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Establishment of a New Genus *Bathystylodactylus* (Crustacea: Decapoda: Stylodactylidae), with Description of a New Species from Northwestern Pacific

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ABSTRACT—A unique specimen of the family Stylodactylidae (Crustacea: Decapoda) collected from a great depth, 3436–3452 m off the east coast of Taiwan, northwestern Pacific, is described as representative of a new species close to *Stylodactylus bathyalis* Cleve, 1994 from the Coral Sea. These two species are characterized by several specialized features which warrant the establishment of a new genus *Bathystylodactylus*. The new species named *B. inflatus* differs from *B. bathyalis* in having the carapace markedly swollen at the posterodorsal part, a greater number of rostral spines, and the rounded third abdominal pleuron.

INTRODUCTION

Over the last decade, knowledge of the deepwater shrimps of the family Stylodactylidae has been greatly improved, resulting in the recognition of 26 species belonging to four genera in the world oceans, of which 24 have been recorded from the Indo-Pacific (Chace, 1983; Burukovsky, 1990; Cleve, 1990a, b, 1994). The genus *Stylodactylus*, the largest group, is represented by two Atlantic, one Atlanto-Indo-Pacific and 13 Indo-Pacific species. Among them, *S. bathyalis* Cleve from the Coral Sea, 3502–3515 m, is the most remarkable for its specialized features, as well as for its depth of occurrence, and no other members of the genus *Stylodactylus* have ever been sampled from such a great depth.

Recently, we encountered a unique specimen in the benthos samples from a bathyal bottom at a depth exceeding 3400 m off the east coast of Taiwan. This specimen shows closest affinity to *S. bathyalis*, but direct comparison of the two specimens revealed some notable differences that seem to be distinct at the specific level.

The North Pacific specimen provided further data on the basic morphology of the bathyal stylodactylids, supplementing to some extent Cleve's original description based on the somewhat damaged male specimen. Examination of these specimens revealed marked differences from other members of the genus *Stylodactylus* in certain features such as a great elongation of the posterior pereopods, rudimentary eyes and the others. Consequently these specimens cannot be comfortably placed in the genus *Stylodactylus*, and the

morphological gaps appear also to warrant their separation from all of the known genera. As a result, a new genus *Bathystylodactylus* is proposed here to accommodate the two species in question, *B. bathyalis* and its close congener, a new species from off Taiwan.

The carapace length (cl) is used to indicate size of the shrimp, measured between orbital and posterodorsal margins. The type specimen is deposited in the National Science Museum, Tokyo (NSMT).

SYSTEMATICS

Family Stylodactylidae
Genus *Bathystylodactylus* nov.

Diagnosis. Integument rather thin, body soft; rostrum long, extending distinctly beyond antennular peduncle, flanked distally with dense, long hairs along ventrolateral margins; carapace with distinct suprabranchial ridge; abdomen with 3rd to 5th somites weakly carinate dorsally; telson rather long, depressed along dorsal margin; eye very small, with rudimentary cornea; stylocerite short, distally pointed, extending as far as mid-length of 1st peduncular segment of antennule, 2nd peduncular segment elongated, nearly as long as 1st segment; antennal scale with sharp distolateral spine, extending far short of distal end of lamella, armed laterally with a series of several small spinules; mandibular palp 2-segmented; posterior 3 pereopods unusually longer than anterior pereopods; appendix masculina distinctly longer than appendix interna; branchial formula as in *Stylodactylus*.

Type species. Stylodactylus bathyalis Cleva, 1994.

Etymology. The name is derived from "Bathys" (deep in Greek) and the generic name *Stylo-**dactylus*, due to the fact that the two known specimens have been obtained from great depths of the western Pacific. Gender is masculine.

