Parasites of Persian Sturgeon (Acipenser persicus) from South – West of Caspian Sea.

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Abstract: A survey has been carried out on parasites of 206 pieces of persian sturgeons (*Acipenser persicus*) in three different major locations, including fisheries sections I, II and a hatchery near the Sefid-Rud River (Sad-e Sangar) in south - west of Caspian Sea (Guilan province - Iran) .Six different species of parasites were isolated from internal organs of the fish . *Cucullanus sphaerocephalus* and *Skrjabinopsolus semiarmatus* had the highest prevalence (84.85% and 51.23% respectively) and also, the intensity of these parasites were higher than others (11.31 and 15.25 respectively), but the other parasites had low prevalence and intensity. The *Eustrongylides excisus* (L), *Anisakis* sp. (L) and *Amphilina foliacea* are reported for the first time from *A. persicus*.

The prevalence and mean intensity of parasites in fisheries section II and Sad-e Sangar were more than section 1. A direct relation was found between some parasites (especially *Cucullanus sphaerocephalus* and *Skrjabinopsolus semiarmatus*) and size of the fish. The prevalence and mean intensity of parasites in females were more than males. It was found that there is a correlation between some parasites (especially *Cucullanus sphaerocephalus* and *Skrjabinopsolus semiarmatus*) and season. As a whole, There was a closely correlation between the diet of the fish and the type (diversity) of the parasites.

Keywords:

Fish, Persian, Sturgeon, ***A. persicus***, Parasite, Caspian Sea

Introduction:

Acipenser persicus Borodin 1897 is an important sturgeon which has valuble caviar and comprises about 30% of sturgeon caught in Iranian shore of Caspian Sea (Emadi 1996). The name ***A.persicus*** is due to high distribution of it in Iranian shore (Holcik 1989). ***A. persicus*** is similar to russian sturgeon (***A. gueldenstaedti***) because of short , round and blunt snout and it has been considered as a subspecies of ***A. gueldenstaedti*** for a long period of time (Berg 1948). ***A. persicus*** can be distinguished from A. gueldenstaedti based on the fewer number of scutes and gill rakers, the longer and deppressed head , the elongate body , the tighter snout which curved inferiorly and the lighter color (Beliaev 1932; Marti 1940 ; Berg 1948 ; Mageramov 1972 ; Artyokhin 1979 ; Putilina 1983b) .

The diet of ***A. persicus*** in southern part of Caspian Sea include small fishes (such as ***Clupeonella spp***. Gobiids; ***Alosa spp***.and ***Vimba vimba***); crustacians (such as shrimps and ***Balanus***) and polychaeta (Teric, 1994).

As most communities of ***A. persicus*** exist near south - east and southern part of Caspian Sea, so the information about parasitology of this fish are mostly related to this area. Some reports in this area are related to the period of time when A.persicus was considered as a subspecies of ***A. gueldenstaedti*** .So these reports could not be useful. But in a survey on 604 samples of ***A. persicus***, only three parasite species were reported, including ***C.sphaerocephalus***, ***S.semiarmatus*** and ***L. plagicephalus*** (Gorogi 1995). So , It was attempted to carry out a comprehensive survey on this fish to indicate the parasite communities of this fish and define the prevalence and mean intensity of them as well as epidemiological

survey and also compare the diversity of parasites of this fish and other sturgeons.

Materials and Methods:

Persian sturgeon ***(A. persicus)*** was collected during April - February 1997 - 99 and samples included whole fish and viscera. A total of 206 samples were examined. The samples included the broodstock fish of a hatchery located near to Sefid-Rud River (Sad-e Sangar) and sturgeons caught in fisheries sections of I and II along with a shore area of more than 200 kilometers (these fish were processed in 16 different fishing stations along with the shore) .

After recording biometric characteristics and removing the viscera, all viscera were examined for parasites; sections of the spleen and liver were squashed and the major ducts in the liver were dissected and examined. Mucus from the first part of intestine was removed and examined between glass plates for protozoans. Live trematodes and acanthocephalans were relaxed in distilled water at 4 C for 1 hour and fixed in 10% hot buffered formalin. Live nematodes were fixed in hot 70% ethanol and cleared in glycerine alcohol or hot lactophenol. Frozen specimens were thawed in water, then fixed with 10% formalin (trematodes and acanthocephalans) or 70% ethanol (nematodes). All specimens which fixed in 10% formalin, were stained with aqueous acetocarmine, dehydrated and mounted in Permount (Fisher Scientific Co., U.S.A.)

