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Cetorhinicola n. g., *Shirleyrhynchus* n. g. and *Stragulorhynchus* n. g., three new genera of trypanorhynch cestodes from elasmobranchs in Australian waters

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Abstract

Three new genera of trypanorhynch cestodes are described from Australian elasmobranchs: *Cetorhinicola acanthocapax* n. g., n. sp. from *Cetorhinus maximus* (Gunner, 1765), with four bothridia joined by a velum, a typical heteroacanthous armature with the ends of the hook rows not meeting on the external surface, and enlarged hooks on the base of the tentacle; *Shirleyrhynchus butlerae* n. g., n. sp., from *Dasyatis fluviorum* Ogilby, 1908 and *D. sephen* (Fðrsskal, 1775), with four bothridia, typical heteroacanthous armature, enlarged basal hooks, testes in linear rows, and lacking seminal vesicles; *Stragulorhynchus orectolobi* n. g., n. sp., from *Orectolobus tentaculatus* (Peters, 1864) (type-host), *O. maculatus* (Bonnaterre, 1788) and *O. ornatus* (de Vis, 1882), with four bothridia, poeciloacanthous armature, with a band of hooklets on the external surface of the tentacle, external seminal vesicle, hermaphroditic duct, accessory seminal vesicle and post-ovarian testes. None of the new genera is readily accommodated by the existing classification of the Trypanorhyncha: the first two genera are tentatively allocated to the Gilquiniidae and the last to the Gymnorhynchidae.

Introduction

The trypanorhynch fauna of Australian elasmobranchs is poorly known, with few species having been described from the adult stage (Beumer *et al.*, 1982). Not surprisingly, recent collections have yielded a variety of genera, including three which are described as new in this paper. The genera are of particular interest because they are not readily accommodated within the currently accepted taxonomy of the trypanorhynch cestodes, and they suggest that a re-evaluation of characters separating the higher taxa (cf. Dollfus, 1942) ought to be considered.

Methods

Cestodes collected by B.G. Robertson and S. Butler were removed from the spiral valves of elasmobranchs and were either relaxed in tap-water to evert the tentacles and then fixed in formalin, or were fixed *in situ* with Bouin's fluid or hot formalin. The method of fixation of specimens borrowed from the South Australian Museum is not known. Tentacles dissected free from scoleces were mounted and examined in glycerine jelly. Cestodes were stained with celestine blue, dehydrated in ethanol, cleared in clove oil and mounted in balsam. Serial sections were cut at a thickness of 7 μm and stained with haematoxylin and eosin. Drawings were made using a drawing tube attached to an Olympus BH microscope. Measurements are given in the text in μm, unless otherwise stated: the range of 10 measurements is followed by the mean in parentheses.

Type-specimens have been deposited in the South Australian Museum (SAM), Adelaide, the British Museum (Natural History) (BMNH), London, and the United States National Museum Helminthological Collection (USNMHC), Beltsville, Ma.

Cetorhinicola n. g.

Diagnosis

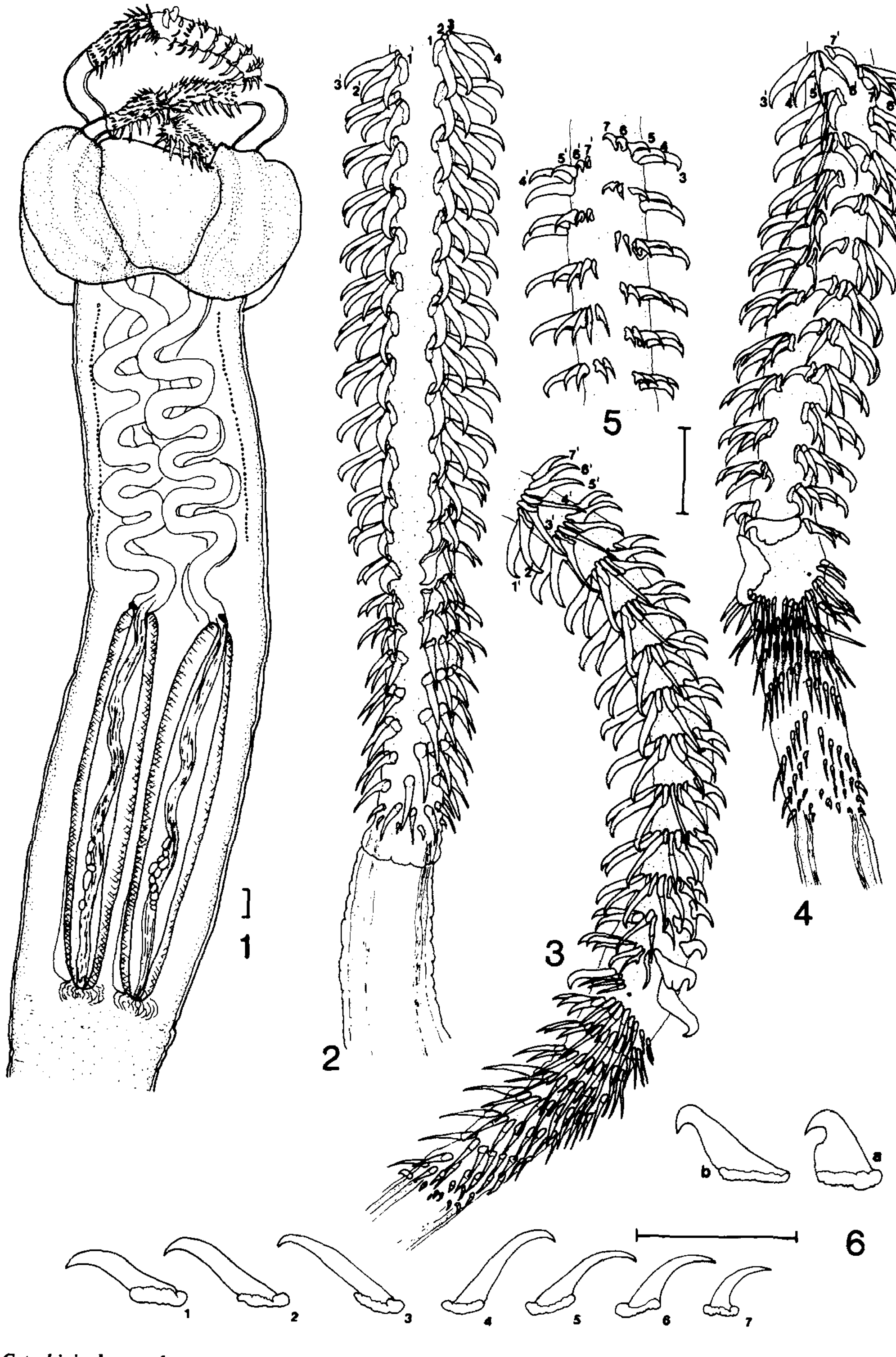
Scolex elongate, craspedote. Four bothridia, joined on posterior margin by velum. Tentacles long, slender; basal swelling and distinctive basal armature present. Metabasal armature heteroacanthous, heteromorphous, typical. Hooks solid, arranged in half-spiral rows ascending from internal to external surface. Hooks 1(1′) of principal rows widely separated on internal surface; rows fail to meet on external surface. Pars vaginalis long; tentacle sheaths sinuous. Bulbs elongate, retractor muscle originates at base of bulb. Prebulbar organ present. Pars postbulbosa short. Proglottis morphology unknown. Parasites of basking sharks (Cetorhinidae).

