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New species and genera of Pinwheel Snails from the brigalow lands of south central Queensland (Gastropoda: Eupulmonata: Charopidae)

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ABSTRACT

Six new genera and 15 new species of Charopidae are described from the brigalow lands of south central Queensland (SCQ) as follows: *Rhophodon moffatt* sp. nov., *Tristanoropa saddler* sp. nov., *Tristanoropa crowman* sp. nov., *Tristanoropa palmgrove* sp. nov., *Brigaloropa costulata* gen. et sp. nov., *Arcadiaropa sunnyholt* gen. et sp. nov., *Eddiea carnarvon* gen. et sp. nov., *Eddiea waddybrae* gen. et sp. nov., *Eddiea oakwells* gen. et sp. nov., *Eddiea bigge* gen. et sp. nov., *Platyumbiropa grafton* gen. et sp. nov., *Platyumbiropa tabor* gen. et sp. nov., *Carnaropa racecourse* gen. et sp. nov., *Carnaropa salvatorosa* gen. et sp. nov. and *Cineropa roma* gen. et sp. nov. *Elsothera hewittorum* Stanisic, 1996 previously only known from Mt Rose Station, via Taroom, SCQ is given a slightly expanded range and reassigned to *Cineropa* gen. nov.; the range of *Spiraliropa carnarvon* Stanisic, 2010 described from the Carnarvon Ranges is greatly expanded to cover more of the SCQ area; and additional new SCQ locality records are provided for the continentally widespread *Discocharopa aperta* (Möllendorff, 1888).

❑ *Mollusca, Eupulmonata, Charopidae, south central Queensland, protoconch sculpture, new genera, new species.*

Pinwheel Snails (Charopidae) from the semi-arid Brigalow Lands Bioregion of South Central Queensland (hereafter SCQ, roughly 23º30′-26º00′S × 146º30′-149º30′E) have historically been poorly represented among the Queensland Museum (QM) land snail collections. Consequently, up to the present only two species, *Elsothera hewittorum* Stanisic, 1996 and *Spiraliropa carnarvon* Stanisic, 2010 have been described from this relatively vast and semi-arid region.

In October 2014 the author was invited to participate in a Bush Blitz land survey (see 'Acknowledgements') on Carnarvon Station Reserve, SCQ that led to the collection of a small number of charopid species from vine thicket habitats including some new species. Shortly thereafter, Roma-based malacologist and environmental consultant Craig Eddie donated 65 lots of assorted SCQ charopids to the QM. These specimens, accumulated over many years from diverse localities and habitats (chiefly vine thickets) in SCQ, included a number of additional species identified as new to science.

The aim of this study was to document these new species from a region greatly damaged by land clearing in the past and currently under threat from mining development.

Six genera and fifteen species of Charopidae from the brigalow region of SCQ are described as new; the previously described *Elsothera hewittorum* Stanisic, 1996 is reassigned to a new genus with additional records documented for the species; and additional distribution data in SCQ are provided for the regionally endemic *Spiraliropa carnarvon* Stanisic, 2010 and the wide-ranging *Discocharopa aperta* (Möllendorff, 1888).

MATERIAL AND METHODS

This study, with a single exception, is based on material housed in the Queensland Museum's land snail collections (QMMO). One lot from the Salvator Rosa Section of Carnarvon NP, SCQ is from the Australian Museum, Sydney (AMSC). Apart from several lots of preserved snails this material is comprised chiefly of dead shells covering a range of age classes (mostly juvenile and sub-adult) recovered from leaf litter sorting. Investigations of shell characters are confined, with one exception, to specimens with greater than 4.0 whorls which designates an adult snail. Characters scored include shell height and diameter, protoconch whorl numbers and diameter, whorl count, rib count on the first whorl and umbilical width. Whorl counts were made to the nearest 1/8 whorl following Solem (1983). Specimens were studied using a WILD M5 stereo microscope. High resolution images of shells were obtained using a Visionary Digital BK-Plus lab system camera set-up located in the Queensland Museum's Digital Imaging Unit. Shell sculpture was investigated and photographed using a TM-1000 Tabletop Scanning Electron Microscope (SEM) located in the Queensland Museum.

Due to the fragile nature of many of the specimens recovered by sorting leaf litter, only limited ultrasonic cleaning of shells was attempted in most cases. Hence, many of the illustrated specimens remain covered in fine dirt particles. This shortcoming in presentation however, should not interfere with species' identifications.

Abbreviations. alt, altitude; AM, Australian Museum, Sydney; Ck, Creek; Mt, Mountain; MV, Museum of Victoria; NP, National Park; NSW, New South Wales; NENSW, north-eastern New South Wales; NEQ, north-eastern Queensland; MEQ. mid-eastern Queensland; NP, National Park; R, River; Ra, Range; RC, dry collection; SC, spirit collection; SCQ, south-central Queensland; SEM, scanning electron microscopy; SEQ, south-eastern Queensland; sevt, semi-evergreen vine thicket; SF, State Forest; Stn, Station.

Generic differentiation and species delimitation

Holcroft (2018a) established a framework for utilising protoconch sculpture as a means of recognising putative charopid genera in the absence of soft parts for the study of reproductive structures and DNA analyses. This protoconch framework, adopted in this study, is considered to produce a more systematic grouping of species' clusters (genera) than has previously been the case. The underlying hypothesis is that protoconch architecture as part of the embryonic shell formed in the egg, is more likely to be an indicator of close relationships between species than the post-hatched teleoconch (adult shell) which is formed subject to varying environmental pressures. The study of Shea *et al*. (2012) has already shown that there is a strong genetic basis for such an approach.

Hence, the new genera introduced in this study are diagnosed on differences in protoconch sculptures, some previously documented but many new. The protoconch sculptures that define the new genera are considered distinctive and unique among the many sculptural patterns documented in previous studies thus far (Stanisic 1990; Hyman & Stanisic 2005; Shea *et al*. 2012; Stanisic 2016; Holcroft 2018 a,b,c; Holcroft & Stanisic 2018). In many cases, they are based on subtle interpretation of sculptural architecture that is visible only by SEM. Charopids are inherently rich in shell characters and consequently new species have been diagnosed on the basis of the protoconch sculpture combined primarily with coiling pattern, shell shape, apertural barrier formation and teleoconch sculpture.

SYSTEMATICS

Order EUPULMONATA

Superfamily PUNCTOIDEA

Family CHAROPIDAE

Spiraliropa Stanisic, 2010

Spiraliropa Stanisic, 2010 (in Stanisic *et al*. 2010): 256.

Type species. *Spiraliropa carnarvon* Stanisic, 2010-by original designation.

Diagnosis. Shell tiny, brown, discoidal with a flat spire; whorls rounded, sutures strongly impressed; protoconch spiral consisting of 12-13 widely spaced, slender, high spiral cords; teleoconch sculpture of crowded, slightly irregularly spaced, bladed radial ribs, microsculpture of fine radial threads and low spiral cords; umbilicus wide, V-shaped.

Remarks. *Spiraliropa* Stanisic, 2010 is readily distinguished among the SCQ charopid genera hitherto diagnosed by the combination of tiny brown shell, protoconch with 12—13 widely spaced, slender spiral lirae and teleoconch with crowded and bladed radial ribs. The protoconch sculpture bears a strong similarity to that of *Comularopa* Holcroft, 2018 described from the highland rainforests of the Clarke Range, MEQ (Holcroft 2018b). A significant difference between the two genera is the structure of the spiral cords on the protoconch which are more slender, almost flimsy, in *S. carnarvon* when compared with the slightly broader and more robust cords of both *C. georginae* Holcroft, 2018 and *C. wendyae* Holcroft & Stanisic, 2018.

Spiraliropa carnarvon Stanisic, 2010
(Figs 1A-B, 6A-B)

Spiraliropa carnarvon Stanisic, 2010 (in Stanisic *et al*. 2010): 256.

Common name. Carnarvon Pinwheel Snail.

Material examined. All SCQ. Holotype. QMMO66493, Carnarvon NP, Mt Moffatt Section, summit of Mt Moffatt, SCQ, 25º 03′ 33″ S, 148º 02′ 36″ E, vine thicket, coll. C. Eddie, 4.ix.1999. Height of shell 1.64 mm, diameter 3.28 mm, width of umbilicus 1.23 mm, D/U 2.67, H/D 0.50, whorls 3.875.

Paratypes. QMMO78979, 3RC, same data as holotype; QMMO65348, 4RC, Carnarvon NP, Mt Moffatt Section, N Marlong Arch plain, 24º 53′ 54″ S, 147º 58′ 07″ E, woodland/vine thicket, coll. C. Eddie, G. Enerver, 27.xi.1996.

Other material. QMMO23488, 8SC/2RC, Blackdown Tableland NP, Rainbow Falls Walk, 23º 49′ S, 149º 05′ E, wet sclerophyll with ferns/palms, under logs, coll. J. Stanisic, D. Potter, J. Chaseling; QMMO66440, 2RC, Lonesome NP, Arcadia Valley Rd, 25º 29′ 26″ S, 148º 48′ 58″ E, brigalow woodland, coll. C. Eddie, 27.v.1999; QMMO65316, 1RC, Taroom, NW at Expedition NP, Amphitheatre Section, 25º 12′ 24″ S, 148º 59′ 18″ E, sevt, under logs, coll. C. Eddie, G. Annabell, 26.v.1998; QMMO86616, 5RC, Injune, 48 km NNE at Hilly Vale Stn, Arcadia Valley, 25º 28′ 41″ S, 148º 49′ 34″ E, sevt/Brachychiton on sandstone, in leaf litter/under and in logs, coll. C. Eddie, 20.i.2004; QMMO86569, 2RC, 36.7 km ENE at Moonah Stn, 25º 43′ 49.1″ S, 148º 54′ 43.4″ E, sevt on sandstone, in leaf litter/under and among rocks, coll. C. Eddie, 09.xi.2011; QMMO86601, 1RC, Injune, 50.1 km NE at Lonesome Holding, NE end of Mt Jiman, 25º 29′ 23″ S, 148º 52′ 47″ E, depauperate sevt on sandstone, in leaf litter/under and among rocks, coll. C. Eddie, 16.xii.2003; QMMO86612, 19RC, Carnarvon NP, Mt Moffatt Section, N side Mt Moffatt peak, 25º 03′ 24″ S, 148º 02′ 41″ E, sevt/basalt scree, in litter among rocks, coll. C. Eddie, 13.x.2002; QMMO86821, 6RC, Carnarvon NP, Mt Moffatt Section, ridge NW Lots Wife, SCQ, 24º 56′ 00″ S, 148º 05′ 43″ E, sevt/sandstone, in litter, coll. C. Eddie, 22.i.1999; QMMO56641, 1RC, Carnarvon NP, beginning of gorge walk, 25º 03′ 25″ S, 148º 13′ 30″ E, palms/ferns on sandstone, under logs and rocks, coll. J. Stanisic, D. Potter, 20.ix.1995; QMMO80597, 1RC, Carnarvon NP, track to Amphitheatre, Carnarvon Gorge, 25º 03′ 25″ S, 148º 13′ 30″ E, coll. G. Annabell, 8.vi.1986; QMMO86568, 4RC, Carnarvon NP, Mt Moffatt Section, on ridge west of Marlong Plain, 24º 57′ 33″ S, 147º 56′ 48″ E, brigalow woodland, in leaf litter, under/among rocks, coll. C. Eddie, 04.ii.2000; QMMO86604, 4RC, Carnarvon NP, Mt Moffatt Section, gully on W side of Gee Gee Gap Rd, 24º 56′ 55″ S, 147º 54′ 10″ E, sevt on sandstone, coll. C. Eddie, 03.iv.1996; QMMO80718, 3RC, Carnarvon Stn, 24º 43′ 44.9″ S, 147º 46′ 14.0″ E, sevt, under rocks and logs in litter, coll. J. Stanisic, L. Holcroft, 26.ix.2012; QMMO80225, 4RC, QMMO80121, 49RC, Carnarvon Stn, rocky knoll NW homestead, 24º 46.007′ S, 147º 43.533′ E, ironbark woodland/basalt scree, coll. J. Stanisic, 10.x.2014; QMMO80260, 1RC, QMMO80257, 5RC, Carnarvon Stn, N homestead, 24º 47.935′ S, 147º 45.284′ E, vine thicket/basalt scree, coll. J. Stanisic, 13.x.2014; QMMO80217, 9RC, Carnarvon Stn, NW homestead, 24º 46.008′ S, 147º 44.530′ E, vine thicket on rocky slope, coll. J. Stanisic, 9.x.2014; QMMO80117, 5RC, Carnarvon Stn, Conglomerate Spring, 24º 50.383′ S, 147º 46.973′ E, eucalypt

woodland, coll. J. Stanisic , 8.x.2014; QMMO86605, 6RC, Augathella, 158 km NE at Carnarvon Stn, 24º 48′ 04″ S, 147º 43′ 49″ E, sevt on basalt, in leaf litter/ under rocks, logs and base of figs, coll. C. Eddie, W. McDonald, 13.iv.2004; QMMO86603, 48RC, Augathella, 161 km NE at Carnarvon Stn, 24º 48′ 40″ S, 147º 46′ 30″ E, sevt on quartzite, in leaf litter/ under rocks and logs, coll. C. Eddie, W. McDonald, 16.iii.2004; QMMO86575, 47RC, Augathella, NE at Mt Tabor Stn, E slope of Urandoo, 25º 13′ 46″ S, 147º 31′ 50″ E, sevt on basalt, in leaf litter/under rocks and logs, coll. C. Eddie, W. McDonald, 22.iv.2004; QMMO86630, 107RC, Augathella, NE at Mt Tabor Stn, ENE of Urandoo, 25º 11′ 45″ S, 147º 30′ 59″ E, sevt on basalt, in leaf litter/among rocks, coll. C. Eddie, R. Alsthorpe, 24.x.2015; QMMO86580, 15RC, Yuleba, 16.5 km SW at Silver Valley Stn, 26º 44′ 10.7″ S, 149º 17′ 18.8″ E, sevt regrowth on laterite, under rocks/in leaf litter, coll. C. Eddie, A. Hoffmann, 04.01.2015; QMMO86563, 3RC, QMMO86631, 3RC, Miles, 40.6 km NW at Gurulmundi SF, 26º 24′ 34″ S, 149º 53′ 05″ E, Ficus on laterite, among leaf litter around fig roots and between boulders, coll. C. Eddie, 17.vii.2014; QMMO86581, 1RC, 'Rossmore', 8.6 km NW of Dulacca, 26º 36′ 34″ S, 149º 40′ 55″ E, open forest, among soil under log. coll. R. Johnson, A. Bendall, 07.xi.2013; QMMO79454, 3RC, Stones Country Resource Reserve, 26º 23′ 24″ S, 149º 52′ 50″ E, sevt/ooline, under logs, coll. C. Eddie, 30.vi.2003.

