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Nybelinia southwelli sp. nov. (Cestoda, Trypanorhyncha) with the re-description of *N. perideraeus* (Shipley & Hornell, 1906) and synonymy of *N. herdmani* (Shipley & Hornell, 1906) with *Kotorella pronosoma* (Stossich, 1901)

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SYNOPSIS. During a study of *Nybelinia* material deposited at The Natural History Museum, London, *Nybelinia southwelli* sp. nov. was discovered amongst material identified and described as *Tetrarhynchus perideraeus* Shipley & Hornell, 1906 from *Rhina ancylostoma* and *Nebrius ferrugineus* from Sri Lanka. The new species belongs to the subgroup IIBa of Palm *et al.* (1997), which includes species having a homeoacanthous heteromorphous metabasal armature and a characteristic basal armature where the basal hooks are smaller or equal in size to the metabasal hooks. It can easily be distinguished from all other members of this group by having characteristic rose-thorn shaped metabasal and slender basal hooks. The type material of *Nybelinia perideraeus* (Shipley & Hornell, 1906) was borrowed from the Natural History Museum, Vienna, for comparison, and is re-described. *N. dakari* Dollfus, 1960 is considered synonymous with *N. perideraeus*. *Nybelinia herdmani* (Shipley & Hornell, 1906), also placed in the subgroup IIBa by Palm *et al.* (1997), is considered synonymous with *Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989. The subgroupings of *Nybelinia* species based on the species specific tentacular armature appear to be useful for further taxonomic studies within the genus.

INTRODUCTION

Trypanorhynch cestodes are common parasites of marine elasmobranchs, where they mature in the stomach or the spiral valve. The plerocercoids are parasitic in many teleosts and a variety of invertebrates while the first intermediate hosts are crustaceans. Among trypanorhynch cestodes, *Nybelinia* Poche, 1926 is the largest genus. Palm *et al.* (1997) listed 43 adequately described species while leaving 4 species of uncertain status, and Jones & Beveridge (1998) added *N. queenslandensis*. Vijayalakshmi *et al.* (1996) described *Tentacularia scoliodoni* on the basis of the tentacular armature, not considering the most recent generic definitions of *Tentacularia* and *Nybelinia* in the key of Campbell & Beveridge (1994). The species strongly resembles *N. indica* Chandra, 1986 and *N. africana* Dollfus, 1960, and should be treated as species of uncertain status pending on examination of further material. Thus, with a total of 44 adequately described species, the genus *Nybelinia* currently comprises the most species-rich genus within the order Trypanorhyncha.

One of the biggest problems for taxonomic work within the genus, apart from poor original descriptions, remains the lack of information on material available in museum collections for comparative morphological studies. Many species have a similar scolex morphology and tentacular armature. Additionally, several species descriptions are based on single specimens and data on intraspecific variability are scarce. Studies of *Nybelinia* deposited in collections are needed to determine validity as well as for re-descriptions.

During a study on *Nybelinia* material deposited at the British Museum, Natural History, slides labelled and described as *Tetrarhynchus perideraeus* Shipley & Hornell, 1906 from the T. Southwell collection (Southwell, 1929a, p. 257–259) appeared to bear a species different to that indicated. The present study was carried out to clarify the identity of this material. The type material of *Nybelinia perideraeus* was borrowed from the Natural History Museum, Vienna, for comparison, and re-description. Beside this, the taxonomic position of *N. herdmani* (Shipley & Hornell, 1906) is clarified.

MATERIAL AND METHODS

Standard measurements and drawings of the scoleces of *Nybelinia* specimens deposited in the Parasitic Worms Division, The Natural History Museum London (BMNH), were made using a Leitz Wetzlar Dialux 20 microscope with an ocular micrometer. The type specimens of *Nybelinia perideraeus* and *N. herdmani* were borrowed from the collection of the Naturhistorisches Museum Wien (VNHM) and examined with a Leitz Wetzlar Orthoplan microscope. Drawings were made using a Leitz Wetzlar Dialux 22 microscope with a drawing tube.

The following measurements were taken: Scolex length (SL), scolex width at level of pars bothridialis (SW), pars bothridialis (pbo), pars vaginalis (pv), pars bulbosa (pb), pars postbulbosa (ppb), velum (vel), appendix (app), bulb length (BL), bulb width (BW), bulb ratio (BR), proportions of pbo/pv/pb (SP), tentacle width (TW), and tentacle sheath width (TSW). If possible, the tentacle length (TL) was estimated. Additionally, the tentacular armature was described as follows: armature homeomorphous or heteromorphous, hooks per half spiral row (hsr), total hook length (L) and the total length of the base (B).

All measurements are given in micrometers unless otherwise indicated. Illustrations are provided where useful, otherwise the reader is referred to illustrations of other authors. The classification follows that of Palm (1995, 1997) and the orientation of the tentacular surfaces follows that of Campbell & Beveridge (1994).

RESULTS

The comparison of *Tetrarhynchus perideraeus* Shipley & Hornell, 1906, BMNH 1977.11.4.7–9, 1977.11.11.38 from the Southwell collection with the co-type material of *T. perideraeus* from the VNHM (2109, 2111) revealed differences. The BMNH material corresponds neither with the co-types from the VNHM nor with specimens of *T. perideraeus* as re-described by Dollfus (1942, Figs 98–100). Similarly, the type material of *T. perideraeus* from the VNHM clearly differs from the specimens described by Dollfus (1942). Thus, the material deposited and described above belongs to three different *Nybelinia* species.

In the following, *Nybelinia perideraeus* (Shipley & Hornell, 1906) is re-described and the material collected by T. Southwell and deposited in the BMNH, which does not fit in any of the currently accepted species (Palm *et al.*, 1997), is described as *N. southwelli* sp. nov. Another species deposited in the VNHM, *Tetrarhynchus herdmani* (Shipley & Hornell, 1906), can be considered synonymous with *Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989.

