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Fish lice *Argulus foliaceus* infestation in Goldfish *Carassius auratus* from Lucknow, U.P. India: A report

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Abstract
The ornamental fish industry is a rapidly growing industry, providing employment opportunities to many people. Ornamental fishes are used for entertainment and decorative purposes in the whole world and goldfish is one of the most common fish species of ornamental fishes. Parasitic infections are great threat to ornamental fishes, causing heavy economical loss. *Argulus foliaceus* is a common crustacean ectoparasite of Goldfish *C. auratus*, which affects fish health and its production. As a parasite, *Argulus* impose severe health effects on fish health. Heavy parasitic infestations cause significant morbidity and mortility. *Argulus* also serves as a vector for several pathogens including bacteria, viruses and several other pathogens. Highly tolerance nature, direct life cycle, cosmopolitan distribution and unavailability of approved drugs for control and treatment of Argulosis, the problem becomes more severe. Proper screening, manual removing, sanitation and quarantine of incoming fish is the best way of prevention and control of *Argulus* infection.

Keywords: *Argulus foliaceus*, goldfish, *C. auratus*, Argulosis

Introduction
Culture and maintenance of ornamental fishes is a good means of entertainment as well as the growing industry, which is helpful in the entrepreneurship of common people. Various organisms infest ornamental fishes and destroy their quality as well as quantity of production. Among all the infesting pathogens, fish lice are widely distributed and infesting the fish population. Fish lice belong to the order Branchiura of Subphylum Crustacea of Arthropods. Genus *Argulus* (Crustacea: Branchiura), commonly known as fish loose, are the common ectoparasite of freshwater as well as marine fishes, causing a common disease called Argulosis. These parasites are common in goldfish and koi fish. Theses parasites apart from stress and damaging they are causing also often leads to secondary parasitic infections which damages the ornamental fish industry. Present study was aimed to identify the parasite and damages it causes to gold fish *C. auratus* from Lucknow U.P. India.

Material and Methods
Goldfish *C. auratus* were collected from locsl market in Lucknow and maintained in glass aquaria containing 20 ltr dechlorinated water under normal photoperiod and standard laboratory conditions. Fish showing altered behavior like letharginess were examined for parasites. Parasites were easily detected by naked eyes attached to the body of fish. Parasites were found stucked on gills, operculum, pectoral fins and near the mouth. Parasites were picked up manually by foreceps, washed in crustacean ringers solution (Brown and Creedy, 1970) [6] and fixed in 80% alcohol for 24 hrs and stored in a 70% alcohol and glycerol mixture. Permanent mounts of the parasite were prepared by routine dehydration with ethanol series, cleared in xylene and mounted in Canada balsam. Parasites were examined under stereoscopic dissecting binocular in live as well as the fixed condition and photographed. Parasites were identified according to Pavlovs *et al.* (1962) and Rushton Mellor (1994).

Observation
During maintenance of goldfish *C. auratus* 10% parasitemia was observed in the whole population. Generally 2-10 parasites (Avg. 5) was recorded per fish.

Infected fish showed alteration in behavior like letharginess, erratic swimming, rubbing of skin with aquarium wall. Hemorrhage was recorded in gills, operculum, pectoral fins and mouth region. Severe infestation cause inflammation of the skin, increased mucous secretion, loss of scale. Loss of appetite and weakness were also recorded in infected fish.

Fish lice *Argulus* was identified as *Argulus foliaceus* (Crustacea: Branchiura). *Argulus foliaceus* was about 6-7mm in length having rounded lobes on the abdomen covered with small seate. The parasite is dorso-ventrally flattend, having an oval body covered by a white carapace and compound eyes. The needle-like stylet is located in front of the mouth for piercing the host skin. Two prominent suckers are located on either side of the mouth and stylet is used to attached to the fish body. Females are slightly larger than males and have pointed seminal recepticles on the posterior end.

Plate 1

Fig 1: Photograph showing *Argulus foliaceus* stuck on the body surface of Goldfish

