Lernanthropus indefinitus

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LERNANTHROPUS INDEFINITUS N. SP. (COPEPODA, SIPHONOSTOMATOIDA, LERNANTHROPIDAE) PARASITIC ON *ARGYROSOMUS REGIUS* (ASSO, 1801) (PISCES, SCIAENIDAE)

BY

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ABSTRACT

Lernanthropus indefinitus n. sp. was found as a new parasite on *Argyrosomus regius* (Asso, 1801). The identity of *L. indefinitus* was determined on the basis of the morphological features of the female, such as the shape of the dorsal plate, shape and size of the fourth leg, length of the fifth leg, and shape and size of the parabasal flagellum. In addition, new data are reported for *Lernanthropus kroyeri* Van Beneden, 1851 on *Dicentrarchus labrax* (L., 1758), and some comments are added on the antennules and parabasal flagellum of *L. kroyeri*. The present paper raises the number of known species of Lernanthropidae in Turkish waters to seven.

RESUMEN

Se describe *Lernanthropus indefinitus*, nueva specie, paràsita sobre *Argyrosomus regius* (Asso, 1801). Su identidad fue determinada sobre la base de características morfológicas de la hembra, tales como la forma de la placa dorsal, forma y talla de la cuarta pata, longitud de la quinta pata, y la forma y talla del flagelo parabasal de la anténula. Además, un nuevo reporte de *Lernanthropus kroyeri* Van Beneden, 1851 sobre *Dicentrarchus labrax* (L., 1758), y algunos comentarios sobre el flagelo de su anténula son agregados. El presente artículo eleva a siete el número de especies de Lernanthropidae conocidas en aguas de Turkìa.

INTRODUCTION

Lernanthropus De Blainville, 1822, with about 120 nominal species, is the most widespread genus of the family Lernanthropidae and is considered to be a common genus of parasitic copepods on fishes (Kabata, 1993; Boxshall & Halsey,

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2004; Ho et al., 2008; Suares-Morales et al., 2010; El-Rashidy & Boxshall, 2012). Some species of *Lernanthropus* are strictly host-specific, but several species are parasites of fish belonging to one genus, or on several genera of the one same family (Kabata, 1979; Castro & Baeza, 1985; Olivier & Van Niekerk, 1995; Timi & Etchegoin, 1996; Luque & Paraguass, 2003).

The most commonly-reported lernanthropid species parasitic on *Dicentrarchus labrax* (L., 1758) is *Lernanthropus kroyeri* Van Beneden, 1851 (cf. Tokşen, 1999; Özel et al., 2004), followed by *Lernanthropus mugilis* Brian, 1898 on *Liza aurata* (Risso, 1810), *Lernanthropus brevis* Richiardi, 1879 on *Dicentrarchus labrax*, *Lernanthropus* spp. on *Dicentrarchus labrax*, *Lernanthropus trachuri* Brian, 1903 on *Trachurus mediterraneus* (Steindachner, 1868), and *Mitrapus oblongus* (Pillai, 1964) on *Sardinella aurita* Valenciennes in Cuvier & Valenciennes, 1847 on the coast of Turkey (Altunel, 1983; Akmirza, 2003; Korun & Tepecik, 2005; Oğuz & Öktener, 2007; Castro Romero & Öktener, 2010).

The objective of this paper is to describe *Lernanthropus indefinitus*, a new parasite found on the gills of *Argyrosomus regius* (Asso, 1801) in Turkish waters, and to describe morphological differences with *L. kroyeri* and *L. gisleri* Van Beneden, 1832 (both previously reported parasites on *A. regius* and *L. brevis*, and also with other *Lernanthropus* species parasitic on sciaenids).

MATERIAL AND METHODS

The parasites were collected with the aid of commercial catches and individual fishermen in Mersin Bay in the Mediterranean Sea. The total length of the fishes was measured. Specimens of *Lernanthropus* were kept in 70% alcohol. Before dissection, the parasites were kept in lactic acid for a few hours in order to cleanse the specimens. Specimens were dissected in lactophenol under an Olympus SZX-16 stereomicroscope. Dissected parts were mounted on slides in lactophenol mounting medium. Broken glass fibres were added to prevent the animal and appendages from being compressed by the coverslip and to facilitate rotation and manipulation, allowing observation from all angles. Preparations were sealed with Entellan® (Merck). All drawings have been prepared using a camera lucida on an Olympus BX-51 differential interference contrast microscope. The terminology of Kabata (1979) and Huys & Boxshall (1991) is adopted for description of some of the structures.

