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HELMINTH PARASITES OF FISHES FROM THE ARABIAN GULF
1. PRELIMINARY GENERAL SURVEY OF FISHES MAINLY FROM QATARI WATERS

M. F. A. SAOUD, M. M. RAMADAN* and K. S. R. AL KAWARI

Department of Zoology, Faculty of Science,
University of Qatar, Doha, State of Qatar

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ABSTRACT

The present work reports the results of a preliminary survey on the helminth parasites of some fish, caught mainly from Qatari waters in the Arabian Gulf. The incidence of helminth infections varied in various fish families, being lowest in Sparidae and highest in Serranidae. Pure infections with trematodes were common, but similar infections with nematodes, cestodes and acanthocephala were less frequent. The majority of double infections with two groups of helminth parasites had trematodes in combination with either nematodes, cestodes or acanthocephala, while simultaneous double infections of nematodes with either cestodes or acanthocephala were less common. Rarely, fish had simultaneous triple or quadruple infections, with various groups of helminths. Certain species of fish had infections with one genus of trematodes, whereas infections with 2–7 genera of trematodes were reported in other species. 18 genera of digenetic trematodes are recorded for the first time in the Arabian Gulf. Host specificity at the generic level was considered. In certain instances, a particular genus of trematodes was restricted to one species of fish, but in other cases, host specificity was less marked, with certain trematode genera being found in 2–9 species of fish. In one species, a correlation was observed between the incidence and intensity of the trematode infection.

INTRODUCTION

The Arabian Gulf is an offshoot from the Indian Ocean with a surface area of approximately 226,000 km^2. The Gulf is a shallow semi-enclosed area in a highly arid climatic zone (Grasshoff, 1976).

Qatar is a peninsula, projecting towards the central part of the Gulf and located almost midway between Shatt Al Arab in the North and the Strait of Hormuz in the

* Department of Biology, Faculty of Education, University of Ain Shams, Cairo, Egypt.

South (Fig. 1). The State of Qatar includes this mainland peninsula and a number of islands around it.

Qatari water is defined as the body of water which is within the boundaries demarcated by the State of Qatar for the 'exclusive economic zone'. The surface area of Qatari water is estimated to be about 35,000 km^2, which is about 15 % of the area of the Arabian Gulf (Sivasubramaniam and Ibrahim, 1984).

The fish fauna in various parts of the Arabian Gulf has been described by various authors (White and Barwani, 1971; Kuronuma and Abe, 1972; Al-Kholy and Soloviov, 1978; Randall *et al,* 1978; Al Daham, 1979; Al Sedfy *et al,* 1982 and Sivasubramaniam and Ibrahim, 1982). Fishes of the Qatari waters belong to 136 species, which are classified in 54 families of teleosts and elasmobranchs (Sivasubramaniam and Ibrahim, 1982).

The study of the parasites of fishes in the Arabian Gulf is very important for a number of reasons. The fish fauna of the Gulf is rich and fishes constitute a popular meal for people of the region. Fisheries of the Gulf are destined to play an increasingly important role as a source of animal protein for local consumption as well as for export. Nowadays, it is well accepted that the development of fish resources could be enhanced through the proper study of various aspects of fish biology, including fish parasitology (Williams, 1967; Williams and Jones, 1976). Worldwide, the study of fish parasitology is recognized as an important subject in many zoological and parasitological institutes.

A survey of the available literature indicates the paucity of information on the parasites of fishes in the Arabian Gulf. Apart from a limited study on the helminth parasites of fishes from Kuwait (Al Yamany and Nahhas, 1981), nothing has been published on the parasitic fauna of fishes in this region. In contrast, several studies have been published on the parasites of fishes from a nearby region, the Red Sea, which is another important offshoot from the Indian Ocean. As early as the thirties and up to the late sixties of this century, Professor H.F. Nagaty and his associates published a series of papers on the digenetic trematodes of Red Sea fish and a full recapitulation of that work has been reported by Nagaty (1973).

Saunders (1960) published the results of a general survey of blood parasites in fishes of the Red Sea. Saoud (1963) described a cestode from the sting ray

