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Original Research Paper

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CONSUMPTION RATE OF CYPRINUS CARPIO L. AGAINST MOSQUITO LARVAE OF AE. ALBOPICTUS, AN. SUBPICTUS AND CX. PIPIENS FATIGANS.

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ABSTRACT *C. carpio* is good bio-control agent of mosquitoes. Therefore, consumption rate of C. carpio at the age of 60 day, 90 day and 120 day against IV instar larvae of *Ae. albopictus*, *An. subpictus* and *Cx. pipiens fatigans*. Consumption rate of *C. carpio against Ae.albopctus* was higher than An. subpictus and *Cx. pipiens* fatigans under laboratory condition (27 ± 1°C, 70-75% R.H. and 24 hr photoperiod).

KEYWORDS :

INTRODUCTION

Mosquitoes transmit life threatening diseases like Malaria, Dengue, Chikunguniya, West Nile virus etc. There is no antiviral drug or vaccine against Malaria, Chikunguniya and Dengue infection and no specific cure for JE and Lymphatic filariasis. These diseases can be minimised by environmental management for source reduction, personal protection, physical, chemical and biological control methods.

The use of chemicals for mosquito control minimizes cost of ecosystem, depletion of biodiversity and cause adverse effect on public health. Therefore, there is need to find out safer, non-toxic and efficient alternative to pesticides (Sathe, 2014). Control of mosquitoes in their larval stage is much easier and efficient than to control in adult stage. This can be achieved by biological control method.

Biological controlling agents used for mosquito control are flatworms, arthropods, insects and amphibians. Besides these all biological mosquito controlling agents, several larvivorous fish species are used for control of mosquitoes. Many fish species together form the major success in biological control of mosquitoes (Raghavendra and Subbarao, 2003). Use of fish of indigenous origin is found to more appropriate (Chandra, 2008; Sathe, 2014). The use of carnivorous fishes as larvicide for mosquito control sometime affects other useful fish fauna in that habitat and become dangerous to the native animal diversity.

Therefore, it is clear that there is need to search efficient and locally abundant fishes for the control of mosquitoes. it is also be good to fetch for bio-control potential of local fishes. *Cyprinus carpio* L. is an indigenous and common omnivorous fish (Flajshans and Hulata, 2006). Hence, in present study *C. carpio* have been used for control of mosquitoes.

MATERIALS AND METHODS

The fingerlings of *C. carpio* were collected from government fish farm, Dhom, District Satara, Maharashtra, India. The glass aquariums of size 45 X 30 X 30 cm (length x width x height) provided with 15 lit. of water, proper aeration and conventional fish feed, groundnut oil cake were used for detecting mosquito bio-control potential of Pisces. Laboratory (27 ± 1°C, 70-75% R.H. and 24 hr photoperiod) reared mosquito larvae (IV instars) of *Cx. pipiens fatigans, Ae. aegypti* and *An. subpictus* with 50, 100 and 150 density were exposed to *C. carpio* of age 60 day old, 90 day old and 120 day old for 24 hr and consumption rate of pisces for mosquito larvae was noted. Experiments were replicated for five times. The results have been tested statistically by standard deviation and ANOVA analysis.

RESULTS

Results are recorded in fig. 1, fig. 2 and fig. 3.

Consumption rate of *C. carpio* of 60 day old with respect to IV instar mosquito larvae was 65±2 % for *Ae. albopictus*, 62±3 % for *An. subpictus* and 54±2 % for *Cx. pipiens fatigans* with 50 larval density. At density of 100 larvae, consumption rate of *C. carpio* was 68±2% for *Ae. albopictus*, 65±1% for *An. subpictus* and 55±2 %, for *Cx. pipiens fatigans*, while, at the density of 150 larvae, bio-control potential of *C. carpio* against *Ae. albopictus, An. subpictus* and *Cx. pipiens fatigans* were 64±1 %, 63±3 % and 58±2 % respectively. The results indicated that the *C. carpio* preferred to feed upon *Ae. albopictus* larvae more than *An. subpictus* and *Cx. pipiens fatigans* larvae . ANOVA analysis indicated that the feeding rate of *C. carpio* for *Ae. albopictus* and *An. subpictus* was significantly higher than that for *Cx. pipiens fatigans* larvae ($p< 0.01$) at all larval densities.

