# *Description of a new species of* Dermoergasilus *Ho & Do, 1982 (Copepoda: Ergasilidae) from the redbelly tilapia* Coptodon zillii *(Gervais) (Perciformes: Cichlidae) in Basrah, southern Iraq*

**Atheer H. Ali & Thamir K. Adday**

**Systematic Parasitology**
An International Journal

ISSN 0165-5752
Volume 96
Number 8

Syst Parasitol (2019) 96:715-722
DOI 10.1007/s11230-019-09882-8


Springer

Syst Parasitol (2019) 96:715–722
https://doi.org/10.1007/s11230-019-09882-8

# Description of a new species of *Dermoergasilus* Ho & Do, 1982 (Copepoda: Ergasilidae) from the redbelly tilapia *Coptodon zillii* (Gervais) (Perciformes: Cichlidae) in Basrah, southern Iraq

**Atheer H. Ali · Thamir K. Adday**

Received: 3 March 2019 / Accepted: 25 August 2019 / Published online: 12 September 2019


**Abstract** A new species of *Dermoergasilus* Ho & Do, 1982 (Copepoda: Ergasilidae) parasitic on the gills of the redbelly tilapia *Coptodon zillii* (Gervais) from Basrah, southern Iraq, is described. *Dermoergasilus cichlidus* n. sp. is morphologically similar to *D. longiabdominalis* El-Rashidy & Boxshall, 2001 in the body length to width ratio, the swimming legs armature, the shape of the urosome and the small slightly spiniform seta on the exopodal segment of leg 5. However, the main differences are the presence of long setae on the endopod of leg 1 in *D. cichlidus* n. sp. (*vs* relatively short setae); the inner apical spine on the tip of the endopod of leg 1 being only slightly longer than the outer apical spine (*vs* inner apical spine about twice as long as the outer); the first interpodal sternite ornamented with spinules (*vs* interpodal sternites not ornamented); and the caudal rami and anal somite of equal length (*vs* caudal rami length *c.*2/3 of the length of the anal somite). *Dermoergasilus occidentalis* can be distinguished from *D. cichlidus* n. sp. by the relative length of the antennal segments, the absence of a minute terminal spine on the digital process of the caudal ramus and by differences in the mouth parts.

This article was registered in the *Official Register of Zoological Nomenclature* (ZooBank) as E8CF8B16-4AA2-4C4A-86F1-760BA875014C. This article was published as an Online First article on the online publication date shown on this page. The article should be cited by using the doi number. This is the Version of Record.

This article is part of the Topical Collection Arthropoda.

A. H. Ali (✉) · T. K. Adday
Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, Basrah, Iraq
e-mail: atheeralibu@gmail.com

## Introduction

The genus *Dermoergasilus* Ho & Do, 1982 (Ergasilidae Burmeister, 1835) with type-species *Dermoergasilus amplectens* (Dogiel & Akhmerov, 1952) includes 11 species of marine and brackish water species considered valid (Walter & Boxshall, 2019). Species of *Dermoergasilus* were reported from different fish species around the world including five species in fishes of the family Mugilidae, three species in fishes of the families Belonidae and Sparidae, one species in fishes of the families Clupeidae, Pericichthyidae and Plotosidae, one species in fishes of the families Chanidae, Cichlidae, Gerreidae, Hemirhamphidae, Megalopidae and Mugilidae and one species in fishes of the families Galaxiidae and Plotosidae (Hassan et al., 2009).

In Iraq, the Ergasilidae is represented by four genera, *Dermoergasilus*, *Ergasilus* von Nordmann, 1832, *Mugilicola* Tripathi, 1960 and *Paraergasilus* Markevich, 1937. Each of these genera is represented by one species except for *Ergasilus* which includes 11 species parasitic on fishes of Iraq (Mhaisen et al.,

2018). *Dermoergasilus varicoleus* Ho, Jayarajan & Radhakrishnan, 1992 was recorded for the first time in Iraq by Khamees & Mhaisen (1995) from the gills of *Planiliza abu* (Heckel) (syn. *Liza abu*) in Garmat-Ali River. Later, this parasite was recorded from nine host species: the greenback mullet *Planiliza subviridis* (Valenciennes), seven cyprinids and one silurid (Mhaisen, Pers. comm.). Unfortunately, the specimens of all these records except for those from *P. abu* were not deposited in a museum collection. Ahmed & Ali (2013) recorded *Dermoergasilus* sp. from gills of *Cyprinus carpio* Linnaeus from Marine Sciences Centre ponds, Basrah.

