DOI:36108/NJE/2002/91.0141

NIGERIAN JOURNAL OF ENTOMOLOGY (2002) 19:109-115

Laboratory Study of Predatory Efficacy of Dragonfly Larvae, Catfish and Tadpoles against Container – Breeding Mosquitoes (Diptera; Culicidae) in Makurdi, Nigeria.

OMUDU,E .A. and IBRAHIM , H . K .
Department of Biological Sciences,
Benue State University,Makurdi.

(Accepted 20 April, 2002)

ABSTRACT

Three known predators of mosquito larvae namely; dragonfly larvae (Libellulidae),catfish (Clariidae) and tadpoles (*Rana temporaria*) were tested for predator efficacy. Four and two individuals of each of the predators were introduced into three replicates each of bowls containing 100 mosquito larvae in 10-12 litres of water with a control. Surviving larvae were counted at 8 hours interval for 48 hours. The reduction of population of mosquito larvae was significant ($P \leq 0.05$) for all predators. Dragonfly larvae consumed more mosquito larvae than catfish and tadpoles (reducing mean number of 100-6.0 in 48 hours). The outcome of this laboratory investigation revealed that larvae of dragonfly possess higher predatory potential as biological control agent for mosquitoes inhabiting man –made breeding habitats.

INTRODUCTION

Domestic water storage containers provide a hygienic means of storing water in both rural and urban communities . Unfortunately these containers have become favourable as breeding habitat for some species of mosquitoes. The multiplicity of these domestic and pre-domestic breeding sites for mosquitoes of medical importance is epidemiologically important (Omudu, 1998, Nweke *et al*, 1993, Moore *et al*, 1990, Aigbodion *et al*, 1995).

The breeding of these vectors of human diseases in and around human dwellings indicates an intense man-vector contact creating a high level risk to crowded settlements. However, due to the confinement of the pre-adult stages of these mosquitoes to water holding containers and their easy accessibility, it has been reported that their suppression can be achieved by releasing predators to feed on them (Sebastian *et al*, 1980, Sebastian *et al*, 1990, Corbet, 1986, Annis *et al* 1990, Annis *et al*, 1989, Omudu and Onah, 1996, Wu *et al*, 1987).

This study was designed to assess the potential efficacy of some known predators of mosquito larvae collected from natural sources in Makurdi, Nigeria. The predators used were dragonfly larvae (Odonata: Libellulidae) catfish (Clariidae) and tadpole (*Rana temporaria*)

MATERIALS AND METHODS

Dragonfly larvae, catfish and tadpoles were collected from natural ponds and were acclimatized in bowls with aquatic weeds to mimic their natural habitat. Acclimatization lasted for at least 24 hours prior to the experiment.

White plastic bowls of about 10-12 litres capacity were used. Nine bowls were filled with water from a natural source, in each of the bowls 100 mosquito larvae (*Aedes aegypti* and *Culex pipiens quinquefasciatus*) were introduced. The second and third instars of these species frequently encountered in water containers in Nigeria were used in no particular proportion. The bowls were then covered with mosquito net with mesh size 0.25mm to prevent adult mosquitoes from depositing new batches of eggs during the experiment.

Four and two dragonfly larvae were introduced into two replicates each containing 100 mosquito larvae. The third replicates served as the control and dragonfly larvae were not introduced. Predation was ascertained by counting the surviving larvae at 8 hours interval for 48 hours as recommended by Service (1976). The same procedure was repeated for catfish and tadpole. All predators used possess adaptive ability to breed in shallow water and man-made water containers and withstand long period of starvation.

RESULTS

The results were subjected to analysis of variance (ANOVA) and the least significant difference (LSD) was used to determine the least significant difference between treatments. The reduction of the mosquito population was significant ($P< 0.05$) in all the treatments, with mean number of 100 mosquito larvae being reduced to 6.0 and 33.0 by four and two dragonfly larvae respectively in 48 hours. The four and two catfish reduced mean number of mosquito larvae to 26.0 and 50.0 from the

initial 100 respectively while the four and two tadpoles reduced the mean number of 2.0 and 36.0 also from the initial 100 respectively in 48 hours.

The higher the number of predators the more mosquito larvae was consumed as seen in Figs 1 and 2. The dragonfly larvae were able to suppress the container-breeding mosquitoes more than the other two predators. The mean consumption rate for dragonfly larvae, catfishes and tadpoles were X = 18, 38 and 28 respectively. The tadpoles on the other hand consumed more mosquito larvae than the catfish. The introduction of the predators reduced the mosquito larvae population sharply during the first 32 hours and then gradually thereafter. The number of mosquito larvae in the bowls used as control were still 100 at the end of 48 hours. No evidence of cannibalism nor mortality was observed.