Systematic position. The family Stylo-dactylidae is now recognized to contain four genera; *Stylo-**dactylus* A. Milne Edwards, 1881, *Neostylo-**dactylus* Hayashi et Miyake, 1968, *Parastylo-**dactylus* Figueira, 1971, and *Stylo-**dactyloides* Cleva, 1994 (A. Milne Edwards, 1881; Hayashi and Miyake, 1968; Figueira, 1971; Chace, 1983; Cleva, 1990a; Holthuis, 1993).

Among the four known genera, *Neostylo-**dactylus* and *Parastylo-**dactylus* are characterized by having no mandibular palp. This feature is associated with the proportionately shorter stylocerite. The genus *Stylo-**dactyloides* is unique in having an unsegmented mandibular palp and a short and distally rounded stylocerite, in addition to the presence of a small spine at the distal lobes of the meri of the posterior three pereopods.

*Stylo-**dactylus* is rather heterogeneous. Most of the members commonly share the following features: 1) the mandibular palp is two-segmented; 2) the stylocerite is sharp, extending well beyond the first peduncular segment of the antennule, the second segment is shorter than the first, and; 3) the antennal scale is fully extended beyond the antennular peduncle, with the distolateral spine extending well beyond the distal end of the lamella. Among the known species, *S. macropus* Chace and *S. profundus* Cleva are somewhat isolated from the other species in that the elongated second peduncular segment of the antennule is longer than the first. The length of the antennal scale is proportionately shorter in *S. macropus* than that in the remaining species, with the distal margin barely reaching the end of the second peduncular segment of the antennule, while in *S. profundus* it is typical of the genus. The posterior three pereopods of *S. macropus* are somewhat long, with the ischio-meral articulation of the third leg extending beyond the antennal scale by slightly more than the combined length of the three distal segments.

Also, *S. major* Hayashi et Miyake and *S. brucei* Cleva are remarkable in having the elongated second peduncular segment of the antennule and the comparatively short antennal scale that extends as far as the end of the antennular peduncle, with the distolateral spine barely reaching the end of the lamella. These features seem to be associated with a difference in size of eggs; *S. brucei* is known to carry smaller numbers of extremely large-sized eggs as compared with those of other species.

Although *S. bathyalis* and the present specimen have the two-segmented mandibular palp and the distally pointed stylocerite, they cannot be satisfactorily placed in *Stylo-**dactylus* or in any of the other known genera. In general appearance, the unusually long posterior three pereopods are particularly specialized within the members of the family. Furthermore, several associated features are also remarkable as follows; 1) the third to fifth abdominal somites have a weak dorsomedial

carina, 2) the suprabranchial ridge is well developed, 3) the stylocerite is pointed distally, but only extends to near the mid-length of the first peduncular segment of the antennule, 4) the appendix masculina is notably longer than the appendix interna, 5) the eye is distinctly reduced in size, with very rudimentary cornea, and 6) the antennal scale is proportionately short, with its distolateral spine ending far short of the distal end of the lamella. These external features appear to warrant separation from *Stylo-**dactylus* and the other three genera at generic rank.

Key to genera of the family Stylo-dactylidae

1. Mandibular palp absent 2
- Mandibular palp present 3
2. Arthrobranchs present at base of first 4 pereopods only in male *Neostylo-**dactylus* Hayashi et Miyake, 1968
- Arthrobranchs present at base of first 4 pereopods in both sexes *Parastylo-**dactylus* Figueira, 1971
3. Mandibular palp unsegmented at least in adult *Stylo-**dactyloides* Cleva, 1994
- Mandibular palp 2-segmented 4
4. Stylocerite extending as far as, or often well beyond end of 1st peduncular segment of antennule; posterior 3 pereopods not unusually longer than anterior pereopods; carapace without distinct suprabranchial ridge; 3rd to 5th abdominal somites rounded dorsally *Stylo-**dactylus* A. Milne Edwards, 1881
- Stylocerite extending nearly to mid-length of 1st peduncular segment of antennule; posterior 3 pereopods unusually longer than anterior pereopods; carapace with distinct suprabranchial ridge; 3rd to 5th abdominal somites weakly carinate dorsally *Bathystylo-**dactylus* gen. nov.

