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DIVERSITY OF AQUATIC INSECT AS A BIOINDICATOR WITH WATER QUALITY PARAMETERS OF SELECTED WAINGANGA RIVER BASIN AREAS OF PAUNI, DISTRICT BHANDARA, (M.S.)

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ABSTRACT: A study was conducted on the diversity of aquatic insects in the area of Pauni which is the Kashi of Vidarbha (Latitude 20° 48' 17" and Longitude 79° 37' 51") is located in Maharashtra. This study is a part of biomonitoring research programme of the basin areas of Pauni using entomological indicator of lotic ecosystem during January-2021 to December-2021. The current study revelated 25 species of aquatic insect belonging to 5 different orders were recorded. At order level highest species of Hemiptera (7) were recorded Similarly, Coleoptera (5), Odonata (6), Diptera (4), Ephemeroptera (3) aquatic insect species was found in basin water ecosystem. Different diversity indices were recorded out in all seasons. Thus, water quality parameter included viz. Water temperature, Water pH, Dissolve oxygen, Biochemical oxygen demand, Water turbidity, and Total dissolve solid. Physiochemical data and biological data showed in the paper.

Key words: - Diversity, Aquatic insects, Basin water quality, Seasonal variation.

INTRODUCTION :

Aquatic ecosystem shows close interaction between Biotic and Abiotic components. Physico-chemical status have great influence on the wellbeing of aquatic species, (Kawo,2005). Insect being a part of an aquatic ecosystem it performs an active role in aquatic nutrient cycle. They act as consumers in food chain and also consumable food for the different animals. It stores major proportion of total nutrients in their body, ultimately it transfers to another trophic level of food chain, due to which insect are considered as mobile link between different ecosystems for limited distance. it also behaves like a biological indicator of water quality by showing changes in factor like Insect density, growth, and distribution which are dependent on good water quality.

Maharashtra is enriched in freshwater sources like rivers, dams, and ponds etc. and its insect diversity. Aquatic ecosystem is helpful in maintaining the biodiversity. The biodiversity has different Arthropoda represent the largest animal phylum and its members are known to show diverse biology, habits and habitat. Most of them are hardy, a character responsible for their occurrence and survival in a wide range of conditions which may not be tenable for many other animal groups. Class Insecta is the largest class of animals, belong to this phylum. This class comprises both useful and harmful insect values natural water resources are abundant in the state so there is great scope for fisheries. Recently in India, the Insect faunal diversity was studied by many researchers to a great extent. The additional integration of biological parameters to physicochemical assessments has proven to be a more complete method to fully assess pollutant effects in aquatic ecosystems most particularly in lotic systems (Oliveira & Cortes 2006) Most importantly, aquatic insects are very good indicators of water quality since

they have various environmental disturbance tolerance levels (Arimoro & Ikomi 2008). Among benthic macroinvertebrates, aquatic insects are one of the most common groups of organisms used to assess the health status of aquatic ecosystems (Rosenberg & Resh 1993; Xu et al. 2014). They are useful indicators, because they represent a diverse group of long living sedentary species that react strongly and often predictably to human influences on aquatic systems (Cairns & Prall 1993). Some aquatic insects respond to specific changes in water conditions and have become indicators of river health condition to aquatic ecologists. The presence and absence of some particular aquatic insect indicate the degree of pollution, though the specific causative physicochemical pollutant may be identified by physicochemical methods (Gupta & Paliwal 2010). Insect diversity of fish pond Balrampur District Utter Pradesh has reported 32 Aquatic insect species (Sadguru Prakash et al., 2020).

For a variety of reasons, aquatic insects are extremely important to the vitality of rivers and streams and thus can be viewed as surrogates for river and stream wealth. First, from a logistic standpoint they make good study specimens because they are abundant, readily surveyed and taxonomically rich. Since diversity and abundance of aquatic insects provides an indication of the overall health of the water body. Identifying the diversity and community composition of a sample of aquatic insect in a selected water bodies will help to determine the overall richness and abundance of the aquatic insect fauna within that stream.

All these studies reveals that the unlimited anthropogenic activities continuously effect on water quality which ultimately affect fish productivity of river which in turn disturbed the aquatic nutrient cycle. Thus, there is an urgent need for proper investigation of Aquatic Insect diversity in order to develop a fresh water.

Study area

Pauni river basin areas banks of Wainganga River (Latitude 20° 48' 17" and Longitude 79° 37' 51") located in Bhandara district of Maharastra. Origin of the river basin lies in the forest area of Umrer-Karhandla forest. During the study period this segment was featured by small and moderate perennial rocky stream with shore-line trees of semi-evergreen and evergreen forests. Cool and clear water was found flowing over eroded bedrock, cobbles and boulders with good current velocity. Moderate waterfalls, creeks, brooks, cascades, alternating riffle and pool sections were also characteristics of this segment. Mid-stream depth was below 1.0m making the segment wadable. Wainganga Pauni river basin segment was divided into two sampling sites.

