extensive and intensive surveys were conducted during 2015-2016 in different villages of study area. Field visits were made on holiday during the period of survey. For collection of beetles, sweep nets, bush beating and collection in inverted umbrella and hand picking techniques were used. Decaying vegetable matter and dung of various animals was also examined to make collection. In evening hours light trap was used to collect nocturnal beetles. Sample after collection were killed in chloroform and preserved in 70 % ethyl alcohol in glass vials. Necessary data regarding locality, date of collection etc noted in notebook. They were then brought to the laboratory, where stretching, pinning, labeling, and drying and photograph is done as per the guidelines laid by zoological survey of India. For authetification, the preserved samples where periodically send to Zoological Survey of India, Western Regional Station, Akurdi, Punc (M.S.), India.

Results and Discussion

Altogether, collected specimens from study area, which yielded the identification of 33 species belonging to 8 families and 19 sub families, are listed in table-1. The highest number (15) species were reported from family Scarabaeidae (45.45 %) followed by Tenebrionidae 5 species (15.15 %), Carabidae 4 species (12.12 %), and Meloidae 3 species (9.09 %), Cerambycidae 2 species (6.06 %) whereas family Buprestidae and Hybosoridae has single species (3.03 %) contribution. The classified lists of beetles were followed by least description of families.

Family- 1: Buprestidae: These are metallic wood borers. Minute or large flat or cylindrical metallic colored; often golden, bronzy, green or blue. Antennae short; serrate, 11 segments. Thorax and abdomen firmly united. Tarsi with membranous expansions. The adults are lovers of bright sunshine and inhabit wooded areas. The beautiful and iridescent colors of elytra have attracted the attention of man from very early times and the buprestid beetles have been utilized in embroidery and other works of art in India and other countries. *Sternocera chrysicoides*, a brilliant green species from India, China and Japan is thus much sought for by jewelers (Mani, 1982).

Family-2: Carabidae: Ground beetles. Lacinia without a movable lobe; clypeus not extending laterally in front on the antennal sockets. Antennae with 11 segments. Basal 3 abdominal sternites connate. Wings absent in many; then with the elytra soldered together along the suture; when present, with areola oblongata. Tarsi with 5 segments. Black, brown, yellowish, reddish or metallic blue, green, bronzy or golden; striated, punctate or smooth. Largely ground living forms and are found under stome, bark, in moss, rotten wood and other similar situations. Adults are carnivorous but many species often feed on seeds (Mani, 1982).

Family-3: Cerambycidae: Long horned beetles, longicorns, cerambycids. Usually large, somewhat flat; with very long antennae. Smooth, shiny, variously sculptured and often clothed with hairs and scales, often cryptically colored and spotted. Eyes large, irregular.antennae simple. Head in front obliquely inclined, sometimes subvertical. Clypeo-frontal sutures mostly truncate. Fore tibiae not sulcate. Mandible large and in some species enormously developed like antlers. The adults are usually nocturnal or diurnal, sluggish and live on woody plants. The family includes many injurious species to timber and forest trees(Mani, 1982).

Family- 4: Chrysomelidae: Beetle minute to small, hard, often brightly colored. Head hypognathus. Antennae short, rarely as long as body. Hind femora sometimes saltatorial. Wings well developed. The adults feed exclusively on leaves of a variety of plants; mine inside the leaves or sometimes in stem of submerged aquatic plants. Some species are serous pest of agriculture. Probably the most injurious species is the Colorado beetle, a pest of potato (Mani, 1982).

Family-5: Hybosoridae: Clypeus with antero-lateral angles obtuse often rounded not protruding forward; pronotum with lateral sides not deplanate; external claws of fore tarsi simple (Kailash Chandra and Devanshu Gupta, 2013).

Family-6: Meloidae: Blister beetles, oil-beetles. Medium sized, soft-bodied, often with the elytra loosely connected; mostly black, brown or sometimes bright metallic-blue or green. Eyes large, widely separated. Wings well developed, vestigial or absent. Elytra longer or shorter than body. Tarsi with 5 segments. Fore and mid coxae contiguous. Apical segments of abdomen often exposed. Development with hypermetamorphosis. The adults are mostly phytophagous, but often also destroy the eggs of grasshoppers. The meloid beetles yield the cantharidin, a crystalline solid from dried beetles, used medicinally as vesicant and diuretic and in the manufacture of hair oils. Genus *Mylabris pustulata* is large black and red stripped species, common throughout the old world, particularly on yellow-coloured flowers (Mani, 1982).

Family-7: Scarabaeidae : Dung beetles, scarabs. Small or very large, robust, smooth, shiny, often nocturnal. The beetles mostly feed on dung of various herbivorous mammals, which they roll into convenient sized ball, bury them in underground chambers and feed at leisure. The brood balls are also made form dung. The sacred scarab, *Scarabaeus sacer*, has attracted the attention of man from very ancient times. Heliocopris bucephalus is a common Indian species. Other important and widely distributed genera include Onthophagus *copris, Carthasius* and *Gymnopleurus*. Most of the species are ornamented with often enormously produced horns and spines on the prothorax and head (Mani, 1982).

Family - 8: Tenebrionidae : Small or larged, somewhat flat, elongated, hard, often sculptured, mostly black, sometimes reddish-brown. Antennae simple, clavate, moniliform, short, with 11 segments. Eyes prominent. Tarsi heteromerous, with 5-5-4 segments. Claws simple. Wings usually vestigial or absent. Elytra often immovably soldered together along the middle. Usually nocturnal beetles, phytophagous scavengers or feeding on dead and decaying vegetable matter, dungs, dried seeds, cereals and other stored products. Few species are pest of flour, cereals and cereal products (Mani, 1982).

Conclusion

Biodiversity survey provides fundamental information needed for conservation planning, design and development of management plan. To conclude, species collected in study area represents pattern of diversity, richness and abundance and variation in beetles. The study will no doubt help in the conservation plans and in maintenance of biological health of the ecosystem. This preliminary information on coleopteran beetle diversity may be utilized in future to assess diversity and conservation problems from the region and also help in solving the beetle as pest problem along with in formulating effective control strategy.

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References

1. Bhawane, G. P., Mamlayya, A. B., Wagh, S. R. and chaugule, A. K. (2012). Diversity of white grub beetles and their host range from northern wetern ghats, Kolhapur district (MS), India. *The Bioscan* 7(4): 589-596, 2012.
2. Devanshu Gupta, Kailash Chandra and Salma Khan (2014). An updated checklist of scarabaeoid beetles (Coleoptera: Scarabaeidae) of Pench Tiger Reserve, Madhya Pradesh, India. *J. Ent. Zool. Studies*. 2(5): 225-240.
3. Hegde, V. D. and Lal, B. (2014). Darkling beetles of Andaman islands with some new records (Tenebrionidae: Coleoptera). *Uttarpradesh State Biodiversity Board*. P. 131-133.
4. Hegde, V. D. and Vasanthakumar, D. (2017). Darkling beetles. Rediscovery of Penthicoides scriatoporus Fairmaire, 1896 (Coleoptera: Tenebrionidae: Tenebrioninae) from India. Bugs R All, *New Letter of South Asia* (ICINSA), 32(9): 13-16.
5. Kailash Chandra and Ahirwar, S. C. (2005 a). Scarabaeid beetles (Coleoptera) of Kanha Tiger Reserve, Madhya Pradesh. *Rec. Zool. Surv. India*:105 (1-2): 147-155.
6. Kailash Chandra and Ahirwar, S. C. (2005 b). Scarabaeid beetles of Bandhavgarh national park, Madhya Pradesh. *ZOOS' Print Journal*. 20(8): 1961-1964.
7. Kailash Chandra and Devanshu Gupta (2012 a). Bolboceratine scarabs of genera *Bolbohamatum* Krikken, 1980 and *Bolbogonium* Boucomont, 1911 (Coleoptera:Geotrupidae) from central India. *Taprobanica* 4(2): 69-76.
8. Kailash Chandra and Devanshu Gupta (2012 b). Diversity and relative abundance of Pleurostict Scarabaeidae (Coleoptera) in Achanakmar-Amarkantak Biosphere Reserve, Central India. *World J. Z.* 7(2): 147-154.
9. Kailash Chandra and Devanshu Gupta (2012 c). An inventory of scarab beetles (Coleoptera:Scarabaeidae) of Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh, India. *J. J. S. N.* 3(4):886-891.
10. Kailash Chandra and Devanshu Gupta (2013). Taxonomic studies on dung beetles (Coleoptera:Scarabaeidae, Geotrupidae, Hybosoridae) of Chhastigarh, India. *Mun. Ent. Zool.* 8(1): 331-360.
11. Kailash Chandra, Devanshu Gupta and S. C. Goel (2015). On Scarab beetles (Coleoptera: Scarabaeidae) from Sidhi district of Madhya Pradesh, India. *Uttar Pradesh J. Zool.* 35(3): 235-243.
12. Kalawate, A. S. and Patole, S. S. (2018). First record of a trogid beetle (Coleoptera: Scarabaeidea: Trogidae) from the western ghats, India. J of Threatened Taxa. 10(7): 11988-11991, 2018.
13. Mani, M. S. (1982). *General Entomology* (3rd ed.). Oxford And IBH Publishing Company, New Delhi.
14. Patole, S. S. (2017 a). Review on the beetle world and human relationship. GIRA- *Global Journal for Research Analysis*, 6(10): 441-444, October 9; 2017.
15. Review on beetles (Coleopteran): An agricultural major crop pests of the world. *Int. J. Life. Sci. Scienti. Res.*, 3(6): 1424-1432, Nov. 2017.

16. Sarkar, S. K., Saha, S. and Raychaudhari, D. (2014). Taxonomic account of Dynastinae fauna (Coleoptera: Scarabaeidae) of Buxa Tiger Reserve (West Bengal, India). *Rom. J. Biol.- Zool.*, 59(2): 89-111.
17. Thakare, V. G., Zade, V. S. and Hegde, V. D. (2012). Darkling beetles (Coleoptera: Tenebrionidae) of Melghat Tiger Reserve, Central India. *J. New Biol. Repor* 1(1): 29-32.

Table-1: A list of Coleopteran beetles from Sakri region.

Sr. No.	Family	Subfamily	Name of the species
01	Buprestidae	Buprenïnae	*Sternocara aequisignata*Saunders, 1866
02	Carabidae	Brachininae	*Brachinus hexagrammus* Chaudoir
03		Harpalinae	*Anthia sexguttata* Fabricius, 1775
04			*Chlaenius ruffemortus* M.
05			*Chlaenius* impunctifrons
06	Cerambycidae	Cerambycinae	*Stromatius barbatum* Fabricius, 1775
07		Lamiinae	*Batocera rufomaculata* De Geer, 1775
08	Chrysomelidae	Chrysomelinae	*Zygogramma bicolorata* Pallister, 1953
09		Scutelleridae	*Chrysocoris* purpureus, Westwood, 1837
10	Hybosoridae	Hybosorinae	*Hybosorus orientalis* Westwood, 1845
11	Meloidae	Eleticinae	*Mylabris pustulata* Fabricius , 1775
12		Melonïnae	*Meloe* proscarabaeus Linnaeus, 1758
13		Tetraonyienae	*Psalydolytta* agyptica Peringuey, 1909
14	Scarabaeidae	Dynastidae	*Phyllognathus Dionysius* Fabricius,
15			*Oryctes rhinoceros* Linnaeus
16			*Eophileurus platypterus* Wiedemann, 1823
17		Rutelinae	*Anomalla ruficapilla* Burmeister, 1855
18			*Adoretus lasiopygus* Burmeister, 1855
19		Scarabaeinae	*Catharsius pithectus* Fabricius, 1775
20			*Gymnopleurus cyaneus* F
21			*Gymnopleurus gemmata* Harold, 1871
22			*Onitis philemon* Fabricius, 1801
23			*Onthophagus hindu* Arrow, 1931
24			*Heliocopris gigas* Linnarus
25		Cetoniinae	*Chiloloba acuta* W.
26			*Oxycetonia versicolor* Fabricius
27		Melolonthinae	*Maladera amboliensis* Ahrens & Silvia 2016
28			*Holotrichia* Sp.
29	Tenebrionidae	Platynotini	*Notocorax minimus*
30		Tenebrioninae	*Gonocephalum byline* Walker, 1858
31			*Platinotus punctipen* Mulsant & Roy, 1853
32		Pimellinae	*Rhytinota indica* Schaufuss, 1872
33			*Adesmia monilis*, Klug, 1830

28. Preliminary Investigation on Spiders Fauna (Arachnida: Araneae) from Sakri Tahsil, District - Dhulia (M.S.), India

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Abstract

Present study reveals on the spider fauna (Araneae) of Sakri tahsil, Dist- Dhulia (M.S.), India. The faunistic study were undertaken during 2017 and collected over more than hundreds of spider specimen which revealed total 16 species belonging to 14 genera from 9 families were reported for the first time from this region. Family araneidae (25 %) and salticidae (18.75 %) were dominant, followed by pholcidae and oxyopidae (12.5 %) each. While families thomsidae, scytotidae, sparassidae, hertilidae and lycosidae were contribute each with 6.25 %. Based on categorized of spider into habitat wise functional groups, the foliage hunters were dominating the foliage web weaver, ground runner and ambushers.

Keywords: Araneae, araneidae, salticidae, thomsidae, sparassidae, lycosidae.

Introduction

Spiders are abundant and widespread in almost all ecosystems. They plays very significant role in the ecology by being one of the exclusive predator of insect including those harmful to human being and help in maintaining ecological equilibrium (Patil et al., 2013 a). Spiders (Araneae) are air breathing arthropods that have eight legs and chelicerae with fangs that inject venom. They are the largest order of arachnids and rank 7th in total species diversity among all other groups of organism (Meshram, 2011). The world spider catalog includes around 42,751 species under 3,859 genera and 110 families (Platnick, 2012). Tikader (1987) described 1,067 species from India in his checklist of Indian spiders. Another workers viz., Siliwal et al (2005) have updated the Indian spider list with 1,442 species under 361 genera and 59 families. Later on Sebastian and Peter (2009) documented 1,520 species under 361 genera and 60 families.

Spider of protected areas in India is extensively studied by earlier workers viz., Gajbe (1995) in Indravati Tiger Reserve and recorded 13 species. Gajbe (2003) reported a checklist of

186 species of spiders in 69 genera under 24 families distributed in Madhya Pradesh and Chhatisgarh. Patel (2003) reported 91 spider species belonging to 53 genera from Parabikulum Wildlife Sanctuary, Keral. Manju et al (2003) recorded 116 species from 66 genera and 25 families from Purna Wildlife Sanctuary, Dangas, Gujarat. Bastawade (2004) described arachnid fauna of orders Araneae, Scorpionida and Solofugi from Melghat Tiger Reserve, Amravati, Maharashtra State. Quasin and Uniyal (2010) studied spider diversity form Kedarnath Wildlife Sanctuary. Sharma et al (2010) reported 44 species belonging to 12 families from Narmada River at Rajghat (Barwani, M. P.). Warghat et al (2010) deals with distribution of 76 spider species of 12 families from agriculture fields adjoining to foot hills of Satpura mountains ranges of Amravati district (M.S.). Hippargi et al (2011) reported occurrence of spiders from 19, 25 and 31 families from Lonar, Melghat and Southern Tropical thorn forest, Solapur respectively. Meshram (2011) recorded 117 spider species of 20 families and 35 genera from Toranmal Sanctuary, Maharashtra. Wankhede et al (2012) revealed 32 spider species of 7 families from Poona (M.S.) University Campus. Patil (2012) reported 117 spider species under 20 families and 58 genera from Jabalpur district (M.P.). Patil et al (2013 a) revealed 29 species belonging to 18 genera under 10 families from various localities in and around the Singhori wildlife sanctuary (M.P.). Patil et al (2013 b) reported 23 spider species belonging to 12 genera under 7 families from Rani Veerangana Durgawati wildlife sactuary, Damoh (M.P.). Deshmu kh and Raut (2014) revealed 104 species belonging to 18 families in Salbardi forest (Satpura Ranges, M.S.). Bhattacharya et al (2017) reported 24 species of spider belonging to 10 families in Jowai area (Jaintia hills) of Meghalaya. Mithali and Pai (2018) revealed 29 spider species belonging to 8 families and 19 genera and 30 species belonging to 7 families and 18 genera from site -1 and site-2 respectively from Goa. Based on Faunistic survey, present study reveals 16 spider species belonging to 14 genera under 9 families were reported for the first time from this region. The knowledge on diversity and distribution of spider from study area was absolutely scanty as compared to other part of the India mentioned above. Hence, attempt has been felt to explore spider diversity from Sakri tahsil (M.S.).

