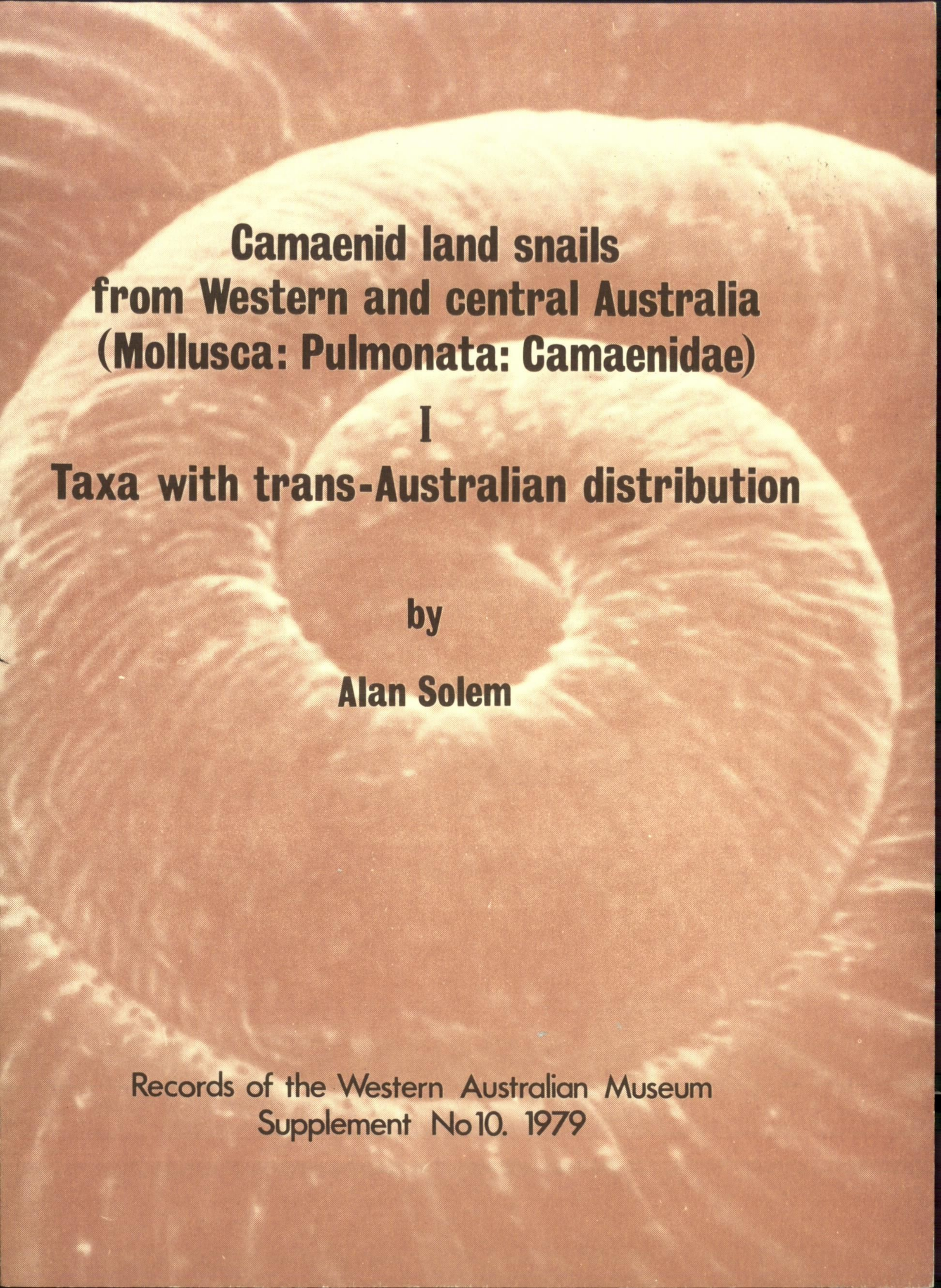

Camaenid land snails from Western and central Australia (Mollusca: Pulmonata: Camaenidae)

I

Taxa with trans-Australian distribution

by

Alan Solem

Records of the Western Australian Museum
Supplement No10. 1979

Records of the Western Australian Museum
Supplement No. 10

CAMAENID LAND SNAILS FROM WESTERN AND CENTRAL AUSTRALIA (MOLLUSCA: PULMONATA: CAMAENIDAE)

I

TAXA WITH TRANS-AUSTRALIAN DISTRIBUTION

by

ALAN SOLEM

PERTH 1979

World List Abbreviation:
Rec. West. Aust. Mus. Suppl. no. 10

ISSN 0313—122X

Published by the Western Australian Museum,
Francis Street, Perth, Western Australia 6000. 328 4411.

CAMAENID LAND SNAILS FROM WESTERN AND CENTRAL AUSTRALIA (MOLLUSCA: PULMONATA: CAMAENIDAE)

I

TAXA WITH TRANS-AUSTRALIAN DISTRIBUTIONS

ALAN SOLEM*

[Received 2 March 1978. Accepted 3 August 1978. Published 31 December 1979.]

INTRODUCTION

This is the first of a series of reports on the semi-arid zone dominant land snails of Western and Central Australia, which belong to the family Camaenidae, *sensu lato*. More than 150 species are available at present from the area covered, which comprises Western Australia and the southern half of the Northern Territory. Limited material has made inclusion of the northern half of the Northern Territory impossible. Most of the species currently are undescribed, and the initial purpose of these reports is to survey the generic and specific diversity. Data accumulated in this process will enable generalizations concerning patterns of reproductive strategy, character displacement in both species recognition features and feeding specializations, plus divergent ecologic tactics used in coping with both seasonal and aseasonal rainfall, periodic bush fires, and predation by vertebrates. This study is a joint project of the Western Australian Museum, Perth and the Field Museum of Natural History, Chicago.

The data bases are the collections accumulated over many years from most parts of Western Australia by the staff and associates of the Western Australian Museum, Perth; special surveys of the Prince Regent River Reserve in 1974, Drysdale River area in 1975, Napier Range in 1976, and Mitchell Plateau in 1976 by scientists from the Western Australian Museum; field work from January through 1 March 1974 in the Pilbara and along the south coast by Alan Solem and Laurie Price, sponsored by Field Museum of Natural History and the Kroc Environmental Fund of Field Museum of Natural History; and extensive field work by Alan Solem, Laurie Price, and Carl

* Field Museum of Natural History, Chicago, Illinois 60605, U.S.A.

Christensen in 1976-1977, sponsored by Field Museum of Natural History, private donors, and National Science Foundation Grant DEB75-20113 A01.

The two most important previous publications are those of Smith (1894) and Iredale (1939). Scattered descriptions of individual species are cited in the above papers and have not been listed here separately. Preliminary reports on the Prince Regent River Reserve (Wilson & Smith, 1975) and Drysdale River Survey (Merrifield, Slack-Smith, & Wilson, 1977) land snail collections have been prepared by staff of the Western Australian Museum.

Formal acknowledgement of the many individuals who have contributed to this study will be deferred until the final section, but an initial expression of appreciation to Barry Wilson, Shirley Slack-Smith, Fred Wells, Clayton Bryce, Lindsay Baxter, and all the staff of the Western Australian Museum who collected specimens, facilitated field work, processed specimens, and made a working stay in Perth a more than pleasant time is mandatory. Without their help, space provided by the Western Australian Museum for several months of research, free access to collections and data, and logistic support of every kind, this project would have been impossible. I am more than grateful for their assistance and friendship. The aid in field work given by Laurie Price, Carl Christensen, and occasionally Laurel Keller and 'Lucky' was essential.

All line illustrations, drawings, and charts have been prepared by Elizabeth A. Liebman, formerly Illustrator, Division of Invertebrates, Field Museum of Natural History. Without her skilled and dedicated efforts, these reports would be of much lower quality. The scanning electron microscope photographs were taken by the author on a Cambridge S4-10 Stereoscan and printed by staff of Field Museum of Natural History. The support of National Science Foundation Grant BMS72-02149 A01, Alan Solem, Principal Investigator, in establishing the SEM facility at Field Museum of Natural History is gratefully acknowledged.

A complete station list, a guide to anatomical abbreviations, biogeographic observations, phyletic conclusions, and ecologic generalizations will be presented in the concluding paper or as separate publications after completion of the systematic survey. Information necessary to locate each listed station, anatomical abbreviations used on each figure are included in each description, and references to the previous literature are cited, so that each paper can be used as a separate unit. Data on radulae and jaw variations are not included in the systematic review, but will be published subsequently.

Because less than a dozen of the several hundred Australian camaenid taxa have had any anatomical data recorded in the previous literature, frequently it has been necessary to dissect and illustrate taxa from other parts of Australia or neighbouring countries. Where inclusion of such data is required to assign

Western or central Australian taxa to generic units, such species are reviewed. For assistance in providing such extralimital materials, I am indebted to Martin J. Bishop, formerly of the Queensland Museum, Brisbane; Winston Ponder, Australian Museum, Sydney; Brian J. Smith, National Museum of Victoria, Melbourne; Edmund Gittenberger, Rijksmuseum van Natuurlijke Historie, Leiden; and Fred and Jan Aslin, Mt Gambier, South Australia.

The assistance of Valerie Connor-Jackson in manuscript production and preparation has been invaluable.

A series of abbreviations indicate the repository of all cited materials:

AMNH—American Museum of Natural History, New York
AM —Australian Museum, Sydney
ANSP —Academy of Natural Sciences, Philadelphia
BMNH—British Museum (Natural History), London
FMNH—Field Museum of Natural History, Chicago
IRSB —Institut Royal des Sciences Naturelles, Brussels
NMV —National Museum of Victoria, Melbourne
QM —Queensland Museum, Brisbane
RNHL —Rijksmuseum van Natuurlijke Historie, Leiden
SAM —South Australian Museum, Adelaide
SMF —Senckenberg Museum, Frankfurt-a.-Main
WAM —Western Australian Museum, Perth.

The order of taxa follows a geographic, rather than a phyletic sequence. This contribution covers those taxa found in both Queensland and Western Australia. The species are assigned to *Xanthomelon* von Martens, 1860, *Torresitrachia* Iredale, 1939, *Damochlora* Iredale, 1938, and *Hadra* Albers, 1860. Because so little material has been collected in the northern half of the Northern Territory, I do not know if the absence of *Hadra* and relatives of the *Damochlora* complex in this region is real or artificial. Certainly *Torresitrachia* and *Xanthomelon* have an essentially continuous distribution from Queensland through the Kimberley area.

For each station, where such data is available, I cite either latitude and longitude (approximated in the case of larger islands or bays) or grid co-ordinates as noted in the field for either the 1:100,000 topographic survey series R 611 or the 1:250,000 series R 502. After initial citation of a map in a list of material, it is subsequently abbreviated by name, sheet number, and co-ordinate, for example 'Warrender 4068−874:066.'

The next contributions will review taxa that are limited to the Kimberley, followed by reviews of taxa with progressively more southern distributions.

LIST OF TAXA

Genus *Chloritis* Beck, 1837:282
'*C.*' *argilacea* (Férussac, 1821):282

Genus *Parglogenia* Iredale, 1938:284
P. pelodes (Pfeiffer, 1846) (+ *Helix prunum* Reeve, 1852; *Chloritis pseudoprunum* Pilsbry, 1893):286

Genus *Hadra* Albers, 1860 (+ *Micardista* Iredale, 1933):289
H. bipartita (Férussac, 1822):290
H. barneyi (Cox, 1873):294
H. wilsoni sp. nov.:295

SYSTEMATIC REVIEW

GENUS *XANTHOMELON* VON MARTENS, 1860

Xanthomelon von Martens, 1860, Die Heliceen, 2nd edition, xv, 174—type species *Helix pomum* Pfeiffer, 1842 (= *Helyx durvillii* Hombron & Jacquinot, 1841) by original designation; Iredale, 1938, Aust. Zool., **9** (2): 100-103.

Globorhagada Iredale, 1933, Records Aust. Mus., **19** (1): 52—type species *Helix (Hadra) prudhoensis* Smith, 1894 by original designation; Iredale, 1938, Australian Zool., **9** (2): 114; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 72-73.

Diagnosis

Shell large to very large in size, spire moderately to strongly elevated, whorl cross-section enlarging very rapidly, form globose with H/D ratio averaging about 1.0. Umbilicus moderately to narrowly open or closed. Apical whorls with sculpture usually eroded or faintly pustulose, postapical sculpture highly varied in different species, ranging from minute pustules on slightly elevated retractive radial ribs that cover the spire but fade out on lower whorls, to oblique radial anastomosing rugosities, to an essentially smooth surface. Body whorl descending abruptly behind lip, which is moderately to strongly expanded and flared, usually white in colour (sometimes brown), partly reflexing over columellar region. Shell colour basically green with varying degrees of yellow suffusion, some taxa with moderate to very heavy suffusion of red on the spire and (sometimes) body whorl. Diagnostic features of the genitalia are the lateral entry of the hermaphroditic duct on the talon; very short spermathecal shaft and head; thickened vaginal region; penis slightly to strongly coiled within a sheath; penial retractor muscle inserting onto a section of the vas deferens at the head of the penis sheath; penis internally variously sculptured with ridges or a large pilaster ridge, but no verge and only a simple entrance of the vas deferens; and absence of any caeca on the male system.

Type species: *Helix pomum* Pfeiffer, 1842 (= *Helyx durvillii* Hombron & Jacquinot, 1841).

Nomenclature and type species

The identity and exact range of the type species, *Xanthomelon durvillii* (Hombron & Jacquinot, 1841) from Raffles Bay-Port Essington area, is unknown. I have assumed that the common species found near Darwin, Northern Territory is the genotype and include a brief review of that taxon. The genus *Globorhagada* Iredale, 1933 was a catch-all for shells with a globose shape and has no systematic unity. Dissection of the type species, *Helix prudhoensis* Smith, 1894, demonstrated that it is a subjective synonym of *Xanthomelon.* The other taxa included in *Globorhagada* by Iredale (1938: 114; Iredale, 1939: 72-73), *Helix leptogramma* Pfeiffer, 1846 and *Rhagada montebelloensis* Preston, 1914, are reallocated subsequently. Neither have any affinity with *Xanthomelon.*

Distribution

Synonymies of Queensland and Northern Territory species remain to be worked out and only a gross outline of extralimital distribution can be presented.

The southern limit of *Xanthomelon* in Queensland seems to be Brisbane (NMV F.1553), with other specimens collected in local gardens near Brisbane by M.J. McKerras on 23-III-1954 (NMV). Samples from central and northern parts of Queensland are numerous. There are scattered records from coastal areas of the Northern Territory. The Wearyan River (FMNH 198440, FMNH 198439, *Xanthomelon jannellei* [Le Guillou, 1842]), Roper River (NMV), Groote Eylandt (AM), Elcho Island (AM), Yirkalla (AM), and several localities on the McArthur River near Borroloola (NMV) lie in the Gulf of Carpentaria drainage. Records from the Wessel Islands (NMV), Bathurst Island (AM), Melville Island (NMV, AM), Liverpool River (NMV, AM), Port Essington (AM), and Darwin (many collections) on the north coast, Daly River (AM), Victoria River (AM), and Port Keats (AM) between Darwin and the Western Australian border, complete the known Northern Territory records. We do not know exactly how far south *Xanthomelon* extends in the Northern Territory, with inland records limited to Adelaide River (AM), Katherine (AM), and 81 km west of Katherine (AM). There is, apparently, a near continuous range through the Northern Territory. I can provide no information as to how far west in Queensland populations of *Xanthomelon* extend. There are, to my knowledge, no records of *Xanthomelon* from New Guinea.

In Western Australia, *Xanthomelon* has been taken in coastal areas as far south as Doubtful Bay, just north of Walcott Inlet (*ca.* 16°S, 124°30′E). Inland the southernmost record of dead shells is from the north-west corner of the Napier Range (*ca.* 17°5′35″S, 124°33′18″E), then progressively northward, Mt Hart Station, Barnett and Manning Gorges on the Barnett River, Mt Elizabeth Station, and then live examples from the Drysdale Reserve. A number of records from Kalumburu Mission and the Ningbing Ranges in the north, Prince Regent Reserve, Mitchell Plateau, and islands in the Admiralty Gulf in the west indicate that the entire northern region is potentially inhabitable by *Xanthomelon*. Many parts of this region have not been collected in to date, so that the ranges outlined here are at best preliminary sketches of distributions.

Species of Western Australia

Three named species of *Xanthomelon* occur in Western Australia, and poor material from the Napier Range to Manning Gorge north of the King Leopold Range is considered to be a possible fourth entity. Two of the species, *X. prudhoensis* (Smith, 1894) and *X. obliquirugosa* (Smith, 1894), have extended northern area ranges and may well cross into the Northern Territory. The third, *X. ruberpumilio,* is known from Doubtful Bay north to the Prince Regent and Roe River basins. These species are readily identifiable on the basis of shell features and have partly non-overlapping distributions.

Xanthomelon prudhoensis (Smith, 1894) averages 29 mm in shell height and diameter, with 5¼ whorls. The upper spire has a dense sculpture of very fine pustules that gradually disappear about 1½ whorls behind the lip **(Plate 1b).** The shell colour is yellow-green to green, the spire is usually strongly elevated with an average H/D ratio usually of more than 1.0. The umbilical margin frequently is shouldered. Anatomically, the penis is shorter, less strongly coiled **(Fig. 4),** and has a very characteristic wall sculpture of oblique ridges **(Fig. 7).** This species has been recorded from Kalumburu, in the lower Drysdale, Mitchell Plateau and Prince Regent areas, with scattered inland records near Gibb River, Mt Elizabeth, and Barnett Gorge of the Upper Fitzroy drainage. Offshore it is known from Prudhoe, Bigge, Borda and Augustus Islands, with coastal records as far south as Doubtful Bay. Possibly the material from the north-west tip of the Napier Range and southern King Leopold Range listed as *Xanthomelon* sp. may represent an outlier of this species.

Xanthomelon obliquirugosa (Smith, 1894) averages 24.5-26 mm in shell height and diameter, with about 4¾ whorls. The spire is less strongly elevated than in *X. prudhoensis,* with an average H/D ratio usually of less than 1.0. The shell often has a reddish suffusion, and the umbilical margin is rounded rather than shouldered. The most obvious shell feature is the strong sculpture of oblique anastomosing radial ridges **(Plate 1a)** that often continues to the reflected lip, although being most strongly developed on the shell spire. They are visible on even the most worn examples. Anatomically the penis is tightly coiled within the sheath **(Fig. 10a).** The walls of the penis are very thick and glandular without marked surface sculpture **(Fig. 11a).** This species has been recorded from the Ningbing Ranges, Kalumburu, Sir Graham Moore Island, near Doongan Homestead, and is the common species in the Drysdale survey region. It is a rather rare species on the Mitchell Plateau itself, and is known from single specimens from the Upper Roe River drainage and from Augustus Island. In the Prince Regent basin and south to Doubtful Bay, *X. obliquirugosa* apparently is replaced by *X. ruberpumilio.*

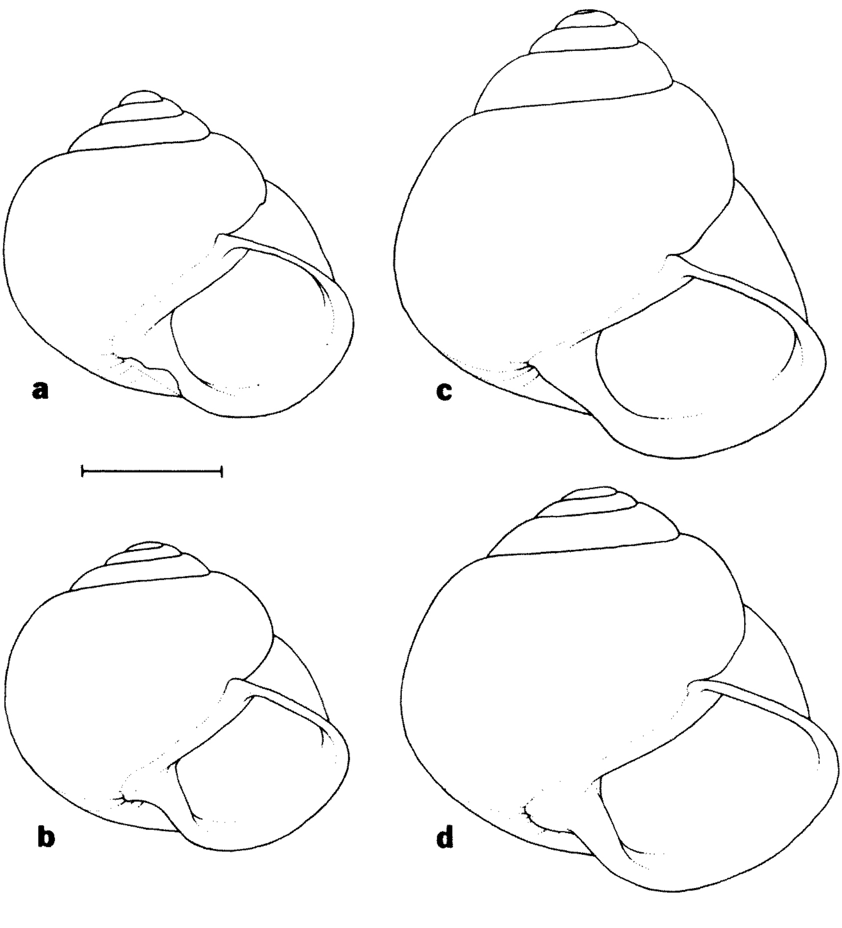

Fig. 1: Shells of *Xanthomelon:* (a-b) *Xanthomelon* sp., Barnet Cave near north-west end of Napier Range, WAM 1012.76; (c-d) *Xanthomelon prudhoensis* (Smith, 1894); (c) is Sta. E5 (3), Prince Regent River Reserve, WAM 201.75, (d) is Sta. W6 (5), Prince Regent River Reserve, WAM 451.75. Scale line equals 10 mm.

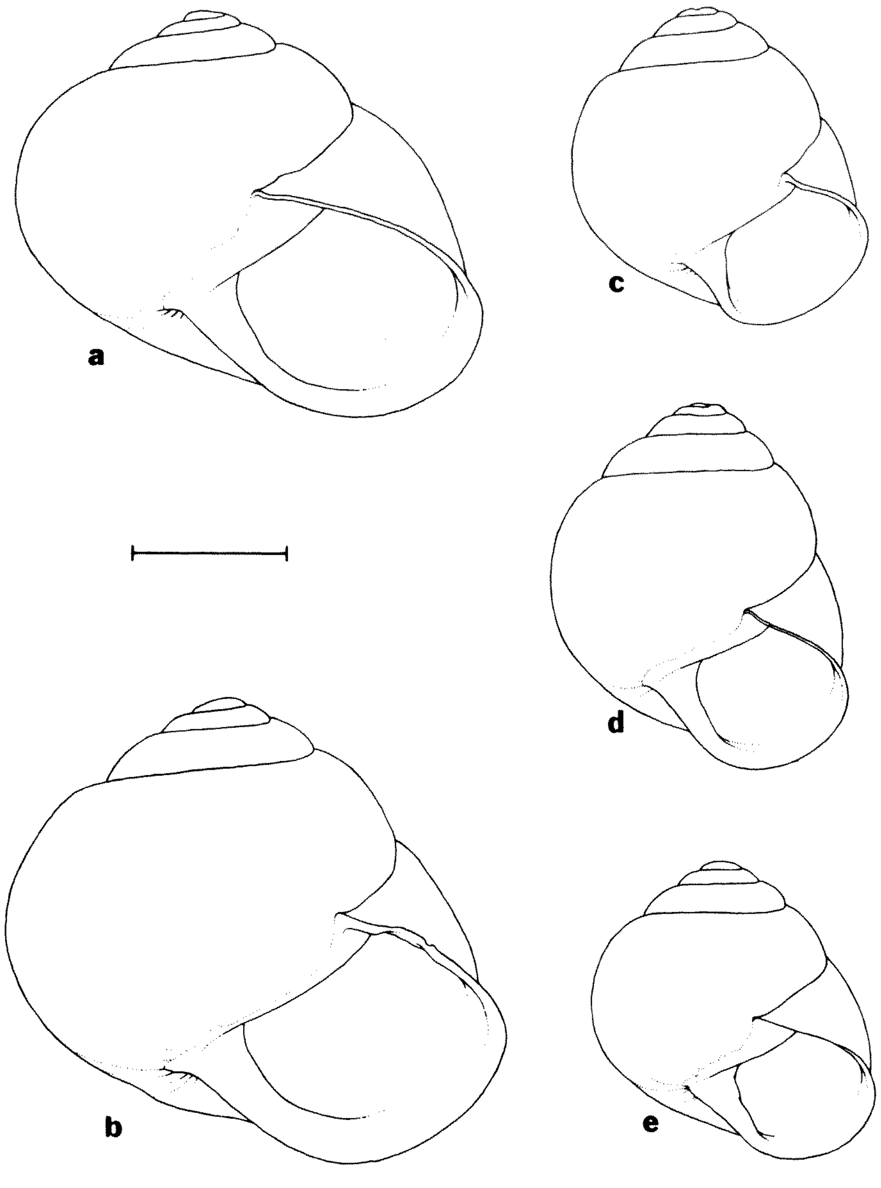

Fig. 2: Shells of *Xanthomelon:* (a-b) *Xanthomelon obliquirugosa* (Smith, 1894), Sta. B1-2, Drysdale River, WAM 219.76; (c-e) *Xanthomelon ruberpumilio;* (c) is holotype, Sta. W6 (5), Prince Regent River Reserve, WAM 322.77, (d) is Sta. W6 (2), Prince Regent River Reserve, WAM 179.75, paratype, (e) is Sta. E1, Prince Regent River Reserve, WAM 176.75, paratype. Scale line equals 10 mm.

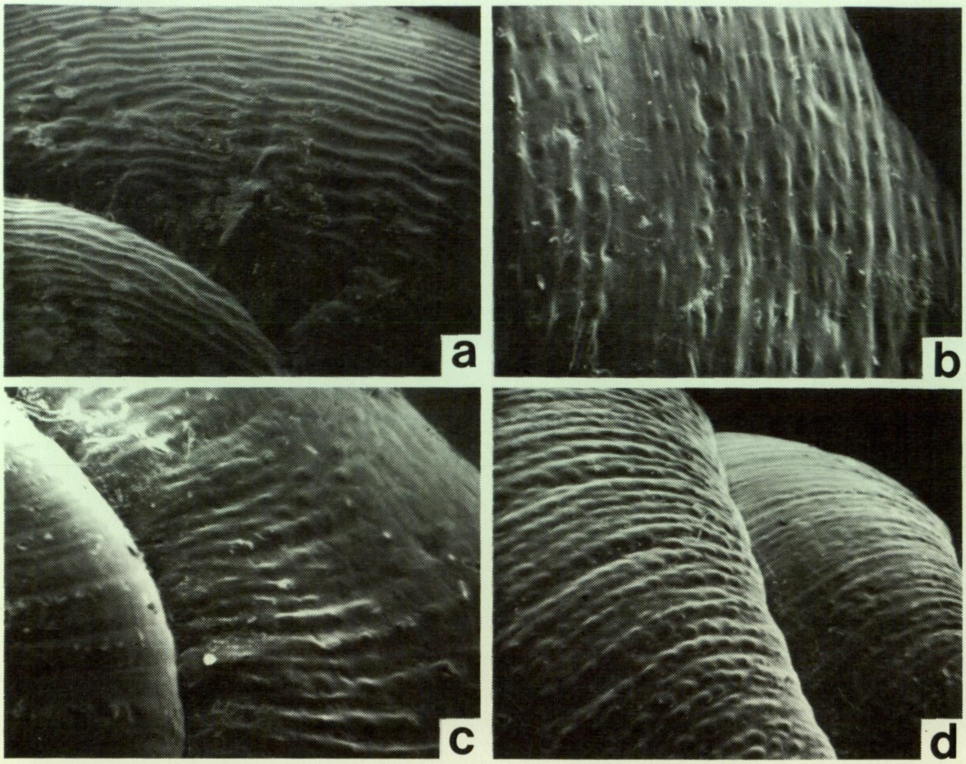

Plate 1: Shell sculpture of *Xanthomelon:* (a) *Xanthomelon obliquirugosa* (Smith, 1894), penultimate and body whorl, 16X, WAM 218.76, Sta. B1, Drysdale River Survey; (b) *X. prudhoensis* (Smith, 1894), body whorl near suture, 41X, FMNH 199350, Sta. WA-394, Mitchell Plateau; (c) *X. ruberpumilio,* apex and upper spire, 36X, WAM 1168.75, Sta. W6 (5), Prince Regent River; (d) *X. ruberpumilio,* lower spire and body whorl, 14X, WAM 1168.75, Sta. W6 (5), Prince Regent River.

Xanthomelon ruberpumilio averages 20.6 mm in shell height and 19 mm in shell diameter with 5 whorls. The spire is strongly elevated, there usually is a very dark reddish suffusion on the spire and body whorl with the base greenish-yellow. The umbilical opening is very narrow, its margin is rounded, and the lip itself less strongly reflected than in the two other species. The shell sculpture on the upper spire consists of rather prominent pustules arranged roughly along weak radial ribs **(Plate 1c-d),** but on the body whorl this is confined to the upper quarter of the whorl profile. Anatomically, the penis is strongly coiled within the sheath, but is noticeably shorter than that of *X. prudhoensis,* and has a most unusually textured wall sculpture **(Fig. 6).** The only records for this species are from the basins of the Roe River, Prince Regent River, and Doubtful Bay.

A few dead shells from the Napier Range and southern King Leopold Range are listed as *Xanthomelon* sp., although they may be dwarf *X. prudhoensis.* They average 22.5 to 23 mm in shell height and diameter, with 4⅞ whorls. Remnants of periostracum show a greenish-yellow colour, but all the material is too worn for microsculpture to be observed. The sutures are deeper and the shell more globose in appearance than *X. prudhoensis.* The status of these shells remains uncertain.

There is thus a south-western coastal species, *X. ruberpumilio;* a series of inland populations or former populations of uncertain status from the north-west Napier to Packhorse Ranges, *X.* sp.; a large, smooth shelled species more common in the coastal areas, *X. prudhoensis;* and a smaller, rugosely sculptured species that is more common inland, although found in some coastal situations, *X. obliquirugosa.*

Ecology and differential abundance

Living *Xanthomelon obliquirugosa* were taken on the fringes of Kalumburu Mission banana patch under fallen fronds and rubbish. Occasionally this area would be sprinkled during the dry season. On the Mitchell Plateau during the dry season, one live adult was found buried 2.5 cm deep in soil under a 46 cm boulder, and one live juvenile was taken in shallow soil under a 61 cm boulder. Both of these were in open forest areas. Living *X. prudhoensis* have been found among sandstone boulders, in sandstone ledges and in crevices, or among the roots of boab trees along Crystal Creek in the Mitchell Plateau, and occasionally in the forested areas on the Plateau itself during both wet and dry seasons. No details were recorded of its occurrence in the Prince Regent Reserve. Living *X. durvillii* near Darwin were found partly buried in coarse gravel soil, under logs, and crawling on tree trunks in heavy forest during rains and in a cultivated garden.

The exact ecological relationships of the species in the few areas of gross sympatry remain to be determined. *Xanthomelon prudhoensis* and *X. ruberpumilio* occur at several stations in the Prince Regent River Reserve (see discussion under *X. ruberpumilio*), with differing dominance, but *X. obliquirugosa* and *X. prudhoensis* have not been taken alive, or represented by fresh material, at the same station. The few occurrences of 'bones' of one species with the other probably result from the transportation effects of wet season flooding, or are a record of extinction and replacement of one taxon by the other. There is a shifting size relationship between these species in their zone of overlap. As shown in **Table 3,** *X. prudhoensis* reaches maximum size in the Mitchell and Prince Regent areas, and is noticeably smaller in the more northern region. In contrast, *X. obliquirugosa* is largest in the Drysdale area and noticeably smaller on the Mitchell Plateau. Specimens of both species from near Kalumburu are small in size. Unfortunately, few of the collections from Kalumburu are precisely localized, and the spatial relationships of populations near

Kalumburu remain to be investigated. In the Prince Regent Reserve, *X. ruberpumilio* seems to have replaced *X. obliquirugosa.*

Patterns of variation

Western Australian *Xanthomelon* show different types of shell sculpture, that, in unworn or only partly worn examples, allow certain identification of even the youngest juvenile shells. The transverse anastomosing radial ridges of *X. obliquirugosa* (Smith, 1894), crowded and prominent pustulations of *X. ruberpumilio* that fade out on the body whorl, and weak pustulations on the spire of *X. prudhoensis* (Smith, 1894) **(Plate 1)** are diagnostic. Size and shape variations show extensive overlap, although when the species have overlapping distributions, there generally are average size differences in that region.

Differences in the wall sculpture of the penial chamber: a sperm gutter with V ridges radiating outwards in *X. prudhoensis* **(Fig. 7)**, combination of long pilasters and fine ridges in *X. ruberpumilio* **(Fig. 6)**, and smooth or weak pustules in *X. obliquirugosa,* are diagnostic. The length of the penial sheath in relation to the contained portion of the vas deferens and the penis itself also differs dramatically, short in *X. prudhoensis* **(Fig. 7)**, slightly longer in *X. obliquirugosa* **(Fig. 11a)**, and much longer in *X. ruberpumilio* **(Fig. 6)**. The Northern Territory *X. durvillii* (Hombron & Jacquinot, 1841) has the penis and vas deferens more than three times the length of the sheath **(Fig. 11e)** and with yet another kind of penis chamber wall sculpture **(Fig. 5)**.

Thus the differences in shell sculpture and penis structures correlate, giving key characters for making identifications. In contrast, the range in size and shape variation is large, although average differences do exist and are discussed under each species.

Systematic review

XANTHOMELON DURVILLII (HOMBRON & JACQUINOT, 1841)

(Figs 3a, 5, 11e)

Helyx durvillii Hombron & Jacquinot, 1841, Annales Sci. Nat., Zool., (Paris), ser. ii, **16:** 62—Raffles Bay, Australia (11°16′S, 132°24′E).

Helix pomum Pfeiffer, 1842, Symbolae ad Historiam Heliceorum, **2:** 37—'Nova Seelandia?'; Philippi, 1843, Abbilb. und Beschreib. neuer oder wenig gekannter Conchylien, **1:** 24, *Helix,* pl. 2, figs 8a-b; Pfeiffer, 1849, Syst. Conch. Cab., I (12) **1:** pl. 55, figs 11-13; Pfeiffer, 1850, *Ibid.,* pp. 318-319—'Port Essington in Neu-Holland'; Reeve, 1852, Conch. Icon., *Helix,* pl. 70, figs 362a-b—'Port Essington, New Holland (about roots of trees); Macgillivray'; Cox, 1868, A Monograph of Australian Land Shells, p. 40, pl. 4, fig. 7—'Arnheim's Land.'

Helix urvillei Hombron & Jacquinot, 1851, Voy. au Pole Sud, 'Astrolabe et Zelee,' Atlas, Moll., pl. 3, figs 1-3; Hombron & Jacquinot, 1854, Voy. au Pole Sud, 'Astrolabe et Zelee,' **5**, Mollusques: 1.

Helix (Xanthomelon) pomum Pfeiffer, Pilsbry, 1890, Man. Conch., (2) **6**: 178-179, pl. 38, figs 73-74.

Thersites (Xanthomelon) pomum (Pfeiffer), Pilsbry, 1894, Man. Conch., (2) **9**: 135, pl. 27, fig. 6.

Xanthomelon durvillii (Hombron & Jacquinot), Iredale, 1938, Australian Zoologist, **9** (2): 100.

Nomenclature and type localities

The somewhat complex variety of early names, illustrations, and locality records are summarized in the above synonymy. I have not seen type specimens of either species, and the diverse appearing illustrations obviously were made from several different specimens. The fact that the several illustrations emphasize different aspects of sculpture in part reflects the real frustrations of illustrators trying to depict the subtle surface features found in this group and in part real individual variation (see below). The subsequent correction for the type locality of *Helix pomum* to Port Essington (11°16'S, 132°09'E), which is essentially identical with the Raffles Bay locality, should be accepted.

Comparative remarks

Xanthomelon durvillii (Hombron & Jacquinot, 1841) is a more globose shell with less elevated spire than *X. prudhoensis* (Smith, 1894). Smaller specimens have easily visible traces of the same oblique anastomosing sculpture seen in *X. obliquirugosa* (Smith, 1894), but they are never as prominent. Larger specimens with thick shells and nearly to completely closed umbilici have a tendency towards weak radial growth ridges and only vague traces of the oblique sculpture. The comparatively low H/D ratio of *X. durvillii* (0.793-0.964, mean 0.877) will separate it from most examples of the Western Australian taxa. The very long and tightly coiled penis **(Figs 3a, 5, 11e)** with its very strong internal sculpture immediately separates *X. durvillii* from all of the Western Australian taxa.

Material studied

Sta. WA-103, East Point Forest Reserve, Darwin, Northern Territory (5 live adults, 53 dead adults, FMNH 182400, FMNH 182449, FMNH 182710, WAM 82.79, A. Solem and L. Price, 7 March 1974); Sta. WA-104, hillside just north of Adelaide River, at Snake Creek Bridge, 113 km south of Darwin (1 dead adult, FMNH 182351, A. Solem and L. Price, 8 March 1974); Sta. WA-105, 3 km south

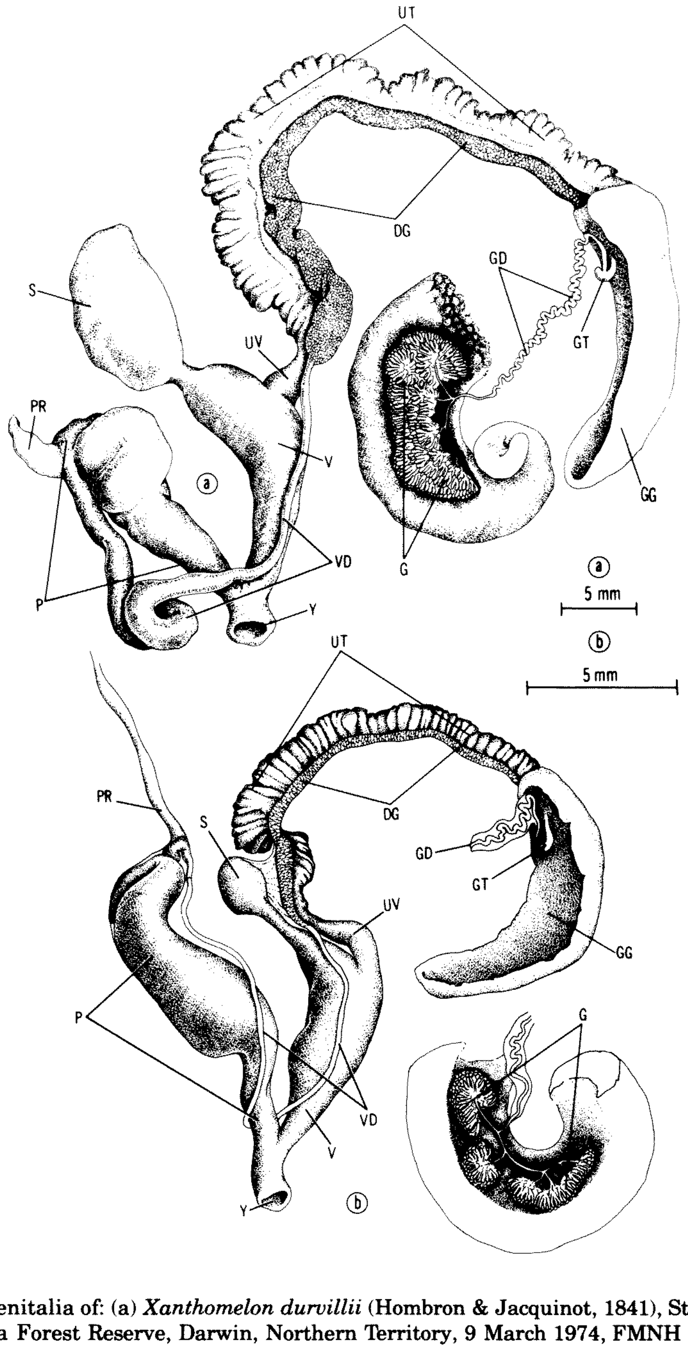

Fig. 3: Genitalia of: (a) *Xanthomelon durvillii* (Hombron & Jacquinot, 1841), Sta. WA-109, Casuarina Forest Reserve, Darwin, Northern Territory, 9 March 1974, FMNH 182611; (b) *Xanthomelon ruberpumilio,* Sta. W6 (5), Prince Regent River Reserve, 21 August 1974, WAM 1169.75, Dissection B. Scale lines as marked.

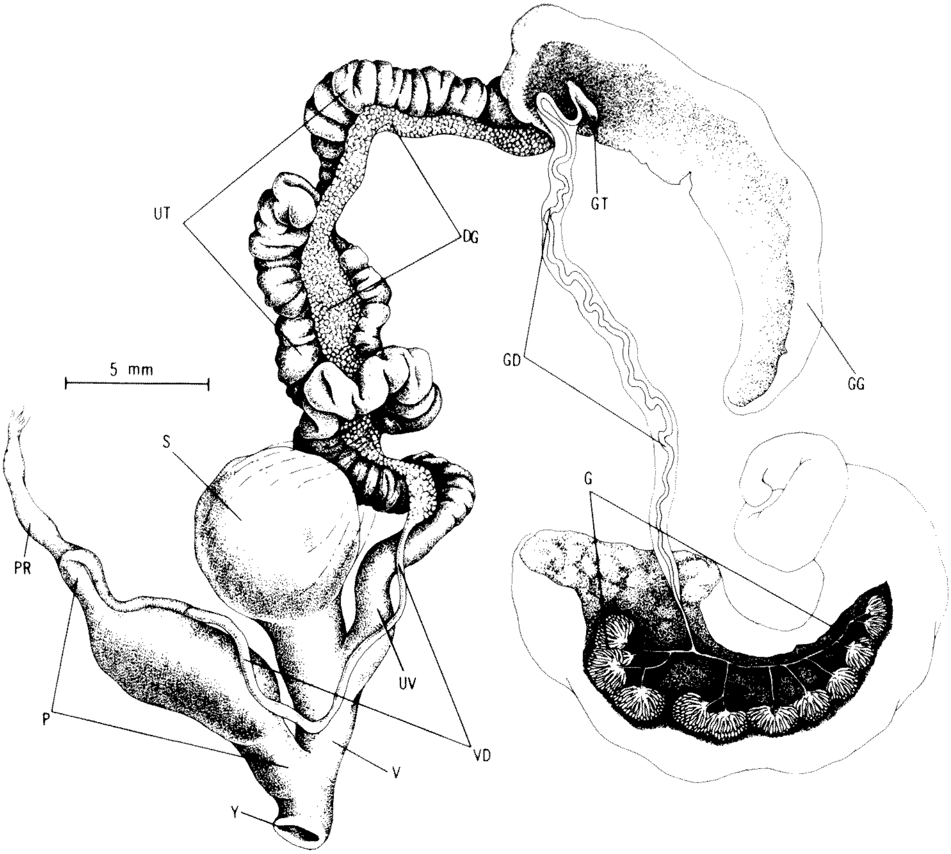

Fig. 4: Genitalia of *Xanthomelon prudhoensis* (Smith, 1894), Sta. WA-394, Mitchell Plateau, 15 March 1977, WAM 600.77, Dissection C. Scale line as marked.

of Rum Jungle on Batchelor Road, near Darwin (2 dead adults, FMNH 182338, WAM 85.79, WAM 87.79, A. Solem and L. Price, 8 March 1974); Sta. WA-106, grounds of Asti Motel, 7 Packard Place, Darwin (25 live adults, 9 dead adults, 1 dead juvenile, FMNH 182365, FMNH 182447, WAM 88.79, WAM 84.79, A. Solem and L. Price, 8 March 1974); Sta. WA-107, Dudley Point, Darwin (2 live adults, FMNH 182451, WAM 86.79, A. Solem and L. Price, 9 March 1974); Sta. WA-109, Casuarina Reserve, north of Brinken, coastal of Tiwi, Darwin (11 live adults, 30 dead adults, 4 dead juveniles, FMNH 182611, FMNH 182399, WAM 83.79, WAM 89.79, WAM 90.79, A. Solem and L. Price, 9 March 1974).

Diagnosis

Shell highly variable in size, 22.3-45.1 mm (mean 31.9 mm) in diameter, with 4¼ to 5½ (mean 4⅞) whorls that rapidly increase in width. Apex and spire only slightly elevated, body whorl deflected strongly just before aperture, height of shell 17.8-41.7 mm (mean 28.2 mm), H/D ratio 0.793-0.964 (mean 0.877). Apex and early spire of juveniles with weak radial ridges, usually worn in adults, lower spire and body whorl frequently with weak anastomosing transversely oblique ridges, in larger specimens a sculpture of vague radial growth ridges replacing the typical sculpture on the spire and body whorl. Lip strongly reflected, white, reflected to nearly completely or occasionally completely cover the umbilicus in very large examples, less reflected and with a narrowly open umbilicus in smaller shells. Shell colour light yellow green, without darker suffusions, parietal callus thin and white. Based on 133 measured adults.

Genitalia (**Figs 3a, 5, 11e**) from late wet season examples beginning to deactivate, with reduced hermaphroditic duct (GD), prostate (DG), and uterus (UT). Head of spermatheca (S) and vagina (V) enlarged, free oviduct (UV) inserting almost at right angles into vaginal-spermathecal channel. Vas deferens (VD) thickened on ascending portion, entering penis sheath (PS) at apex, coiled several times (**Fig. 11e**) before opening into penis chamber through a simple pore (EPO) at apex of a high pilaster (PP, **Fig. 5**). Penis sheath (PS, **Fig. 5**) starting well above atrium (Y), short. Interior of penis chamber (**Fig. 5**) showing complex pustules, high apical pilasters (PP), and a peculiar lateral pocket just at base of sheath area. Portion of penial chamber below sheath with high, smooth ridges and gradually diminishing pustulations. Based on dissection of 9 adults and 1 juvenile example.

Discussion

The several collections made near Darwin in March 1974 (**Table 2**) are highly variable in size. For the three stations from which numbers of both live and dead examples were available, it is interesting that there is only minor difference in size between live and dead examples. The great size difference between populations is remarkable. Sta. WA-106 was the cultivated garden of a motel in the heart of Darwin. The specimens were very thin, a darker colour, and with more prominent transverse sculpture. Sta. WA-103, East Point Forest Reserve, was an area of vine thicket with large trees giving a closed canopy, moderately difficult to enter, rather flat land subject to flooding during rains, with the living examples partly buried in the coarse gravel soil, or sitting on logs and tree trunks. The shells are slightly larger, solid but not thickened, have less prominent transverse and more prominent radial sculpture, and are slightly lighter in colour. Sta. WA-109, Casuarina Reserve, was a heavily shaded gully with moderately steep sides, very large trees, little undergrowth, and the specimens are variable in size and features. Some specimens are the same as those from WA-103, but most are significantly larger in size, quite solid and thickened, lighter in shell colour, almost without trace of the transverse sculpture, have the columellar lip more strongly and flatly reflected with the umbilicus almost to completely closed. Live examples were mostly crawling on fallen vegetation, in crotches of trees, or partly buried in gravel soil.

Table 1: Size and shape variation in Western Australian *Xanthomelon*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
X. sp.	5	22.52 (21.1-24.1)	23.09 (21.75-24.0)	0.975 (0.946-1.004)	4⅞ (4⅝-5⅛)
X. obliquirugosa	111	24.54 (17.85-29.8)	25.82 (19.65-31.1)	0.952 (0.846-1.052)	4¾ (4¼-5⅜)
X. prudhoensis	185	29.30 (19.95-35.5)	29.03 (22.5-34.2)	1.009 (0.880-1.145)	5¼ (4⅝-5¾)
X. ruberpumilio	64	20.62 (17.7-23.4)	18.93 (17.7-20.45)	1.089 (0.960-1.223)	5 (4½-5½)

Iredale (1938: 100) separated the Northern Territory *Xanthomelon* into 'four distinct species,' of which 'Two are openly perforate, two have the umbilicus closed, two have the columella smooth and two have the inner lip granulose.' The material from near Darwin shows all of these combinations, but dissections failed to reveal any differences in penial structure between shell types. In view of the very noticeable anatomical differences found between the species living in Western Australia, I conclude that the variations existing among and within the Darwin populations are phenotypic and that only one species is represented in this material.

Table 2: Variation in *Xanthomelon durvillii* (Hombron & Jacquinot, 1841) from Darwin, Northern Territory

Region	Number of Adults Measured	Mean, SEM, and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
WA-103, FMNH 182449[1] (live)	5	26.18±0.350 (25.0-27.1)	28.78±0.409 (27.8-30.1)	0.910±0.009 (0.890-0.935)	4⅞ (4½-5¼)
WA-103, FMNH 182400 (dead)	53	24.31±0.291 (19.8-29.6)	27.74±0.264 (23.5-32.5)	0.876±0.004 (0.793-0.940)	4⅞ – (4½-5½)
WA-106, FMNH 182447 (live)	25	22.20±0.466 (17.5-27.2)	25.69±0.423 (22.4-29.7)	0.863±0.006 (0.799-0.917)	5⅛ – (4⅞-5¼)
WA-106, FMNH 182365[2] (dead)	9	21.84±0.675 (17.8-25.1)	25.39±0.680 (22.3-29.0)	0.860±0.011 (0.798-0.902)	4¾ (4½-5)
WA-109, FMNH 182446[3] (live)	11	33.94±1.108 (27.9-38.8)	38.38±1.133 (32.3-43.0)	0.884±0.010 (0.820-0.938)	4⅝ (4¼-5⅜)
WA-109, FMNH 182399 (dead)	30	35.78±0.620 (29.0-41.7)	40.28±0.600 (32.9-45.1)	0.888±0.007 (0.793-0.964)	4¾ + (4½-5½)

[1] WA-103, East Point Forest Reserve, Darwin. 7-III-1974.
[2] WA-106, grounds of Asti Motel, 7 Packard Place, Darwin. 8-III-1974.
[3] WA-109, Casuarina Reserve, north of Brinken, coastal of Tiwi, Darwin. 9-III-1974.

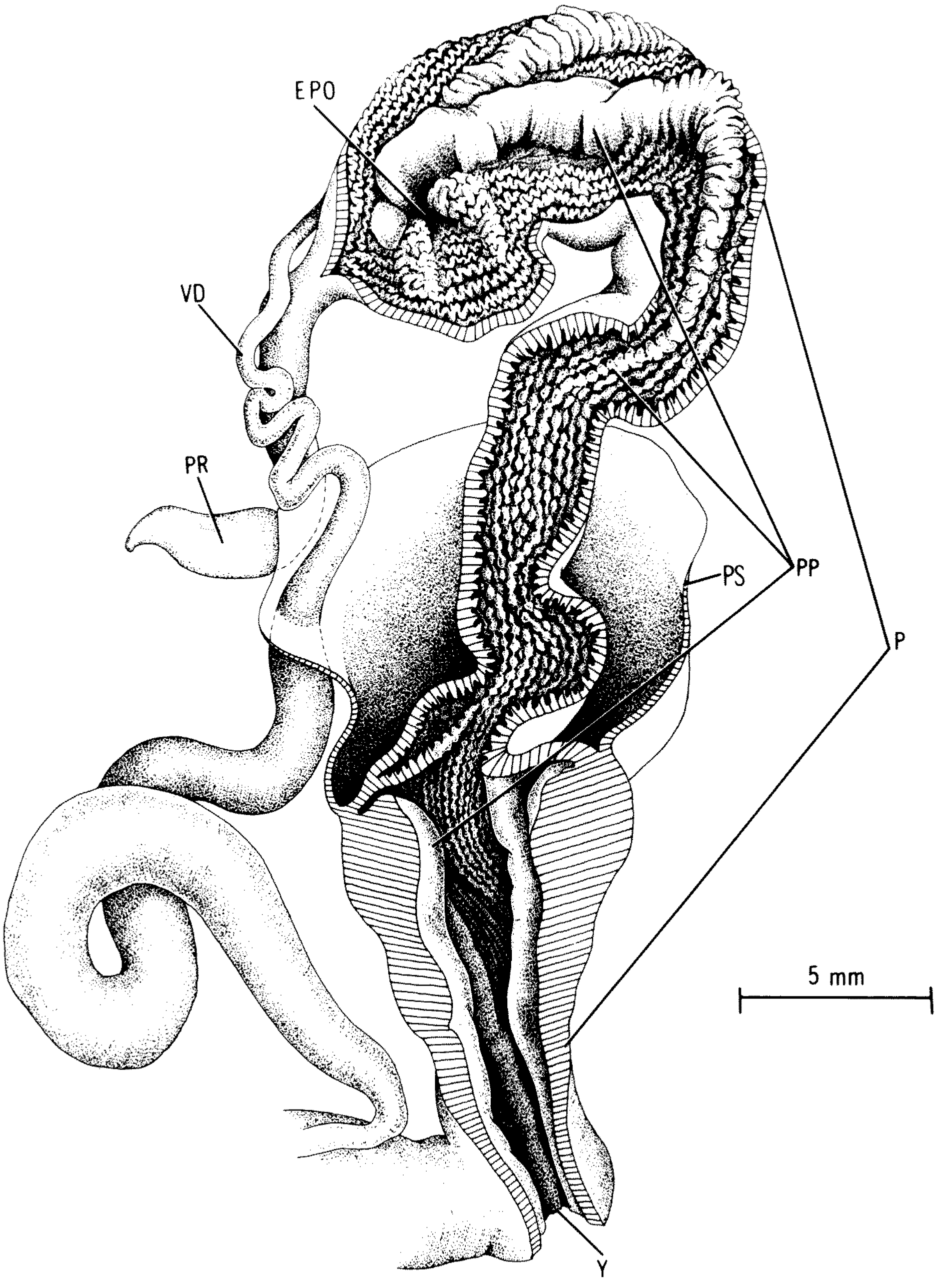

Fig. 5: Penis interior of *Xanthomelon durvillii* (Hombron & Jacquinot, 1841), Sta. WA-109, Casuarina Forest Reserve, Darwin, Northern Territory, 9 March 1974, FMNH 182611. Scale line as marked.