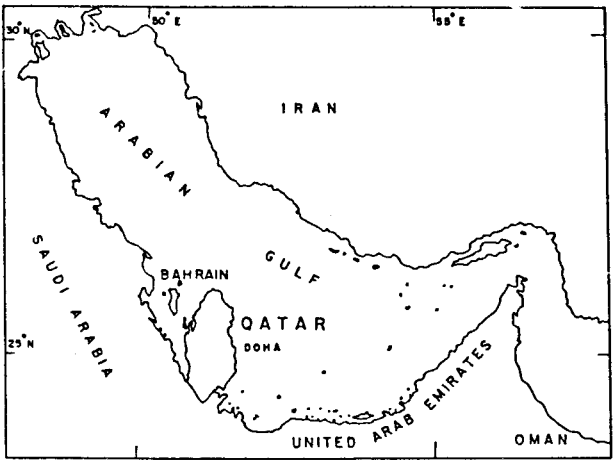

Fig. (1 A) The Arabian Gulf

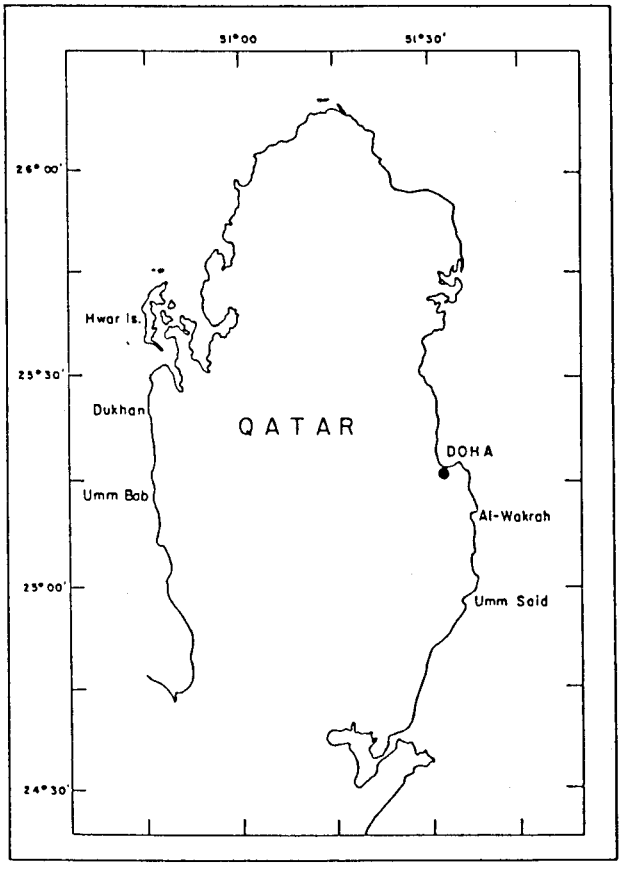

Fig. (1 B) State of Qatar

Taeniura lymma. Parukhin (1970) recorded several trematodes from the fishes of the Red Sea and Gulf of Aden. Hassan (1976) made a comprehensive study of helminth parasites, mainly cestodes of marine elasmobranchs collected from the Egyptian coastal waters of the Mediterranean and Red Sea. Saoud *et al* (1977) described a trematode parasite of a perciform fish from the Sudanese coast on the Red Sea.

Ramadan (1979) described 34 species of trematodes and cestodes from the Red Sea fishes. Ramadan (1982) described *Rhagorchis manteri* from a scarid fish from the Red Sea. Ramadan (1983a) described two species of the genus *Stephanostomum* from Red Sea fishes. In the same year, he revised the genus *Hamacreadium* with a description of two species of the same genus from the Red Sea fishes (Ramadan, 1983b). The same author described trematodes of the genus *Monostephanostomum* from a lethrinid fish from the Red Sea and in the same year, he revised the genus *Tubulovesicula* and described another species from that genus from Red Sea fishes (Ramadan, 1984a and b).

Saoud and Ramadan (1983) published the results of a general survey on the digenetic trematodes of some Red Sea fishes. Later, both authors described two trematodes of the genus *Pseudoplagioporus* from Red Sea fishes (Saoud and Ramadan 1984a). Moreover, they described two trematodes of the genus *Pedunculacetabulum* from fish of the same region (Saoud and Ramadan, 1984b).

The main obejectives of the present work include :

1. Conducting a preliminary general survey on the helminth parasites of some common fishes from the Arabian Gulf, including the determination of the incidence of infection with termatodes, cestodes, nematodes and acanthocephala.

2. Study of the inter-relationships between members of the parasitic fauna in simultaneous double and multiple infections, particularly in digenetic trematode infections.

Besides augmenting our knowledge on the parasitic fauna of fishes from the Gulf, it is hoped that the results of this work may form a suitable basis for future detailed studies on the pathogenicity and other aspects of host-parasite relationships of these parasites and their hosts. Moreover, it is envisaged that these studies may eventually throw some light on the zoogeographical relationships between parasites of fish in the Red Sea and the Arabian Gulf.

MATERIAL AND METHODS

The fishes studied during the present investigation were obtained from two sources; namely Doha fish market and Qatar National Fish Company. Although the main source of fish from the Doha fish market may be the Qatari waters, yet the possibility of fish landings from other regions of the Arab Gulf, particularly Bahrain, United Arab Emirates and Oman cannot be always excluded. On the other hand, Qatar National Fish Company frequently makes catches outside Qatari waters in the Gulf (Sivasubramaniam and Ibrahim, 1984).

Five references were used for the identification of the fish. These are :

1. Common fishes of Qatar (Sivasubramaniam and Ibrahim, 1982).
2. Fishes of Qatar (Al Sedfy *et al,* 1982).
3. Fishes of Kuwait (Kuronuma and Abe, 1972).
4. Illustrated identification guide to commercial fishes, Regional Fishery Survey and Development Project (Randall *et al,* 1978).
5. Taxonomical studies on fishes of the family Serranidae from the North–Western region of the Red Sea, with special reference to the biology of the Serranid *Epinephelus chlorostigma* (Hassan, 1983).

The methods and techniques of collection, relaxation, fixation and staining of helminths are basically those described by Saoud and Ramadan (1983). Identification of digenetic trematodes to the generic level is largely based on Yamaguti (1971).

RESULTS AND DISCUSSION

The incidence of helminth parasites in families of fish is given in Table (1) and the results are summarized as follows :

1. Altogether 462 fishes, belonging to 11 families and 33 species were examined. 314 fishes were found positive for helminths. From these, 222 had trematodes, 152 harboured nematodes, 59 were infected with cestodes and 15 were positive for acanthocephala.

2. The incidence of infection with helminths varied in different fish families, being lowest (38.4 %) in Sparidae and highest (95.7 %) in Serranidae.

Table 1
Incidence of Helminth Parasites in Families of Fishes

FISH FAMILIES	NO. EXAMINED	POSITIVE		INFECTIONS							
				Trematodes		Nematodes		Cestodes		Acanthocephala	
		No.	%	No.	%	No.	%	No.	%	No.	%
1. Lethrinidae	41	26	63.4	22	53.6	17	41.4	6	14.6	–	–
2. Serranidae	47	45	95.7	36	80.0	24	53.3	21	46.6	–	–
3. Lutjanidae	44	41	93.2	22	53.6	29	70.7	7	17.0	9	21.9
4. Carangidae	54	49	90.7	47	95.9	14	28.5	3	6.1	–	–
5. Sparidae	39	15	38.4	9	23.0	6	15.3	1	7.6	–	–
6. Mugilidae	36	18	50.0	18	50.0	1	2.7	–	–	–	–
7. Mullidae	46	19	41.3	9	19.5	10	21.7	2	4.3	2	4.3
8. Scaridea	35	20	57.1	20	57.1	–	–	–	–	2	5.7
9. Gerreidea	40	26	65.0	17	42.5	7	17.5	3	7.5	–	–
10. Nemipteridae	40	37	92.5	6	15.0	37	92.5	16	40.0	2	5.0
11. Sphyraenidae	40	18	45.0	16	40.0	7	17.5	–	–	–	–
Total	462	314	67.9	222	48.0	152	32.9	59	12.7	15	3.2

3. The trematode infections were more frequent (48.0 %) than other helminths and were recorded in all the fish families examined. This was followed by nematode infections (32.9 %), which were found in all the fish families examined, with the exception of Scaridae; the highest incidence (92.5 %) was found in Nemipteridae, while the lowest incidence (2.7 %) was found in Mugilidae.