Materials and Methods

The study has been carried out during the month of March to September, 2017; from study area. It lies between 20^0 to 52^0 North latitude and 73^0 to 55^0 North longitudes in North west side of Maharashtra. Spiders were collected from different localities by active visual

search, vegetable beating, pitfall trapping, hand collection and sweep netting. The collected spider specimens were preserved in rectified spirit with few drops of glycerin was used as preservative. Before preservation photographs of natural live specimen were taken into different view and documented. The identification of specimen was done on the basis of morphometric characters of various body parts using existing identification keys (Tikader and Malhotra, 1980; Tikader, 1982; 1987). Adult spider specimens were observed under stereo zoom microscope. Identified as well as unidentified specimens were sending to Western Regional Station, Zoological Survey of India, Rawat road, Akurdi, Pune for final authetification.

Results and Discussion

Present study revealed with 16 spider species belonging 9 families with their habit, morphological characteristics and distribution are listed in table-1. Among these family araneidae (25 %) and salticidae (18.75 %) were dominant, followed by pholcidae and oxyopidae (12.5 %) each. While families like thomsidae, scytotidae, sparassidae, hertilidae and lycosidae were contribute each with 6.25 %. The reported spiders were found to be living in different types of habitats viz., ground runner, web weaver, ambusher, foliage hunter and foliage web weaver etc. No exceptionally poisonous spider was found among the species recorded from study area. The spiders are most abundant and ecological important. They are exclusively carnivorous and hence help naturally to control insect pest agro-ecosystem and indicators.

This is the first attempt in this region spider diversity were studied during the present study. Nobody has done work on such aspect. Sakri tahsil is geographically the largest tahsil in Dhulia district. It is adjoining to Satpura ranges and Dang region including Charanmal and Kondaibari forest etc having various habitats with a rich spider fauna. However, this is not an end and final conclusion regarding species richness as number of areas and habitat still to be explored. The present results indicate there is scope for further extensive studies that will generate more informative database on the spider fauna of this region.

Conclusion

- From study area, first time author reporting diversity and relative abundance of spiders which revealed total 16 species belonging to 14 genera belonging 9 families.
- Family araneidae (25 %) and salticidae (18.75 %) were dominant families.
- Family pholcidae and oxyopidae contributes (12.5 %) each.

- Families like thomsidae, scytotidae, sparassidae, hertilidae and lycosidae were contributing each with 6.25 %.
- Based on categorized of spider into habitat wise functional groups, the foliage hunters were dominating over the foliage web weaver, ground runner and ambushers.

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Author is highly grateful to the Director and Scientist, Western Regional Station (WRS), Zoological Survey of India, Akurdi, Pune (M.S.) for their keen interest and constant help in identification of beetles.

References

1. Bastawade, D. B. (2004). Arachnid fauna of orders araneae, Scorpionida and Solifugi from Melghat Tiger Reserve, Dist- Amaravati, Maharashtra. In the proceeding of symposium on three decades of Project Tiger in Melghats. 8-9 Oct., PP. 70-71.
2. Bhatacharya, A., Chetri, M. and Sarkar Prabhal (2017). Spider diversity in different habitats at Jaintia hills of Meghalaya. Int. J. of Life Sci. 5(4): 613-619.
3. Deshmukh, U. S. and Raut, N. M. (2014). Seasonal diversity and status of spiders (Arachnida: Araneae) in Salbardi forest (Satpura Range), Maharashtra, India. J. Entomol and Zool Studies. 2(6): 278-281.
4. Gajbe, U. A. (1995). Spiders fauna of conservation areas: Fauna of Kanha Tiger Reserve, Madhya Pradesh. Zoological Survey of India, Publication: 27-30.
5. Gajbe, P. (2003). Checklist of Spiders (Arachnida: Araneae) of Madhya Pradesh and Chhatisgarh. Zoos. Print Journal. 18 (10): 1223-1226.
6. Hippargi, R. V., Bodkhe, A. k., Chikhale, M. P., Santape, G. P., Behere, R. M., Bolde, P. M., Manthen, S., Rao, K. R. and Shah, N. V. (2011). Spider (Arachnida: Araneae) families of three ecosystems of Maharashtra, India. E-Int. Sci. Res. J. 3(1).
7. Manju, S., Suresh, B. and Bonny Pilo. (2003). Spiders of Purna Wildlife Sanctuary, Dangs, Gujarat. Zoos. Print Journal. 18 (11): 1259-1263.
8. Meshram Archana (2011). Spiders (Arachnida: Araneae) from Toranmal sanctuary, Maharashtra, India. E-Int. Sci. Res. J. III (4): 326-334.
9. Mithali, M. H. and Pai, I. K. (2018). Distribution, diversity and ecology of spider species at two different habitats. Int. J. of Environ. Sci and Nat. Res. 8(5): 1-6.

10. Patil, Sachin R. (2012). Spiders of Jabalpur district (Arachchnia:Araneae): updated checklist-2011. Ind. Soc. of Arachnology. 1(1): 143-149.
11. Patil, S. R., Sambath, S. and Bhandari, R. (2013 a). Preliminary study on spider fauna (Arachnida: Araneae) of Singhori Wildlife Sanctuary, District Raisen, Madhya Pradesh, India. Bugs R All. 20: 8-11.
12. Patil, S. R., Sambath, S. and Bhandari, R. (2013 b). Preliminary investigation on spiders (Arachnida:Araneae) in Rani Veerangana Durgavati wildlife sanctuary, Damoh, Madhya Pradesh, India. Indian Forester, 139(10): 943-946.
13. Patel, B. H. (2003). Fauna of protected areas- A preliminary list of spiders with the description of three new species from Parambikulum Wildlife sanctuary, Kerala. Zoos. Print. Journal. 18 (10): 1207-1212.
14. Platnick, N. I. (2012). The world spider catalog. Version 12.5. American Museum of Natural History. http://research.amnh.org/entomology/spiders/catalog/index.html
15. Quasim, S. and Uniyal, V. P. (2010). Preliminary investigation of spider diversity in Kedarnath Wildlife sanctuary, Uttarakhand, India. Indian Forester. 136 (10): 1340-1345.
16. Sebastian, P. K. and Peter, K. V. (2009). Spiders of India. First Edition, University Press, Hyderabad: 1-614.
17. Sharma, S., Vyas, A. and Sharma, R. (2010). Diversity and abundance of spider fauna of Narmada River at Rajghat (Barwani) Madhyapradesh, India. Researcher. 2(11): 1-5.
18. Siliwal, M., Molur, S. and Biswas, B. K. (2005). Indian Spiders (Arachnida: Araneae): Updated checklist 2005, Zoos, Print Journal. 20 (10): 1999-2049.
19. Tikader, B. K. and Malhotra, M. S. (1980). Lycosidae (Wolf-spiders). Fauna India (Araneae). 1:248-447.
20. Tikader, B. K. (1982). Family Araneidae (Aegiopidae), typical orb weavers. Fauna of India (Araneae). 2:1-293.
21. Tikader, B. K. (1987). Handbook: Indian spiders (Anon. Ed.) Zoological Survey of India, Calcutta, pp. 251.
22. Warghat, N. E., Sharma, N. R., Chirde, S. G. and Chandrakar, M. R. (2010). Distribution of spiders from foothill agricultural fields of Satpura Mountain ranges of Amravati district, Maharashtra, India. Biosci. Biotech. Res. Comm. 3(2): 150-153.

23. Wankhede, V. W., Manwar, N. A., Rupwate, A. A. and Raut, N. M. (2012). Diversity and abundance of spider fauna at different habitats of University of Pune, M. S. (India). Global Adv. Res. J. of Environ. Sci and Toxico. 1(8): 203-210.

Table-1: Taxonomic List of Spiders (Arachnida: Araneae) from Sakri Tahsil, District – Dhulia (M.S.)

Taxa and Zoological name	Habit	Morphological characteristics and distribution
Family-Pholcidae 1. Crossopriza lyoni Blackwall, 1867	Ground runner / hunter	**Crossopriza lyoni** is a widespread species of cellar spiders that prefer to live in or around human structures. They are commonly known as **tailed cellar spiders, tailed daddy longlegs spiders,** and sometimes **box spiders**. They all possess extremely long fragile legs that can reach up to 6 cm (2.4 in) long and a body length of that ranges from 2.5 to 7 mm (0.098 to 0.276 in). Their abdomens are distinctly squarish when viewed from the side and their carapace is more or less circular when viewed from above.
2. Pholcus phalangioides Fuesslin, 1775	Ceiling web weaver	**Pholcus phalangioides**, also known as the **longbodied cellar spider or** the **skull spider** due its cephalothorax resembling a human skull. Females have a body length of about 9 mm and males are slightly smaller. The length of its legs is about 5 or 6 times the length of its body (reaching a legspan up to 7 cm in females).
Family – Thomisidae 3. Thomisus projectus Tikader, 1960	Ambushers	**Thomisus** is a genus of crab spiders with almost 150 species described. The genus includes species that vary widely in their ecology, but the best known crab spiders are those species that people call the **flower crab spiders**, because they are ambush predators that feed on insects visiting flowers.
Family-Oxypidae 4. Oxypes pankaji Gajbe & Gajbe, 2001	Foliage hunter	**Oxyopes** is a genus of lynx spiders found worldwide. It includes arounds 300 species and is classified under the lynx spider family Oxyopidae. Like other lynx spiders, they are easily recognizable by the six larger eyes arranged hexagonally on top of the head (prosoma), with the remaining smaller two eyes in front.
5. Oxypes chitrae Tikader, 1966	Foliage hunter	On some new species of spiders of the family Oxyopidae from India.

Family-Salticidae 6. Plexippus paykulli Audouin, 1826	Foliage hunter	**Plexippus paykulli** is a jumping spider in the family Salticidae. It is native to south east Asia but has spread to other parts of the world. In the United States it is called the **pantropical jumping spider.** It is usually associated with buildings and may be found near light sources catching insects attracted by the light.
7. Teamonia dimidiate Simon, 1899	Foliage hunter	It is a jumping spider found in various Asian tropical rain forests, in foliage in wooded environments. Since 1999, the spider has been the subject of an email hoax claiming that it was a fatal spider found lurking under toilet seats in North Florida.
8. Habrocestoides nitidus Logunov, 1999	Foliage hunter	**Habrocestoides** is a genus of the spider family Salticidae (jumping spiders). Most species are endemic to India, with H. phulchokiensis found only in Nepal. **Habrocestoides nitidus** is a spider species in the taxonomic classification of the jumping spiders.
Family-Scytotidae 9. Scytodes thoracica (Spliting spider)	Spitting spider	**Scytodes thoracica** is a spitting spider, so called because it spits a venomous sticky silken substance over its prey. Its size ranges between 3–6 mm (0.12–0.24 in). The carapace is unusual in sloping upwards towards its rear end, whereas the abdomen slopes downwards. It has six eyes instead of the eight spiders usually have.
Family-Sparassidae 10. Heterropoda venatoria Linnaeus, 1767	Foliage hunter	**Heteropoda venatoria** is a species of spider in the family Sparassidae, the huntsman spiders. It is native to the tropical regions of the world, and it is present in some subtropical areas as an introduced species. Its common names include **giant crab spider** and **cane spider.** The adult has a flat, brown body 2 to 2.5 cm long, 7 to 10 cm wide, including the legs. The female may be slightly larger than the male, particularly in the abdomen, but the male has longer legs and larger tips on its pedipalps.
Family-Araneidae 11. Eriovixia excelsa Simon,1889	Foliage web weaver	**Eriovixia** is a genus of spiders in the Araneidae family. It was first described in 1951 by Archer. As of 2017, it contains 21 species from throughout Africa and Asia. Carapace and legs brownish, colour of abdomen variable but usually brown to black. Cephalothorax narrowed in front. Ocular region slightly longer than wide. Anterior median eyes smallest. Lateral eyes closely situated on a tubercle. Sternum heart shaped, pointed posteriorly. Abdomen globular, pointed posteriorly with a black tip.

12. Neoscona theisi Walckenaer, 1842	Foliage web weaver	Spiders in the Neoscona genus have a mostly pantropical distribution. Neoscona theisi females have a body length up to 11 mm, and males are slightly smaller measuring up to 9 mm. They build an orb web and rest near the centre. Neoscona theisi vary in color from dark reddish-brown to pale-yellow with a distinct pattern on the upper abdomen, lighter along the centre-line and darker on the sides.
13. Neoscona mukerjei Tikader, 1980	Foliage web weaver	Cephalic region with 'V' shaped dark brown patch; abdomen sub-triangular in shape. Epigynal scape having deep constriction and an unclear lateral lobe. Juveniles of this species are seen at the beginning of rainy season. Females lay egg sac on ground or wall surface with debris during post rains. colour. Abdomen grey, almost triangular in shape with posterior tapering end and covered with hairs and pubescence. Legs are yellow in colour, long and strong, covered with hairs and spines.
14. Argiope aemula Walckenaer, 1842	Foliage web weaver	**Argiope aemula** is a species of spider in the family Araneidae, found from India to the Philippines, in Sulawesi and in the New Hebrides. It is one of the species of giant conspicuous "signature spiders" of the genus Argiopê, seen in tropical and subtropical grasslands. Signature spiders get their name from the zigzag design embossed on the web, the stabilimentum that is believed to serve a camouflage function. They show extreme sexual dimorphism and males are only 10% of the female in size and as a result become victims of sexual cannibalism. If the males survive the first copulation, then they almost always die during the second attempt.
Family-Hersilidae 15. Hersilias vignyi Lucas, 1836	Foliage hunter	A hersiliid spider foundin Kerala, Maharashtra, Gujarat, WestBengal,Karnataka, Myanmar, Philippines, Singapore, and Sri Lanka. Popularly called the "two-tailed spider", this spider is common in southern India. It lives on the trunks of large trees — including commonly on the trunk of the coconut palm. Its colour closely matches that of the tree trunks in which it lives. It feeds on moths, ants, and other smaller spiders. Its cocoon is generally laid in the holes or crevices of trees.
Family-Lycosidae 16. Lycosa tarantula (wolf spdier)	Ground runner / hunter	**Lycosa tarantula** is the species originally known as the **tarantula**, a name that nowadays commonly refers to spiders in another family entirely, the Theraphosidae. It now may be better called the **tarantula wolf spider**, being in the wolf spider family, the Lycosidae. L. tarantula is a large species found in southern Europe, especially in the Apulia region of Italy and near the city of Taranto, from which it gets its name.

