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POPULATION DYNAMICS OF CHIRONOMID LARVAE (DIPTERA : CHIRONOMIDAE) IN FRESHWATER RESERVOIR

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ABSTRACT

The paper deals with population dynamics of chironomid larvae which shared 13.49% to 70.61% of the total macrobenthic fauna with population density ranging from $154/M^2$ to $3324/M^2$ in different months. The intra-lake distribution as well as dominance pattern of different genera of chironomid have been discussed.

INTRODUCTION

Studies on population density, its dynamics and dominance pattern (group or whole of macrobenthic community) are of great ecological significance for aquatic ecosystems. They provide direct evidence of effects of any sort of stress by environmental changes capable of inducing changes in structure and function of biological system, whereas physical and chemical data provide only indirect evidence (Wilhm, 1975; Tudorancea *et al.*, 1979; James, 1979; Mason, 1981; Sinha, 1986; Sinha *et al.*, 1989). The benthic community structure presents an integral measure of autotrophic and heterotrophic processes in the system and reflects disturbances in the processes (Wielderholm, 1980) particularly those groups which are sedentary or sessile, long lived, easy in sampling and sorting (Phillips, 1976) like chironomids. They indicate past and present state of the aquatic ecosystem, including accumulative effects of intermediate discharges and show long term or chronic effects of all possible stress (Wise and O'Sullivan, 1980). Study on chironomid larvae population is of special importance on account of their universal presence in every benthic community with dominance in fauna of eutrophic and polluted water ecosystems (Wetzel, 1975). Previous studies on chironomids indicated the specific differences between the fauna of river and stream and even between two aquatic systems, located fairly close to one another (Singh and Harrison, 1984) explaining their population dynamics and seasonal variation. Since only a few such autoecological works on chironomid larvae have been carried out in India the present project was taken up to have basic information on the trend of population fluctuation and dominance pattern in chironomid larvae community of a freshwater reservoir in Ranchi.

MATERIAL AND METHODS

The study area is located at 639M above MSL between 23°13-38" N Lat. and 85°4-52" E long. with more than 102.4 sq. km. of catchment area.

Monthly sampling was done for one year (Jul. '85 to Jun. '86) collecting macrobenthic fauna by means of Ekman's dredge (523 sq. cm.). Three dredging constituted one sample, seived through a metallic guage (256 meshes/sq. cm.). The residual organisms were sorted out, preserved in 4% formaldehyde solution and enumerated both qualitatively and quantitatively. The results were expressed as number per square metre and computed for analysis.

RESULTS AND DISCUSSION

The result obtained after the sample analysis has been presented in Table 1. The chironomid population showed a marked seasonal variation of the total macrobenthic invertebrate population of the water body being 13.49% (Sep. '85) to 70.61% (Mar. '86). The number of individuals in group ranged from 154/M^2 (Oct. '85) to 3328/M^2 (Mar. '86) with considerable variation during 12 months of investigation.

Table 1. Seasonal variation in chironomid population (figures per square metre).

Month	No. of Taxa	No. of individual	Average No. per Taxon	Taxon absent	Maximum No. of Taxa	Minimum No. of Taxa	% of benthos
Jul. 85	4	664	166.00	*5,6,7	1-550	*4-12	22.17
Aug.	5	909	181.80	4,7	1-819	5-14	30.49
Sep.	4	196	49.75	4,5,6	7-96	3-12	13.49
Oct.	3	154	51.33	4,5,6,7	1-115	2-10	13.81
Nov.	3	167	55.66	3,4,6,7	1-128	5-12	26.50
Dec.	4	1293	323.25	4,6,7	1-1203	3-29	57.67
Jan. 76	5	2316	463.20	5,7	1-2022	2-38	66.26
Feb.	5	3073	614.60	6,7	1-2867	5-26	65.20
Mar.	5	3328	665.60	6,7	1.2842	5-29	70.61
Apr.	6	2330	383.33	7	1-1946	6-22	61.88
May.	3	449	149.66	4,5,6,7	1-310	3-15	26.48
Jun.	5	487	97.40	6,7	1-269	2-27	19.70

*1=*Chironomus* sp., 2=*Tanypus* sp., 3=*Orthocladius* sp., 4=*Polypedilum* sp., 5=*Coelotanypus* sp., 6=*Glyptotendipus* sp., 7=*Procladius* sp.