Diagnosis. As for genus.

Description. Shell tiny, brown, discoidal with a flat, shiny spire; whorls rounded, sutures strongly impressed; diameter 2.46-3.54 mm (mean 2.88 mm), height 1.31-1.97 mm (mean 1.45 mm), H/D 0.43-0.56 (mean 0.51): protoconch spiral, diameter 570 µm, sculptured with 12-13 widely spaced, slender, high spiral cords; teleoconch sculpture of crowded, slightly irregularly spaced, bladed radial ribs 56-90 (mean 76) on first whorl; microsculpture of fine radial threads and low, broad spiral cords forming elongate beads at their intersection; aperture ovately lunate; umbilicus wide, V-shaped, diameter 0.90-1.48 mm (mean 1.18 mm), D/U 2.20-3.08 mm (mean 2.45 mm). Based on 32 measured specimens (QMMO66493[1], QMMO78979[2], QMMO86612[4], QMMO80117[2], QMMO86630[10], QMMO86603[4], QMMO80121[4], QMMO57095[2], QMMO86580[3]).

Distribution and habitat. From Blackdown Tableland in the north to Yuleba and Gurulmundi in the south, SCQ; living under forest debris (rocks and timber) in vine thicket and brigalow woodland.

Remarks. *Spiraliropa carnarvon* Stanisic, 2010 is the most widespread charopid species investigated in the current study. Although there is some variation in the shell size of different populations this variability is also present within populations. Originally described from the Carnarvon Ranges, the range of this species is herein extended to include parts of the Expedition Range in the north, Mt Tabor and Yuleba in the south-west and south respectively.

Rhophodon Hedley, 1924

Rhophodon Hedley, 1924: 219; Iredale, 1937: 329; Iredale, 1941: 2; Kershaw, 1955: 30; Burch, 1976: 133; Smith & Kershaw, 1979: 175; Stanisic, 1990: 114; Smith, 1992: 202; Hyman & Stanisic, 2005: 222; Stanisic *et al*., 2010: 234; Stanisic *et al*., 2018: 168.

Type species. *Rhophodon peregrinus* Hedley, 1924-by original designation.

Diagnosis. Shell minute to tiny, discoidal; brown occasionally light straw-yellow with brown radial streaks and suffusions; whorls tightly coiled, sutures impressed; protoconch radial with bold radial ribs, becoming more crowded toward the protoconch-teleoconch boundary and weak, moderately spaced, short discontinuous spiral wrinkles; teleoconch sculpture of crowded radial ribs; umbilicus wide cup to saucer-shaped; apertural barriers present.

Remarks. Hedley (1924) introduced *Rhophodon* for three Australian charopids with apertural barriers. Iredale (1941) later removed *Rhophodon contortus* Hedley, 1924 and placed it in a new genus *Letomola* on the basis of differences in barrier formation and protoconch sculpture. Stanisic (1990) synonymized the Victorian *Egilodonta* Iredale, 1937 with *Rhophodon* and added four additional new species from NENSW and SEQ. Subsequently Hyman & Stanisic (2005) added a further four new species from NENSW but removed *Egilodonta* from the synonymy of *Rhophodon*. The species below is included in *Rhophodon* because it conforms to the current concept of the genus in all respects. The discovery of a species of *Rhophodon* in the moist refugia of the Carnarvon Ranges suggests

possible past connections with rainforests further east. A similar biogeographic pattern is seen in the camaenid genus *Mussonena* (see Stanisic *et al*. 2010).

Rhophodon moffatt sp. nov.
(Figs 1C-D, 6C-D)

Etymology. Named for the Mount Moffatt Section, Carnarvon NP, SCQ.

Preferred common name. Mount Moffatt Pinwheel Snail.

Material examined. All SCQ. Holotype. MO86600, RC, Carnarvon NP, Mount Moffatt Section, gorge downstream of Racecourse Spring, 24º 56′ 04″ S, 148º 05′ 49″ E, woodland with vines on basalt scree, in leaf litter among rocks, coll. C. Eddie, 18.ii.2001. Height of shell 0.82 mm, diameter 1.72 mm, width of umbilicus 0.82 mm, D/U 2.10, H/D 0.48, whorls 4.50.

Paratypes. QMMO86540, 5RC, same data as holotype; QMMO86614, 16RC, Carnarvon NP, Mount Moffatt Section, on N side of Mt Moffatt peak, 25º 03′ 24″ S, 148º 02′ 41″ E, sevt on basalt scree, in leaf litter among rocks, coll. C. Eddie, 13.x.2002.

Other material. QMMO66490, 4RC, Carnarvon NP, Mount Moffatt Section, at Racecourse Spring, 24º 56′ 00″ S, 148º 05′ 43″ E, coll. C. Eddie, 22.i.1999; QMMO86598, 1RC, Carnarvon NP, Mount Moffatt Section, gorge downstream of Foley's Spring, 24º 57′ 17″ S, 148º 09′ 57″ E, basalt gorge with tree ferns, in leaf litter among rocks, coll. C. Eddie, 12.xii.2002; QMMO86570, 8RC, Carnarvon NP, Moolayember Section, at Moolayember Gorge, 25º 12′ 13″ S, 148º 23′ 19″ E, dry rainforest on sandstone, in leaf litter from under rock and inside logs, coll. C. Eddie, 12.iv.2004; QMMO86610, 48RC, Injune 95 km NNW at Saddler Springs Stn, 25º 04′ 48″ S, 148º 07′ 27″ E, alt. 820m, vine ticket on basalt scree, in soil/leaf litter among rocks, coll. C. Eddie, 11.xii.2008; QMMO79444, 3RC, Saddler Springs Stn, Carnarvon Range, NW Injune, 25º 04′ 48″ S, 148º 07′ 27″ E, vine thicket on basalt scree, coll. C. Eddie, 11.xii.2008.

Diagnosis. Shell tiny, discoidal with a flat spire, whorls tightly coiled; protoconch radial with bold radial ribs and weak, moderately spaced, short discontinuous spiral wrinkles, teleoconch with moderately crowded radial ribs (mean 52 on first whorl) and numerous interstitial microradial threads; umbilicus wide cup-shaped; six apertural barriers present.

Description. Shell tiny, golden-brown, discoidal with a flat spire; whorls 4.125-4.50 whorls, tightly coiled, sutures impressed; diameter 1.56-1.96 mm (mean 1.75 mm), height 0.66-0.90 mm (mean 0.70 mm), H/D 0.40-0.50 (mean 0.45); protoconch radial, mean diameter 430 µm, sculptured with moderately spaced, bold radial ribs that tend to be more crowded at the protoconch-teleoconch boundary and weak, moderately spaced, short discontinuous spiral wrinkles; teleoconch sculpture of moderately crowded radial ribs 48-55 (mean 52) on first whorl, microsculpture of fine crowded microradial threads (8-10 between each major rib) continuous on the major ribs and low, slender spiral cords forming elongate beads at their intersection; aperture ovately lunate with six apertural barriers: three parietal lamellae expanded posteriorly with two long protruding beyond the aperture and one short and reset, two palatal nodules and one basal nodule; umbilicus wide, cup-shaped, diameter 0.66-0.82 mm (mean 0.78 mm) D/U 2.10-2.67 mm (mean 2.25 mm). Based on 21 measured specimens (QMMO86610 [10], QMMO86614 [10], QMMO86600 [1]).

Distribution and habitat. Carnarvon NP; living among rocks in vine thicket on basalt.

Remarks. *Rhophodon moffatt* sp. nov. is readily distinguished from the other charopids described here by the combination of tiny, discoidal shell with radially sculptured protoconch, wide cup-shaped umbilicus and the presence of six apertural barriers. *R. moffatt* most closely resembles the smaller *R. minutissimus* Stanisic, 1990 from SEQ in both general shell sculpture and the number of apertural barriers present. However, the latter differs in having three palatal barriers (rather than two) and in lacking a basal barrier.

Tristanoropa Holcroft, 2018

Tristanoropa Holcroft, 2018c: 98; Holcroft & Stanisic, 2018: 172.

Type species. *Tristanoropa hughesae* Holcroft, 2018- by original designation.

Diagnosis. Shell tiny, brown to golden-brown, discoidal, multi-whorled with a slightly sunken to slightly elevated spire, whorls numerous (>4.5) and tightly coiled; protoconch finely cancellate with 15-19 scalloped spiral cords and weak to prominent radial ribs, teleoconch with

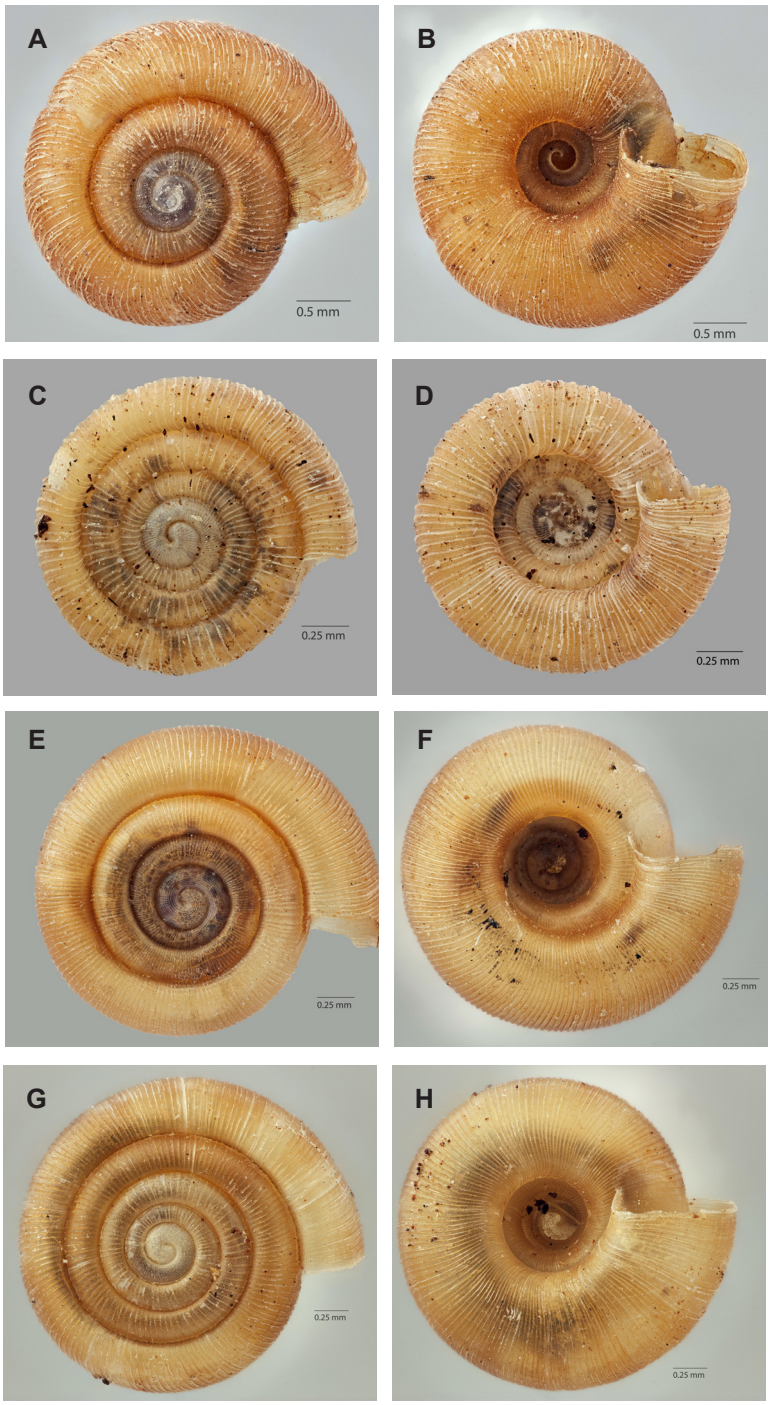

FIG. 1. Holotypes. **A-B**, *Spiraliropa carnarvon* Stanisic, 2010, QMMO66493; **C-D**, *Rhophodon moffatt* sp. nov., QMMO86600; **E-F**, *Tristanoropa saddler* sp. nov., QMMO86779; **G-H**, *T. crowman* sp. nov., QMMO86778,

crowded radial ribs; umbilicus wide V-shaped. Apertural barriers may or may not be present.

Remarks. *Tristanoropa* Holcroft, 2018 was introduced for MEQ charopids with 4.5 or more tightly coiled whorls, wide umbilicus and a finely cancellate protoconch consisting of scalloped spiral cords and prominent radial ribbing in a web-like arrangement (Holcroft 2018c). Holcroft and Stanisic (2018) added an additional four species from MEQ one of which (*Tristanoropa jaxut*) had weak rather than prominent radial ribs on the teleoconch. This trend is seen in two of the three species described below and has resulted in a slight modification of the generic diagnosis. The species described below are the first records of the genus from SCQ. Their localised distributions suggest that more species will be discovered in the numerous scattered vine thickets of the brigalow country.

Tristanoropa saddler sp. nov.
(Figs 1E–F, 6E)

Etymology. Named for Saddler Springs Station.

Preferred common name. Saddler Springs Pinwheel Snail.

Material examined. Holotype. QMMO86779, RC, Saddler Springs Stn, Carnarvon Range, SCQ, 25° 04′ 48″ S, 148° 07′ 27″ E, vine thicket on basalt scree, among rocks, coll. C. Eddie, 11.xii.2008. Height of shell 1.23 mm, diameter 2.46 mm, width of umbilicus 0.98 mm, D/U 2.50, H/D 0.50, whorls 4.625.

Paratypes. QMMO79445, 4RC; QMMO86607, 10RC, same data as holotype.