RESULTS

Lernanthropus indefinitus n. sp. (figs. 1-4)

Material examined.— Holotype ♀ preserved in alcohol (deposited in NHMN reg. no. 1156920). Paratypes: 3 ♀♀ preserved in alcohol (deposited in NHMN reg. no. 1156921), collected from the

teleost fish host *Argyrosomus regius* (Asso, 1801) caught at Mersin Bay, in the Mediterranean Sea off the coast of Turkey, 36.65-36.8°N 34.55-34.8°E. The specimens were collected on the gills of fish with a prevalence of 23.4%. The total length (including the fourth leg length), based on 11 specimens, is 4.8 mm (range = 3.7-5.3 mm). Three females are kept in the collection of Prof. R. Castro Romero (University of Antofagasta, Chile) and eight adult females were deposited in the collection of the Department of Fisheries Faculty at Mersin University (Turkey).

Host synonyms.— *Argyrosomus procerus* (De la Pylaie, 1835), *Cheilodipterus aquila* (Lacepède, 1803), *Perca regia* (Asso, 1801), *Perca vanloo* (Risso, 1810), *Sciaena aquila* (Lacepède, 1803), *Sciaena aquila* (Cuvier, 1817), *Sciaena regius* (Asso, 1801).

Description.— Female body (fig. 1A, B, C) comprises head, trunk and posterior dorsal plate, the latter with lateral sides and rounded distal margin. Head with dorsal shield equally broad and long in dorsal aspect, with short produced anterior margins, its ventrolateral sides flange its entire length. Anterior part of trunk narrower than the posterior part. Dorsal plate (fig. 1C), parallel side in the anterior part, broadening in the posterior part, usually with abdomen and uropods partially hidden from the dorsal side, but leaving the fourth leg largely exposed. Genito-abdomen cylindrical.

Antennule (fig. 2A, C) 7 segmented, with soft flexibility between first and second segment. Armature formula: 1, 3, 1, 2, 1, 2 + aesthetasc, 7 + aesthetasc. Parabasal flagellum (fig. 2B) with inflated base, and robust whip about as long as the antennule.

Antenna (fig. 3A, B) robust, with corpus indistinctly subdivided into short basal and longer second segment, inner margin of second segment without papilliform process; subchela without arms and with strongly curved stout claw, claw with a small spinule near the base dorsally.

Mandible (fig. 3D) two segmented, basal segment short, distal segment elongated, with arms and 7 teeth.

Maxillule (fig. 3C) bilobate, smaller outer lobe arm with a spiniform process, inner lobe larger, arms with 3 unequal elements, no other armature visible on the surface.

Maxilla (fig. 2D) two segmented, brachiform; lacertus robust, no arms, about the same length as the brachium, the latter with a spiniform process on inner margin distally; terminal claw with two rows of denticles as figured.

Maxilliped (fig. 2E) two segmented; corpus robust, suboval, myxal area bare; subchela elongated and smooth; claw with a short robust spinule at base, with fine longitudinal ridges.

First leg (fig. 4A) biramous, with fine setules along the surface of protopoda, basal seta to the exopod long and plumose, with robust plumose basal seta to endopod, exopod and endopod covered with fine setules along the ventral surfaces, exopod arm distally with 5 spiniform processes bearing spinular rows at the bases, all in a line, with denticulated margin, endopod a lobe with a few spinules along inner margin and with a long terminal spinulose spine.

