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Acipenser stellatus as a new host record for *Lernaea cyprinacea* linnaeus, 1758 (crustacea; copepoda), a parasites of freshwater fishes in Iran

Abstract

Acipenser stellatus is the most euryhaline sturgeon in the Caspian Sea which is reputed to have the tastiest flesh and also the best caviar in Iran. The main objective of the current study was to investigate the gill parasites of *A. stellatus* in "Rajaee Aquaculture Centre" in northeast of Caspian Sea Basin, Mazandaran Province. A total of 22 individuals were selected accidentally and examined for the parasites during the spring of 2017. Six adult female of *Lernaea cyprinacea* L. 1758, an ectoparasitic copepod species was detected on the gill filaments and archs. Five (22.7%) out of 22 specimens of the examined fish were infected with adult anchor worms containing egg sacs and *A.stellatus* is presented as a new host for *L.cyprinacea* in the present report. The presence of this parasite on sturgeon fishes has not previously been reported in all over the world. Also this is the first report of occurrence of adult female of *L.cyprinacea* on the fish gills.

Keywords: *Acipenser stellatus, adult Lernaea cyprinacea,* gills, caspian sea

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Introduction

Lernaea cyprinacea Linnaeus, 1758 (Crustacea: Copepoda) is a parasite of freshwater fishes in various regions of the world and it is often called anchor worm. It is a thermophilic organism and finds excellent conditions for reproduction at temperatures between 23-30°C.[1,2] *L.cyprinacea* has nine stages throughout its lifetime and goes through many metamorphoses including three free living naupliar stages, five copepodid stages, and one adult stage.[3] After male and female adults mate on the fish host and then males die, females metamorphose, insert their anterior body into the host tissue whereas the remaining body protrudes in the water.[4] The invasion of adult female destroys scales, skin, muscles and penetration of the fish body results in deep ulcers, abscesses or fistulas accommodating with serious economic loss and heavy parasitosis could be the cause of mass mortalities and also secondary bacterial or fungal infections. The copepod is also known as a pathogen of cultured and aquarium fishes and typically occurs on the gills. This parasite was described in more than 100 fish species belonging to 25 different families.[5] *Lernaea cyprinacea* was accidentally introduced to Iran with exotic cyprinids[6] and currently it could be found on several species of cultured and wild fish from different families living in aquarium, ponds and natural water bodies throughout the country. Various studies on the occurrence and outbreak of *L. cyprinacea* have been conducted to date. Barzegar & Jalali[7] listed the Crustacean parasites of fresh and brackish (Caspian Sea) water fishes of Iran and reported this parasites on the gills, skin and fins of 14 cultured and wild fish species from 13 genera and four families. Then Pazooki & Masoumian[8] made a synopsis of the parasites in Iranian freshwater fishes and added five more species to the list and Raissy et al.,[9] studied the outbreak of *L.cyprinacea* Linnaeus (Crustacea: Copepoda) in Cyprinid fish from Chaghakhor lagoon. Also the occurrence of *L.cyprinacea* has been reported on ornamental fished by several researchers. Ebrahimzadeh Mousavi & Meshgi, et al.,[10,11] reported *Lernaea cyprinacea* from goldfish, then Adel et al.,[12] recorded *L. cyprinacea* on *Carassius auratus*, *Poecilia reticulate*, *Pterophyllum scalare, Symphsodon discus* and *Poecilia latipinna* from local ornamental fish farm in the north of Iran.

Acipenser stellatus Pallas, 1771 is the most euryhaline sturgeon in the Caspian Sea Basin which is reputed to have the tastiest flesh and also the best caviar in Iran. Adults and juveniles occur in the North, Middle and South Caspian at salinity range of 0-14.34‰[13] but it is now rare in the rivers because of dam construction and irrigation control structures near river mouths which in hibits the spawning in their migration. Kiabi & Abdoli[14] consider this species to be vulnerable in the south Caspian Sea basin according to IUCN criteria. The main objective of the current study was to investigate the gill parasites of *A. stellatus* in "Rajaee Aquaculture Centre" in northeast of Caspian Sea Basin, Mazandaran Province.

Material and methods

A total of 22 individuals of *A. stellatus,* were selected accidentally from "Rajaee Aquaculture Center" situated in Mazandaran Province, Iran and examined for gill parasites during the spring of 2017. After recording biometric characteristics of the fish, the parasites were collected from the gills of fish using dissecting pens, preserved in 70% ethanol. For light microscopical examination, parasite specimens were cleared, stained and mounted following Kabata et al.,[15] and photographing was made with the aid of a digital microscope camera (Sony, SSC-DC80P). The terminology and measurements were carried out in accordance with the keys were given by Gussev et al.,[15–17]

Results

Six adult female of *Lernaea cyprinacea* Linnaeus, 1758, with egg sacs were found attached to thefilaments and archs of the examined fish (Figure 1) (Figure 2). The female has a slender and tubular body with3.9±0.8 mm long. The cephalic holdfast was developed well and was comprised a pair of unbranched ventral processes and a pair of larger, slightly dorsal processes. Five (22.7%) out of 22 specimens of the examined fish, were infected by six adult female of *L. cyprinacea* with egg sacs.