The present paper provides the description of a new species of *Dermoergasilus* isolated from the gill filaments of *Coptodon zillii* (Gervais) (Cichlidae).

## Materials and methods

A total of 53 redbelly tilapia *Coptodon zillii* (Gervais) were collected from two localities. These include 20 specimens of 75–85 mm (mean 80 mm) in total length (TL) from Shatt Al-Arab River at Al-Hartha District during October 2017 as well as 33 specimens from ponds of Marine Science Centre (TL 80–170 mm), during the period from October and December 2017. Copepods were removed from the gill filaments under a dissection microscope Optika S2-ST1. Specimens were preserved in 70% ethanol, mounted in 90% lactic acid overnight in glass slides [see Khamees & Adday (2013) for the modified procedure instead of the wooden slides which were conducted by Humes & Gooding (1964)] and then transferred to another glass slide with a drop of lactic acid. All measurements are in micrometres. Copepod morphology was studied under a compound microscope Olympus CX 21 FS1; all drawings were made with the aid of a drawing tube.

## Family Ergasilidae Burmeister, 1835
## Genus *Dermoergasilus* Ho & Do, 1982

### *Dermoergasilus cichlidus* n. sp.

*Type-host*: *Coptodon zillii* (Gervais) (Perciformes: Cichlidae), redbelly tilapia.
*Type-locality*: Shatt Al-Arab River (30°29′26″N, 47°44′38″E), Al-Hartha District, Iraq.
*Other locality*: Pond of Marine Sciences Centre, Basrah, Iraq.
*Type-material*: Female holotype (NHMUK 2018.107) and two paratypes (NHMUK 2018.108-109) are deposited in the Natural History Museum, London (NHMUK).
*Prevalence and abundance*: 45% (9 out of 20 fish from the type-locality; 9 female specimens); 3.03% (1 out of 33 fish from the pond of Marine Science Centre; 1 specimen).
*Etymology*: The specific name refers to the name of the host's family.

Description (Figs. 1–4)

*Female* [Based on 9 specimens; metrical data provided in Table 1.] Body 679–713 (692) long (n = 4), slightly convex (Fig. 1A, B). Cephalothorax oval, longer than wide (< 1.5 times), constituting less than half (0.34) body length (excluding caudal setae). Cephalon oval, well differentiated from thorax, with narrow in anterior part and rounded posterior part, with inverted T-shaped surface marking (Fig. 1A). First pedigerous somite large, dorsally concave in lateral view (Fig. 1B). Second to fourth pedigerous somites free, narrowing posteriorly from second to fourth, width greater than length. Genital double-somite (Fig. 1C) elongated, slightly widest anteriorly, longer than wide; mean length *c.*1.6 times longer than wide and 1.3–1.9 (1.5) times longer than second and third thoracic segments and caudal rami combined. First free abdominal somite 1.2–1.3 times longer than wide, nearly 1.5 times longer than second and third abdominal somites and caudal rami combined. Second free abdominal somite *c.*0.6 length of anal somite and caudal rami combined, ornamentation not clear on both abdominal somites and caudal rami. Anal somite with deep incision medially. Length of caudal rami *c.*1.15 times longer than wide, about equal to anal somite, with the digitiform process bearing minute terminal seta; process 1.6–1.9 times longer than ramus; longest caudal seta *c.*9 times longer than ramus. Longest caudal seta armed with rows of spinules (Fig. 3C); two lateral setae slightly longer than digitiform process.

Antennule (Fig. 2A) small, 6-segmented, narrowing distally; setal formula 3: 9: 4: 4: 3+ae: 7+ae. Antenna (Fig. 3A) 4-segmented, comprising short coxobasis and 3-segmented endopod terminating with

