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Original Research Article

Mayfly Nymphs as Water Pollution Bioindicator

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ABSTRACT:
Ephemeroptera is an order of insects, comprising of over 3000 species (Barber-James et al., 2008). Ephemeroptera means Short lived, winged adults having lifespan about 1-2 hours to few days and maximum of 14 days. They are terrestrial in adult life and aquatic in the immature called naiads (nymphs). The sub-imago is the early, reproductively immature adult and the mature ones are imago. The nymphal stage of mayflies is always aquatic and they are dominant in life history stage. Depends upon external factors such as temperature, food availability and current velocity the nymphs undergo a series of molts as they grow (Brittain and Sartori, 2003). Water temperature is higher at summer season and lower at winter season. The maximum pH value recorded in the month of August (monsoon) and minimum in the April (summer). The pH was alkaline throughout study period. The maximum values recorded in the month of summer and winter. The high Do in summer attributed to increase in temperature and duration of bright sunlight. The maximum value recorded in the month of December (winter) and absent in the month of March (monsoon). The results showed that nymphs of mayfly are abundant in the month of March, April and May because of suitable water conditions like temperature, pH and DO. The lower number of nymphs observed in month of July, August and September in rainy season.

Keywords: Mayfly nymphs, water physicochemical Parameters, Bioindicator, Kolhapur district.

INTRODUCTION

Ephemeroptera is an order of insects, comprising of over 3000 species (Barber James et al., 2008). Ephemeroptera means Short lived, winged adults having lifespan about 1-2 hours to few days and maximum of 14 days. They are terrestrial in adult life and aquatic in the immature called naiads (nymphs). The subimago is the early, reproductively immature adult and the mature ones are imago (http://wgbis.ces.iisc.ernet.in). Mayflies are very good indicators of

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conservation importance and of centres of endemicity and they can be used to identify significant localities at much smaller scale than those identified by studies on vertebrates. The nymphal stage of mayflies is always aquatic and they are dominant in life history stage. Depends upon external factors such as temperature, food availability and current velocity the nymphs undergo a series of molts as they grow (Brittain and Sartori, 2003). Globally 3000 species of mayflies are scattered into 400 genera and 42 families (Barber James et al., 2008). Of these, 390 species in 84 genera and 20 families occur in the Oriental region. About 49% of the genera (41 genera) are endemic to the region (Barber James et al., 2008). A greater part of Mayflies life cycle spent as larvae in water, while their short terrestrial adult life is simply for reproduction. They are amphibiotic insects and represents order Ephemeroptera which inhabit both lotic and lentic ecosystem of waters (Srivastava, 1991). According to Dubey et al., (2013) Mayflies are important fish food item in all of their life stages (nymphs, subimagos and imagos). Ecological studies on lotic systems in India with emphasis on Ephemeroptera are very few (Gupta and Gupta 1983).

Mayfly nymphs can live in the water having high oxygen content. Mayfly lives in freshwater bodies, lakes and ponds. The samples collected in Kolhapur district & two species of nymphs collected like Baetidae and Caenidae. These species found dominated in Kolhapur rivers including.In present, study their bio indicator value in biomonitoring technique of water quality based on occurrence of mayfly nymphs in different environmental condition. The mayfly nymphs feeds on detritus and are thus highly sensitive to change in the substrate and any toxic materials entering the water Mayfly produce many eggs and the rate of growth of egg is usually affected by biotic and abiotic factors which indicates the ecological conditions (Landa, 1969).

Most of mayfly nymphs have very small requirements regarding their tolerance to dissolved oxygen, pH, type of substrate, size and currents of the streams and temperature of water.

Along the microinvertebrates community mayflies are considered as keystone species and their presence is believed to be an important environmental indicator of running water (Baulenfeind and Moog, 2000).

MATERIALS AND METHODS

Sample collection method:
Mayfly nymphs collected by selecting different spots of Kolhapur district rivers using insect collection net having mesh size 40 from January to December 2019. The net is dipped in water and swipe for 4-5 times just above the bottom to collect the nymphs. The nymphs along with water brought to laboratory for photography and identification.

Sample collection for water testing:
For water sample plastic containers of 100 ml capacity used having size 10×8, 8×6 cms (height and diameter). The water sample brought to laboratory for water testing.

Physico-chemical water parameters:
a. Water temperature: A universal standard thermometer having mercury bulb dipped in each study spots river water for measuring water temperature.
b. pH: The pH of water is determined by using pH meter having glasselectrode HI 2215 pH/ORP, Hanna instrument.
c. Dissolved oxygen: For measuring DO Winkler's Iodometric method used.
d. Free carbon dioxide: For measuring free Co_2 APHA-AWWA-WPCF (1980) Titrimrtric method used.

