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***Bathygrillotia* n. g. (Cestoda: Trypanorhyncha), with redescriptions of *B. rowei* (Campbell, 1977) n. comb. and *B. kovalevae* (Palm, 1995) n. comb.**

I. Beveridge * R. A. Campbell

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I. Beveridge (✉)

Department of Veterinary Science, The University of Melbourne, Veterinary Clinical Centre, 250 Princes Highway, Werribee, VIC 3030, Australia

e-mail: ibeve@unimelb.edu.au

R. A. Campbell

7473 North Valley Pike, Harrisonburg, VA 22802, USA

Abstract *Bathygrillotia* n. g. (Cestoda: Trypanorhyncha) is erected for *B. rowei* (Campbell, 1977) n. comb. and *B. kovalevae* (Palm, 1995) n. comb. The new genus is based on the possession of two bothria, an atypical, heteroacanthous, heteromorphous armature with longitudinal files of

hooks on the external surface of the tentacle associated with each principal row, each consisting of a large anterior hook followed by two smaller hooks. *Bathygrillotia* is allocated to the Lacistorhynchoidea Guiart, 1927 and its relationships with *Grillotia* Guiart, 1927 are discussed.

Introduction

The trypanorhynch cestode genus *Grillotia* Guiart, 1927, based on the species included by Schmidt (1986), was recognised as being polyphyletic in nature and in need of revision by Beveridge et al. (1999). Palm (2004) subsequently rearranged the species in this genus, transferring some to *Pseudogrillotia* Dollfus, 1969 based on the presence of a slightly craspedote scolex, others to *Paragrillotia* Dollfus, 1969 based on the possession of a chainette on the external surface of the tentacle, and additional species to *Pseudolacistorhynchus* Palm, 1995 in which the intercalary hook rows form the bands of hooks on the external surface of the tentacle. In an attempt to define the principal characteristic features of the genus, the type-species, *Grillotia erinaceus* (van Beneden, 1858), was redescribed by Beveridge & Campbell (2007) along with related species, loosely referred to as members of the ‘*G. erinaceus* species complex’. Subsequently, Beveridge & Campbell (2010) identified a second morphological group of species within this genus, which they defined as the subgenus *Christianella* Guiart, 1931, thereby validating a name which had long been of uncertain status (Dollfus, 1942; Schmidt, 1986; Campbell & Beveridge, 1994).

Palm (2004) identified species within *Grillotia* (*G. rowei* Campbell, 1977 and *G. kovalevae* Palm, 1995) in which the hooks on the external surface of the tentacle were arranged in two files. Campbell (1977) had placed *G. rowei* in the subgenus *Paragrillotia*, subsequently recognised as a

genus based on the presence of a chainette (Palm, 2004). It was consequently placed in *Grillotia* (*sensu lato*) rather than *Paragrillotia* by Palm (2004). We here redescribe *G. rowei* and *G. kovalevae* as part of an ongoing review of species of *Grillotia* and erect a new genus for them.

Materials and methods

All of the specimens of *G. rowei* and *G. kovalevae* in the collections of the United States National Parasite Collection (USNPC) and the Natural History Museum, London (BMNH) were examined. Drawings were made with an Olympus BH-2 microscope using a drawing tube; measurements were made with an ocular micrometer and are presented in millimetres or micrometres as the range followed by the mean.

The terminology for the morphological features follows Dollfus (1942) and Campbell & Beveridge (1994), except that the attachment organs are referred to as bothria, following Jones et al. (2004).

Grillotiidae Dollfus, 1969

***Bathygrillotia* n. g.**

Diagnosis. Scolex elongate, acraspedote; 2 patelliform bothria, with free posterior margins. Pars vaginalis longer than pars bothrialis; tentacle sheaths sinuous. Bulbs elongate; retractor muscle

attaching in anterior region of bulb. Pars postbulbosa of variable length. Metabasal armature heteroacanthous, atypical, heteromorphous, consisting of alternating half-spirals of hooks, commencing on internal surface, terminating on external surface of tentacle; 5 to 6 hooks in each principal row; hook files 1 (1') separated by space on internal surface of tentacle; single intercalary row of hooks present or absent; external surface of tentacle with 2 longitudinal files of hooks arranged in groups of 3, with 1 larger hook followed by 2 smaller hooks; distinctive metabasal armature and swelling absent; hooks hollow. Strobila unknown.

