STUDIES ON THE ECOLOGY OF AQUATIC INSECTS WITH SPECIAL REFERENCE TO FISHPONDS

(Abstract)

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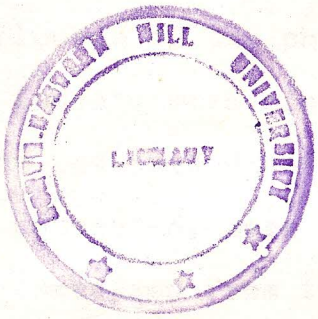

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A B S T R A C T

Of the great variety of insects, aquatic forms, though of less diversity, are important constituents of freshwater ecosystems. While some of these insects may be beneficial to the human beings, few others are quite harmful. The freshwater bodies of the hilly region of North-East India contain insect species from various taxonomic categories. The present investigation was undertaken to obtain a generalized knowledge of the biology and ecology of these insects.

Population studies dealt with the seasonality of occurrence and abundance. The influence of the physico-chemical factors on the population of these insects were also studied. One major fact emerged from this study was that density and biomass, as far as all the insects are concerned, were inversely related to altitude. However, density increased from the higher altitude to the lower, while it was in the reverse order when biomass was considered. This tendency was evident even when the insects were grouped into major orders such as Hemiptera, Ephemeroptera, Odonata, Coleoptera and Diptera. Hemiptera was usually seen to be the dominant group, followed by Ephemeroptera and Odonata. This study revealed that in general, the insects had an autumn or early winter peak, though however, Hemiptera, Ephemeroptera and Odonata showed summer peaks at the foot hills. The high altitude Ephemeropteran and Dipteran forms, usually indicated an early winter or late spring maximum. It was seen that the magnitude of fluctuations in biomass though in the reverse order to density, generally followed the rise and fall of density fluctuations. In some cases the peak occurred with a time lag of a month or so. Physico-chemical factors revealed in most habitats

a spring or summer maxima and winter minima. The order Hemiptera seemed to be largely effected by temperature and rainfall. Members of order Ephemeroptera, while synchronizing with temperature fluctuations, yet was probably also influenced by the amount of detritus and life-cycle periodicity. In case of Odonata, Coleoptera and Diptera, it seemed that submerged and emergent vegetation, detritus and the suitability of substrate had greater influence. When a linear correlation and multiple correlation analysis were performed for the various orders and the abiotic factors, it was shown that Ephemeroptera and Diptera negatively correlated with most of the factors at higher altitudes. However, Odonata and Coleoptera indicated positive significant relationship with temperature, the former at the foot hills and the latter at higher altitudes. The multiple correlation analysis revealed that only order Odonata shows positive correlation at all the stations with abiotic factors, while the rest of the orders only in one or two stations.

Light-trap studies dealt with the migration and dispersal of insects belonging to the orders Hemiptera and Coleoptera. It was seen that the maximum catch invariably occurred in the monsoon season agreeing with earlier reports that rainfall influence dispersal rate most. However, in addition to the monsoon peak, there was a small pre-winter peak. While the monsoon peak may be attributed to the search for food and habitat for reproduction, the smaller pre-winter peak may be for habitats suitable for survival during the adverse period. The maximum dispersal always seemed to occur just before midnight, and this trend was true for both the orders and families. Hemiptera seemed to be more attracted to light than Coleoptera, and this may be attributed to the greater flying ability of the Corixids.

Studies on the colonization of artificial substrate by aquatic insects revealed that although all the five major orders were represented in both substrates, generally the total insects were more in Littorella than Rotala rotundifolia. This is probably due to the greater surface area and the far richer dense cover it provided. Members of the order Ephemeroptera showed the highest colonization in both Littorella and R. rotundifolia in Kyrdemkulai Fish Pond, while at Ulubari Fish Pond at the foot hills, the same order was more in Littorella and Odonata in R. rotundifolia. When the genera and species were considered, it was revealed that most of them colonized the artificial vegetation attracted by the accumulation of inorganic and organic detritus and the growth of periphyton. It was also seen that the seasonality of insects in these artificial substrates synchronized very closely to the natural population fluctuations in the water systems. Thus, it can be suggested that artificial substrates are very useful for population measurements, as they cause very little disturbance to the system.

Laboratory experiments on the predatory propensities of a dragonfly nymph (Orthetrum sp.), indicated that it is a potential predator of fish spawn. It was revealed that the satiation time of the nymph was about 40 minutes and it took 85 seconds to consume a prey. Its predatory capacity amounted to nearly 16 spawn, and the same maximum appetite was restored after every 24-36 hours of deprivation of food. It was shown that a decline in 'predatory efficiency' occurs after the first 10 minutes of feeding. The time required for predation of a single spawn as well as consumption of the same, was less in high prey densities than in low prey densities. The study enabled in identifying a

major group of aquatic insects as a highly potential predator of fish spawn and as well provided quantitative data.

Finally, data on a general survey of aquatic insect fauna in twenty lentic systems are provided. This survey was undertaken with the objective of obtaining an overview of the inland waters in the region separated by altitudinal differences. A clear pattern of difference emerged in the total number of species, which was always high in the altitudes than foot hills. However, the abundance seems to increase as one goes from hills towards the plains. It was also seen that there were differences in species composition between high and low altitudes and further, irrespective of the altitude some species occur more in summer and others in winter.

In conclusion, the present investigation helped to obtain baseline information on the biology and ecology of aquatic insects of lentic water bodies of a region which was hitherto remained unexplored. The study also provides some field and experimental data for possible applications in the management of fish ponds.