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Assessment of Mosquito *Culex quinquefasciatus* Larvivorous Prospective of the fish *Poecilia reticulata* and *Gambusia affinis*

S.R. Karlekar* and R.J. Andrew**
**Research cum Training Center, Public Health Department, Shradhanandpeth, Matakachery, Nagpur-440 022, India.*
***Post Graduate Department of Zoology, Hislop College, Civil line Nagpur-440001, India.*

(Corresponding author: S.R. Karlekar)
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ABSTRACT: The fishes *Poecilia reticulate* and *Gambusia affinis* of size measuring 4 ± 0.5 cm in length were evaluated for mosquito larvivorous prospective against third instar larva of *Culex quinquefasciatus.* The experiment was carried out with five replicates without supplementary food. The results shown that *Poecilia reticulata* consumed maximum 31 and minimum 25 larvae, at an average of 27± 2.54 larvae per day, while the fish *Gambusia affinis* consumed a maximum of 44 and minimum 38 larvae at an average of 41± 2.82 per day. The post twenty four hours exposure shown that *Poecilia reticulata* consumed maximum 35 and minimum 28 larvae, at an average of 31± 2.91 larvae, while the fish *Gambusia affinis* consumed a maximum of 48 and minimum 40 larvae at an average of 43±3.16.

Keywords: *Poecilia reticulata*, *Gambusia affinis, Culex quinquefasciatus*, larvae.

INTRODUCTION

For mosquito borne diseases, vector control is an essential component of disease-eradication programme. Earlier, the mosquito population was controlled in adult phase using a wide range of insecticides which resulted in degradation of environment, development of resistant variety heavy mortality of non-target organisms. Since larval forms of mosquitoes being aquatic are unable to move from their habitat, they have become easy target for implementation of mosquito control measures (WHO 2010).

The use of biological control agents to target mosquito population at larval stage has been found to be a promising alternative to chemical control. However, utilizing a controlled system *via* aquaponics provides the mosquito control without any adverse effects to the ecosystem (Medlock & Snow 2008)**.** Larvivorous fishes feeding on immature stages of mosquito form an efficient bio-control agent. According to Job (1940), larvivorous fish must be small, hardy, drought resistant and a prolific breeder in confined water with a short life span. It should be a surface feeder and carnivorous in habit with a preference for mosquito larvae.

In the 21st century, biological control using larvivorous fish, was become an important tool for mosquito borne diseases control, particularly in urban and periurban areas (Gratz & Pal, 1988). The present investigation has been undertaken to find the consumption level of the larvivorous fishes *Poecilia reticulata* and *Gambusia affinis* for the third instar larval stage of the mosquito *Culex quinquefasciatus* in central India.

MATERIAL AND METHOD

Larvivorus potential of the fishes *Poecilia reticulata* and *Gumbussia affinis* was evaluated against third instar larva of *Cx. quinquefasciatus* in laboratory condition by the methods of Jayawardhana *et al*., (2000) and Phukon & Biswas (2013) with slight modifications and without providing alternate food material. Five beakers of 500 ml were kept in a series containing 300 ml of de-chlorinated water. A single female fish of each species measuring 4 ± 0.5 cm was introduced in each beaker containing fifty larvae of 3rd instar stage. The consumption potential of the fish was noted after 24 hours. For post twenty four hours experiment, the same fishes were reintroduced in fresh beaker with fifty larvae in each beaker. Five replicates of each species were averaged and per day consumption rate was calculated.

RESULTS

The maximum numbers of 31 larvae were consumed by the fishes *Poecilia reticulata* in the fourth replicate followed by 28 in the first replicate, 26 in the third replicate and 25 in the second and fifth replicates. On an average, *Poecilia reticulata* consumed 27± 2.54 larvae per day. A maximum of 44 larvae were consumed by the fish *Gambusia affinis* in the fifth replicate followed by 43 in the third replicate, 42 in the fourth replicate and 38 in the first and second replicates. The average number of *Cx. quinquefasciatus* third instar larvae consumed by *Gambusia affinis* was found to be 41±2.82 larvae per day. The consumption of larvae in 24 hours by *Poecilia reticulata* and *Gambusia affinis* is represented in Table 1 and Fig. 1.

Table 1: The consumption of third instar larvae of *Cx. quinquefasciatus* in 24 hour duration by the fishes *Poecilia reticulata* and *Gambusia affinis.*

Fish	Replicates of larval consumption in 24 hour					Average
	I	II	III	IV	V	
Poecilia reticulata	28	25	26	31	25	27± 2.54
Gambusia affinis	38	38	43	42	44	41± 2.82

±SD- Standard deviations

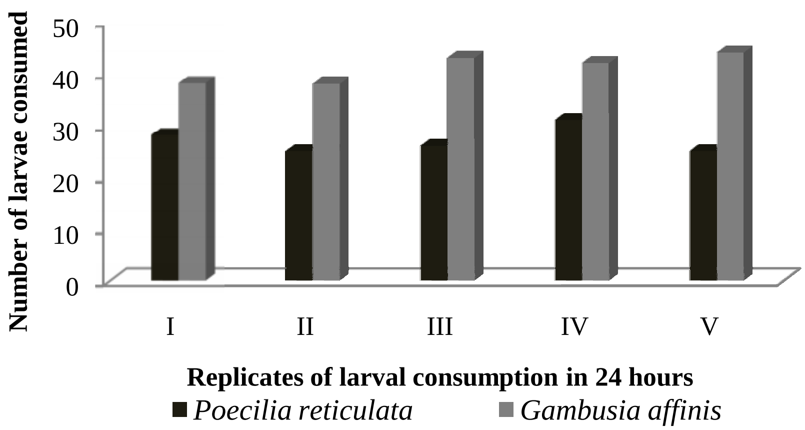

Fig. 1. Number of third instar larvae of *Cx. quinquefasciatus* consumed in twenty four hour by the larvivorus fishes.

