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POPULATION FLUCTUATIONS OF THREE FAMILIES OF AQUATIC HETEROPTERA IN A PERENNIAL POND.

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INTRODUCTION

Notwithstanding the abundance of aquatic heteropterans in lentic habitats, not much information is available on their seasonal fluctuations. Available information relating to the fluctuation in natural population with particular reference to the aquatic bugs (Tonapi, 1959 ; Rao, 1976 ; Julka, 1977 ; Ahmad & Ahmad, 1983) appear to indicate that when biotic factors are not operating, abiotic factors such as temperature, rainfall or alkalinity could exert an influence over the population of aquatic bugs. On the contrary, biotic factors like migration, vegetation and organic matter in the water have also been observed to play an important role in the bionomics of many species especially among notonectids and corixids (Hutchinson, 1933 ; Maccan, 1976 ; Fernando, 1961). The observations include the population fluctuations of Gerridae, Notonectidae and Corixidae and their seasonal variations particularly among the population of notonectids along with the periodicity and abundance of gerrids and corixids also inhabiting along with the notonectids. This study was undertaken in Kovur Pond.

TOPOGRAPHY OF KOVUR POND

Kovur pond is rectangular, situated about 25 Kms. west of Madras city, with an area of 0.5 hectares and an average depth of 0.6 metres. It has only one inlet on the northern

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side and no outlet. It mainly depends on rain water besides the inlet from Chambarambakkam tank, which is 30 Kms. west of Madras city. During the period of investigation the following macrophytes namely *Pistia* sp. and *Neptunia* sp. were noted near the margins. No regular fishing is carried out in this pond and the occasional fishing by hook and line reveals the following species namely *Puntius sarana*, *P. dorsalis* and *Channa* sp.

Material and Methods

The aquatic bugs were collected bimonthly for a period of 13 months from May, 1981 to May, 1982 at different stations by filtering a sample of forty litres of water, with the help of a pond net. The stations were established in transects so as to constitute a sample, covering the entire pond. Five replicates of samples were made during each collection and number of insects were calculated per litre. The relative frequency indices of occurrence of all the species were determined basing the formula followed by Julka (1969). To confirm whether the fluctuations are random or not on the population, non-parametric statistical tests namely 'runs' technique and 'The Kruskal Wallis test' were also applied (Schefler, 1980).

Surface water samples collected from different stations were analysed for dissolved oxygen and p^H. Dissolved oxygen was estimated by Winkler's method with azide modification. The p^H was measured in the field by using wide and narrow range 'BDH' p^H papers. The values were again corroborated in the laboratory by using a philips p^H meter. The transparency values were noted by using a Secchi disc. Other parameters like depth, air temperature, and weather conditions were also noted.

For productivity studies initial dissolved oxygen values were noted first. Then light and dark bottles were incubated just below the water level and the quantum of respiration, net production and gross production were estimated.

RESULTS

Temperature : The water surface temperature tends to increase gradually from March, the maximum being reached during May. During the present study, the surface temperature ranged from 23.5°C to 31.5°C, The Figure 1 indicates that the population of aquatic bugs were sufficiently high during the summer months when the maximum temperature is 33.0°C and as well as during the winter months (Temperature 22.5°C), thereby indicating that the temperature range did not appear to determine the population density of aquatic bugs.