Superfamily TENTACULARIOIDEA Poche, 1926
Family **TENTACULARIIDAE** Poche, 1926
Genus ***NYBELINIA*** Poche, 1926

Nybelinia southwelli sp. nov. (Figs 1–3c)

SYNONYMY.
N. perideraeus (Shipley & Hornell, 1906) of Southwell (1924, 1929a, b, 1930)

MATERIAL DESCRIBED. Holotype, BMNH 1977.11.4.7, J. Pearson *leg.*, 30.9.1925, 1 adult from *Rhina ancylostoma* Bloch & Schneider, 1801 (=*Rhynchobatus anchylostomus*) Sri Lanka (Ceylon); Paratype, BMNH 1977.11.4.8–9, J. Pearson *leg.*, 30.09.1925, 1 adult from *Nebrius ferrugineus* (Lesson, 1830) (=*Ginglymostoma concolor*), Sri Lanka. Other material: BMNH 1977.11.4.8–9 (2 slides) and BMNH 1977.11.11.38.

DESCRIPTION. With the characters of the genus *Nybelinia*: The scolex (BMNH 1977–11.4.8–9, Fig. 28B in Southwell, 1929a; BMNH 1977.11.11.38, see Fig. 1) is craspedote with a total length (with velum) of 1701/holotype (1739/paratype). The length of the bothridia is more than half the scolex length, the width at the pars

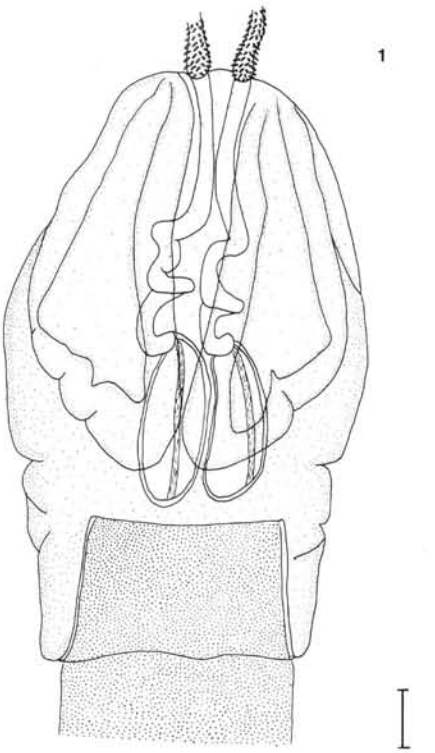

Fig. 1 Scolex of *Nybelinia southwelli* sp. nov. from *Nebrius ferrugineus*. Scale bar=150 μm.

bothridialis is 945 (1134); pbo=1078 (1058), pv=982 (926), pb=485 (415), ppb=56 (38), vel=298 (420), BL=474 (404), BW=166 (185), BR=2.9:1 (2.2:1), SP=2.2:2:1 (2.5:2.2:1).The tentacles are long and slender and diminish in size towards the tip; TW basal=46–51 (51–56), TW metabasal 33–38. A basal tentacular swelling is not present. The tentacle sheaths are sinuous or spirally coiled; TSW 66–70 (51–56). Prebulbular organs and muscular rings around the basal part of the tentacle sheaths are absent. The retractor muscles originate in the basal part of the bulbs.

The armature is homeoacanthous, heteromorphous with a characteristic basal armature consisting of 13–14 rows of homeomorphous hooks (Figs 2a, c(i)). The number of hooks per half spiral diminishes towards the apical part of the tentacles: hsr=6 (basal), hsr=4–5 (apical). The massive hooks of the metabasal (Figs 2b, c(ii)) and apical (Figs 2b, c(iii)) armature are different in shape and size on bothridial and antibothridial tentacle surfaces. The metabasal tentacular armature on the bothridial surface consists of strongly recurved solid hooks with a large base; L=17–18 (13–15), B=14–16 (10–12). On the antibothridial surface, the hooks are more slender and slightly curved with a stout base; L=20–22 (15–18), B=12–14 (8–9). The basal armature is homeomorphous, basal hooks with a stout base, a slender shaft, and strongly recurved at the tip (L=18–20 (14–16), B=7–8 (6–7)) (Figs 2a, c(i)). The first basal hooks are smaller than those of the remaining basal armature.

The morphology of the mature and gravid segments of *N. southwelli* sp. nov. is given in Southwell (1929a, Figs 28E–F), a description and measurements of the proglottids is given in Southwell (1929a, p. 259). The morphology of the strobila and mature and gravid proglottids of BMNH 1977.11.11.38 is given on Figs 3a–c. *N. southwelli* sp. nov. has a long acraspedote strobila of more than 232 proglottids (BMNH 1977.11.4.8–9, strobila not complete), which

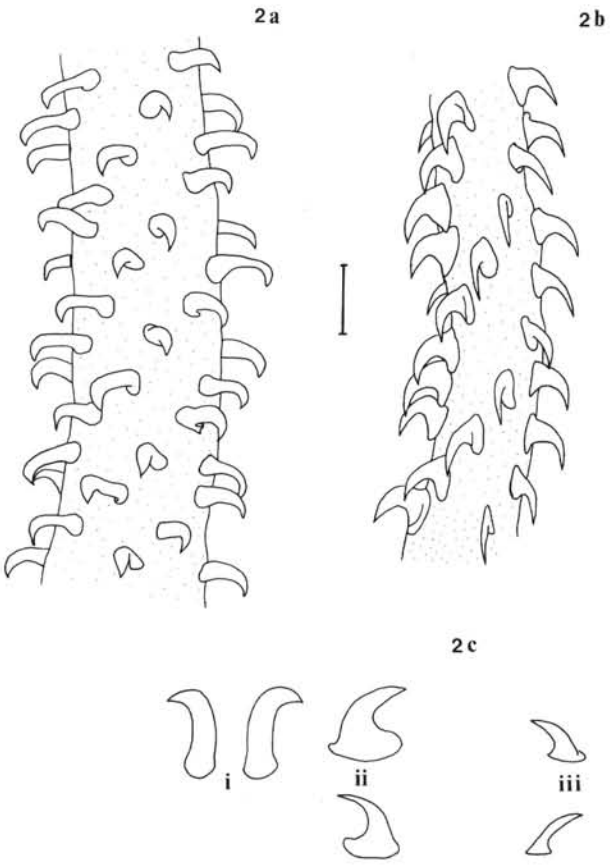

Fig. 2a–c *Nybelinia southwelli* sp. nov. a. homeomorphous basal tentacular armature, external surface. b. metabasal tentacular armature, external surface. c. basal (i), metabasal (ii) and apical (iii) tentacular hooks. Scale bar=20 µm.

