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Australia's smallest punctid: a description of four new species of minute punctids from Tasmania (Stylommatophora: Punctidae)

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Abstract

The Punctidae is a family of small to minute land snails that are often under-represented in museum collections, with investigations hampered by small size and lack of material. Herein we describe four species of minute punctids (1.0-1.2 mm in shell width) from Tasmania, three of which extend into mainland Australia, using comparative shell morphology and phylogenetic analyses of mitochondrial (COI, 16S) and nuclear (ELAVI8) DNA. We introduce *Paralaoma albina*, *Paralaoma corrugata*, *Paralaoma miniscula* and *Paralaoma monticunea*, and demonstrate that they are genetically distinct and can also be separated on subtle but consistent shell characteristics, including tightness of coiling, shell height, umbilical width, shell colour, and rib strength and spacing. *Paralaoma miniscula* becomes Australia's smallest punctid, with a shell width of only 1 mm.

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Introduction

The Punctidae are a group of small to minute land snails with their centre of diversity in Australasia, with around 90 species recorded from New Zealand (Barker, 2005) and 56 from Australia (Stanisic, 2013). The majority of Australian species are 1.2-2.5 mm in shell diameter, although there are a few larger species, the largest reaching 7 mm (Stanisic *et al.*, 2010, 2018). Their small size means that punctids are often missed in general surveys and consequently tend to be under-represented in museum collections. Targeted collecting methods, including the collection and sieving of leaf litter, are usually required to collect these elusive species.

The smallest of Australia's punctids, with shells only 1.2 mm wide at adult size, present challenges for taxonomic revisions. Sequencing is only possible with recently collected material and the whole specimen must be sacri-

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ficed to obtain sufficient DNA. Often very few specimens are collected, and the available material may not represent a full growth series. Many small punctids also have quite large geographic ranges. Eastern Australia's smallest punctids to date include *Paralaoma microcosmos* (shell width 1.2 mm), recorded from northern Victoria to mideastern Queensland; *P. eurysiana* (shell width 1.3 mm), with much the same distribution; and *P. parvissima* (shell width 1.2 mm), distributed in Tasmania, Victoria and southern New South Wales (Stanisic *et al.*, 2010, 2018).

The present study focuses on manuscript name 'Minilaoma corrugata', a tag name created by the third author for minute (SW 1.0-1.2 mm), relatively high-spired punctids from Tasmania with closely spaced ribs, with microsculpture of microradial lirae and spiral grooves. The most distinctive feature is the presence of strong spiral corrugations around the narrow umbilicus. The morphospecies showed some similarity to *Paralaoma parvissima* and *P. microcosmos*, but could generally be distinguished from the former by the presence of distinct ribs on the teleoconch, which *P. parvissima* lacks, and from the latter by its more crowded teleoconch ribs and wider umbilicus. Some specimens were not immediately distinguishable from *P. parvissima* based on sculptural features but were smaller, with a lower spire and lower whorl count. Some morphological variation in rib spacing, shell colour, sculpture around the umbilicus and tightness of coiling was noted in the group, leading it to be targeted for detailed investigation. Herein we present the results of a revision of this candidate species using shell morphology and both mitochondrial and nuclear DNA sequences, as part of a comprehensive revision of all Australian punctids.

Methods

Material examined

This study is based on the examination of types, ethanol-preserved specimens and supplementary dry material from the Australian Museum (AM) and the Tasmanian Museum and Art Gallery (TMAG), including freshly collected material (available on Figshare: https://doi.org/10.6084/m9.figshare.31130602).

Our study group initially comprised a candidate species with the tag name 'Minilaoma corrugata', a minute punctid found throughout most of Tasmania. Outgroup taxa included other Australian punctid sequences already available on GenBank (available on Figshare: https://doi.org/10.6084/m9.figshare.31129615), including two members of the family Cystopeltidae as outgroup taxa, and taxa newly sequenced for the present study. During fieldwork a new candidate species with the tag name 'Minilaoma sp. Wedge' was collected and immediately recognised as morphologically distinct.

Abbreviations used

Institutional abbreviations: AM: Australian Museum, Sydney; TMAG: Tasmanian Museum and Art Gallery.

Molecular studies and phylogenetic analyses

DNA was extracted from whole snail specimens by use of a QIAGEN DNA extraction kit for animal tissue (Qiagen, Hilden) following the standard procedure of the manual. Specimens were first photographed in dorsal, lateral and ventral views using a Leica M205C motorized stereomicroscope with a DMC5400 Leica camera, stacked in software LAS-X. Two mitochondrial and one nuclear phylogenetic markers were amplified by means of PCR: an approximately 450 base pair long fragment of the 16S gene by using the primers 16Sar and 16Sbr (Palumbi *et al.*, 1991); a 655 base pair long fragment of the COI gene by using the primers LCO1940 and HCOI2198 (Folmer *et al.*, 1994); and sequences of intron 8 of the embryonic lethality and abnormal visual system gene (ELAVI8) by use of the primers ELAVI8F and ELAVI8R (Nekola *et al.*, 2022). Reactions were performed using standard protocols with annealing temperatures times between 50 and 55 °C and elongation times between 60 and 90s for all gene fragments.

PCR fragments were purified by using EXOSAP-IT (Applied Biosystems, Waltham, Mass.) and both strands were cycle sequenced by use of the PCR primers. Electropherograms were corrected for misreads and forward and reverse strands were merged into one contig using CodonCode Aligner v. 3.6.1 (CodonCode Corp., Dedham, MA). All newly produced sequences have been deposited in GenBank under the accession numbers PZ956138-PZ956164, PZ956190-956200 and PZ979829-PZ979839.

Ribosomal and ELAVI8 sequences were aligned using the online version of MAFFT (version 7) available at www. http://mafft.cbrc.jp/alignment/server/ by employing the iterative refinement method E-INS-i suitable for sequences with multiple conserved domains and long gaps (Katoh *et al.*, 2002). All sequence datasets were partitioned by gene. Phylogenetic relationships were estimated by employing a Maximum Likelihood-based method of tree reconstruction using the software IQ-TREE vs. 1.6 (Nguyen *et al.*, 2015). This analysis was performed using the integrated modelfinder function (Kalyaanamoorthy *et al.*, 2017) by using the option to merge partitions. Nodal support was estimated by performing 10,000 ultrafast bootstrap repeats (Minh *et al.*, 2013).

Uncorrected pairwise genetic distances were calculated using MEGA version 11 (Tamura *et al.*, 2021) under the option 'pair-wise deletion of gaps'.

Morphological studies

Shells were photographed using a Leica M205C motorized stereomicroscope with a DMC5400 Leica camera, and measured from photographs. Dimensions mea-

sured were height (SH = maximum dimension parallel to axis of coiling), width (SW = maximum dimension perpendicular to SH), umbilicus width (UW = maximum dimension between the end of the shell and the inner umbilicus), and number of whorls (NW = whorl count using method shown by Köhler (2011). Analyses of covariance (ANOVA) of morphometric parameters were performed using XLStatistics (Carr, 1997–2011) and used to compare MOTUs.

Shells were prepared for scanning electron microscopy (SEM) (used to examine the shell microsculpture) by soaking in water with detergent and cleaning gently with a fine brush. If necessary, a fine dissecting pin was used to gently remove debris. Shells were air-dried and mounted on SEM stubs using carbon tabs. Mounted shells were sputter-coated with gold and examined using a JEOL JCM-7000 Benchtop Scanning Electron Microscope.

When describing the teleoconch sculpture, the term 'major ribs' was used to refer to distinct raised ribs, often topped with a periostracal blade or thread. The term 'microradial threads' was used to refer to finer sculpture, usually positioned between major ribs, sometimes also with a small periostracal extension.

Species identification and delineation

Our operational criterion for the delimitation of species was to test whether candidate species were phenotypically and genotypically distinct from each other (Sites & Marshall, 2004). Candidate species were initially delimited by grouping specimens into molecular operational taxonomic units (MOTUs). We then assessed whether these MOTUs represented morphologically, anatomically and genetically coherent groups, distinguishable from each other. In such cases we considered the MOTUs to be independent species and assigned available taxon names to them based on their morphological similarity to and geographic concurrence with types. Subsequently, we employed basic statistics of morphometric characters to assess the amounts of phenotypic differentiation within and among the so recognized species.