p^H : During the present study, p^H of the water varied

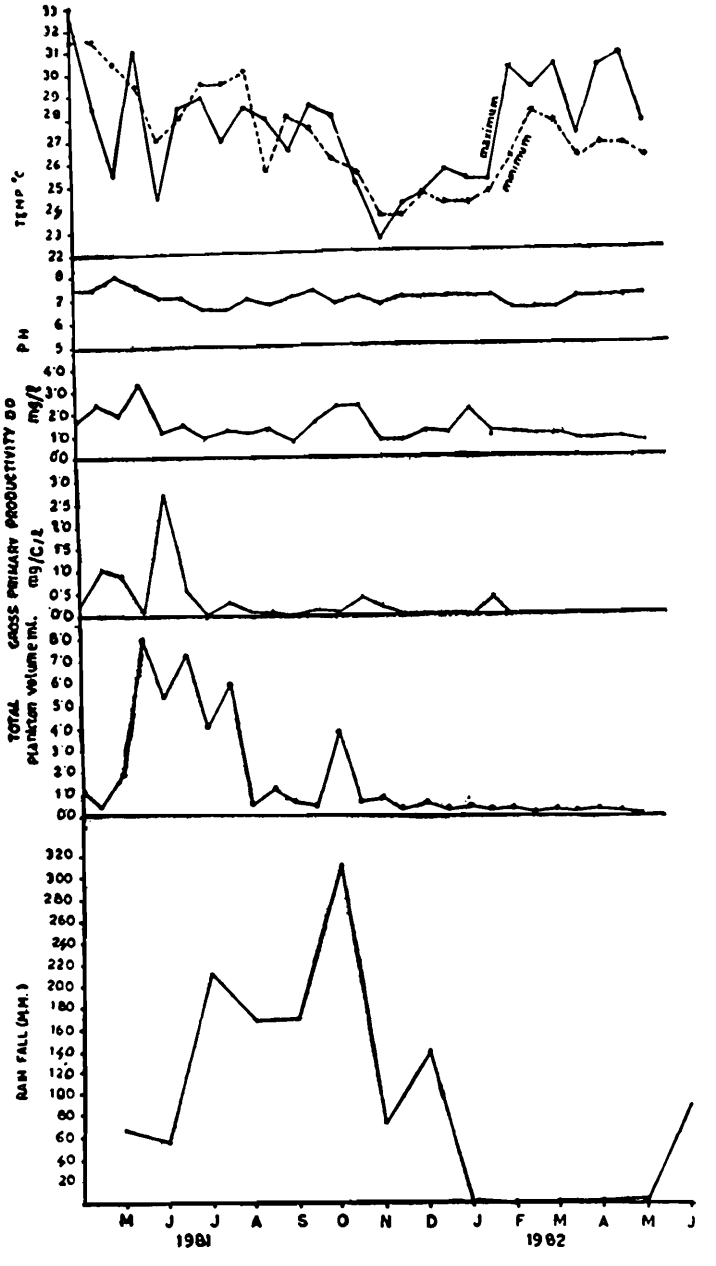

Fig. 1. Graph showing physico chemical parameters along with total planktonic volume and gross primary propuctivity.

from 6.5 to 8.0 and this range did not seem to appear to affect the density of the population.

Dissolvod Oxygen : The D. O. concentration during the study period ranged from 0.76 to 2.4mg/lit. The figures 1 & 3 show that when the D. O. is at its maximum, the population of bugs is high. However, the population is not reduced to lowest levels with minimum D. O., indicating no direct correlation between these two.

Rainfall : The rainfall is observed to be maximum during the month of October (312.0 mm) and the minimum is recorded during June (55.2 mm). There is no rainfall during the months of February and March. The presented graphs 1 & 3 clearly indicate the rainfall has no significane on the fluctuation of aquatic bugs.