Diagnosis. Shell tiny, with a flat to slightly sunken spire, whorls tightly coiled; protoconch finely cancellate of 1.625 whorls with spirals and radials forming a web-like pattern, teleoconch with very crowded radial ribs (mean 98 on first whorl); umbilicus wide V-shaped. Apertural barriers absent.

Description. Shell tiny, golden-brown, discoidal with flat to slightly sunken spire; whorls 4.50-4.625, tightly coiled, sutures impressed; diameter 2.38-2.46 mm (mean 2.42 mm), height 1.23 mm, H/D 0.50-0.52 (mean 0.51); protoconch finely cancellate of 1.625 whorls, diameter 410 µm, sculptured with 17-19 scalloped spiral cords and prominent radial ribs forming a web-like pattern; teleoconch sculpture of bladed, crowded radial ribs 97-98 (mean 98) on the first whorl, microsculpture of weak microradial threads and crowded, prominent microspiral cords forming elongate beads at their intersection; umbilicus wide V-shaped, diameter 0.98-1.07 mm (mean 1.02 mm), D/U 2.23-2.50 (mean 2.36). Based on 2 measured specimens (QMMO86779, QMMO86607[1]).

Distribution and habitat. Known only from the type locality; living among rocks in vine thicket on basalt scree.

Remarks. *Tristanoropa saddler* sp nov. is microsympatric with *Rhophodon moffatt* sp. nov. but can be readily distinguished from that species by having a larger shell with greater number of whorls and lack of apertural barriers. The radial ribs on the protoconch of *T. saddler* are more pronounced than in the other two species described below.

Tristanoropa crowman sp. nov.
(Figs 1G-H, 6F-G)

Etymology. Named for Crowman Station.

Preferred common name. Crowman Pinwheel Snail.

Material examined. All SCQ. Holotype. QMMO86778, RC, Injune, 31 km WNW at Crowman Stn, N slope of Mt Hutton, 25° 49′ 29″ S, 148° 15′ 24″ E, sevt on basalt scree, undersides of rocks, coll. C. Eddie, B. Cosh, 2.xi.2017. Height of shell 1.48 mm, diameter 2.70 mm, width of umbilicus 1.07 mm, D/U 2.54, H/D 0.55, whorls 5.00.

Paratypes. QMMO86585, 3SC/13RC, same data as holotype.

Other material. QMMO66516, 3SC/10RC, Injune, WNW at Oakwells Stn, 25° 48′ 05″ S, 148° 15′ 14″ E, sevt on basalt scree, under rocks, coll. C. Eddie, 10.vi.1999.

Diagnosis. Shell tiny, with a flat to slightly elevated spire, whorls tightly coiled; protoconch finely cancellate of 1.5 whorls with crisp spirals over weaker radial ribs, teleoconch with crowded radial ribs (mean 59 on first whorl); umbilicus wide V-shaped. Apertural barriers absent.

Description. Shell tiny, golden-brown, discoidal with slightly sunken spire; whorls

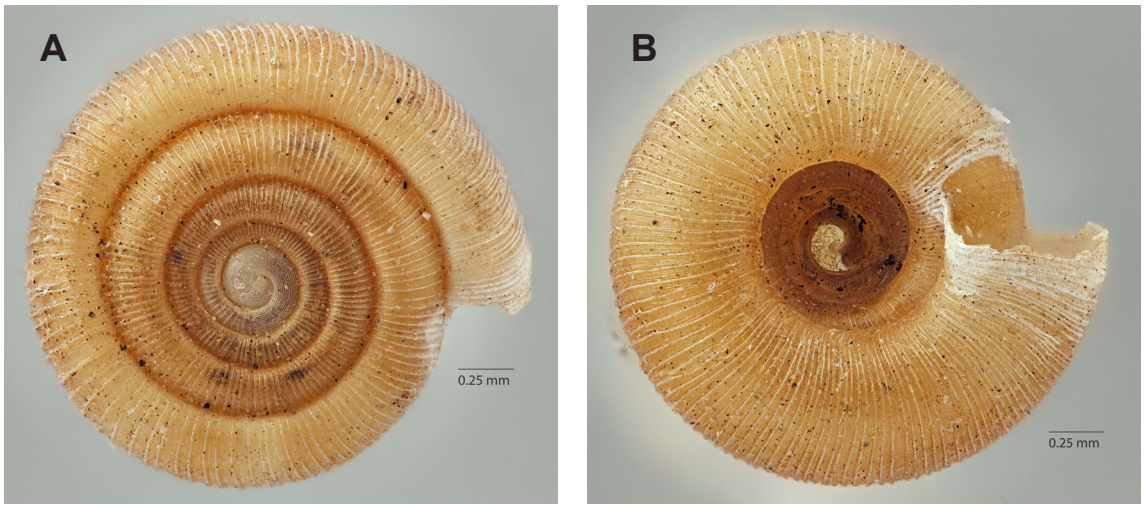

FIG. 2. **A-B**, *Tristanoropa palmgrove* sp. nov., QMMO86780, holotype.

FIG. 3. **A-B**, *Brigaloropa costulata* sp. nov., QMMO86781, holotype.

4.75-5.00, tightly coiled, sutures impressed; diameter 2.30-2.70 mm (mean 2.54 mm), height 1.23-1.48 mm (mean 1.36 mm), H/D 0.52-0.55 (mean 0.54); protoconch finely cancellate of 1.5 whorls, diameter 410 µm, sculptured with 15-17 scalloped spiral cords and weak radial ribs; teleoconch sculpture of bladed, crowded radial ribs 48-71 (mean 59) on the first whorl, microsculpture of weak microradial threads and low, weak microspiral cords forming weak elongate beads at their intersection; umbilicus wide V-shaped, diameter 1.07-1.15 mm (mean 1.10 mm), D/U 2.15-2.54 (mean 2.31). Based on 5 measured specimens (QMMO86778, QMMO86585[4]).

Distribution and habitat. Known only from Crowman and Oakwells Stns, SCQ; living on the underside of rocks in vine thicket on basalt scree.

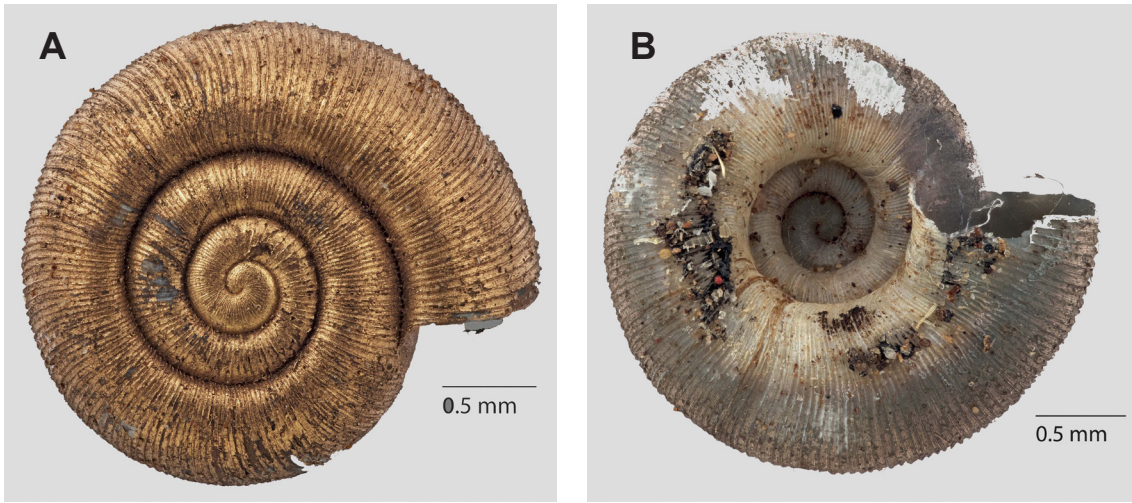

FIG. 4. **A-B**, *Arcadiaropa sunnyholt* sp. nov., QMMO79452, holotype.

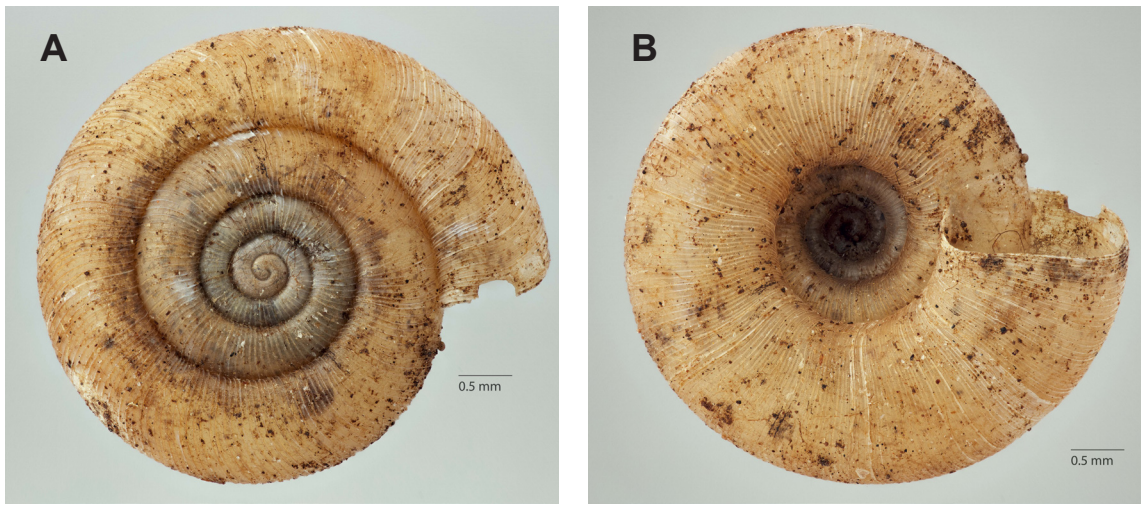

FIG. 5. **A-B**, *Eddiea carnarvon* sp. nov., QMMO86789, holotype.

Remarks. *Tristanoropa crowman* sp. nov. differs from *T. saddler* sp. nov. by having a greater number of whorls, weaker protoconch ribbing and less crowded teleoconch ribbing.

Tristanoropa palmgrove sp. nov.
(Figs 2A-B, 6H, 7A-B, 8)

Etymology. Named for Palmgrove National Park.

Preferred common name. Palmgrove Pinwheel Snail.

Material examined. Holotype. QMMO86780, RC, Palmgrove NP (Scientific), Bigge Range, SCQ, 25° 58′ 42″ S, 149° 24′ 53″ E, sevt in gorge with boulders, in leaf litter among logs/rocks, coll. C. Eddie, F. Carter, 28.ix.2001. Height of shell 1.23 mm, diameter 2.38 mm, width of umbilicus 0.98 mm, D/U 2.42, H/D 0.52, whorls 5.125.

Paratypes. QMMO86624, 45RC, same data as holotype; QMMO86621, 51RC, Palmgrove NP (Scientific), Middle Creek, SCQ, 25° 58′ 59.5″ S, 149° 13′ 32″ E, sevt on hill slope above watercourse, in leaf litter

under logs and bark piles at the base of trees, coll. C. Eddie, 13.xii.2000.

Other material. QMMO86618, 31RC, Palmgrove NP (Scientific), Middle Bigge Range, SCQ, 25º 58′ 59″ S, 149º 13′ 30″ E, sevt on slope beside watercourse, in leaf litter among logs/rocks, coll. C. Eddie, 14.xii.2000; QMMO73323, 45RC, Palmgrove NP, on E side of un-named hills, SCQ, 25º 01′ 47″ S, 149º 14′ 55″ E, sevt, in litter, coll. C. Eddie, 26.ix.2001.

Diagnosis. Shell tiny, with a flat to slightly sunken spire, whorls tightly coiled; protoconch finely cancellate of 1.5 whorls with crisp spirals over much weaker radial ribs, teleoconch with crowded radial ribs (mean 89 on first whorl); apertural barriers present in sub-adult specimens; umbilicus very wide V-shaped.

Description. Shell tiny, golden-brown, discoidal with slightly sunken spire; whorls 4.875-5.250, tightly coiled, sutures impressed; diameter 2.05-2.38 mm (mean 2.17 mm), height 0.98-1.31 mm (mean 1.12 mm), H/D 0.48-0.56 (mean 0.52); protoconch finely cancellate of 1.5 whorls, diameter 410 μm, sculptured with 15-17 scalloped spiral cords and weak radial ribs; teleoconch sculpture of bladed, crowded radial ribs 78-112 (mean 89) on the first whorl, microsculpture of weak microradial threads and weak microspiral cords forming weak elongate beads at their intersection; six apertural barriers present in sub-adult specimens (to about 4.5 whorls): three long palatal lamellae expanded posteriorly, two supra-palatal traces and one short basal lamellae; umbilicus very wide V-shaped, diameter 0.82-1.07 mm (mean 0.95 mm), D/U 1.69-2.55 (mean 2.30). Based on 17 measured specimens (QMMO86780, QMMO86624[4], QMMO86618[4], QMMO86621[3], QMMO73323[5]).

Distribution and habitat. Known only from Palmgrove NP, Bigge Range, SCQ; living in litter among logs and rocks in vine thicket.

Remarks. *Tristanoropa palmgrove* sp. nov. is distinguished from both *T. saddler* sp. nov. and *T. crowman* sp. nov. by the combination of very crowded ribs on the teleoconch and the possession of apertural barriers in sub-adult growth stages that are fully resorbed prior to becoming adult (Fig. 8). As far as is known this is the first record of total barrier resorption in any species of Charopidae. In Pacific Island and Australian charopids with barriers that have been studied to date, these appear shortly after hatching and are added to anteriorly and resorbed posteriorly through to adulthood (Solem 1983; Stanisic 1990). Barriers constrict the aperture and ostensibly protect the snail against prey such as ants. The question arises as to what function do the barriers in this species serve? Another intriguing aspect is the lack of any parietal barriers which are the most commonly encountered barriers in other charopids.

Brigaloropa gen. nov.

Type species. *Brigaloropa costulata* sp. nov. -herein designated.

Etymology. A contraction of brigalow combined with a contraction of Charopa.

