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## Research article

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# Taxonomic Studies on Australian *Psammoecus* Latreille (Coleoptera, Silvanidae, Brontinae)

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**Abstract.** Two new species of *Psammoecus* Latreille, 1829 from Australia are described: *Psammoecus australis* sp. nov. and *P. venustus* sp. nov. A taxonomic revision and diagnoses for other Australian species are provided. *Psammoecus obesus* Grouvelle, 1919 is recorded from Australia for the first time. Two new synonyms are discovered: *Psammoecus t-notatus* Blackburn, 1908 = *P. amoenus* Grouvelle, 1912 syn. nov.; *Psammoecus vittifer* Blackburn, 1903 = *P. concolor* Grouvelle, 1919 syn. nov. A lectotype is designated for *Psammoecus concolor* Grouvelle, 1919.

**Keywords.** Coleoptera, Silvanidae, *Psammoecus*, Australia, taxonomy.

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## Introduction

*Psammoecus* Latreille, 1829 is a diverse genus within the Telephanini (Coleoptera: Silvanidae: Brontinae), with its highest diversity in the Oriental, Indo-Malayan, and Papua-Melanesian regions (Hetschko 1930). The genus remains poorly known, despite several studies in recent years (Pal 1985; Karner 2012, 2014; Yoshida & Hirowatari 2014; Yoshida *et al.* 2018). Hetschko (1930) reported four species of *Psammoecus* from Australia: *Psammoecus cruciger* (Waterhouse, 1876) (as *P. epsilon* Blackburn, 1903), *P. incertior* Blackburn, 1903, *P. t-notatus* Blackburn, 1908 and *P. vittifer* Blackburn, 1903. By erroneously treating *Psammoecus cruciger* as a junior synonym of *P. trimaculatus* Motschulsky, 1858, Pal (1985) also listed *P. trimaculatus* as occurring in Australia.

A monographic revision of the entire genus would be highly desirable, but the sheer amount of work that such an endeavour would require renders it currently impossible for the present author. Instead, a step-wise approach is followed by dividing revisionary work into geographical areas of varying sizes, i.e., into manageable parts.

In the present paper, two new species of *Psammoecus* are described and two new synonymies are proposed; diagnoses and distribution data for other Australian species are provided.

## Material and methods

Observations and measurements were made using an Olympus SZX16 stereo microscope. Habitus photographs were taken with Canon EOS 650D and EOS 7D Mark II digital cameras and a Canon MP-E 65 mm macro objective. Higher magnifications were obtained with Mitutoyo M Plan Apo objectives (10 × and 20 ×), with Asahi Takumar 200 mm and Carl Zeiss MC Sonnar 135 mm telephoto lenses as converging lenses. Photographs of genitalia were taken with Canon EOS 650D and EOS 7D Mark II digital cameras attached to an Olympus CH microscope. Images and image layers were processed with Zerene Stacker (Version 1.04), Adobe Lightroom 5.7 and GIMP (ver. 2.8.0) software.

A total of 383 specimens were studied.

Measurements were taken as follows: length, from apical margin of clypeus to apex of elytra; head width, across eyes; head length, from apical margin of clypeus to an imaginary line between hind margins of eyes; eye length, from anterior to posterior margin; antennal length, from base of 1<sup>st</sup> antennomere to apex of 11<sup>th</sup> antennomere; antennomere proportions were derived from actual measurements; pronotal width, across maximum width, excluding spines; pronotal length, from anterior to posterior margin; widths of anterior and posterior pronotal margins, across anterior and posterior denticles, respectively; elytral width, across maximum joint width; elytral length, along suture including scutellar shield. Temple angles were measured as described in Karner (2014).

In addition to the definitions proposed by Karner (2014), some further remarks on diagnostic characters are necessary:

The shape of the punctures on the vertex and pronotum has considerable diagnostic value. Punctures can be round or narrowed; sometimes they are represented by slit-like, very deep impressions. If punctures are narrowed, the term ‘elongate’ indicates an elongation in the direction of the body axis (e.g., Fig. 2B, punctation on vertex), while ‘widened’ indicates an elongation perpendicular to the body axis (e.g., Fig. 2C, punctation on pronotum).

Assessing the width of elytral striae (i.e., the width of strial punctures) can be difficult due to the presence of darkened areas surrounding the individual punctures. The width of these areas does not indicate the actual width of the striae. The strial puncturation should therefore be assessed under oblique, diffused illumination. Strial width in the sense of this work is the width of rows of punctures as indicated by the impressed area of the elytral surface.

Male genitalia vary greatly in shape and in the degree of sclerotization. It was found that strongly sclerotised types often have a more complex three-dimensional structure, whereas weakly sclerotised types are in general dorso-ventrally flattened. Lateral views of male genitalia are only provided if important diagnostic characters were found. Accordingly, both ventral and dorsal views are only depicted if the ventral aspect alone does not provide a sufficiently clear view of the shape of the median lobe.

For holotypes and type material of previous authors, label data are given verbatim, including atypical use of punctuation and spaces. The labels are cited beginning with the uppermost one, the respective lines of text are separated by ‘|’. Comments on label colours, label shapes, etc., regarding the respective specimen are included in square brackets. Data are condensed for paratypes of newly described species and for other material.

Genitalia were prepared as described by Karner (2012). For photography, isolated aedeagi were placed in Kaiser’s glycerol gelatin (Carl Roth GmbH) to enable precise orientation. After study, dissected parts were embedded in dimethylhydantoin formaldehyde resin on cellulose acetate labels and attached to the pins of the respective specimens.

**Institutional abbreviations**

ANIC	= Australian National Insect Collection, Canberra, Australia
HNHM	= Hungarian Natural History Museum, Budapest, Hungary
MKF	= private collection of Michael Karner, Frankfurt, Germany
MNHN	= Muséum national d'histoire naturelle, Paris, France
MSNG	= Museo di Storia Naturale, Genova, Italy
NHMUK	= Natural History Museum (formerly British Museum, Natural History), London, UK
RMNH	= Naturalis Biodiversity Center (formerly Rijksmuseum van Natuurlijke Historie), Leiden, the Netherlands

**Results**

Class Insecta Linnaeus, 1758  
 Order Coleoptera Linnaeus, 1758  
 Superfamily Cucujoidea Latreille, 1802  
 Family Silvanidae Kirby, 1837  
 Subfamily Brontinae Erichson, 1845  
 Tribe Telephanini LeConte, 1861  
 Genus *Psammoecus* Latreille, 1829

*Psammoecus cruciger* (Waterhouse, 1876)

Fig. 1

*Telephanus cruciger* Waterhouse, 1876: 125.

*Psammoecus epsilon* Blackburn, 1903: 155.

*Psammoecus cephalotes* Grouvelle, 1919: 20.

*Psammoecus cruciger* – Grouvelle 1908: 476. — Arrow 1927: 44. — Hetschko 1930: 82.

*Psammoecus cephalotes* – Arrow 1927: 44. — Hetschko 1930: 82. — Pal 1985: 41.

*Psammoecus epsilon* – Arrow 1927: 44.

*Psammoecus ypsilon* – Hetschko 1930: 82. — Pal 1985: 41 (misspellings).

non *Psammoecus trimaculatus* – Grouvelle 1908: 476 (misidentification). — Pal 1985: 41.

**Diagnosis**

The following combination of character states distinguishes this species: body oval (Fig. 1A) length 1.97–2.73 mm; eyes (Fig. 1B) large, evenly rounded; temples distinct, narrowed evenly immediately behind eyes; frontal grooves flat, slightly curved, short, reaching anterior fifth of eyes; antennae stout (Fig. 1C), antennomere 6 sometimes slightly darkened, antennomeres 7–10 distinctly darkened, antennomere 11 whitish yellow; punctation on head and pronotal disc dense, microsculpture absent, punctures round, somewhat smaller than an eye facet diameter, pubescence on head and pronotum moderate; pronotum (Fig. 1B) widest at anterior third, pronotal punctation moderate, punctures widened, about as wide as eye facet diameter, lateral pronotal margins with four, sometimes only three teeth of moderate size, anterior and posterior denticles present, small; elytra (Fig. 1A) widest at middle, elytra with piceous maculae: wide band near middle, posterior half of suture and elytral apex darkened, humeral area often slightly to distinctly darkened; elytral pubescence short, longer setae along anterior half of interstice between 9<sup>th</sup> and 11<sup>th</sup> stria; male genitalia (Fig. 1D–F) moderately sclerotised, with short, blunt median lobe that bears distinct, complex sclerotizations in apical part of internal sac, parameres short, bearing three distinct, long setae, parameres fused with tegmen, inner margins fused medially at flat angle, almost forming arc.

## Material examined

### Types

PAPUA NEW GUINEA • ♀, holotype of *Telephanus cruciger* Waterhouse, 1876; Dory; “Type” [round label with red border]; “59 58. Dory. | New Guinea”; “*Telephanus | cruciger*, | (Type) C. Waterh.”. [59–58 refers to 703 Coleoptera specimens collected by Alfred Russel Wallace in Dory, New Guinea, and purchased by NHMUK from Stevens’ Auction House in 1859 (M.V.L. Barclay pers. comm.)]; NHMUK.

AUSTRALIA • ♀, holotype of *Psammoecus upsilon* Blackburn, 1903 (= *P. upsilon* sensu Hetschko 1930); [Northern Queensland?]; “T. | 7223 | N. Qv [?]” [written on mounting label, last line in red ink]; “Type | H. T.” [round label with red border]; “*Psammoecus | upsilon*, Blackb.”; “Australia. | Blackburn Coll. | B.M. 1910–236.”; NHMUK.

AUSTRALIA • ♀, holotype of *Psammoecus cephalotes* Grouvelle, 1919; Port Darwin; “Type” [round label with red border]; “Port Darwin. | 92–2.”; “4716”; “*Psammoecus | cephalotes* | G. Grouv” [Grouvelle’s hand]; NHMUK.