4. The infections with cestodes were less frequent (12.7 %) among the fishes examined; they were lacking in Mugilidae, Scaridae and Sphyraenidae. The highest incidence of cestodes (46.6 %) was recorded in Serranidae, while the lowest incidence (4.3 %) was reported in Mullidae.

5. Infections with acanthocephala were less frequent; the incidence in the fishes examined was 3.2 %. Only 4 families of fish, *viz.* Lutjanidae, Mullidae, Scaridae and Nemipteridae were found infected with small numbers of acanthocephala. The highest incidence of infection with acanthocephala (21.9 %) was recorded in Lutjanidae, while the lowest (4.3 %) was reported in Mullidae.

II. INCIDENCE OF MAJOR GROUPS OF HELMINTH PARASITES IN PURE AND SIMULTANEOUS DOUBLE AND MULTIPLE INFECTIONS OF FISHES

The incidence of the major helminthic groups in pure (single) as well as simultaneous double and triple infections of fishes is shown in Tables 2a, b and c; these include only species of fish from which fairly good numbers were examined.

1. PURE INFECTIONS (Table 2a)

Pure trematode infections are present in all species of fish. The incidence of such infections is high in *Gnathanodon speciosus* (77.7 %) and *Liza macrolepis* (68.7 %); it is low in *Lutjanus malabaricus* (5 %) while it is low to very moderate in the other species.

The incidence of pure infections with nematodes is moderate in *Nemipterus japonicus* and *Lutjanus malabaricus* (38 % and 30 % respectively) and very low in *Epinephelus tauvina* (4.7 %), with the other species in between.

Pure cestode infections are less frequent; they are highest in *Gerres oyena* (6.4 %) and lowest in *Parupeneus pleurotaenia* (2.1 %).

Table 2 a

Incidence of Single Infections with Main Groups of Helminth Parasites in Fish

SPECIES OF FISH *	TOTAL NO. EXAMINED	POSITIVE		INFECTIONS							
		No.	%	Trematodes		Nematodes		Cestodes		Acanthocephala	
				No.	%	No.	%	No.	%	No.	%
1. Family Lethrinidae											
a. Lethrinus lentjan	19	8	42.1	3	15.7	0	0	1	5.0	0	0
b. Lethrinus nebulosus	19	17	89.5	5	26.3	2	10.5	0	0	0	0
2. Family Serranidae											
a. Epinephelus tauvina	21	20	95.2	10	47.6	1	4.7	0	0	0	0
b. Epinephelus areolatus	16	16	100	5	31.2	3	18.7	1	6.2	0	0
3. Family Lutjanidae											
a. Lutjanus fulviflamma	22	20	90.9	7	31.8	3	13.6	0	0	0	0
b. Lutjanus malabaricus	20	18	90.0	1	5.0	6	30.0	0	0	2	10.0
4. Family Carangidae											
Gnathanodon speciosus	18	15	83.3	14	77.7	1	5.5	0	0	0	0
5. Family Mugilidae											
a. Liza macrolepis	16	12	75.0	11	68.7	1	6.2	0	0	0	0
b. Valamugil seheli	20	6	30.0	6	30.0	0	0	0	0	0	0
6. Family Mullidae											
Parupeneus pleurotaenia	46	20	43.5	7	15.2	7	15.2	1	2.1	2	4.3
7. Family Scaridae											
Scarus ghobban	35	20	57.1	17	48.5	0	0	0	0	2	5.7
8. Family Gerreidae											
Gerres oyena	31	21	67.7	15	48.3	4	12.9	2	6.4	0	0
9. Family Nemipteridae											
Nemipterus japonicus	21	18	85.7	4	19.0	8	38.0	0	0	0	0
10. Family Sphyraenidae											
Sphyraena jello	39	22	56.4	15	38.5	2	5.1	0	0	0	0

* The examined species of fish which are less than 15 in number were excluded from Tables 2a, b and c

2. DOUBLE INFECTIONS (Table 2b)

The majority of such infections have trematodes in combination with either nematodes, cestodes or acanthocephala. Simultaneous infections of nematodes with either cestodes or acanthocephala are less frequently observed.

a. *Trematodes + Nematodes*

Although pure infections of trematodes are recorded in 14 species of fish, simultaneous double infections with trematodes and nematodes are reported in 8 species only. The incidence of infections in this combination is moderate in *Lutjanus fulviflamma* and *Lethrinus nebulosus* (31.8 % and 26.3 % respectively); low in *Nemipterus japonicus, Lethrinus lentjan, Sphyraena jello* and *Epinephelus areolatus* (19.0, 15.7, 12.8 and 12.5 % respectively) and very low in *Lutjanus malabaricus* and *Parupeneus pleurotaenia* (5.0 and 4.3 % respectively).

b. *Trematodes + Cestodes*

This combination is less frequent. It is recorded in four out of fourteen species of fish. In all cases, the incidence of pure trematode infections is higher than simultaneous double infections of trematodes and cestodes.

c. *Termatodes + Acanthocephala*

This combination is very rarely seen. Out of fourteen species of fish, only *Scarus ghobban* has double infections of trematodes and acanthocephala.

d. *Nematodes + Cestodes*

Although pure infections with nematodes are reported in 11 species of fish, double infections with nematodes and cestodes are observed in 6 species of fish only. The incidence of infections with this combination is low in *Epinephelus areolatus, Lutjanus malabaricus and Lutjanus fulviflamma* (12.5, 10.0 and 9.0 % respectively) and very low in *Lethrinus nebulosus, Epinephelus tauvina* and *Parupeneus pleurotaenia* (5.2, 4.7 and 2.1 % respectively).

e. *Nematodes + Acanthocephala*

This combination is observed in *Lutjanus malabaricus* and *Nemipterus japonicus* only; their incidence reaches 25.0 and 9.5 % respectively.