Consumption rate of *C. carpio* of 90 day old was 78±3 % against *Ae. albopictus* larvae, 73±3 % for *An. subpictus* and 61±3 % for *Cx. pipiens fatigans* larvae at density of 50 larvae. At 100 larval densities, bio-control potential of *C. carpio* was 76±54% for *Ae. albopictus*, 71±3% for *An. subpictus* and 70±5 %, for *Cx. pipiens fatigans*. At the density of 150 larvae, the bio-control potential of *C. carpio* was 77±5 % for *Ae. albopictus,* 71±3 % for *An. subpictus* and 70±5 % for *Cx. pipiens fatigans*. These results indicated that, *C. carpio* preferred to feed upon *Ae. albopictus* larvae more than *An. subpictus* and *Cx. pipiens fatigans* larvae at all larval densities exposed. ANOVA analysis indicated that the bio-control potential of *C. carpio* for *Ae. albopictus* was significantly higher than *Cx. pipiens fatigans* larvae ($p< 0.0001$) at all larval densities.

Bio-control potential of *C. carpio* of 120 day old (size 7.8 cm) was 79±1 % for *Ae. albopictus* larvae , 78±3% for *An. subpictus* and 68±5 % for *Cx. pipiens fatigans* at 50 larval density. At density of 100 larvae, its bio-control potential was 81±2% for *Ae. albopictus*, 80±3 % for *An. subpictus* and 69±2 %, for *Cx. pipiens* larvae. At the density of 150 larvae, the bio-control potential of *C. carpio* was 82±2 % for *Ae. albopictus*, 75±3 % for *An. subpictus* and 65±5 % for *Cx. pipiens fatigans*. These results indicated that the *C. carpio* preferred *Ae. albopictus* larvae more than *An. subpictus* and *Cx. pipiens fatigans* larvae. ANOVA analysis indicated that the consumption rate of *C. carpio* for *Ae. albopictus* was significantly higher than that of *An. subpictus* followed by *Cx. pipiens fatigans* larvae ($p< 0.001$) at all larval densities. There was no statistically significant effect of larval density of *Ae. albopictus, An. subpictus* and *Cx. pipiens fatigans* on bio-control potential of *C. carpio* ($p >0.05$). However, results indicated that bio-control potential of *C. carpio* increased with increase in age and size against mosquito larvae.

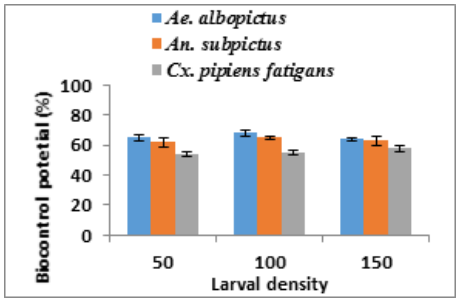

FIG.1 Bio-control potential of 60 day old *C. carpio* with respect to different densities of IV instar mosquitoes.

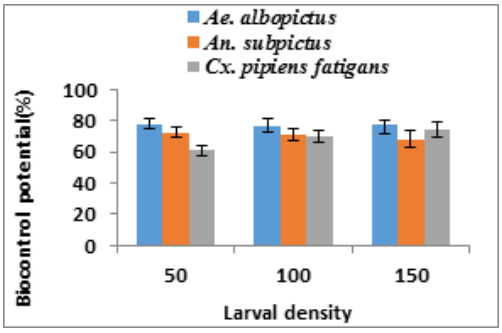

FIG. 2 Bio-control potential of 90 day old *C. carpio* with respect to different densities of IV instar mosquitoes.