MATERIALS AND METHODS:

Aquatic insects were sampled using aquatic D-hand net with a dimension of 30 × 30 cm frame, 250 µm mesh, 50 cm length was used throughout the sampling. At each sampling locality, a stretch of approximately 50 m was chosen for collection of samples from the three target habitats - riparian vegetation, leaf litter, low gradient riffles and pools. The sampling time at each habitat was 3 min. In each sampling period, three replicate samples were collected at each basin site, considering all possible insect habitats over representative sections of the basin stream. Samples were placed in white trays for sorting and screening of the aquatic insects. The aquatic insects were handpicked from the tray. Any non-aquatic insects caught were immediately returned to the stream. The content of each sample (net) was transferred into properly labelled plastic containers, preserved in 95% ethanol and taken back to the laboratory for analysis. In the laboratory, aquatic insects were sorted on a Petri dish and identified in binocular and using to the family level taxonomic keys by several authors (Dudgeon

1999; Wiggins 1996; Yule & Sen 2004). Large aquatic insects were sorted by the naked eye whereas the sorting of the smaller ones was done under a dissecting microscope. All the sorted samples were kept in properly labelled vials containing 95% ethanol.

Physio-chemical parameters such as water temperature and pH of water sample were analysed by using a mercury bulb thermometer and pH meter respectively. Dissolved oxygen (DO), Biochemical oxygen demand (BOD), Water turbidity, Total dissolved solids (TDS) of water samples were analysed by following standard titrimetric methods.

RESULT AND DISCUSSION:

The present study indicated that Pauni River basin water bodies are rich in aquatic insects (Table 1). The diversity of insect fauna of these lotic ecosystem was represented by 25 species belonging to 18 families and 5 orders. Among the aquatic insects collected from basin area lotic water bodies, the order Hemiptera (7 species) was dominant and followed by order Odonta (6 species), Ephemeroptera (3 species), Diptera (3 species), Coleoptera (6 species), Among the collected aquatic insects the order Hemiptera was diverse in number of genera. It was represented by 5 families viz, Pleidae (*Neoplea species*), Notonectidae (*Notonecta glauca*, *Anisops* species), Gerridae (*Limnogonus fossarum*), Nepidae (*Nepa cinera*), Belostomatidae *Diplonychus annulatus*), Mesoveliidae (*Mesovelia amnena*) and rest of the families. Of these, Pleidae, Belostomatidae and Nepidae were the most common family among Hemiptera in river basin. Water strider, Aquarius species, Marsh treaders, Hydrometra species and Gerris species were found on the surface of the water bodies. The Order Coleoptera was represent 5 families viz. Dytiscidae (*Cybister tripunctatus),* Hydrophilidae (*Helochares species),* Scirtidae (*Scirtes hemisphericus),* Hydraenidae (*Hydranidae species) and Psephenidae (Psephnus species)* each family represent one species. Insect order Odonta was represented by two families viz, Libellulidae (*Brachythemis contaminata, Crocothenies servilia and Acisoma species*), Coenagrionidae (*Ceriagrion coromandelianum, Ischnura heterostricta) and Pseudagrion species*). The Order Diptera was represented by three families viz., Anophilinae, Culicidaeand Chironomidae and each family was represented (*Anophiles* species, *Culex* species, *Simulium* species, *Tipula* species), Most of the Dipterans inhabited in the marginal polluted zone of river basin water bodies with wide range of tolerance. Ephemeroptera was one of the intolerant and sensitive group and was represented by two families viz., Baetidae (*Cloeon fluviatile and Platybaetis anunahalae*), Caenidae (*Caenis stephenus*), which are indicator of water quality ecosystem health. The biodiversity of aquatic insect communities in a given basin water ecosystem reflect the environmental conditions. The sensitive species inhabiting the habitats of the adverse environmental conditions are gradually eliminated and the tolerant species establish their colonies and grow in abundance The structure and composition of biotic community is well reflected with altering water quality and are also shown in their distribution, diversity and abundance pattern of species. Most aquatic habitats with acceptable water quality and substrate conditions support diverse macro invertebrate community. Such community responds to changing habitats and community structure such as invertebrate abundance and composition. Present study reveals greater diversity and abundance of insects in Pauni Wainganga River basin. The results of the study revealed greater diversity of aquatic insects in basin areas of Pauni with a possibility of pollution in lower reaches and suggest effectively for stringent biomonitoring programmes.