Diagnosis. Shell tiny, white, subdiscoidal with a domed spire, whorls evenly coiled, sutures impressed; protoconch radial with widely spaced, bold radial ribs, teleoconch with bold, moderately spaced and curved radial ribs; umbilicus wide U-shaped.

Remarks. *Brigaloropa* gen. nov. can be distinguished by the following combination of characters: white shell, radial protoconch, dome-shaped spire, bold radial ribs on the teleoconch and wide U-shaped umbilicus.

Brigaloropa costulata sp. nov.
(Figs 3A-B, 7C-D)

Etymology. From the Latin *costulatus* = ribbed, referring to the pronounced, radially ribbed shell sculpture.

Preferred common name. Costulate Pinwheel Snail.

Material examined. Holotype. QMMO86781, RC, Palmgrove NP, on E side of un-named hills, SCQ, 25º 01′ 47″ S, 149º 14′ 55″ E, sevt, in litter, coll. C. Eddie, 26.ix.2001. Height of shell 1.23 mm, diameter 2.38 mm, width of umbilicus 0.82 mm, D/U 2.90, H/D 0.52, whorls 4.500.

Paratypes. QMMO73322, 22RC, same data as holotype.

Diagnosis. As for genus.

Description. Shell tiny, white, subdiscoidal with a domed spire; whorls 4.125-4.750, evenly coiled, sutures impressed; diameter 2.21-2.70

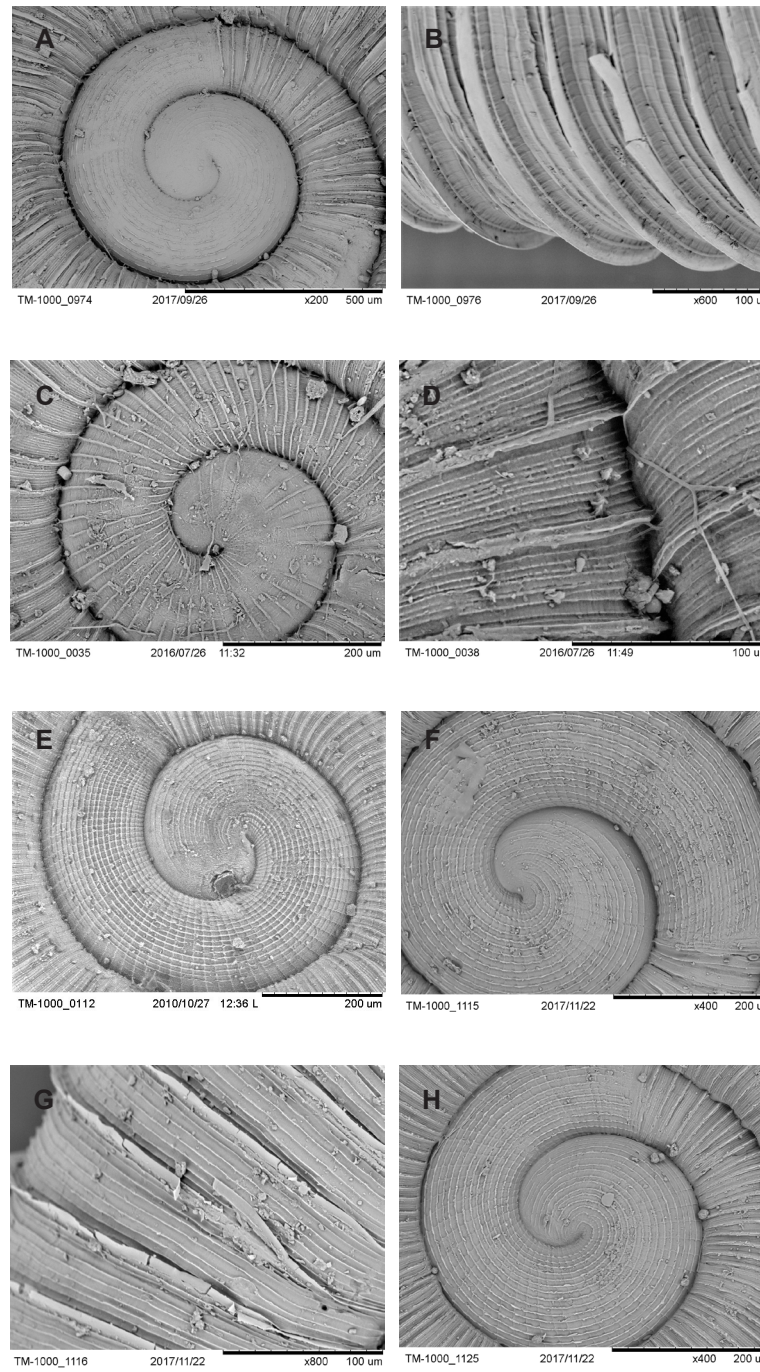

FIG. 6. Shell sculpture. **A-B**, *Spiraliropa carnarvon* Stanisic, 2010, QMMO78979. **A**, protoconch; **B**, teleoconch. **C-D**, *Rhophodon moffatt* sp. nov. , QMMO79444. **C**, protoconch; **D**, teleoconch. **E**, *Tristanoropa saddler* sp. nov., QMMO79445, protoconch; **F-G**, *T. crowman* sp. nov., QMMO66516. **F**, protoconch; **G**, teleoconch. **H**, *T. palmgrove* sp. nov., QMMO86624, protoconch.

mm (mean 2.39 mm), height 1.23-1.56 mm (mean 1.33 mm), H/D 0.52-0.60 (mean 0.56); protoconch radial of 1.75 whorls, diameter 410um, sculptured with bold, widely spaced radial ribs; teleoconch with moderately spaced curved, bold radial ribs 51-60 (mean 54) on the first whorl, microsculpture of fine interstitial radial threads and crowded microspiral cords forming bead-like nodules at their intersection; umbilicus very wide U-shaped, diameter 0.82-0.90 mm (mean 0.89 mm), D/U 2.45-2.90 (mean 2.68). Based on 11 measured specimens (QMMO86781, QMMO73322 [10]).

Distribution and habitat. Known only from Palmgrove NP, Bigge Range, SCQ; recovered from litter in vine thicket.

Remarks. *Brigaloropa costulata* sp. nov. is immediately recognizable by the tiny white shell with domed spire, prominent radial sculpture and wide U-shaped umbilicus. The minute and widespread *Discocharopa aperta* (Möllendorff, 1888) also has a white shell with flat spire, much more crowded radial ribs on the teleoconch and a very wide saucer-shaped umbilicus. *D. aperta* also lacks spiral microsculpture on the teleoconch.

Arcadiaropa gen. nov.

Type species. *Arcadiaropa sunnyholt* sp. nov.-herein designated.

Etymology. A combination of Arcadia and a contraction of Charopa.

Diagnosis. Shell tiny, light brown, discoidal, nautiliform with a slightly sunken spire; protoconch superior radial with prominent, slender and curved radial ribs and low spiral cords that become visible toward the protoconch-teleoconch boundary; teleoconch with very crowded, bladed radial ribs; umbilicus wide, U-shaped.

Remarks. *Arcadiaropa* gen. nov. is introduced to accommodate a nautiliform species with a superior radial protoconch in which weak spiral cords appear toward the protoconch-teleoconch boundary. In possessing continuous weak spiral cords, the superior radial protoconch differs from the strictly radial protoconchs seen in *Rhophodon* Hedley, 1924 and *Brigaloropa* gen. nov. Although appearing similar, the protoconch of *Arcadiaropa* differs from the early spiral protoconch of the MEQ *Radiolaropa* Holcroft, 2018 in lacking spiral elements on the first whorl.

Arcadiaropa sunnyholt sp. nov.
(Figs 4A-B, 7E-G)

Etymology. For Sunnyholt Station, Arcadia Valley, SCQ.

Preferred common name. Sunnyholt Pinwheel Snail

Material examined. Holotype. QMMO79452, RC, Sunnyholt Stn, Arcadia Valley, NE Injune, SCQ, 25° 17′ 14″ S, 148° 55′ 21″ E, sevt on sandstone slope, in litter among rocks, coll. C. Eddie, 01.x.2008. Height of shell 1.41 mm, diameter 2.60 mm, width of umbilicus 1.28 mm, D/U 2.03, H/D 0.52, whorls 3.750.

Diagnosis. Shell tiny, light brown, discoidal, nautiliform with a slightly sunken spire; sutures strongly impressed; protoconch superior radial with crowded, slender radial ribs and low spiral cords appearing toward the protoconch-teleoconch boundary; teleoconch with very crowded, bladed radial ribs (95 on the first whorl); umbilicus very wide, U-shaped.

Description. Shell tiny, light brown, discoidal, nautiliform with a slightly sunken spire; whorls 3.75, evenly coiled, rounded; sutures strongly impressed; diameter 2.60 mm, height 1.41 mm, H/D 0.54; protoconch superior radial, of 1.5 whorls, diameter 625 μm, sculptured with crowded, slender radial ribs and low spiral cords appearing toward the protoconch-teleoconch boundary; teleoconch with very crowded, bladed radial ribs, 95 on the first whorl (180 on last whorl); microsculpture of prominent microradial threads over very low microspiral cords forming weak buttresses at their intersection with the microradials; umbilicus very wide U-shaped, diameter 1.28 mm, D/U 2.03. Based on one measured specimen (QMMO79452).

Distribution and habitat. Known only from the type locality; recovered from litter in vine thicket on sandstone.

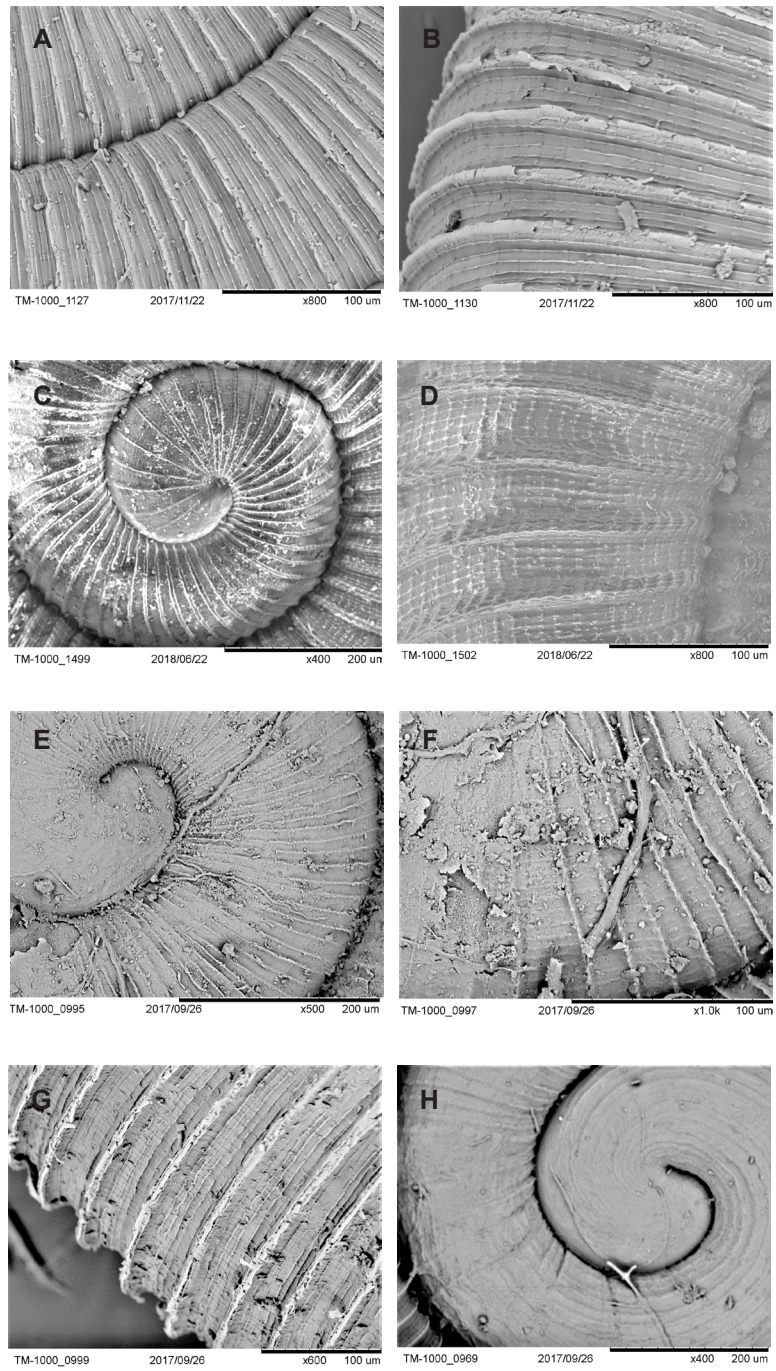

FIG. 7. Shell sculpture. **A-B**, *Tristanoropa palmgrove* sp. nov., QMMO86780. **A-B**, teleoconch; **C-D**, *Brigaloropa costulata* sp. nov., QMMO73322. **C**, protoconch; **D**, teleoconch. **E-G**, *Arcadiaropa sunnyholt* sp. nov., QMMO79452. **E**, protoconch; **F**, protoconch close-up showing spiral elements; **G** teleoconch. **H**, *Eddiea carnarvon* sp. nov., QMMO80259, protoconch.

Remarks. *Arcadiaropa sunnyholt* sp. nov. is known only from a single specimen but can be readily distinguished by the combination of nautiliform shell with superior radial protoconch, heavily ribbed teleoconch and very wide U-shaped umbilicus. The protoconch of *A. sunnyholt* bears some similarity to that of *Radiolaropa. danieli* Holcroft, 2018 but the two species differ in the intensity of the spiral cords on the protoconch. The illustrated type specimen is slightly sub-adult and gold coated for SEM.

Eddiea gen. nov.

Type species. *Eddiea carnarvon* sp nov.-herein designated.

Etymology. Named for Craig Eddie.

Diagnosis. Shell tiny, discoidal, nautiliform with a slightly sunken spire; protoconch superior spiral of 1.625 whorls with 12-17 broad, widely and regularly spaced rounded spiral cords and broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded radial ribs, umbilicus wide V to wide U-shaped.

