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New Taxon

Description of *Austrodevonia sharnae* n. gen. n. sp. (Galeommatidae : Bivalvia), an ectocommensal of *Taeniogyrus australianus* (Stimpson, 1855) (Synaptidae : Holothuroidea)

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Abstract

Austrodevonia sharnae n. gen. n. sp. is an ectocommensal on the sand dwelling holothurian *Taeonigyrus australianus* (Stimpson, 1855) in the intertidal zone in the vicinity of Sydney, New South Wales, Australia. The species adheres by way of a dorsoventrally flattened foot and byssus, and is located predominantly medioventrally on the holothurian. The species is compared with other galeommatoidean taxa that coexist with holothurians, i.e. *Devonia*, *Anisodevonia*, *Benthoquetia*, *Entovalva*, *Scintillona* and *Cycladoconcha*.

Introduction

Several bivalve taxa are known to live in commensal or parasitic relationships with holothurians. Some live in the digestive tract of the holothurian, while others live attached to the exterior integument of burrowing species. Kato (1998) noted similarities between endo- and ectocommensal species. A short review of the bivalves found in association with holothurians is provided here.

The earliest record of ectocommensal bivalves on holothurians was Semper's (1868) brief record of a bivalve adhering to *Bohadschia similis* (Semper, 1868) in the Philippines (Ohshima 1930; Boss 1965) and a possible conspecific, *Devonia semperi* (Ohshima, 1930) (Fig. 1*b,c*), subsequently found on the holothurian *Protankyra bidentata* (Woodward & Barrett, 1858) in Japan by Ohshima (1930). The first comprehensive description of ectocommensal bivalves on holothurians was Malard's (1903) description of the European *Devonia perrieri* (Malard, 1903) (Fig. 1*a*) from northern France. Malard noted the presence of up to three specimens of *D. perrieri* attached to the skin of *Leptosynapta inhaerens* (O. F. Müller, 1776) by means of byssus and crawling on the skin with the aid of a very large expanded foot. *Devonia perrieri* has subsequently been recorded throughout northern Europe (Johannessen and Wikander 1976). A record of *D. perrieri* from the western Atlantic (Clench and Aguayo 1931) is likely erroneous as the shells of the species described are not covered by the mantle (and is thus more like the new genus and species described here). An additional ectocommensal species, *Devonia ohshimai* Kawahara, 1942 (Fig. 1*d,e*), was described from Japan on *Patinapta ooplax* (von Marenzeller, 1881) and is now type species of the genus *Anisodevonia* Kato, 1998.

Other galeommatoidean taxa adhering to holothurian integument include *Scintillona zelandica* (Odhner, 1924) (type of *Scintillona* Finlay, 1927) from New Zealand living attached to *Trochodota dendyi* Mortensen, 1925 (Finlay 1927) and *Scintillona bellerophon* Ó Foighil & Gibson, 1984 from British Columbia living on *Leptosynapta clarki* Heding, 1928 (Ó Foighil & Gibson, 1984). Both species of *Scintillona* use the lateral side of the foot

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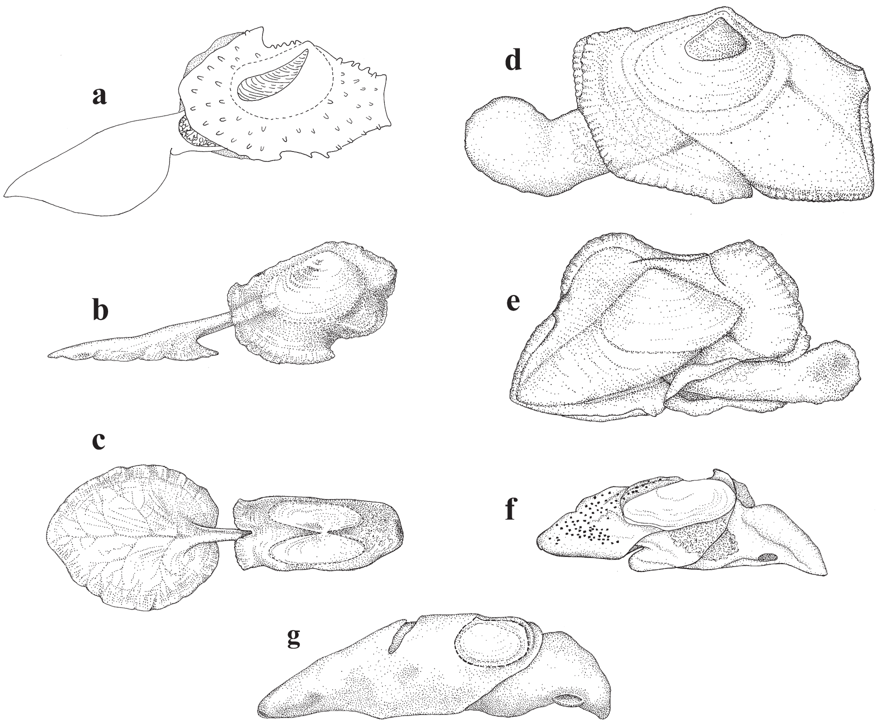