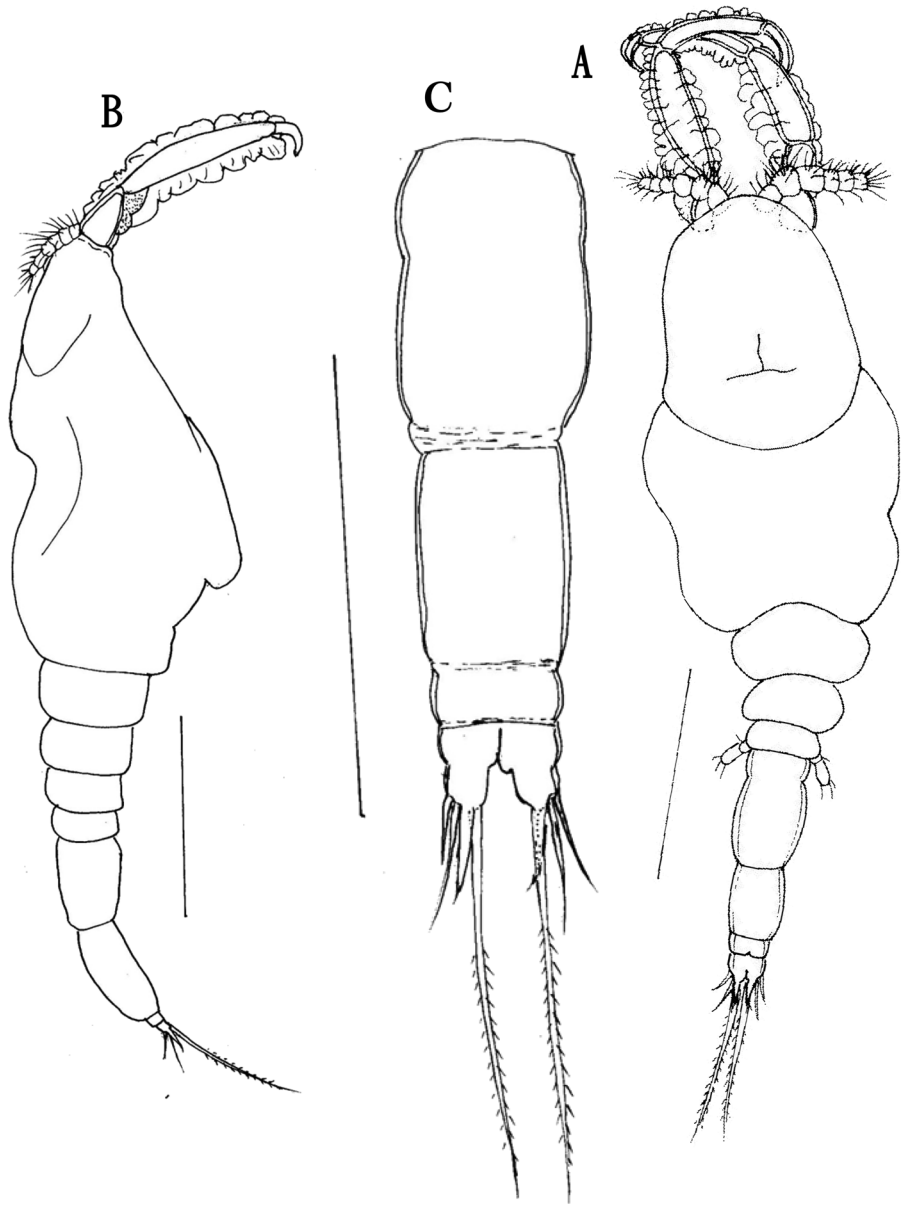


**Fig. 1** *Dermoergasilus cichlidus* n. sp. adult female. A, Habitus, dorsal view; B, Habitus, lateral view; C, Urosome, ventral view. *Scale-bars*: A, B, 240 μm; C, 500 μm

curved claw. Coxobasis long, with developed pedestal. Second segment longest, *c.*1.65 times as long as coxobasis. Third and fourth segments together, *c.*1.37 times longer than second segment. Terminal claw slightly curved, about half length of third segment. Antenna covered with inflated cuticular membrane except for terminal claw (Fig. 3A).

Mouthparts consisting of mandible, maxilla and maxillule (Fig. 2B). Mandible unsegmented with three blades; anterior blade with teeth on anterior margin; distal and posterior blades large, with teeth on posterior margins only. Maxillule lobate, with three unequal setae. Maxilla 2-segmented, with large syncoxa tapering distally and long spatula-shaped basis bearing rows of teeth.

