

## A study on the morphology of *Argulus foliaceus* Lin., 1758 (Crustacea; Branchiura) procured from Çavuşçu Lake (Central Anatolia-Turkey) with scanning electron microscopy

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**Abstract:** In this study, 24 carps (*Cyprinus carpio* Lin., 1758) caught from Çavuşçu Lake (Konya; 36°41' N, 34°26' E) were examined for metazoan parasites. Infestation rate of *Argulus foliaceus* Lin., 1758 was found to be 45.8%. In addition, *Argulus foliaceus* was photographed using a scanning electron microscope (SEM) and a light microscope.

**Key words:** Çavuşçu Lake, *Cyprinus carpio*, fish louse, *Argulus foliaceus*, SEM

### Çavuşçu Gölü (İç Anadolu-Türkiye)'den temin edilen *Argulus foliaceus* Lin., 1758 (Crustacea; Branchiura)'un morfolojisi üzerine scanning electron mikroskop çalışması

**Özet:** Bu çalışmada, Çavuşçu Gölü (Konya; 36°41' N, 34°26' E)'nden yakalanan 24 *Cyprinus carpio* Lin., 1758'nun Metazoon parazitleri incelenmiştir. İncelenen balıklarda *Argulus foliaceus* Lin., 1758'un enfestasyon oranının % 45,8 olduğu belirlenmiştir. Ayrıca, *Argulus foliaceus* scanning electron mikroskobu (SEM) ve ışık mikroskobu ile fotoğraflanmıştır.

**Anahtar sözcükler:** Çavuşçu Gölü, *Cyprinus carpio*, balık biti, *Argulus foliaceus*, SEM

#### Introduction

The freshwater fish louse, *Argulus foliaceus* L., 1758 (Crustacea, Branchiura) is a branchiuran parasite occurring on a wide range of fish species and has also been reported from amphibians (1,2). It feeds by piercing the skin of their hosts, injecting a toxin, and

drawing off blood (3,4). Heavy infestations can cause serious damage to the skin and subsequent mortality (3,5,6). *A. foliaceus* in Turkey was reported from 19 different hosts between 1974 and 2006. It was reported parasitizing several freshwater fishes from all regions of Turkey (i.e., Marmara Region, Central

Anatolia Region, Southeastern Anatolia Region, East Anatolia Region, Aegean Region, Mediterranean Region, Black Sea Region) (7-13).

The key objective of this paper is to provide accurate knowledge concerning the detailed structure of *A. foliaceus*. *A. foliaceus* from freshwater fishes was first studied and reported in Turkey in 1974 (13).

### Materials and methods

In 2006, 24 carps were caught from Çavuşçu Lake (Konya; 36°41'N, 34°26'E) using gill nets. The parasites collected were fixed in 70% alcohol to be observed under light microscope (LM). *Argulus foliaceus* specimens were removed from the fish, fixed in 3% glutaraldehyde in 0.1 M phosphate buffer (pH 7.2) at 4 °C for 1 h, and prepared for scanning electron microscope (SEM) observation. They were washed in a buffer 1% osmium tetroxide before post-fixation at 4 °C for 1 h. Then, the specimens were dehydrated through alcohol series and critical-point dried. Next, they were sputter-coated with gold (14). SEM photographs were taken with a JEOL (6400) electron microscope. The identification of morphometric characteristics of this parasite was carried out as described previously (2, 5, 15-19).

### Results and discussion

Eleven carps were found to be heavily infested with *Argulus foliaceus*. Acute haemorrhagic inflamed skin wounds, an increased production of mucosal material, spill of scales, and corrosion of fins were observed in these infested carps. Bauer et al. (6) determined that these small lesions and collagen of the dermis had been secondarily infected by bacteria and fungi leading to further degeneration of epidermal layer and disruption of basal membrane. Materials were collected from body surfaces and fins of the host fish. Infestation values are given in the Table.

This ectoparasitic species is widely adaptable and can live in marine, brackish, and freshwater habitats. It lives not only on fish, but also on amphibians (13). *A. foliaceus* is a cosmopolitan species and its geographical range includes Europe, Central Asia, and North America (1,2,5,15-19). The systematic position of the genus *Argulus* is as follows:

- Class** : Crustacea
- Subclass** : Branchiuran
- Order** : Arguloidea
- Family** : Argulidae
- Genus** : *Argulus*

*Argulus foliaceus* Linnaeus, 1758 (Figure 1).

