

A New *Ergasilus* Nordmann, 1832 Species (Copepoda: Cyclopoida, Ergasilidae) from Gills of Two Freshwater Fishes at Al-Gharraf River, Southern Iraq

Basem A. A. Al-Sahlany, Thamir K. Adday, Atheer H. Ali*

Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, Basrah, Iraq

*Corresponding Author: atheeralibu@gmail.com

ARTICLE INFO

Article History:

Received: Oct. 21, 2024

Accepted: Nov. 14, 2024

Online: Nov. 18, 2024

Keywords:

Ergasilidae,
Ectoparasites,
Freshwater fish,
Thi Qar Province,
Iraq

ABSTRACT

A survey of parasitic crustaceans on the gills of two freshwater fish species in Southern Iraq, specifically in the Al-Gharraf River (Thi Qar Province), was conducted from December 2022 to December 2023. The results led to the discovery of a new species: *Ergasilus luteusi* sp. nov., found on both the yellow barbell, *Carasobarbus luteus* (Heckel) (type host), and the Abu mullet, *Planiliza abu* (Heckel). This new species shares a guitar-shaped cephalothorax with 11 other species of *Ergasilus*; however, *Ergasilus luteusi* sp. nov. differs from all these species, except for *E. iraquensis* Amado, 2001, in the armature of legs 1-4. *Ergasilus luteusi* is very similar to *E. iraquensis*, but it can be distinguished by possessing three setae in the terminal segment of leg 5 (only two setae in *E. iraquensis*). The ratio of the second endopod segment to the first endopod segment of the antenna is 65% in *E. luteusi*, compared to 80% in *E. iraquensis*. Additionally, the length-to-width ratio of the caudal rami in the new species is 1.5:1, whereas it is 1.1:1 in *E. iraquensis*.

INTRODUCTION

The family Ergasilidae comprises 30 genera, including 163 species of the fish-parasitic copepod *Ergasilus*, in which only the females are parasites. Most species are found in freshwater environments, and they primarily attach to the gills of their piscine hosts (Hadfield, 2019; Walter & Boxshall, 2024). In Iraq, the family Ergasilidae is represented by four genera: *Dermoergasilus* Ho & Do, 1982; *Ergasilus* Nordmann, 1832; *Mugilicola* Tripathi, 1960; and *Paraergasilus* Markevich, 1937. Among these, *Ergasilus* is the richest genus, with 11 valid species (Ali & Adday, 2019; Mhaisen & Al-Daraji, 2023). Mhaisen and Al-Daraji (2023) gave a checklist of all *Ergasilus* species, with their fish hosts and their distribution in Iraq. These are *Ergasilus barbi*, with 15 freshwater hosts (F), *E. boleophthalmi*, with 2 marine hosts (M), *E. iraquensis* (1M), *E. lizae* (1M), *E. mosulensis* (22F and 2M), *E. ogawai* (14F and 3M), *E. pararostralis* (1F and 1M), *E. peregrinus* (9F), *E. rostralis* (16F and 3M), *E. seiboldi* (21F and 4M) and *E. synanceiensis* (1M).

Due to numerous problematic records regarding the accurate identification of *Ergasilus* species from a wide range of freshwater and marine fish hosts, the current study was conducted to ensure precise identification of some *Ergasilus* species in an area where no previous studies have been established (Al-Gharraf River, Thi Qar Province).

MATERIALS AND METHODS

Specimens of freshwater fish included two species: 436 yellow barbels, *Carasobarbus luteus* (Heckel), and 884 Abu mullets, *Planiliza abu* (Heckel), collected from the Al-Gharraf River in Thi Qar Province. The fish were transported from both localities in boxes filled with crushed ice to the Laboratory of Fish Diseases and Parasites, Department of Fisheries and Marine Resources, University of Basrah, Iraq, for ectoparasite examination within 48 hours. Fish were classified according to **Coad (2010)** and verified by **Fricke *et al.* (2024)**, with common names following **Froese and Pauly (2024)**. Ecological terms adhered to **Bush *et al.* (1997)**.

Parasites were detected from the gill arches using a dissecting microscope, then preserved in 70% ethanol, soaked, and cleared in 90% lactic acid for approximately 12 hours on modified glass slides (**Khamees & Adday, 2013**). All illustrations were drawn using a Camera Lucida fixed on a Leica compound microscope, and all measurements are presented in micrometers.