*Bathystylo-**dactylus inflatus* sp. nov.

(Figs. 1-3)

Material. Holotype, male (NSMT-Cr 11777; cl 27.0 mm); KH-73-2, stn. 24, off east coast of Taiwan (23° 42'03"N, 123° 45'08"E), 3436-3452 m deep, 5 March 1973, RV *Hakuho-Mar*u, Beam trawl.

Description of holotype. Body pubescent, but pleopods less so. Integument thin, body consequently soft.

Rostrum (Figs. 1 and 2a) long, slender, more than twice as long as carapace, slightly curved dorsad, armed dorsally with at least 62 irregularly spaced spines on rostrum proper, including additional 11 more regularly spaced spines posterior to orbital margin; ventral margin with 46 slightly larger and more widely spaced spines, posteriormost ventral spine situated posterior to distal end of 1st peduncular segment of antennule; ventrolateral margin of rostrum flanked with fine and dense hairs, concealing ventral spines anteriorly to antennular peduncle, but entirely naked proximally; lateral rostral carina obtuse, but defined proximally.

Carapace (Figs. 1 and 2a) with marked wide elevation

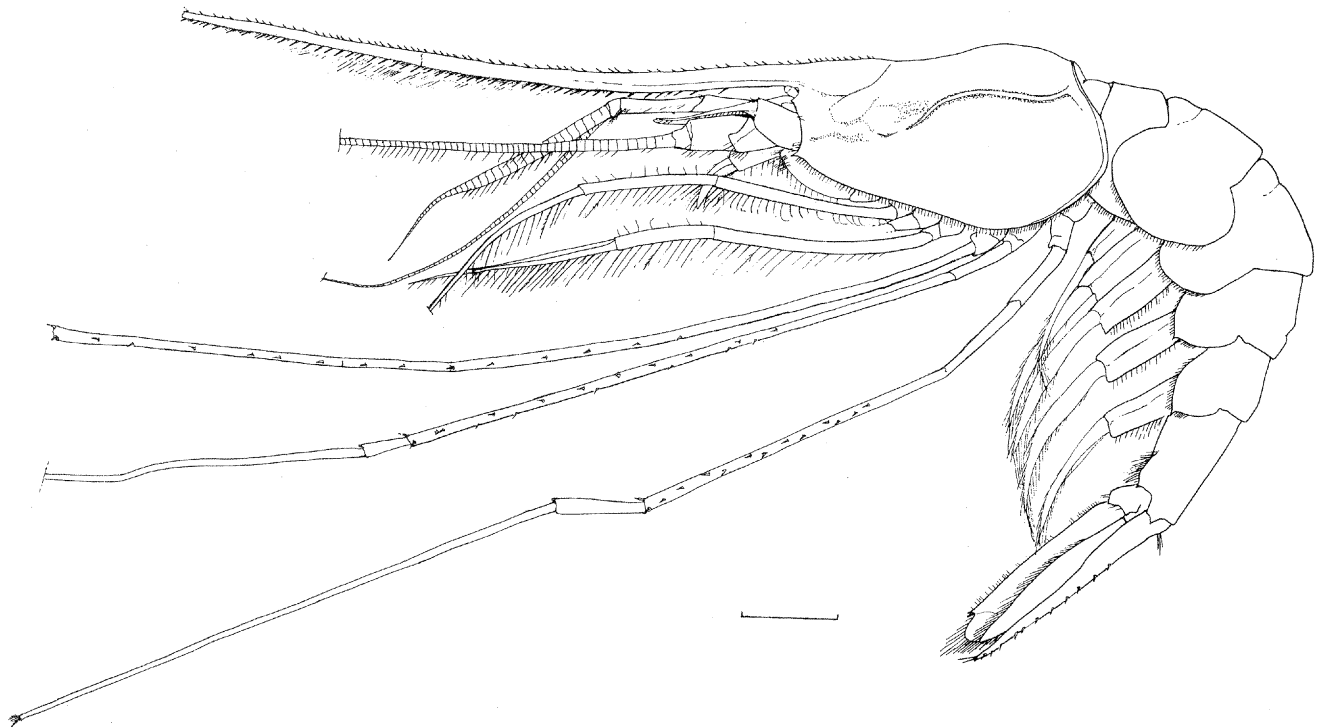


Fig. 1. *Bathystyrodactylus inflatus* sp. nov., holotype, male (NSMT-Cr 11777; cl 27.0 mm): entire body, lateral view. Scale represents 10 mm.

near posterodorsal margin, dorsal margin noticeably concave at anterior 2/5 in lateral view; hepatic sulcus distinct on lateral surface, but not well defined dorsally; supraorbital spine absent; suborbital angle somewhat obtuse, small antennal spine situated below suborbital angle at some distance; branchiostegal spine small; hepatic hollow marked; suprabranchial carina well developed.

Abdomen (Figs. 1 and 2b) with first 2 somites rounded dorsally, 3rd to 5th weakly carinate dorsally, carina on 4th interrupted at posterior 1/4 by shallow depression; 6th 1.71 times as long as 5th, 2.10 times as long as posterior height; pleura of 4th and 5th somites with posteroventral spine, 3rd rounded, without posteroventral spine. Telson (Fig. 2c) about 1.9 times as long as 6th somite, 4.38 times as long as wide, and ending in posteromedian tooth; dorsal surface widely depressed along medial margin, armed dorsally with 10 spinules on each side, in addition to pair of subterminal and 2 pairs of terminal spines.