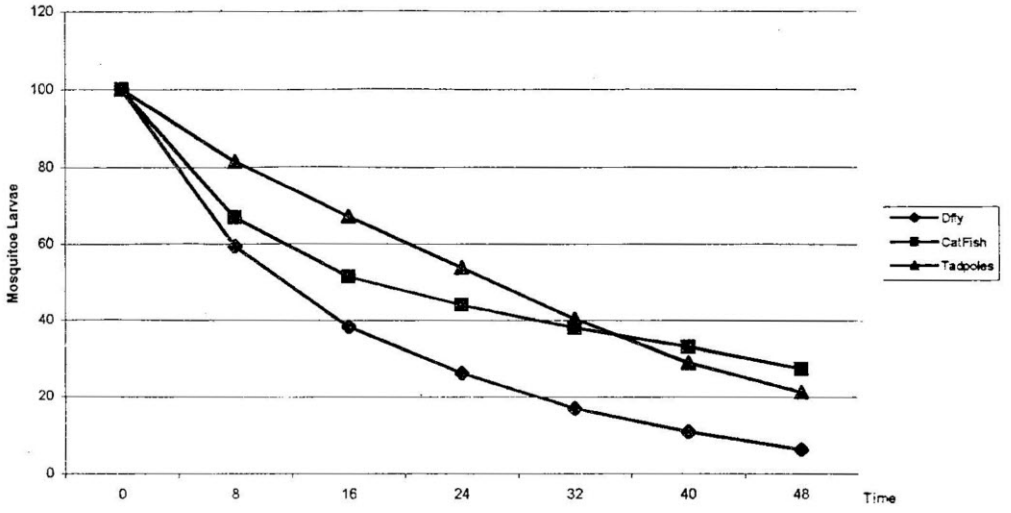

Fig.1: Predatory Effect of 4 Dragon Fly Larvae, CatFish and Tadpoles on 100 Mosquito Larvae

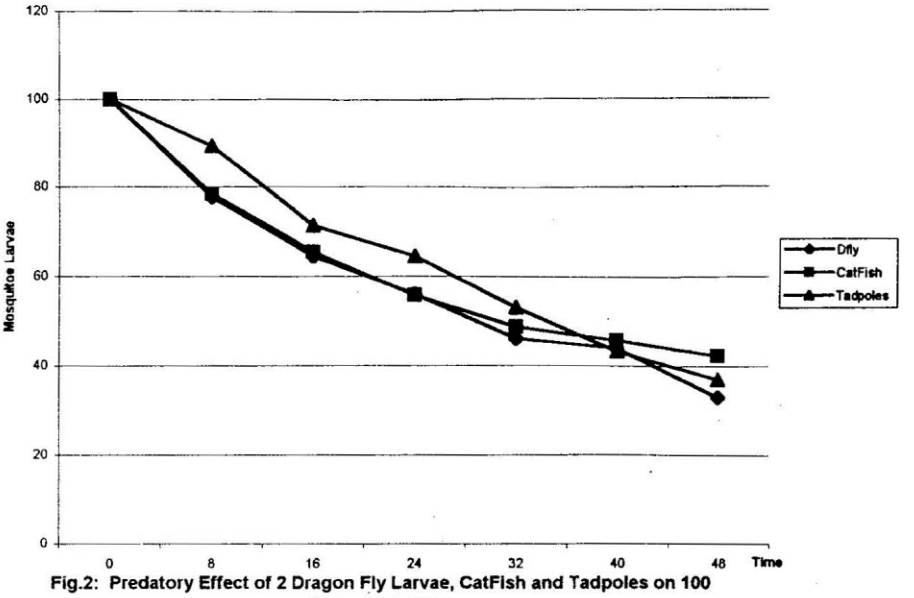

Fig.2: Predatory Effect of 2 Dragon Fly Larvae, CatFish and Tadpoles on 100 Mosquito Larvae

DISCUSSION

As Africa roll out the roll back malaria programme, a comprehensive integrated and sustainable mosquito control approach needs to be adopted. Human activities continue to create new habitats for disease vectors including mosquitoes. Therefore bio-environmentally friendly initiatives used elsewhere to suppress pre-adult stages of mosquitoes (Sebastian *et al.*, 1990; Annis *et al.*, 1990; Wu *et al.*, 1987; Majares 1987; Chan *et al* 1990) can be introduced as a component of broad based mosquito control programme.

The predators used in this study are readily available in man-made ponds and can be propagated in large numbers. Though tadpoles consumed more mosquito larvae than catfish its usage might not be generally accepted due to socio-cultural factors. This may be the reason why dragonfly larvae and catfish are more often used and reported at community level (Sebastian *et al*, '1990; Wu *et al*, 1987). Furthermore, dragonfly larvae and catfish have ability to breed in shallow water and tolerate long period of starvation. Other species of fishes that possess these adaptive qualities may be explored to suit local acceptability.

The outcome of these laboratory trial using locally available predators in Nigeria agree with similar successful studies in Asia and East Africa where augmentative field release of these predators has already yielded success (Sebastian *et al*, 1990; Wu *et al*, 1987; Annis *et al*, 1989; Chan *et al*, 1990).