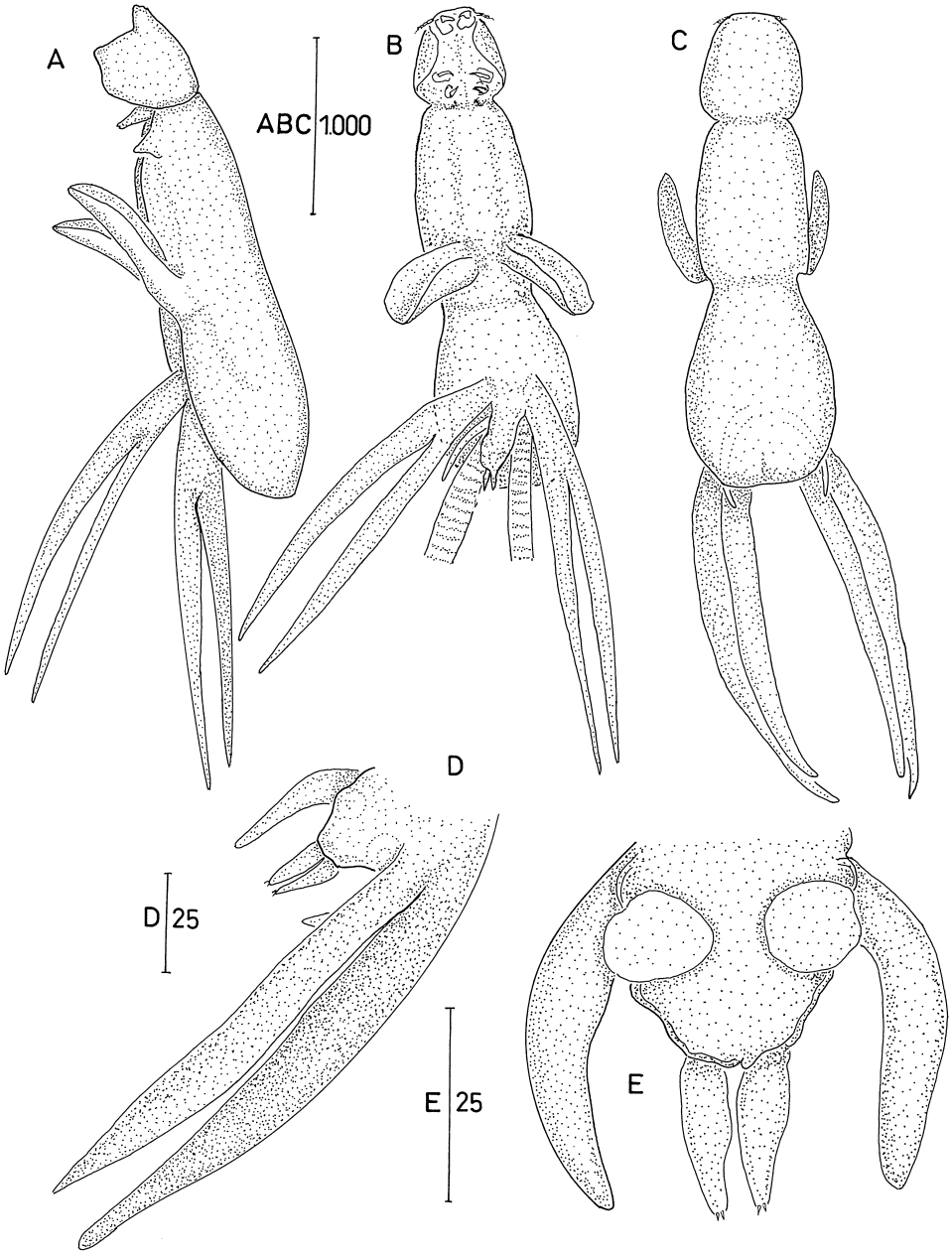

Fig. 1. *Lernanthropus indefinitus* n. sp., female. A, habitus, lateral; B, habitus, ventral; C, habitus, dorsal; D, fourth and fifth leg and uropod, lateral; E, fifth leg and uropod, ventral. Scales are in μm.