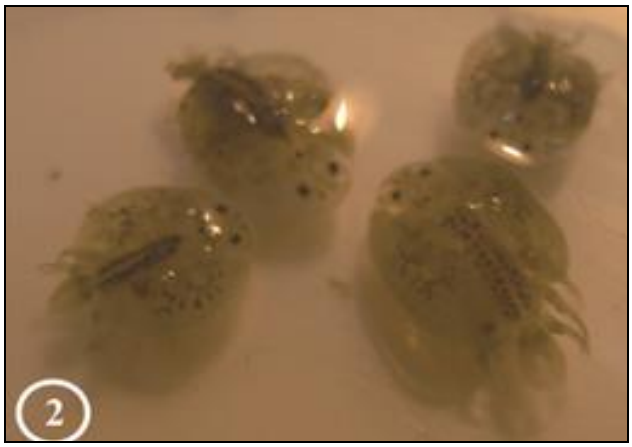

Fig 2: Photograph showing Live Specimen collected from fish

Fig 3: Photomicrograph showing Ventral view of *Argulus foliaceus*

Fig 4: Photomicrograph showing Dorsal view of *Argulus foliaceus*

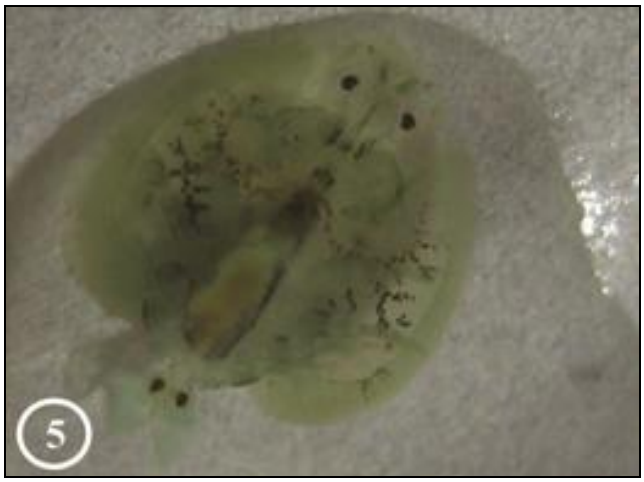

Fig 5: Photograph showing a live specimen of *Argulus foliaceus* dorsal view

Fig 6: Photomicrograph of *Argulus foliaceus* showing stylet and Suckers

Discussion

Argulus foliaceus is rounded in shape, about 6-7mm in length, with two posterior oval lobes of the abdomen. Two prominent suckers are located ventrally below the mouth on either sides and are used to attach to the host body.

Argulus is an ectoparasite and it feeds on the blood of fish. For blood-sucking parasite pierce the skin of the host with the help of needle-like stylets located anteriorly in the mouth tube, inject toxic enzymes and sucks liquefied body fluid and blood. These toxic enzymes cause irritation and inflammatory lesion on the skin of fish, resulting in the formation of ulcers due to microbial infections (Toksen 2006; Noaman *et al.* 2010; Noga 2010; Purivirojkul 2012; Sharma *et al.* 2012; Vasilean *et al.* 2012; Myer 2013) [19, 12, 13, 15, 17, 20, 10].

As a parasite *Argulus* impose severe health effects on fish health. Infected fish shows many unusual behavioural changes like erratic movement, rubbing of the body with aquaria wall, increased mucous secretion, loss of appetite, irregular swimming. Weakness and restlessness etc. Similar behavioural alterations of infected fish were also reported by several authors Yıldız and Kumantas (2002) [22], Tokşen (2006) [19], Noaman *et al.* (2010) [12], Noga (2010) [13], Abd el-mohsen (2013) [2], Adnan AL-Darwesh (2014) [3], Mirzaei and Khovand, (2015) [11], Stewart *et al.*, (2018) [18].

Similar pathological signs are also reported in goldfis due to *Argulus* infection by Yıldız and Kumantas, 2002 [22]; Noaman *et al.* 2010 [12]; Chanda *et al.* 2011[7]; Roberts, 2012 [16] and Wafer *et al.* 2015 [21].

The extent of infection is related with temperature *i.e.* infection is more prevalent during summer (30-35ºC) because higher temperature facilitates hatching of larva much earlier than low temperature (Koyun, 2011). Prevalence of infection also depends on the host size and body weight. Heavier fish appeared more prone to be infected than small ones (Peter *et al.*, 2008) [14].

Argulus also serves as a vector for several pathogens including bacteria, viruses and several other pathogens (Aalberg *et al.* 2016) [1]. *Argulus* infection causes great damage to fish production due to slow growth and. Heavy infection causes serious injuries and secondary infections, which leads to the death of the host (Harrison *et al.* 2006; Alom *et al.*, 2019) [9, 4].

Conclusion

It is evident from present study that fish lice *Argulus foliaceus* is an ectoparasite damaging skin, gills, fins and mouth region of goldfish *C. auratus*. Severe infestation have been assessed during pre monsoon period. During out break this parasite is highly detrimental to ornamental fish industry not only causing direct damage but also leads to secondary parasitic infections. General control measures and drugs are not sufficient to kill all stages of parasite. Locally available anti-parasitic drugs are found ineffective on fish lice and impose adverse effect on fish health. Therefore study in this direction is necessary.

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