Table 2 b

Incidence of Simulataneous Double Infections with Helminths in Fish

SPECIES OF FISH	INFECTIONS									
	Trematodes + Nematodes		Trematodes +Cestodes		Trematodes +Acanthocephala		Nematodes +Cestodes		Nematodes +Acanthocephala	
	No.	%	No.	%	No.	%	No.	%	No.	%
1. Family Lethrinidae										
a. Lethrinus lentjan	3	15.7	0	0	0	0	0	0	0	0
b. Lethrinus nebulosus	5	26.3	1	5.2	0	0	1	5.2	0	0
2. Family Serranidae										
a. Epinephelus tauvina	0	0	3	14.2	0	0	1	4.7	0	0
b. Epinephelus areolatus	2	12.5	1	6.2	0	0	2	12.5	0	0
3. Family Lutjanidae										
a. Lutjanus fulviflamma	7	31.8	1	4.5	0	0	2	9.0	0	0
b. Lutjanus malabaricus	1	5.0	0	0	0	0	2	10.0	5	25.0
4. Family Carangidae										
Gnathanodon speciosus	0	0	0	0	0	0	0	0	0	0
5. Family Mugilidae										
a. Liza macrolepis	0	0	0	0	0	0	0	0	0	0
b. Valamugil seheli	0	0	0	0	0	0	0	0	0	0
6. Family Mullidae										
Parupeneus pleurotaenia	2	4.3	0	0	0	0	1	2.1	0	0
7. Family Scaridae										
Scarus ghobban	0	0	0	0	1	2.8	0	0	0	0
8. Family Gerreidae										
Gerres oyena	0	0	0	0	0	0	0	0	0	0
9. Family Nemipteridae										
Nemipterus japonicus	4	19.0	0	0	0	0	0	0	2	9.5
10. Family Sphyraenidae										
Sphyraena jello	5	12.8	0	0	0	0	0	0	0	0

Table 2 c

Incidence of Simulataneous Multiple Infections with Helminths in Fish

SPECIES OF FISH	INFECTIONS			
	Nematodes + Trematodes + Cestodes		Trematodes + Cestodes + Nematodes + Acanthocephala	
	No.	%	No.	%
1. Family Lethrinidae				
a. Lethrinus lentjan	1	5.2	0	0
b. Lethrinus nebulosus	3	15.7	0	0
2. Family Serranidae				
a. Epinephelus tauvina	5	23.8	0	0
b. Epinephelus areolatus	2	12.5	0	0
3. Family Lutjanidae				
a. Lutjanus fulviflamma	0	0	0	0
b. Lutjanus malabaricus	1	5.0	1	5.0
4. Family Carangidae				
Gnathanodon speciosus	0	0	0	0
5. Family Mugilidae				
a. Liza macrolepis	0	0	0	0
b. Valamugil seheli	0	0	0	0
6. Family Mullidae				
Parupeneus pleurotaenia	0	0	0	0
7. Family Scaridae				
Scarus ghobban	0	0	0	0
8. Family Gerreidae				
Gerres oyena	0	0	0	0
9. Family Nemipteridae				
Nemipterus japonicus	0	0	0	0
10. Family Sphyraenidae				
Sphyraena jello	0	0	0	0

3. MULTIPLE INFECTIONS (Table 2c)

Five species of fish have simultaneous triple infections with trematodes, cestodes and nematodes. The incidence of such infections is higher in *Epinephelus tauvina* (23.8 %) and lowest in *Lutjanus malabaricus* (5.0 %), with the incidence in *Lethrinus nebulosus, Epinephelus areolatus* and *Lethrinus lentjan* in between (15.7, 12.5 and 5.2 % respectively).

Quadruple infections are very rarely observed and only one species of fish, *viz. Lutjanus malabaricus,* has simultaneous quadruple infections of trematodes, nematodes, cestodes and acanthocephala, the incidence reaching 5 %.

III. GENERAL INCIDENCE OF TREMATODES IN FISH FAMILIES

All the fish families examined were infected with one or more genera of digenetic trematodes. Among 462 fishes examined, 222 (48.05 %) were positive for trematodes. The general incidence of trematodes in fish families is shown in Table 3. The incidence of infections varied in fish families, being lowest (15 %) in Nemipteridae and highest (87 %) in Carangidae. The incidence was low in Mullidae (19.6 %) and Sparidae (23.1 %), while it was moderate in Sphyraenidae (40 %), Gerreidae (42.5 %), Mugilidae (50 %) Lutjanidae (50 %) Lethrinidae (53.7 %) and Scaridae (57.1 %). The incidence was high in Serranidae (76.6 %) and Carangidae (87 %).

It must be noted that although the observed differences in the incidence of trematodes in fish families may be significant, yet they may be always considered in relation to the numbers of fish examined from each species of fish in the respective family. Moreover, analysis of the differences in the incidence of trematode infections between male and female fishes of each family is not attempted, due to the relatively smaller numbers of certain species of fish examined from various families during the present investigation. Future studies, involving the examination of larger numbers from each species of fish, may indicate the effect of the host sex on the incidence of helminth infections (Saoud and Wannas, 1984).

IV. INCIDENCE OF TREMATODE GENERA IN FISHES

Previous studies on digenetic trematodes of bats in Egypt indicated that there are some interactions between members of the parasitic fauna in these hosts. Infections with certain trematode genera are found to be antagonistic to infections with other genera. On the contrary, certain trematode genera occurred only in the presence of

Table 3
Incidence of Digenetic Trematode Infections
in Families of Fishes

HOST FAMILIES	NO. EXAMINED			INFECTED					
				Male		Female		Total	
	Male	Female	Total	No.	%	No.	%	No.	%
1. Lethrinidae	17	24	41	12	70.6	10	41.7	22	53.7
2. Serranidae	35	12	47	27	77.1	9	75.0	36	76.6
3. Lutjanidae	25	19	44	12	48.0	10	52.6	22	50.0
4. Carangidae	25	29	54	20	80.0	27	93.1	47	87.0
5. Sparidae	16	23	39	4	25.0	5	21.7	9	23.1
6. Mugilidae	15	21	36	8	53.3	10	47.6	18	50.0
7. Mullidae	26	20	46	3	11.5	6	30.0	9	19.6
8. Scaridae	22	13	35	10	45.5	10	76.9	20	57.1
9. Gerreidae	22	18	40	10	45.5	7	38.9	17	42.5
10. Nemipteridae	19	21	40	4	21.1	2	9.5	6	15.0
11. Sphyraenidae	25	15	40	9	36.0	7	46.7	16	40.0
Total	247	215	462	119	48.2	103	47.9	222	48.05

some other genera of parasites (Saoud and Ramadan, 1976).