In post twenty four hours experiments, maximum number of 35 larvae were consumed by *Poecilia reticulata* in the second replicate followed by 33 in the first replicate, 30 in the third replicate, 29 in the fifth replicate and 28 in the fourth replicate. On an average *Poecilia reticulata* consumed 31±2.91 larvae on the second day. The maximum number of 48 larvae were consumed by this fish in the third replicate followed by 44 in the fifth replicate, 42 in the second replicate, 41 in the first and 40 in the fourth replicate. The average number of larvae consumed on the second day by *Gambusia affinis* was found to be 43± 3.16 larvae per day. The consumption of larvae post 24 hours experiment by *Poecilia reticulata* and *Gambusia affinis* is represented in Table 2 and Fig. 2.

Table 2: The consumption of third instar larvae of *Cx. quinquefasciatus* post 24 hour duration by the fishes *Poecilia reticulata* and *Gambusia affinis.*

Fish	Replicates of larval consumption in post 24 hour					Average
	I	II	III	IV	V	
Poecilia reticulata	33	35	30	28	29	31±2.91
Gambusia affinis	41	42	48	40	44	43±3.16

±SD-Standard deviations

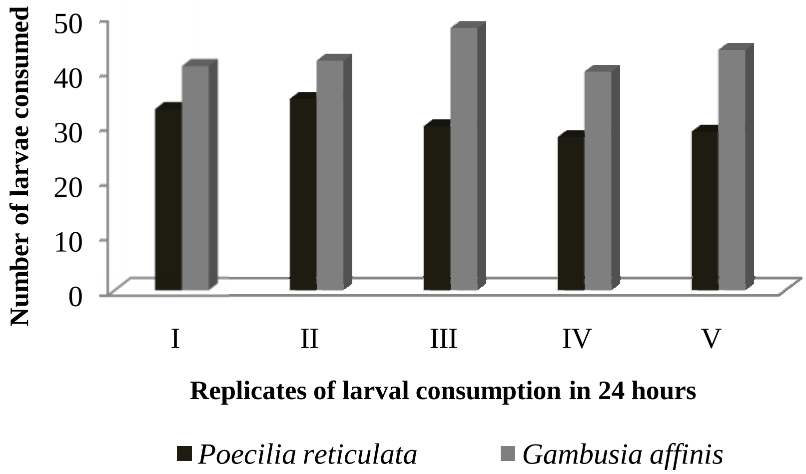

Fig. 2. Number of third instar larvae of *Cx. quinquefasciatus* consumed in post twenty four hour experiment by the larvivorus fishes.

DISCUSSION

Biological control, particularly using larvivorous fish, is an important ingredient in malaria control programs (Gratz & Pal, 1988). Elias *et al*., (1995) reported that the fish *Poecilia reticulata* consume 41 larvae of *Cx. quinquefasciatus* per day. Devi & Juhari (2011) found that size is an important factor in mosquito larval consumption activity of a fish. Aditya *et al*., (2012) studied the efficiency of the fishes, *Poecilia reticulata, Ambassis nama, Ambassis panchax, Colisa fasciatus, Esomus danricus, Parambassis ranga* as potential biological control agents for *Cx. quinquefasciatus* in the presence of alternate food sources. Das (2012) reported that between the fishes *Mystus bleekeri*, *Channa stewartii*, *Rasbora daniconius*, *Colisa fasciatus* and *Danio aequipinnatus,* maximum consumption of *Cx. quinquefasciatus* larva was undertaken by *Channa stewartii* (82.33) followed by *Danio aequipinnatus* (43.33) after three hours of exposure**.** Phukon & Biswas (2013) studied the consumption efficiency of the fishes *Channa gachua* (179), followed by *Puntius sophore* (66) and *Trichogaster fasciata* (45) in 21 hour exposure. Griffin (2014) reported that the consumption rate of the fishes *Gambusia holbrooki*, *Psuedomugil signifer, Hyseleotris galii* and *Pseudogobius* sp. for the fourth instar larva of *Aedes vigilex* was 46.33, 31.5, 22.67 and 4.51, respectively, after an exposure period of eight hours. Londhe & Sathe (2015) reported that the fish *Cyprinus carpio* consume 95% and 63% mosquito larvae in light and dark period, respectively, while *Labeo rohita* consume 40% and 25% during the light and dark period, respectively. Recently, Rao *et al.*, (2015) observed that the fishes *Amblypharyngodon mola*, *Colisa lalia*, *Mystus bleekeri* and *Rasbora daniconius* of size 10 cm consumed 9, 10, 6 and 2.5 mosquito larvae in three hours, respectively. Jayapria & Shobha (2014) documented that the consumption rate increased with the size of the fish. The feeding rate is directly proportional to light and temperature (Maglio & Rosin, 1969) and volume of water (Reddy and Pandyan 1973).

In the present study the 4±0.5 cm long fishes *Poecilia reticulata* and *Gambusia affinis* consumed 27± 2.54 and 41± 2.82 third instar larvae of *Cx. quinquefasciatus*, respectively. Post twenty four hours experiment shown increased consumption rate in both the fishes: *Poecilia reticulata* (31±2.91) and *Gambusia affinis* (43±3.16). Hass & Thomas (2003) observed that introduction of exotic fishes for the control of mosquito larvae had a negative effect on native invertebrates, fishes and amphibians making it necessary to evaluate the larvivorous capacity of local fishes for the control of mosquito population. The present study confirms that the fishes *Poecilia reticulate* and *Gambusia affinis* can be integrated in various vector control programme in central India for the filaria vector *Culex quinquefasciatus*.

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