### Other material

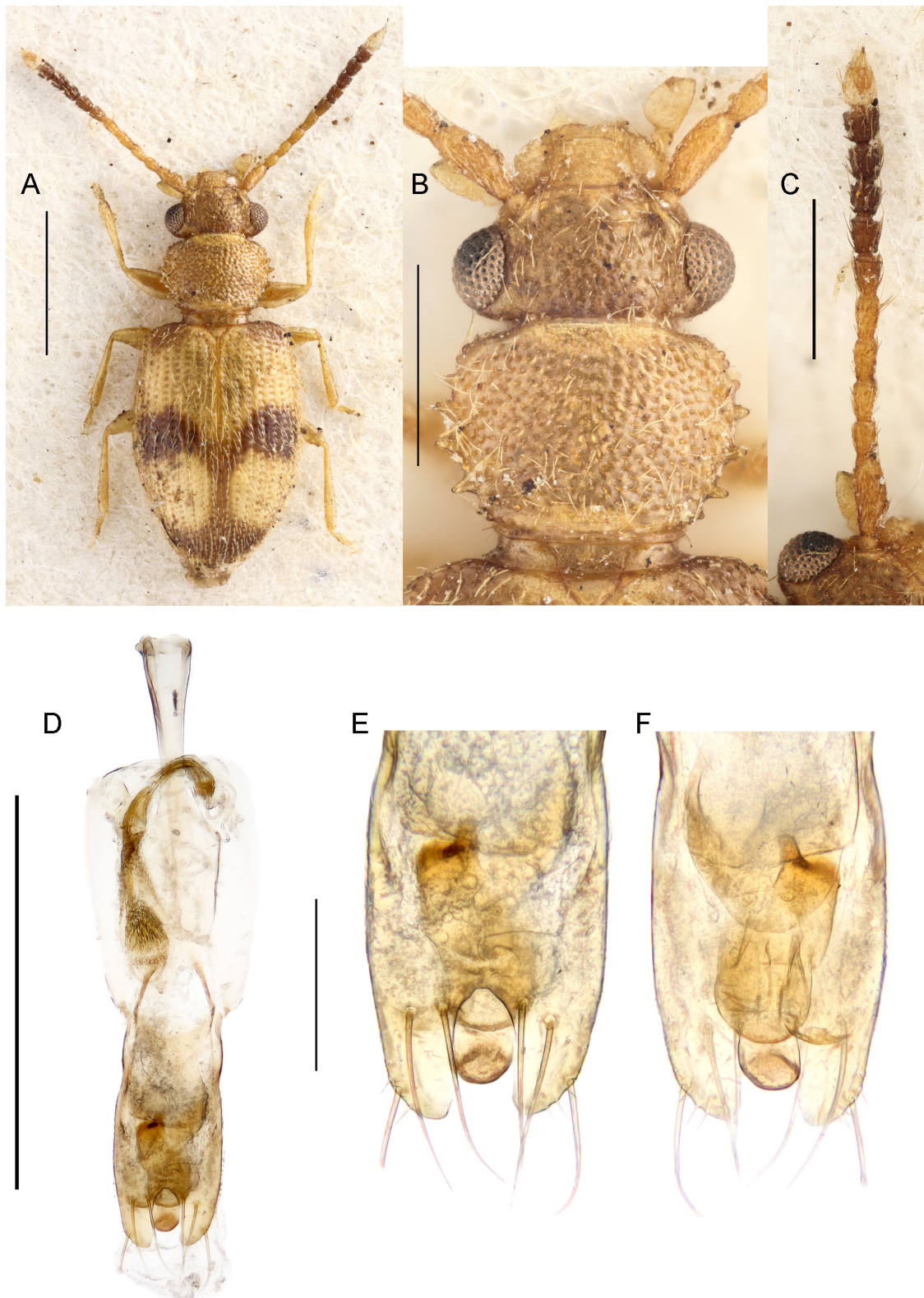
AUSTRALIA – **Queensland** – **Cairns** • 3 specs; Aug. 1947; ANIC • 4 specs; ANIC • 6 specs; Sep. 1949; ANIC • 1 spec.; 16°55’ S, 145°46’ E; 26 Jan. 1938; Brooks leg.; ANIC • 1 spec.; same locality; 18 Apr.–14 May 1965; Brooks leg.; at indoor light; ANIC • 1 spec.; 25 Mar. 1965; Balogh leg.; HNHM • 1 spec.; Little Mulgrave National Park; 16 Dec. 1967; Brooks leg.; ANIC • 1 spec.; Russell River Xing; 17°26’ S, 145°54’ E; 11 Jun. 1992; Reid leg.; weedy rainforest, beating *Hibiscus*; ANIC • 10 specs; Edge Hill; 16°55’ S, 145°46’ E; 9 Aug. 1968; Balogh and Loksa leg.; HNHM. – **Cassowary Coast Region** • 1 spec.; Cardstone; 1 Jan. 1966; Hyde leg.; ANIC • 1 spec.; same locality; 2 Feb. 1966; Brooks leg.; ANIC • 6 specs; same locality; 10–13 Mar. 1966; Hyde leg.; ANIC • 1 spec.; same locality; 14 Nov. 1966; Brooks leg.; ANIC • 4 specs; same locality; 15 Nov. 1966; Brooks leg.; ANIC • 1 spec.; same locality; 16 Nov. 1966; Brooks leg.; ANIC • 2 specs; same data as for preceding; MKF • 1 spec.; same locality; 19 Nov. 1966; Brooks leg.; ANIC • 1 spec.; same locality; 28 Nov. 1966; Brooks leg.; ANIC • 1 spec.; same locality; 1–2 Dec. 1966; Brooks leg.; ANIC • 1 spec.; same locality; 5–6 Dec. 1966; Brooks leg.; ANIC • 1 spec.; same locality; 20 Jan. 1967; Hyde leg.; ANIC • 4 specs; Hinchinbrook Island, Gayundah Creek; 8–9 Nov. 1984; Marks leg.; light trap; ANIC • 1 spec.; same locality; 15–17 Nov. 1984; Marks leg.; light trap; ANIC • 1 spec.; Innisfail, Seymour Range; 6 Nov. 1966; Britton leg.; rainforest at light; ANIC. – **Mackay Region** • 4 specs; Finch Hatton, Cattle Ck Xing; 9 Jun. 1992; Reid leg.; beaten from flowering *Eucalyptus*; ANIC • 1 spec.; Bucasia; 3 Jan. 2007; Sandery leg.; ANIC. – **Shire of Cook** • 1 spec.; Iron Range National Park, Mount Tozer; 12°43’ S, 143°17’ E; 5–10 Jul. 1986; Weir and Calder leg.; at light; ANIC. – **Shire of Douglas** • 1 spec.; Daintree; 29 Oct. 1966; Britton leg.; dead leaves edge of rainforest; ANIC • 1 spec.; same data as for preceding; MKF. – **Shire of Mareeba** • 1 spec.; Kuranda; 16°49’ S, 145°38’ E; 24 Nov. 1964; Brooks leg.; at light; ANIC.

MALAYSIA • 2 specs; Sarawak, W Kuching, Mt Matang; Dec. 1913; Bryant leg.; NHMUK • 1 spec.; same data as for preceding; MKF.

PAPUA NEW GUINEA • 1 spec.; NE Madang, Gogol River; 17 Sep. 1969; Balogh leg.; HNHM • 1 spec.; Western Province, SE Kiunga; 23 Jul.–2 Aug. 1969; Balogh leg.; HNHM.

### Distribution

*Psammoecus cruciger* has been found in Australia (Queensland), Malaysia and Papua New Guinea.



**Fig. 1.** *Psammoecus cruciger* (Waterhouse, 1876). **A–C.** Holotype, ♀ (NHMUK). **A.** Habitus. **B.** Head and pronotum. **C.** Left antenna. **D–F.** Specimen from Queensland, ♂ (ANIC). **D.** Aedeagus, ventral view. **E.** Parameres, ventral view. **F.** Median lobe, dorsal view. Scale bars: A = 1.0 mm; B–D = 0.5 mm; E–F = 0.1 mm.

## Remarks

Grouvelle (1908) erroneously synonymised *P. cruciger* with *P. trimaculatus* Motschulsky, 1858. In his revision of Indian *Psammoecus*, Pal (1985) agreed with this, treating *P. epsilon* (“*P. ypsilon*”) and *P. cephalotes* as “probable synonyms” of *P. trimaculatus*. Arrow (1927) did not adopt Grouvelle’s synonymization of *P. cruciger* with *P. trimaculatus*. Instead, he regarded *P. epsilon* and *P. cephalotes* as junior synonyms of *P. cruciger*. Examination of type material confirmed the synonymy according to Arrow. There are few similarities to *P. trimaculatus*; the structure of the male genitalia indicates a very close relationship to *P. simonis* Grouvelle, 1882. Both *P. trimaculatus* and *P. simonis* were redescribed by Yoshida & Hirowatari (2014).

## *Psammoecus incertior* Blackburn, 1903

Fig. 2

*Psammoecus incertior* Blackburn, 1903: 154.

*Psammoecus incertior* – Hetschko 1930: 83.

## Diagnosis

The following combination of character states distinguishes this species: body elongate-oval (Fig. 2A), length 2.86–3.30 mm; eyes large (Fig. 2B), unevenly rounded with distinctly stronger curvature posteriorly; temples very short; frontal of moderate length, diverging anteriorly, almost parallel posteriorly, reaching anterior  $\frac{2}{5}$  of eyes; antennae somewhat short (Fig. 2D), stout, antennomere 8 castaneous, antennomeres 9–10 piceous; antennomere 11 yellowish brown; punctation on vertex moderate (Fig. 2B), punctures strongly elongate, almost twice as long as eye facet diameter, microsculpture absent, pubescence moderate; pronotum widest at anterior third (Fig. 2C), lateral pronotal margins with six small but distinct teeth; teeth II, V, and VI somewhat larger than others, anterior denticles small, posterior denticles very small; pronotal punctation moderate, punctures distinctly widened, microsculpture absent, pubescence moderate, setae directed medially; elytra widest just in front of middle (Fig. 2A), with large brown medio-lateral maculae and small darkened area at posterior third of suture, striae as wide as interstices, pubescence moderate, microsculpture absent; male genitalia strongly sclerotised (Fig. 2E–H), median lobe slender, evenly narrowed towards apex, tip blunt in dorsal view; curved ventrally with sharp tip in lateral view; parameres short, wide, with short protrusion at postero-lateral margin, two long setae near protrusion and few short setae along inner margins.

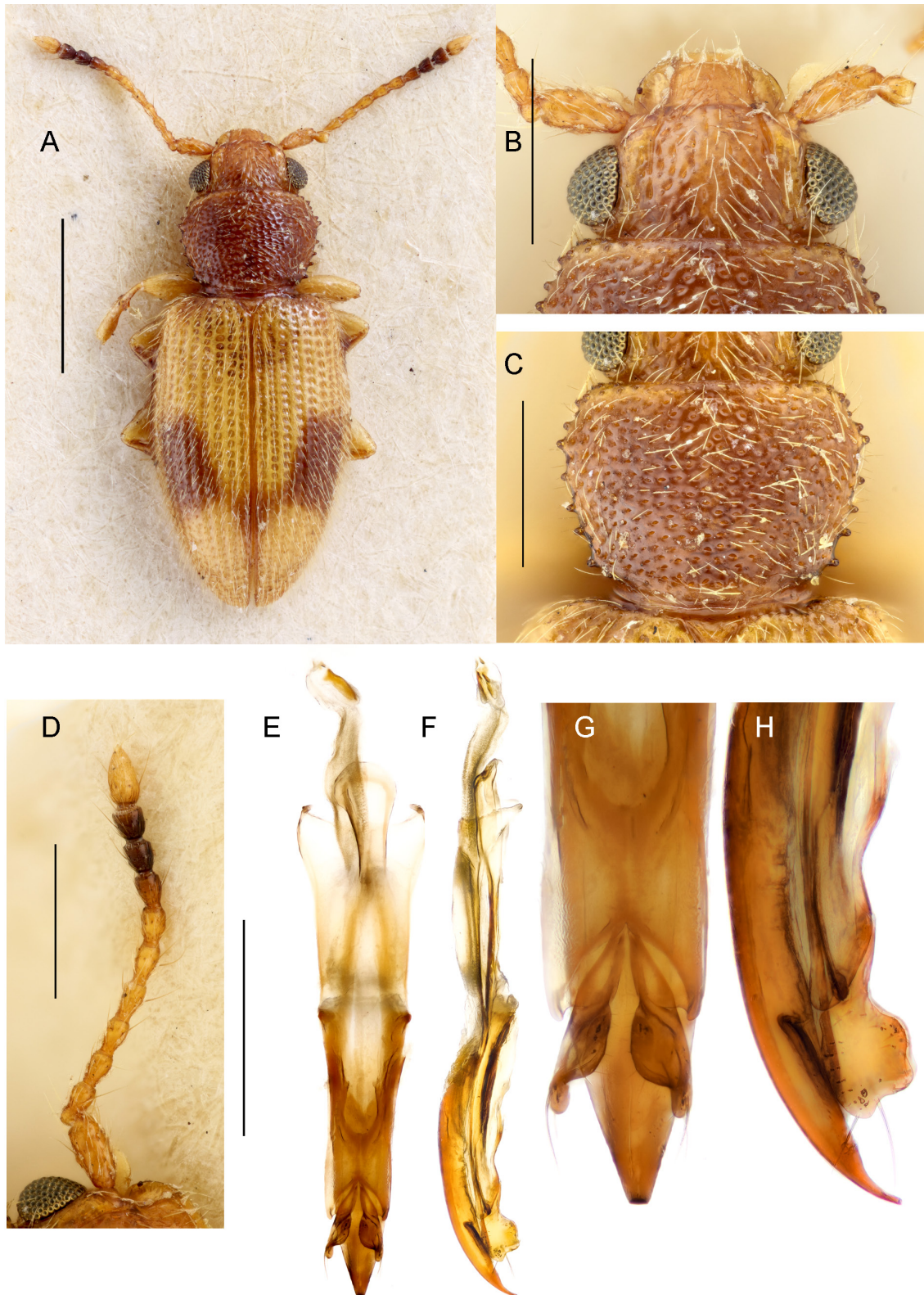
## Material examined

### Holotype

AUSTRALIA • ♂; “Type | H.T.” [round label with red border]; “Australia. | Blackburn Coll. | B.M.1910-236.”; “*Psammoecus* | *incertior* Blackb.”; NHMUK.

