Aquatic insects associated with plants in two reservoirs at Ibadan, Nigeria

J.K. Saliu, Jr.
Departament of Biological Sciences, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria.

(Rec. 6-IV-1988. Acep. 24-IV-1989)

Resumen: Se estudiaron las comunidades de insectos de plantas acuáticas de dos represas en Nigeria, Eleiyele y Obadam, la primera con mayor diversidad faunística. En Obadam hay 59 insectos por m^2 (16 especies) y en Eleiyele 51 por m^2 (14 especies). Los cinco grupos más comunes, en orden decreciente de abundancia, fueron Hemiptera, Odonata, Diptera, Ephemeroptera y Coleoptera. La "lechuga de agua" *Pistia stratiotes* tenía más insectos, talvez porque provee ventajas en cuanto al área total de refugio y anclaje.
Key words: Aquatic insects, diversity, *Pistia stratiotes*, freshwater, reservoirs.

Aquatic insects are considered vital to many freshwaterecosystems, because they playa major role in their energy flow. Price (1975) observed that insects have been found to frequently fit into the second and third links of the food chain. If they were not part of such communities, one would therefore expect a significant drop in the possible number of trophic levels and a gross simplification of the feeding links in the food web.

The role of organisms in the community is closely tied to their feeding relationships and thus the niche has been defined traditionally in terms of food requirements and how these relate to needs of other species. Cummins (1973) also observed that statements about food habits are subject to considerable variation and require qualification with regard to habitat and age specific differences.

Most of these aquatic insects are known to use aquatic vegetation as their habitat. Krecker (1939) discussed the importance of aquatic vegetation as a habitat for aquatic animals and animal population studies of aquatic habitats have usually included at least some references to the animals on the vegetation, which provides shelter, food and avoidance of species competition.

Due consideration has to be given to aquatic plant organisms; such biotic communities are often of a complex nature and an assessment of their diversity and abundance is of value regarding biological productivity and feeding habits of cultured fishes for example.

The Eleiyele reservoir is located at an altitude of 125 m (7ºN, 3-4ºE).

The lake (5.4 km^2; 12 m mean depth), was formed by damming the Ona river, which is part of the dense network of inland water courses that flow southward into the Lagos lagoon (Imevbore 1968). The basin is long and narrow and divided into two main areas. On each side of the lake, there is a stretch of forest reserve which ends near the lake on the western side. The lake, used intensively by local fishermen, receives water during the rainy season mainly through the Ona stream, but other streams also contribute.

Imevbore (1968) found that the maximum heights of water level correlated with the peaks of rainfall (June-November). A stretch of grass covers the banks of the lake and also trees. A notable herb along the bank is *Talinum triangulare*. The dominant aquatic plants are *Alterantheria sessilis, Drymaris cordata, Nymphea lotus, Ophimenus* sp., *Acroceros* sp., *Salvinia* sp. *Pistia stratiotes* and *Marsilla polycarpa*.

The Oba reservoiris located on the South western area of the University of Ibadan Campus (185 m.s.m., 7º26-27'N; 3º53-54'E).

The Oba stream was dammed on April 1964 (2.67km^2 ; 5.5 m mean depth). The banks have grasses and very few trees along their length.

The dominant aquatic vegetation includes *Commelina gambiae*, and *Marsillia quadrifolia*, whilst *Pistia stratiotes* covers the entire surface of the eastern portion and extends for about 200 metres from the mouth of the inflowing stream. The surface of the shallow water along the northern and southern bank is covered with patches of *Nymphae lotus*, *Pistia stratiotes* and *Salvinia*. The submerged plant is *Ceratophylum* sp.

The two lakes were sampled on thursdays (10 am-2 pm) on a fortnightly basis. A site of 10 m^2 each was delimited within the 2 lakes as the sampling site, seven samplings were done in each.

At each site an 18 litre plastic bucket was submerged under a specific cluster of aquatic plants and lifted out with the plants filling the bucket. Where the plastic bucket could not be effectively used, the aquatic plants were picked or uprooted and immediately placed in a bucket.

Each plant species collected was put in a white rectangular tray (35 x 25 x 6.5cm), washed thoroughly with tap water and the insects dislodged picked with fine forceps. The foliage area was specially searched. All insects were preserved in 4% formalin. The organic matter content was determined according to Misra and Ball (1976).

TABLE 1

Aquatic plants in Eleiyele and Oba dams, Nigeria

\+ Presence, - Absence, * Sheltered aquatic insects during sampling

Species	Eleiyele Dam	Oba Dam
Polygonum senegalensis	+	-
Echinochola stagnina	+	-
* *Salvinia nymphellula*	+	+
* *Nymphae lotus*	+	+
* *Ceratophyllum demersum*	+	+
Commelina	+	+
Acroceros amplecteus	+	-
* *Pistia stratiotes*	+	+
Ipomea ascartolia	-	+
Ipomea aquatica	-	+
TOTAL	8	7

Eleiyele showed a more diverse plant composition than Oba dam. Oba was dominated by *Pistia stratiotes*, leaving only pockets for other plants.

Only four out of the ten aquatic plants listed supported insects; the population on each type of plant was variable. *Pistia stratiotes* was the most supportive of aquatic insects in terms of abundance and diversity (Table 2).