Legs 1–4 (Fig. 4A–E) with 3-segmented rami, except 2-segmented exopod of leg 4. Posterior margins of first and second segments of leg 1 with row of

**Table 1** Comparative metrical data for *D. cichlidus* n. sp. and related species

| Species | *D. varicoleus* | *D. longabdominalis* | *D. cichlidus* n. sp. | |
|---|---|---|---|---|
| Source | Ho et al. (1992)[a] | El-Rashidy & Boxshall (2001)[a] | Present study | |
| Character | Holotype | Holotype | Range | Mean |
| Total length | 648 | 869 | 679–713 | 692 |
| Body width | 240 | 254 | 169–240 | 208 |
| Cephalon length | 261 | 296 | 286–303 | 295 |
| Cephalon width | 204 | 244 | 169–240 | 208 |
| Antennule length | 97 | 86 | 70–85 | 76 |
| Antenna length | 1,240 | 497 | 285–369 | 329 |
| Antennal segment 1 length | 875 | 142 | 59–75 | 67 |
| Antennal segment 2 length | 109 | 130 | 92–127 | 111 |
| Antennal segment 3 length | 200 | 175 | 81–112 | 97 |
| Antennal segment 4 (claw) length | 56 | 50 | 53–55 | 54 |
| Cephalothorax length | 400 | 433 | 286–303 | 296 |
| Cephalothorax width | 240 | 260 | 170–240 | 208 |
| Thoracic segment 2 length | 65 | 61 | 67–70 | 68 |
| Thoracic segment 2 width | 134 | 154 | 112–146 | 128 |
| Thoracic segment 3 length | 52 | 61 | 62–70 | 64 |
| Thoracic segment 3 width | 103 | 123 | 92–137 | 111 |
| Thoracic segment 4 length | 34 | 69 | 36–40 | 37 |
| Thoracic segment 4 width | 65 | 85 | 72–92 | 78 |
| Thoracic segment 5 length | 130 | 77 | 20–32 | 24 |
| Thoracic segment 5 width | 65 | 61 | 45–60 | 49. |
| Genital double somite length | 166 | 115 | 88–90 | 88 |
| Genital double somite width | 113 | 69 | 55–57 | 56 |
| Abdominal segment 1 length | 133 | 77 | 55–75 | 65 |
| Abdominal segment 1 width | 76 | 69 | 46–57 | 52 |
| Abdominal segment 2 length | 33 | 52 | 15–17 | 16 |
| Abdominal segment 2 width | 63 | 46 | 42–50 | 44 |
| Abdominal segment 3 length | 20 | 15 | 12–15 | 13 |
| Abdominal segment 3 width | 50 | 38 | 31–40 | 35 |
| Caudal ramus length | 19 | 11 | 13–13 | 13 |
| Caudal ramus width | 12 | 15 | 15–15 | 15 |
| Egg-sac length | 753 | – | 700–765 | 738 |

[a]Measurements from the original illustration of the holotype

spinules; outer spines slightly curved but inner one on terminal endopodal segment straight, outer one slightly longer than inner one (Fig. 4A). Interpodal sternites wide and interpodal sternite of leg 1 with rows of spinules at posterior margin. Armature as follows (spines: Roman numerals; setae, Arabic numerals):

| | Coxa | Basis | Exopod | Endopod |
|---|---|---|---|---|
| Leg 1 | 0-0 | 0-1 | I-0; 0-1; II-5 | 0-1; 0-1; II, 4 |
| Leg 2 | 0-0 | 0-1 | I-0; 0-1; 0-6 | 0-1; 0-1; I-4 |
| Leg 3 | 0-0 | 0-1 | I-0; 0-1; 0-6 | 0-1; 0-1; I-4 |
| Leg 4 | 0-0 | 0-1 | I-0; 0-5 | 0-1; 0-2; I-3 |