Remarks. *Eddiea* gen. nov. is introduced to accommodate species with a superior spiral protoconch of 1.625 whorls on which radial ribs appear after 1.25 whorls. It differs from *Amfractaropa* Holcroft, 2018 (type *A. bretti* Holcroft, 2018) from the upland rainforests of the Clarke Range in MEQ which has a spiral protoconch of 1.75 whorls on which radial ribs appear after 1.50 whorls. The bimodal protoconch pattern (prominent broad spiral cords followed by prominent radial ribs on the last part of the protoconch) of *Eddiea* is also present in *Diphyoropa* Hyman & Stanisic, 2005 but the two genera differ in the structure of the spiral cords. Those of the species documented below are regularly spaced and of uniform height compared with those of *Diphyoropa* which are irregularly spaced and of irregular height.

Eddiea carnarvon sp. nov.
(Figs 5A-B, 7H, 11A)

Etymology. Named for Carnarvon Station Reserve.

Preferred common name. Carnarvon Station Pinwheel Snail.

Material examined. Holotype. QMMO86789, RC, Carnarvon Station, N of homestead, SCQ, 24º 47.935' S, 147º 45.284' E, sevt on basalt, in litter among rocks, coll. J. Stanisic, 11.x.2014. Height of shell 2.14 mm, diameter 4.74 mm, width of umbilicus 1.43 mm, D/U 3.31, H/D 0.45, whorls 4.875.

Paratypes. QMMO80249, 2SC/16RC, same data as holotype; QMMO80256, 2SC/27RC, Carnarvon Stn, N of homestead, SCQ, 24º 47.935' S, 147º 45.284' E, sevt on basalt, in litter among rocks, coll. J. Stanisic, 12.x.2014; QMMO80259, 28RC, Carnarvon Stn, N of homestead, SCQ, 24º 47.935' S, 147º 45.284' E, sevt on basalt, in litter among rocks, coll. J. Stanisic, 13.x.2014.

Other material. QMMO80238, 2RC, Piebald Spring, Carnarvon Stn, SCQ, 24º 49.871' S, 147º 44.487' E, remnant vine thicket/rocky outcrop, in litter among rocks, coll. J. Stanisic, 10.x.2014; QMMO80246, 3RC, Hillock N homestead, Carnarvon Stn, SCQ, 24º 48.627' S, 147º 45.135' E, vine thicket/basalt scree, in litter among rocks, coll. J. Stanisic, 11.x.2014.

Diagnosis. Shell tiny, brown, discoidal, nautiliform with a slightly sunken spire; protoconch superior spiral, of 1.625 whorls with broad, widely and regularly spaced rounded spiral cords initially and broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs (approx. 60 on the first whorl), umbilicus very wide U-shaped.

Description. Shell tiny, brown, discoidal, nautiliform with a slightly sunken spire; whorls 4.250-4.875 rounded, sutures strongly impressed; diameter 3.36-4.67 mm (mean 4.25 mm), height 1.72-2.46 mm (mean 2.07 mm), H/D 0.43-0.63 (mean 0.49); protoconch superior spiral, of 1.625 whorls, diameter 570 µm, sculptured with 12-15 broad, widely and regularly spaced rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls, forming nodules at their intersection; teleoconch with very crowded, bladed radial ribs (approx. 60 on the first whorl), microsculpture of microradial threads and low microspiral cords forming rounded beads at their intersection; aperture ovately lunate; umbilicus very wide U-shaped, diameter 1.48-2.13 mm (mean 1.81 mm), D/U 1.86-2.67 (mean 2.35). Based on 10 measured specimens (QMMO80259).

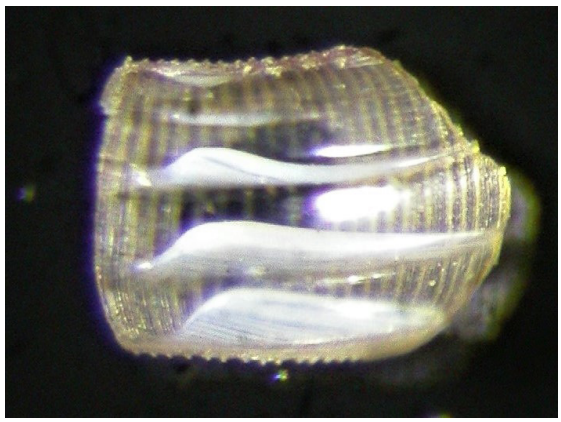

FIG. 8. Apertural barriers. Palatal barriers of *Tristanoropa palmgrove* sp. nov.

Distribution and habitat. Known only from Carnarvon Stn, SCQ; living under logs and rocks in vine thicket.

Remarks. *Eddiea carnarvon* sp nov. is confined to the vine thickets on Carnarvon Station, SCQ and occurs microsympatrically with the widespread *Spiraliropa carnarvon* Stanisic, 2010. *E. carnarvon* is distinguished from the latter by its larger size and by the broad, rounded spiral cords (approx. 15-17) and radial ribs on a slightly longer protoconch of 1.625 whorls. *S. carnarvon* has a strictly spiral protoconch of 1.5 whorls with 12-13 slender spiral cords.

Eddiea waddybrae sp. nov.
(Figs 9A-B, 11B-C)

Etymology. Named for Waddy Brae Station.

Preferred common name. Waddy Brae Pinwheel Snail.

Material examined. Holotype. QMMO86816, RC, Injune, 41.9 km ENE at Waddy Brae Station, SCQ, 28º 38′ 55.5″ S, 148º 55′ 39.7″ E, sevt on sandstone ridge, in leaf litter under/among rocks, coll. C. Eddie, H. Rose, 01.iv.2007. Height of shell 1.80 mm, diameter 3.69 mm, width of umbilicus 1.03 mm, D/U 2.65, H/D 0.49, whorls 4.375.

Paratypes. QMMO86578, 39RC, same data as holotype.

Other material. QMMO86579, 24RC, Injune, 51 km ENE at Fairview Station, SCQ, 25º 40′ 04″ S, 149º 02′ 24″ E, woodland with sevt understorey on sandstone ridge, in leaf litter around roots and boulders, coll. C. Eddie, A. Bendall, 18.xii.2013.

Diagnosis. Shell tiny, beige, discoidal, nautiliform with a flat spire; protoconch superior spiral, of 1.625 whorls with broad, widely and regularly spaced rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs (approx. 75 on the first whorl), umbilicus very wide V-shaped.

Description. Shell tiny, light brown, discoidal, nautiliform with a flat spire; whorls 4.250-4.500 rounded, sutures strongly impressed; diameter 3.44-3.93 mm (mean 3.74 mm), height 1.72-2.05 mm (mean 1.84 mm), H/D 0.47-0.52 (mean 0.49); protoconch superior spiral, of 1.625 whorls, diameter 490 µm, sculptured with 15-17 broad, widely and regularly spaced, low rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 69-94 (mean 75) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus very wide V-shaped, diameter 1.03-1.16 mm (mean 1.12 mm), D/U 3.34-3.36 (mean 3.35). Based on 10 measured specimens (QMMO86816, QMMO86578 [9]).

Distribution and habitat. Known only from the type locality and nearby Fairview Station, SCQ; living under rocks in vine thicket on sandstone.

Remarks. *Eddiea waddybrae* sp. nov. differs from *E. carnarvon* sp. nov. in having a smaller shell with less whorls and a smaller umbilicus. These two species are widely separated geographically with *E. waddybrae* occurring in a relatively drier environment on sandstone compared with the wetter basaltic environment of *E. carnarvon*. Specimens of *E. waddybrae* from the nearby Fairview Station have slightly coarser teleoconch sculpture but in all other aspects are similar to those from the type locality and are considered conspecific.

Eddiea oakwells sp. nov.
(Figs 9C-D, 11B-C)

Etymology. Named for Oakwells Station.

Preferred common name. Oakwells Pinwheel Snail.

Material examined. Holotype. QMMO86817, RC, Injune, WNW at Oakwells Station, SCQ, 25º 48′ 05″ S, 148º 15′ 14″ E, sevt on basalt scree, under rocks, coll. C. Eddie, 10.vi.1999. Height of shell 1.95 mm, diameter 3.90 mm, width of umbilicus 1.17 mm, H/D 0.50, D/U 3.33, whorls 4.375.

Paratypes. QMMO66515, 21RC, same data as holotype.

Diagnosis. Shell tiny, light brown, discoidal, nautiliform with a flat spire; protoconch superior spiral, of 1.625 whorls with broad, widely and regularly spaced rounded spiral cords initially and broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs (approx. 55-60 on the first whorl), umbilicus very wide U-shaped.

Description. Shell tiny, light brown, discoidal, nautiliform with a flat spire; whorls 4.375-4.625 rounded, sutures impressed; diameter 3.90-4.02 mm (mean 3.96 mm), height 1.95 mm, H/D 0.49-0.50 (mean 0.50); protoconch superior spiral, of 1.625 whorls, diameter 570 µm, sculptured with 15-17 broad, widely and regularly spaced, low rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 55-60 (mean 57) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus very wide U-shaped, diameter 1.17 mm, D/U 3.33-3.44 (mean 3.38). Based on 2 measured specimens (QMMO86817, QMMO66515).

Distribution and habitat. Known only from the type locality; living under rocks in vine thicket on basalt scree.

Remarks. *Eddiea oakwells* sp. nov. has a slightly larger adult shell than *E. waddybrae* sp. nov. but smaller than that of *E. carnarvon* sp. nov.. *E. oakwells* can be further distinguished from the similar looking *E. waddybrae* by having more widely spaced ribs on the first teleoconch whorl and a slightly wider U-shaped rather than V-shaped umbilicus. The paratype series, while numerically sizeable, consists chiefly of juvenile and subadult specimens highlighting the general difficulty in collecting good adult series of charopids for study.

Eddiea bigge sp. nov.
(Figs9E-F, 11D-E)

Etymology. Named for the Bigge Range, SCQ.

Preferred common name. Bigge Range Pinwheel Snail.

Material examined. Holotype. QMMO86823, RC, Palmgrove NP (Scientific), Bigge Range, SCQ, 24º 58′ 42″ S, 149º 24′ 53″ E, sevt in narrow gorge with boulders, in litter under rocks/logs, coll. C. Eddie, F. Carter, 28.ix.2001. Height of shell 1.75 mm, diameter 3.57 mm, width of umbilicus 1.17 mm, H/D 0.49, D/U 3.06, whorls 4.375.

Paratypes. QMMO86619, 31RC, Palmgrove NP (Scientific), Middle Creek, SCQ, 24º 58′ 59″ S, 149º 13′ 30″ E, sevt on slope beside watercourse. Sandstone boulders/rocks, in litte runder rocks/logs, coll. C. Eddie, 14.xii.2000.

Other material. QMMO86622, 6RC, Palmgrove NP (Scientific), Middle Creek, SCQ, 24º 58′ 59″ S, 149º 13′ 32″ E, sevt on slope above watercourse/sandstone boulders and rocks, in litter under rocks/logs, coll. C. Eddie, 13.xii.2000; QMMO73324, 3RC, Palmgrove NP, on E side of unnamed hills, SCQ, 25º 01′ 47″ S, 149º 14′ 55″ E, sevt, coll. C. Eddie, 26.ix.2001.

Diagnosis. Shell tiny, golden brown, discoidal, nautiliform with a flat to slightly sunken spire; protoconch superior spiral of 1.625 whorls with broad, widely and regularly spaced, low rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs, mean 75 on the first whorl; umbilicus wide U-shaped.

Description. Shell tiny, light brown, discoidal, nautiliform with a sunken spire; whorls 4.000-4.375 rounded, sutures impressed; diameter 3.11-3.57 mm (mean 3.33 mm), height 1.48-1.75 mm (mean 1.59 mm), H/D 0.45-0.49 (mean 0.47); protoconch superior spiral, of 1.625 whorls, diameter 490 µm, sculptured with 15-17 broad, widely and regularly spaced, low rounded spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 69-79 (mean 74) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus very wide U-shaped,

diameter 1.17-1.39 mm (mean 1.30 mm), D/U 2.24-3.06 (mean 2.60). Based on 4 measured specimens (QMMO86823, QMMO86619 [3]).

Distribution and habitat. Known only from Palmgrove NP, Bigge Range, SCQ; living under logs and rocks.

Remarks. *Eddiea bigge* sp. nov. occurs microsympatrically with several other charopids including *Spiraliropa Carnarvon* Stanisic, 2010. From this species *E. bigge* may be distinguished by the larger sized shell, longer superior spiral protoconch (spiral in *S. carnarvon*) with broad and rounded rather than slender spiral cords, less impressed sutures and wider umbilicus.

Platyumbiropa gen. nov.

Type species. *Platyumbiropa tabor* sp nov.-herein designated.

Etymology. A combination of the Greek platys = wide, and contractions of umbilicus and *Charopa*; referring to the very wide V-shaped umbilicus of the species.

Diagnosis. Shell tiny, discoidal, nautiliform with a slightly sunken spire; protoconch superior spiral of 1.625 whorls with 12-17 crowded, broad and regularly spaced flattish spiral cords, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded radial ribs, umbilicus very wide V-shaped.

Remarks. *Platyumbiropa* gen. nov. differs from *Eddiea* gen. nov. by the combination of low and crowded, broad spiral cords on the protoconch and wide umbilicus compared with the bolder and much more widely spaced protoconch spirals and narrower umbilicus of *Eddiea.*

Platyumbiropa tabor sp. nov.
(Figs 9G-H, 12A-B)

Etymology. Named for Mount Tabor.

Preferred common name. Mount Tabor Pinwheel Snail.

Material examined. Holotype. QMMO86825, RC, Augathella, NE at Mt Tabor Station, ESE of Urandoo, SCQ, 25º 11′ 45″ S, 147º 30′ 59″ E, vine thicket on steep basalt scree, in leaf litter among rocks, Coll. C. Eddie, R. Aisthorpe, 21.x.2015. height of shell 1.80 mm, diameter 3.93 mm, width of umbilicus 1.89 mm, H/D 0.46, D/U 2.09, whorls 4.875.

Paratypes. MO86629, 34RC, same data as holotype.

Diagnosis. Shell tiny, light brown, discoidal, nautiliform with a sunken spire; protoconch superior spiral of 1.625 whorls with crowded, low, broad flattish spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs, mean 62 on the first whorl; umbilicus very wide V-shaped.