RESULTS AND DISCUSSION

Ergasilus luteusi sp. nov. (Figs. 1-3).

Type-material: Female holotype: Reg. No. INHM-CRC 2.

19 female paratypes: Reg. No. INHM-CRC 3-21.

Prevalence: 7.33%.

Deposited in Iraq Natural History Research Center and Museum (INHM).

Type-locality: Iraq, Al-Gharraf River, Thi Qar Province, Southern Iraq.

Type-host: Yellow barbell *Carasobarbus luteus* (Heckel, 1843).

Other host: Abu mullet *Planiliza abu* (Heckel, 1843).

20 female paratypes: Reg. No. INHM-CRC 2- INHM-CRC 11.

Prevalence: 24.7%.

Site of infection: Gill filaments.

Etymology: The specific name of this copepod relates to the specific name of the type host.

1.1 Description of females (10 specimens)

The body is elongated (Fig. 1A-B), measuring 854–1310 (1113) in total length. The prosome (cephalosome) is dome-like, being as long as it is wide, with a well-

developed depression between the cephalosome and the first pediger somite (Fig. 1A). The somites of the metasome gradually narrow posteriorly. Spinules on the ventral surface of the urosome are illustrated in Fig. (2C-D). The genital segment is wider than being long (Fig. 2B), and the abdomen is comprised of three segments. The caudal ramus is 1.5 times longer than wide and features one very long and three unequal setae (Fig. 2E). The egg sacs are long, arranged in three longitudinal rows (Fig. 2I).

The antennule is 6-segmented, armed with 3, 11, 3, 4, 1+ae, and 7+ae setae (Fig. 1C). The antenna is long and slender, with the second segment (first endopodal segment) being the longest. The segment ratios are 1.1, 2.2, 1.26, and 1 (Table 1). The coxabasis is nearly equal in length to the claw, with a non-inflated outer cuticular membrane. The middle of the second segment (first endopodal segment) bears a papilla with sensilla, while the third segment has a pair of sensillae (Fig. 1D).

The mandible (Fig. 2A) features one short and one long blade anteriorly, armed with long teeth. The posterior blade has moderate teeth along its margin. The maxillule is small and has two relatively unequal setae. The maxilla comprises a large syncoxa, with the second segment being spatula-like and possessing prolonged sharp-edged teeth.

Legs 1-4 (Fig. 3) biramous, with following formula

Leg	Coxa	Basis	segments
First leg exopod	0-0	0-1	I-0, 0-1, II-5
First leg endopod			0-1, 0-1, II-4
Second leg exopod	0-0	0-1	I-0, 0-1, 0-6
Second leg endopod			0-1, 0-1, I-4
Third leg exopod	0-0	0-1	I-0, 0-1, 0-6
Third leg endopod			0-1, 0-1, I-4
Fourth leg exopod	0-0	0-1	I-0, 0-5
Fourth leg endopod			I-0, 0-2, 1-3

Interpodal plates 1-3 feature a row of spinules along the posterior margin. Leg 5 has a single seta on the basal segment, two distally unequal setae, and an additional single lateral seta on the distal segment.

1.2 Remarks

E. luteusi sp. nov. has a guitar-shaped body, which it shares with the following 11 species: *Ergasilus arthrosis* Roberts, 1969 from *Ictalurus punctatus* in the United States; *Ergasilus atafonensis* Amado & Rocha, 1996 from five mullet species (*Mugil curema*, *M. trichodon*, *M. platamus*, *M. liza*, and *M. gaimardianus*) in Brazil; *Ergasilus bahiensis* Amado & Rocha, 1996 from *Mugil curema* in Brazil; *Ergasilus barbi* Rahemo, 1982

