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A Search for Mosquitocidal Fish Species as Biocontrol Agents

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bstract

xperiment were conducted to investigate the feeding preferences of different indigenous fishes in natural habitat of NWFP. total of 426 fish specimens were collected from two diverse localities of Peshawar and Swat. Identification of fish ecimen revealed 9 and 6 different species from Peshawar and Swat respectively. Fishes were further categorized in rnivores, omnivores and herbivores by analyzing their gut contents. Main objective of our study; was to identify digenous fishes which can serve as biocontrol agents to eradicate mosquito larvae in local conditions. Our preliminary sults indicated that five species were carnivorous, four herbivorous and three omnivorous.

ntroduction

xcessive use of deadly chemical pesticides to control osquito, people have now unfortunately concerned about sistant mosquitoes to chemical pesticides, health hazards ssociated with the more toxic chemicals and adverse ffects on the environment. In the presence of resistant osquitores, scientific studies to develop alternate rategies require long-term sustained commitment, which as become more difficult to achieve. The development of secticide resistance in disease vectors and other etermental effects of chemicals on flora and fauna, have invigorated the research on biological control of osquitoes.

oth mosquito and fish are closely associated in an aquatic abitat. Larvicidal fish has a great potential to be employed s mosquito control agent in the breeding places (Amjad, 968). Since, larvicidal fishes are a potential sources to educe mosquito larval populations (Ahmad *et al.*, 1988), so earch to the local fish habitat may help in mosquito ontrol.

n the past fishes have been recognized as effective and heap source of mosquito control for almost past whole entury (Coykendal, 1980). Biological control has a long istory of use in pest management and has gained a enewed interest because of problems encountered with the se of pesticides.

During present century the use of fish for control of mosquitoes has also been grown. Mosquitorcidal fish *Gambusia affinis* has been imported from South Eastern USA to waters in many countries around the globe for mosquito control. Two American fishes *G. affinis* and Poecilia reticulata has been used extensively for the eradication of mosquitoes. A total of 216 fishes has been documented as mosquitocidal ability so far (Gerberich, 1966).

The historical biological control has been spectacularly successful in many instances, with a number of pest problems permanently resolved by importation and successful establishment of natural enemies. These importation successes have been limited largely to certain type of ecosystems. Thus importation progress to date, are largely a matter of trial and error based on experience of the individual agents involved. It is thus preferable to use fish species that are already present in local habitat. Mosquitocidal fishes are found in almost every country in a wide variety of habitat.

Materials and Methods

Area of fish collection: Two drains were selected to undertake our search in N.W.F.P. One drain was situated in Swat valley, 6 km away from Mingora city near a moderately populated village, Aligrama. This drain passed through agricultural landscape. The flow of water varied at different places. The second water drain used for our fish collection, was a man made agricultural water drain in Shahi Payan village in District Peshawar. Fishes were collected from June through September, 1995.

Fish collection: Fish samples were collected with the help of a small narrow-meshed (size ranging) from 1 to 3.24 cm^2) hand net. The fish samples were immediately preserved in 10 percent formalin after collection to stop their metabolism.

Fish identification: Collected fish samples were identified as documented (Mirza, 1982, 1990; Talwar and Jhingran, 1991).

Fish gut contents:Fish samples were dissected and their gut contents removed carefully and studied under binocular microscope. The insects recovered from the gut were identified as described (Pennak, 1953; Edmondson, 1959; Borror and Delong, 1970).

Results

This study was carried out on a total of 426 fish specimens belonging to 12 different species of local fishes. Five fish species were observed to be carnivores because no plant mater was found in their gut contents (Table 1). These five species were identified as *Barilus. vagra, Channa. punctatus, Danio. devario, Mystus. bleekeri* and *Noemacheilus. Botia*. The food found in gut contents of *B.*

Table 1: Distribution of the total sample of fishes studied according to the nature of the stomach contents

Fish species	Insects	Plant matter	Insects + Plants	Empty stomach	Total
Aspidoparia morar	Nil	10	Nil	Nil	10
Barilius vagra	33	Nil	Nil	50	83
Channa punctatus	10	Nil	Nil	17	27
Crossocheilus latius	Nil	94	Nil	Nil	94
Danio devario	3	Nil	Nil	4	7
Garra gotyla	Nil	40	Nil	Nil	40
Mastacembelus armatus	19	2	4	7	32
Mystus bleekeri	8	Nil	Nil	11	19
Noemacheilus botia	6	Nil	Nil	20	26
Puntius sophore	1	13	Nil	Nil	14
Puntius ticto	5	57	8	2	72
Unidentified	Nil	2	Nil	Nil	2
Total	85	218	12	111	426