Analysis:

Standard statistical computations (mean intensity, standard deviation and prevalence) were calculated for the all samples and for the samples categoried based on season, geographical location, sex, length and weight. The dominance of a parasite species was calculated as N/N sum (where N= abundance of a parasite species and N sum= sum of the abundance of all parasite species isolated) and expressed as a percentage. The correlation between growth rate and the number of Parasites were determined by Pearson, s Correlation Coefficient. Computations were performed using Lotus 1-2-3 as a data sheet and sx (Walts - stuff, vertion 4.0) for statistics.

Results:

In this survey, 3039 worms of nine different parasite species were recovered, which their name, prevalence (including Confidence Interval of prevalence with Confidence Level of 95%, $p<0.05$), mean Intensity and Range (Minimum and Maximum) of parasites are shown in Table 1.

According to the Table 1, ***C. sphaerocephalus*** had the highest prevalence (84.75%) and ***S. semiarmatus*** was the second parasite (with the prevalence of 51.23%). The mean ntensity of these two parasites were 11.31 and 15.25 respectively. The other parasites had low prevalence and mean ntensity.

According to the Table 2, the dominance of ***C. sphaerocephalus*** and ***S.semiarmatus*** were more than other parasites (57.75% and 41.79% respectively) and these two parasites comprised more than 99.5% of parasite communities of this fish.

According to the Table 3, the prevalence and mean intensity of ***C.sphaerocephalus*** in ***A. persicus*** during spring were more than summer, fall and winter respectively (though the differences were not significant based on One Way Anova Test, $p<0.05$) .The prevalence and mean intensity of ***S. semiarmatus*** during spring and winter were significantly more than fall and summer respectively (One Way Anova Test, $p<0.05$). The prevalence and mean intensity of other parasites were low during all seasons.

According to the Table 4, the prevalence and mean intensity of ***C. sphaerocephalus*** in ***A. persicus*** in fisheries section II and Sad-e Sangar were more than fisheries section I (though the differences between locations were not significant based on One Way Anova Test, $p<0.05$). The prevalence and mean intensity of ***S. semiarmatus*** in fisheries section II and sad-e sangar were significantly more than section I (One Way Anova Test, $p<0.05$).The prevalence and mean intensity of other parasites in all locations were low .

According to the Table 5, the prevalence and mean intensity of ***C.sphaerocephalus*** and ***S.semiarmatus*** in females of ***A. persicus*** were more than males. Especially the mean intensity of these parasites showed significant differences (Z Test, $p<0.05$). The prevalence and mean intensity of other parasites in both females and males were low.

According to the Table 6 and 7, prevalence and mean intensity of ***C.sphaerocephalus*** and ***S. semiarmatus*** in ***A. persicus*** of different sizes (lengths and weights) were different and specially as the fish got bigger (and longer), the mean intensity of these parasites increased (though the differences between different sizes were not significant , One Way Anova Test , $p<0.05$).

Discussion and Conclusion:

As ***A. persicus*** is mostly caught in Iranian shore of Caspian Sea, so the information about parasites of this fish confine to this area. But most of investigations have been carried out when ***A. persicus*** was not a valid species and was considered as a subspecies of ***A. gueldenstaedti***. So, the reports could not be considered (Rostami, 1943; Mokhayer, 1972). There is only one report about the parasites of ***A. persicus*** (Gorogi, 1995) which only three parasite species have been isolated from 604 fish samples (including ***C.sphaerocephalus, S.semiarmatus*** and ***L.plagicephalus***). The low diversity of parasites in that research encouraged us to do a comprehensive and precise survey on the parasites of ***A.persicus***.

In present survey, 206 samples of ***A. persicus*** were examined and 3039 parasites of six different species were isolated. So , in present survey , the three other species , ***A.foliacea ,Anisakis sp.(L)*** and ***Eustrongylides excisus*** (L) , are reported for the first time from ***A.persicus*** (new host species). In the present survey, ***C. sphaerocephalus*** and ***S.semiarmatus*** had the highest prevalence and mean intensity and also more than 99.5% of parasite communities of ***A.persicus*** belonged to these two parasites. The high prevalence and high mean intensity of these two parasites may be due to high abundance of Polychaeta (Nereids) and Oligochaeta in the diet of ***A. persicus*** (Nereids and Oligochaeta are considered to be the intermediate hosts of C. ***sphaerocephalus*** and ***S.semiarmatus*** respectively).