Fig. 1. (*a*) *Devonia perrieri* (Malard, 1903) reproduced from Anthony (1916, fig. 3), length ~8 mm; (*b*,*c*) *Devonia semperi* (Ohshima, 1930, pl. 2, figs 3, 4), length ~20 mm; (*d*,*e*) *Anisodevonia ohshimai* (Kawahara, 1942, text figs 1, 2), length ~6 mm; (*f*) *Entovalva mirabilis* Voeltzkow, 1898 reproduced from Schepman and Nierstrasz (1914, pl. 30, fig. 63), length ~5 mm; (*g*) *Cycladoconcha amboinensis* Spaerck, 1932, (fig. 2), length ~7.5 mm. All lengths are of whole animal, measured from the original illustrations and reproduced from original illustration unless otherwise stated.

for locomotion (like the ectocommensal *Anisodevonia* and the endoparasitic *Entovalva* Voeltzkow, 1891 and *Cycladoconcha* Spaerk, 1932) and adhere with a posterior pedal byssus to the host (Ó Foighil and Gibson 1984). Finally, *Benthoquetia* Iredale, 1930 (type species *Turquetia integra* Hedley, 1907), is known to cluster around the anus of the holothurian *Mesothuria lactea* Théel, 1886 in south-east Australia and New Zealand (Ponder 1968).

Two endocommensal galeommatoidean genera are know to inhabit the oesophagus of holothurians: *Entovalva* from east Africa (type *E. mirabilis* Voeltzkow, 1891; Fig. 1*f*) and *Cycladoconcha* (type species *C. amboinensis* Spaerck, 1932; Fig. 1*g*) from Indonesia. Additional species of *Entovalva* are known from the Red Sea (Bruun 1938), Japan (Kato 1998) and Australia's Great Barrier Reef (P. Middelfart unpublished data).

Besides records of *Benthoquetia integra* there are no published species descriptions of galeommtoideans living in association with holothurians in Australia, except for one photo in Coleman (1981, 2003) of a galeommatid adhering to the holothurian *Chirodota* in Western Australia.

This paper is part of a two-part study into the systematics of galeommatoidean bivalves associated with holothurians. The second part will focus on the endocommensal species, *Entovalva s.l.*

Materials and methods

Material used in the paper was collected alive from Long Reef, north Sydney, New South Wales in 2003 and deposited in the Australian Museum, Sydney (AM) and Muséum National d'Histoire Naturelle, Paris (MNHN). Additional previously collected material in the AM was also examined. Live specimens were removed from their valves, dyed in methylene blue, examined using a stereo microscope at 25–50× magnification and drawn with the aid of a camera lucida. The shells were mounted on stubs, gold coated, examined in a LEO s.e.m. and photographed digitally. Shell length, height, inflation and prodissoconch length were measured with an ocular ruler on a stereo microscope.

Systematics

GALEOMMATOIDEA Gray, 1840

GALEOMMATIDAE *sensu lato* (Beesley *et al*., 1993)

Austrodevovia n. gen.

Type species: *Austrodevonia sharnae* n. sp.

