Review Article

First record of the Glugea sp. on the Alosa fallax (Lacepède, 1803) caught in the marine waters of Syria(eastern Mediterranean).

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ABSTRACT

During the implementation of the current research entitled (Study of diet, growth, reproduction, and determination of the concentrations of some trace elements in Alosa fallax (Lacepède, 1803) in the marine waters of the Lattakian coast), we found the parasite Glugea sp. Inside one of the Alosa fallax caught on 7/24/2023 AD from the Ras Al-Baseet area (35.8524°N, 35.8378°E) using Purse nets. Infection with the parasite Glugea sp. In colonies of yellowish-white masses over the digestive system and muscles. The anatomical and histological characteristics were consistent with scientific references, and this is the first record of the parasite Glugea sp. In the Syrian marine waters (and the eastern Mediterranean).

Keywords: Glugea, Alosa fallax, Microsporidea, Syria

1. INTRODUCTION

Clupeidae occupies the first place in economic fisheries in the world, as the annual catch rate of its species reached (11) million tons (more than 20% of the total catch of fish in the world), of which more than a thousand tons are caught annually in the Mediterranean Sea (Sayskan 1988; FAO.2018).
Alosa fallax is characterized by a moderately deep body (the maximum body height is medium), short notched jaw, colour: bright blue back, silver to white fins, with a dark spot behind the gill cover, and (5-6) other spots to follow (Whithead et al.1986).
Pelagic fish that migrate long distances. enter estuaries. It feeds on zooplankton and small fish. reproduction season in the spring. They spawn in tidal places and estuaries. Lay eggs on the bottom. It is spread in the Mediterranean from Finland and Iceland to Morocco and the countries of the eastern Mediterranean.)Golani et al., 2006).(Sindermann 1990, Lom and Dyková 1992, Shaw and Kent 1999, Lom and Nilsen 2003).
Glugea sp. belongs to the class Microsporidea and they are protozoan parasites, It is believed to be closely related to the fungus Mecoza. These parasites are transmitted between hosts by monocytes cells bacteria and may be transmitted by ingestion by fish directly without the presence of an intermediary. Microsporidea can be found in almost any environment and can infect large numbers of vertebrate and invertebrate species (Kent et al.,2014). They range in length from less than 1 µm to more than 30 µm (Larsson, 1999).
Juvenile hosts are more likely to cause mortality than adults (Show and Kent, 1999). It causes the enlargement of host cells that look like tumors and are full of bacteria, and this is common in fish infected with the genus Glugea. (Sindermann 1990, Lom and Dyková 1992, Shaw and Kent 1999, Lom and Nilsen 2003).

The immune response is often weak or non-existent, as the parasites are protected within host cells or encapsulated in xenomas. However, parasites can attack the host's immune system during primary infection or if the host cell or tumor ruptures (Rohde, 2005).
Microsporidea infection may result in altered host-sex ratios by killing or transforming males into females (sex inversion) of the host as well as changes in behavior and alterations in feeding (Dunn et al., 2001).

2. MATERIALS AND METHODS

Alosa fallax was collected with an average of (1100) individuals from the Ras Al-Baseet area on the coast of Lattakia Governorate, Syria, eastern Mediterranean. (35.8524°N, 35.8378°E) from 10/19/2021 to 7/24/2023 using a Purse net to carry out a biological study (nutrition, reproduction, growth, and determination of heavy metal concentrations in the muscles of the Alosa fallax) and during the anatomy of the sample collected on 24/7/2023 we noticed the presence of xenomas located on the internal organs of the fish (Stomach and Intestines). A microscopic swab was taken from one of the tumors (xenomas), and the presence of germs was noted inside the tumors. The sample was kept in 4% formaldehyde for a day to stabilize it, then a series of routine procedures were performed to treat it with paraffin wax and to obtain a permanent slide containing the tissue sections of this parasitic infection according to the reference (Carleton et al., 1962).

3. RESULTS AND DISCUSSIONS

Alosa fallax was collected from the Syrian marine waters using Purse nets during the period from 10/19/2021 to 7/24/2023, and its total number reached 1100 individuals. On 7/24/2023, one of the individuals was found infected with a parasitic disease (Fig. 1), as it was found during the anatomy of the sample. The presence of fatty tumors on the viscera (Stomach and Intestines, as well as some tumors within the muscles), Figure (2). A smear was taken from one of the tumors and examined microscopically using a light microscope, and it was found that there were germs within the tumors, Figure (3). Then a part of the digestive system was taken and a histological study was conducted and it was found that there are Injuries and infections within the tissue Figure (4) Upon research and reference comparison, it was found that the parasite belongs to the *Microsporidea* class specifically of the genus *Glugea sp.*, There is no scientific article yet on the infection of *Alosa fallax* fishes with the parasite *Glugea sp.* in the eastern basin of the Mediterranean. We will mention some of the parasites of the genus *Glugea*, which have been recorded infecting different fish species in the following table.

