Korean J. Syst. Zool. Vol. 22, No. 2: 121-125, November 2006

Redescription of *Ergasilus zacconis* (Copepoda: Poesilostomatoida: Ergasilidae) Parasitic on the Freshwater Fish *Zacco platypus* from Japan

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ABSTRACT

Ergasilus zacconis (Yamaguti, 1936), the copepod parasite originally named as *Pseudergasilus zaconnis*, is redescribed based on the specimens newly collected from the freshwater fish *Zacco platypus* (Temminck and Schlegel) from Japan. Some errors appearing in the original description are emended. An explanation for the generic position of this species is given.

Key words: *Ergasilus zacconis*, redescription, parasitic Copepoda, *Zacco platypus*

INTRODUCTION

The genus *Pseudergasilus* was proposed by Yamaguti (1936) to incorporate two new species *P. parasiluri* and *P. zacconis*. Of these, the type species *P. parasiluri* has been rediscovered in China (Yin, 1956, 1962; Wang, 1964) and eastern Siberia (Dogiel and Akhmerov, 1952). This copepod is known to parasitize to the freshwater fishes *Siniperca chuatsi* (Basilewski), *Pseudobagrus fulvidraco* (Richardson) and *Leiocassis* sp. in China, and *Parasilurus asotus* (L.) in Japan.

On the other hand, *P. zacconis* was originally found on the freshwater fish *Zacco platypus* (Temminck and Schlegel). This species was once rediscovered from *Plecoglossus altivelis* Temminck and Schlegel in Japan (Nakajima and Egusa, 1973). Although one of its known hosts, *Z. platypus*, is distributed widely in Asia, the parasite *P. zacconis* has never been discovered from the regions outside Japan. In Korea, *Z. platypus* is known to harbor as many as seven species of parasitic copepods (Kim and Choi, 2003), the most diverse copepod fauna on a species of freshwater fish, but not including *P. zacconis*.

Because *P. zacconis* was incompletely described, we redescribe this species in the present paper based on the specimens collected recently in Japan.

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REDESCRIPTION

***Ergasilus zacconis* (Yamaguti, 1936) (Figs. 1, 2)**

Pseudergasilus zacconis Yamaguti, 1936, p. 3, pl. 2, Figs. 21-29.

Material examined. Twenty females from gills of the fish *Zacco platypus* (Temminck and Schlegel) at Nuta River, Hiroshima Prefecture, Japan, 21 October 2005. Collected by K. Nagasawa.

Female. Body (Fig. 1A, B) vermiform, cylindrical, and gradually tapering posteriorly, with large prosome and small urosome. Dissected fully grown specimen 1.15 mm. Prosome 946 μm long. Greatest width of prosome 317 μm, and greatest dorsoventral depth 267 μm. Cephalothorax 500 μm long, with lateral constriction delimiting cephalosome and first pedigerous somite. Antennary area well-marked and broad, with weakly defined rostral area. Metasomal somites distinguishable from each others by dorsolateral rudimentary segmentation lines between them. Second to fourth pedigerous somites with pair of vestigial dorsal tergites (hardly visible) in anterior area of each somites.

Urosome (Fig. 1C, D) small, tapering, unsegmented, but original segments definable by faint dorsal lines. Ventral margin of urosome distinctly convex. Fifth pedigerous somite short and obscure. In lateral view 2 faint sclerotized areas observed in posterior part of urosome, each representing first and second abdominal somites. Anal somite with spinules on outer sides of posteroventral margin. Caudal ramus (Fig. 1E) rectangular, 43 × 17 μm, 2.53 times as long as wide, with 4 caudal setae: 1 largest inner teminal,

