

Two New Marine Tardigrades from Palawan Island, the Philippines

Cheon Young Chang* and Hyun Soo Rho

Department of Biology, College of Natural Sciences, Taegu University, Kyungsan 712-714, Korea

Key Words:

Philippines
Tardigrada
Halechiniscidae
Batillipedidae
Florarctus
Batillipes

Two new marine tardigrades, *Florarctus kwoni* n. sp. and *Batillipes philippinensis* n. sp. belonging to Halechiniscidae and Batillipedidae, respectively, are described on the basis of the specimens sieved from sublittoral coral sands and shell gravels of Palawan Island, the Philippines. *Florarctus kwoni* n. sp. is characterized by the rocket-shaped aliform expansion, with the distal margin of posterior ala flattened. *Batillipes philippinensis* n. sp. closely resembles *B. similis* Schulz, 1955 and *B. annulatus* De Zio, 1962. However, it is clearly discernible from the former by the shape of lateral body projection between leg III and leg IV, and the relative length of cirrus E and the spine on leg IV, and from the latter by the shape of the lateral body projection and the clava shape. This is the first report of the marine tardigrades from the Philippines.

The marine tardigrade fauna of the northwestern Pacific is still poorly known. From Japan, five species, *Echiniscoides sigismundi* (Schultze, 1865) (see Morikawa, 1951), *Isohypsibius itoi* (Tsurusaki, 1980), *Stygarcus spinifer* Hiruta, 1985, *Angursa bicuspis clavifera* Noda, 1985, and *Florarctus glareolus* Noda, 1987, were recorded. Tchesunov and Mokievsky (1995) described a new species of *Batillipes crassipes* from Furughelm Island, Russia in northern East Sea. Chang and Rho (1997) described *B. longispinosus* and *B. orientalis* from South Korea. Until now, the marine tardigrades of the Philippines is entirely unknown. In a study of the meiofauna of the Philippines, we collected and examined marine tardigrades, two of which were turned out as new species each belonging to genus *Florarctus* Delamare-Deboutteville and Renaud-Mornant and genus *Batillipes* Richters.

Materials were collected from the upper 10 cm of coralline sands and shell gravels in the shallow subtidal zone at three localities of Quezon, Snake Island, and Sabang in central Palawan during April 20-29, 1997. Samples were dredged into polyethylene vinyl bags by scuba divers, and in the field filtered through nylon net after freshwater rinsing for less than a minute. Specimens were drawn and measured in lactophenol on Cobb's aluminium hole slide, and examined under differential interference contrast (DIC) microscope.

Systematic Accounts

Class Heterotardigrada

Order Arthrotardigrada

Family Halechiniscidae Thulin, 1928

Subfamily Florarctinae Renaud-Mornant, 1982

Genus *Florarctus* Delamare-Deboutteville and Renaud-Mornant, 1965

Florarctus kwoni n. sp.
(Fig. 1)

Material examined: 5 adult females, sublittoral (1-2 m in depth) shell gravels of Tabon Beach, Quezon, 29 April 1997, H S Rho and J W Choi. Holotype and two paratypes will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Other paratypes are kept in the collection of the authors.

Diagnosis: With rocket-shaped aliform expansion - proximal third of outer margins of lateral alae widened posteriorly, then parallel to median line, ending with outerodistal protrusion, with distal margin of caudal ala flattened; procuticular supports present; dorsal cuticle bearing numerable rows of mammilliform sculptures.

Holotype: Body 249 μ m long, including aliform expansion, 155 μ m wide between legs III and legs IV. Dorsal cuticle with regularly arranged mammilliform projections, especially much stronger dorsolaterally. Ventral cuticle nearly smooth. Body with aliform expansions, comprising reduced frontal, relatively narrow lateral and caudal expansion. Frontal expansion with a small notch in the middle. Other aliform expansions relatively smooth on their margins, not subdivided. Lateral alae, proximal third of its outer margins widened posteriorly, then parallel to median line, ending with outerodistal protrusion. Distal margin of caudal ala flattened, 98 μ m wide, tapering anteriorly. All aliform expansions except frontal one with procuticular supports.

