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Study of mosquito control using larvivorous fish *Danio rerio* Hamilton and *Oreochromis mossambicus* Peters

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ABSTRACT

Objective: To evaluate the larval consumption rate of *Danio rerio* (*D. rerio*) and *Oreochromis mossambicus* (*O. mossambicus*) for the control of filarial vector mosquito *Culex quinquefasciatus* (*Cx. quinquefasciatus*).
Methods: The fishes *D. rerio* and *O. mossambicus* were tested by feeding assay against *Cx. quinquefasciatus* for 24 h.
Results: After 24 h of feeding assay the fishes *D. rerio* and *O. mossambicus* exhibited potential reduction rate of *Cx. quinquefasciatus* larvae.
Conclusions: The present research work demonstrates that the *D. rerio* and *O. mossambicus* can be used for integrated mosquito management, which is simple and safe to non target organisms.

1. Introduction

Mosquitoes are responsible for the transmission of dreadful diseases such as malaria, yellow fever, dengue fever, chikungunya, filariasis *etc*. in tropical and subtropical countries. Lymphatic filariasis caused by *Wuchereria bancrofti* and *Brugia malayi* is an important public health problem in India[1]. *Culex quinquefasciatus* (*Cx. quinquefasciatus*) is the major vector of *Wuchereria bancrofti*. Use of synthetic pyrethroids has always given top most priority to the mosquito control and prevention[2]. Environmental protection agencies have banned or placed severe restrictions on the use of many pesticides, which were formerly used in mosquito control programmes, and there are now fewer adulticides available than there have been for the last 20 years[3]. Development of strong form of insecticide resistance stimulated interest in alternative control methods like biological control and biopesticides[4]. Biological control, particularly using larvivorous fish, was important to malaria control programmes in the 20th century, particularly in urban and periurban areas for immediate use in developed and developing countries[5]. The present study was aimed to evaluate the larval consumption rate of *Danio rerio* (*D. rerio*) and *Oreochromis mossambicus* (*O. mossambicus*) for the control of filarial vector mosquito *Cx. quinquefasciatus*.

2. Materials and methods

2.1. Feeding assay

The average weight of fishes 0.470 mg of *D. rerio* and 0.475 mg of *O. mossambicus* were used for feeding assay[6]. After a period of 7 days of acclimatization, the experiment was conducted in laboratory conditions. Pre-starved fish (n = 1) was individually placed in 1 L of dechlorinated water with 50 late third instar or early fourth instar larvae of *Cx. quinquefasciatus*

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in a glass container. Five replicates were maintained at a time. No food was added in the jar as per World Health Organization norm. Larval consumption rates of *D. rerio* and *O. mossambicus* were observed every 3 h. Total larval consumption was recorded at the end of 24 h.

3. Results

In the present investigation, five fishes of *O. mossambicus* and *D. rerio* were individually fed on 50 *Cx. quinquefasciatus* larvae, and the feeding behaviour was observed for every 3 h interval. The *O. mossambicus* consumed 50 larvae at end of 3rd h. However, the *D. rerio* consumed 20, 20, 20, 20, 20; 16, 17, 15, 16, 15 and 14, 13, 15, 14, 15 at 3, 6 and 9 h intervals (Table 1).

Table 1
Larval consumption of *D. rerio* and *O. mossambicus* by feeding on *Cx. quinquefasciatus* larvae for 24 h.

Replications	Larval consumption								Total
	3 h	6 h	9 h	12 h	15 h	18 h	21 h	24 h	
D. rerio									
1.	20	16	14	-	-	-	-	-	50
2.	20	17	13	-	-	-	-	-	50
3.	20	15	15	-	-	-	-	-	50
4.	20	16	14	-	-	-	-	-	50
5.	20	15	15	-	-	-	-	-	50
Mean ± SD	20.00 ± 0.00	15.80 ± 0.83	14.20 ± 0.83	-	-	-	-	-	-
O. mossambicus									
1.	50	-	-	-	-	-	-	-	50
2.	50	-	-	-	-	-	-	-	50
3.	50	-	-	-	-	-	-	-	50
4.	50	-	-	-	-	-	-	-	50
5.	50	-	-	-	-	-	-	-	50
Mean ± SD	50.00 ± 0.00	-	-	-	-	-	-	-	-

4. Discussion

In the present study, *O. mossambicus* and *D. rerio* were considered as an efficient biocontrol agent against the larvae of *Cx. quinquefasciatus*. All sizes of *Channa gauchua* was found to consume a maximum number of mosquito larvae [(179.00 ± 21.21)/h)] followed by *Puntius sophore* and *Trichogaster fasciata* with a maximum of (66.33 ± 1.52)//h and (45.67 ± 0.58)/h, respectively[7]. Both female and male guppies showed greater preference for *Aedes aegypti* larvae, followed by *Aedes albopictus*, and the least preferred was *Cx. quinquefasciatus*[8]. One adult fish of *Oryzias melastigma* with any sex can consume 87.1% first instars mosquito larvae per day[9]. An average larval consumption of *Aphanius dispar* against *Anopheles stephensi* was 128.0 ± 0.2 to 204.0 ± 6.0; *Cx. quinquefasciatus* 24.0 ± 4.0 to 58.0 ± 10.0; *Aedes aegypti* 43.0 ± 5.0 to 68.0 ± 2.0[10]. In integrated vector mosquito control strategies, using the larvivorous fishes is simple, inexpensive and the native fish should be given first preference to avoid possible undesired implications of introduction of new fish species.

Conflict of interest statement

We declare that we have no conflict of interest.

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