Description. Shell tiny, light-brown, discoidal, nautiliform with a sunken spire; whorls 4.125-4.875, rounded, sutures impressed; diameter 3.28-3.93 mm (mean 3.63 mm), height 1.56-1.80 mm (mean 1.67 mm), H/D 0.43-0.50 (mean 0.46); protoconch superior spiral, of 1.625 whorls, diameter 490 µm, sculptured with low, broad flattish spiral cords and broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 60-67 (mean 62) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus wide U-shaped, diameter 1.48-1.97 mm (mean 1.64 mm), D/U 1.88-2.42 (mean 2.20). Based on 12 measured specimens (QMMO86629[11], QMMO86825).

Distribution and habitat. Known only from the type locality; living among rocks in vine thicket on basalt scree.

Remarks. *Platyumbiropa tabor* sp. nov. is similar in size and shape to *P. grafton* sp. nov. but differs by having a light brown shell, more intense spiral cords on the protoconch and slightly larger umbilicus.

Platyumbiropa grafton sp. nov.
(Figs 10A-B, 12C-D)

Etymology. Named for the Grafton Range, SCQ.

Preferred common name. Grafton Range Pinwheel Snail.

Material examined. Holotype. MO86824, RC, Grafton Range, NE Roma at Belbri Station, SCQ, 26º 25′ 15″ S, 148º 54′ 33″, vine thicket/open woodland, in litter, coll. C. Eddie, 13.xii.2001. Height of shell 1.72 mm,

diameter 4.10 mm, width of umbilicus 1.42 mm, H/D 0.42, D/U 2.89, whorls 4.750.

Paratypes. QMMO86573, 5RC, Grafton Range, NE Roma at Belbri Station, SCQ, 26º 24′ 44″ S, 148º 55′ 15″, sevt in gully/basalt, in leaf litter under logs and rocks, coll. C. Eddie, 13.xii.2001; QMMO87172, 24RC, Grafton Range, NE Roma, SCQ, 26º 24′ 12″ S, 148º 54′ 43″, vine thicket/figs/*Brachychiton*, in litter among rocks at base of fig, coll, C. Eddie, M, Gane, 13. xi.2016.

Other material. QMMO73115, 1RC, Grafton Range, NE Roma at Belbri Station, SCQ, 26º 25′ 15″ S, 148º 54′ 33″, vine thicket/open woodland, in litter, coll. C. Eddie, 13.xii.2001; QMMO86571, 1RC, Grafton Range, NE Roma at Belbri Station, SCQ, 26º 24′ 54″ S, 148º 55′ 18″, vine thicket/open forest, in litter under logs and fallen bark, coll. C. Eddie, 27.iv.2003; QMMO86572, 3RC, Grafton Range, NE Roma at Belbri Station, SCQ, 26º 24′ 54″ S, 148º 55′ 04″, sevt/basalt, in litter under logs/rocks, coll. C. Eddie, 14.iv.2008.

Diagnosis. Shell tiny, golden brown, discoidal, nautiliform with a flat to slightly sunken spire; protoconch superior spiral of 1.625 whorls with barely visible, low, broad, flattish spiral cords initially, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs, mean 60 on the first whorl; umbilicus very wide V-shaped.

Description. Shell tiny, golden brown, discoidal, nautiliform with a sunken spire; whorls 4.125-4.750, rounded, sutures impressed; diameter 3.28-4.10 mm (mean 3.64 mm), height 1.56-1.72 mm (mean 1.66 mm), H/D 0.42-0.48 (mean 0.46); protoconch superior spiral, of 1.625 whorls, diameter 490 µm, sculptured with barely visible low, broad, flattish spiral cords, broad radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 60-61 (mean 61) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus wide U-shaped, diameter 1.39-1.42 mm (mean 1.41 mm), D/U 2.89. Based on 2 measured specimens (QMMO86824, QMMO73115).

Distribution and habitat. Known only from Belbri Station, Grafton Range, SCQ; found in litter under logs and rocks in vine thicket.

Remarks. *Platyumbiropa grafton* sp. nov. differs from *P. tabor* sp. nov. chiefly by the very weak apical sculpture which is barely visible by both optical and scanning microscopy. *P. grafton* also has a smaller umbilicus than *P. tabor*. Much of the Grafton Range has been cleared for farming and the few remaining bottle trees indicate the past presence of more extensive vine thicket communities in the area.

Carnaropa gen. nov

Type species. *Carnaropa racecourse* sp nov.-herein designated.

Etymology. A combination of a contraction of Carnarvon and a contraction of Charopa.

Diagnosis. Shell tiny, discoidal, nautiliform with a slightly sunken spire; protoconch superior spiral of 1.625 whorls with 9-11 widely and regularly spaced, wide and flat spiral cords and slender radial ribs only appearing after 1.25 whorls; teleoconch with very crowded radial ribs, umbilicus wide V to wide U-shaped.

Remarks. *Carnaropa* gen. nov. differs from *Eddiea* in having slender and widely spaced spiral cords on protoconch as opposed to the crowded, and relatively broad spiral cords of the latter. Currently the genus is only known from two species in two locations in the Carnarvon NP, SCQ. However, given the difficulty in collecting these tiny snails, additional species may yet be found in other locations within the Carnarvon Range.

Carnaropa racecourse sp. nov.
(Figs 10C-D, 12E-F)

Etymology. Named for Racecourse Spring, Mt Moffatt Section, Carnarvon NP, SCQ.

Preferred common name. Racecourse Spring Pinwheel Snail

Material examined. Holotype. QMMO86820, RC, Carnarvon NP, Mt Moffatt Section, ridge NW Lots Wife, SCQ, 24º 56′ 00″ S, 148º 05′ 43″ E, sevt/sandstone, in litter, coll. C. Eddie, 22.i.1999. Height of shell 2.01 mm, diameter 3.90 mm, width of umbilicus 1.30 mm, H/D 0.52, D/U 3.00, whorls 4.500.

Paratypes. QMMO86602, 23RC, same data as holotype.

Other material. QMMO86599, 1RC, Carnarvon NP, Mt Moffatt Section, gorge downstream of Racecourse Spring, SCQ, 24º 56′ 04″ S, 148º 05′ 49″ E, basalt scree with vines, in leaf litter among rocks, coll. C. Eddie, 18.ii.2002; QMMO66459, 1RC, Carnarvon NP, Mt Moffatt Section, at Racecourse Spring, SCQ, 24º 56′ 00″ S, 148º 05′ 43″ E, coll. C. Eddie, 22.i.1999.

Diagnosis. Shell tiny, golden brown, discoidal, nautiliform with a flat to slightly sunken spire; protoconch superior spiral of 1.625 whorls with 9-11 widely and regularly spaced, wide and flat spiral cords, slender radial ribs only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs, mean 80 on the first whorl; umbilicus wide U-shaped.

Description. Shell tiny, golden brown, discoidal, nautiliform with a slightly sunken spire; whorls 4.125-4.625, rounded, sutures impressed; diameter 3.70-3.90 mm (mean 3.78 mm), height 1.68-2.01 mm (mean 1.84 mm), H/D 0.45-0.52 (mean 0.49); protoconch superior spiral, of 1.625 whorls, diameter 490 µm, sculptured with 9-11 widely and regularly spaced, wide and flat spiral cords, slender radial ribs only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 76-85 (mean 80) on the first whorl, microsculpture of microradial threads and low microspiral cords forming beads at their intersection; aperture ovately lunate; umbilicus wide U-shaped, diameter 1.10-1.30 mm (mean 1.24 mm), D/U 2.74-3.36 (mean 3.01). Based on 5 measured specimens (QMMO86820, QMMO86602 [4]).

Distribution and habitat. Mt Moffatt Section, Carnarvon NP, SCQ; living under rocks in vine thicket.

Remarks. *Carnaropa racecourse* sp. nov. is distinguished from the geographically proximate *Eddiea carnarvon* sp. nov. by a combination of smaller shell with fewer and more slender apical spiral cords, a greater number of ribs on the first whorl and narrower U-shaped umbilicus.

Carnaropa salvatorosa sp. nov.
(Figs 10E-F, 12G-H)

Etymology. Named for the Salvator Rosa Section, Carnarvon NP, SCQ.

Preferred common name. Salvator Rosa Pinwheel Snail.

Material examined. Holotype. AMSC162130, RC, Belinda Springs, Salvator Rosa Section, Carnarvon Gorge NP, SCQ, 24º 50.000′ S, 147º 11.750′ E, in litter from damp sides of spring outflow, coll. W. F. Ponder, P. H. Colman, 29.ix.1984. Height of shell 1.72 mm, diameter 3.44 mm, width of umbilicus 1.23 mm, H/D 0.50, D/U 2.80, whorls 4.5.

Paratype. AMSC575657, 1RC, same data as holotype.

Diagnosis. Shell tiny, golden brown, discoidal, nautiliform with a slightly sunken spire; protoconch superior spiral of 1.625 whorls with 9-11 widely and regularly spaced, wide and flat spiral cords initially, slender radial ribs only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs, mean 70 on the first whorl; umbilicus wide U-shaped.

Description. Shell tiny, golden brown, discoidal, nautiliform with a slightly sunken spire; whorls 4.00-4.50, rounded, sutures impressed; diameter 3.20-3.44 mm (mean 3.32 mm), height 1.64-1.72 mm (mean 1.68 mm), H/D 0.50-0.51 (mean 0.51); protoconch superior spiral, of 1.625 whorls, diameter 410 µm, sculptured with 9-11 widely and regularly spaced, wide and flat spiral cords, slender radial ridges only appearing after 1.25 whorls; teleoconch with very crowded, bladed radial ribs 66-74 (mean 70) on the first whorl, microsculpture of microradial threads and low microspiral cords forming tiny beads at their intersection; aperture ovately lunate; umbilicus wide U-shaped, diameter 1.15-1.23 mm (mean 1.19 mm), D/U 2.79-2.80 (mean 2.79). Based on 2 measured specimens (AMSC162130, AMSC575657).

Distribution and habitat. Known only from the type locality; found in litter in damp places.

Remarks. *Carnaropa salvatorosa* sp. nov. differs from *Ca. racecourse* by the combination of smaller shell with smaller diameter protoconch, fewer ribs on the first whorl and less crowded ribs on the teleoconch. *Ca. salvatorosa* is the first charopid recorded from the western-most section of Carnarvon NP. Both *Ca. salvatorosa* and *Ca. racecourse* sp. nov. were found in

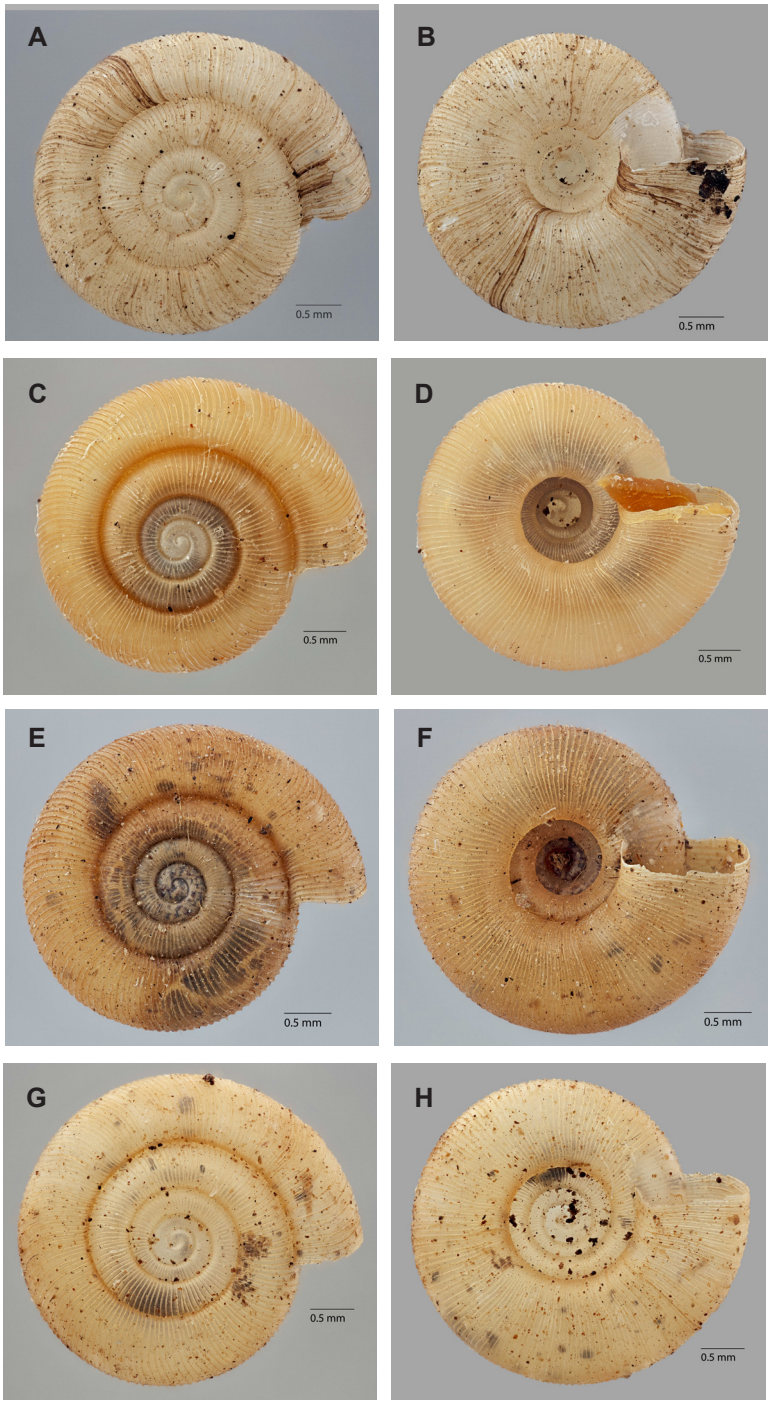

FIG. 9. Holotypes. **A-B**, *Eddiea waddybrae* sp. nov., QMMO86816; **C-D**, *E. oakwells* sp. nov., QMMO86817; **E-F**, *E. bigge* sp.nov., QMMO86823; **G-H**, *Platyumbiropa tabor* sp. nov., QMMO86825.