are wider than long and have distinct convex margins (Fig. 3a). The size of the proglottids is similar along a large part of the strobila (around 130th proglottid: 800–870 × 260–300, last proglottids: 900–970 × 300–370). The genital atrium is ventrosubmarginal in about the middle of the proglottids and alternates irregularly. The cirrus sac is elongate, large, directed anteromedially from the genital atrium and the sac is thin-walled (Figs 3b–c). The cirrus is unarmed, coiled within the sac and an internal seminal vesicle was not seen; external seminal vesicle absent. Testes arranged in double layer, number 70–80, ovoid, 25–42 in diameter, encircle the female genital complex, and some testes are present anterior to the cirrus sac. Vagina not seen. Ovary bilobed, 130–160 wide × 80–105 long (BMNH 1977.11.4.8–9). Gravid segments with vitelline follicles of 15–20 in diameter, uterus extending over most of the proglottids. Other details of the female genital complex not seen.

ETYMOLOGY. The new species was named after T. Southwell, in whose collection the present specimens were found.

REMARKS.
Southwell (1924, 1929a, 1930) gave a first description of *N. southwelli* sp. nov. but identified the specimens as *N. perideraeus* Shipley & Hornell, 1906. His scolex measurements lie within the same range (Southwell, 1929a, p. 257–258; 1930, p. 84–86), and the illustrations of the tentacular armature are similar to Figs 2a–c. Fig. 28d in Southwell (1929a) as well as Fig. 16d in Southwell (1930) illustrate the slender, strongly recurved hooks of the basal tentacular armature (Fig. 2a), and Southwell´s Figs (28c and 16c) illustrate the metabasal armature with the rose-thorn shaped hooks (Fig. 2b). However, in contrast to his drawings, Southwell wrongly interpreted the tentacular hooks as being uniform in size, between 10 and 12 µm, and shape.

The present material illustrates that the material belongs to *Nybelinia* subgroup IIBa of Palm *et al.* (1997), which includes species having an homeoacanthous heteromorphous metabasal armature, a characteristic basal armature and basal hooks smaller than or equal to the metabasal hooks. The species can be easily distinguished from *N. nipponica* Yamaguti, 1952, *N. rougetcampanae* Dollfus, 1960 and *N. yamagutii* Dollfus, 1960 by the lack of bill hooks and the presence of a homeomorphous basal armature. *N. herdmani* can be considered synonymous with *Kotorella pronosoma* (see following), and has a different scolex as well as a different tentacular armature. *Nybelinia southwelli* sp. nov. is similar to *N. beveridgei* Palm, Walter, Schwerdtfeger & Reimer, 1997, the only other species having a homeomorphous basal and heteromorphous metabasal armature. It can be distinguished by a much smaller scolex size, smaller tentacular hooks, 13–14 rows of basal hooks in contrast to 6–7 in *N. beveridgei*, and the absence of a muscular ring around the tentacle sheaths.

It has to be pointed out that though the form and characteristic arrangement of the tentacular armature was the same, *N. southwelli* from the two different elasmobranch species differs slightly in hook sizes along the tentacle. The holotype obtained from *Rhina ancylostoma* had basal hooks with a maximal length of 20, while 3 scolices taken from *Nebrius ferrugineus* had basal hooks with a maximal length of 16. Similarly, the metabasal hooks of the holotype were larger. This observation can be interpreted as a record of morphological variability for *N. southwelli* depending on two different elasmobranch hosts.

Nybelinia perideraeus (Shipley & Hornell, 1906) Dollfus, 1930 (Figs 4–6)

SYNONYMY.
Tetrarhynchus perideraeus Shipley & Hornell, 1906
Stenobothrium perideraeum (Shipley & Hornell, 1906) Pintner, 1913
Nybelinia dakari Dollfus, 1960 (new synonymy)

MATERIAL EXAMINED. Co-types VNHM 2109 and 2111; 3 adults from the small intestine of *Glyphis gangeticus* (Müller & Henle, 1839) (=*Carcharhinus gangeticus*) (collection of T. Southwell).

DESCRIPTION. The scolex is craspedote (Fig. 4) with a total length (with velum) of 1222, 1092/co-type VNHM 2109 (1352/ co-type VNHM 2111); SW 767, 770 (715), pbo=546, 533 (637), pv=520, 390 (540), pb=408, 461 (429), ppb=59, 16 (69), vel=195, 299 (276), BL=390, 430 (445), BW=103, 114 (115), BR=3.8:1, 3.8:1 (3.9:1), SP=1.3:1.3:1, 1.2:0.8:1 (1.5:1.3:1). A basal tentacular swelling is absent, TW basal=39, 33 (42), TW metabasal=30, 33 (35), TW apical=20, TL=500–570; prebulbular organs and muscular rings around the tentacle sheaths are absent; the retractor muscle inserts in the basal part of the bulbs; TSW=35–40.

The armature is homeoacanthous, heteromorphous, and the hooks of the basal armature are similar to those of the metabasal armature (Figs 5a–b). hsr=6–7. The hooks of the metabasal armature are different in shape and size on bothridial and antibothridial tentacle surfaces (Figs 5a). On the bothridial surface, the tentacular armature consists of strongly recurved, solid hooks with a large base; L=10.5–13.0, B=10.5–11.5. On the antibothridial surface, the hooks are