Eye (Fig. 2a, d) reduced in size, transparent in preserved material, with whitish tube-like structure (medullae ?) inside of eyestalk; cornea rudimentary, with feeble mesh-like structure (possibly trace of ommatidia) as a weak elevation under higher magnification.

Antennular peduncle (Fig. 2e) with short stylocerite, reaching to near mid-length of 1st segment, pointed distally, mesial margin not greatly convex. First and 2nd peduncular segments elongated, subequal in length, 3rd shortest, about 1/7 times as long as 2nd.

Antennal scale (Fig. 2f) reaching distal 2/7 of 2nd peduncular segment of antennule, 0.44 times as long as carapace, 4.8 times as long as wide, lateral margin slightly

concave, armed with minute, narrowly spaced spinules throughout entire length; distolateral spine sharp, falling far short of distal end of lamella.

Mouthparts as illustrated (Fig. 3a-e).

Third maxilliped extending beyond antennular peduncle by distal segment and distal 2/5 length of penultimate segment, distal and penultimate segments fringed with long hairs.

First pereopod slightly longer than 2nd, extending beyond antennular peduncle by fingers and about distal 1/3 of carpus; fingers long, slender, slightly more than twice as long as carpus, fringed with long hairs. Second pereopod extending beyond antennular peduncle by fingers and distal part of carpus. Third pereopod (distal 3 segments missing) outstandingly long, ischium and merus indistinctly fused, ischio-meral segment extending beyond antennular peduncle by distal 2/3, armed laterally with 15 small spines. Fourth pereopod (part of propodus and dactylus missing) probably shorter than 3rd pereopod, ischium and merus completely separated by suture, and merus extending beyond antennular peduncle by slightly less than 1/2, armed laterally with 16-18 small spines; percent length ratio of merus and carpus = 92.0 : 8.0 (=100). Fifth pereopod (damaged, but left is still attached) probably shorter than 4th, ischium and merus completely separated by suture, and merus extending slightly beyond antennular peduncle, latter armed laterally with 13 spines; dactylus (Fig. 2g) slender, short, without stout ventral spines; percent length ratio of merus, carpus, propodus and dactylus = 38.6 : 8.6 : 51.5 : 1.3.