* To whom correspondence should be addressed.
Tel: 82-53-850-6454, Fax: 82-53-850-5834

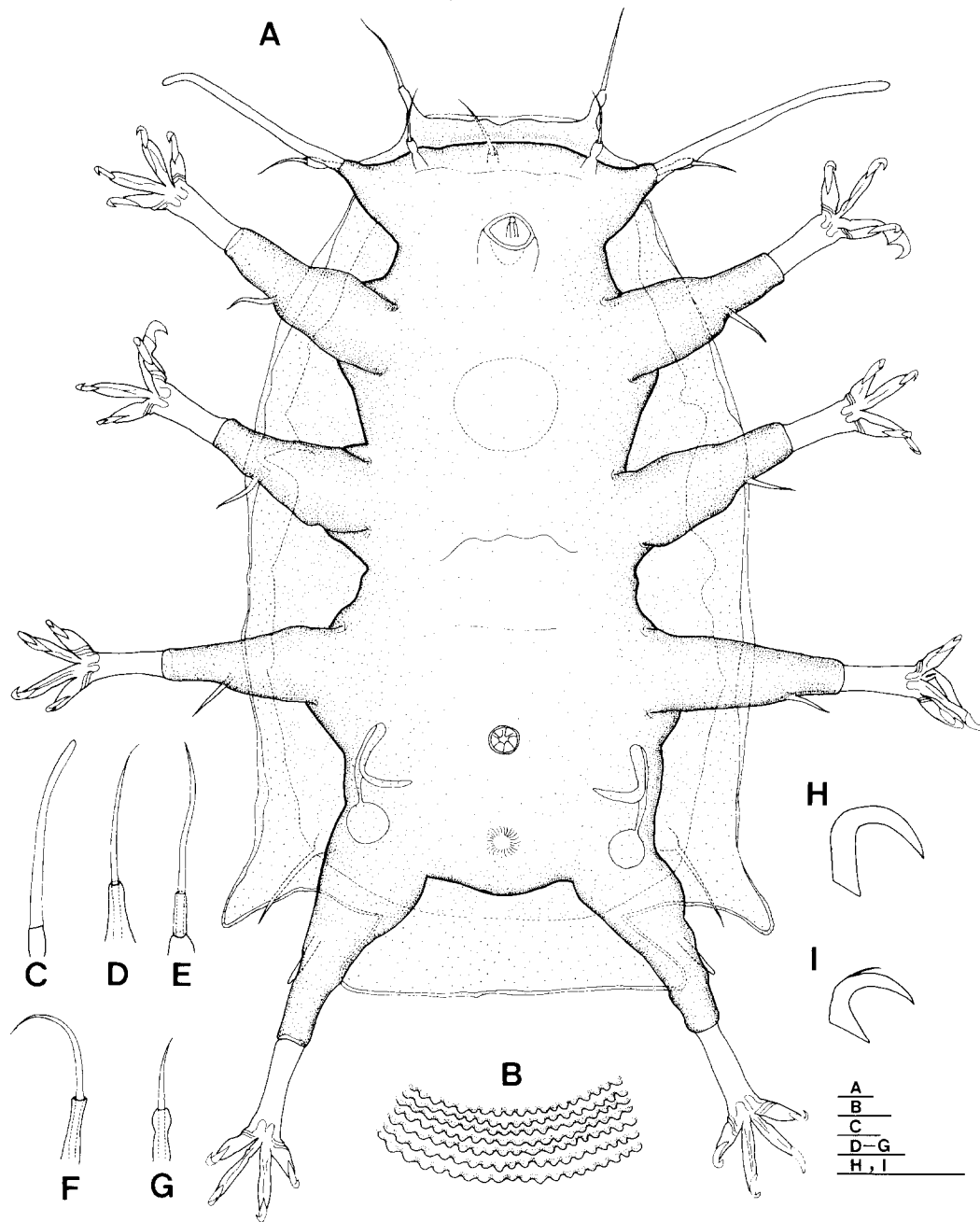


Fig. 1. *Florarctus kwoni* n. sp. A, habitus, ventral view. B, structure of cuticle, dorsolateral view. C, clava. D, internal cirrus. E, cirrus E. F, lateral cirrus. G, external cirrus. H, uncus of leg III (external digit). I, uncus of leg III (internal digit). Scale bars=0.01 mm.