from *Barbus grypus* (= *Arabibarbus grypus*) in Iraq; *Ergasilus briani* Markevich, 1933 from 12 cyprinid species in the UK and 15 fish species in China; *Ergasilus curticus* Muriel-Hoyos, Santana-Pineros, Cruz-Quintana & Suarez-Morales, 2015 from *Bryconops giacopinii* in Colombia; *Ergasilus cyanopictus* Carvalho, 1962 from *Mugil cephalus* in Brazil; *Ergasilus iraquensis* Amado in Amado, da Rocha, Piasecki, Al-Daraji & Mhaisen, 2001 from *Liza subviridis* (= *Planiliza subviridis*) in Iraq; *Ergasilus mosulensis* Rahemo, 1982 from *Cyprinion macrostomum* in Iraq (Rahemo, 1982; Ho *et al.*, 1996); *Ergasilus parabahiensis* El-Rashidy & Boxshall, 1999 from *Agonostomus monticola* in New Guinea; and *Ergasilus mirabilis* Oldewadge & Van As, 1987 from *Synodontis leopardinus* in Southern Africa.

The new species (*E. luteusi*) differs from *E. arthrosis* in the exopodal armature of the terminal segment of legs 1-4, and it possesses double setae in the second segment of legs 2 and 3 of the endopodal limb, whereas *E. arthrosis* has only one seta.

E. luteusi differs from *E. atafonensis* and *E. bahiensis* by having two setae in the middle segment of legs 2 and 3 of the endopodal limb (one seta in *E. luteusi*), as well as a single spine in the middle segment of leg 1 of the exopod limb (which is absent in the others). *E. bahiensis* has four setae (instead of five) in the terminal segment of the exopod limb of leg 4.