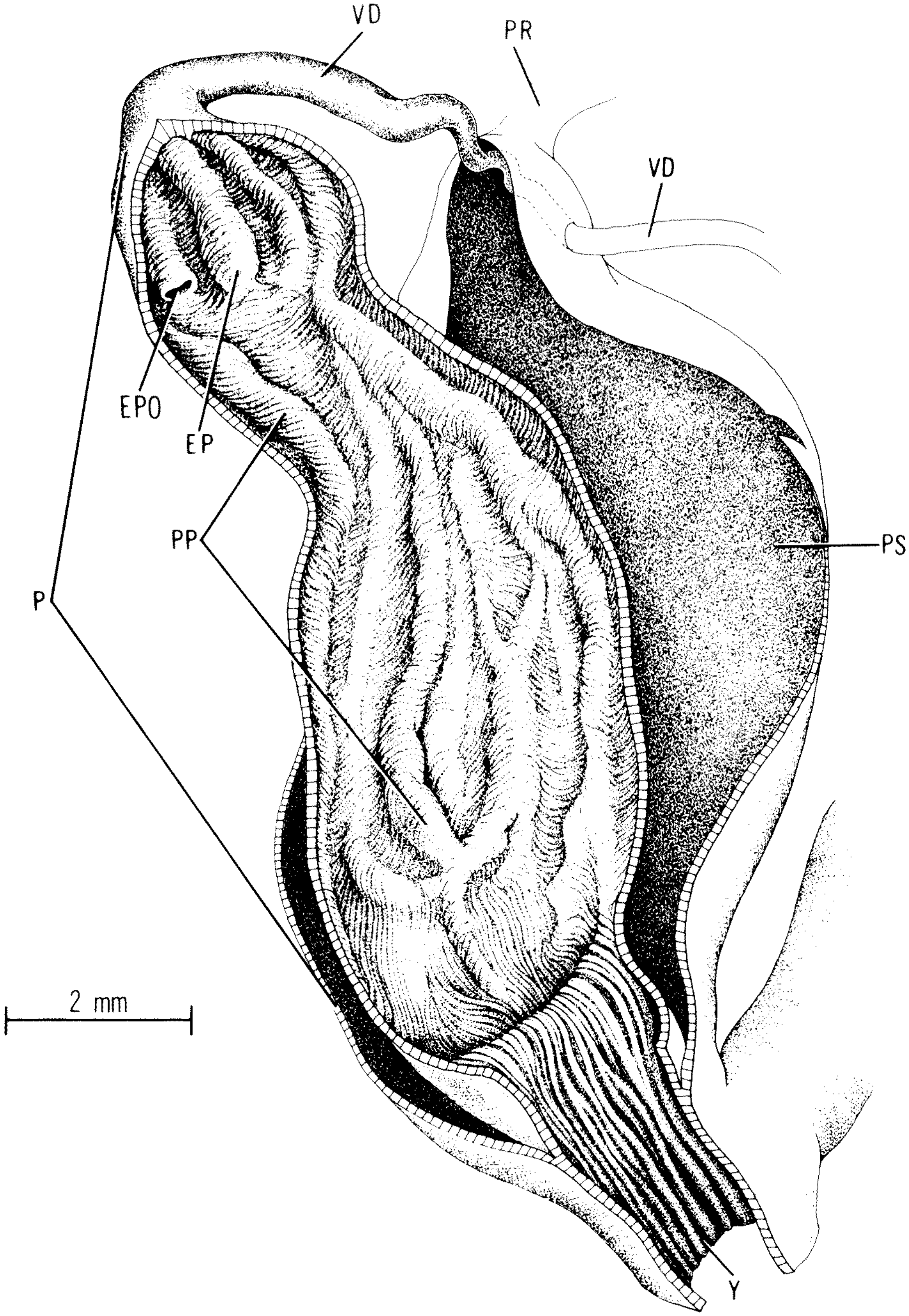

Fig. 6: Penis interior of *Xanthomelon ruberpumilio,* Sta. W6 (5), Prince Regent River Reserve, 21 August 1974, WAM 1169.75, Dissection B. Scale line as marked.

Whether I am correct in assigning this complex of populations to *Xanthomelon durvillii* (Hombron & Jacquinot, 1841) will have to be tested by study of material from Port Essington and eventual location of type material in London and Paris. To what extent such names as *X. spheroideum* (Le Guillou, 1845), *X. meadei* (Brazier, 1870), *X. pseudomeadei* (Bednall, 1876), *X. lyndi* (Angas, 1872), and *X. interpositum* Iredale, 1938, will be involved in the synonymy of these populations is unknown. Even the Queensland species, *X. pachystylum* (Pfeiffer, 1845) may be related.

XANTHOMELON PRUDHOENSIS (SMITH, 1894)

(Plate 1b; Figs 1c-d, 4, 7, 8a-c, 9a-b)

Helix (Hadra) prudhoensis Smith, 1894, Proc. malac. Soc. London, **1:** 91, pl. VII, fig. 9—Prudhoe Island, north-west Australia.

Globorhagada prudhoensis (Smith), Iredale, 1938, Australian Zool., **9** (2): 114; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 72, pl. V, fig. 19.

Comparative remarks

Xanthomelon prudhoensis (Smith, 1894) differs most obviously from the Northern Territory *X. durvillii* (Hombron & Jacquinot, 1841) in having the early postapical sculpture consist of fine pustules arranged along weak radial ribs **(Plate 1b),** rather than weak anastomosing transverse ridges. In Western Australia, the overlapping *X. obliquirugosa* (Smith, 1894) is less elevated and generally is smaller, has a lower whorl count, but is most easily separated by its strong obliquely radial sculpture of low anastomosing ridges **(Plate 1a).** The sometimes sympatric *X. ruberpumilio* is much smaller, always less than 21 mm in adult diameter (*X. prudhoensis* is always more than 21 mm in adult diameter), has a deep reddish suffusion on the spire, and a sculpture of much more prominent pustules on the upper spire **(Plate 1c-d).**

Anatomically, the nearly uncoiled and relatively short penis of *X. prudhoensis* **(Figs 4, 7)** with its internal sculpture of V ridges that form a sperm gutter **(Fig. 7)** easily distinguish it from *X. obliquirugosa* with its longer and strongly coiled penis **(Fig. 10)** with essentially no special internal wall sculpture **(Fig. 11a),** and *X. ruberpumilio* with a penis of intermediate length and coiling **(Fig. 3b)** and internal wall sculpture of very unusual texture **(Fig. 6).** *X. durvillii* **(Fig. 3a)** has an exceedingly long and tightly coiled penis with strong wall sculpture **(Figs 5, 11e).**

Lectotype

British Museum (Natural History) number 92.1. 29.165, Prudhoe Island, north-west Australia (12°26′S, 125°14′E). Collected by J.W. Combe, September 1891. Height of shell 23.2 mm, diameter 24.1 mm, H/D ratio 0.963, whorls 5⅛-.

Paralectotype

British Museum (Natural History) number 92.1. 29.166, 1 adult specimen from the type locality.

Material studied

North-west Kimberley: Kalumburu Mission (29 live adults, 12 live juveniles, WAM 1205.75, WAM 637.77, FMNH 200808, Father Sanz, May 1969); Kalumburu (1 live adult, 2 dead adults, 2 dead juveniles, WAM 346.74, WAM 1157.75, WAM 1199.75, W.H. Butler, December 1965); Tamarindu, 27 km north of Kalumburu (WAM 2 broken shells, Ian Crawford, August 1966); Plain Creek, north of Gibb River Station (5 dead adults, 1 dead juvenile, WAM 1191.75, Ian Crawford, 23 July 1966); 27 km west of Mt Elizabeth Station homestead (5 dead adults, 2 dead juveniles, WAM 1197.75, Ian Crawford, 5 August 1966); 32 km east of Mt Elizabeth Station homestead (2 dead adults, WAM 96.69, Ian Crawford, 5 August 1966); Barnett River Gorge, north of Beverley Springs Station on Gibb River Road (2 dead adults, 2 dead juveniles, WAM 1201.75, B.R. Wilson and S. Slack-Smith, 26 August 1975); 57 km west west of Gibb River Station (1 dead adult, WAM 1198.75, F. Wells, 23 August 1976); Sta. C4, Carlia creek running into Carson Escarpment 1-2 km east of Carson River (15°01'S, 126°49'E) (2 dead adults, WAM 1203.75, R. Johnstone, August 1975); Sta. C2-11a, display bower of Great Bowerbird, plateau on north-west side of Woorakin Creek Gorge, Carson River (48 dead adults, 1 dead juvenile, WAM 229.76, J. Dell, August 1975); Mongonai Creek, 24 km south of Carson River Crossing, Gibb River–Kalumburu Road (3 dead adults, NMV F30051, A.C. Beauglehole, 4-VI-1976); Borda Island, Bonaparte Archipelago (1 dead adult, 1 dead juvenile, WAM 1193.75, A. Burbidge, 14 June 1972); Bigge Island, Bonaparte Archipelago (1 dead adult, WAM 1195.75, A. Burbidge, 5 June 1972); *ca.* 8 km north of AMAX camp, Mitchell Plateau (1 live adult, WAM 1207.75, L. Smith and R. Johnstone, 5 February 1973); Mitchell Plateau (1 dead adult, WAM 1188.75, K. Kenneally, June 1976); Sta. MP-7, crossing of track and Camp Creek, Mitchell Plateau (1:100,000 'Warrender' map sheet 4068, grid reference 553:046) (2 dead adults, WAM 1187.75, B.R. Wilson and S. Slack-Smith, 23 August 1975); creek west of Mitchell River (1 dead adult, WAM 319.77, R. Randolph, July 1976); Mitchell Falls, Mitchell River (1 live adult, 2 dead adults, 3 broken specimens, WAM 1184.75, WAM 1206.75, F. Wells, 5 August 1976); Sta. WA-394, south-east side Crystal Creek, north-east of road, 8.2 km from Port Warrender Road (Warrender 4068-946:001) (16 live adults, 16 dead adults, 1 live juvenile, FMNH 199350, FMNH 200014, WAM 91.79, WAM 324.77, WAM 600.77, L. Price and C. Christensen, 15 March 1977); Crystal Creek near Crystal Head, Mitchell Plateau (1 dead adult, 1 dead juvenile, WAM 1185.75, R.E. Johnstone, 23 January 1973;) Crystal Creek Pool, Mitchell Plateau (1 dead adult, WAM 1202.75, 30 October 1976); near Crystal Creek Pool, Mitchell Plateau (grid reference 993:944) (6 live adults, 3 live juveniles, 2 dead adults, 2

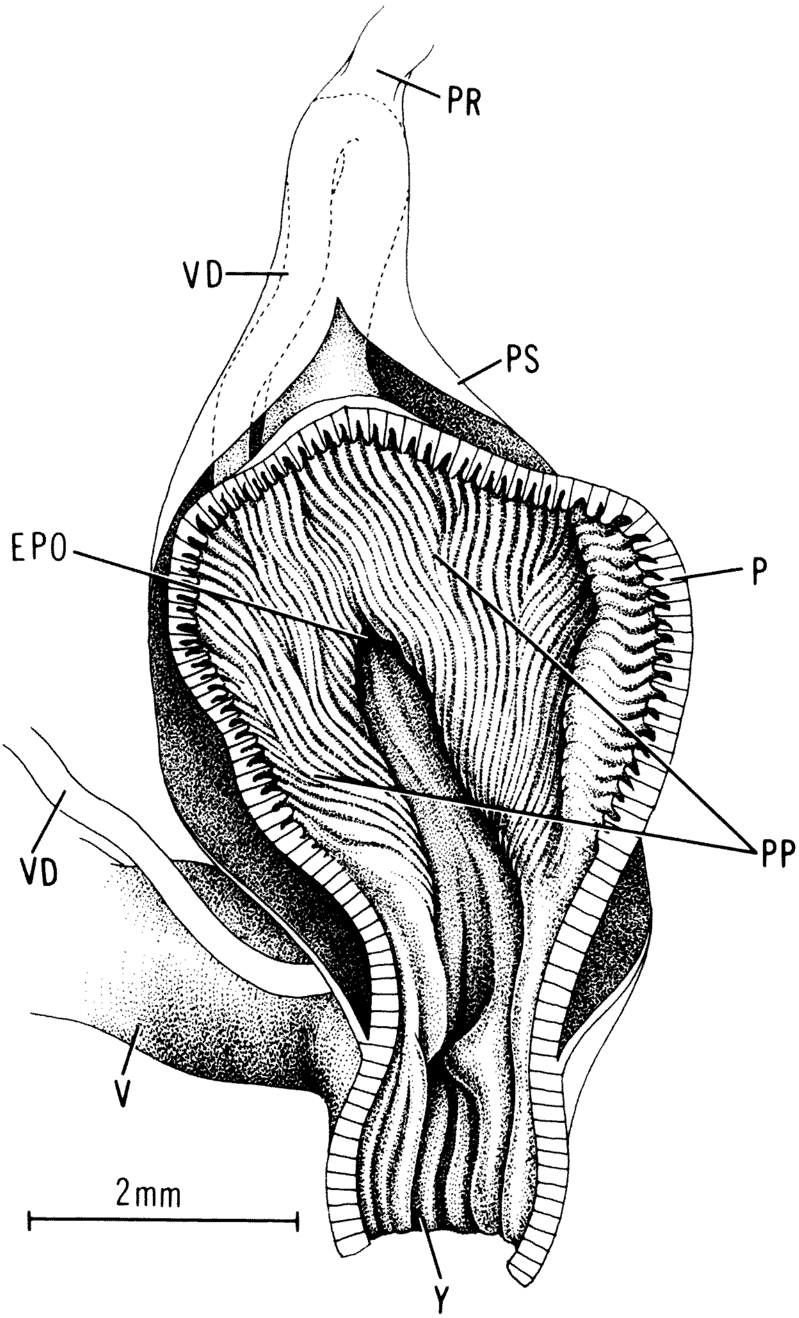

Fig. 7: Penis interior of *Xanthomelon prudhoensis* (Smith, 1894), Kalumburu Mission, May 1969, WAM 637.77, Dissection B. Scale line as marked.

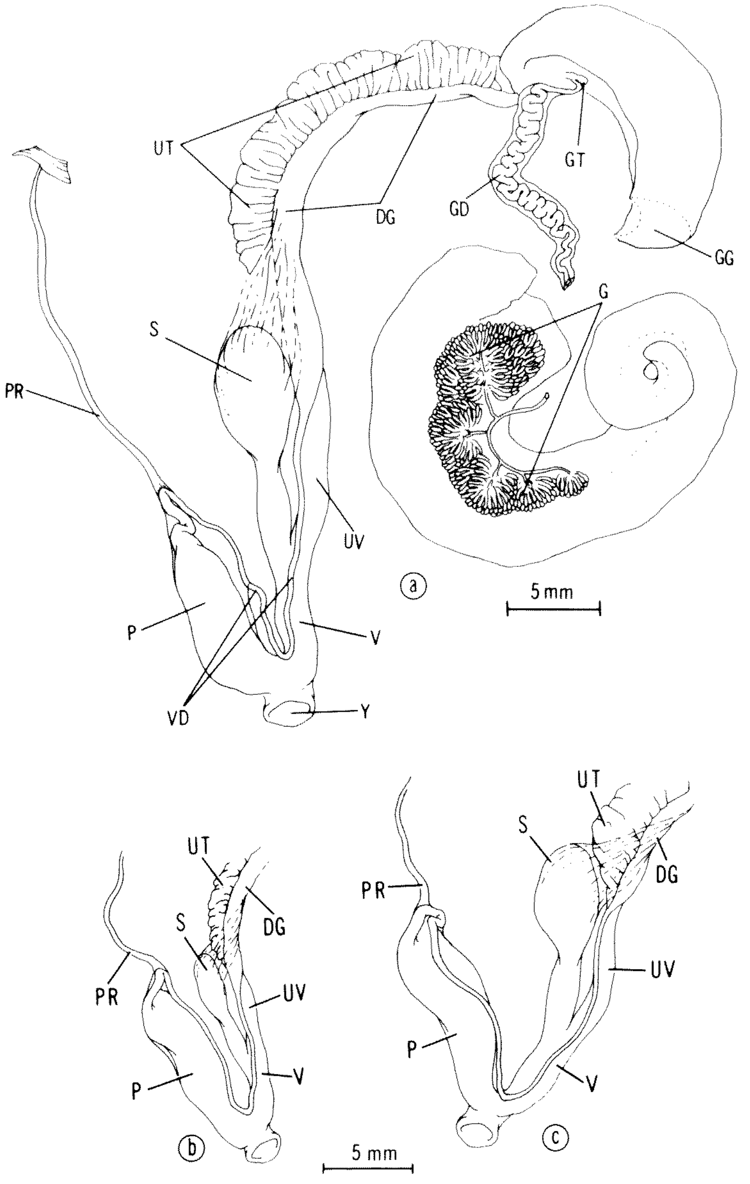

Fig. 8: Genitalia of *Xanthomelon prudhoensis* (Smith, 1894) showing seasonal variations: (a) Sta. 3, Crystal Creek, Mitchell Plateau, 2 November 1976, WAM 1208.75, Dissection A, male active reproductive phase; (b) Sta. W6 (5), Prince Regent River Reserve, 21 August 1974, WAM 635.77, Dissection A, inactive reproductive phase with nearly empty spermatheca; (c) Station W6 (5), Prince Regent River Reserve, 21 August 1974, WAM 451.75, Dissection B, inactive reproductive phase with enlarged spermathecal head. Scale lines as marked.

dead juveniles, WAM 318.77, WAM 1186.75, WAM 1200.75, 30 October 1976); Sta. 1, Crystal Creek, Mitchell Plateau (2 live adults, WAM 1209.75, 2 November 1976); Sta. 3 and Sta. WA-399, boab tree above gauging station, Crystal Creek, Mitchell Plateau (Admiralty Gulf 4069-965:013) (22 live adults, 1 dead adult, FMNH 200802, FMNH 199817, WAM 1208.75, WAM 1210.75, WAM 1211.75, WAM 92.79, 2 November 1976 and 15 March 1977); Augustus Island (1 dead adult, 2 dead juveniles, WAM 1192.75, WAM 1194.75, 12 May 1972); Sta. E1, Upper Prince Regent River (15°49′S, 125°37′E) (7 dead adults, 3 dead broken, WAM 207.75, K.T. Richards, 22 August 1974); Sta. E4, Wyulda Creek, Upper Roe River, Prince Regent River Reserve (15°26′S, 125°36′E) (1 dead adult, WAM 206.75, 15 August 1974); Sta. E5 (3), campsite on top of Enid Falls, Prince Regent River Reserve (2 dead adults, 1 live juvenile, 1 dead juvenile, WAM 201.75, WAM 204.75, WAM 466.75, 14-16 August 1974); Sta. E5 (6), eastern side of steep gully about 2 km west of Enid Falls campsite (1 live adult, WAM 464.75, 17 August 1974); Sta. E5 (10), spring feeding into northern tributary of Rufous Creek, Roe River, Prince Regent River Reserve (1 dead adult, WAM 203.75, 18 August 1975); Sta. W6 (5), valley slopes on south side of Youwanjela Creek, near main campsite, Prince Regent River (8 live adults, 2 dead adults, 3 live juveniles, 1 dead juvenile, WAM 200.75, WAM 202.75, WAM 451.75, WAM 465.75, WAM 467.75, WAM 635.77, FMNH 200801, 21-23 August, 1974); Glenelg River, *ca.* 6 km up from tidal influence (1 dead juvenile, WAM 1189.75, Ian Crawford, 10 August 1965); Doubtful Bay (1:250,000 'Camden Sound' map sheet SD51-15, grid reference 210:003) 1 dead juvenile, WAM 1190.75).

Diagnosis

Shell very large, 22.5-34.2 mm in diameter (mean 29.03 mm), with 4⅝ to 5¾ (mean 5¼) whorls that rapidly increase in width. Apex and spire normally strongly elevated, spire angle at times becoming acute, height of shell 19.95-35.5 mm (mean 29.3 mm), H/D ratio 0.880-1.145 (mean 1.009). Apex usually worn smooth even in juveniles, postapical sculpture of microscopic pustules along weak radial ridges on upper spire (**Plate lb**), absent from body whorl and replaced by extremely fine incised spiral lines and irregular occasional growth lines. Lip strongly flared, white, reflexed to partly cover umbilical opening, which has a distinctly shouldered margin in most examples. Shell color greenish-yellow, occasionally with a weak reddish suffusion on the apical whorls and first postapical whorl, parietal callus thin and white. Based on 185 measured adults.

Genitalia (**Figs 4, 8-9**) seasonally variable in apical structures. Ovotestis (G) inactive in August (not illustrated), greatly swollen in early November (**Fig. 8a**), deactivating in March (**Fig. 4**), inactive in May (**Fig. 9a**), changes in hermaphroditic duct (GD) coiling matching those in ovotestis condition. Prostate (DG) and uterus (UT) inactive size in May (**Fig. 9a**) and August,

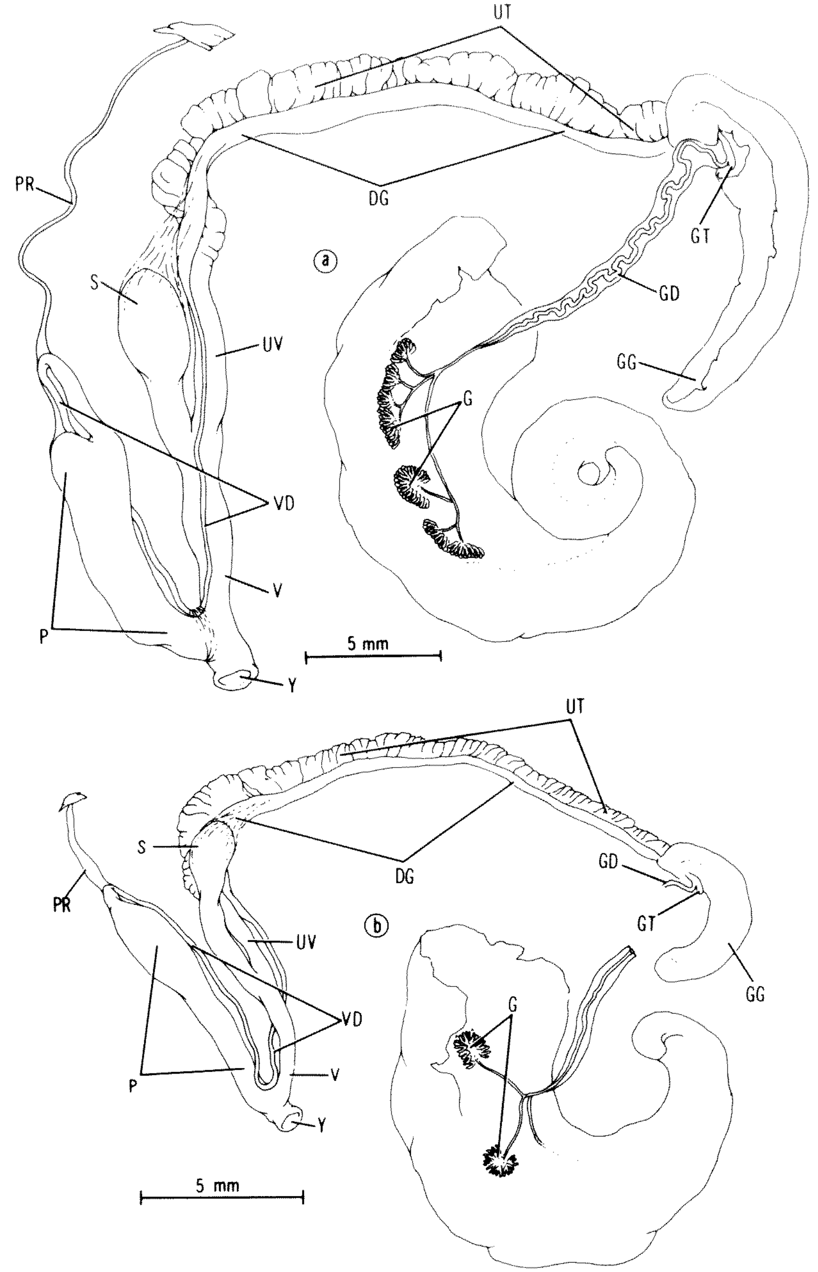

Fig. 9: Genitalia of *Xanthomelon prudhoensis* (Smith, 1894) showing seasonal variations: (a) Kalumburu Mission, May 1969, WAM 637.77, Dissection B, adult inactive reproductive phase; (b) Sta. WA-394, Crystal Creek, Mitchell Plateau, 15 March 1977, WAM 598.77, Dissection D, shell newly adult with barely reflected lip edge. Scale lines as marked.

prostate large in early November (**Fig. 8a**) but uterus still small, uterus still large in March (**Fig. 4**) but prostate reduced in size and clarity of acini. Spermatheca (S) short, shaft not looped or coiled, size of head highly variable, large and globose when packed with sperm masses (March, **Fig. 4**, less in October to November, **Fig. 8a**), very slender when newly adult (**Fig. 9b**), and in May and August (**Fig. 9a**), bound to prostate-uterus by a thin sheath. Free oviduct (UV) a simple tube, merging at sharp angle with spermathecal-vaginal tract, angle sharpening during periods of sexual activity. Vagina (V) variable in length (**Figs. 4, 8, 9**) both within and between populations. Vas deferens (VD) entering penis sheath one-third to half way up, bound to wall of penis sheath up to point of insertion of penial retractor muscle (PR), then reflexing, thickening, and curving laterally to enter chamber of penis (P) through a simple pore. Penis sheath (PS) thin walled (**Fig. 7**), starting very slightly above atrium (Y). Penis (P) cylindrical, not coiled within sheath, internally (**Fig. 7**) with a sperm gutter from which narrow oblique crowded ridges radiate upwards meeting to form a V on opposite wall. Both basally and apically small pockets cause the bulging of the penis seen in **Fig. 9a.** Based on 17 dissections and partial checks of several other specimens.

Type specimens

The two specimens used by Smith (1894) are whitened bones without trace of periostracum or fine sculpture. They are at the low end of the size range for the species, but compare well in shape and umbilicus with recently collected examples. The depressed shape of the paralectotype results from a repaired spire injury that also caused this specimen to have the smallest height of any adult specimen measured. The shouldered umbilical margin, high spire of the type, and greater whorl count are sufficient to identify these as *X. prudhoensis*. Since specimens of *X. obliquirugosa* that are equally worn retain noticeable transverse ridges, I have no hesitation in assigning the name *X. prudhoensis* to this taxon, despite the absence of sculpture and small size.

Discussion

Variation in spire elevation and H/D ratio is greater within than between populations. A specimen of average elevation (**Fig. 1d**) and a high spired example (**Fig. 1c**) from the Prince Regent Reserve give a good indication of shape range. The even squatter shells simply have a less protruding spire and lower H/D ratio. Variation in the few samples with significant specimen numbers is summarized in **Table 4.** Most other samples contained only one or two specimens. **Table 3** gives the mean and range for all adult material from several regions. The 'Inland' area refers to the region from south of the Drysdale Reserve survey to the Barnett River Gorge; 'Drysdale' and 'Prince Regent' refer to the areas covered by the survey reports (Wilson & Smith, 1975; Merrifield, Slack-Smith & Wilson, 1977); 'Mitchell Plateau' to the area between the Mitchell and Lawley Rivers, and 'Kalumburu' to collections made

Table 3: Geographic variation in *Xanthomelon prudhoensis* and *X. obliquirugosa*

Xanthomelon prudhoensis (Smith, 1894)

Region	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D ratio	Whorls
Kalumburu	31	26.97 (24.6-29.4)	26.51 (23.55-28.9)	1.018 (0.948-1.145)	5⅛ + (4⅞-5¾)
Drysdale	50	28.79 (26.3-31.95)	29.26 (25.4-31.5)	0.981 (0.905-1.094)	5¼ (5-5⅝)
Inland	15	27.12 (22.55-30.35)	26.62 (22.5-28.85)	1.020 (0.941-1.086)	5⅛ + (4¾-5⅝)
Mitchell	63	30.97 (27.3-35.5)	30.35 (27.2-35.5)	1.023 (0.941-1.114)	5¼ (4⅞-5⅝)
Prince Regent	22	31.45 (28.6-34.0)	30.72 (28.4-34.2)	1.025 (0.927-1.136)	5⅛ + (5-5⅜)

Xanthomelon obliquirugosa (Smith, 1894)

Region	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D ratio	Whorls
Kalumburu	22	23.89 (17.85-29.05)	25.23 (19.65-30.2)	0.989 (0.877-1.049)	4⅞ − (4⅜-5⅜)
Drysdale	60	25.76 (21.05-29.8)	27.17 (22.2-31.1)	0.948 (0.846-1.052)	5 (4⅝-5¼)
Mitchell	24	23.64 (19.2-26.5)	24.48 (21.2-27.0)	0.971 (0.889-1.030)	4¾ + (4⅜-5)
Ningbing	3	21.10 (19.6-23.0)	22.57 (21.45-24.15)	0.934 (0.914-0.952)	4¾ (4⅝-4⅞)
Parry Harbour	3	18.78 (18.4-19.1)	20.15 (20.0-20.35)	0.932 (0.920-0.950)	4½ + (4¼-4¾)

in the vicinity of Kalumburu Mission. The near identity in size of the larger Mitchell and Prince Regent shells contrasts with the comparatively dwarfed Kalumburu and Inland shells. The Drysdale populations are intermediate in size. Differences in whorl count are negligible, with the local differences in height and diameter being more noticeable. Populations taken along Crystal Creek (**Table 4**) in the Mitchell Plateau region show a 3.57 mm difference in diameter between means. Since there is only a 4.21 mm difference between area extremes, these differences must not be given undue weight.

Table 4: Local variation in Western Australian *Xanthomelon*

Xanthomelon ruberpumilio

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
Sta. E1, Prince Regent Reserve (dead)	7	18.56±0.343 (17.7-20.4)	18.32±0.190 (17.7-18.9)	1.013±0.019 (0.960-1.079)	5 − (4¾-5¼)
Sta. E5 (3) Prince Regent Reserve (dead)	17	19.39±0.206 (18.35-21.35)	18.23±0.122 (17.45-19.2)	1.064±0.010 (1.008-1.152)	4⅞ (4⅝-5)
Sta. W6 (5), Prince Regent Reserve (live)	26	21.38±0.229 (18.6-23.3)	19.22±0.136 (18.4-20.35)	1.113±0.012 (1.046-1.223)	5⅛ − (4¾-5⅜)
Sta. W6 (6), Prince Regent Reserve (live)	7	22.19±0.419 (20.2-23.4)	19.91±0.135 (19.45-20.45)	1.115±0.018 (1.020-1.156)	5⅛ + (4⅞-5½)

Table 4: Local variation in Western Australian *Xanthomelon* (continued)

Xanthomelon prudhoensis (Smith, 1894)

Station	Number of Adults Measured	Mean, SEM and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls
Kalumburu, V-1969 (live)	29	26.88±0.236 (24.6-29.05)	26.46±0.169 (23.55-28.9)	1.017±0.009 (0.948-1.145)	5⅛+ (4⅞-5¼)
Sta. C2-11A, Drysdale Reserve (dead)	48	28.75±0.169 (26.3-31.5)	29.29±0.169 (26.4-31.5)	0.978±0.009 (0.905-1.089)	5¼ (5-5⅝)
27 km west of Mt Elizabeth Homestead	5	27.54±0.650 (25.9-29.6)	26.69±0.495 (25.3-28.25)	1.032±0.011 (1.011-1.064)	5⅛– (4⅞-5⅜)
Plain Creek north of Gibb River Station (dead)	5	28.48±0.380 (27.5-29.7)	27.43±0.428 (26.15-28.85)	1.039±0.017 (1.002-1.086)	5⅜– (5¼-5⅝)
Sta. 3, Crystal Creek, Mitchell Plateau, 2-XI-1976 (live)	12	32.45±0.454 (29.9-35.1)	32.31±0.430 (29.8-34.2)	1.005±0.122 (0.958-1.091)	5⅜– (5-5½)
Crystal Creek near pool, Mitchell Plateau, 30-X-1976 (live & dead)	9	29.32±0.520 (27.3-32.35)	28.74±0.338 (28.0-31.15)	1.020±0.013 (0.941-1.078)	5¼ (5-5⅜)
Sta. WA-394, Crystal Creek, Mitchell Plateau, 15-III-1977 (dead)	15	30.51±0.360 (28.4-32.9)	29.86±0.318 (27.35-31.6)	1.022±0.011 (0.949-1.092)	5¼ (5-5½)
Sta. WA-394, Crystal Creek, Mitchell Plateau, 15-III-1977 (live)	16	30.57±0.460 (27.6-34.25)	29.33±0.292 (27.2-31.3)	1.043±0.010 (0.959-1.114)	5¼– (4⅞-5⅝)
Sta. WA-399, Crystal Creek, Mitchell Plateau, 18-III-1977 (live)	8	32.38±0.597 (30.3-34.6)	31.77±0.312 (30.4-32.45)	1.019±0.015 (0.944-1.066)	5⅛+ (5-5⅜)
Sta. E1, Prince Regent Reserve	7	31.68±0.717 (28.6-34.0)	30.74±0.705 (28.4-34.2)	1.031±0.012 (0.988-1.071)	5¼ (5⅛-5⅜)
Sta. W6 (5), Prince Regent Reserve	10	31.26±0.424 (29.0-33.5)	30.91±0.416 (29.0-33.0)	1.013±0.016 (0.927-1.066)	5⅛ (5-5¼)
Xanthomelon obliquirugosa (Smith, 1894)					
Kalumburu, I-1966 (live)	5	23.34±1.962 (17.85-28.3)	25.01±1.709 (19.65-28.55)	0.934±0.028 (0.888-1.042)	4¾ (4¼-5½)
Sta. WA-218, Kalumburu, 28-X-1976 (live & dead)	7	23.22±0.754 (20.7-26.2)	24.91±0.562 (23.35-27.4)	0.931±0.014 (0.877-0.973)	4⅞– (4⅝-5)
Sta. B1-1, Drysdale Reserve (live)	12	26.47±0.409 (24.2-28.55)	27.89±0.302 (26.7-29.5)	0.949±0.011 (0.879-1.006)	5– (4¾-5¼)
Sta. B1-2, Drysdale Reserve (live & dead)	6	27.23±0.714 (25.6-29.8)	29.06±0.552 (27.3-31.1)	0.937±0.013 (0.909-0.995)	5+ (4⅝-5¼)
Sta. B1-3, Drysdale Reserve (live & dead)	7	24.84±0.678 (22.6-27.05)	26.50±0.365 (24.9-28.1)	0.937±0.019 (0.850-1.006)	5 (4¾-5¼)
Sta. C4, Drysdale Reserve (dead)	18	25.94±0.427 (23.4-28.85)	26.93±0.338 (24.8-29.7)	0.963±0.010 (0.894-1.052)	5 (4¾-5¼)
Sta. C5, Drysdale Reserve (dead)	7	27.02±0.669 (24.3-29.05)	28.36±0.627 (26.2-30.25)	0.953±0.009 (0.926-0.983)	5+ (4⅞-5¼)
Sta. 3, east of Crystal Creek pools, Mitchell Plateau, 2-XI-1976 (dead)	6	23.58±0.364 (22.65-25.2)	24.67±0.418 (23.5-26.3)	0.977±0.022 (0.943-1.081)	4⅝+ (4½-4⅞)

To a quite surprising extent even the most worn examples retain traces of the early postapical microsculpture and thus can be identified with certainty. Specimens of *X. obliquirugosa* (Smith, 1894) are even more apt to retain sculpture, so that rarely is identification a problem.

Seasonal differences in the genitalia are dramatic. While it was not possible to dissect materials from the same populations taken at different seasons, enough was obtained to permit outlining reproductive events. Two sets taken on the Mitchell Plateau contained shells with the lip slightly reflected, but not thickened, indicating maturation in the current wet season. A specimen collected 5 February 1973 from 8 km north of the AMAX camp (WAM 1207.75), and one example from Station WA-394, Crystal Creek (FMNH 200014) collected 15 March 1977 were in this stage of development. The genitalia has been outlined **(Fig. 9b)** for comparison with August material from the Prince Regent area **(Fig. 8b)**, May specimens from Kalumburu **(Fig. 9a)**, November **(Fig. 8a)** and March **(Fig. 4)** from the Mitchell Plateau. The small size of the albumen gland **(Fig. 9b,** GG) in the newly adult material, more slender penis, and very tiny ovotestis (G) are the major noticeable differences from the May **(Fig. 9a)** and August examples. In both of the latter, the ovotestis is quite small, in March **(Fig. 4)** the ovotestis is empty and shrinking, and only in November **(Fig. 8a)** is the ovotestis obviously swollen and functional. Prostate tissue is enlarged in November, shrunken at other seasons. The uterus is partly enlarged in November **(Fig. 8a)**, still enlarged in March **(Fig. 4,** except for the newly adult where it was not yet developed). The spermathecal head shape varies in a little more complex pattern. In the newly matured examples **(Fig. 9b)** the head (S) is barely enlarged. In early November **(Fig. 8a)** it is only moderately swollen, but in March **(Fig. 4)** the spermathecal head is enormously distended by a mass of material. The May specimens **(Fig. 9a)** had the head moderately swollen, while in August **(Figs 8b-c)** it is variable in size, but obviously reduced. Since late October rains had produced activity prior to the November collecting, presumably mating had occurred, thus accounting for the swollen spermathecal head. The enormous spermathecal head enlargement in March, combined with the empty condition of the ovotestis, suggests that emptying of the system had taken place, with products unused for reproduction in the current wet accumulated and stored in the spermatheca as a source of nourishment during the coming dry season. The European *Helix pomatia* Linné, 1758 accumulates both endogenous and exogenous sperm in the spermatheca (Lind, 1973), but destroys or eliminates them rather rapidly by a variety of means. The presence of gross swelling in March and residual swelling even in August suggests that the spermatheca stores reproductive products for gradual resorption during the dry season, thus providing a store of nourishment.

The above structures and sequences are consistent with the animal reaching shell maturity in its second wet season (half grown in first), then functioning as a male at the beginning of the third wet season. Female functioning could occur later in that wet season, or be postponed to the fourth year. During the dry season, the reproductive tract is deactivated, with a stored food source in the spermatheca at the end of the wet and start of the next dry season. Whether this food source is used for general body functions or to 'charge up' the genitalia before the start of the next wet season is unknown.

XANTHOMELON SP.

(Figs 1a-b)

Comparative remarks

Material from the north-west Napier Range to Manning Gorge near Mt Barnett near the Packhorse Range may be small examples of *Xanthomelon prudhoensis* (Smith, 1894), but seem to have more rounded whorls, deeper sutures, and a more evenly globose appearance. None of the specimens seen are well enough preserved to show the apical and spire sculpture. Pending collection of live or fresh examples, they are not assigned a species name.

Material studied

Barnet Cave, north-west Napier Range (2 dead adults, WAM 1012.76, 1:100,000 'Lennard' map sheet 3863-grid reference *ca.* 096:655); Sta. WA-317, 5 km north of Mt Hart Homestead, just west of Mt Matthew, King Leopold Range (1:100,000 'Matthew' map sheet 3864–443:046) (1 dead adult, FMNH 199324, L. Price and C. Christensen, 14 December 1976); Sta. WA-318, 14.5 km north-west Mt Hart Homestead, Humbert Creek Road, King Leopold Range (Matthew 3864–970:495) (3 dead adults, 3 dead juveniles, FMNH 199309, WAM 178.79, L. Price and C. Christensen, 14 December 1976); Manning Gorge, Packhorse Range, near Mt Barnett Station (Packhorse Range 4064–*ca.* 520:125) (1 dead juvenile, NMV F30052, A.C. Beauglehole, 8 June 1976).

Remarks

In addition to the shape differences mentioned in the 'Comparative remarks,' the few adult specimens overlap or are slightly below the size range recorded for *X. prudhoensis* **(Table 1)**. The nearest records for specimens definitely assignable to *X. prudhoensis* are from the Barnett River Gorge (WAM 1201.75), 57 km west of Gibb River Station (WAM 1198.75), and 27 km west of Mt Elizabeth Station Homestead (WAM 1197.75). The two Barnett River Gorge adults are 22.5 and 24.0 mm in diameter, but have the shape of typical *X. prudhoensis,* while the other six adults are 25.3-28.25 mm in diameter, and thus more nearly typical in size. Since Manning and Barnett Gorges are only about 27 km apart, the possibility of clinal variation is high. Nevertheless, without live or recently dead material, the placement of these populations within *X. prudhoensis* is premature.

The two specimens from the Napier Range were found buried in soil, and this may well represent an extinct colony. The examples from near Mt Hart had at least traces of periostracum and were loose under rocks, suggesting that the taxon may still exist in that area. Further collecting will be needed to see if these records are outliers of range expansion or remnants of a contracting range.

XANTHOMELON OBLIQUIRUGOSA (SMITH, 1894)

(Plate la; Figs 2a-b, 10a-b, 11a-d)

Helix (Hadra) obliquirugosa Smith, 1894, Proc. Malac. Soc. London, **1**: 90, pl. VII, fig. 17–Parry Harbour, north-west Australia.

Globorhagada obliquirugosa (Smith), Iredale, 1938, Australian Zool., **9** (2): 114; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25**: 73, pl. 5, fig. 21.

Comparative remarks

Xanthomelon obliquirugosa (Smith, 1894) is immediately separable from other Western Australian *Xanthomelon* by its shell sculpture of strong oblique radial corrugations **(Plate 1a)**, that tend to anastomose. Both *X. ruberpumilio* and *X. prudhoensis* (Smith, 1894) **(Plate 1b-d)** have shell sculpture of fine pustules on the apex and/or spire with most or all of the body whorl smooth. The shell of *X. ruberpumilio* is distinctly smaller, more elevated, and has a very strong reddish cast to the apex and spire. The shell of *X. prudhoensis* is slightly larger, has little or no sculpture on the body whorl, and the umbilical margin is shouldered. In *X. obliquirugosa,* the umbilical margin is rounded. Many of the Northern Territory and Queensland populations of *Xanthomelon* have shells with the same type of rugose sculpture as this species, but generally they are much larger in size, have not been dissected, and thus are of uncertain relationship to *X. obliquirugosa.* Automatically, the very long and tightly coiled penis within the sheath **(Fig. 11a),** and lack of strong interior wall sculpture inside the penis separate *X. obliquirugosa* from *X. prudhoensis* with its shorter penis and very prominent **(Fig. 7)** wall sculpture or *X. durvillii* with its even longer penis **(Fig. 11e)** with highly complex wall sculpture **(Fig. 5).** *X. ruberpumilio* has a penis of intermediate length **(Fig. 3b)** with a very finely textured wall sculpture **(Fig. 6)**.

Lectotype

British Museum (Natural History) number 92.1.29.159, Parry Harbour, north-west Australia (1:100,000 'Vansittart' map sheet 4169, grid reference *ca.*

460:850). Height of shell 18.85 mm, diameter 20.35 mm, H/D ratio 0.926, whorls 4¾–.

Paralectotypes

British Museum (Natural History) number 92.1.29.160-161, 2 dead specimens from the type locality.

Material studied

Sta. WA-226, limestone hill 4.3 km south of Ningbing Bore, Ningbing Ranges, north of Kununurra (1:100,000 'Carlton' map sheet 4667–108:658) (1 dead adult, 1 dead juvenile, FMNH 199017, WAM 165.79, A. Solem and C. Christensen, 11 November 1976); Sta. WA-228, limestone hill, 1.5 km north of Tanmurra Creek, Ningbing Ranges, north of Kununurra (Carlton 4667-367:576) (1 fragment, FMNH 199018, A. Solem and C. Christensen, 11 November 1976); Sta. WA-233, 2.5 km south of Tanmurra Bore, Ningbing Ranges, north of Kununurra (Carlton 4667–287:613) (1 dead juvenile, FMNH 199824, A. Solem and C. Christensen, 12 November 1976); Sta. WA-426, east facing large hill just south of No. 8 Bore, north end Ningbing Ranges, N of Kununurra (Knob Peak 4668–449:563) (1 dead adult, FMNH 199029, A. Solem, 17 May 1977); Sta. WA-427, 5.7 km north of No. 8 Bore, north end Ningbing Ranges, north of Kununurra (Knob Peak 4668–449:563) (1 dead juvenile, FMNH 199437, A. Solem, 17 May 1977); Sta. WA-429, 5.45 km north of No. 8 Bore, north end Ningbing Ranges, north of Kununurra (Knob Peak 4668–499:543) (2 dead adults, FMNH 199055, WAM 166.79, A. Solem, 17 May 1977); Tamarindu, 27 km north of Kalumburu (1 dead juvenile, WAM 1179.75, Ian Crawford, August 1968); Sta. WA-218, banana patch, Kalumburu Mission gardens (Drysdale 4269–180:457) (2 live adults, 5 dead adults, FMNH 200023, WAM 325.77, WAM 618.77, A. Solem, 27-28 October 1976); Kalumburu (8 live adults, 3 dead adults, 1 live juvenile, 4 dead juveniles, WAM 1158.75, WAM 336.74, 4 December 1965 to 1 February 1966); Kalumburu (4 dead adults, 1 dead juvenile, WAM 320.77, Ian Crawford, July 1972); Sta. 3, east of Crystal Creek Pool, Mitchell Plateau (6 dead adults, 1 broken adult, WAM 1176.75, B. Wilson and C. Bryce, 2 November 1976); near AMAX camp, Mitchell Plateau (3 dead adults, 1 dead juvenile, WAM 1180.75, Ian Crawford, 31 October, 1967); Mitchell Plateau airstrip (1 dead adult, 1 dead juvenile, WAM 1182.75, 3 September 1971); Sta. MP–2, 200 m from track to Camp Creek, Mitchell Plateau (1:100,000 'Warrender' map sheet 4068, grid reference 018:535) (1 dead adult, WAM 1181.75, B. Wilson and S. Slack-Smith, 23 August 1975); Sta. WA-201, upper slopes of cove to south of 'drop-off' camp area, Mitchell Plateau (Warrender 4068–813:011) (1 live adult, 2 dead adults, FMNH 200691, FMNH 199385, WAM 162.79, 15-16 October 1976); Sta. WA-202, 1st and 2nd line of boulders at base of slope north of Warrender Road, 'drop-off' camp area, Mitchell Plateau (Warrender 4068–814:014) (1 dead adult, 2 dead juveniles, 1 live juvenile, FMNH 200035, A. Solem, 16-17 October 1976); Sta. WA-207, Walsh Point, Point Warrender, Mitchell Plateau (Warrender 4068–875:066) (2 dead adults, 3 dead juveniles, FMNH 198375, WAM 161.79, A. Solem, 20 October 1976); Sta. WA-208, 3.8-5.7 km east of 'drop-off' camp, Mitchell Plateau (Warrender 4068–748:013 est.) (3 dead adults, FMNH 199606, WAM 163.79, A. Solem, 21 October 1976); Sta. WA-209, 10.7–13.9 km east of 'drop-off' camp area, main road, Mitchell Plateau (Warrender 4068–696:998) (1 dead adult, 2 dead juveniles, FMNH 199986, WAM 160.79, A. Solem, 21 October 1976); Sta. WA-211, 1.5 km east of airport cut-off, main road, Mitchell Plateau (Warrender 4068–612:039 est.) (3 dead juveniles, FMNH 199602, WAM 164.79, A. Solem, 21 October, 1976); Sta. WA-221, single rock pile at WA-201 valley base, Mitchell Plateau (Warrender 4068–813:007) (1 dead adult, FMNH 200129, A. Solem, 30 October 1976); 10 km west of mouth of Lawley River, Mitchell Plateau (Warrender 4068–723:082) (1 dead juvenile, WAM 1294.75); Sta. WA-386A, stream banks west of 'drop-off' camp area, Mitchell Plateau (Warrender 4068–813:007) (1 dead adult, FMNH 199997, L. Price and C. Christensen, 12 March 1977); Sta. WA-389, liana patch about 300 m east of WA-215, Mitchell Plateau (Warrender 4068–832:013) (1 dead adult, FMNH 199981, L. Price and C. Christensen, 13 March 1977); Sta. WA-397, under boulders, 10.2 km south-east of AMAX camp, road to Gibb River, Junction, Mitchell Plateau (Warrender 4068–542:137) (1 dead juvenile, FMNH 199295, L. Price and C. Christensen, 17 March 1977); Rocky Creek, 27.6 km N of Doggan River, Gibb River-Kalumburu Road (1 dead adult, NMV F30048, A.C. Beauglehole, 31-V-1976); Carson River, 113.3 road km north-east of Mitchell River turnoff (1 dead adult, 1 dead juvenile, NMV F30047, A.C. Beauglehole, 3-VI-1976); King Edward River, 2 km west of Mitchell Plateau Road (1 dead juvenile, NMV F30048, A.C. Beauglehole, 2-VI-1976); 1 km north of Carson River Crossing, Gibb River-Kalumburu Road (1 dead juvenile, NMV F30050, A.C. Beauglehole, 3-VI-1976); Sir Graham Moore Island, Bonaparte Archipelago (1 dead adult, WAM 1196.75, J. Dell, 1 July 1973); Old Doongan Homestead (3 fragments, WAM); 6 km north of Hair Creek, Doongan Homestead (Couchman 4167–990:125) (1 dead juvenile, WAM 1177.75); Sta. 1, Ashton Range, Drysdale Reserve (15°11'S, 126°48'E) (1 dead adult, 3 dead juveniles, WAM 215.76); Sta. 2, deep gully at head of a tributary of the Drysdale River (14°35'S, 127°02'E) (4 fragments, WAM 216.76, WAM 217.76); Sta. B1, campsite on Orchid Creek at base of Carson Escarpment, Drysdale Reserve (14°49'S, 126°49'E, Carson 4268–648:603) (13 live adults, WAM 218.76, WAM 1183.75, FMNH 200806); Sta. B1-2, about 1 km west of B1, Orchid Creek, Carson Escarpment, Drysdale Reserve (Carson 4268–636:603) (1 live adult, 5 dead adults, WAM 219.76); Sta. B1-3, entrance to Glider Gorge, Carson Escarpment, Drysdale Reserve (Carson 4268–655:602) (1 live adult, 6 dead adults, WAM 221.76); Sta. B2-1, east of B2 campsite opposite junction of Drysdale River with Nymphaea Creek (Carson 4268–766:605) (1 dead adult, 1 fragment, WAM 222.76, WAM 223.76); Sta. B3, Johnson Creek, 1.6 km downstream from large pool (Carson 4268–940:655) (1 dead adult, WAM 224.76); Sta. C1-1, Palmoondoora Creek above Morgan Falls, Drysdale Reserve (Ashton 4267–488:371) (1 dead adult, WAM 225.76); Sta. C1-7, east side of valley of Colochasia Creek entering Palmoondoora Creek to the north-east of Worriga Gorge (Ashton 4267–490:394) (3 dead adults, 2 dead juveniles, WAM 226.76); Sta. C2-1, west of Carson River and north of its junction with Woorakin Creek, Drysdale Reserve (Ashton 4267–585:347) (1 fragment, WAM 227.76); Sta. C2-3, creek flowing west into Carson River about 0.5 km north of junction with Woorakin Creek, Drysdale Reserve (Ashton 4267–590:345) (1 dead adult, WAM 228.76); Sta. C4, Carlia Creek running into Carson Escarpment 1-2 km east of Carson River, Drysdale Reserve (15°01′S, 126°49′E) (18 dead adults, 3 dead juveniles, WAM 230.76, FMNH 200807); Sta. C5-3, Forest Creek about 0.5 km upstream from C5 campsite at Dysphania Gorge, Drysdale Reserve (Carson 4268–768:789) (1 dead adult, WAM 232.76); Sta. C5-4, Ferny Gully near Dysphania Gorge, Drysdale Reserve (1 dead juvenile, WAM 233.76); Sta. C5-5, Forest Creek about 0.75 km upstream from C5 campsite at Dysphania Gorge, Drysdale Reserve (Carson 4268–786:785) (1 dead adult, WAM 234.76); Sta. C5, Dysphania Gorge, Drysdale Reserve (14°39′S, 126°56′E) (7 dead adults, WAM 231.76); Augustus Island (2 dead adults, WAM, 12 May 1972); Sta. E3, Bushfire Hill, Upper Roe River, Prince Regent Reserve (15°28′S, 125°39′E) (1 dead adult, WAM 1178.75, 14 August 1974).