Differential diagnosis

Species of *Devonia* Winckworth, 1930 are most similar to *Austrodevonia*, but differ in a few very important aspects. First, the mantle of *Austrodevonia* only covers the shells marginally antero- and posterodorsally. Second, the hinge of *Austrodevonia* is more like that of species of *Montacuta s.s.*, including the presence of one large down-turned anterior cardinal in the right valve and a small anterior cardinal in the left valve. *Devonia* is entirely toothless and the hinge resembles *Entovalva s.s*. Additional differences include: ventral gape between valves, tentaculate mantle of *D. perrieri* (Fig. 1*a*) covering a larger part of the shell and almost enclosing it, and an extended anterior mantle and a posterior exhalant chamber (which also serves as a brood chamber). It is interesting to note that despite the obvious morphological differences from *Devonia*, *Austrodevonia* have a very similar foot, gill and palp structure, with no major differences observed here (for details of *Devonia* see Popham 1940, figs 20, 21). *Anisodevonia* and *Entovalva* may be separated from *Austrodevonia* in being bilaterally asymmetrical with a lateral right byssus gland on the foot and having dysodont fragile shells. *Cycladoconcha* is asymmetrical like *Entovalva*, but differs in that the central dissoconch is dissolved with only a shell-ring remaining. The ectocommensal *Benthoquetia* differs most markedly in the simple laterally flattened foot and in shell characters (see Ponder 1968). Species of *Scintillona* differ from *Austrodevonia* in many characters such as external shell structure, the laterally flattened foot with distal ciliated grooves, and in having inner and outer demibranchs.

Etymology

The genus name, *Austrodevonia*, is derived from the Latin 'austro', meaning 'southern', and the genus name *Devonia*, literally meaning 'the southern *Devonia*'.

Austrodevonia sharnae n. sp.

(Figs 2–4; Table 1)

Material examined

Holotype. New South Wales, Sydney N., Collaroy, Long Reef, Fishermans Beach, 33°44.3′S, 151°18.6′E, 17 Apr. 2003 (AM C.205093) (ex. AM C.205062). Measurements: dissoconch: 3.04 mm long, 2.48 mm high, 1.22 mm inflation (both valves); prodissoconch: 0.44 mm long.