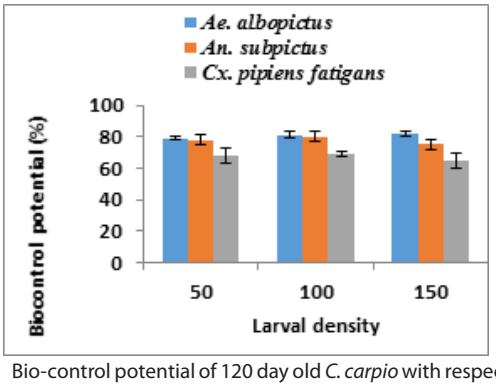

FIG. 3 Bio-control potential of 120 day old *C. carpio* with respect to different densities of IV instar mosquitoes.

DISCUSSION

Pesticides are harmful in the sense of bioaccumulation, biomagnif ications as well as being toxic to animal food chain and human health (Pauluhn, 1996, 1999; Stahl 2002; Enserink *et al.* 2013). The biological control of mosquitoes is possible through use of many predators feeding on mosquito adults and larvae. *P. reticulata* and *G. affinis* were commonly used for the control of mosquito larvae (Elias *et al*., 1995; Chandra *et al*., 2008). Ghosh *et al*., (2005) studied the use of *C. carpio* in biological control of *An. stephensi*. 2 fingerlings of *C. carpio* consumed 295±1.73 larvae and 227±6.12 pupae per day. A significant decrease in larval abundance was observed during 35 days of fish introduction. Because of this feeding behaviour, *Ae. albopictus* larvae spend more time at bottom. The *C. carpio* is omnivorous bottom feeder fish mostly feeding on Zooplanktons and debris (Sibbing, 1988, Manon and Hossain, 2011). However, in present study *C. carpio* was efficient bio-control agent of *Ae. albopictus* larvae than *Cx. pipiens fatigans* and *An. subpictus*. Carp also feed on *An. subpictus* and *Cx. pipiens fatigans* larvae but in fewer numbers. In previous studies *C. carpio* were used in composite fish culture in rice field which resulted in 81% reduction in population of anopheline and 83.5% reduction in culicines (Victor *et.al.*, 1994).

Indian major carps, Rohu, Catla and Mrigal along with Guppy have been used for control of malaria (Kant *et al.*, 2013). In China Wu *et al.* (1991) found the stocking rice paddies with edible fishes like grass carp, tilapia and common carp improved rice field and greatly reduced the number of malaria cases by reducing population of *Anopheles sinensis* Wiedemann within 150-170 days.

Sathe and Bhoje (2005) studied the bio-control potential of *P. reticulata* for mosquitoes *An. stephensi* and *Cx. pipiens fatigans* under laboratory conditions (25 ± 1°C, 65-70% R.H. and 12 hr photoperiod) with mixed prey density. After 72 hr exposure they reported 79.6 % and 58.4 % consumption of *An. stephensi* and *Cx. pipiens fatigans* larvae respectively. Consumption of mosquito larvae was higher in females than males in both the species of mosquitoes. Two main factors which determines the efficacy and suitability of fish as bio-control agent includes the ability of the fish to eat enough larvae of vector species to reduce the number and the suitability of the breeding environment of the mosquitoes. The second factor is best known by finding a native fishes that thrives under conditions prevalent in breeding sites rather than to change breeding sites to accustom the fish (Chandra, 2008).

Sathe and Kawane (2014) studied a role of 19 Indigenous and 7 exotic fish species in mosquito control with their morphological, breeding and utility features. According to Sathe and Kawane (2014) fish used for bio-control should have potential for unintended impacts, self replicating capacity, climatic compatibility, capability to maintain very close interactions with target prey populations and search efficiency.

Present finding confirms the bio-control potential of *C. carpio* against *Ae. albopictus*, *An. subpictus* and *Cx. pipiens fatigans* by causing 74 %, 70% and 64% mortality respectively. It would be interesting to release the fish *C. carpio* in open breeding environment of mosquitoes for their control. The results showed that the *C. carpio* can be used efficiently to control the *Ae. albopictus* larvae.

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