Similar observations are reported in freshwater fish (Mohammed, 1978; Saoud and Wannas, 1984), elasmobranchs (Saoud and Hassan, 1983) and marine teleosts (Saoud and Ramadan, 1983).

Trematodes collected from fishes during the present work are identified at the generic level and their incidence is shown in Table 4.

Eleven species of fish were infected with one genus of trematodes, eight species harboured two genera of trematodes, four species had three genera of trematodes, three species had four genera, one species of fish had five genera and another species of fish examined was even infected with seven genera of trematodes. These infections were distributed as follows :

1. FISHES INFECTED WITH ONE GENUS OF TREMATODES :

Carangoides malabaricus, Trichinotus blochii, Scomberoides commeronianus, Seriola nigrofasciata, Mylio bifasciatus, Argyrops spinifer, Valamugil seheli, Scarus ghobban, Nemipterus delagoae, Nemipterus tolu and *Nemipterus japonicus.*

2. FISHES INFECTED WITH TWO GENERA OF TREMATODES :

Epinephelus areolatus, Lutjanus russelli, Seriola dumerili, Rhabdosargus sarba, Liza macrolepis, Parupeneus pleurotaenia, Gerres oyena and *Sphyraena jello.*

3. FISHES INFECTED WITH THREE GENERA OF TREMATODES :

Lethrinus lentjan, Lutjanus malabaricus, Alepes mate and *Decapterus kiliche.*

4. FISHES INFECTED WITH FOUR GENERA OF TREMATODES :

Lethrinus nebulosus, Epinephelus chlorostigma and *Epinephelus summana.*

5. FISH INFECTED WITH FIVE GENERA OF TREMATODES :

Lutjanus fulviflamma

6. FISH INFECTED WITH SEVEN GENERA OF TREMATODES :

Epinephelus tauvina.

Table 4

Incidence of Trematode Genera in Fish

HOSTS	NO. EXAMINED		INFECTED FISH				TREMATODE INFECTIONS		
			Male		Female				
	M	F	No.	%	No.	%	Genera	No.	%
1. Family Lethrindae									
Lethrinus lentjan	10	9	5	50.0	2	22.2	*Hamacreadium*	3	15.8
							Plagioporus	3	15.8
							Pseudoplagioporus	1	5.3
Lethrinus nebulosus	7	12	7	100	8	66.6	*Hamacreadium*	8	42.1
							Stephanostomum	1	5.3
							Pseudoplagioporus	3	15.8
							Plagioporus	3	15.8
Lethrinus kallopterus	0	3	0	0	0	0	–	–	–
2. Family Serranidae									
Epinephelus tauvina	16	5	14	87.5	4	80.0	*Ectenurus*	8	38.1
							Stephanostomum	2	9.5
							Hamacreadium	9	42.9
							Podocotyle	4	19.1
							Bucephalopsis	4	19.1
							Helicometrina	1	4.8
							Rhibidocotyle	1	4.8
Epinephelus chlorostigma	5	3	3	37.5	2	25.0	*Hamacreadium*	2	25.0
							Stephanostomum	1	12.5
							Prosorhynchus	2	25.0
							Rhibidocotyle	1	12.5

Continued

HOSTS	NO. EXAMINED		INFECTED FISH				TREMATODE INFECTIONS		
			Male		Female				
	M	F	No.	%	No.	%	Genera	No.	%
Epinephelus areolatus	13	3	10	76.9	1	33.3	*Hamacreadium*	7	43.8
							Ectenurus	8	50.0
Epinephelus summana	1	1	1	100	1	100	*Hamacreadium*	2	100
							Ectenurus	2	100
							Helicometrina	1	50.0
							Podocotyle	1	50.0
3. Family Lutjanidae									
Lutjanus fulviflamma	15	7	9	60.0	7	100	*Metadena*	6	27.3
							Allacanthochasmus	9	40.9
							Ectenurus	2	9.1
							Hamacreadium	2	9.1
							Proenenterum	3	13.6
Lutjanus malabaricus	10	10	3	30.0	1	10.0	*Hamacreadium*	2	10.0
							Plagioporus	1	5.0
							Allacanthochasmus	1	5.0
Lutjanus russelli	0	2	0	0	2	100	*Hamacreadium*	1	50.0
							Proenenterum	1	50.0
4. Family Carangidae									
Carangoides malabaricus	1	5	1	100	5	100	*Bucephalopsis*	6	100
Seriola dumerili	1	4	1	100	4	100	*Ectenurus*	4	80.0
							Bucephalopsis	5	100

Continued

HOSTS	NO. EXAMINED		INFECTED FISH				TREMATODE INFECTIONS		
			Male		Female				
	M	F	No.	%	No.	%	Genera	No.	%
Gnathanodon speciosus	14	4	10	71.4	4	100	*Bucephalopsis* *Monorocheides*	4 14	22.2 77.8
Trichinotus blochii	0	6	0	0	4	66.7	*Prosorchis*	4	66.7
Scomberoides commeronianus	2	1	2	100	1	100	*Ectenurus*	3	100
Alepes mate	2	6	2	100	6	100	*Lecithochirium* *Proctotrema* *Bucephalopsis*	4 4 1	50.0 50.0 12.5
Decapterus kiliche	3	3	3	100	3	100	*Lecithochirium* *Bucephalopsis* *Lepidapedon*	4 1 1	66.7 16.7 16.7
Seriola nigrofasciata	2	0	1	50.0	0	0	Unidentified digenetic trematode	1	50.0
5. *Family Sparidae* *Mylio bifasciatus*	8	5	1	12.5	0	0	*Plagioporus*	1	7.7
Rhabdosargus sarba	3	8	2	66.7	5	62.5	Unidentified digenetic trematode *Lecithochirium*	7 1	63.6 9.1
Argyrops spinifer	3	6	1	33.3	0	0	*Proenenterum*	1	11.1
Diplodus kotschyi	2	4	0	0	0	0	–	–	–