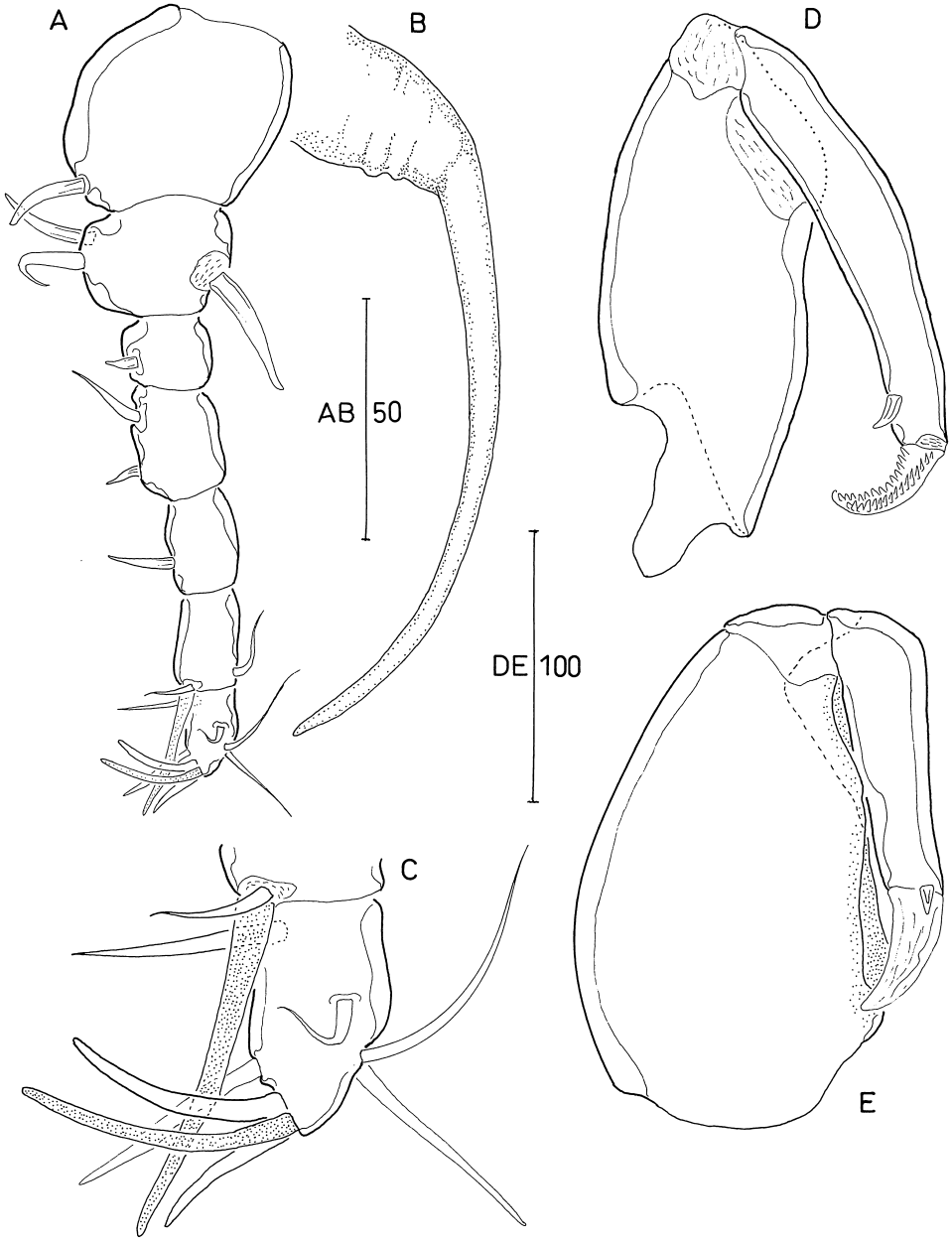

Fig. 2. *Lernanthropus indefinitus* n. sp., female. A, antennule, ventral; B, parabasal flagellum, ventral; C, antennule, tip of terminal segment; D, maxilla, dorsal; E, maxilliped, ventral. Scale bars are in μm.

Second leg (fig. 4B) biramous, smaller than the first leg, with a small papilla bearing a simple seta, lateral to base of exopod; exopod arms with only four short distal spines; endopod a lobe arm with long terminal spine with denticulated margins, as an endopod.

Third leg (fig. 1A, B) long, oriented obliquely outwards; base of third leg not meeting at mid-ventral line, not forming a notch in the joint with the dorsal plate.

Fourth leg (fig. 1D, E) bifid lobes, rami about the same length, somewhat shorter than the entire body.

Fifth leg (fig. 1D, E) uniramous, lanceolate with narrow base, tip reaching the distal margin of the uropod.

Uropods (fig. 1D, E) long, slender arms with two distal setae.

Male.— Not found.