### Other material

AUSTRALIA–Queensland • 1 spec.; Cairns; 16°55′ S, 145°46′ E; May 1947; ANIC • 2 specs; Cassowary Coast Region, Palmerston National Park, 1 mi. E of Crawford’s Lookout; 17°36′ S, 145°48′ E; 6 Nov. 1966; Britton leg.; under bark; ANIC • 2 specs; Shire of Mareeba, Kuranda; 16°49′ S, 145°38′ E; Oct. 1950; ANIC • 6 specs; same locality; 16°49′ S, 145°38′ E; Feb. 1950; ANIC • 3 specs; same locality; Feb. 1909; Bryant leg.; NHMUK • 1 spec.; same data as for preceding; MKF • 1 spec.; Shire of Mareeba, 6 km NE of Kuranda, Black Mt Road; 16°46′ S, 145°40′ E; 21 May 1976; Britton leg.; MKF • 2 specs; Tablelands, 6.8 km W of Atherton, Russel River Crossing; 17°26′ S, 145°54′ E; 11 Jun. 1992; Reid leg.; rainforest, beaten; ANIC • 1 spec.; Townsville Regional City, Magnetic Island; 19°8′ S, 146°50′ E; Jul. 1921; Carter leg.; ANIC.



**Fig. 2.** *Psammoecus incertior* Blackburn, 1903, ♂♂. **A–C.** Holotype (NHMUK). **A.** Habitus. **B.** Head. **C.** Pronotum. **D–H.** Specimen from Queensland (ANIC). **D.** Left antenna. **E.** Aedeagus, ventral view. **F.** Aedeagus, lateral view. **G.** Parameres, ventral view. **H.** Median lobe and parameres, lateral view. Scale bars: A = 1.0 mm; B–F = 0.5 mm; G–H = 0.2 mm.

### Distribution

Australia (Queensland).

### Remarks

The colouration of this species is rather variable, but the general pattern remains constant. A very distinct character is the peculiar shape of the male parameres, which differs considerably from all other known species of *Psammoecus*.

*Psammoecus obesus* Grouvelle, 1919

Fig. 3

*Psammoecus obesus* Grouvelle, 1919: 11.

*Psammoecus obesus* – Hetschko 1930: 83.

### Diagnosis

The following combination of character states distinguishes this species: body elongate-oval (Fig. 3A), length 3.08–3.29 mm; eyes large (Fig. 3B), irregularly rounded with stronger curvature posteriorly; temples distinct, short, strongly curved; frontal grooves distinct, diverging anteriorly, parallel near end; reaching anterior  $\frac{2}{5}$  of eyes; antennae stout (Fig. 3D), antennomere 8 slightly darkened, antennomeres 9–10 darkened, antennomere 11 bright yellowish-brown; punctation on vertex moderate, punctures distinctly elongate, as large as eye facet diameter; microsculpture on vertex absent, pubescence moderate; pronotum widest just in front of middle (Fig. 3C), lateral pronotal margins with five teeth; tooth I slightly and tooth V distinctly bigger than II–IV, distance between I and II wider than distances between other teeth, anterior and posterior denticles present, small; pronotal punctation dense, punctures as large as on vertex, distinctly widened, microsculpture absent, pubescence moderate, setae directed medially; elytra widest at middle (Fig. 3A), with transverse brown maculae behind middle, interstices distinctly wider than striae, pubescence moderate, microsculpture absent; male genitalia (Fig. 3E–H) strongly sclerotised, median lobe in dorsal view wide, narrowed abruptly near ostium, apical end well rounded, in lateral view also narrowed abruptly, with sharp apical end; parameres in ventral view very wide, inner margins, apex and apical third of lateral margins with distinct setae; in lateral view with very wide basis, narrowed abruptly towards apex with dorsal margin almost forming angle.

### Material examined

#### Holotype

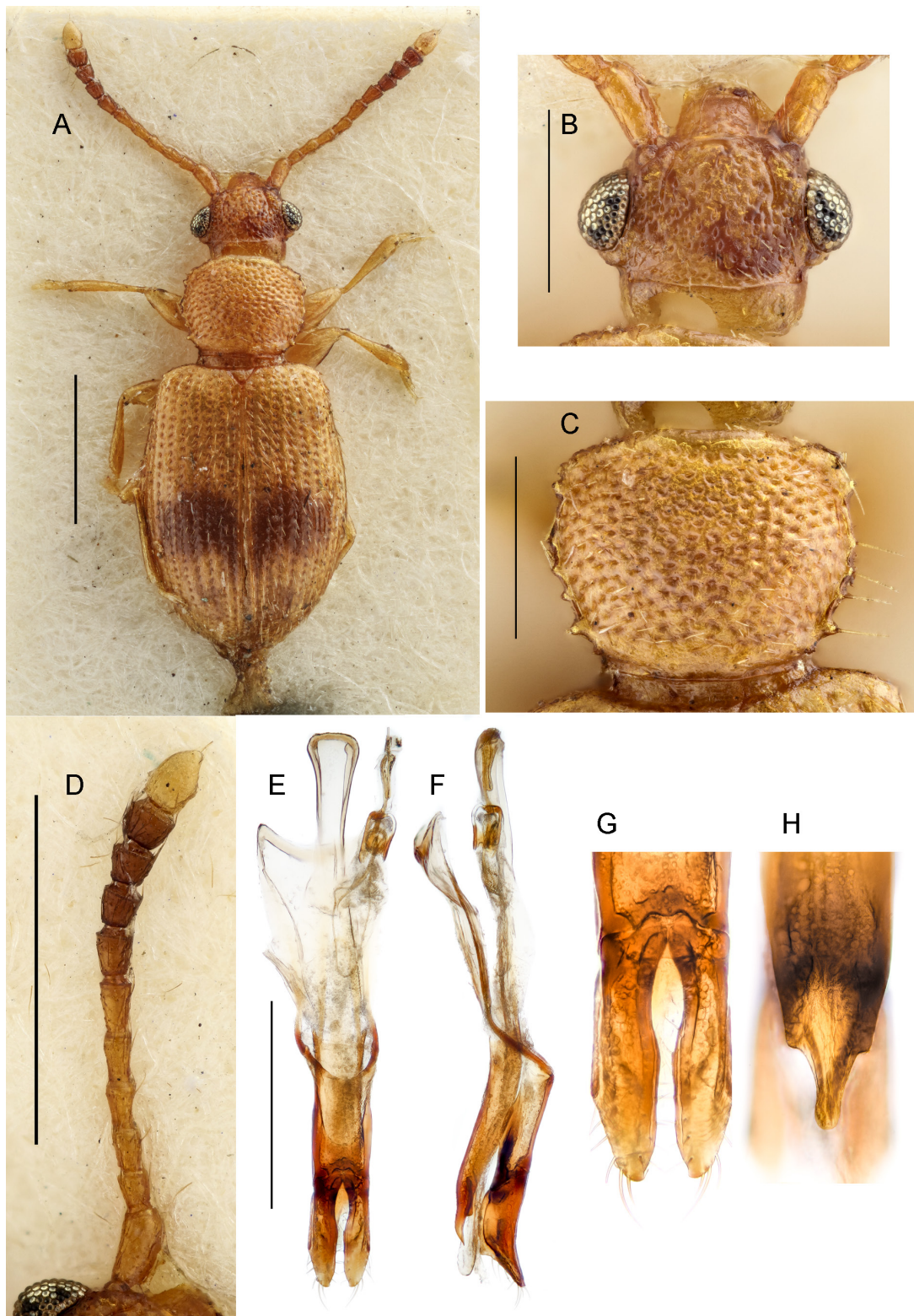
INDONESIA • ♀; Maluku, Seram; Pascoe leg.; “HOLO - | Type” [round label with red border]; “Ceram” [blue, elliptic label]; “Pascoe | Coll. | 93–60”; “*Psammoecus* | *obesus* | ty. Grouv” [Grouvelle’s hand]; “HOLOTYPUS | *Psammoecus* | *obesus* Grouv. 1919 | det. R.G. Booth 2013”; NHMUK.

#### Other material

AUSTRALIA • 1 spec.; Queensland, Cairns; 16°55′ S, 145°46′ E; 1942; Perkins leg.; NHMUK • 1 spec.; Queensland, Cassowary Coast Region, 10 km NE of Tully; Nov. 1994; C. Reid leg.; rainforest; ANIC • 1 spec.; Queensland, Cassowary Coast Region, Cardstone; 1–2 Dec. 1966; J.G. Brooks leg.; ANIC • 1 spec.; Queensland, Shire of Cook, McIlwraith Range; 500 m a.s.l.; 13°45′ S, 143°22′ E; 27 Jun.–12 Jul. 1989; T.A. Weir leg.; at light; ANIC • 1 spm; Queensland, Shire of Douglas, Daintree; 29 Oct. 1966; E. Britton leg.; dead leaves, edge of rainforest; ANIC • 1 spm; same data as for preceding; MKF.

INDONESIA • 2 specs; West Papua, Waigeo, Camp Nok; 2500 ft a.s.l.; 0°12′ S, 130°50′ E; Apr. 1938; Cheesman leg.; NHMUK.





**Fig. 3.** *Psammoecus obesus* Grouvelle, 1919. A–D. Holotype, ♀ (NHMUK). A. Habitus. B. Head. C. Pronotum. D. Left antenna. E–H. Specimen from Queensland, ♂ (ANIC). E. Aedeagus, ventral view. F. Aedeagus, lateral view. G. Parameres, ventral view. H. Median lobe, dorsal view. Scale bars: A, D = 1.0 mm; B–C, E–F = 0.5 mm; G–H = 0.2 mm.

### Distribution

The species has been found in Australia (Queensland) and Indonesia.

### Remarks

*Psammoecus obesus* is closely related to *P. hirsutus* Grouvelle, 1883, *P. decoratus* Grouvelle, 1919, and *P. signatus* Grouvelle, 1919. It differs from all three by the shape of the male genitalia.