Mayfly evaluates the quality of water in study area. This done by assessing the survival of different mayfly species in water bodies by checking physico-chemical water parameters such as temperature, pH, DO, and free CO_2. Mayfly nymphs collected and preserved in to the laboratory for further study.

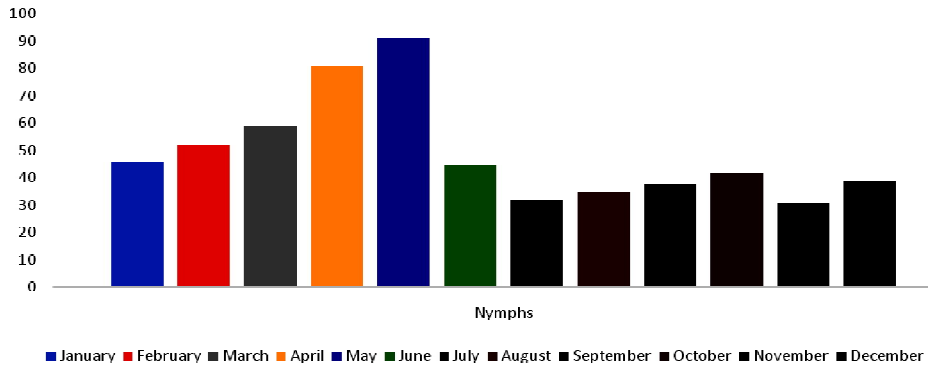

Figure 1: The bar diagram showing month wise abundance nymphs of mayfly of Kolhapur district.

RESULTS AND DISCUSSION

The lowering in number of nymphs were observed in month of July, August and September in rainy season during investigation (Fig. 1).Water temperature is higher at summer season and lower at winter season.The maximum pH value recorded in the month of August (monsoon) and minimum in the April (summer) (Fig. 2).

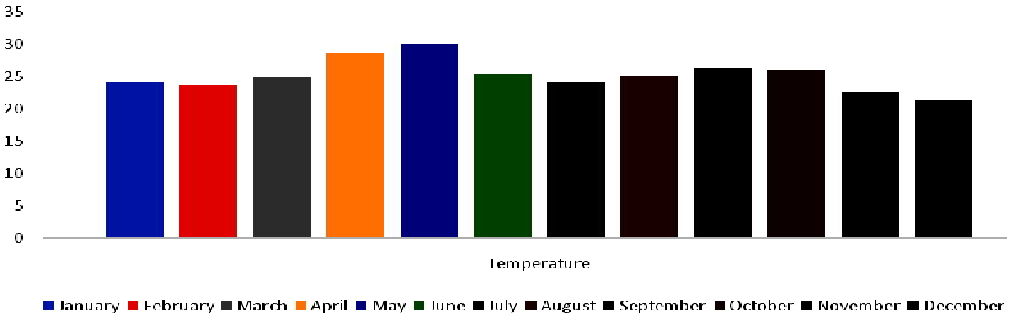

Figure 2: The chart showing water temperature of rivers of Kolhapur district.

The pH was alkaline throughout study period (Fig 3). The maximum values recorded in the month of summer and winter. The high Do in summer attributed to increase in temperature and duration of bright sunlight (Fig. 4). The maximum value recorded in the month of December (winter) and absent in the month of March (monsoon).The results shows that nymphs of mayfly are abundant in the month of March, April and May because of suitable water conditions like temperature, pH, DO and free CO_2 (Fig. 5).

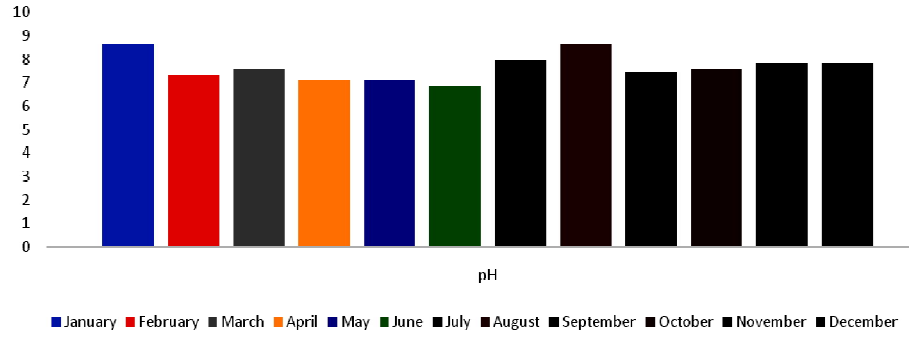

Figure 3: The chart showing water pH of rivers of Kolhapur district.