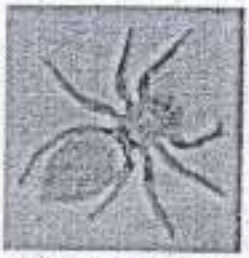
PP-1: *Oxyopes lyoni*

PP-2: *Pholcus phalangioides*

PP-3: *Thomisus projectus*

PP-4: *Oxyopes panhyi*

PP-5: *Oxyopes shivrus*



PP-6: *Plexippus paykulli*

PP- 7: *Scytodes thoracica*

PP-8: *Heteropoda venatoria*

PP-9: *Taxeotis discolorata*

PP- 10: *Erigonella ascia*

PP- 11: *Habrocestoides nitidus*

PP-12: *Neoscona theisi*

PP-13: *Hersiliasa vigni*

PP-14: *Lycosa tarantula*

PP-15: *Argiope aemula*

PP- 16: *Neoscona mukerjei.*

14. Studies of Sublethal Effects of Cypermethrin and Oxyfluorfen on Reproductive Parameters of Earthworm Species, Eisenia Foetida Savigny, 18266

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Abstract

In common practice, sub lethal effects of pesticide are not regularly taken into account when assessing agrochemicals toxicity. With these objective sub lethal effects of the widely used pesticides was performed using *Eisenia foetida* as a model organism. Earthworm adults were randomly assigned to the treatment of these two pesticides. At the end of experiments number of adults, their weight, number of cocoons and juveniles were recorded. The result shows significant decrease in above parameters as compare to control animals. The pesticide treatment showed negative impact on the growth and reproductive parameters. The results suggest that in sub lethal dose the no target animal populations are at risk. So this study is important in agrochemical environmental risk assessment.

Key words: Pesticides, Sub lethal, Earthworm, Cocoon, Juveniles, Toxicity etc.

Introduction

A great proportional of biomass (780%) of terrestrial invertebrates is represented by earthworm which plays important role in structuring and increasing the nutrient content of the soil. Therefore, these animals can be suitable bio indicators of chemical contamination of the soil in terrestrial ecosystems giving an early warning of soil quality determination (Culy and Berry, 1995). Now, it is very important to protect the human health and health of other terrestrial vertebrates which prey upon earthworms (Beeby, 2001).

Eisenia foetida is the standard test organism used in terrestrial ecotoxicology, because it can be easily breed on variety of organic wastes and having short life cycle (ISO, 1998 and OECD, 2004). Studies show that earthworm skin is a significant route of contaminant uptake (Lord et al.,1980). Mortality has been the most frequently used parameters to evaluate the

chemical toxicity in earthworm (Van and van, 1989). Acute mortality test would not provide the most sensitive risk estimate for earthworms in the majority of cases (Frampton et al., 2006). Amorium et al (2005) tested earthworms with herbicide and found reproduction is the more sensitive end point than mortality in worms like *Enchytracus albidus* and *Enchytraeus luxurious*. It is suggested that sublethal effects is more sensitive and is a more realistic approach for the prediction of environmental effects. Because in the field, the exposure concentration of pesticides are usually quite low (Rombke et al., 2007).

Weight loss is another parameter, appears to be a valuable indicator of physiological stress, related to the degree of intoxication and time of exposure (Frampton et al., 2006). Numerous reproductive parameters have been studied in earthworms exposed to various xenobiotics, cocoon and hatching production, viability of worms produced.

Cypermethrin is a synthetic pyrethroid used as an insecticide in large scale. It behaves as a fast acting neurotoxin in insects and easily degraded on soil. It is highly toxic to fish, bees and aquatic insects. Similarly Oxyfluorfen is selective pre and post emergent herbicide used to control broadleaf and grassy weeds in vegetables. It is highly toxic to aquatic invertebrates. Scanty information is available on the effects of these pesticides on growth and cocoon production of earthworms. Therefore, present study is undertaken to find out the sub lethal effects of Cypermethrin and Oxyfluorfen on growth and cocoon production of *Eisenia foetida*.

Materials and Method

Biological Material: Earthworm species, *Eisenia foetida* were obtained from State Government agricultural nursery, Sakri (Dhule) M.S. They were maintained in the laboratory as per OECD guideline (OECD, 1984). Only healthy adult worms having well developed clitella were used for the experiment.

Chemical Material: Two chemicals i.e. commercially available Cypermethrin (10% EC) an insecticide belongs to synthetic pyrethroid and selective herbicide, Oxyfluorfen (23.5% EC) commonly called "Goal" were purchased from local pesticide shop. The quality soil and a month old cow dung were collected from agriculture field and cow shed respectively.

Experimental Set-Up: The experiment was performed in plastic tough having five kg capacities. A dried quality soil was ground and sieved. In a tough 800 g of fine soil thoroughly mixed with 200 g Cow dung (CD) and appropriate amount of water was added to moisten the mixture.

Treatment: The LC_{50} values of both the pesticide in earthworms were already estimated in our previous study, which was 2.240 ml/kg for Cypermethrin and 0.420 ml/kg for

Oxyfluorfen. Both lower ($1/4^{th}$) and higher ($3/4^{th}$) sub lethal doses i.e. 0.56 & 1.68 and 0.105 & 0.315 ml/kg of Cypermethrin and Oxyfluorfen respectively were added in 100ml of water and that was mixed thoroughly in the experimental groups only. On next day, 20 mature worms were added to each tough. The tough was covered with perforated lid and kept for 45 days. The experimental set up was prepared in triplicate for each treatment.

Study of reproductive parameters

At the end of experiment earthworms were separated by hand sorting washed with distilled water and kept on filter paper weight was taken to calculate the growth or biomass. Similarly the cocoons, number of juveniles are also hand sorted, count and tabulated, the data was statistically analyzed.

Result and Discussion

The control as well as $1/4^{th}$ and $3/4^{th}$ sub lethal experimental data after exposé of worm to pesticide concentration are presented in table-1. This shows that;

On Growth: In control sample significant increase was observed in body weight of earthworms while comparatively less significant increase was observed in both pesticides sub lethal treatment. Our results are corroborated with kobeticaya et al (2010) they reported that, *Eisenia foetida* is the most sensitive species and shown decrease weight in industrial wastes. Growth of *Aporrectodea caliginosa* significantly reduced in the exposure of Chloropyrifos and diazo non insecticidal treatment Espinoza and Obregon (2005) treated *Eisenia foetida* with organophosphate insecticide malathion and Parathion both observed decrease in body weight. Choo and Baker (1998) found Endosulfan did significant reduction in body weight and juveniles of *Aporrectodea trapezoids* species of earthworm. Zhou et al (2006) studied on worm speices, *Eisenia foetida* have reported that the weight of the earthworm was a more sensitive index compared to the mortality in indicating toxic effects of herbicide Acetochlor and Methamidophos. Further they also reported that weight loss in worms treated with fungicide and herbicide.

On Cocoon and juvenile Production: There was significant decrease in the cocoon production and number of juveniles count in Cypermethrin and Oxyfluorfen sub lethal treatments as compare to control. Cocoon production was found to be the most sensitive parameter for many pesticides (Yasmin and D'Souza, 2007). Bustas and Goicochea (2002) explored the effect of commercial parathion on the reproductive parameters such as sperm and cocoon production of *Eisenia foetida* and reported that alternations in reproductive parameters were conspicuous in regard to the number of sperm, cocoon and worms born. Number of juveniles per cocoon can be

regarded as sensitive parameters to evaluate the toxicity of Acetachlor on earthworm reported by Xiao et al (2006). Several scientists have reported that pesticides enhance the reproduction i.e. cocoon production and number of hatchings (Robidoux et al 2000). According to Zhou et al (2008) reproduction of earthworms appeared to be more severely affected by Cypermethrin at juvenile stage than at adult stage. Higher concentration of Cypermethrin causes significant toxic effect on reproduction of worms. Bagul et al (2015) reported that decrease in reproduction rate along with some morphological and behavioral changes of earthworm, *Eisenia foetida* exposed to acute toxicity of Cypermethrin and Oxyfluorfen. Similar results were reported by More et al (2016) they revealed that the silver coated dishes with waste food are not significantly affect on growth and mortality of earthworm but decrease the reproduction rate.

Conclusion

We conclude that;

- Growth and reproduction parameters of earthworms exposed to agro pesticides seem to be useful bio indicator of soil pollution.
- Results of the study provide evidence that sub lethal doses of pesticides affect on growth, cocoon and juvenile production.
- Higher ($3/4^{th}$) sub lethal doses showed slightly more effective than lower ($1/4^{th}$) sub lethal concentration.
- Finding of the present study can be used to plan and implement remediation strategies for the pesticidal polluted soils, where risk of soil pesticide contamination is associated with population dynamics of soil invertebrates.

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References

1. Amorium, M.J.B., Ronbke, J. and soares, A. M. Avoidance behavior of *Enchtraeus albidus*: effects of Benomyl, Carbendacimphemedipharm and different soil types. *Chemosphere*. 59(4): 501-510, 2005.
2. Bagul, P. K., More, B. C. and Patole, S. S. Studies on acute toxicity of Cypermethrin and Oxyfluorfen on earthworm species, *Eisenia foetida* Savigny, 1826. *J. Res. Dev.* 5(6): 14-18, 2015.

3. Beeby, A. What do sentinels stand for?. *Environ pollu.* Vol.112 (2): 285-298, 2001.
4. Bustos, O. and Goicochea, R. I. Pesticide soil contamination mainly affects earthworm male reproductive parameters, *Asian Journal of Andrology.* 4(3): 195-199, 2002.
5. Choo, L.P. D. and Baker, G.H. Influence of four commonly used pesticides on the survival, growth and reproduction of the earthworm (lumbricidae). *Arst. J. Agr. Res* 49: 1297-1303, 1998.
6. Culy, M. D., and Berry, E.C. Toxicity of soil applied granular insecticides to earthworm population in cornfields. *Down to earth,* 50:20-25, 1995.
7. Espinoza, N. and Obregon, E. B. Sub lethal doses of Malathion alter male reproductive parameters of *Eisenia foetida. Int. J. Morphos.* 22(4): 297-302, 2005.
8. Frampton, G. K., Jansch, S., Scott-Fordsmand, J.J., Rombke, J. Van Den Brink, P. J. Effects of pesticides on soil invertebrates in laboratory studies : A review an analysis using species sensitivity distributions. *Enviorn, toxicol, Chem.* 25(9): 2480-2489, 2006.
9. ISO. Soil quality – effect of pollutants on earthworms (*Eisenia fetida*) – part 2: determination of effects on reproduction", ISO 11268-2, International Organization for Standardization, Geneva, Switzerland. 1998.
10. Lord, K. A., Briggs, G. G., Neale, M. C. and Manlove, R. *Update of pesticides Science.*, 11(4): 401 – 408, 1980.
11. More, B. C., Patil, D. S. and Patole, S. S. Effects of Silver coated paper dishes on growth, reproduction, nutrient content and bioaccumulation of earthworm species, *Eudrilus eugeniae* Kinberg, 1867. *Int. J. Inno. Res. Sci. Eng. and Technol.* 5(8): 15393-15397, 2016.
12. OECD. Organization for Economic cooperation and Development Guideline for testing of chemicals: Earthworm Acute Toxicity test, OECD Guidelines No. 207, Paris, France., 1984.
13. OECD. Guideline for testing of chemicals: Earthworm reproduction test", No. 222, Paris, France., 2004.
14. Robidoux, P. Y., Svendsen, C., Caumartin, J. Chronic toxicity of energetic compounds in soil determined using the earthworm (*Eisenia andrei)* reproduction test. *Environ. Toxicol and Chem.* 19(7): 1764-1773, 2000.
15. Rombke, J., Garcia, M. V. and Scheffczyk, L. Effect of the fungicide Benomyl on earthworm in laboratory tests under tropical conditions. *Arch Environ Contom Toxicol,* 53(4): 590-598, 2007.

16. Van Gestel CAM and Van Dis WA. The influence of soil characterstics on the toxicity of four chemicals to the earthworm *Eisenia fetida* Andrei (Oligochaeta). *Bool Fertil soils.* 6: 262 – 265, 1989.

17. Xiao, N., Jing, B., Ge, F., Liu, X. The fate of herbicide Acetochlor and its toxicity to *Eisenia fetida* under laboratory conditions. *Chemosphere.* 62: 1366-1373, 2006.

18. Yasmin S. and D'souza D. Effect of pesticides on the reproductive output of *Eisenia foetida. Bull. Environ. Contam. Toxicol.*, 79 (5): 529-532, 2007.

19. Zhou, Q. X., Zhang, Q. R., Liang, J. D. Toxic effect of Acetochlore and Metha midophos on earthworm *Eisenia fetida* in phaiozem, Northeast China. *J. Environ. Sci.*18: 741-745, 2006.

20. Zhou, S., Duan, X., Wang, W. H. G. Michelle, Z. Yu, and H. Fu. Assessing Cypermethrin – contaminated soil with three different earthworm test methods. *J. of Environ. Sci,* 20(11): 1381-1385, 2008.

Pesticides	Vermibed Groups	Weight of worms (g)		% increase	Number of	
		Initial	Final		Cocoon	Juveniles
	Control	9 ± 0.5	16 ± 1.2	43.75	38	70
Cypermethrin	Expt. I (1/4th)	9 ± 0.6	10.6± 0.6	15.09	34	62
	Expt. II (3/4th)	10 ± 1.0	12± 0.5	23.07	22	46
Oxyfluorfen	Expt. I (1/4th)	9 ± 0.8	12.5 ± 0.4	0.28	32	64
	Expt. II (3/4th)	9.8 ± 0.7	14 ± 0.6	30.00	27	55

Table- 1: Biomass, cocoon and juvenile count

Per cent values are % change over control. CD (Mean + SEM, n = 3)

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Study of Synchronise Effect of Cow Urine (Gomutra) and Yoga Therapy to Reduce the Hypertension in Obese Patients.

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Abstract: *Background: Hypertension and obesity are now greatest health problems in the developed world's, which are the major risk factors for CVD, kidney diseases and premature death. Use of cow urine has a special significance in the Indian tradition. Cow urine is a divine medicine because it contains all substances, which are naturally present in human body. So cow urine is used for the treatment many diseases. Yoga is also play an important role to maintain complete health. Yoga is a science, is a mind ,-body therapy has shown to be useful to patients with hypertension and obesity. So our Aim was observe beneficial effects of 2 months of cow urine and yoga therapy on parameters (Wt.,BMI, BP) in patients of hypertension with obesity. Method: 40 patients of hypertension with obesity, in the age group of 30-60 were selected based on exclusion criteria & are divided in to 4 groups, each group had 10 patients. In order to determine effectiveness of cow urine and yoga exercise, physiological parameters (Weight, height, BMI, Blood Pressure) before and after 2 months program were analyzed. Result: At the end of study, there was significant decrease in the mean blood pressure as well as weight and BMI by single cow urine, by yoga but, synchronise effect of cow urine + yoga was more significant to decrease in the mean blood pressure, weight and BMI. Conclusion: In the present research concluded that fresh Cow urine and yoga both having significant anti-hypertension and anti-obesity activity. Synchronise effect of both therapies are having more significant anti-hypertension and anti-obesity activity.*

***Key words**: Cow urine, Yoga, BMI, Blood pressure, Obesity etc.*

Introduction

Hypertension is one of the most serious negative health consequence associated with obesity [1]. Health is a basic human right of human being but we are not aware of this fact. So, one of the key element of health is Yog, which play an important role to maintain the complete health [2]. Hypertension is a major chronic lifestyle disease and an important public health problem worldwide. Yoga is a mind- body therapy and an alternative to medication; also contribute to an increased feeling of empowerment for patients in preventing and treating hypertension [3]. Yoga health benefits are curative as well as preventive. Yoga has been shown to have therapeutic benefits for individuals with a wide range of health conditions, including hypertension [4, 5].

Yoga provides one of the best means of self improvement and gaining full potential of one's body, mind and soul. It has been proved beyond doubt that pranayam and certain asanas are very important means for preventing and curing many ailments. Since 10 years, research studies have shown that the practice of yoga improves strength and flexibility and may help in control parameters as blood pressure, respiration, heart rate and metabolic rates [6].India is experiencing a rapid health transition, with large and rising burdens of chronic diseases. The prevalence of hypertension has been reported to range between 20-40% in urban adults and 12-17% among rural adults [7]. Hypertension and obesity are common in a large group of population worldwide. These people are at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease. According to yogic belief, people can be relieved by the complications of hypertension and obesity by practicing yogic exercise [8].