TABLE 2

Association between aquatic insects and plants in Eleiyele and Oba dam, Nigeria

Aquatic plant / Insect species sheltered	Order
Salvinia nymphellula	
Culex pipiens (larvae and pupae)	Diptera
Centroptiloides	Ephemeroptera
Nymphae lotus	
Argia	Odonata
Coenagrion	"
Ischnura	"
Aeschna	"
Pistia stratiotes	
Tabanus	Diptera
Chrysops	"
Argia	Odonata
Ischnura	"
Coenagrion	"
Aeschna	"
Lethocerus	Hemiptera
Poissonia	"
Cybister larvae	Coleoptera
Hydrochara	"
Donacia	"
Ceratophyllum demersum	
Argia	Odonata
Ischnura	"
Coenagrion	"
Tendipes (larvae and pupae)	Diptera
Plea	Hemiptera
Ranatra	"

The aquatic plants in Oba had a greater insect abundance and species diversity than those of Eleiyele. A total of 587 insects/10 m^2 (16 species) were found in Oba; and 515 insects/10 m^2 (14 species) in Eleiyele (Fig.1). There is difference between both insect populations (t. - student, $p<0.05$).

In Eleiyele and Oba the Hemipterans and Odonates were the predominant orders, while Ephemeropterans and Coleopterans were the least frequent.

The largest order associated with plants in Obadam was Hemiptera while that of Eleiyele was Odonata.

The greater abundance and diversity at Oba may be due to the presence of *Pistia stratiotes*.

P. stratiotes is very abundant in Oba; it formed a cover for the entire eastern part of the

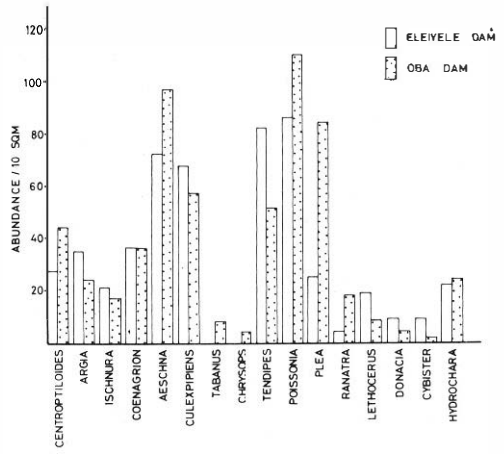

Fig. 1 Insect abundance and species diversity in Eleiyele and Oba Dam, Nigeria.

lake extending for about 200 meters off shore, leaving only pockets of spaces for other aquatic plants. The *P. stratiotes* in Oba attained larger sizes than in Eleiyele, because of the conditions in Oba, which had a higher soil organic matter content of 18.10-65.30g/100 g (Eleiyele: 19.90-49.40g/100 g.). The suggested reason is the morphology of *P. stratiotes*. The plant afforded aquatic insects a large surface area, protection, anchorage, food and avoidance of species competition.

The most important reason for making aquatic vegetation a habitat was the provision of shelter. Krecker (1939) and Rosine (1955) observed from the studies of vegetation in ponds and lakes that different plants shelter different animals. The shapes of the plants themselves have been solely implicated in these differences and not the physical condition of the environment, since all plants in the same area grow under similar environmental conditions.

Rosine (1955) observed that plants which provided surface and no protection supported fewer species of aquatic insects, and that plants with finely divided leaves offered a certain amount of protection to animals, thus supporting a large number of them.

The provision of food was also an important factor in selecting aquatic vegetation as habitat by insects. Cummins (1973) gave a classification of aquatic insects on the basis of the general type of feeding mechanism: *Shredders* (vascular plant tissue, collectors; detrital particles) and *Scrapers* (attached algae; predators, live prey).

Apart from feeding on the tissues of the aquatic plant itself, the periphyton on the aquatic plants were seen as an important factor for the presence of herbivores, as herbivores feed mainly on the periphyton at surfaces of macrophytic vegetation (Percival and Whitehead 1929).

Cummins (1973) observed that microhabitat selection could be on some non-food basis (like species competition avoidance) and in such a case the animal is automatically exposed to a narrow range of nutritive substances.

The Hemipterans and Odonates were the most predominant insects associated with *Pistia*. This may be due to the fact that the plants formed a suitable medium for eggs as observed by Fischer (1961) and a suitable substrate for clinging, a view supported by Pennak (1953). Cummins (1973) also mentioned that Hemipterans, except the Corixidae, were fluid feeders, which they obviously received from the tissues of *Pistia*. The abundance of Odonates which are predaceous organisms resulted from the abundance and diversity of other aquatic insects which served as their prey.

I thank the Department of Botany, University of Ibadan for determinations, the Department of Zoology for providing facilities and A.T. Hassan for reviewing the manuscript.

REFERENCES

Cummins, K.W. 1973. Trophic relations of aquatic insect. Ann. Rev. Ent. 18: 183-206.

Fischer, A.G. 1961. Latitudinal variations in organic diversity. Amer. Sci. 49(1):50.

Imevbore, A.M.A. 1968. Hydrology and plankton of Eleiyele reservoir, Ibadan, Nigeria. Hydrobiologia 31: 37-57.

Krecker, F.H. 1939. A comparative study of the animal population of certain submerged aquatic plants. Ecology 20:553-561.

Misra, R. 1968. Ecology workbook. Oxford and I.B.H. Publ. Comp. New Delhi. 44 p.

Pennak, R.W. 1953, Freshwater invertebrates of the United States. Ronald Press, N.Y. 796 p.

Percival, E. & H. Whitehead. 1929. A quantitative study of some type of streambeds. J. Ecol. 17:282-304.

Price, P.W. 1975. Insect Ecology. John Wiley and Sons, New York. 514 p.

Rosine, W.W. 1955. The distribution of invertebrates on submerged aquatic plant surfaces in Muskee Lake Colorado. Ecology 36: 308-314.