



## Introduction to Some Species of *Argulus* (Crustacea: Branchiura), Parasitic Infections in the Freshwater Fishes

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**ABSTRACT:** The ectoparasitic are frequently found on various species of freshwater fishes. Species of genus *Argulus* are common and important parasites of freshwater fishes. These species are temporary parasites of fish and cannot survive without a host for long period. Many studies reported the transmission of *Argulus* species through freshwater fishes worldwide. The aim of this study is to review previous information on *Argulus* species, parasitic infections in freshwater fishes. The present study suggests that the biological controls can be used to reduce *Argulus* species among fish populations. In addition to prevent the spread of disease and parasites, this study recommends that fish should be examined for high risk parasites and other pathogens before their intended uses.

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Diseases in freshwater fishes are a major threat to production and have become a limiting factor. Parasitic infections are among the most important factors that may affect the fish populations. Hence, the parasitic infections have recently been identified as an important health problem of fish (Phan *et al.*, 2010; Khalil Mokhtar *et al.*, 2014; Iqbal and Imtiaz, 2016).

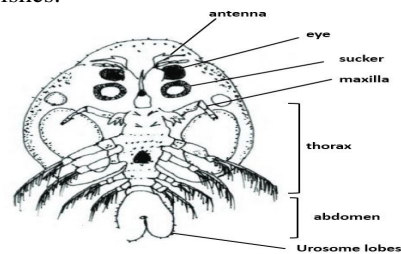
The most common members of the Branchiura belong to the genus *Argulus*. The *Argulus* species (Family: Argulidae), more commonly known as fish lice and are common parasites of freshwater fishes (Saha and Bandyopadhyay, 2015). These parasites have a direct life cycle using the fish as hosts. In the other words, *Argulus* species survive on fish species as hosts for most part of their life cycle (Ebrahimzadeh Mousavi *et al.*, 2011; Woo and Buchmann, 2012).

Many studies reported the transmission of parasites and other pathogens through freshwater fishes worldwide. Over 170 species of *Argulus* reported from freshwater and marine fishes (Boxshall, 2009). According to Ruane *et al.* (1999) and Tavares-Dias *et al.* (2007), *Argulus* species are causing great losses in fish stocks in several countries. These species have been reported from marine fish farming facilities in different countries like Chile, Canada and Norway. In addition these can cause mortality in farmed fish stocks (Schram *et al.*, 2005; Catalano and Hutson, 2010). Therefore, the present study was planned to

investigate *Argulus* species, common parasitic infections in freshwater fishes. This article provides useful information about diagnosis, control and management of parasitic diseases in freshwater fishes to enthusiasts.

The genus *Argulus* is group of crustacean parasites found on the fins, gills and skin of different fish species. The general body-form of *Argulus* is a dorso-ventrally flattened and covered by a large chitinous carapace (Lester and Roubal, 1995; Tokşen, 2006). There are three region on *Argulus*: cephalothorax, thorax and abdomen (Figure 1).

*Argulus* usually carries some bacterial and viral diseases. The lesions caused by this parasite are usually infected with bacterial, viral and fungal infections, and in some cases, bloody rashes or septicemia. In some cases, the ulcers caused by *Argulus* are attacked by other parasites such as *Costia* sp. In this case, the risk of mortality will increase among fishes.



**Fig 1:** Ventral view of *Argulus foliaceus* (modified from Alas *et al.*, 2010)

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**Taxonomic Notes****Kingdom:** Animalia**Phylum:** Arthropoda**Subphylum:** Crustacea**Class:** Maxillopoda**Subclass:** Branchiura**Order:** Arguloidea**Family:** Argulidae**Genus:** *Argulus*Species: *Argulus foliaceus*, *Argulus coregoni*, *Argulus japonicus*.**Some Species of *Argulus***

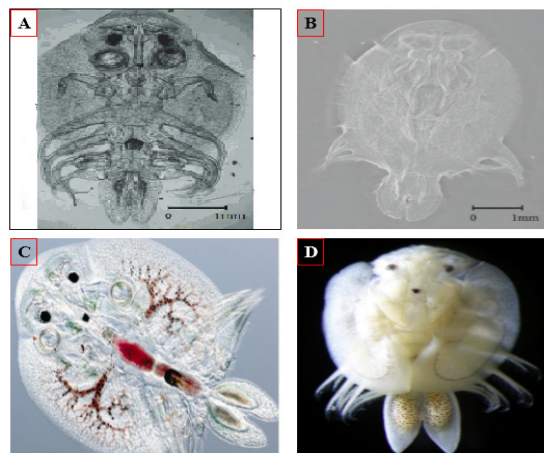
The genus *Argulus* has a worldwide distribution and has been found in Asia, Europe, Africa, Australia and North, Central, and South America (Poly, 2017). The most common species of *Argulus* are listed:

**Africa:** *Argulus rhipidophorus*, *Argulus ambloplites*, *Argulus exiguous*, *Argulus striatus*, *Argulus africanus*, *Argulus jollymanni* and *Argulus brachypeltis*

**North America:** *Argulus flavescens*, *Argulus maculosus*, *Argulus appendiculosus*, *Argulus alosa*, *Argulus japonicus*, *Argulus stizostethii*, *Argulus borealis*, *Argulus americanus*, *Argulus funduli*, *Argulus coregoni*, *Argulus catastomi* and *Argulus pugattensis*

**South America:** *Argulus juparensis*, *Argulus pestifer*, *Argulus nattereri*, *Argulus violaceus* and *Argulus chromidis*

**Eurasia:** *Argulus scutiformis*, *Argulus viridis*, *Argulus indicus*, *Argulus foliaceus*, *Argulus japonicus* and *Argulus coregoni* (Figure 2)



**Fig 2:** Some species of *Argulus* **A:** *A. foliaceus*, ventral view, **B:** *A. foliaceus*, dorsal view (Alas *et al.*, 2010), **C:** *A. japonicus* (Moller, 2015), **D:** *A. coregoni* (Nagasawa and Ishikawa, 2015)

*Argulus foliaceus* (Linne, 1758): Common Parasitic Infection in the Freshwater Fishes

*Argulus foliaceus* (fish-louse) has been implicated as an intermediate host. This species is a temporary parasite of fish and can leave the fish host and move freely for short periods of time (Svobodova and Kolarova, 2004). *A. foliaceus* is one of the most studied species in freshwater systems like rivers, lakes, ponds and fish farms. This species has been recorded from several species of freshwater fishes, whereas *Argulus coregoni* is a specialist species found mainly on salmonids (Karvonen *et al.*, 2005). In addition, *A. foliaceus* was reported on the skin of common carp and some cyprinid fish species like Goldfish (*C. auratus*) in Iran (Asadzadeh Mangili *et al.*, 2000; Barzegar and Jalali, 2009).

**RESULTS AND DISCUSSION**

In the aquatic bodies, disease parasites are ubiquitous and often present as opportunistic pathogens. Hence, fish parasites and their effects have become increasingly visible during the latest decades. These parasites are important pathogens of both farmed and natural fishes (Tavares-Dias *et al.*, 2007; Khoi, 2011). *Argulus* species are common parasites in freshwater and marine fishes because these species can rapidly escalate. These species must be able to locate and attach to a host in order to survive (Hanson *et al.*, 2011; Khan *et al.*, 2017). It can be concluded that biological factors of host and the water quality has an important role on the abundance of these parasites and surviving on the host (Tak *et al.*, 2014).

There are several methods to management and prevention of *Argulus* diseases. An example can be cited drugs. But drugs available for treatment of these diseases are limited. Therefore, determining fish drug dose must be a careful and precise process. These drugs should only be applied when there are specific indications of disease (Madhu and Madhu, 2009). For example, Cypermethrin is a widely used to control *Argulus* diseases in aquaculture.

The present study suggests that the biological controls can be used to reduce *Argulus* species among fish populations. In addition, this study recommends that fish populations should be examined for high risk parasites and other pathogens (Ebrahimzadeh Mousavi *et al.*, 2009; Seik *et al.*, 2010). There are many approaches to prevention and management of fish diseases in freshwater systems. These approaches include monitoring, water filtration, treatment, isolation and management of disease in fish stocks.

**Conclusion:** *Argulus* species (Family: Argulidae) known as one of the most important parasites in freshwater bodies. Hence, these organisms will have adverse effects on freshwater fish species. The aim of this study was to introduce some important species of *Argulus* in the freshwater fishes. It seems that considering the quality of environmental conditions in aquatic ecosystems and fish farms can greatly reduce the harmful effects of these parasites. Designing a specific plan to controlling of the *Argulus* populations can be very helpful. It is clear that realization of this will not be possible except with the full participation of fisheries management specialists. The present investigation will provide the basic data which could be useful in further studies to investigate the adverse effects of *Argulus* parasites on freshwater fishes.

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