Diagnosis

Shell 19.65–31.1 mm (mean 25.8 mm) in diameter, with 4¼ to 5⅜ (mean 4¾) whorls that rapidly increase in width. Apex and spire moderately to strongly elevated (**Figs 2a-b**), spire angle approaching right angle but never acute, height of shell 17.85–29.8 mm (mean 24.5 mm), H/D ratio 0.846–1.052 (mean 0.952). Apex and early spire worn or with irregular growth lines, characteristic sculpture of strongly oblique anastomosing radial rugosities **(Plate 1a)** developing by second whorl, continuing onto body whorl and almost to shell base, sometimes reduced just before end of body whorl. Lip narrowly to strongly flared, white, reflexed sharply to more nearly cover umbilical chink than in *X. prudhoensis,* umbilical margin rounded, not shouldered. Shell colour light yellow-green, sometimes with a weak reddish suffusion on the spire and body whorl, parietal callus thin and white. Based on 111 measured adults.

Genitalia **(Figs 10a-b, 11a-d)** seasonally variable in apical structures. Ovotestis (G) minute in August **(Figs 11b-d,** activated and swollen in October **(Figs 10a-b)**. Hermaphroditic duct (GD) slender and uncoiled in August **(Figs 11c-d),** highly coiled and swollen in October **(Figs 10a-b)**. Talon (GT) and albumen gland (GG) without obvious seasonal differentiation, hermaphroditic duct entering near base of talon. Prostate (DG) partly enlarged in August **(Fig. 11c),** uterus (UT) reduced in August **(Fig. 11c),** grossly enlarged in October

(Figs 10a-b). Free oviduct (UV) short, curved to fit alongside short stalk of spermatheca (S), which is bound to the lower prostate-uterine section by a thin sheath. Base of spermatheca and vagina (V) slightly swollen in August, enormously expanded in October **(Figs 10a-b),** free oviduct merging with spermathecal-vaginal tract at an acute angle. Length of vagina apparently rather variable. Vas deferens (VD) tightly bound to peni-oviducal angle, loosely to side of penis sheath, entering penis sheath near top, reflexing apically where penial retractor muscle (PR) inserts on it, then entering head of penis through a simple pore. Penis sheath (PS) with rather thick walls, externally **(Fig. 10b, 11c)** with slender base and bulging head caused by multiple coiling of the penis (P, **Fig. 10a**). Penis very long, slender, coiled apically several times, internally **(Fig. 11a)** with very thick glandular walls, a few irregular and individually variable folds, but no clear surface sculpture in most examples dissected. One individual did have minutely pustulose surface and one ridge raised in the form of a pilaster, and another appeared to have pustules aligned in radial rows, but whether the others simply swelled up during preservation and lost defined surface sculpture or whether this is a true difference is unknown. Area of penis tract below start of penis sheath with no definable wall sculpture in all examined examples, condition of area around free oviduct pore highly varied, from a cluster of huge pustulations in one Kalumburu example to no apparent sculpture in the other Kalumburu specimen. Based on complete dissections of 6 adults.

Type specimens

The three syntypes are very worn, thick shelled, and are at the low end of the size range for this species **(Table 3).** In shape and whorl count they closely match recently collected examples. The shell sculpture in the types is coarser than in many examples seen, but this probably is caused by the several growth interruptions recorded on the shells by incised radial lines at irregular intervals on the last whorl.

Discussion

The abundance of *Xanthomelon obliquirugosa* (Smith, 1894) varies greatly from area to area. In the Drysdale Reserve it is the common and widespread species. In the vicinity of Kalumburu, about equal numbers of it and *X. prudhoensis* (Smith, 1894) have been taken, but on different occasions. Their spatial relationship in this area is unknown. On the Mitchell Plateau, *X. prudhoensis* is common along the coastal area and only sparsely represented up on the Plateau. Dead shells of *X. obliquirugosa* are fairly common on the Plateau itself, and are recorded from Walsh Point on the Admiralty Gulf, but live specimens are extremely scarce. The first rock I turned on the Mitchell Plateau (Sta. WA-201) had a live adult *X. obliquirugosa* buried just beneath the surface of the soil. Subsequent collecting in October and early November

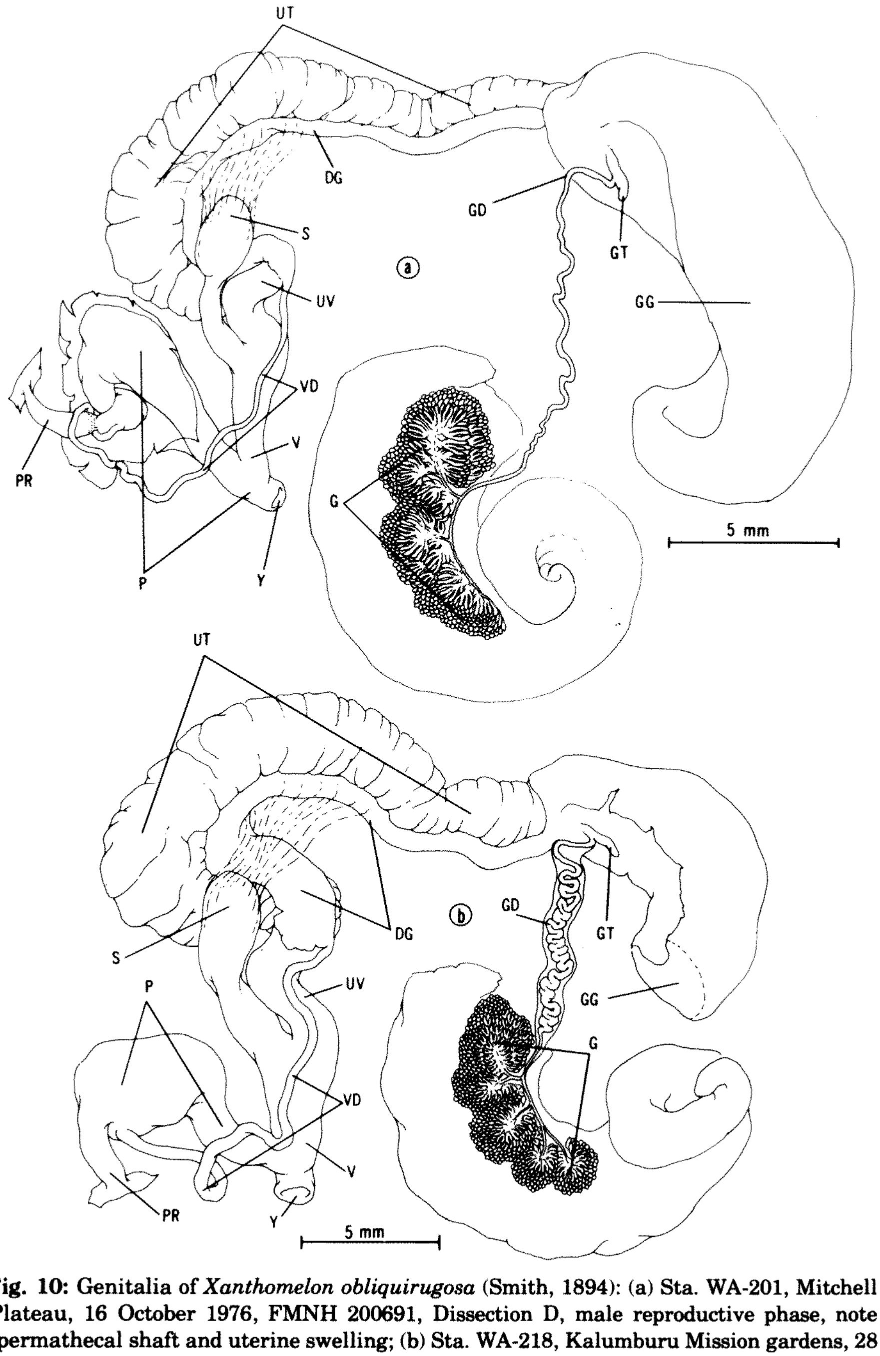

Fig. 10: Genitalia of *Xanthomelon obliquirugosa* (Smith, 1894): (a) Sta. WA-201, Mitchell Plateau, 16 October 1976, FMNH 200691, Dissection D, male reproductive phase, note spermathecal shaft and uterine swelling; (b) Sta. WA-218, Kalumburu Mission gardens, 28 October 1976, WAM 618.77, Dissection B, note shrinkage of ovotestis and swelling of both uterus and spermathecal shaft. Scale lines as marked.

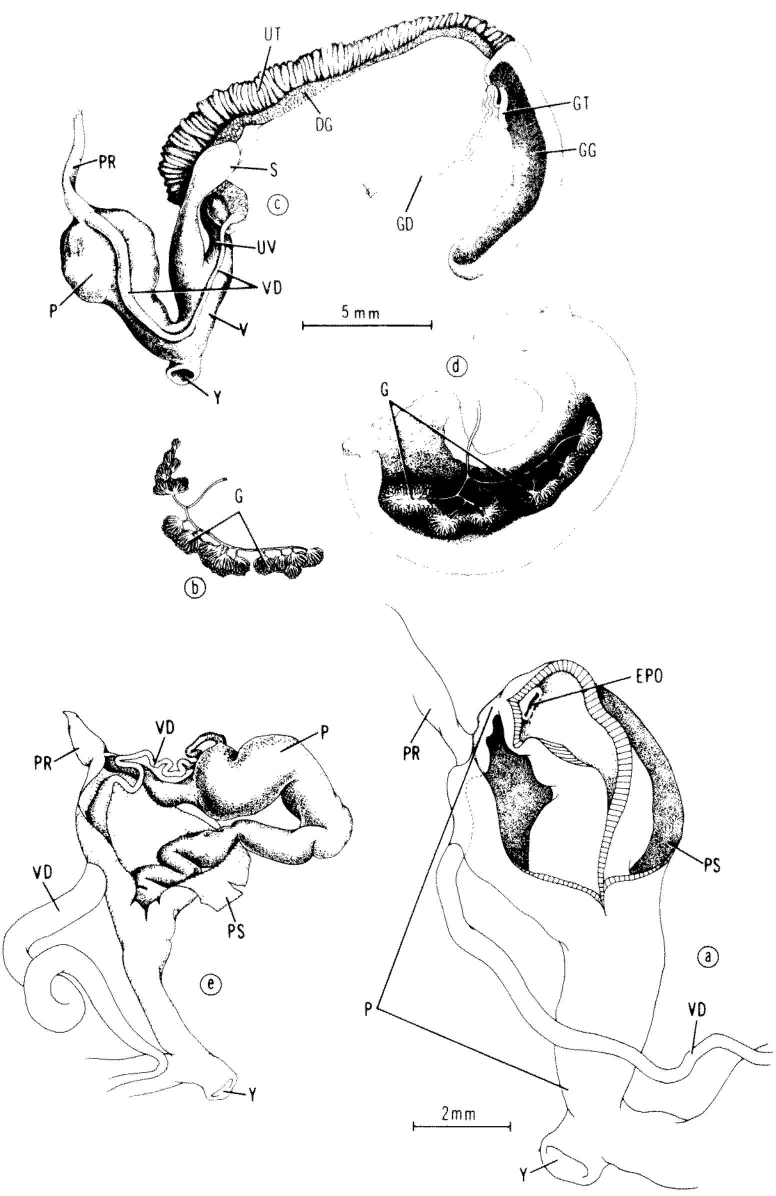

Fig. 11: Penis sheaths opened for: (a-d) *Xanthomelon obliquirugosa* (Smith, 1894), Sta. B1, Drysdale River Survey, 12 August 1975, WAM 1183.75, Dissection B; (a) is opened penis sheath, note slight coiling of penis within sheath and lack of pilasters inside penis chamber, (b) is inactive ovotestis and hermaphroditic duct from Dissection C, (c) is genitalia from Dissection B, (d) is ovotestis from Dissection B; (e) *Xanthomelon durvillii* (Hombron & Jacquinot, 1841), Sta. WA-109, Casuarina Reserve, Darwin, Northern Territory, FMNH 182611, note extreme coiling of penis within sheath. Scale lines as marked.

yielded only two live juveniles. No live specimens were taken by Price and Christensen in March 1977. In the Prince Regent Reserve only one example of *X. obliquirugosa* has been found. *X. prudhoensis* is the common and widespread species in this area. In most of the Prince Regent River Reserve area *X. ruberpumilio* seems to have replaced *X. obliquirugosa*.

Only 25 live collected adults were available, 7 from Kalumburu, 14 from the Drysdale region, and one from the Mitchell Plateau. Thus very little data is available about seasonal changes in genitalia. The enormous size of the uterus **(Figs 10a, b)** in mid to late October examples is unusual compared with the uterus size in examples of *X. prudhoensis* collected at the same time, and contrasts with the reduced uterus in August examples of *X. obliquirugosa* **(Fig. 11c)**. Because of the limited preserved material, aspects of penis wall and vaginal-spermathecal wall sculpture must remain unsolved. The texture of the walls varied greatly from specimen to specimen, as outlined in the diagnosis above, but whether this is the result of turgor changes or actual variation is unknown.

One interesting difference exists between the dissected example from the Mitchell Plateau collected 16 October 1976 (FMNH 200691, **Fig. 10a**) and the Kalumburu examples collected 28 October 1976 (WAM 618.77, **Fig. 10b**). In the latter, the vagina (V) and shaft of the spermatheca (S) are noticeably distended compared with the former. The Mitchell Plateau example was buried in dry soil under a large boulder. No significant rainfall had been recorded on the Mitchell Plateau since the end of the previous wet season, and this specimen undoubtedly had been several months in aestivation. In contrast, the Kalumburu examples were taken shortly after measurable showers and within crawling distance of an area sprinkled regularly during the dry season. Presumably they had mated shortly before being collected.

Shell variation among populations of *X. obliquirugosa* is less dramatic than in *X. prudhoensis* **(Tables 3 and 4)**. Except for the dwarf types, and the relatively small Ningbing shells **(Table 3)**, material from the Kalumburu, Drysdale and Mitchell areas were relatively similar in size. In contrast with the situation in *X. prudhoensis,* the Drysdale shells were the largest in average size. Within the Drysdale Reserve (see **Table 4**), populations varied up to 2.56 mm in mean diameter, which is only slightly less than the average difference between the larger Drysdale and smaller Mitchell Plateau shells.

Differences in sculptural prominence may exist on an average basis but it was not possible to study this aspect of variation.

XANTHOMELON RUBERPUMILIO SP. NOV.

(Plate 1 c-d; Figs 2c-e, 3b, 6)

Comparative remarks

Xanthomelon ruberpumilio is immediately separable from other Western Australian *Xanthomelon* by its small size, shell diameter less than 21.0 mm, dark red colour, shell sculpture of relatively coarse pustules on the upper spire **(Plate 1c-d)**, and elevated shape. *X. obliquirugosa* (Smith, 1894), has a very prominent sculpture **(Plate 1a)** of oblique anastomosing radial ridges, and the sometimes sympatric *X. prudhoensis* (Smith, 1894) has much finer pustulose sculpture **(Plate 1b)**, is much larger, more globose in shape, and is usually green-yellow in colour. Anatomically, *X. ruberpumilio* has the penis intermediate in length between those of *X. prudhoensis* and *X. obliquirugosa*. Internally the penis has a very characteristic wall texture that is very different from that found in the other species (see **Figs 5, 6, 7, 11a**).

Holotype

WAM 322.77, Sta. W6 (5), valley slopes on south side of Youwanjela Creek near main campsite, upper Prince Regent River, Western Australia (1:250,000 'Prince Regent' map sheet SD51-16, grid reference 332:023). Collected by P. Smith 23 August 1974. Height of shell 20.6 mm, diameter 18.4 mm, H/D ratio 1.120, whorls 4⅞+.

Paratopotypes

WAM 174.75, WAM 1164.75, WAM 1167.75, WAM 1168.75, WAM 1169.75, FMNH 200805, 25 live and 1 dead adult, 2 live juveniles from the type locality.

Paratypes

Western Australia, Prince Regent Reserve, all collected August 1974: Sta. E1, upper Prince Regent River campsite (15°49'S, 125°37'E) (7 dead adults and 4 broken adults, WAM 172.75, WAM 176.75); Sta. E4, Wyulda Creek, upper Roe River (15°26'S, 125°36'E) (1 dead, 1 broken adult, WAM 175.75, WAM 180.75); Sta. E5 (3), campsite on top of Enid Falls, Rufous Creek, upper Roe River (15°07'S, 125°33'E, Prince Regent SD51-16−347:087) (17 dead adults, 1 live juvenile, 11 dead juveniles, WAM 184.75, WAM 173.75; WAM 1174.75, FMNH 200803); Sta. E5 (6), eastern side of deep gully about 2 km due west of Enid Falls campsite (Prince Regent SD51-16−344:085) (1 live adult, 2 live, 1 dead juvenile, WAM 178.75, WAM 1175.75); Sta. W2, King Cascade, Cascade Creek, Prince Regent River (15°37'S, 125°18'E) (2 broken adults, WAM 182.75); Sta. W6 (1), valley slope on north side of Youwanjela Creek near main campsite, Prince Regent River (15°34'S, 125°25'E, Prince Regent SD51-16−332:032) (1 live adult, 5 live, 2 dead juveniles, WAM 177.75, WAM 1165.75, WAM 1166.75, WAM 1170.75, WAM 1171.75, WAM 1172.75); Sta. W6 (2), v-shaped gully in front of south facing fissure in cliff about 300 m west of main campsite, Youwanjela Creek, Prince Regent River (Prince Regent SD51-16−332:033) (1 dead adult, WAM 179.75); Sta. W6 (3), eastern bank of northern tributary of Youwanjela Creek at junction about 1.5 km west of main campsite, Prince Regent River (Prince Regent SD51-16−331:034) (1 live adult, 1 live juvenile, WAM); Sta. W6 (6), rock outcrops in flat country close to creek bed west of main campsite, Youwanjela Creek, Prince Regent River (Prince

Regent SD51-16–331:033) (7 live adults, 1 dead juvenile, WAM 205.75, WAM 1173.75, FMNH 200804).

Doubtful Bay (Charnley SE51-4–232:963), (2 dead adults, 1 dead juvenile, WAM 1163.75, Ian Crawford, 23 August 1965).

Diagnosis

Shell small for genus, diameter 17.7-20.5 mm (mean 18.9 mm), with 4½ to 5½ (mean 5) whorls that increase in width rather rapidly. Apex and spire strongly to abruptly elevated, spire angle at times approaching a right angle, height of shell 17.7-23.4 mm (mean 20.6 mm), H/D ratio 0.960–1.223 (mean 1.089). Apical whorls worn or smooth if not eroded, postapical sculpture of relatively prominent pustules lined up on weak radial ridges **(Plate 1c-d)**, prominent on early spire, becoming confined to upper portion of whorl on lower spire and to a narrow fringe below the suture on the body whorl. Last part of body whorl and shell base smooth, with only weak irregular radial growth lines. Lip narrowly reflected and expanded, usually with reddish purple tint from the shell suffusion, sometimes white on edge with columellar region tinted. Umbilical chink very narrow, margin strongly rounded. Shell greenish-yellow in colour, spire and most of body whorl with a heavy suffusion of red or reddish-purple tones, at times invading lip, but absent from most of shell base. Based on 64 measured adults.

Genitalia **(Fig. 3b)** in inactive stage, with ovotestis (G), hermaphroditic duct (GD), prostate (DG) and uterus (UT) reduced in size. Hermaphroditic duct (GD) entering laterally onto head of talon. Spermatheca (S) with short shaft, tapered from wide base, bound to prostate-uterus by a thin sheath. Vagina (V) with very thickened cross-section, tapering abruptly to atrium (Y). Penis sheath (PS) starting near to atrium (Y), thin. Vas deferens (VD) entering sheath near top, reflexing at point of penial retractor muscle (PR) insertion, entering penis chamber through a simple pore. Penis (P) coiled within sheath, cyclindrical except for narrow base, internally **(Fig. 6)** with weak folds in lower section, upper part with two small pilasters (PP) flanking entrance of vas deferens, entire wall finely textured. Based on 3 dissected adults.

Discussion

The specimens of *Xanthomelon ruberpumilio* from Youwanjela Creek are slightly larger, with a greater whorl count and H/D ratio than those from the other stations **(Table 4)**. Considerable shape variation exists, with near extreme specimens shown in **Figs 2c-e.** These variants occur within populations and are not considered to be significant.

Both *X. ruberpumilio* and *X. prudhoensis* occurred at Sta. E1, E4, E5 (3), and W6 (5) in the Prince Regent Survey area, with the former species dominant at Sta. E5 (3) and the latter at Sta. E1. They are very different in shell size, shape and colour so that confusion of even long dead examples is unlikely.

The name *ruberpumilio* refers to the very small, indeed dwarfed, size for a *Xanthomelon* and the highly unusual red shell colour.

GENUS *TORRESITRACHIA* IREDALE, 1939

Torresitrachia Iredale, 1933, Records of the Australian Museum, **19** (1): 55–nude name; Iredale, 1938, Australian Zool., **9** (2): 110-111–a check list of included species, but not description; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 48-49–valid description, type species *Helix endeavourensis* Brazier, 1872 by original designation.

Magitrachia Iredale, 1941, Australian Zool., **10** (1): 91-92–type species *Planispira (Trachiopsis) blackiana* Preston, 1905 by original designation.

Diagnosis

Shell of medium size, spire slightly to strongly and evenly elevated, umbilicus moderately open to nearly closed. Apical sculpture varying from essentially absent **(Plate 2a, c, e)** through scattered fine pustules **(Plate 3b)** to densely pustulose or ridged **(Plate 4a, b).** Postapical sculpture usually of strongly to reduced radial ribs, generally 5-7 per mm on the body whorl, that may stop abruptly at the periphery, continue with reduced prominence to the umbilicus, or continue unchanged in prominence to the umbilicus. Walls of umbilicus **(Plate 3g)** densely pustulose. Microsculpture of vertical **(Plate 2f),** angled **(Plate 2b, d),** or spiral **(Plate 3e, f)** ridgelets, which continue onto rib tops where ribs are reduced **(Plate 2f)** in prominence, absent from rib tops where radial ribs high and sharply defined **(Plate 3e).** Few to many pustules **(Plate 4c, d)** along sutures or over entire whorl when radial ribbing essentially absent. Body whorl not or only slightly deflected behind lip, except in *T. umbonis* and *T. crawfordi,* where it is sharply deflected **(Plate 7b, e).** Lip moderately to very strongly expanded, sharply reflexed, only partly covering umbilicus, white. Basal lip simple, except in *T. umbonis* and *T. crawfordi,* where there is a prominent protrusion on the basal lip **(Plate 7c, f).** Parietal wall with at most a very thin callus. Shell colour yellow brown, often with a greenish cast. Genitalia **(Figs 12-18)** with hermaphroditic duct (GD) entering laterally on talon (GT), spermatheca (S) with slender duct and expanded head lying next to base of albumen gland (GG), except shorter in *T. weaberana* **(Fig. 15d).** Free oviduct (UV) usually short, vagina (V) short except in some *T. regula* **(Fig. 17a)** where it is greatly elongated. Vas deferens (VD) entering epiphallus (E) through complex pilasters, interior of epiphallus with structures ranging from longitudinal ridges to a complex pilaster **(Fig. 18a).** Epiphallic caecum (EC) variable in size and shape among species. Demarcation between penis (P) and epiphallus (E) by a constricting circular ridge **(Figs 12b, 16a, c)** to only a change in pilasters **(Fig. 14a).** No penis sheath or verge.

Upper portion of penis walls with dense high pustules that may have chitinized pointed tips **(Fig. 16b)**, in some species arranged in rows **(Fig. 14a)**, in others quite crowded **(Figs 14b, 16a, b)**, lower portion of penis with longitudinal pilasters. Upper sculpture altered to circular short ridges in *T. umbonis* **(Fig. 18a)**. Artrium (Y) short. Penial retractor muscle (PR) inserting on mid-portion of epiphallus.

Type species: *Helix endeavourensis* Brazier, 1872 by original designation.

Previous work and nomenclature

Iredale (1933: 54-55) stated that '...the larger form known as *delessertiana* appears to need separation, ...The generic name *Torresitrachia* is here proposed, the large form *endeavourensis* being the type.' At the time of publication, the requirements of the then prevailing International Code of Zoological Nomenclature were for a new name to be published 'with a summary of characters (seu diagnosis; seu definition; seu condensed description) which differentiate or distinguish the genus or the species from other genera or species' (Article 25 [c]). In the Zoological Record for 1933 (Salisbury, 1934: 85), the name *Torresitrachia* is listed as 'non descr.,' indicating contemporary rejection of the above as a valid description. I agree with this evaluation.

Iredale (1938: 110-111) described new species from the Gulf of Carpentaria *(stipata)* and North Queensland *(glomerans)*. For the latter species he proposed a subgeneric name, *Melostrachia,* because 'The globose form suggests separation, and therefore a new subgeneric name *Melostrachia* is introduced with this species as type.'

The species names are adequately differentiated either by direct comparison with another species *(stipata)* or a several line description *(glomerans)*. The generic names were not adequately differentiated, and the Zoological Record for 1938 did not list *Melostrachia,* although listing the two new species and many other taxa described in the same paper. Iredale (1939: 48-49) finally provided an adequate description of the genus *Torresitrachia,* named *T. monticola* from the Napier Range, and copied the description of *T. bathurstensis* (Smith, 1894) from Bathurst and Heywood Islands. He had not seen the type specimens of this species and offhandedly designated Heywood Island as the type locality. Since the species was named after Bathurst Island and the type figure (Smith, 1894: pl. 7, fig. 20) is of the Bathurst specimen, I am rejecting Iredale's selection of a type locality for this species and designating Bathurst Island as the type locality. Iredale (1941: 91-92) validly described a genus *Magitrachia,* comparing it with *Torresitrachia.* It was based on the Port Moresby species, *M. blackiana* (Preston, 1905). While this species has not been dissected, in shell structure it agrees with the characteristic features of *Torresitrachia* and is here listed as a subjective synonym.

Distribution

Besides the complex of populations lumped as *Torresitrachia torresiana* (Hombron & Jacquinot, 1841) from the vicinity of Torres Strait, specimens with the typical microsculpture of *Torresitrachia* have been collected as far south as Mornington Island off the coast of Queensland (QM MO 6381, 16°29′S, 139°34′E). From inland areas of Queensland, very worn specimens found at Black Braes Lava Tunnel, south-west of Townsville (QM MO 6380, 19°32′S, 144°10′E) and fresh material with typical sculpture from Wando Vale, Queensland (QM MO 6379, 19°40′S, 144°54′E) represent the southernmost records. Subfossil shells from Colless Creek Caves, south of Burketown (QM MO 6382, 18°41′S, 138°24′E) are too worn for certain assignment to *Torresitrachia,* but probably belong to that genus.

The species *Torresitrachia blackiana* (Preston, 1905) is known only from the vicinity of Port Moresby, New Guinea.

In the Northern Territory, *T. stipata* (Iredale, 1938), was described from the Sir Edward Pellew Islands, and may range up into the Wessel Islands and Cape Wessel. Material from the Roper River (QM MO 6384, 14°41′S, 134°26′E) may be referrable to this taxon, as are two specimens from the Daly River (AM C.19500), one from 50 km south of Borroloola along the McArthur River (AM), and one from Millingimby (AM C.76415). All of these records are based on dead, often very worn shells. Examples from near Katherine, Northern Territory are referred to *T. weaberana,* on the basis of dissection.

In Western Australia, material is known from the Weaber Ranges *(T. weaberana),* near Kalumburu (*T.* sp.), the Mitchell Plateau *(T. amaxensis),* Prince Regent River area *(T. regula, T. umbonis),* Doubtful Bay to King Sound *(T. crawfordi, T. bathurstensis* [Smith, 1894]), and then inland in the King Leopold and Napier Ranges *(T. monticola* Iredale, 1939). No material assignable to *Torresitrachia* was taken during the Drysdale Survey or in the Ningbing Ranges, but it is anticipated that additional records and species will be found in the coastal areas between the Mitchell Plateau and Northern Territory border.

Thus *Torresitrachia* has a coastal to inland range across the north of Australia with one outlying species in New Guinea. In Queensland the southernmost record is 19°32′S; in Western Australia it is 17°26′S near Windjana Gorge in the Napier Range and 16°02′S at Doubtful Bay on the coast.

Species of Western Australia

A series of allopatric populations group into five generalized taxa that are characterized by differing combinations of shell sculpture and features of the terminal genitalia. Overlap in shell shape and size **(Table 5)** is so extensive that no key based on meristic shell features could be prepared. The Western Australian species are *T. bathurstensis* (Smith, 1894) from the Stewart River on the north side of King Sound to Doubtful Bay; *T. regula* from the Prince

Regent River Reserve; *T. amaxensis* from the Mitchell Plateau; *T. weaberana* from the Weaber Ranges north-east of Kununurra (also from near Katherine, Northern Territory); and *T. monticola* Iredale, 1939 from the Barker and Lennard River drainages in the King Leopold and Napier Ranges. A probable additional species is known from Napier-Broome Bay and near Kalumburu Mission. These specimens are listed as *Torresitrachia* sp.

Table 5: Size and shape variation in Western Australian *Torresitrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio	Whorls	Umbilical Width	D/U Ratio
T. bathurstensis	29	7.41 (6.7-8.5)	14.26 (12.65-15.7)	0.520 (0.477-0.580)	4⅞ (4½-5¼)	2.27 (1.65-2.95)	6.39 (5.12-8.36)
T. monticola	83	9.78 (7.2-10.8)	15.89 (12.7-19.3)	0.573 (0.500-0.625)	5+ (4½-5½)	1.97 (1.4-2.85)	8.12 (6.32-11.4)
T. regula	36	9.08 (7.1-11.4)	15.6 (12.7-19.1)	0.581 (0.497-0.622)	5⅛– (4⅝-5½)	1.80 (1.3-2.8)	8.78 (6.50-10.6)
T. amaxensis	97	12.38 (7.9-16.75)	19.35 (12.1-24.5)	0.632 (0.570-0.707)	5½– (4¾-6)	1.55 (0.9-2.0)	12.7 (8.61-19.1)
T. weaberana	135	8.53 (6.6-10.3)	14.75 (11.4-16.6)	0.579 (0.515-0.652)	5⅜– (4¾-5⅞)	1.60 (1.0-2.5)	9.41 (6.16-15.8)
T. umbonis	27	11.50 (9.95-13.0)	20.41 (16.8-23.0)	0.564 (0.476-0.626)	5⅝ (5⅛-6)	1.16 (0.6-1.7)	19.1 (11.3-38.5)
T. crawfordi	1	15.45	24.6	0.628	6+	2.2	11.2

Two specialized taxa, *T. umbonis* and *T. crawfordi,* characterized by a strongly deflected body whorl, nearly closed umbilicus, basal lip protrusion **(Plate 7),** and shell sculpture of very prominent and dense pustules without radial ribs **(Plate 4a-d),** have been found at Doubtful Bay and in the Prince Regent River Reserve, thus over-lapping the ranges of *T. bathurstensis* (Smith, 1894) and *T. regula.*

Torresitrachia bathurstensis (Smith, 1894) is relatively small, depressed and with a rather widely open umbilicus. The radial ribs are numerous, high, and extend onto the shell base without reduction in size. The shell microsculpture is unknown. The terminal genitalia **(Figs 13a, 14a)** have an extremely long and slender epiphallic caecum (EC), the zone of pustules (PPR) on the upper penis wall is shortened and they are aligned in definite rows, the ridge between the penis and epiphallus is a narrow neck, and the vas deferens (VD) enters the epiphallus (E) through a double set of U-pilasters. This species has been recorded from the Stewart River near Kimbolton, Bathurst Island off Yampi Sound, and Doubtful Bay north of Walcott Inlet.

Torresitrachia regula is average in size, spire elevation, and umbilical width. The radial ribs are quite prominent above the shell periphery, but are distinctly reduced in prominence on the shell base, although less so than in *T. amaxensis.* The apex **(Plate 2c)** is smooth, microsculpture between the major ribs **(Plate 2d)** is typical and prominent, but tends to be absent from the upper side and top of the major ribs. The terminal genitalia **(Figs 17a-d, 18b)** are bimorphic in length, with a tapered epiphallic caecum (EC) of average length, typical penis wall pustules (PPR, **Fig. 17b**), the ridge between the penis (P) and epiphallus (E) is lost, and the vas deferens (VD) enters the epiphallus through two small but very high U-pilasters. *T. regula* has been recorded from the Prince Regent River Reserve and Heywood Island off Camden Sound.

Torresitrachia amaxensis is quite large in size, more elevated, and with an usually narrowed umbilicus. The radial ribs are moderately prominent above the shell periphery and then drastically reduced in prominence on the shell base. The apex **(Plate 4e)** has weak radials in the sutures, and there are a few scattered pustules near the suture on the spire **(Plate 4f)**. Microsculpture between the major ribs **(Plate 4f)** tends to be sinuated and is present on the major ribs. The terminal genitalia **(Figs 15a-c, 16a-b)** are quite short and bulky, with a short, fatly conical epiphallic caecum (EC), densely packed and large penial wall pustules **(Figs 16a-b)**, a high narrow ridge between the epiphallus (E) and penis (P), and the vas deferens entering the epiphallus through a pore with a long, tongue-shaped epiphallic verge (EV, **Fig. 16a**). *T. amaxensis* has been recorded from the Mitchell River, Crystal Creek, and numerous places on the Mitchell Plateau, but not from coastal sites.

Torresitrachia weaberana is relatively small in size, of average spire elevation and umbilical width, and has an increased whorl count. The apex **(Plate 3a-b)** has scattered pustules, which continue in reduced number along the suture **(Plate 3c)**. The radial ribs are very high and crowded **(Plate 3d)**, with a reduction to about half their prominence on the shell base. Microsculpture is **(Plate 3c, e, f)** generally of short wavy ridges, present on the radial ribs near the suture, but absent **(Plate 3e)** from the top of the ribs elsewhere. The terminal genitalia **(Figs 15d, 16c)** have a long, finger-like epiphallic caecum (EC), short penis (P) with very thick walls, a narrow zone of very large penial pustules (PPR, **Fig. 16c**), a thick ridge between the epiphallus (E) and penis (P), and the vas deferens (VD) enters the epiphallus through a pair of unequal sized U-pilasters. *T. weaberana* is known from the vicinity of Point Spring, Weaber Ranges and Katherine, Northern Territory.

Torresitrachia monticola Iredale, 1939, is average in size, spire elevation, umbilical width and whorl count. The shell apex **(Plate 2a)** is smooth, and the radial ribs moderately prominent above the periphery and then slightly reduced in prominence on the shell base. Microsculpture **(Plate 2b)** is of long wavy ridges that tend to continue on top of the radial ribs. The terminal genitalia **(Figs 13c-e, 14b)** are of average length, have a long, finger-like epiphallic caecum (EC) with tapered base, rather long penis (P) with a short zone of densely packed penial pustules (PPR, **Fig. 14b**), a low rather long ridge between the penis (P) and the epiphallus (E), and the vas deferens (VD) enters the epiphallus through a single low U-pilaster **(Fig. 14b)**. *T. monticola* has been found near Mt Hart and Mac's Jumpup on the Gibb River Road, in the King Leopold Ranges and then Barker Gorge, Windjana Gorge, and Tunnel Creek in the Napier Range, all in the Barker and Lennard River drainages of the South Kimberley. Undoubtedly additional colonies will be located in the King Leopold Ranges.

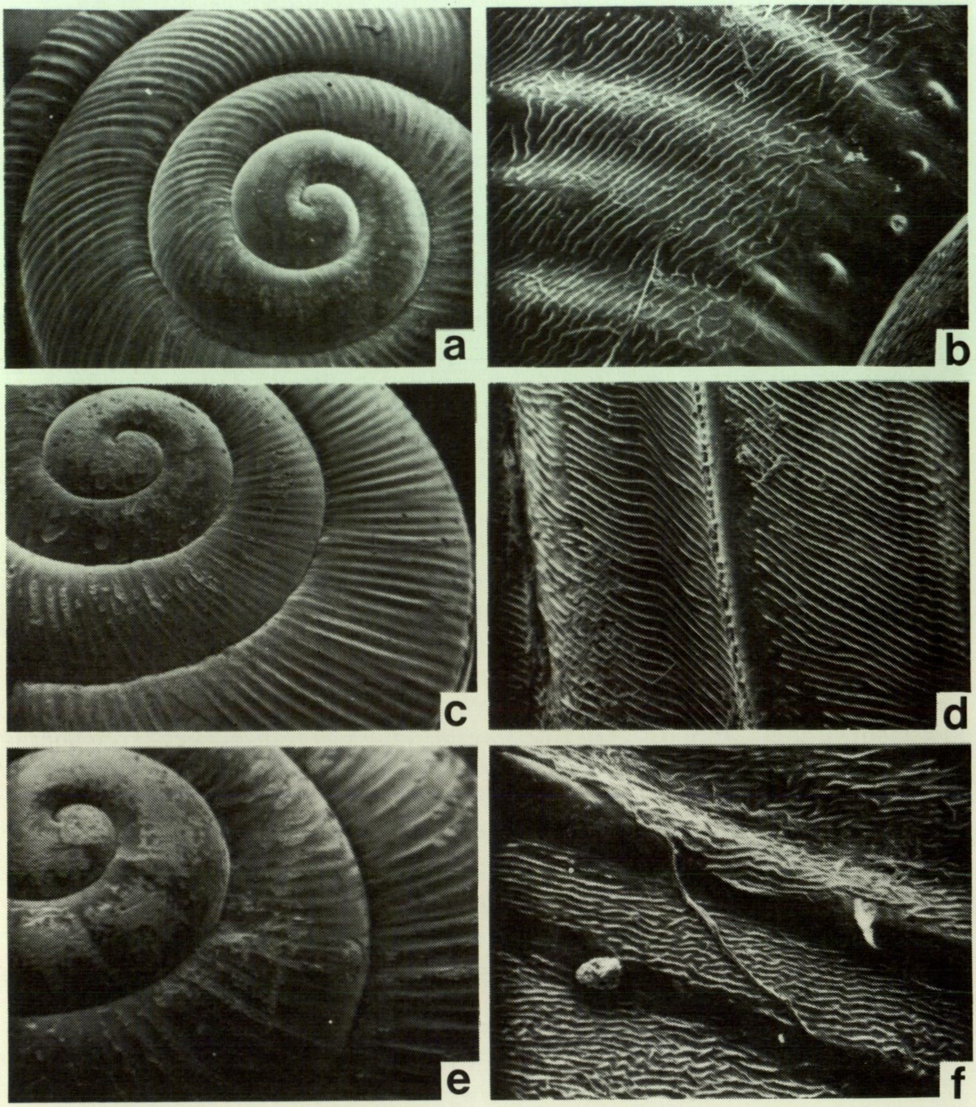

Plate 2: Shell sculpture of *Torresitrachia:* (a-b) *Torresitrachia monticola* Iredale, 1939, WAM 602.77, Sta. WA-193B, Windjana Gorge, Napier Range; (a) is apex and spire at 12X, (b) is detail of lower spire at 130X; (c-d) *T. regula,* WAM 630.77, Sta. E5 (3), Prince Regent River Reserve; (c) is apex and spire at 14X, (d) is microsculpture between two ribs on body whorl at 139X; (e-f) *T. torresiana* (Hombron & Jacquinot, 1841), AM C.107129, Prince of Wales I., Torres Strait, Queensland, (e) is apex and early spire at 18X, (f) is body whorl near suture, microsculpture between major ribs at 158X.

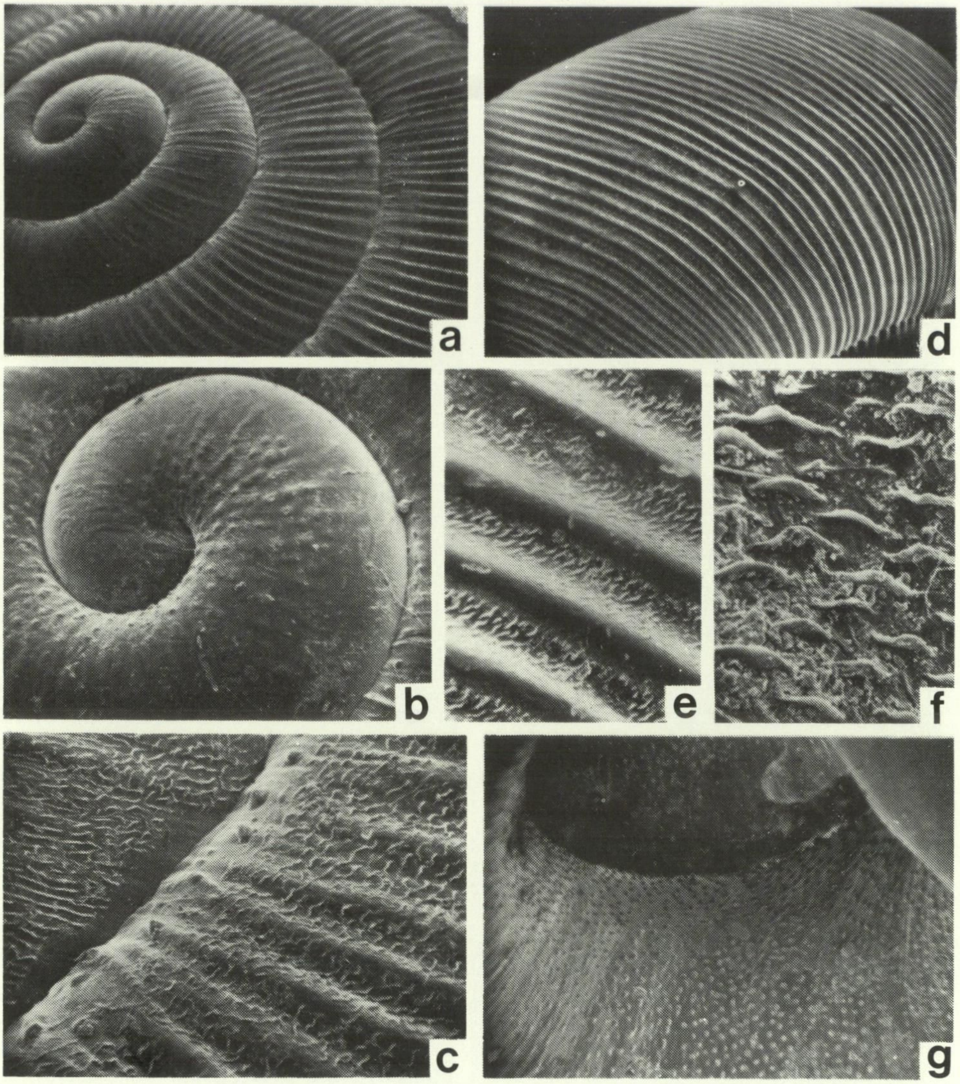

Plate 3: Shell sculpture of *Torresitrachia weaberana:* Sta. WA-239, Weaber Ranges; (a) apex and spire, 15X, FMNH 199613; (b) detail of apex, 44X, FMNH 199613; (c) postapical sculpture from mid-spire, 123X, FMNH 199613; (d) sculpture on body whorl, 13X, WAM 604.77; (e) five ribs from body whorl showing smooth upper margins, 65X, WAM 604.77; (f) microsculpture between two ribs on the body whorl, 315X, WAM 604.77; (g) pustules in umbilicus of shell, 21X, FMNH 199613.

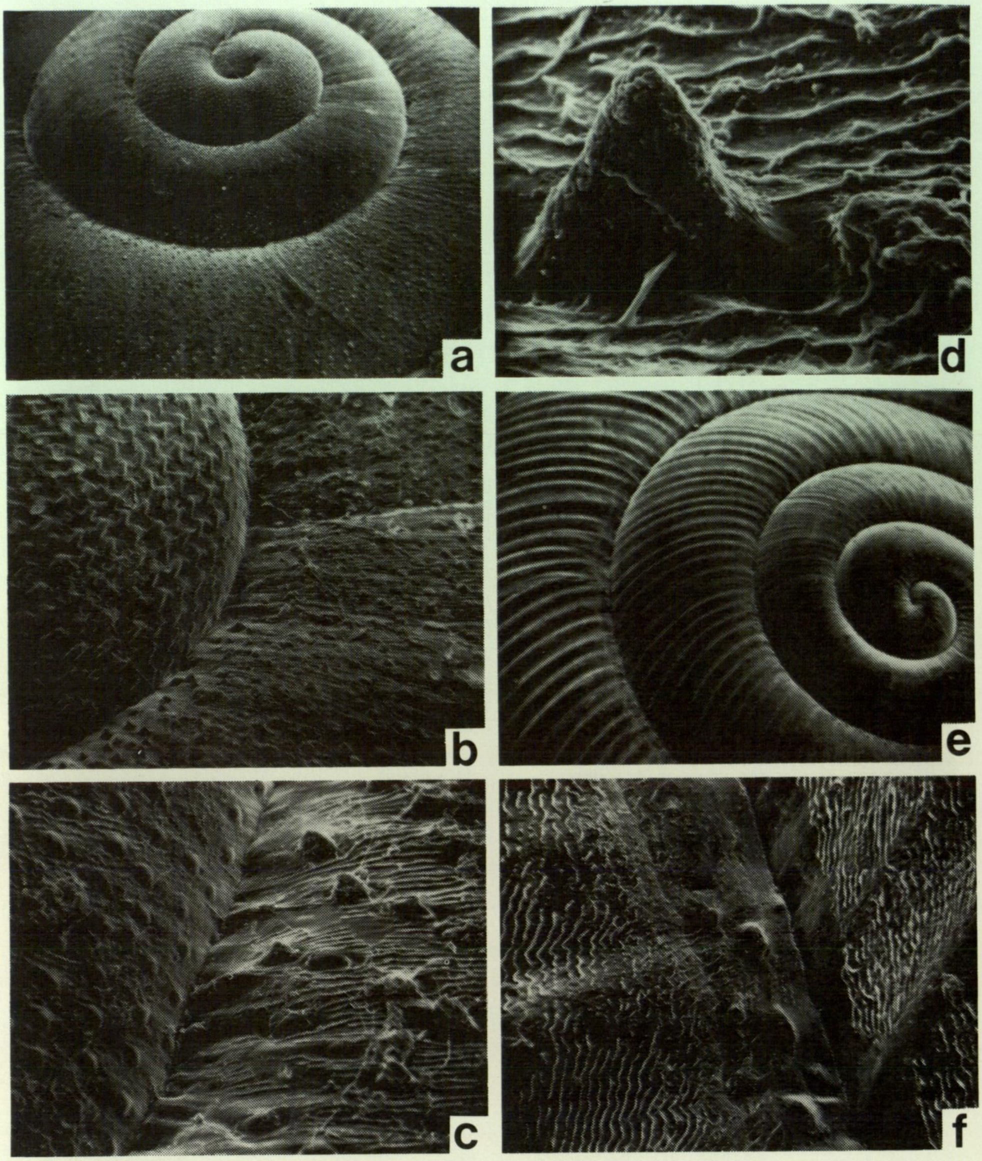

Plate 4: Shell sculpture of: (a) *Torresitrachia umbonis,* apex and upper spire, 17X, WAM 633.77, Sta. E5 (1), Prince Regent River; (b) *T. umbonis,* detail of late apex and early spire, 66X, WAM 633.77; (c) *T. umbonis,* detail of mid-apex and early spire sculpture, 330X, WAM 633.77; (d) *T. umbonis,* single spire pustule and microridges, 655X, WAM 633.77; (e) *T. amaxensis,* apex and upper spire, 14X, WAM 606.77, Sta. WA-205, Mitchell Plateau; (f) *T. amaxensis,* postapical sculpture at body whorl suture, 145X, WAM 606.77.

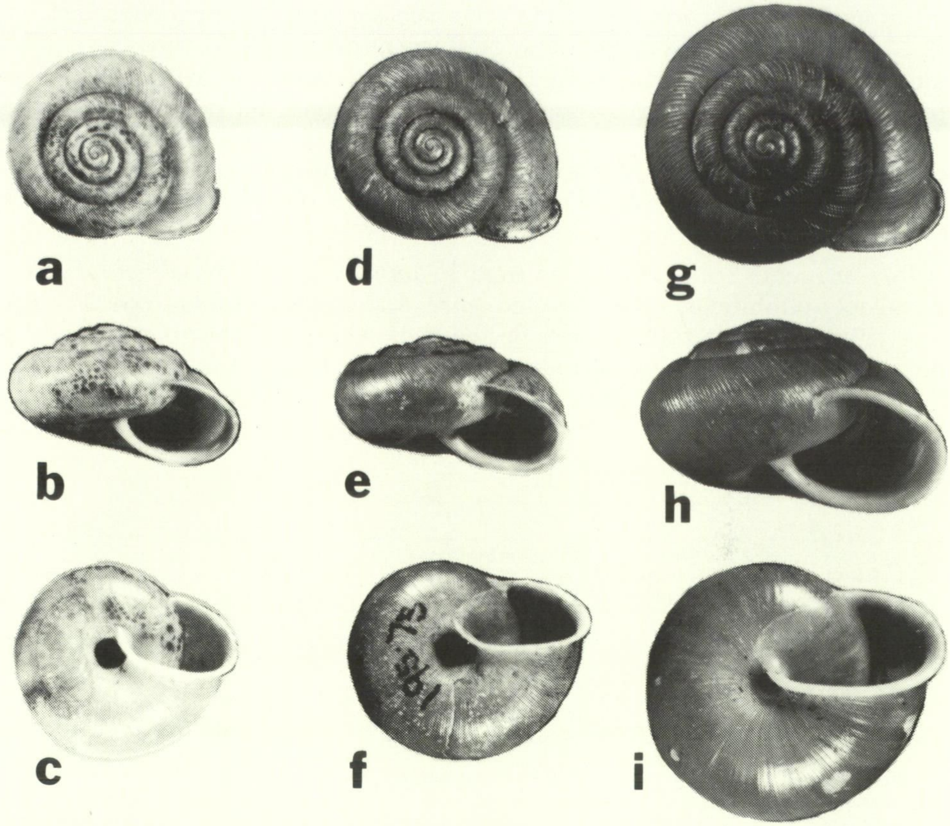

Plate 5: Shells of: (a-c) *Torresitrachia monticola* Iredale, 1939, WAM 49.40, Napier Ranges, paratype, diameter 14.4 mm; (d-f) *T. regula,* WAM 352.77, Sta. E5 (10), Prince Regent River, holotype, diameter 15.8 mm; (g-i) *T. amaxensis,* WAM 363.77, Sta. WA-205, Mitchell Plateau, holotype, diameter 19.5 mm.

Torresitrachia sp. from near Kalumburu and Napier-Broome Bay is known only from dead or juvenile examples. The only adult (FMNH 200531) is a high spired shell, probably as a result of two repaired breaks, with prominent radial ribs that are drastically reduced on the shell base. Only juvenile live specimens were taken, and the only dissected example (WAM 619.77) was too immature for details to be checked. On the basis of shell features, this probably is another species of the typical group.