Figure 1 Female adult of *L. cyprinacea* on the gill filament of *Acipenser stellatus* from Rajaee Aquaculture Center, 2014. Magnification: 10x.

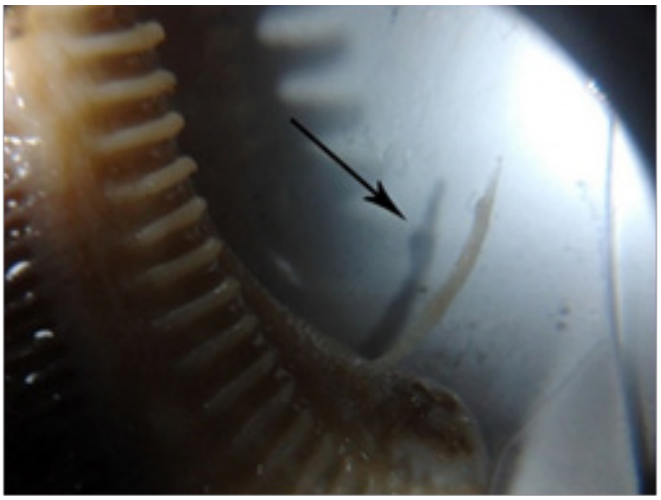

Figure 2 Female adult of *L. cyprinacea* with egg sacs on the gill arch of *Acipenser stellatus* from Rajaee Aquaculture Center. 2014. Magnification: 10x.

Discussion

Considering the commercial importance of the sturgeon, several studies have been carried out on the parasites of different species of the sturgeon particularly *A.stellatus* in Iran. A total of 15 parasite species have been isolated from different parts of the body of *A. stellatus,* contains; *Diclobothriumarmatum*, *Nitzschia sturionis, Diplostomum spathaceum, Skrjabinopsolus semiarmatus, Bothrimonus fallax, Eubothrium acipenserinum, Amphilina foliacea, Cucullanus sphaerocephalus, Cyclozon acipenserina, Eustrongilides excisus, Corynosoma capsicum, Corynosoma strumosum, Leptorhynchoides plagicephalus,, Pomphorhynchus leavis, Pseudotracheliastes stellatus*[17–21] and this is the first report of occurrence of adult female of *Lernaea cyprinacea* on the gills of *A. stellatus* in all over the world.

In the last decade sturgeons are generally conserved by fish farming and releasing of young and fry, attempting to extend natural populations in Iran. In this regard, Rajaee Aquaculture Center in southeast of Caspian Sea Basin, is produced 2-3 million sturgeon fingerlings including *A. stellatus*, annually and releases them to Caspian Sea rivers at the size of 10-15 cm. Rajaee Aquaculture Centre, mainly is a place to produce warm water fishes including common and Chinese carp. So the infestation of *A. stellatus* by *L. cyprinacea* is probably arrived by infected cyprinoid fishes. In the conditions of farming (high density of fish and appropriate physical and chemical condition such as temperature and salinity) the parasites could established host-parasite systems, completed its life cycle and produced viable eggs.

L. cyprinacea is not host specific and has the widest host range. The parasites with wide host rang are potentially serious danger for fish populations.[1,4] stage is typically occurs on the gills and adult females usually attach on the body surface and insert their anterior body into superficial layers of the body musculature. They may attach to head, eye, fins, and operculum surface or on buccal cavity of fish specimens and in several cases the parasite specimens penetrated into the body cavity and inserted itself into the liver of fingerlings of fish host.[6] And this is the first report of occurrence of adult female of *L.cyprinacea* with egg sacs on the fish gill filaments and archs.

Whitaker & Schlueter and Barson et al.,[24,25] suggested that differences in susceptibility of fish species to the parasite, could be due to differences in ecological, behavioral and physiological mechanisms and morphological variations. *L.cyprinacea* is very sensitive to the salinity, the osmolarity of the haemolymph of attached metamorphosed females is similar to that of the host, though attached females can survived in salinity of 15 or 30‰ for at least 6 days but failed to produce viable eggs. *A. stellatus* is an anadromous fish species (spending at least part of its life in salt water and returning to rivers to breed), despite this, the presence of few gill plates under a single large gill operculum which protects the gills cavity, lets copepodid *L. cyprinacea* to find a suitable place in order to develop to mature.[5]

Conclusion

In the case of occurrence of infestation in juveniles, after releasing fishes to the rivers, although the parasite may not be able to produce viable eggs but can continue for a long to exist. Definitely as the sturgeon fingerlings are in sensitive ages and endure stressful conditions during their migration to the sea, even mild infection can also lead to reduction of their survival chances and high mortality would be occurred because of respiratory distress through poor gas transfer, slow blood circulation in the gill lamellae and osmoregulation failure. In resistant fish, the parasites may complete its life cycle and produce the new generation that cause infection among the new host species. As *A. stellatus* is on the list of endangered species and accordance with the commercial value of the fish, preventive measures for pollution control in breeding center is the basics of controlling of the parasites and guarantees the success in the restoration and conservation of the fish stocks in the Caspian Sea.

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Conflict of interest

The author declares that there is no conflict of interest.

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