Etymology.— The new species name *Lernanthropus indefinitus* makes reference to the nondescript condition of the species among other reported congeners parasitic on the same host within the study area. The species name thus is an adjective agreeing in gender with the (masculine) generic name.

Remarks.— Identification of *Lernanthropus* species is a major problem because a lot of species have not been described particularly well (there is no detailed knowledge on appendages, antennule armature, shape of the parabasal flagellum and length in comparison to the antennule length, and their possible variations, etc., for several species). The species parasitic on sciaenids show a unique variation on the dorsal plate (on the fourth leg-bearing somite) length, shape and the genito-abdomen length, which can be covered partially or fully by the dorsal plate when observed in dorsal view. To identify their exact position, the present specimens were compared to those previously reported as parasites on sciaenid fish on European coasts. Papers mentioning *Lernanthropus gisleri* (cf. Van Beneden, 1832), *L. otolithi* Pillai, 1963 (cf. Pillai, 1963) and *L. brevis* (cf. Richiardi, 1879) are examples of such reports.

First it is necessary to compare the present new species *L. indefinitus* with *L. gisleri*, a copepod that has been reported as parasitic on several sciaenids, in particular on *Sciaena aquila*, in the study area, and also reported as parasitical on *Argyrosomus regius*. *L. indefinitus* n. sp. differs from *L. gisleri* by having a more rounded posterior dorsal plate and by having more parallel sides. In addition, in *L. gisleri* the dorsal plate completely covers the genito-abdomen and uropods (when seen in dorsal view). However, in the new species the uropods can be seen only partially in dorsal view. Other differences can be found on the fifth leg, which in *L. gisleri* reaches beyond the distal margin of the uropod. However, in *L. indefinitus* n. sp., the fifth leg extends only up to the distal margin of the uropods. Clearly both species are not conspecific. A notable case is that of *L. gisleri* on *Sciaena* sp., reported by Yamaguti (1936, 1963). Ho et al. (2008) refer to Yamaguti's (1936,