Head well distinguished from body, with normal arrangement of sense organs. Head 89 μ m broad between lateral cephalic cirri. Neck width 57 μ m. Distance from anterior margin of head to neck 19 μ m including frontal expansion. Unpaired median cephalic cirrus with sharp point (22 μ m long) arising middorsally. Paired internal cephalic cirri (33 μ m) longest of all cirri, protruding from anterior margin of head, consisting of thick scapus (11 μ m) and tapered flagellum (22 μ m);

distance between internal cephalic cirri 52 μ m, without any papilla between them. Paired external cephalic cirri (25 μ m) shortest, situated on line connecting lateral cephalic cirri; divided into thick scapus (10 μ m) and tapered flagellum (15 μ m); distance between cirri 51 μ m. Paired lateral cephalic cirri (26 μ m) located dorsally on bases of primary clavae; scapus 12 μ m, flagellum 14 μ m; distance between cirri 89 μ m. Primary clavae long (77 μ m), slender, undivided, cylindrical,

round-tipped, and directed anterolaterally, connected with lateral cirri at its proximal part. Secondary clava not observed.

Eye spots absent. Mouth cone located somewhat anteriorly. Pharyngeal bulb situated between legs I and II, nearly circular (length 28 μm , width 29 μm).

Caudal region slightly convex, bearing no caudal projection. Ventrolateral body projections absent between each leg pair. Cirrus E, postolateral body spine, located near leg IV, relatively long (33 μm) and thin, originating from cirrophorus.

Each leg composed of coxa, femur, tibia and tarsus. Legs I-IV each bearing spine I-III and papilla on dorsomedial part of femur, respectively. Papilla on leg IV club-like, 14 μm long. Legs I through IV bearing four digits of different size; external digit shorter than internal digit (external digit 18 μm long while internal one 26 μm at leg IV); accessory spine lacking in external digit, but present on internal digit; strong calcar externum present.

Female gonopore just behind leg III, relatively large, 9 μm in diameter, surrounded by 6 identical plates. Anus 28 μm posterior to gonopore, closed with cuticular membrane. Paired seminal receptacles located between leg III and leg IV; tubules of them once folded near the middle, then distal half bent to "L"-shape.

Etymology: To our pleasure, the specific name is taken in honor of Dr. Do Heon Kwon, the authoritative scientist on the terrestrial isopods of East Asia, who provided us with an opportunity to join this survey to Palawan Island, the Philippines.

Remarks: Eleven species are currently recognized in the genus *Florarctus*, the classification of which depends on the characters such as the ornamentation of dorsal cuticle, the presence or absence of procuticular supports, and the shape of aliform expansion (alae) (Villora-Moreno and De Zio Grimaldi, 1996). *F. kwoni* n. sp. accords with *F. cinctus* Renaud-Mornant, 1976, *F. stellatus* Renaud-Mornant, 1989, *F. asper* Renaud-Mornant, 1989, and *F. acer* Renaud-Mornant, 1989 by the dorsal cuticle with mammilliform ornamentation. However, the present new species is easily discernible from them in having not-subdivided lateral alae, which is most characteristic in this new species. *F. kwoni* differs from *F. heimi* Delamare-Deboutteville and Renaud-Mornant, 1965 and *F. hulingsi* Renaud-Mornant, 1976 by the procuticular support. Furthermore, *F. kwoni* shares undivided lateral alae with *F. salvati* Delamare-Deboutteville and Renaud-Mornant, 1965, *F. cervinus* Renaud-Mornant, 1987, and *F. vulcanius* Renaud-Mornant, 1987, but this new species is different from them in having the mammilliform processes on dorsal cuticle. Additionally, *F. kwoni* is readily distinguished by the major discrepancies of the alae shape, and the cuticular ornamentation from *F. glareolus*, the only species of *Florarctus* in East Asia recorded from Tanabe Bay on the Pacific coast of central Japan by Noda (1987) (*F.*

glareolus bears faint and transverse creases on dorsal cuticle, and flower-like subdivided aliform expansion).

Family Batillipedidae Ramazzotti, 1962

Genus *Batillipes* Richters, 1909

Batillipes philippinensis n. sp.