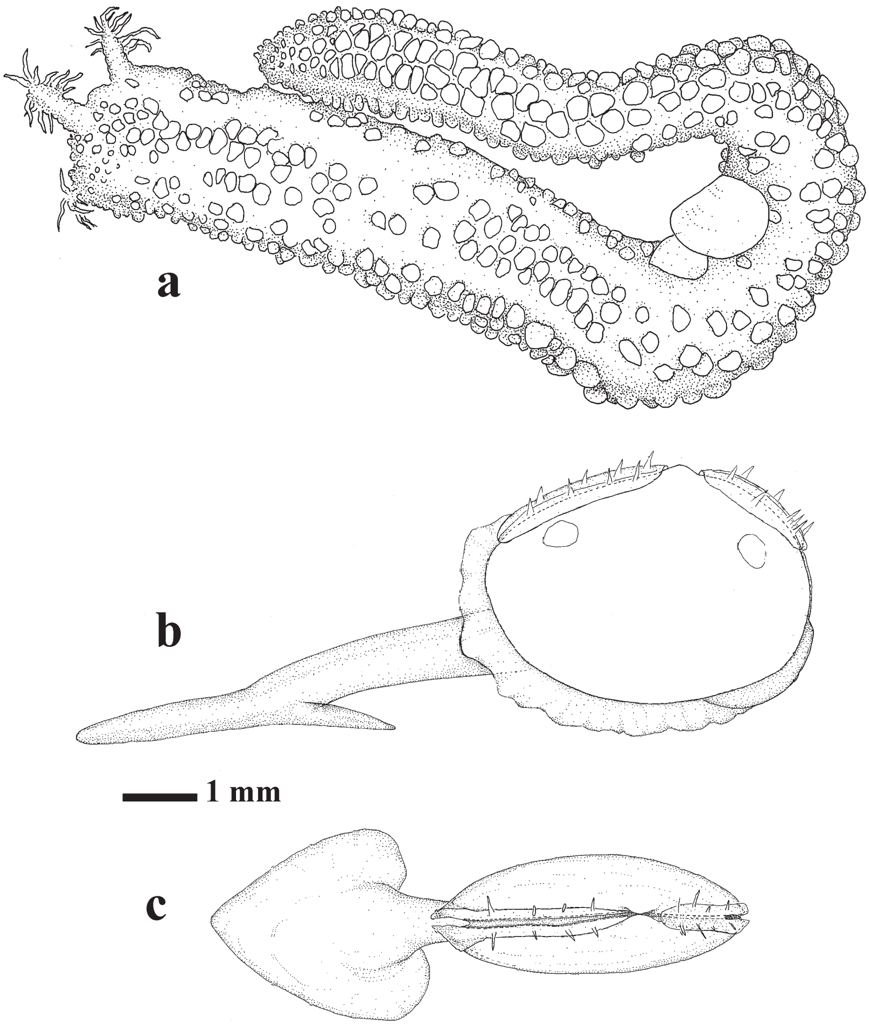

Fig. 2. *Austrodevonia sharnae* n. sp. (*a*) attached to integument of *Taeniogyrus australianus* (AM C.126713); (*b*) left side aspect of living animal with foot extended; (*c*) dorsal aspect with foot slightly contracted (*b* and *c* drawn from AM C.205062).

Paratypes. **New South Wales:** Sydney N., Collaroy, Long Reef, Fishermans Beach, 33°44.3′S, 151°18.6′E, in gutter: 8 specimens, 8 Mar. 1981 (AM C.126713); 1, 13 Apr. 1980 (AM C.205061); 1, 19 Sep. 1979 (AM C.428576); 2, 29 Jan. 1979 (AM C.428582); 1, 25 Sep. 1977 (AM C.428586); 14, 17 Apr. 2003 (AM C.205062); 2, 17 Apr. 2003 (MNHN); 4, 15 Oct. 1977 (AM C.107868), 2, 8 Jan. 1978 (AM C.428574); 1, 19 Aug. 1978 (AM C.428578); 7, 14 Jan. 1979 (AM C.428580).

Other material examined. **New South Wales:** 3, N. of Woolgoolga, Arrawarra, 30°4′S, 153°12′E, 13 Mar. 1982 (AM C.400904); 2, N. of Cronulla, Boat Harbour, 34°2.5′S, 151°12′E, 3 Nov. 1982 (AM C.428577).

Description

Shell (Fig. 3). Largest specimen measured 4.4 mm long, 3.3 mm high (n = 39). Smallest specimen observed 1.2 mm long. Valves white to translucent, broadly oval, equivalve,