Torresitrachia umbonis is very large, with a nearly closed umbilicus, and increased whorl and prominent basal lip protrusion **(Plate 7b-c)** are very different in form from the typical species. The shell apex **(Plate 4a-c)** has a dense sculpture of very fine pustules that continue onto the spire and body whorl. Radial ribs are weakly present on 3rd whorl, absent by the body whorl. Microsculpture is **(Plate 4c-d)** of fine ridges that are vertical, rather than spiral or upwardly transverse as in other species, plus the micropustulations. The terminal genitalia **(Figs 17e-f, 18a)** are quite elongated, have a very fat conical epiphallic caecum (EC), long and thin penis (P) with the penial pustules (PPR, **Fig. 18a**) altered into circular ridges, no ridge between the penis and the epiphallus, and the vas deferens (VD) entering the epiphallus through a tiny pair of U-pilasters which lie in a split epiphallic pilaster (EPP). It is known from the Roe and Prince Regent Rivers in the Prince Regent River Reserve.

Torresitrachia crawfordi differs from *T. umbonis* by its larger size, slightly more open umbilicus, more elevated spire, and essential loss of radial sculpture **(Plate 7d-f)**. It shares the deflected body whorl and prominent basal lip protrusion. The anatomy is unknown. The two known examples are from Doubtful Bay, north of Walcott Inlet.

Table 6: Size and shape variation in Northern Territory and Queensland *Torresitrachia* and *Melostrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio
T. blackiana	15	12.79 (10.3-14.2)	20.09 (15.8-23.1)	0.639 (0.599-0.683)
T. stipata	16	7.70 (7.1-9.7)	13.58 (12.7-17.95)	0.567 (0.522-0.616)
T. torresiana	47	11.37 (8.5-15.8)	18.53 (14.4-24.5)	0.614 (0.558-0.728)
T. sp. Mornington I., Queensland	3	7.63 (6.9-8.4)	13.25 (11.4-15.1)	0.578 (0.556-0.605)
T. sp. Wando Vale, Queensland	5	9.60 (8.9-10.3)	14.07 (13.35-14.8)	0.682 (0.667-0.696)
M. acuticosta	3	9.93 (9.1-11.3)	13.75 (12.7-15.15)	0.721 (0.701-0.746)
M. glomerans	64	15.75 (10.9-21.15)	20.77 (14.7-26.5)	0.756 (0.681-0.866)

Taxon	Number of Adults Measured	Mean and Range of: Whorls	Umbilical Width	D/U Ratio
T. blackiana	15	4⅞+ (4½-5⅛)	2.27 (1.75-2.9)	8.94 (7.76-11.2)
T. spitata	16	5 (4¾-5⅝)	1.73 (1.55-2.65)	7.49 (6.34-10.3)
T. torresiana	47	5+ (4½-5⅝)	2.14 (1.4-3.45)	8.83 (6.31-12.8)
T. sp. Mornington I., Queensland	3	4¾+ (4⅝-4⅞)	1.42 (1.3-1.5)	9.33 (8.77-10.4)
T. sp. Wando Vale, Queensland	5	4¾ (4⅝-4⅞)		6.14 (4.67-7.16)
M. acuticosta	3	4¾− (4⅝-5)	1.62 (1.45-1.8)	8.52 (8.38-8.76)
M. glomerans	64	5− (4⅜-5½)	2.69 (1.6-3.9)	8.32 (6.61-11.3)

Extralimital species

Size and shape variation in *Torresitrachia blackiana* (Preston, 1905), *T. torresiana* (Hombron & Jacquinot, 1841), *T. stipata* Iredale, 1938, and two probably new species from Queensland is summarized in **Table 6.** The conchologically convergent genus *Melostrachia* is included in the same table.

Limitations of time and material prevented detailed treatment of these taxa, but dissection and illustration of the genotype, *T. torresiana* (Hombron & Jacquinot, 1841) established the trans-Australian distribution of the genus, while the brief synoptic comments on the other taxa point out field problems for study by others. The contrasting size and shape variations of the Mornington Island and Wando Vale sets **(Table 6)** are of the order of magnitude separating species in Western Australia. Without more material and preserved soft parts for dissection, description of these as new species is unwarranted.

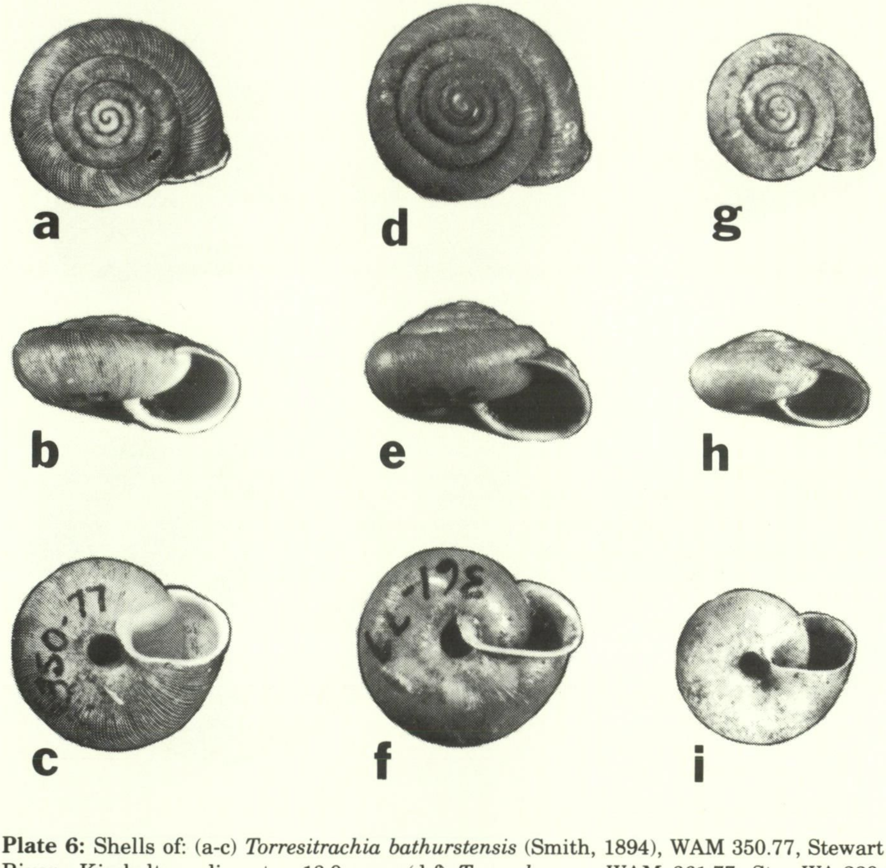

Plate 6: Shells of: (a-c) *Torresitrachia bathurstensis* (Smith, 1894), WAM 350.77, Stewart River, Kimbolton, diameter 13.9 mm; (d-f) *T. weaberana,* WAM 361.77, Sta. WA-239, Weaber Ranges, holotype, diameter 14.65 mm; (g-i) *Damochlora rectilabrum* (Smith, 1894), WAM 359.77, Sta. WA-220, Kalumburu, diameter 11.5 mm.

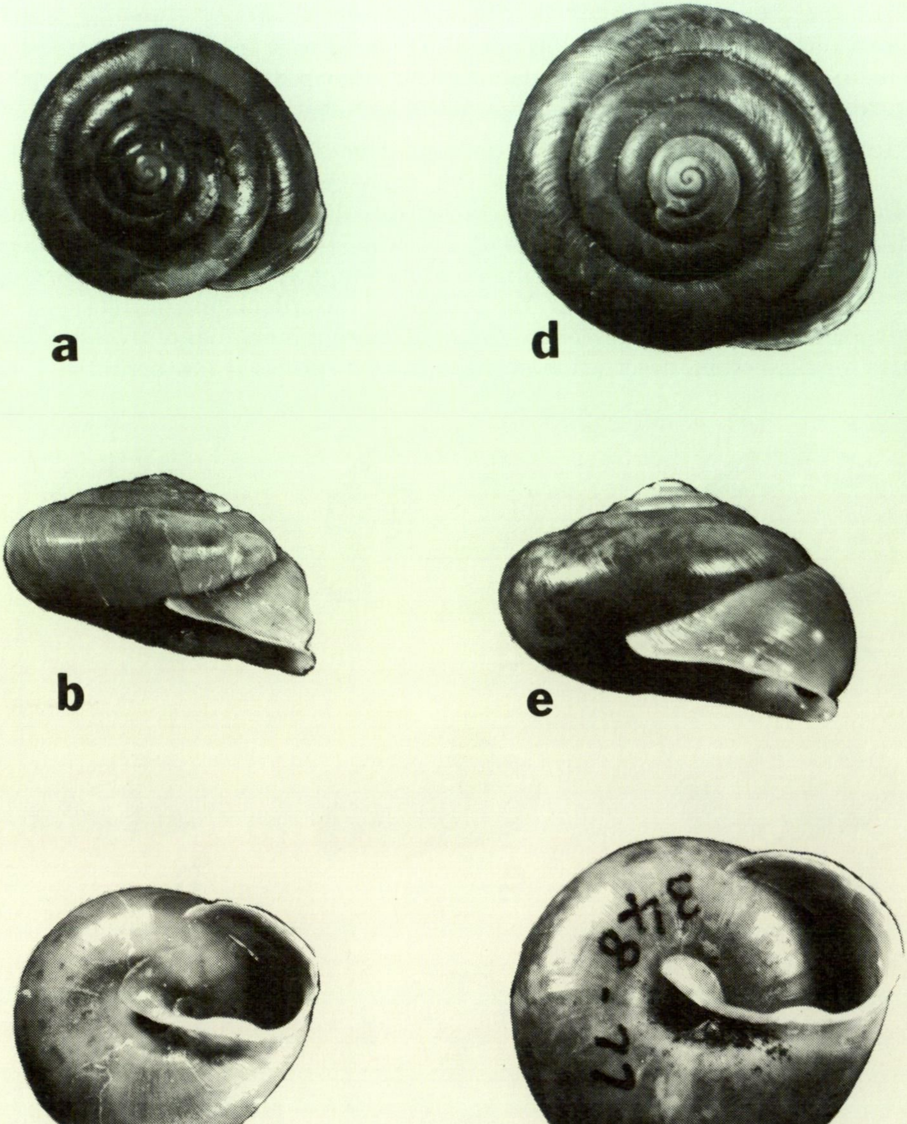

Plate 7: Shells of: (a-c) *Torresitrachia umbonis,* WAM 347.77, Sta. E5 (1), Prince Regent River, holotype, diameter 20.15 mm; (d-f) *T. crawfordi,* WAM 348.77, Doubtful Bay, Walcott Inlet, holotype, diameter 24.6 mm.

Ecology in Western Australia

Torresitrachia amaxensis was moderately uncommon under large boulders on ravine slopes of the Mitchell Plateau. It nowhere was abundant, and was found lying on the soil surface underneath either individual rocks or in shallow talus. *Torresitrachia* sp. at Kalumburu was taken under single small flat rocks in the shade of a large boab. *Torresitrachia weaberana* was found in cave mouth talus and rock ledge crevices in well-shaded ravine areas with south exposure. *Torresitrachia monticola* Iredale, 1939, was taken in the King Leopold Ranges from small rock piles along streams in shaded areas, and at Windjana Gorge was found in a litter pocket about four feet down a narrow crevice of a large limestone slab within a south facing deep fissure. The habitat was revealed only by prying the slab loose and collecting down through layers of *Amplirhagada burnerensis* (Smith, 1894), both living and accumulated dead shells.

Thus in the inland south fringes of the genus range, live examples were far more deeply hidden than in the remaining area. The almost uniform association of live specimens with rocky ravines that at least seasonally have flowing water, suggest that *Torresitrachia* is only marginally adapted to the severe climate of Western Australia. In the Napier Range, for example, only the one live collection from Windjana Gorge is known. Dead specimens have been taken only at the major gaps with drainage from the northern ranges—Tunnel Creek, Windjana Gorge (Lennard River), and Barker Gorge (Barker River) plus Kongorow Pool further up the Barker River. I suspect that the Napier Range collections represent a combination of occasional drift specimens from the King Leopold Ranges or rare tenuous colonies established by wet season flood strandees that persist for a short time before dying out or being replenished by subsequent floods.

Patterns of variation

The intraspecific range in size is so great that differences between species cannot be used to identify individual specimens or small series. If, using data from **Tables 1, 2 and 5,** the difference in adult shell diameter between the largest and smallest observed example is expressed as a percentage of the minimum diameter, the following pattern emerges:

Xanthomelon sp.	10.3%	*Torresitrachia bathurstensis*	24.1%
X. obliquirugosa	58.3%	*T. monticola*	52.0%
X. prudhoensis	52.0%	*T. regula*	50.4%
X. ruberpumilio	15.3%	*T. amaxensis*	102.5%
X. durvillii	102.2%	*T. weaberana*	45.6%
		T. umbonis	36.9%

Most species cluster between two-fifths and three-fifths, with *X. durvillii* and *T. amaxensis* showing an incredible range in variation. The lowered variability for *T. bathurstensis* may reflect sampling essentially only one population. The low variability for *X. ruberpumilio* is not amenable to the same explanation, while *Xanthomelon* sp. is known only from a few individuals.

Variation in H/D ratio is much less dramatic. There is sufficient overlap in D/U ratio that it lacks predictive value for identification, although the tendency for a wider umbilicus in *T. bathurstensis* and narrower umbilici in *T. amaxensis, T. umbonis,* and *T. crawfordi* is clear.

Sculpture variation is a much more useful indicator of specific identity, although some of the differences are difficult to verbalize. The pustulations in the umbilicus **(Plate 3g)** are a constant, but the distribution of pustules on the rest of the shell differs depending on the prominence of the radial sculpture. In *T. umbonis* **(Plate 4a-d)** and *T. crawfordi,* the pustules are the dominant sculptural feature. Some are found near the suture and on the apex in *T. monticola* **(Plate 2a-b)**, more in *T. weaberana* **(Plate 3b-c)**, practically none in *T. amaxensis* **(Plate 4e-f)** and *T. regula* **(Plate 2c)**. The nature of the pustulations in *T. bathurstensis* is unknown.

The microsculpture between the postapical radial ribs varies in a number of features among the species. In general, the species with more prominent radial sculpture lack the microsculpture on top of the ribs, while those with reduced ribbing have the microsculpture continuous. In *T. weaberana* **(Plate 3c, e-f)**, the microsculpture consists of short ridgelets that are confined to the troughs between the ribs except near the sutures **(Plate 3c)** and orientated spirally. They are somewhat wavy in shape. They are more regularly aligned than the ridgelets seen in *Austrochloritis* **(Plate 10b-f)**, *Parglogenia* **(Plate 11b)** and *'Chloritis' argilacea* (Férussac, 1821) **(Plate 11d)**, but probably are of the same origin. In *T. monticola* **(Plate 2b)**,*T. amaxensis* **(Plate 4f)**, *T. regula* **(Plate 2d)**, these ridgelets are angled upwards from the spiral pattern, are very long and parallel each other. In *T. torresiana* (Hombron & Jacquinot, 1841) **(Plate 2f)** and *T. umbonis* **(Plate 4c)**, the ridgelets are nearly vertical, very long, but irregularly broken up into segments. There is thus a shift in composition and orientation of the microsculpture among the species.

The prominence and sharpness of the postapical radial sculpture varies greatly, but is difficult to quantify. A series of low magnification SEM photographs **(Plate 2a, c, e, 3a, d, e, 4a, e)** suggest the differences in rib height and contour on the upper spire. The status of the radial sculpture on the shell base is much more easily communicated. In *T. bathurstensis* the radials are as prominent on the shell base as on the spire; *T. monticola* and *T. weaberana* have the sculpture still prominent on the shell base, but noticeably less prominent than above the periphery; *T. umbonis* and *T. regula* have weak radials present on the base; *T. amaxensis* and *T. torresiana* have the radials prominent above the periphery, but totally absent from the shell base.

Considerable variation exists in the genital tract. Most obviously there are differences in the lengths of the terminal organs, then the shape, prominence and position of the epiphallic caecum. In most species the vagina (V) is rather short, but in *T. monticola* **(Fig. 13c)** it is slightly longer, and in some populations of *T. regula* **(Fig. 17a)** it is very elongated, although other populations of that species **(Fig. 18b)** have a vaginal length more equivalent to that of *T. monticola.* Penis elongation has occurred in both *T. regula* **(Fig. 17a)** and *T. umbonis* **(Fig. 17e)** with some elongation of the shaft in both *T. bathurstensis* **(Fig. 13a)** and *T. amaxensis* **(Fig. 15a).** Probably the penis length of *T. bathurstensis* **(Fig. 13a)** and *T. torresiana* **(Fig. 12b)** are near the ancestral form. In contrast, the penis of *T. weaberana* **(Fig. 15d)** seems to have been secondarily shortened.

The epiphallic caecum normally is located directly opposite the entrance of the vas deferens, but is slightly shifted apically in *T. monticola* **(Figs 13c, e),** and is shifted significantly anteriorly in both *T. amaxensis* **(Fig. 16a)** and *T. regula* **(Fig. 17c).** In shape it varies from the slender finger-like projection of *T. bathurstensis* **(Fig. 13a)** to the fat projections of *T. amaxensis* **(Fig. 15a),** *T. torresiana* **(Fig. 12a),** and *T. umbonis* **(Fig. 17e).** *T. regula* **(Figs 17a, 18b)** and *T. monticola* **(Fig. 13c)** provide a transition between the extremes. The entrance of the vas deferens into the epiphallus shows a whole range of structures, from the simple hooded shield of *T. monticola* **(Fig. 14b),** two simple U-pilasters of *T. regula* **(Fig. 17c),** *T. torresiana* **(Fig. 12b),** and *T. umbonis* **(Fig. 18a),** moderately unequal pilasters of *T. bathurstensis* **(Fig. 14a),** grossly unequal pilasters in *T. weaberana* **(Fig. 16c),** and finally the unique protrusion seen in *T. amaxensis* **(Fig. 16a).** The angle of the vas entrance also is different in that species **(Fig. 16a).** The latter conditions would appear to be the most specialized states found in the genus.

Surface sculpture on the wall of the epiphallus normally consists of low folds or undulations, but the large pilaster in *T. umbonis* **(Fig. 18a)** and the rather striking sculpture in *T. bathurstensis* **(Fig. 14a)** are departures from the average. The boundary between the eipihallic and penial section of the male chamber is interpreted as being marked by a constricting ridge or sphincter (*T. amaxensis,* **Fig. 16a**) that separates a dramatic change in wall surface sculpture. The ridge itself has formed into a trumpet-like opening in *T. bathurstensis* **(Fig. 14a),** is very constricting in *T. weaberana* **(Fig. 16c)** and *T. amaxensis* **(Fig. 16a),** low in *T. monticola* **(Fig. 14b)** and *T. torresiana* **(Fig. 12b),** absent in *T. regula* **(Fig. 17b)** and *T. umbonis* **(Fig. 18a).**

The upper part of the penis chamber has an area of diamond shaped, rather high pustules that were most highly developed and clearly defined in specimens of *T. amaxensis* **(Fig. 16a)** and *T. weaberana* **(Fig. 16a).** In *T. umbonis* **(Fig. 18a)** these have become altered into circular ridges, probably as a means of species recognition in contrast with the sympatric *T. regula.* The apparent reduction of the pustules in the other species almost certainly is an artifact of collecting seasons. In *T. amaxensis,* October specimens had the pustules topped with a 'chitinized' substance and with very sharp anteriorly directed points **(Fig. 16b,** left). March samples **(Fig. 16b,** right) lacked this topping and the pustules were very soft. Since *T. weaberana* **(Fig. 16c)** also was taken after the normal start of the wet season (November) and after a few showers, the prominence of its pustules, that were not topped with a 'chitinized' substance, may indicate that reproductive activity had occurred. The October specimens of *T. monticola* **(Fig. 14b)** have reduced points. In the sympatric *Amplirhagada burnerensis* (Smith, 1894), October samples were in dry season reproductive state and not until early December was the male system in active condition. Thus all species of *Torresitrachia* seen, except *T. amaxensis* and *T. weaberana,* were represented by reproductively inactive (=dry season) or late wet season *(T. torresiana,* **Fig. 12b***)* material. Their reduced sized pustules may indicate seasonal reduction.

The lower portion of the penis chamber has simple folds relating to eversion stresses and without structural peculiarities.

Other seasonal changes remain unknown because of comparatively limited material, except the expected pattern of ovotestis (G) enlargement in North Kimberley October and early November specimens *(T. amaxensis,* **Fig. 15a,** and *T. weaberana,* **Fig. 15d***)*. In March the former **(Fig. 15c)** has the ovotestis dramatically shrunken, presumably in preparation for aestivation during the next dry season. February examples of *T. torresiana* **(Fig. 12a)** have the vagina and spermathecal shaft greatly swollen, suggesting storage of sex products, and a reduced ovotestis. No obvious changes in the size of the prostate-uterus to match those seen in *Xanthomelon* were found, nor did any dissections reveal individuals with developed penis but small albumen gland, which is a good indicator of newly matured examples. Since I could dissect a relatively small number of examples in all, the absence of such new adults may be accidental rather than suggesting that maturation occurs in one wet season.

Formal suggestion of a phylogeny within *Torresitrachia* is premature, but tentative clustering of at least some species is possible. *T. monticola* and *T. regula* share caecum shape, and similar vas deferens entrance. They differ from each other in dividing ridge prominence and length of the genitalia, but have very similar shells with only a slight difference in basal sculpture. *T. weaberana* and *T. amaxensis* share a peculiar vas deferens entrance and are basically similar despite the effects of penis shortening in the former and shell sculpture reduction in the latter. The shifted caecum position in *T. amaxensis* also is a difference. *T. bathurstensis* shows some similarities to *T. regula,* but is less similar to that species than to *T. monticola. T. umbonis* is specialized in shell (deflected body whorl, basal lip protrusion) and anatomy (altered penis chamber sculpture, epiphallic caecum pilaster). *T. crawfordi,* which has not been dissected, is extremely close in shell features to *T. umbonis.* The last two are probably the most specialized taxa of the Western Australian species. Until the Northern Territory and Queensland species are reviewed and their anatomical variations known, attempting to project directions of character change will be hazardous.

Except for *T. regula* and *T. umbonis,* all the species are allopatric. The penis differences between them are interpreted as species recognition features. Enough collecting has been done in the Napier Range that the patchy distribution of *T. monticola* and its deep retreat into crevices suggests that this species is on the fringe of distribution. In contrast, the abundant records of collections in the Prince Regent River Reserve and Mitchell Plateau areas suggest wide local distributions, although specimens are not locally abundant.

Along the coast, from south to north, there is replacement from *T. bathurstensis* (Smith, 1894), to first *T. crawfordi, T. umbonis,* and *T. regula,* then to *T. amaxensis, T.* sp. near Kalumburu, and finally *T. weaberana* in the Weaber Rangers and Northern Territory. *T. monticola* Iredale, 1939 of the King Leopold and Napier Ranges is the only known inland representative. No species were found during the Drysdale Survey or in the Ningbing Ranges.

Systematic review

Synoptic comments on shell variation and anatomy, where available, are given first for the genotype, *Torresitrachia torresiana* (Hombron and Jacquinot, 1841); the only named Northern Territory species, *T. stipata* Iredale, 1938; and the New Guinea species, *T. blackiana* (Preston, 1905). Next, the several generalized Western Australian species, *T. bathurstensis* (Smith, 1894), *T. monticola* Iredale, 1939, *T. regula, T. amaxensis, T. weaberana,* and *T.* sp. from Kalumburu are reviewed. Finally, the two specialized taxa *T. umbonis and T. crawfordi* are treated.

TORRESITRACHIA TORRESIANA (HOMBRON & JACQUINOT, 1841)

(Plate 2e-f; Figs 12a-b, 19a-c)

Helyx torresiana Hombron & Jacquinot, 1841, Annales Sci. Nat., Zool., (Paris), ser. ii, **16:** 63–Ile Toud, Torres Strait, Queensland.

Helix Delessertiana Le Guillou, 1842, Revue Zool. Soc. Cuvierienne, **1842:** 138–Ile Warrior, Torres Strait, Queensland.

Helix taranaki Pfeiffer, 1846, Symb. hist. Helic., **3:** 74–New Zealand (error); Reeve, 1852, Conch. Icon., *Helix,* pl. 83, fig. 443–corrected type locality to Possession Island, Torres Strait, Queensland.

Helix torresiana Hombron & Jacquinot, 1851, Voy. au Pole Sud, 'Astrolabe et Zelee', Atlas, Moll., pl. 4, figs. 24-27; Hombron & Jacquinot, 1854, Voy. au Pole Sud, 'Astrolabe et Zelee,' **5,** Mollusques: 10.

Helix torresii (sic) Forbes, 1852, in MacGillivray's 'Narrative of the Voyage of H.M.S. Rattlesnake,' **2:** 370–typographical error, Nogo Island, Endeavour Strait.

Helix leucolena Crosse, 1867, Jour. de Conchyl., **15:** 447–Vaneea (sic) Levu, archipel. Viti (error); Crosse, 1868, *Ibid.,* **16:** 171-172, pl. 6, fig. 6: Ancey, 1904, *Ibid.,* **52:** 295-296–corrected type locality to North Queensland.

Helix (Trachia) endeavourensis Brazier, 1872, Proc. Zool. Soc. London, **1871:** 640–Endeavour River, North Queensland (15°20'S, 145°11'E).

Nomenclature and type localities

The above synonymy essentially is adopted from Iredale (1938: 110), who in turn had followed synonymies suggested earlier by European workers. Determination of the true type localities and location of type specimens is beyond the scope of this review, but this basic listing will provide a starting point for revision.

Material in historic collections with the locality 'Torres Strait' or 'Islands in Torres Strait' are common. The shells are variable in both size and shape. Sorting out the relationships among these populations from the islands in Torres Strait and Cape York will be an interesting but difficult task.

Comparative remarks

Torresitrachia torresiana (Hombron & Jacquinot, 1841) is relatively large, with normal spire elevation and average umbilical width. The shell apex is smooth **(Plate 2e)** and there are low but prominent radial ribs on the spire and body whorl that stop abruptly at the shell periphery, leaving the shell base smooth except for vague radial growth lines. Microsculpture **(Plate 2f)** is of fine, almost vertical, anastomosing ridges that extend on top of the radial ribs. *T. amaxensis* is most similar in size and subperipheral reduction of the radial sculpture, but differs obviously in its narrowed umbilicus, greater whorl count (5½ compared with 5+), and in having transverse, rather than vertical microsculpture. The short, very thick terminal genitalia of *T. torresiana* **(Figs 12a-b)** with very short epiphallic caecum (EC), relatively long area of penial pustules (PPR), reduced ridge between the penis (P) and epiphallus (E), and entry of the vas deferens (VD) through two fat U-pilasters offer considerable contrast to the same structures as seen in *T. amaxensis* **(Figs 15a-b, 16a-b).**

Material studied

Torres Strait (16 dead adults, NMV, FMNH 95478, FMNH 95564, FMNH 104161, FMNH 158065); Isles in Torres Strait (5 dead adults, NMV, FMNH 41302, FMNH 41328); Adolphus Island, Torres Strait (2 dead adults, FMNH 41666); Coconut Island, Torres Strait (4 live adults, AM C.107157); Murray Island, Torres Strait (4 live adults, AM C.107159); Thursday Island, Torres Strait (2 live and 2 dead adults, NMV 12768, AM C.107138); Mobiag Island, Torres Strait (4 dead adults, NMV); Prince of Wales Island, Torres Strait (7 live adults, 4 live juveniles, FMNH 200822, AM C.107156, AM C.107129); Darnly Island, Torres Strait (2 dead adults, NMV).

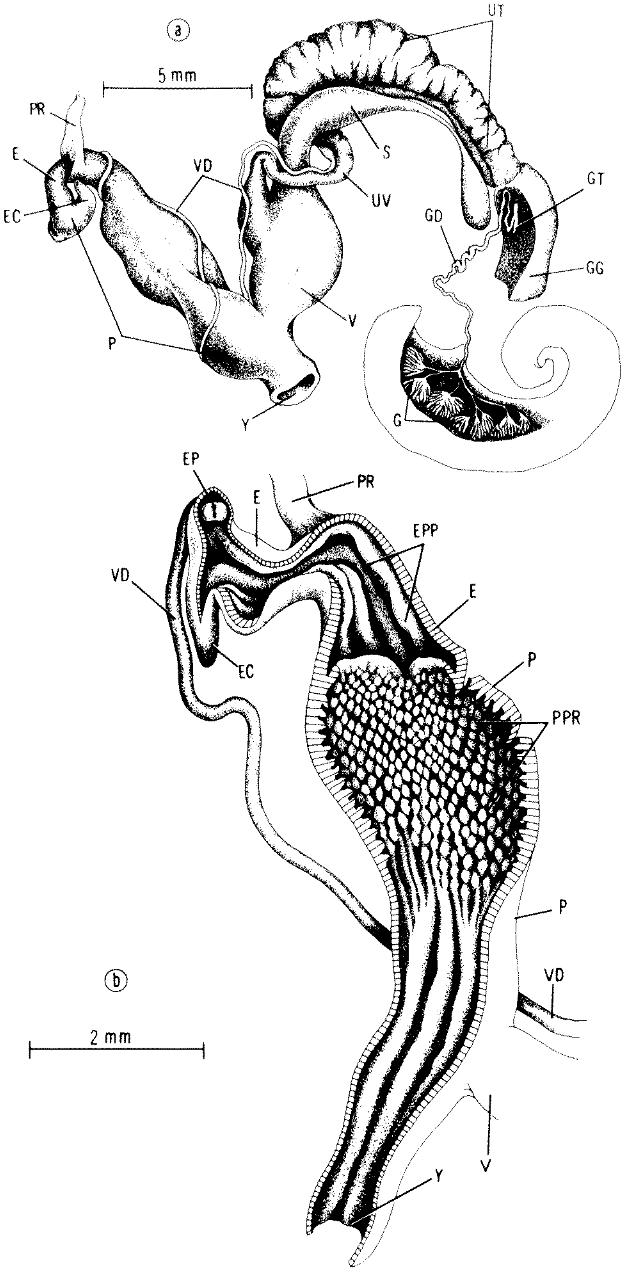

Fig. 12: Genitalia of *Torresitrachia torresiana* (Hombron & Jacquinot, 1841), Savannah woodland, Prince of Wales Island, Torres Strait, Queensland, 6 February 1975, AM C.107156: (a) genitalia, Dissection C; (b) interior of penis and epiphallus, 11 February 1975, AM C.107129, Dissection B. Scale lines as marked.

Diagnosis

Shell 14.4-24.5 mm (mean 18.53 mm) in diameter, with 4½ to 5⅝ (mean 5+) whorls. Apex and spire moderately and evenly elevated, height of shell 8.5-15.8 mm (mean 11.37 mm), H/D ratio 0.558-0.728 (mean 0.614). Apex smooth **(Plate 2e),** spire and body whorl with low, rounded radial ribs that stop at the periphery, shell base smooth. Microsculpture **(Plate 2f)** of nearly vertical ridges that continue on top of the major ribs. Umbilicus normal for genus, regularly decoiling, width 1.4-3.45 mm (mean 2.14 mm), D/U ratio 6.31-12.8 (mean 8.83), walls of umbilicus with dense pustulations. Shell colour greenish yellow brown. Based on 47 measured adults.

Genitalia **(Figs 12a-b)** in late wet season phase with reduced ovotestis, prostate and uterus, spermathecal shaft and vagina swollen. Terminal sections short and thick. Epiphallic caecum (EC) short and fat, epiphallus (E) internally with prominent pilasters. Penis relatively long, area of pustules (PPR, **Fig. 12b**) elongated, with dense clusters, ridge between penis (P) and epiphallus low and relatively long. Vas deferens (VD) entering through two swollen U-pilasters. Based on 3 dissected individuals.

Discussion

It is quite probable that more than one species is clumped here, since the measured material shows both size and sculpture variation. In both the living and historical collection material, a smaller morph (diameter 14-19 mm) which has a more open umbilicus and very widely spaced radial sculpture, contrasts with a larger morph (diameter 17-24 mm) which has a narrower umbilicus and finer, more crowded radial ribs. It is the latter morph whose anatomy **(Figs 12a-b)** and shell microsculpture **(Plate 2e-f)** has been figured. The total range in observed size, however, does not exceed that found in several Western Australian taxa.

Because the available live collected material had been preserved in formalin, dissections were difficult and the results not particularly satisfactory. Thus I have not attempted a comparative study of the two morphs, which were always allopatric.

The smaller morph was seen from Darnly, Mobiag, and Coconut Islands, plus 'Isles in Torres Strait.' The larger morph was seen from Thursday, Prince of Wales and Murray Islands, plus 'Isles in Torres Strait.'

The illustrated material from Prince of Wales Island (10°41′S, 142°09′E) has adult shell measurements of: height 11.6-12.8 mm, diameter 18.4-19.95 mm, H/D ratio 0.630-0.642, whorls 4⅞ to 5⅛, umbilical width 1.6-2.1 mm, D/U ratio 8.76-12.1. This is presumed to be the genotype morph, subject to later correction when synonymies of the Torres Strait taxa are worked out in detail.

TORRESITRACHIA STIPATA IREDALE, 1938
(Figs 19d-f)

Torresitrachia stipata Iredale, 1938, Australian Zool., **9** (2): 110, pl. 12, fig. 27–Sir Edward Pellew Group, Gulf of Carpentaria, Northern Territory.

Comparative remarks

Torresitrachia stipata Iredale, 1938 is used as a convenient catch-all for worn shells from the Northern Territory that are relatively small in size, have a low spire, and a rather wide umbilicus. The shells are too worn for comments to be made concerning sculptural details and no preserved material has been seen. *T. torresiana* (Hombron & Jacquinot, 1841) from Cape York and Torres Strait, Queensland is much larger, more elevated, narrowly umbilicated, and has the radial ribbing absent below the shell periphery. *T. weaberana* from the Weaber Ranges and Katherine, Northern Territory is smaller, has a narrower umbilicus, and stronger, more sharply defined sculpture.

Holotype

AM C.101149, Observation Island, Sir Edward Pellew Group, Gulf of Carpentaria, Northern Territory (1:250,000 'Pellew' map sheet SD53-16, 15°37′S, 136°54′E), Collected by W.E.J. Paradice. Height of shell 9.7 mm, diameter 17.95 mm, H/D ratio 0.540, whorls 5½+, umbilical width 2.2 mm, D/U ratio 8.16.

Paratypes

AM C.49548, 5 dead adults from the type locality.

Other material

Northern Territory: Cape Wessel (5 dead adults, AM C.77821, Helen Blackburn); Wessel Island (3 dead adults, AM); Rimbija Island, Cape Wessel (2 dead adults, AM, Helen Blackburn, April 1970).

Discussion

No diagnosis is presented in view of the limited, worn material available. I have used this name for the Cape Wessel and Sir Edward Pellew populations. Scattered, worn material from the Roper River (4 dead adults, QM MO 6384, 14°41′S, 134°26′E, mean diameter 20.54 mm, mean H/D ratio 0.623, mean whorls 5⅛–, mean D/U ratio 9.52); 50 km south of Borroloola along the McArthur River (1 dead adult, AM, H.S. Cogger, 4 December 1975, diameter 13.55 mm, H/D ratio 0.531, whorls 4⅝, D/U ratio 7.97); Daly River (2 dead adults, AM C.19500, diameters 16.3-16.6 mm, H/D ratio 0.540-0.578, whorls 5¼ to 5½, D/U ratios 11.1-12.5); and Millingimby (1 dead adult, AM C.76415, diameter 14.25 mm. H/D ratio 0.604, whorls 5⅛, D/U ratio 9.50) may be conspecific or may represent a variety of other taxa. They do demonstrate that *Torresitrachia* has a wide distribution in the Northern Territory.

TORRESITRACHIA BLACKIANA (PRESTON, 1905)

(Figs 20a-c)

Planispira (Trachiopsis) blackiana Preston, 1905, Proc. Malac. Soc. London, **6** (4): 207, 1 text fig.–Port Moresby District, British New Guinea.
Magitrachia blackiana (Preston), Iredale, 1941, Australian Zool., **10:** 92.

Comparative remarks

Torresitrachia blackiana (Preston, 1905) is a large, elevated species with normal width umbilicus and a relatively low whorl count. There are very low, rather indistinct, widely spaced radial ribs on the spire that continue onto the shell base. The umbilicus has dense pustulations. Material available in Chicago was not suitable for illustration of the microsculpture. No preserved specimens were located and the species has not been dissected.

Holotype

BMNH 1905.4.7.7, Port Moresby District, British New Guinea, *ex* Preston. Height of shell 12.7 mm, diameter 21.2 mm, H/D ratio 0.599, whorls 5+, umbilical width 2.2 mm, D/U ratio 9.64.

Other material, probably paratypes

Port Moresby District (12 dead adults, AM, AM C.20676, IRSB, FMNH 41272).

Other material

Loki River, 22 km from Port Moresby (2 dead adults, AM, Lawrence Jones, 1944).

Diagnosis

Shell 15.8-23.1 mm (mean 20.09 mm) in diameter, with 4½ to 5⅛ (mean 4⅞+) whorls. Apex and spire moderately and evenly elevated, body whorl somewhat globose, height of shell 10.3-14.2 mm (mean 12.79 mm), H/D ratio 0.599-0.683 (mean 0.639). Apical whorls with fine pustulations and weak radial ribs, postapical whorls with very low, rounded, irregular radial ribs that are equally prominent on the shell base, but absent from the umbilicus, which is densely pustulated. Body whorl very slightly descending behind lip, which is broadly reflected and expanded. Umbilicus open, slightly decoiling, margin shouldered, width 1.75-2.9 mm (mean 2.27 mm), D/U ratio 7.76-11.2 (mean 8.94). Shell colour light greenish yellow. Based on 15 measured adults.

Anatomy unknown.

Discussion

In size and shape, *Torresitrachia blackiana* (Preston, 1905) is similar to *Melostrachia glomerans* (Iredale, 1938), but the latter species has much stronger radial sculpture, lacks the characteristic microsculpture of *Torresitrachia,* and has very different anatomy **(Figs 21a-b).** The small morph of *T. torresiana* (Hombron & Jacquinot, 1841) has the same radial shell sculpture as *T. blackiana.*

Probably most of the cited museum specimens are paratypes originating from Preston's collection. Only the Loki River material (AM) is from another collecting period. These two shells are very small, diameter 15.8 and 16.3 mm, but typical in shape and sculpture.

TORRESITRACHIA BATHURSTENSIS (SMITH, 1894)

(Plate 6a-c; Figs 13a-b, 14a)

Helix (Trachia) bathurstensis Smith, 1894, Proc. malac. Soc. London, **1**: 93, pl. VII, fig. 20–Bathurst and Heywood Islands, King Sound, Western Australia. Type locality here restricted to Bathurst Island.

Torresitrachia bathurstensis (Smith, 1894), Iredale, 1938, Australian Zool., **9** (2): 110; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 48, pl. 3, fig. 2 (part).

Comparative remarks

Torresitrachia bathurstensis (Smith, 1894) is the smallest, most depressed, and most widely umbilicated species of *Torresitrachia* in Western Australia. Considerable overlap with other species exists **(Table 5),** so that individual specimens may be hard to identify from shell measurements alone. The continuation of the narrow and very sharply defined sculpture onto the shell base without size reduction is the one conchological character that separates it readily from other Western Australian species. *T. weaberana* is more elevated and narrowly umbilicated with the sculpture wider, less sharply defined and more crowded **(Plate 3a-b).** Other species have the sculpture on the base noticeably reduced or absent. Both *T. umbonis* and *T. crawfordi* have a raised knob on the basal lip that separates them from *T. bathurstensis* (Smith, 1894). Anatomically, the extremely long and slender epiphallic caecum (EC, **Fig. 13a**) and very narrow opening into the main penis chamber from the epiphallic section **(Fig. 14a)** characterize *T. bathurstensis.*

Lectotype

BMNH 90.12.30.159, Bathurst Island, Western Australia (1:250,000 'Yampi' map sheet SE51-3, grid co-ordinates 973:112). Height of shell 7.65 mm, diameter 13.5 mm, H/D ratio 0.567, whorls 4⅞, umbilical width 1.65 mm, D/U ratio 8.18.

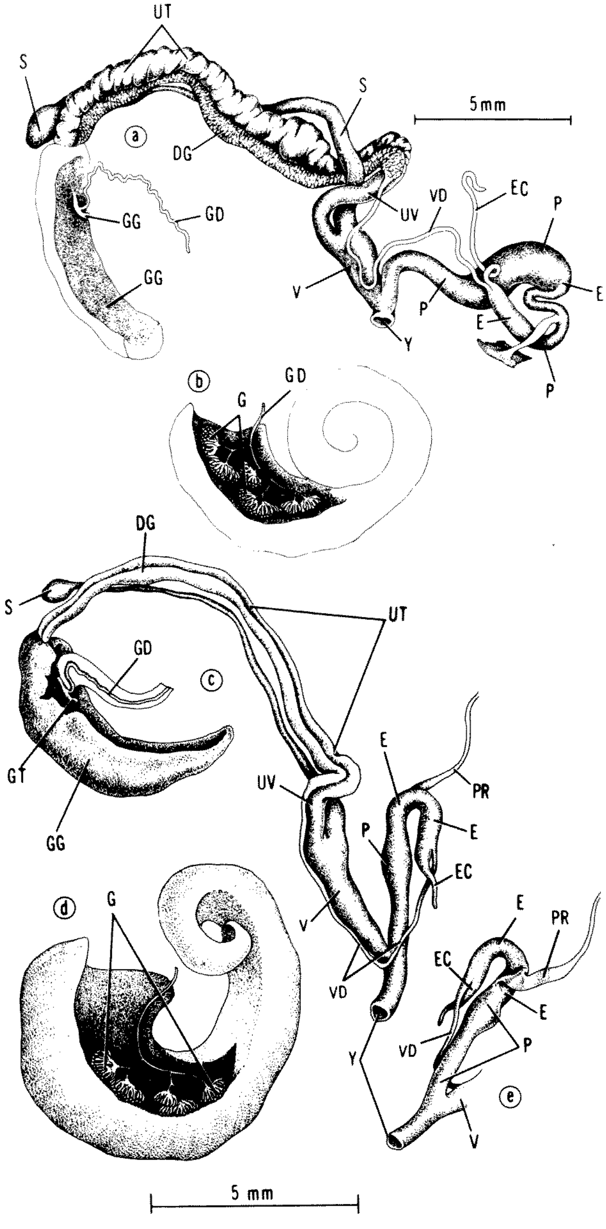

Fig. 13: Genitalia of: (a-b) *Torresitrachia bathurstensis* (Smith, 1894), Stewart River, Kimbolton, 18 September 1975, WAM 640.77, Dissection B; (a) is genitalia, (b) is ovotestis (G); (c-e) *Torresitrachia monticola* Iredale, 1939, Sta. WA-193B, Windjana Gorge, Napier Range, 10 October 1976, WAM 602.77, Dissection B; (c) is genitalia, (d) is ovotestis, (e) is terminal genitalia reversed to show insertion of penial retractor muscle (PR). Scale line equals 5 mm.

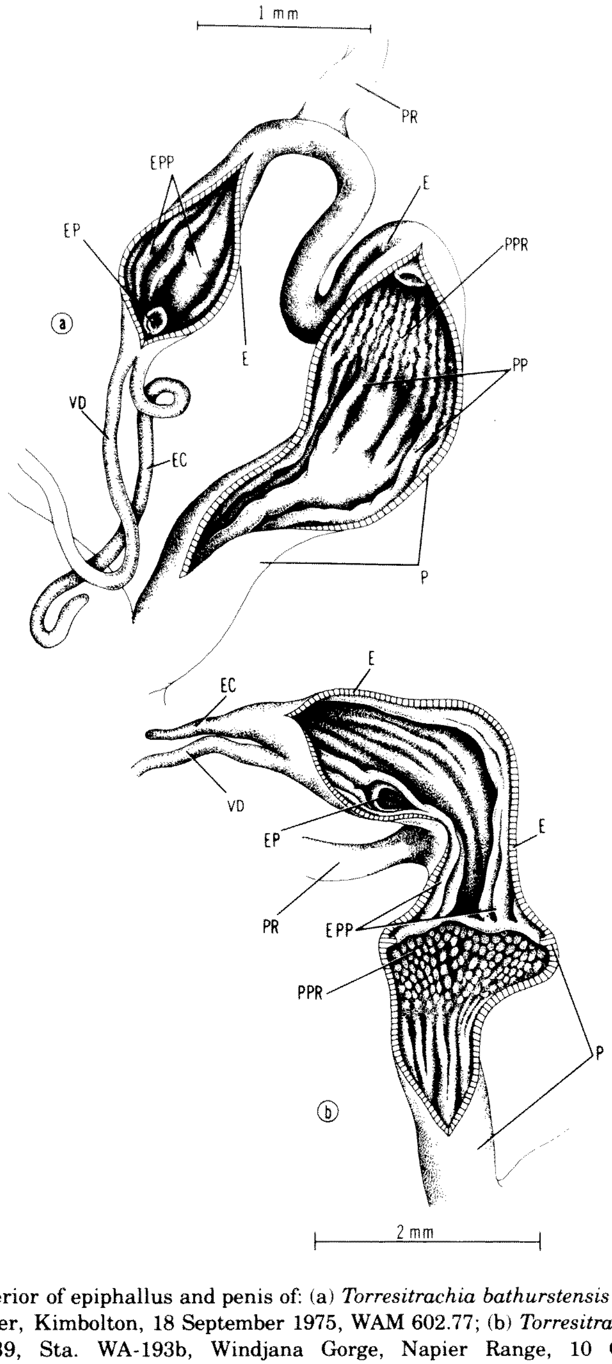

Fig. 14: Interior of epiphallus and penis of: (a) *Torresitrachia bathurstensis* (Smith, 1894), Stewart River, Kimbolton, 18 September 1975, WAM 602.77; (b) *Torresitrachia monticola* Iredale, 1939, Sta. WA-193b, Windjana Gorge, Napier Range, 10 October 1976, WAM 601.77 and WAM 602.77, composite of Dissections A and B. Scale line equals 1 mm.

Paratype

BMNH 90.12.30.158, Heywood Island, Western Australia (1:250,000 'Camden Sound' map sheet SD51-15, grid co-ordinates 060:204), is *Torresitrachia regula.*

Material studied

Western Australia: Stewart River, Kimbolton (16°36'S, 123°51'E) (27 live and 2 dead adults, many juveniles and broken individuals, WAM 350.77, WAM 351.77, WAM 639.77, WAM 640.77, WAM 648.77, FMNH 200819, Harry Butler, 18 September 1975); Doubtful Bay, north of Walcott Inlet (Charnley SE51-4–*ca.* 963:232) (1 dead adult, WAM 449.77, Ian Crawford, 23 August 1965).

Diagnosis

Shell 12.65-15.7 mm (mean 14.26 mm) in diameter, with 4½ to 5¼ (mean 4⅞) whorls. Apex and spire slightly and evenly elevated, height of shell 6.7-8.5 mm (mean 7.41 mm), H/D ratio 0.477-0.580 (mean 0.520). Apical sculpture not seen, postapical whorls with sharply defined, high, prominent radial ribs, about 7-8 per mm, that extend onto shell base without size reduction, disappearing abruptly in umbilicus, whose walls are covered with fine pustules. Lip abruptly reflexed, rather narrow, white. Umbilicus widely open for genus, regularly decoiling, width 1.65-2.95 mm (mean 2.27 mm), D/U ratio 5.12-8.36 (mean 6.39). Shell colour probably brownish yellow, bleached by preservative. Based on 29 measured adults.

Genitalia **(Figs 13a-b, 14a)** in dry season inactive phase, although organs more swollen than in August collected examples of *T. regula* or *T. umbonis* **(Figs 17, 18).** Vaginal region short, penis relatively long, with very long and slender epiphallic caecum (EC). Penis internally **(Fig. 14a)** with reduced zone of pustules below a trumpet-shaped dividing range. Entrance of vas deferens (VD) through a double U set of pilasters, two or more high pilasters in upper section of epiphallus. Pilasters on the lower portion of the penis relatively thick and prominent. Based on 3 dissected individuals.

Discussion

The lectotype of *Torresitrachia bathurstensis* (Smith, 1894) (BMNH 90.12.30.159) is a small example of the taxon from the Kimbolton area that was dissected. The shell is quite worn, probably was collected from semi-consolidated sand dunes, and has sculpture missing from much of the shell base and parietal wall. Nevertheless, the strong radial sculpture seen behind the lip convinces me that the name is correctly applied to the Kimbolton material. Radial sculpture visible on the spire is the same strength and spacing as on shells of the Kimbolton population (direct comparison). The paratype of *T. bathurstensis* (BMNH 90.12.30.158) from Heywood Island is a very worn example that falls within the variation range of *T. regula.* The sculpture on the shell (direct optical comparison) is slightly finer and more crowded than that of the directly compared paratypes of *T. regula.* Until more material from Heywood Island is available, the population is tentatively referred to *T. regula.*

Field preservation techniques, use of apparently unbuffered formalin, had resulted in seriously weakening to destroying the shell in most of the sample from Stewart River, Kimbolton. Thus it was impossible to study the microsculpture and only a small portion of the shells remained sufficiently intact to permit all measurements to be made. The single dead, bleached adult from Doubtful Bay is more depressed (H/D ratio 0.477) than any other specimen seen, but otherwise falls within the range of variation for *T. bathurstensis* and has the radial sculpture undiminished on the shell base.

T. regula from the Prince Regent River Reserve has the sculpture greatly reduced on the shell base, is larger, higher, and has a noticeably smaller umbilicus. Anatomically, the very slender and long epiphallic caecum (EC, **Fig. 14a**) of *T. bathurstensis* easily separates this species from *T. regula,* which has a much shorter epiphallic caecum **(Fig. 18b)** with a wide base and tapered shape.

TORRESITRACHIA MONTICOLA IREDALE, 1939

(Plate 2a-b, 5a-c; Figs 13c-e, 14b)

Torresitrachia monticola Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 48-49, pl. III, fig. 13–Napier Range, Western Australia, type locality here restricted to Windjana Gorge, Napier Range.

Comparative remarks

Torresitrachia monticola Iredale, 1939 is very similar to *T. regula* from the Prince Regent River Reserve, but has stronger radial sculpture on the shell base and several anatomical differences. *T. bathurstensis* (Smith, 1894) and *T. weaberana* have even stronger sculpture on the shell base, and differ in size, spire elevation and whorl counts. Anatomically the shorter terminal genitalia, more slender epiphallic caecum, and different entrance of the vas deferens into the epiphallus separate *T. monticola* **(Figs 13c, 14b)** from *T. regula* **(Figs 17a-c).** *T. bathurstensis* has a very long, finger-like caecum **(Fig. 14a),** while *T. weaberana* has a shortened penis with thick walls and unusual entrance of the vas deferens **(Fig. 16c).**

Holotype

AM C.106526, Barrier (Napier) Ranges, Western Australia. Collected by W.W. Froggatt. Type locality here restricted to Windjana Gorge, Napier Range.

Height of shell 9.5 mm, diameter 15.4 mm, H/D ratio 0.613, whorls 5¼, umbilical width 2.0 mm, D/U ratio 7.70.

Paratypes

AM C.79563, WAM 49.40, 2 adult shells from the type locality.

