

Review Article

ARGULOSIS: THREAT FOR SUSTAINABLE FISH FARMING

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Introduction

Fish farming is rapidly spreading becoming the fastest growing food-production sector. Fish is rich in high quality proteins followed by lipids, minerals and vitamins. Due to high demand, farmers are trying to manage it more intensively for high productivity, which has increased occurrences of diseases and other environmental consequences. Diseases in aquatic animals are a major threat to production and have become a limiting factor. Fish production of Nepal is 86544 MT of which 75.7% is from commercial fish farming with annual productivity of 4.91 MT/ha and availability per person per year is 3.39kg (CFPCC, 2019). Fish parasites are considered to be an opportunistic under farming systems and can cause havoc in many a case. Among the wide range of fish parasites, manifestations of ectoparasites are ubiquitous in the aquatic environment and are disastrous on aquatic animals in the rearing unit that may affects fish population.

Argulosis poses a major threat by infesting a wide range of fishes in the world. The ectoparasitic crustacean *Argulus* species, more commonly known as fish louse and is widespread in the fishes having adverse effects. In the recent years *Argulus* caused epizootics and problems in different fish farms of Nepal.

Systematic position

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Crustacea

Class: Maxillopoda

Subclass: Branchiura

Order: Arguloida

Family: Argulidae

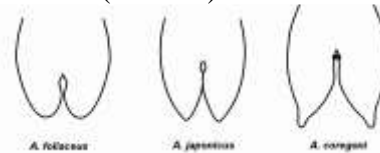
Genus: *Argulus*

Species: *Argulus foliaceus*;

A. japonicus

Diversity of *Argulus*

Several species (129 valid species) of *Argulus* are reported from the globe. Among them three species are dealt here. These three species of *Argulus* (*Argulus foliaceus*; *Argulus japonicus*; and *Argulus coregoni*) are commonly occurring in many continents and can be identified by using nature of urosome (Table 1)



The *Argulus coregoni* is significantly bigger and obviously characterized with its extremely sharp pointed abdominal lobes not having urosome marginal spines and their whole body length is more than 10 mm. In *A. foliaceus* urosome with rounded lobes is covered marginally with small spines and in *A. japonica* scarapace is more pointed than *A. foliaceus* and covers forth leg.

Morphology

The *Argulus* is a macro-ectoparasite measuring about 2-12 mm in size and consists of a head, thorax and abdomen. This parasite is dorso-ventrally flattened, equipped with a set of specialized first maxillae also called “suction discs” for adhesion to the host surface. The Suckers help the parasite in aggressive attachment and feeding by inserting a long spine-like structure into the skin, which breaks down tissues through the secretion of enzymes. They use their mouth and mandibles to consume the blood, mucous, tissue at the puncture site. It will also release a chemical messenger that attracts other fish lice which attach primarily to caudal peduncle of carp. The *Argulus* has a wide oval body flattened dorso-ventrally having two complex faceted eyes in the head (fig. 1). The head is

covered by a compacted horseshoe-shaped carapace, maxillipeds, peroral sting and basal glands. A sharp pointed dart or stylet which is horn like situated in front of the mouth between antennae. The thorax has four segments, each bearing a pair of swimming legs and a simple bilobed abdomen bearing spermatheca in female and testes in males. The mating of male and female takes place on the host fish. After mating, the adult female detaches from the fish to lay eggs on the vegetation in the aquatic environment. The eggs are attached to objects by a sticky mucus material. Generally, the adult female lays eggs in strings and the number of string of eggs ranges from 1-9 with 5-226 on an average number of eggs per string arranged in 1-6 rows. The eggs are small, measuring 0.275-0.375 mm. The eggs change their color from pale yellow to light brown within 24 hours after being laid. The female again returns to the host and start feeding upon blood.