Type-species: *Bathygrillotia rowei* (Campbell, 1977) n. comb.

Other-species: *Bathygrillotia kovalevae* (Palm, 1995) n. comb.

Etymology: The prefix *bathy-* alludes to the fact that both species are known only from deep-sea fishes.

***Bathygrillotia rowei* (Campbell, 1977) n. comb.**

Type-material: Holotype from mesentery of *Coryphaenoides armatus* (Hector), Hudson Submarine Canyon, Atlantic Ocean, USNPC 74487; paratypes: 4 plerocerci from *Coryphaenoides carapinus* Goode & Bean and *C. leptolepis* Günther, same collection data, USNPC 74488; 3 plerocerci from *C. armatus*, same collection data, BMNH 2011.10.10.1-3); adult from *Bathyraja richardsoni* (Garrick) (immature and without segments), same collection data, BMNH unregistered.

Material examined

From *Coryphaenoides armatus*: holotype and paratypes.

From *Bathyraja* cf. *richardsoni*: paratype.

From *Trachyrincus murrayi* Günther (liver): 2 plerocerci, North Atlantic Ocean (56°34'N, 9°31'W), depth 1310-1445 m, 21.ix.1991 (Challenger station 86/91/14/2) (BMNH 1992.3. 24.1-2).

From *Coelorhynchus fasciatus* (Günther) (liver): 1 plerocercus, North Atlantic Ocean (56°34'N, 9°31'W), depth 1310-1445 m, 21.ix.1991 (Challenger station 86/91/14/3) (BMNH 1992.6.25.81).

From *Coryphaenoides brevibarbis* (Goode & Bean) (body-cavity): 2 plerocerci, Porcupine Sea Bight, North Atlantic Ocean (49°54'N, 12°46'W), depth 2500 m, 10.x.2002 (Discovery D 266, stn 15052-5) (BMNH 2003.6.5.2-3).

Description (Figs. 1-8, Table 1)

Scolex acraspedote; 2 large patelliform bothria with thick, free posterior rims; pars vaginalis longer than pars bothrialis; tentacle sheaths sinuous; bulbs elongate; prebulbar organ and gland cells within bulb absent; bulbs elongate; retractor muscle originating in anterior part of bulb; site of attachment continued posteriorly by band of glandular rather than muscular tissue, extending almost to base of bulb; pars postbulbosa variable in length.

Tentacular armature heteroacanthous, heteromorphous; hooks hollow. Basal swelling of tentacle and distinctive basal armature absent. Principal hook rows commence on internal surface, terminate on external surface of tentacle; space present between hook files 1 and (1') on internal surface of tentacle. Hooks 1(1') unciniate with elongate base; hooks 2(2') shorter, erect unciniate, with shorter base; hooks 3(3') shorter, recurved spiniform, with short base; hooks 4(4') shorter, spiniform; hooks 5(5') larger than hooks 4(4'), falcate, with base extended towards hooks 4(4'). Single intercalary row of 2 hooks; hooks a (a') between hooks 4(4') and 5(5'), with unilaterally

extended base; hooks b(b') larger, posterior to hooks 5(5'), with unilaterally extended base. External surface of tentacle with 2 longitudinal files of hooks arranged in groups of 3; hooks A(A') large, hastate, aligned with intercalary hook row; hooks B(B') smaller, aligned with hooks 5(5') of principal rows; hooks C(C') of similar size to hooks B(B'), not aligned with either principal or intercalary rows. Strobila unknown.

