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# LABORATORY TRIALS ON THE FEEDING PATTERN OF MOSQUITO LARVAE BY ORNAMENTAL FISHES (MOLLIES AND SWORDTAILS) IN DOMESTIC WELL WATER

**AMAL KUMAR PATRA**
DEPARTMENT OF ZOOLOGY, ANANDA CHANDRA COLLEGE,
JALPAIGURI-735 101, INDIA.
**(e-mail: amalpatra@yahoo.co.in)**

The present experiment was carried out on the feeding pattern of different developmental stages of mosquitoes (*Anopheles* and *Culex*) and seven individuals of two ornamental fish species (Mollies and Swordtails).The developmental stages of mosquitoes were zero instars, 1st instars, 2nd instars, 3rd instars larvae, and pupa. The ornamental fishes were *Poecilia sphenops*-White female, *Poecilia sphenops*-Black female, *Poecilia sphenops*-Black balloon male, *Xiphophorus helleri*- Black eyed marigold male, *Xiphophorus helleri*- Red eyed tangerine male, *Xiphophorus helleri*- Red eyed marigold female and *Xiphophorus helleri*- Red eyed tangerine female. The experimental results revealed the positive responses in all cases except in pupa stage. The correlation coefficient (r) of length of larvae (Y) and number of larvae intake by each individual fish (X) showed the negative significant correlation at 5% level of significance by the *Poecilia sphenops*-Black balloon male (r = -0.96), the *Xiphophorus helleri*- Red eyed tangerine male (r = - 0.953), and the *Xiphophorus helleri*- Red eyed tangerine female(r = - 0.99). This may be due to their omnivorous habit, width of gape of mouth and likeness to live food.

**Key words :** Larvivorous fish, Bio-control, Larvivorous ornamental fishes.

## INTRODUCTION

Mosquitoes are cosmopolitan in distribution, nocturnal in habit and found in abundance in dams, ditches, ponds, lakes, canals, marshy lands, drains, wells etc. Taxonomically they belong to class insecta, subclass ectognatha and order Diptera (Ruppert & Barnes, 1994) and are the causative agent of malaria, filaria, yellow fever, dengue fever and chikungunia. They are very noxious in tropical and subtropical regions. Only females are adopted to suck the blood of human beings and function as a biological vector of viral, bacterial and protozoan diseases. *Anopheles spp.* carry the sexual and infective (sporozoite) stages of malarial parasites, *Culex sp.* transmits the causative agent of filariasis, *Aedes spp.* are the carrier of yellow fever, dengue fever etc. Breeding of these mosquitoes continue through out the year in warm and humid places. The fertilized females ($O_+$) lay their eggs in the stagnant water of dams, marshy lands, canals, and untreated domestic wells. The eggs after 2-3 days of incubation hatch into larvae which are purely aquatic in habit and are known as "Wrigglers". In order to control and prevent different mosquito borne diseases, four different methods may be adopted. One of them is destruction of larvae, which is easier and more convenient than the control of adult mosquitoes. For destruction of larvae of mosquito, vector biologists use different fishes, aquatic nymph and adults insects, water bugs, fungus, aquatic insectivorous plants etc. Larvae feeding fishes are commonly known as larvivorous fishes. The Biological control of mosquito larvae by larvivorous fishes was important in malaria control programmes in the 20th century, particularly in urban and periurban areas of developed and developing

countries (Gratz & Pal, 1988). Hora & Mukherjee (1938) classified the larvivorous fishes into typical surface feeder, sub-surface feeder, column feeder, fry of carps and mullets, and predator fishes. These fishes may be ornamental or non-ornamental. While there are a number of reports on larvivorus ornamental fishes (Tabibzadeh *et al.*, 1971; Rao *et al.*, 1982; Saha *et al.*, 1986; Nalim & Tribuwono, 1987; Fletcher *et al.*, 1992; Prasad *et al.*, 1993; Dua & Sharma, 1994; Chatterjee *et al.*, 1997; Chatterjee & Chandra, 1997; Singaravelu *et al.*, 1997; Martinez-Ibarra *et al.*, 2002; Ghosh *et al.*, 2004; Willems *et al.*, 2005; Marti *et al.*, 2006, Chandra *et al.*, 2008) but no information is available regarding the control of mosquito larvae by ornamental fishes, Molly and Swordtail. All available reports are on guppy-, gambusia-, and gold fishes. This communication reports the control of mosquito larvae by ornamental fishes which are commonly called Molly and Swordtail. The aim of present study is the destruction of mosquito breeding ground (Domestic well) by transforming this technology from laboratory to field.

