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Mosquito larvivorous potential of some indigenous fishes

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Abstract

Natural enemies such as predators play an important role in checking the proferation of vectors in Natural habitat in breeding grounds. *Gambusia affinis* popularly known as Doctor fish is well known predatory fish can be cultured and used in vector control programme. In the present study, use of 3 indigenous fishes in vector control have been reported. The fishes were recovered from Machna river and used in the laboratory to control *Anophelese stephensi* and *Aedes aegypti* larvae. Laboratory testing in glass aquarium contaning 5 fishes of each *Ajystus cavasius, Danio devario, Rasbora daniconius* alongwith *Gambusia affinis*, revealed that as far as predatory efficacy is concerned *Mystus cavasius* stands 1st and consumed 130 larvae/day/fish. It was noticed during the course of experiment that fishes prefer I/II instar larvae than III/ IVth instar larvae of both the species. The study was also conducted with and without fish food. To observe larvivorous potential. It was noticed that fish food has some effect on the predatory habit of these fishes. In the presence of fish food, the predatory period was found to be increased by 5 minutes to 20 minutes more. Gut content analysis of the fishes showed not only the mosquito larvae but some nematodes, annelids. beetles, algae and unidentified material. The result of the present study thus suggest that indigenous fishes edible value can be cultured in small ponds and other water bodies to reduce the vector bone diseases. Without disturbing the ecosystem and causing no ill effect to the human health.

KEYWORDS:Larvivorous, Indigenous, Anopheles, Eco-friendly,Gambusia,Mystus ,Rasbora.

Introduction

Haas (1984) provided a guide for the preliminary identification of larvivorous fishes. Das and Prasad (1991) reported that rice cultivation in the country contributes to the production of many mosquito vectors. It provides breeding places for *Anopheles, Culex, Aedes* and *Monsonia*. The control of the mosquitoes in rice-field can be achieved through the introduction of *Gambusia affinis* with two indigenous fish *Danio oryzias*. Yadav and Das (1990) also have described the role of these two fishes in the control of mosquito breeding in the rice-field. Gerverich and Laird (1985) have mentioned that as many as 253 species of larvivorous fishes are used in the biological control of mosquitoes in different parts of the world. Nelson and Keenan (1992) mentioned that

indigenous fish species *Fundulus zebrius* are among the most important agents use for mosquito control. Similar views have also been expressed by Sholdt *et al.* (1972).But WHO Expert Committee (1982) recommends that Doctor fish should be used less than the local fishes. Haas and Pal (1984) suggest the need for more careful evaluation of larvivorous fish species besides *Gambusia affinis*. Recently, Saxena. (1996) also emphasized the need of local fishes for mosquito control in aquatic habitat.

Bioenvironmental control of malaria was launnched in Vizadandi Block in Mandla district of Madhya Pradesh by Singh *et al.* in (1989).,since then there is no much progress made in the direction of bioenvironmental control of mosquito in this state. During 1970 widespread resurgence of malaria was reported in India. (Sharma 1989) and recently also there have been an outbreak of malaria in the Eastern pocket of India. The cerebral malaria caused by the *Plasmodium falciparum* is on the rise now-a-days. Therefore, biological control looking to the local ecological and environmental conditions, needs a special attention, Haq *et al.* (1991) described the role of *Gumbusia affinis* along with food fishes for the control of mosquito vector. Panicker *et al.* (1992) made a study on the cost-benefit analysis report . Panicker 1986 mentioned that mosquito control strategies are closely associated with social economy, so in any future program, economic factor should be dealt with care.

A number of tropical diseases are transmitted by different species of mosquito vectors which breed a variety of aquatic habitats. As pointed out by Prasad *et al.* (1993) rice fields play a very important role in building up a high adult vector density because of vast.

Materials and Methods

For the present study, the three indigenous fishes were used.The equipments were collected in glass aquarium in laboratory condition. During the course of present study, three indigenous fishes were collected from fresh water bodies in and around Vidisha.The fishes tested for the present study for predatory efficiency test were *Danio devario, Mystus cavasius, Rasbora daniconius* along with *Gambusia affinis* which served as standard predatory fish. The fish larvivorous potential was examined individually or each fish as well as all the three fishes taken together in a group. The experiments were done alongwith fish food and without food.

Results

From the result in table no.-1, predatory performance test was performed in glass aquarium (22x22x38cm.)having five fishes of each species to which 50 IV instar larvae of *Anopheles stephensi* were added in which two litre of water was already poured. The predatory period which was recorded show that *Mystus cavasius* took 2 minute period to consume 50 larvae. This was followed by *Rasbora daniconius* which took 5 minutes to consume entire 50 larvae. The *Danio devario* fishes, however, took 30 minutes to consume 50 larvae.

Therefore, from the results in Table-1, predatory rate was found to be quite high in case of *Mystus cavasius*. These preliminary observations were further confirmed by taking each species of fishes individually in glass beaker. The results mentioned in Table-1 indicate the predatory efficacy of these fishes without fish food.