### *Psammoecus t-notatus* Blackburn, 1903

Fig. 4

*Psammoecus t-notatus* Blackburn, 1903: 154.

*Psammoecus amoenus* Grouvelle, 1912: 92. **Syn. nov.**

*Psammoecus t-notatus* – Hetschko 1930: 84.

### Diagnosis

The following combination of character states distinguishes this species: body oval (Fig. 4A), length 2.35–2.83 mm; eyes of moderate size (Fig. 4B), slightly unevenly rounded with somewhat stronger curvature posteriorly; temples distinct, evenly rounded; frontal grooves short, slightly curved, reaching anterior third of eyes; antennae slender (Fig. 4D), antennomeres 9–10 darkened; antennomere 11 testaceous; punctation on vertex moderate (Fig. 4B), punctures round, slightly smaller than eye facet diameter; microsculpture on vertex absent, pubescence moderate; pronotum (Fig. 4C) often brown with testaceous discal area of variable size, sometimes entire pronotum testaceous; widest at anterior third, lateral pronotal margins with four distinct teeth; teeth I and II small, III and IV larger; anterior and posterior denticles present, distinct; pronotal punctation dense, punctures slightly widened antero-medially, microsculpture absent, pubescence moderate, setae directed antero-medially; elytra widest at middle (Fig. 4A), with transverse piceous maculae closely behind middle, posterior part of suture, elytral apex and, in most specimens, humeral area darkened, interstices slightly wider than striae, pubescence moderate, microsculpture absent; male genitalia (Fig. 4E–F) comparatively weakly sclerotised, median lobe slender, evenly narrowed towards apex, tip of apex blunt, tegmen with wide, very weakly sclerotised basis, paramere long, slender, club-shaped, inner margin of widened basis with numerous setae, along inner margins with few short, thin setae, apex with long seta.

### Material examined

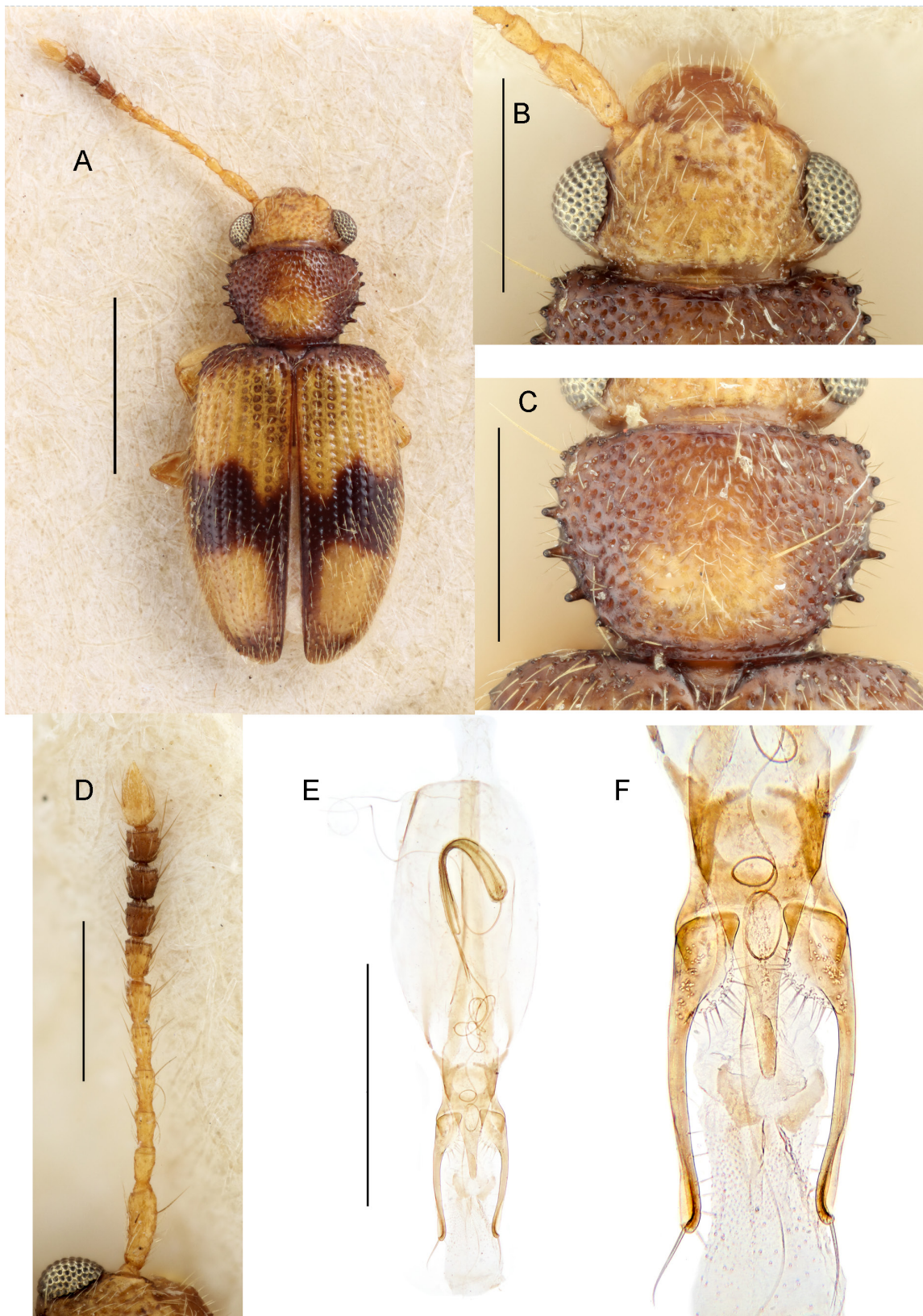
#### Types

AUSTRALIA • ♀, holotype of *Psammoecus t-notatus* Blackburn, 1903; “Type | H.T.” [round label with red border]; “Australia. | Blackburn Coll. | B.M.1910-236.”; “*Psammoecus* | *T-notatus*., Blackb.”; NHMUK.

VIETNAM • ♂, holotype of *Psammoecus amoenus* Grouvelle, 1912; Annam, Phúc Sơn; “Annam | Phuc-Son | Nov. Dez. | H. Fruhstorfer”; “*Psammoecus* | *amoenus* | G. Grouv” [Grouvelle’s hand]; “N.L.M. 34. | p. 92.”; “Museum Leiden | *Psammoecus* | *amoenus* | Det: Grouv.”; “Type” [red label]; RMNH.

#### Other material

AUSTRALIA • 2 specs; Queensland, Cairns; 16°55' S, 145°46' E; ANIC • 3 specs; Queensland, Cairns, Bellenden Ker Range, 1 km south of Cable Tower; 1054 m a.s.l.; 17 Oct.–5 Nov. 1981; QLD Museum leg.; rainforest, malaise trap; ANIC • 1 spec.; Queensland, Cassowary Coast Region, Cardstone; 14 Nov. 1966; Brooks leg.; ANIC • 1 spm; same locality; 15 Nov. 1966; Brooks leg.; ANIC • 1 spm; same data as for preceding; MKF • 1 spec.; same locality; 20 Nov. 1966; Hyde leg.; MKF • 2 specs; same



**Fig. 4.** *Psammoecus t-notatus* Blackburn, 1903. **A–D.** Holotype, ♀ (NHMUK). **A.** Habitus. **B.** Head. **C.** Pronotum. **D.** Left antenna. **E–F.** Specimen from Papua New Guinea, ♂ (NHMUK), aedeagus, ventral view. Scale bars: A = 1.0 mm; B–E = 0.5 mm; F = 0.2 mm.

locality; 1 Feb. 1966; Hyde leg.; ANIC • 1 spec.; same locality; 2 Feb. 1966; Hyde leg.; ANIC • 1 spec.; Queensland, Shire of Douglas, Daintree, 4 mi. S. of Daintree; 29 Oct. 1966; Britton leg.; edge of rainforest on dead leaves; ANIC • 2 specs; Queensland, Shire of Mareeba, Kuranda; 16°49' S, 145°38' E; Dec. 1964; Brooks leg.; ANIC • 4 specs; same locality; Mar. 1950; Brooks leg.; ANIC • 1 spec.; Queensland, Shire of Mareeba, Kuranda, Black Mountain Road 10 mi. N of Kuranda; 16°46' S, 145°40' E; 8 Mar. 1969; Brooks leg.; ANIC • 1 spec.; Queensland, Tablelands Region, Ravenshoe; 25 Dec. 1937; ANIC.

FIJI • 2 specs; Taveuni; 10 Dec. 1923; Evans leg.; NHMUK • 1 spm; same data as for preceding; MKF • 2 specs; Rotuma Island, Noatau; 12°29.9' S, 177°2.82' E; 26 Apr. 1971; Robinson leg.; at light; NHMUK.

INDONESIA • 6 specs; Java; NHMUK • 2 specs; Java; Wallace leg.; NHMUK • 1 spec.; Sumatra; Doherty leg.; NHMUK.

MALAYSIA • 8 specs; Pahang, Taman Negara; 1–13 Mar. 1984; Jessop leg.; at light; NHMUK • 2 specs; same data as for preceding; MKF • 5 specs; Sarawak, Mt Matang; Dec. 1913; Bryant leg.; NHMUK • 1 spm; same data as for preceding; MKF • 1 spec.; Sarawak, Muara Tuang, Kampung Quop; Feb.–Mar. 1914; Bryant leg.; NHMUK.

PAPUA NEW GUINEA • 8 specs; Madang, R. Buru, 90 m NW of Lae; 1200 ft a.s.l.; 5°13' S, 145°48' E; 1 Oct. 1964; Bacchus leg.; at light; NHMUK • 1 spec.; Morobe, Lae; 6°44' S, 147°0' E; 10 Dec. 1964; Bacchus leg.; NHMUK • 11 specs; Morobe, Finisterre Range, Budemu; 4000 ft a.s.l.; 5°48' S, 146°6' E; 15–24 Oct. 1964; Bacchus leg.; at light; NHMUK • 1 spm; same data as for preceding; MKF • 12 specs; Morobe, Finisterre Range, Damanti; 3550 ft a.s.l.; 5°48' S, 146°6' E; 2–11 Oct. 1964; Bacchus leg.; at light; NHMUK • 1 spm; same data as for preceding; MKF • 1 spec.; Morobe, Herzog Mountains, Vagau; 4000 ft a.s.l.; 4–17 Jan. 1965; Bacchus leg.; NHMUK.

THAILAND • 1 spec.; Ranong; Doherty leg.; NHMUK.

VANUATU • 1 spec.; Malakula Island; 16°15' S, 167°30' E; Mar.–Apr. 1929; Cheesman leg.; NHMUK • 2 specs; Espiritu Santo; 15°15' S, 166°50' E; Aug. 1929; Cheesman leg.; NHMUK • 2 specs; same locality; Aug.–Sep. 1929; Cheesman leg.; NHMUK • 1 spm; same data as for preceding; MKF.

### Distribution

Specimens of *P. t-notatus* have been recorded from Australia (Queensland), Fiji, Indonesia, Malaysia, Papua New Guinea, Thailand and Vanuatu.

### Remarks

*Psammoecus t-notatus* is closely related to *P. trimaculatus* Motschulsky, 1858 and *P. triguttatus* Reitter, 1874. Most specimens can easily be recognised by their distinct colouration/colour pattern. The determination of unusually coloured specimens requires examination of male genitalia. *Psammoecus t-notatus* differs from *P. trimaculatus* by the distinctly longer apical part of the parameres; it differs from *P. triguttatus* by the elongate, slender median lobe and the large, wide basal part of the tegmen.