Table 1: Some parasites of the genus *Glugea* that have been recorded to be infecting different fish species

Parasite	The host	References
Glugea hertwigi	*Rainbow smelt Osmerus mordax,*	Canada (Lovy et al.,2009)
Glugea gasterostei	*Three-spined stickleback Gasterosteus aculeatus (Actinopterygii: Gasterosteiformes)*	(Tokarev et al.,2015)
Glugea nagelia	*Cephalopholis hemistiktos (Actinopterygii: Serranidae)*	Red Sea (Abdel-Baki et al.,2015b)
Glugea jazanensis	*Lutjanus bohar*	Red Sea (Abdel-Baki et al.,2015)
Glugea arabica	*Epinephelus polyphekadion*	Red Sea (Azevedo et al.,2016)
Glugea serranus	*Blacktail comber, Serranus atricauda (Teleostei: Serranidae*	the Madeira Archipelago (Portugal) (Casal et al.,2016)
Glugea sardinellensis	*Sardinella aurita*	Tunisian coasts. (Mansour et al.,2016)
Glugea eda	*Striated fusilier, Caesio striata,*	Red Sea off Saudi Arabia (Mansour et al.,2020)
G. sardinellesis	*Sardinella aurita*	Algeria (Ramdani,2022)
G. thunni	*Blue fins tunna Thunnus thynnus*	Atlantic Ocean (López-Verdejo,2022)
Glugea sp.	*Alosa fallax*	Syrian marine waters Current research,2023

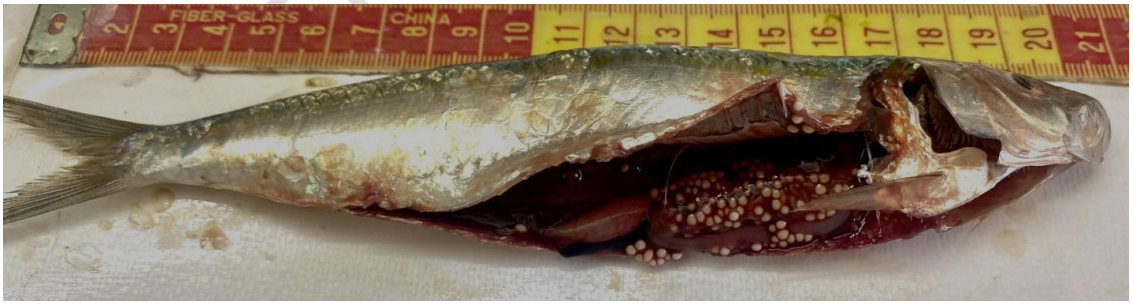

Figure (1): *Alosa fallax* caught from Ras Al-Bassit on 24/7/2023, with a length of 21 cm and a weight of 59.83gr

Figure (2): Fatty tumors within the bowels of *Alosa fallax* Caught from Ras Al-Baseet on 7/24/2023

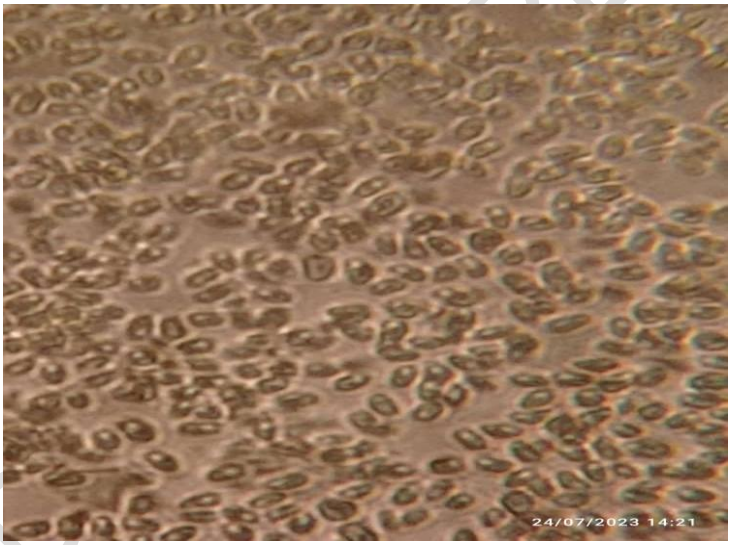

Figure (3): Microscopic smears at 40 magnification of sebaceous tumors taken from parasite-infected fish showing the spores inside the tumors.

Figure (4): Histological section of fatty tumor on the guts of *Alosa fallax* fish infected with the parasite *Glugea sp*.

4. CONCLUSION

The results showed that Alosa fallax was infected with the parasite Glugea sp. In terms of fatty tumors full of bacteria, this is the first record of parasitic infection with this parasite among marine fish in the Syrian and eastern Mediterranean waters.

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