Morphological description of the parasite can be expressed as follows; a wide, oval body, flattened dorso-ventrally (Figures 1a and 1b), 2 complex faceted eyes. Cephalothorax is covered with a wide convex scutum and its posterior margin is indented. First maxillae are usually modified as powerful suckorial organs, which are clearly visible at ventral surface (Figures 1c and 1d). The second maxilla, posterior to the sucker, with 5 segments. (Figures 1a and 2f). Four pairs of thoracic legs modified for swimming. Each thoracic segment bears a single pair of biramous swimming legs (thoracopods), the first 2 pairs of which in both sexes have a backwardly projecting process or flabellum. Urosome with rounded lobes is covered marginally with small spines. Anterior end of cephalothorax forming broad protrusion is delimited laterally by shallow grooves. Posterior incisures of urosome do not reach into center (Figure 1e). Ventral view of *A. foliaceus*, 1<sup>st</sup> maxilla, 1<sup>st</sup> and 2<sup>nd</sup> antennae, respiratory areas, urosome lobes and 2<sup>nd</sup> maxilla are given in Figures 2a-f.

There is dense ornamentation on the 2<sup>nd</sup> maxilla. Coxa of the 2<sup>nd</sup> maxilla with 3 robust spines posteriorly (Figures 1f and 2f). Antennae I is modified

Table. Infestation values of *Argulus foliaceus* on the carp caught from Çavuşçu Lake.

Number of fish investigated	Number of fish infested	Prevalence (%)	Maximum number on 1 fish
24	11	45.8	5



Figure 1a. Ventral view of *A. foliaceus* (LM).

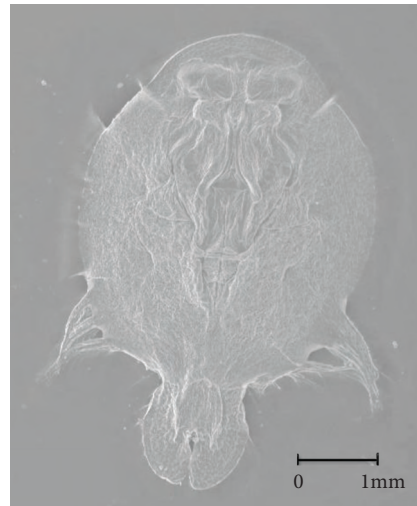


Figure 1b. Dorsal view of *A. foliaceus* (SEM).

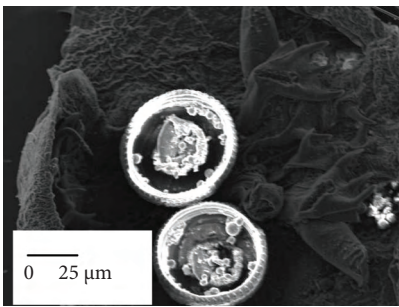


Figure 1c. First maxillae of *A. foliaceus* (SEM).

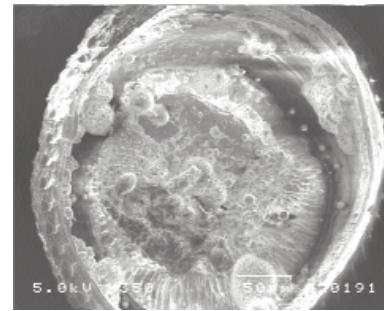


Figure 1d. Supporting sclerites of sucker (1<sup>st</sup> maxilla) (SEM).

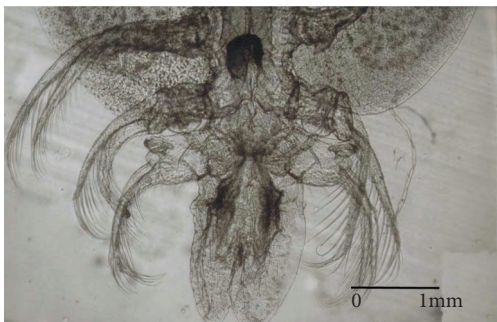


Figure 1e. Urosome lobes of *A. foliaceus*.