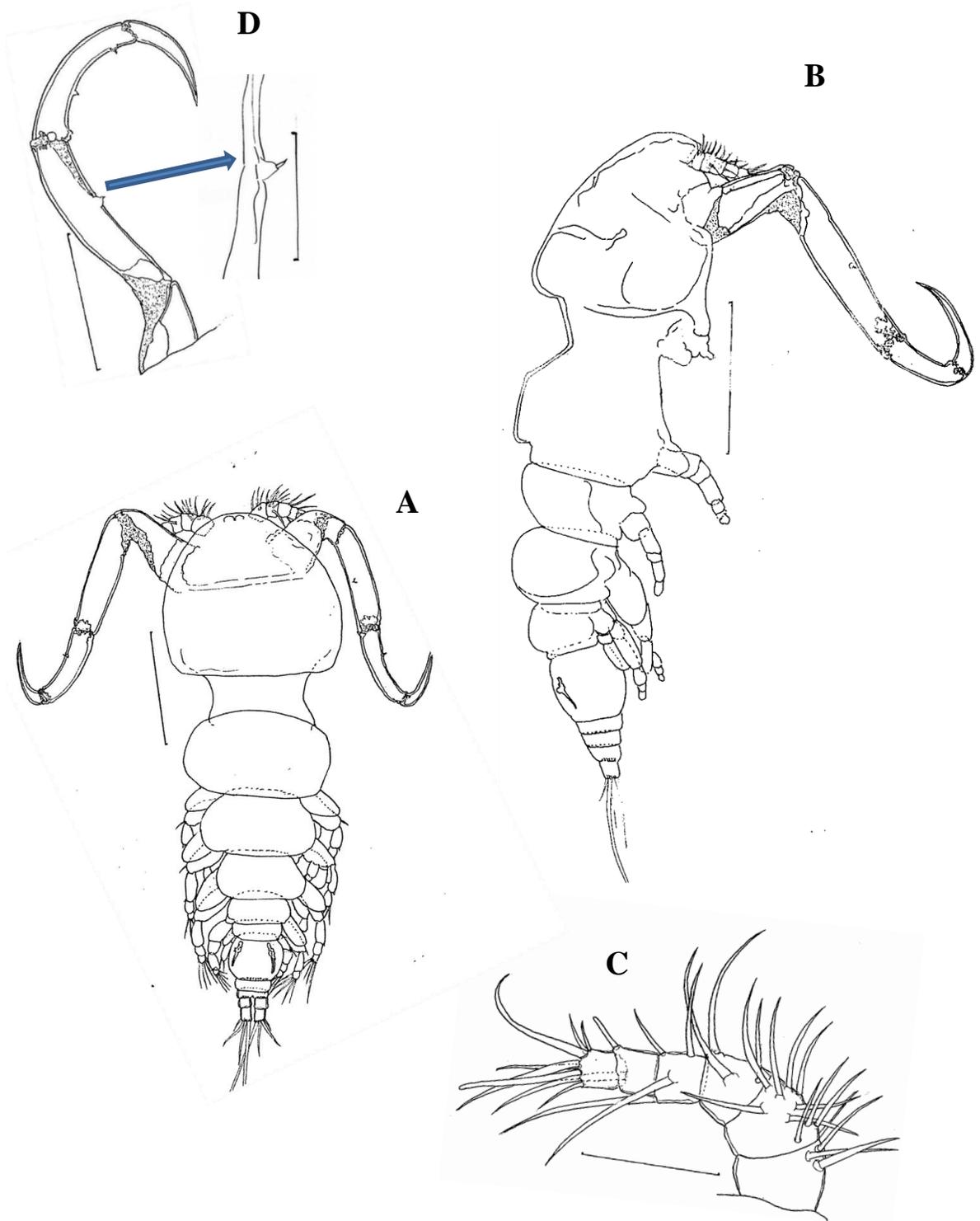


Fig. 1. *Ergasilus luteusi* sp. nov. female. **A:** Habitus, dorsal view; **B:** Habitus, lateral view; **C:** Antennule; **D:** Antenna and sensilla (blue arrow). Scale bars: 200 μ m in A-D; 50 μ m for sensilla