*Psammoecus t-notatus* has a remarkably large area of distribution. As for other species of the genus, records from Malaise traps and at light suggest high mobility and a tendency to accumulate near human settlements. This, combined with an association with plant detritus and/or fungi, is likely to facilitate distribution by human trade of agricultural goods.

*Psammoecus vittifer* Blackburn, 1903

Fig. 5

*Psammoecus vittifer* Blackburn, 1903: 155.*Psammoecus concolor* Grouvelle, 1919: 8. **Syn. nov.***Psammoecus vittifer* – Hetschko 1930: 84.**Diagnosis**

The following combination of character states distinguishes this species: body elongate-oval (Fig. 5A), length 2.36–2.85 mm; eyes of moderate size (Fig. 5B), unevenly rounded with distinctly stronger curvature posteriorly; temples very short; frontal grooves short, slightly curved, reaching anterior third of eyes; antennae short, stout (Fig. 5D), antennomere 6 slightly darkened, antennomeres 7–10 dark brown; antennomere 11 whitish; punctation on vertex dense (Fig. 5B), punctures strongly elongate, slightly longer than eye facet diameter, microsculpture absent, pubescence moderate; pronotum widest at anterior third (Fig. 5C), lateral pronotal margins with five small, but distinct teeth; I and V larger than II–IV, anterior denticles small, spread over larger distance and reaching anterior 1/6 of lateral margins, posterior denticles very small; pronotal punctation dense, punctures distinctly widened, microsculpture absent, pubescence moderate, setae directed antero-medially; elytra widest at middle (Fig. 5A), with elongate brown maculae along anterior 2/3 of margins and sutural area darkened near apex, striae wider than interstices, pubescence moderate, microsculpture absent; male genitalia strongly sclerotised (Fig. 5E–H), median lobe slender, evenly narrowed towards apex, tip blunt in dorsal and lateral view, parameres long, wide, apex thin, flattened and widened, lateral margin near apex with two long setae. Left paramere of holotype of *P. vittifer* (Fig. 5G) permanently bent ventrally, probably a drying artifact.

**Material examined****Types**

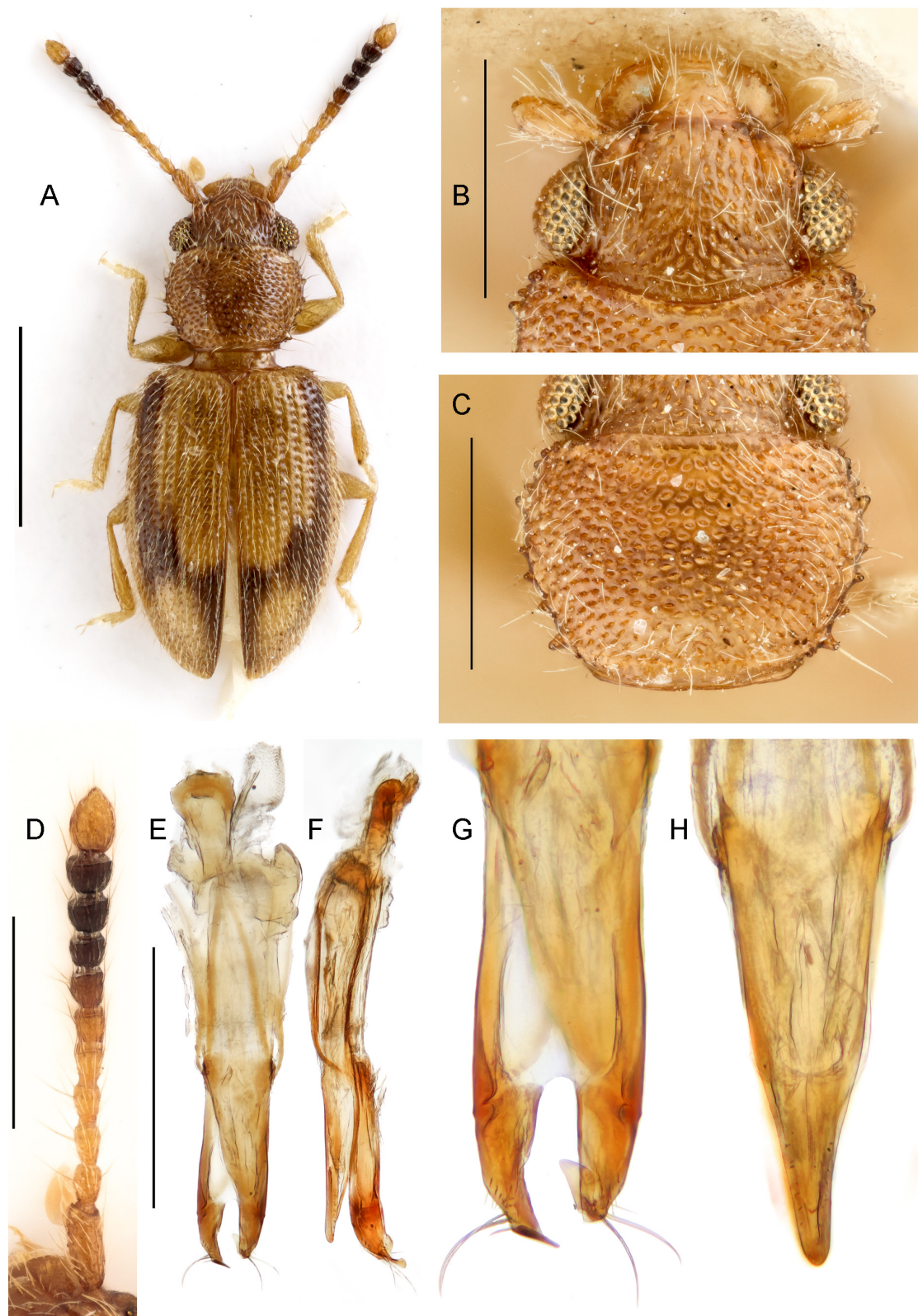
AUSTRALIA • 1 ♂, holotype of *Psammoecus vittifer* Blackburn, 1903; “Type | H.T.” [round label with red border]; “Australia. | Blackburn Coll. | B.M.1910-236.”; “*Psammoechus* [sic!] | *vittiferus*, Blackb.”; NHMUK.

INDONESIA • 1 ♂, lectotype (here designated) of *Psammoecus concolor* Grouvelle, 1919; Java; “Co- | type” [round label with yellow border]; “Java.”; “Bowring. | 63.47\*”; “*Psammoecus* | *concolor* Grouv.” [not Grouvelle’s hand]; Bowring leg.; MNHN • 1 ♀; same data as for preceding; NHMUK.

Of *P. concolor*, Grouvelle (1919: 8) mentions two type specimens from Java in the collection of the NHMUK. Only one syntype (♀) could be located in the NHMUK collection; a further syntype (♂) with identical data is stored in the MNHN collection, indicating that Grouvelle kept one specimen for his own collection. The MNHN specimen is hereby designated as lectotype.

**Other material**

AUSTRALIA – Queensland • 3 specs; Cairns Region, Cairns; Sep. 1949; ANIC • 3 specs; same locality; Nov. 1949; ANIC • 1 spec.; Cairns, Edge Hill; 16°55' S, 145°46' E; 18 Apr.–14 May 1965; J.G. Brooks leg.; at indoor lights; ANIC • 4 specs; same locality; 11 Nov. 1967; J.G. Brooks leg.; ANIC • 1 spec.; same locality; 14 Oct. 1970; J.G. Brooks leg.; MKF • 1 spec.; Cassowary Coast Region, Cardstone; 25 Nov. 1966; J.G. Brooks leg.; ANIC • 1 spec.; same locality; 26 Nov. 1966; J.G. Brooks leg.; ANIC • 1 spec.; same locality; 29 Nov. 1966; J.G. Brooks leg.; ANIC • 1 spec.; same locality; 15–16 Jan. 1967; K. Hyde leg.; MKF • 1 spec.; Cassowary Coast Region, W slopes of Seymour Range, near Innisfail, Dinner Creek Road; 6 Nov. 1966; E. Britton leg.; rainforest, at light; ANIC • 1 spec.; Cassowary Coast Region, Palmerston National Park, Tully-Cairns Powerline; 300 m a.s.l.; 6 Nov. 1966; E. Britton leg.;



**Fig. 5.** *Psammoecus vittifer* Blackburn, 1903, ♂♂. **A, D.** Specimen from Queensland (HNHM). **B–C, E–H.** Holotype (NHMUK). **A.** Habitus. **B.** Head. **C.** Pronotum. **D.** Right antenna. **E.** Aedeagus, ventral view. **F.** Aedeagus, lateral view. **G.** Parameres, ventral view. **H.** Median lobe, dorsal view. Scale bars: A = 1.0 mm; B–F = 0.5 mm; G–H = 0.2 mm.

rainforest, at light; ANIC • 1 spec.; City of Townsville, Townsville; 16–22 Mar. 1965; Balogh leg.; HNHM • 3 specs; Shire of Burdekin, Ayr; 19°135' S, 147°24' E; 1 Sep. 1970; W.B. Muir leg.; ANIC • 2 specs; Shire of Douglas, Mossman; 16°28' S, 145°23' E; 5 Dec. 1990; T. Gush leg.; at white light in laundromat; ANIC • 1 spec.; Shire of Douglas, Wonga, Pinnacle Village Holiday Park; 0 m a.s.l.; 13 Jan. 1999; Podlussány leg.; HNHM • 1 spec.; Shire of Mareeba/Douglas Shire, Mount Lewis; 1010 m a.s.l.; 20 Jun. 1971; Taylor Feehan leg.; ANIC • 1 spec.; Shire of Mareeba, Kuranda, Barron Falls; 16°49' S, 145°38' E; 24 Nov. 1964; J.G. Brooks leg.; at light; ANIC.

THAILAND • 1 spec.; Isan, Khon-Kaen; 16°26' N, 102°50' E; 23 Feb. 1980; Saowakontha leg.; at light; HNHM • 1 spm; same data as for preceding; MKF.

PAPUA NEW GUINEA • 1 spec.; Central Province, Ighibirei, Kemp Welch River; Jul.–Aug. 1890; Loria leg.; MSNG.

### Distribution

This species was found in Australia (Queensland), Indonesia, Papua New Guinea and Thailand.

### Remarks

*Psammoecus vittifer* is easily identified by its general habitus and the very distinct structure of the male genitalia. One specimen from Papua New Guinea in the MSNG collection is labelled as “*Psammoecus ocellaris* ty. Grouv.” in Grouvelle’s hand. This name was never published, hence *P. ocellaris* is considered a manuscript name.

### *Psammoecus australis* sp. nov.

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Fig. 6

### Diagnosis

The following combination of character states distinguishes this species: body length 1.96–2.45 mm; eyes very large, evenly rounded; temples extremely short, strongly narrowed immediately behind eyes; frontal grooves diverging posteriorly, reaching middle of eyes; punctation on vertex very sparse; pronotal punctation sparse; pronotal teeth long; lateral pronotal margin simple; lateral elytral interstices with very long setae; median lobe wide, apex blunt, rounded; parameres short, roundish.

### Etymology

The specific epithet is derived from the continent name Australia.

### Material examined

#### Holotype

AUSTRALIA • ♂; Queensland, Cook Shire, 30 km S of Cooktown, Mt Finnigan Sl.; 400 m a.s.l.; 3 Jul. 1982; S. and J. Peck leg.; rainforest, moist litter; ANIC.