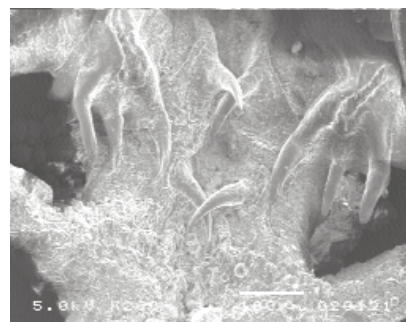


Figure 1f. Basal plates of second maxilla (SEM).

into attachment organs terminating in highly curved hooks (Figure 2c). Anterior respiratory areas are much smaller than posterior respiratory areas. Relative sizes of these respiratory areas are shown with

a scale bar in Figure 2d. All of *A. foliaceus* samples were adult females. The specimens in this study ranged from 3-7 mm in length and 2.5-5 mm in width in their mature stage.

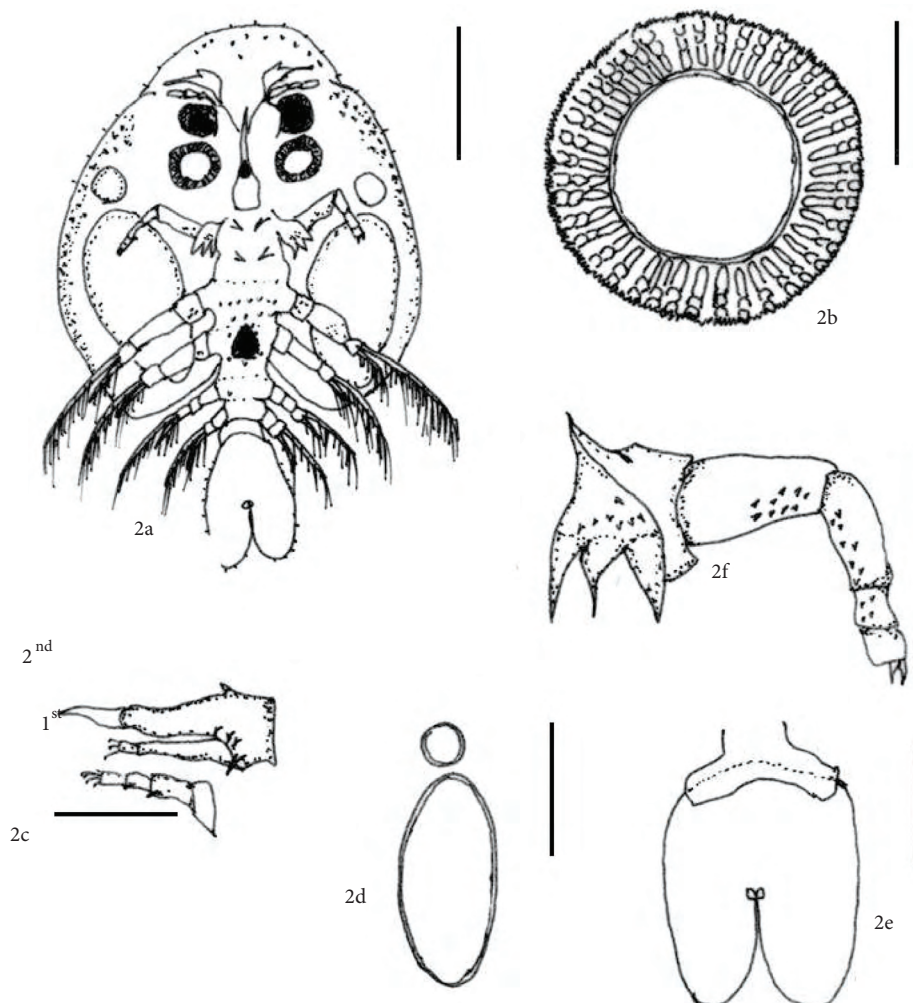


Figure 2a. Ventral view of *A. foliaceus* (Scale bars 1.5mm), Figure 2b. 1st maxilla (Scale bar 0.15mm), Figure 2c. 1<sup>st</sup> and 2<sup>nd</sup> antennae (Scale bar 0.15mm), Figure 2d. Respiratory areas (Scale bar 1.5mm), Figure 2e. Urosome lobes (Scale bar 1.25 mm), Figure 2f. 2nd maxilla (Scale bar 0.8mm).

Our specimens did not vary significantly in size, range, or appendage morphology, e.g. urosome with small spines, respiratory areas, cephalic area, which had been found in some previous studies (2, 5, 15-19).

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