Results

Molecular studies and phylogenetic analysis

The final sequence data set contained sequences from thirteen specimens initially identified as 'Minilaoma corrugata' or 'Minilaoma sp. Wedge', along with 27 other punctid specimens from Australia, including representation of other minute trochoidal punctids (*Trocholaoma parvissima*, *Iotula microcosmos* and *Pseudiotula eurysiana*). The tree was rooted using two specimens of Cystopeltidae based on the phylogenetic tree of Hyman & Köhler (2025). The final alignment had a length of 2,088 aligned nucleotide positions.

The phylogenetic analysis showed that specimens initially identified as 'Minilaoma corrugata' comprised three separate clades (clades A, B and D; Figure 1) and that specimens initially identified as 'Minilaoma sp. Wedge' comprised their own clade (clade C). Each clade was well supported (bootstrap 100%) and well differentiated with average genetic *p*-distances in COI across the four clades ranging from 10% to 14% (average 13%), while the intraspecific differences were 0 to 5% (average 3%) (Figure 2, Table 1). Clades C and D were sister taxa with bootstrap support of 92%; the relationships of the other taxa were not well supported and could not be resolved.

Clades A, C and D also included specimens from NSW, Victoria and South Australia that were initially identified as *Paralaoma microcosmos*, *P. parvissima* or as unidentified species. However, all clades were distinct from existing species of minute trochoidal punctids (*P. parvissima*, *P. microcosmos*, *P. eurysiana*).

Morphological studies

After preliminary molecular analysis revealed four MOTUs, further morphological study was undertaken to determine whether shell variation previously noted in 'Minilaoma' was in alignment with the molecular groupings. Examination showed that the taxa did in fact readily separate into four groups concordant with the MOTUs, with subtle differences in size, tightness of coiling, spire height, umbilicus width, rib spacing, and shell colour. The species were found to exist in microsympatry, with up to three MOTUs being found at some locations.

Analysis of basic shell measurements was hampered by the lack of available material of adult specimens, particularly for clades B and C. However, some significant differences among clades were found. Shells in clade C were significantly larger than shells in clades B (SW: $p < 0.01$; SH: $p < 0.01$) and D (SW, $p < 0.01$) and shells in clade D were significantly larger than shells in clade B (SW: $p < 0.05$). Shells belonging to clade A were higher-spired than shells in clade D (SH/SW: $p < 0.05$). All groups differed in the ratio of number of whorls to shell width (NW/SW: $p < 0.05$), except for clades B and D. Both umbilical width and the ratio of umbilical width to shell width were significantly larger in clade A than in clades B or D (UW, UW/SW: $p < 0.05$). Shell measurements are available on FigShare (https://doi.org/10.6084/m9.figshare.31130680) and can be visualised in Figure 3.

Discussion

Molecular phylogenetics shows clearly that the four MOTUs found by our analysis are distinct from one another, although their relationships cannot be fully resolved. Pairwise differences in COI are 10-14%, a similar range to other charopid and punctid taxa (e.g. 10.6%-11.7% in Lord Howe Island punctids; Hyman & Köhler, 2025; 9.8%-17.7% in Lord Howe Island charopids; Hyman & Köhler, 2024). The MOTUs are also microsympatric with no signs of gene flow between them, another indication that they are distinct from one

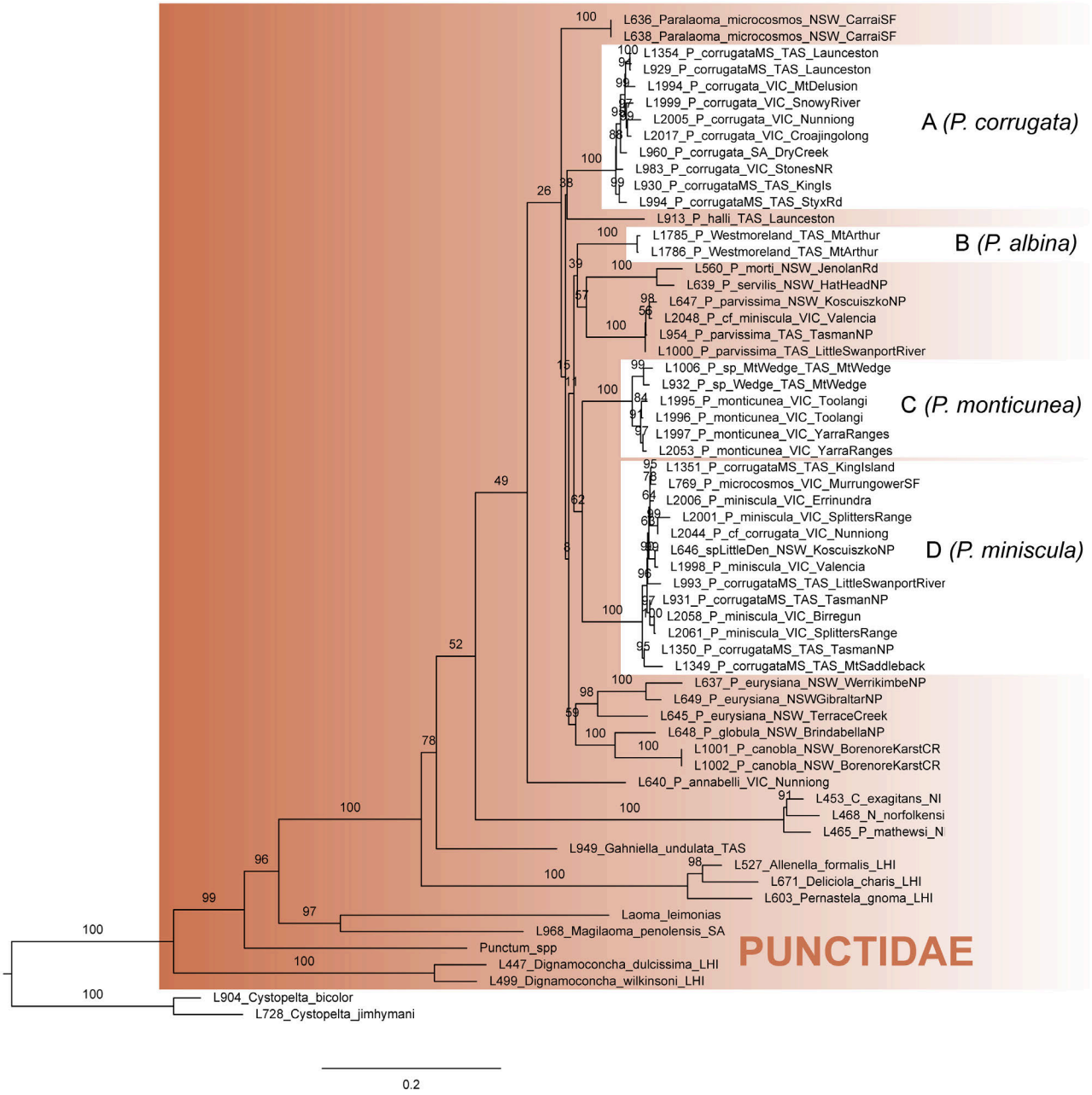

Figure 1. Best maximum likelihood consensus tree of Punctidae based on analysis of the concatenated data set of fragments of mitochondrial genes 16S and COI and nuclear marker ELAVi8 using IQ-TREE. Numbers on branches indicate nodal support based on 10 000 ultra-fast bootstrap repeats. Scale bar indicating 20% of modelled sequence divergence.

another. They can be separated by examination of shell features, supported by the statistical analysis of shell characters which found significant differences in shell size, spire height, tightness of coiling (shown by the ratio of number of whorls to shell width) and umbilical width. All species pairs could be separated by significant differences in at least one parameter; however, the differences are subtle.

One deficiency of our study is the lack of sufficient adult shells for adequate analysis for clade B in particular. Juvenile shells may differ in shape to adult shells, being more likely to have an open umbilicus that narrows or closes with maturity (Goodfriend, 1986). They may also have a flatter shell profile, especially if the last whorl descends rapidly in adults. Another complicating factor is the subtle differences in shell shape combined with the very small size of the species involved. Shells must be in the correct orientation to be accurately measured, and handling and positioning such tiny and fragile specimens correctly is extremely difficult. Human error becomes more significant at this scale, and may blur the boundaries of the groups.