High blood pressure is one of the most important preventable causes of premature morbidity and mortality in the world. Overall prevalence for the hypertension in India is 29.8%. Hypertension is a major risk factor for ischaemic and haemorrhagic stroke, myocardial infraction, heart failure, chronic kidney disease and premature death [9]. The cause of primary hypertension is not known, although genetic and environmental factors may affect blood pressure regulation [10]. Today, Yoga has acquired global recognition and exalted status as an ancient health building system. Regular practice of yoga reduces blood pressure, it also reduces body weight [11]. Yoga being a form of physical exercise is commonly translated as "union" and is the combination of heart mind and body. Practice of asana, pranayama and meditation results in reduced mental stress. Yogic practice and its beneficial effect have been observed on physiological and physical state of body and mind [12].

Gomutra has a great medicinal value and is very effective in the management of obesity [13]. Cow urine contains nitrogen, sulphur, phosphate, sodium, manganese, iron, silicon ,chlorine, magnesium, maleic, citric, tartaric and calcium salts, vitamin A, B, C, D, E, minerals, lactose, enzymes, hormones, creatinine and gold acids. Ingredients of cow urine are similar with human body. Hence consumption of cow urine is useful to maintain the balance of these substances and

cures incurable diseases [14]. In Ayurveda, there are many medicines made from cow urine, milk, dung, ghee and curds. This purifies and clears all blocks in the bodily channels [15].

Medicinal properties of Cow urine has been granted by US, as Patents (No. 6,896,907 and 6,410,059); bioenhancer, antibiotic, antifungal and anticancer agent properties are particularly mentioned in these patents [16]. Cow urine has a special significance in Indian tradition. Cow urine is said to have a spiritual cleansing effect as well. Cow urine has been described as water of life or "Amrita", nectar of the God. "Panchagavya" is a combination of cow urine, milk, dung, ghee and curd. In Charaka Samhita, Sushruta Samhita and Vangbhata, described cow urine that can be used in medicine and therapeutics. Urine can relieve Kaphaja and Vataja disorders [17].

So in this study we have observed comparative beneficial effects of Cow Urine and Yogic exercise for 2 months on hypertension in obese patients.

Objectives

1. To study the effect of yoga-pranayama on parameters of obesity viz weight reduction (there by reduction of BMI).
2. To study the effect of yoga-pranayama on blood pressure in the patients of hypertension.
3. To study the effect of gomutra (cow urine) on parameters of obesity and blood pressure in the patients of hypertension.
4. To study the synchronise effect of yoga-pranayama and gomutra (cow urine) on parameters of obesity and blood pressure in the patients of hypertension.

Materials And Methods

Inclusion criteria: Adult patients (an age group of 30-60 yrs.) of both sexes suffering from obesity (whose BMI > 30) and hypertension were selected for the present study.

Exclusion criteria: Patients suffering from other disorders like liver disease, pulmonary disease, malabsorption, thyrotoxicosis, diabetes, cardiac failure, pregnant females, lactating mothers, alcoholism and non- cooperative patients were excluded from the study.

Investigation: Weight , BMI and Blood pressure.

Selection of patients and duration of study: The study was counducted in Maratha Mangal Karayalay Pimpalner, District Dhule, Maharashtra, During Jan. – Feb. 2018. In present study 40 patients were included after scree- ning by inclusion and exclusion criteria for BMI,obesity and hypertension.. These patients were randomly segregated in to four groups, each group have 10 patients.

1. **Group-1 (Control group):** In this group, 10 obese and hypertensive patients were included and suggested them only diet restriction of 1600 Kcal/day and other lifestyle modification.
2. **Group-2 (Gomutra therapy group):** In this group, 10 obese and hypertensive patients were included and were given only pure Gomutra (cow urine) in dose ranging from 30 ml to 40 ml/day early in the morning with empty stomach for 60 days & diet restriction of 1600 Kcal/day.
3. **Group-3 (Yoga group):** In this group, 10 obese and hypertensive patients were included and suggested them for life style modification including specific Yoga techniques and diet restriction of 1600 Kcal/day.
4. **Group-4 (Gomutra + Yoga group):** In this group, 10 obese and hypertensive patients were included and were also given pure Gomutra (cow urine) in dose ranging from 30 ml to 40 ml/day early in the morning with empty stomach for 60 days and also suggested them for life style modification including specific Yoga techniques and diet restriction of 1600 Kcal/day.

The study protocol was ethically approved by the Institutional Ethical Committee. An informed consent of the volunteers was undertaken on an approved proforma. Control group-1 & Gomutra group-2 containing 10 subjects in each groups, which was not exposed to any yogic practices. Yoga therapy was introduced to the experimental group-3 & Group-4 for 90 min. six day in a week for o8 weeks (2 months).

The set of Asanas and Pranayama included in the course (10)

I. Humming in meditative postures- Sukhasana (Easy pose)/ Padmasana (Lotus pose) / Vajrasana (Thunderbolt)

II. Loosening Exercises- Warm ups: starting from head, working towards the toes.

Neck rolls, Shoulder rotation, Arm rotation, Elbow movements, Wrist movements, Finger movements

Waist movements, Knee rotation, Ankle rotation, Toe movements

III. Asanas - A Standing

(a) **Konasan** (Side bend pose) Tadasana, Ardhakatichakrasana (Lateral arc pose), Padahastasana (Forward bend pose),Ardhachakrasana (Backward bend pose),Vrikshasana (Tree pose),

(b) **Sitting**

1. Shashankasana (Forward bending),Mandukasana (Frog pose),Ustrasana/Ardhachandrasana(Backward pose),Vakrasana (Twist pose)/ Ardhamatsyendra -sana (Half-spine twist pose)

2. Paschimotanasana (Back stretch pose),Konasana (Angular pose)

(c) Lying on stomach (prone)

1. Makarasana (Crocodile pose),2.Bhujangasana (Cobra pose),3.Shalbhasana (Leg back bend),4.Dhanurasana (Bow pose)

(d) Lying on back (Supine)

1. Uthitapadasana (Straight leg raising),2. Markatasana (Twisting pose),3. Pavanmuktasana (Wind relieving pose),4.Setubandhasana (Bridge pose),5. Sarvangasana (Shoulder pose), 6. Matsysana (Fish pose)

IV. Deep Relaxation In Shavasana pose (Corpse pose)

V. Pranayama (Breathing practices)

1. Bhastrika,Kapalbhati (Short and strong forceful exhalation and inhalation happens automatically)
2. Anuloma-viloma(Alternate nostrilbreathing),Ujjai,Bhramari (Om Chating/ Honybee sound during expiration),Udgeeth (Chating of Om mantra)

VI. Deep Relaxation In Shavasana pose (Corpse pose)

VII. Hum0ming in meditative postures- Sukhasana (Easy pose)/ Padmasana (Lotus pose) / Vajrasana (Thunderbolt)

Anthropometric measurements- hight, weljht & blood pressure were measured.

Height: Height of the patient was measured up to an accuracy of 0.5 cm on a scale prepared on the wall. Patients were instructed to remove chapels or shoes and stand on a flat floor by the scale with feet parallel and with heels, buttocks, shoulders and back of the head touching wall upright. The horizontal plate was gently lowered on the scalp to give correct height.

Weight: Weight of the patient was taken up to an accuracy of 0.5 kg. Patients were asked to stand on the centre of the platform after removing chapels and without touching anything else. Reliability of weighing machine was verified initially with known weight. It was adjusted to zero each time before taking weight. Same weighting machine was used for recording weight of the subjects throughout the study. **BMI:** BMI was calculated in Kg/m2.

Blood pressure : It was measured by an automated electronic device. Hypertension was categorized as BP systolic 120-139 mmHg & diastolic 80-89 mmHg as normal.

Hypertension- BP systolic >140 mmHg and diastolic >90 mmHg

Results

Table: 2 Comparison of weight, BMI & BP of control (G 1), Cow Urine Therapy (G 2),Yoga Therapy (G 3) and Cow Urine + Yoga Therapy (G 4). at before and after 2 months.

Object ive	Control G 1				Cow Urine Therapy G 2				Yoga Therapy G 3				Cow Urine + Yoga Therapy G 4			
	Pre. 0M	Post 2M	M D	% Relife	Pre. 0M	Post 2M	M D	% Relife	Pre. 0M	Post 2M	M D	% Relife	Pre. 0 M	Post 2M	M D	% Relife
Weight (in Kg.)	73.66	73.41	0.25	0.33 NS	73.00	71.00	2.0	2.73 *	73.33	69.66	3.67	5.00 **	88.16	81.33	6.83	7.74 **
BMI (Kg m 2)	27.64	27.54	0.1	0.36 NS	28.13	27.34	0.79	2.80 *	27.0 o	25.50	1.5	5.55 **	30.95	26.43	2.52	8.14 **
SBP (mmHg)	152.16	152	0.16	0.16 NS	154.0	150. o	4.0	2.59 *	155.0	130.0	25	16.21 ***	155.33	122	33.33	21.45 ***
DBP MMHg)	106.53	106	0.53	0.77 NS	89.16	85.0	4.16	4.66 **	108.0	88.0	20	18.51 ***	111.16	82	29.16	26.23 ***

All values are expressed as mean score- Weight, BMI- Body Mass Index, SBP- Systolic blood pressure, DBP- Diastolic blood pressure and MD- Mean difference.

NS= Non Significant (P>0.05), Significant values: * P<0.o5, ** P<0.01, *** P<0.001.

40 patients were selected in this study and are categorized into four groups (as table 2) for Cow urine therapy, Yoga therapy and also Cow urine +Yoga therapy are carried out to reduce weight, BMI and BP. Table 2 depicts the physiological parameters of the sample, the baseline and post assessment i. e. prior to starting only cow urine therapy, only yoga therapy

nd cow urine + yoga therapy and after 2 months therapies. **Control G 1** depicts no significant reduction in weight 73.66 to 73.71 (MD 0.25, relief 0.33 NS), BMI 27.64 to 27.54 (MD 0.1, relief 0.36 NS) , SBP 152.16 to 152 (MD 0.16, relief 0.10 NS) & DBP 106.83 to 106 (MD 0.83, relief 0.77 NS). **Cow urine therapy G 2** depicts significant reduction in weight 73.00 to 71.00 (MD 2, relief 2.73 *), BMI 28.13 to 27.34 (MD 0.7 , relief 2.80 *), SBP 154.00 to 150.00 (MD 4, relief 3.59 *) & DBP 89.16 to 85 (MD 4.16, relief 4.66 **).**Yoga Therapy G 3** depicts more significant reduction in weight 73.33 to 69.66 (MD 3.67, relief 5.00 **), BMI 27.00 to 25.50 (MD 1.5, relief 5.55 **), SBP 155 to 130 (MD 25, relief 16.21 ***) & DBP 108 to 88 (MD 20, relief 18.51 ***) these results are more significant than that of above cow urine therapy group. **Cow urine +yoga Therapy G 4** depicts more significant reduction in weight 88.16 to 81.33 (MD 6.83, relief 7.74**) , BMI 30.95 to 28.43 (MD 2,52, relief 8.24**), SBP 155.33 to 122 (MD 33.33, relief 21.45***) and DBP 108.16 to 82 (MD 29,16, relief 26.23 ***) and these were better results than that of only cow urine & only yoga therapy groups.

DISCUSSION

The outcome of this study are consistent with Naveen kumar Saini (2016), Dhara Doshi et al; (2012) they had observed significant weight reduction after Gomutra therapy and Yogic lifestyle intervention[13,18].Shukla Ravi et, al; (2016)[19], Guarracino, et al; (2006)[20] also showed that Yoga had a statistically significant role in controlling BMI and weight and even hypertension and mood. The results of this study are also consistent with Manchanda et al; (2000) they had observed weight reduction-6.8+-8.2% (p=0.0019) after lifestyle intervention in coronary atherosclerotic patients.[21] Similarly Jayram Gadham et al; (2015) studied and observed a statistically significant decrease in BMI and BP after 3 months of Yoga training.[22] & Anapoorna K. & Vasantalaxmi K. also studied the effect of 3 months yoga training resulted in a significant reductions in all body weight measures such as decrease in BMI (0.001), WHR (0.001), SBP (0.01) & DBP (0.038)[23].

Raman Gokal et, al; (2007) studied positive impact of Yoga and Pranayama on obesity and observed that the effect on BMI appeared most pronounced among the severely obese patients (BMI>40 kg/m2), in them the mean BMI dropped by 7.8 kg (p=0.004, n=18) and the obese patients the BMI dropped by 0.62 kg (p=0.0,o12, n=135). Overall 56% of subjects lost weight[24].

Similar study by Subramanian S. et al, in 2012 have shown that 7 days Yoga training, significant decrease in WHR, systolic and diastolic blood pressure, weight, BMI, glucose and cholesterol[25]. Also another study by Telles et al in 2010 observed that 6 day reside -ntial program on diet and yoga decreased BMI (1.6%) and Waist and Hip circumference (1.7%) [26]. Singla et al; 20016 studied biological activities of cow urine and concluded that cow urine comes with a bunch of health benefits. It has anti-obesity effect is due to the presence of copper ions and it has also several different activities like antioxidant, anti-diabetic, wound healing property, immunomodulator, also acts as bioenhancer to increase the efficacy of various antibiotic nutrients and anticancer drugs. Cow urine therapy is capable of curing several curable and incurable diseases, so it is used for many health problems worldwide including India[27]. In study of Sanjay Sharma et,al; 2017 conclude that fresh cow urine and its distillate both are having significant anti-obesity activity against high fat diet induced obesity in Wistar rats[28].

Conclusion

Nowdays obesity and hypertension are big social problems which lead to many psychology-somatic disorders or diseases. It is noticed that obese and hypertensive subjects have many other problems and complications at emotional and psychological level. We concluded that 1) It can be asserted that intervened Cow urine therapy along with Yoga therapy showed a very good results i. e. decrease in weight, BMI and hypertension. Thus, we can say that Cow urine and Yoga has great medicinal value and are very effective in the management of obesity, hypertension and it can be prove cow urine and yoga are boon in today's life. 2) Domestication of Cow is a very common in rural areas. So collection of Cow urine from locally indigenous varieties of cow will be the supportive business practices.

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References :

1. Yadav S,. Boddula R,. Genitta G,. Bhatia V. (2008). Prevalence & risk factors of pre-hypertension and hypertension in an affluent north Indian population. Indian J Med Res 128, pp 712-720.
2. Nandre Y. M,. More B. C,. Pawar L. B. (2017). Human Rights and Pranayama. Vichar Manthan (A Peer Reviewed Journal) ISSN-2347-9639. V0l.-4, No-3, Issue-12 Atharva Publications 1, pp 58-60.
3. Jayaram Gadham, Srikanth Sajja & V. Rooha (2015). Effect of Yoga on Obesity, hypertension and lipid profile. Int J Res Med Sci, 3 (5): 1061-1065.