In the present survey , the prevalence and mean intensity of ***E. excisus*** and ***Anisakis sp***. were low, which may be due to lower amounts of vertebrates, including benthic fishes such as Gobiids and Cyprinids (obligatory second intermediate hosts of the parasite) (Moravec 1994) in the diet of ***A. persicus***. The low prevalence and low mean intensity of ***A. foliacea*** may be due to decreasing rate of the migratory ***A. persicus*** into the freshwater (as a result of deterioration of river ecosystems and unfavourable conditions of them). ***A. foliacea*** and ***Polypodium sp***. are to be the freshwater parasites. In the present survey , the diversity of parasites in ***A. persicus*** was lower than other sturgeons (Sattari 1999) which may be due to low diversity of food items in it's diet and selective nature of food consuming in ***A. persicus*** (Holcik , 1989) . In the present survey, among different parameters affecting the parasitic infections in ***A. persicus***, size, location, season, and to some extent, sex had more effects respectively (especially on the prevalence and mean intensity of ***C. sphaerocephalus*** and ***S.semiarmatus***). For example ,the prevalence and mean intensity of ***S. semiarmatus*** in spring and winter were more than fall and summer respectively which may be due to the time period of spawning migration to the coastal areas at the end of fall - early winter and spring which may cause low resistance of their immunity system as a result of migration stress . Furthermore , the mean intensity of C. sphaerocephalus in spring was more than summer , fall and winter respectively (even tough the differences between seasons were not significant based on One Way Anova Test $p<0.05$) , which again may be related to the time period of spawning migration. In the present survey , it was found that the prevalence and mean intensity of ***C.sphaerocephalus*** and ***S.semiarmatus*** in fisheries section II and Sad-e Sangar , were more than section I and specially the differences between locations were significant for ***S.semiarmatus*** . It may be due to the abundance of food items (such as Nereids and Oligochaeta) in fisheries section II and Sad-e Sangar compared with section I. It is necessary to explain that the Sefid-Rud River (which is the biggest river in the south -west of Caspian Sea), enters into the Sea at fisheries section II and Sad-e Sangar. So, the effects of this important river on eutrophication of these sections should be considered. Furthermore, all of the fingerling sturgeons hatched in Sad-e Sangar facillity, are released into the Sefid-Rud River and then they move into the Sea. So, we can expect that most of them will come back to these sections and the rates of catching sturgeons (and also the rate of infections) in these sections are more than section I

(generally speaking, the availability of sturgeons is easier for parasites). Based on comparing the results of present survey and the results of Gorogi (1995), the parasitic infections of ***A. persicus*** in south - west of Caspian Sea, is higher than south-east due to higher salinity of sea water in south - east(which sometimes reach to 20 ppt compared to 14 ppt in south-west).

In the this survey, it has been found that the size (length and weight) of the fish had correlation (direct relation) with prevalence and mean intensity of ***C.sphaerocephalus*** and ***S.semiarmatus*** (even tough the differences between sizes were not significant based on One Way Anova Test $p<0.05$). However, it is presumably due to higher amounts of consumed food (including intermediate hosts) and longer period of exposure to the parasites in bigger (and longer) fish. In the present survey, it was found that the mean intensity of ***C. sphaerocephalus*** and ***S.semiarmatus*** in females are significantly more than males (Z Test, $p< 0.05$). It is presumably because the females which are caught for induced spawning in hatcheries and also for caviar in fishing stations, have bigger size than males (see previous paragraph). In this study, it was shown that the rate and diversity of infections in ***A.persicus***, like other sturgeon species, had close correlation with the type of food items. Hence, the type and amount of parasites in ***A. persicus*** were different from piscivorus sturgeons such as ***H.huso, A. nudiventris*** and ***A. gueldenstaedti*** (sattari 1999). In the three latter fish species, prevalence and mean intensity of ***E. excisus***, ***Corynosoma strumosum*** and ***Anisakis sp.*** Were significantly more than ***A. persicus*** (sattari 1999). In the present survey, some parasite species which have zoonotic importance (Common between fish and human), such as Anisakis ***sp***. (L), were isolated from ***A.persicus***. But fortunately the prevalence and mean intensity of them were low. However, some fishmen may consume the internal organs (gut and liver) as barbique (kabab), and this may tend to transmission of parasites to them. Furthermore, in some fishing stations, the internal organs of sturgeons are removed into the Sea, which may complete the life cycle of some parasites and should be avoided.

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Table.1: Distribution of Prevalence, confidence interval of prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in *A.persicus*.