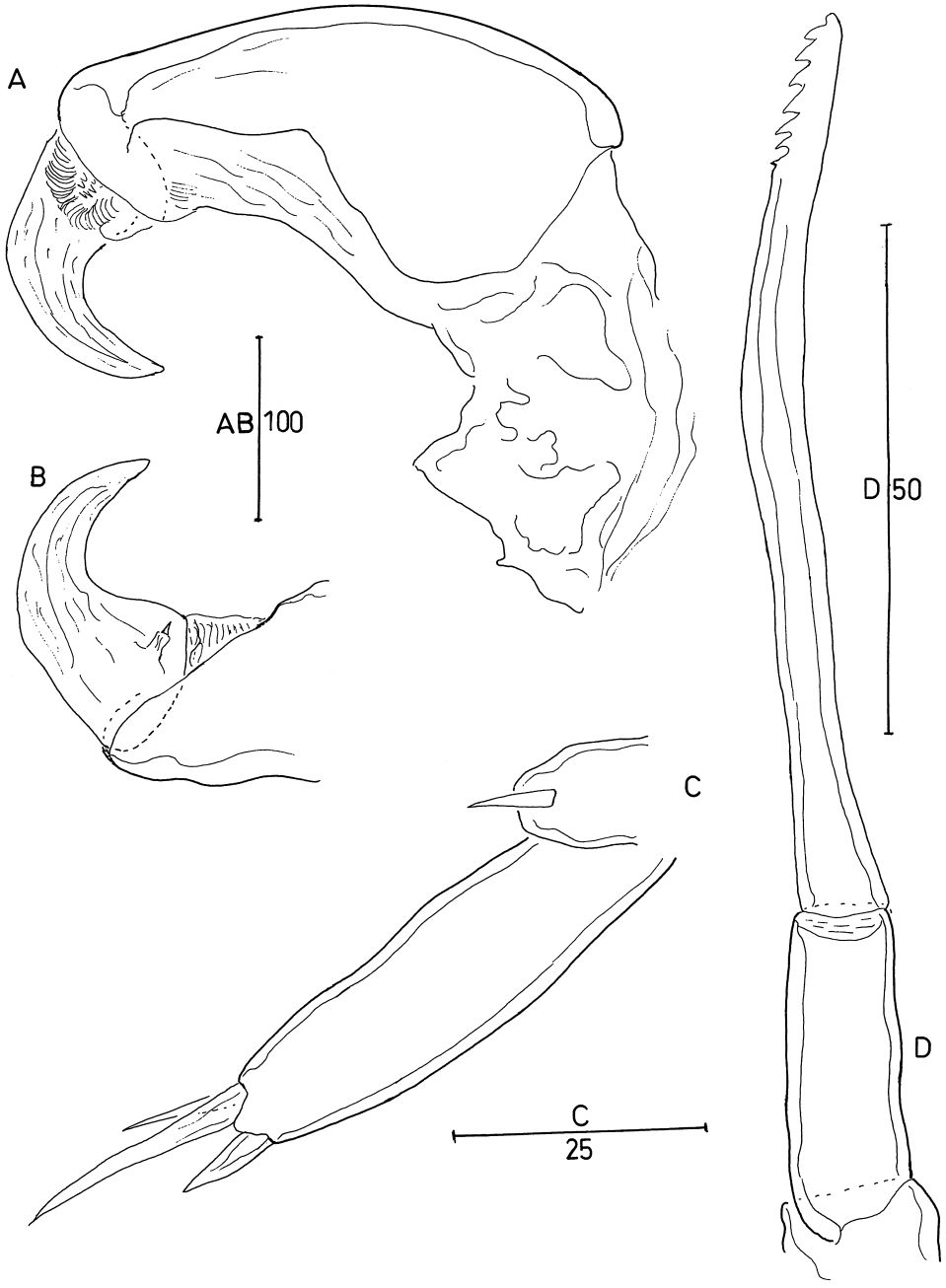

Fig. 3. *Lernanthropus indefinitus* n. sp., female. A, antenna, ventral; B, antenna, tip, dorsal; C, maxillule, lateral; D, mandible, lateral. Scale bars are in μm.