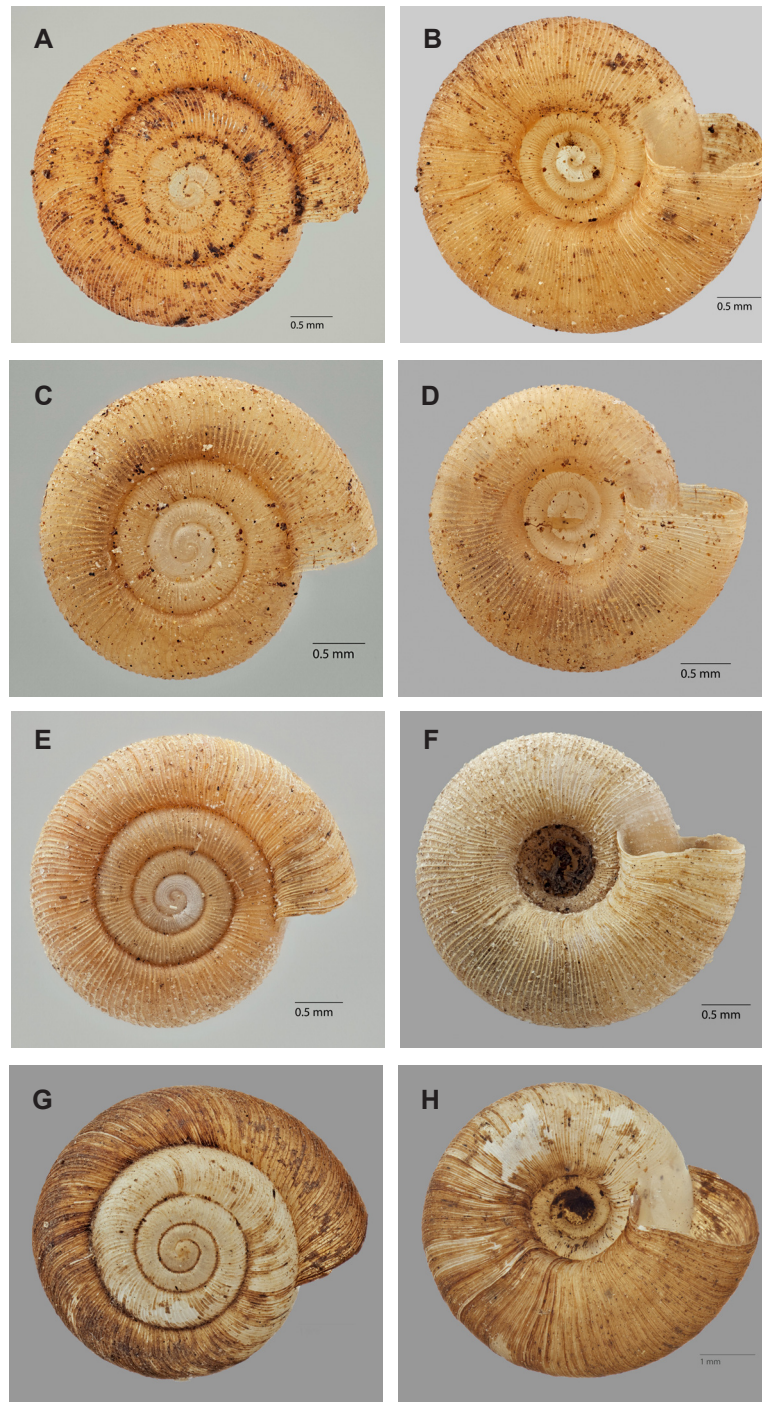

FIG. 10. Holotypes. **A-B**, *Platyumbiropa grafton* sp. nov., QMMO86824; **C-D**, *Carnaropa racecourse* sp. nov., QMMO86820; **E-F**,*Carnaropa salvatorosa* sp. nov., AMSC162130; **G-H**, *Cineropa roma* sp. nov., QMMO86826.

relatively damp places in otherwise drier eucalypt/*Callitris* forest.

Cineropa gen. nov.

Type species. *Cineropa roma* sp. nov.- herein designated.

Etymology. A contraction of the Latin *cinereus* = ash-colored alluding to the grey-brown shell colour, combined with a contraction of Charopa.

Diagnosis. Shell tiny, greyish-brown with darker periostracal streaks, discoidal with a flat to raised spire; protoconch superior spiral of 1.5 whorls with 25-35 crowded, slender and wrinkled, spiral cords overlying weak, low radial ridges that become more prominent on the latter part of the protoconch; teleoconch with very crowded, prominent, bladed radial ribs, umbilicus wide U-shaped.

Remarks. *Elsothera* Iredale, 1933 (type species. *Helix sericatula* Pfeiffer, 1849), as defined by Iredale (1937) and more recently Stanisic *et al*. (2010), is considered to be polyphyletic. *Tasmathera* Bonham (in Stanisic *et al*. 2018) and *Huntiana* Stanisic, 2018 (in Stanisic *et al*. 2018) were introduced to accommodate several southern Australian species previously included in *Elsothera* on the basis of major differences in protoconch sculpture from that of the type. *Cineropa* gen. nov. represents a further subdivision. *Cineropa* has a superior spiral protoconch (many crowded spiral cords) with weak radial ridges mainly toward the latter part of the protoconch. *Elsothera s.s.* as defined by *E. sericatula* (Pfeiffer, 1849) has a superior radial protoconch with crowded, bold and complex radial ribs and weaker spiral elements (Fig. 13D). A thorough revision of *Elsothera s.l*. as it currently stands is proposed but is beyond the scope of the current study. Both *Cineropa roma* sp. nov. and *Ci. hewittorum* (Stanisic, 1996) comb. nov. appear to prefer open woodland in contrast to many of the charopids included in this study that favour the moister and closed habitats provided by semi-evergreen vine thicket.

Cineropa roma sp. nov.
(Figs 10G-H, 13A-B)

Etymology. For the town of Roma, SCQ.

Preferred common name. Roma Pinwheel Snail.

Material examined. Holotype. QMMO86826, RC, Roma, NNW on Bungil Creek floodplain, SCQ, 26° 13′ 32″ S, 148° 42′ 00″E, cleared paddock/scattered trees, litter, coll. C. Eddie, 10.x.1999. Height of shell 3.11 mm, diameter 6.15 mm, width of umbilicus 1.89 mm, H/D 0.51, D/U 3.26, whorls 4.875.

Paratypes. QMMO66112, 9RC, same data as holotype.

Other material. QMMO86606, 1RC, Bungil Creek, 36 km NNW Roma, SCQ, 26° 15′ 18″ S, 148° 42′ 33″ E, eucalypt/*Casuarina* woodland, among soil on creek bank, coll. C. Eddie, 29.xi.2009.

Diagnosis. Shell tiny, greyish-brown with darker periostracal streaks, discoidal with a flat to raised spire; protoconch superior spiral of 1.5 whorls with numerous, crowded, regularly spaced, slender and wrinkled spiral cords overlying weak, low radial ridges that become more prominent on the latter part of the protoconch; teleoconch with very crowded, prominent, bladed radial ribs, umbilicus wide U-shaped.

Description. Shell tiny, greyish-brown, discoidal, with a flat to slightly raised spire; whorls 4.4.25-4.875, rounded, sutures impressed; diameter 5.25-6.15 mm (mean 5.56 mm), height 2.21-3.11 mm (mean 2.61 mm), H/D 0.42-0.55 (mean 0.47); protoconch superior spiral, of 1.5 whorls, diameter 690 μm, sculptured with 30-35 crowded, regularly spaced, wrinkled spiral cords overlying weak, low radial ridges that become more prominent on the latter part of the protoconch; teleoconch with very crowded, bladed radial ribs 42-59 (mean 52) on the first whorl, microsculpture of microradial threads and low microspiral cords forming tiny beads at their intersection; aperture ovately lunate; umbilicus wide U-shaped, diameter 1.89-2.21 mm (mean 2.05 mm), D/U 2.37-3.26 (mean 2.73). Based on 5 measured specimens (QMMO86826, QMMO66112[4]).

Distribution and habitat. Known only from the type locality; living in open woodland.

Remarks. *Cineropa roma* sp. nov. is the largest pinwheel snail yet recorded from the brigalow country. The species occupies a similar woodland habitat to that of *Ci. hewittorum* (Stanisic, 1996)

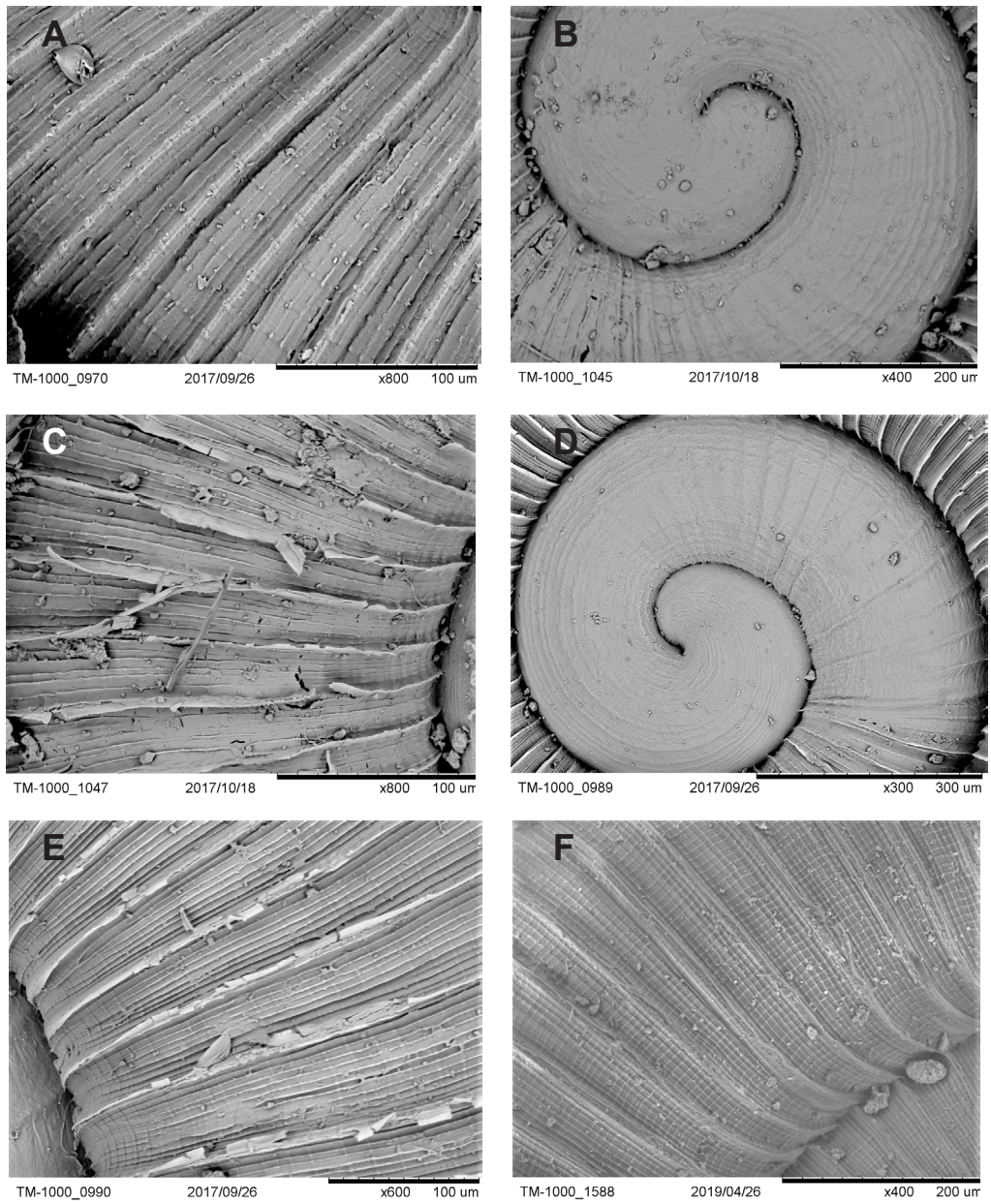

FIG. 11. Shell sculpture. **A**, *Eddiea carnarvon* sp. nov., QMMO80259, teleoconch; **B-C**, *E. waddybrae* sp. nov., QMMO86578. **B**, protoconch; **C**, teleoconch; **D-E**, *E. oakwells* sp. nov., QMMO66516. **D**, protoconch; **E**, teleoconch; **F**. *E. bigge* sp. nov., QMMO73324, teleoconch.