#### Paratypes

AUSTRALIA – Queensland – Cairns Region • 1 spec.; Bellenden, Ker Range, Cable Tower 3; 1054 m a.s.l.; 17°16'12.04" S, 145°53'59.76" E; 25–31 Oct. 1981; rainforest, stick brushings; ANIC • 1 spec.; same locality; 17 Oct.–9 Nov. 1981; pyrethrum knockdown; ANIC • 1 spec.; Bellenden, Ker Range, Cableway Base Station; 100 a.s.l.; 17°16' S, 145°54' E; 25–31 Oct. 1981; rainforest, sieved litter; ANIC • 10 specs; same locality; 17–24 Oct. 1981; rainforest, sieved litter; ANIC • 3 specs; same data as for preceding; MKF • 2 specs; Bellenden, Ker Range, Cableway Base Station; 100 m a.s.l.; 17°16'12.04" S,

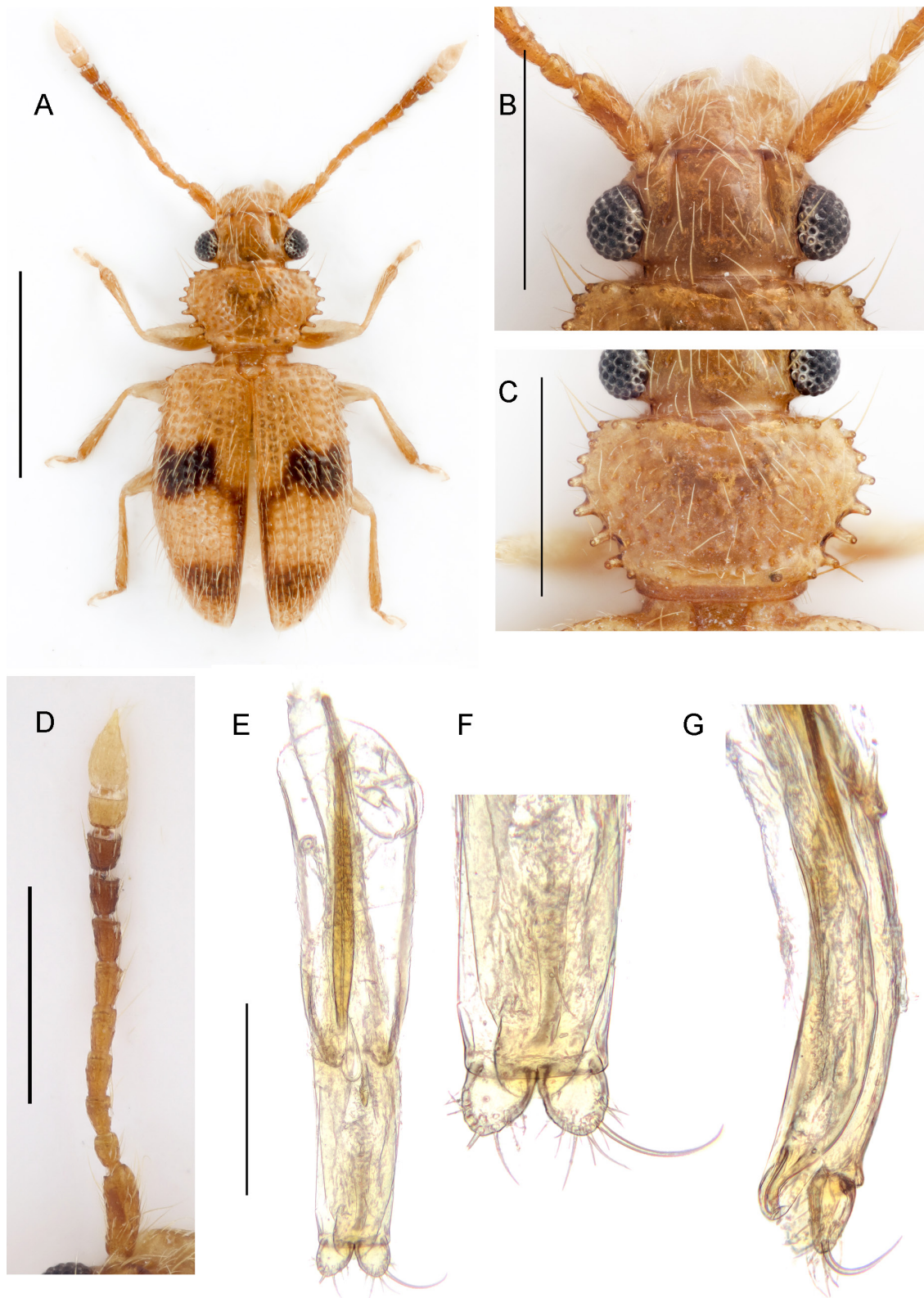
145°53'59.76" E; 25–31 Oct. 1981; rainforest, sieved litter; ANIC • 2 specs; Mulgrave River Road, 7 km SW of Bellenden, Ker; 60 m a.s.l.; 17°16' S, 145°47' E; 2 Apr. 1984; Calder and Weir leg.; rainforest; ANIC. – **Cassowary Coast Region** • 1 spec.; Mission Beach; 10 m a.s.l.; 17°50' S, 146°06' E; 29 Jan.–4 Mar. 1996; Cermak leg.; Malaise trap; ANIC • 2 specs; Mission Beach; 40 m a.s.l.; 17°52' S, 146°04' E; 29 Jan.–4 Mar. 1996; Cermak leg.; flight intercept trap; ANIC • 1 spec.; same locality; 4 Mar.–1 Apr. 1996; Cermak leg.; flight intercept trap; ANIC. **Shire of Douglas** • 2 specs; 2 km SSW of Cape Tribulation; 10 m a.s.l.; 16°05' S, 145°28' E; 28 Feb.–27 Mar. 1996; Zborowski leg.; flight intercept trap; ANIC • 1 spec.; 1 km WNW of Cape Tribulation; 10 m a.s.l.; 16°04' S, 145°28' E; 5 Dec. 1995–4 Jan. 1996; Umback leg.; flight intercept trap; ANIC • 1 spec.; 2 km WSW of Cape Tribulation; 30 m a.s.l.; 16°05' S, 145°27' E; 4 Jan.–1 Feb. 1996; Umback leg.; pitfall trap; ANIC • 1 spec.; same locality; 1–28 Feb. 1996; Umback leg.; pitfall trap; ANIC • 1 spec.; same locality; 28 Feb.–27 Mar. 1996; Zborowski leg.; flight intercept trap; ANIC • 4 specs; Cape Tribulation Area; 16°03' S, 145°28' E; 1–11 May 1992; Lawrence leg.; leaf and log litter; ANIC • 2 specs; 45 km N of Port Douglas, Cape Tribulation; 16°03' S, 145°28' E; 21–28 Mar. 1984; Calder and Weir leg.; lowland rainforest; ANIC • 2 specs; 40 km N of Daintree, Cape Tribulation; 10 m a.s.l.; 12 Jul. 1982; S. and J. Peck leg.; rainforest, leaf and log litter; ANIC • 1 spm; same data as for preceding; MKF • 1 spec.; Shire of Cook, Moses Creek 4 km NE of Mount Finnigan; 15°47' S, 145°17' E; 14–16 Oct. 1980; Weir leg.; rainforest litter; ANIC • 1 spec.; Shire of Cook, 30 km S of Cooktown, Mt Finnigan; 400 m a.s.l.; 1 Jul. 1982; S. and J. Peck leg.; rainforest, litter and fungi; ANIC • 1 spec.; Kuranda, Black Mountain Road; 390 m a.s.l.; 17°26' S, 145°35' E; 22 Jun. 1971; Feehan leg.; rainforest; ANIC • 1 spec.; Kuranda, Black Mountain Road; 350 m a.s.l.; 27 Jun. 1971; Feehan leg.; ANIC • 1 spec.; Shire of Cook, 3 km NE of Mount Webb; 15°03' S, 145°09' E; 1–3 Oct. 1980; Weir leg.; rainforest litter; ANIC • 3 specs; Shire of Cook, Cape York Peninsula, Mount Webb National Park; 15°04' S, 145°07' E; 28–30 Sep. 1980; Weir leg.; rainforest litter; ANIC • 1 spec.; Shire of Douglas, Mossman Gorge National Park, 6 km SW of Mossman; 50 m a.s.l.; 11 Jul. 1982; S. and J. Peck leg.; rainforest leaf litter; ANIC • 3 specs; Shire of Douglas, Daintree, Pilgrims Sands; 10 m a.s.l.; 20–27 Jan. 1991; Hammond leg.; lowland tropical forest, flight interception trap; NHMUK • 1 spm; same data as for preceding; MKF • 2 specs; Shire of Lockhart River, 9 km ENE of Mount Tozer; 12°43' S, 143°17' E; 5–10 Jul. 1986; Weir leg.; rainforest litter; ANIC.

### **Description of holotype**

Body oval, stout, 2.13 mm long; testaceous (Fig. 6A); elytra with dark maculae near middle and near apex; antennomeres 8–9 slightly and 7 very slightly darkened, antennomeres 10–11 whitish (Fig. 6D). Head (Fig. 6B) 0.36 mm long, 0.55 mm wide; frontal grooves distinct, deep, curved outwards toward posterior end, reaching middle of eyes; vertex with sparse punctation, punctures small; setae of very uneven lengths, directed straight forward, seta near end of each frontal groove almost as long as eyes, shortest setae only as long as two eye facet diameters; microsculpture absent; eyes large, strongly protruding, unevenly rounded, 0.16 mm long, eye distance 0.32 mm; temples absent, head narrowed immediately behind eyes, temple angle 83°; antennae (Fig. 6D) long, slender, length 1.29 mm, antennomere proportions 3.0 : 1.1 : 1.3 : 1.4 : 1.5 : 1.4 : 1.4 : 1.2 : 1.1 : 1.0 : 2.7. Pronotum (Fig. 6C) 0.63 mm wide, 0.43 mm long, widest at anterior third; at anterior denticles 1.32 × as wide as at posterior denticles; very shallowly impressed near posterior margin; lateral margin slightly ridged between lateral teeth III and V, with distinct group of three anterior denticles and additional small denticles along anterior pronotal margin, lateral margin with distinct teeth; I small, only slightly larger than anterior denticles, II to IV of increasing length, V as large as III; posterior denticle distinct, slightly smaller than anterior denticles; punctation on pronotal disc slightly denser than on vertex, punctures somewhat smaller than eye facet diameter; setae on pronotal disc of very uneven lengths, directed anteromedially, longest setae about  $\frac{3}{5}$  as long as eyes, shortest 1.5 × as long as eye facet diameter.

Elytra (Fig. 6A) oval, 1.29 mm long, 0.94 mm wide, striae twice as wide as interstices, pubescence semierect, interstitial setae about twice as long as striae setae, even longer near elytral margins; interstice





**Fig. 6.** *Psammoecus australis* sp. nov, ♂♂. **A–C.** Holotype (ANIC). **A.** Habitus. **B.** Head. **C.** Pronotum. **D.** Left antenna. **E–G.** Paratype from Queensland (ANIC). **E.** Aedeagus, ventral view. **F.** Parameres, ventral view. **G.** Parameres and median lobe, lateral view. Scale bars: A = 1.0 mm; B–D = 0.5 mm; E = 0.2 mm; F–G = 0.1 mm.

between 9<sup>th</sup> and 11<sup>th</sup> stria with distinct denticles near humerus; microsculpture absent. Male genitalia (Fig. 6E–G) with wide median lobe, apex evenly rounded, in the shape of a half-circle, parameres short, stout, almost circular in ventral view, each with one very long and several shorter setae.