According to Danish (1909), pH is a determined value based on a defined scale. The pH of water is in between 0 and 14 defining acidity or basicity of water, along a logarithmic scale. The lower the number, more the acidic water and higher the number, the more basic it is. Neutral pH accounts at 7 numbers. The pH of water is harmful to the aquatic organism if it is too high or too low. It also affects the solubility and toxicity of chemicals and heavy metals in the water. Most of the aquatic creatures live in water with a pH range of 6.5-9.0, but some individuals can live outside of this range in limnology (the study of lakes).

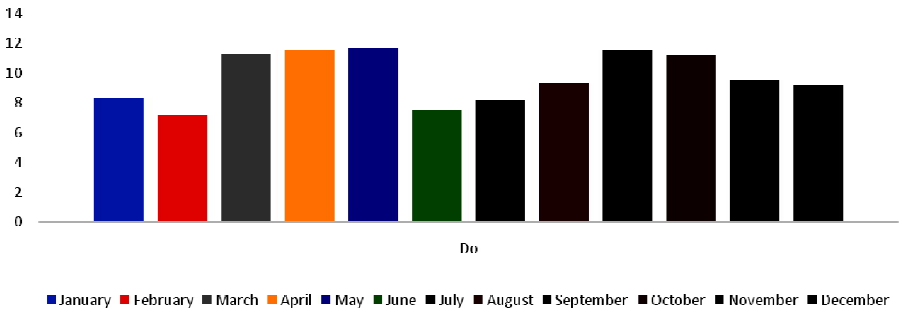

Figure 4: Chart showing DO of rivers of Kolhapur district.

Dissolved oxygen is an essential factor second only to water itself. A dissolved oxygen level, which is too high or too low, can affect aquatic life and water quality seriously (http://www.fondriest.com). When the oxygen concentration in waters containing organic matter is reduced, the carbon dioxide concentration rises. The rise in carbon dioxide makes it more difficult for an organism to use the limited amount of oxygen present.

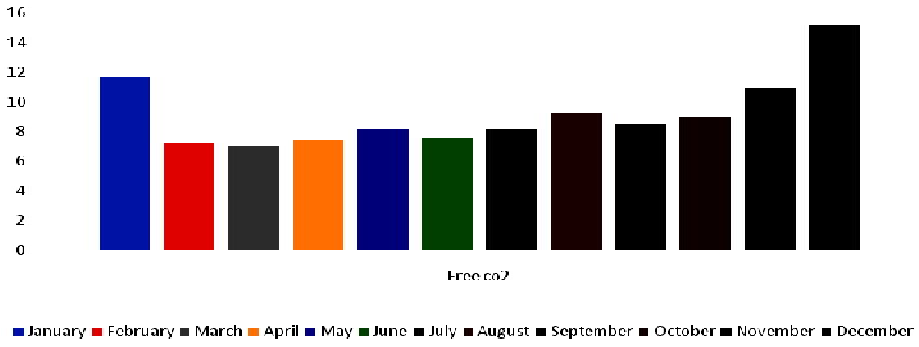

Figure 5: The chart showing Free Co_2 of rivers of Kolhapur district.

CONCLUSIONS

The Ephemeroptera are short winged adults having very little lifespan maximum up to two weeks. The adults are terrestrial having aquatic immature called naiads (nymphs) during life cycle. Depending upon external factors the naids passed through successive molts to attain the adult stage. The hydrobiological factors biased population biology was well marked. Thus the findings reflected that the naids of mayfly are abundant in spring and early summer season because of favourable water conditions. However, the lowering in the population of nymphs was observed in month of rainy season.

REFERENCES

1. Barber-James H.M., Gattolliat, J., Sartori, M. and Hubbard, M.D. (2008). Global diversity of mayflies (Ephemeroptera: Insecta) in freshwater. Hydrobiol., 595: 339-350.
2. Bauernfeind, E. and Moog O. (2000). Mayflies (Insecta: Ephemeroptera) and the assessment of ecological integrity: A methodological approach. Hydrobiol., 422 & 423: 71-83.
3. Brittain, J.E. and Sartori M. (2003). Ephemeroptera (Mayflies). Encyclopedia of Insects, pp. 373-380.
4. Dubey, S., Sharma, S. and Chaurasia, R. (2013). The insect diversity of River Kunda Khargone district M.P. (India). Glo. J. Bio, 2(3): 454-455.
5. Gupta, A., Micheal, R. and Gupta, A. (1993). Influence of diet on growth, food retention time, and gill ventilation rate of nymphs of *Cloeon* sp. (Ephemeroptera: Baetidae). Hydrobiol., 271: 41-44.
6. Landa V. (1969). Comparative anatomy of mayfly larvae (Ephemeroptera). Actaent. Bohemoslov, 66: 289-316.
7. Srivastava, V. D. (1991). On an account of Indian Heptageniidae (Ephemeroptera) with key to their identification. Rec. Zool. Surv. India, 88(1): 135-145.