## MATERIALS AND METHODS

The ornamental fishes, mollies and sword tails, were collected from Moue Aquarium Park, Mohuripara, Jalpaiguri, West Bengal, India. These fishes belong to order Cyprinodontiformes and family Poecillidae. The selected mollies were *Poecilia sphenops* -White female, *Poecilia sphenops*- Black female, and *Poecilia sphenops*-Black balloon male. The selected sword tails were *Xiphophorus helleri*- Black eyed marigold male, *Xiphophorus helleri*-Red eyed tangerine male, *Xiphophorus helleri*-Red eyed marigold female and *Xiphophorus helleri*-Red eyed tangerine female. They are exotic and the average weight was 0.62 ± 0.03 gm. The collected fishes were cultured individually in glass tank (1′x ½′x 1′). The culture of these fishes were maintained by chemically untreated and unused domestic well water with temperature 18°C - 22°C, pH 7.2-7.6, and dissolve oxygen (DO) 6-8 ppm. The collected water was reserved in a glass tank (2′x 2′ x 1½′) for 3-4 days. The fishes were acclimatized with this reserved well water and then were cultured in separate glass tank (1′x ½′x 1′) individually. The culture was maintained by pre-acclimatized different instars of mosquito (*Anopheles* and *Culex*) larvae. The developmental stages were zero (without metamorphosis or just hatching), first, second and third instars with average 0.3 cm, 0.7 cm, 0.9 cm, and 1.1 cm length respectively. The result was taken at 24 hours interval. The experiment was conducted for six months from January to June, 2009. These fishes were also cultured with pupa stage of mosquitoes. Statistical analysis, the simple correlation coefficient (r) between number of larvae intake by individual fish/day (X) and length of larvae (Y) was calculated by the following equation :

$$r = \frac{\Sigma XY - \frac{\Sigma X \Sigma Y}{n}}{\sqrt{\{\Sigma X^2 - \frac{(\Sigma X)^2}{n}\}\{\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\}}}$$ (Symonds, 1926)

The calculated "r" value was compared at 2 degree of freedom by critical value of the correlation coefficient (Zar, 1999). The level of significance used was 5% level of significance.

## RESULTS AND DISCUSSION

The experimental results revealed the positive responses in all cases except for pupa in twenty four hours interval (Table I). Ranking of individual efficiency against the zero instars larval form showed the following sequences: *Xiphophorus helleri*- Black eyed marigold male and *Xiphophorus helleri*-Red eyed marigold female > *Xiphophorus helleri*-Red eyed tangerine male > *Poecilia sphenops*-Black balloon male and *Xiphophorus helleri*- Red eyed tangerine female > *Poecilia sphenops*-White female > *Poecilia sphenops*- Black female. The ranking of individual efficiency against the first instars larval form showed the *Xiphophorus helleri*- Black eyed marigold male > *Xiphophorus helleri*- Red eyed marigold female > *Xiphophorus helleri*- Red eyed tangerine male > *Poecilia sphenops*-White female and *Poecilia sphenops*-Black balloon male > *Poecilia sphenops*- Black female and *Xiphophorus helleri*-Red eyed tangerine female, sequence with second instars larvae the result was *Xiphophorus helleri*-Red eyed marigold female > *Xiphophorus helleri*- Red eyed tangerine male > *Xiphophorus helleri*-Black eyed marigold male > *Poecilia sphenops*-White female and *Poecilia sphenops*-Black balloon male > *Poecilia sphenops*-Black female > *Xiphophorus helleri*-Red eyed tangerine female, with third instars larval form it was *Xiphophorus helleri*-Red eyed marigold female > *Xiphophorus helleri*- Black eyed marigold male >*Poecilia sphenops*-Black balloon male and *Xiphophorus helleri*-Red eyed tangerine male > *Poecilia sphenops*-White female > *Poecilia sphenops*- Black female and *Xiphophorus helleri*-Red eyed tangerine female (Fig. 1), and with pupa stage all fishes showed the negative result *i.e.* they did not feed the pupa stage of mosquitoes.

At 5% level of significance the *Poecilia sphenops*-Black balloon male (r = -0.96), the *Xiphophorus helleri*-Red eyed tangerine male (r = -0.953), and the *Xiphophorus helleri*-

**Table I :** Average number of different instars of mosquito larvae intake by different ornamental fishes per day.

| S. No. | Name of fishes | Average number of different instars of mosquito larvae intake per day. | | | | |
|---|---|---|---|---|---|---|
| | | Zero instars | 1st instars | 2nd instars | 3rd instars | Pupa |
| I | *Poecilia sphenops*-White female | 22 | 20 | 17 | 9 | 0 |
| II | *Poecilia sphenops*-Black female | 20 | 17 | 15 | 8 | 0 |
| III | *Poecilia sphenops*-Black balloon male | 25 | 20 | 17 | 11 | 0 |
| IV | *Xiphophorus helleri*-Black eyed marigold male | 30 | 27 | 18 | 12 | 0 |
| V | *Xiphophorus helleri*- Red eyed marigold female | 30 | 26 | 20 | 13 | 0 |
| VI | *Xiphophorus helleri*- Red eyed tangerine male | 28 | 22 | 19 | 11 | 0 |
| VII | *Xiphophorus helleri*- Red eyed tangerine female | 25 | 17 | 12 | 8 | 0 |