Other characters such as differences in rib spacing are difficult to quantify and analyse, since some taxa have distinct major ribs as well as microradial threads (clades A and B), while one has merely radial growth lines and microradial threads (clade C), and the fourth has rela-

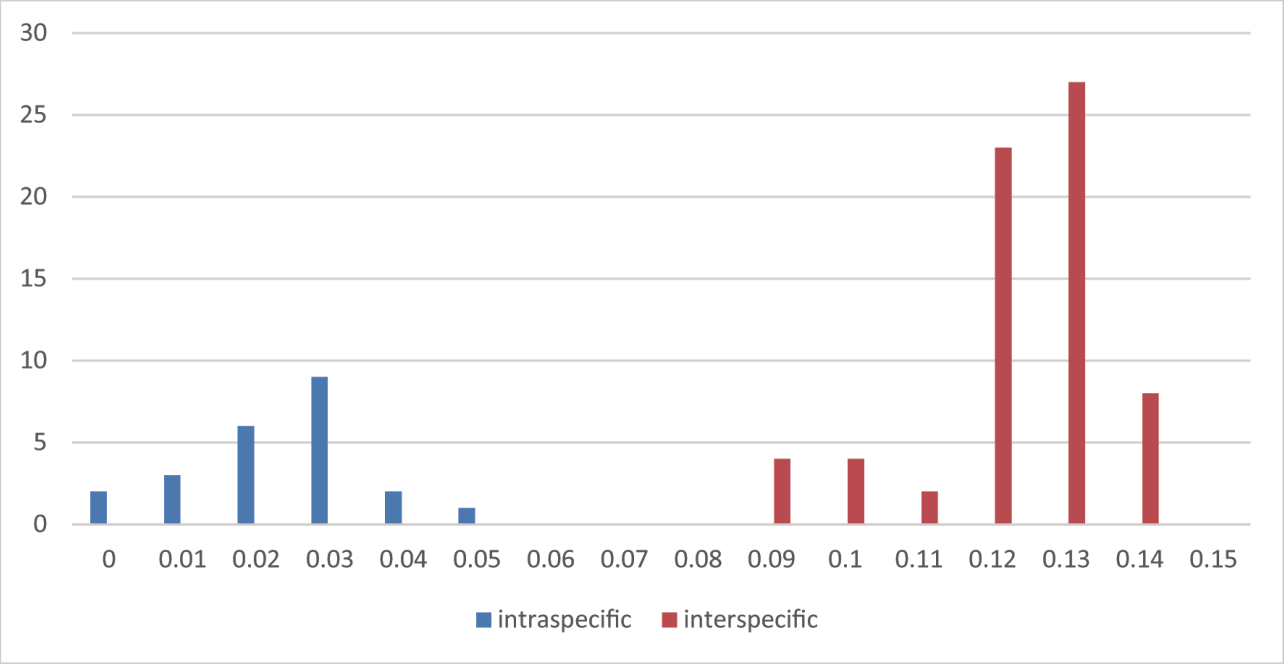

Figure 2. Comparison of intra- and interspecific genetic *p*-distances for COI sequences.

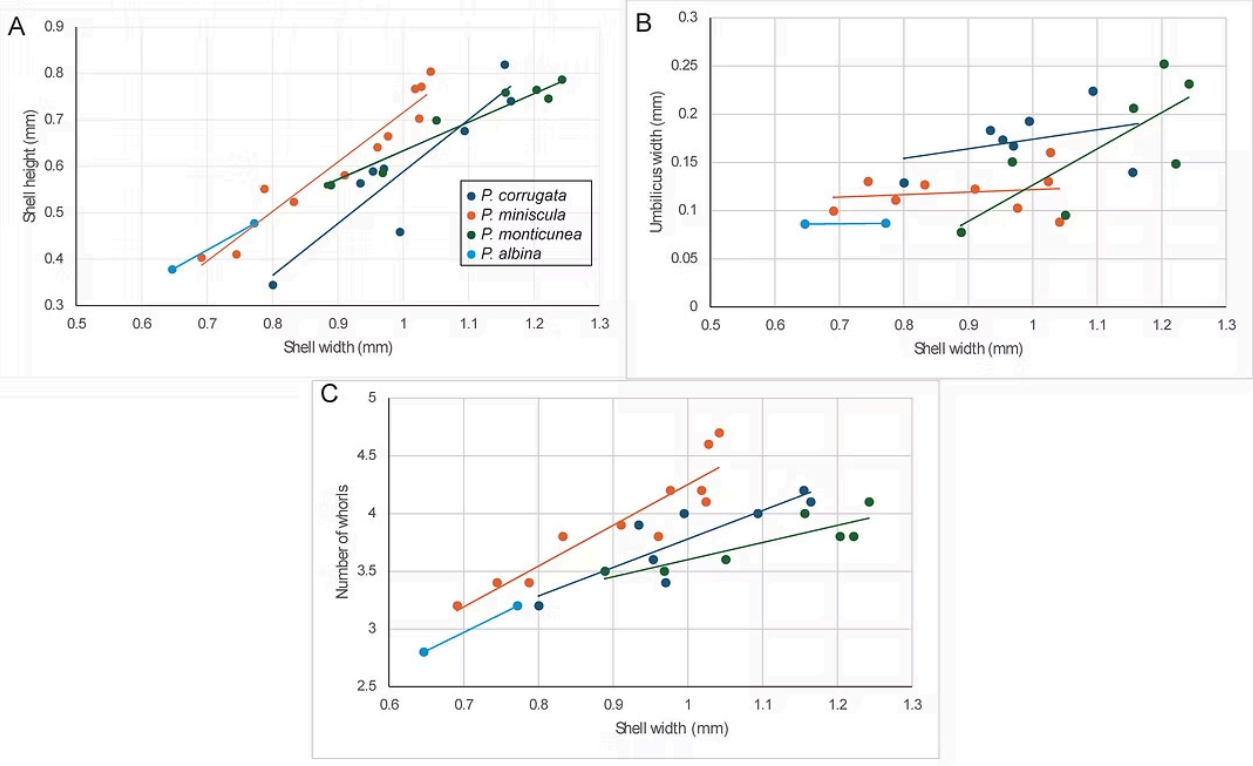

Figure 3. Shell shape parameters visualised on a scatter plot with linear trendlines. A. Shell height against shell width. B. Umbilicus width against shell width. C. Number of whorls against shell width.

tively weak major ribs that are often difficult to distinguish from microradial threads (clade D).

Despite the rather slight morphological differences among the taxa, we are confident that the shell differences in rib size and spacing, shell shape, size, colour and coiling are sufficient to distinguish them, supported by molecular evidence of distinctness. We describe the four MOTUs as new species in the Taxonomic Section below. The distribution of each species is shown in Figure 4.

We place all four species in the genus *Paralaoma*, following a recent analysis of Australian Punctidae using molecular and shell shape data that synonymised genera *Gratilaoma*, *Iotula*, *Pseudiotula*, *Laomavix*, *Trocholaoma*,

