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Survey on the Digenean and Monogenean Helminthes of *Clupeidae* (Teleostes) from Southern Part of Caspian Sea

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Abstract: The helminthes parasites fauna of 313 specimens of Caspian herrings (*Clupeonella cultriventris*, *Clupeonella engrauliformis*, *Clupeonella grimmi*) caught from catching localities situated in southeast of Caspian Sea Were investigated during winter 2008 until autumn 2009. A total of 3 helminthes species were found. They were including *Pseudopentagramma symmetrica* from intestine (mid gut, hind gut and cecae) *Bunocotyle cingulata* in intestine, *Mazocreas alosae* the only monogenean with Marine origin in the gills of infected specimens. In addition to two zoonotic species including *Contracecum* sp. and *Anisakis* sp. in digestive system, muscle and ovary and an Acanthocephal, *Corynosoma strumosum* in intestine which were previously reported. We can conclude that the main characteristic of the helminthes parasites community of *Clupeidae* species studied is the dominance of the endoparasites species due mainly to the digenean *Pseudopentagramma symmetrica* and *Bunocotyle cingulata* and the relative scarcity of ectohelminthes fauna. In this paper the latest data of helminthes fauna and community ecology of digenean of *Clupeidae* species are presented and the community structure of *Pseudopentagramma symmetrica* is discussed.

Key words: *Clupeidae*, digenean, monogenean, ecology, South of Caspian Sea, Iran

INTRODUCTION

Members of *Clupeidae* family are present in all seas and oceans, some always live in freshwater while most species inhabits in sea or brackish water, a relatively small numbers are anadroumous and enter to freshwater for propagation porpose. Genus *Clupea* is found in black and Caspian seas basins with 5 species, 3 of which are living in the Caspian Sea and Iranian waters (*Clupeonella cultriventris*, *Clupeonella engrauliformis*, *Clupeonella grimmi*). Among them, however, *C. engrauliformis* is mainly live in Northern and central part of Caspian Sea and does not enter freshwater. While two other species migrate between the two environment.

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Clupeonella sp. are economic fish species in Caspian Sea either as an important food fish for valuable sturgeon, sander, Caspian foca and Caspian salmon or as human food. Plankton is the main food and copepods predominate but diet also includes *Cladocera*, *Balanus* and clam larvae (Berg, 1964). The most intensive feeding is in summer and autumn decreasing in winter and during reproduction in *C. cultriventris* (kilka-ye-maamoli or common kilka). In *C. engrauliformis* (anchovy kilka) the dominant food item is the copepod *Eurytemora grimmi* particularly in winter when plankton biomass is lowered (Abdoli and Naderi, 2009). While in *Clupeonella grimmi* (kilka-ye-cheshmdorosht or big eye kilka) migratory Mysides often predominate in planktonic diet of this species, fish fry are also eaten (Abdoli and Naderi, 2009).

These three *Clupeonella* share the available habitat and its foods: Common kilka in shallow, coastal waters, the anchovy kilka in the upper layers of the open sea and the big eye kilka in the deeper water of the open sea. During 1999-2004 years' sudden depletion of *Clupeids* stock happened from 85000 to 7500 ton in south part of Caspian sea (Esmaili Sari *et al*., 2001). The first report on the parasite fauna of *Clupea* sp. in Caspian Sea was appeared by Dogielov and Bychowsky (1983). After a neglectful period, Shamsi *et al*. (1998) reported the degenian parasites *Pseudopentagramma symmetrica* and *Bunocotyle cingulata*, the Acanthocephal *Corynosoma strumosum*, Metacercaria of a *Bucephalus* sp., larvae of *Contracecum* and *Anisakis* species in all three *Clupeids* species in samples caught from Babolsar and Bandar-e-anzali catching sites. This study provides the recent data on prevalence, intensity of digenean and community of helminthes of three *Clupeids* species in the south of Caspian Sea with emphasis to population structure of *P. symmetrica* and *B. cingulata* in *Clupeids* in Caspian Sea.

MATERIALS AND METHODS

Three *Clupeonella* species (*Clupeonella engrauliformis*, *Clupeonella cultriventris* and *Clupeonella grimmi*) were subjected for helminthology examination during winter 2008 until autumn 2009 (Fig. 2a-c).

Samples were taken from catching site Babol-sar (52-39-30 longitude and 36-43 latitude) and Bandar-e-anzali (49-28-longitude and 37-28-latitude) both situated in south part of Caspian Sea (Fig. 1). Samples were first bioexamined and then helminthological investigations were carried out as follows:

Monogenea

Fish gills were cut out and examined under a stereomicroscope at ×4-40 magnification. Vigorously moving worms were separated from the gills with a pipette and fixed under a cover slip according to Fernando *et al.* (1972) and Gussev (1983) either in ammonium picrate or glycoral-gelatine.