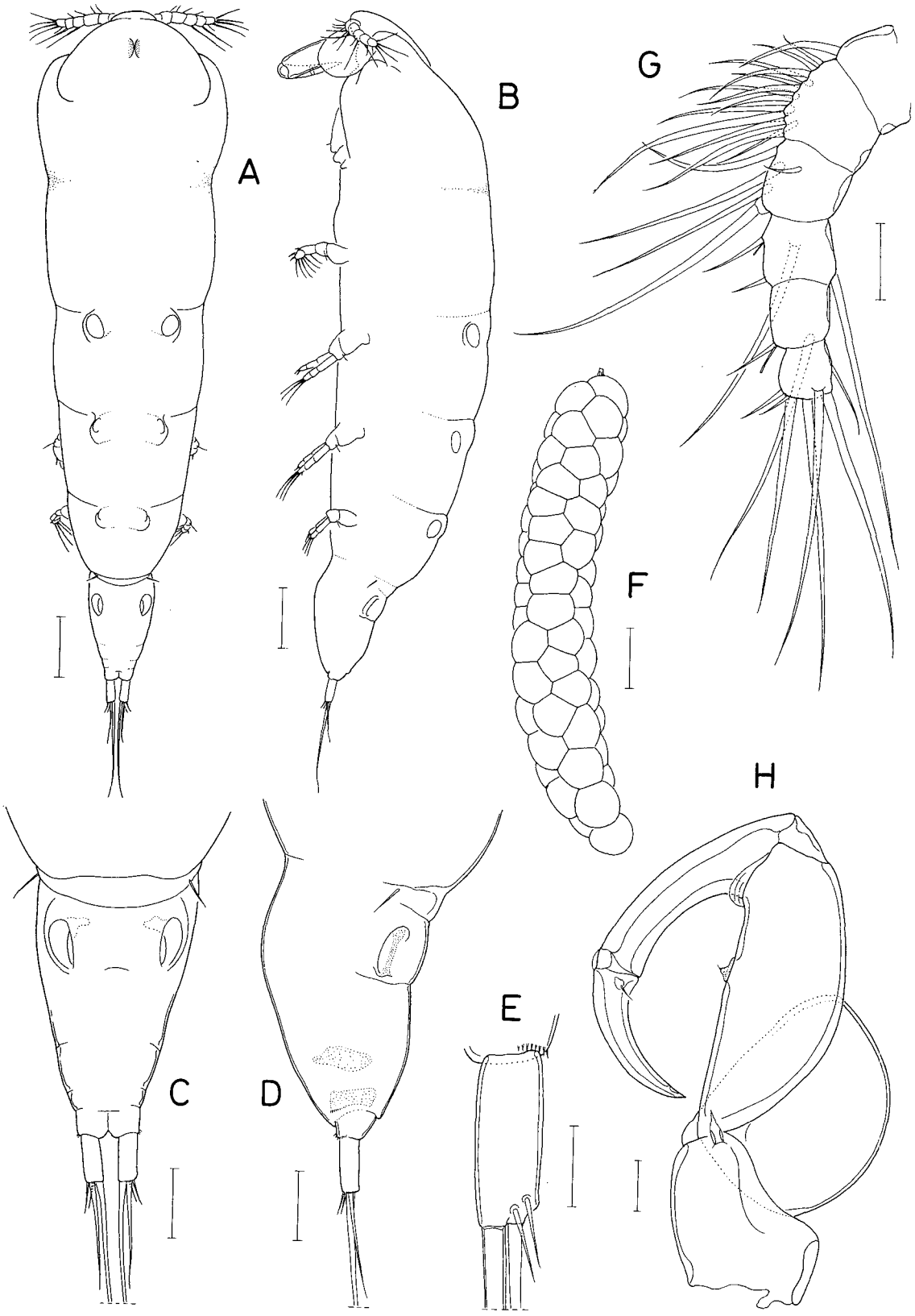

Fig. 1. *Ergasilus zacconis*, female. A, habitus, dorsal; B, habitus, lateral; C, urosome, dorsal; D, urosome lateral; E, left caudal ramus, ventral; F, egg sac; G, antennule; H, antenna. Scale bars=100 μm (A, B, F), 50 μm (C, D), 20 μm (E, G, H).