First pleopod (Fig. 3f) with endopod long, leaf-shaped, about 0.7 times as long as exopod. Appendix masculina (Fig. 3g) distinctly long, about 1.65 times as long as appendix

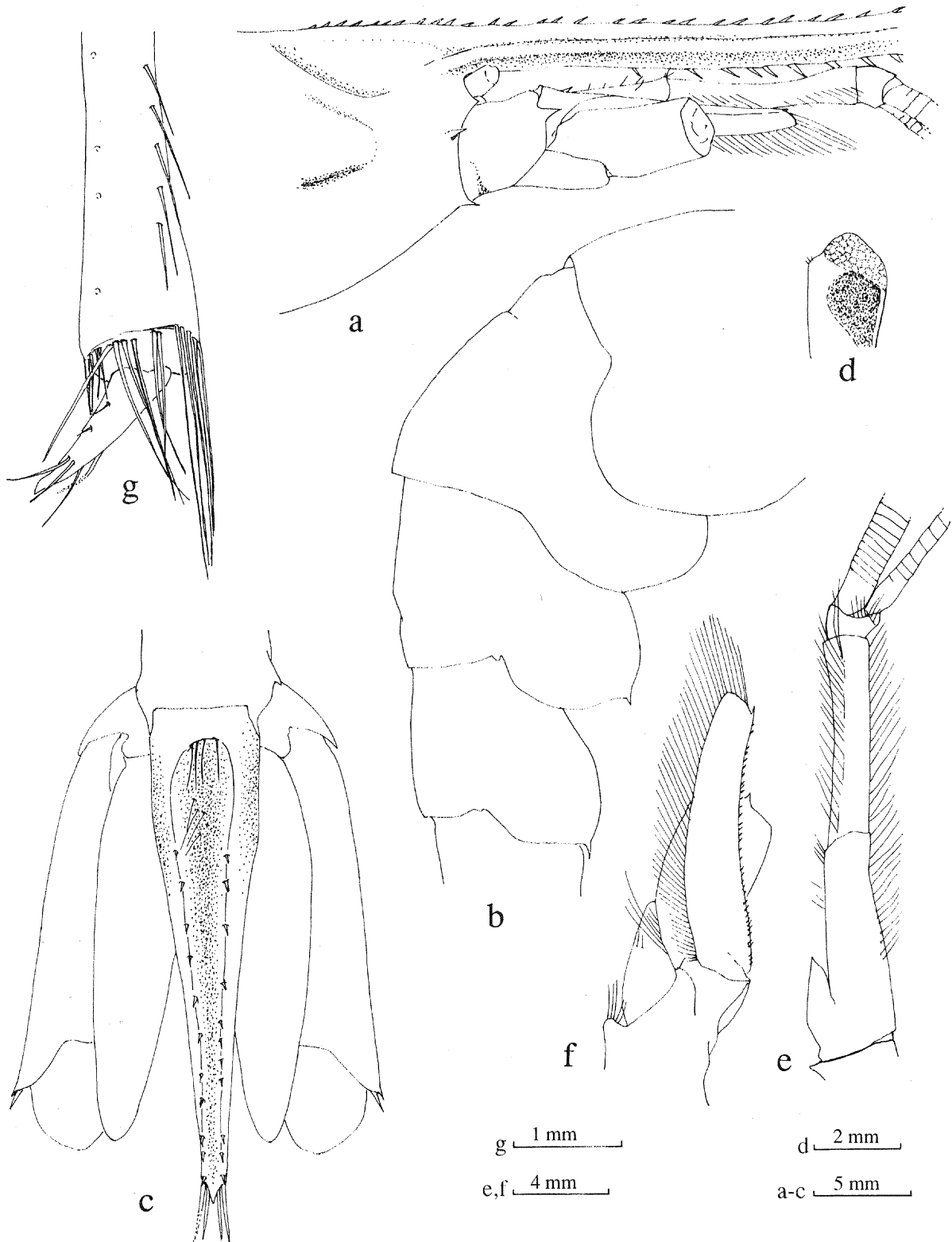


Fig. 2. *Bathystylodactylus inflatus* sp. nov., holotype, male (NSMT-Cr 11777; cl 27.0 mm): a, anterior part of body; b, 3rd to 5th abdominal somites; c, tailfan; d, eye; e, antennule; f, antenna; g, dactylus of 5th pereopod.