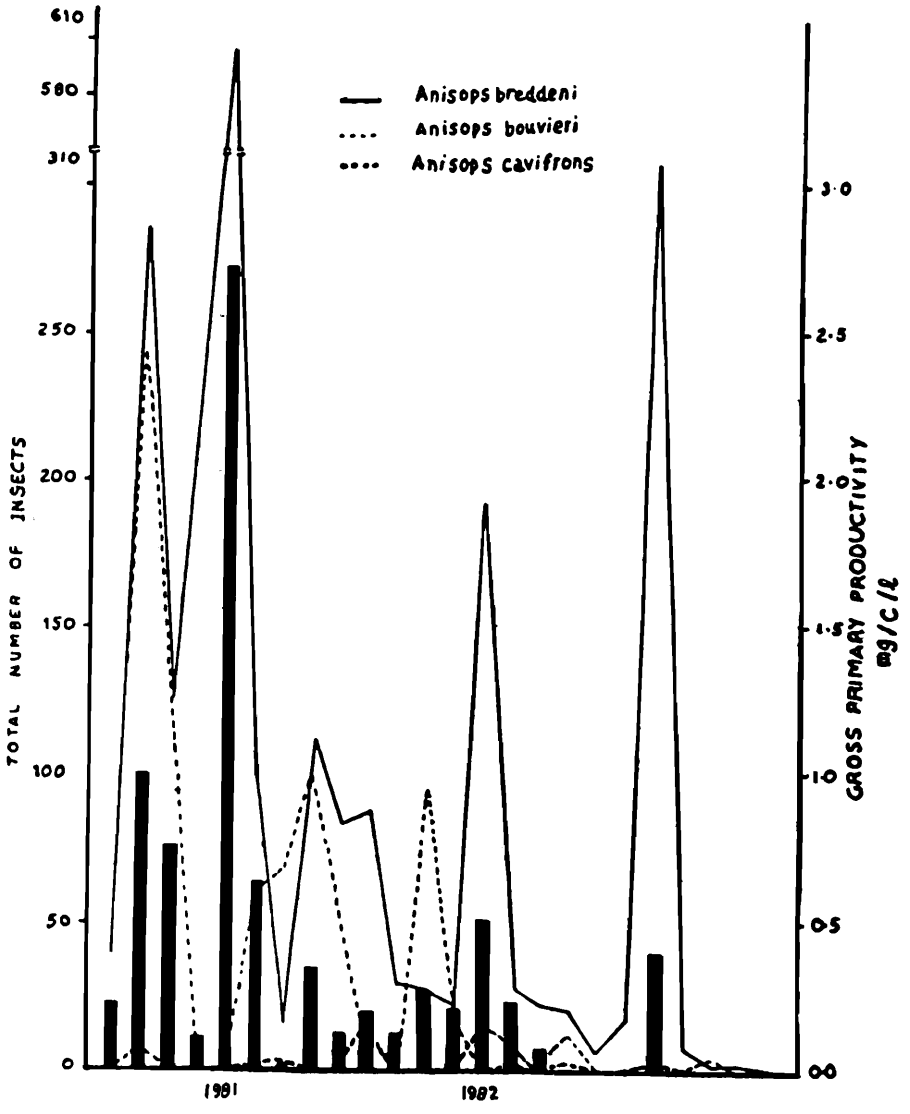

Fig. 2. Graph showing effect of gross primary productivity on the population of *Anisops* spp.

Gross Primary Productivity : The gross primary productivity during the study period ranged from 0.013 to 2.715 mg/c/l. During January, February, April and May the gross production was nil due to a thick carpet of macrophytic vegetation over the water. The insect during these months was also correspondingly very low.

Total Plankton volume : The plankton volume fluctuated between 0.2 ml to 8.0 ml with maximum in July and minimum in April and May. During July and August, the planktonic volume was more due to increase in numbers of

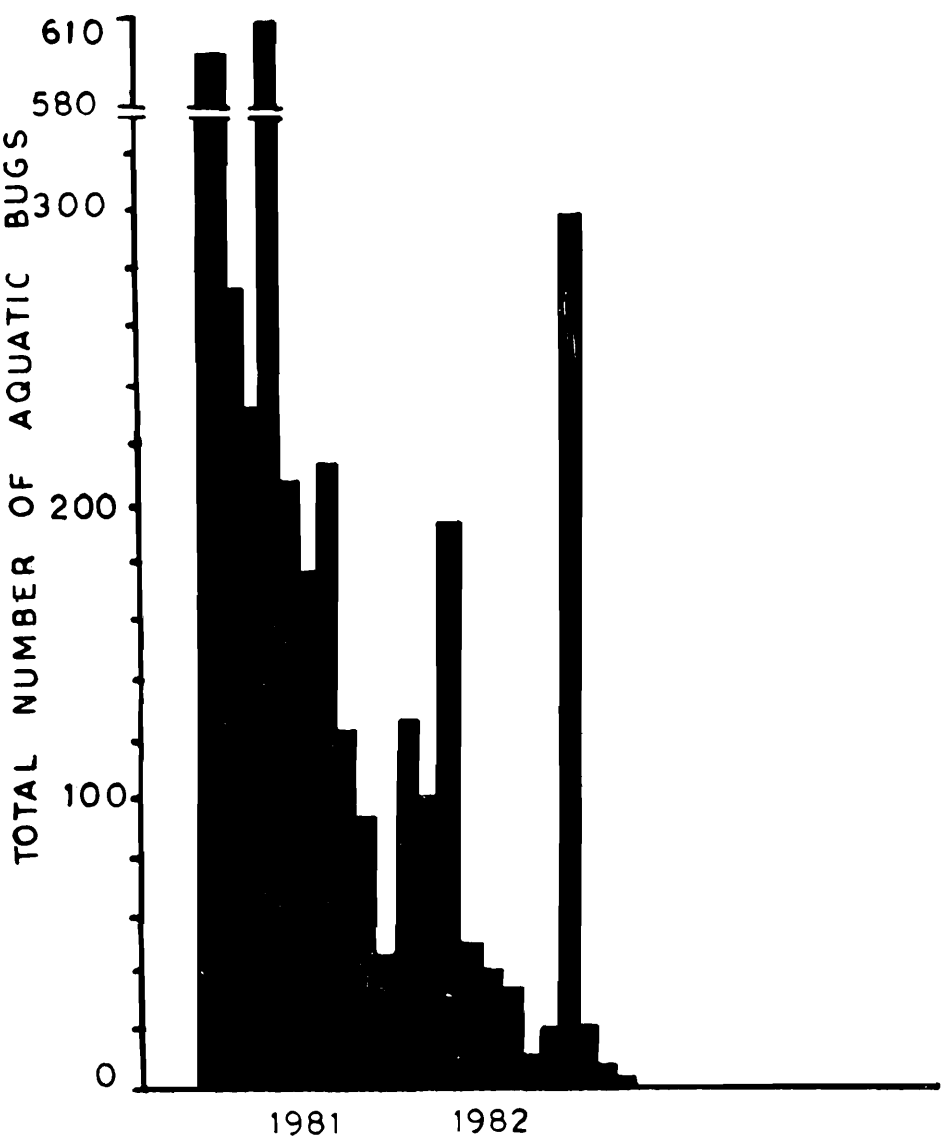

Fig. 3. Bar chart showing the total number of Aquatic bugs during the study period.

two cladocerans namely, *Moina micrura* and *Ceriodaphiania laticaudata*. During November also there was an increase in the volume of plankton due to increase of *C. laticaudata*.