Digenean

Adult's digenean were recovered from different part of intestine and collected in a 0.6% saline solution. The sample was placed with a little saline on a glass slide and appropriate pressure applied. It was fixed with 90% ethyl alcohol and was held in 70% ethyl alcohol and finally stained with alum haematoxylin according to Fernando *et al*. (1972) and Roberts (2001).

Fig. 1: The Caspian Sea and catching sites (www.dusharm.com/content/view/21/2/), 1-Bandar-e-anzali; 2-Babol-sar

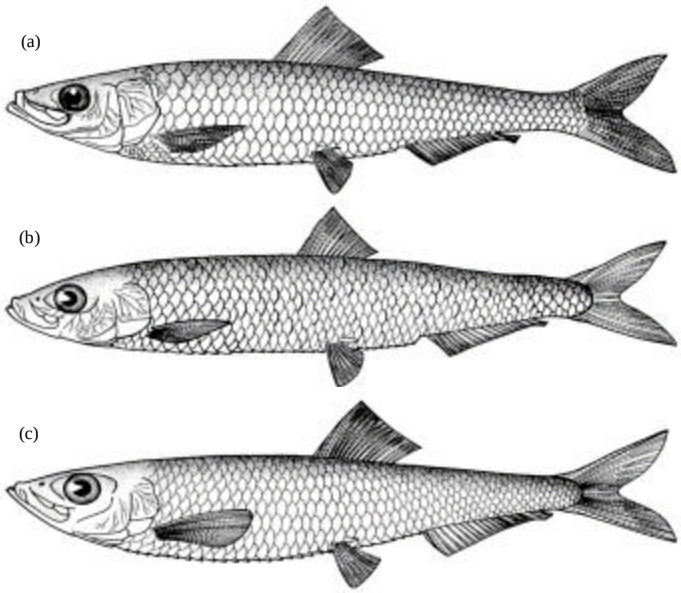

Fig. 2: Three *Clupeids* species in Caspian Sea (www.briancoad.com2008), (a) *Clupeonella cultriventris:* Length 17-5 (11.1) cm, Weight 14-2 (8.1) g (Nordmann, 1840), (b) *Clupeonella engrauliformis:* Length 16-9 (11.58) cm, Weight 15-3(8.4) g (Borodin, 1904) and (c) *Clupeonella grimmi:* Length 14-8 (11.6) cm, Weight 13-6.2 (9.3) g (Kessler, 1877)

Identification of fishes were carried out by Iranian ichthyologist according to Abdoli (1999). The identification of parasites was carried out in accordance with the keys given by Gussev (1985, 1987) and Jalali (1998).

RESULTS AND DISCUSSION

During winter 2008 until autumn 2009 total 313 fish specimens of three *Clupeids* species inhabits in southern part of Caspian Sea were collected for helminthological purposes. According to our results these were composed 3 helminthes from intestine and gills which identified to species level. These finding and those which reported by Shamsi *et al.* (1998) are shown in Table 1. In total 181 specimens (57.82%) including 47.52% male and 52.48% female were infected by gill and intestine helminthes. Among them, however, *P. symmetrica* was regarded as a major helmenthes in the Clupeid fish with 53.1, 50 and 58.8% prevalence in *C. cultriventris*, *C. grimmi* and *C. engrauliformis* respectively. It should be taken into consideration, that in spite of examination of 313 specimens of 3 *Clupeids* in the present survey, two zoonotic species including *Contracecum* and *Anisakis* in digestive system, muscle, ovary and Acanthocephal, *Corynosoma strumosum* in intestine of infected *Clupeids* which were previously reported by Shamsi *et al.* (1998), were absent in our examined specimens (Table 2). In same table prevalence of *B. cingulata* in Babolsar catching site is also presented. In Table 3, prevalence of helminthes in *Clupeids* in different seasons of the study year in southern part of the Caspian sea are shown.