Cetorhinicola acanthocapax n. sp. (Figs 1–6).

Description

Scolex 2.7–3.2 (3.0) mm long; maximum width 510–720 (620). Pars bothridialis 400–500 (530), rectangular in transverse section. Bothridia auriculate, widely separated as pairs on dorsal and ventral surfaces; pairs united posteriorly by distinct velum; margins not prominently elevated. Pars vaginalis 1.40–1.92 (1.70) mm, sheaths regularly sinuous; bulbs 1.17–1.30 (1.23) mm long, diameter 150–220 (190). Prebulbar organs present, retractor muscle originates at base of bulb. Small clusters of gland cells associated with retractor muscle in posterior half of bulb. Pars postbulbosa short, 60–140 (90), not apparent in contracted specimens; prominent muscle fibres connect bases of bulbs with pars proliferans. Tentacles emerge from anterior bothridial margins, hyperextensive; proximal region up to 560 long, unarmed, enveloped by sleeve-like sheath; distal portion armed, divided into basal and metabasal regions. Metabasal region 66–80 (73) in diameter; basal swelling only slightly enlarged, tapering, 80–100 (94) in diameter.

Hooks of basal armature (Figs 2, 5) dissimilar on external and internal surfaces. Hooks form 10–11 half spiral rows with up to 12 hooks per row; rows begin on internal face and end on external face. Distal region of external face of bulb with two large bill-hooks which are hooks 7(7′) of rows 10 or 11 (Figs 3, 4); proximal hook (1′), 66–84 (75) long, base length 36–56 (40); distal hook (1), 50–72 (59) long, base length 36–50 (42). Remainder of external basal armature with rows of spiniform hooks aligned in inverted 'V' formations. Hooks of most proximal row tiny, gradually elongating through row 4; hooks of rows 5–9 much longer, spiniform, up to 70 long. Internal surface of basal armature appears as subtle continuation of metabasal armature. Hooks 1(1′) of half spiral rows widely separated, rows alternate except for most proximal two rows which completely encircle base. Hooks 1(1′) of rows 10 and 11 robust, falciform; remaining hooks spiniform, decreasing in size at extremities. Metabasal armature composed of ascending half-spiral rows of seven principal hooks each; alternate rows widely separated on internal and external face of tentacle (Figs 2, 5). All hooks falciform; longest hooks at middle of row; base length decreases as row continues toward external face. Hooks 1(1′) 62–74 (67) long, base length 28–38 (32); hooks 2(2′) 64–80 (73) long, base 20–28 (24); hooks 3(3′) 74–82 (79) long, base 18–28 (25); hooks 4(4′) 66–76 (71) long, base 14–28 (23); hooks 5(5′) 60–70 (65) long, base 16–28 (24); hooks 6(6′) 48–68 (56) long, base 16–26 (22); hooks 7(7′) 36–50 (44) long, base 18–24 (21). Initiation of segmentation evident but none contains genitalia.



Figs 1–6. Cetorhinicola acanthocapax n. g., n. sp. 1. Scolex. 2. Tentacle, basal and metabasal regions, internal surface; bothridial surface to right hand side. 3. Tentacle, basal and metabasal regions, antibothridial surface. 4. Tentacle, basal and metabasal regions, external surface, bothridial surface to right hand side. 5. Tentacle, metabasal region, external surface; bothridial surface to right hand side. 6. Hooks 1–7 of metabasal region in profile; enlarged hooks of antibothridial (a) and bothridial (b) surfaces of tentacle in profile. Scale lines 0.1 mm.

Type host: Cetorhinus maximus (Gunner, 1765) (Lamniformes: Cetorhinidae).
Site in host: Spiral valve.
Type-specimens: Holotype, in SAM no. V4087; 36 paratypes in SAM no. S2774; 43 paratypes no. HC16703; one paratype in BMNH no. 1987.5.1.2; one paratype in USNMHC no. 79702.
Type-locality: Encounter Bay, South Australia.
Etymology: acanthocapax from 'acanth' = hook and 'capax' = spacious, referring to the hookless longitudinal space on the external surface of the tentacle.

Remarks

Dollfus (1942) divided the genera and families of the Trypanorhyncha into three major groups based primarily upon the armature of the tentacle. Heteroacanthous trypanorhynchs with hooks of differing shape arranged in ascending rows or half-circles were divided by Dollfus (1942) into typical forms, if the ascending rows abutted or over-ran one another on the external surface, or poeciloacanthous forms if a chainette or band of small hooks was present on the external surface. The only exception to this pattern occurs in the genus *Pterobothrium* Diesing, 1850, in which most species have a band of small hooks on the external face of the tentacle, while two, *P. dasybati* Yamaguti, 1936 and *P. hawaiiensis* Carvajal, Campbell & Cornford, 1976, have none. The latter phenomenon is generally interpreted as a secondary loss of the band of hooks. The armature of *Cetorhinicola* could thus be interpreted either as that of a typical heteroacanth with the minor modification that the hook rows neither abut nor overlap, but fail to meet at all, leaving a space along the external surface of the tentacle, or alternatively, it could be interpreted as a poeciloacanth with secondary loss of the armature of the external surface, as occurs in certain species of *Pterobothrium*. Several factors mitigate against accepting the latter interpretation. First, in the genus *Pterobothrium*, congeners exist which enable the absence of hooks on the external surface to be interpreted as a secondary loss. *Cetorhinicola*, being monotypic, allows no such interpretation at present. Secondly, intercalary rows of hooks occur in all species of *Pterobothrium*, and this character is common in other poeciloacanthous genera (*Dasyrhynchus* Pintner, 1928; *Grillotia* Guiart, 1927) but does not occur among the typical heteroacanths. On this basis *Cetorhinicola* can be aligned with the latter group only. A number of additional characters support this conclusion. A prebulbar enigmatic organ, as present in *Cetorhinicola*, is present in the heteroacanths (Eutetrarhynchidae Guiart, 1927) and homeoacanths (Tentaculariidae Poche, 1926; Tetrarhynchobothriidae Dollfus, 1969), but is not known to occur in any of the poeciloacanthous genera (Dollfus, 1942). Clusters of gland cells around the retractor muscle within the bulbs, such as occur in *Cetorhinicola*, are also common in the Eutetrarhynchidae, Tetrarhynchobothriidae and Gilquiniidae, but do not occur in any poeciloacanthous genera. The hooks of *Cetorhinicola* are solid rather than hollow, and solid hooks are also known from the Tentaculariidae and the Eutetrarhynchidae (e.g. *Trimacracanthus* Beveridge & Campbell, 1987) but not among the poeciloacanthous genera. Finally, the gross, asymmetrical enlargement of one to three hooks on the internal surface of the basal swelling occurs in the heteroacanthous genera *Trimacracanthus* and *Oncomegas* Dollfus, 1929 but not in poeciloacanthous genera. Hook enlargement, in this instance of hollow hooks, on the base of the tentacle of poeciloacanthous genera *Gymnorhynchus* Rudolphi, 1819, *Molicola* Dollfus, 1935 and *Lacistorhynchus* Pintner, 1913, is generally symmetrical, involving longitudinal rows of hollow hooks and may be a parallel but unrelated development. Proglottis anatomy, which might have helped decide the systematic position of *Cetrohinicola* is not available, but evidence from the scolex and tentacular armature suggests that the genus should be interpreted as a typical heteroacanth rather than as a poeciloacanth.