Remarks

Campbell (1977) described *Grillotia (Paragrillotia) rowei* as a new species based on plerocerci from the liver and mesenteries of the deep-sea macrourids *Coryphaenoides armatus*, *C. carapinus* and *C. leptolepis*, as well as a single immature adult from a ray, probably *Bathyraja richardsoni*, all collected from the Hudson Submarine Canyon in the north-west Atlantic Ocean. Campbell (1977) placed the new species in the subgenus *Paragrillotia*, since there was no distinction between the intercalary rows of hooks and the hook files present on the internal surface of the tentacle. Palm (2004) elevated *Paragrillotia* to generic status based on the presence of a chainette on the external surface of the tentacle of the type-species, excluding *G. rowei*, which he left within *Grillotia* and in a subgroup characterised by longitudinal files of hooks on the external surface of the tentacle. The present redescription confirms this anomalous situation. Contrary to previous interpretations, examination of paratypes as well as additional material in the BMNH collection indicated that the armature consists of principal rows of five hooks, a single intercalary row of two hooks and two longitudinal files of alternating hooks on the external surface of the tentacle arranged in groups of three hooks. Campbell (1977) considered that the principal rows contained six to seven hooks and the single intercalary row two to three hooks. Palm (1995) gave a brief redescription and provided

scanning electron micrographs of the species based on specimens in the BMNH and used a slightly different method of numbering the hooks, with one hook of the files on the external surface of the tentacle (not precisely specified) considered to be hook 6(6') of the principal row, two intercalary hooks, a(a') and b(b'), and an additional hook of the files on the external surface labelled as 'c'. In the system of Palm (2004), there is a hook missing. Neither numbering systems is followed here; if any hook of the longitudinal files on the external surface were to be considered an extension of the principal rows, then it would have to be the second small hook of the repeated pattern of one large and two small hooks in the two longitudinal files (hook B'B) (Figs. 6-8). For this reason, the hook numbering system suggested above appears preferable, especially since it corresponds more readily with that of the proposed congener, *G. kovalevae*.

Campbell (1977) described the retractor muscle as inserting at the base of the bulb. In the present description, by contrast, the retractor is described as inserting in the anterior region of the bulb, with the site of insertion being continued towards the base of the bulb by glandular rather than muscular tissue (Fig. 4). A similar situation was reported for *G. erinaceus* by Beveridge & Campbell (2007).

Palm (1995) noted differences in measurements between the type-series and the more recent collections made from the related teleost species *C. fasciatus*, *C. brevibarbis* and *Trachyrincus murrayi* also collected in the Atlantic from deep-sea sites by the Challenger and Discovery expeditions. Palm (2004) included the original measurements of Campbell (1977) in his morphological summary of the species. Consequently, detailed measurements of the two collections are provided in Table 1. While there are obvious differences in scolex dimensions, the hook sizes are remarkably similar. The hooks of specimens from the Challenger and Discovery collections are more crowded than those of the paratypes (Figs. 7, 8), but this may simply be related to the degree

of contraction of the specimens, as may be the scolex measurements. Similar differences in hook arrangements have been described for *G. heptanchi* (Vaullegeard, 1899) by Dollfus (1942, figs. 272-275). The bulb ratios differ slightly between the two lots of specimens as illustrated in Figs. 1 and 2, but the significance of this difference is unclear. Consequently, the specimens from the Challenger and Discovery expedition are considered to be conspecific with the type-series despite some differences in hook sizes and metrical data of the scolex.

***Bathygrillotia kovalevae* (Palm, 1995) n. comb.**

Type-material: Holotype from mesentery of *Coelorincus karrerae* Trunov, south-west Atlantic (30°14' S, 3°10' W) (BMNH 1995.4.13.1).

Description (Figs. 9-13, Table 2)

Scolex acraspedote; 2 large, patelliform bothria with thick, free, posterior rims; pars vaginalis longer than pars bothrialis; tentacle sheaths sinuous; bulbs elongate; prebulbar organ and gland-cells within bulb absent; retractor muscle originates in anterior part of bulb; site of attachment continued posteriorly by band of glandular rather than muscular tissue, extending almost to base of bulb; pars postbulbosa short.