Material studied

Sta. WA-190, north-east corner Barker Gorge, just east of Wombarella Creek Crossing, Napier Range (Lennard 3863–914:841) (1 dead adult, FMNH 200771, A. Solem, 8 October 1976); Sta. WA-193A, single fissure, south-west corner Windjana Gorge, Napier Range (Lennard 3863-743:063) (2 dead adults, FMNH 199433, WAM 177.79, A. Solem, 10 October 1976); Sta. WA-193B, south-west side Windjana Gorge, 2nd fissure from gorge, Napier Range (Lennard 3863–743:063) (6 live and 4 dead adults, FMNH 200710, FMNH 200773, WAM 357.77, WAM 601.77, WAM 602.77, Alan Solem, 10 October 1976); Sta. WA-194, south-east corner Windjana Gorge, Napier Range (Lennard 3863–737:065) (4 dead adults, FMNH 199198, WAM 170.79, L. Price and C. Christensen, 4 January 1977); Sta. WA-308, north-west side Windjana Gorge at entrance (Lennard 3863–740:093) (2 dead adults, FMNH 199176, WAM 171.79, L.Price & C. Christensen, 11 December 1976); Sta. WA-315, 12.9 km south of Mt Hart outcamp, below falls on south-west side Fern Creek Valley, King Leopold Ranges (Richenda 3963–012:423) (1 live and 5 dead adults, 2 live juveniles, WAM 169.79, WAM 172.79, FMNH 199318, FMNH 200162, L. Price and C. Christensen, 13 December 1976); Sta. WA-334, cliff base just north of Lillimilura Police Station ruins, 3 km south-east Windjana Gorge, south-west side Napier Range (Lennard 3863–725:088) (1 dead adult, WAM 173.79, L. Price and C. Christensen, 22 December 1976); Sta. WA-357, 0.2 km south of Wombarella Creek Crossing, Barker Gorge, north-east side Napier Range (Lennard 3863–914:841) (1 dead adult, WAM 174.79, L. Price and C. Christensen, 31 January 1977); Sta. WA-362, 11.6 km east of Mt Hart outcamp, King Leopold Ranges (Richenda 3963–030:410) (4 live juveniles, FMNH 200237, WAM 176.79, L. Price and C. Christensen, 27 January 1977); Sta. WA-379, north slope of hill *ca.* 6 km north-east of Mac's Jumpup, Gibb River Road, King Leopold Ranges (Richenda 3963–023:165) (19 dead adults, FMNH 199288, WAM 175.79, L. Price and C. Christensen, 28 February 1977); 6 km north-east of Mac's Jumpup, Gibb River Road, King Leopold Ranges (4 dead adults and 10 dead juveniles, WAM 356.77, B. Wilson & S. Slack-Smith, 28 August 1975); near Kongorow Pool, west of Barker River, north of Napier Range (Lennard 3863–037:892) (14 dead adults, 14 dead juveniles, B. Wilson & S. Slack-Smith, 16 May 1976); gully to north side of Mt Bell with creek, tributary of Bell Creek, east side of valley, King Leopold Ranges (6 dead adults and fragments, WAM 355.77, B. Wilson & S. Slack-Smith, 27 August 1975); north bank Tunnel Creek, south-west side Napier

Range (1 dead adult, WAM 765.76, B. Wilson & S. Slack-Smith, 1 September 1975); 100 m north-west of south-west entrance to Windjana Gorge, Napier Range to 3 km south-east of Windjana Gorge (10 dead adults, 4 dead juveniles, plus fragments, WAM 760.76, WAM 761.76, WAM 762.76, WAM 763.76, WAM 764.76, B. Wilson & S. Slack-Smith, 31 August 1975).

Diagnosis

Shell 12.7-19.3 mm (mean 15.89 mm) in diameter, with 4½ to 5½ (mean 5+) whorls. Apex and spire moderately and evenly elevated, height of shell 7.2-10.8 mm (mean 9.78 mm), H/D ratio 0.500-0.625 (mean 0.573). Apical sculpture of scattered fine pustules and rare traces of low radial ribs, postapical sculpture of low, prominent, rounded radial ribs, about 6-7 per mm on the body whorl, that continue onto shell base gradually diminishing in prominence as they near the umbilicus. Walls of umbilicus with fine pustules, quite crowded. Lip sharply reflexed, rather narrowly expanded. Umbilicus narrowly open, barely decoiling, width 1.4-2.85 mm (mean 1.97 mm), D/U ratio 6.32-11.4 (mean 8.12). Shell colour light yellow brown. Based on 83 measured adults.

Genitalia **(Fig. 13c)** with relatively long penis (P) and vagina (V). Epiphallic caecum (EC) long, broad at base, tapering and then finger-like. Internally **(Fig. 14b)** vas deferens (VD) entering epiphallus through a low U-pilaster. Walls of epiphallus without prominent sculpture, ridge between epiphallic and penis chamber narrow and not very high. Pustulations on upper penis wall prominent, area of these pustulations of average length. Genitalia in resting phase. Based on 3 dissected adults.

Discussion

In the Napier Range *Torresitrachia monticola* Iredale, 1939 is a scarce species. Occasional single specimens have been taken near Barker Gorge and Tunnel Creek and several collections of dead shells have been made in the vicinity of Windjana Gorge. Since the latter locality was visited by Froggatt (see Iredale, 1939: 58, Lennard River Gorge=Windjana Gorge) and the types fall within the size range of Windjana Gorge material, this has been selected as the type locality. The only living Napier Range specimens were found almost by accident. A large limestone slab had been pried loose to reveal a number of living and dead *Amplirhagada burnerensis* (Smith, 1894) and several *Westraltrachia*. The living specimens of *Amplirhagada* were in the debris near the upper edge of the crack with a mass of dead shells extending downwards into the dirt caked in the crack. Near the bottom of the crack, in an area too narrow for the dead *Amplirhagada* to fit, was a small pocket of dirt and leafy debris. Six live adults of *Torresitrachia monticola* and several dead shells were taken from this one pocket. Despite repetitive visits to this station and nearby localities during the wet season, no additional live specimens were taken in the Napier Range.

Table 7: Local variation in Western Australian *Torresitrachia*

Taxon	Number of Adults Measured	Mean and Range of: Shell Height	Shell Diameter	H/D Ratio
T. bathurstensis				
Stewart R.	27	7.43±0.091 (6.7-8.5)	14.29±0.150 (12.65-15.7)	0.520±0.004 (0.487-0.580)
T. monticola				
WA-193B, 10 Oct. 1976	10	9.33±0.127 (8.75-9.95)	15.66±0.178 (14.8-16.65)	0.596±0.007 (0.559-0.622)
N side Mt Bell, 27 Aug. 1975	6	8.98±0.282 (7.9-9.9)	15.92±0.436 (14.65-17.4)	0.564±0.006 (0.539-0.583)
Mac's Jumpup, 28 Aug. 1975	4	9.79±0.449 (8.7-10.8)	17.54±0.688 (15.65-18.95)	0.559±0.017 (0.535-0.607)
Mac's Jumpup, 28 Feb. 1976	19	9.92±0.133 (8.8-10.75)	17.62±0.254 (16.0-19.3)	0.564±0.004 (0.525-0.600)
Kongorow Pool, 16 May 1976	14	8.83±0.176 (7.85-9.85)	15.12±0.273 (13.75-17.0)	0.587±0.004 (0.571-0.623)
WA-315, Mt Hart, 13 Dec. 1976	5	8.13±0.275 (7.2-8.75)	14.40±0.568 (12.7-15.6)	0.565±0.007 (0.545-0.586)
T. regula				
Sta. E5 (3) Aug. 1974	5	9.01±0.276 (8.4-10.0)	15.19±0.287 (14.65-16.3)	0.593±0.009 (0.562-0.613)
Sta. E5 (10), Aug. 1974	7	8.21±0.247 (7.1-8.85)	14.17±0.445 (12.7-15.8)	0.580±0.008 (0.559-0.613)
Sta. E6, Aug. 1974	4	9.48±0.434 (8.4-10.45)	16.69±0.860 (14.25-18.3)	0.569±0.010 (0.541-0.589)
T. amaxensis				
WA-205 (dead), 18 Oct. 1976	14	12.26±0.234 (10.75-13.8)	18.91±0.329 (17.25-22.15)	0.648±0.008 (0.600-0.696)
WA-205 (live), 18 Oct. 1976	5	12.38±0.326 (11.5-13.1)	19.33±0.473 (18.1-20.75)	0.641±0.010 (0.612-0.662)
WA-210, 21 Oct. 1976	9	12.54±0.283 (11.5-14.1)	19.92±0.378 (18.3-21.9)	0.630±0.010 (0.578-0.671)
WA-211, 21 Oct. 1976	9	11.24±0.425 (9.95-14.0)	18.28±0.677 (15.6-22.6)	0.615±0.008 (0.574-0.644)
MP7, 23 Aug. 1976	4	8.63±0.263 (7.9-9.1)	14.03±0.682 (12.1-15.3)	0.617±0.014 (0.593-0.653)
MP5, 23 Aug. 1976	8	11.34±0.362 (9.6-13.3)	17.57±0.535 (15.15-20.2)	0.646±0.006 (0.623-0.665)
WA-391 (dead), 14 Mar. 1977	11	12.48±0.149 (11.9-13.55)	19.59±0.194 (18.7-21.2)	0.637±0.004 (0.623-0.669)
WA-391 (live), 14 Mar. 1977	5	12.71±0.272 (11.8-13.5)	19.89±0.290 (18.8-20.5)	0.639±0.015 (0.593-0.673)
T. weaberana				
Point Spring, 19 June 1966	27	8.14±0.123 (6.6-9.1)	14.37±0.229 (11.4-16.3)	0.569±0.006 (0.515-0.652)
WA-238, 14 Nov. 1976	18	8.78±0.121 (7.9-9.65)	15.24±0.189 (13.7-16.6)	0.577±0.005 (0.542-0.611)
WA-239, 14 Nov. 1976	86	8.62±0.066 (7.3-10.3)	14.78±0.094 (12.85-16.6)	0.584±0.003 (0.534-0.650)
T. umbonis				
Sta. E5 (1), Aug. 1974	5	11.67±0.235 (11.0-12.15)	20.23±0.339 (19.4-21.1)	0.577±0.015 (0.533-0.626)
W6 (1), Aug. 1974	6	11.47±0.442 (10.15-13.0)	21.73±0.755 (18.4-24.15)	0.529±0.016 (0.476-0.590)

Table 7: Local variation in Western Australian *Torresitrachia* (continued)

Taxon	Number of Adults Measured	Mean and Range of: Whorls	Umbilical Width	D/U Ratio
T. bathurstensis				
Stewart R.	27	4⅞ (4½-5¼)	2.29±0.057 (1.65-2.95)	6.34±0.161 (5.12-8.36)
T. monticola				
WA-193B, 10 Oct. 1976	10	5+ (5.5¼)	1.92±0.080 (1.6-2.5)	8.25±0.245 (6.66-9.31)
N side Mt Bell, 27 Aug. 1975	6	5− (4¾-5⅛)	2.09±0.064 (1.85-2.3)	7.64±0.256 (6.37-7.97)
Mac's Jumpup, 28 Aug. 1975	4	5⅛ (5⅛-5¼)	2.27±0.093 (2.15-2.45)	8.36±0.725 (7.28-9.74)
Mac's Jumpup, 28 Feb. 1976	19	5⅛ (4⅞-5½)	2.32±0.282 (1.85-2.85)	7.65±0.621 (6.32-8.65)
Kongorow Pool, 16 May 1976	14	5+ (4⅝-5⅜)	1.84±0.077 (1.5-2.45)	8.32±0.290 (6.39-9.71)
WA-315, Mt Hart, 13 Dec. 1976	5	4¾ (4½-4⅞)	1.86±0.156 (1.4-2.2)	7.87±0.394 (6.86-9.07)
T. regula				
Sta. E5 (3), Aug. 1974	5	5− (4¾-5¼)	1.72±0.089 (1.55-2.05)	8.92±0.454 (7.29-9.88)
Sta. E5 (10), Aug. 1974	7	4⅞ (4¾-5⅛)	1.61±0.080 (1.3-2.0)	8.90±0.356 (7.03-9.78)
Sta. E6, Aug. 1974	4	5¼ (5-5⅜)	1.94±0.063 (1.8-2.1)	8.60±0.235 (7.92-9.00)
T. amaxensis				
WA-205 (dead), 18 Oct. 1976	14	5⅜+ (5¼-5¾)	1.43±0.040 (1.2-1.7)	13.32±0.261 (11.1-14.6)
WA-205 (live), 18 Oct. 1976	5	5⅜+ (5¼-5½)	1.49±0.102 (1.25-1.7)	13.20±0.403 (10.6-15.6)
WA-210, 21 Oct. 1976	9	5⅝− (5⅜-5¾)	1.73±0.49 (1.5-2.0)	11.57±0.340 (10.2-13.1)
WA-211, 21 Oct. 1976	9	5¼+ (4⅝-5⅞)	1.50±0.091 (0.9-1.8)	12.60±0.945 (9.56-19.1)
MP7, 23 Aug. 1976	4	5− (4⅜-5⅛)	1.44±0.118 (1.1-1.65)	9.87±0.501 (8.61-11.0)
MP5, 23 Aug. 1976	8	5⅜ (5⅛-5⅝)	1.51±0.061 (1.25-1.8)	11.79±0.563 (9.28-14.2)
WA-391 (dead), 14 Mar. 1977	11	5+ (5¼-5½)	1.53±0.043 (1.3-1.7)	12.87±0.297 (11.7-14.7)
WA-391 (live), 14 Mar. 1977	5	5⅜+ (5⅜-5½)	1.55±0.097 (1.2-1.8)	13.00±0.757 (11.1-15.7)
T. weaberana				
Point Springs, 19 June 1966	27	4⅞ (4⅜-5¼)	1.61±0.064 (1.2-2.5)	9.22±0.376 (7.15-15.8)
WA-238, 14 Nov. 1976	18	5¼− (4⅞-5⅜)	1.51±0.052 (1.0-1.85)	10.31±0.405 (8.11-15.8)
WA-239, 14 Nov. 1976	86	5⅜ (4⅞-5⅞)	1.61±0.025 (1.0-2.2)	9.32±0.150 (7.11-14.8)
T. umbonis				
Sta. E5 (1), Aug. 1974	5	5⅝+ (5½-5¾)	1.26±0.075 (1.0-1.4)	16.3±1.01 (14.9-20.2)
W6 (1), Aug. 1974	6	5¾ (5¼-6)	0.99±0.178 (0.6-1.3)	25.4±5.21 (16.0-38.5)

A few live juveniles and one live adult were collected near Mt Hart Station, and a number of dead specimens have been taken near Mac's Jumpup and Kongorow Pool in the Upper Barker drainage. Undoubtedly other colonies exist in the King Leopold Ranges, but most probably in very widely scattered localities. The Napier Range occurrences probably are the result of periodic colonization resulting from the wet season floods down the Barker River, Wombarella Creek, and Lennard Rivers. The scarcity of *T. monticola* in the well collected Napier Range indicates that they are not very successful in surviving there.

There are only minor shape and size differences among the populations studied of *T. monticola* (**Table 7**).

The differences between *T. regula* from the Prince Regent River Reserve and *T. monticola* are less than those found among most other species of *Torresitrachia*. Until populations in intermediate areas can be sampled and dissected, I cannot be positive that they do not intergrade. The difference in entrance of the vas deferens into the epiphallus (**Figs 14b, 17c**) and the rather striking change in length of the terminal genitalia led me to propose specific status for the two taxa.

TORRESITRACHIA REGULA SP. NOV.

(Plate 2c-d, 5d-f; Figs 17a-d, 18b)

Helix (Trachia) bathurstensis Smith, 1894, Proc. malac. Soc. London, **1:** 93–Heywood Island, Camden Sound, Western Australia (part).

Torresitrachia bathurstensis (Smith, 1894), Iredale, 1938, Australian Zool., **9** (2): 110; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 48 (part).

Comparative remarks

Torresitrachia regula is of average size, with a moderately elevated spire and average umbilical opening. The reduction, but not loss, of sculpture on the shell base separates it from *T. bathurstensis* (Smith, 1894), which has no diminution of sculpture on the base, and from *T. amaxensis* which has lost the basal sculpture, and is a much larger species with narrower umbilicus. The sympatric *T. umbonis* has a strong basal lip protrusion, an extremely narrow umbilicus, and is much larger in size. *T. monticola* Iredale, 1939 from the King Leopold and Napier Ranges is very similar in shell features, differing only in having stronger sculpture on the shell base, and in the size of the radial ribbing. Anatomically, *T. regula* shows highly variable length of the terminal genitalia (**Figs 17a, 18b**), but is readily recognizable by its relatively long epiphallic caecum that tapers gradually from a very thick base, and the entrance of the vas deferens through two small U-pilasters (**Fig. 17c**). The conchologically very similar *T. monticola* has a much shorter caecum **(Figs 13c, e)** that is more slender at the base, and entrance of the vas deferens takes place through one large U-pilaster **(Fig. 14b)**.

Holotype

WAM 352.77, Sta. E5 (10), spring feeding into northern tributary of Rufous Creek about 1.5 km north of Enid Falls campsite, Roe River, Prince Regent River Reserve, north-west Kimberley, Western Australia (1:250,000 'Prince Regent' map sheet SD51-16, grid reference 346:089). Collected by B. Wilson and P. Smith, 18 August 1974. Height of shell 8.85 mm, diameter 15.8 mm, H/D ratio 0.560, whorls 5, umbilical width 1.7 mm, D/U ratio 9.29.

Paratopotypes

WAM 195.75, FMNH 200813, 6 dead adults and 5 dead juveniles, from the type locality.

Paratypes

Prince Regent River Reserve, all collected August, 1974: forward fuel dump near junction of Charnley River and Maurice Creek (1:250,000 'Charnley' map sheet SE51-4, grid reference approximately 357:946) (2 dead adults, 1 dead juvenile, WAM 192.75, WAM 186.75); Sta. E4, Wyulda Creek, Upper Roe River (15°26'S, 125°33'E) (1 dead adult, WAM 193.75); Sta. E5 (2), east side of main gorge below Enid Falls (1:250,000 'Prince Regent' map sheet SD51-16, grid reference 348:086) (2 live adults, WAM 484.75); Sta. E5 (3), campsite on top of Enid Falls (Prince Regent SD51-16–347:087) (5 live, 3 dead adults, 6 live, 3 dead juveniles, WAM 188.75, WAM 189.75, WAM 482.75, FMNH 200818); Sta. E5 (6), eastern side of deep gully about 2 km due west of Enid Falls campsite (Prince Regent SD51-16–344:085) (2 dead adults, 1 dead juvenile, WAM 196.75, WAM 197.75); Sta. E5 (7), below opening of deep gully about 3 km west of Enid Falls campsite (Prince Regent SD51-16–343:085) (1 live adult, WAM 483.75); Sta. E5 (9), west slope of valley of northern tributary of Rufous Creek about 1.5 km north of Enid Falls campsite (Prince Regent SD51-16–346:088) (1 dead adult, 3 dead juveniles, WAM 187.75); Sta. E6, Garimbu Creek, Roe River (15°28'S, 125°29'E) (6 dead adults, 6 dead juveniles, WAM 190.75, WAM 191.75); Sta. W6, Youwanjela Creek, Prince Regent River (1 live adult, WAM 485.75); Sta. W6 (1), valley slope on north side of Youwanjela Creek (Prince Regent SD51-16–332:032) (1 broken shell, WAM 353.77); Sta. W6 (3), eastern bank of northern tributary of Youwanjela Creek at junction about 1.5 km west of main campsite (Prince Regent SD51-16–331:034) (1 live adult, WAM 480.75); Sta. W6 (5), valley slopes on south side of Youwanjela Creek near main campsite (Prince Regent SD51-16–332:032) (2 live, 2 dead adults, WAM 194.75, WAM 481.75, WAM 507.75).

Other material

Heywood Island, Camden Sound (1 dead adult, BMNH 90.12.30.158, paratype of *Helix bathurstensis* Smith, 1894); north-west Australia (2 dead adults, AM C.8869, J.J. Walker).

Diagnosis

Shell 12.7-19.1 mm (mean 15.60 mm) in diameter, with 4⅝ to 5½ (mean 5⅛−) whorls. Apex and spire moderately and evenly elevated, height of shell 7.1-11.4 mm (mean 9.08 mm), H/D ratio 0.497-0.622 (mean 0.581). Apex, when unworn, smooth and shining, with at most faint traces of radial riblets. Postapical sculpture of prominent, rounded, crowded, radial ribs, about 6-7 per mm, whose interstices are about equal to their width. Shell sculpture greatly reduced on shell base, but still visible as low swellings, umbilical region with fine pustules. Lip sharply reflexed, wider than in *T. bathurstensis* (Smith, 1894). Umbilicus open, slightly and regularly decoiling, width 1.3-2.8 mm (mean 1.80 mm), D/U ratio 6.50-10.6 (mean 8.78). Shell colour greenish yellow brown. Based on 36 measured adults.

Genitalia **(Figs 17a-d, 18b),** variable in length of terminalia, most examples with very long penis and vagina, (V, **Fig. 17a**), some with intermediate length structures **(Fig. 18b).** Epiphallic caecum (EC) long, fat at the base, tapering gradually to a slender point. Internally **(Fig. 17c)** vas deferens (VD) entering caecum through two small U-pilasters, walls of caecum rather strongly sculptured. Upper part of penis chamber **(Fig. 17b)** with low pustules of average size and prominence. Based on 4 dissected individuals.

Discussion

Only 12 living adults of *Torresitrachia regula* were available and four of these were dissected. Specimens from Stas. E5 (2) and E5 (3) were with shorter penis and vagina from those at Stas. W6 (3) and W6 (5). All specimens agreed in the shape and structure of the epiphallic caeca and thus are considered to be one species.

Specimens of *T. umbonis* were taken sympatrically with *T. regula* at Stas. E4, E5 (2), E5 (6), E5 (7), W6, W6 (1) and W6 (5). Considering the small numbers of individuals obtained, this is a very high degree of coexistence. The two species are easily separable by much larger size, nearly absent radial sculpture, and the presence of a basal lip protrusion in *T. umbonis*.

Relationships with *T. monticola* Iredale, 1939 are more difficult to assess. The latter has more prominent sculpture on the shell base, a noticeably more slender epiphallic caecum, and a quite different entrance of the vas deferens into the caecum **(Fig. 14b).** The length of the terminal genitalia is also distinctly shorter than in *T. regula*. Adult material from near Mt Hart in the King Leopold Ranges was typical of *T. monticola*. It is possible that the two species will be shown to intergrade, but at our present state of knowledge they are best considered to be full species.

The paratype of *Torresitrachia bathurstensis* (Smith, 1894) that I am listing as an example of *T. regula* (BMNH 90.12.30.158) is a very worn shell that falls within the size and shape variation range of *T. regula.* While the shell sculpture is finer and more crowded than that seen on several directly compared paratypes, the differences are minor. Tentative reference of the Heywood Island populations to *T. regula* is proposed, but I am not listing this specimen as a paratype. Two examples from 'Northwest Australia' collected by J.J. Walker (AM C.8869) compare exactly with paratypes of *T. regula,* and probably came from Heywood Island, but again will not be considered as paratypes.

TORRESITRACHIA AMAXENSIS SP. NOV.

(Plate 4e-f, 5g-i; Figs 15a-c, 16a-b)

Comparative remarks

Torresitrachia amaxensis differs conchologically in its large size, higher spire, very narrow umbilicus, and in having the radial sculpture nearly absent from the shell base. The other large Western Australian species, *T. umbonis* and *T. crawfordi,* have a marked protrusion on the basal lip, a strongly deflected body whorl just behind the lip, nearly absent radial sculpture on the spire, and an even smaller umbilical opening. The other Western Australian species are distinctly smaller and retain fairly to very prominent sculpture on the shell base. *T. torresiana* (Hombron & Jacquinot, 1841) from Torres Strait is similar in size and sculpture, but has a lower spire and a wider umbilicus. Anatomically, the shifted position of the epiphallic caecum **(Figs 15a-b),** most peculiar very long single pilaster by the vas deferens entrance (EV, **Fig. 16a**), and the increased size of the penis chamber wall pustules **(Fig. 16b),** immediately separate *T. amaxensis* from the other species. *T. umbonis* has the shifted epiphallic caecum position, but the long pilaster at the vas deferens entrance and the intensification of the penis chamber wall sculpture are not duplicated elsewhere in the Western Australian species.

Holotype

WAM 363.77, Sta. WA-205, weak gully above Camp Creek on track to big liana patch, Mitchell Plateau, North-west Kimberley, Western Australia (1:100,000 'Warrender' map sheet 4068, grid reference 520:039). Collected by Alan Solem, 18 October 1976. Height of shell 12.9 mm, diameter 19.5 mm, H/D ratio 0.662, whorls 5½, umbilical width 1.25 mm. D/U ratio 15.6.

Paratopotypes

WAM 364.77, FMNH 199409, FMNH 200070, FMNH 200715 (seals), FMNH 200811, 4 live adults, 14 dead adults, 1 live and 10 dead juveniles from the type locality.

Paratypes

Mitchell Plateau: Sta. WA-201, 'drop-off' camp area, AMAX-Port Warrender Road (Warrender 4068–813:011) (2 live, one dead adults, FMNH 199376, FMNH 200700, A. Solem, 19 October 1976); Sta. WA-202, 2nd line of boulders east of AMAX-Port Warrender Road, 'drop-off' camp area (Warrender 4068–814:014) (1 live juvenile, FMNH 200032, A. Solem, 17 October 1976); Sta. WA-204, liana patch 1.6 km towards Crystal Creek from AMAX-Port Warrender Road (Warrender 4068–887:005) (1 fragment, FMNH 199394, A. Solem, 22 October 1976); Sta. WA-208, 3.8-5.7 km east of 'drop-off' camp area, AMAX-Port Warrender Road (Warrender 4068–784:013) (3 dead adults, FMNH 199605, WAM 104.79, A. Solem, 21 October 1976); Sta. WA-209, 10.7-13.9 km, east of 'drop-off' camp area, AMAX-Port Warrender Road (Warrender 4068–696:998) (1 dead adult, 1 dead juvenile, FMNH 199983, WAM 101.79, A. Solem, 21 October 1976); Sta. WA-210, 5 km from AMAX Road turnoff to Camp Creek quarry (Warrender 4068–563:049) (9 dead adults, 2 live, 6 dead juveniles, FMNH 199615, FMNH 200066, FMNH 200444, WAM 100.79, A. Solem, 21 October 1976); Sta. WA-211, 1.5 km east of airport road toward AMAX camp (Warrender 4068–612:039, est.) (9 dead adults, 2 fragments, FMNH 199603, WAM 97.79, A. Solem, 21 October 1976); Sta. WA-221, single pile of boulders at base of WA-201 valley, 'drop-off' camp area (Warrender 4068–813:007) (2 dead adults, FMNH 200130, WAM A. Solem, 30 October 1976); Sta. WA-386, banks of WA-213 stream, west of 'drop-off' camp area (Warrender 4068–813:007) (2 dead adults, FMNH 200210, WAM 95.79, L. Price and C. Christensen, 12 March 1977); Sta. WA-391, under boulders, 0.8 km south-east of AMAX camp, main road (Warrender 4068–596:067) (5 live, 11 dead adults, FMNH 199286, FMNH 199803, WAM 94.79, WAM 102.79, L. Price & C. Christensen, 14 March 1977); Sta. WA-392, under boulders along road to Surveyor's Pool, 0.3 km west of AMAX-Port Warrender Road (Warrender 4068–769:007) (3 live adults, FMNH 199814, WAM 93.79); Sta. WA-394, south-east side Crystal Creek, 8.2 km from junction with Walsh Point Road (Warrender 4068–946:001) (1 live, 1 dead adult, FMNH 199354, FMNH 200810); Sta. WA-396, slope 1 km east-south-east of 'Crusher' (Warrender 4068–543:053) (1 live, 1 dead adult, FMNH 199977, WAM 103.79, L. Price and C. Christensen, 16 March 1977); Sta. WA-397, under boulders 10.2 km south-east AMAX Camp, main road (Warrender 4068–542:137) (3 live, 7 dead adults, FMNH 199296, FMNH 200809, WAM 99.79, L. Price & C. Christensen, 17 March 1977); Sta. MP-2, 200 m from track, near Camp Creek (Warrender 4068–535:018) (1 dead adult, WAM 374.77, B. Wilson & S. Slack-Smith, August 1975); Sta. MP-3, 300 m from track, near Camp Creek (Warrender 4068–537:022) (2 dead adults, WAM 368.77, B. Wilson & S. Slack-Smith, August 1975); Sta. MP-5, rim of laterite above rain forest patch (Warrender 4068–537:023) (8 dead adults, 4 fragments, WAM 373.77, WAM 375.77, WAM 377.77, B. Wilson & S. Slack-Smith, August 1975); Sta. MP-7, Mitchell River about 0.24 km east of river near end of road (Warrender 4068–553:046) (4 dead adults, 3 fragments, WAM 369.77, WAM 372.77, B. Wilson & S. Slack-Smith, August 1975); Sta. MP-15, open eucalypt woodland (Warrender 4068–860:010) (1 dead adult, 2 fragments, WAM 371.77, B. Wilson & S. Slack-Smith, August 1975); 8 km north of AMAX camp (1 dead adult, WAM 366.77, R. Johnstone & L. Smith, 5 February 1973); Mitchell Plateau airstrip (1 dead adult, WAM 367.77, L. Smith and Norm McKenzie, 3 September 1971); Crystal Creek (1 dead adult, WAM 365.77, B. Wilson & C. Bryce, 30 October 1976); 2.5 km west of 'The Crusher' (4 dead adults, WAM 370.77, B. Wilson & S. Slack-Smith, 22 August 1975).

Diagnosis

Shell 12.1-24.5 mm (mean 19.35 mm) in diameter, with 4¾ to 6 (mean 5½–) whorls. Apex and spire moderately and evenly elevated, height of shell 7.9-16.75 mm (mean 12.38 mm), H/D ratio 0.570-0.707 (mean 0.632). Apical whorls worn or with at most a trace of weak radial riblets, postapical whorls with prominent, broadly rounded, rather crowded radial ribs, about 4 per mm on the body whorl, whose interstices are equal to or less than their width. Radial ribs stopping abruptly at shell periphery, shell base with low and irregular radial growth striae, umbilical whorls very finely pustulated. Body whorl not or only slightly descending behind lip, which is sharply reflexed and moderately expanded. Umbilicus very narrowly open, barely decoiling, partly covered by lip reflexion, width 0.9-2.0 mm (mean 1.55 mm), D/U ratio 8.61-19.1 (mean 12.7). Shell colour light greenish yellow, occasional individuals with a red peripheral band and dark spire suffusion, fading in storage. Based on 97 measured adults.

Genitalia **(Figs 15a-c, 16a-b)** with long penis (P) and short vagina (V), main chamber of penis greatly expanded into a club-like head. Epiphallic caecum (EC) short, very fat at base, abruptly tapering, shifted significantly from entrance of vas deferens (VD) into epiphallus (E, **Fig. 15b)**. Internally **(Fig. 16a)** the vas deferens (VD) enters alongside a slender, tongue-like free pilaster (EV). Walls of epiphallic chamber and penis chamber thick, barrier ridge between epiphallus and penis high and narrow. Upper portion of penis chamber with numerous high, crowded pustules that in October **(Fig. 16b,** left) are tipped with a chitinized cover and point and in March (**Fig. 16b,** right) are soft and blunt tipped. Lower part of penis with simple longitudinal stress folds. Based on 7 dissected individuals.

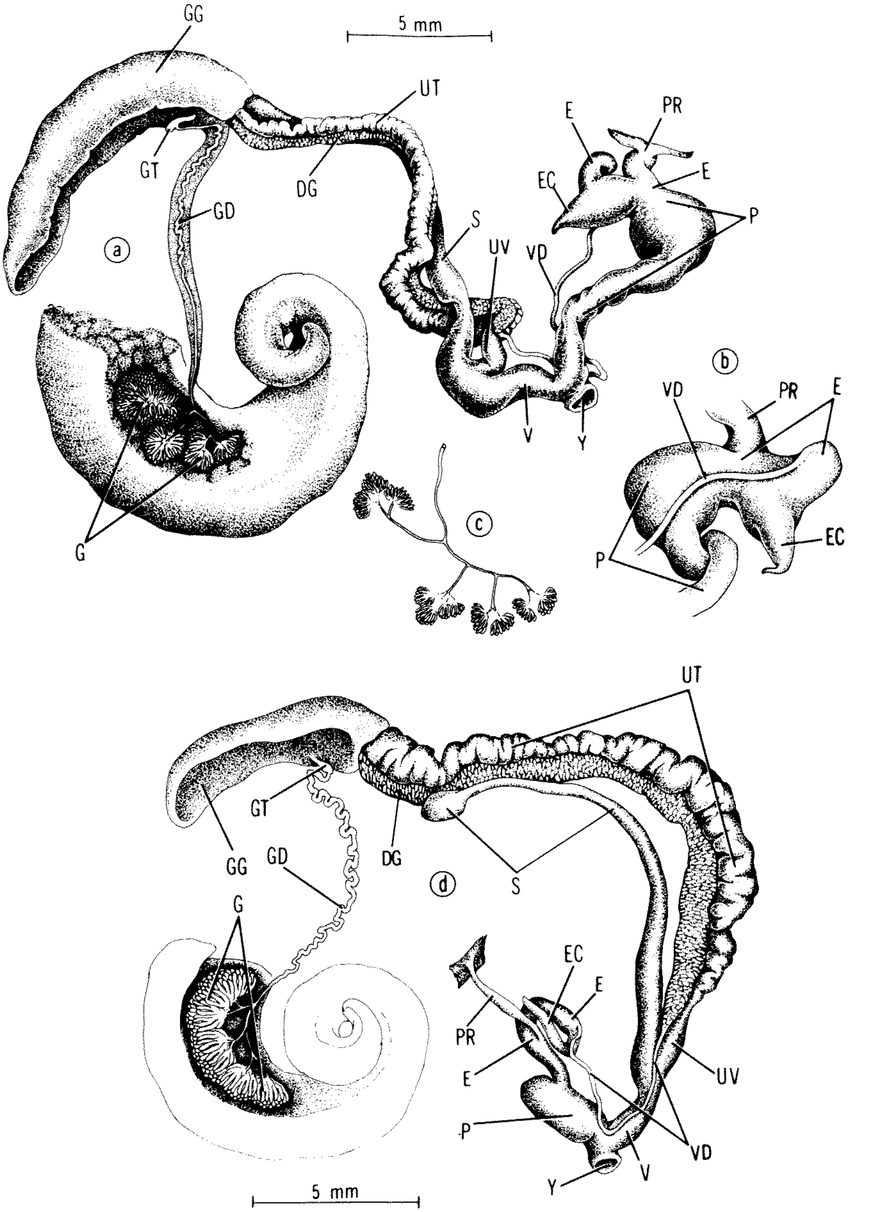

Fig. 15: Genitalia of: (a-b) *Torresitrachia amaxensis*, Sta. WA-205, Mitchell Plateau, 18 October 1976, WAM 363.77, holotype, Dissection A; (a) is genitalia, (b) is detail of epiphallus and penis junction; (c) *Torresitrachia amaxensis*, Sta. WA-394, Crystal Creek, Mitchell Platea, 15 March 1977, FMNH 200810, ovotestis in inactive state; (d) *Torresitrachia weaberana*, Sta. WA-239, east of Point Springs, Weaber Ranges, 14 November 1976, WAM 604.77. Scale lines as marked.

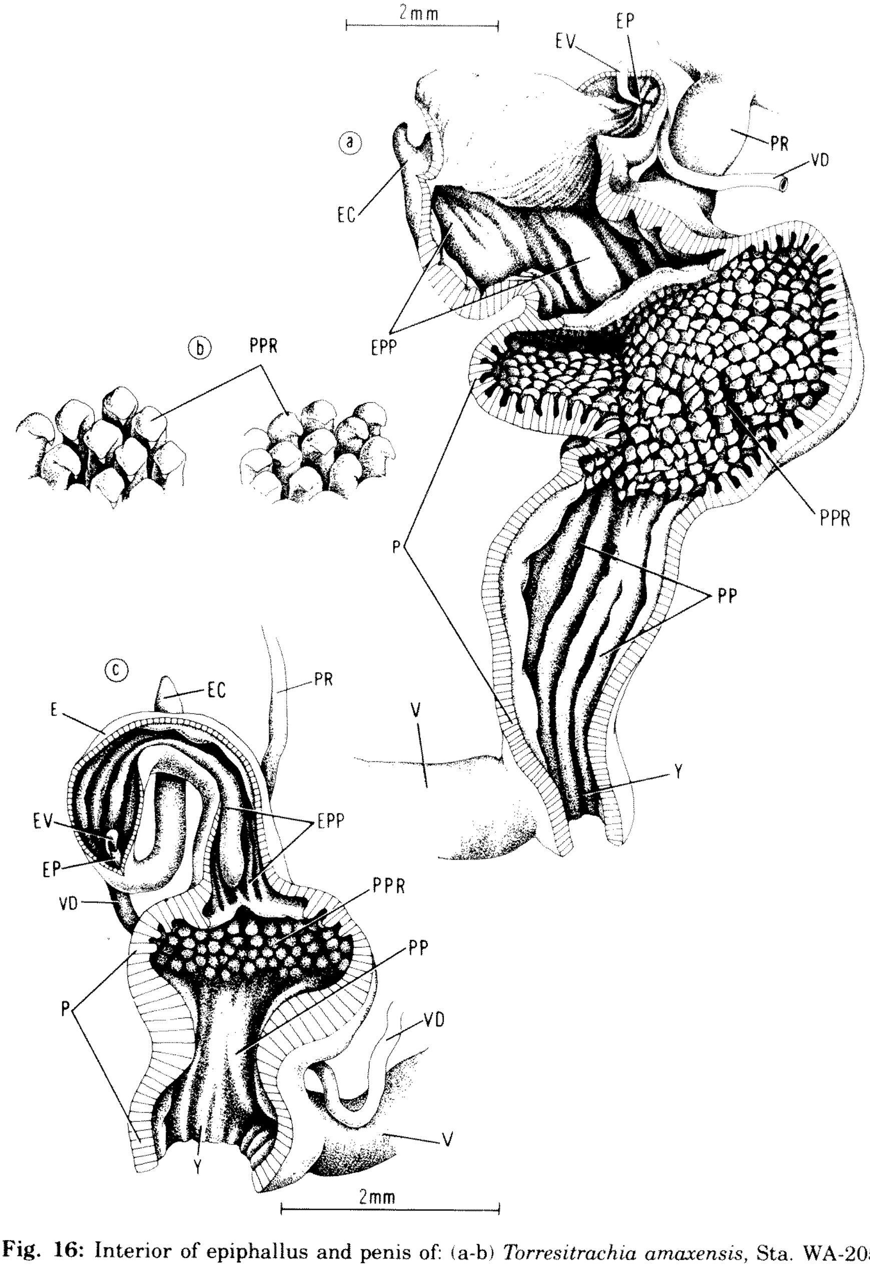

Fig. 16: Interior of epiphallus and penis of: (a-b) *Torresitrachia amaxensis*, Sta. WA-205, Mitchell Plateau, 18 October 1976, WAM 363.77, holotype, Dissection A; (a) is entire interior, (b) is details of penis chamber pustules (PPR) from late dry season (18 October 1976, left, Sta. WA-205, WAM 363.77) and late wet season (15 March 1977, right, Sta. WA-394, FMNH 200810); (c) *Torresitrachia weaberana*, Sta. WA-239, east of Point Springs, Weaber Ranges, 14 November 1976, WAM 604.77. Scale lines as marked.

Discussion

Samples from October and March were available for dissection. The pustules on the penis chamber walls in four October samples all were topped with a clear 'chitin'-like substance and had the anterior edge of this topping prolonged into a sharp point. None of the three March samples, all of which had the large albumen gland indicative of reaching maturity at least one year previously, had this hard covering remaining. This suggests that the points may be a seasonal development related to mating activity. In October **(Fig. 15a)** the ovotestis (G) was fully expanded, while in March **(Fig. 15c)** it was greatly shrivelled. The seasonal differences seen in the prostate-uterus region and hermaphroditic duct are far less dramatic than in either *Xanthomelon* or *Amplirhagada*.

Considerable intra- and interpopulation size variation exists in *Torresitrachia amaxensis* **(Table 7)**, particularly in regard to dead specimens that may well cover several year classes. The examples from the Mitchell River near the meteorological station are far smaller than any other examples seen. A similar dwarfing effect was observed in examples of *Amplirhagada* from near Mitchell Falls. I have no explanation as to why these populations are smaller than usual.

Some specimens from Sta. WA-391 showed a red supraperipheral colour band and darker spire suffusion. Within 24 months of collecting, all had faded dramatically. Nowhere on the Mitchell Plateau is *Torresitrachia amaxensis* locally abundant, but it is widely distributed.

Over the past several years, the administration and staff of AMAX, the Australian subsidiary of Amax, Inc., have provided great co-operation to the staff of the Western Australian Museum in their inventory of the fauna of the Mitchell Plateau. In recognition of their many courtesies extended both in the past and during field work by several staff of Field Museum of Natural History, I am pleased to name this species after AMAX. Their enlightened co-operation in attempting to balance development of resources and preservation of unique features in a natural area is greatly appreciated.

TORRESITRACHIA WEABERANA SP. NOV.

(Plates 3a-g, 6d-f; Figs 15d, 16c)

Comparative remarks

Torresitrachia weaberana is a relatively small, elevated species with higher than average whorl count and a small umbilicus. The moderately expanded lip and pattern of the sculpture continuing onto the shell base about half as prominent as on the spire, and absence of any basal lip protrusion separate it from most other Western Australian species. The other species with prominent basal shell sculpture, *T. bathurstensis* (Smith, 1894) and *T. monticola* Iredale, 1939, differ in several features. The former is much more depressed and openly umbilicated and the sculpture shows no diminution from spire to base, while *T. monticola* is larger, with a smaller average whorl count, and there is a much greater reduction in prominence of the radial sculpture on the shell base. The Northern Territory species *T. stipata* Iredale, 1938 has a larger shell with wider umbilicus (see **Table 6**) and slightly narrower, more widely spaced sculpture, although the available material is so worn that the exact sculptural structure may be altered. Anatomically the shortened penis with its very thick walls and lateral bulge **(Fig. 15d)** combine with the slender, finger-like epiphallic caecum **(Fig. 15d)** to separate *T. weaberana* from other Western Australian species. The entrance of the vas deferens into the epiphallus **(Fig. 16c)** also is unusual in the unequal size of the flanking pilasters.

Holotype

WAM 361.77, Sta. WA-239, gully 0.3 km east of track to Keep River Road, 2.3 km east of Point Springs, Weaber Ranges, north of Kununurra, north Kimberley, Western Australia (1:100,000 'Carlton' map sheet 4667, grid reference 969:898). Collected by Alan Solem and Carl Christensen, 14 November 1976. Height of shell 8.8 mm, diameter 14.65 mm, H/D ratio 0.601, whorls 5½, umbilical width 1.5 mm, D/U ratio 9.77.

Paratopotypes

WAM 360.77, FMNH 199613, FMNH 200064, FMNH 200344, 3 live and 82 dead adults, 14 dead juveniles from the type locality.

Paratypes

North Kimberley: Sta. WA-238, cliff slope just north-west of Point Spring, Weaber Ranges, north of Kununurra (Carlton 4667−877:965) (18 dead adults, 12 dead juveniles, WAM 168.79, FMNH 199540); Point Spring cliff, Weaber Ranges (4 live and 27 dead adults, 3 live and 4 dead juveniles, WAM 138.68, FMNH 200820, WAM 362.77, G.W. Kendrick and A.M. Douglas, 19 June 1966); Northern Territory: Katherine (1 live adult, 1 live juvenile, NMV F23306, AM C.107160, K. Parry, 1962).

Diagnosis

Shell 11.4-16.6 mm (mean 14.75 mm) in diameter, with 4¾ to 5⅞ (mean 5⅜−) whorls. Apex and spire moderately and evenly elevated, height of shell 6.6-10.3 mm (mean 8.53 mm), H/D ratio 0.515-0.652 (mean 0.579). Apical sculpture of scattered fine pustules and a very few weak radial riblets. Postapical sculpture of strong radial ribs, high and clearly defined, about 6 per mm on the body whorl, that continue onto the shell base at about half their spire prominence. Walls of umbilicus with fine pustules. Lip sharply reflexed, moderately expanded. Umbilicus open, only slightly decoiling, partly covered by reflexion of lip, width 1.0-2.5 mm (mean 1.60 mm), D/U ratio 6.16-15.8 (mean 9.41). Shell colour light brownish yellow. Based on 135 measured adults.

Genitalia **(Figs 15d, 16c)** with very short terminalia, the penis with a very prominent lateral bulge. Epiphallic caecum (EC) finger-like, but little wider at the base than the apex. Internally **(Fig. 16c)** vas deferens (VD) entering by one long and one short flanking pilaster, longitudinal ridges on epiphallus prominent as is the ridge separating the epiphallic and penis (P) chambers. Walls of penis very thick and solid, pustulated portion restricted to a short area indicated externally by the very pronounced lateral bulge. Pustules large and prominent. Genitalia in male active phase. Based on 2 dissected adults.

Discussion

Dissection of the live examples from Point Springs collected in June 1966 (WAM 353.74) was not successful as the preservation was very poor. Only part of the terminal genitalia could be extracted. The lateral bulge on the penis is absent, and the prostate-uterus clearly was in an inactive phase. Such a seasonal change in organ size parallels the situation seen in *Xanthomelon* and *Amplirhagada*. The single preserved specimen from Katherine was partly dissected and shows no difference from the Weaber Ranges material. Its date of collection is unknown.

Moderate local variation exists between allochronic and allopatric populations **(Table 7)**. The eastern range of *T. weaberana* is unknown pending extensive collections in the Northern Territory.

TORRESITRACHIA SP.

Comparative remarks

Material from near Kalumburu Mission and Napier-Broome Bay is represented by juveniles and one dead adult that has two very severe repaired breaks. On the basis of the prominent, rather widely spaced radial sculpture that is drastically reduced below the periphery, I suspect that these sets represent an undescribed species, but the material is inadequate for description.

Material studied

Sta. WA-218, boab tree near banana patch, under shaded rocks, Kalumburu Mission (Drysdale 4269–180:457) (1 dead adult, 7 dead and 10 live juveniles, FMNH 200531, FMNH 200540, WAM 620.77, WAM 619.77, A. Solem, 28

October 1976); Napier-Broome Bay (2 dead juveniles, WAM 594.77, G.F. Hill, 29 August 1910); Gibb River-Kalumburu Mission Road, 113.3 km north of Mitchell River turnoff (2 dead juveniles, NMV, A.C. Beauglehole, 3 June 1976).

Remarks

The Kalumburu examples were taken under single rocks scattered in the shade of a large boab tree near the Mission gardens together with such characteristic Kimberley species as *Westracystis lissus* (Smith, 1894), *Stenopylis coarctata* (Möllendorff, 1894), *Eremopeas,* and various pupillids. The rib spacing and character are different from those found in *T. amaxensis* and *T. weaberana,* so that I list this as a possible undescribed species.

The dead shells from south of Kalumburu (NMV) may belong to yet another species.

TORRESITRACHIA UMBONIS SP. NOV.

(Plates 4a-d, 7a-c; Figs 17e-f, 18a)

Comparative remarks

The very large size, nearly closed umbilicus, strongly deflected body whorl, strongly expanded shell lip with its basal protrusion, and angulated periphery readily separate *Torresitrachia umbonis* from all other species except *T. crawfordi.* That species is larger, more elevated, with reduced sculpture, rounded periphery and with a more prominent basal lip protrusion. Only *T. amaxensis* approaches it in size, but that species has a rounded periphery, no basal lip protrusion and a more open umbilicus. Anatomically, the changed position of the epiphallic caecum **(Fig. 17e),** altered pattern of pilasters inside the caecum **(Fig. 18a),** and different type of pustulation on the wall of the penis easily separate *T. umbonis* from the other species. The change from diamond shaped pustules to almost circular ridges in the penis chamber is striking.

Holotype

WAM 347.77, Sta. E5 (1), small gully entering at north-east corner of the main gorge below Enid Falls, Rufous Creek, Roe River, Prince Regent River Reserve, north-west Kimberley, Western Australia (1:250,000 'Prince Regent' map sheet SD51-16, grid reference 348:086). Collected by B. Wilson and P. Smith, 14 August 1974. Height of shell 11.8 mm, diameter 20.15 mm, H/D ratio 0.586, whorls 5⅝+, umbilical width 1.0 mm, D/U ratio 20.2.

Paratopotypes

WAM 503.75, WAM 168.75, 2 live and 5 dead adults, 1 live and 1 dead juvenile from the type locality.

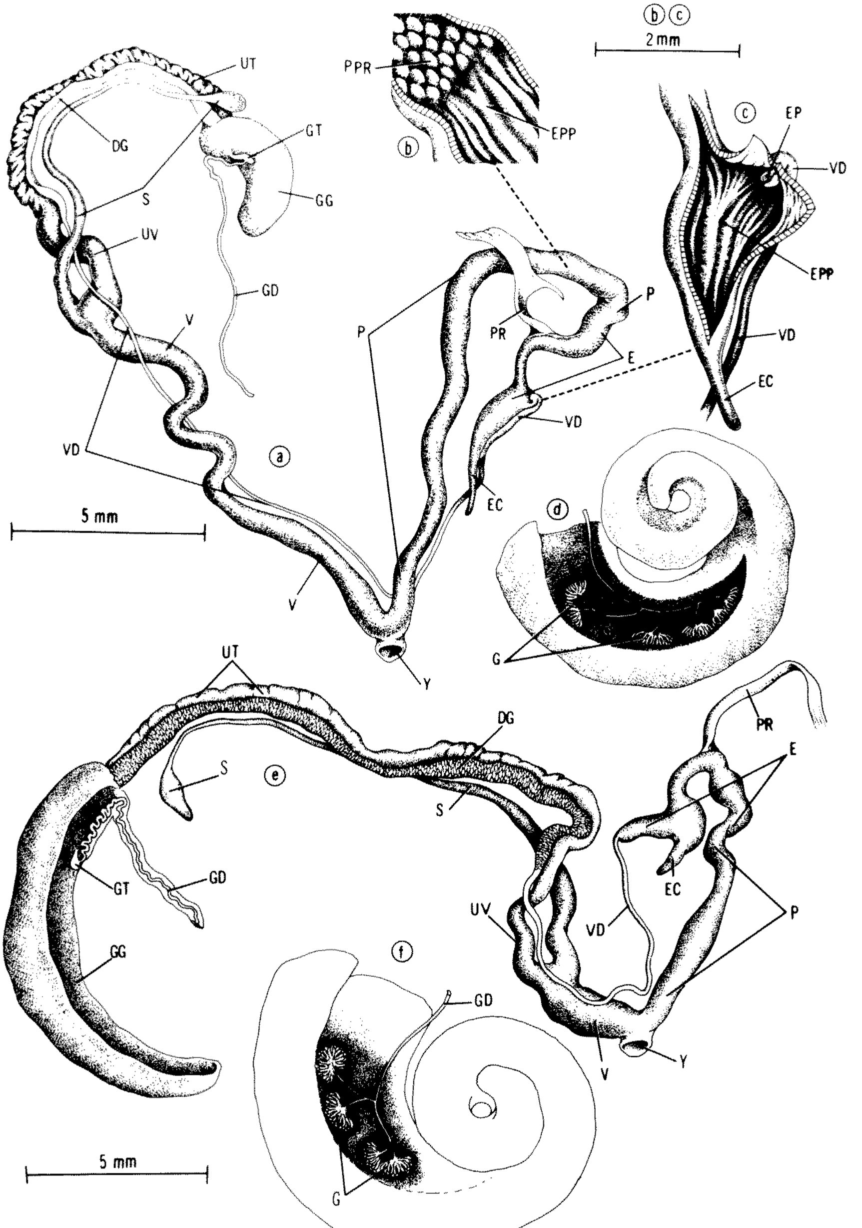

Fig. 17: Genitalia and details of: (a-d) *Torresitrachia regula,* Sta. W6 (5), Prince Regent River Reserve, 23 August 1974, WAM 632.77, Dissection B; (a) is genitalia, (b) is detail of penis interior, (c) is detail of epiphallus interior, (d) is ovotestis in resting state; (e-f) *Torresitrachia umbonis,* Sta. E5 (1), Prince Regent River Reserve, 14-16 August 1974, WAM 633.77, Dissection B; (e) is genitalia, (f) is ovotestis in resting state. Scale lines equal 5 mm.