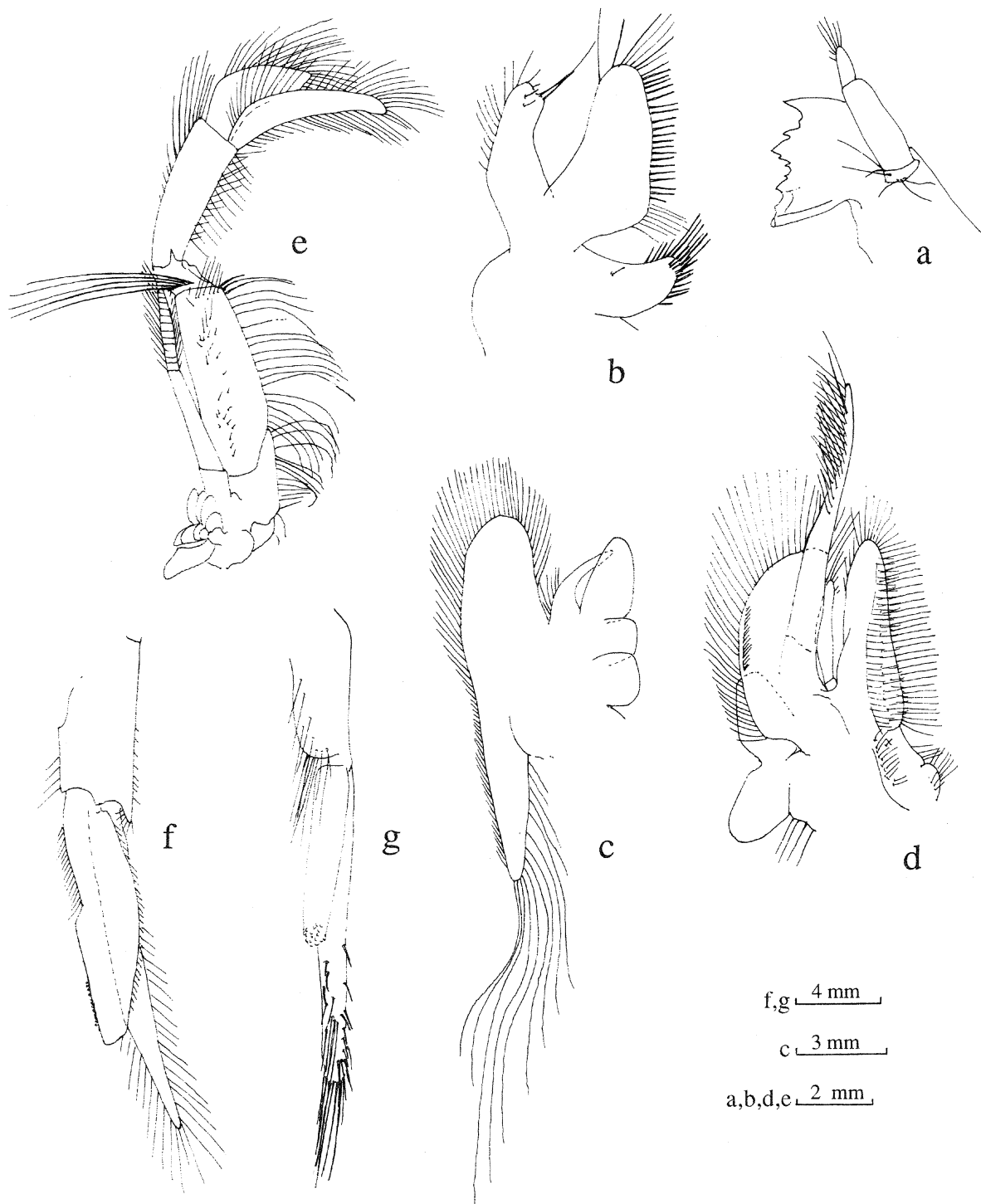


Fig. 3. *Bathystylodactylus inflatus* sp. nov., holotype, male (NSMT-Cr 11777; cl 27.0 mm): a, mandible; b, maxillula; c, maxilla; d, 1st maxilliped; e, 2nd maxilliped; f, endopod of 1st pleopod; g, appendix masculina.

interna. Exopod of 3rd pleopod 0.61 times as long as carapace.

Color in life. Unknown.

Distribution. Known only from the type locality off the east coast of Taiwan, at a depth between 3436 and 3452 m.

Etymology. The name "*inflatus*" (swollen in Latin) refers to a marked elevation on the posterodorsal margin of the carapace.

Remarks. The single male specimen from off Taiwan, the holotype of the new species, shows a close affinity to

Bathystylodactylus bathyalis (Cleva) from the Coral Sea, which was also described from a single specimen. With the kind cooperation of Drs. P. Davie and P. Arnold of the Queensland Museum, we were able to examine the male holotype of *Stylodactylus bathyalis* (QM W. 13594; cl 23.9 mm). Comparison of the two specimens has revealed the North Pacific specimen to be distinct in several external features from the congener as follows.

1) In the new species, the rostral spines are comparatively smaller and spaced more closely on the dorsal margin, having 17 spines above the antennular peduncle, as opposed to only nine spines in *B. bathyalis*, and the proximalmost ventral tooth is placed above the first peduncular segment of the antennule rather than above mid-length of the second segment as in *B. bathyalis*.

2) The posterodorsal margin of the carapace is markedly swollen, and as a consequence the dorsal margin is concave just anterior to the mid-length in lateral view in the new species, while such a depression is very feebly indicated in *B. bathyalis*.

3) The third abdominal pleuron is rounded in the new species, but in contrast it is armed with a distinct posteroventral spine in *B. bathyalis* (the spine on the left side is not certain in the Australian specimen due to slight damage).