(Fig. 2)

Material examined: 11 adult males and 1 juvenile, submerged coral sand (1-4 m deep) of Snake Island, Honda Bay, 21 April 1997, H S Rho and J W Choi. Holotype and three paratypes will be deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Other paratypes are kept in the collection of the authors.

Additional material examined: 2 adult males, Sabang, Puerto Princesa City, 24 April 1997, H S Rho and J W Choi.

Diagnosis: With relatively long cephalic appendages, cirrus E, leg spine IV, and very large pharyngeal bulb; body expanding posteriorly; with prominent ventrolateral body projection; ventrolateral region between leg III and IV much swollen, but not protruding into projection; with conical caudal projection.

Holotype: Body flattened dorsoventrally, and fairly small; 130 μm long excluding caudal projection; expanding posteriorly, 47 μm broad at position between leg III and leg IV. Cuticle transparent with fairly regular punctations.

Head well separated from body, bearing normal arrangement of sense organs; 43 μm wide between bases of lateral cephalic cirri; frontal margin arched gently. Unpaired median cephalic cirrus very long (24 μm) with sharp point. Paired internal cephalic cirri (22 μm), comparatively long, but shorter than lateral cephalic cirri (29 μm). No papilla between them. Paired external cephalic cirri (16 μm) shortest. All cephalic cirri bearing distinct pedunculate base. Clavae club-like, inserted ventrally to base of lateral cephalic cirri and directed anteriorly.

Body with distinct 'neck' constriction (24 μm wide). Cheek region not so swollen, while 'shoulder' above legs I expanding exteriorly. Pharyngeal bulb very large and oval (length 18 μm , width 15 μm , length to width ratio 1.2).

Prominent conical projections present ventrolaterally each between head and leg pairs I-III, respectively (2 μm , 3 μm , 5 μm long in order). Last projections between legs III and IV represented by only protuberance. Cirrus E long (20 μm) and thin, located dorsally just posterior to lateral protuberance between legs III-IV. Distal part of body bearing conical caudal projections (7.3 μm long).

Proximal part (femur) of legs I-III conical, each with dorsal leg spines, 9 μm , 7 μm , and 8 μm long, respectively. Spine on leg IV (27 μm) strong and long,

