Laboratory evaluation of *Mesocyclops aspericornis* as a biocontrol agent of *Aedes aegypti*

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Abstract

Mesocyclops aspericornis abounds in village ponds. Hence, the predatory capacity of *M. aspericornis* was considered for use as a biological control agent for *Aedes aegypti* mosquitoes. In laboratory experiments, *M. aspericornis* consumed 33–50 mosquitoe larvae within 24-hours time period. *M. aspericornis* preyed upon only the first instar larvae of *Ae. aegypti* within a few seconds after their introduction. It started feeding on the tail portion first and ended with the head capsule. The mean value (triplicate) showed that the predatory capacity was 45.76 against the control 1.2. *M. aspericornis* prefers only the first instar mosquitoe larvae and feeds on them voraciously. When the *Aedes* larvae attained the second instar stage, *M. aspericornis* attacked and killed them.

Keywords: Biological control; *Aedes aegypti*; *Mesocyclops apericornis*; Predatory capacity.

Introduction

In India, particularly in the state of Tamil Nadu, dengue and chikungunya have been reported from many places. The National Vector-Borne Disease Control Programme (NVBDCP) recommended the Integrated Vector Management (IVM) approach. This includes biocontrol agents. It has been proved that larvicidal measures sustain mosquito population for a short period and require repeated applications of chemicals and eventually develop resistance against that chemical[1]). Therefore, search for an effective biocontrol agent to control mosquito population has become top priority among researchers. Predatory fishes and zooplankton have been widely used as a biocontrol method to control vector population[2,3,4]. Integration of these methods can be a low-cost and environmentally-friendly approach in controlling mosquito vectors[5,6]. Cyclopoid copepods (planktonic microcrustaceans) have been extensively used as biocontrol agents in the South-East Asian countries for container-breeding mosquito species like *Ae. aegypti*[7]. The copepod, *Mesocyclops aspericornis,* is an effective predator of *Ae. aegypti*. It is known

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for its wide distribution and predatory efficiency against several species of mosquito larvae. The present study was conducted as a brief laboratory experiment designed to understand the mode of destruction of mosquito larvae by *M. aspericornis*.

Methodology

Out of a few preliminary surveys carried out in the nearby environs of Chennai, Capital of Tamil Nadu, two ponds were identified for the collection of cyclopoid copepods. The plankton mesh size used for the collection was 100 μm. Mesocyclops were isolated from the sample and identified up to species level with the help of standard keys[8,9]. *M. aspericornis*, once its species identity was confirmed, was selected for experimental studies and reared in the laboratory. Females with egg sacs collected from the stock were placed on a petridish and were examined under the dissection microscope. These were transferred into 600 ml beaker where 50 newly-hatched *Ae. aegypti* larvae were introduced. We sacrificed the second-generation *Mesocyclops* collected from our stock for experimental purposes. Fully-fed *Ae. aegypti* females were collected from the house and kept in a small cloth cage for egg-laying. The mosquitoes were provided a small dish, half filled with water, and a paper strip for egg-laying. The eggs were hatched in a Petri dish and used for experiment.

Fifty newly-hatched first instar larvae were introduced into a 600 ml beaker containing 500 ml dechlorinated water where a single *M. aspericornis* was introduced. The experiment lasted for 24 hours. The number of larvae that survived at the end of 24 hours was recorded. Triplicates were maintained simultaneously at 26±1 °C under photoperiod 12L:12D along with the control without the introduction of *M. aspericornis*.

Results

M. aspericornis preyed upon the first instar of *Ae. aegypti* larvae within 24 hours, which was recorded. In general, they attacked the tail region of the mosquito larvae and consumed them. On a few occasions they left out the head capsule of the mosquito larvae, and, at times they killed the mosquito larvae without consuming them. Ten experiments were conducted for 10 days in the laboratory on relay basis. *M. aspericornis* consumed about 33 to 50 first instar larvae of *Ae. aegypti* within 24 hours time period. The number of mosquito larvae left inside the experimental beakers ranged from nil to 17 nos. On the whole, the mean predatory capacity of a single *M. aspericornis* was calculated at 45.75 (see Table).

Discussion and conclusions

According to Nam *et* al.[10], the daily consumption/killing average of a single *M. aspericornis* ranged between 16 to 41 larvae. Through continuous observations, *M. aspericornis* attacked the first instar larvae within a few seconds. They mainly consumed the central portion, leaving the head capsule. Occasionally, they just killed the larvae without consuming it. Using their strong mandible they pierced and crammed the larvae into pieces. According to Lardeux et al.[11], *M. aspericornis* served as a good biocontrol agent against *Ae. aegypti* within a three-weeks time period. In the present study, 10 experiments were conducted simultaneously to know the predatory capacity of *M. aspericornis* under laboratory conditions. The maximum predatory capacity of *M. apericornis* was found to be 49.3 (mean value) and the minimum 39.3 (Table). Our results demonstrate that *M. aspericornis* is an efficient predator of *Ae. aegypti* under laboratory conditions.

Table: The mean value of *Ae. aegypti* larvae consumed by *M. aspericornis*

S. no.	Experiment no.	No. of *Ae. aegypti* larvae consumed by *M. aspericornis*			Mean value
		Triplicates			
		A	B	C	
1	1	42	42	45	43
2	2	33	40	45	39.3
3	3	50	50	48	49.3
4	4	50	44	46	46.6
5	5	46	50	46	47.3
6	6	47	47	48	47.3
7	7	46	46	48	46.6
8	8	50	48	48	48.6
9	9	45	47	45	45.6
10	10	44	44	44	44
					Total mean: 45.75

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