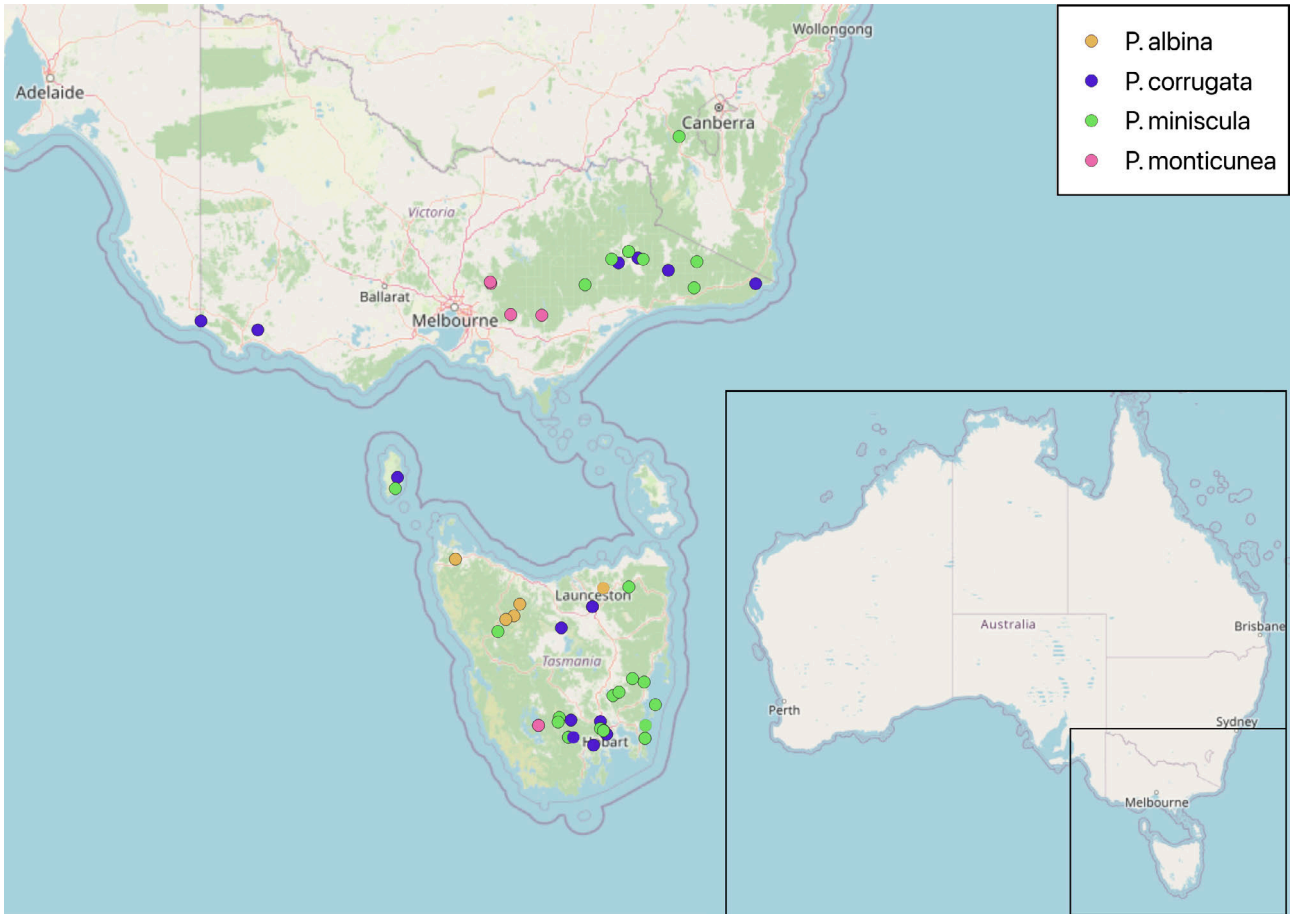

Figure 4. Map showing the distribution of *Paralaoma albina*, *P. corrugata*, *P. miniscula* and *P. monticunea* based on material examined.

Table 1. Average pairwise distances in COI within and between species. Intraspecific distances are shown in bold.

	P. miniscula	*P. corrugata*	*P. monticunea*	*P. albina*
Paralaoma miniscula	**3%**			
Paralaoma corrugata	13%	**3%**		
Paralaoma monticunea	13%	13%	**3%**	
Paralaoma albina	13%	10%	14%	**1%**

Miselaoma, *Tescilaoma*and *Westralaoma* with *Paralaoma* (Hyman et al., 2026).

Taxonomy

Family Punctidae Morse, 1864

Type species *Punctum* Morse, 1864

Remarks

The small to minute Punctidae are as yet poorly understood. Molecular evidence which includes members of the type genus, *Punctum*, demonstrates that they are a monophyletic group nested within Charopidae (Salvador *et al.*, 2020, Salvador, 2022). Shell shape and whorl counts are highly variable (Solem, 1983). Consistent features include a protoconch sculpture of raised spiral cords and a diagnostic radula consisting of bicuspidate latero-marginal teeth with three minute accessory cusps (Stanisic 1998). Punctids can be found in the Northern Hemisphere as well as in Australia, New Zealand, and some sub-Antarctic and Pacific Islands (Stanisic, 1998). The Australian taxa are distributed primarily along the southern part of the continent, with

radiations on Lord Howe Island and Norfolk Island as well.

Genus Paralaoma Iredale, 1913

Paralaoma Iredale, 1913: 380. Type species *Paralaoma raoulensis* Iredale, 1913 (by subsequent designation; Zilch, 1959).

Remarks

The type species of *Paralaoma* is *P. raoulensis*, a species from the Kermadec Islands. It is recognised as a possible junior synonym of *P. servilis* based on shell landmark analysis (Nekola et al., 2025), but at the present time the evidence is inconclusive. *Paralaoma* is described by Stanisic et al. (2010) as comprising taxa with a minute to small, depressedly turbinate to trochoidal shell with a low to high, dome-shaped spire, rounded or shouldered whorls, a spiral protoconch, closely to widely spaced teleoconch ribs overlaying fine spiral threads, and a narrow to wide umbilicus.

Paralaoma albina Hyman, Bell & Bonham sp. nov.

urn:lsid:zoobank.org:act:59DF1221-5A6D-40ED-8BC2-7CE5445AA4A1

Holotype: TMAG E51774, Tasmania: Fagans Rd, Togari Block (-40.8828, 144.9667), coll. 10 Oct 2016, K. Bonham.

Shell (Fig 5, 6) minute (SW up to 1.1 mm), turbinate with a low spire, up to 4.2 moderately tightly coiled whorls (mean NW/SW = 4.24) with a rounded whorl profile. Shell colour white to pale yellow. Protoconch (Fig. 6E-F) spirally lirate, with 11-13 distinct, strong spiral lirae. Teleoconch (Fig. 6G-H) sculptured with moderately spaced, prominent, bladed radial ribs, 45-51 on first teleoconch whorl, 40-49 on last teleoconch whorl; microsculpture of spiral grooves crossed by narrow radial threads; 2-3 radial threads between ribs on the early teleoconch, 6-10 between ribs on the last whorl. Aperture ovately lunate; umbilicus (Fig. 6I-J) moderately narrow (mean UW 0.09 mm; mean UW/SW 0.12). Spiral sculpture around and inside the umbilicus usually weakly present, less distinct than in *P. corrugata*.

See Supplementary material (available at https://doi.org/10.6084/m9.figshare.31130602)

Etymology

From the Latin *albinus*, meaning 'white, bright, pure'; referring to the white shell colour.

Distribution

Paralaoma albina is currently only known from the north of Tasmania, from Mt Arthur to the far north-west (Fig. 4).

Remarks

This species can be distinguished from other members of *Paralaoma* by a combination of characters, including its minute size (shell width up to 1.1 mm in adult specimens), its pale shell colour, and its teleoconch sculpture of moderately spaced, bladed ribs. The ratio of number of whorls to shell width shows relatively tight coiling, exceeded in this study only by *P. miniscula*. However, due to the lack of adult material, measurements used herein for analysis were based solely on two juvenile

Figure 5. Shell of *Paralaoma albina*, Mt Arthur, Tasmania. A. AM C.609649. B. AM C.609650. Scale bar 1 mm. Images by I. Hyman.