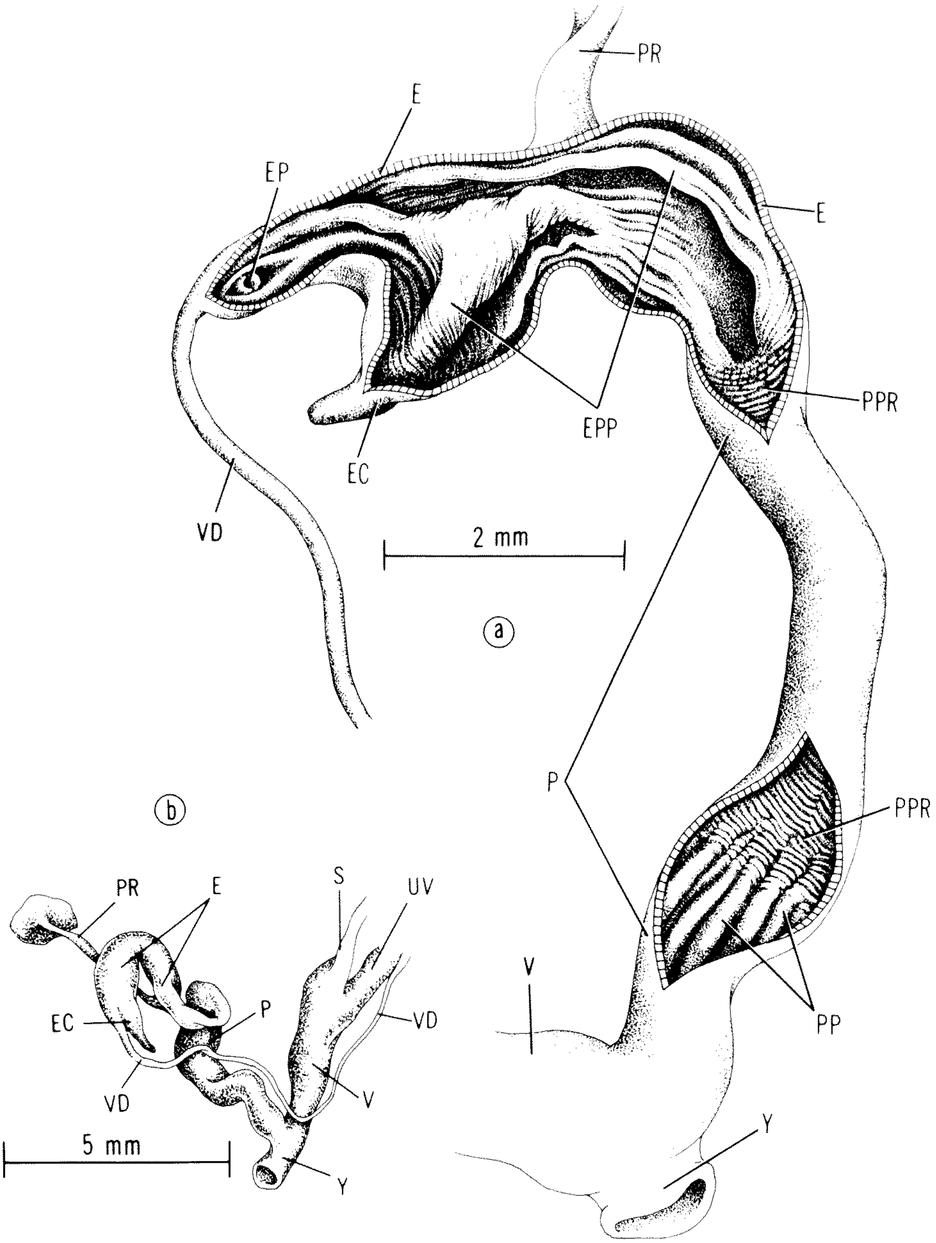

Fig. 18: Genitalia and details of: (a) *Torresitrachia umbonis,* Sta. E5 (1), Prince Regent River Reserve, 14-16 August 1974, WAM 633.77, Dissection B, interior of penis and epiphallus; (b) terminal genitalia of *Torresitrachia regula,* Sta. E5 (2), Prince Regent River Reserve, 14 August 1974, WAM 647.77, form with shortened vagina and penis. Scale lines as marked.

Paratypes

North-west Kimberley, Prince Regent River Reserve, all collected August 1974: Sta. E4, Wyulda Creek, upper Roe River (15°26'S, 125°36'E) (2 dead adults, WAM 166.75); Sta. E5 (8), steep scree below western rampart of deep gully 2-3 km west of Enid Falls campsite (Prince Regent SD51-16–346:088) (2 dead adults, WAM 163.75); Sta. E5 (2), east side of main gorge below Enid Falls (Prince Regent SD51-16–348:086) (2 dead adults, WAM 171.75); Sta. E5 (6), eastern side of deep gully about 2 km due west of Enid Falls campsite (Prince Regent SD51-16–344:085) (1 dead adult, WAM 167.75); Sta. E5 (7), below opening of deep gully about 3 km west of Enid Falls Campsite (Prince Regent SD51-16–343:085) (1 live adult, WAM 506.75); Sta. W5, Python Cliffs, Saint George Basin (15°20'S, 124°56'E) (1 live adult, WAM 505.75); Sta. W6, Youwanjela Creek, Prince Regent River (15°34'S, 125°25'E) (2 dead adults, WAM 169.75); Sta. W6 (1), valley slope on north side of Youwanjela Creek (Prince Regent SD51-16–332:032) (6 dead adults, 1 dead juvenile, WAM 162.75, FMNH 200814); Sta. W6 (5), valley slopes on south side of Youwanjela Creek near main campsite (Prince Regent SD51-16–332:032) (1 dead juvenile, WAM 170.75); Sta. W6 (6), rock outcrops in flat country close to creek bed west of main campsite, Youwanjela Creek (Prince Regent SD51-16–331:033) (1 dead juvenile, WAM 165.75).

Diagnosis

Shell 16.8-23.0 mm (mean 20.41 mm) in diameter, with 5⅛ to 6 (mean 5⅝) whorls. Apex and spire moderately elevated, lower whorls slightly bulging and giving a slightly concave spire outline, height of shell 9.95-13.0 mm (mean 11.50 mm), H/D ratio 0.476-0.633 (mean 0.564). Apical sculpture of fine, rather widely spaced but dense pustules, which are joined by weak radial ridges. Spire with pustules continuing until last half of penultimate whorl in diminishing frequency, radial ribs becoming more prominent on third whorl, by body whorl radial ribs low and rounded, weak, about 7 per mm near aperture, greatly reduced in prominence on shell base. Shell periphery roundly angulated. Lip sharply descending behind aperture, strongly reflexed and broadly expanded, basal lip with a prominent protrusion on lip edge that has a sloping inner edge and a sharply descending outer edge. Umbilicus nearly closed by reflexion of lip, narrowly open, width 0.6-1.7 mm (mean 1.16 mm), D/U ratio 11.3-38.5 (mean 19.1). Shell colour light greenish yellow horn. Based on 27 measured adults.

Genitalia **(Figs 17e-f, 18a)** with long penis and short vagina (V). Epiphallic caecum shifted distinctly anterior of entrance of vas deferens (VD). Internally **(Fig. 18a)** penis chamber with circular sculpture rather than diamond shaped pustules, sculptured area quite long, no main ridge separating the sculptured portion of penis from the epiphallus. Epiphallic caecum (EC, **Fig. 18a**) with a large main pilaster that extends up toward entrance of vas deferens (VD) through a tiny pair of U-pilasters that are flanked by a larger split pilaster. Based on 2 dissected adults.

Discussion

Only five live adults of *Torresitrachia umbonis* were available. All had retracted well within the shell and breaking of the shell was necessary in order to extract the soft parts. Because of the limited material available, only two of the adults were dissected. They showed no differences in structure.

The elongation of the sculptured section of the penis with its different pattern of sculpture, change in the epiphallic caecum position and development of a large pilaster inside the caecum probably relate to the sympatry of *T. regula* and *T. umbonis*. This is the only situation known in which two species of *Torresitrachia* are sympatric. The differences in the genitalia of *T. umbonis* are equivalent to species recognition differences seen in other genera of Western Australian camaenids such as *Amplirhagada* in which sympatry is a more common phenomenon.

TORRESITRACHIA CRAWFORDI SP. NOV.

(Plate 7d-f)

Comparative remarks

Torresitrachia crawfordi is characterized by its large size (diameter 24.6 mm), greatly reduced sculpture, rounded periphery, very prominent basal lip protrusion, sharply descending aperture and slightly open umbilicus. The only other species with a basal lip protrusion, *T. umbonis,* has an angulated periphery, much more prominent radial sculpture, and a narrower umbilicus in addition to being smaller in size. Other Western Australian species of *Torresitrachia* lack the basal protrusion on the lip, have a more open umbilicus, the body whorl does not descend behind the aperture, and lack the fine pustulations on the upper spire. The anatomy of *T. crawfordi* is unknown.

Holotype

WAM 348.77, Doubtful Bay, north of Walcott Inlet, south-west Kimberley, Western Australia (1:250,000 'Charnley' map sheet SE51-4, grid reference *ca.* 963:232). Collected by Ian Crawford, 23 August 1965. Height of shell 15.45 mm, diameter 24.6 mm, H/D ratio 0.628, whorls 6+, umbilical width 2.2 mm, D/U ratio 11.2.

Paratopotype

WAM 349.77, 1 dead juvenile from the type locality.

Diagnosis

Shell 24.6 mm in diameter, with 6+ whorls. Apex and spire strongly elevated, straight sided, height of shell 15.45 mm, H/D ratio 0.628. Apical sculpture worn, but traces of fine crowded pustules and weak radial ridges visible in sutures. Postapical sculpture of scattered pustules and weak radial ridges with the pustules more prominent until the penultimate whorl, pustules then reduced in number and size progressively, all sculpture greatly reduced on shell base. Shell periphery evenly rounded, body whorl descending abruptly behind aperture, lip strongly reflexed and moderately expanded, basal lip with a high protrusion that descends sharply both anteriorly and posteriorly. Umbilicus partly closed by reflexion of lip, width 2.2 mm, D/U ratio 11.2. Shell colour light yellow brown, probably partly faded. Based on adult holotype and juvenile paratopotype.

Discussion

Considerable reluctance is felt in describing a species from a single dead adult, but the conchological differences from *T. umbonis* are of the same order of magnitude as those that separate species of *Torresitrachia* whose anatomies are distinctive.

Over the years, Ian Crawford of the Western Australian Museum has brought back snails from many places during his travels in the Kimberley. These are proving to be a major aid in my studies of the Western Australian Camaenidae, and great pleasure is taken in dedicating this species to Ian Crawford in recognition of his contributions to the mollusc collection of the Western Australian Museum.

GENUS *MELOSTRACHIA*, NEW GENUS

Melostrachia Iredale, 1938, Australian Zool., **9** (2): 111–nude name.

Nomenclature

After describing the species *Torresitrachia glomerans,* Iredale (1938: 111) stated 'The globose form suggests separation, and therefore a new subgeneric name *Melostrachia* is introduced with this species as type.' The name was not listed in the *Zoological Record for 1938,* although validly introduced taxa in that paper were included. I consider this to be a nude name, as was *Torresitrachia* at that time. The description of the species was excellent by Iredalian standards, and I accept *glomerans* as a validly proposed species.

Diagnosis

Shell relatively large, with strongly and evenly elevated spire, body whorl expanding rapidly in cross-sectional area. Apical sculpture **(Plate 10a)** of irregular radial ridgelets, mostly short and wavy or angled, on spire turning into prominent, rounded, radial ribs without trace of microsculpture on most examined specimens. Fresh juveniles with very fine spiral ridgelets in troughs between ribs in area of new growth. Umbilicus narrow, regularly decoiling, about one-third covered by reflected lip, internally with widely scattered pustules. Body whorl globose, rounded, not descending behind lip, which is thin, white, rather narrow, and sharply reflected. Shell light yellow brown, without colour zones or bands. Genitalia **(Figs 21a-b)** with hermaphroditic duct (GD) apparently entering head of talon (GT), spermatheca (S) long with slightly expanded head, free oviduct (UV) very long and multicoiled, vagina (V) extremely long, atrium (Y) short. Vas deferens (VD) entering epiphallus (E) through a pore with high raised pilasters (EP, **Fig. 21b**). Epiphallic caecum (EC) short, internally with longitudinal pilasters. Epiphallus and penis (P) folded within a long penis sheath (PS) that starts distinctly above level of atrium. Internally epiphallus and penis with narrow to wide circular ridges, that break up into pustules lower in penis. In basal area of penis the sculpture changes to simple longitudinal folds. A tubular verge (PV) with wide pore marks the apex of the penis. Penial retractor muscle inserting near top of epiphallus at apex of penial sheath.

Type species: *Torresitrachia glomerans* Iredale, 1938.

Discussion

The presence of the penis sheath is shared with *Damochlora* Iredale, 1938 and *Trachiopsis* Pilsbry, 1893, both of which have a vergic papilla rather than a true verge. *Damochlora* agrees with *Melostrachia* in having pilasters around the epiphallic pore, and in the general nature of the penial sculpture, but differs in the presence of a long epiphallic flagellum (EF), pustulose sculpture inside the epiphallic caecum **(Fig. 22b)**, length of the female organs and many minor details. The apparent absence of any microsculpture on the shell surface reflects worn nature of available material. Very fine spiral ridgelets were found in areas of new growth on the two juveniles (QM MO 6383). *Trachiopsis* has a different insertion of the penial retractor muscle, altered sculpture inside the penis, a simple vergic papilla, and slightly shorter female organs. Its most obvious difference is in the shell sculpture and shape. The very long and folded epiphallus inside the penis sheath is one of the more unusual features of *Melostrachia.*

In general shell appearance, *Melostrachia* shows greatest similarity to *Torresitrachia,* and thus has been placed next to that genus, but anatomically it is part of the chloritid complex.

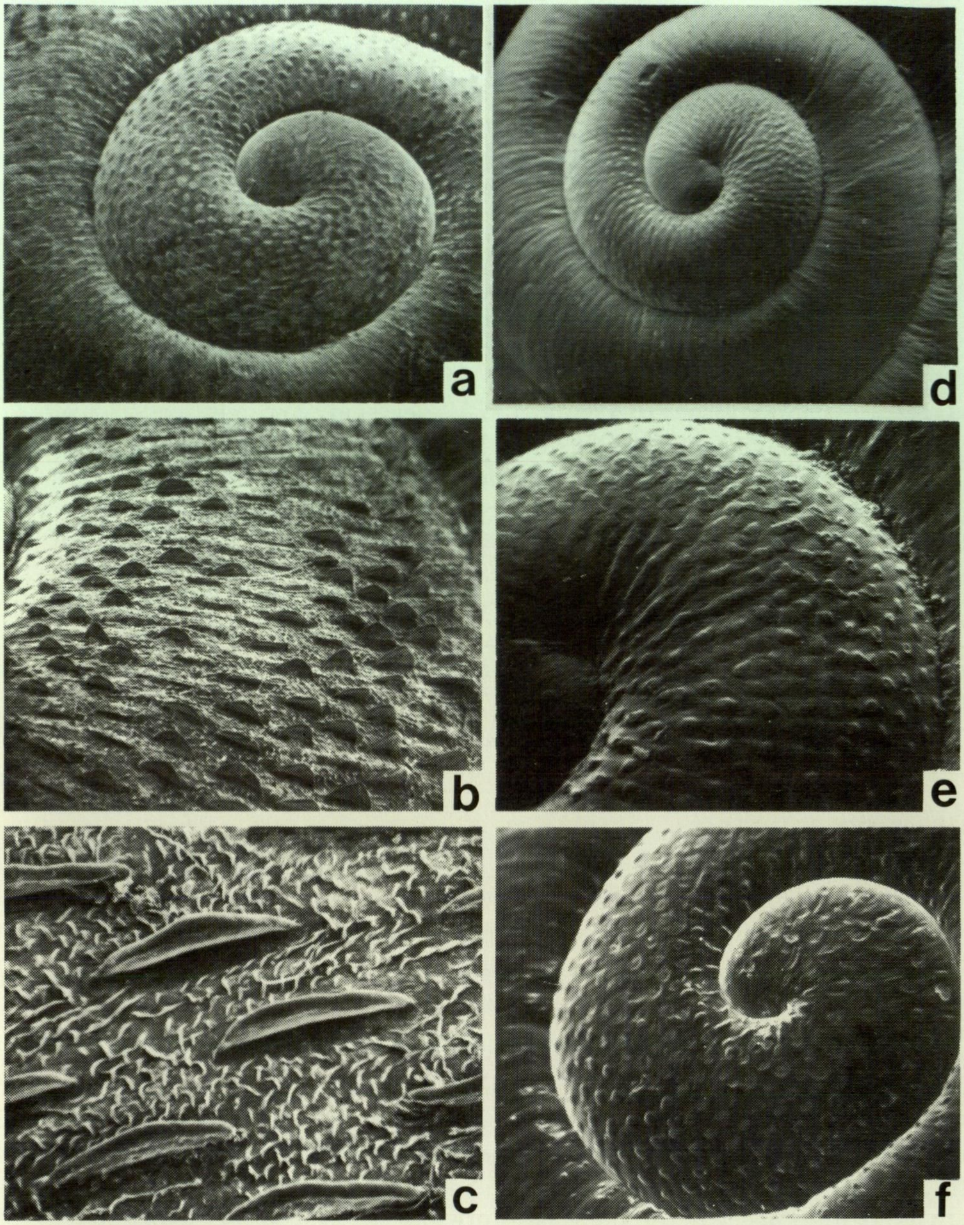

Plate 8: Shell sculpture in *Damochlora:* (a-c) *D. rectilabrum* (Smith, 1894), WAM 621.77, Sta. WA-220, Kalumburu; (a) is apical region at 35X, (b) is penultimate whorl viewed from a low anterior angle at 68X, (c) is detail of radial ridges and microsculpture on penultimate whorl at 135X; (d-e), *D. millepunctata* (Smith, 1894), BMNH 1890.12.30.120, Baudin I., cotype, (d) is apex and early spire at 27X, (e) is detail of apex at 6IX; (f) *D. millepunctata* var. *cassiniensis* (Smith, 1894), BMNH 1891.11.21.127, Cassini I., cotype, detail of apex at 42X.

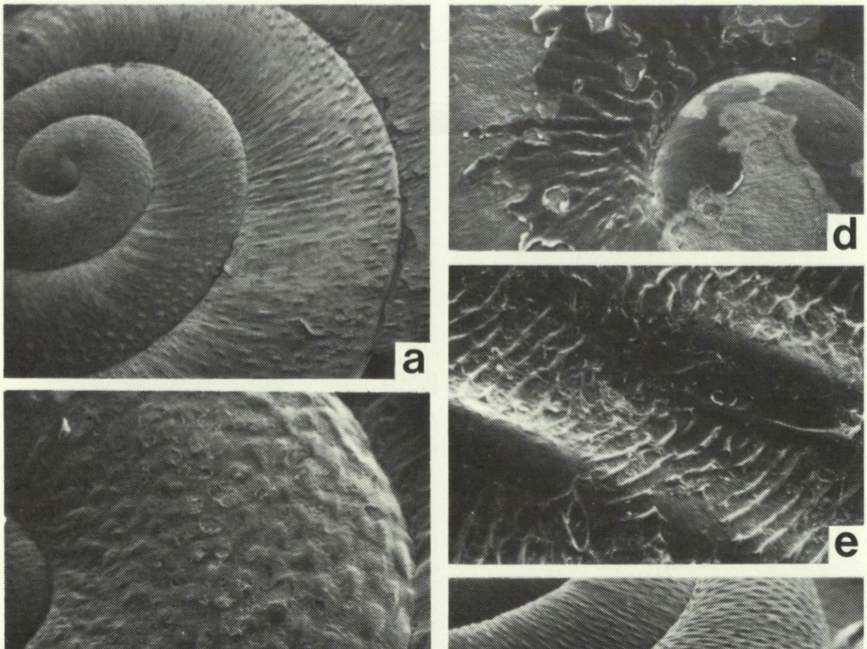

Plate 9: Shell sculpture in *Trozena* and *Trachiopsis:* (a-c) *Trozena morata* Iredale, 1938, AM C.107136, Lappa Junction, Queensland; (a) is apex and early spire at 20X, (b) is detail of apex at 94X, (c) is detail of radial and microsculpture on 4th whorl at 141X; (d-h) *Trachiopsis strangulata* (Hombron & Jacquinot, 1841), AM C.107135, Prince of Wales I., Torres Strait, Queensland; (d) is apex showing remnant of sculpture at 137X, (e) is microsculpture between radial projections on 3rd whorl at 355X, (f) shows the pattern of lip deflection and narrowing at 14X, (g) is sculpture on 3rd whorl at 73X, (h) is sculpture just behind lip on body whorl at 148X.

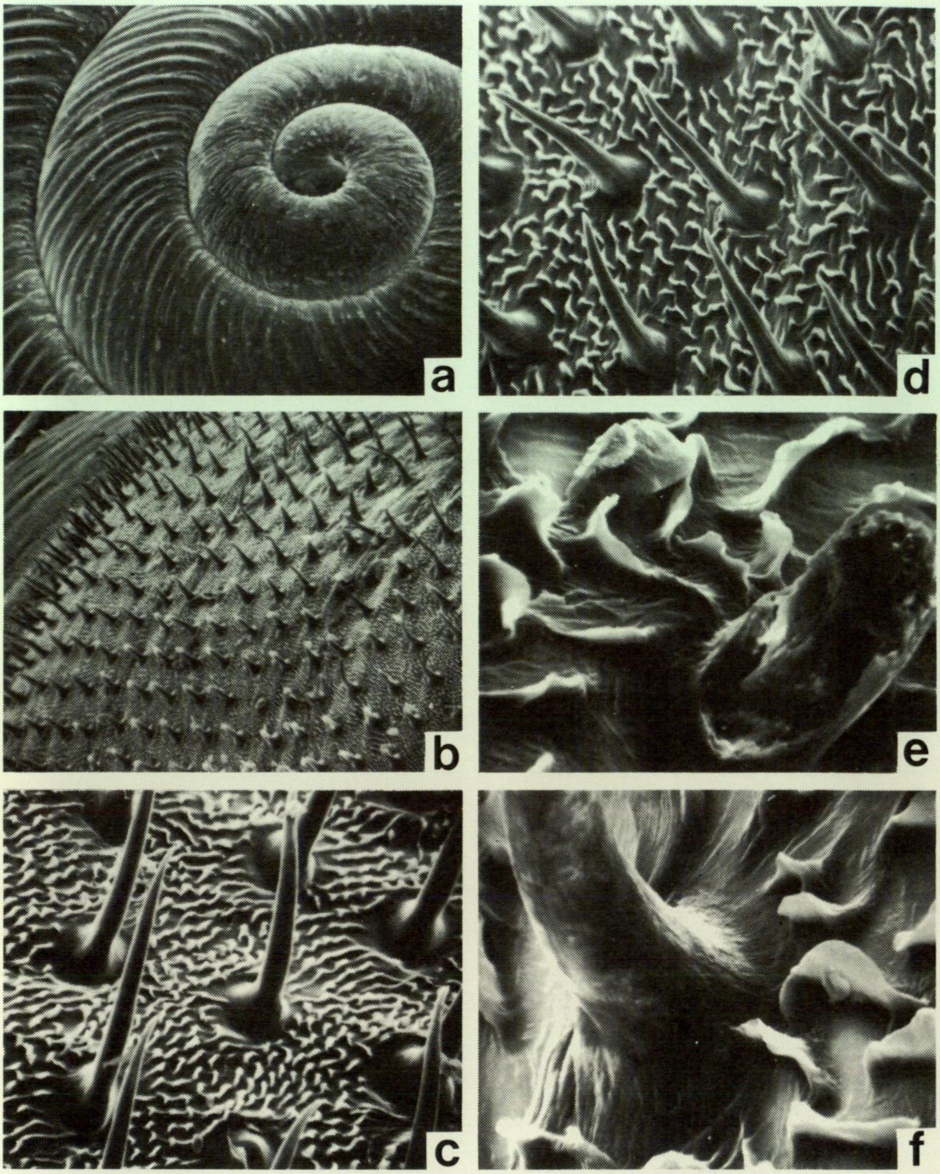

Plate 10: Shell sculpture of *Melostrachia* and *Austrochloritis:* (a) *Melostrachia glomerans* (Iredale, 1938), QM, Chillagoe Caves, Queensland, apex and early spire at 15X; (b-c) *Austrochloritis disjuncta* (Gude, 1906), FMNH 160061, Barrington Tops, Williams River, north-west of Sydney, N.S.W.; (b) is sculpture on body whorl near lip at 36X, (c) is detail of setae from near lip at 168X; (d-f) *Austrochloritis victoriae* (Cox, 1868), NMV F6706, Sealers Cove, Fern Gully, Wilson's Promontory, Victoria; (d) is detail of setae on body whorl at 150X, (e) shows a single broken seta and microridges at 775X, (f) is a detail of a setal base and microridges at 720X.

MELOSTRACHIA GLOMERANS (IREDALE, 1938)

(Plate 10a; Figs 20d-f, 21a-b)

Torresitrachia glomerans Iredale, 1938, Australian Zool., **9** (2): 111, pl. 13, fig. 12–Chillagoe, North Queensland.

Comparative remarks

Melostrachia glomerans (Iredale, 1938) differs conchologically from described *Torresitrachia* primarily in its larger size, more elevated spire, and lack of microsculpture. Anatomically, the verge, penis sheath, very different sculpture inside the penis, and elongated female organs are major differences from *Torresitrachia*. The prominent radial ribs easily separate it from the chloritid genera that follow, although *Trachiopsis* Pilsbry, 1893, in particular, has many anatomical similarities.

Holotype

AM C.100670, Chillagoe, North Queensland (17°7′S, 144°30′E). Collected by W.D. Campbell. Height of shell 19.8 mm, diameter 26.2 mm, H/D ratio 0.756, whorls 5⅛, umbilical width 3.5 mm, D/U ratio 7.49.

Paratypes

AM C.54097, 25 dead adults from the type locality.

Other material studied

Chillagoe Caves, Queensland (1 live adult, QM, M. Bishop, August 1977; 11 dead adults, AM; 17 dead adults, AM C.54101); limestone ridge adjacent to tower, Chillagoe Caves (8 dead adults, AM C.54096); 1 km north of Almaden, North Queensland (17°21′S, 144°41′E) (1 dead adult, 3 dead juveniles, QM MO 6383, 11 June 1977).

Diagnosis

Shell large, 14.7-26.5 mm (mean 20.77 mm) in diameter, with 4⅜ to 5½ (mean 5–) whorls that increase rapidly in cross-sectional area. Apex and spire strongly and evenly elevated, body whorl not descending behind lip, shell height 10.9-21.15 mm (mean 15.75 mm), H/D ratio 0.681-0.866 (mean 0.756). Apex **(Plate 10a)** with shorter, irregular, radial ribs, postapical sculpture of high, prominent radial ribs that are rounded in contour microsculpture of very fine spiral ridgelets eroded in nearly all examples. Lip thin, white, sharply but narrowly deflected, partly covering umbilicus, which is 1.6-3.9 mm (mean 2.69 mm) wide, D/U ratio 6.61-11.3 (mean 8.32). Shell colour light yellow brown, without any colour bands or zones. Based on 64 measured adults.

Genitalia **(Figs 21a-b)** as outlined in generic diagnosis. Based on dissection of 1 adult.

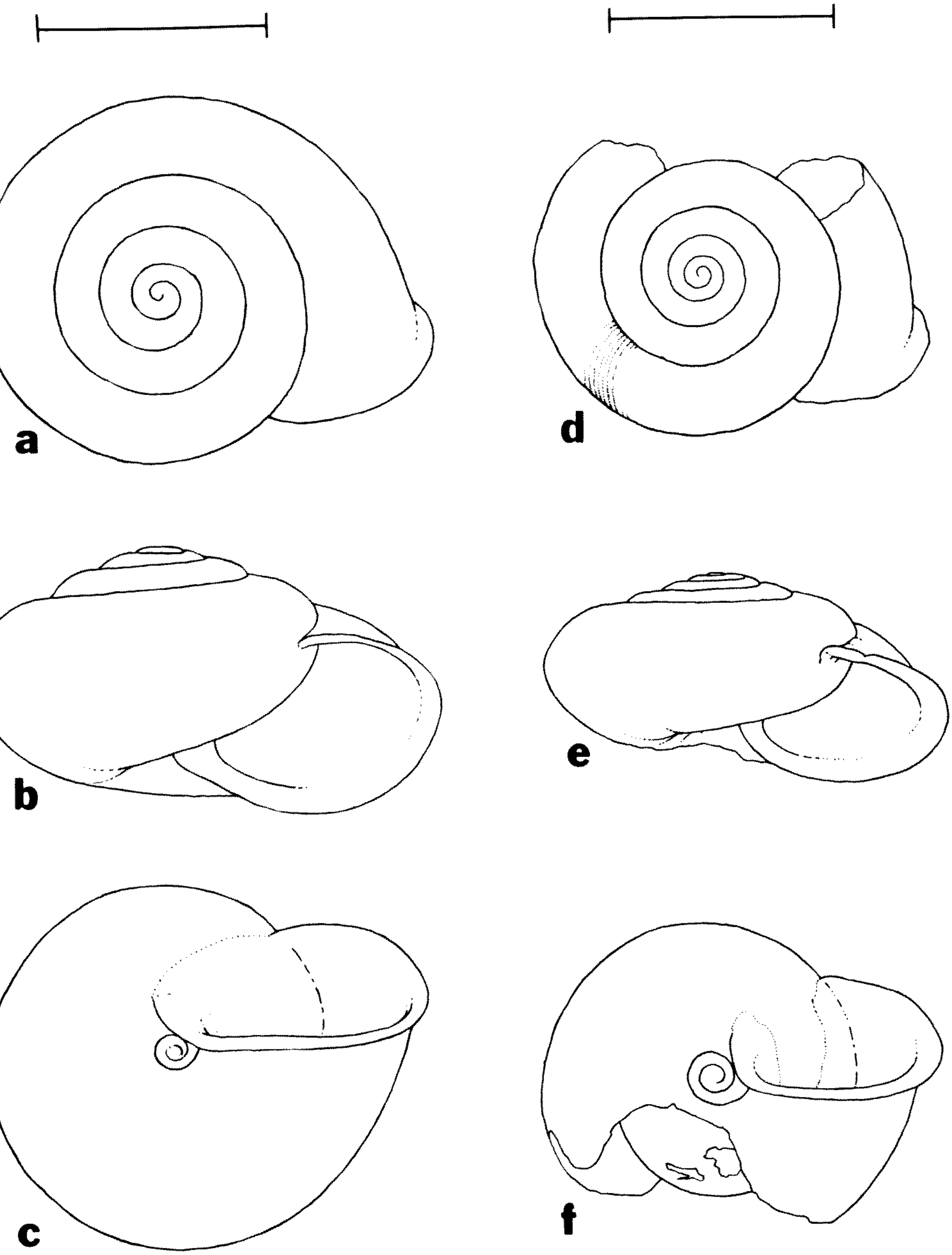

Fig. 19: Shells of extralimital *Torresitrachia:* (a-c) *Torresitrachia torresiana* (Hombron & Jacquinot, 1841), Prince of Wales I., Torres Strait, Queensland, AM C.107129; (d-f) *Torresitrachia stipata* Iredale, 1938, Observation I., Sir Edward Pellew Group, Gulf of Carpentaria, Northern Territory, AM C.101149, holotype. Scale lines equal 10 mm.

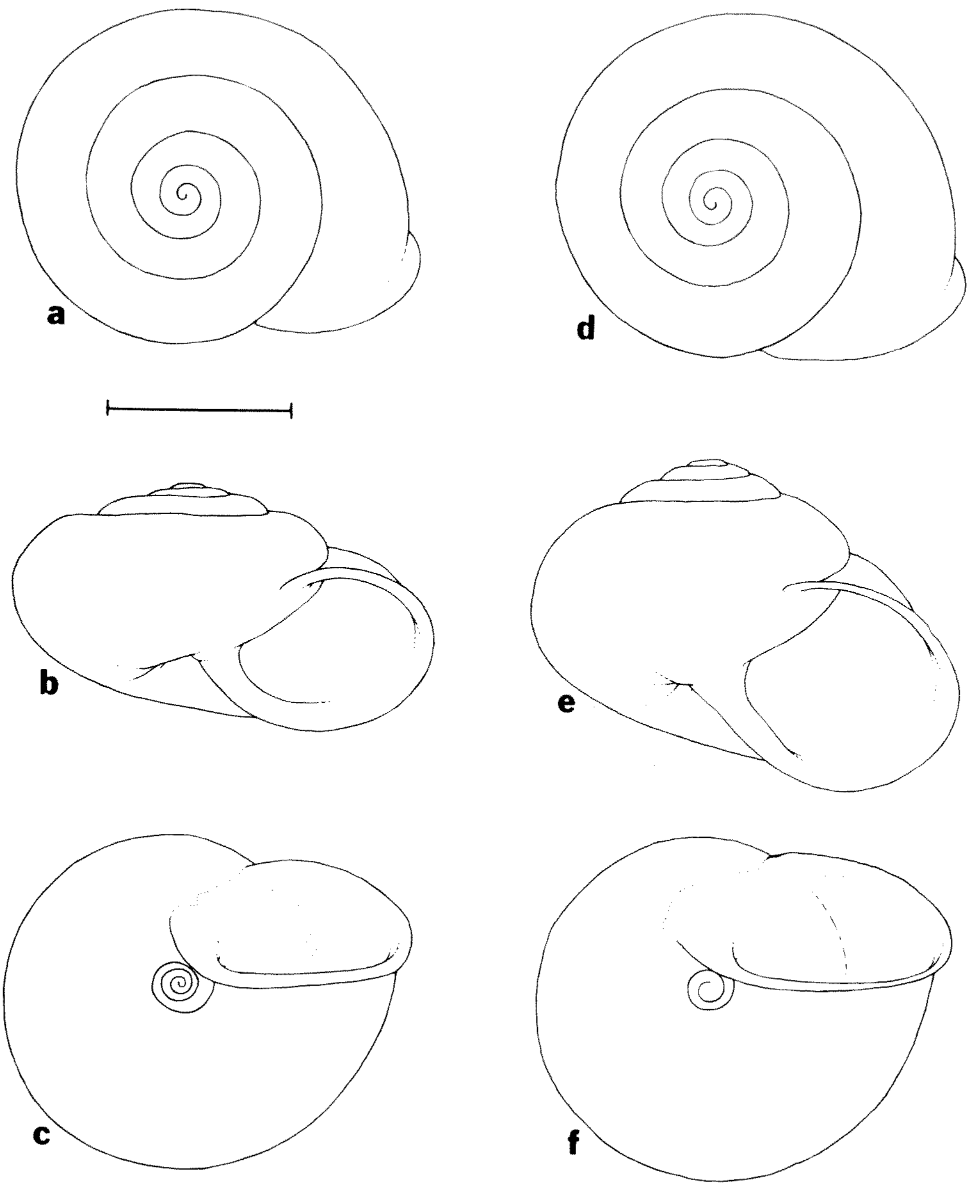

Fig. 20: Shells of extralimital *Torresitrachia* and *Melostrachia:* (a-c) *Torresitrachia blackiana* (Preston, 1905), Port Moresby Disctrict, New Guinea, FMNH 41271; (d-f) *Melostrachia glomerans* (Iredale, 1938), Chillagoe Caves, Northern Queensland, QM MO 6383. Scale line equals 10 mm.

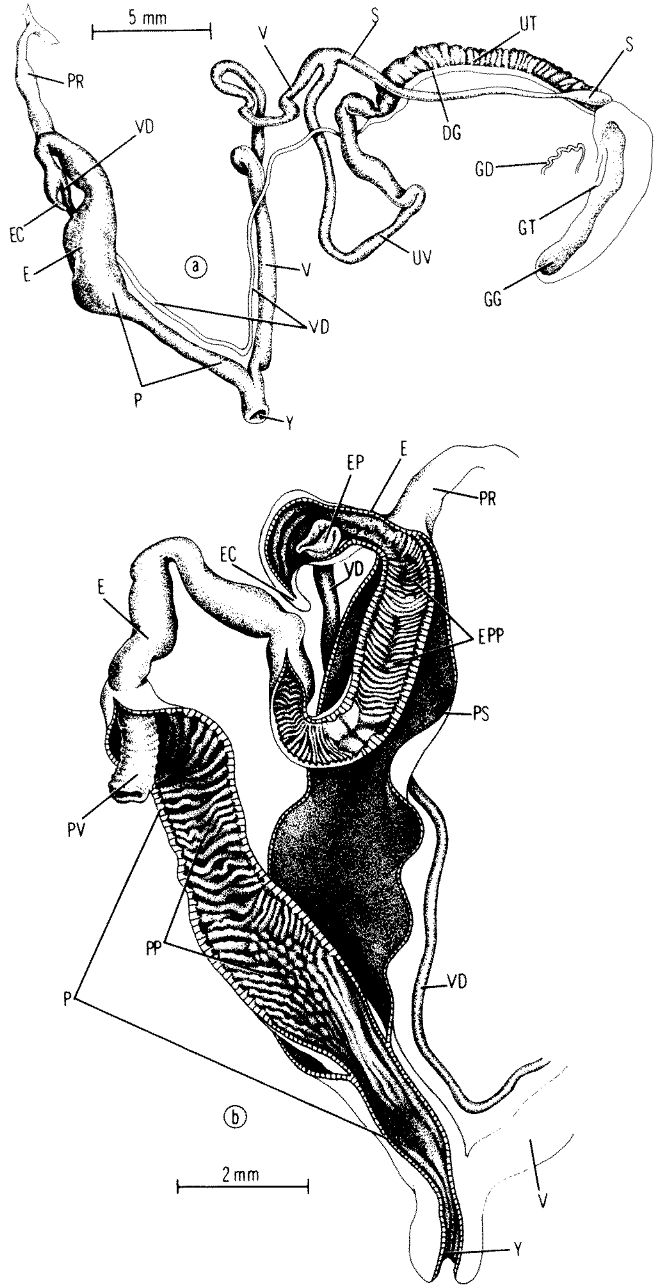

Fig. 21: Genitalia of *Melostrachia glomerans* (Iredale, 1938), Chillagoe Caves, Queensland, August 1977, QM MO: (a) genitalia; (b) interior of penis and epiphallus. Scale lines as marked.

Discussion

Variation among the several samples from near Chillagoe is extensive **(Table 8),** about equivalent to that seen in *Torresitrachia amaxensis*. No information is available concerning the ecological conditions from which the samples were taken. In view of this large variation, I am uncertain as to whether *Planispira (Trachiopsis) acuticostata* Fulton, 1907, which Iredale (1938: 111) referred to *Torresitrachia,* should be included in *Melostrachia,* or even synonymized with this species. Only three specimens were seen of this taxon, and it was not possible to study the shell surface with the SEM (see **Table 6** for size variation).

Table 8: Size and shape variation in *Melostrachia glomerans*

Set	Number of Adults Measured	Mean, Range and SEM of: Shell Height	Shell Diameter	H/D Ratio
AM C.100670, AM C.54097, types	26	19.20±0.188 (18.2-21.15)	24.64±0.186 (22.9-26.5)	0.779±0.007 (0.718-0.866)
AM C.54096	8	14.24±0.261 (12.9-15.2)	19.01±0.387 (16.8-20.35)	0.749±0.005 (0.725-0.771)
AM C.	11	13.98±0.206 (12.5-15.2)	19.22±0.299 (17.3-20.95)	0.728±0.008 (0.687-0.777)
AM C.54101	17	12.20±0.219 (10.9-13.6)	16.46±0.303 (14.7-19.0)	0.741±0.006 (0.681-0.775)

Set	Number of Adults Measured	Mean, Range and SEM of: Whorls	Umbilical Width	D/U Ratio
AM C.100670, AM C.54097, types	26	5⅛+ (4⅞-5½)	2.99±0.081 (2.05-3.9)	8.36±0.212 (6.61-11.3)
AM C.54096	8	4⅞− (4⅝-5)	2.39±0.091 (2.1-2.75)	8.00±0.237 (7.11-9.07)
AM C.	11	4⅞+ (4¾-5)	2.33±0.068 (2.0-2.8)	8.32±0.179 (7.14-9.45)
AM C.54101	17	4¾− (4⅜-4⅞)	2.03±0.062 (1.6-2.55)	8.22±0.247 (7.11-10.8)

GENUS *DAMOCHLORA* IREDALE, 1938

?Offachloritis Iredale,1933, Rec. Australian Mus., **19:** 50–type species *Helix dryanderensis* Cox, 1872 by original designation.

Damochlora Iredale, 1938, Australian Zool., **9** (2): 97–type species *Helix (Chloritis) millepunctata* Smith, 1894 by original designation.

Perochlora Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 46–nude name proposed for *Damochlora rectilabrum* (Smith, 1894).

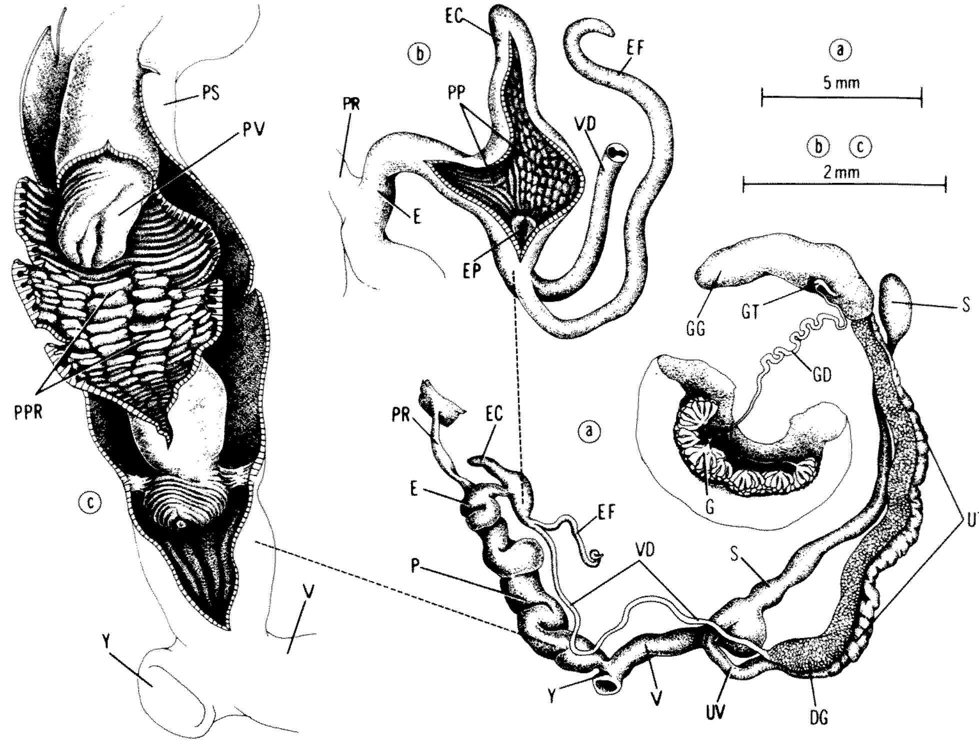

Fig. 22: Genitalia of *Damochlora rectilabrum* (Smith, 1894), Sta. WA-220, 6.5 km south of Kalumburu Mission, 28 October 1976, WAM 621.77: (a) genitalia; (b) interior of epiphallic caecum; (c) interior of lower penial tract and penis sheath. Scale lines as marked.

Diagnosis

Shell relatively small in size with moderately and evenly elevated spire, body whorl moderately expanding in cross-section. Apical sculpture **(Plate 8a, d-f)** of crowded, prominent pustules. Postapical whorls in fresh specimens with short blade-like to conical ridges **(Plate 8b-c)** oriented radially, plus a secondary sculpture of extremely fine and short irregular wavy ridges **(Plate 8c),** both replaced in umbilicus by short, crowded setae. Umbilicus open, decoiling regularly, D/U ratio 5-10. Body whorl without descension behind lip, which is slightly reflected, white in colour, but little thickened, and only partly covering umbilical opening. Shell colour light brown, without bands or colour zones. Genitalia **(Figs 22a-c)** with large and oddly shaped ovotestis lobes **(Fig. 22a),** hermaphroditic duct (GD) entering head of talon (GT), spermatheca (S) long, free oviduct (UV) and vagina (V) rather short. Vas deferens (VD) entering epiphallus (E) through a pair of low pilasters (EP, **Fig. 22b**). Epiphallus with both a long flagellum (EF) and a fat caecum (EC), penis with a long sheath (PS), internally with a vergic papilla (PV, **Fig. 22c**) and prominent radial pustulations. Epiphallic caecum (EC, **Fig. 22b**) sculptured internally with pustules. Penial retractor muscle (PR) inserting near top of epiphallus.

Type species: *Helix (Chloritis) millepunctata* Smith, 1894 by original designation.

Previous work and nomenclature

Except for the initial descriptions of the included species (Cox, 1872; Smith, 1894) and the proposal of generic units by Iredale (1933, 1938, 1939), no information has been recorded in the literature concerning these species. Only the types are known for *Damochlora millepunctata* (Smith, 1894), *D. m.* variety *cassiniensis* (Smith, 1894), and *Offachloritis dryanderensis* (Cox, 1872). New collections of *Damochlora rectilabrum* (Smith, 1894) permitted dissection and a better understanding of variation.

There is at present insufficient information to formally propose the union of *Offachloritis* Iredale, 1933 and *Damochlora* Iredale, 1938. Both genera were validly, although poorly, described. The previously unfigured type of *Offachloritis dryanderensis* (Cox, 1872) **(Figs 26d-f)** has a strongly deflected body whorl, more depressed shape, reduced whorl count, much wider umbilicus, and is smaller in size **(Table 9).** Under optical examination, the holotype and only known specimen (AM C.101194) appears to have the same apical pustules seen in *Damochlora rectilabrum* (direct comparison of specimens). Over much of the shell, the periostracal extensions are worn off, probably as the result of a note in Cox's handwriting stating 'I gave it a wash to take the mud off.' A series of low curved ridges that are fewer in number and much more widely spaced than those found in *Damochlora,* show the same shape and spacing pattern as in *Damochlora*. Just behind the lip, where the surface is not abraded, the ridges have extensions that appear to rise from the top of each ridge, ending in a fairly sharp point, which frequently is broken off. So far as I could tell from optical study, these ridges appear identical in form and origin to the more crowded ones found in *Damochlora,* except for the top extensions seen near the lip. Without SEM study of the ridges and collection of live material from Mt Dryander, west of Port Denison, Queensland (20°15′S, 148°33′E, type locality of *Offachloritis dryanderensis*), the degree of affinity between *Damochlora* and *Offachloritis* cannot be determined. I consider it possible that they will prove to be closely related, if not actually congeneric.

The differences in shell shape and body whorl deflection may be sufficient to keep *Offachloritis* and *Damochlora* as separate genera, even if they prove to be close in anatomical structure. Thus, I prefer, at this time, to use *Damochlora* for the Western Australian taxa.

The name *Perochlora* was invalidly proposed and was ignored by the *Zoological Record.*

Table 9: Size and shape variation in Chloritid-like Taxa

Taxon	Number of Adults Measured	Mean, Range and SEM of: Shell Height	Shell Diameter	H/D Ratio
Trozena morata	6	5.44±0.112 (5.1-5.85)	10.88±0.328 (10.2-12.25)	0.501±0.009 (0.478-0.533)
Trachiopsis strangulata	40	3.74±0.046 (3.0-4.45)	7.40±0.087 (5.8-8.55)	0.506±0.006 (0.421-0.618)
Offachloritis dryanderensis	1	4.7	9.6	0.490
Damochlora millepunctata	4	8.91±0.059 (8.75-9.0)	15.64±0.177 (15.15-15.9)	0.570±0.004 (0.560-0.578)
D. m. cassiniensis	3	7.55±0.125 (7.4-7.8)	12.52±0.188 (12.2-12.85)	0.603±0.004 (0.596-0.607)
D. rectilabrum				
types	3	6.27±0.233 (5.8-6.5)	11.93±0.561 (11.1-13.0)	0.529±0.019 (0.500-0.564)
WA-220	22	6.44±0.628 (5.05-7.6)	12.30±0.995 (9.7-14.2)	0.523±0.024 (0.476-0.563)
Austrochloritis disjuncta	5	9.69±0.780 (6.95-11.8)	14.23±0.820 (11.35-16.3)	0.677±0.019 (0.612-0.724)
Parglogenia pelodes	48	18.71 (15.8-21.6)	23.50 (20.6-26.8)	0.797 (0.735-0.868)
Chloritis argilacea	4	17.17±0.798 (15.3-19.2)	22.90±0.991 (20.2-24.7)	0.750±0.012 (0.717-0.757)

Taxon	Number of Adults Measured	Mean, Range and SEM of: Whorls	Umbilical Width	D/U Ratio
Trozena morata	6	4⅞+ (4¾-5⅛)	3.01±0.055 (2.8-3.15)	3.63±0.133 (3.24-4.09)
Trachiopsis strangulata	40	4½ (4⅛-4⅞)	1.46±0.026 (1.1-1.8)	5.20±0.139 (4.07-6.05)
Offachloritis dryanderensis	1	3⅞	2.22	4.32
Damochlora millepunctata	4	5⅛+ (5-5¼)	2.11±0.078 (2.0-2.3)	7.43±0.262 (6.91-7.95)
D. m. cassiniensis	3	4⅞ (4¾-4⅞)	1.40±0.058 (1.3-1.5)	8.97±0.466 (8.33-9.88)
D. rectilabrum				
types	3	4¾+ (4¾-4⅞)	1.97±0.174 (1.65-2.25)	6.21±0.841 (5.20-7.88)
WA-220	22	4⅞− (4½-5)	1.80±0.238 (1.35-2.2)	6.92±0.643 (5.59-8.07)
Austrochloritis disjuncta	5	4⅝+ (4¼-4⅞)	0.72±0.046 (0.6-0.85)	20.3±2.04 (13.4-25.1)
Parglogenia pelodes	48	5¼ (5-5½)	1.73 (1.2-3.0)	13.9 (8.88-19.2)
Chloritis argilacea	4	4⅞ (4¾-5⅛)	–	–

Distribution

Damochlora is known only from the coastal areas and offshore islands of Western Australia between Baudin Island (14°8′S, 125°36′E) and Kalumburu Mission (14°18′S, 126°38′E). No specimens have been taken in the Ningbing

Range, Mitchell Plateau, Drysdale River or Prince Regent River areas, suggesting that it is indeed limited in distribution. *D. rectilabrum* is known from Kalumburu Mission and Parry Harbour, while *D. millepunctata* has been found only on Baudin and Cassini Islands near the Admiralty Gulf. Possible eastern relatives have been found near Port Denison, Queensland *(Offachloritis)* and from Torres Strait to northern New South Wales *(Trachiopsis* Pilsbry, 1893).

Species of Western Australia

Two species are known at present. *Damochlora rectilabrum* (Smith, 1894) is distinctly more depressed (mean H/D ratio 0.523) with an angulated body whorl **(Fig. 24b),** while *D. millepunctata* (Smith, 1894) is more elevated (mean H/D ratio 0.586) with a rounded body whorl **(Figs 23b, e).** The latter species has a dwarfed population on Cassini Island that has been named var. *cassiniensis* Smith, 1894.

Ecology

Living specimens of *Damochlora rectilabrum* were taken on top of soil under scattered small boulders in the shade of a boab tree near Kalumburu Mission, and then in a talus of .3 to .6 m boulders in a vine thicket up a shaded ravine south of Kalumburu Mission. These specimens were lying loose in the accumulated dry litter in deeper crevices. A number of dead examples were taken in similar pockets, but buried by washed-in soil during a previous wet season.

Discussion

For nearly a century and a half, globose, brownish shells, many of which have a surface covering of minute periostracal hairs, have been grouped in various subdivisions of the genus *Chloritis* Beck, 1837. Gude (1906) provided a comprehensive list of taxa, illustrated and described a number of new species and provided good illustrations of the microsculpture. A number of section (=subgeneric) names were used, expanding on the treatment given by Pilsbry (1894: 117-124). Subsequently Iredale (1933, 1938, 1939) proposed a number of new genera for Australian taxa, splitting them among several of his fragmented families.