4. McCaffrey R, Ruknui P, Hatthakit U, Kasetsomboon P (2005). The effect of Yoga on hypertensive persons in Thailand. Holistic Nurs Prac;19: 173-80.
5. Murugesan R, Govindarajulu N, Bera TK. (2000). Effect of selected yogic practices on the management of hypertension. Indian J Physiol Pharmacol; 44(2):207-230.
6. Vijay Tundwala, R. P. et,al; (2012). A study on effect of yoga and various asanas on obesity, hypertension and dyslipidemia. Int J of Basic and Applied Medical Science,Vol. 2(1).pp93-98.
7. Gupta R. (2004). Trends in hypertension epidemiology in India. J Hum Hypertens; 18: 73-78.
8. Shrirang Hollcar, Surinder Makhija. (2015). Alternation in Anthropometric measurements before and after Yogic exercises in Patients of Hypertension with Obesity. Int J of Health Sci and Res,Vol; Issue:4,pp 159-164.
9. Upadhyay AK, Balkrishna A, Upadhyay RT, (2008). Effect of Pranayama and Yogasana in Diabetes Mellitus; A Scientific Review, Journal of Complementary and Integrative Medicine, Vol.5, Issue 1/ Review Articles.
10. Bijlani RL, Vempati RP, Yadav RK, Ray RB, Gupta V, Sharma R, Mehta N, Mahapatra SC, Josephson B,GyBersward C; (2005). A brief but comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. J Altern Compliment Medicine,11:267-274.
11. Nandre Y. M., More B. C., Patole S. S.,(2010). Non-Biopharmacological Approach to control Hypertension by Yoga. Int Referred Res JournalISSN-0975-3486,Vol, Issue-8.pp 36-39.
12. Pal R. & Saha M, (2013). Role of Yogic practices on Physical Health: A Review.Indian J of Applied Research; 3(4):2249-555.
13. Naveen Kumar Saini. Clinical trial of Gomutra (Cow urine) in Obesity Management. Int. J. of Ayurveda & Pharma Research .2016, Vol. 4, Issue 10.
14. Pathak MI, Kumar A. Cow praising and importance of Panchyagavya as a medicine. Sachitra Ayurveda 2003; 5:569.
15. Sastri KN & Chaturvedi GN. Charakasmhita Vol. I (Sutrasthan) Varanasi; Chaukhambha Bharati Academy; 2009; p.n.45.
16. Randhawa GK. Cow urine distillate as bioenhancer. J. Ayurveda Integr Med 2010; 1:2401.
17. Valiathan M. S. Hyderabad, India, Orient Longaman Private Ltd, The Legacy Of Susruta, Page no. 158.
18. Dhara R. Doshi & Yogesh A. Jogsan. A Stydy on Impact of Yoga on Self-Control in Obese Women. Int. J. of Sci. & Res. Publications, Vol. 2, Issue 8, Aug. 2012.
19. Shukla Ravi, Singh Girish & Gehlot Sangeeta. How Obese individuals respond to Paschimottanasana and Kapalbhati on Body Fat, Visceral Fat and Lipid Profile. World Jou. Of Pharmacy and Pharmaceutical sci. Vol. 5, Issue 1,2016, pp 595-607.
20. Guarracino,Joanna Lazos MS et, al; Yoga Participation is beneficial to Obesity prevention, Hypertension control and Positive quality of life. Topics in clinical Nutrition : 2006, Vol. 21- Issue 2- p 108-113.
21. Manchanda Sc, Narang R, Reddy KS, Sachdeva U, Prabhakaran D, Dharmananda S, Rajani M & Bijalani RL (2000). Coronary Atherosclerotic reversal potentential of Yoga life style intervention. JAPI 48(7), 687-689.
22. Jayaram Gadham, Srikanth sajja, & V. Rooha. Effect of Yoga on Obesity, Hypertension and Lipid profile. Int J Res Med Sci. 2015; 3(5): 1061-1065
23. Annapoorna K. & Vasantalaxmi K. Effect of Yoga therapy on Obesity and Quality of life in Women: A Longitudinal study. Int J of Yoga and Allied Sci. Vol:2, Issue:1, pp18-24, (ISSN:2278-5159)
24. Raman Gokal, Louisa Shillito & Swami Ramdevji Maharaj. Positive Impact of Yoga and Pranayama on Obesity, Hypertension, Blood suger and Cholestrol: a Pilot Assessment. Journal of Alternative and Complementary Medicine. Dec.2007, 13(10):1056-1058.
25. Subramanian S., Dayalan H., Elango T. & Malligarjuna H (2012). Impact of short and intense Yoga trainind on Obesity risk factors in Diabetic and hypertensive patients. J. of Pharmacy Res. 5(8), 4207-4211.
26. Telles s, Naveen VK, Balkrishna A, Kumar S. Short term health impact of Yoga and diet change program on Obesity. Med Sci Monit 2010; 16 (1): 35-4o.
27. Sonia Singla & Satwinder Kaur. Biological activities of cow urine: an Ayrvedic Elixer. European Journal of Pharmaceutical & Medical Research, 2016,3(4), 118-124.
28. Sanjay Sharma, Ketan Hatware, Ashwini Deshpande, Payal Dande & Sravani Karri. Antiobesity Potential of Fresh Cow urine and its Distillate- A Biomedicine for Tomorrow. Ind J of Pharmaceutical and Res. 2017,Vol. 51, Issue 4S, pp S712-S721.

A Review on Classification of Indian Condiments

Dr. S. S. Patole*

INTRODUCTION

All over the world, India has been recognized as the home of condiments (spices). Being predominant export item spices constitute an important group of horticultural commodities which play a significant role in the national economy (Anonymous, 1988). The term condiment refers to aromatic or pungent vegetable substances used for flavoring foods and have several commercial uses (Edison, 1990). India produces most of tropical and temperate spices from Kerala to Kashmir about 2.0 million tonnes from an area about 2 million hectares and earning Rs 30,00,000 per annum from export (Anonymous, 1990). Kerala enjoys unique position in spices as it leads in black pepper, small cardamom, ginger, clove, nutmeg, vanilla and cinnamon etc. Karnataka, Tamil Nadu, Andhra Pradesh also have significant cultivation in tropical and some of subtropical spices (Pruthi, 1979). Gujarat, Maharashtra, Rajasthan, Madhya Pradesh, Punjab, Haryana, Uttar Pradesh and Bihar are famous for seed and bulb spices like fennel, coriander, cumin, fenugreek, onion and garlic. Kashmir is well known for saffron, Kalazira, celery seed, asafetida and other temperate cultivated and wild spices (Singh, 1990). Odisha shares appreciable amount of turmeric and ginger production. Sikkim and Darjeeling hills are well known for big cardamom. The north eastern state like Meghalaya, Assam and Tripura are famous for ginger and turmeric whereas the warmer valleys of north-eastern hill states are potential areas for black pepper and cardamom (Anonymous, 1989).

There are huge numbers of plants which are used as spices and these could be classified according to different systems of classification as below;

(A) Classification based on part used

This type of spices classification (table-1) facilitates the arranging of crops which may also be helpful in describing their cultivation.

(B) Classification based on climatic requirement

Plants are classified according to her stability of particular climatic zone like tropical, subtropical and temperate etc. This type of classification helps in identifying the spice crop suited to a particular climatic zone. The climatic classification is as follows;

i. **Tropical:** The tropical spices are those which require high temperature and abundant rainfall or moisture and are easily damaged by low temperature. These tropical spice plants continue their growth and production throughout the year through the intensity of production may not be equal throughout the year. Examples- Clove, nutmeg, cinnamon, kokam, galangal, small cardamom, vanilla, black pepper, ginger and turmeric etc.

ii. **Subtropical:** It is the mesothermal temperate area where three distinct seasons mainly occurs i.e. winter, summer and monsoon. Perennial plants have to resist low temperature in winter and high temperature in summer. Most of the seed spices like cumin, dill, fennel, coriander, fenugreek and bulb spices like onion and garlic are commonly grown during winter season and most of them require relatively low temperature during vegetative or early stages of growth and high temperature during

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reproductive or maturity stage. Some of the temperate spices like celery are grown during winter and tropical spices like turmeric and ginger are grown during the summer and rainy seasons.

iii. **Temperate:** These are spices which can resist low temperature or frost conditions but are easily damaged by hot weather. Seed and floral spices are grown during the summer season. Perennial temperate tree spices are mostly grown in wild and cultivated form in the western Himalayas. On limited scale they are also found in the eastern Himalayas and Nilgiri hills. Example- Saffron, kalazira, asafetida, caraway seed, celery seed, savory, caper, balam, origanum, calamus and thyme.

Table-1: Classification of spices based on part used

Part used	Name of plant (Spice)
Flower and floral part	Clove, saffron, caper, cassi bud, savory.
Fruit	Small cardamom, big cardamom, chillies.
Berry	Allspice, black pepper and juniper.
Seed	Aniseed, caraway, celery, fennel, cumin, kalazira, coriander, dill, mustard and fenugreek.
Rhizome	Ginger, turmeric, galangal, calamus.
Root	Angelica, horse-radish, lovage and calamus.
Leaves	Bayleaf, mints, marjoram, origanum, chervil, chives, basil, spearmint, tejpata, sage, savory.
Bark	Cinnamom
Bulb	Garlic, onion.
Kernel	Nutmeg
Aril	Mace
Resins	Asafetida

(C) Classification based on number of seasons required by crops

In this type of classification, the spices are grouped according to their requirement of growing season or years for life cycle or for commercial production viz annuals, biennials and perennials.

i. **Annuals:** Most of seed spices like coriander, fennel, fenugreek, cumin, caraway, dill etc are annuals since they complete their life cycle in one growing season.

ii. **Biennials:** These spices require two years or two growing seasons to complete a growth cycle. Example- onion and parsley.

iii. **Perennials:** The spice plant which normally live for more than two years are called perennials. These include herbaceous perennials - kalazira, creepers-black peppers, bulbus perennials-saffron and woody perennials-nutmeg, clvoe, cinnamon etc.

(D) Classification based on economic importance of spices

In this type of classification, the spices are classified and groups according their economic values in national and international trade. These are;

i. **Major spices:** Black pepper, small cardamom, chillies, ginger, turmeric etc.
ii. **Seed spices:** Coriander, cumin, celery, funnel and fenugreek.
iii. **Tree spices:** Clove, nutmeg, mace, cinnamon, tejpata, kokam and allspice.
iv. **Miscellaneous spices:** Garlic, saffron, vanilla, curryleaf, mint and other minor spices.

(E) Botanical classification

This type of spices classification is of value in showing relationships and gives an idea of the plant families represented as well as the important crops belonging to each of these families. These are further divided into two main sub-division or classes i.e. monocotyledonae and dicotyledonae.

Table-2: Monocotyledon families and spice plant

Family	Vernacular name	Botanical name
Araceae	Calamus	*Acorus calamus*
Iridaceae	Saffron	*Crocus sativus* L
Orchidaceae	Vanilla	*Vanilla fragrans*
Alliaceae	Chives	*Allium schoenoparasum*
	Garlic	*Allium sativum* L
	Onion	*Allium cepa* L
	Stone Leek	*Allium fistulosum* L
	Shallot	*Allium ascalonicum* L
Zingiberaceae	Ganangal	*Alpinia galangal* L
	Ginger	*Zingiber officinale* L
	Large Cardamom	*Amomum subulatum*
	Small cardamom	*Eleltaria cardamomum*
	Turmeric	*Curcuma longa* L

i. **Monocotyledonae (Monocot):** The spices in this class have one cotyledon in the embryo and flower parts, mostly in three of its multiple and parallel leaf veins. It includes the following families of spices (table-2).

ii. **Dicotyledonae (Dicot):** Spices plant of this class has two seed leaves in embryo flower parts mostly in 4, 5 or their multiples and leaves with netted veins. The following families of spice (table-3) come under this class.

Table-3: Dicotyledon families and spice plant

Family	Vernacular name	Botanical name
Capparidaceae	Caper	*Capparis spinosa* L.
Guttuferae	Kokam	*Garacinia indica* Choisy
Lauraceae	Bay leaf	*Laurus nobilis* L.
	Cassia (Cassia china)	*Cinnamomum aromaticum* L.
	Tejpatta (Indian cassia)	*Cinnamomum tamala* Nees
	Cinnamomum	*Cinnamomum zeylanicum* Blume
Leguminosae	Fenugreek	*Trigonella foenum gracum* L.
	Tamarind	*Tamarindus indica* L.
Labiatae	Balm	*Melisso officinalis* L.
	Basil	*Ocimum basilicum* L.
	Hyssop	*Hyssopus officinalis* L.
	Marjoram	*Majorana hortensis* Moench
	Mint	*Mentha arvensis* L.
	Pepper mint	*Mentha pipenta* L.
	Origanum	*Origanum vulgare* L.
	Rosemary	*Rosmarinus officinalis* L.
	Sage	*Salvia officinalis* L.
	Savory	*Satureia hontensis* L.
	Thyme	*Thymus vulgaris* L.
Myristaceae	Nutmeg	*Myristica fragrans* Hout
Myrtaceae	Allspice	*Pimenta officinalis* L.
	Clove	*Eugenia carryophyllus* Spregal
Piperaceae	Black pepper	*Piper nigram* L.
	Long pepper	*Piper longum* L.

Family	Vernacular nam	Botanical name
Rutaceae	Curryleaf	*Murraya koenigii* L
Umbelliferae	Ajowan	*Trachyspermum ammi* L
	Angelica	*Angelica archangelica* L
	Aniseed	*Pimpinella anisum* L
	Asafoetida	*Ferula assafoetida* L
	Caraway	*Carum carvi* L
	Celery	*Apium graveolens* L
	Celeriac	*Apium graveolens* var
	Chervil	*Anthriscus cerefolium* Hoffim
	Coriander	*Coriandrum sativum* L
	Cumin	*Cuminum cyminum* L
	Cumin black	*Nigella sativa* L
	Dill (Indian)	*Anethum sowa* Roxb
	Dill (European)	*Anethum graveolens*
	Fennel	*Foeniculum vulgare* Mill
	Lovage	*Lovistcum officinale* Koth
	Parsely	*Petroselinum crispum* Miller
	Kalazira	*Carum bylbocastanum* Koch
Solanaceae	Chillies	*Capsicum annum* L
	Paprika	*Capsicum annum* L
	Birdchillies	*Capsicum frutesens* L
Cruciferae	Indian brown mustard	*Brassica juncea* L
	Black mustard (True mustard)	*Brassica nigra* Koch
	White mustard (Sufai Rai)	*Brassica alba*
	Horse – radish	*Armoracia rusticana*
Compositae	Tarragon	*Artemisia dracunculus* L

REFERENCES

1. Anonymous (1988). *Status Pappers on Spices*, Spices Board, Calicut, Kerala. Pp. 1-110.
2. Anonymous (1989). *Abstracts of Papers*. International Conference on Recent Advances in Medicinal, Aromatic and spices Crops held at New Delhi, India. January, 28-31.
3. Anonymous (1990). *Recommendations of National Symposium on Onion and Garlic (Production, Marketing and Export)* held at Dr. Y. S. Parmar University of Horticulture and Forestry, Solan, India. June, 2-3.
4. Edison, S. (1990) *Indian Cocoa*, Arecanut and Spices Journal, 13-3: 124-126.
5. Pruthi, J. S. (1979). *Spices and Condiments*. National Book Trust, India, New Delhi. Pp 1-5.
6. Singh, V. B. (1990). *Fruits of North Eastern Region of India*, Wiley Eastern Ltd., New Delhi.

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First record of a trogid beetle (Coleoptera: Scarabaeoidea: Trogidae) from the Western Ghats, India

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Trogidae is a small, cosmopolitan family consisting of about 300 species (Scholtz 1986a; Smith 2003; Pittino 2006; Zidek 2013, 2017). The family name Trogidae was proposed by MacLeay (1819). Trogid beetles are commonly called hide beetles (Houston 2010), and keratin beetles (Strümpher et al. 2014). The beetles of this family are necrophagous (Scholtz 1986b) and are of forensic importance. These insects utilize a wide array of food containing keratinous material. They feed on carcasses and are the last among other groups of organisms to feed on the carcass. They have been reported feeding on bat guano in caves, locust eggs, fly maggots and also on products which contain animal keratin, like an old carpet, coat, etc. (Scholtz 1986b).

These are the only members of this type of feeding habit (keratinophagous) from Scarabaeoidea. Adults lay eggs in soil under the food source. The larvae feed on that food source after hatching. The larva completes three instars in about four weeks, it stops feeding and prepares a light cocoon of agglutinated soil, where the pupation takes place (Verdugo 2014), and pupates for about two weeks.

Many adults of this family are attracted to light at night. Trogids are considered primitive in the superfamily Scarabaeoidea (Crowson 1954, 1981). The insects of this family are of forensic importance, and are being utilized to estimate post-mortem intervals in legal investigations of the human body (Tabor et al. 2004). India harbours a very rich Trogidae fauna, but work carried out on this family is less in comparison to other parts of the world. The Oriental trogid fauna was studied by a few researchers (Blackburn 1904; Arrow 1927; Haaf 1954a,b; Scholtz 1980, 1986b, 1990; Pittino 2005) and the world trogid fauna was catalogued by Zidek (2013, 2017).