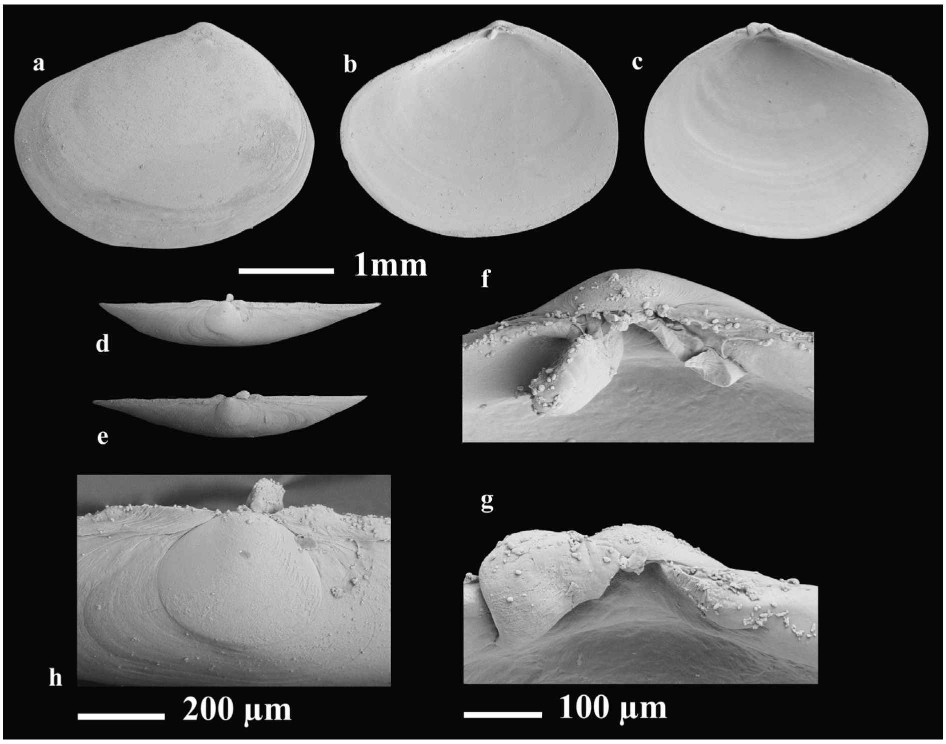

Fig. 3. *Austrodevonia sharnae* n. sp. (AM C.205062). (*a*) left valve; (*b*,*d*,*f*,*h*) right valve in interior, dorsal, hinge and prodissoconch aspects; (*c*,*e*,*g*) left valve in interior, dorsal and hinge aspect.

inequilateral, with orthogyrous umbo slightly posterior, anterior end extended and rounded. No gape between valves. Cardinal teeth consist of anteroventral directed elongate cardinal tooth (CA3b), slight rim near edge (CA3a) in right valve. Left valve with anteroventral direct elongate-triangular cardinal tooth (CA2a). Posterior cardinal lacking. Elongate lateral teeth present on anterior dorsal slope in right (LA1) and left (LA2) valves. Periostracum not visible, ligament internal in resilium. Surface smooth with weak commarginal growth rings. Prodissoconch oval, 0.3–0.46 mm in length (0.38 mm ± 0.05 mm, X ± s.d., n = 16, AM C.205062).

Animal (Figs 2, 4) with large anterior opening, consisting of laterally flared middle mantle fold expanded to narrow cowl, extending posterior past median line. Posterior exhalant opening small; among small tentacles of the middle mantle fold. Mantle fusion between inhalant and exhalant openings slightly extended beyond shell edge to accommodate demibranchs when inflated (gill pouch). Antero- and posterodorsal middle mantle with about eight paired tentacles anterodorsal and posterodorsal. Foot very large, dart-shaped, and dorsoventrally flattened to form wide sole. Anterior end pointed, posterior end with two lateral rounded flaps. Byssus gland on distal part of cordiform foot shaft. Only inner demibranch present. Cilial currents on inner and outer lamellae direct food ventrally. Ventral food groove directs food string anteriorly to small paired labial palps. Adductors small and isomyarian, paired anterior and posterior pedal retractors observed.

Table 1. ***Austrodevonia sharnae*** **n. sp., measurements of material examined**

Type	Shell length (mm)		Shell height (mm)		Shell width (mm)		Prodissoconch length (mm)	
	Range	Mean ± s.d.	Range	Mean ± s.d.	Range	Mean ± s.d.	Range	Mean ± s.d.
A. sharnae holotype C.205093	3.04	–	2.48	–	1.22	–	0.44	–
A. sharnae all paratypes from Long Reef, Sydney ($n = 33$)	1.16–3.92	2.52 ± 0.60	0.76–2.75	1.87 ± 0.41	0.42–1.30	0.93 ± 0.24	0.30 – 0.46	0.38 ± 0.05
A. sharnae, C.400904 ($n = 3$)	1.58–2.67	2.11 ± 0.54	067–1.92	1.36 ± 0.64				
A. sharnae, C.428577 ($n = 2$)	3.08, 4.42	–	2.67, 3.33	–				