Qualitatively, seven genera of Chironomids recorded in quantitative order were : *Chironomus* sp., *Coelotanypus* sp., *Glyptotendipus* sp. and *Procladius* sp.

with 100%, 91%, 50%, 58%, 25% and 8% freguency of occurrence respectively. The frequency of occurrence of texa per sample ranged between maximum 85.71% (Apr. '86) to minimum 42.85% (Oct. and Nov. '85 and May '86). *Chironomus* sp. dominated over the chironomid population never sharing less than 45% (Sep. '85) and with a maximum of 93.29% (Feb. '86). Hence the abundance pattern of the larvae population as a whole was determined by *Chironomus* sp. population, confirming the findings of Titmus and Badcock (1981). Of the individual genera *Tanypus* sp. larvae were abundant in Feb. and Mar. while they were in least number during Sep. and Oct. *Orthocladius* sp. larvae were absent in Nov. and abundant in Feb. The other larval forms were of intermittent occurrence. The period from Dec. to Apr. appeared to be most favourable for larvae when both species and individuals were maximum in contrast to the period between Sep. to Nov. when least number of species and individuals were observed.

The availability, abundance and distribution of chironomids of intra-lake level have been attributed to many factors (Carter, 1976), both physico-chemical and biological. Ramcharan and Peterson (1978) demonstrated that the chironomids could be segregated with reference to food, space and time. The dominance of *Chironomus* sp. in population may be attributed to versetile nature of feeding on material available on the mud water interface such as detritus, algae etc. (Kajak and Warda, 1968). Further, the distribution of species of chironomid larvae is density dependent (Mc Lachlan, 1977). Hence, the pattern in frequency of larval occurrence may be attributed to pachyness of the system and higher density of *Chironomus* sp. population. Taylor (1961) while studying chironomids inditated that owing to trophic factor *Chironomus* sp. larvae have a random distribution while their high density makes the habitat more competitive for other species. The restriction of *polypedilum* sp. to a short period of the year with high *Chironomus* sp. population may be due to resource based competition which does not allow the former to establish.

Tanypus sp. larvae, next to *Chironomus* sp. was only to be recorded round the year in fairly good number. This trend of their population dynamics may be ascribed to the trophic factor as the *Tanypus* larvae have been reported to be predator of *Chironomus* sp. larvae (Titmus and Badcock, 1981).

REFERENCES

Carter, C.E. (1976) A population study of the Chironomidae (Diptera) of Lough Neagh. *Oikos.*, **27** : 346–358.

James, A. (1979) The value of biological indicators in relation to other parameters of water quality. In : James, A. and Evision, L. (Ed). ***Biological Indicators of water Quality***. John Wiley & Sons, Chichester. pp. 1-16.

Kajak, Z. and Warda, J. (1968) Feeding of benthic non-predatory Chironomids in lakes. *Annals. Zoologici Fennici.*, **5** : 57–64.

Mason, C.F. (1981) *Biology of Freshwater Population.* Longman Gr. Ltd. London pp. 305–407.

Mc Lachlan, A.J. (1977) Density and distribution of laboratory population of midge larvae (Chironomidae : Diptera). *Hydrobiologia*, **55** : 195–199.

Phillips, D.J.H. (1976) Importance of macroinvertebrates in assessment of pollution and water quality. *Mar. Biol.*, **38** : 71–79.

Ramcharan, V. and Paterson, C.G. (1978) A partial analysis of ecological segregation in the Chironomid community of a bog laka. *Hydrobiologia*, **52** : 129-135.

Singh, M.P. and Harrison, A.D. (1984) The chironomid community (Diptera : Chironomidae) in a Southern Ontario stream and the annual emergence patterns of common species. *Arch Hydrobiol*, **99** : 221–253.

Sinha, M.P. (1986) Limnobiotic study on trophic status of polluted freshwater reservoir of coalfield area. *Poll. Res.*, **5** : 13–18.

Sinha, M.P.; Pandey, P.N. and Mehrotra, P.N. (1989) Some aspects of biological studies of organically polluted urban stream in Ranchi. II. Macrobenthic fauna. *The Indian Zoologist*, **13** : 79–83.

Taylor, L.R. (1961) Aggregation, variance and mean. *Nature*, **189** : 732–735.

Titmus, G. and Badcock, R.M. (1981) Distribution and feeding of larval Chironomidae in a gravel-pit lake. *Freshwater Biology*, **11** : 263–271.

Tudorancea, C.; Grace, R.H. and Hueber, J. (1979) Macrobenthic fauna as bioindicators of water pollution. *Hydrobiologia*, **64** : 59–62.

Wetzel, R.G. (1975) *Limnology*. W.B. Saunders Co. Philadelphia., pp. 743.

Wiederholm, T. (1980) Indicator system to assess pollution due to sewage, human and animal faecal material. *Jour. Water Poll. Control Fed.*, **52** : 537–556.

Wilhm, J.L. (1975) Biological indicators of pollution. In : B.A. Witton (Ed). *River Ecology*. Backwell Sci. Pub. Osney Mead. Oxford. pp. 375–402.

Wise, E.J. and O'Sullivan, A. (1980) Assessment and prediction of impacts of effluents on communities of benthic steam macroinvertebrates. *Water Research*, **14** : 1–25.