Continued

HOSTS	NO. EXAMINED		INFECTED FISH				TREMATODE INFECTIONS		
			Male		Female				
	M	F	No.	%	No.	%	Genera	No.	%
6. Family Mugilidae									
Liza macrolepis	8	8	6	75.0	6	75.0	*Derogenes*	1	6.25
							Proctotrema	11	68.8
Valamugil seheli	7	13	2	28.5	4	30.7	*Proctotrema*	6	30.0
7. Family Mullidae									
Parupeneus pleurotaenia	26	20	3	11.5	6	30.0	*Proenenterum*	2	4.3
							Unidentified digenetic trematode	7	15.2
8. Family Scaridae									
Scarus ghobban	23	12	10	43.5	10	83.0	*Rhagorchis*	20	57.1
9. Family Gerreidae									
Gerres oyena	20	11	10	50.0	7	63.6	*Proenenterum*	2	6.5
							Unidentified digenetic trematodes	13	41.9
Gerres filamentosus	2	7	0	0	0	0	—	–	–
10. Family Nemipteridae									
Nemipterus tolu	3	5	1	33.3	0	0	*Lecithochirium*	1	12.5
Nemipterus japonicus	12	9	3	25.0	1	11.1	*Ectenurus*	3	14.3
Nemipterus delagoae	4	7	0	0	1	14.2	*Ectenurus*	1	9.1

Continued

HOSTS	NO. EXAMINED		INFECTED FISH				TREMATODE INFECTIONS		
			Male		Female				
	M	F	No.	%	No.	%	Genera	No.	%
11. Family Sphyraenidae									
Sphyraena jello	24	15	9	37.5	7	46.6	*Bucephalopsis*	16	41.0
							Lecithochirium	1	2.6
Sphyraena obtusata	1	0	0	0	0	0	–	–	–
12. Family Pomadasyidae									
Plectorhynchus pictus	3	–	2	66.7	–	–	*Paraproctotrema*	2	66.7
							Lepidapedon	2	66.7

V. HOST SPECIFICITY

The question of host-specificity in various species of fish has been recently considered in trematodes of freshwater and marine fishes (Saoud and Wannas, 1984; Saoud and Ramadan, 1983). These authors have shown that in some trematode genera, host specificity is very marked, with each genus of parasites restricted to one species of host fish. More often, particularly in the termatodes of marine fishes, host specificity is less marked with trematode genera found in two or more species of host fish. Moreover, a correlation is frequently observed between the incidence of trematode genera and the intensity of infection (Saoud and Ramadan, 1983).

1. Host Specificity in Species of Fish

During the present investigation, host specificity at the generic level was considered from the parasite/host list given in Table 5, which includes digenetic trematodes collected in different fishes and their numbers per fish.

The following seven trematode genera are recorded from only one species of fish : *Rhagorchis, Derogenes, Prosorchis, Metadena, Prosorhynchus, Paraproctotrema* and *Monorocheides.*

Six trematode genera are recorded from two species of fish : *Helicometrina, Podocotyle, Pseudoplagioporus, Allacanthochasmus, Rhibidocotyle* and *Lepidapedon.*

The trematode genera *Stephanostomum* and *Proctotrema* are reported from three species of fish while *Plagioporus* is recorded from four species of fish.

Two trematode genera, viz. *Lecithochirium* and *Proenenterum* are reported from five species of fish. *Bucephalopsis* is reported from seven species of fish. *Ectenurus* is recorded from eight species of fish, while *Hamacreadium* is reported from nine species of fish.

2. Correlation Between the Incidence of Trematodes Genera and the Intensity of Infection

Saoud and Ramadan (1983) in their studies on digenetic trematodes of some Red Sea fishes, found that in some cases, there was a significant correlation between the incidence of trematode genera in fishes and the intensity of infection with these parasites in their respective hosts, indicating a certain aspect of host

Table 5

List of Digenetic Trematodes in Different Host Fish Together with Their Incidence and Intensity of Infection

TREMATODES	HOSTS	INCIDENCE %	NO. OF WORMS PER FISH	
			Range	Mean
1. Family Opecoelidae Ozaki, 1925				
a. Subfamily Plagioporinae Manter, 1947				
Genus *Hamacreadium* Linton 1910	*Lethrinus lentjan*	15.8	1–2	1.3
	Lethrinus nebulosus	42.1	1–6	2.8
	Epinephelus tauvina	42.9	1–8	3.5
	Epinephelus chlorostigma	25.0	1–5	3.0
	Epinephelus areolatus	43.8	1–3	1.3
	Epinephelus summana	100	2–4	3.0
	Lutjanus fulviflamma	9.1	6–7	6.5
	Lutjanus malabaricus	10.0	1–4	2.5
	Lutjanus russelli	50.0	6	6.0
Genus *Plagioporus* Stafford, 1904	*Lethrinus lentjan*	15.8	1–2	1.3
	Lethrinus nebulosus	15.8	1	1.0
	Lutjanus malabaricus	5.0	1	1.0
	Mylio bifasciatus	7.7	1	1.0
Genus *Helicometrina* Linton, 1910	*Epinephelus tauvina*	4.8	6	6.0
	Epinephelus summana	50.0	5	5.0
Genus *Podocotyle* (Dujardin, 1845) Odhner, 1905	*Epinephelus tauvina*	19.1	1–10	5.5
	Epinephelus summana	50.0	2	2.0
b. Subfamily Opecoelinae Stunkard, 1931				
Genus *Proenenterum* Manter 1954	*Lutjanus fulviflamma*	13.6	1–2	1.3
	Lutjanus russelli	50.0	16	16.0
	Argyrops spinifer	11.1	2	2.0
	Parupeneus pleurotaenia	4.3	1	1.0
	Gerres oyena	6.5	1	1.0