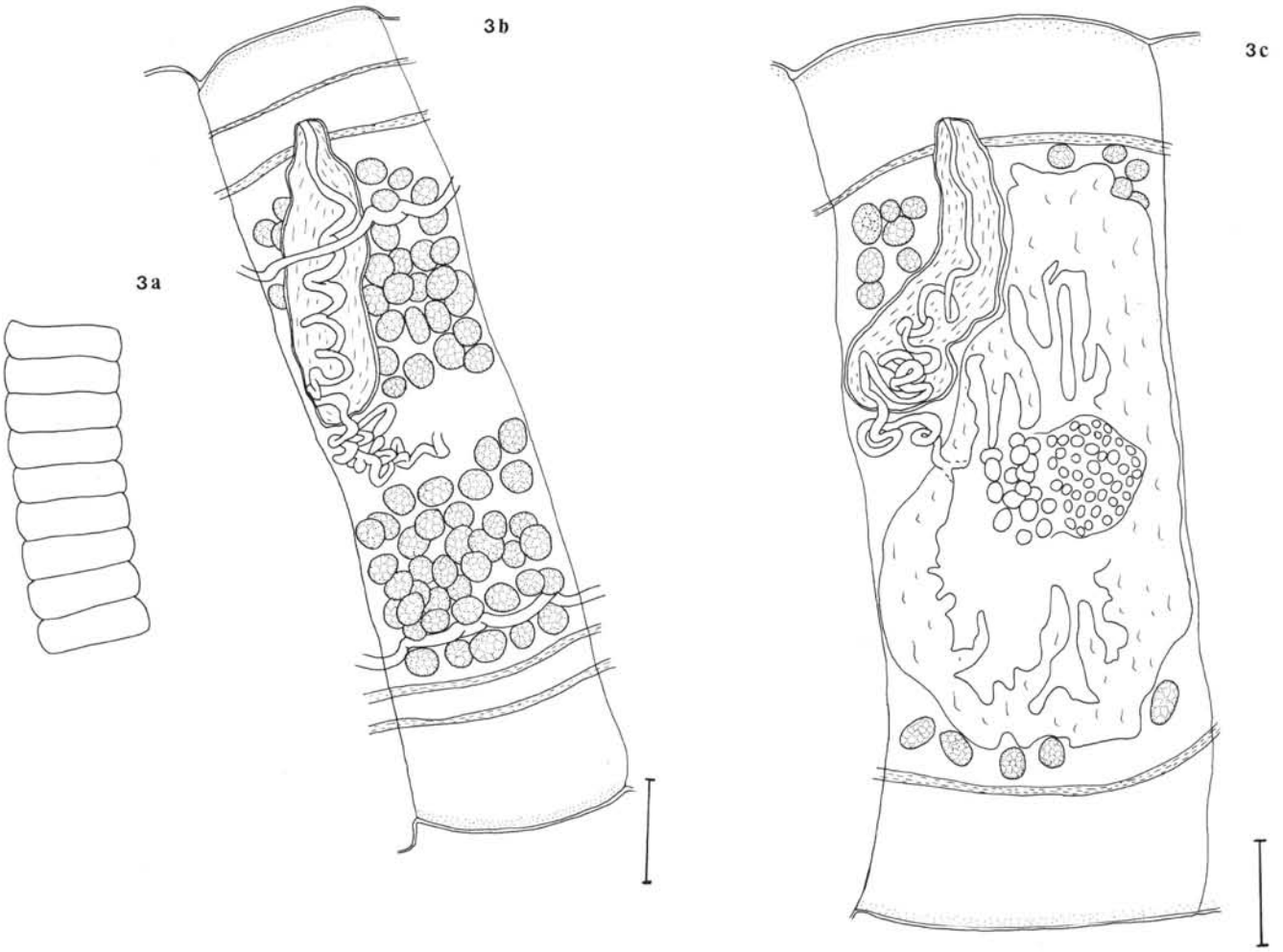

Fig. 3a–c Strobila of *Nybelinia southwelli* sp. nov. a. acraspedote arrangement of the proglottids with characteristic convex margins. b. mature proglottid with the large cirrus sac and oviform testes. c. gravid proglottid. Scale bar b=100 µm and scale bar c=110 µm.

more slender and slightly curved; L=7.5–10.0, B=8–9. The basal armature is heteromorphous (Fig. 5b). The basal hooks are of the same shape and size as those in the metabasal region of the tentacle. External surface hooks, L=10.5–11.5, B=10.5–11.8; internal hooks, L=6.5–8, B=8–9.

The morphology of the mature proglottid of *N. perideraeus* (VNHM 2109) is given as Fig. 6. *N. perideraeus* has a long acraspedote strobila of about 300 proglottids (strobila on 2 slides). While the anterior proglottids are wider than long (520–560 × 266–300), the final proglottids are longer than wide (559–741 × 520–530), and continuously increasing in size. The genital atrium is ventrosubmarginal in about the anterior third of the proglottids and alternates irregularly. The cirrus sac is elongate (254 × 60), directed anteromedially from the genital atrium and the sac is thin-walled. The cirrus is unarmed, coiled within the sac and an internal seminal vesicle was not seen; external seminal vesicle absent. Testes arranged in double layer, number 86–97, ovoid, 33–49 in diameter, encircle the female genital complex, and some testes are present anterior to the cirrus sac. Other details of the female genital complex not seen.

REMARKS.

In the original description of *Tetrarhynchus perideraeus*, Shipley & Hornell (1906) described long worms with a slender scolex bearing long bulbs as well as slender tentacles. The tentacles as well as the tentacular sheaths are short and the tentacular armature consists of oblique rows of very minute hooks of uniform size. However, these characters do not adequately define the species. Dollfus (1930) remarked that without examination of the original material, *N. perideraeus* is not distinguishable from *N. lingualis*. A description of *Stenobothrium perideraeum* by Pintner (1930) did not consider the form and arrangement of the tentacular armature, and thus, was not helpful in solving this taxonomic problem. Southwell (1924, 1929a, 1930) described specimens which he named *N. perideraeus*. However, Pintner (1930) noticed that the material observed by Southwell (1929a, 1930) belonged to a different species.