Results mentioned in Table-2 show the predatory efficacy of the fishes provided with 10 mg. of fish food per container per day along with the IV instar larve of *Anopheles Stephensi*. It was noticed that predatory period got increased, it was found to be 5 minutes, which was just double to the period of consumption of larvae in the absence of fish food in case of *Mystus cavasius,* the highly voracious fish. However, in case of *Danio devario* presence of fish food does not affect the predatory habit and as indicated in the Tables-1 & 2 the fishes took 30 minutes to consume 50 IV instar larvae.

From the results, it appears that fish food has some effect on the predatory habit of these fishes as *Rasbora daniconius* also in the presence of fish food, the period of predation of 50 larvae was found to be increased as compared to the fishes tested without fish-food. Even the larvivorous fish *Gambusia affinis* also took five minutes more to consume 50 larvae in the container having fish food. Therefore, it seems that fish-food in the natural habitat may influence the predatory behaviour of these fishes.

Table-3 shows the predatory efficacy of the fishes in group. When four different species of fishes were taken together in a glass aquarium with and without fish food. 75.1% Consumption without fish food while there was only 60.8% consumption of prey in the aquarium provided with fish food along with the prey.

The result showed that predation rate per fish per minute got considerably decreased in the container provided with the fish food. 0.760/min./ fish as compared to 1.121/min./fish in glass

aquarium without fish food. Thus, it is quite apparent from the results that the standard fish food reduce the rate of predation of fish.

This, therefore, should be taken into consideration while working on larvivorous potential of the fishes as biological control agents against mosquito vectors. Since, in the aquatic ecosystem, the natural habitat of fishes harbours variety of other organism along with mosquito larvae.

Laboratory test were conducted in glass aquarium containing five fishes each, (except) *Mystus cavasius* (3). 400 IV instar Anopheline larvae were introduced in the aquarium on the first day, those that survived 24 hours later were counted and the number made up to 400 again. The experiment lasted for four days.

Tests on larvivoracity revealed (Table-4) that *Poecilia reticulata* and *Gambusia affinis* fed on an average 40.5 larvae per day while maximum 132 larvae per day were consumed by *Mystus cavasius.* The other two fishes *Danio devario* and *Rasbora daniconius* consumed only 80 larvae per day. Therefore, among 5 fishes. *Mystus cavasius* consumed the highest number of IV instar larvae of Anopheline mosquitoes.

Results in Table-5 shows the ranking of the fishes with larvivorous behaviour of each. The initial ranking was done on the actual number of larvae consumed. However, the rate of consumption, when compared in relation to the body weight of fishes was very high for *Mystus cavasius* (18.95 gm.body wt./day), followed by *Poecilia reticulata* (15.5 gm body wt./day).

The Table also shows that maximum initial ranking was noticed in *Mystus cavasius* for culicine and Anopheline larvae equally (130 larvae/day/fish).There is a slight difference in the initial ranking of anopheline and culicine larvae of the five different fishes. Except *Mystus cavasius*, the other fishes showed slightly higher consumption of culicine rather than anophelene larvae.

Table-6 showed the predatory habit of fishes on culex and anopheles larvae. The five different fishes were kept separately in glass beaker containing a single specimen of each I/II instar and III/ IV instar larvae of culex and anopheles in counted number were released in each beaker and the predatory habit was examined after 24 hour interval .The results mentioned in the table are the data for 24 hour duration. The results showed that there is no preference regarding the two different larval species of mosquitoes. Only in *Danio, Rasbora* and *Gambusia,* it was noticed that they show some preference to the I/II instar larvae of both the species and a little less to the III/IV instar larvae.

Discussion

It is quite apparent that the maximum rate of consumption of larvae was noticed in *Mystus cavasius, Rasbora daniconious* ranks second as far as its predatory habits are concerned. The rate of feeding in *Gambusia affinis* was ranked third. From the results it was noticed that *Mystus cavasius* consume all the larvae within 5 minutes when the fish-food also dispersed in the aquarium (10 mg/aquarium). No doubt, all the fishes consume the larvae left in the aquarium but their predatory rating was quite different. *Mystus* seems to be a potent larvivorous fish which preferred the larvae diet even if there is a preferential choice of fish food.

The predatory behaviour of all the fishes were also examined by taking all the five different fishes in a group. From the results, it is quite clear that predatory potenial was suppressed when fishes were provided with larvae and fish food (60.8%) as compared to the 75.1% larvivorous potential of the fishes when there was no choice except larvae.

The larvivorous potenital when analysed in terms of number of larvae consumed/ minute/fish. the *Mystus cavasius* and *Rasbora daniconius* passed the highest rate of predation in laboratory condition. Therefore, the results conclude that *Mystus* and *Rasbora* could be introduced in small ponds ditches, reservoirs and other such habitats where mosquito breed as biological control agents.