Tentacular armature heteroacanthous, heteromorphous; hooks hollow. Basal swelling of tentacle and distinctive basal armature absent. Principal hook rows commence on internal surface, terminate on external surface of tentacle; space present between hook files 1 and (1') on internal

surface of tentacle. Hooks 1(1') uncinata with elongate base; hooks 2(2') shorter, erect, with shorter base; hooks 3(3') shorter, recurved spiniform, with narrow base; hooks 4(4') shorter, spiniform; hooks 5(5') shorter, spiniform, with narrower base; hooks 6(6') spiniform with narrow base.

Intercalary rows absent. External surface of tentacle with 2 longitudinal files of hooks arranged in groups of 3; hooks A(A') large, hastate, aligned with intercalary hook row; hooks B(B') smaller, not aligned with principal rows; hooks C(C') larger than hooks B(B'), not aligned with principal rows.

Strobila unknown.

Remarks

Palm (1995) described this species from a single, extremely flattened plerocercus found in the mesentery of *Coelorincus karrerae* from the Atlantic Ocean. The current redescription confirms and expands Palm's (1995) description. A comprehensive series of measurements of hooks is provided as well as details of the origin of the retractor muscle, which inserts, as in *G. rowei*, in the anterior region of the bulb. However, the insertion is continued posteriorly by a column of tissue on the luminal surface of the bulb. Some details, such as the precise orientation of figures of the tentacle, could not be determined due to the flattening of the only specimen.

Palm (1995) described the armature as consisting of seven hooks in each principal row with two additional hooks (a, b) posterior to the seventh hook. The hook numbering has been altered slightly in the current redescription, with six hooks in each principal row and the seventh hook of Palm (1995) assigned to the two files of hooks on the external surface of the tentacle, such that these files consist of a large hook (A(A')) followed by two smaller hooks (B(B'), C(C')) in a repeating pattern. In the case of *G. kovalevae*, the large hook (A(A')) is aligned with the principal

row, whereas, in *G. rowei*, the hook aligned with each principal row is a smaller hook (B(B')).

Grillotia kovalevae therefore differs from *G. rowei* in having an extra hook in the principal row and in lacking an intercalary row of two hooks.

Discussion

Palm (2004) identified *G. rowei* and *G. kovalevae* as two morphologically related species within *Grillotia* distinguished from their congeners by a distinctive armature, consisting of two longitudinal files of hooks on the external surface of the tentacle, which was excellently illustrated in the scanning electron micrographs of *G. rowei* presented by Palm (2004). The current redescriptions of both species confirm these observations and provide evidence for their accommodation in a distinct genus. As redefined by Beveridge & Campbell (2007) based on a redescription of the type-species, *Grillotia (Grillotia)* is defined as possessing two bothria, principal hook rows composed of four hooks, multiple intercalary hook rows and a band of hooklets on the external surface of the tentacle. *Christianella*, treated as a subgenus of *Grillotia* by Beveridge & Campbell (2010), resembles *Grillotia (Grillotia)* in having two bothria, principal hook rows composed of four hooks and a band of hooklets on the external surface of the tentacle, but differs in having a single row of intercalary hooks and a distinctive basal armature. The remaining species of *Grillotia (sensu lato)* [i.e. *G. acanthoscolex* Rees, 1944 (syn. *G. spinosissima* Dollfus, 1969), *G. amblyrhynchos* Campbell & Beveridge, 1993, *G. heptanchi* (Vaullegeard, 1899), *G. meteori* Palm & Schröder, 2001, *G. pristiophori* Beveridge & Campbell, 2001, and the *species inquirendae* *G. adenoplusius* (Pintner, 1903), *G. dolichophora* Guiart, 1935, *G. hippoglossi* (Olsson, 1869), *G. minor*

Guiart, 1935 and *G. scolecina* (Rudolphi, 1819)) form a heterogeneous assemblage in need of revision, but none has two files of hooks on the external surface of the tentacle.