Among the typical heteroacanths, a similar metabasal armature occurs in *Prochristianella* Dollfus, 1946 with hooks 3(3′) of each row the largest and the remainder diminishing in size. The presence of asymmetrical, enlarged hooks on the anterior internal surface of the basal swelling suggests similarities between *Cetorhinicola* and *Trimacracanthus*, both genera having solid hooks. However, the traditional divisions of the typical heteroacanths, on the basis of number of bothridia (Dollfus, 1942) aligns *Cetorhinicola* with *Gilquinia* and the Gilquiniidae which possesses four bothridia rather than the Eutetrarhynchidae and Tetrarhynchobothriidae which possess two bothridia. The auriculate bothridia jointed by a velum, the hook-free space on the external face of the tentacle, and the presence of two asymmetrical large hooks on the basal swelling separate *Cetorhinicola* from all other genera and a new genus has been erected on the basis of these characters. The genus is assigned to the Gilquiniidae because it possesses four bothridia: however, many characters link the genus to the Eutetrarhynchidae rather than the Gilquiniidae. The only other genus of trypanorhynch cestodes known from pelagic, plankton feeding sharks is *Mixodigma* Dailey & Vogelbein, 1982 from *Megachasma pelagios* Taylor, Compagno & Struchsakes, 1983. This genus, curiously enough, is characterized by having both poeciloacanthous (a chainette) and heteroacanthous armatures on the same tentacle and for that reason was placed in its own family, the Mixodigmatidae. *Mixodigma* is clearly different from *Cetorhinicola* and appears to be more closely aligned to the poeciloacanths than to the typical heteroacanths.

Cetorhinicola was found in very large numbers in the preserved spiral valve contents of a single basking shark. Although segmentation had begun in many specimens no mature segments were found.

***Shirleyrhynchus* n. g.**

Diagnosis

Scolex long, craspedote. Four ovate bothridia present. Bulbs elongate, retractor muscle originates at base of bulb. Prebulbar organs present. Pars vaginalis long; tentacle sheaths sinuous; pars postbulbosa short. Metabasal armature heteroacanthous, heteromorphous, typical. Basal armature distinctive; basal swelling present. Basal hooks hollow; metabasal hooks solid. Strobila acraspedote, apolytic; segments elongate, numerous. Testes preovarian, in parallel longitudinal rows. Genital pores marginal, irregularly alternate. Seminal vesicles absent. Vitelline follicles circumcortical. Uterus simple, tubular, extends to anterior extremity of segment; uterine pore present. Eggs tanned, spherical. Parasites of Batoidea (Dasyatidae).

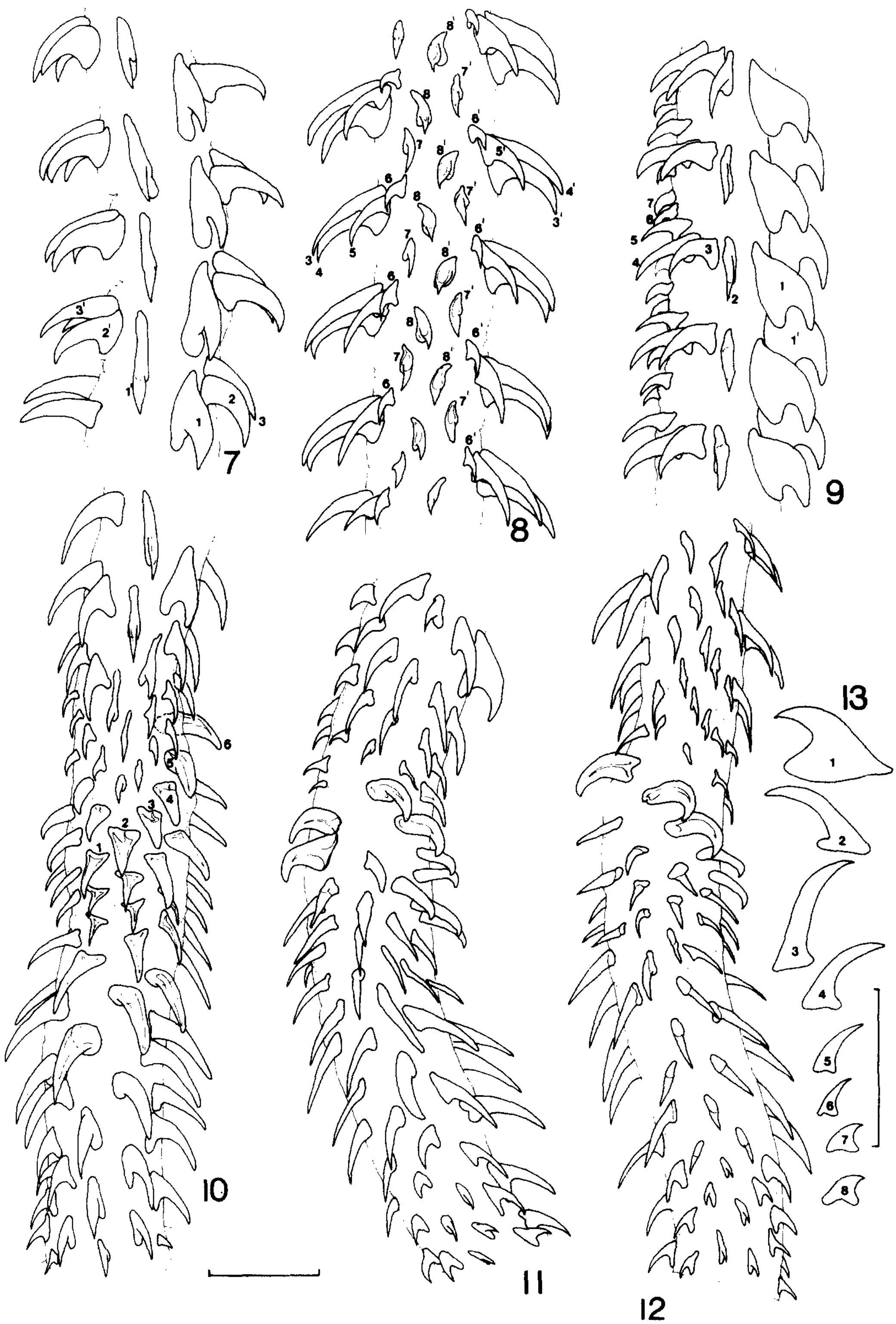
***Shirleyrhynchus butlerae* n. sp.** (Figs 7–21)