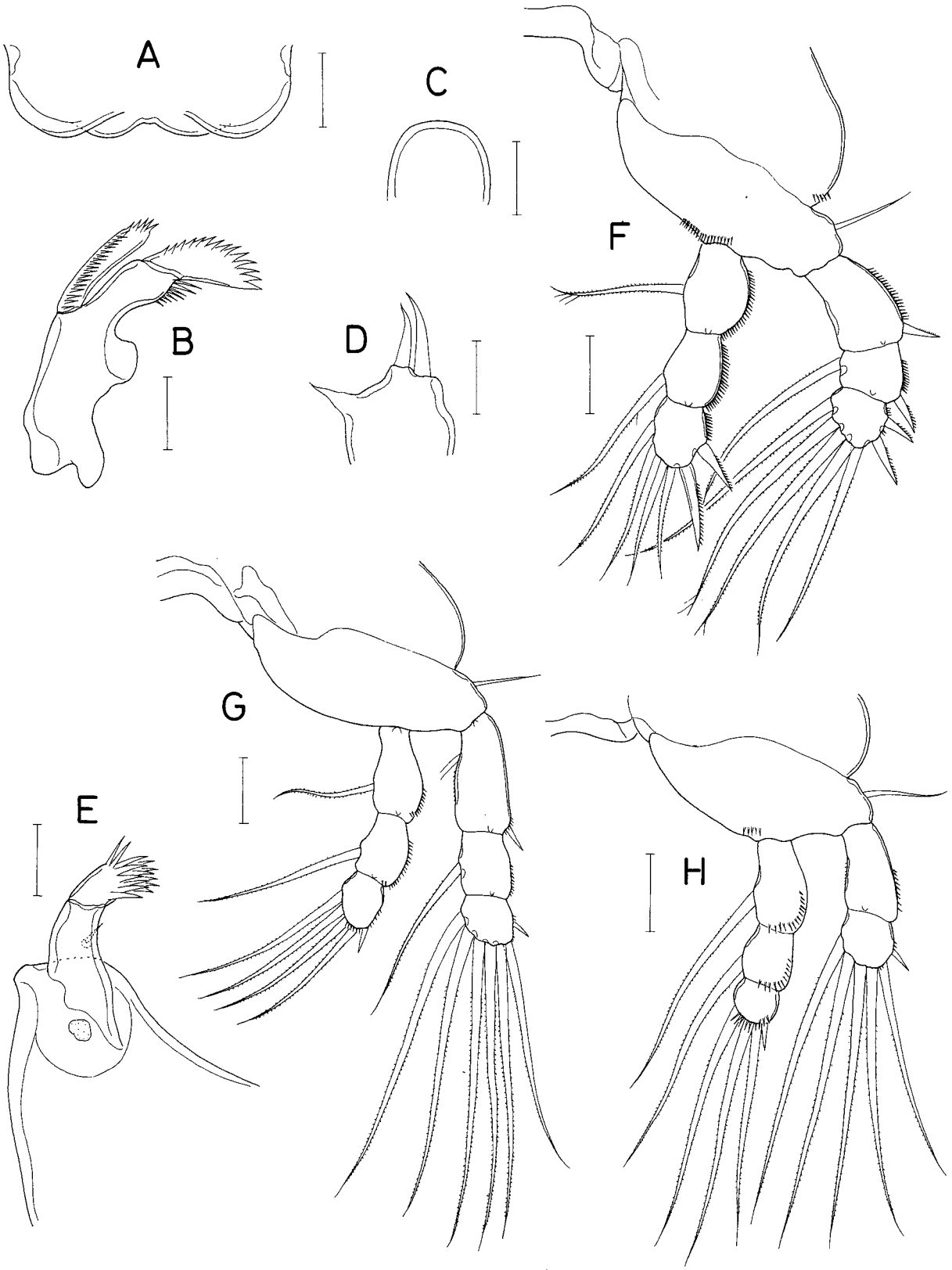

Fig. 2. *Ergasilus zacconis*, female. A, labrum; B, mandible; C, paragnath; D, maxillule; E, maxilla; F, leg 1; G, leg 2; H, leg 4. Scale bars=20 μm (A, F-H), 10 μm (B-E).

1 smaller outer teminal (distally weakly plumous), and 2 minute ventral setae.

Egg sac (Fig. 1F) 792 × 142 μm, usually slightly curved; each egg about 79 μm in diameter.

Rostrum not defined. Antennule (Fig. 1G) 102 μm long and 6-segmented, with armature formula: 1, 13, 5, 4+1 aesthetasc, 2+1 aesthetasc, and 7. All setae naked. Aesthetascs rudimentary and hardly visible. Antenna (Fig. 1H) 4-segmented. First segment (coxobasis) slightly wider than long, with 1 distal, scalpel-like seta. Second segment (first endopodal segment) with 1 hyaline papilla (trans-formed seta) on inner margin. One large outer inflation developed between first and second segments. Third segment slightly curved, about 0.8 times as long as second segment and unarmed. Fourth segment forming claw, curved, about 0.7 times as long as third segment, with 1 small proximal setule.

Labrum (Fig. 2A) formed by indistinct posterolateal lobes and weakly defined posteromedian lobes. Mandible (Fig. 2B) with 2 plate-like elements (blades), each bearing spinules (or teeth) on posterior margin, and spinulated anterodistal margin. Paragnath (Fig. 2C) represented by simple, unornamented lobe. Maxillule (Fig. 2D) lobate bearing 2 apical setae and 1 transparent, setiform process on inner margin. Maxilla (Fig. 2E) 2-segmented. First segment (syncoxa) large, tapering and unarmed. Second segment (basis) divided by articulation into proximal part bearing 1 small seta and distal part bearing dense spines. Maxilliped absent.