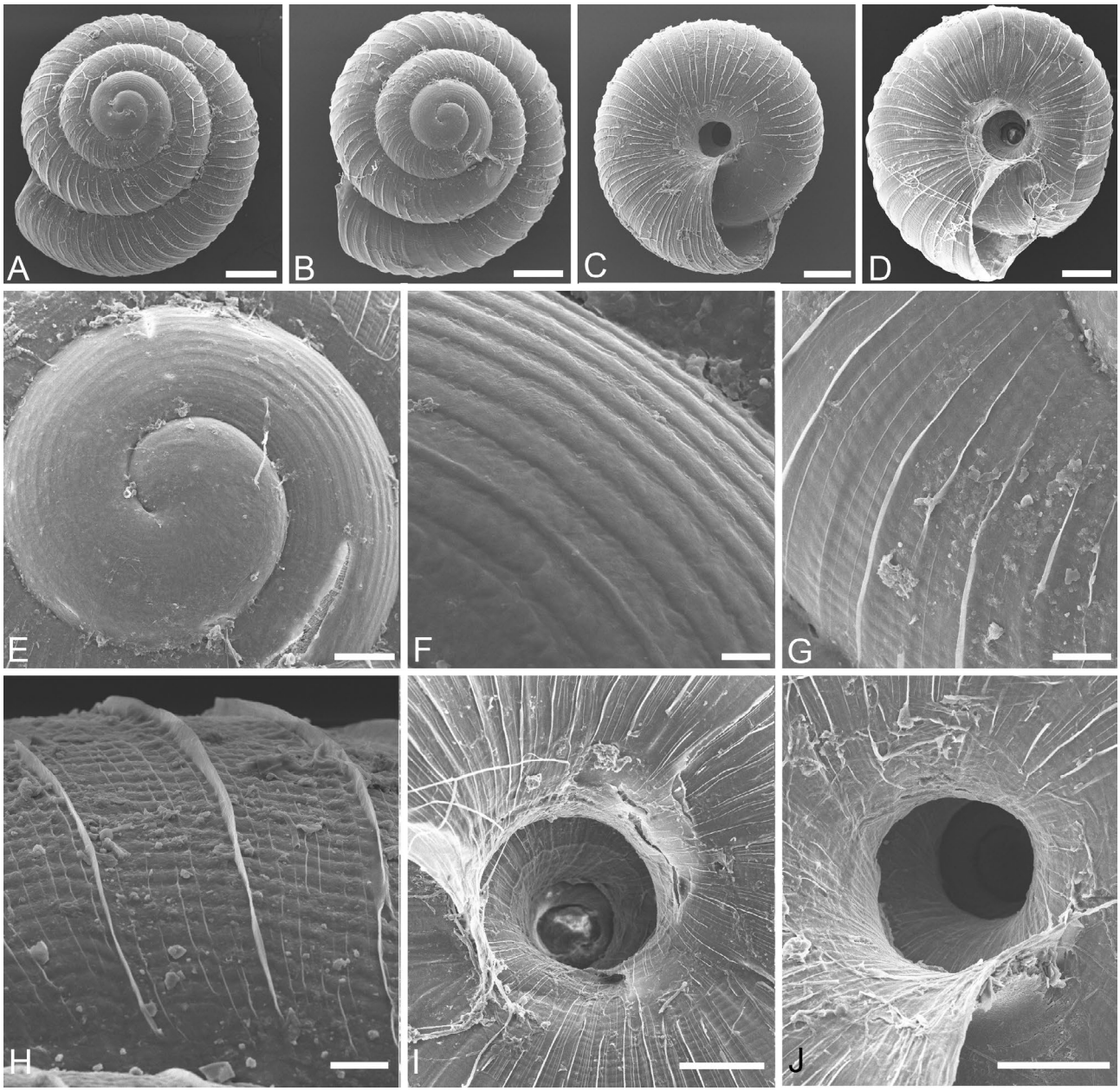

Figure 6. Shell microsculpture of *Paralaoma albina*. A, F, H. TMAG E51774 (holotype). B, E, G. TMAG E51776. C, J. TMAG E51773. D, I. TMAG E51772. A-B. Dorsal view. C-D. Ventral view. E-F. Protoconch. G. Early teleoconch. H. late teleoconch. I-J. Umbilicus. Scale bars 10 µm (F), 20 µm (G-H), 50 µm (E), 100 µm (I-J), 200 µm (A-D). Images by B. Bell.

specimens. It would be beneficial to expand this dataset once more suitable material is available.

Paralaoma corrugata Hyman, Bell & Bonham sp. nov.

urn:lsid:zoobank.org:act:3CF0B6BF-3A8B-489D-AF86-915FE4F00019

Holotype: TMAG E51780, Tasmania, Poimena Reserve (-42.783, 147.246), collected 1 August 2019, K. Bonham.

Shell (Figs 7, 8) minute (SW up to 1.2 mm, SH up to 0.8), depressedly trochoidal with a low spire, with up to 4.2 moderately tightly coiled whorls (mean NW/SW 3.79) with a rounded whorl profile. Shell colour brownish yellow. Protoconch (Fig. 8E-F) spirally lirate, with 10-14 distinct, strong spiral lirae. Teleoconch (Fig. 8G-H) sculptured with crowded radial ribs, becoming less crowded, about 94-102 on last whorl. Microsculpture of weak spiral grooves, becoming stronger towards outer whorls, crossed by narrow spiral threads; no radial microsculpture for first half-whorl of teleoconch; after this, 2-3 microradials between each major rib, increasing to around 5 by last whorl. Aperture ovately lunate; umbilicus (Fig. 8I-J) moderately narrow (mean UW 0.17 mm; mean UW/SW 0.18). Spiral sculpture around and inside the umbilicus strongly present (Fig. 8I-J).

Body white with grey neck and eyestalks (Fig. 7C-D); blotches of dark pigment on the mantle are visible through the shell.

See Supplementary material (available at https://doi.org/10.6084/m9.figshare.31130602)

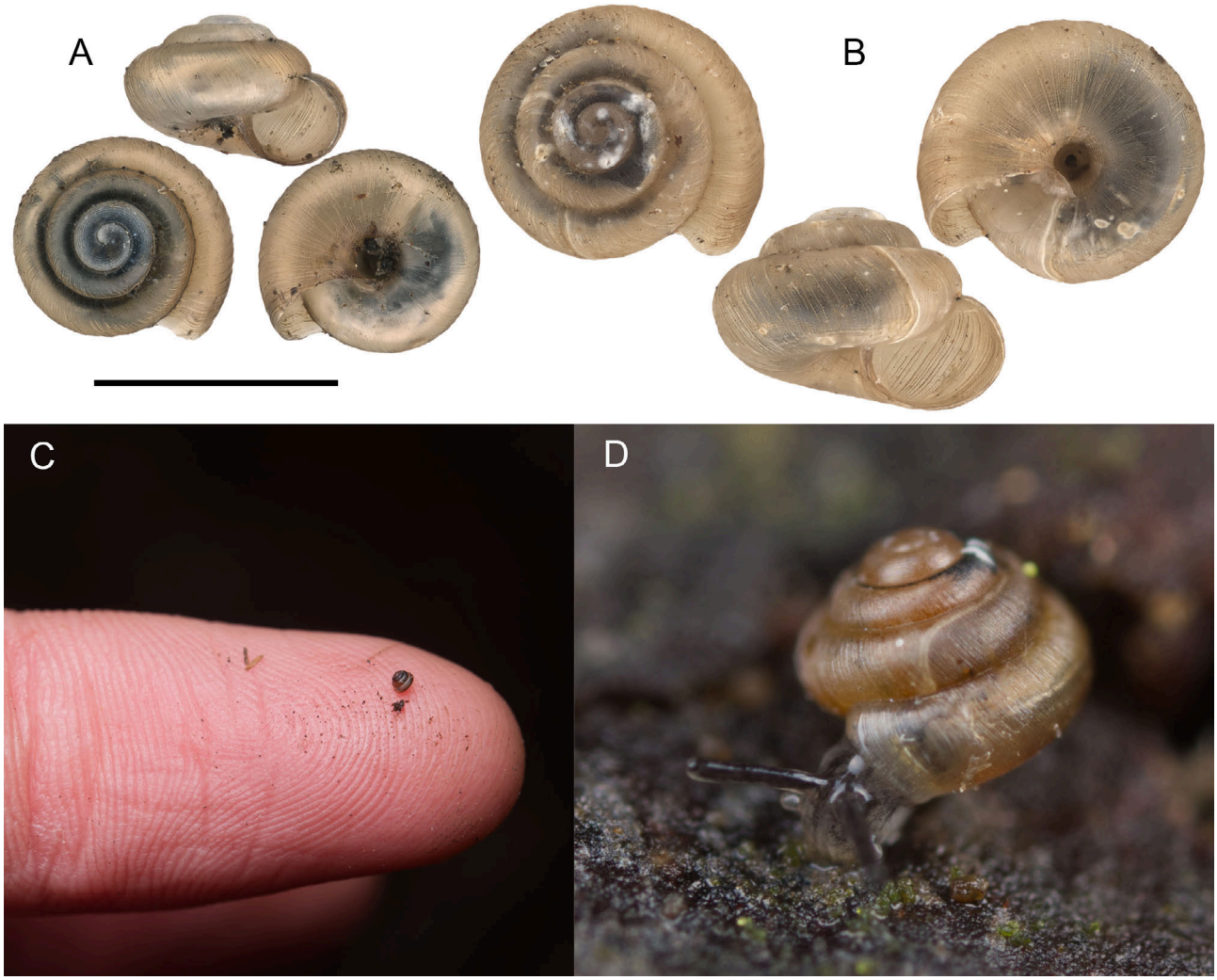

Figure 7. Shell and live images of *Paralaoma corrugata*. A. AM C.594902, Dry Creek, South Australia. B. TMAG E51784, Styx Rd, Tasmania. C-D. Truganini Reserve, Taroona. Scale bar 1 mm; live images not to scale. Images by J. Caiza (A-B), B. Bell (C-D).

Etymology

From the Latin *corrugatus*, meaning 'wrinkled, ridged', referring to the distinctive spiral ridges around the umbilicus.