It includes five genera viz. *Trox* Fabricius, 1775; *Polynoncus* Burmeister, 1876; *Omorgus* Erichson, 1847; *Glyptotrox* Nikolaev, 2016 and *Phoberus* Macleay, 1819 (Zidek 2017). The first trogid was described and named as *Scarabaeus sabulosus* Linnaeus 257 years back (Strümpher et al. 2016). The subfamily Omorginae Nikolajev, 2005 is monophyletic, and the members of this subfamily have elongated antennal scape and the metatibial spur is as long as the first two tarsomeres (Strümpher et al. 2016). As per Strümpher et al. (2016), *Afromorgus* was described as a subgenus of *Omorgus by* Scholtz (1986a), which was elevated to the genus level by Pittino (2006), but again considered as a subgenus

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Figure 1. New collection locality and first record in the Western Ghats of the trogid beetle *Omorgus* (*Afromorgus*) *italicus* (Reiche, 1853).

of *Omorgus* (see Zidek 2013). At present, 13 species of Trogidae are known from India (Zidek 2013, 2017) (Table 1). The present study documents the occurrence of the trogid beetle from Maharashtra for the first time (Table 1), they have been reported from the other parts of India. As mentioned earlier, the work on this family of beetles of forensic importance is negligible in India. The objective of the present study is to provide a new distributional record of *Omorgus* (*Afromorgus*) *italicus*.

The material (single male) was collected from Sakri Taluka, Dhule District, Maharashtra, India, by the second author. The specimen was brought to the laboratory, dried and pinned. The dried specimen was studied under Leica EZ 4 HD stereozoom microscope. The identification was done with the help of relevant literature (Haaf 1954a; Reiche 1853; Scholtz 1986b, 1990). The structure of the genitalia was compared with the line diagram of genitalia given by Haaf (1954a). The terminology used for describing morphological features and male genitalia follows Scholtz (1986b, 1990). The identified specimen was labeled, duly registered and deposited in the collection of Zoological Survey of India, Western Regional Centre, Pune, Maharashtra, India (ZSI-WRC-ENT-1/2638). The known distribution of this species was verified from the checklist of the world Trogidae (Zidek 2013, 2017). The survey locality has been mentioned under material examined and also shown in Fig. 1. The survey locality map was prepared using the open-free access QGIS software.

Male aedeagus was dissected from the abdomen and kept in 10% KOH solution (at room temperature) for 30 minutes for softening of the sclerotized portion. The specimens were studied, photographed and measured using a Leica EZ 4 HD stereozoom microscope with Leica application suite, Version 3.0.0.

Systematic account of the species along with material examined, description and distribution in India as well as outside India with the description of male genitalia are discussed and illustrated here.

Systematic account

Order Coleoptera Linnaeus, 1758
Suborder: Polyphaga Emery, 1886
Superfamily Scarabaeoidea Latreille, 1802
Family Trogidae MacLeay, 1819
Subfamily Omorginae Nikolajev, 2005
Genus: *Omorgus* Erichson, 1847
Subgenus: *Omorgus* (*Afromorgus*) Scholtz, 1986

***Omorgus* (*Afromorgus*) *italicus* (Reiche, 1853) (Image 1)**

Trox italicus Reiche, 1853; *Annales de la Société Entomologique de France* (3)1: 87–90.

Material examined: ZSI-WRC-ENT-1/2638, 07.vii.2016, 01 male, Sakri, Dhule, (20.9913°N & 74.3188°E, elevation 422m), coll. S.S. Patole.

Description: (Image 1 A, B) Length about 14mm, width about 7mm; Colour: Black

Head finely granulated with two tubercles close together in the middle of the forehead, tubercles rounded and raised; eyes entirely hidden under the projection of the head; clypeus triangular, margins slightly reflexed, apex slightly pointed, with anterolaterally two deep, shiny pits; frons throughout coarsely punctate, two rounded tubercles on frons, tubercles coarsly punctate; anterolaterally two deep almost triangular pits on the genae; antennal scape arcuate, stout, exceeding to half of the antenna, with yellowish long setae; dark reddish-brown pedicel, attached subapically; antennal club tawny.

Pronotum punctate throughout, sides broad; the pronotal width narrower than the elytral width; lateral margins of pronotum smooth, setose, anterolaterally with thin margin; posteriorly furrowed; the discal area raised in the middle, punctate; posteriorly two raised tubercles on each side of the disc.

Elytra almost parallel, rounded dorsally and truncate apically; lateral margins smooth, with short setae; sutural margin slightly raised; humeral callus prominent; elytra with ten ridges or costae, costae interrupted by

Table 1. List of species from Trogidae family reported from India (Adopted from Zidek (2013, 2017).

	Name of species	Distribution
1	*Glyptotrox brahminus* (Pittino, 1985)	China, India (Himachal Pradesh, Punjab, Sikkim, West Bengal), Malaya, Vietnam.
2	*Omorgus (Afromorgus) fatei* Pittino, 2005	India, Pakistan, Sri Lanka.
3	*Omorgus (Afromorgus) granulatus* (Herbst, 1789)	Afghanistan, India (Himachal Pradesh, West Bengal, central and southern states), Pakistan.
4	*Omorgus (Afromorgus) hoogi* (Harold, 1872)	India (West Bengal), Pakistan.
5	*Omorgus (Afromorgus) inclusus* (Waller, 1858)	China, India, Sri Lanka.
6	*Omorgus (Afromorgus) inermis* Pittino, 2005	Southern India, Sri Lanka, southern Vietnam.
7	*Omorgus (Afromorgus) omocanthus* (Harold, 1872)	India (Sikkim, Uttar Pradesh, West Bengal, central states).
8	*Omorgus (Afromorgus) paulseni* (Hoaf, 1954)	China, India (Sikkim, West Bengal), Indonesia, Nepal, Sri Lanka, Cambodia, northern Vietnam, Annam, Indonesia.
9	*Omorgus (Afromorgus) testudo* (Arrow, 1927)	India, Pakistan.
10	*Omorgus (Afromorgus) trifidus* (Harold, 1872)	China, India (West Bengal, Tamil Nadu, Cochin), Thailand.
11	*Omorgus (Afromorgus) procerus* (Harold, 1872)	Arabia, Chad, Egypt, Ethiopia, central India, Iran, Mali, Niger, Nigeria, Pakistan, Senegal, Somalia, Sudan.
12	*Omorgus (Afromorgus) rimulosus* (Haaf, 1957)	British India, Coromandel (= southeastern coast of the Indian subcontinent).
13	*Omorgus (Afromorgus) tuberculatus* (Reiche, 1853)	India (Himachal Pradesh, Maharashtra, Jammu & Kashmir, Sikkim, West Bengal), China, Pakistan, Italy.

small transverse tubercles; the tubercles of odd costae moderately more elevated than even ones; intervals are smooth, finely punctate; pygidium concealed by elytra.

Scutellum hastate, constricted at the base (Image 1C).

Protibia appears slightly bifid, robust, coarsely punctate, dorsally setose; apical spur hooked, robust, pointed, long reaching to first 4 tarsal segments; meso and metatibia with two spurs; metatibial spur reaching first tarsal segment; meso and metatarsi setose (Image 1D).

Male genitalia (Image 1E–G), trilobed; aedeagus robust; pars basalis fused dorsally; median lobe (complex) with ridges, knobs, foveae.

Known distribution until this study: India (Himachal Pradesh, Jammu & Kashmir, Sikkim, West Bengal), China, Pakistan, Italy.

References

Arrow, G.J. (1927). A note on the coleopterous genus *Trox*, with description of a few new Asiatic species. *Annals and Magazine of Natural History* 19(9): 465–468.

Blackburn, T. (1904). Further notes on Australian Coleoptera, with descriptions of new genera and species 34. *Transactions of the Royal Society of South Australia* 28: 281–297.

Crowson, R.A. (1954). *The Natural Classification of the Families of Coleoptera*. E.W. Classey, Ltd., Middlesex, 214pp.

Crowson, R.A. (1981). *The Biology of the Coleoptera*. Academic Press, London, 802pp.

Haaf, E. (1954a). Die afrikanischen und orientalischen Arten der Gattung *Trox* (Col. Scarab.) 2. Beitrag zur Kenntnis der Subfam. Troginae. *Entomologische Arbeiten aus dem Museum Georg Frey* 5: 326–393.

Haaf, E. (1954b). Die australischen Arten der Gattung *Trox* (Col. Scarab.). *Entomologische Arbeiten aus dem Museum Georg Frey* 5: 691–740.

Houston, T.F. (2010). Flightless Carcass Beetles (Trogidae). Available from http://museum.wa.gov.au/sites/default/files/Flightless%20Carcass%20Beetles%202010.pdf: 1-2 accessed on 06 March 2018.

MacLeay, W.S. (1819). Horae entomologicae: or essays on the annulose animals. Containing general observations on the geography, manners, and natural affinities of the Insects which compose the genus *Scarabaeus* of Linnaeus; to which are added a few incidental remarks on the genera *Lucanus* and *Hister* of the same author. With an appendix and plates. Vol. 1, Pt. 1. S. Bagster; London, 160pp.

Reiche, L.J. (1853). Note sur *Hybosorus arator Auctorum*, et sur le *Trox granulatus*, F. et description d'une nouvelle espèce. *Annales de la Société Entomologique de France* 1(3): 87–90.

Pittino, R. (2005). Four new Asian species of *Omorgus* Erichson, 1847 (Coleoptera, Scarabaeoidea, Trogidae). *Kogane* 6: 71–79.

Pittino, R. (2006). Trogidae, pp. 26–28, 79–81. In: Löbl, I. & A. Smetana (eds). *Catalogue of Palaearctic Coleoptera, Volume 3. Scarabaeoidea–Scirtoidea–Dascilloidea–Buprestoidea*. Apollo Books, Stenstrup, Denmark.

Scholtz, C. H. (1980). Monograph of the genus *Trox* F. (Coleoptera: Trogidae) of subsaharan Africa. *Combebasia, Memoir*, 4: 1-104.

Scholtz, C.H. (1986a). Revision of the genus *Trox* Fabricius (Coleoptera: Trogidae) of the Australian Region. *Australian Journal of Zoology: Supplementary Series* 125: 1–99; http://doi.org/10.1071/AJZS125

Scholtz, C.H. (1986b). Phylogeny and systematics of the Trogidae (Coleoptera: Scarabaeoidea). *Systematic Entomology* 11: 355–363; http://doi.org/10.1111/j.1365-3113.1986.tb00186.x

Scholtz, C.H. (1990). Phylogenetic trends in the Scarabaeoidea. *Journal of Natural History* 24: 1027–1066; http://doi.org/10.1080/00222939000770631

Smith, A.B.T. (2003). *Checklist of the Scarabaeoidea of the Nearctic Realm*. Version 3. Electronically published. Lincoln, Nebraska, 74 pp. Available from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?referer=https://www.google.co.in/&httpsredir=1&article=1002&context=entomologypapers accessed on 01 November 2017.

Strümpher, W.P., J. Farrell & C.H. Scholtz (2014). Trogidae (Coleoptera: Scarabaeoidea) in forensic entomology: occurrence of known and new species in Queensland, Australia. *Austral Entomology* 53: 368–373; http://doi.org/10.1111/aen.12084

Strümpher, W.P., M.H. Villet, C.L. Sole & C.H. Scholtz (2016). Overview and revision of the extant genera and subgenera of Trogidae (Coleoptera: Scarabaeoidea). *Insect Systematics & Evolution* 47: 53–82; http://doi.org/10.1163/1876312X-48052139

Tabor, K.L., C.C. Brewster & R.D. Fell (2004). Analysis of the successional patterns of insects on carrion in southwest Virginia. *Journal of*

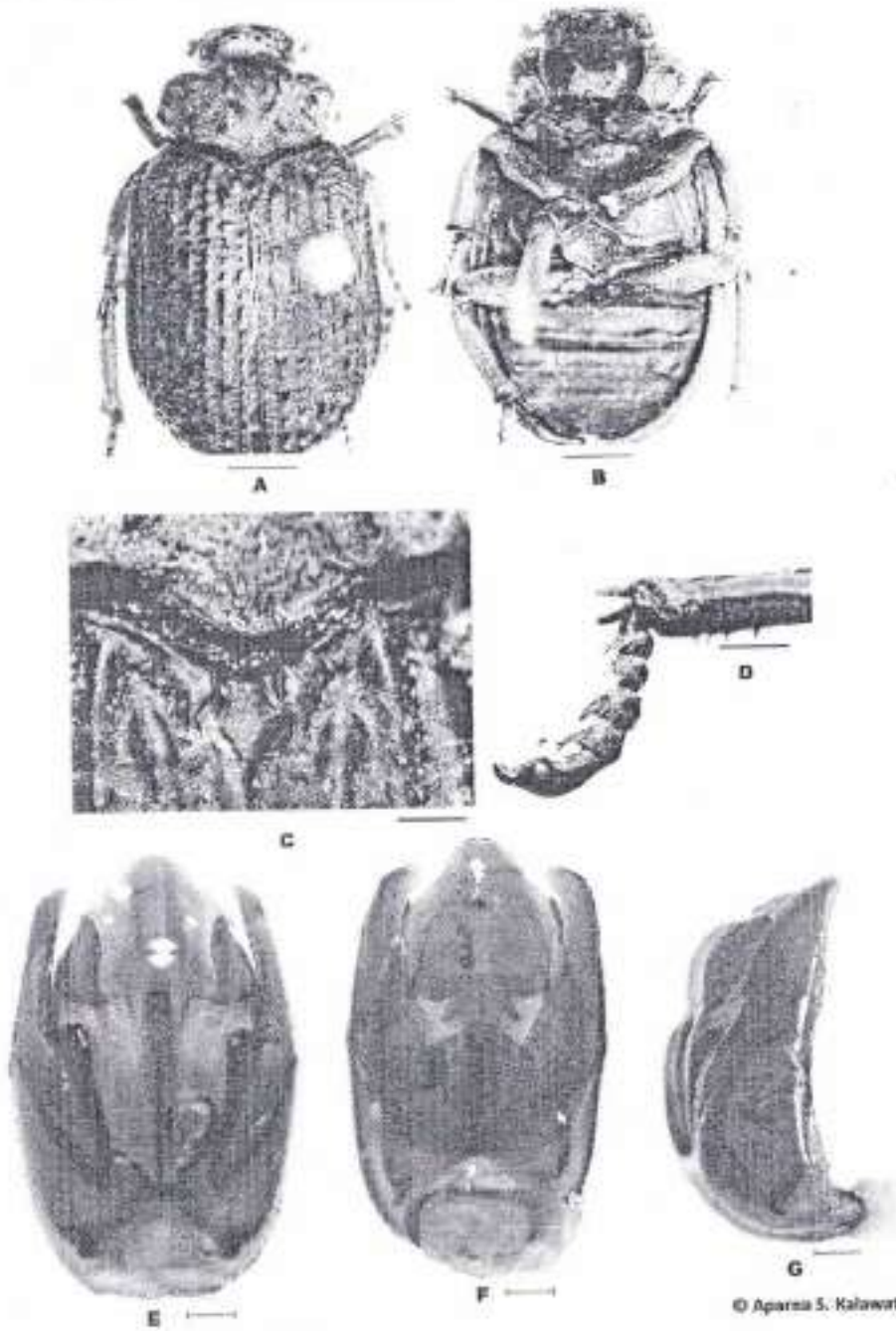

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Image 1. *Omorgus* (*Afromorgus*) *itolicus*
A - dorsal habitus, B - ventral Habitus, C - shape of scutellum; D - mesotarsus; male genitalia (E–G); E - Dorsal view; F - ventral view, G - lateral view. Scale = 2mm (A–D); 0.5mm (E–G).