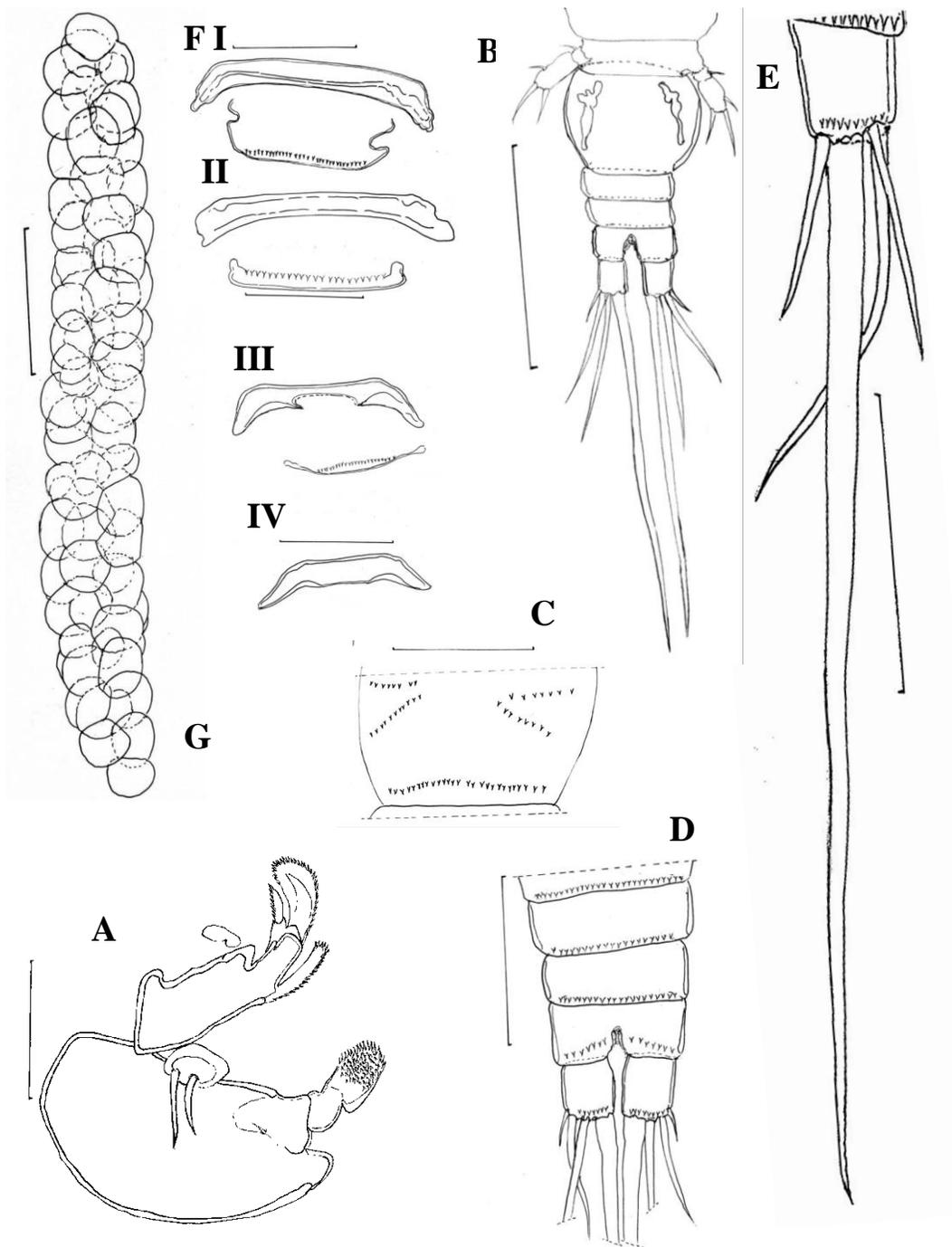


Fig. 2. *Ergasilus luteusi* sp. nov. female. **A:** Mouth parts; **B:** Urosome; **C:** Ornamentation of genital segment, ventral view; **D:** Uropod (left) and setae; **E:** Caudal ramus; **F:** Interpodal plates of legs 1 to 4 (numbered I to IV); **G:** Egg sac. Scale bars: 200 μm in A, C, D, and E; 500 μm in B; 125 μm in F

