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BIOTIC INDEX AS A MEANS OF BIOMONITORING OF AQUATIC HABITAT

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ABSTRACT

The biotic index based on insect population has been calculated to assess the water quality. The biotic index value varied from 2.25 to 4.83 suggesting that the pollution-status of the habitat ranged from the state of some organic enrichment to gross disturbed level. It can be used as readily available and reliable biological tool for water quality assessment.

Key words: Biomonitoring, biotic index, water quality, pollution-status.

INTRODUCTION

Biomonitoring of aquatic biotopes has now become an important as well as widely used means to evaluate the pollution status (Michael 1985 ; Sinha *et al* 1989). A number of biological indices have been proposed such as evaluation based simply on phytoplankton (Nugaard 1949; Palmar 1968), zooplankton (Sladecek 1983; Michael 1985) and also more sophisticated and complex diversity indices (Harrel & Dorris 1968 ; Wilhm & Dorris 1968) derived from information theory. The evaluation of pollutional status of an aquatic ecosystem on the basis of biotic index (Hilsenhoff 1977) is however based on the community composition of aquatic insects which without doubt, constitute an important part of overall fauna of the aquatic systems and occupy almost all conceivable habitat. Further more the insects have a complete range of food habits and possess a great variety of adaptations. As the review of literature revealed that research pertaining to water quality monitoring and evaluation by calculating biotic index in India is meagre (Michael 1985 ; Sinha *et al* 1989), while considerable work has been done in this regard in temperate regions (Gaufin & Tarzwell 1952 ; Gaufin 1956 ; Harrel & Dorris 1968 ; Wilhm & Dorris 1968 ; Wilhm 1970; Resh & Unzicker 1975 ; Allan 1975 ; Dennis & Patil 1977), the present project was taken up. This communication records the pollution-status of a water body (Rajendra Sarovar) based on biotic index.

MATERIALS AND METHODS

The present work carried out in a water body known as Rajendra Sarovar, is located in the heart of Dhanbad Town (86°48"EL and 23°27"NL). The water body is organically polluted as it receives considerable amount of sewage and organic wastes from catchment area as well as it is used for washing of clothes and cattle.

Monthly sampling was done for one year (July 85 to June 86) by modified scoop sampler and method used by Allan (1975) was adopted for taking the samples from the marginal benthic zone. The samples were sieved (B.S. No. 72) under continuous flow of water and the organisms were sorted by hand and then preserved in four percent formaldehyde solution. The insects were analysed both qualitatively and quantitatively and then Biotic Index (BI) was calculated according to Hilsenhoff (1977) taking into account the population of different

insect families and the corresponding pollution tolerance score of the different toxon by the statistical formula

$$BI = ni\ ai/N$$

where ni represents the number of a particular taxon having pollution tolerance score ai, while N is the total number of insect population in the sample.

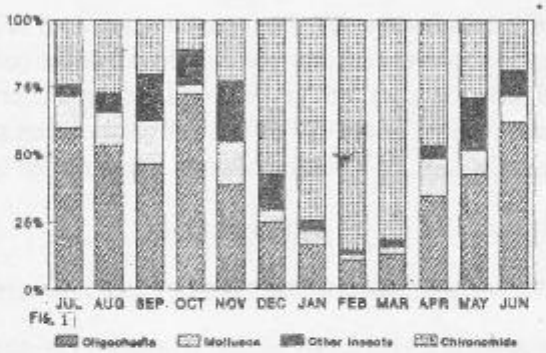
RESULTS AND DISCUSSION

The insect community was represented by six orders namely Odonata, Ephemeroptera, Trichoptera ,Hemiptera, Coleoptera and Diptera. Out of the six orders Dipteran insects were dominant over the rest, while the order Diptera was dominated by one of the families - Chironomidae and genus *Chironomus*. The second dominating genus recorded during the study was *Tanypus* sp. belonging to the same family Chironomidae. The percentage composition of insect in relation to other groups of macrobenthic fauna has been presented in Fig. 1. The seasonal variation of insect population (Fig.2) has shown a bimodal peak pattern of seaaonality. Excepting a few months insects were the dominant constituents of the benthic fauna. Insects shared minimum 24.5% of the total population in October, while maximum 86.9 in February and 84.4% in March. The maximum and minimum were due to the high and low population density of Chironomids and particularly of *Chiromomus* sp. Mandal & Moitra (1975) and Bass (1986) reported the dominance of insect population in macrobenthic fauna and higher and lower population densities in January and November respectively, while in the present investigation higher catch was during February and March and lower in October (Fig. 2) which probably be due to prevailing environmental conditions in this plateau.

Table 1 Water quality basd on biotic index (after Hilsenhoff 1977).

Biotic Index	Grade (Fig.-2)	Water Quality
Under 1.75	A	Excellent
1.75-2.25	B	Some organic enrichment
2.25 -3.00	C	Some disturbance
3.00-3.75	D	Significant disturbance
Over 3.75	E	Gross disturbance

The result of biotic index calculation based on insect population has been presented in Fig. 2. The biotic index varied from 2.25 to 4.83 during the period of study. On the basis of explanation given by Hilsenhoff (1977) as presented in Table 1, the polluted condition of the



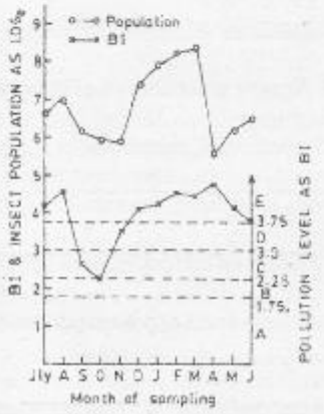


Fig 1 Seasoanl variation in percentage composition of major macrobenthic groups. Fig.2 Index (BI) and insect population (as $\log_e$) and correlated pollution level

water body varied from some organic enrichment to gross disturbance level during the period of study. In September and October the level of pollution was low as the biotic index was between 2.25 and 3.0 suggesting some disturbance. In November the biotic index value was between 3.0 and 3.75 indicating significant level of pollution, while in all other months of study, it was above 3.75 and hence gross disturbed state of water quality.

The majority of insect species found in the average eutrophic body of water (the dominant types) have been reported to tolerate a broad range of water chemistry and physical condition to render them useless singly as indicator of pollutional state of the biotope (Roback 1974). The biotic index derived on the basis of Hilsenhoff (1977) however, provides a firm ground of monitoring the aquatic system as it is based on assemblage of the whole community and not on the basis of merely presence or absence (may be accidental) of particular species. The year long survival of different species is an outcome of habitat characteristics and absence

(may be accidental) of particular species. The year long survival of different species is an out come of habitat characteristics and henceconclusions drawn on the basis of dominant group with continuned occurrence provide a real and reliable state of aquatic environment of not only the present, but also the past (Cairns *et al* 1977). Thus B.I. can be taken as readily available reliable biological tool to assess the level of aquatic pollution in quantified terms.

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