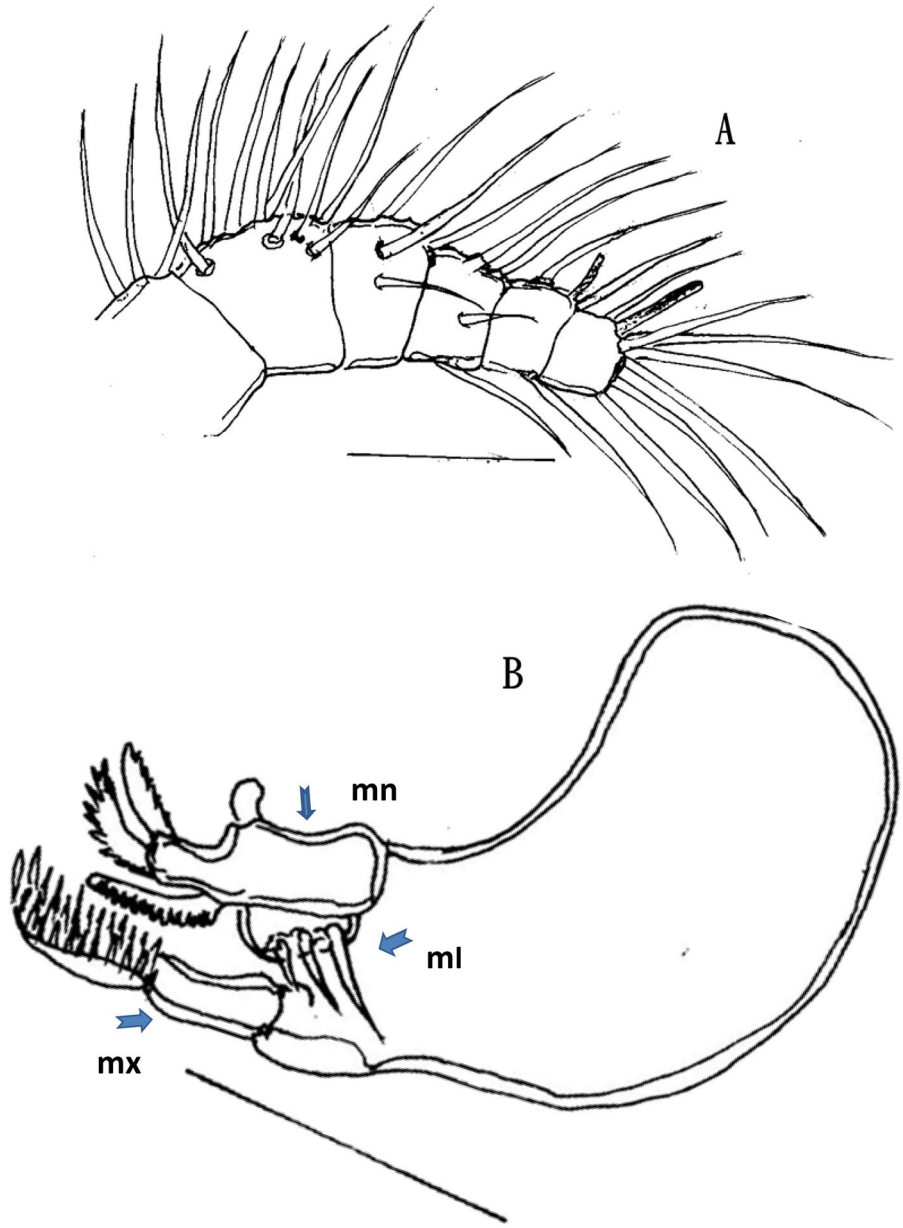


**Fig. 2** *Dermoergasilus cichlidus* n. sp. adult female. A, Antennule; B, Mouth parts. *Abbreviations*: ml, maxillule; mn, mandible; mx, maxilla). *Scale-bars*: 50 μm

Leg 5 (Fig.4E) 2-segmented; first segment short, small, naked, slightly curved setal element (spiniform seta); second segment with short lateral seta and 2 terminal setae.

## Discussion

Ho & Do (1982) erected *Dermoergasilus* based on three diagnostic characters: (i) antenna, except terminal claw, covered with inflated transparent membrane; (ii) paired caudal rami each with a digitiform process; and (iii) middle segment of endopod of legs 2 and 3 possessing a single seta. The validity of *Dermergasilus* was questioned by Gussev (1987), who found four species of *Ergasilus* sharing character (iii) with *Dermoergasilus*. Kabata (1992) discussed Gussev's opinion, confirmed the validity of *Dermoergasilus* and explained that the