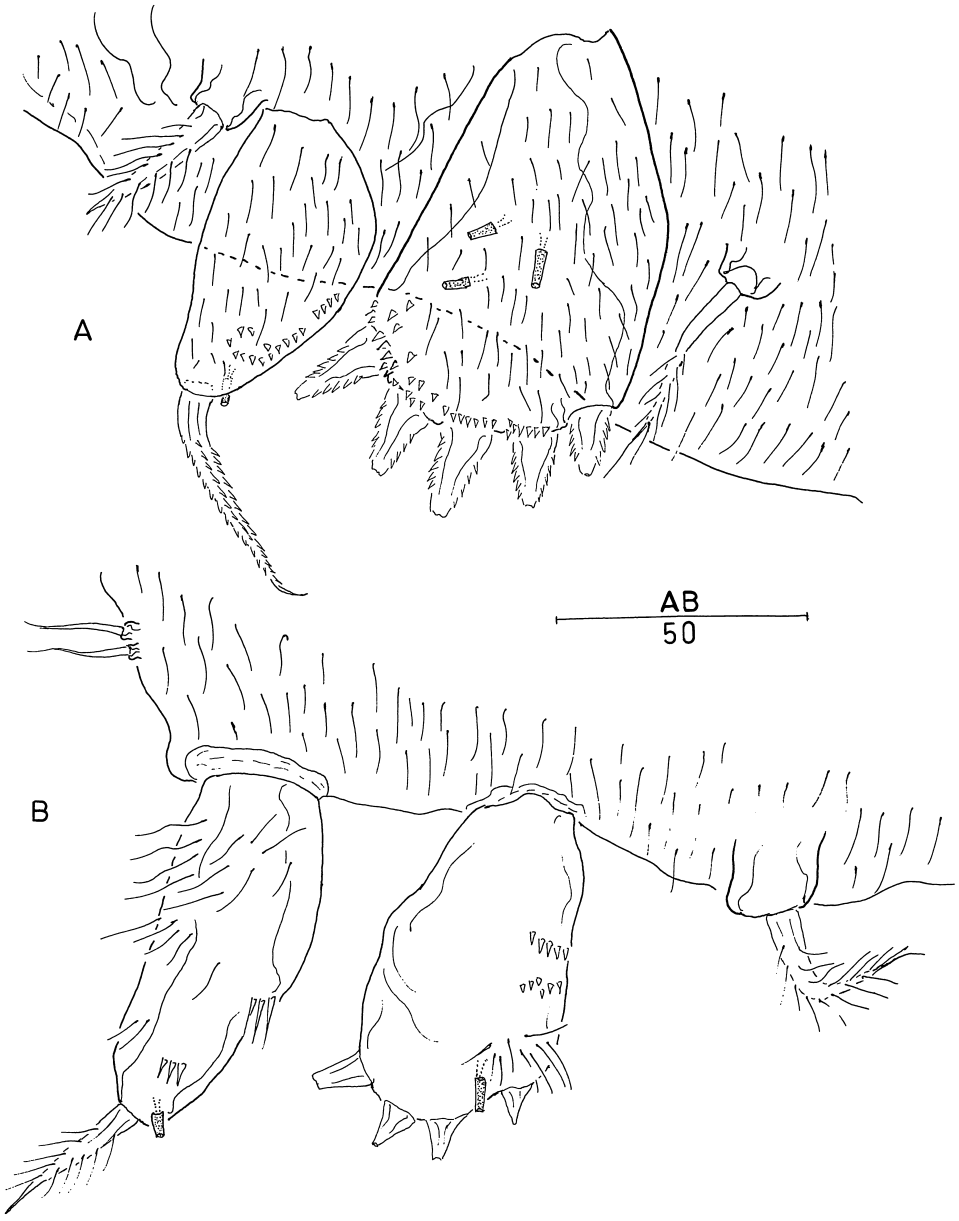

Fig. 4. *Lernanthropus indefinitus* n. sp., female. A, first leg, ventral; B, second leg, ventral. Scale bars are in μm.

1963) reports stating that "this is different from the European form (of *L. gisleri*) in having the posterior extremity of the body protruding out of the dorsal plate in dorsal view." In essence, the species reported by Yamaguti (1936, 1963) does not belong to *L. gisleri*.

The other species morphologically close to *L. indefinitus* n. sp. is *L. otolithi*. The latter can be differentiated from the new species because of the shape of the dorsal plate being well demarcated (sub-circular) in its anterior part in *L. otolithi*, while parallel-sided in the new species. Other differences found between the two species are the parabasal flagellum, being straight in *L. otolithi*, while, in contrast, it is strongly curved in the new species. Also the endopod of the fourth leg is shorter than the exopod, but these are about the same length in the new species.

The species reported by Yamaguti (1936) as *L. gisleri* clearly does not belong to that species, but is more closely similar to *L. indefinitus* n. sp. Both can be differentiated by their cephalosome shape, sub-orbicular in Yamaguti's specimen, while oblong in the new species; the cephalosome anterior margin is protruding in the Yamaguti specimen, but has a more straight margin in the new species. Also the fifth leg is longer than the uropod in the Yamaguti specimen; conversely it is about the same size in the new one. In addition, the posterior margin of the dorsal plate is concave in Yamaguti's specimen, while convex in the new species.

Comparison of the new species with that reported by Yamaguti (1936) clearly indicates that his specimen probably represents a new species that should be further studied.

Based on a report on *L. brevis* (cf. Richiardi, 1879) and other species found in the area, the new species can be distinguished by the shape of the dorsal plate, by the length of the genito-abdomen and by the lack of a fifth leg in *L. brevis*, which, conversely, is well-developed in the new species.

When the present new species is compared with other *Lernanthropus* species parasitic on sciaenid fish, e.g., *L. pacificus* Oliva & Durán, 1982, *L. huamani* Luque & Farfán, 1990 and *L. cynoscicola* Timi & Etchegoin, 1996, all of these can be distinguished from *L. indefinitus* n. sp. because in those species the dorsal plate shows a shortened condition. That is, in all specimens the dorsal plate leaves the genito-abdomen free, while in the new species the dorsal plate covers about 3/4 of the uropods and the fifth leg and also partially the fourth leg.