### Distribution

Australia (Queensland).

### Biology

The species was found in flight intercept traps, in berlese funnels and in plant detritus.

### Variation

Paratypes range in length: 1.96–2.45 mm. The elytral maculae differ considerably in size. In some specimens, only the 11<sup>th</sup> antennomere is whitish.

### Remarks

*Psammoecus australis* sp. nov. is closely related to *Psammoecus delicatus* Grouvelle, 1908 and *Psammoecus complexus* Pal, 1985. It can be distinguished from *P. complexus* by the distinctly different colouration, and from both species by the different shape of lateral pronotal teeth and male genitalia.

*Psammoecus venustus* sp. nov.

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Fig. 7

### Diagnosis

The following combination of character states distinguishes this species: body length 2.32–3.14 mm; eyes moderately sized, evenly rounded; temples well developed, evenly rounded; frontal grooves parallel posteriorly, almost reaching middle of eyes; punctation on vertex sparse; pronotal punctation moderate; pronotal teeth short; lateral pronotal margin ridged; lateral elytral interstices with very long setae; median lobe slender, lancet-shaped; parameres slender, parallel-sided, curved.

### Etymology

The specific epithet was chosen in reference to the beautiful habitus of this species.

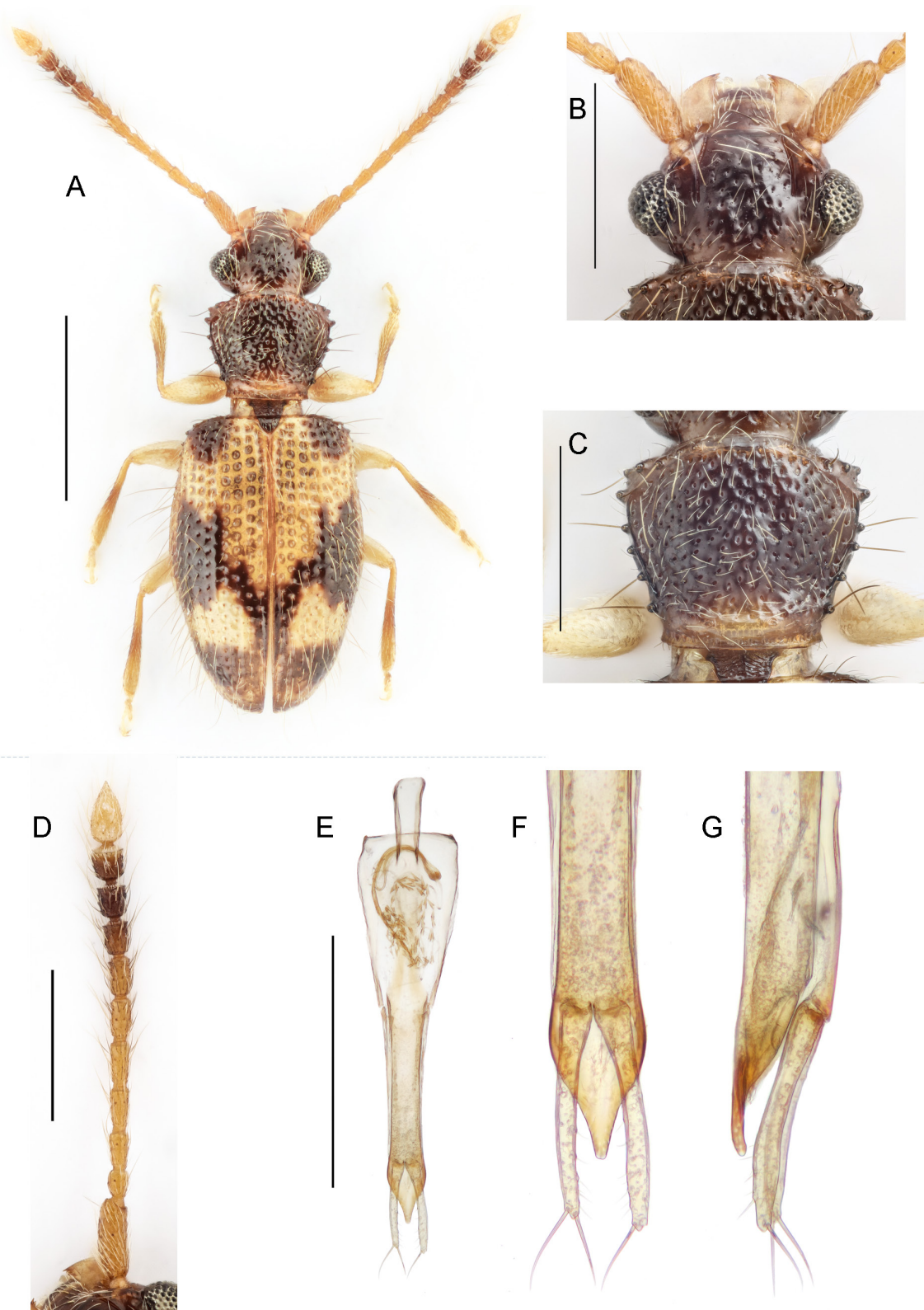
### Material examined

#### Holotype

AUSTRALIA • ♂; New South Wales, City of Shoalhaven, Kioloa State Forest; 4–5 Mar. 1986; Lawrence leg.; rainforest, leaf and log litter; ANIC.

#### Paratypes

AUSTRALIA – **New South Wales** • 2 specs; Canberra, 3.5 km E of Piccadilly Circus ACT, Blundells Creek Road; 850 m a.s.l.; 27 Jan. 1982; Lawrence leg.; leaf and log litter; ANIC • 1 spec.; Sydney; ANIC • 10 specs; Armidale Dumaresq Council, Kookaburra, Carrai National Park; 943 m a.s.l.; 31°01'434" S, 152°20'288" E; 27–28 Oct. 2000; Podlussány leg.; HNHM • 1 spec.; Bellingen Shire, 6 km NNE of Raleigh, Pine Creek State Forest; 30°24' S, 153°01' E; 16 Nov. 1976; Common and Edwards leg.; ANIC • 1 spec.; Blue Mountains, Mount Wilson; 14 Mar. 1978; HNHM • 1 spec.; Bombala Council, 4 km NE of Wog Wog, 17 km SE of Bombala; 31°04'30" S, 149°28'00" E; Oct. 1995; Milkovits leg.; pitfall trap; HNHM • 4 specs; Central Coast Council, 5 km N Somersby; 33°19' S, 151°18' E; 12 May 1991; Gush leg.; leaf litter; ANIC • 3 specs; Central Coast Council, Strickland State Forest; 33°23' S, 151°19' E;



**Fig. 7.** *Psammoecus venustus* sp. nov., ♂♂. **A–C.** Holotype (ANIC). **A.** Habitus. **B.** Head. **C.** Pronotum. **D.** Right antenna. **E–G.** Paratype spec. from Queensland (ANIC). **E.** Aedeagus, ventral view. **F.** Parameres, ventral view. **G.** Parameres and median lobe, lateral view. Scale bars: A = 1.0 mm; B–E = 0.5 mm; F–G = 0.2 mm.

26 May 1991; Gush leg.; leaf litter; ANIC • 1 spec.; City of Blue Mountains, Wentworth Falls; 16 Jan. 1909; Bryant leg.; NHMUK • 1 spec.; City of Coffs Harbour, Bruxner Park, Park Creek Picknick site; 30°14' S, 153°06' E; 6 Apr. 1993; Reid leg.; rainforest, beaten from vegetation; ANIC • 1 spec.; City of Coffs Harbour, Bruxner Park, Park Creek Picknick site; 30°14' S, 153°05' E; 8 Apr. 1993; Reid leg.; rainforest, beaten from vegetation; ANIC • 1 spec.; City of Maitland, Brown Mountain, Rutherford Creek; 15 Jan. 1969; Curtis leg.; ANIC • 1 spec.; City of Shoalhaven, Barrengarry Mountain; 460 m a.s.l.; 28 Dec. 1966; rainforest, leaf mould; ANIC • 1 spec.; City of Shoalhaven, Barrengarry Mountain, 24 km SE of Mossvale; 600 m a.s.l.; 29 Aug. 1982; S and J Peck leg.; rainforest, log and leaf litter; ANIC • 1 spec.; City of Shoalhaven, Bawley Point; 35°30' S, 150°24' E; 14 Nov. 1993; Rentz and MacCarron leg.; at light; MKF • 1 spec.; Dungog Shire, Upper Allyn Road; 22 Apr. 1970; Colless leg.; ANIC • 1 spec.; Dungog Shire, Upper Williams River; Oct. 1926; Lea and Wilson leg.; ANIC • 3 specs; Eurobodalla Shire, Buckenbowra State Forest; 33°33' S, 159°57' E; 22 Dec. 1991; Gush leg.; moist debris in creek; ANIC • 1 spec.; Illawarra; 13 Sep. 1908; Bryant leg.; NHMUK • 1 spec.; same locality; 27 Sep. 1908; Bryant leg.; NHMUK • 2 specs; same locality; 2 Oct. 1908; Bryant leg.; NHMUK, 1 spm; same data as for preceding; MKF • 4 specs; same locality; Oct. 1908; Bryant leg.; NHMUK • 1 spec.; same locality; Nov. 1908; Bryant leg.; NHMUK • 3 specs; Kyogle Council, Acacia Plateau; Armstrong leg.; ANIC • 4 specs; Mid North Coast, Kerewong; 21 Dec. 1978; HNHM • 2 specs; Mid-Coast Council, 3 km NE of Wootton; 32°16' S, 152°19' E; 22 Sep. 1991; Gush leg.; leaf litter at edge of river; ANIC • 1 spec.; Mid-Coast Council, Landsdowne State Forest; 31°44' S, 152°31' E; 22 May 1992; Gush leg.; creek debris; ANIC • 1 spec.; Mid-Coast Council, Taree, 3 km N of Landsdowne; 19–26 Sep. 1992; Williams leg.; riparian rainforest, Malaise trap; ANIC • 1 spec.; Mid-Coast Council, Lorien Wildlife Refuge, Landsdowne, Taree; Dec. 1986; H. and A. Howden leg.; flight intercept trap; ANIC • 1 spec.; Mid-Coast Council, Wang Wauk State Forest; 32°20' S, 152°15' E; 22 Sep. 1991; Gush leg.; leaf litter in creek bed; ANIC • 1 spec.; Municipality of Kiama, 13 km W of Kiama, Jamberoo Pass; 27 Feb. 1969; Britton, Upton and Misko leg.; ANIC • 1 spec.; Queanbeyan-Palerang Regional Council, Clyde Mountain; 750 m a.s.l.; 4 Dec. 1967; Taylor and Brooks leg.; wet sclerophyll; ANIC • 1 spec.; Queanbeyan-Palerang Regional Council, 6 km SSE of Monga; Oct. 1989; Reid leg.; beating RF bushes; ANIC • 1 spec.; Queanbeyan-Palerang, 4 km N of Mongarlowe; 25 May 1991; Reid leg.; on shrubs by river; ANIC • 1 spec.; Southern Tablelands Region, Clyde Mountain; 16 Mar. 1977; Moore leg.; ANIC • 1 spec.; Southern Tablelands Region, Clyde Mountain, Cabbage Tree Creek; 27 Sep. 1979; Naumann and Cardale leg.; ANIC • 1 spec.; Tenterfield Shire Council, Unumgar S. F., Grevillia, Coxs Road; 580 m a.s.l.; 28°27' S, 152°45' E; 2–11 Jan. 1987; Newton and Thayer leg.; subtropical rainforest, flight intercept trap; ANIC • 1 spec.; Tenterfield Shire Council, Unumgar S. F., near Woodenbong, Pole Bridge Road; 430 m a.s.l.; 28°24' S, 152°40' E; 2–11 Jan. 1987; Newton and Thayer leg.; dry rainforest (Araucaria, Eucalyptus), flight intercept trap; ANIC. – **Queensland** • 1 spec.; Atherton Tableland, Eacham National Park; 760 m a.s.l.; 17°18' S, 145°37' E; 20 Feb. 1973; Taylor leg.; rainforest; ANIC • 1 spec.; Cairns Region, 22 km from Cairns, Whitfield Road; 670 m a.s.l.; 21 Oct. 1971; Brooks leg.; ANIC • 1 spec.; Cassowary Coast Region, Cardstone; 10 Dec. 1966; Brooks leg.; ANIC • 2 specs; Cassowary Coast Region, Tully Falls; 15 Dec. 1976; Walford-Huggins leg.; NHMUK • 1 spec.; Charters Towers Region, 19 km W of Paluma, Ewan Road; 6 Jan. 1966; J.G. and J.A.G. Brooks leg.; ANIC • 1 spec.; Charters Towers Region, Mount Spec; 880 m a.s.l.; 18°55' S, 146°09' E; 8 May–5 Jun. 1995; Cermak leg.; flight intercept trap; ANIC • 1 spec.; same locality; 5 Jun.–3 Jul. 1995; Cermak leg.; flight intercept trap; ANIC • 1 spec.; same locality; 4 Sep.–1 Oct. 1995; Cermak leg.; flight intercept trap; ANIC • 1 spec.; same locality; 1 Oct.–4 Nov. 1995; Cermak leg.; flight intercept trap; MKF • 3 specs; same locality; 4 Nov.–1 Dec. 1995; Cermak leg.; flight intercept trap; ANIC • 1 spec.; Charters Towers Region, Mount Spec; 880 m a.s.l.; 18°55' S, 146°10' E; 9 Mar.–6 Apr. 1995; Cermak leg.; flight intercept trap; ANIC • 3 specs; same locality; 4 Nov.–1 Dec. 1995; Cermak leg.; flight intercept trap; ANIC • 1 spec.; City of Townsville, Townsville; Jul. 1921; Carter leg.; ANIC • 1 spec.; City of Townsville, 6 km WNW of Paluma, Birthday Creek; 18°59' S, 146°10' E; 25 Sep. 1980; Weir leg.; leaf and log litter; ANIC • 1 spec.; Hichinbrook Shire Council, Ingham; 22–28 Mar. 1965; Balogh leg.; HNHM • 1 spec.;