Medical Entomology 41(4): 785–795.

Verdugo, A. (2014). Morfología de los estadios inmaduros, biología y comportamiento de *Trox cotodognomensis* Compte, 1986 en Cádiz (Coleoptera: Scarabaeoidea: Trogidae). *Revista gaditana de Entomología* V(1): 211–224.

Zídek, J. (2013). Checklist and bibliography of the Trogidae (Coleoptera: Scarabaeoidea). *Insecta Mundi* 0314: 1–38.

Zídek, J. (2017). Updated Checklist and bibliography of family Trogidae (Coleoptera: Scarabaeoidea). *Folia Heyrovskyana* (Series A) 25(1): 93–127.

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Impact of 1/4th sub lethal concentration of Cypermethrin and Fenvalerate on Acid and Alkaline phosphatase enzymes of fresh water fish *Channa marulius* (Ham Buch).

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ABSTRACT

The present study is aimed to investigate acid and alkaline phosphatase enzymes in liver, muscle and gill tissues of *Channa marulius* exposed to 1/4th sub lethal concentration of Cypermethrin and Fenvalerate. In present study the activity of acid and alkaline phosphatase enzymes in liver and gill were decreased, whereas in muscle it was increased in exposure period as compared to control groups.

Key Words: Acid phosphatase, Alkaline phosphatase, Cypermethrin, Fenvalerate.

INTRODUCTION

Fishes are very sensitive to a wide variety of toxicants in water, various species of fish show uptake and accumulation of many contaminants or toxicants such as pesticides (Srinivasan et al., 2011). Due to accumulation of pesticides in tissues produces many physiological and biochemical changes in the fishes and freshwater fauna by influencing the activities of several enzymes and metabolites (Rajini et al., 2014). Cells naturally contain enzymes for their functions such that damages to cellular membrane lead to their escape into the blood where their presence or activities can easily be measured as an index of cell integrity (Abalaka et al., 2011). Certain serum chemistry could be used to identify tissue damage (Susan et al., 2010). Phosphatase is mainly localized at cell membrane. Any damage in the cells may result in alteration in phosphatase activity (Shabnam and Badre Alam, 2012). Phosphatases are good indicators of stress condition in the biological system (Yi et al., 2009). Phosphatases are of two types, namely, Acid phosphatase and alkaline phosphatase. Acid phosphatase, the liposomal enzyme plays a vital role in autolysis degradation of tissues

capable of catalytic transphosphorylation where as Alkaline phosphatase is an enzyme found throughout the body, but it is mostly found in the liver, bones, kidney and digestive system. The lysosomes system has been shown to be very sensitive to change in the intra and extra cellular environment and subsequently to be involved directly or indirectly in controlling many physiological and pathological processes (Nafisa and Pirazada, 2016).

The present investigation was assessing the phosphatase activity in gill, liver and muscle of *Channa marulius* exposed to 1/4th sub lethal concentrations of Cypermethrin and Fenvalerate.

MATERIAL AND METHODS

The fresh water fish *Channa marulius* weighing (15±5 g) and length (10±3 cm) were collected from Kan and Panzara river of Sakri Tahsil (Dhule). Live fishes were brought to the laboratory and thoroughly washed under tap water and acclimatized in laboratory conditions for 15 days. They were fed with standard fish diet (Tokyu grow certified company). Water in the tank was changes after 2 days of interval. Technical grade Cypermethrin (25%) and Fenvalerate (ISAGRO ASIA), 20% (EC) were purchased from Sushil Agricultural pesticide and fertilizer Agency, Sakri for present study.

The fishes were divided into a 4 group, each group of ten healthy fishes were transferred to plastic tough having capacity of 10 litres and they exposed to1/4th sub lethal concentrations of Cypermethrin (0.06 ppm) and Fenvalerate (0.085 ppm). One group was kept as control. At the end of exposure period, fish were randomly selected for biochemical study. Tissues like muscle, gill and liver were excised rapidly and processed for the biochemical estimation. Acid and alkaline phosphatase was estimated by Kinetic method by using kits which are manufactured by Autospan, Span Diagnostics, Ltd. Surat, Gujarat State India (Aspen Laboratories Pvt. Ltd. Delhi).

RESULTS AND DISCUSSION

A comparative data of liver, muscle and gill ACP and ALP levels in control and fish exposed to 1/4th sub lethal concentrations of Cypermethrin and Fenvalerate have been presented in Table1 and 2(Fig 1 and 2).

Cypermethrin

In the present investigation the liver acid phosphatase enzyme was decreased in the treated with 1/4th sub lethal concentration of Cypermethrin. The liver acid phosphate was 3.12, 2.91, 2.55, 2.45 and 2.40µ/l in control, 24 h, 48 h, 72 h and 96 h of exposure

respectively. The acid phosphatase content in muscle tissues of control fish was 4.18 and fish exposed to 1/4th sub lethal concentration of Cypermethrin contained 4.60, 4.72, 4.99 and 4.71µ/l for 24 h, 48 h,72 h and 96 h respectively acid phosphatase were increased significantly over control. In present study the ACP of gill observed in control fish was 2.03 and exposed fish contained 1.63, 1.64, 1.42µ/l and 1.30µ/l for 24 h, 48 h, 72h and 96 h respectively. The acid phosphatase level was decreased after 1/4th sub lethal concentration of Cypermethrin intoxication when compared with control. The fish exposed to 1/4th sub lethal concentration of Cypermethrin the liver alkaline phosphatase levels was decreased by 4.36, 3.98, 4.09, 3.56 and 3.04µ/l in control, 24 h, 48 h, 72 h and 96 h respectively (Table 14). At the end of 96 h exposure ALP were decreased over control. The alkaline phosphatase in muscle tissue of control fish was 4.66±0.49µ/l and fish exposed to 1/4th Cypermethrin was 4.67l, 5.18, 6.15 and 8.05µ/l for 24 h, 48 h, 72 h and 96 h respectively. ALP showed an increased in all concentrations applied, on the 24 h to 96 h of observation. In the present investigation the fish *Channa marulius* treated with 1/4th sub lethal concentrations of Cypermethrin a perceptible decrease of alkaline phosphatase was observed in the gill for 24 h, 48 h, 72 h, 96 h and control respectively. The alkaline phosphatase of exposed fish was, 2.12, 2.08, 1.81 and 1.56µ/l respectively control was 2.36µ/l. The alkaline phosphatase activity in fish was decreased.

Fenvalerate

Liver acid phosphatase enzyme level indicated 3.12, 3.12, 3.10, 3.04 and 3.02µ/l gain after control, 24 h, 48 h, 72 h and 96 h duration at 1/4th sub lethal concentration of Fenvalerate. Liver acid phosphatase was decreased when compared to control. The level of acid phosphatase exhibited remarkable changes from a mean control to exposure period, when the fish exposed to 1/4th sub lethal concentration of Fenvalerate. The acid phosphatase in muscle tissue was 7.54, 6.58, 6.02, 5.75 and 4.18 on exposure to 24 h, 48 h, 72 h, 96 h and control respectively. Acid phosphatase found to be increased for 96 h over control. The fish exposed to 1/4th sub lethal concentration of a Fenvalerate the acid phosphatase enzyme activities of gill for 24 h, 48 h, 72 h and 96 h showed 2.07, 2.05, 2.04, 2.01µ/l respectively and control was 2.03µ/l. The acid phosphatase was decreased in exposure periods over the control. At 1/4th sub lethal concentration of Fenvalerate exposed fish liver alkaline phosphatase level was decreased. The level of alkaline phosphatase was 4.36, 4.35, 4.33, 4.32µ/l and 4.24µ/l in control, 24 h, 48 h, 72 h and 96 h respectively. Alkaline phosphatase decreased as compared to control. The level of alkaline phosphatase in muscle showed changes from a mean control level to exposure, when the fishes were exposed to 1/4th sub

lethal concentration of Fenvalerate. The alkaline phosphatase in muscle tissue was 8.71, 9.26, 10.15, 11.73 and 4.66µ/l on exposure to 24 h, 48 h, 72 h, 96 h and control respectively found to be increased for 96 h. In the present investigation the fish exposed to 1/4th sub lethal concentrations of Fenvalerate a perceptible decreased in the gills alkaline phosphatase has been observed in 24 h, 48 h, 72 h, 96 h exposure as 2.45, 2.38, 2.36, 2.27µ/l respectively and mean control was 2.36µ/l. The alkaline phosphatase activity was decreased in gills as compared to control.

At the end of the exposure period decrease in acid and alkaline phosphatase of liver and gills of fish exposed to pesticide Cypermethrin Fenvalerate. While in muscles acid and alkaline phosphatase activities were increased in fish exposed to pesticide. Findings in the present study are corroborated with findings of Shamshun et al (2010) reported decreased serum alkaline phosphatase value in the air breathing catfish, *Clarias batrachus* as a result of stress induced by low doses of Lead. Kumar et al (2012) reported a reduction in gill, liver and kidney alkaline phosphatase activity of *Carscious auratus* exposed to Azadiractin. The freshwater fish, *Clarias gariepinus* when exposed to sub lethal concentrations of Cypermethrin then its impact on the activity of alkaline phosphatase in the liver was studied. It was reported that the alkaline phosphatase activity was significantly inhibited (Gabriel et al., 2012). Palanisamy et al (2012) reported a notable Reduction in alkaline phosphatase activity in the whole body homogenate of *Mystus cavasius* when exposed to industrial effluent of Chromium. Reduced in the tissue alkaline phosphatase of the fish *Labeo bata* has been observed by Sarower et al (2012). Decrease in alkaline phosphatase level in blood was reported in *Claria gariepinus* exposed to sub lethal concentration of a synthetic Pyrethroids pesticide Cypermethrin (Ojutiku et al., 2013). Sudhish, 2013 reported that the freshwater fish, *Clarias batrachus* exposed to sub lethal concentrations of Rogar, the acid phosphatase and alkaline phosphatase activity was significantly reduced. Alkaline phosphatase is a widely observed enzyme in vertebrate species. It is mainly found in several tissues like liver, bone, kidney, intestine, epidermis etc. of the animals (Sripriya et al., 2015). Decreased activity of acid phosphatase was also reported in the blood of pesticide Dimethiote treated freshwater fish, *Catla catla.* (Mohammad et al, 2015). In fresh water teleost, *Labeo rohita* the Monocrotophos insecticide caused no significant difference in alkaline phosphatase activity in comparison with the control fishes (Devi et al., 2016). Kalaimani and There was an increase in the activity of acid phosphatase in Phosphamidon treated freshwater fish, *Labeo rohita* (Christobher et al 2016). Similar observations were made by Deshmukh (2016) in the *Channa striatus* exposed to endosufan. Kandeepan (2017) study on *Labeo rohita*, the alkaline

phosphatase activity has been decreased significantly in intestine and liver tissues with increasing sub lethal concentrations of Phosalone at different exposure period from 24 - 96 hours and this decrease may be due to the inhibition of enzyme activity by the pesticide Phosalone.

Table-1: Effects of sub lethal concentration 1/4th (0.06 ppm) of Cypermethrin on ACP and ALP in the liver, muscle and gill of *Channa marulius*.

Parameters	Tissues	Control	1/4th dose concentration of Cypermethrin			
			24 h	48 h	72 h	96 h
Acid Phosphatase (µ/l)	Liver	3.12±0.046	2.91±0.022 (-7.21)*	2.55±0.06 (-22.35)**	2.45±0.04 (27.34)**	2.40±0.03 (-30.0)***
	Muscle	4.18± 0.18	4.60±0.97 (9.13)*	4.72±0.86 (11.44)*	4.99±0.87 (16.23)*	4.71±0.06 (11.25)*
	Gill	2.03±0.03	1.63±0.05 (-20.83)**	1.64±0.042 (-23.78)**	1.42±0.04 (21.42)**	1.30±0.03 (56.15)***
Alkaline Phosphatase (µ/l)	Liver	4.36±0.056	3.98±0.08 (-9.54)*	4.09±0.063 (-6.60)*	3.56±0.05 (-22.47) **	3.04±0.086 (-7.92) *
	Muscle	4.66±0.49	4.67±0.55 (0.21)NS	5.18±1.22 (10.03)*	6.15±0.20 (24.22)**	8.05±0.83 (42.11)**
	Gill	2.36±0.020	2.12±0.04 (-11.32*)	2.08±0.03 (-13.46)**	1.81±0.01 (30.38)**	1.56±0.04 (51.28)***

Table-2: Effects of sub lethal concentration 1/4th (0.085 ppm) of Fenvalerate on ACP and ALP in the liver, muscle and gill of *Channa marulius*.

Parameters	Tissues	Control	1/4th dose concentration of Fenvalerate			
			24 h	48 h	72 h	96 h
Acid Phosphatase (µ/l)	Liver	3.12±0.046	3.12±0.037 (0.32)NS	3.10±0.03 (0.96)NS	3.04±0.05 (-2.96)NS	3.02±0.07 (-3.64)NS
	Muscle	4.18± 0.18	7.54± 0.48 (33.02)**	6.58±0.06 (23.25) **	6.02±0.38 (16.11) *	5.75±0.05 (12.17) *
	Gill	2.03±0.03	2.07±0.03 (-0.96) NS	2.05±0.05 (-1.95)NS	2.04±0.04 (-2.45) *	2.01±0.9 (-3.98)*
Alkaline Phosphatase (µ/l)	Liver	4.36±0.056	4.35±0.05 (-0.22)NS	4.33±0.096 (-0.69)NS	4.32±0.07 (-0.92)NS	4.24±0.06 (-2.83)*
	Muscle	4.66±0.49	8.71±0.16 (33.65)**	9.26±0.16 (35.63)**	10.15±0.59 (41.28)**	11.73±0.72 (49.19)**
	Gill	2.36±0.020	2.45±0.045 (-0.81)NS	2.38±0.05 (-3.78)NS	2.36±0.04 (-4.66)NS	2.27±0.06 (-8.81)**

Mean ± S.D. values differ significantly ($p<0.05$) within same column.*Significant value: $p<0.05$, ** $p<0.01$, *** $p<0.001$. NS = Non-Significant ($p>0.05$). Values in the parenthesis are percentage change over control treated as 100 per cent.

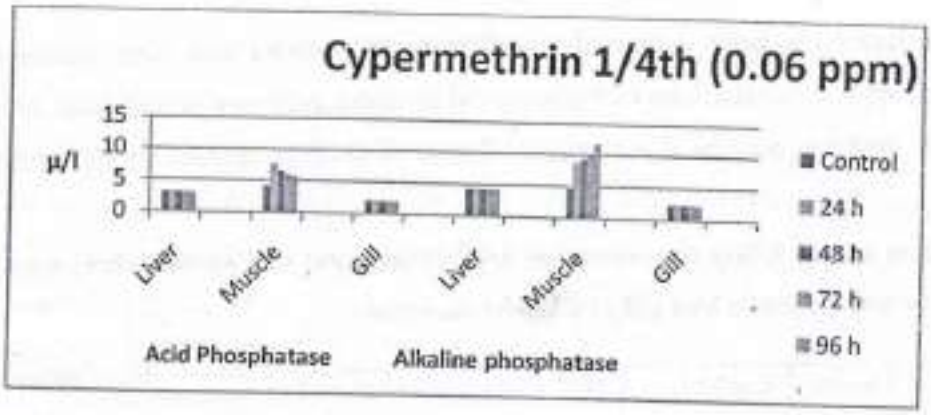

Fig 1 Effects of sub lethal concentration 1/4th (0.06 ppm) of Cypermethrin on ACP and ALP in the liver, muscle and gill of *Channa marulius*.