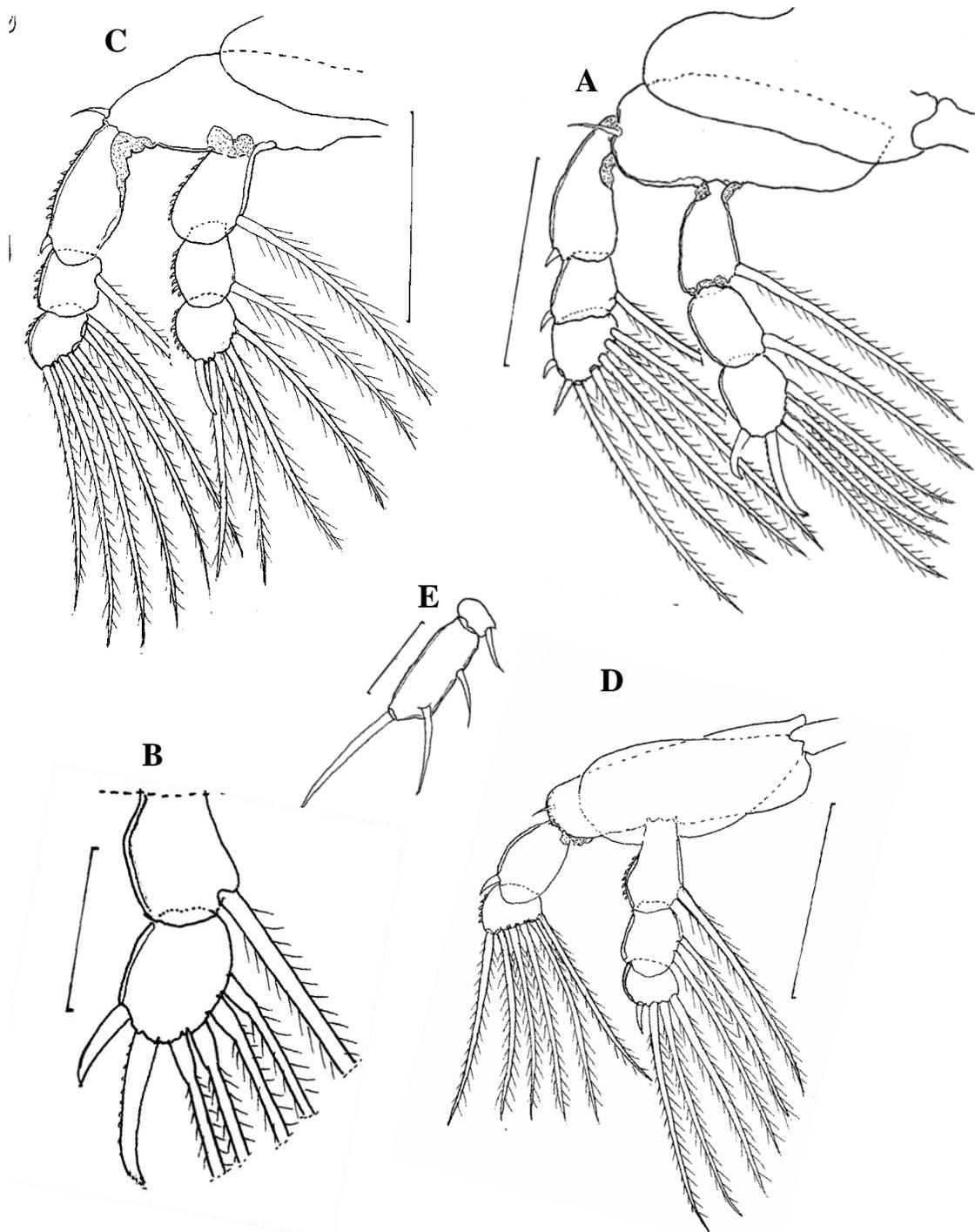


Fig. 3. *Ergasilus luteusi* sp. nov. female. **A:** Leg 1; **B:** Distal endopod segment of leg 1; **C:** Leg 2 and leg 3; **D:** Leg 4; **E:** Leg 5 (Scale bar= 200 μ in A- E)

Table 1. Comparison of maxillule, caudal rami length: width, leg 5, antenna and antennule of *Ergasilus* guitar-shaped species

Species	maxillule	Caudal rami L:W	Leg 5	Antenna	Antennule	Reference
<i>E. arthrosis</i>	2 setae	1.5:1	2 segments, 3 setae in terminal segment.	1.75, 3.25, 2.75, 1	3, 11, 6, 4, 3+ae, 6	Roberts (1969)
<i>E. atafonensis</i>	2 setae	1:1	2 segments, 3 setae in terminal segment	1, 1.4, 1.4, 1	1, 7, 4, 3, 3, 5+ae	Amado and Rocha (1996)
<i>E. bahiensis</i>	2 setae	1.66: 1	2 segments, 3 setae in terminal segment	1, 3.3, 3, 1.67	3, 12, 6, 4, 2, 6+ae	Amado and Rocha (1996)
<i>E. barbi</i>	2 short setae	1.25:1	2 segments, 2 setae in terminal segment	1.67, 2.5, 2, 1	3, 9, 3, 4, 3, 6 +ae	Rahemo (1982)
<i>E. briani</i>	3 setae	1.66: 1	2 segments, 2 setae in terminal segment (one seta on papilla, (Alison et al. 1993)	1, 3.1, 2.9, 1.83	3, 9, 6, 2, 3, 9+ae	Alston <i>et al.</i> (1993)
<i>E. curticus</i>	3 setae	1.14:1	2 segments, 3 setae in terminal segment.	1, 2.1, 2.5, 1.1	3, 11, 3, 2, 2+ae, 7+ae	Muriel-Hoyos <i>et al.</i> (2015)
<i>E. cyanopictus</i>	2 setae	1:1	1 segment, 3 setae in terminal segment.	1, 4.5, 3.5, 1.4	3, 8, 4, 3, 2, 7	Carvalho (1962)
<i>E. iraquensis</i>	2 long setae	1.1:1	2 segments, 2 setae in terminal segment	1, 4.6, 2.2, 2	3, 13, 6, 4, 2+ae, 7+ae	Amado <i>et al.</i> (2001)
<i>E. mirabilis</i>	2+1 setae	2:1	2 segments, 3 setae in terminal segment	2.1, 4, 3.8, 1	2, 11, 3, 3, 2, 6	Fikiye <i>et al.</i> (2023)
<i>E. mosulensis</i>	2 setae	1:1	2 segments, 2 setae in terminal segment	1, 2.2, 1.85, 1.1	4, 10, 4, 4, 3, 5	Ho <i>et al.</i> (1996)
<i>E. parabahiensis</i>	4 setae	1.3:1	2 segments, 3 setae in terminal segment	1.1, 1.85, 1.2, 1	3, 13, 5, 4+ae, 2+ae, 7+ae	El-Rashidy & Boxshall 1999
<i>E. luteusi</i> sp. nov.	2 setae	1.5:1	2 segments, 3 setae in terminal segment	1.1, 2.2, 1.26, 1	3, 11, 3, 4, 1+ae, 7+ae	The present study

Ergasilus luteusi sp. nov. differs from *E. barbi* and *E. musulensis* in the setal formula of the terminal segment of the exopod for legs 2 and 3 (0-6 vs. I-5). Additionally, *E. barbi* has an outer spine on the middle segment of leg 1 of the endopod, which is absent in *E. luteusi*.