Table 2: Frequency distribution of fishes by aquatic animals found in their guts

Fish species	Total	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
A.armatus	32	-	2	-	1	7	2	-	11	-	4	4	-	-	-	-	-	2	3
C.punctatus	27	-	-	-	-	4	2	1	2	-	1	-	-	-	-	2	2	-	1
D.devario	7	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	-	-	3
P. ticto	72	-	1	1	-	-	2	-	-	-	-	-	-	-	8	1	-	-	1
B. vagra	83	4	-	-	-	1	-	-	3	-	-	-	7	1	1	10	3	-	3
M.bleekeri	19	8	-	-	-	-	-	-	1	1	1	1	-	-	5	1	4	-	1
N. botia	26	-	-	-	-	-	-	-	-	-	-	1	-	-	4	-	-	-	1
P.sophore	14	-	-	-	-	-	-		-	-	-	-	-	-	1	-	-	-	
G.gotyla	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
C. latius	94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
A.morar	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unidentified	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	426	12	3	1	1	12	7	1	17	1	6	13	1	1	30	7	6	2	

Key:

A. Ephemeroptera B. Odonata C. Orthoptera D. Plecoptera
E. Hemiptera F. Coleoptera G. Neuroptera H. Trichoptera
I. Lepidoptera J. Tabinids K. Chironomids L. Mosquitoes
M. Hymenoptera N. Insect parts O. Other arthropods P. Mollusks
Q. Fishes R. Total

vagra and *D. devario* were mainly insects. A mosquito larva (*Culex quinquefasciatus*) was also identified from the gut contents of *B. vagra. C. punctatus* and *M. Bleekeri* fed on a variety of animals like mollusks, insects and other arthropods. *N. botia* gut contents had caddisfly and chironmoid as its food (Table 2).

Out of 12 species, three species, Mastacembelus armatus, Puntius sophore and *Puntius ticto* can be categorized omnivorous. *M. armatus* was found to be mainly carnivorous though some plant matter was also found in their guts. Gut contents of 23 specimens of M. armatus had eaten insects. *Noemacheilus botia* and *Puntius ticto*, two small fishes, were also found in the guts of two specimens of *M. armatus. Puntius sophore* and *Puntius ticto* gut contents contained a mixed food of plant and animal.

The remaining four species, *Crossocheilus latius, Garra gotyla, Aspidoparia morar* and the unidentified one, were found to be herbivorous.

Discussion

Some of the fish specimens were found with e stomachs which showed no availability of food mate their surroundings. The other possible reason could the possibility of microorganisms as their food, t possibility of digestion of all food materials. The s reason seems more plausible, because there are reports which show marked periodicity in their f activity (Spencer, 1929; Spoor and Schloemer, 193

Channa punctatus: It was found to be a carnivor Hodgson (1914) had documented C. punctatus as predator of mosquito larvae.

Danio devario: It was also found to be a carnivore collection while Khushdl (1979) reported some plant in the gut c ontents of this fish. The possible reas

pure carnivore in our fishes may be the availability of nsects. This fish may prefer insect than plant material. In ther report by Perri (1914) quoted that another related pecies of D. devario, Danio rerio can eradicate all the nosquito larvae in paddy field. Rao and Yazdani (1977) ad also recommended the augmentation of this species as nosquito control agent.

arilius vagra: In our collection this species turned out to be carnivore. Our observations are in total agreement with Vilson (1914), Meehean (1967) and Ali (1971).

untius ticto: Previous reports (Chacko and Kurigan, 1948) howed it as an insect eating fish. Later Ali (1971) found his fish as herbivore. Our results are in agreement with Ali 1971) found this fish as herbivore where as Khushdil 1979) had reported this species as a herbivore. Our results re in agreement with Ali (1971).

untius sophore: Khan (1943) had reported that P. sophore s a good predator in captivity but in natural conditions, it refers plant matter. There are contradictory reports Ali 1971), Ali and Hussain (1973) and Khushdil (1979).

arra gotyla: Previous reports from Khushdil (1979). Ali and lussain (1973) confirmed its herbivore nature.

spidoparia morar: Ali (1971) had reported this fish a erbivore and our results are also in agreement.

lystus bleekeri: Our result showed this fish species a arnivore which has already been reported (Khushdil, 979). On the basis of our observations in present study, . vagra, P.l ticto and P. sophore and C. punctatus found to e good choices for biological control and can be used for nosquito control. A detail study must be carried out before ntroduction of these fishes for mosquito control.

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