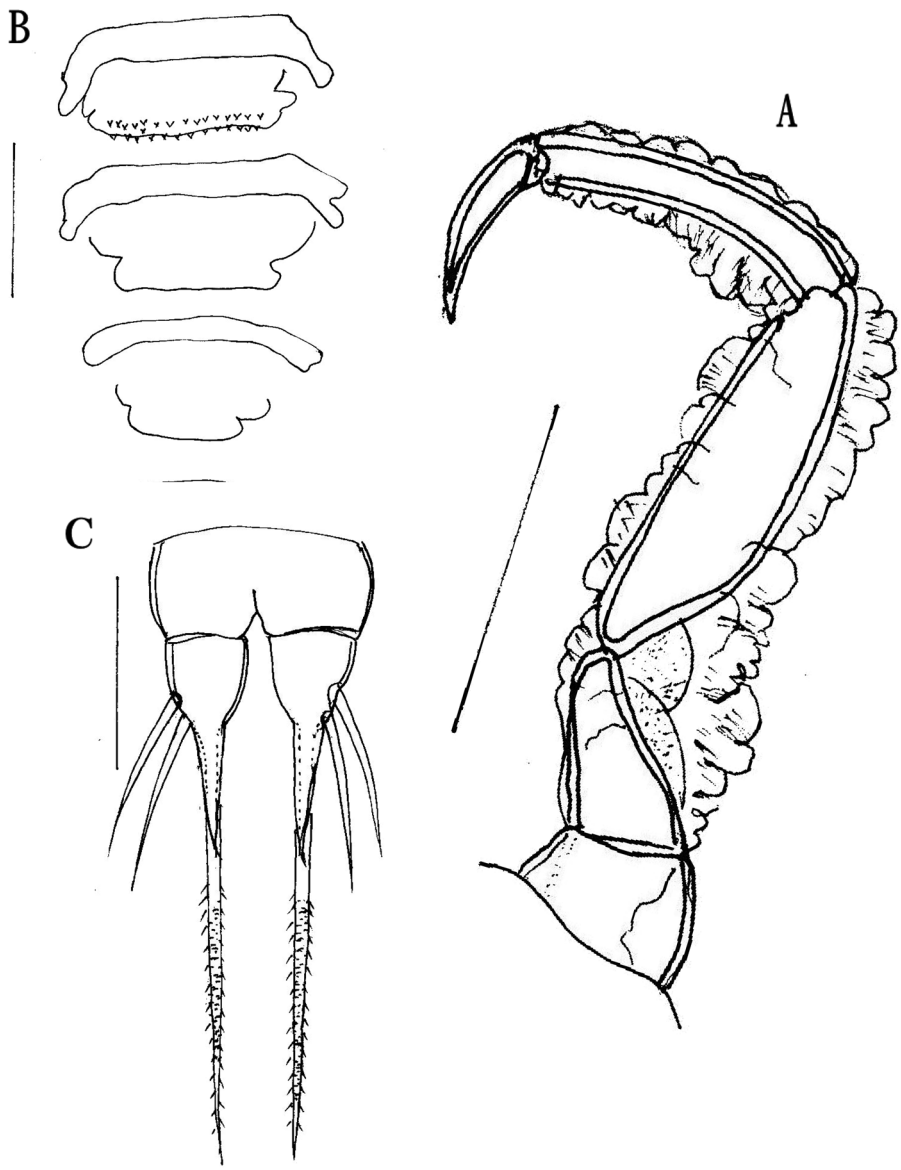


**Fig. 3** *Dermoergasilus cichlidus* n. sp. adult female. A, Antenna; B, Interpodal sternites; C, Anal somite and caudal rami. *Scale-bars*: 50 μm

character (ii), i.e. digitiform process on the caudal rami, alone might be considered as a taxonomic character to distinguish *Dermoergasilus* from *Ergasilus*. He showed that character (iii) could be found in ten *Ergasilus* species. Furthermore, character (i), i.e. hyaline inflated cuticle around the antenna, has weak taxonomic importance as it is not well developed in some species such as *E. intermedius* Kabata, 1992, which was named so, due to its possessing some common characters between *Dermoergasilus* and *Ergasilus*. Ho et al. (1992) showed that the four *Ergasilus* spp. highlighted by Gussev (1987) to share with *Dermoergasilus* character (iii) did not possess other taxonomic characters of *Dermoergasilus*. El-Rashidy & Boxshall (1999) transferred *E. intermedius* to *Dermoergasilus* and also described a new species of *Ergasilus* from the Goldie river mullet *Cestraeus goldiei* (Macleay) in New Guinea with a transparent