Dollfus (1942) gave a description of *N. perideraeus,* summarising the information given by Shipley & Hornell (1906) and Pintner (1930), and illustrated the species on basis of material collected from *Carcharhinus melanopterus* (Quoy & Gaimard, 1824) from the Gulf of Suez, Egypt. While remarking that the descriptions of the

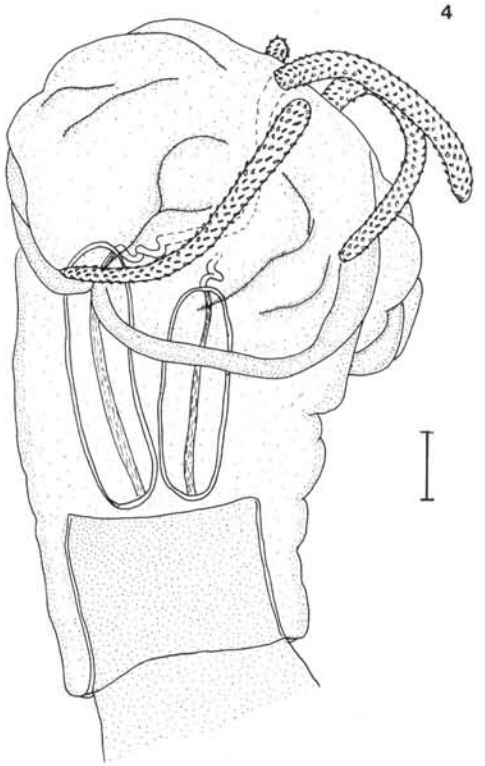

Fig. 4 Scolex of *Nybelinia perideraeus* sp. nov. from *Glyphis gangeticus*. Scale bar=150 µm.

tentacular hooks by Shipley & Hornell (1906) and Pintner (1930) were not unambiguous, he added with his own illustrations given in figs 97–100 a further type of tentacular armature for *N. perideraeus*. He described a characteristic basal armature, where the hook form changes from rose-thorn shaped in the basal part to slender spiniform with sharply recurved tip in the metabasal part. Additionally, the size of the scolex illustrated, 400–500 µm, is much smaller than that given before for *N. perideraeus*. The illustrated specimens from *C. melanoperus* correspond in scolex size and morphology as well as in the detailed described tentacular armature to *N. africana* Dollfus, 1960 (compare Figs 97–100 in Dollfus (1942) with figs 10–19 in Dollfus (1960). Thus, we consider both sets of material to belong to the same species, *N. africana* Dollfus, 1960.

Vijayalakshmi *et al.* (1996) described *N. perideraeus* from *Scoliodon palasorrah* from India with a uniform tentacular armature of minute curved hooks 10µm long. The co-type material examined in the present study demonstrates that the tentacular armature of *N. perideraeus* is homeoacanthous heteromorphous with rose-thorn shaped tentacular hooks of the same size along the tentacle. Thus, the identity of the material described by Vijayalakshmi *et al.* (1996) still needs to be clarified.

The measurements and figures of the co-type specimen VNHM 2109 as well as the size of the tentacular hooks correspond closely with those of *N. dakari* Dollfus, 1960 from the west African coast and it is therefore considered synonymous with *N. perideraeus*. Thus, *Nybelinia perideraeus* is the only species in subgrouping IIAb of Palm *et al.* (1997), characterized by a homeoacanthous, heteromorphous metabasal armature without a characteristic basal armature and basal tentacular hooks of similar size or bigger than in the metabasal part of the tentacle.

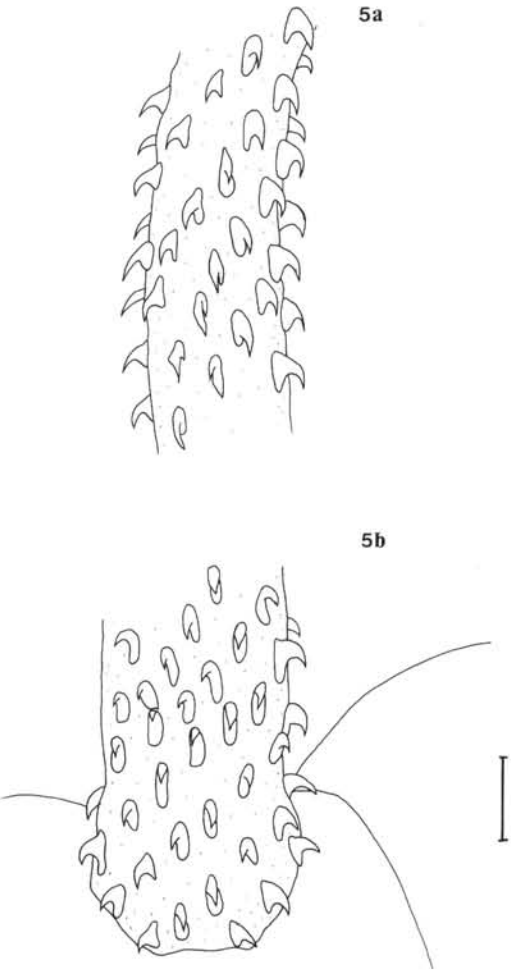

Fig. 5a–b *Nybelinia perideraeus*. a. metabasal tentacular armature, internal surface. b. basal tentacular armature, external surface. Abbreviation: B=bothridia. Scale bar=20 µm.

Kotorella pronosoma (Stossich, 1901) Euzet & Radujkovic, 1989 (Figs 7–9)

SYNONYMY.
Rhynchobothrium pronosomum Stossich, 1901
Nybelinia pronosomum (Stossich, 1900) Dollfus, 1930
Otobothrium pronosomum (Stossich, 1900) Dollfus, 1942
Tetrarhynchus herdmani Shipley & Hornell, 1906 of Southwell (1929a, b 1930)
Stenobothrium herdmani (Shipley & Hornell, 1906) Pintner, 1913
Nybelinia (Nybelinia) herdmani (Shipley & Hornell, 1906) Dollfus, 1930

MATERIAL EXAMINED. Type VNHM 2095, 1 adult from *Himantura imbricata* (Bloch & Schneider, 1801) (=*Trygon walga*), Sri Lanka (Ceylon) (collection of Shipley & Hornell); VNHM 2097, 1 adult from *Himantura imbricata*, Sri Lanka (collection of Shipley & Hornell).