In Table 4, measurements of *P. symmetrica* and *B. cingulata* from respective hosts and locality:

Table 1: Helminthes species in *Clupeids* species in south of Caspian sea

Parasites	Host(s)	Locality (ies)	Catching site(s)	Reference(s)
Mazocreas alosae (Hermann, 1782)	*C. cultriventris* *C. grimmi* *C. engrauliformis*	Gill	Babolsa, Bandare-anzali	Present survey Shamsi *et al.* (1998)
Bunocotyle cingulata (Odhner, 1928)	*C. cultriventris* *C. grimmi* *C. engrauliformis*	Intestine (mid gut, hind gut and cecae)	Babolsar, Bandare-anzali	Present survey Shamsi *et al.* (1998)
Pseudo *Pentagramma symmetrica* (Chulkova, 1939)	*C. cultriventris* *C. grimmi* *C. engrauliformis*	Intestine (mid gut, hind gut and cecae)	Babolsar, Bandare-anzali	Present survey Shamsi *et al.* (1998)
Corynosoma strumosum (Rudolphi, 1802)	*C. cultriventris* *C. grimmi* *C. engrauliformis*	Body cavity organs (intestine, muscle, testis, ovary)	Babolsar, Bandare-anzali	Shamsi *et al.* (1998)
Contracaecum sp. (Railliet and Henry, 1912)	*C. cultriventris* *C. grimmi* *C. engrauliformis*	Intestine, muscle, ovary	Babolsar, Bandare-anzali	Shamsi *et al.* (1998)
Anisakis sp. (Dujardin, 1845)	*C. cultriventris* *C. grimmi*	Intestine, muscle, ovary	Babolsar, Bandare- anzali	Shamsi *et al.* (1998)

Table 2: Prevalence of two digenean parasites in examined fishes in Babolsar catching site

	Pseudopentagramma symmetrica			*Bunocotyle cingulata*		
Fish species	Uninfected	Infected	%	Uninfected	Infected	%
C. cultriventris	132	150	53.1	238	44	15.6
C. grimmi	7	7	50.0	12	2	14.2
C. engrauliformis	7	10	58.8	15	2	11.7

Table 3: Prevalence of helminthes in *Clupeids* in Caspian Sea

Seasons of the study year	No. of examine species	No. of infected species	Prevalence (%)	Species
Winter 2008	75	41	54.60	*C. cultriventris*
	2	1	50.00	*C. grimmi*
	3	1	33.30	*C. engrauliformis*
Total	80	43	45.96	
Spring 2009	58	37	63.70	*C. cultriventris*
	4	3	75.00	*C. grimmi*
	7	4	57.10	*C. engrauliformis*
Total	69	44	65.26	
Summer 2009	70	43	61.40	*C. cultriventris*
	--	--	--	*C. grimmi*
	--	--	--	*C. engrauliformis*
Total	70	43	61.40	
Autumn 2009	79	41	51.80	*C. cultriventris*
	8	5	62.50	*C. grimmi*
	6	5	83.30	*C. engrauliformis*
Total	93	51	65.86	

--These species are rarely caught and in summer 2009 were not caught

Table 4: Measurements of *P. symmetrica* and *B. cingulata*

Species	Measurements
P. symmetrica	
Eggs	14.2×4-19.6×4.8(4.3×16.8)
Pharynx	25×27-38×40(31×33)
Ventral sucker	30×30-120×100(58×65)
Oral sucker	40×30-100×110(70×78)
Body width	140-210(178)
Body length	290-420(345)
B. cingulata	
Eggs	14.9×4.8-20.5×5.9(5.1×17.4)
Pharynx	27×30-37×41(31×35.4)
Ventral sucker	60×55-115×80(67.4×87.2)
Oral sucker	80×30-92×78(52.6×87.8)
Body width	135-150(142)
Body length	510-630(598)

Pseudopentagramma symmetrica (Chulkova, 1939) (Fig. 4)

- Specimens studied: 5
- Host(s): *C. cultriventris*, *C. engrauliformis*, *C. grimmi*

- Infected organ: Intestine (mid gut, hind gut and cecae)
- Locality: Babolsar catching site

Bunocotyle cingulata (Odhner, 1928) (Fig. 3)

- Specimens studied: 5
- Host(s): *C. cultriventris*, *C. engrauliformis* and *C. grimmi*
- Infected organ: Intestine (mid gut, hind gut and cecae)
- Locality: Babolsar catching site

The main characteristic of helminthes community of *Clupeids* studied is the dominance of the endohelminthes species and individuals, due mainly to the digenean *P. symmetrica* and the relative scarcity of ectohelminthes fauna, it is interesting to note that except ectoparasite *Mazocreas alosae* and endoparasite *P. symmetrica* which specific to *Clupeidae*