Aquatic Heteropteran Fauna : *Micronecta* (Family : Corixidae), *Gerris*, *Limnogonus* (Family : Gerridae) and *Anisops* (Family : Notonectidae) were the four genera of aquatic bugs found in the samples. The genus *Micronecta* was represented by *M. scutellaris* (Stål) and *M. quadristrigata* Breddin, while three species of *Anisops*, viz., *A. bouvieri* Kirkaldy, *A. breddini* Kirkaldy and *A. cavifrons* Brooks were present. Gerridae was represented by *G. spinolae* Leth. & Serv., and *L. fossarum* (Stål). In view of its occurrence almost throughout the study period, *A. breddini* is the 'Primary Species' among the aquatic bugs collected while *A. bouvieri*, is the 'Secondary Species' and *M. scutellaris*, the 'Tertiary Species' on the basis of their relative abundance. Relative frequency indices show that *A. breddini* (0.958), *A. bouvieri* (0.542) and *M. scutellaris* (0.375) may be considered as fairly well represented forms constituting substantially to the Heteropteran fauna of the of the pond. The rest of the species namely, *A. cavifrons* (0.292), *G. spinolae* (0.25), *L. fossarum* (0.25) and *M. quadristrigata* (0.18) are found to occur less frequently.

The maximum abundance of the primary species was noticed in July and the minimum in April corresponding to the maximum and minimum gross primary productivity of of the tank (2.715 mg/c/l and O restpectively) (Fig. 2). The associated secondary and tertiary species namely *A. bouvieri* and *M. scutellaris* also had their maximum abundance when the gross primary productivity values were at their optimum level. The higher incidence of notonectids during the month of July tends to suggest that their predominent occurrence, was directly related to the gross primary productivity of the tank. The non-parametric statistics tests also confirm that there are no random fluctuations among the notonectids during the study period, the existing fluctuations being related to external factor, the gross primary productivity of the tank in this study. By commutating the values the 'Kruskal-Wallis Test' also proved that significant difference exist among the seasonal population of notonectids, the significance being well beyond 0.005 level.

DISCUSSION

Studies and analysis of the samples establish the existence of seasonal fluctuations and periodicity among *A. breddeni* and *A. bouvieri.* The build up of peak population of *A. breddeni* during July, in particular, appears to be directly related to high gross primary productivity of the pond and the abundant supply of these will explain the build up. The presence of *A. breddeni* through out the study period and their presence even in the situations when the gross primary production of the tank was zero, marks it as the most successful inhabitant compared with other two dominant species. While studying the population of Nepidae, Rao (1976) has pointed out that abiotic factors such as rainfall, temperature together with abundance of food have an augumentative effect on their population.

Tonapi (1959) and Julka (1977) have observed that the governing factors among five families of aquatic bugs including notonectids are temperature and rainfall. During the present study, however, these factors appear to play a less significant role in the annual rhythm of the notonectids population. It may be that rainfall and temperature could together control the population only when density-dependent factors are not operating as has been established in some terrestrial insects (Andrewartha & Birch, 1954 ; Anantha-krishnan & Thirumalai, 1978).

Though Devic (1954) considers p^H as the most important chemical factor affecting the abundance of living organisms in water, the present study does not seem to support it. Alkalinity of the water beyond p^H 8.5 proved to be unsuitable to the corixid, *M. scutellaris* (Ahmad & Ahmad 1983). This is perhape due to the respiratory distress among the population of the aquatic animals caused by higher level in p^H (Thornton and Wilhm, 1974).

Dissolved oxygen apparently has no effect on the population during this study. Popham and Lansbury (1960) have indicated that the deficiency in oxygen is a strong stimulus

for migration of corixids. The capacity of aquatic bugs to migrate appears to be yet another important factor causing fluctuation in their population (Hutchinson, 1933 ; Fernando, 1961 ; Julka, 1977). The sudden decline of *A. breddeni* during August appears to suggest that emigration caused due to over crowding. Such a trend was observed by Julka (1977) while studying the notonectids population in a perennial rainfed tank in Barrackpore. The present study clearly indicates that *A. breddeni* and *A. bouvieri* show a regular annual rhythm while the other species studied including corixids and gerrids exhibit a random fluctuation due to emigration.

Summary

Data collected over a period of thirteen months indicate certain seasonal fluctuations on three families of aquatic bugs viz., Gerridae, Notonectidae and Corixidae from a perennial pond. High incidence of notonectids is correlated with the high gross productivity of the tank. The abiotic factors play a secondary role.

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