Parasite	Prevalence (%)	CI of prevalence (%)	Mean intensity	Range
C.sphaerocephalus	84.85	79.6-89.5	11.31	1-109
S.semiarmatus	51.25	44.4-58-1	15.25	1-109
L.plagicephalus	1.85	0.01-3.69	1	1
E.excisus	1	0.01-2.73	3	2-4
Anisakis sp.	2	-	1	1
A.foliacea	1	-	1.5	1-2

Table.2: The number and Dominance (%) of parasites in *A.persicus*.

Parasite	Number	Dominance (%)
C.sphaerocephalus	1755	57.75
S.semiarmatus	1270	41.79
L.plagicephalus	6	0.197
E.excisus	3	0.099
Anisakis sp.	3	0.099
A.foliacea	2	0.066

Table.3: Distribution of Prevalence, Confidence Interval of Prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in *A.persicus* in different seasons

C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	Anisakis sp. Prevalence (%) Mean±SD Range	A.foliacea Prevalence (%) Mean±SD Range	E.exisus Prevalence (%) Mean±SD Range
90	73.73	1.11	0	0	0
13.14+16.81 (1-109)	17.05+22.84 (1-109)	1 1	0 0	0 0	0 0
67.68	14.71	5.88	5.88	2.94	2.94
11+13.96 (1-53)	5.2+5.58 (1-15)	1 1	1 1	2 2	4 4
88.46	19.23	0	0	3.85	0
7.65+7.49 (1-33)	2.4+2.61 (1-7)	0 0	0 0	1 1	0 0
83.33	58.33	0	0	0	8.33
5.6+3.69 (1-13)	14.71+15.91 (1-44)	0 0	0 0	0 0	2 2

Table.4: Distribution of Prevalence, Confidence Interval of Prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in *A.persicus* in different locations

Parasite Prevalence (%) Mean±SD Location	C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatu Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	Anisakis sp. Prevalence (%) Mean±SD Range	A. foliacea Prevalence (%) Mean±SD Range	E.excisus Prevalence (%) Mean±SD Range
st.1	74.42	16.28	2.33	2.33	4.65	0
N=43	6.72+7.14 (1-37)	2.71+2.63 (1-7)	1 1	1 1	1.5+0.71 (1-2)	0 0
St.2	80	33.33	3.33	3.33	0	6.67
N= 30	11.25+13.23 (1-53)	1 1	1 1	1 1	0 0	3+1.14 (2-4)
St.3	91.01	1.12	1.12	0	0	0
N= 89	13.14+16.81 (1-109)	1 1	1 1	0 0	0 0	0 0

Table.5: Distribution of Prevalence, confidence interval of prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in *A.persicus* in male and female

Prevalence (%) Mean±SD sex	C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	Anisakis sp. Prevalence (%) Mean±SD Range	A.foliacea Prevalence (%) Mean±SD Range	E.excisus Prevalence (%) Mean±SD Range
female	85.09	51.75	2.63	0.88	1.75	0
N=114	12.55+15.93 (1-109)	17.22+23.96 (1-109)	1 1	1 1	1.5+0.71 (1-2)	0 0
Male	82.22	48.89	2.22	2.22	0	4.44
N=45	7.84+9.81 (1-41)	9.95+11.95 (1-44)	1 1	1 1	0 0	3+1.41 (2-4)

Table.6: Distribution of Prevalence, confidence interval of prevalence (p<0.05), Mean and Range (Maximum and Minimum) of parasites in *A.persicus* based on fork length

Prevalence (%) Mean±SD Length(cm)	C.sphaerocephalus Prevalence (%) Mean±SD Range	S.semiarmatus Prevalence (%) Mean±SD Range	L.plagicephalus Prevalence (%) Mean±SD Range	E.acipenserinum Prevalence (%) Mean±SD Range	E.excisus Prevalence(%) Mean±SD Range	B.fallax Prevalence(%) Mean±SD Range
100-119	80	60	0	2	0	20
N=5	6.75+7.14 (1-17)	11.67+9.81 (6-23)	0 0	1 1	0 0	4 4
120-139	70.73	34.15	2.44	2.44	0	0
N=41	9.9+13.03 (1-61)	12.07+12.75 (1-44)	1 1	1 1	0 0	0 0
14 0-159	90.91	58.44	1.3	0	2.6	1.3
N=77	12.3+13.47 (1-55)	13.89+19.79 (1-109)	1 1	0 0	1.5+0.71 (1-2)	2 2
160<	86.11	50	2.67	0	0	0
N=36	11.32+19.48 (1-109)	23.39 (1-105)	1 1	0 0	0 0	0 0