E. luteusi also differs from *E. briani* by lacking an outer spine in the terminal segment of the exopod for legs 2-4. Furthermore, *E. briani* possesses an outer spine on the middle segment of the exopod of leg 1, and the terminal segment of the exopod of leg 4 has 4 setae, compared to 5 in *E. luteusi*.

In comparison to *E. curticus*, *E. luteusi* shows a different number of segments in leg 4 for both the exopod and endopod (2 vs. 1 and 3 vs. 2, respectively).

When comparing with *E. cyanopictus*, *E. luteusi* has a different number of segments in the endopod of leg 1 (3 vs. 2) and lacks an outer spine in the terminal segment of legs 2-4, which is present in *E. cyanopictus*. Moreover, *E. cyanopictus* has two setae in the second segment of legs 2 and 3 of the endopodal limb, whereas *E. luteusi* has only one seta.

E. luteusi is also distinct from both *E. parabahiensis* and *E. mirabilis* by having 1 seta in the second segment of endopod legs 2 and 3 instead of two setae. Additionally, *E. mirabilis* differs by possessing an outer spine in the exopod of the middle segment of leg 1.

Only *E. iraquensis* shares a guitar-shaped body and the setal formula for legs 1-4 with *E. luteusi*. However, *E. luteusi* can be distinguished from *E. iraquensis* by the presence of three setae in the terminal segment of leg 5 (only 2 setae in *E. iraquensis*). The ratio of the second endopod segment to the first endopod segment of the antenna is 65% in *E. luteusi* compared to 80% in *E. iraquensis*. Furthermore, the ratio of the length to width of the caudal rami in *E. luteusi* is 1.5:1, while in *E. iraquensis* it is 1.1:1.

Finally, the presence of a well-developed depression between the cephalosome and the first pediger somite distinguishes *E. luteusi* and *E. mirabilis* from the other 11 valid *Ergasilus* species. Both species are distinct from each other based on the setal formula of legs and the antennule setal formula, as well as differences in the shape of the antenna (the second endopodal segment of *E. mirabilis* is sickle-shaped).

ACKNOWLEDGEMENTS

The authors would like to thank the Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, for their support of this work. Special thanks are extended to Prof. Dr. Geoffrey A. Boxshall from the Natural History Museum, England, for his valuable suggestions and for providing many rare papers.

REFERENCES

- Ali, A. H. and Adday, T. K. (2019).** Description of a new species of *Dermoergasilus* Ho & Do, 1982 (Copepoda: Ergasilidae) from the redbelly tilapia *Coptodon zillii* (Gervais) in Basrah, southern Iraq. *Systematic Parasitology*, 96: 715–722.
- Alston, S.; Boxshall, G. A. and Lewis, J. W. (1993).** A redescription of the adult female *Ergasilus briani* Markewitsch 1933 (Copepoda: Poecilostomatoida). *Systematic Parasitology*, 24: 217–227.
- Amado, M. A. P. M. and Rocha, C. E. F. (1996).** Três novas espécies de copépodes parasitas do gênero *Ergasilus* (Poecilostomatoida, Ergasilidae) coletadas em filamentos branquiais de peixes mugilídeos do Brasil. Three new species of parasitic copepods of the genus *Ergasilus* (Poecilostomatoida, Ergasilidae) collected from the branchial filaments of the mugilid fishes in Brazil. *Nauplius, Rio Grande*, 3: 33–48.
- Amado, M. A. P. M.; Rocha, C. E. F.; Piasecki, W.; Al-Daraji, S. A. M. and Mhaisen, F. T. (2001).** Copepods of the family Ergasilidae (Poecilostomatoida) parasitic on fishes from Khor Al-Zubair lagoon, Iraq. *Hydrobiologia*, 459: 213–221.
- Bush, A. O.; Lafferty K. D.; Lotz J. M. and Shostak, A. W. (1997).** Parasitology meets ecology on its own terms: Margolis *et al.* revisited. *Journal of Parasitology*, 83: 575–583.
- Carvalho, J. de P. (1962).** *Ergasilus cyanopictus* sp. nov., parasito da Tainha - *Mugil cephalus* (L.). *Archivos do Museu Nacional do Rio de Janeiro*, 52: 31–36.
- Coad, B. W. (2010).** *Freshwater fishes of Iraq*. Pensoft Publishers, Sofia-Moscow. 274+16pls.
- El-Rashidy, H. H. and Boxshall, G. A. (1999).** Ergasilid copepods (Poecilostomatoida) from the gills of primitive Mugilidae (grey mullet). *Systematic Parasitology*, 42: 161–186.
- Fikiye, P. P.; Smit, N. J.; Van As, L. L.; Truter, M. and Hadfield, K. A. (2023).** Integrative morphological and genetic characterisation of the fish parasitic copepod *Ergasilus mirabilis* Oldewage & Van As, 1987: Insights into host specificity and distribution in Southern Africa. *Diversity*, 15: 965. <https://doi.org/10.3390/d15090965>.
- Fricke, R., Eschmeyer, W.N., and Van der Laan, R, eds. (2024).** *Eschmeyer's Catalog of Fishes: Genera, Species, References*. Available at <http://researcharchive.calcademy.org/research/ichthyology/catalog/fishcatmain.asp>. Accessed 14 February 2024.