Continued

TREMATODES	HOSTS	INCIDENCE %	NO. OF WORMS PER FISH	
			Range	Mean
c. Subfamily Sphaerostomatinae Poche, 1926				
Genus *Pseudoplagioporus* Yamaguti,1938	*Lethrinus lentjan*	5.3	2	2.0
	Lethrinus nebulosus	15.8	1–3	1.7
2. Family Acanthocolpidae *Lühe*, 1909				
Subfamily Stephanostominae Yamaguti, 1958				
Genus *Stephanostomum* Looss, 1899	*Lethrinus nebulosus*	5.3	1	1.0
	Epinephelus tauvina	9.5	1–5	3.0
	Epinephelus chlorostigma	12.5	2	2.0
3. Family Lepocreadiidae (Odhner, 1905) Nicoll, 1935				
a. Subfamily Folliochiinae Yamaguti, 1958				
Genus *Rhagorchis* Manter, 1931	*Scarus ghobban*	57.1	1–18	4.9
b. Subfamily Lepidapedinae Yamaguti, 1958				
Genus *Lepidapedon* Stafford, 1904	*Decapterus kiliche*	16.7	1	1.0
	Plectorhynchus pictus	66.6	5–9	7.0
4. Family Hemiuridae Lühe, 1901				
a. Subfamily Derogeninae Nicoll, 1910				
Genus *Derogenes* Lühe, 1900	*Liza macrolepis*	6.25	1	1.0
b. Subfamily Dinurinae Looss, 1907				
Genus *Ectenurus Looss, 1907*	*Epinephelus tauvina*	38.1	1–5	2.6
	Epinephelus areolatus	50.0	1–9	3.5
	Epinephelus summana	100	3	3.0
	Lutjanus fulviflamma	9.1	1–3	2.0
	Seriola dumerili	80.0	1–8	3.5
	Nemipterus delagoae	9.1	1	1.0
	Nemipterus japonicus	14.3	1–2	1.3
	Scomberoides commeronianus	100	1–7	3.6

Continued

TREMATODES	HOSTS	INCIDENCE %	NO. OF WORMS PER FISH	
			Range	Mean
c. Subfamily Lecithochiriinae Lühe, 1901	*Nemipterus tolu*	12.5	1	1.0
Genus Lecithochirium Lühe, 1901	*Alepes mate*	50.0	2–13	7.7
	Rhadbosargus sarba	9.1	3	3.0
	Sphyraena jello	2.6	1	1.0
	Decapterus kiliche	66.7	2–6	3.8
d. Subfamily Prosorchiinae Yamaguti, 1934				
Genus *Prosorchis* Yamaguti, 1934	*Trichinotus blochii*	66.7	2–7	4.0
5. Family Cryptogonimidae (Ward, 1917) Cirurea 1933				
a. Subfamily Metadeninae Yamaguti, 1958				
Genus *Metadena* Linton, 1910	*Lutjanus fulviflamma*	22.3	1–18	5.1
b. Subfamily Neochasminae Van Cleave and Mueller, 1932				
Genus *Allacanthochasmus* Van Cleave, 1922	*Lutjanus fulviflamma*	40.9	1–15	4.5
	Lutjanus malabaricus	5.0	2	1.0
6. Family Bucephalidae Poche, 1907				
a. Subfamily Prosorhynchinae Nicoll, 1914				
Genus *Prosorhynchus* Odhner, 1905	*Epinephelus chlorostigma*	25.0	2–6	4.0
Genus *Bucephalopsis* (Diesing 1855)	*Gnathanodon speciosus*	22.2	1–6	2.7
	Epinephelus tauvina	19.1	1	1.0
	Carangoides malabaricus	100	10–60	24.5
	Sphyraena jello	41.0	1–18	4.3
	Seriola dumerili	100	23–50	35.6
	Decapterus kiliche	16.7	2	2.0
	Alepes mate	12.5	1	1.0

Continued

TREMATODES	HOSTS	INCIDENCE %	NO. OF WORMS PER FISH	
			Range	Mean
b. Subfamily Bucephalinae Nicoll, 1914				
Genus *Rhibidocotyle* Diesing, 1858	*Epinephelus tauvina*	4.8	1	1.0
	Epinephelus chlorostigma	12.5	1	1.0
7. Family Monorchiidae Odhner, 1911				
a. Subfamily Lasiotocinae Yamaguti, 1958				
Genus *Proctotrema* Odhner, 1911	*Alepes mate*	50.0	1–5	3.0
	Liza macrolepis	68.8	8–27	28.1
	Valamugil seheli	30.0	1–27	5.8
Genus *Paraproctotrema* Yamaguti, 1934	*Plectorhynchus pictus*	66.7	5–21	13.0
b. Subfamily Monorchiinae (Odhner, 1911) Nicoll, 1915				
Genus *Monorcheides* Odhner, 1905	*Gnathandon speciosus*	77.8	1–52	12.9

specificity. In these cases, the highest incidence of a trematode genus in a fish species was correlated with the heaviest worm load in that fish. The genus *Gyliauchen,* for example, was recorded in four species of fish, the highest incidence (85.7 %) being in *Acanthurus lurida,* while its incidence was much lower in *Acanthurus oramen, Balistes aculetus* and *Anampses caeruleopunctatus* being 10.5, 4.0 and 2.0 respectively. It was significant to note that the highest incidence of this trematode genus in *Acanthurus lurida* was correlated with the highest intensity of infection in this species of fish (68.8 worms per fish) compared with a lower intensity in the other three species, being 21.0, 4.0 and 4.5 worms per fish respectively. These authors assumed that populations of fish, with the highest incidence of infection with a certain trematode genus, associated with the highest intensity of infection, were the most important hosts in the maintenance of the life cycle of these parasites.

In the present investigation, a significant correlation is observed between the incidence of the trematode genus *Bucephalopsis* and the intensity of infection with that trematode. *Bucephalopsis* was recorded in seven species of fish. The highest incidence of this trematode was observed in both *Carangoides malabaricus* as well as *Seriola dumerili* (100 %); the incidence was lower in *Sphyraena jello, Gnathanodon speciosus, Epinephelus tauvina, Decapterus kiliche* and *Alepes mate,* being 41, 22.2, 19.1, 16.7 and 12.5 % respectively. The intensity of infection in both *Carangoides malabaricus* and *Seriola dumerili* was significantly higher (35.6 and 24.5 worms per fish respectively), compared with the other five species (4.25, 2.7, 1.0, 2.0 and 1.0 worms per fish respectively). Unfortunately, a similar correlation could not be established in other species of fish examined during the present work.

3. Trematode Infections in Related Hosts

Dogiel (1962) has postulated that related hosts are infected with inter–related parasites. Saoud and Ramadan (1983) reported the incidence and intensity of trematode genera in fish families Lethrinidae and Sparidae caught from the Egyptian territorial waters of the Red Sea. These authors concluded that a distinct picture for each species of fish was obtained if the trematode genera were arranged in the order of their frequency.

A similar approach is followed in the present work. Tables 6 and 7 include the incidence of trematode genera in species of fish families Serranidae and Lethrinidae, from which fairly large numbers were examined.