The proposed new genus *Bathygrillotia* has two bothria and five to six hooks in each principal row, but lacks the band of hooklets present on the external surface of the tentacle found in *Grillotia* (*Grillotia*) and *Grillotia* (*Christianella*). The external surface rather consists of two files of hooks formed by the serial repetition of groups of three hooks, one of which is large and hastate followed by two smaller hooks. In *B. kovalevae*, the larger hastate hook could be considered the extension of the principal row (Palm, 1995), but this is not the case for *B. rowei* in which one of the smaller hooks (B(B')) would represent the continuation of the principal hook row and, in view of this, the hook numbering system proposed by Palm (1995) has been modified slightly.

The pattern of hook arrangement on the external surface of the tentacle of *B. rowei* and *B. kovalevae* thus differs significantly from that found in any other species of *Grillotia* and consequently warrants generic recognition. Similar patterns of distinctive longitudinal files of hooks on the external surface of the tentacle which have been accorded generic rank are *Proemotobothrium* Beveridge & Campbell, 2001 (Otobothriidae) and *Fossobothrium* Beveridge & Campbell, 2005 (Otobothriidae) (Beveridge & Campbell, 2001, 2005). For consistency in the use of generic characteristics within the trypanorhynch cestodes, the erection of the new genus *Bathygrillotia* thus appears to be justifiable.

Using the keys provided by Campbell & Beveridge (1994), this genus would belong to the family Grillotiidae Dollfus, 1969, as defined therein, since it was not defined when erected (Dollfus, 1969), and would be closest to the genus *Grillotia*, a situation concordant with the molecular phylogenies of Palm et al. (2009) and Olson et al. (2010) in which *B. rowei* was closely aligned with but distinct from *G. erinaceus* and *G. pristiophori*. Palm (2004) did not recognise the family

Grillotiidae, but utilised the earlier classification of Dollfus (1942) with the family Lacistorhynchidae Guiart, 1927 divided into two subfamilies, the Lacistorhynchinae Guiart, 1927 and the Grillotiinae Dollfus, 1942, the latter corresponding to the Grillotiidae as used by Campbell & Beveridge (1994). Palm (2004) separated these two subfamilies based on the presence of a single intercalary hook row (Lacistorhynchinae) or two or more intercalary hook rows (Grillotiinae) as well as ultrastructural characteristics which are not amenable to study in conventionally mounted specimens. The key of Palm (2004) also highlighted an apparent deficiency in the current terminology, namely that of the definition of an intercalary row of hooks. The term as used by Dollfus (1942) implies a single hook or a series of hooks interpolated between the principal rows of hooks on the bothrial and antibothrial surfaces of the tentacles (depending upon the origins of the principal hook rows). The term did not originally apply to the number of hook rows on the external surface of the tentacle which can clearly vary, depending, for example, on the type of chainette present (e.g. species of *Dasyrhyinchus* Pintner, 1928). Palm (2004), however, referred to intercalary hooks on the external surface of the tentacle. This apparently minor difference in the interpretation of terminology is in fact critical to the placement of the new genus erected here. Utilising the keys of Palm (2004), *Bathygrillotia* would belong to the Lacistorhynchinae as it possesses only a single intercalary row of hooks in the case of *B. rowei* and no intercalary hook row in the case of *B. kovalevae*. However, members of this subfamily are characterised primarily by a chainette on the external surface of the tentacle, a feature which is lacking in *Bathygrillotia*. In addition, the classification of Palm (2004) does not take into account the fact that within *Grillotia*, characterised by several rows of intercalary hooks (Beveridge & Campbell, 2007) members of the subgenus *Christianella* possess a single row of intercalary hooks as interpreted here (Beveridge & Campbell, 2010). Based on the wording in the key in the classification of Palm (2004), these

members of the same genus should be distributed between two subfamilies. Consequently, the new genus *Bathygrillotia* would belong to the Grillotiidae (*sensu* Campbell & Beveridge, 1994) or the Grillotiinae (*sensu* Palm, 2004), depending upon the classification followed. Based on current limited molecular studies (Palm et al., 2009, Olson et al., 2010), which included *B. rowei*, it belongs within the clade identified as the Grillotiinae but has no affinities with the Lacistorhynchinae as defined by Palm (2004). We therefore allocate the new genus to the Grillotiidae (*sensu* Campbell & Beveridge, 1994) or the Grillotiinae (*sensu* Palm, 2004), depending upon which classification is utilised.