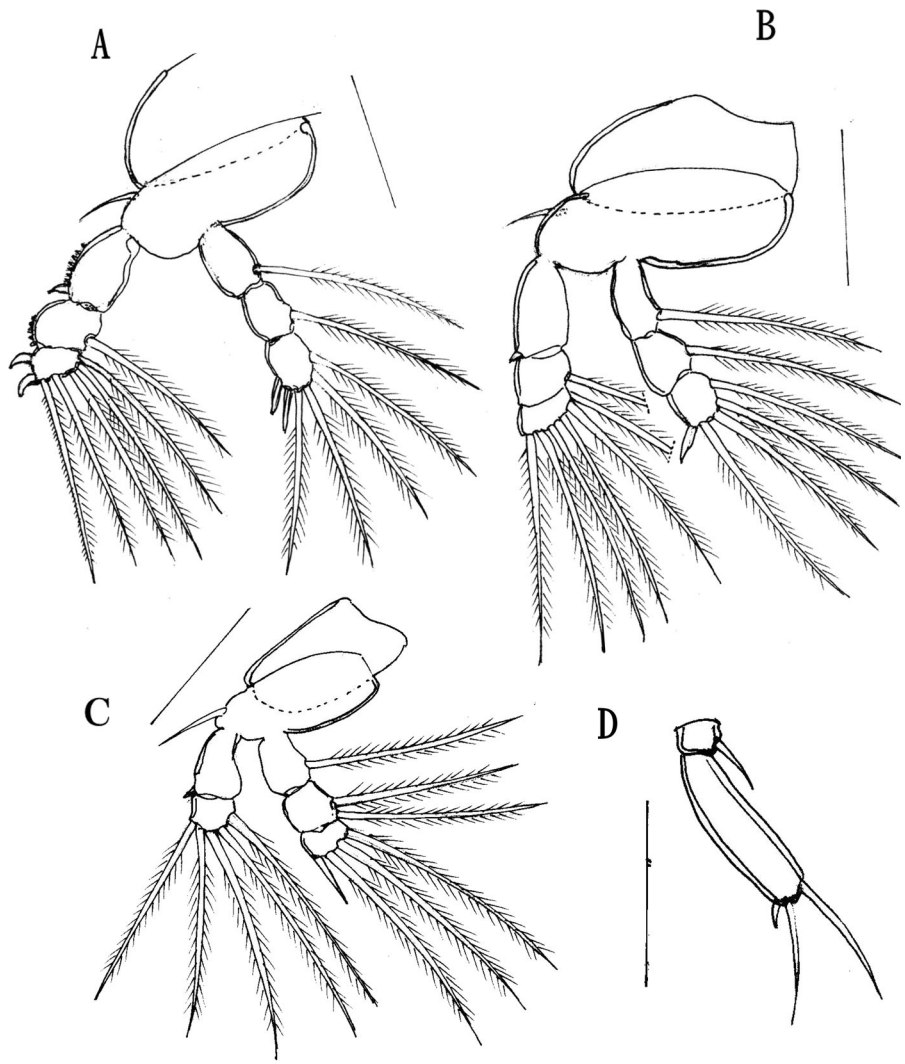


**Fig. 4** *Dermoergasilus cichlidus* n. sp. adult female. A, Swimming leg 1; B, Swimming leg 2; C, Swimming leg 4; D, Swimming leg 5. *Scale-bars*: 50 μm

inflated membrane around antenna, but other characters fit with *Ergasilus* instead of *Dermoergasilus*. On the other hand, El-Rashidy & Boxshall (2001) described three new *Dermoergasilus* species from museum specimens and prepared a key for all ten known species. Hassan et al. (2009) added a new species, *Dermoergasilus occidentalis* Hassan, Jones & Lymbery, 2009 from *Tandanus bostocki* Whitely (Plotosidae) and *Galaxias occidentalis* Ogilby (Galaxiidae) in Western Australia.

Based on the eleven species considered valid by El-Rashidy & Boxshall (2001) and Hassan et al. (2009), the new species shares with *D. longiabdominalis* El-Rashidy & Boxshall, 2001, *D. occidentalis*, *D. semiamplectens* (Cressey, 1970) and *D. varicoleus* the same leg setation pattern and long urosome. The body length to width ratio is about 1.5:1 in *D. cichlidus* n. sp., compared with 1.05:1 (in *D. semiamplectens*), 1.7:1 in *D. varicoleus*, 1.58:1 in *D. occidentalis* and 1.47:1 in *D. longiabdominalis*. These proportions suggest that *D. cichlidus* is most closely related to *D. longiabdominalis* and *D. occidentalis*. The small nacked slightly curved setal element on the exopodal segment of leg 5 is also similar among these three species. Both *D. cichlidus* and *D. longiabdominalis* have the same proportion for the length of lateral setae