The water quality parameters showed in (Table No.2) Temperature is one of the most important basic environmental factors for all aquatic organisms which effects chemical and biological reaction in water. The changes in temperature affect the metabolism and physiology of aquatic organisms. In the present study, authors recorded a varied temperature in different season viz. Monsoon, Winter and Summer in basin lotic water ecosystem its show highest temperature in summer season 29.46 °C and Lowest temperature in Winter 25.05 °C. The pH is a measure of hydrogen ion concentration and it indicates the acid base balance of the water. In the present study, the pH values of basin water ecosystem varied from 8.15 – 8.45 which showed the favourable condition of pond productivity. Dissolved oxygen plays a vital role in the growth, survival, behaviour and physiology of aquatic organisms. The optimum concentration of DO in basin water is 5.0-7.0mg/L. In the present study, DO obtained were in the range of 4.1 -3.2 mg/L and these values lower the standards. The values obtained are within the range of standards. Biochemical oxygen demand (BOD) is the amount of oxygen taken up by micro-organism for the decomposition of organic waste materials in water. In the present study, the value of BOD of basin water ecosystem ranged between 2.52-2.62. Turbidity is defined as the sum of calcium and magnesium concentration in aquatic bodies which are present in the combination of carbohydrates and bicarbonates which causes temporary hardness. The TDS in the present water bodies varied between 287 and 138 mg/L (NTU) which are within the range. A total dissolved solid (TDS) is the direct measure of all the dissolved substances (both inorganic and organic) in the water bodies. In the present study, TDS values obtained ranged from 620 – 230 mg/L (PPM).

There is less information on the abundance and diversity of aquatic insects in lotic ecosystem water bodies of Bhandara District, Maharashtra. Therefore, it is imperative to make continuous investigation, census and research activities on the taxonomy and diversity of aquatic insects, so that knowledge regarding this important group can be utilized by future researchers as baseline data for further research and conservation planning.

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Table 1: Distribution of different species of aquatic insects in Wainganga Pauni River basin lotic ecosystem water bodies.

S.N	Species	Monsoon	Winter	Summer
	Order: Hemiptera			
1	Nepidae: *Nepa cinera*	++	+	-
2	Notonectidae: *Notonecta glauca*	++	++	+
3	Belostomatidae: *Diplonychus annulatus*	++	+	+
4	Gerridae: *Limnogonus fossarum*	+	++	++
5	Notonectidae: *Anisops species*	+	++	+
6	Mesoveliidae: *Mesovelia amnena*	+	+	-
7	Pleidae: *Neoplea species*	+	+	+
	Order: Coleoptera			
8	Dytiscidae: *Cybister tripunctatus*	++	++	++
9	Hydrophilidae: *Helochares species*	+	++	-
10	Scirtidae: *Scirtes hemisphericus*	-	+	-
11	Hydraenidae: *Hydranidae species*	++	++	+
12	*Psephenidae: Psephnus species*	++	-	-
	Order: Odonata			
13	Libellulidae: *Brachythemis contaminata*	++	++	++
14	Libellulidae: *Crocothenies servilia*	+	++	+
15	Coenagrionidae: *Ceriagrion coromandelianum*	++	+	+
16	Coenagrionidae: *Ischnura heterostricta*	++	++	+
17	Libellulidae: *Acisoma species*	+	++	+
18	Coenagrionidae: *Pseudagrion*	+	++	+
	Order: Diptera			
19	Anophilinae: *Anophiles species*	++	++	++
20	Culicidae: *Culex species*	++	++	++
21	Simuliidae: *Simulium species*	+	+	-
22	Tipulidae: *Tipula species*	-	+	-
	Order: Ephemeroptera			
23	Caenidae*: Caenis stephenus*	+	++	-
24	Baetidae: *Cloeon fluviatile*	+	+	-
25	Baetidae: *Platybaetis anunahalae*	+	++	+

Table 2: Water Quality Parameters of Wainganga Pauni River basin lotic ecosystem water bodies and Comparison of results.

S.N	Parameters	Monsoon	Winter	Summer
1	Temperature °C	27.07	25.05	29.46
2	pH	8.15	8.32	8.45
3	Dissolve oxygen (DO) (mg/l)	4.1	2.25	3.23
4	Biochemical oxygen demand (BOD) (mg/l)	2.52	2.73	2.62
5	Total dissolve solid (TDS) PPM	620	280	230
6	Water Turbidity NTU	287	119	138

Fig 1. Map of Bhandara District showing study site

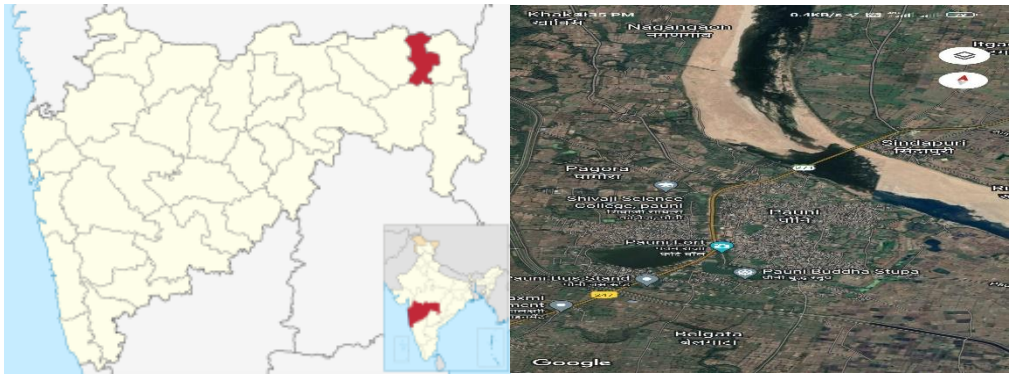

Fig 2. Study site basin areas of Pauni