Pilsbry (1894: 117-122) reviewed previous literature on the anatomy and provided new data on a species he called *Austrochloritis porteri* (Cox, 1866). Unfortunately, the locality of the dissected material was not indicated and the specimens used could not be located in the ANSP collection. Earlier, Hedley (1890: 249-250, pl. 15, figs) had figured the jaw, radula and genitalia of an *Austrochloritis* from Upper Nerang Creek near Brisbane, Queensland (28°12′S, 153°14′E), again as *A. porteri*. The type locality of the latter is Upper Clarence River, New South Wales, so that the identity of the dissected

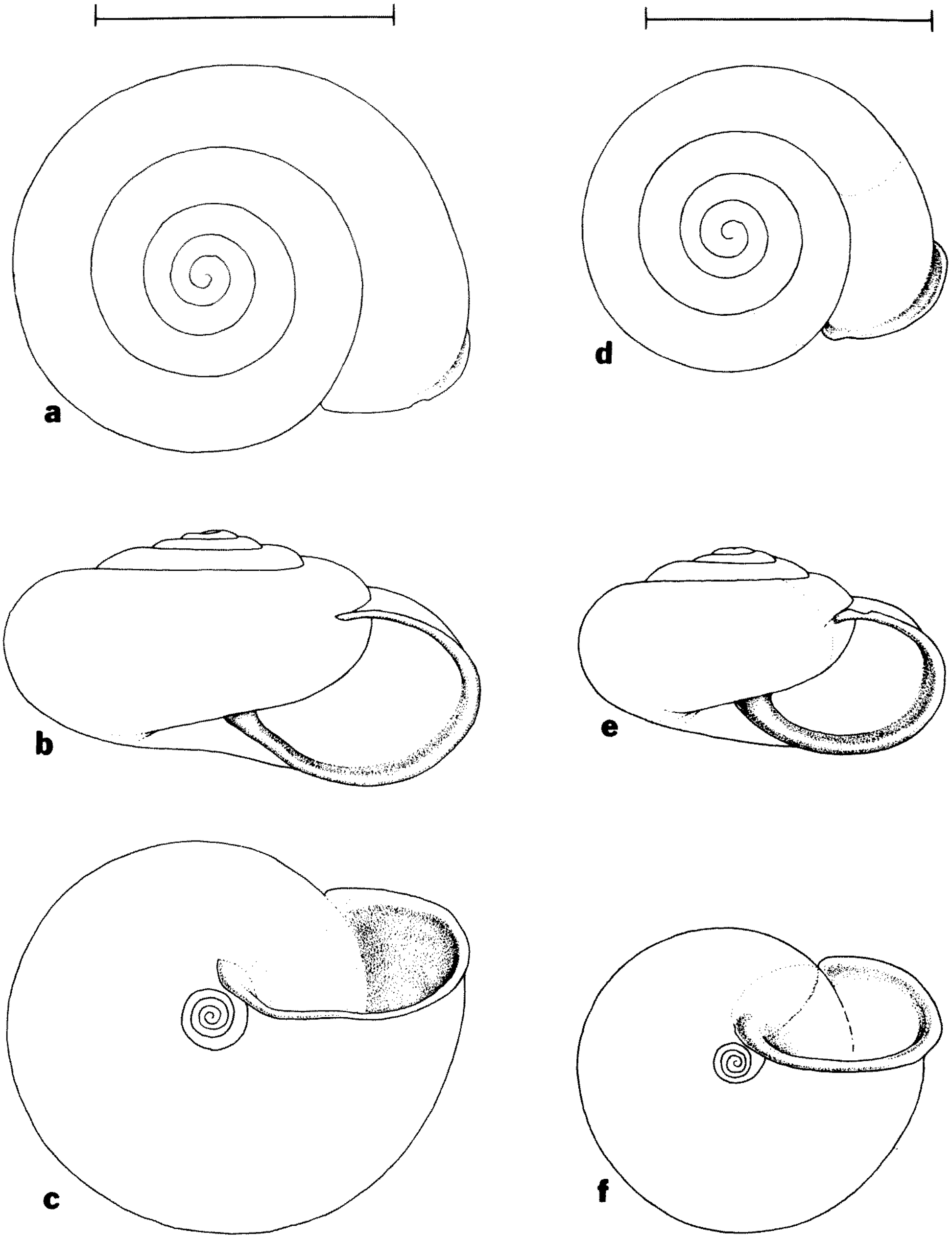

Fig. 23: Shells of *Damochlora:* (a-c) *Damochlora millepunctata* (Smith, 1894), Baudin Island, north of Admiralty Gulf, BMNH 90.12.30.120, paratype; (d-f) *Damochlora millepunctata* var. *cassiniensis* (Smith, 1894), Câssini Island, Admiralty Gulf, BMNH 91.11.21.127, paratype. Scale line equals 10 mm.

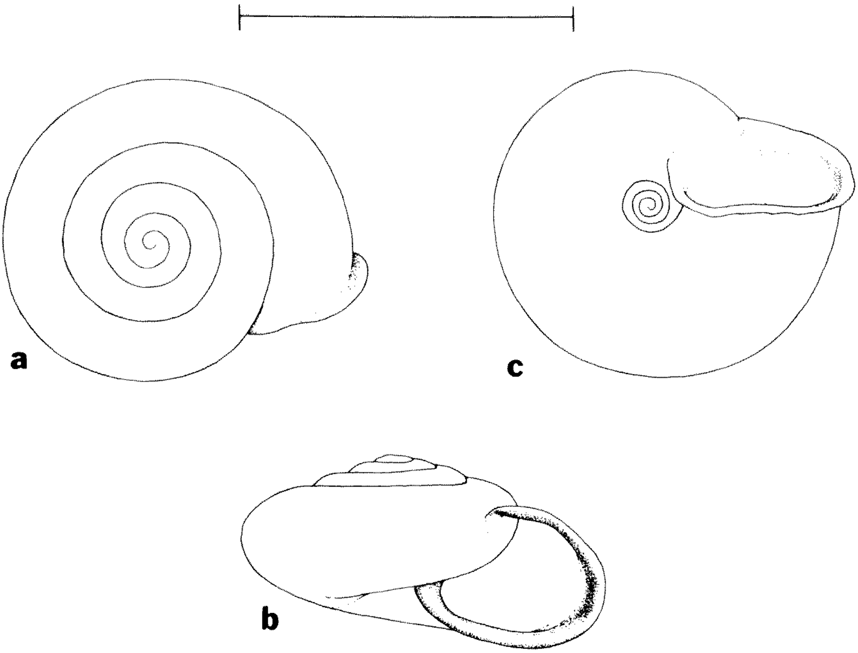

Fig. 24–Shell of *Damochlora rectilabrum* (Smith, 1894): (a-c) Sta. WA-220, near Kalumburu Mission, FMNH 200342. Scale line equals 10 mm.

material remains to be determined. The presence of a long epiphallic caecum and a verge or vergic papilla is a consistent character noticed in the early work, but further details are not given.

In order to relate *Damochlora* to the other Australian 'chloritids' or '*Chloritis*-like' taxa, data are presented here on the genital anatomy of *Trozena* Iredale, 1938 **(Figs 27a-c)**, *Trachiopsis* Pilsbry, 1893 **(Figs 25a-d)**, *Parglogenia* Iredale, 1938 **(Figs 32a-d)**, *Austrochloritis* Pilsbry, 1891 **(Figs 28a-b, 29, 30b)**, '*Chloritis*' *argilacea* **(Figs 31a-b)**, and *Melostrachia* **(Figs 21a-b)**. Data on the structure and distribution of setal hairs and periostracal ridges are given for several taxa **(Plates 8-11)**. These genera prove to be varied in structures.

In postapical shell microsculpture, *Damochlora* **(Plate 8b-c)** is most closely approached by *Trozena* **(Plate 9c)**, with *Trachiopsis* **(Plate 9f-g)** showing a somewhat intermediate pattern of ridging on the spire that becomes quite modified on the reflected portion of the lip **(Plate 9h)**. In contrast, *Melostrachia* **(Plate 10a)** has no special microsculpture, while *Austrochloritis* **(Plate 10b-f)** has typical dense setae accompanied by ridgelets. This same sculpture is seen in reduced fashion on the shells of '*Chloritis*' *argilacea* (Férussac, 1821) **(Plate 11d)** and *Parglogenia pelodes* (Pfeiffer, 1846) **(Plate 11b)**. Except for

Melostrachia **(Plate 10a)** and *Trachiopsis* **(Plate 9d)**, all these taxa share an apical sculpture of crowded pustules.

Table 10: Anatomical structures in chloritid-like genera.

	Genus								
Character	*Damochlora*	*Trachiopsis*	*Melostrachia*	*Austrochloritis victoriae*	*Austrochloritis disjuncta*	*Semotrachia*	*Trozena*	*Parglogenia*	*'Chloritis' argilacea*
Penis sheath	+	+	+	−	−	−	−	−	−
Tubular verge	−	−	+	±[1]	±[1]	+	−	−	−
Vergic papilla	+	+	−	±[1]	±[1]	−	−	−	−
Epiphallic caecum	+	+	+	+	−	+	+	−	+
Epiphallic flagellum	+	−	−	−	−	−	−	−	+
Epiphallic pore	+	−	+	−	−	+	−	−	+
Vas caecum	−	−	−	−	−	−	−	+	−
Ridge at penis junction	−	−	−	−	−	−	−	+	−
Long spermatheca	+	+	+	+	+	+	+	−	−
Penis caecum	−	−	−	−	−	−	+	−	−
Heavy vaginal pilasters	−	−	−	+	+	−	−	−	−

[1] Structure transitional between states.

There are even greater differences in genital structures and combinations of features. The more obvious have been summarized in **Table 10.** A '+' indicates the presence of a structure, a '−' the absence of the structure, and a '±' an intermediate state. The lack of structural unity is obvious, with only the presence of an epiphallic caecum (except *Parglogenia*) and possession of a long spermathecal shaft with the head reaching the albumen gland (except *Parglogenia* and *'Chloritis' argilacea*) present in most taxa. The appearance of unusual features, such as the caecum on the vas deferens in *Parglogenia,* heavy vaginal pilasters in the two *Austrochloritis,* a ridge at the epiphallus-penis junction (as in *Torresitrachia*) in *Parglogenia,* a penis caecum in *Trozena,* and a large epiphallic flagellum in *Damochlora* and *'Chloritis' argilacea,* also emphasizes the variety of structures.

The formation of a tubular verge in *Melostrachia* **(Fig. 21b)** and *Semotrachia* is an advanced condition over the simple vergic papilla seen in *Trachiopsis* **(Fig. 25d),** nearly closed vergic papilla in *Damochlora* **(Fig. 22c),** and nearly tubular verge in *Austrochloritis* **(Figs 29, 30b).** The presence of a penis sheath in *Damochlora, Trachiopsis* and *Melostrachia* does not mean that these taxa are necessarily closely related. While they share a greater number of the listed anatomical features than do the other genera, the shell form and sculpture of *Melostrachia* are very different from the other two genera. The shell sculpture of *Trozena* is nearest to that of *Damochlora,* yet these genera share few anatomical traits, while *Trachiopsis* has the most anatomical features in common with *Damochlora,* despite somewhat altered shell microsculpture.

Until more of the eastern Australia and Indonesian-New Guinea-Solomon Island taxa of '*Chloritis*-like' mien have been dissected, it will not be possible to relate the many genera with certainty. In all probability, these Australian taxa represent multiple invasions from the north and are thus the ends of several phyletic lines. The data presented here on both shell sculpture and anatomical patterns permit investigation of these extra-limital taxa with at least some knowledge of what features to note.

Several other genera and nude names proposed by Iredale for chloritid-like genera from Eastern Australia could not be investigated. Among these are *Calvigenia* Iredale, 1938, *Chloritisanax* Iredale, 1933, *Gloreugenia* Iredale, 1933, *Nannochloritis* Iredale, 1938, *Neveritis* Iredale, 1938, *Obsteugenia* Iredale, 1933, *Ramogenia* Iredale, 1938, and *Tolgachloritis* Iredale, 1933.

DAMOCHLORA MILLEPUNCTATA (SMITH, 1894)

(Plate 8d-e; Figs 23a-c)

Helix (Chloritis) millepunctata Smith, 1894, Proc. Malac. Soc. London, **1:** 88, pl. VII, fig. 11–Baudin Island, Australia.
Helix (Chloritis) millepunctata var. *cassiniensis* Smith, 1894, *Ibid.,* **1:** 88, pl. VII, fig. 12–Cassini Island, Australia.
Chloritis (Austrochloritis) millepunctata (Smith), Gude, 1906, Proc. Malac. Soc. London, **7:** 114.
Chloritis (Austrochloritis) millepunctata var. *cassiniensis* (Smith), Gude, 1906, *Ibid.,* **7:** 114.
Damochlora millepunctata (Smith), Iredale, 1938, Australian Zool., **9** (2): 97; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 46.
Damochlora cassiniensis (Smith), Iredale, 1938, Australian Zool., **9** (2): 97; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 46-47.

Comparative remarks

Damochlora millepunctata (Smith, 1894) differs from *D. rectilabrum* (Smith, 1894) in having a rounded, not angulated, periphery **(Figs 23b, 24b).** Its shell is distinctly larger and more elevated. The lack of any clear radial sculpture on the spire and the peculiar pustulations on the apex **(Plate 8d-f)** easily separate *D. millepunctata* from any *Torresitrachia.* The anatomy is unknown.

Lectotype of *millepunctata*

BMNH 90.12.30.117, Baudin Island, north of Admiralty Gulf, Western Australia (1:100,000 'Admiralty Gulf,' map sheet 4069, grid reference 363:811, 14°8'S, 125°36'E). Collected by J.J. Walker. Height of shell 9.0 mm, diameter 15.9 mm, H/D ratio 0.566, whorls 5+, umbilical width 2.0 mm, D/U ratio 7.95.

Paratypes of *millepunctata*

BMNH 90.12.30.118-120, 3 dead adults from the type locality.

Lectotype of *cassiniensis*

BMNH 91.11.21.125, Cassini Island, Admiralty Gulf, Western Australia (13°59'S, 125°36'E). Collected by J.J. Walker. Height of shell 7.4 mm, diameter 12.2 mm, H/D ratio 0.607, whorls 4⅞, umbilical width 1.4 mm, D/U ratio 8.71.

Paratypes of *cassiniensis*

BMNH 91.11.21.126-7, 2 dead adults from the type locality.

Diagnosis of *millepunctata*

Shell 15.15-15.9 mm (mean 15.64 mm) in diameter, with 5 to 5¼ (mean 5⅛) normally coiled whorls. Apex and spire slightly and evenly elevated, height of shell 8.75-9.0 mm (mean 8.91 mm), H/D ratio 0.560-0.578 (mean 0.570). Apical sculpture **(Plate 8d-e)** of crowded, rather prominent pustulations, postapical whorls with low and irregular vague radial features of ridges and pits, possibly remnants of attachment points for the sculpture found in *D. rectilabrum* (Smith, 1894) **(Plate 8b-c).** Walls of umbilicus with fine pustulations, umbilical width 2.0-2.3 mm (mean 2.11 mm), D/U ratio 6.91-7.95 (mean 7.43). Body whorl evenly rounded, not deflected behind aperture, lip thin and only slightly expanded, partly reflected over umbilicus. Based on 4 measured adults. Anatomy unknown.

Diagnosis of *cassiniensis*

Shell 12.2-12.85 mm (mean 12.52 mm), with 4¾ to 4⅞ (mean 4⅞) whorls. Apex and spire slightly and evenly elevated, height of shell 7.4-7.8 mm (mean 7.55 mm), H/D ratio 0.596-0.607 (mean 0.603). Sculpture **(Plate 8f)** as in *D. millepunctata*. Body whorl, lip, umbilical contours as in *D. millepunctata*. Umbilical width 1.3-1.5 mm (mean 1.4 mm), D/U ratio 8.33-9.88 (mean 8.97). Based on 3 measured adults. Anatomy unknown.

Discussion

The types are the only material known of *Damochlora millepunctata* (Smith, 1894), despite subsequent collections on both Baudin and Cassini Islands by staff of the Western Australian Museum and extensive collections in the Mitchell Plateau area by several malacologists. Unfortunately, all of the available material is worn, and the postapical sculptural remnants are difficult to interpret. I was not able to get satisfactory SEM photographs of this area because of preparation problems. My impression is that the surface could represent the attachment points for the radial ridges seen in *D. rectilabrum* (Smith, 1894), but only collection of fresh material will permit deciding this point.

The specimens from Cassini Island are smaller, with fewer whorls, more elevated, and with a narrower umbilicus than the specimens from Baudin Island **(Table 9).** Iredale (1938, 1939) elevated *cassiniensis* to full specific rank, without having seen specimens of either form. In view of the great variability shown by species of *Torresitrachia* in Western Australia, I prefer not to separate them at this time, but for convenient reference have provided separate diagnoses for the two populations. The same pattern of size variation is shown in *Amplirhagada imitata* (Smith, 1894) from Baudin Island and *A. combeana* Iredale, 1938 from Cassini Island, but in this genus the extent of intraspecific size variation is less and there are distinct shell sculpture differences between the populations, thus justifying tentative specific rank.

DAMOCHLORA RECTILABRUM (SMITH, 1984)

(Plates 6g-i, 8a-c; Figs 22a-c, 24a-c)

Helix (Chloritis) rectilabrum Smith, 1894, Proc. Malac. Soc. London, **1:** 88, pl. VII, fig. 14–Parry Harbour, N.W. Australia.

Chloritis (Austrochloritis) rectilabrum (Smith), Gude, 1906, Proc. Malac. Soc. London, **7:** 114.

Damochlora rectilabrum (Smith), Iredale, 1938, Australian Zool., **9** (2): 98; Iredale, 1939, Jour. Roy. Soc. Western Australia, **25:** 47.

Comparative remarks

The angulated periphery, slightly smaller size, and sculpture of fine postapical radial ridges **(Plate 8b-c)** in the periostracum combine to separate *Damochlora rectilabrum* (Smith, 1894) from the related *D. millepunctata* (Smith, 1894). The absence of noticeable radial ribs on the spire combined with the strong apical pustulations separate both species from any *Torresitrachia* or *Amplirhagada,* whether adult or juvenile.

Lectotype

BMNH 92.1.29.19, Parry Harbour, north-east of Admiralty Gulf, Western Australia (1:100,000 'Vansittart' map sheet 4169, grid reference *ca.* 460:850). Collected by J.J. Walker. Height of shell 6.5 mm, diameter 13.0 mm, H/D ratio 0.500, whorls 4⅞+, umbilical width 1.65 mm, D/U ratio 7.88.

Paratypes

BMNH 92.1.29.20-21, 2 dead adults from the type locality.

Other material

Sta. WA-218, single rocks in shade of boab tree near gardens at Kalumburu Mission (Drysdale 4269–180:457) (12 live juveniles, FMNH 200549, WAM 184.79, A. Solem, 28 October 1976); Sta. WA-220, north-west facing cove 6.5 km south of Kalumburu Mission, east of Gibb River Road (Drysdale 4269–132:474) (2 live and 20 dead adults, 6 live and 10 dead juveniles, FMNH 199504, FMNH 199508, FMNH 200341, FMNH 200342, FMNH 200675, WAM 621.77, WAM 359.77, WAM 185.79, AM C.106527, A. Solem, 28 October 1976).

Diagnosis

Shell of average size, diameter 9.7-14.2 mm (mean 12.26 mm), with 4½ to 5 (mean 4⅞–) whorls. Apex and spire slightly and evenly elevated, shell height 5.05-7.6 mm (mean 6.42 mm), H/D ratio 0.476-0.564 (mean 0.523). Apex **(Plate 8a)** with sculpture of prominent pustulations, at least initially arranged in diagonal rows. Postapical whorls with fine periostracal sculpture of short blade-like to conical ridges, radially oriented but not in linear rows **(Plate 8b-c)** with thickened upper edge. Between the radial elements is a very fine microsculpture of short ridgelets oriented in various fashions **(Plate 8c)**. Sculpture continuing onto base of shell, replaced in umbilicus by microscopic typical setal hairs. Body whorl noticeably angulated, not descending behind lip, which is slightly reflected and thickened, white in colour, only partly covering umbilicus. Umbilicus open, regularly and slightly decoiling, umbilical width 1.35-2.25 mm (mean 1.82 mm), D/U ratio 5.20-8.07 (mean 6.83). Based on 25 measured adults and subadults.

Genitalia **(Figs 22a-c)** in male reproductive phase with enlarged ovotestis (G) and prostate (DG). Uterus (UT) still small. Free oviduct (UV) short, vagina (V) long and slender. Spermatheca (S) with long shaft and slender head, not coiled. Vas deferens (VD, **Fig. 22b**) entering epiphallus (E) at base of long epiphallic flagellum (EF) through a pore (EP) flanked by two low pilasters. A fat, fingerlike epiphallic caecum (EC, **Fig. 22a**) internally has pustules (EPP) changing to long ridges in the epiphallus. Penis (P) with a thin sheath (PS, **Fig. 22c**) starting just above atrium (Y), both sheath and penis coiled. Internally, penis **(Fig. 22c)** with a vergic papilla (PV) with sheath extending far above level of papilla, walls of lower penis chamber with circular ridges at the level of the papilla, changing to short radial ridges (PPR) on the lower area **(Fig. 22c)**. Penial retractor muscle (PR) inserting on epiphallus. Based on one dissected adult.

Discussion

Since only two live adults were collected, only one was dissected at this time. The anatomy is sufficiently different from other Western Australian taxa, that it was thought prudent to retain the other adult undissected for later study availability.

Direct optical comparisons of adults from Sta. WA-220 with the types at the BMNH revealed no differences and assignment of the Kalumburu shells to this species is proposed. The lectotype is a worn, somewhat depressed shell, but falls within the size and shape range of the Kalumburu examples.

Worn samples appear optically to have the same surface sculpture as *D. millepunctata*.

GENUS *TRACHIOPSIS* PILSBRY, 1893

Trachiopsis Pilsbry, 1893, Man. Conch., (2) **8:** 284—type species *Helix tuckeri* Pfeiffer, 1846 by original designation; Pilsbry, 1894, *Ibid.*, (2) **9:** 114; Iredale, 1938, Australian Zool., **9** (2): 111-112.

Diagnosis

Shell very small, with slightly to moderately elevated, domed spire. Apical sculpture of pustules to irregular radial corrugations **(Plate 9d).** Postapical whorls with very low irregularly spaced, radial, blade-like ridges **(Plate 9f-g),** sometimes weak radial ridges on spire **(Plate 9e),** with area behind lip having oval pustules **(Plate 9h).** Microsculpture of irregular, nearly spiral ridgelets **(Plate 9e)** present on at least part of spire. Umbilicus with dense pustules. Body whorl rounded to distinctly angulated, sharply descending **(Plate 9f)** behind lip, which is broadly expanded and without a basal projection. Umbilicus narrowly to moderately open, regularly decoiling. Shell yellow brown, frequently with a pale reddish spiral band at the periphery. Genitalia **(Figs 25a-d)** with hermaphroditic duct (GD) entering laterally on talon (GT), spermatheca (S) and free oviduct (UV) long. Vas deferens (VD) entering epiphallus (E) by a simple pore between two large pilasters **(Fig. 25c),** epiphallic caecum (EC) very short **(Fig. 25b)** to long and finger-like **(Fig. 25a),** internally with longitudinal pilasters, long caecum narrowed apically. Epiphallus very long, penis (P) with a thin sheath (PS, **Fig. 25d**), internally with a large vergic papilla (PV, **Fig. 25d**) that is U-shaped and not closed completely, walls of penis with longitudinal folds. Penial retractor muscle (PR) inserting on upper third of epiphallus.

Type species: *Helix tuckeri* Pfeiffer, 1846 by original designation.

Discussion

The less completely closed vergic papilla (PV), absence of an epiphallic flagellum (EF), different wall sculpture in the epiphallic caecum and penis, deflected body whorl, and modified shell sculpture are the main features separating *Trachiopsis* from *Damochlora* Iredale, 1938. *Trozena* Iredale, 1938

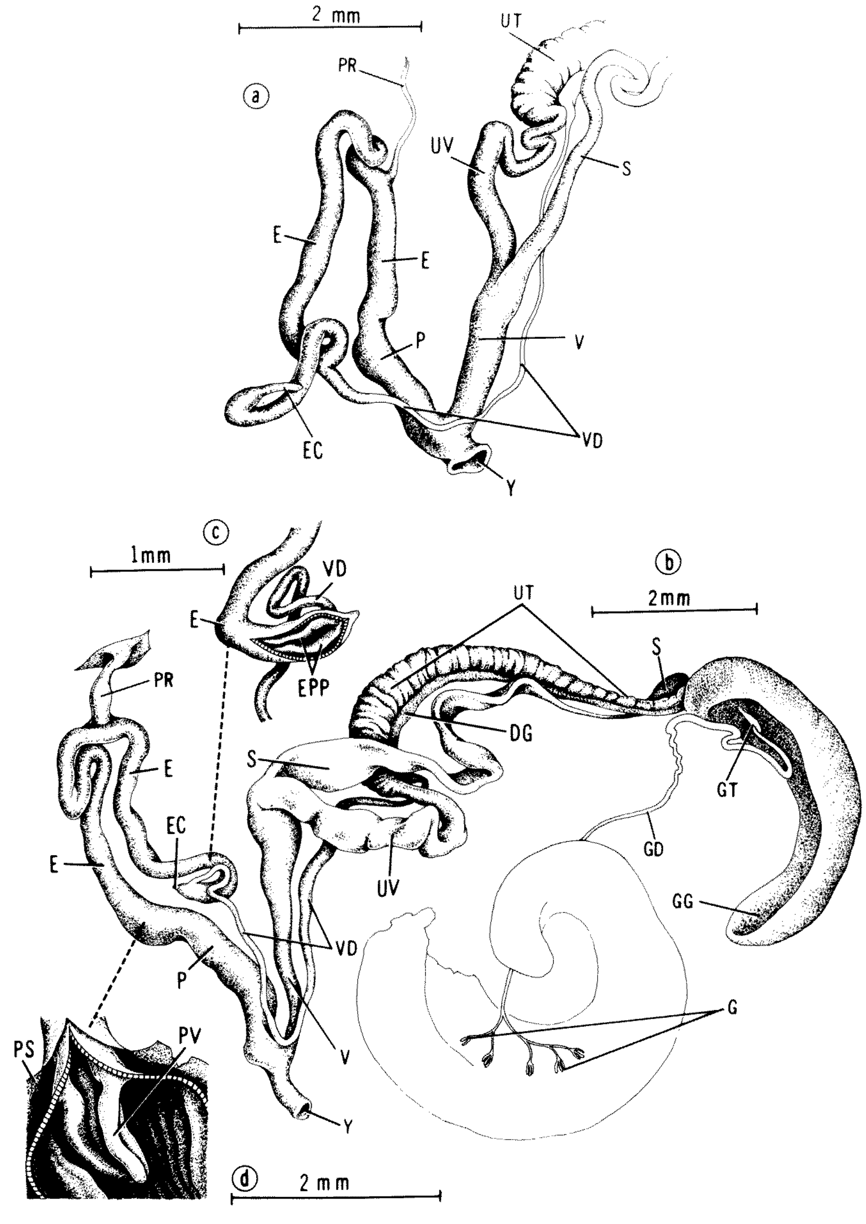

Fig. 25: Genitalia of *Trachiopsis:* (a) *Trachiopsis mucosa* (Cox, 1868), 3.2 km north of Bororen, north of Miriam Vale, south of Gladstone, Queensland, 22 July 1969, AM C.107132, terminal genitalia; (b-d) *Trachiopsis strangulata* (Hombron & Jacquinot, 1841), Terry Beach, Prince of Wales I., Torres Strait, Queensland, 30 June to 2 July 1976, AM C.107135; (b) is genitalia, (c) is detail of epiphallic caecum interior, (d) is detail of vergic papilla in penis. Scale lines as marked.

has shell sculpture midway between these two genera (**Plate 9a-c**), an angulated body whorl (**Fig. 26b**), lacks the spiral colour band, has no penis sheath or vergic papilla, and has a prominent penis caecum (PC, **Fig. 27a**) that is lacking in the other two genera.

Dissection of two species showed minor differences. Whether the other forms associated with these by Iredale (1938: 111-112) actually belong to *Trachiopsis* or not is uncertain. *Trachiopsis tuckeri* (Pfeiffer, 1846) (the genotype) from Sir Charles Hardy's Island, Queensland (11°54′S, 143°26′E) and *T. truculenta* (Hedley, 1912) from Port Curtis, Queensland (23°55′S, 151°23′E) need to be investigated as to anatomy and shell microsculpture. The original concept of *Trachiopsis* (Pilsbry, 1894: 114) encompassed both *Torresitrachia* and *Trachiopsis* as defined in this report.

TRACHIOPSIS STRANGULATA (HOMBRON & JACQUINOT, 1841)

(Plate 9d-h; Figs 25b-d)

Helyx strangulata Hombron & Jacquinot, 1841, Annales Sci. Nat., Zool., (Paris), ser. ii, **16:** 64 – Ile Toud, Torres Strait, Australia.

Helix cyclostomata Le Guillou, 1842, Rev. Zool. Soc. Cuvierienne, **1842:** 141 – Ile Warrior, Torres Strait, Australia.

Helix strangulata Hombron & Jacquinot, 1851, Voy. au Pole Sud, 'Astrolabe et Zelee,' Atlas, Moll., pl. 6, figs. 1-4; Hombron & Jacquinot, 1854, Voy. au Pole Sud, 'Astrolabe et Zelee,' **5,** Mollusques: 16.

Helix (Trachia) dentoni Ford, 1889, Nautilus, **3** (2): 17-18 – New Guinea (error).

Trachiopsis strangulata (Hombron & Jacquinot, 1841), Iredale, 1938, Australian Zool., **9** (2): 111.

Holotype of *dentoni*

ANSP 33294, New Guinea (error), ex George W. Dean. Height of shell 3.5 mm, diameter 6.7 mm, H/D ratio 0.522, whorls 4½, umbilical width 1.2 mm, D/U ratio 5.58.

Other material

Terry Beach, Prince of Wales Island, Torres Strait, Queensland (10°41′S, 142°09′E) (40 live adults, AM C.107135, FMNH 200821, W.F. Ponder, 30 June to 2 July 1976).

Discussion

The longer epiphallic caecum (EC, **Fig. 25a**) and shorter vagina (V) of *Trachiopsis mucosa* (Cox, 1868) from near Gladstone, Queensland, contrast with the very short epiphallic caecum and longer vagina in *T. strangulata* (Hombron & Jacquinot, 1841) **(Figs 25b-d).** The internal features of the penis and epiphallus were the same in the two species.

On 26 June, 1912 Charles Hedley penned a note with the type of *Helix dentoni* Ford, 1889 that it was a synonym of this species. Iredale (1938: 110) mistakenly referred it to *Torresitrachia torresiana* (Hombron & Jacquinot, 1841), although correctly indicating that the type locality was in error.

TRACHIOPSIS MUCOSA (COX, 1868)

(Fig. 25a)

Helix mucosa Cox, 1868, Proc. Zool. Soc. London, **1867:** 725–Clarence River, New South Wales, Australia; Cox, 1868, Monog. Australian Land Shells, p. 19, pl. 11, fig. 14.

Trachiopsis mucosa (Cox), Iredale, 1938, Australian Zool., **9** (2): 112; Iredale, 1943, The Australian Naturalist, **11** (3): 66, fig. 3.

Holotype

AM C.101089, Clarence River, New South Wales. Height of shell 4.0 mm, diameter 7.1 mm, H/D ratio 0.565, whorls 4¼, umbilical width 1.44 mm, D/U ratio 4.91.

Other material studied

2 miles north of Bororen, north of Miriam Vale, south of Gladstone, Queensland (*ca.* 24°15′S, 151°30′E) (4 live adults, AM C.107132, W.F. Ponder and L. Moore, 22 July 1969).

Discussion

The dissected specimens were optically compared with the holotype and judged to be conspecific.

GENUS *TROZENA* IREDALE, 1938

Trozena Iredale, 1938, Australian Zool., **9** (2): 111–type species *Trozena morata* Iredale, 1938 by original designation.

Diagnosis

Shell small, with moderately and almost evenly elevated spire. Apical sculpture **(Plate 9a-b)** of crowded, prominent pustules. Postapical whorls with short, radially oriented, scattered raised blade-like ridges **(Plate 9c),** with a very fine, and reduced **(Plate 9c)** microsculpture of ridgelets, replaced by dense pustules in umbilicus. Body whorl distinctly angulated **(Fig. 26b)**, slightly descending behind lip, which is broadly expanded and with a weak to moderate basal projection. Umbilicus open, decoiling regularly **(Fig. 26c)**. Shell colour dark yellow brown in fresh examples, without colour zones. Genitalia **(Figs 27a-c)** with hermaphroditic duct (GD) entering head of talon (GT), long spermathecal duct (S) and relatively long free oviduct (UV). Vas deferens (VD) entering head of epiphallus (E) through a simple pore, interior of long epiphallic caecum (EC) with longitudinal pilasters, caecum narrowing apically. Epiphallus very long, no clear differentiation between epiphallus and penis (P). Latter with a small penis caecum (PC, **Fig. 27b**) and weak internal pilasters, no penis sheath. Penial retractor muscle (PR) inserting on lower third of epiphallus.

Type species: *Trozena morata* Iredale, 1938 by original designation.

Discussion

The absence of both a penis sheath and any vergic papilla or verge, simple internal wall sculpture of the penis, and development of a penis caecum are the main anatomical features separating *Trozena* from *Damochlora* Iredale, 1938 and *Trachiopsis* Pilsbry, 1893, both of which have similar shell features and sculpture. *Damochlora* **(Figs. 22a-c)** has a vergic papilla (PV), an epiphallic flagellum (EF), pilasters surrounding the epiphallic pore (EP), a well-developed penis sheath (PS), and complex sculpture inside both the penis and epiphallic caecum **(Figs 22b, c)**. *Trachiopsis* **(Figs 25a-d)** has similar apical and female genitalia, but the development of a penis sheath (PS), vergic papilla (PV), variable length of the epiphallic caecum (EC), and higher insertion of the penial retractor muscle (PR), are differentiating features. Without opening of the penis complex, the two genera could easily be confused. They also differ in shell sculpture **(Plate 9)**.

TROZENA MORATA IREDALE, 1938

(Plate 9a-c; Figs 26a-c, 27a-c)

Trozena morata Iredale, 1938, Australian Zool., **9** (2): 111, pl. 12, fig. 18–Chillagoe, Queensland.

Holotype

AM C.101126, Chillagoe, Queensland. Height of shell 4.7 mm, diameter 10.4 mm, H/D ratio 0.452, whorls 4⅝+, umbilical width 3.0 mm, D/U ratio 3.47.

Other material

1.6 km east of Lappa Junction, Queensland (10 live and dead adults, AM C.107131, AM C.107136, FMNH 200823, 6 July 1960).

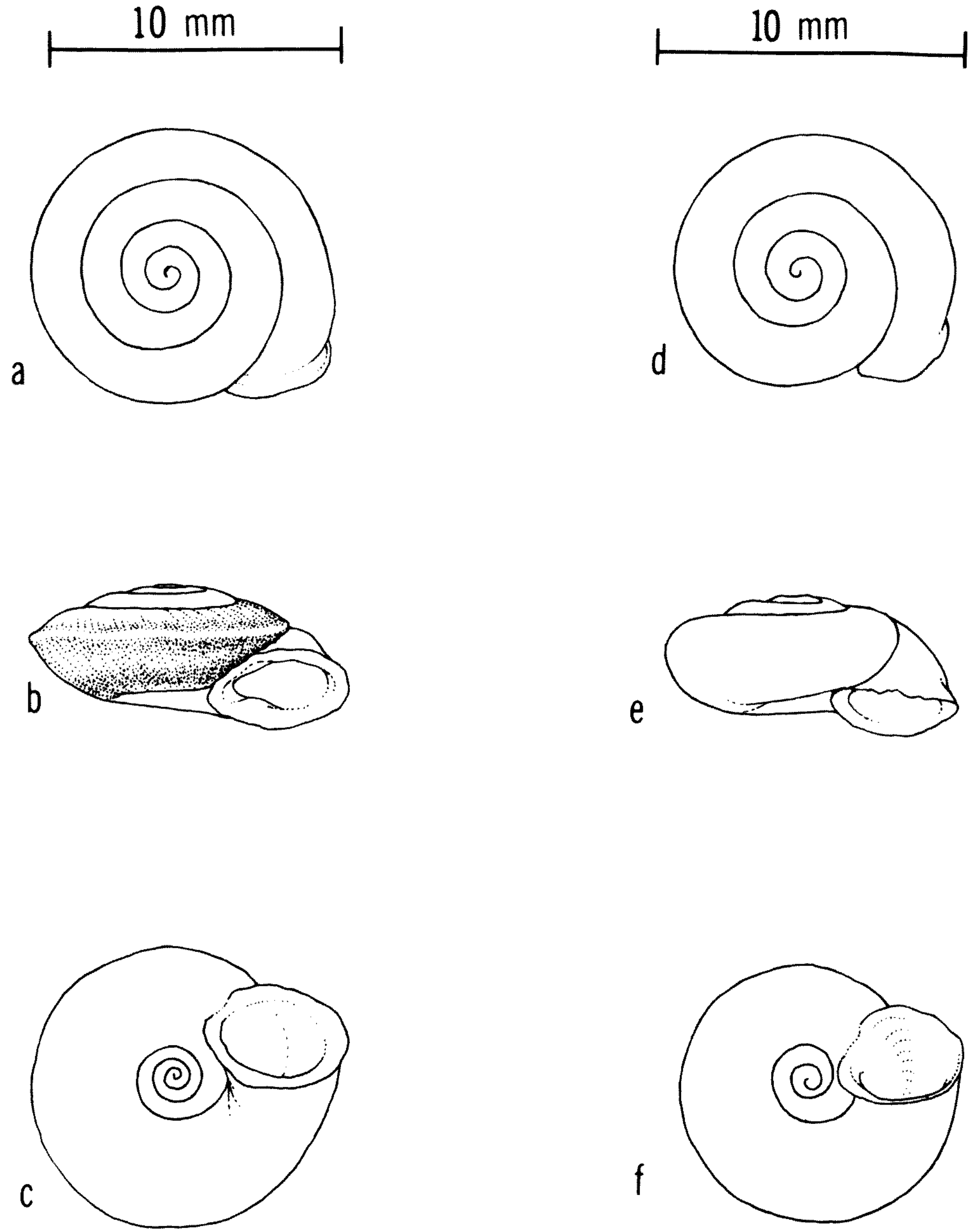

Fig. 26: Shells of *Trozena* and *Offachloritis:* (a-c) *Trozena morata* Iredale, 1938, Chillagoe Caves, Queensland, AM C.101126, holotype: (d-f) *'Offachloritis' dryanderensis* (Cox, 1872); Mount Dryander, Port Denison, Queensland, AM C.101194, holotype.

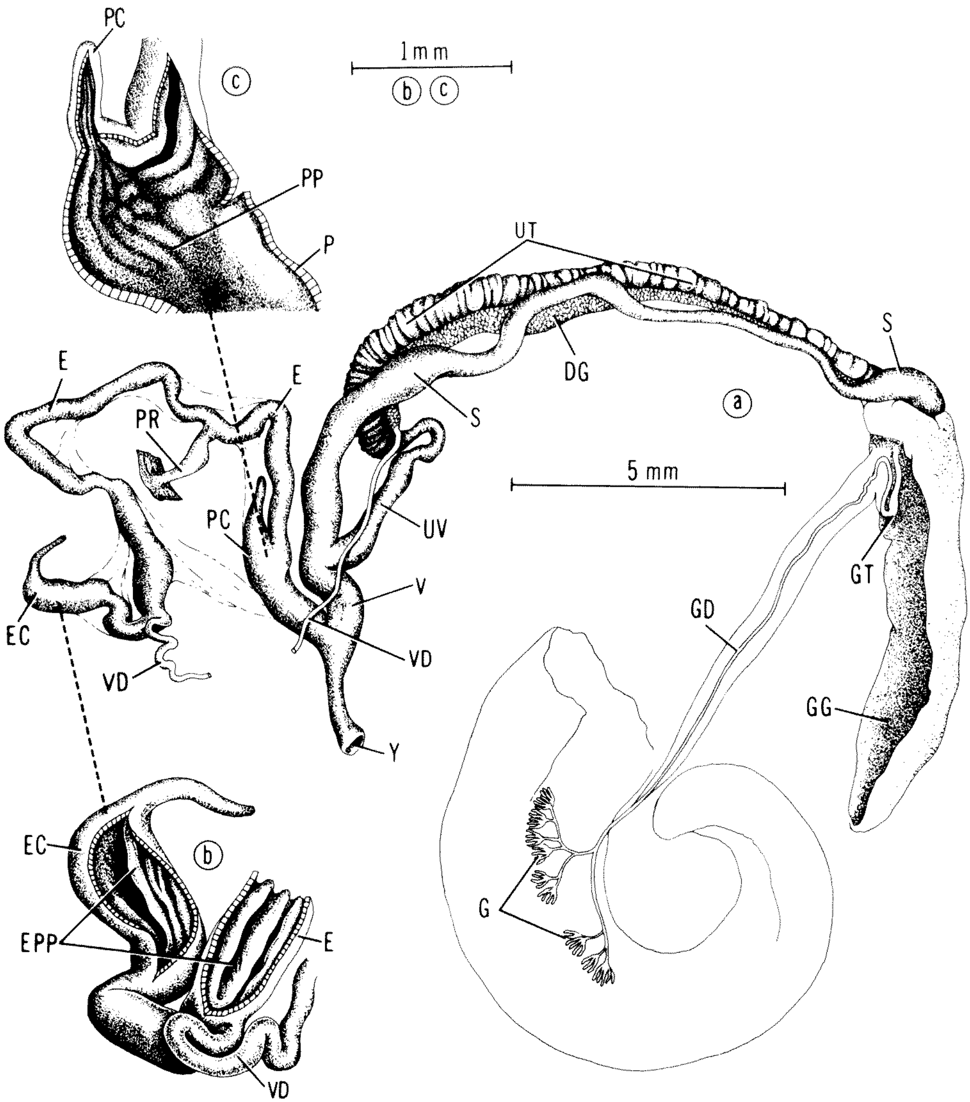

Fig. 27: Genitalia of *Trozena morata* Iredale, 1938, Lappa Junction, Queensland, 6 July 1960, AM C.107131, Dissection B: (a) genitalia; (b) detail of penis and epiphallus interior; (c) detail of penis caecum. Scale lines as marked.

Discussion

Lappa (17°22′S, 144°53′E) is sufficiently near to Chillagoe (17°09′S, 144°31′E), Queensland that I have no doubt that the dissected material belongs to the same species as the type. Variation in size and shape is summarized in **Table 9.**

GENUS *AUSTROCHLORITIS* PILSBRY, 1891

Austrochloritis Pilsbry, 1891, Man. Conch., (2) **6:** 262-263–type species *Helix porteri* Cox, 1866 by original designation; Pilsbry, 1894, *Ibid.*, (2) **9:** 121-122; Gude, 1906, Proc. Malac. Soc. London, **7:** 114-115; Iredale, 1938, Australian Zool., **9** (2): 93-95; Iredale, 1943, The Australian Naturalist, **11** (2): 64-65, fig. 2.

Chloritobadistes Iredale, 1933, Rec. Australian Mus., **19:** 49–nude name for *Helix victoriae* Cox, 1868; Iredale, 1938, Australian Zool., **9** (2): 86–citation in a check list.

Nomenclature and previous work

The identity of the many taxa referred to this genus will require extensive new collections, dissections, and study of types. I have not been able to locate material of the genotype for dissection, but in view of the great conchological similarity shown by the included species, I am reasonably confident that the anatomical features delineated will represent the generic concept fairly.

Chloritobadistes is another Iredalian name that was listed as 'non descr.' in the *Zoological Record* (Salisbury, 1934: 82). Since it is a synonym of *Austrochloritis* on the basis of its anatomy, the fact that it is still a nude name is unimportant.

Diagnosis

Shell of medium size with moderately to strongly elevated spire, umbilicus narrowly open to nearly closed. Apical sculpture of prominent pustules, postapical whorls with a dense covering of crowded setae **(Plate 10b-f)** arranged in regular rows and with a secondary sculpture of very fine, irregularly wavy microridgelets **(Plate 10e-f)**. Body whorl at most slightly descending behind lip, rounded to weakly angulated. Lip white, thin, slightly expanded after sharp reflection. Shell colour yellow-brown, without colour bands or zones. Genitalia **(Figs 28a-b, 29, 30b)** with hermaphroditic duct (GD) inserting into head of talon (GT, **Figs 28a-b**), spermatheca relatively short (S, **Fig. 28b**) to very long with multifolded shaft **(Fig. 28a)**, free oviduct (UV) short. Vas deferens (VD) entering head of epiphallus (E) through a single pore **(Fig. 30b)**, epiphallus with **(Fig. 30b)** or without **(Fig. 29)** a very short caecum (EC). Penis (P) without a sheath, internally **(Figs 29, 30b)** with a vergic papilla (PV) that may have a conical tip **(Fig. 30b)** although open laterally apically, or have one lobe fastened to the penis wall and the other lobe free **(Fig. 29)**. Walls of penis chamber with irregular longitudinal ridges and pustulations of various lengths. Lower vagina (V, **Figs 29, 30b**) with very prominent longitudinal pilasters, decreasing in height apically. Penial retractor muscle (PR) inserting about midway on epiphallus.

Type species: *Helix porteri* Cox, 1866 by original designation.

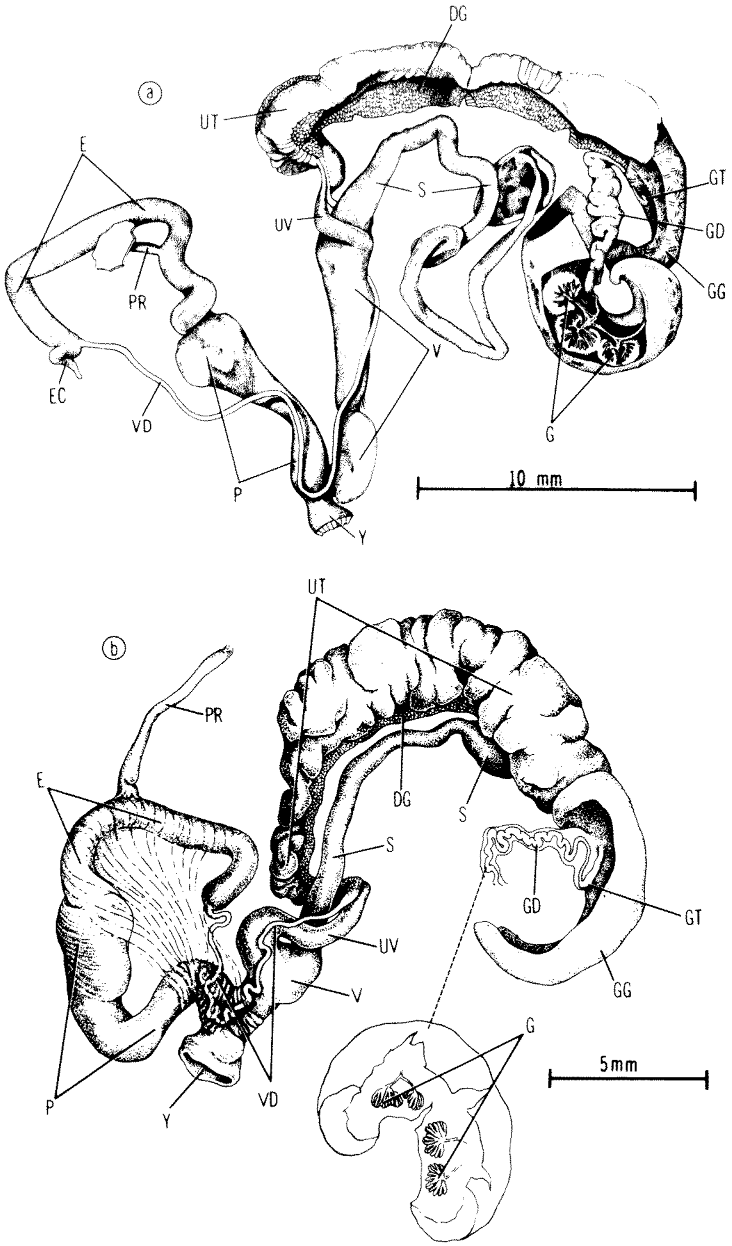

Fig. 28: Genitalia of *Austrochloritis:* (a) *Austrochloritis disjuncta* (Gude, 1906), Sta. A-1, banks of William River near Barrington Tops, New South Wales, 28-29 October 1968, FMNH 160061; (b) *Austrochloritis victoriae* (Cox, 1868), Sealers Cove, Fern Gully, Wilson's Promontory, Victoria, NMV F6706. Scale lines as marked. **Fig. 28a** drawn by Claire Kryczka.

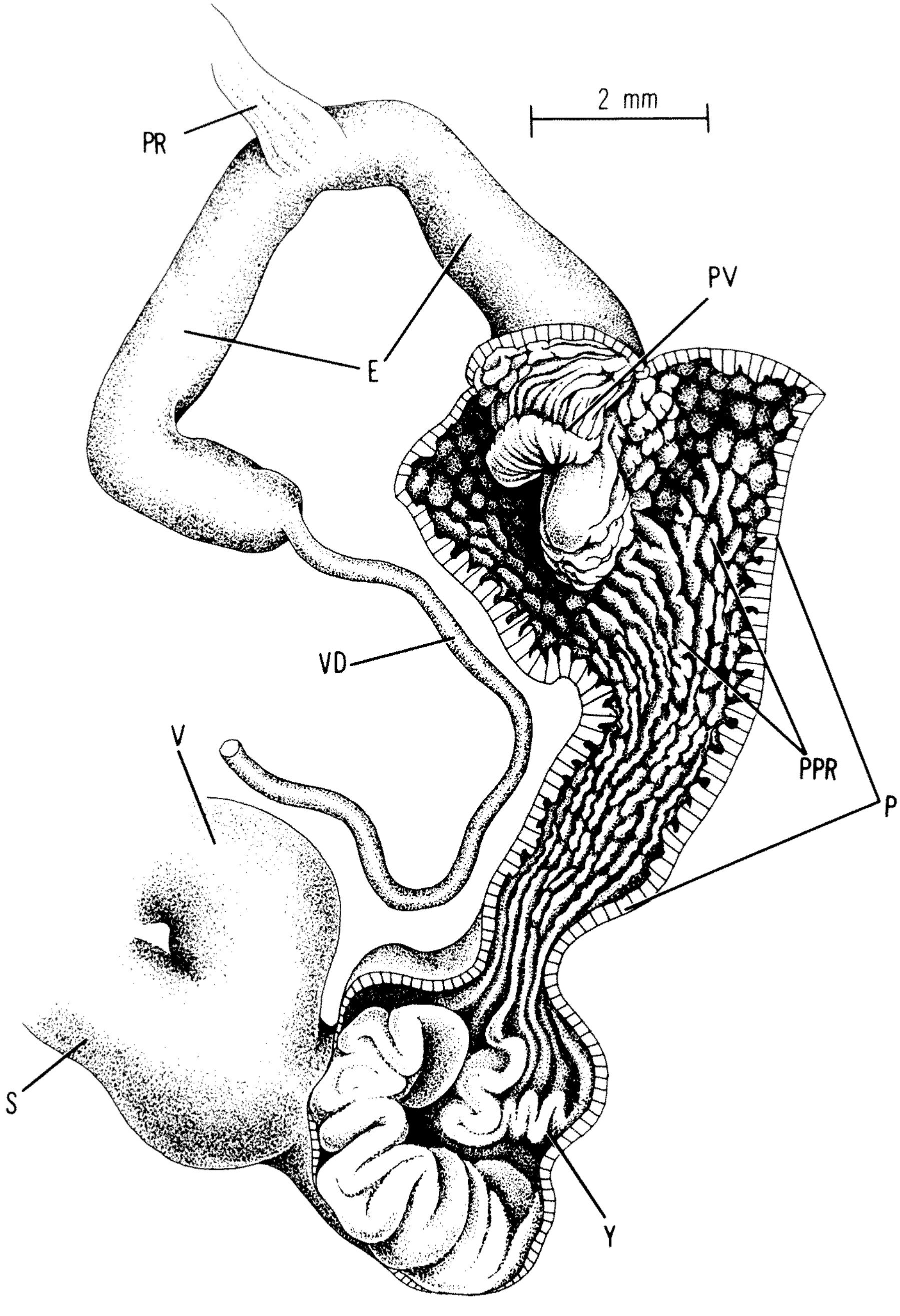

Fig. 29: Penis interior of *Austrochloritis victoriae* (Cox, 1868), Sealers Cove, Fern Gully, Wilson's Promontory, Victoria, NMV F6706. Scale line as marked.