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Captions to figures

Figs. 1-4 *Bathygrillotia rowei* (Campbell, 1977) n. comb. 1. Scolex of paratype (RHB-C86-14); 2. Scolex of specimen from *Trachyurus murrayi* (BMNH 1992.3.24.1-2) showing variation in shape of bulbs; 3. Scolex of specimen from *Coryphaenoides brevibarbis* (BMNH 1992.2.24.3) showing surface of bothrium; 4. Tentacular bulb (paratype (RHB-C86-14)) showing insertion of retractor muscle in anterior region of bulb (arrow) followed posteriorly by non-muscular tissue extending almost to posterior end of bulb. *Scale-bars*: 1-2, 1.0 mm; 3-4, 0.1 mm.

Figs. 5-8 *Bathygrillotia rowei* (Campbell, 1977) n. comb. Tentacular armature. 5. Internal surface, basal and metabasal regions, paratype from *Coryphaenoides armatus*; 6. Metabasal region, antibothrial surface (paratypes from *Coryphaenoides armatus*); 7. Metabasal region, external surface, paratype from *Coryphaenoides armatus*; 8. Metabasal region, antibothrial surface, specimen from *Trachyurus murrayi* (BMNH 1992.3.24.1-2) showing more crowded arrangement of hooks. *Scale-bars*: 5-6, 0.1 mm; 7-8, 0.01 mm.

Figs. 9-13 *Bathygrillotia kovalevae* (Palm, 1995) n. comb. Drawings from holotype. 9. Scolex; 10. Tentacular bulb showing insertion of retractor muscle in anterior region of bulb (arrow) followed posteriorly by non-muscular tissue extending almost to posterior end of bulb. 11. Tentacular armature, basal and metabasal regions, internal surface; 12. Tentacular armature, metabasal region, external surface; 13. Profiles of hooks 1(1') - 6(6') of principal rows. *Scale-bars*: 9, 1.0 mm; 10-13, 0.1 mm.

Table 1 Measurements of *Bathygrillotia rowei* (Campbell, 1977) n. comb.

Source of data	Campbell (1977)	Palm (1995)	Present study	Additional specimens in
Specimens examined	Types	Material not specified	Paratypes (BMNH 2011.10.10.1-3)	BMNH
<i>Scolex</i> (mm):	n = 11	n = 2	n = 3	n = 8
Scolex length	6.1–10.1 (7.9)	3, 4 (3.5)	6.15–7.7 (6.68)	4.29–7.41 (5.73)
Scolex width (pars bothriialis)	-	1.09–1.40 (1.25)	2.40–2.55 (2.47)	1.19 (n = 1)
Scolex width (pars vaginalis)	-	0.48–0.56 (0.52)	1.33–1.62 (1.50)	1.13–1.64 (1.17)
Scolex width (pars bulbosa)	-	0.70–1.05 (0.86)	1.50–1.77 (1.65)	-
Pars bothriialis	1.7–2.7 (2.2)	0.98–0.104 (0.101)	2.04–2.35 (2.16)	1.44–2.34 (1.78)
Pars vaginalis	2.8–4.6 (3.7)	1.5–2.0 (1.8)	2.50–4.15 (3.09)	2.13–4.45 (2.81)
Pars bulbosa	1.7–2.2 (1.9)	0.68–0.75 (0.72)	1.70–1.90 (1.78)	-
Bulb length	1.2–2.1 (1.7)	-	1.65–1.86 (1.73)	1.72–2.18 (1.97)
Bulb width	0.276–0.437 (0.369)	-	0.31–0.42 (0.36)	0.27–0.41 (0.35)
Bulb ratio (L:W)	-	3:1–4.2:1 (3.6:1)	4:1–5.3:1 (4.9:1)	4.59: 1–7.0: 1 (5.68:1)
Pars post-bulbosa	1.4–3.5 (2.1)	-	1.25–1.83 (1.59)	0.45–2.34 (0.92)
<i>Hooks</i> (µm)			n = 10	n = 10
Hooks 1 (1') length	57–65	-	61–72 (66)	63–78 (70)
Hooks 1 (1') base	40–46	-	46–57 (51)	42–65 (53)
Hooks 1 (1') height	31–34	-	-	-
Hooks 2 (2') length	50–70	-	53–68 (63)	46–67 (55)
Hooks 2 (2') base	26–29	-	25–32 (0.029)	21–30 (25)
Hooks 2 (2') height	38–56	-	-	-
Hooks 3 (3') length	26–43	-	38–49 (45)	13–32 (29)
Hooks 3 (3') base	21–36	-	10–21 (15)	15–21 (17)
Hooks 3 (3') height	16–29	-	-	-
Hooks 4 (4') length	26–31	-	29–51 (40)	28–32 (29)
Hooks 4 (4') base	7–10	-	8–13 (10)	8–13 (11)