- Froese, R., and Pauly, D., eds. (2024).** FishBase. Available at www.fishbase.org, version (06/2024). Accessed 10 October 2024.
- Hadfield, K. A. (2019).** History of discovery of parasitic Crustacea. Pp, 7–72. In Smit, N. J., Bruce, N. L. and Hadfield, K. A. (Eds.). Parasitic Crustacea: State of knowledge and future trends. Zoological Monographs Vol. 3, Springer: 481pp.
- Ho, J.-S.; Khamees, N. R. and Mhaisen, F. T. (1996).** Ergasilid copepods (Poecilostomatoida) parasitic on the mullet *Liza abu* in Iraq, with the description of a new species of *Paraergasilus* Markevich, 1973. Systematic Parasitology, 33: 79–87. <https://doi.org/10.1007/BF00009424>.
- Khamees, N. R. and Adday, T. K. (2013).** Occurrence of sea lice *Caligus epinepheli* Yamaguti, 1936 (Copepoda: Siphonostomatoida) on gills of *Nemipterus japonicus* (Bloch, 1775) from northwest of the Arabian Gulf. Basrah Journal of Agricultural Sciences, 26: 1–14.
- Mhaisen, F. T. and Al-Daraji, S. A. M. (2023).** Checklists of species of *Ergasilus* von Nordmann, 1832 (Copepoda: Ergasilidae) parasitic on fishes of Iraq. Iraqi Journal of Aquaculture, 20(2): 217–250.
- Muriel-Hoyos, F.; Santana-Pineros, A.; Cruz-Quintana, Y. and Suárez-Morales, E. (2015).** A new species of *Ergasilus* Nordmann, 1832 (Copepoda: Cyclopoida: Ergasilidae) from *Bryconops giacopinii* Fernandez-Yepez (Characidae) in the Vichada River Basin, Colombia. Systematic Parasitology, 92(3): 241–249.
- Rahemo, Z. I. F. (1982).** Two new species of *Ergasilus* (Copepoda: Cyclopoida) from the gills of two Iraqi freshwater fishes. Bulletin of the Basrah Natural History Museum, 5: 39–59.
- Roberts, L. S. (1969).** *Ergasilus arthrosis* n. sp. (Copepoda: Cyclopoida) and the taxonomic status of *Ergasilus versicolor* Wilson, 1911, *Ergasilus elegans* Wilson, 1916, and *Ergasilus celestis* Mueller, 1936, from North American fishes. Journal of the Fisheries Research Board of Canada, 26: 997–1011.
- Walter, T. C. and Boxshall, G. (2024).** World of Copepods Database. *Ergasilus* Nordmann, 1832. Accessed through: World Register of Marine Species at: <https://www.marinespecies.org/aphia.php?p=taxdetails&id=128641> on 2024-10-2