It is clear from Table 6 that although 8 genera of trematodes have been recorded from 3 species of fish belonging to family Serranidae, yet only one genus, *viz. Hamacreadium* is present in all the three species, while 3 genera, *viz Stephanostomum, Ectenurus* and *Rhibidocotyle* are present in two species of fish. The other 4 genera: *Helicometrina, Podocotyle, Prosorhynchus* and *Bucephalopsis* are recorded in only one species of fish in that family.

If the infections with trematode genera are arranged in the order of their incidence, a distinct picture is obtained as follows :

a. *Epinephelus tauvina :*

Hamacreadium > *Ectenurus* > *Podocotyle* = *Bucephalopsis* > *Helicometrina* = *Rhibidocotyle*

b. *Epinephelus chlorostigma :*

Hamacreadium = *Prosorhynchus* > *Stephanostomum* = *Rhibidocotyle*

c. *Epinephelus areolatus :*

Ectenurus > *Hamacreadium*

In family Lethrinidae, 4 genera of trematodes are recorded from two species of fish (Table 7). Three of these trematode genera *(Hamacreadium, Plagioporus* and *Pseudoplagioporus)* are recorded in both species, while *Stephanostomum* is present in only one of them. When the infections with trematode genera are arranged in the order of their incidence, the picture obtained is outlined as follows :

a. *Lethrinus lentjan :*

Hamacreadium = *Plagioporus* > *Pseudoplagioporus*

b. *Lethrinus nebulosus :*

Hamacreadium > *Plagioporus* = *Pseudoplagioporus* > *Stephanostomum*

VI. NEW LOCALITY RECORDS

The following 18 genera of digenetic trematodes are recorded for the first time in the Arabian Gulf :

Table 6
Infections with Trematode Genera
in Family Serranidae *

Fish Hosts / Trematode Genera	*Epinephelus tauvina*	*Epinephelus chlorostigma*	*Epinephelus areolatus*
Hamacreadium	42.8 %	25.0 %	43.7 %
Helicometrina	4.7 %	0	0
Podocotyle	19.0 %	0	0
Stephanostomum	9.5 %	12.5 %	0
Ectenurus	38.0 %	0	50.0 %
Prosorhynchus	0	25.0 %	0
Bucephalopsis	19.0 %	0	0
Rhibidocotyle	4.7 %	12.5 %	0

* *Epinephelus summana* is excluded since few numbers of fish are examined.

Table 7
Infections with Trematode Genera
in Family Lethrinidae *

Fish Hosts / Trematode Genera	*Lethrinus lentjan*	*Lethrinus nebulosus*
Hamacreadium	15.7 %	42.1 %
Plagioporus	15.7 %	15.7 %
Pseudoplagioporus	5.2 %	15.7 %
Stephanostomum	0	5.2 %

* *Lethrinus kallopterus* is excluded since few numbers of fish are examined.

Hamacreadium Linton, 1910; *Podocotyle* Obhner, 1905; *Proenenterum* Manter, 1954; *Pseudoplagioporus* Yamaguti, 1938; *Rhagorchis* Manter, 1931; *Lepidapedon* Stafford, 1904; *Derogenes* Lühe, 1900; *Ectenurus* Looss, 1907; *Lecithochirium* Lühe, 1901; *Prosorchis* Yamaguti, 1934; *Metadena* Linton, 1910; *Allacanthochasmus* Van Cleave, 1922; *Prosorhynchus* Odhner, 1905; *Bucephalopsis* Diesing, 1855; *Rhibidocotyle* Diesing, 1858; *Proctotrema* Odhner, 1911; *Paraprocotrema* Yamaguti, 1934 and *Monorcheides* Odhner, 1905.

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الديدان الطفيلية في أسماك الخليج العربي
(١) تقصي أولى عام للأسماك من المياه القطرية

محمد فتحي عبد الفتاح سعود و مصطفى محمود رمضان
و
كلثم سالم الكواري

عرض المؤلفون نتائج تقصي أولى عام للديدان الطفيلية في الأسماك التي جُمعَت أساساً من المياه القطرية في الخليج العربي .

وقد تبين أن هناك إختلافات ذات دلالة في نسب الإصابة بالطفيليات بين مختلف فصائل الأسماك ، فقد كانت النسبة متوسطة في الأسماك من فصيلة سباريدي (٣٨,٤ ٪) ومرتفعة جداً في الأسماك من فصيلة سيرانيدي (٩٥,٧ ٪) ، كما لوحظ تباين في نسب الإصابة بالمجموعات الرئيسية من الديدان الطفيلية ، فالإصابة بديدان التريماتودا ثنائية العائل مرتفعة ، بينما الإصابات بديدان النماتودا والسستودا والأكانثوكيفالا منخفضة أو نادرة .

وقد سجلت الدراسة نسباً مرتفعة من الإصابات المزدوجة المتزامنة بديدان التريماتودا مع كل من مجموعات الديدان الأخرى ، بينما كانت نسب الإصابات المزدوجة بالنماتودا مع أي من السستودا أو الأكانثوكيفالا منخفضة ، ونادراً ما سجلت إصابات ثلاثية أو رباعية متزامنة بمختلف مجموعات الديدان الطفيلية معاً .

وسجل المؤلفون ثمانية عشر جنساً من ديدان التريماتودا ثنائية العائل ، تُسجل لأول مرة في أسماك الخليج العربي ، وتصاب بعض أنواع الأسماك بجنس واحد من الطفيليات ، غير أن النتائج سجلت وجود ٢ – ٧ أجناس من الطفيليات في أنواع أخرى منها ، كما قدم المؤلفون دراسة محدودة لظاهرة تحديد نوعية العائل في إصابات أسماك الخليج العربي بطفيليات التريماتودا ، وتبين أن أجناساً معينة من التريماتودا تتطفل في أنواع محددة من الأسماك ، غير أن هذا التحديد لنوعية العائل أصبح أقل وضوحاً في أجناس أخرى من التريماتودا التي تنتشر في مدى واسع من أنواع الأسماك ، وقد سجل المؤلفون نسب ومدى شدة إصابة كل نوع من أنواع الأسماك بالأجناس المختلفة من الطفيليات التي تم تسجيلها .