DESCRIPTION. *Kotorella pronosoma* was described in detail by Euzet & Radujkovic (1989). The scolex measurements of *K. pronosoma* together with the measurements of the type material of

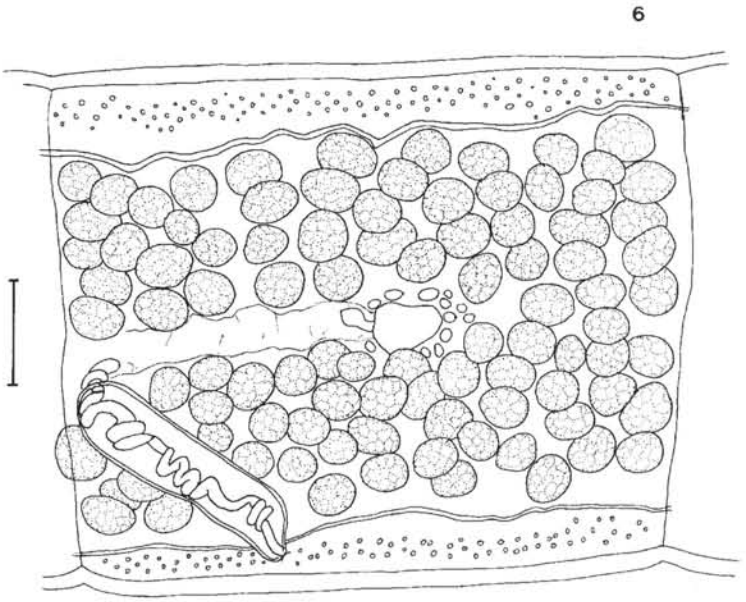

Fig. 6 Mature proglottid of *Nybelinia perideraeus*. Scale bar=100 µm.

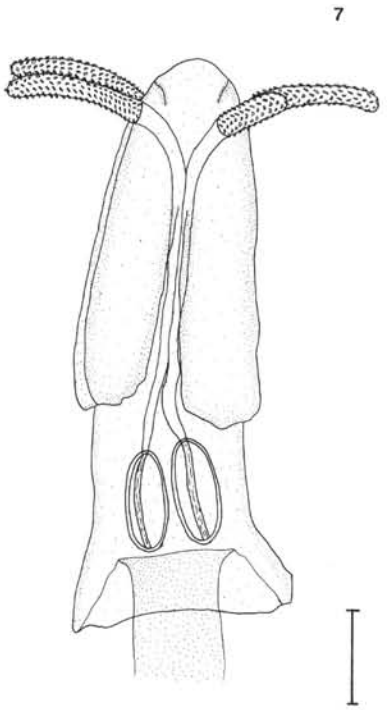

Fig. 7 Scolex of *Kotorella pronosoma* (*Nybelinia herdmani*) from *Himantura imbricata*. Scale bar=150 µm.

N. herdmani are summarised in Table 1. In addition to these data, the following characters were observed: The 4 bothridia of *N. herdmani* (Shipley & Hornell, 1906) have free lateral and posterior margins with a distinct space between the bothridia (Fig. 7). The bothridial margins seem not to be fused with the scolex even apically. Prebulbular organs around the tentacle sheaths are absent and muscular rings are not visible.

The armature of *Kotorella pronosoma* was described by Euzet & Radujkovic (1989) and Campbell & Beveridge (1994). The armature of the type material of *N. herdmani* is homeoacanthous, heteromorphous (Figs 8a–b). The tentacular hooks on the antibothridial tentacle surface increase in size towards the distal part of the tentacle, the hooks on the bothridial tentacular surface are of similar size along the tentacle. The metabasal hooks on the bothridial surface are tightly packed and have a broad, diamond-shaped basal plate (L=13.5–14.5, B=8). The distance between these hooks appears to be slightly wider towards the apical part of the tentacle. On the antibothridial surface, slender and spiniform hooks without enlarged basal plates increase in size towards the end of the tentacle. The hooks are more widely spaced than on the bothridial surface. Basal hooks: L=6–8, B=2–3; metabasal hooks: L=13–14, B=3–4. A basal tentacular swelling is absent. hsr (basal)=8, hsr (metabasal)=6–7.

The morphology of the mature proglottid of *N. herdmani* is given in Fig. 9. *N. herdmani* has a short acraspedote strobila of about 76 proglottids behind the velum. While the anterior proglottids behind the velum are wider than long (345–360 × 20–40), their length increases in size towards a rectangular shape (276–310 × 175–215). The final proglottids are longer than wide (715–755 × 560–610). The genital atrium is ventrosubmarginal, pre-equatorial and alternates irregularly. The cirrus sac is elongate (242 × 70), directed medially from the genital atrium and the sac is thin-walled. The cirrus is unarmed, coiled within the sac and an internal seminal vesicle was not seen; external seminal vesicle absent. Testes overlapping but arranged in single layer, number between 35–48. The size of ovoid testes varies depending on number of proglottid (anterior proglottids: 37–47; median proglottids: 53–64; posterior