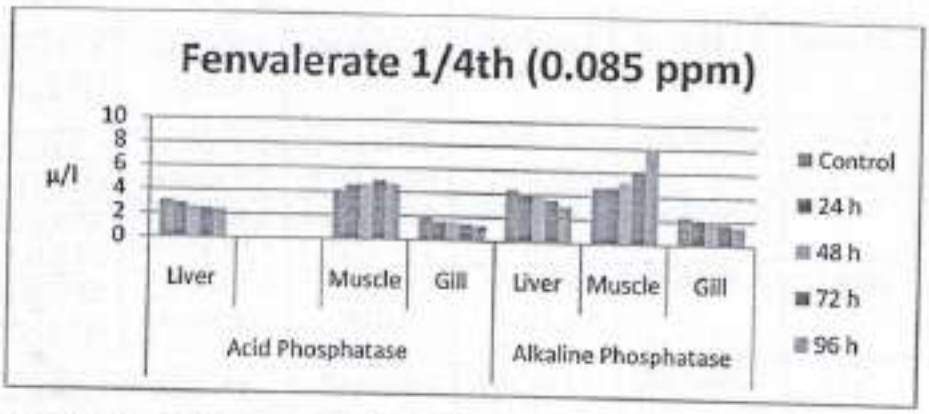

Fig 2 Effects of sub lethal concentration 1/4th (0.085 ppm) of Fenvalerate on ACP and ALP in the liver, muscle and gill of *Channa marulius*.

CONCLUSSION

We conclude that the acid phosphatase and alkaline phosphatase enzyme levels in the fish organs like liver, gill and muscle are altered by the effect of Cypermethrin and Fenvalerate in *Channa marulius*. Therefore, these chemicals should be handle with care and prevent its entrance in to aquatic environment.

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REFERENCES

1. Abalaka, S. E., Esievo, K. A. N. and Shoyinka, S. V. O. (2011). Evaluation of biochemical changes in *Clarias gariepinus* adults exposed to aqueous and ethanolic extracts of Parkia biglobosa pods. *Afri. J. Biotechnol.* 10: 234-240.
2. Christobher, S., Perisamy, M., Sughanti, P. and Saravanan, T. S. (2016). Effect of Phosphamidon on haematological and biochemical parameters of fresh water fish, *Labeo rohita. Int. J. Fauna and Biol. Stud.* 3(1): 114-116.
3. Deshmukh, D. R. (2016). Haematological responses in fresh water fish *Channa striatus* exposed to endosufan. *Biosci. Discov.* 7(1): 67-69.
4. Devi, A. K., Binukumari, S. and Vasanthi, J. (2016). Effect of enzymes in the fresh water fish, *Labeo rohita* during acute and chronic sub lethal exposure to the pesticide Monocrotophos. *Int. J. Appl. Res.* 2(5): 1067-1072.
5. Gabriel, U. U., Akinrotimi, O. A., Ariwerikuma, V. S. (2012). Changes in metabolic enzymes activities in selected organs a tissue of *Clarias gariepinus* exposed to Cypermethrin. *J. Environ. Eng. Technol.* 1(2):12-18.
6. Kalaimani, S. and Kandeepan, C. (2017). Effect of organophosphate pesticide on the freshwater fish *Labeo rohita* (Hamilton). *Ind. J. Nat. Sci.* 8 (44):12700- 12706.
7. Kumar, A., Sharma, B. and Pandey, R. S. (2012) Alterations in nitrogen metabolism in freshwater fishes, *Channa punctatus* and *Clarias batrachus*, exposed to a commercial-grade K-Cyhalothrin, REEVA-5. *Int. J. Expt. Path.* 93(1):34–45.
8. Mohhamad, I. H., Baidyanath, K. and Mumtaj, A. (215). Acute toxicity behaviour response and biochemical composition of blood of common carp, *Catla catla*, (Hamilton) on organophosphate insecticide, Dimethiote. *Int. J. Curr. Microbiol. App. Sci.* 4(5): 1189-1199.
9. Nafisa, S. and Pirazada, J. A. S. (2016). Impact of Organophosphate pesticide, Methyl Parathion and Chlorpyrifos on some tissue enzymes in fish (*Ahanius dispar*). *Indian J. Mar. Sci.* 45(7): 869-874.
10. Ojutiku, R. O., Asuwaju, F. P., Ayanda, I. O., Obande, R. A. and Agbelege, O. O. (2013). Effect of acute toxicity of Cypermethrin on some biochemical parameters of juveniles of *Claria gariepinus* (Burchell, 1822), *Int. J. Engi. Sci. Inven.* 2(3): 1-7.

11. Rajini, A., Gopi, R. A., Bhuvana, V., Goparaju, A. and Anbumani, S. (2014). Alachlor 50% EC induced biochemical alterations in *Clarias batrachus* during and after cessation of exposure. *Int. J. Fish. Aqua. Stud.* 2(2): 59-63.

12. Palanisamy, P., Sasikal, G., Mallikaray, D., Bhuvaneshwar, N. and Natarajan, G. M. (2012). Activity levels of phosphatase of air breathing catfish, *Mystus cavasius* exposed to electroplating industrial effluent Chromium. *Biol. Med.* 4(2):60-64.

13. Sarower, E., Mahfuj, M., Belal, H. M. and Minar, M. H. (2012). Biochemical composition of an endangered fish, *Labeo bata* (Hamilton, 1822) from Bangladesh waters. *American J. Food Technol.* 7(10):633-641.

14. Shabnam, A. and Badre, A. A. (2012). Alphamethrin toxicity effect on the reproductive ability and the activities of phosphatase in the tissues of zebra fish, *Danio rerio Int. J. Life Sci. and Pharma. Res.* 2(1): 89-100.

15. Shamshun, N., Chandan, K., Kavitha, M. and Mamta, K. (2010). Lead induced alteration in blood profile of air breathing catfish, *Clarias batrachus* Linn. *The Bioscan an Int. Quar. J. Life Sci.* 2: 335-341.

16. Sreenivasan, R. S., Krishna, M. P. and Deecaraman, M. (2011). Effect of Phosphatase activity in the hepatopancreas and muscle of the fresh water female field crab, *Spiralothelphusa hydrodroma* (Herbst) treated with Cypermethrin, *Int. J. Pharma. Sci. Drug Res.* 3 (2): 123-126.

17. Sripriya, R., Kumar, K. and Rajendran, K. (2015). Seasonal variation of serum enzymes of Indian freshwater eel, *Anguila bicolor* (Meelelanand). *Int. J. Fish. Aqua. Stud.* 3(2): 50-54.

18. Sudhish, C. (2013). Impact of pesticide Rogar toxicity on serum phosphomonoesters levels of freshwater catfish *Clarias batrachus*. *J. Appl. Nat. Sci.* 5 (1): 20-23.

19. Susan, T. A., Sobha, K., Veeraiah, K. and Tilak, K. S. (2010). Studies on biochemical changes in the tissues of *Labeo,rohita* and *Cirrhinus mrigala* exposed to Fenvalerate technical grade. *J. Toxicol. Environ. Heal. Sci.* 2(5):53-62.

20. Yi, X., Ding, H., Lu, Y., Liu, H., Zhang, M., Jiang, W. (2009). Effects of long-term exposure on hepatic antioxidant defense and detoxifying enzyme activities in crucian carp (*Carassius auratus*). Chemosphere, 68:1576-158.

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EFFECT OF BIODEGRADABLE PLASTIC PAPER ON GROWTH AND REPRODUCTION OF EARTHWORM, *EUDRILUS EUGENIAE*.

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ABSTRACT

Present study deals with the effect of biodegradable plastic paper on growth and reproduction of earthworm (*Eudrilus eugeniae*). A mixture of Soil + Cow-dung+ Earthworms was treated as control, whereas this mixture along with biodegradable plastic paper (1%) served as experimental material. The mixtures were incubated for 60 days, and thereafter, growth and reproductive performance of earthworm was observed. Maximum growth, number juveniles and cocoons were recorded in control, while those were significantly decreased in the experimental material. Thus, sever effect of biodegradable plastic on growth and reproduction of earthworm was observed.

Keywords: Biodegradable plastic, soil, cow-dung, earthworm, juveniles, Cocoons

Introduction

Earthworm have been proved as the best decomposers of organic waste (More and Patole, 2013). Present investigation was undertaken to find out the effect of biodegradable plastic paper fragments (which is often used by the farmers for mulching, covering and other farm operations) on reproductive behaviour of earthworm (*Eudrilus eugenise*).

Material and methods

The earthworms were procured form horticulture nursery, Department of Agriculture, Sakri, Dist. Dhule. Those were maintained in the mixture of cow dung and soil for 15 days. One month old cow dung (CD) and black cotton soil was collected from cow shed and agricultural field respectively. Biodegradable plastic paper was purchased from local market.

The experiment was performed in the plastic bags having capacity of around 5 kg. Two groups of vermi-beds were prepared. The control vermi-bed contained 50 % soil + 50 % CD + earthworms (50), while experimental vermi-bed was comprised of 49 % soil + 50 % CD + 1 % biodegradable plastic + earthworms (50). Sufficient water was added to the mixtures so as to keep them moist.

Biodegradable plastic paper was cut into pieces (1 cm x 1 cm) and mixed with experimental beds. Worms with equal size were selected, their weights recorded and then added in both control and experimental beds next day. The bags were kept in the laboratory undisturbed for 60 days with intermittent water spray.

The experiment was terminated on the 60th day. The contents were removed and dried for two days. All large worms, small juveniles and Cocoons were carefully removed, washed, counted, dried and their dry weights were recorded.

Results and discussion

Table 1 : Effect of plastic on earthworm

Sr. No.	Group	Weight of worms (g)		% increase	count	
		Initial	Final		cocoons	juveniles
1	Control	24	33	37.5	30	62
2	Experimental	23	28	21.7	22	56

The results obtained have been summarised in Table 1. Both vermi-beds showed increase in the weight of worms, however, the weight of the worms from control group was higher than that noticed in the experimental group. It seems that biodegradable plastic papers might have eaten by earthworms.

References

More B.C. and Patole S. S. (2013) *Uttar Pradesh J. Zoo.***33(1)**: 51.

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EFFECT OF YOGA THERAPY ON TSH AND BMI

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ABSTRACT

Twenty men and women subjects were divided in two groups, the experimental or yoga and control groups. Yoga and pranayama therapy was practiced on experimental group. The level of TSH, weight and height of all the subjects were measured and body mass index (BMI) was calculated, before starting yoga and after 6 weeks of yogic training. The influence of yogic practices showed statistically significant decrease s in the levels of TSH and BMI.

Key words: yoga, pranayama, ujai, kapalbhati, hypothyroidsm, BMI, TSH.

Introduction

In order to evaluate efficacy of selective yoga therapy in the management of hypothyroidism, and its effect on body mass index (BMI) and Thyroid Stimulating Hormone (TSH) present investigation was undertaken.

Material and Methods

The present research work was carried out in the Department of Zoology, Karm. A. M. Patil Arts, commerce & Kai. Annasaheb N. K. Patil Science Senior College, Pimpalner, District Dhule. The subjects included in this investigation were mild to moderate cases of Hypothyroidism, with Serum TSH level in between 5.0 - 46.6 m IU/ml. Those were within the age group of 18-60 years. The subjects with cardiac diseases, pregnant women, suffering with auto immune diseases, Patients suffering from any kind of diagnosed / clinically seems to be neurological and orthopedic disorders and those having Body weight more than 90 kg were excluded. The subjects were selected from Pimpalner town. The study was under taken at Sant Thakursingh Dnyanpeeth Highschool, Pimpalner.

Twenty subjects were thus included in the experimental trial, after screening by inclusion and exclusion criteria, and randomly segregated into two groups, each group had 10 patients. Group- 1 was Experimental or Yoga group. The subjects from this group were executed to life style modification, including specific Yoga techniques and diet restriction of 1600 Kcal/day.

Group-2 was Control group. The subjects from this group were also executed for life style modification with diet restriction of 1600 Kcal/day.

The study protocol was ethically approved by the Institutional Ethical Committee. An informed consent of the volunteers was undertaken in an approved format. Control group was not exposed to any yogic practices. Yoga therapy was, however, introduced to the experimental group. Which contained Asanas, Pranayamas, Meditation and Relaxation techniques in a proper sequence. Asanas were taught for a period of 30 minutes, Pranayama for 20 minutes, Meditation for 5 minutes and Relaxation for 15 minutes. All the practices were taught gradually.

Yoga schedule included 7 Pranayamas (Bhastrika : 2 - 3 min.,

Kapalbhati : 5-10 min., Bahya with tribandh : 2 times, Anulom-Vilom : 10-20 min., Brahmari and Udgeet : 25min. and Ujjayi : 25times), 12 Asanas (Vajrasana, Suptavajrasana, Simhasana, Tadasana, Trikonasana, Paschimottanasana, Pavanamuktasana, Bhujangasana, Shalabhasana, Dhanurasana, Makarasana and Ustrasana) and Micro-exercises for relaxation of hand and legs, as per the 'theory of Swami Ramdev " (Acharya Balkrishna, 2007).

The Yoga program was undertaken from February 1, to March 17, 2017 during 5.30 to 6.45 AM. It was scheduled for 6 days/ week and continued for 6 weeks. The basal level of TSH, weight and height were measured before starting and completion of yogic training. The Body mass index was calculated as BMI = Weight (Kg) / height^2(m) as described by Malcolm Kendrick. (2015). Statistical methods used were one way analysis of variance (ANOVA) and student "t" test for descriptive statistics and 'p' value.

Results and Discussion

Table 1 gives an account on pre and post-yoga changes in experimental and control groups. As compared to the non-yoga group, yoga group revealed significant improvement in BMI and TSH levels. Singh and Barnwal (2014) also found significant effect of yogic practices on TSH. Specific yogic poses (Sarvangasana, Halasana, Usthrasana, Matyasana, Bhujagasana) can stimulate throat area by squeezing and stretching, massaging thyroid gland (Chatterjee and Mondal, 2010).

The results obtained during present study are similar to those obtained by Krishna Sharma (2016). Similarly Syeda Islam and Dhiren Deka (2016) also reported that yoga increases TSH level to a normal range. The results, however, are contradictory to the results recorded by Gorden et. al. (2008) who reported no significant change in TSH, T3 & T4 levels after practice of yoga.

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References

Acharya Balkrishna. (2007). *"Yog in Synergy with Medical Science"* First Edition Divya Prakashan , Patanjali Yogpeeth, Hardwar. pp 234-236.

Chatterjee S. and Mondal S. (2010)., *Yoga Mimamsa*, **42 (1)** : 40-47.

Gordon L, Morrison E.Y., Mc Growder D, Penas Y.E., Zamoraz, E.M, Lindo, R'A, (2008). *Am J. Biotechnol*, **4(1)** : 35.

Krishna Sharma. (2016). *Global Journal for Research Analysis.*, **5(8)** : 3739.

Malcolm Kendrick. (2015)., https://www.independent.co.uk.

Singh, S. and Barnwal, S. (2014).. *AMASS Multilateral Research Journal*, **6**(1):40-48.

Syeeda Semin Islam and Dhiren Deka. (2016).. *IJMDRR*, **1(16)** :1.

Table1: Effect of yoga on weight, BMI and TSH.

Experimental Criteria	scores		% Relief (significance level)	
	Pre -Test	Post-Test		
Weight (in kg.)	74.8	71.2	4.81%*	
B. M. I. (kg/m2)	27.23	25.87	4.99%**	
TSH mU/mL	14.45	1.95	86.50%***	
Control Criteria	scores		% Relief (significance level)	
	Pre -Test	Post -Test		
Weight (in kg.)	72.4	72.1	0.41%	NS
B. M. I. (kg/m2)	27.67	27.57	0.36%	NS
TSH mU/mL	12.6	11.8	6.34%	NS

All values are expressed as mean score- Weight, BMI-Body Mass Index, TSH-Thyroid Stimulating Hormone, Test-Pre-Before yoga intervention, Test-Post- After yoga intervention, NS-Non Significant (P>0.05), Significant values: *P<0.05, **P<0.01, ***P<0.001.