Description

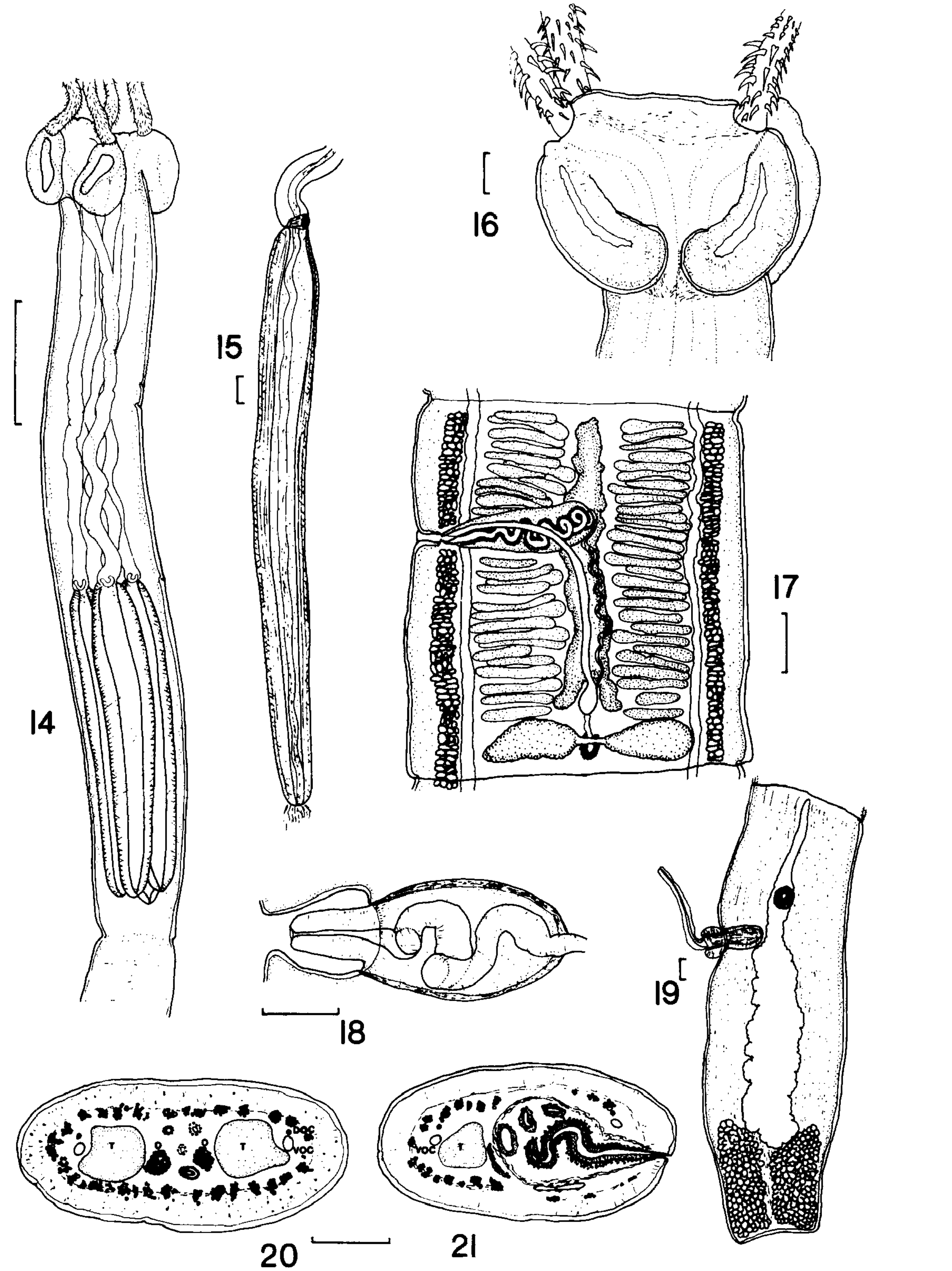
Small cestodes up to 22 mm long, with up to 38 segments in gravid strobilae. Segments apolytic. Scolex acraspedote, 4.37–5.20 (4.74) mm long; maximum width at bulbs 550–1000 (690). Four bothridia, narrow, ovate; tentacular aperture resembling longitudinal slit; pars bothridialis 450–630 (520). Pars vaginalis 2.42–3.05 (2.75) mm long, sheaths only slightly sinuous. Bulbs elongate, 1.62–2.03 (1.83) mm long, 120–230 (180) in diameter; prebulbar organ present; retractor muscle originates at posterior end of bulb, not associated with gland cells; pars postbulbosa short, 110–270 (200). Neck present at junction of scolex and strobila.

Tentacles long with slight basal swelling, 80–110 (90) in diameter, 30–50 (40) in diameter at mid-tentacle. Armature heteroacanthous, heteromorphous, typical. Hooks of basal armature hollow; metabasal hooks solid. Basal armature consists of 10–11 rows of hooks forming quincunxes around tentacle; hooks dissimilar in different rows (Figs 10–12). Hooks of rows 1–3 thorn-like with well-developed posterior heel, increasing in size distally; hooks of rows 4–6 spiniform, 56–74 (63) long, base length 16–28 (21); hooks of rows 7–9, shorter, sagittate with transverse base; rows 10–11 of very stout triangular, recurved hooks, 30–54 (44) long, base 14–28 (18).