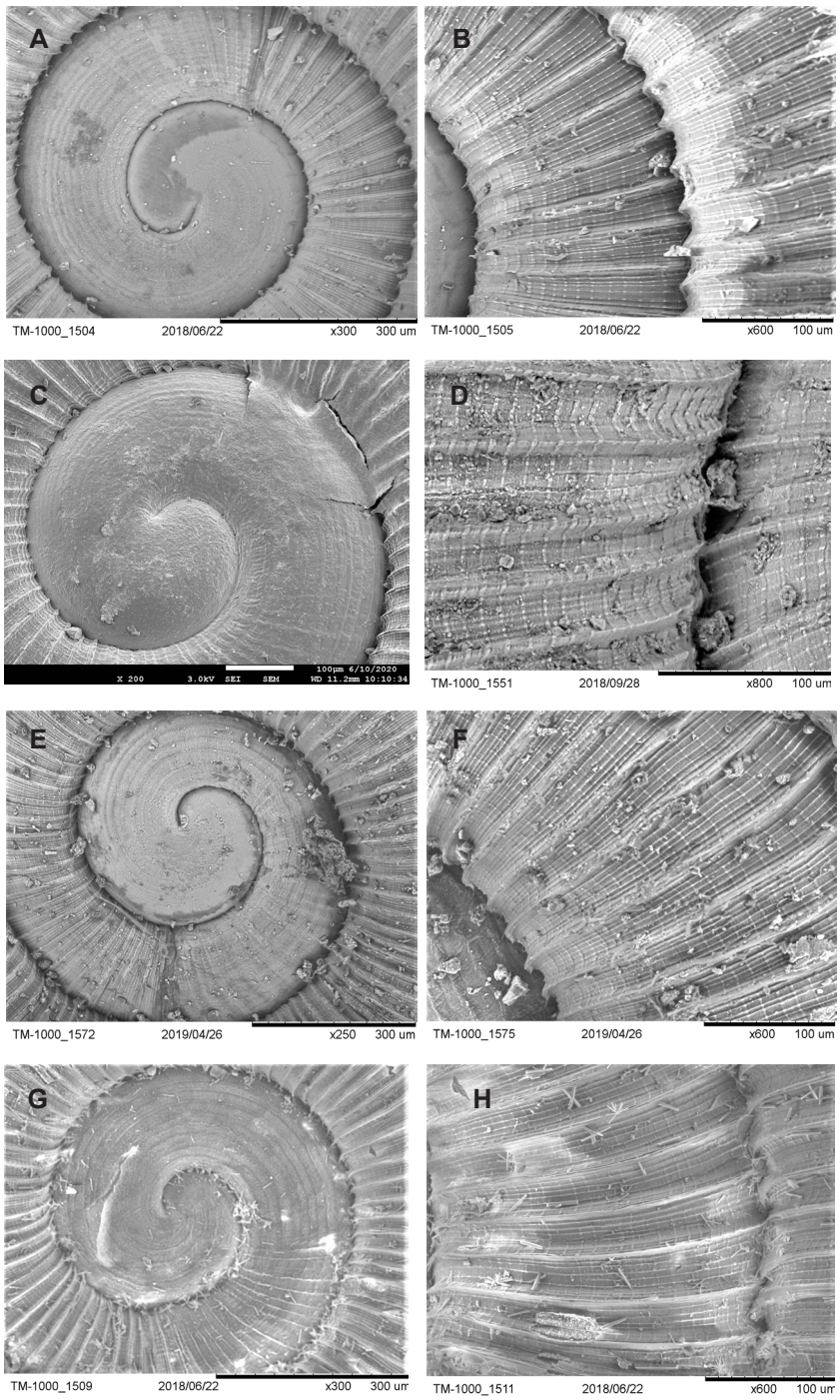

FIG. 12. Shell sculpture. **A-B**, *Platyumbiropa tabor* sp. nov., QMMO86629. **A**, protoconch; **B**, teleoconch. **C-D**, *P. grafton* sp. nov., **C**, QMMO87172, protoconch; **D**, QMMO86573, teleoconch. **E-F**, *Carnaropa racecourse* sp. nov., QMMO86602. **E**, protoconch; **F**, teleoconch. **G-H**, *Carnaropa salvatorosa* sp. nov., AMSC162130. **G**, protoconch; **H**, teleoconch.

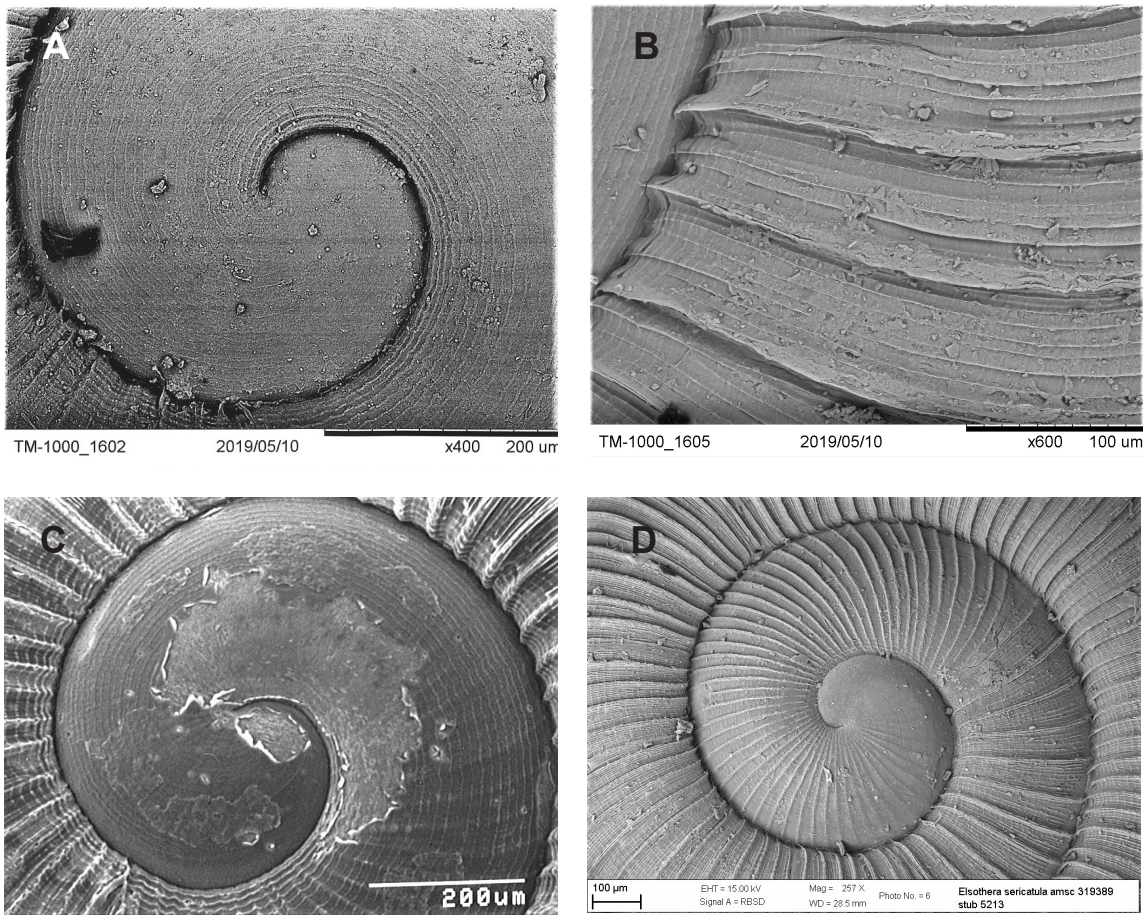

FIG. 13. Shell sculpture. **A-B**, *Cineropa roma* sp. nov., QMMO66112. **A**, protoconch; **B**, teleoconch. **C**, *Cineropa hewittorum* (Stanisic, 1996) comb. nov., QMMO56281, protoconch; **D**, *Elsothera sericatula* (Pfeiffer, 1849) AMSC319389, Concord, Sydney, NSW, teleoconch.

comb. nov. and is in contrast to the vine thicket habitats of other species included in this study.

Cineropa hewittorum (Stanisic, 1996) comb. nov. (Fig. 13C)

Common name. Dawson Valley Pinwheel Snail.

Diagnosis. Shell tiny, brown with darker periostracal streaks, discoidal with a flat to raised spire; protoconch superior spiral of 1.5 whorls with 28-30 crowded, regularly spaced, slender and wrinkled spiral cords overlying low, weak radial ridges that become more intense on the latter part of the protoconch; teleoconch with crowded, prominent, bladed radial ribs, umbilicus wide U-shaped.

Material examined. (Additional to Stanisic 1996). QMMO64384, 26SC/1RC, Theodore, S at Dawson River crossing on Isla-Delusion Rd, SEQ, 25º 11′ 01″ S, 150º 10′ 52″ E, palm/eucalypt, coll. J. Stanisic, G. Ingram, 20.viii.1997; QMMO60853,1SC/1RC, Dawson River crossing on Isla-Delusion Rd, SEQ, 25º 11′ 01″ S, 150º 10′ 52″ E, palm/eucalypt, coll. J. Stanisic, G. Ingram, 4.ii.1997; QMMO60807, 1RC, Taroom, E on Cracow Rd at Cockatoo Ck, SEQ, 25º 34′ 05″ S, 150º 05′ 08″, eucalypt woodland, under logs, coll. J Stanisic, 20.vi.1996; QMMO60746, 2RC, Taroom, ENE, along Dawson River near Nathan Gorge, SEQ, 25º 27′ 08″ S, 150º 08′ 12″ E, vine thicket/ eucalypt/palm, under logs, coll. J Stanisic, 14.vi.1996.

Remarks. Originally described from Mt Rose Stn, Taroom, SEQ and allocated to *Elsothera* Iredale, 1933 by Stanisic (1996), *E. hewittorum* is herein reassigned to *Cineropa* on the basis of having similar protoconch sculpture to *Ci. roma* sp. nov. *Ci. hewittorum* differs from *Ci. roma* by the combination of smaller shell, more widely spaced radial ribs on the teleoconch and a smaller umbilicus. The additional records represent a range extension for the species.

Discocharopa Iredale, 1913

Discocharopa aperta (Möllendorff, 1888)

Common name. Miniscule White Pinwheel Snail.

New locality records in SCQ. Carnarvon NP: QMMO86613, Mount Moffatt peak; QMMO86590, Lot's Wife; QMMO86593, Racecourse Spring; QMMO86611, Saddler Spring; QMMO, 86592, Moolayember Gorge. Others. QMMO86615, Hilly Vale Stn, Arcadia Valley; QMMO86623, QMMO86620, QMMO86617, Palmgrove NP; QMMO86596, Fairview Stn; QMMO86627, Wallaroo Stn; QMMO86589, QMMO86584, QMMO86591, QMMO86628, MT Tabor Stn; QMMO86594, QMMO86595, Belbri Stn, Grafton Range.

Remarks. *Discocharopa aperta* is a widespread species in most of northern Australia preferring to live in dry vine thickets and lithorefugia. The species is characterised by dense radial ribbing on the teleoconch without traces of spiral sculpture, serrated interstitial microradial threads and a very wide saucer-shaped umbilicus. This combination of characters distinguishes the species from other small white charopids such as *Brigaloropa costulatai* sp. nov. *D aperta* also has an extensive distribution beyond Australia (Solem 1983).

DISCUSSION

Charopids from the south central Queensland brigalow lands have historically been poorly represented in museum collections. Reasons for this are many and diverse. Charopids are fundamentally a wet forest family in Queensland whose distribution attenuates from the coast to parts further inland. Hence, because of their low numbers and their extremely localised distributions, often in small and moister scattered patches of vine thicket in the SCQ region, charopids have been extremely difficult to collect: either alive (very rarely) or as dead shells recovered by sorting leaf litter.

As a consequence of the more intensive collecting efforts of C. Eddie, this study has shown that the SCQ brigalow region does support a relatively diverse charopid fauna. Nine genera (excluding *Discocharopa*) are represented in the cohort of species comprising this study. Seven genera are made up of regionally endemic taxa (*Spiraliropa*, *Brigaloropa*, *Arcadiaropa, Eddiea*, *Platyumbiropa*, *Carnaropa*, *Cineropa*) while two have extralimital connections further east (*Rhophodon*, *Tristanoropa*). Species vary in distribution from widespread (*Spiraliropa carnarvon*) to locally common (*Rhophodon moffatt*, *Carnaropa racecourse*) to uncommon and extremely localised (e.g. *Eddiea* spp., *Platyumbiropa* spp., *Brigaloropa costulata, Arcadiaropa sunnyholt*). Additional locality is presented for *Discocharopa aperta* which has a wider continental as well as extralimital distribution (Solem 1983, Stanisic *et al*. 2010).

The protoconch configurations of the genera documented in this study fall into the following categories: one spiral, four superior spiral, two radial, one superior radial and one finely cancellate. The differing superior spiral protoconch configurations involve subtle interpretations of the microarchitecture of the spiral elements. All are considered to represent separate generic-level lineages. Thus, the widely and regularly spaced rounded spiral cords of *Eddiea* are considered to be structurally distinct from the crowded, broad and regularly spaced flattish spiral cords of *Platyumbiropa* and the regularly spaced, wide and flat spiral cords of *Carnaropa*. These three configurations all differ dramatically from the crowded and wrinkled, spiral cords of *Cineropa*.

While the former approach may appear to be 'splitting hairs', the hypothesised evolutionary variability is within the domain of an ancient Gondwanan group of snails. The long-term history of charopids on the continent combined with their tiny size, moisture sensitivity and extremely low vagility (likely inter-generational existence under one log or rock) suggests that charopids in the semi-arid

FIG. 14. Charopid habitats (all SCQ). A-D, Vine thicket on basalt scree. **A,** Crowman Stn; **B**, Saddler Springs Stn; **C**, Grafton Range; **D**, Mt Tabor Stn. **E**, Vine thicket on sandstone, Waddy Brae Stn; **F**, Woodland, Bungil Creek floodplain, north north-west of Roma. Images: C. Eddie.

brigalow have been subject to many episodes of climate induced habitat reduction and fragmentation. Continental xerification that began in the Miocene would have begun the gradual isolation of moist refugia in the semi-arid brigalow lands which would in turn have caused some widespread ancestral populations to fragment. Over millennia, and driven by local and varied environmental pressures, local radiations would have developed from these ancestral species'clusters. Continued continental drying in the Plio-Pleistocene would have caused further population fragmentation leading to present day distribution patterns.

It is also reasonable to assume that some extinctions would have occurred. The roughly circumscribed geographic patterns displayed by each of the four superior spiral genera offers broad support for the preceding scenario. The broad similarity in the shells of these four genera is considered to indicate descent from a common ancestor. In contrast, the widespread occurrence of *Spiraliropa carnarvon* in isolated vine thicket patches attests to the past connectivity of this vine thicket archipelago.

The fact that most of this charopid fauna, with the possible exception of *Cineropa* spp. and to a lesser extent *Carnaropa* spp., is confined to small and scattered vine thicket patches, suggests that the current inventory of 18 species will surely increase with additional targeted field work and litter sorting. That will probably also increase the generic diversity of the SCQ charopids and only at that stage will this fauna be able to be put into biogeographic context. On the downside, the extremely localised distribution of many brigalow charopids, brings into sharp focus the inescapable fact that the large-scale land clearing of the brigalow in the past, has led to the extinction of some species.

The charopids of eastern Australia remain relatively poorly known and comprise many more undescribed species in museum collections than have been formally documented. The recently published studies on the MEQ charopids is a case in point (Holcroft 2018b, 2018c; Holcroft & Stanisic 2018). Collectively those studies elevated the number of known charopids from that region from 12 to 37 species based solely on material housed in museum collections. Hence, it is not surprising that 15 new species are described from SCQ. More than 450 undescribed species of charopids from wet, humid east coast rainforests are languishing in eastern state museum collections (QM, AM, MV) awaiting study. These include more than 80 from the Wet Tropics Bioregion alone that are housed in the Queensland Museum (Stanisic pers. obs.).

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