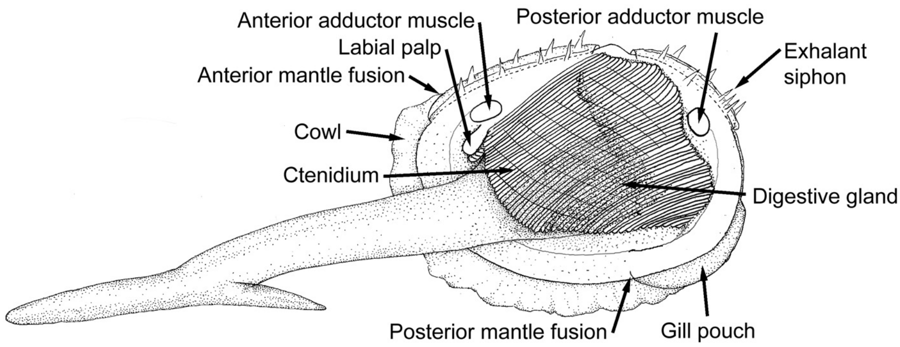

Fig. 4. *Austrodevonia sharnae* n. sp. (AM C.205061), anatomy.

Association

The association of *A. sharnae* with *T. australianus* (see Fig. 2*a*) was studied in some detail in a small habitat on the northern side of Long Reef, Sydney. A total of ten clusters of sea cucumbers were found under large rocks and examined in the laboratory within hours of capture. An average of two holothurians (range 1–4, total 20 specimens) were found under each of the inhabited rocks, in the sand. The holothurians were only found where this microhabitat was present.

Of the 20 holothurians examined, 16 (80%) had bivalves attached to the integument and of these, four had two specimens attached (the remaining had one specimen attached). The position and direction of the bivalves were observed in 12 holothurians with a total of 16 bivalves attached. Eight specimens (50%) were arranged with the anterior end of the bivalve pointing anteriorly on the holothurians, six (37.5%) were directed across or obliquely across and two (12.5%) pointing posteriorly. Seven specimens (43.75%) were located medially on the holothurian, four (25%) near the anterior 1/3 of the holothurian, two (12.5%) near the posterior 1/3, two (12.5%) on the posterior end and one (6.25%) on the anterior end. Fifteen (93.75%) were located on the ventral side of the holothurian, while one specimen was located on the lateral side. In conclusion, the preferred location on the host seems to be approximately medioventrally on the holothurian, with the anterior end of the bivalve facing anteriorly on the host.

Distribution

This species has only been recorded from the north and central NSW coasts, but detailed searches in other parts of NSW have not been undertaken.

Remarks

The structure and cilial patterns of this species closely resemble those illustrated and discussed in Popham (1940) for *Devonia perrieri*; probably an indication of close relationship.

One additional record of a species resembling *Austrodevonia* exists from Gun Island, Houtman Abrolhos, Western Australia (Coleman 1981: 83, fig. bottom left; Coleman 2003: 77, lower left). This species appears to be more elongate than *A. sharnae* as far as can be judged from the figure, but specimens have not been examined. The host, which is cited as *Chirodota* in Coleman (1981), is different from the host *T. australianus* in NSW, but that is not in itself an indication that they are separate species (see Johannessen and Wikander 1976).

Etymology

This species is named after Ms Sharn Rose, a dedicated volunteer at AM, in appreciation of the many illustrations she has prepared for projects on small marine bivalves.

Discussion

Austrodevonia sharnae, as shown here, seems to be distinct from other ecto- and endocommensal galeommatoideans when shell and soft-part morphological characters are used in conjunction. Molecular studies are currently underway and it is hoped that the molecular data will enhance our understanding of the phylogenetic position of this species.

In a recent paper of the ecology of *A. ohshimai* from southern Japan (Kosuge 2001), the prevalence and abundance of the species on *P. ooplax* was studied. The prevalence of bivalves was close to the rate found at Long Reef (67–72% in southern Japan *v.* 80% at Long Reef). While the abundance of *A. sharnae* on *T. australianus* varies from one to two specimens (80% of hosts with one specimen), *P. ooplax* may have up to eight specimens attached, with up to five being more frequent. It is puzzling why more specimens are attached to *P. ooplax* than *T. australianus* as the size range of the host and bivalve is closely similar. It is possible that the prevalence is a result of the higher abundance of *P. ooplax*, resulting in more available substrate for settling larvae.

Only a very small part of the Australian coastline has been investigated for commensal bivalves living in association with echinoderms. With the rich echinoderm fauna of Australia it is very likely that many more interesting species and associations will be found in the future.

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