Hooks of metabasal armature (Figs 7–9) arranged in alternate, ascending halfspiral rows of eight principal hooks each; rows begin on inner surface and alternately overlap in inverted 'V' formations on external surface. Hooks 1(1′) large, rose-thorn-shaped, length 68–80 (74), base 52–70 (63). Hooks 2(2′) falciform, 64–78 (72) long, base



Figs 7–13. Shirleyrhynchus butlerae n. g., n. sp. Tentacular armature. 7. Metabasal region, internal surface; bothridial surface on right hand side. 8. Metabasal region, external surface; bothridial surface on left hand side. 9. Metabasal region, bothridial surface. 10. Basal region, internal surface; bothridial surface on right hand side. 11. Basal region, antibothridial surface, internal surface on right hand side. 12. Basal region, external surface. 13. Metabasal hooks 1–8 in profile. Scale lines 0.1 mm.



Figs 14–21. Shirleyrhynchus butlerae n. g., n. sp. 14. Scolex. 15. Bulb. 16. Pars bothridialis. 17. Mature proglottis. 18. Cirrus sac. 19. Gravid proglottis. 20. Transverse section showing two rows of testes (T), two lobes of ovary (O) and dorsal (DOC) and ventral (VOC) osmoregulatory canals. 21. Transverse section through cirrus sac. Scale lines: Fig. 14, 1.0 mm; Figs 15–21, 0.1 mm.

24–40 (33). Hooks 3(3′) and 4(4′) falciform, decreasing in size; respective dimensions, length 62–76 (71), base 24–28 (26), and length 52–66 (61), base 20–28 (24). Hooks 5(5′) smaller, almost spiniform, 34–44 (41) long, base 12–20 (17). Hooks 6(6′)–8(8′) displaced antero-medially to hooks 1(1′)–5(5′) of same row. Hooks 6(6′) spiniform, 30–36 (32) long, base 12–18 (16); hooks 7(7′) rose-thorn-shaped, 22–32 (29) long, base 18–24 (22); hooks 8(8′) rose-thorn-shaped, 20–30 (25) long, base 16–24 (21).

Immature segments wider than long, becoming longer than wide with maturity. Mature segments 0.81–1.40 (1.13) mm by 500–700 (580). Gravid segments 1.13–2.05 (1.61) mm by 570–800 (680). Testes fusiform in immature segments, rounded in mature segments, medullary, pre-ovarian, in two longitudinal rows terminating at anterior end of segment. Testes per segment 32–45 (39). Vas deferens sinuous, in midline between ovary and proximal pole of cirrus sac. Cirrus sac large, c.300 by 150, pyriform, thin-walled, reaching midline or slightly beyond. Seminal vesicles absent. Cirrus armed, proximal portion stout, distal portion slender. Genital pores alternating irregularly, marginal, in anterior 35–40% of segment. Genital atrium small. Vagina thick-walled, opening into genital atrium ventral to cirrus sac, curving posteriorly to midline, sinuous as it descends to globular seminal receptacle situated immediately anterior to ovary. Ovary tetra-lobed in cross-section, posterior, dumb-bell-shaped in dorsoventral view; lobes subequal, 180–260 (210) by 200–270 (230), elongate in gravid segments. Ovarian isthmus slender; Mehlis' gland postero-ventral. Uterus median, bifurcated into two short diverticula at proximal end; distal portion tubular, extending to anterior end of segment; gravid uterus saccate; preformed uterine pore present in midline anterior to genital pore. Eggs spherical, tanned.

Type-specimens: Holotype in SAM no. V4088; seven paratypes, serial sections, mounted tentacles, in SAM no. S2773; one paratype in BMNH no. 1987.5.1.1; one paratype in USNMHC no. 79701.
Type host: Dasyatis fluviorum Ogilby, 1908 (Dasyatidae).
Type localities: Moreton and Deception Bays, Queensland.
Other material examined: Four specimens from *Dasyatis sephen* (Fõrsskal, 1775), Fog Bay, Northern Territory.
Etymology: Genus and species are named after the collector, Dr Shirley Butler.

Remarks

The metabasal armature of *S. butlerae*, with ascending rows of hooks, overrunning on the external surface, indicates that the species belongs among the typical heteroacanths, of which three families have been proposed, Gilquiniidae, Eutetrarhynchidae and Tetrarhynchobothriidae. Two of the families (Eutetrarhynchidae and Tetrarhynchobothriidae) have been separated from the Gilquiniidae (Dollfus, 1942, 1969) on the basis of two as opposed to four bothridia. *S. butlerae,* however, has four bothridia, a feature of the Gilquiniidae, but possesses an armature and proglottis morphology more closely related to the Eutetrarhynchidae. In *Gilquinia,* the type-genus of the Gilquiniidae and the only genus with tentacles, hooks 1(1′) are strongly recurved such that the blade tip is adjacent to the surface of the tentacle, and the hook rows abut rather than over-run on the external surface. In *S. butlerae,* hooks 1(1′) are large and rose-thorn-shaped and the hook rows overrun. In species of *Gilquinia,* the bulbs are short and a prebulbar organ is lacking, while the long bulbs and prebulbar organs in *S. butlerae* are common among genera of the Eutetrarhynchidae and Tetrarhynchobothriidae. Similarly, in *Gilquinia,* an accessory seminal vesicle is present, the testes are scattered, the uterus is deviated porally and terminates adjacent to the cirrus sac. In *S. butlerae,* seminal vesicles are absent, the testes are arranged in two longitudinal rows and the uterus is median, as in the Eutetrarhynchidae. In addition, a pre-formed uterine pore is present. Thus, *S. butlerae* clearly represents a new genus, and is here assigned to the Gilquiniidae, because the presence of four bothridia, the traditional means of family separation, indicates an association with this family. However, segment and other characters indicate close similarities with the Eutetrarhynchidae and throw into question total reliance on the number of bothridia to separate trypanorhynch families.

S. butlerae is unusual in that the basal hooks on the tentacle are hollow while those of the metabasal region are solid. Solid hooks are also common in genera of the Eutetrarhynchidae and the Tentaculariidae. *S. butlerae* shows a number of similarities with *Rhinoptericola* Carvajal & Campbell, 1975, particularly the genital ducts, testes and uterine diverticula. It differs markedly in armature, since *Rhinoptericola* has an atypical heteroacanthous armature, and consequently was placed in its own family, the Rhinoptericolidae.