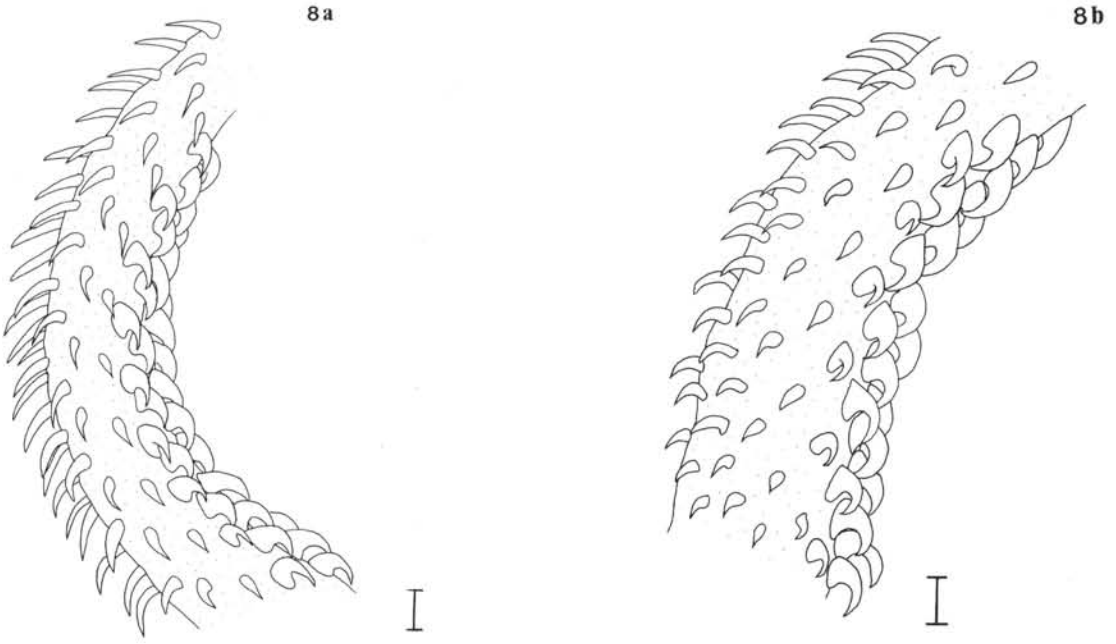

Fig. 8a–b *Kotorella pronosoma* (*Nybelinia herdmani*). a. metabasal tentacular armature, external surface. b. basal tentacular armature, external surface. Scale bars=10 µm.

proglottids: 71–85 in diameter). Testes encircle the female genital complex (Fig. 9). Female genital complex median.

REMARKS.

In 1906, Shipley & Hornell described *Tetrarhynchus herdmani* from the alimentary canal of *Himantura imbricata* and *Rhynchobatus djeddensis* from the Gulf of Mannar (Sri Lanka). However, only a few measurements were given and the tentacular hooks were described as being similar and of the same size (10 µm) along the tentacle. Southwell (1929a) cited Shipley and Hornell (1906) and listed *T. herdmani* with *T. perideraeus* as a species with extremely minute (practically equal in size) hooks arranged in spirals (Southwell, 1929b). Pintner (1930) re-described the type material of *T. herdmani* and reported a homeoacanthous, heteromorphous armature. His description of the tentacles with about 10 small hooks per row, tightly arranged and forming a mosaic on one side, was emended by Dollfus (1942), who reported 14 µm large hooks with a large base. The drawings of Pintner (1930, Figs 67a–b´) also give a metabasal hook size between 10–11 µm on the lateral (antibothridial) and 10–14 µm on the medial (bothridial) tentacle surface (7–8 µm of basal antibothridial hooks and 10–14 µm of basal bothridial hooks? / Fig. 67a´and 67b´). Thus, the drawings of the tentacular armature as given by Pintner (1930) correspond to the armature of the type material as described above. Our scolex measurements of the types of *N. herdmani* also correspond to those given by Pintner (1930) and Dollfus (1942) for *N. herdmani* (Table 1).

Euzet & Radujkovic (1989) re-described *Kotorella pronosoma* (Stossich, 1901) from the spiral valve of *Dasyatis pastinaca* L. from the Mediterranean Sea. Though the absolute values of their scolex measurements are about 1/3rd smaller than those given for *Nybelinia herdmani* (Table 1), the scolex and bulb ratios are very similar (see above). The hooks size as given by Euzet & Radujkovic (1989) for *K. pronosoma* is also about 1/3rd smaller (hooks size between 5–8 µm). Campbell & Beveridge (1994, Figs 7.48–7.50) gave additional figures of the scolex and tentacular armature of *K. pronosoma* with a metabasal/apical hook size of about 10–11 µm (bothridial and antibothridial) and a basal hooks size of about 8–9 µm (bothridial) and 5–6 µm (antibothridial). The arrangement of the tentacular hooks, however, correspond between all specimens of *N. herdmani* and *K. pronosoma* considered above.

The only detailed description of the strobila is given by Euzet & Radujkovic (1989) for *Kotorella pronosoma*. The general morphology of the proglottids (Fig. 2 in Euzet & Radujkovic, 1989), the central female genital complex, the pre-equatorial irregularly alternating cirrus sac and number of testes is corresponding to the type material of *N. herdmani* (Fig. 9). Thus we conclude that both material belongs to the same species, *Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989.

DISCUSSION

With the description of *Nybelinia southwelli* sp. nov. and the synonymy of *N. dakari* with *N. perideraeus* and *N. herdmani* with *Kotorella pronosoma*, the number of adequately described valid species within the genus *Nybelinia* is reduced from 44 to 43. However, the genus remains the most species-rich within the order Trypanorhyncha.

Palm *et al.* (1997) pointed out that the genus *Nybelinia* seems to have many species with a cosmopolitan distribution pattern. In the present study, the two synonymies reported further extend the reported range of distribution for both species. *Nybelinia perideraeus* now can be considered to have a transoceanic distribution. It was originally described from Sri Lanka by Shipley & Hornell (1906), and was re-described as *N. dakari* from the north-west African coast (Dollfus, 1960) and recorded as *N. dakari* from the China Sea by Yang *et al.* (1995). If the specimens labelled *N. perideraeus* in the

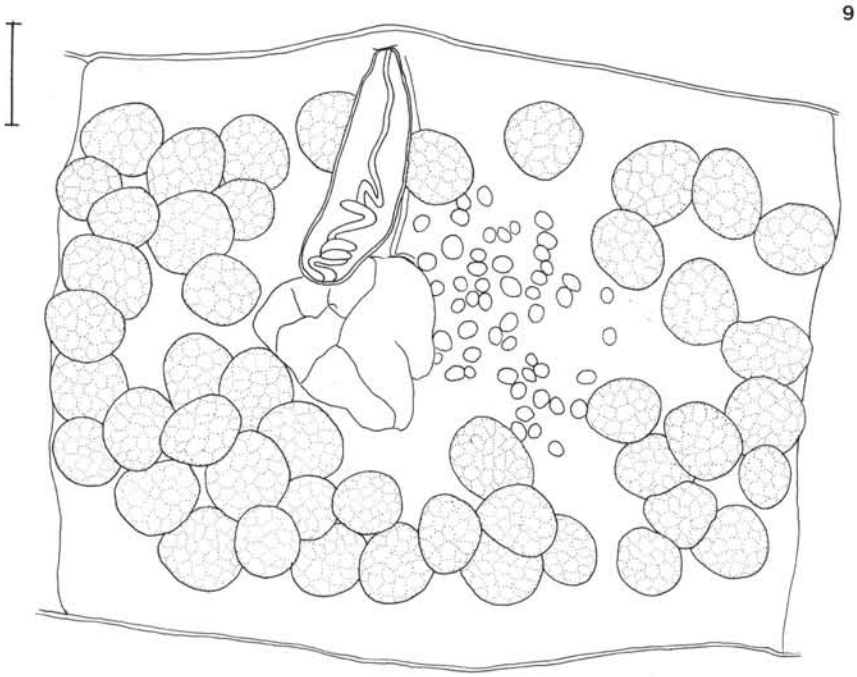

Fig. 9 Mature proglottid of *Kotorella pronosoma* (*Nybelinia herdmani*). Scale bar=100 µm.