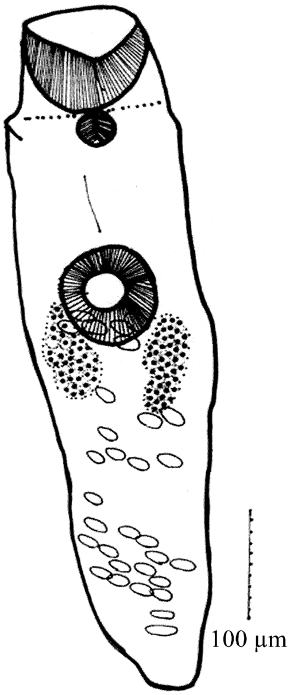

Fig. 3: *Bunocotyle cingulata*

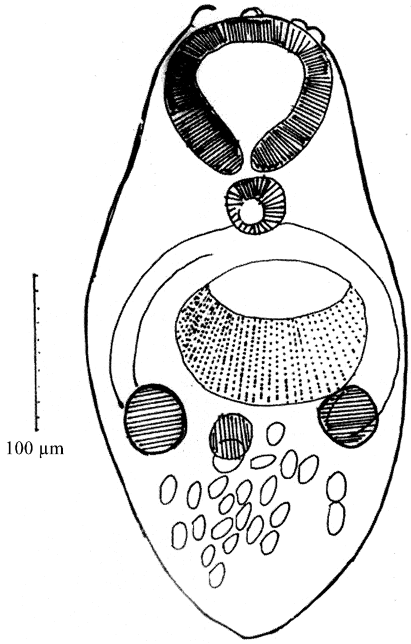

Fig. 4: *Pseudopentagramma symmetrica*

Table 5: Intensity of two digenean parasites in *Clupeids* Babolsar catching site

	Pseudopentagramma symmetrica			*Bunocotyle cingulata*		
Fish species	The lowest No. of parasites in infected fish	The highest No. of parasites in infected fish	Mean No.	The lowest No. of parasites in infected fish	The highest No. of parasites in infected fish	Mean No.
C. cultriventris	2	350	26.0	2	50	12.3
C. grimmi	5	32	19.4	2	5	3.5
C. engrauliformis	7	30	15.8	7	12	9.5

fish family and distributed in all of the world (Gussev, 1985, 1987), other 4 helminthes parasites species reported herein and by Shamsi *et al.* (1998) are generalist, explaining their occurrence in other fish hosts of elsewhere also. For instance, genera *Contracecum* and *Anisakis* larvae occurred in various Cyprinid, Percid, Esocid and Clupeid fishes in encysted in flat or rounded capsulate in the serosa of different organ, mesentery or musculature of hosts (Moravec, 1994).

In the present study, prevalence and intensity of infection by *P. symmetrica* in three *Clupeid* species was taken to consideration. According to our finding prevalence of infection by *P. symmetrica* in *C. engrauliformis* was 58.8%, in *C. cultriventris* was 53.1% and in *C. grimmi* was 50% which was lower than two other fish species (Table 2). In contrary, the intensity of infection log *P. symmetrica* in *C. cultriventris* varying from 2 to 350 (mean of 26) where as in *C. grimmi* varying from 5 to 32 (mean of 19.4) and in *C. engrauliformis* varying from 7 to 30 (mean of 15.8) (Table 5).

The highest number of *P. symmetrica* counted in *C. cultriventris* was 350. In total 3900 parasites specimens were collected from in 150 *C. cultriventris* specimens while, the no of parasites specimens in *C. grimmi* counted 135.8 and for *C. engrauliformis* 158 parasites specimens. As mentioned be for, lack of zoonotic nematodes larvae and Acanthocephal species in the present study may be interpreted due to both chemical and biological environmental alteration of Caspian sea between two different period of study (Shamsi *et al.*, 1998; Present Survey, 2009) which has not yet fully understood, although the chemical pollutions are suggested the main accuser.

Such environmental alteration in Caspian Sea which caused unexpected depletion of *Clupeids* stocks {sudden depletion of *Clupeids* stock from 85000 to 7500 ton in south part of Caspian sea (Esmaili Sari *et al.*, 2001)} or sudden increasing population of Jellyfish (*Cnidaria*) *Mnemiopsis leidyi* (Agassiz, 1865) (Esmaili Sari *et al.*, 1999) are good examples of the results of such ecological changes.

In conclusion, Helminthes species composition and species richness of digenean in clupeid fishes in south of Caspian sea appear to vary significantly from time to time, particularly on the species of genera *Contracecum* and *Anisakis* which can adversely affects public health when ingested, therefore permanent monitoring of infection of *Clupeids* and continues researches on uncontrolled entry of chemical pollutions due to agricultural and industrial development activities are strongly recommended.

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