Distribution

Paralaoma corrugata is distributed in the eastern half of Tasmania, extending to the far north-west, including King Island; it is also recorded from six locations in eastern Victoria, western Victoria and eastern South Australia (Fig. 4). It is likely that this tiny, elusive species is more widespread in southern Australia; targeted leaf litter collecting would be the best way to better determine its distribution.

Remarks

The clearest distinguishing feature of this species is the strong spiral sculpture around and inside the umbilicus. It is generally slightly larger than *P. miniscula*, with a more loosely coiled shell with a lower spire and wider umbilicus; however, the difference is less clear with juvenile specimens. The shell is a distinct brownish yellow.

Paralaoma miniscula Hyman, Bell & Bonham sp. nov.

urn:lsid:zoobank.org:act:57C08BA6-0D74-41E8-9A6A-2B69EF4918A1

Holotype: TMAG E51894, Tasmania, Truganini Conservation Area (42° 55' 47'', 147° 20' 38''), collected 13 June 2024, K. Bonham.

Shell (Fig. 9, 10) minute (SW up to 1.0 mm, SH up to 0.8 mm), trochoidal with a raised spire, with up to 4.7 tightly coiled whorls (mean NW/SW 4.34) with a rounded whorl profile. Shell colour white or greenish tinged. Protoconch (Fig. 10D-E) spirally lirate, with 13-14 distinct, strong spiral lirae. Teleoconch (Fig. 10F-H) sculptured with crowded radial ribs, becoming less crowded towards last whorl, about 85-90 on last whorl. Microsculpture of spiral grooves, crossed by narrow spiral threads; initially with 2-3 microradials between major ribs, increasing to 3-5 by last whorl (Fig. 10A, F-H). Some specimens lack distinct major ribs, only exhibiting microradial threads (e.g. Fig. 10B-C, I). Aperture ovately lunate; umbilicus (Fig. 10I) very narrow (mean UW 0.12 mm; mean UW/SW 0.14). Spiral sculpture around and

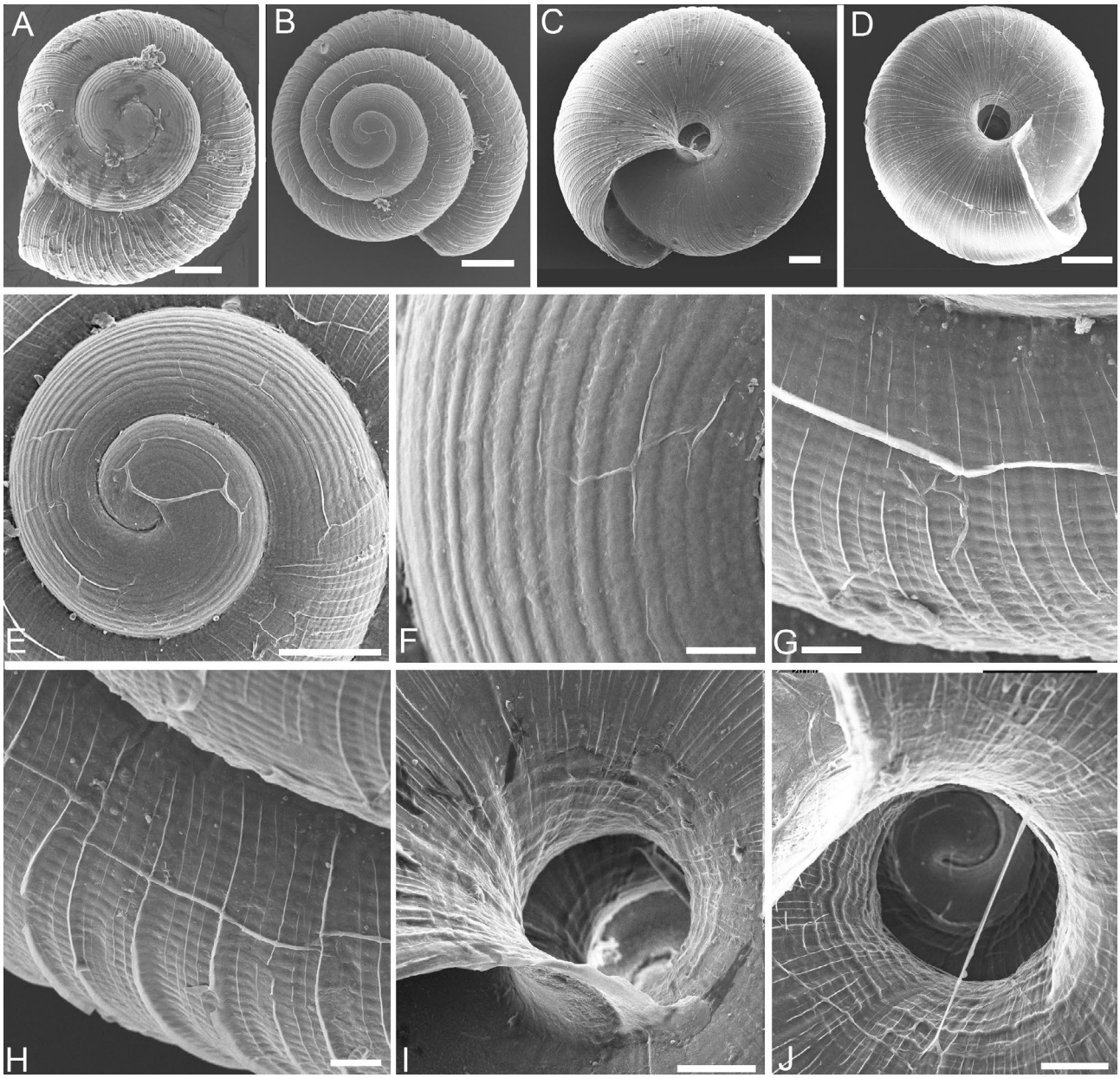

Figure 8. Shell microsculpture of *Paralaoma corrugata*. A. C.609755. B, E-I. TMAG E51780 (holotype). C, J. C.609756. D. TMAG E51778. A-B. Dorsal view. C-D. Ventral view. E-F. Protoconch. G. Early teleoconch. H. late teleoconch. I-J. Umbilicus. Scale bars 20 µm (F-H), 50 µm (I-J), 100 µm (A, C, E), 200 µm (B, D). Images by B. Bell.

inside the umbilicus usually lacking; sometimes traces visible in larger specimens.

See Supplementary material (available at https://doi.org/10.6084/m9.figshare.31130602)

Etymology

From the Latin *minisculus*, meaning 'rather small', referring to the small size of this species.

Distribution

Paralaoma miniscula appears to be the most widespread and abundant of the four study taxa, being found throughout Tasmania, and is also recorded from Victoria and New South Wales (Fig. 6).

Remarks

This species is Australia's smallest recorded punctid to date. It can be distinguished from other members of *Paralaoma* by its minute size and white shell colour, its trochoidal, tightly coiled shell with a relatively high spire, its narrow umbilicus usually lacking the distinct spirals seen in *P. corrugata*, a higher adult whorl count and lower whorl expansion rate than the other taxa in the present study, and its relatively weak, crowded radial ribs that are not always distinguishable from microradials. Examination of a wide set of morphological material indicated that distinct raised radial ribs separated by microradial threads are present in some specimens, but in others there are only microradial threads with no raised ribs.