Omudu (1998) stressed the need for community participation in designing, implementing and monitoring control programme involving use of predators. Successes reported in South East Asia depended on the desire by the local community to achieve suppression of mosquito population without using chemical insecticides in their domestic water supply. It is important to adequately sensitize and mobilize communities to see the need for alternative mosquito control measures. Acceptance by the local community of the rationale of releasing predators in domestic water storage containers and willingness to participate in the practical aspect of the programme is the key to achieving success. The emphasis of the roll back malaria programme has been on the use of mosquito net. Important as this may be, experience has shown that no one method of controlling mosquito has ever yielded desired impact. Therefore the integrated control method is the most recommended. Mosquito species colonizing domestic containers in Nigeria are predominantly *A. aegypti* and *C. p. quinquefasciatus* (Nwoke *et al.*, 1993; Aigbodion *et al*, 1995), these are important yellow fever and filarial vectors that bite mainly during the day or early evening. It may be necessary for further investigation to separate the two mosquito species (*A. aegypti* and *C. p. quinquefaciatus*) to determine the prey preference for each predator. The need to consider other cheap, readily available and sustainable means of reducing the menace of mosquitoes cannot be over emphasized.

The potential predatory efficacy of the predators used in this experiment hold out promising opportunities for their massive cisterns to achieve bio-environmentally sound and sustainable suppression of mosquitoes.

REFERENCES

AIGBODION, F. I., ONYEKA, J.O.A., OKOLO, C.J. and AKO, J. I. 1995: Dry season breeding site preferences of *Culex quinquefasciatus* in Jos, Nigeria. *Journal of Pest, Disease and Vector Management.* In Press.

ANNIS, B., KRINOWARDOJO, S., ATMOSEODOJO, S. and SUPARDI, P. 1989: Suppression of larval *Aedes aegypti* population in household water storage containers in Kakarata, Indonesia, through release of first instar *Toxorhynchites splendens* larvae. *Journal of the American Mosquito Control Association* 5(4):121-125.

CHAN, K. L., CHANG, M. S., LAIRD, M. and PHANTHUMACHINDA, L. B. 1990: Control of *Aedes* mosquito by the community: appropriate technology in vector control. Edited by Curtis, C. F. Florida, USA. CRC Press.

CORBET, R. S. 1986: Using dragonflies to suppress mosquitoes in domestic water storage containers. *Waterlines* 4: 10-11.

MAJARES, A. S. 1987: Comparative Study of *Romanomermis culicivorax* infection of larvae of *culex quiquefasciatus* under laboratory condition. *Review Cubaana. Medical Tropicana* 39: 4-48.

MOORE, C. G., FRANCY, D. B., ELIASON, D.A., BAILY, R. E. and CAMPOS, E. G. 1990: *Aedes albopictus* and other container inhabiting mosquitoes in USA: Results of eight cities surveyed. *Journal American Mosquito Control Association* 6(2): 173-178.

NWOKE, B.E.B., NDUKA, F. O., OKEREKE, O. M. and EHIGHIBE, O. C. 1993: Sustainable urban development and human health: septic tanks as major breeding habitat of mosquito vectors of human diseases in South-eastern Nigeria. *Applied Parasitology* 34: 1-10.

OMUDU, E. A. and ONAH, J. A. 1996: Suppression of container-breeding mosquitoes (Diptera: Culicidae) by predatory larvae of dragonfly (Odonata: Libelullidae) and mosquito (*Toxorhynchites* species) in the laboratory. *Nigerian Journal of Parasitology* 17: 139-143.

OMUDU, E. A. 1998: Feasibility of community involvement in sustainable bio-environmental control of container-breeding mosquitoes in Nigeria. In: *Entomology in the Nigerian Economy: Research focus in the 21st Century.* Eds. M. C. Dike., N.E.S. Lale. N. B. Molta, P. O. Donli and M. Aminu-Kano ESN Occasional Publication 31: 91-100.

SEBASTIAN, A., THU, M. M., KYAV, M. and SEIN, M. M. 1980: The use of dragonfly nymphs in the control of *Aedes aegypti. SE Asian Journal Tropical Medicine & Public Health.* 11: 104-107.

SEBASTIAN, A., THU, M. M., SEIN, M. M. and CORBET, P. S. 1990: Suppression of *Aedes aegypti* using augmentative release of dragonfly larvae with participation in Yangon. *Bulletin of Entomological Research* 80: 97-103.

SERVICE, M. W. 1976: *Mosquito Ecology: field sampling methods.* Applied Science. London 583 pp.

WU, N., WANG, S., HAN, G., XU, R., TANG, g. and QUIAN, C. 1987: Control of *Aedes aegypti* larvae in household containers by Chinese catfish. *Bulletin of the World Health Organisation* 65 (4):503 – 506.