Table 1 Scolex measurements (in µm) of *Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989 and *Nybelinia herdmani* (Shipley & Hornell, 1906) (n=number of specimens examined)

species	*Kotorella pronosoma*		*Nybelinia herdmani*	
Author / Year	Euzet & Radujkovic (1989)	Shipley & Hornell (1906)	Pintner (1930)	Present study
n	2	¾	–	2
Scolex length:	650	1000	900 (880)[2]—1000	980 (900–1060)
Scolex width[1]	–	–	–	374 (297–450)
Pars bothridialis	380	–	600 (570–630)	610 (570–650)
Pars vaginalis	550	–	615 (590–640)	615 (590–640)
Pars bulbosa	110	80–100	155 (150–160)	192 (188–195)
Bulb length	100	Short	160 (140–180)	170 (160–180)
Bulb width	60	–	110 (90–130)	100 (90–110)
Velum	140	–	160 (140–180)	160 (140–180)
Bulb length/bulb width	1,6 : 1	–	1,5 : 1	1,7 : 1
pbo/pv/pb..	3,5 : 5 : 1	–	3,9 : 4,0 : 1	3,2 : 3,2 : 1
Tentacle length	250–275	–	–	308 (260–357)
Tentacle width	12–15	–	–	16–29

[1] Maximum width
[2] Pintner (1930) in Dollfus (1942)

drawings by Dollfus (1942) are considered to belong to *N. africana*, *N. africana* has now been reported to occur all around Africa, from the Mediterranean, the Gulf of Suez and the north-west and south-east African coasts (Dollfus, 1942, 1960, Palm *et al.*, 1997). Similarly, *Kotorella pronosoma* (*N. herdmani*) is known to occur in the Mediterranean (Euzet & Radujkovic, 1989) and in the Indian Ocean (Shipley & Hornell, 1906). This indicates not only a transoceanic distribution pattern for the tentacullariid trypanorhynch species within the genera *Tentacularia* and *Nybelinia* but also for *Kotorella*. Thus, it seems that the tentacullariid trypanorhynchs *sensu* Palm (1995, 1997) not only demonstrate a remarkable morphological uniformity within the family but also a similar distribution pattern, indicating a similar life cycle biology. This supports the suppression of the family Kotorellidae Euzet & Radujkovic, 1989, as proposed by Campbell & Beveridge (1994) and Palm (1995, 1997).

The synonymy of *Nybelinia herdmani* with *Kotorella pronosoma* demonstrates the high similarity between species belonging to these two tentacullariid genera. However, in *K. pronosoma*, the basal hooks with a diamond shaped basal plate also demonstrate a similarity to the basal hooks of *Tentacularia coryphaenae* Bosc, 1797 (see Figs 2–4 in Palm, 1995). Additionally, a wide space between the elongated bothridia appears to be characteristic only for these two genera, which is in contrast to more triangular and more tightly spaced bothridia within the genus *Nybelinia*. These differences still

justify the genus *Kotorella* Euzet & Radujkovic, 1989 within the Tentaculariidae Poche, 1926. However, the gross morphological characters such as scolex form, proportions and form of the bulbs indicate a close phylogenetic relationship between *Kotorella* and *Nybelina*, as proposed by Campbell & Beveridge (1994) and Palm (1995, 1997). Interestingly, a cladistic analysis of the genera within the Trypanorhyncha failed to assign the genus *Kotorella* to the same clade as the other tentacullariid genera (Beveridge *et al.*, 1999).

The scolex measurements for *Nybelinia southwelli* sp. nov. appear to be variable. Although having a similar scolex size to the holotype, the tentacular hooks of the paratype were distinctly smaller. It appears that measurements of armature within a species can show variability as do other scolex measurements, e.g. scolex length (*N. nipponica*: 1.35–2.9; *N. karachii*: 1.25–2.5 (Yamaguti, 1952, Kurshid & Bilqees, 1988)), scolex width (*N. beveridgei*: 2.1–3.1; *N. thyrsites*: 0.66–1.06 (Palm *et al.*, 1997, Beveridge & Campbell, 1996)) and bulb length (*N. nipponica*: 310–550 (Yamaguti, 1952)). The synonymy of *Nybelinia herdmani* with *Kotorella pronosoma* gives a further example on scolex variability within tentacullariid trypanorhynchs. The absolute values of scolex measurements as well as hook sizes varied about 1/3rd of total value between the different specimens. *Kotorella pronosoma* as described by Euzet & Radujkovic (1989) can be considered as smaller specimens than the material examined by us, which is reflected in both, smaller scolex measurements and smaller hooks. This observation generally questions the usage of minor absolute values in scolex and hook measurements as main species distinguishing characters within tentacullariid cestodes. A similar variability in the scolex morphology of trypanorhynch plerocerci has been demonstrated for *Otobothrium penetrans* by Palm *et al.* (1993). Whether such differences are generally due to different host species or a different age of the postlarvae, plerocerci or adults compared cannot be decided at present.

This variability within trypanorhynch cestodes has resulted in the description of several invalid species, especially within the genus *Nybelina*, as proposed by Palm *et al.* (1997). However, the subgrouping of *Nybelinia* species based on characters of the tentacular armature appears to be a useful tool for further taxonomic studies within the genus (see Palm *et al.*, 1997). In the present study, all species within the subgroupings IIAb and IIBa are clearly defined. Further studies are needed to clarify the validity of species within the other 6 groupings, leading to a complete revision of the genus *Nybelina*.

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