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ROLE OF AQUATIC INSECTS AS BIOINDICATOR OF POLLUTION OF AQUATIC BIOTOPE

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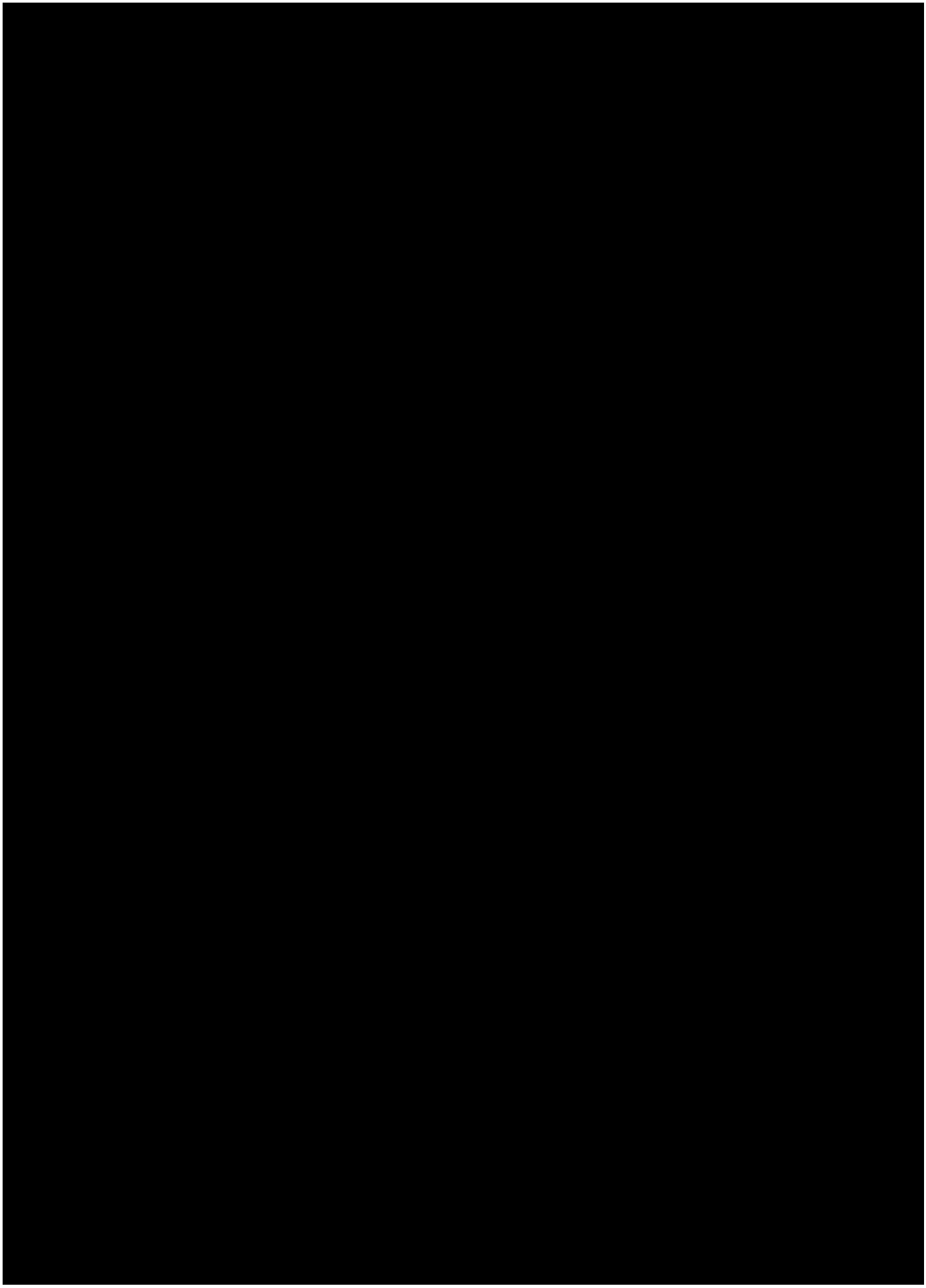
ABSTRACT

Pollution status of an aquatic biotope based on insect population at family level and their corresponding pollution tolerance score has been calculated. The biotic index of the biotope thus obtained ranged from 2.34 to 4.23 suggested that the habitat had some organic enrichment to gross disturbed state from pollution view point during the period of investigation.

INTRODUCTION

The assessment of water pollution essentially becomes a biological problem particularly because the society's interest in water pollution is centred upon its effects on living organisms. Even after such important relationship the pollution-state of generally expressed in physical and chemical terms placing the biological one in a subsidiary position (Cairns *et al.*, 1971), while the physico-chemical standard provide the picture of the present state only in contrast to the biological indices with give the idea of both past and present. Among biological communities, macrobenthic fauna has been considered the most suitable means as bioindicator of pollution (Hirsch, 1958; Hynes, 1960; Sarkar & Krishnamoorthy, 1977; Sinha *et al.*, 1989). Insects, since they occupy almost all conceivable habitats, have a complete range of food habits and possess a great variety of adaptation, without doubt constitute an important part of not only the benthic but overall fauna of an aquatic biotope. Hence the use of aquatic insect as bioindicator of pollution becomes an important aspect of pollution ecology. Paucity of information needed for incalcating population status using insects as bioindicator of tropical waters in general and Indian waters in particular (Rama Rao *et al.*, 1978; Sarkar and Krishnamoorthy, 1977; Sinha *et al.*, 1989) led the authors to take up the project. The present communication records the assessment of water quality on the basis of biotic index derived from insect population study.



broad enough range of physico-chemical conditions of water to render them useless singly, as indicator of pollutional state of the biotope (Roback and Richardson, 1969). Hence it appears to be valid as advocated by Cairns *et al.* (1972) and Cairns (1977) to speak of indicator assemblage of species of insects in particular and other groups in general or indicator communities. The present investigation, therefore, is based on year round observation of species assemblage to avoid the shortcomings in results.