4) The antennal scale is armed with a series of small spines along its entire lateral margin in the new species, as opposed to such spines being widely spaced anteriorly in *B. bathyalis*.

5) The telson is proportionately longer, with the distomedial spine fully reaching the distal end of the uropodal exopod in the new species, whereas it barely reaches the end of the uropodal endopod in *B. bathyalis*.

There is a slight possibility that the Australian specimen was not yet fully mature, since the appendix masculina is proportionately short, about 1.4 times as long as the appendix interna, and the setae on the distal part are notably inferior in number as compared with those of the North Pacific specimen. However, we consider these differences, at least the first three characters mentioned above as size independent within such a small size range. Therefore, at this stage, we prefer to consider them as representatives of two distinct species.

Although the posterior three pereopods are more or less damaged in the present specimen, the remaining parts indicate with reasonable confidence that their unusual length is established by a great elongation of the merus (particularly of the third pereopod) and propodus, as the ischium and carpus are not so unusually long in relation to the body size. The carpi of the posterior two pereopods are noticed to be more slender than the basal segments of these ambulatory legs. Also, the dactylus of the fifth pereopod is revealed to be

rudimentary in condition and has been observed to be shorter and more slender (Fig. 2g) than that in species of the other genera, and with no stout spines present on the posterior margin.

So far, the recorded distribution of the genus *Bathystylodactylus* is limited to the western edges of the Pacific, at depths over 3000 m. General appearance of these specimens suggests that the bathyal stylodactylids have adapted well for the environment of great depths of the ocean.

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