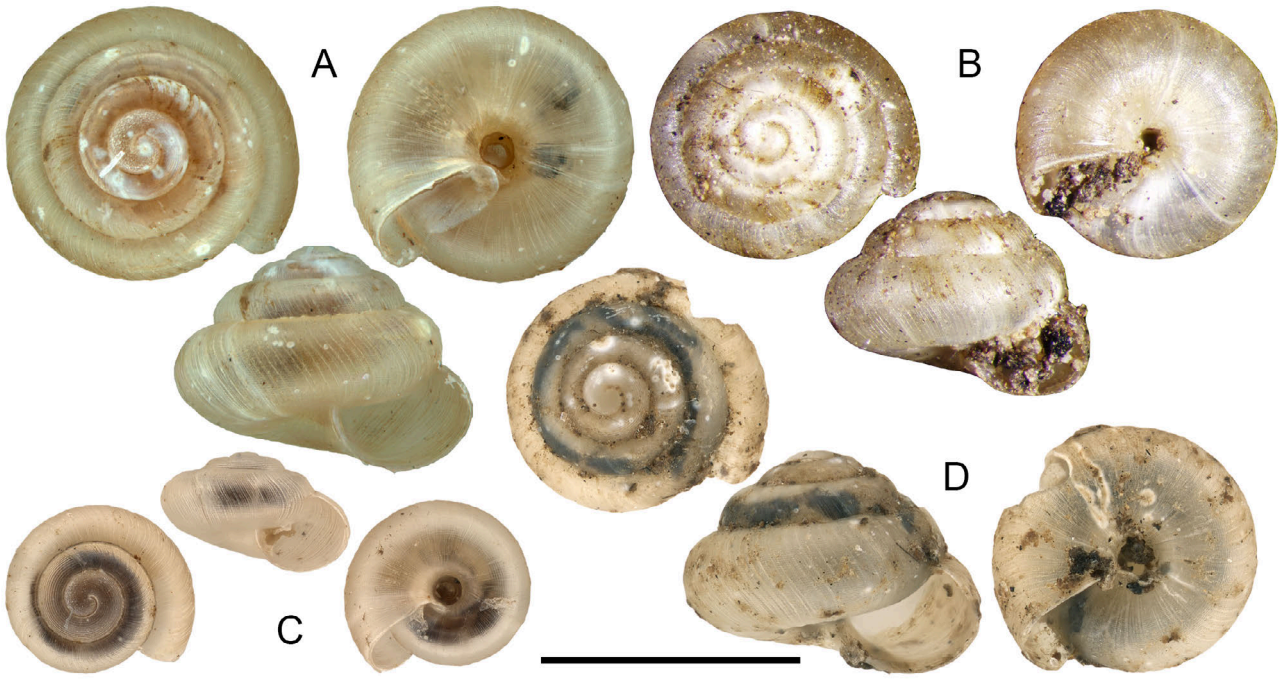

Figure 9. Shell of *Paralaoma miniscula*. A. TMAG E51894 (holotype), Truganini Conservation Area, Tasmania. B. AM C.588441, Kosciuszko National Park, NSW. C. TMAG E51815, Little Swanport River, Tasmania. D. AM C.594784, Murrungower State Forest, Victoria. Scale bar 1 mm. Images by I. Hyman (A), J. K. Foon (B), J. Caiza (C-D).

Paralaoma monticunea Hyman, Bell & Bonham sp. nov.

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Holotype: TMAG E51786, Tasmania, Mt Wedge Forest Reserve, Nature Trail (-42.82911771, 146.2726283), collected 29 April 2023, I.T. Hyman, K. Bonham, B. Bell.

Shell (Figs 11, 12) minute (SW up to 1.2 mm, SH up to 0.8 mm), depressedly turbinate with a low spire, with up to 4.1 moderately loosely coiled whorls (mean NW/SW 3.43) slightly flattened above and below a rounded periphery. Shell colour pale gold. Protoconch (Fig. 12C-D) spirally lirate, with 15 distinct, strong spiral lirae. Teleoconch (Fig. 12E-G) sculptured with weakly raised, indistinct radial ribs. Microsculpture of spiral grooves, crossed by narrow spiral threads; spiral threads often indistinct on early whorls, becoming stronger and clearly distinct by last whorl. Aperture ovately lunate; umbilicus (Fig. 12H) moderately narrow (mean UW 0.17 mm; mean UW/SW 0.15). Spiral sculpture around and inside the umbilicus lacking.

See Supplementary material (available at https://doi.org/10.6084/m9.figshare.31130602)

Etymology

From the Latin *montis*, meaning 'mountain', and *cuneus*, meaning 'wedge', after the type locality, Mt Wedge in Tasmania.

Distribution

The only material available for this study was from Mt Wedge in Tasmania and from Yarra Ranges and Toolangi in Victoria (Fig. 4). However, specimens from Franklin Nature Trail near the Lyell Highway in western Tasmania and from Harman River in northwestern Tasmania may also belong to this species.

Remarks

Paralaoma monticunea is sympatric with *P. miniscula* at Mt Wedge. It can be distinguished from *P. miniscula* by its larger size, more loosely coiled whorls (giving a lower NW/SW ratio), lower spire, and wider umbilicus.

Disclosures

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Acknowledgments

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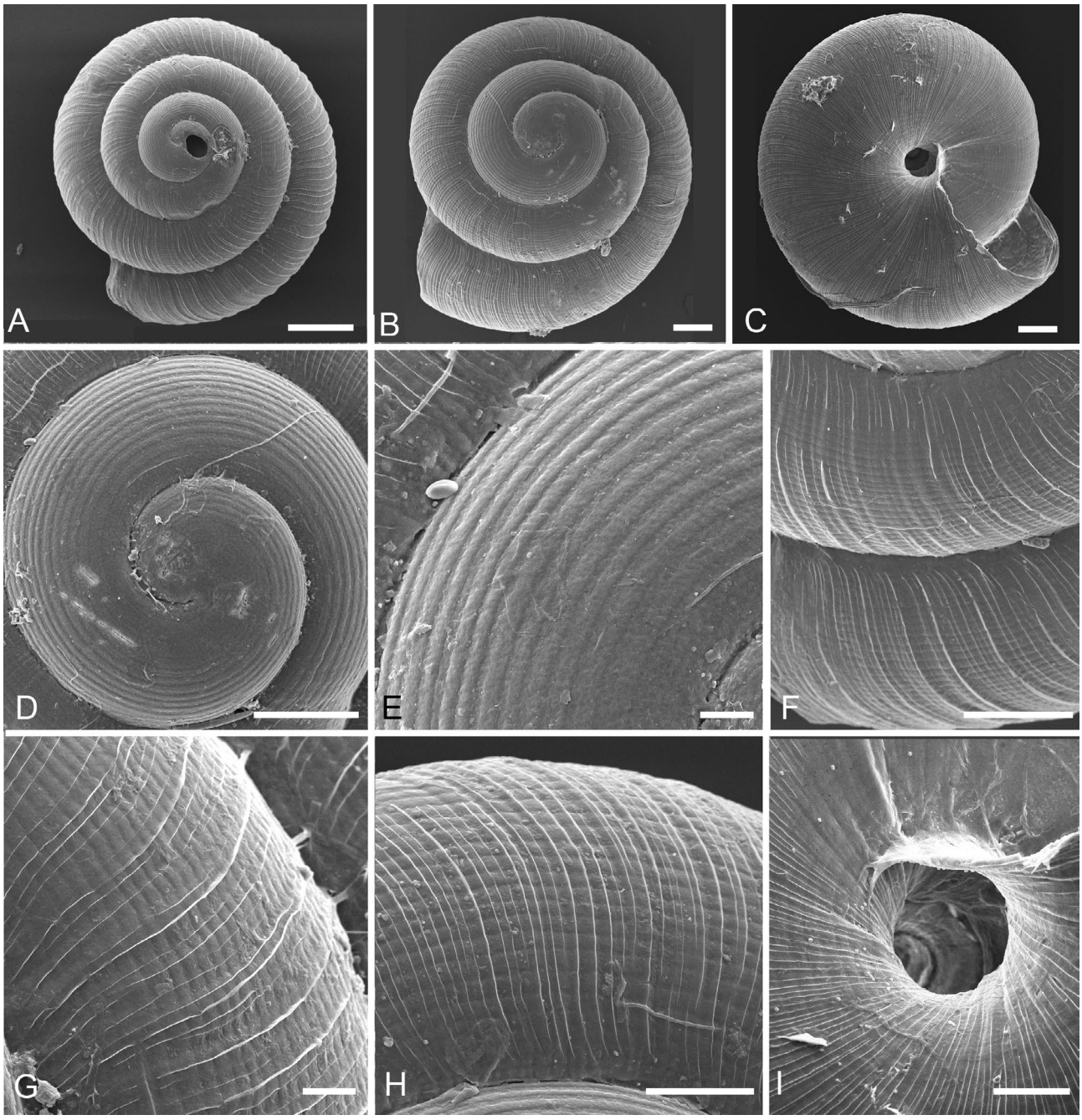

Figure 10. Shell microsculpture of *Paralaoma miniscula*. A, G-H. TMAG E51777. B, E-F, I. TMAG E51782. C, J. TMAG E51775. A-B. Dorsal view. C. Ventral view. D-E. Protoconch. F. Teleoconch. G. Early teleoconch. H. Late teleoconch. I. Umbilicus. Scale bars 20 µm (E, G), 50 µm (H-I), 100 µm (B-D, F), 200 µm (A). Images by B. Bell.