Legs 1-3 with 3-segmented rami (Fig. 2F, G). Leg 4 (Fig. 2H) with 2-segmented exopod and 3-segented endopod. All of these legs without inner coxal seta. All setae on rami of these legs with minute dots on margins as remnants of eroded hairs. Armature formula of legs 1-4 as follows:

Leg 1: coxa 0-0; basis 1-0; exp. I-0; I-1; II, 5;
enp. 0-1; 0-1; II, 4

Legs 2 & 3: coxa 0-0; basis 1-0; exp. I-0; 0-1; I, 6;
enp. 0-1; 0-1; I, 4

Leg 4: coxa 0-0; basis 1-0; exp. 0-0; I, 5;
enp. 0-1; 0-1; I, 3

Leg 5 represented by 1 seta on lateral sides of fifth pedigerous somite (Fig. 1C, D). Leg 6 lacking.

Body transparent, but nauplian eye and gut with blue color.

Male. Unknown.

DISCUSSION

In the original description of *Pseudergasilus zacconis*, Yamaguti (1936) erroneously recorded the third exopodal segment as bearing six setae. Bearing two spines and five setae on the same segment is correct. He also recorded the absence of leg 5; it is small, but present as a single seta.

Yamaguti (1936) pointed to the fusion of body somites as a diagnostic feature of the genus *Pseudergasilus*. While describing *Ergasilus coniformis*, as new species from *Z. platypus* from Korea, Kim and Choi (2003) noted that this species from Korea is very similar to *P. zacconis* in having the weakly segmented body and simplified (as a seta) leg 5. They questioned about the validity of the genus *Pseudergasilus*, and Boxshall and Halsey (2004) synonymized this genus with *Ergasilus*. In many ergasilid copepods the body segmentation may be variable within a species depending on growth states.

Markewitsch (1956) already mentioned that *Pseudergasilus* was differentiated from *Ergasilus* by plastic features. Yin (1956) redescribed *P. parasiluri* from China. His illustrations, especially for leg 1 bearing two pointed processes on posterior margin between bases of rami, reveal that the Chinese specimens belong to *P. parasiluri*. He illustrated the clearly segmented body of a female adult (bearing egg sacs). Therefore the fusion of body somites cannot be a reliable character to define *Pseudergasilus* as a distinct genus.

Another diagnostic feature of *Pseudergasilus*, which Yamaguti (1936) probably considered seriously, was the rudimentary leg 5 represented by a single seta. This feature is observable among species of *Ergasilus*, such as *E. briani* Markewitsch, 1933, *E. anchoratus* Markewitsch, 1946, and *E. ventriosus* Kim and Choi, 2003, all of which carrying a single seta as a leg 5 and exhibiting segmented body. In *E. tumidus* Markewitch, 1940, leg 5 is even completely absent. Therefore the genus *Pseudergasilus* cannot be defined from *Ergasilus* that comprises more than 180 species of polyphyletic lineages (Boxshall and Halsey, 2004).

Kim and Choi (2003) reported as many as seven species of copepods, six of them as ergasilids, parasitic on *Zacco platypus* captured from various regions of Korea. Nevertheless, no sample of *E. zacconis* was found from the same and other species of fishes. This species of copepod is considered to be confined to Japan in distribution. This distribution is in contrast to that of *E. parasiluri* that was the only congener of the previous genus *Pseudergasilus* Yamaguti, 1936, because *E. parasiluri* has been reported from China (Yin, 1956; Wang, 1964) and eastern Siberia (Dogiel and Akhmerov, 1952), in addition to the original locality in Japan.

Zacco platypus is widely distributed in Asia, ranging from Japan, Korea, Taiwan, and most of South East China. According to Perdices et al. (2003), at least eight species are currently synonymized under *Z. platypus* and their high morphological variability has prevented their stable taxonomy. They studied the genetic structure and phylogenetic relationships of some Chinese populations of *Z. platypus* from the upper and middle drainage of Yangze River and suggested that the populations of this region correspond to four different species. This result and the quite different fauna of parasitic copepods on *Z. platypus* between Japan and Korea may suggest that the populations of Japan and Korea are genetically different or are different species.

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Received June 18, 2006
Accepted October 31, 2006