Hooks 5 (5') length	-	-	32-42 (37)	29-40 (36)
Hooks 5 (5') base	-	-	11-21 (16)	6-11 (8)
Hooks a (a'), b (b') length	31-34	-	23-40 (31)	29-36 (30)
Hooks a (a'), b (b') base	13-23	-	10-21 (14)	6-13 (8)
Hooks of files on external face				
Large hook A(A') length	-	-	36-48 (43)	25-49 (36)
Large hook A(A') base	-	-	17-32 (25)	8-23 (17)
Small hook 1 B(B') length	-	-	23-30 (27)	17-30 (25)
Small hook 1 B(B') base	-	-	10-17 (13)	4-10 (7)
Small hook 2 C(C') length	-	-	21-34 (27)	15-25 (21)
Small hook 2 C(C') base	-	-	10-13 (12)	8-10 (7)

Table 2 Measurements of *Bathygrillotia kovalevae* (Palm, 1995) n. comb.

Source of data	Palm (1995)	Present study
<i>Scolex</i> (mm)		
Scolex length	12.8	11.3
Scolex width (pars bulbosa)	-	2.8
Pars bothrials	4.01	4.5
Bothrial width	3.2	-
Pars vaginalis	8.16	7.9
Scolex width (pars vaginalis)	1.76	-
Length of bulbs	2.43–2.69	2.50
Width of bulbs	0.61–0.67	0.66
Bulb ratio	4: 1	3.8: 1
Scolex ratio	1.6: 3.2 : 1	1: 1.8: 0.6
Pars postbulbosa	2.08	-
<i>Hooks</i> (µm)		
		n = 10
Hooks 1 (1') length	85–100	82–101 (94)
Hooks 1 (1') base	75–85	62–78 (75)
Hooks 1 (1') height	45–50	
Hooks 2 (2') length	75–85	62–90 (97)
Hooks 2 (2') base	25–30	31–51 (41)
Hooks 3 (3') length	52–58	43–62 (55)
Hooks 3(3') base	-	20–31 (25)
Hooks 4(4') length	60–65	47–66 (60)
Hooks 4(4') base	-	16–27 (20)
Hooks 5(5') length	52–58	39–62 (55)
Hooks 5(5') base		7–23 (15)
Hooks 6(6') length	52–58	43–62 (59)

Hooks 6(6') base	-	07-20 (12)
Hooks of files on external surface		
Large hook A(A') length	75-85	51-94 (70)
Large hook A(A') base	40-47	23-47 (37)
First small hook B(B') length	25-30	31-39 (35)
First small hook B(B') base	-	7-14 (9)
Second small hook C(C') length	47-52	39-62 (52)
Second small hook C(C') base	-	12-20 (17)