The mosquito control measures being shifted towards ecologically safe, less hazardous and economically feasible methods such as bioenvironmental and biological control measures. Larvivorous fishes,predatory insects as well as other bioagents are therefore being tried and the results of the present study seemed to be quite encouraging for using fishes *Mystus cavasius* and *Rasbora daniconius* as a potential biocontrol agent of mosquito larvae. Prasad & Sharma (1994) also stressed the needs of indigenous fishes in biological control of mosquitoes. Similarly, Jayshee & Panicker (1992) also reported the use of more than 34 indigenous fish species for larvivorous potential and found that *M.cupanus* possessed the highest rate of predation in laboratory-cum-field trial. Ismail (1988) also suggested the use of fishes as potential biocontrol agents for mosquito. The results of the laboratory experiments by taking indigenous fishes, therefore, seems quite encouraging that besides , Guppy fishes, *Mystus & Rasbora* like small sized fishes could be used as biocontrol agents of mosquitoes. A field trial will be followed later on.

As many as 253 or more species of larvivorous fishes have been reported as biocontrol agents of mosquito by Geberich and Laird (1985). From the present study also, it emerges that indigenous larvivorous fishes have more advantage than exotic ones as they are well-suited to the local conditions, similar views have also been expressed by Hass (1984). The maximum feeding intensity was observed for *Mystus cavasius* (132.0 larvae/day) which was found to be superior predatory intensity as reported by Jayshree & Panicker (1992) in the case of *A.testudinus* (88.89%). Sharma *et al*. (1987) also reported the role of indigenous fishes in the control of mosquito breeding. They have emphasized the production of edible fishes with indigenous larvivorous fishes to motivate the village community for the composite fish culture on large scale to control mosquito breeding and improve the village economy. Haq *et al*. (1991) have prompted the culture of *Gambusia affinis* with fishes. Victor *et al.* (1994) have also reported the use of fish as biological control agents to control the breeding of mosquitoes in the rice-fields of Southern India. Therefore from the discussion, it seems that composite fish culture can be a good source of economy as well as of biological control agents of vectors.

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Table-1 Predatory Efficiency of Fishes without Fish Food (Individual Fishes)

S.No.	Fish name	Number of Fishes	Predation onIV instar larvae	Predatory Period	Larvae Fed
1.	*Danio devario*	*5*	*50*	*30 minutes*	*50*
2.	*Mystus cavasius*	*5*	*50*	*2 minutes*	*50*
3.	*Rasbora daniconius*	*5*	*50*	*5 minutes*	*50*
4.	*Gambusia affinis*	*5*	*50*	*10 minutes*	*50*

* IV instar larve of *Anopheles stephensi* in three replicates

Table-2 **Predatory Efficiency of fish with fish food (Individual fish)**

S.No.	Fish Name	Number of Fishes	Fish Food	Predation on Larvae	Predatory Period	Larvae Fed
1.	*Danio devario*	5	10 mg.	50	30 Mintues	50
2.	*Mystus cavasius*	5	10 mg.	50	5 Minutes	50
3.	*Rasbora daniconius*	5	10 mg.	50	30 Minutes	50
4.	*Gambusia affinis*	5	10 mg.	50	15 Minutes	50

* *Anopheles stephensi* IV instar in three replicates.

Table- 3 Predatory efficiency of fishes in Group

S.No.		No. of Fishes	No.of prey	Predatory period	No. of prey consumed	% of feeding	Predatory rate/min./fish
1.	Without fish food	4	200	33.3 minutes	151.3	75.1%	1.2080
2.	With fish food	4	200	40.0 minutes	121.66	60.8%	0.7602

Table- 4 Laboratory test for larvivoracity

S.No.	Fishes	Size in cms.	Fishes No.	Number of Mosquito larvae consumed					
				Day-1	Day-2	Day-3	Day-4	Total	Average
1.	*Danio devario*	4.0-6.0	5	400	400	400	400	1600	80
2.	*Mystus cavacius*	4.0-7.0	3	396	386	400	400	1582	132
3.	*Rasbora daniconius*	3.0-4.0	5	400	400	400	400	1600	80
4.	*Gambusia affinis*	2.5-3.0	5	350	130	100	330	810	40.5
5.	*Poecilia reticulata*	2.5-3.0	5	350	100	130	330	810	40.5

Table - 5 Ranking of Larvivorous fishes based on predatory efficiency

S.No.	Fish species	Predatory on Culicine Larvae		Predation on Anaphelene larvae	
		Initial	Ranking based on per gm. body weight	Initial	Ranking based on per gm. body weight
1.	*Mystus cavasius*	130	18.45 gm	130	18.45 gm
2.	*Poecilia reticulata*	120	15.5 gm	120	15.5 gm
3.	*Rasbora daniconius*	115	10.2 gm	110	10.2 gm
4.	*Danio devario*	110	5 gm	110	5 gm
5.	*Gambusia* affinis	90	5 gm	80	5 gm

Table - 6 Predatory Habits of Fishes on Mosquito Larvae

S.NO.	Fish species	Pre density of IV instar larver of			
		Culex quinquefasciatus		*Anopheles stephensi*	
		I/II instar	III/IV instar	I/II instar	III/IV instar
1.	*Mystus cavasius*	130	90	130	90
2.	*Poecilia reticulata*	120	85	120	85
3.	*Rasbora daniconius*	115	85	110	75
4.	*Danio devario*	110	80	110	70
5.	*Gambusia affinis*	90	45	80	35