Stragulorhynchus n. g.

Diagnosis

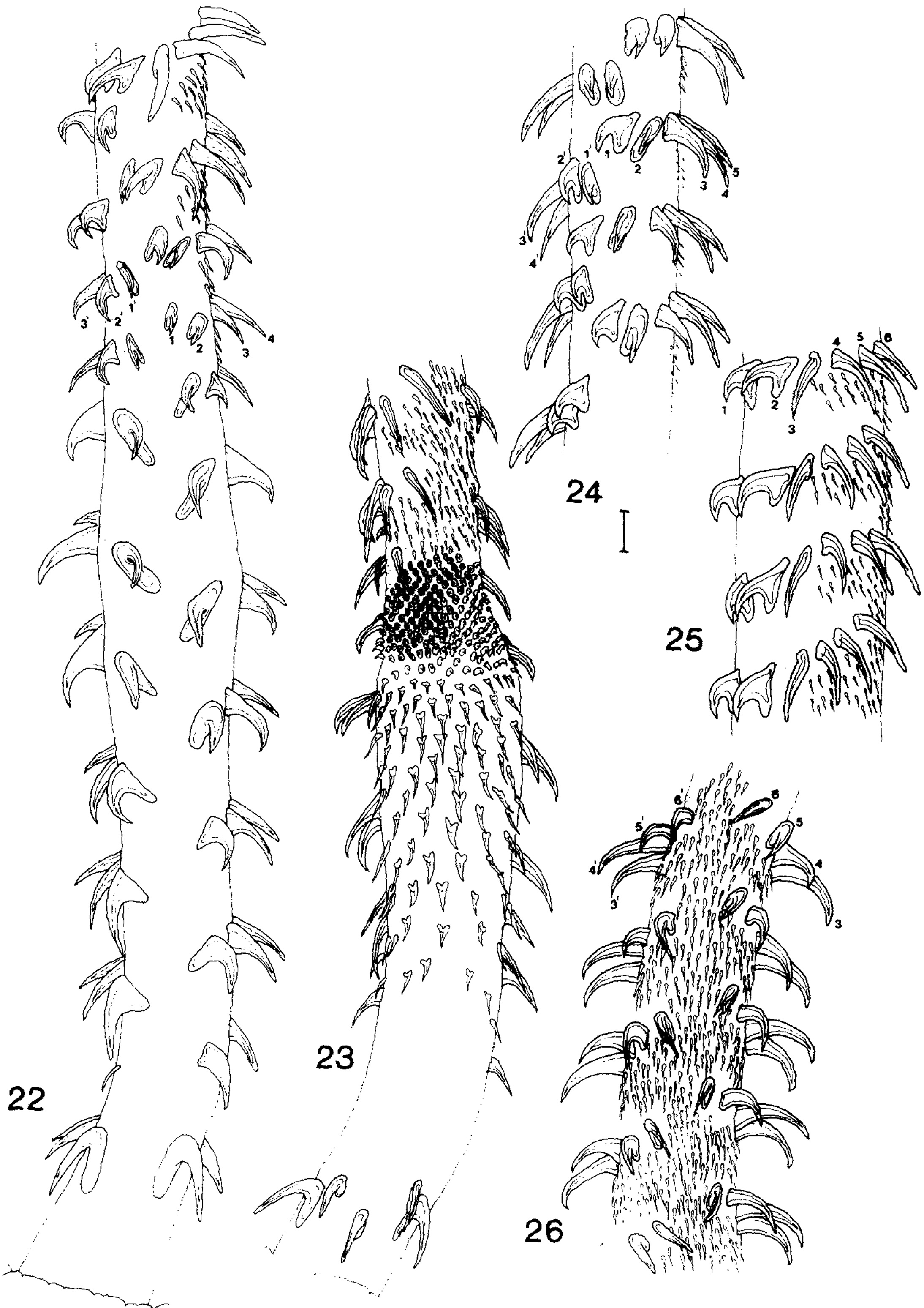
Scolex elongate, acraspedote. Four auriculate, spinose, bothridia. Tentacles emerge from apex of bothridia; basal swelling present. Metabasal armature poeciloacanthous; broad band of hooks present on external surface of tentacle; intercalary rows merge with band of hooks. Distinctive basal armature present. Tentacle sheaths coiled. Prebulbar organs absent. Retractor muscle originates in anterior half of bulb. Pars postbulbosa absent. Neck absent. Segments acraspedote, hyperapolytic. Testes numerous, scattered; pre- and post-ovarian. Genital pores marginal, irregularly alternate. External and accessory seminal vesicles present. Male and female terminalia unite to form hermaphroditic duct. Vitelline follicles circumcortical. Uterus simple, median, tubular; uterine pore absent. Parasites of sharks (Orectolobidae).

Stragulorhynchus orectolobi n. sp. (Figs 22–34)