Another *Lernanthropus* parasitic on sciaenids is *L. paralonchuri* Luque, Bruno & Covarrubia, 1989, but this species is distinct because the head does not form an anterior projection (which is present in *L. indefinitus* n. sp.). The lengths of the fifth leg and of the uropod are more than half the entire body length and much more visible from dorsal view in *L. paralonchuri*, while only one-third of the entire body length in *L. indefinitus* n. sp. The length of the fourth leg also shows a discrepancy between these two species (the fourth leg longer than the entire body in *L. paralonchuri* but about as long as the entire body in *L. indefinitus* n. sp. *Lernanthropus chlamydotus* Wilson, 1922 can be disregarded, because the dorsal plate covers the genito-abdomen and the fourth leg in this species, whereas in the new species the dorsal plate partially covers the fifth leg and uropods, leaving

almost all of the fourth leg free (in dorsal view). *L. paenulatus* Wilson, 1922 has a short fourth leg and, from a dorsal perspective, can be seen only partially; while in the new species it is longer, and can be seen almost completely in dorsal view. In *L. cruciatus* Pillai, 1962 the dorsal plate almost completely covers the fourth leg, but in the new species, the fourth leg can be seen almost fully in dorsal view.

If compared with *L. pomatomi* Rathbun, 1887, the trunk offers a difference with the new species (in *L. pomatomi* the anterior part is subquadrangular, but elongated in the new species). The dorsal plate is almost sub-circular in *L. pomatomi* and more elongated in the new species. The dorsal plate completely covers the uropods in *L. pomatomi*, in contrast these are partially visible (in dorsal view) in the new species. The fourth leg is shorter than the body in *L. pomatomi*, whereas the fourth leg is of equal length to the body in the new species.

Lernanthropus leidyi Wilson, 1922 can be distinguished from the new species because in *L. leidyi* the fourth leg is longer than the entire body, while in the new species it is about the same length as the body. Also notable is the dorsal plate length, short in *L. leidyi*, versus more developed in the new species. The third leg is wide in *L. leidyi* and more slender in the new species.

Another *Lernanthropus* parasitic on *Sciaena aquila* is *Lernanthropus sciaenae* Gnanamuthu, 1947, described by Gnanamuthu (1947). The latter can be easily differentiated from the present new species because of its sub-triangular head, while, by contrast, the head is almost sub-circular in the new species. The wide dorsal plate completely covers the genito-abdomen, the fifth leg and the uropods in *L. sciaenae*; by contrast, in *L. indefinitus* n. sp. the fifth leg and the uropods are partially visible in dorsal view.

It is possible that previous reports of *Lernanthropus* spp. on *Argyrosomus* are confusing. Also the same can be true for other *Lernanthropus* species throughout their distributional range in the Mediterranean, the Sea of Marmara, the Black Sea western border, the Red Sea and the Indian Ocean, as quoted by Diebakate & Raibaut (1996).

Lernanthropus kroyeri Van Beneden, 1851

Material examined.— Three females are kept in the collection of Prof. R. Castro Romero (University of Antofagasta, Chile) and 36 adult females were deposited in the collection of the Department of Fisheries Faculty at Mersin University Museum, Turkey. Specimens were collected from *Dicentrarchus labrax* (L., 1758), synonym: *Morone labrax* (L., 1758), caught in Mersin Bay, the Mediterranean Sea, Turkey, 36.65-36.8°N 34.55-34.8°E. Specimens were living on the gills of its host, with a prevalence of 61%.

Measurements.— Total length (including the fourth leg), based on 42 specimens, was 3.7 mm (range = 3.3-4.5 mm).

Description.— These specimens are in agreement with all previous descriptions (Kabata, 1989; Özel et al., 2004; Tokşen et al., 2008) and, therefore, a redescription is not necessary.

Remarks.— Specimens of *Lernanthropus kroyeri* Van Beneden, 1851, found parasitic on *Dicentrarchus labrax* are in accord with all previous descriptions of this species. It is only necessary to point out that the parabasal flagellum (not previously reported) is large, with a wide base, as long as the antennules and strongly curved (similar to that of *L. indefinitus* n. sp. described herein). *Lernanthropus kroyeri* is probably one of the most-studied *Lernanthropus* species, due to its notoriety in causing problems to the culture of *Dicentrarchus labrax* throughout the Mediterranean (Altunel, 1983; Tokşen, 1999, 2007). Recently, Antonelli et al. (2012) reported morphological and ecological aspects for this species.

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