to length of the digitiform process. Examination of figures of *D. longiabdominalis* provided by El-Rashidy & Boxshall (2001), showed that the main differences are the relatively short setae on the endopod of leg 1 in *D. longiabdominalis* compared to long setae in the new species. Also, the inner apical spine on the tip of the endopod of leg 1 is only slightly longer than the outer in *D. cichlidus* n. sp. whereas the inner spine is about twice as long as the outer one in *D. longiabdominalis*. In addition, the interpodal sternites in *D. longiabdominalis* are not ornamented, while the first one in the new species is ornamented with spinules. The caudal rami are about 2/3 the length of the anal somite in *D. longiabdominalis* in comparison with the caudal rami which are the same length as the anal somite in the new species. The digitiform process is 2.4–2.8 times longer than ramus in *D. longiabdominalis* in comparison with 1.6–1.9 times longer than ramus in *D. cichlidus*. *Dermoergasilus occidentalis* can be easily distinguished from *D. cichlidus* by the proportional length of the antennal segments, the absence of a minute terminal spine on the digital process of the caudal ramus and by differences in the mouth parts.

**Acknowledgements** The authors give sincere thanks to Professor Furhan T. Mhaisen for his permission to use his early data base of index catalogue of parasites and disease agents of fishes of Iraq and his proofreading the draft of manuscript, to Professor Geoffrey A. Boxshall, Department of Life Sciences, Natural History Museum, London, UK, for confirming the identification of the parasite.

**Compliance with ethical standards**

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All applicable institutional, national and international guidelines for the care and use of animals were followed.

## References

Ahmed, S. M., & Ali, A. H. (2013). Serum proteins and leucocytes differential count in common carp (*Cyprinus carpio* L.) infested with ectoparasites. *Mesopotamian Journal of Marine Science, 28,* 151–162.

El-Rashidy, H. H., & Boxshall, G. A. (1999). Ergasilid copepods (Poecilostomatoida) from the gills of primitive Mugilidae (grey mullet). *Systematic Parasitology, 42,* 161–186.

El-Rashidy, H. H., & Boxshall, G. A. (2001). Biogeography and phylogeny of *Dermoergasilus* Ho & Do, 1982 (Copepoda: Ergasilidae), with description of three new species. *Systematic Parasitology, 94,* 89–112.

Gussev, A. V. (1987). Phylum Arthropoda. In: O. B. Bauer (Ed.), *Key to parasites of freshwater fishes of the USSR* (pp. 378–524). Leningrad: Nauka.

Hassan, M., Jones, B., & Lymbery, A. J. (2009). A new species of *Dermoergasilus* Ho & Do, 1982 (Copepoda: Ergasilidae) from freshwater fishes in the south-west of Western Australia. *Systematic Parasitology, 74,* 143–148.

Ho, J. S., & Do, T. T. (1982). Two species of Ergasilidae (Copepoda: Poecilostomatoida) parasitic on gills of *Mugil cephalus* Linnaeus (Pisces: Teleostei) with the proposition of a new genus *Dermoergasilus*. *Hydrobiologia, 89,* 247–252.

Ho, J. S., Jayarajan, P., & Radhakrishnan, S. (1992). Copepods of the family Ergasilidae (Poecilostomatoida) parasitic on coastal fishes of Kerala, India. *Journal of Natural History, 26,* 1227–1241.

Humes, A. G., & Gooding, R. H. (1964). A method of studying the external anatomy of copepods. *Crustaceana, 6,* 238–240.

Kabata, Z. (1992). Copepoda parasitic on Australian fishes, XV Family Ergasilidae (Poecilostomatoida). *Journal of Natural History, 26,* 47–66.

Khamees, N. R., & 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 Agricultural Sciences, 26,* 1–14.

Khamees, N. R., & Mhaisen, F. T. (1995). Two copepod crustaceans as additional species to the parasitic fauna of fishes of Iraq. *Basrah Journal of Science, 13,* 49–56.

Mhaisen, F. T., Ali, A. H., & Khamees, N. R. (2018). Marine fish parasitology of Iraq: A review and checklists. *Biological and Applied Environmental Research, 2,* 231–297.

Walter, T. C., & Boxshall, G. (2019). World of copepods database. *Dermoergasilus* Ho & Do, 1982. Accessed through World Register of Marine Species at http// .www.Marinespecies. org. Date of Accessed on 20-01-2019.