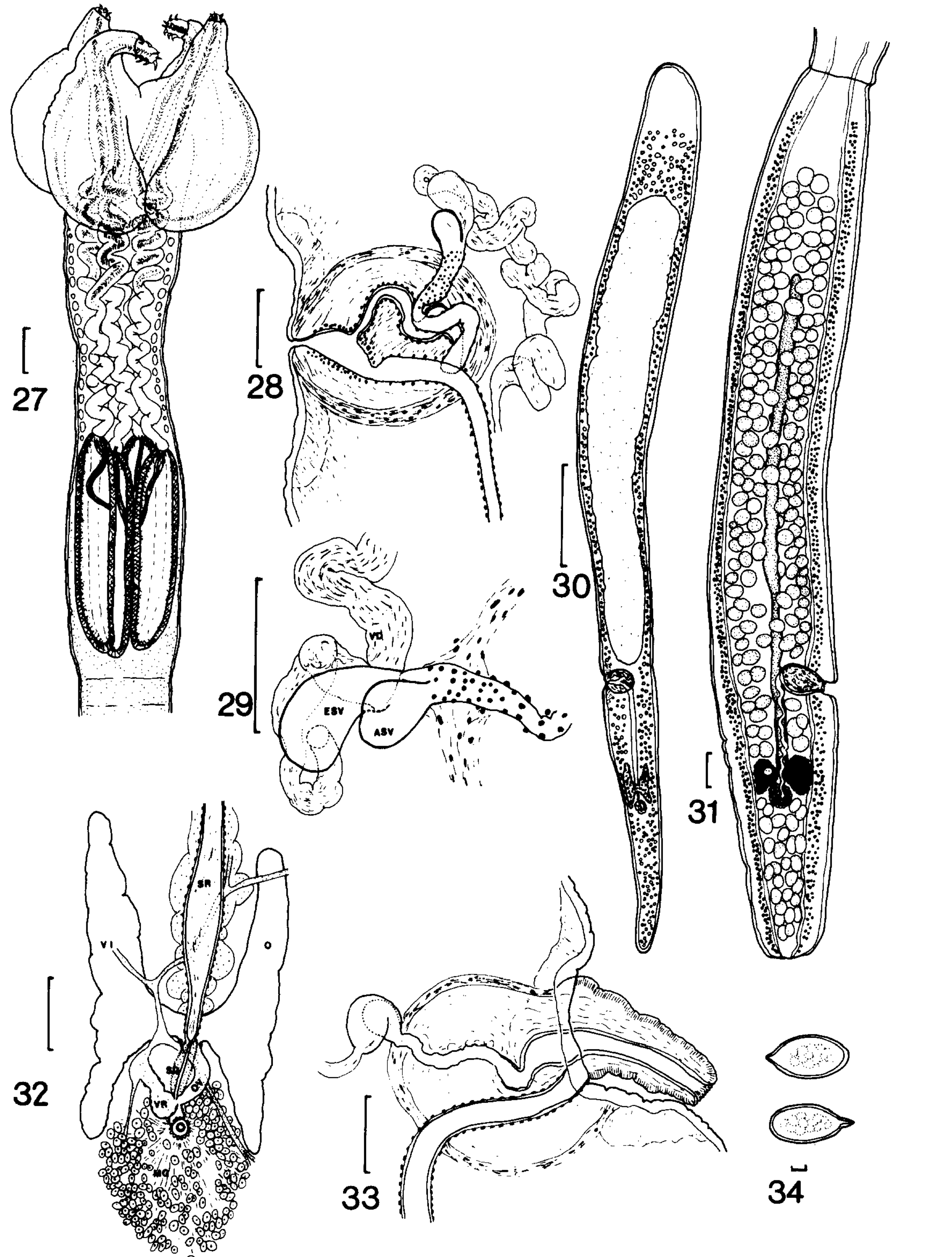
Description

Small cestodes up to 20 mm long, with up to 23 segments in mature strobila; hyperapolytic. Scolex acraspedote, 1.00–1.35 (1.14) mm long, maximum width at bulbs 160–270 (210). Four bothridia, auriculate, fused with scolex antero-medially, spinose; outer margins armed with large spines forming oblique rows of 7–8 spines each. Anterior extremity of each bothridium with conical projection from which tentacle emerges. Pars bothridialis 290–350 (320). Pars vaginalis 650–940 (760); sheaths coiled; large gland cells present in lateral margins of pedunculus scolecis. Bulbs relatively short, 310–460 (370) by 60-100 (70) in diameter; prebulbar organs absent; sheaths distended at unions with bulbs; retractor muscles originate in anterior third of bulb. Bulbs penetrate pars proliferans of strobila; pars postbulbosa absent; neck present.

Tentacles elongate with slight basal swelling; diameter in metabasal region c.20. Hooks hollow, metabasal armature poeciloacanthous. Basal armature consists of dissimilar hooks on internal and external surfaces (Figs 22, 23) and circle of large recurved hooks at base of tentacle, separated from remainder of armature on external face by hook-free space c.80 in length. Internal face of basal armature resembles continuation of seven principal rows in metabasal region except hooks 1(1′) greatly enlarged and widely separated. Distal portion of external face of basal armature densely covered with small, recurved hooks in quincunxial arrangement, up to 15 hooks per row. Proximal portion of basal armature traversed by about 11 rows of sagittate hooks with bifurcate bases. Distal basal armature abuts external band of hooks of metabasal region. Metabasal armature (Figs 24–26) consists of alternating, ascending half-spiral rows of six principal hooks each; two intercalary rows present between principal rows, commencing posterior to hooks 3(3′) or 4(4′), merging imperceptibly with band of hooks on external surface. Principal rows begin on internal face, hooks 1(1′) closely spaced, rows distinctly alternate; hooks 1′ well anterior to hook 1 of opposing row. Hooks 1 and 2 similar, stout, recurved, with long bases of implantation; hooks 1(1′) 14–18 (15) long, base 10–14 (13); hooks 2(2′) elongate, 18–21 (19) long, base 10–15 (13). Remaining hooks of principal rows falciform and similar in size. Hooks 3(3′), 20–23 (21) long, base 4–9 (7); hooks 4(4′) 18–22 (21), base 5–7 (6); hooks 5(5′) 19–22 (21) long, base 4–6 (5);



Figs 22–26. Stragulorhynchus orectolobi n. g., n. sp. Tentacular armature. 22. Basal region, internal surface; bothridial surface on right hand side. 23. Basal region, external surface. 24. Metabasal region, internal surface; bothridial surface on right hand side. 25. Metabasal region, bothridial surface. 26. Metabasal region, external surface; bothridial surface on right hand side. Scale line 0.01 mm.



Figs 27–34. Stragulorhynchus orectolobi n. g., n. sp. 27. Scolex. 28. Hemaphroditic sac; cirrus invaginated. 29. External seminal vesicle (ESV), accessory seminal vesicle (ASV) and vas deferens (VD). 30. Gravid segment. 31. Mature segment. 32. Female genital complex, showing seminal receptacle (SR), sperm duct (SD), oviduct (OV), ovary (O), vitelline ducts (VI) and reservoir (VR) and Mehlis' gland (MG). 33. Hermaphroditic sac with cirrus everted. 34. Eggs. Scale lines: Fig. 30, 1.0 mm; Figs 27–29, 31–33, 0.1 mm; Fig. 34, 0.01 mm.

hooks 6(6′) 18–19 (18) long, base 3–5 (4). Hooks 6(6′) well separated on external face, space between principal rows occupied by small spiniform hooks forming continuous longitudinal band from tip of tentacle to basal armature.