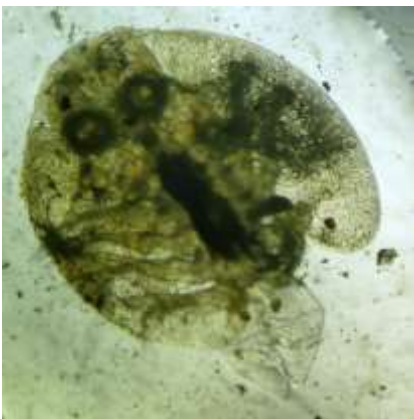


Fig. 1. *Argulus* collected from *Labeorohitain* AFU Fish farm, Rampur, Chitwan

Life cycle

The *Argulus* posse's direct life cycle and all life stages of both sexes are parasitic. The nauplius, metanauplius and first copepodid stages of most argulus species developed in the egg. Other metamorphic stages include the second through the seventh copepodid, sub adult and adult. The second copepodid have paired swimming legs on all four thoracic segments and actively seeks host after 3-4 days of hatching. In this stage it is approximately 1mm in length with a body shape similar to adult apart from size, with reduced antennal exopod and mandibular palp. First maxilla (hook like structure)

modified to sucker as an attaching organ and then it can parasitize the fish host immediately. Once attached to the fish host, they undergo a series of molts until they reach sexual maturity. Generally, 14 or more days are required for the lice to reach the seventh copepodid stage depending on the species and water temperature. The sub-adult molts several times before becoming adult taking 14-16 days to complete metamorphosis. Mating then occurs and the female again leave the host to deposit eggs on the submerged objects. The entire life cycle take 40-100 days depending on the parasite species and water temperature.

Pathology

The *Argulus* infected fish shows erratic swimming and poor growth as clinical signs. The red blotches on the skin are seen in the affected fish. Also the fish show nervousness and scratch themselves to get rid of the parasite. Sometimes, acute hemorrhagic inflamed skin wounds, an increased production of mucosal materials, spill of scales, and corrosion of fins are observed in the heavily infested fishes. The lesions and collagen of dermis has been secondarily infected by bacteria and fungi leading to further degeneration of epidermal layer and disruption of basal membrane. Pathological changes due to direct tissue damage and secondary infections.

Prevention and treatments

The physical methods to get rid of *Argulus* may include constant monitoring, water filtration, matting, ozonisation, isolation and reduced temperature may have positive results. The most effective treatment against argulosis is organophosphates. It has been reported that several chemicals like avermectin and doramectin (oral dose 500µg/kg and 750µg/kg body weight), (Hemaprasanth et al., 2012) teflubenzuron, deltamethrin, pyrethroids, malathion, cypermethrin, Nuvan, trichlorfon (Dipterex) 0.25 ppm for several hours, Butox Vet, Cliner, Ectodel (2.8%), and chlorophenol found effective against Argulosis in aquaculture system. However, frequent use of these drugs cause bioaccumulation in the host, and leading reduced sensitivity of the *Argulus* to the organophosphate. The Duroclean was found effective against this parasite. The effective dose of the drug

was 0.3g per kg fish feed and fed for 3 days consecutively with one day off and then again for 2 days (Rayamajhi et al., 2017). The chemical Cypermethrin is a widely used in Nepal to control *Argulus* in aquaculture. Proper steps should be taken to prevent *Argulus* infection and to protect fisheries

enterprises from heavy loss. Therefore, management of lice should be given top priority to save the aquaculture industry from the economic loss every year at farmer level.

Table 1: Differences among common *Argulus* species

Species	Body length(mm)	Posterior lobe of carapace	Urosome	Posterior incisures of urosome
<i>A. foliaceus</i>	6-7	Not extend beyond beginning of urosome	Round lobes is covered marginally with small spines	Not reach into center
<i>A.japonicus</i>	4-8	Extend beyond level of the middle of urosome, carapace covers forth leg	Round lobes (though more pointed than <i>A. foliaceus</i>) is covered marginally with small spines	Reach into center
<i>A.coregoni</i>	12	Not extend beyond beginning of urosome	Acuminate lobes without any small spines	Reach beyond center

References

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Rayamajhi, A., K.C. S., G.C., S., and Kunwor, P., (2017).First record of *Argulusjaponicus* (crustacea: branchiura) on *Cyprinuscarpio*in Nepal, with additional notes on morphology and Prevalence of *A. Japonicus*and its treatment. Nepalese Vet J. 34: 119-127.