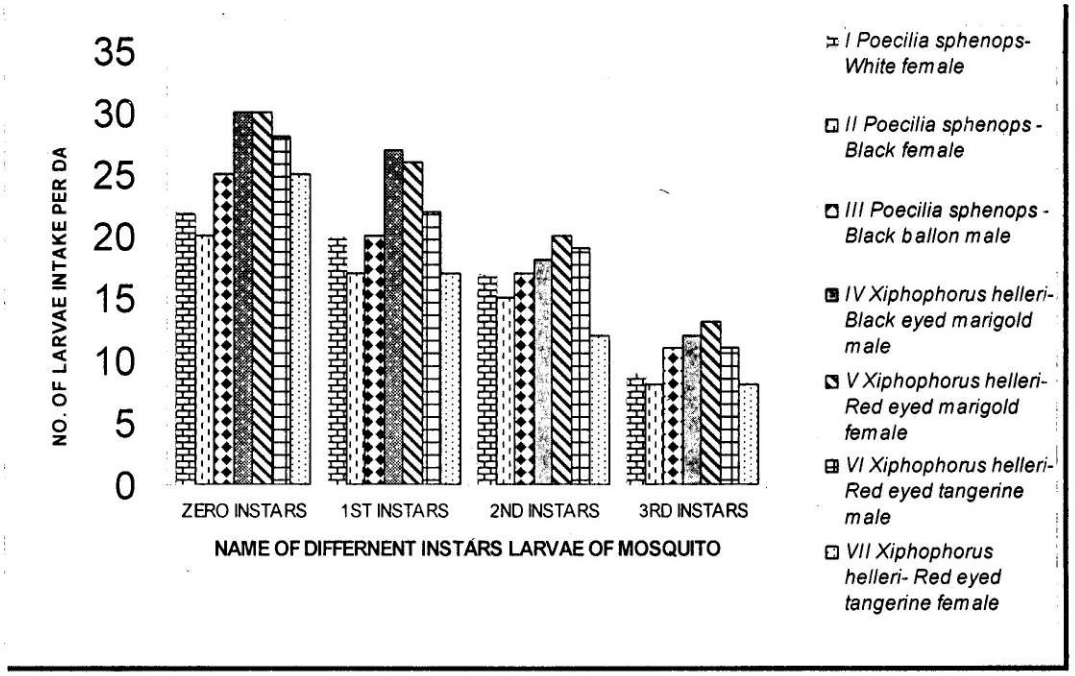


**Fig. 1 :** Ranking of individual efficiency against the different instars of mosquito larvae.

Red eyed tangerine female(r = -0.99) showed significant negative correlation except *Poecilia sphenops*-White female ( r = -0.875), *Poecilia sphenops*- Black female ( r = -0.901) , *Xiphophorus hełleri*-Black eyed marigold male ( r = -0.927), and *Xiphophorus helleri*-Red eyed marigold female ( r = -0.941 ).

Mollies and Swordtails are the representative of Cyprinodonts which are a large group of relatively small fresh- and marine water fishes. Body is moderately elongated and compressed. Head and body with scales. Presence of teeth on the jaws. Because they have teeth in their jaws they are often referred to as tooth carps. Aquarists tend to divide them into two groups: livebearers (which produce live fry) and killifishes (which lay eggs). Mollies and swordtails are live bearers and belonging to the family Poeciliidae. They have rounded abdomen, short head, and prefer both hard and soft water. The mouth is oblique, small, cleft, and not extends to the orbit. Lips of them are thin, upper jaw shorter than lower jaw. During collection of live foods the mouth of them is protruded, teeth of jaws help to capture the foods. Like other poeciliidae, they are true omnivorous (Balley & Sandford 2001). Due to their omnivorous habit aquarists maintain the culture of them in aquarium by different branded formulated foods which contain fish meal, shrimp meal, wheat flour, rice bran, soybean meal, corn meal, carotenoid, vitamin A,B1,B2,C,E, calcium, magnesium, biotin, and other trace elements.

There are two main factors determining the efficacy of the carnivorous fishes to intake the mosquito larvae are suitability of the fish specimen to the water bodies where the vectors breed and the ability of the fish to eat enough larvae of vector species (Chandra et al.. 2008). The last factor may be influenced by aquatic vegetation grow in breeding ground of mosquitoes. The effectiveness of larvivorous fish to destruct the

mosquito breeding ground may vary due to the environmental complexity which is an external factor and internal factors like likeness capture of their prey.

In the laboratory trial seven individuals of two species of ornamental fishes showed varying results may be due to their different transverse distance across the opening of the mouth (width of gape of mouth) and length, morphology, and active movement of larvae. The width of gape of mouth was varied from 0.2cm to 0.4cm. They feed maximum when the larvae were small sized (0.3 cm) and minimum when the length of the larvae were larger (1.1 cm). In case of pupa, the morphological appearance prevents these fishes to capture their prey.

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