The insect population revealed bimodal peak pattern in seasonal succession (Fig. 1) with maxima and minima of population density in March (4023/m²) and October (367/m²); the former period differing while the latter coinciding with the earlier reports (Bass, 1986; Barbhuyan & Khan 1992). Except for a few months, the insect population dominated over the other benthic group (Table 2), sharing minimum 24.5% (October and maximum 85.99% (February) of the total benthic fauna. The insect population, however, was dominated by chironomids.

Considering family level population and the corresponding score (Hilsenhoff, 1977) the biotic index for the twelve months of study was calculated (Fig. 1). The biotic index varied from 2.25 to 4.76 in different months. As per the explanation of biotic index in Table 1 the polluted condition of the water body ranged from some organic enrichment to a gross disturbance level. Except for September, October and November, the water body was highly polluted, a situation which will only allow the

Table 2. Seasonal Variation in Percentage Composition of Different Groups in Macrobenthic Fauna (1990-91)

	JUL.	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Oligochaeta	59.54	53.18	46.29	71.91	38.44	24.67	16.30	10.70	13.17	34.48	42.55	61.57
Mollusca	11.81	12.49	16.29	3.55	16.30	4.63	5.63	2.36	2.45	13.97	8.85	9.98
Other insects	4.47	6.69	16.73	12.87	22.14	12.96	3.58	0.95	2.37	4.69	19.40	9.13
Chironomids	24.18	27.64	20.69	11.67	23.12	57.74	74.49	85.99	82.01	46.86	29.20	19.32

pollution tolerant species to survive and thereby decrease the species diversity and enhance the individual richness.

The evolution by this method quantifies the state of pollution and has thus benefit over over methods. The results show that the water body was having some organic load in October which increased to significant level in the following month, while a condition in between these two was prevailing in September.

Thus it can be concluded that the evaluation of purity or pollution by using insects provides more accurate and realistic picture and appears to be a reliable biological tool in pollution ecology.

REFERENCES

Allan, J.D. 1975. the distribution, ecology and diversity of benthic insects in Cement Creek, Colorado. *Ecology.* **56** : 1040-1053.

Bass, D. 1986. Larval Chironomids of the Big Thicket Stream. *Hydrobiol.* **135** : 271-285.

Brbhuyan, S.I. & Khan A.A. 1992. Studies on structure and function of Benthic ecosysten in an eutrophic body of water : Temporal and spatial distribution of benthos. *J. Freshwater Biol.* **4** (4) : 239-247.

Cairns, J., Crossman, J.S., Dickson K.L. and Herriks E.E. 1971. The recovery of damaged streams. *Ass. South-east Biol. Bull.* **18** : 49-106.

Cairns, J., Dickson, K.L. and Crossman. J.S. 1972. The response of aquatic communities to spills of hazardous materials *Proc. 1972 Nat. Conf. Hazardous Mater. Spills.* 179-197.

Cairns, J. 1977. Indicator species vs. the concept of community structure as an index of pollution. *Wat. Resour. Bull.* **10** : 338-347.

Hilsenhoff, W.L. 1977. Use of Arthropods to evaluate water quality of streams, *Tech. Bull. Deptt. Nat. Res. Madison.* Wiscosin. **100** : 1-15.

Hirsch, A. 1958. Biological evaluation of organic pollution in New Zealand streams. *N.Z.J. Sci.* **1** : 500-553.

Hynes, H.B.N. *The Biology of Polluted Water* Liverpool Univ. Press, Liverpool.

Rama Rao, S.V., V.P. Singh, L.P. Mall. 1978. Biological methods for monitoring water pollution levels : studies at Ujjain. *Wat Res.* 341-348.

Roback, S.S. 1974. Insects (Arthropoda : Insecta) pp. 313. In C.W. Hart and S.L.H. Fuller (eds) *Pollution Ecology of Freshwater Invertebrates.* Academic Press, London.

Roback, S.S. and J.W. Richardson. 1969. The effects of acid mine drainage on aquatic insects. *Proc. Acad. Natur. Sci.* Philadelphia. **121** : 81-107.

Sarkar, R. and K.P. Krishnamoorthi. 1977. Biological methods for monitoring water pollution level : studies at Nagpur. *Indian J. Environ. Hlth.* **19** : 132-139.

Sinha, M.P., Pandey P.N. and Mehrotra P.N. 1989. Biological investigation of an organically polluted urban stream of Ranchi-II macrobenthic fauna. *The Indian Zoologist.* **13** (1 & 2) : 79-83.