Immature segments wider than long; mature segments greatly elongated, 1.67–4.10 (2.52) mm by 0.23–0.34 (0.28) mm. Genital pores alternate irregularly; genital atrium in posterior half of segment, 0.90–2.90 (1.74) mm from anterior end. Testes scattered throughout medulla in single dorso-ventral layer, 30–60 (40) in diameter, numbering c.150 per segment; 85–138 (119) testes anterior to genital pore, 8–19 (13) between genital pore and ovary, 14–26 (20) testes posterior to ovary. Hermaphroditic sac pyriform, thick-walled, 230–350 (300) by 170–300 (260); thick-walled hermaphroditic duct present, sometimes forming sinus within sac; cirrus unarmed; internal seminal vesicle absent; external seminal vesicle present with small accessory sac or accessory seminal vesicle attached; vas deferens leads from proximal pole of external seminal vesicle, coils posteriorly. Vagina penetrates posterior margin of cirrus sac, joining cirrus within sac (Fig. 28); when cirrus everted, vagina opens directly to genital atrium (Fig. 33); vagina thick-walled, curves posteriorly, at mid-line runs directly posterior and gradually enlarges to form seminal receptacle; seminal duct very narrow, straight, runs posteriorly to small dilatation on poral side of Mehlis' gland which receives oviduct and vitelline duct; ovary tetra-lobed; lobes distinctly triangular in shape; ovarian lobes 280–520 (380) by 80–160 (120); oöcapt present; oviduct coils posteriorly from ovarian isthmus to join seminal duct; vitelline follicles circumcortical; vitelline ducts meet in small vitelline reservoir on poral side of Mehlis' gland, then joins oviduct. Mehlis' gland 90–220 (170) in diameter; uterine duct thin-walled, coils anteriorly from Mehlis' gland to level of genital pore; uterus extends from level of genital pore but does not reach anterior extremity even in gravid segments; gravid segments 5.62–10.18 (8.59) mm by 500–1220 (760); eggs ovoid, tanned, 40–65 (52) by 25–30 (26) with distinct spine, 4–10 long.

Type-specimens: Holotype in SAM no. V4089; 60 paratypes in SAM nos. S2775; three paratypes in BMNH nos. 1987.5.1.3–5; two paratypes in USNMHC no. 79700.

Type-host: Orectolobus tentaculatus (Peters,1864) (Orectolobidae).

Type-locality: Spencer Gulf, South Australia.

Other hosts and localities: Orectolobus maculatus (Bonnaterre, 1788); two specimens, Beachport, South Australia; *O. ornatus* (de Vis, 1883); three specimens, Young Rocks, Kangaroo Island, South Australia (S2776).

Etymology: Generic name from 'stragulum' (n) = carpet, derived from the common names of the hosts, 'carpet sharks'.

Remarks

S. orectolobi has obvious affinities with those poeciloacanth genera exhibiting a band of hooklets on the external surface of the tentacle, namely *Grillotia* Guiart, 1927, *Pseudogrillotia* Dollfus, 1969, *Pterobothrium* Diesing, 1850 and *Molicola* (Dollfus, 1935). The last mentioned taxon was treated as a subgenus of *Gymnorhynchus* by Dollfus (1942, 1969) but was used as a genus by Yamaguti (1959) and Schmidt (1970, 1986). The latter authors are followed here. *S. orectolobi* differs from *Grillotia* and *Pseudogrillotia* in having four rather than two bothridia, and in addition differs from *Pseudogrillotia* in having an acraspedote scolex and circumcortical rather than lateral vitelline distribution (see Carvajal, Campbell & Cornford, 1976 for generic diagnosis). In addition, it differs from *Grillotia erinaceus* (van Beneden, 1958) and *G. heptanchi* (Vaullegaard, 1889) in lacking a prominent accessory seminal vesicle (Dollfus, 1942), but the proglottis anatomy of many other *Grillotia* species is unknown and the accessory sac to the external seminal vesicle could be considered homologous to the typical accessory seminal vesicle of *Gilquinia* spp. and *Grillotia* spp. In the absence of detailed information on other species, it is assumed that the presence of an accessory seminal vesicle is typical of the subgenus *Grillotia.* The subgenus *Progrillotia* Dollfus, 1946, differs in that the testes are arranged in longitudinal rows rather than being scattered, and post-ovarian testes are absent. An accessory seminal vesicle is not present in *Progrillotia*. The subgenus *Paragrillotia* Dollfus, 1969 is known from scoleces only.

Pterobothrium is characterised by pedicellate bothridia which are clearly absent in the genus described above, and in no species of *Pterobothrium* is a distinctive basal armature or basal swelling present.

The new genus thus lies closest to *Molicola* in possessing four bothridia which merge anteriorly into the scolex and in possessing a distinctive basal armature. However, *Stragulorhynchus* differs in that (1) intercalary rows of hooks are absent in *Molicola,* (2) the basal armature of *Molicola horrida* (Goodsir, 1841) and *M. thyrsitae* (Robinson, 1959), the only two species adequately described, consists of very large falciform hooks compared with the small recurved hooks in *S. orectolobi,* (3) an hermaphroditic duct is present in *S. orectolobi,* but not in *Molicola* and (4) in *M. horrida,* a typical accessory seminal vesicle is present, and the uterine pore is not median, but lies adjacent to the genital atrium, whereas in *Stragulorhynchus* the accessory seminal vesicle is diminutive, the uterus straight and a uterine pore absent.

Thus, although *Stragulorhynchus* lies closest to Molicola on the basis of oncotaxy, these are important differences in the morphology of the genital ducts. Because of these differences, a new genus is proposed to accommodate it. The genus is of particular interest because it appears to lie between the families Gymnorhynchidae and Grillotiidae.

The presence of bands of sagittate and rose-thorn-shaped hooks on the external surface of the base of the tentacle in *Stragulorhynchus* is very similar to *Pseudogrillotia basipunctata* Carjaval, Campbell & Cornford, 1976 and to *Dasyrhynchus giganteus* (Diesing, 1850) (see Carvajal *et al.*, 1976), but the similarities appear to be parallel developments in otherwise distantly related groups. A similar cluster of hooks was described by Bilqees & Khatoon (1980) in *Pseudogilquinia karachiense* (sic). The latter genus was placed in a new family Pseudogilquiniidae, related to the Gilquiniidae. However, the metabasal armature of *P. karachiense* is impossible to determine from either the description or drawings. Specimens of a related species, *P. magna* Bilqees & Kurshid, 1985 were examined and are unrelated to *Stragulorhynchus*. The relationships of the Pseudogilquiniidae must await a more detailed description of the type-genus.

The Grillotiinae, a subfamily of the Lacistorhynchidae, was raised to family status by Dollfus (1969), but this change of rank has subsequently been overlooked (Schmidt, 1986). We have followed Dollfus (1969), since it appears useful to us to distinguish at the family level those genera with two bothridia and with a chainette (*Lacistorhynchus*) from those with two bothridia and a band of hooks on the external surface of the tentacle (*Grillotia, Pseudogrillotia*). *Stragulorhynchus* has a basal and metabasal armature closely related to *Grillotia* since it possesses intercalary rows of hooks, and lacks rows of elongate falciform hooks on the base which are typical of *Molicola.* On the other hand, the emphasis traditionally placed on the number of bothridia aligns *Stragulorhynchus* with *Molicola.* We have followed tradition and allocated the new genus to the Gymnorhynchidae.

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