LP230100176. Specimens were collected under permit numbers TFA 23062 (IH) and TFA 25210 (KB) from the Tasmanian Department of Natural Resources and Environment, Y27294-3 from the South Australian Department for Environment and Water, and AA-0001167 from Parks Victoria.

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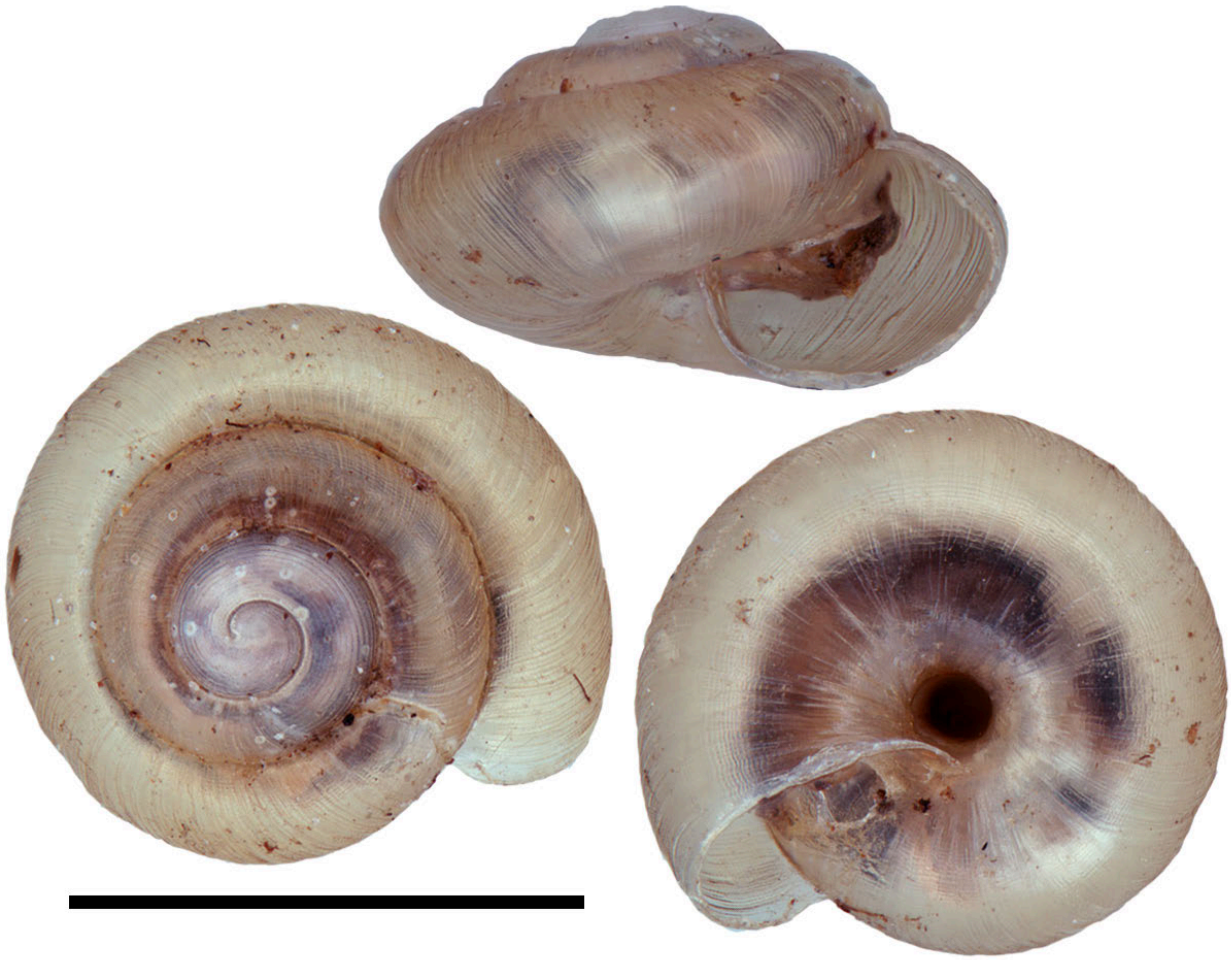

Figure 11. Shell of *Paralaoma monticunea*, TMAG E51786, Mt Wedge (holotype). Scale bar 1 mm. Images by I. Hyman.

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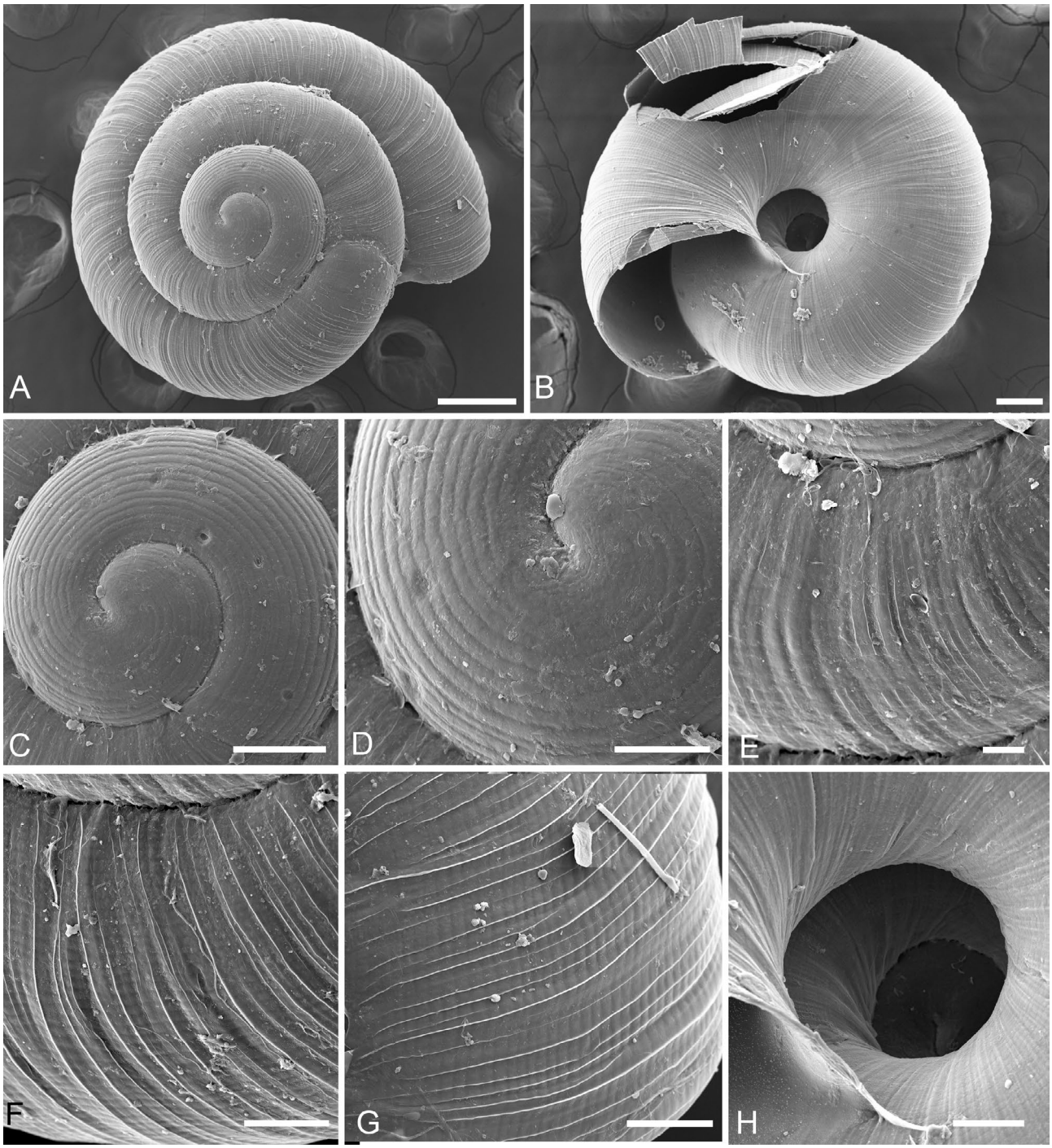

Figure 12. Shell microsculpture of *Paralaoma monticunea*. A, C-G. TMAG E51786 (dorsal, holotype). B, H. AM C.599695. Scale bars 20 µm (E), 50 µm (D, F-G), 100 µm (B-C, H), 200 µm (A). Images by I. Hyman.

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