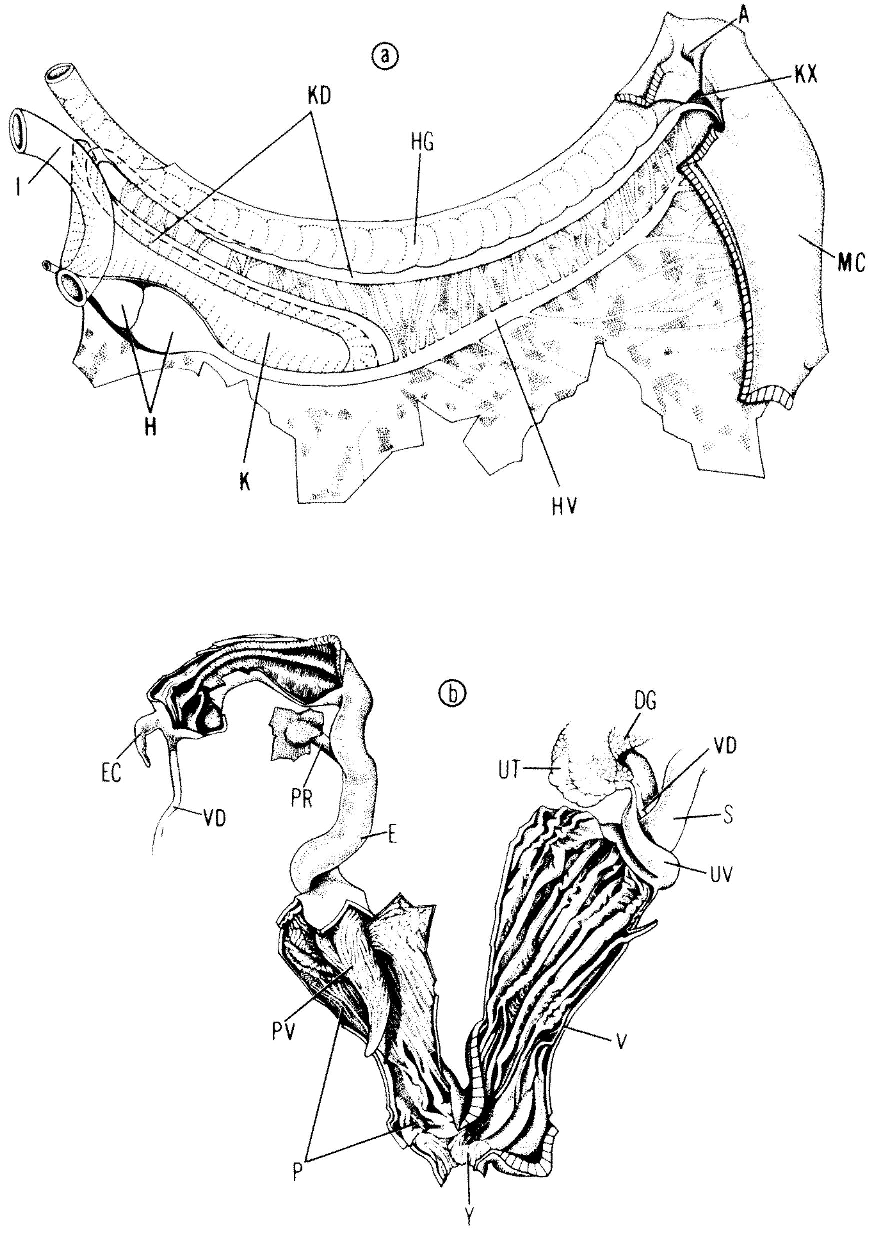

Fig. 30: Pallial region and interior of terminal genitalia of *Austrochloritis disjuncta* (Gude, 1906), Sta. A-1, banks of Williams River near Barrington Tops, New South Wales, 28-29 October 1968, FMNH 160061: (a) pallial region; (b) interior of lower female tract, epiphallus and penis. Scale lines as marked. Both figures drawn by Claire Kryczka.

Discussion

The reduced or absent epiphallic caecum, absence of a penis sheath, very large vaginal pilasters, and near formation of a tubular vas deferens are the main anatomical features separating *Austrochloritis* from the other Australian chloritid taxa. The densely pilose postapical setae and irregular ridgelets on the shell **(Plate 10b-f)** are shared with *Semotrachia* Iredale, 1937, *Parglogenia* Iredale, 1938 **(Plate 11b)**, and *'Chloritis' argilacea* (Férussac, 1821) **(Plate 11d)**, although the prominence of this sculpture is much reduced in these taxa. *Semotrachia* typically has a tubular verge, elaborate pilasters around the epiphallic pore, more pustulose penial wall sculpture, elaborated epiphallic pilasters, and the shell is mostly widely umbilicated. It is perhaps the nearest in structure to *Austrochloritis*. *Parglogenia* lacks verge, penis sheath, any epiphallic accessory structures, but has a most peculiar two part caecum on the vas deferens, elongated penis and vagina, very short spermatheca, and a ridge between the penis and epiphallus **(Fig. 32b)** that is very much like those seen in *Torresitrachia* **(Figs 14b, 16a, b)**. Despite the similarity in shell ornamentation, the anatomy of *Parglogenia* and *Austrochloritis* is very different. *'Chloritis' argilacea* from Timor **(Figs 31a-b)** has a spermatheca that is intermediate in length between those of *Parglogenia* and *Austrochloritis,* lacks penis sheath and verge or vergic papilla, and has elaborate epiphallic pilasters, caecum and flagellum.

The problem of species names in *Austrochloritis* currently is insurmountable. Iredale (1938: 93-95) listed or described nineteen taxa and subsequently (Iredale, 1943: 64-65) added three more names with casual flare. No revision of this group has been attempted and the extent of variation within and among populations is unknown. The anatomy of two taxa have been illustrated here, the Victorian *Austrochloritis victoriae* (Cox, 1868) and examples collected near Barrington Tops, north-west of Sydney. Problems concerning the appropriate name for these shells are discussed below. Anatomically, the two taxa differ in the form of the vergic papilla, presence or absence of an epiphallic caecum, length of the spermathecal duct and vaginal length. These are more than sufficient to maintain specific separation, even if the shells did not differ obviously in size, shape, and presence or absence of a reflected lip when adult.

AUSTROCHLORITIS VICTORIAE (COX, 1868)

(Plate 10d-f; figs 28b, 29)

Helix victoriae Cox, 1868, Monog. Australian Land Shells, p. 37, pl. 12, fig. 5—Western Port, Victoria.

Chloritobadistes victoriae (Cox), Iredale, 1938, Australian Zool., **9** (2): 86.

Material studied

Sealers Cove, Fern Gully, Wilson's Promontory, Victoria (3 live adults, 2 live juveniles, NMV F6706,); Wilhelm's Gully, Forrest, Victoria (5 live adults NMV F7217).

Discussion

The lack of a reflected lip and more globose shell immediately separates *Austrochloritis victoriae* (Cox, 1868) from the other described species. The anatomical differences outlined above, when combined with these shell features, may be sufficient to separate it generically. Until more *Austrochloritis* have been dissected and the pattern of variation within the genus delineated, the differences seem no greater than those encountered among species of *Torresitrachia, Xanthomelon* or *Amplirhagada,* and retention within one genus is suggested.

AUSTROCHLORITIS DISJUNCTA (GUDE, 1906)

(Plate 10b-c; Figs 28a, 30a-b)

Chloritis disjuncta Gude, 1906, Proc. Malac. Soc. London, **7:** 49, pl. 5, figs. 3, a-c–Port Stephens, New South Wales (32°02′S, 152°06′E).

Austrochloritis disjuncta (Gude), Iredale, 1938, Australian Zool., **9** (2): 95.

?*Austrochloritis ascensa* Iredale, 1943, The Australian Naturalist, **11** (3): 64–Barrington Tops, New South Wales (32°02′S, 151°24′E).

Material studied

Sta. A-1, on banks of Williams River, near Barrington Tops, north-west of Sydney, New South Wales (5 live adults, FMNH 160061, Laurie Price, 28-29 October 1968).

Discussion

The 5 mm range in diameter **(Table 9)** for the adults in the sampled population indicates the problem in assessing the value of named forms, most of which have been differentiated on size. The smaller shells match well a worn example of *Austrochloritis disjuncta* (Gude, 1906) from New South Wales (FMNH 41178, ex Webb, Fulton, Gude), while the larger come very close to an example of *A. novocambrica* (Gude, 1906) from Byron Bay, New South Wales (FMNH 41648, ex Webb, Gude, Cox), except in having a slightly smaller umbilicus. *Austrochloritis ascensa* Iredale, 1943 was based on a '⅔rd in. broad' shell from Barrington Tops, with smaller lower spired shells from the base of the mountain considered probably to be *A. novocambrica.*

It is thus impossible at present to be certain of the correct name for this population.

GENUS *CHLORITIS* BECK, 1837

Chloritis Beck, 1837, Index Molluscorum...Christiani Frederici, p. 24–type species *Helix ungulina* Linné, 1758 by subsequent designation of von Martens (1860: 162).

Discussion

Because the type species, *Chloritis ungulina* (Linné, 1758) from Ceram, Indonesia, has not been dissected and is very different in shell form (sunken apex, globose body whorl, surface texture) from the species dissected here, *'Chloritis' argilacea* (Férussac, 1821) from Timor, no formal diagnosis is presented. Quite probably they will be placed in different genera, but until the genotype of *Chloritis* has been dissected, separation is premature.

The absence of a penis sheath and verge or vergic papilla, shortened duct and non-expanded head of the spermatheca, long epiphallic flagellum (EF, **Fig. 31a**), large epiphallic caecum (EC), and very short free oviduct (UV) easily separate *'Chloritis' argilacea* (Férussac, 1821) from the dissected Australian chloritids. *Parglogenia* Iredale, 1938 **(Fig. 32a)** has an even shorter spermatheca, but lacks the epiphallic appendages and has very different internal sculpture in the penis (P) and epiphallus (E) (compare **Figs 31b** and **32b-d**). Both taxa have a reduced form of the postapical sculpture **(Plate 11b, d)** that is so well developed in *Austrochloritis* **(Plate 10b-f)**. This dissection does confirm that the *'Chloritis'* complex of Indonesia, and probably South East Asia and China, is clearly related to the Australian taxa, even though differing in at least details.

'CHLORITIS' ARGILACEA (FÉRUSSAC, 1821)

(Plate 11c-d; Figs 31a-b)

Helix argilacea Férussac, 1821, Tableau Systématique de la famille des Limacons, Cochleae, p. 30, no. 38–Timor, les Moluques.

Helix argillacea (sic) (Férussac), Pfeiffer, 1848, Monog. helic. viv., **1:** 320-321–references to early literature.

Helix (Hadra) argillacea (Férussac), Wiegmann, 1892, *in* Weber's Zool. Ergeb. einer Reise Niederl. Öst-Indien, **3:** 171-189, pl. 13, figs. 1-9–anatomy and shell microsculpture.

Material studied

Near Kupang, west coast of Timor, Indonesia (4 live adults, FMNH 198441, Snellius Expedition, November 1929, ex RNHL).

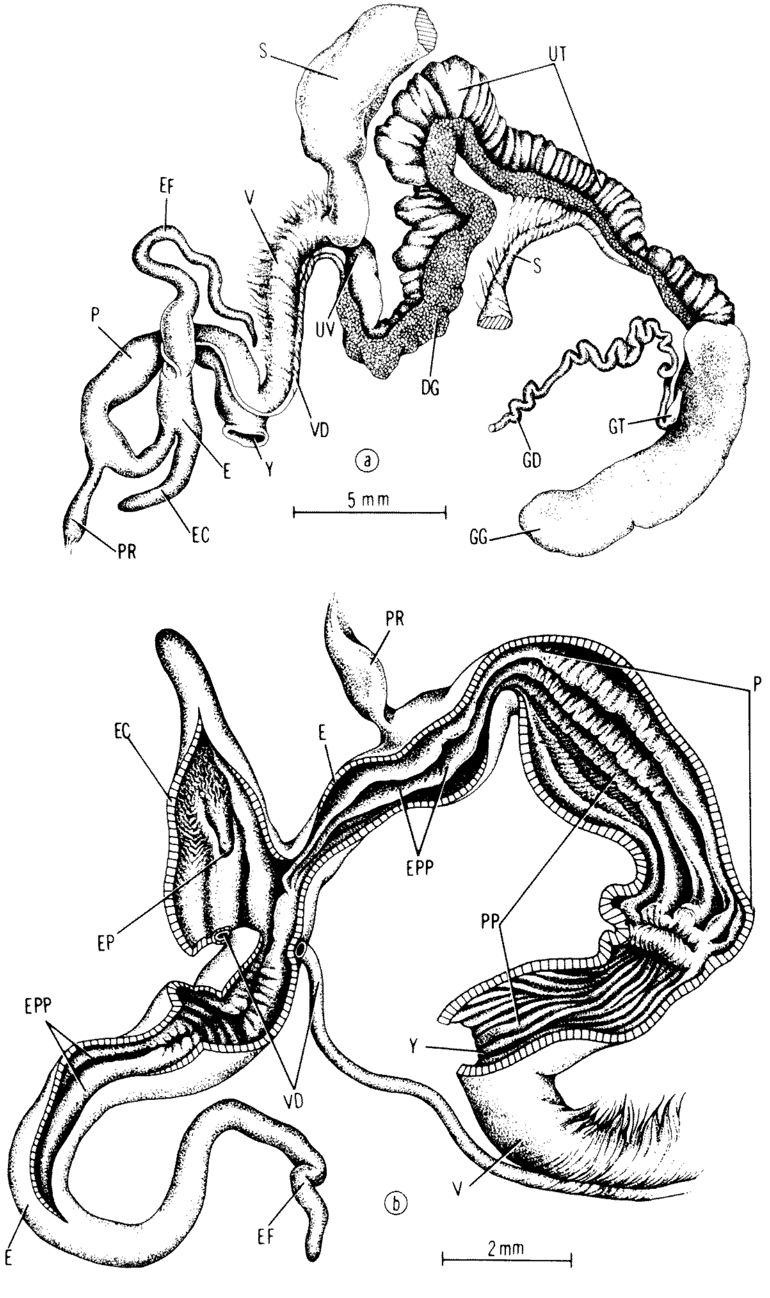

Fig. 31: Genitalia of *'Chloritis' argilacea* (Férussac, 1821), near Kupang, Timor, Indonesia, November 1929, FMNH 198441: (a) genitalia; (b) interior of penis and epiphallus. Scale lines as marked.

Discussion

The material dissected by Wiegmann (loc. cit.) was collected at 'Kupang, Timor' in February 1889, so that the material I examined is from at least a neighbouring population. Except for differing terminology, our observations on the genitalia agree except for seasonal factors. His adult specimen (Wiegmann, 1892: pl. 13, fig. 13) has the spermathecal shaft swollen noticeably, indicating mating had occurred. His juvenile example (Wiegmann, 1892: pl. 13, fig. 7) has the small albumen gland indicative of adolescence in that wet season, although the male genitalia looks to be of functional size. The ovotestis is juvenile in appearance. The preservation of the November 1929 specimens was such that the ovotestis details could not be worked out. The widened area in the base of the epiphallic flagellum (EF, **Fig. 31b**) shown just below the cut vas deferens in the drawing, was filled with a congealed mass similar to that occupying the expanded portion of the spermathecal shaft, but the nature of the material could not be determined.

Most references to this species have used *'argillacea'* rather than the correct *'argilacea'* in the early literature. No attempt has been made to present a complete synonymy. The variation in shell size and shape is summarized in **Table 9** for comparative purposes.

GENUS *PARGLOGENIA* IREDALE, 1938

Parglogenia Iredale, 1938, Australian Zool., **9** (2): 99–type species *Helix pelodes* Pfeiffer, 1846 by original designation.

Diagnosis

Shell relatively large, with strongly and almost evenly elevated spire. Apical sculpture of anastomosing ridges initially, becoming pustulated after first half whorl **(Plate 11a).** Postapical whorls with microsculpture of very small, rather widely spaced setae and extremely fine ridgelets **(Plate 11b)** with weak radial ribs appearing on spire and body whorl. Umbilicus very narrow, partly covered by reflected lip, internally with crowded pustules. Body whorl globose, rounded, only slightly descending behind lip, which is strongly reflected, thin, white, widest at umbilical margin. Shell very light yellow brown, without bands or colour zones. Genitalia **(Figs 32a-d)** with hermaphroditic duct (GD) entering laterally on talon (GT), spermatheca (S) very short, without enlarged head. Free oviduct (UV) with glandular, convoluted walls rather than a simple tube. Vagina (V) and penis (P) very long, atrium (Y) short. Vas deferens (VD) with a very peculiar bifurcated caecum (VC) on ascending arm and entering the epiphallus (E) at the point of insertion of the penial retractor muscle (PR) without differentiation. A narrow, raised ridge

Fig. 32: Genitalia of *Parglogenia pelodes* (Pfeiffer, 1846), Sta. WA-107, Dudley Point, Darwin, Northern Territory, 9 March 1974, FMNH 182450, Dissection A: (a) genitalia; (b) detail of penis-epiphallus junction; (c) detail of middle of penis interior; (d) detail of penis base interior. Scale lines as marked.

separates the epiphallus (E, **Fig. 32b**) from the penis, whose walls **(Figs 32b-d)** are sculptured with longitudinal corrugated ridges until just before atrium (Y, **Fig. 32d**). No penis sheath, verge, or epiphallic appendages present. Penial retractor muscle (PR) inserting on head of epiphallus.

Type species: *Helix pelodes* Pfeiffer, 1846 by original designation.

Discussion

Ignoring the elongation of the penis and vagina, which may have led to the changed insertion of the penial retractor muscle, the absence of penis sheath, verge, any epiphallic appendages, the great shortening of the spermatheca, changed entrance of the hermaphroditic duct into the talon, presence of a ridge between the penis and epiphallus, a caecum on the vas deferens, and the corrugated longitudinal pilasters in the penis chamber offer rather striking contrast to the structural pattern seen in the other genera. In retaining the shell microsculpture of setae and ridgelets **(Plate 11b),** *Parglogenia* agrees with *Semotrachia, Austrochloritis,* and *'Chloritis' argilacea,* but the anatomy is very different. Only the latter species, in having a distinctly shortened spermatheca that lacks an expanded head **(Fig. 31a)** approaches in any way the features of *Parglogenia.* It stands as the phylogenetically most isolated taxon of this group.

Iredale (1938: 99-100) raised a number of questions concerning the identity of several mid-1800 taxa from Western Australia and the Northern Territory. Solution of these problems is beyond the scope of this report. The populations from near Darwin seem to be correctly referred to *Helix pelodes* Pfeiffer, 1846. Whether *Helix prunum* Férussac, 1819, or *Helix subgranosa* Le Guillou, 1842 have any relationship to *Helix pelodes* is uncertain. I also consider it highly unlikely that *Helix forrestiana* Angas, 1875 is related to this group at all. It looks like no Western Australian shell that I have seen and may be from a very different locality. Resolution of these problems is left to others.

PARGLOGENIA PELODES (PFEIFFER, 1846)

(Plate 11a-b; Figs 32a-d)

Helix pelodes Pfeiffer, 1846, Proc. Zool. Soc. London, **1845:** 126–North Coast of Australia; Pfeiffer, 1848, Monog. helic. viv., **1:** 333.

Helix prunum Reeve, 1852 (not Férussac, 1819), Conch. Icon., *Helix,* pl. 68, fig. 353–Australia; Cox, 1868, Monog. Australian Land Shells, p. 43, pl. 4, fig. 6–Port Essington, Australia.

Chloritis pseudoprunum Pilsbry, 1893, Man. Conch., (2) **8:** 271-272, pl. 55, figs. 13-15–North-western Australia.

Parglogenia pelodes (Pfeiffer), Iredale, 1938, Australian Zool., **9** (2): 99.
Austrochlorites (sic) (Gloreugenia) coxeni Smith & Dartnall, 1976, J. Malac. Soc. Aust., **3** (3-4): 186 – native bush near Darwin.

Nomenclature and types

Considerable confusion exists concerning this taxon. Pfeiffer's original measurements of diameter 31 mm, height 20 mm, with 6 whorls exceeds the range of material studied in this report. The type has not been illustrated and I could not locate it in the BMNH. A reference to Martini and Chemnitz, 2nd edition, *Helix*, no. 327, pl. 58, figs. 6-7 in Pfeiffer (1848: 333) was copied by Iredale (1938: 99). This reference appeared several years before the Martini and Chemnitz section alluded to, and apparently Pfeiffer had changed his mind, since no. 327 and pl. 58, figs 6-7 cover the California land snail *Helminthoglypta dupetithouarsi* (Deshayes, 1840). Assignment of *Helix pelodes* to this taxon, rather than the well described and figured *Chloritis pseudoprunum* Pilsbry, 1893 is from a desire to avoid a genus with an unknown species as type and the size variability found in Northern Territory *Xanthomelon*. Accepting their synonymy seems the most practical solution.

The restriction of the type locality of *pseudoprunum* to Darwin is proposed here, since the specimens from there are the same range in size as the type. The type locality of *pelodes* was restricted to Port Essington by Iredale (1938: 99), probably on the basis of the Cox (1868: 43) commentary. Until the type is seen and the range of the species is known, such restriction is unwise and is not accepted here.

Comparative remarks

The very high spire, globose shape, large size, presence of setae in reduced number, and weak radial ribs on the shell combine to separate *Parglogenia pelodes* conchologically from *Xanthomelon* **(Plate 1; Figs 1-2).** The Napier Range *Kimboraga micromphala* (Gude, 1907) is very similar in size and shape, but the shell sculpture of incised spiral lines on the spire and body whorl plus very different anatomy show that the similarities are convergent. No other Western Australian taxa are apt to be confused with *Parglogenia pelodes*. Comparisons with other possible *Parglogenia* and eastern Australian 'chloritids' such as *Gloreugenia* Iredale, 1933 and *Calvigenia* Iredale, 1938 are beyond the scope of this report.

Holotype of *Chloritis pseudoprunum* Pilsbry, 1893

ANSP 62411, north-western Australia. Height of shell 21.2 mm, diameter 26.1 mm, H/D ratio 0.812, whorls 5⅜+, umbilical width 2.3 mm, D/U ratio 11.3.

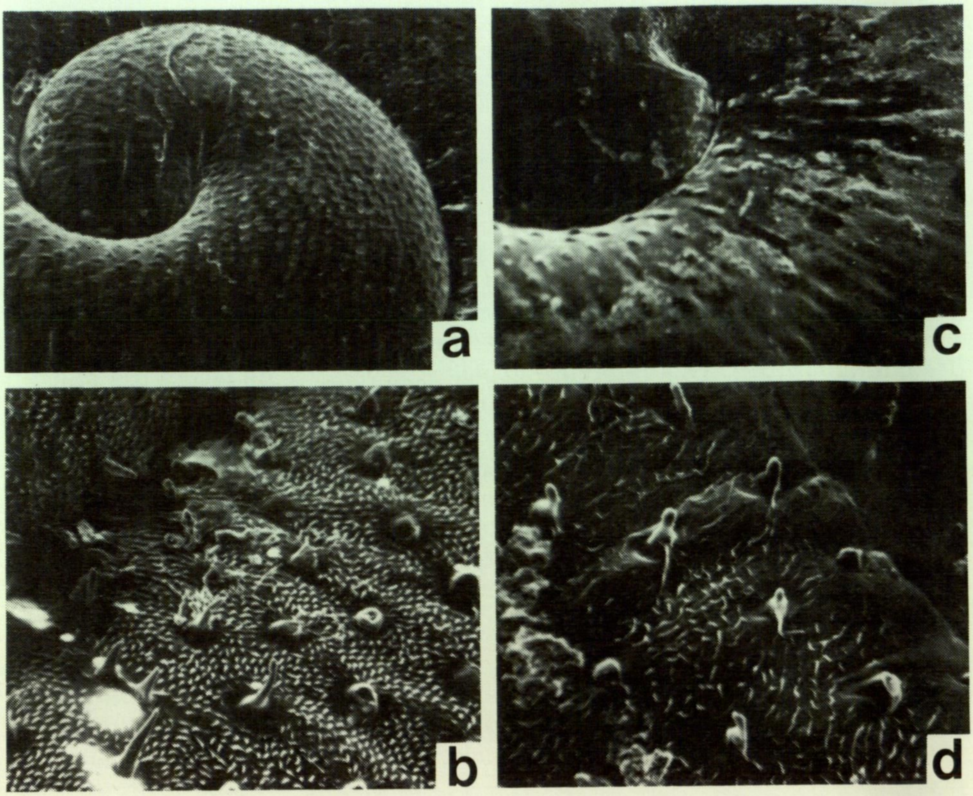

Plate 11: Shell sculpture of *Parglogenia* and *'Chloritis' argilacea:* (a-b) *Parglogenia pelodes* (Pfeiffer, 1846), FMNH 182450, Sta. WA-107, Darwin, Northern Territory; (a) shell apex at 39X, (b) midspire sculpture at 91X; (c-d) *'Chloritis' argilacea* (Férussac, 1821), FMNH 198441, near Kupang, Timor, Indonesia; (c) shell apex at 8IX, (d) midspire sculpture at 174X.

Material studied

Sta. WA-103, East Point Forest Reserve, Darwin, Northern Territory (16 dead adults, FMNH 182329, FMNH 182711, WAM 182.79, A. Solem and L. Price, 7 March 1974); Sta. WA-105, 3 km south of Rum Jungle on Batchelor Road, near Darwin (2 dead adults, FMNH 182339, WAM 180.79, A. Solem and L. Price, 8 March 1974); Sta. WA-107, Dudley Point, Darwin (10 live and 17 dead adults, FMNH 182337, FMNH 182450, WAM 181.79, WAM 183.79, A. Solem and L. Price, 7 March 1974); Sta. WA-109, Casuarina Reserve, north of Brinkin, coastal of Tiwi, Darwin (3 dead adults, FMNH 182355, WAM 179.79, A Solem and L. Price, 9 March 1974); Port Darwin (2 dead adults, FMNH 41579, ex Webb, Fulton, Gude).

Diagnosis

Shell large, diameter 20.6-26.8 mm (mean 23.50 mm), with 5 to 5½ (mean 5¼) normally coiled whorls. Apex and spire strongly and almost evenly elevated, body whorl not to very slightly deflected behind aperture, shell height 15.8-21.6 mm (mean 18.7 mm), H/D ratio 0.735-0.868 (mean 0.797). Apex with anastomosing radial ridges and pustules **(Plate 11a)**, postapical sculpture of fine, rather widely spaced setae and microridgelets **(Plate 11b)**, joined by weak radial ribs on the lower spire and body whorl, sculpture generally eroded or abraded except near sutures. Lip thin, sharply reflected, white to purple in colour, expanded to partly cover umbilicus, which is 1.2-3.0 mm (mean 1.73 mm) in width, D/U ratio 8.88-19.2 (mean 13.9). Shell colour yellow brown, without darker markings, fresh collected shells with coloured lip that rapidly fades, parietal callus thin and white. Based on 48 measured adults.

Genitalia **(Figs 32a-d)** as outlined in the generic diagnosis. Based on dissection of 3 adults.

Discussion

Because the shell of *Parglogenia pelodes* (Pfeiffer, 1846) is very similar in size and shape to that of *Kimboraga micromphala* (Gude, 1907) from the Napier Range, a diagnosis of the shell variation has been presented. It is quite possible that *Parglogenia* might range into Western Australia, although it was not taken in the Ningbing Ranges during 1976 and 1977.

Variation among the populations sampled near Darwin was less than that found in *Xanthomelon durvillii* (Hombron & Jacquinot, 1841) **(Table 2)**, but in the same direction. Comparing materials of the two species from Stas. WA-103 and WA-109, the mean difference in diameter is 14.6% larger in the WA-109 *P. pelodes*, but 42.9% larger in *X. durvillii*. Shell height differed equivalently, but whorl counts and H/D ratios showed no trends in variation.

As in the *Xanthomelon* collected simultaneously, the genitalia was in the process of deactivating for the dry season with reduced prostate (DG), uterus (UT), and ovotestis (G).

GENUS *HADRA* ALBERS, 1860

Hadra Albers, 1860, Die heliceen, 2nd edition edited by von Martens, pp. xiv, 165-166–type species *Helix bipartita* Férussac, 1822 by original designation; Pilsbry, 1894, Man. Conch., (2) **9**:131-132; Iredale, 1937, Australian Zool., **9** (1): 19-22.

Micardista Iredale, 1933, Rec. Australian Mus., **19:** 47–type species *Helix (Camaena) barneyi* Cox, 1873 by original designation.

Nomenclature and previous work

The larger camaenids from Queensland and northern New South Wales are extremely variable and have received a plethora of specific and generic names. Martin J. Bishop, formerly Curator of Molluscs at the Queensland Museum, Brisbane, has spent considerable time studying this interesting group and will be publishing on them. He has indicated to me (pers.comm.) that *Micardista* has the same basic anatomy as does the genotype of *Hadra* and thus the two genera are synonymous. Illustrations of the anatomy of *Hadra bipartita* (Férussac, 1822) have been prepared **(Figs 34, 35)** since the family name Hadridae Iredale, 1937 is based on this species. The data presented here agree with the account of Pace (1901). No diagnosis of *Hadra* is presented since Martin Bishop is in the process of revisionary studies on the Queensland genera.

The probable expanded range of *Hadra* will include part of New Guinea and many wet areas of Queensland, thus extending much further south than the North Queensland range that has been cited traditionally.

Discussion

The inclusion of a Western Australian species in *Hadra* on the basis of shell structure only is subject to questioning and possible correction upon eventual obtaining of material for dissection. The alternative to inclusion of this species in *Hadra* is description of a new genus. Because the shells of *Hadra barneyi* (Cox, 1873) **(Figs 33a-c)** and *Hadra wilsoni* **(Figs 33d-f)** are so very similar, *Xanthomelon, Torresitrachia* and the chloritid-like complex do have trans-Australian distributions, and too many uncharacterized and poorly differentiated genera are clogging the Australian literature, I find assignment of this Prince Regent River species to *Hadra* a far preferable option.

HADRA BIPARTITA (FÉRUSSAC, 1822)

(Figs 34-35)

Helix bipartita Férussac, 1822, Hist. nat. Moll. terr. fluv., **1:** pl. 75A, figs. 1 left and right–Australia; Cox, 1868, Monog. Australian Land Shells, p. 54, pl. 5, fig. 7–Cape York, Albany Island, Cape Direction, north-east Australia.

Hadra bipartita (Férussac), Pilsbry, 1890, Man. Conch., (2) **6:** 126, pl. 21, figs. 43-44; Iredale, 1937, Australian Zool., **9** (1): 20–restricted type locality to Cooktown, North Queensland (15°28′S, 145°15′E).

Material studied

Below Post Office, Cooktown, Queensland (1 live adult, NMV, G. Heinsohn, June 1975).

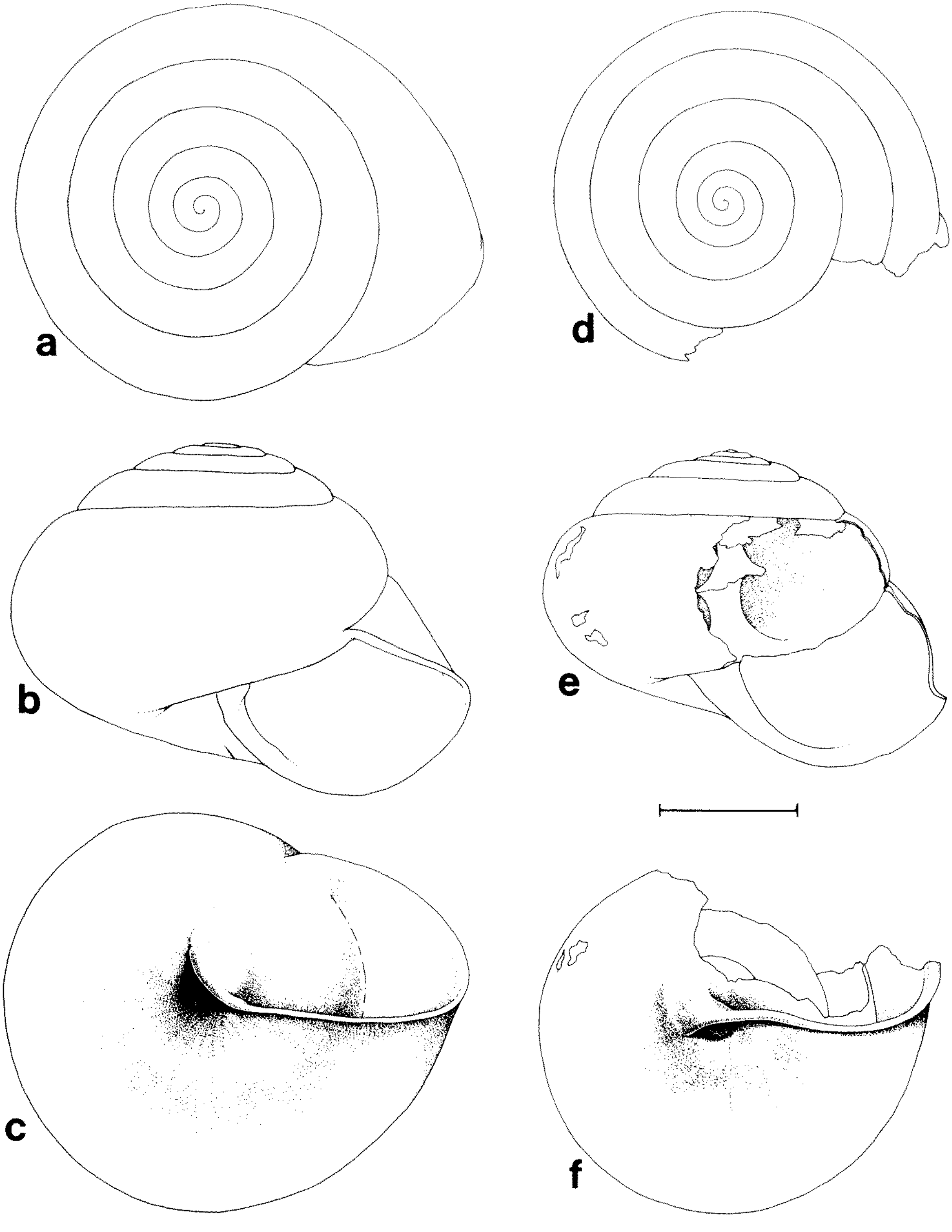

Fig. 33: Shells of *Hadra:* (a-c) *Hadra barneyi* (Cox, 1873), Island in Torres Strait, Queensland, FMNH 41585, ex Webb, Gude, Parry; (d-f) *Hadra wilsoni,* Sta. W6 (1), Youwanjela Creek, Prince Regent River Reserve, WAM holotype. Scale line equals 10 mm.

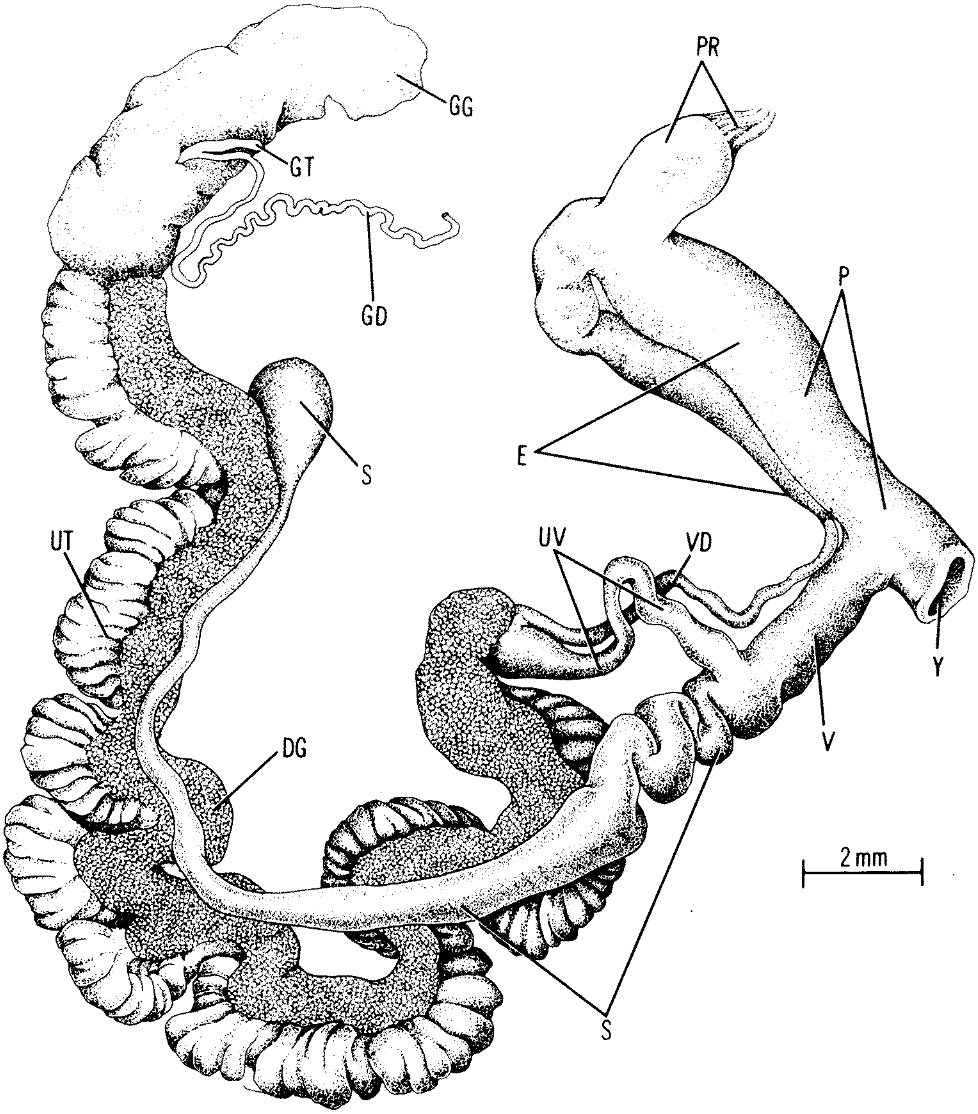

Fig. 34: Genitalia of *Hadra bipartita* (Férussac, 1822), below Post Office, Cooktown, Queensland, June 1975, G. Heinsohn, NMV. Scale line equals 5 mm.

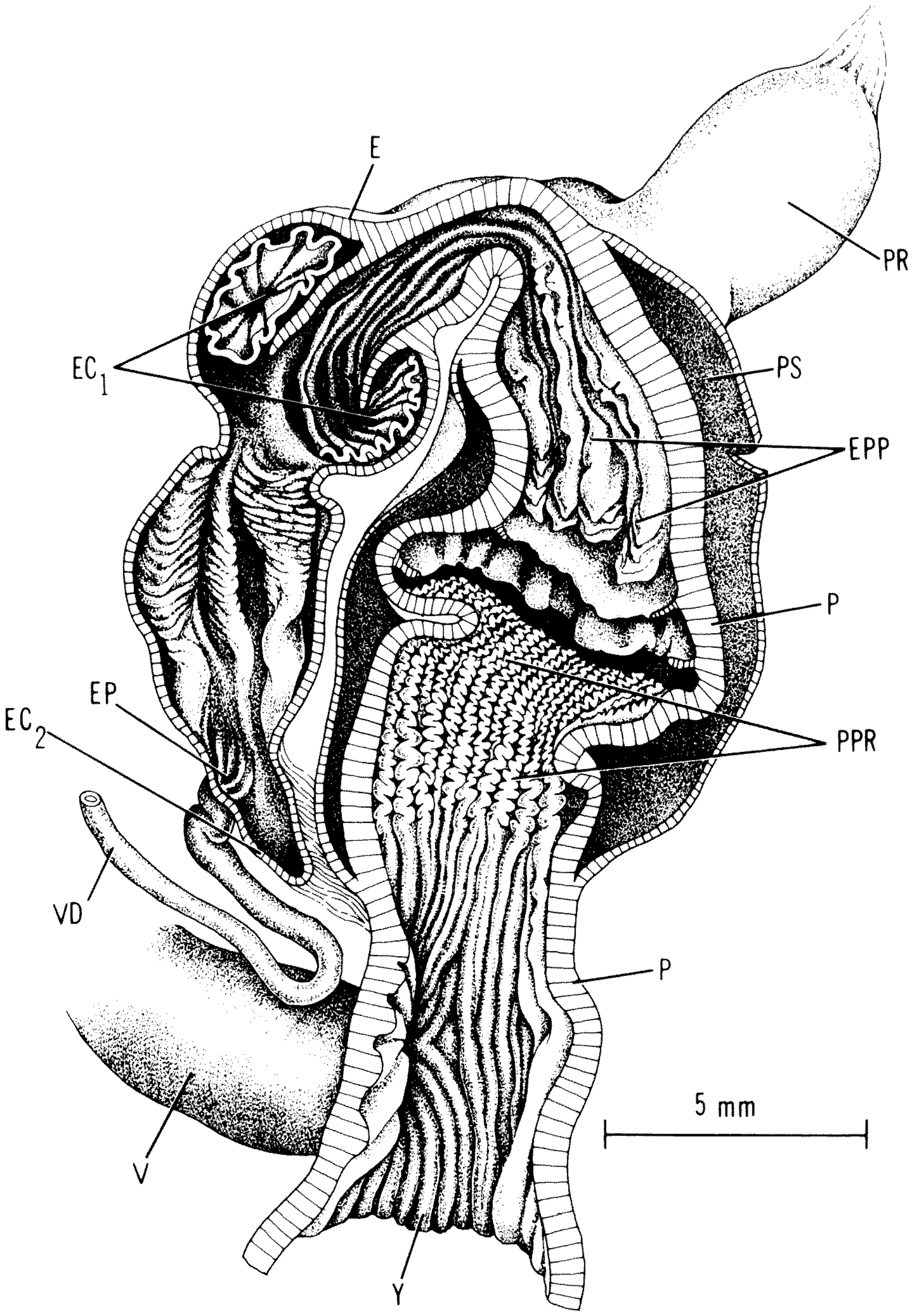

Fig. 35: Penis and epiphallus interior of *Hadra bipartita* (Férussac, 1822), below Post Office, Cooktown, Queensland, June 1975, NMV. Scale line equals 5mm.

Discussion

There is an extensive and confusing array of illustrations in the early and mid-1800s concerning this and other species of *Hadra*. The idea that the populations from near Cooktown are topotypic is accepted here, and the anatomy of an adult from this area has been illustrated **(Figs 34, 35)**. The shell has the same bicoloured pattern and matched quite well in shape the original figures.

Because it had been preserved in formalin, details of the ovotestis were not determinable, but the rest of the genitalia is illustrated. Because of the early dry season collection (June), the genitalia was in an inactive state, with greatly shrunken hermaphroditic duct (GD, **Fig. 34**), which enters near the base of the talon (GT). Prostate (DG) relatively swollen, uterus (UT) normal dry season size, spermatheca (S) with long shaft and expanded head that lies short of albumen gland base (GG). Free oviduct (UV) and basal part of spermatheca (S) coiled as artifact of partial retraction, free oviduct entering short vagina (V) at right angle. Vas deferens (VD) bound to peni-oviducal angle, then reflexing apically to enter mass of tissue and join epiphallus through a pore (EP, **Fig. 35**) surrounded by low pilasters. Penial retractor muscle (PR) inserting on head of penis sheath (PS) at point where epiphallus reflexes. Internal structure of epiphallus **(Fig. 35)** rather complex, with both a small apical caecum (EC_2) and a medial outpocketing (EC_1). Upper portion of epiphallus with a few high corrugated pilasters, lower section below EC_1 with high pilasters that initially come out of the caecum, increasing in size just before two low sphincter ridges that separate the epiphallic from the penial (P) section of the chamber. Below the sphincters, there is a corrugated line of ridges (PPR) that abruptly become simple folds near the base of the penial sheath (PS), which starts slightly above the level of the vaginal (V) entrance into the atrium (Y).

HADRA BARNEYI (COX, 1873)

(Figs 33a-c)

Helix (Camaena) barneyi Cox, 1873, Proc. Zool. Soc. London, **1873:** 148, pl. 16, fig. 2–Barney Island, Torres Strait.
Helix (Hadra) barneyi Cox, Pilsbry, 1890, Man. Conch., (2) **6:** 165, pl. 34, fig. 6.
Thersites (Sphaerospira) barneyi (Cox), Pilsbry, 1894, Man. Conch., (2) **9:** 133.
Micardista barneyi (Cox), Iredale, 1933, Rec. Australian Mus., **19** (1): 47–corrects type locality to Cape Sidmouth, North Queensland (13°25′S, 143°36′E); Iredale, 1937, Australian Zool., **9** (1): 37.

Material studied

Barney Island, Torres Strait, Queensland (6 dead adults, 1 dead juvenile, AM); island in Torres Strait (5 dead adults, AM C.11729, ex Hargraves, FMNH

41585, ex Gude, Layard, Parry); Queensland (2 dead adults, AM C.17628, ex Brazier); main telegraph station, Cape York (1 dead adult, AM, F.J. Briggs); 16 km east of Coen (4 dead juveniles, AM, 21 June 1960); Silver Plains, Coen (3 dead juveniles, AM, 23 June 1960); Batavia River (1 dead adult, AM C.6650, W.E. Roth); under logs in scrub, Weipa (1 dead adult, AM); Mapoon, Gulf of Carpentaria (1 dead adult, AM, ex Hedley); Warlock Downs, Batavia River, Cape York (3 dead adults, 1 dead juvenile, AM, F.J. Briggs); 32 km south of Archer River (8 dead juveniles, AM, 27 June 1960); near junction of Hayes Mission River, Weipa, Cape York (3 dead adults, 9 dead juveniles, AM C.88682, K. O'Gower, 17 June 1972).

Diagnosis

Shell medium in size, diameter 32.6-41.3 mm (mean 35.49 mm), with 5¾ to 6¾ (mean 6¼ –) whorls that increase regularly in size. Apex and spire strongly elevated, dome-shaped, shell height 25.4-34.35 mm (mean 28.13 mm), H/D ratio 0.747-0.899 (mean 0.792). Apical whorls worn smooth in all available material, postapical sculpture of at most weak radial growth ridges. Body whorl rounded, descending sharply behind lip **(Fig. 33b).** Lip narrow, slightly reflected except wider near the umbilicus. Umbilicus narrow, not decoiling, umbilical width 1.85-3.15 mm (mean 2.40 mm), D/U ratio 11.5-19.1 (mean 15.1). Umbilical lip folded partly over umbilicus **(Fig. 33c)** with gradual merging to parietal wall. Colour in fresher examples greenish brown, usually faded on spire, with a white peripheral band, darker on base, lip and area around umbilicus brown to purplish, faded in older material. Based on 23 measured adults.

Anatomy not examined.

Discussion

The above summary of shell variation has been prepared to provide a basis of comparison for the few examples of *Hadra wilsoni*. This diagnosis includes only material in the AM that agrees with the type figures of *Hadra barneyi,* and is not intended as a formal revision of the species.

Material dissected by Martin Bishop was on loan in Queensland when I reviewed the shell material in the Australian Museum and thus is not included in the variational summary above.

HADRA WILSONI SP. NOV.

(Figs 33d-f)

Comparative remarks

Hadra wilsoni shows greatest similarity to *Hadra barneyi* (Cox, 1873) in terms of size, shape, and shell colour. The latter is slightly larger in size, has the whorl width increasing more regularly, and has the umbilical lip 'folded over' **(Fig. 33c)** the umbilicus, rather than 'wrapped around' **(Fig. 33f)** as in *H. wilsoni.* The colour and texture of the shells are extremely similar, the only difference being the tendency toward a slightly smoother surface and dark peripheral colour band in *H. wilsoni,* rather than the white peripheral colour and slightly rougher surface in *H. barneyi. Hadra bipartita* (Férussac, 1822) has the same umbilicus 'fold over' as in *H. barneyi,* is much larger, evenly elevated, with a higher whorl count, and has the very striking pale spire and dark base.

Holotype

WAM 1500.78, Sta. W6 (1), valley slope on north side of Youwanjela Creek near main campsite, Upper Prince Regent River, Prince Regent River Reserve, Western Australia (1:250,000 'Prince Regent' map sheet SD51-16, grid reference 332:032, 15°34′S, 125°25′E). Collected by Barry Wilson and Peter Smith, 20 August 1974. Height of shell 24.0 mm, diameter 30.85 mm, H/D ratio 0.778, whorls 6⅛, umbilical width 1.5 mm, D/U ratio 20.6.

Paratopotypes

WAM 255.75, FMNH 200834, 2 dead adults, 1 dead juvenile from the type locality.

Diagnosis

Shell small for genus, diameter of only whole adult 30.85 mm with 6⅛ to 6¼ (mean 6+) whorls that increase slowly and evenly in width. Apex and spire strongly and almost evenly elevated, slightly dome-shaped, shell height 23.6-24.0 mm (mean 23.8 mm), H/D ratio of whole adult shell 0.778. Apical whorls and early spire smooth, shining, lower spire with irregular very weak radial growth striae. Body whorl rounded, pattern to descension of lip unknown. Lip thin, sharply reflected, wider than in *H. barneyi,* white in colour until near umbilicus where a reddish-purple suffusion exists on lip and sometimes on the parietal wall. Umbilicus narrow, not decoiling, umbilical width 1.5-2.5 mm (mean 2.0 mm), D/U ratio 9.44-20.6 (mean 14.3). Umbilical lip curved strongly around umbilicus **(Fig. 33f)** with sharp angle to parietal wall. Colour greenish brown on spire with somewhat lighter base and a tendency toward a darker peripheral band, with a reddish-purple colour spot on umbilical lip. Based on three dead adults, which had been eaten by an unknown vertebrate.

Anatomy unknown.

Discussion

The holotype and most complete adult **(Figs 33d-f)** had the upper palatal lip and portions of the penultimate whorl missing because of vertebrate predation. Two adult paratopotypes (WAM 255.75, FMNH 200834) have even greater portions of the palatal lip and penultimate whorl missing, with the damage extending further up the spire in both individuals. Apparently the same method of attack on each shell was used by the predator. The juvenile showed no equivalent damage. Unfortunately, all three adults had the upper palatal lip and the area just behind the lip missing, so that the degree of body whorl descension cannot be determined. The portion of the lip remaining curves identically to that of *H. barneyi*, so that I suspect there was fair lip descension.

The different pattern of joining the columellar lip to the parietal wall in *H. barneyi* (Cox, 1873) **(Fig. 33c)** and *H. wilsoni* **(Fig. 33f)** is the most noticeable difference between the two species. It would not surprise me if anatomical studies showed that *H. wilsoni* belongs to an undescribed genus, but except for the lip difference, I can find no reason to separate *H. wilsoni* from *Hadra*. At present it seems best to consider that *Hadra* is another trans-Australian genus.

Great pleasure is taken in dedicating this species to Barry Wilson, formerly Head, Division of Natural Sciences, Western Australian Museum, Perth and now Director, National Museum of Victoria, Melbourne, in recognition of his many contributions to the knowledge of the Western Australian biota and in appreciation of his many efforts to facilitate this project.

REFERENCES

COX, J.C. (1868)–*A monograph of Australian land shells*. Sydney: William Maddock. 111 pp., 20 pls.

COX, J.C. (1872)–Descriptions of new land-shells from Australia and the South-Sea Islands. *Proc. zool. Soc. London*. **1872:** 18-20, pl. 4.

GUDE, G.K. (1906)–Further remarks on the genus *Chloritis*, with descriptions of eleven new species. *Proc. malac. Soc. Lond.* **7:** 105-118, pl. 13.

HEDLEY, C. (1890)–Anatomical notes of the Helicidae. Part III. *Proc. R. Soc. Qd* **6:** 249-251, pl. 15.

IREDALE, T. (1933)–Systematic notes on Australian land shells. *Rec. Aust. Mus.* **19:** 37-59.

IREDALE. T. (1937)–An annotated check list of the land shells of South and Central Australia. *S. Aust. Nat.* **18:** 6-59, 2 pls.

IREDALE, T. (1938)–A basic list of the land Mollusca of Australia–Part III. *Aust. Zool.* **9:** 83-124, pls 12-13.

IREDALE, T. (1939)–A review of the land Mollusca of Western Australia. *J.R. Soc. West. Aust.* **25:** 1-88, pls 1-5, map.

IREDALE, T. (1941)–A basic list of the land Mollusca of Papua. *Aust. Zool.* **10:** 51-94, pls 3-4.

IREDALE, T. (1943)–Guide to the land shells of New South Wales. Part V. *Aust. Nat.* **11:** 61-69, 4 text figs.

LIND, H. (1973)–The functional significance of the spermatophore and the fate of spermatozoa in the genital tract of *Helix pomatia* (Gastropoda: Stylommatophora). *J. Zool., Lond.* **169:** 39-64, 2 pls, 8 tables, 5 text figs.

MARTENS, E. von (1860)–*Die Heliceen nach natiirlicher Verwandtschaft.* 2nd ed. Leipzig: Engelmann. xviii, 359 pp.

MERRIFIELD, H.E., SLACK-SMITH, S.M. & WILSON, B.R. (1977)–Report on the mollusc fauna of the Drysdale River National Park, North Kimberley, Western Australia. *Wild. Res. Bull. West. Aust.* no. 6: 110-120.

PACE, S. (1901)–Note on the anatomy of *Thersites (Hadra) bipartita* (Fér.). *Proc. malac. Soc. London.* **4:** 205-207, 2 text figs.

PFEIFFER, L. (1848)–*Monographia heliceorum viventium* **1.** Leipzig: Brockhaus.

PILSBRY, H.A. (1894)–*Manual of conchology.* (2) **9:** 49-160.

SALISBURY, A.E. (1934)–VIII. Mollusca. *Zool. Rec.* **1933:** 1-118.

SMITH, E.A. (1894)–On the land-shells of Western Australia. *Proc. malac. Soc. Lond.* **1:** 84-99, pl. 7, figs 8-32.

WIEGMANN, F. (1892)–Beiträge zur Anatomie der Landschnecken des Indischen Archipels. Vol. 3, pp. 112-259, pls 9-16. in *Zoologische Ergebnisse einer Reise in niederlandisch Öst-Indien;* ed. Max Weber. Leiden: Brill.

WILSON, B.R. & SMITH P.R. (1975)–A report on the mollusc fauna of the Prince Regent River Reserve, North-West Kimberley, Western Australia. *Wild. Res. Bull. West. Aust.* no. 3: 97-100.