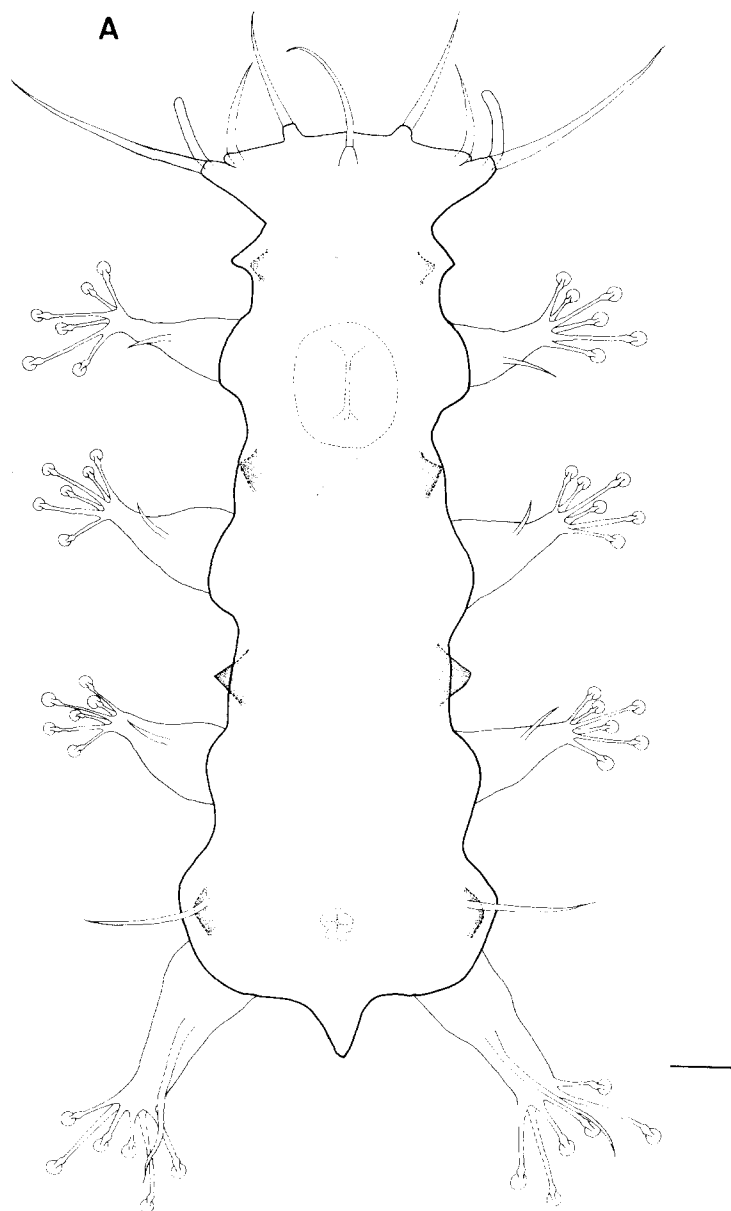


Fig. 2. *Batillipes philippinensis* n. sp. A, habitus, dorsal view. Scale bar=0.01 mm.

forming a spinal process on femoral portion. Papilla on legs I-IV absent. Toe on legs I-III with round terminal discs, conforming to established pattern; toe '5' clearly longest in legs I-III. Innermost two toes on legs IV slightly unequal, shortest. Discs appeared somewhat circular or oval rather than rectangular with blunt edges, similar to those of *B. bullacaudatus* McGinty and Higgins, 1968 (see McKirdy, 1975).

Etymology: The specific name is based on the Philippines, the type locality of the new species.

Remarks: The present new species, by the character combination of the conical caudal projection and

absence of head papillae, shows resemblance with *B. annulatus* De Zio, 1962 and *B. similis* Schulz, 1955. But *B. philippinensis* n. sp. is distinguished from the former species by body shape (body expanding posteriorly in *B. philippinensis*, whereas widest near leg III in *B. annulatus*), the smooth clava against *B. annulatus* having the clava with four annular constriction, the presence of lateral body projections between head and leg III, against *B. annulatus* bearing a wing-formed projection only between legs III and IV (De Zio, 1962).

B. philippinensis n. sp. is most related to *B. similis* in the presence of conical caudal projection, developed head appendages, a long spine on leg IV, and lateral

body projections between head and leg III, but clearly discernible from it by the shape of lateral body projection between legs III and IV, and the length of cirrus E (*B. philippinensis* bearing a long cirrus E with the short leg spine IV, whilst vice versa in *B. similis*).

References

- Chang CY and Rho HS (1997) Two new marine tardigrades of genus *Batillipes* (Heterotardigrada: Batillipedidae) from Korea. *Korean J Syst Zool* 13: 29-40.
- De Zio S (1962) Descrizione di *Batillipes annulatus* n. sp. e note su *Batillipes pennaki* Marcus, nuovo rinvenimento nel Mediterraneo (Heterotardigrada.). *Ann Ist Mus Zool Univ Napoli* 14: 1-7.
- Mckirdy DJ (1975) *Batillipes* (Heterotardigrada): comparison of six species from Florida (USA) and a discussion of taxonomic characters within the genus. *Mem Ist Ital Idrobiol Suppl* 32: 177-223.
- Morikawa K (1951) Notes on a marine water-bear (Tardigrada). *Saishu Shiiku* 13: 170-172.
- Noda H (1987) A new species of marine Tardigrada of the genus *Florarctus* (Heterotardigrada, Halechiniscidae) from Japan. *Publ Seto Mar Biol Lab* 32: 323-328.
- Tchesunov AV and Mokievsky VO (1995) A new marine tardigrade, *Batillipes crassipes* sp. nov., from the Japan Sea (Tardigrada, Arthrotardigrada, Batillipedidae). *Cah Biol Mar* 36: 153-157.
- Villora-Moreno S and Grimaldi De Zio S (1996) New records of marine Tardigrada in the Mediterranean Sea. *Zool J Linn Soc* 116: 149-166.

[Received May 5, 1997; accepted June 27, 1997]