Mackay Region, Eungella; Naumann and Cardale leg.; ANIC • 1 spec.; Moreton Bay Region, Miala National Park; 27°20' S, 152°46' E; 13 Mar. 1973; rainforest; ANIC • 1 spec.; Moreton Bay Region, Mount Glorious; 630 m a.s.l.; 14 Nov. 1986–30 Jan. 1987; Hiller leg.; rainforest, flight intercept trough trap; ANIC • 1 spec.; Scenic Rim Region, Joalah National Park, Tamborine Mountain; 23 Jul. 1976; Lawrence leg.; litter and flood debris; ANIC • 2 specs; Shire of Mareeba, Kuranda; May 1970; Brooks leg.; ANIC • 1 spec.; Shire of Mareeba, Massey Creek; 1000 m a.s.l.; 17°37' S, 135°34' E; 2 Jun.–4 Jul. 1995; Zborowski leg.; flight intercept trap; ANIC • 1 spec.; same locality; 4 Jul.–2 Aug. 1995; Zborowski leg.; flight intercept trap; ANIC • 1 spec.; same locality; 2–30 Nov. 1995; Umback leg.; flight intercept trap; ANIC • 3 specs; Shire of Mareeba, Kuranda, Lamb Range; 23 May 1970; Brooks leg.; ANIC • 1 spec.; Shire of Mareeba, Windsor Tableland, Mt Carbine; 9 Sep.–4 Nov. 1976; Storey leg.; rainforest, pitfall trap; NHMUK • 1 spec.; Tablelands Region, Evelyn; May 1954; Brooks leg.; ANIC • 1 spec.; Tablelands Region, Hugh Nelson Range; 17°27' S, 145°29' E; 30 Nov. 1993; Umback leg.; flight intercept trap; ANIC • 1 spec.; Tablelands Region, Wongabel S.F., 6 km S of Atherton; 1 Dec. 1983–9 Jan. 1984; Storey and Brown leg.; flight intercept trap; NHMUK • 1 spec.; Tablelands Region, Barrine National Park; 760 m a.s.l.; 21 Mar. 1975; Taylor leg.; ANIC • 2 specs; Tablelands Region, 8 km N of Gillies Highway, Boar Pocket Road; 13 Dec. 1969; Brooks leg.; leaf litter; ANIC • 1 spec.; Tablelands Region, Danbulla, Cathedral Fig; 17°10' S, 145°39' E; 25 Jun. 1992; Reid leg.; beaten from rainforest trees and vines; ANIC • 1 spec.; Tablelands Region, Sm. Tinaroo Falls, Danbulla Road; 26 Apr. 1967; Colless leg.; at light; ANIC • 1 spec.; Tablelands Region, Mount Baldy near Atherton, Forest Reserve No. 194; 1200 m a.s.l.; 5 Dec. 1968; Britton and Misko leg.; rainforest; MKF • 1 spec.; Tablelands Region, Lake Barrine; 720 m a.s.l.; 25 Feb. 1970; Brooks leg.; ANIC • 1 spec.; Tablelands Region, Wongabel State Forest, via Atherton; 19–20 May 1970; Naumann and Cardale leg.; ANIC • 1 spec.; Tablelands Region, Alberton, Wongabel State Forest; 19–20 May 1980; Naumann and Cardale leg.; MKF • 7 specs; Townsville City, Townsville; 16–22 Mar. 1965; Balogh leg.; HNHM. – **Victoria** • 1 spec.; Shire of East Gippsland, Croajingolong National Park, South-West Arm Road, 11 km NW of Mallacoota; 20 m a.s.l.; 37°31' S, 149°41' E; 10–23 Feb. 1993; Newton and Thayer leg.; Banksia woodland, window trap; ANIC • 1 spec.; Shire of East Gippsland, Lind National Park, Euchre Valley, Olive Branch Creek; 140 m a.s.l.; 37°34' S, 148°57' E; 10–23 Feb. 1993; Newton and Thayer leg.; riparian forest, window trap; ANIC • 1 spec.; Shire of East Gippsland, 12 km N of Orbost, Bonang Highway, Young's Creek; 9 Nov. 1976; Colless and Liepa leg.; ANIC • 2 specs; South Gippsland Shire, Wilson's Promontory National Park, Lilly Pilly Tr. VIC; 14 May 1978; S. and J. Peck leg.; ANIC.

### Description of holotype

Body (Fig. 7A) elongate, length 2.71 mm; yellowish brown; head piceous, pronotum piceous, narrow region at anterior margin lighter brown, wider, distinctly yellowish brown region across posterior margin, elytra with piceous maculae: humeral area, irregular maculae near middle, and apex dark, scutellar shield piceous, antennomeres 8–10 darkened, antennomere 11 lighter; middle of tibiae slightly darkened. Head (Fig. 7B) 0.4 mm long, 0.64 mm wide; frontal grooves distinct, deep, converging anteriorly, parallel posteriorly, almost reaching middle of eyes; vertex with sparse punctation; punctures distinctly smaller than eye facet diameter, somewhat longitudinally stretched; setae of variable length, mostly about  $\frac{1}{3}$  as long as eyes, directed anteromedially; microsculpture absent; eyes of moderate size, evenly rounded, 0.18 mm long, eye distance 0.4 mm; temples distinct, long, well rounded, temple angle 55°; antennae (Fig. 7D) long, slender, 1.69 mm long, antennomere proportions 2.9 : 1.0 : 1.4 : 1.5 : 1.6 : 1.4 : 1.4 : 1.2 : 1.1 : 1.1 : 2.3. Pronotum (Fig. 7C) 1.1 × as wide as long, widest at anterior quarter; at anterior denticles 1.3 × as wide as at posterior denticles; lateral margin almost straight along posterior  $\frac{3}{4}$ , with ridge between anterior and posterior denticles; anterior end of ridge curved medially, 0.63 mm wide, 0.57 mm long, with group of three anterior denticles, lateral margin with distinct, short teeth, I slightly larger than II–IV, posterior denticle very distinct, almost as large as I, punctation on pronotal disc moderate, punctures slightly larger and denser, as on vertex; slightly stretched longitudinally; setae as on vertex, directed anteromedially; microsculpture absent. Elytra (Fig. 7A) elongate oval, widest at middle, 1.60 mm long,

1.04 mm wide, striae about as wide as interstices, pubescence strial setae  $\frac{1}{3}$  to  $\frac{1}{2}$  as long as interstitial setae; lateral interstices with very long, erect setae; microsculpture absent. Male genitalia (Fig. 7E–G) with slender, lancet shaped median lobe, internal sac with numerous small denticles and long, curved ductus; parameres long, slender, parallel-sided, slightly curved medially, with two large apical setae and numerous setae along the inner margins.

### Variation

Paratypes range in length from 2.32 mm to 3.14 mm. The elytral colouration varies considerably in the size of the dark maculae, but with the general pattern of colouration present in all specimens. The colour of head and pronotum ranges from entirely testaceous to piceous. The 10<sup>th</sup> antennomere is often whitish, like the 11<sup>th</sup>.

### Distribution

Australia (Canberra, New South Wales, Queensland, Victoria).

### Biology

The species was found on plants, in plant detritus, in flight intercept and pitfall traps and only once at light.

### Remarks

This species somewhat resembles *Psammoecus felix* (Waterhouse, 1876), described from Sri Lanka. *Psammoecus venustus* differs distinctly in colouration, in the shape of the male genitalia, and in the structure of the frontal grooves.

### Discussion

The present paper is the first to provide a revision of all species of *Psammoecus* known from Australia. It records seven species, two of them new to science and one new to Australia. Surprisingly to the author, no Australian specimen of *Psammoecus trimaculatus* was among the numerous specimens that were studied, even though it is a very widely distributed species, most likely by human trade (see Mola & Yoshida 2019 for an overview on the current knowledge about its distribution).

Several species of the genus show extraordinarily large areas of distribution (Mola & Yoshida 2019; Yoshida 2018). The three exclusively Australian species (*P. australis* sp. nov., *P. venustus* sp. nov., *P. incertior*) do not represent a distinct group within the genus, and a look at all seven species reveals a quite typical representation of *Psammoecus* diversity. It can not be ruled out that the current Australian fauna of *Psammoecus* is a mixture of mostly imported species. Human trade is likely an important factor for the spread of many species of *Psammoecus* (see also Lu & Han 2006; Ouellette 2018); their association with plant detritus and high flight activity corroborates this hypothesis.

However, the generally poor knowledge about the genus and lack of faunistic data do not allow for more than speculation. Future studies on the *Psammoecus* of Australia and adjacent areas might shed light on this question.

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