



Revision of the stag beetle genus *Ryssonotus* MacLeay (Coleoptera: Lucanidae), with descriptions of a new genus and three new species

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Abstract

The Australian lucanid genus *Ryssonotus* MacLeay, 1819 is redefined and reduced to one species: *R. nebulosus* (Kirby, 1819). The supposed senior synonym of this species, *Lucanus foveolatus* Thunberg, 1806 is a junior synonym of the North American species *Lucanus capreolus* (Linnaeus, 1763) (**new synonym**). *Safrina* **new genus**, is described for the remaining species formerly in *Ryssonotus* and three new species: *S. dekeyzeri* **new species**, *S. grandis* (Lea, 1915) **new combination**, *S. jaedoni* **new species**, *S. jugularis* (Westwood, 1863) **new combination**, *S. laticeps* (Macleay, 1885) **new combination**, *S. moorei* **new species**, *S. parallela* (Deyrolle, 1881) **new combination**, and *S. polita* (Carter, 1921) **new combination**. *Safrina grandis* is a senior synonym of *S. costata* (Carter, 1929) **new synonym**. The type species of *Safrina* is *Rhyssonotus laticeps* Macleay, 1885. All species of *Safrina* are described and a key is provided to the adults of *Ryssonotus* and *Safrina*. The species are confined to the ranges of eastern mainland Australia. Diagnostic descriptions of the larvae of *Ryssonotus* and *Safrina* are provided. *Safrina* and *Ryssonotus* are placed in the tribe Chiasognathini and their systematic position is discussed.

Key words: Stag beetle, larva, taxonomy, morphology, conservation, Australia

Introduction

The stag beetle family Lucanidae (Coleoptera) is relatively depauperate in Australia, where it is most diverse in the temperate forests of the southeast (Moore & Cassis 1992). However, there is high endemism, with 7 of the 17 Australian genera endemic (Moore & Cassis 1992; Reid 1999; Moore & Monteith 2004; Reid, in press). One of these, *Ryssonotus* MacLeay, 1819, was founded on a distinctively mottled species, *R. nebulosus* (Kirby, 1819). This species is common enough in eastern Australia to have received a vernacular name, the brown stag beetle (Naumann 1993). The other species hitherto described in *Ryssonotus* are much more rarely collected and more localised in distribution, generally in small isolated populations from central Victoria to central Queensland. A survey by Australian Museum staff of northern New South Wales rainforests (Gray & Cassis 1994; Ferrier *et al.* 1999) provided material of two undescribed species belonging to this group. This discovery prompted revision of all *Ryssonotus* material available to the authors, revealing an additional species. As a result of this morphological study, the genus *Ryssonotus* appears to be non-monophyletic, comprising two distinct genera, which may not be sister taxa. There is also molecular evidence for this conclusion (Kim & Farrell 2015). The purpose of our paper is to revise *Ryssonotus*, describe the new species and describe the new genus to which they belong.

Historical notes

Some small corrections need to be made to Australian lucanid literature. *Ryssonotus* was named by William Sharp MacLeay in 1819 in his 'Essays on annulose animals' (MacLeay 1819). In that work his familial name is referred to with a capital 'L', as MacLeay, not Macleay as used by Australian cataloguers (for example, Moore & Cassis 1992). However, the orthography of his nephew's name, William John Macleay, has varied from upper case 'L' in early works to lower case 'l' in later works (for example the work cited here, Macleay 1885). We use the two

orthographic variants for W.S. MacLeay and W.J. Macleay, which also serve to distinguish between these two authors. Another error in Australian and New Zealand literature (for example, Moore & Cassis 1992; Holloway 2007) is the correct date of Kirby's 'century of insects' published in *Transactions of the Linnean Society of London*. Raphael (1970) reviewed publication dates of all parts of this journal, showing that Kirby's work was published in 1819, not 1818 as written on Volume 12 part 2 of the journal.

Methods

Terminology for adults and larvae generally follows that used in Lawrence & Ślipiński (2013). For the new genus, areas of the head and pronotum are measured or delimited as follows. Mandibles are measured from their tip to the base of the inner margin (because the anterior margin of the head is usually concave). The head length is measured at the midline, from the anterior margin to the posterior (base) of the median basal depression. The ratio of these two measurements provides a measure of the relative size of the mandibles. The heads of all species are laterally expanded anterior to the eyes. We term this area the genal lobe, defined as the expansion lateral to a line parallel to the body axis, from the outer margin of the eye to the anterior of the head. This lobe is often almost quadrangular, with posterior and anterior angles. The pronotum of the new genus is deeply concavely excavate from anteriorly from its posterior angles on the relatively narrow hind margin to a secondary posterior angle, which is often prominent, on the lateral margin. We refer to the latter as the posterolateral angle.

Abbreviations. Specimens were examined from the following collections: AMS—Australian Museum, Sydney, Australia; ANIC—Australian National Insect Collection, Canberra, Australia; BMNH—Natural History Museum, London, United Kingdom; BPM—Barry Moore, Canberra, Australia (now ANIC); DPIM—Queensland Department of Primary Industry, Mareeba, Australia; GWT—Geoff Williams, Taree, Australia; JB—John Balderson, Canberra, Australia; (now ANIC) MDB—Murdoch De Baar, Brisbane, Australia; MMM—Melbourne Museum, Melbourne, Australia; MMS—Macleay Museum, Sydney, Australia; QMB—Queensland Museum, Brisbane, Australia; RB—Vratislav Ricardo Bejšák-Collaredo-Mansfeld, Sydney, Australia; RDK - Roger de Keyzer, Sydney, Australia; SAM—South Australian Museum, Adelaide, Australia; UUS—University of Uppsala, Uppsala, Sweden.

Descriptions

Ryssonotus MacLeay, 1819

Ryssonotus MacLeay 1819: 98; Thorpe 2001: 22; Holloway 2007: 115.
Rhyssonotus Agassiz, 1846: 329, unjustified emendation.

Type species. *Lucanus nebulosus* Kirby, 1819, by monotypy.

Diagnostic description. Adult. Length: excluding mandibles: 12–26 mm; including mandibles: 15–33 mm. Upper surface densely microreticulate, with mottled colour pattern; ventral setae multifid; eyes completely divided by expanded canthus, eye segments separated by less than half upper eye segment height in lateral view; antennae geniculate, with antennomeres 1–5 sparsely setose and symmetrical, and antennomeres 6–10 partly densely setose and asymmetric, forming a loose club; mandibles strongly punctured, inner faces densely setose; side of head without genal lobe; upper surface of head with median tubercle, without deep pit at base; mentum relatively small, semicircular, impunctate and membranous; preular area feebly convex, with slightly convergent sides; pronotum with foveolate depressions; posterior corners of pronotum not margined, but also not deeply concavely excavate; prosternal process strongly arched and visible between coxae; lateral margins of female pronotum almost even, with a few irregularly spaced small indentations about middle, but not distinctly crenulate; lateral margins of elytra not explanate; mesoventrite process anteriorly excavate; tarsal empodium short, much less than half length of claws; aedeagus with everted unbranched endophallus; dorsal edge of parameres not notched; male paraproct fused dorsally not split into two sclerites; proctiger of ovipositor weakly sclerotised and quadrate, paraproct complete; vaginal palp conico-cylindrical and thickly setose; spermatheca membranous.

Larva. The following diagnosis is based on examined material from the Dorrigo area, New South Wales (AMS, collected Reid & Day), North Queensland (ANIC, collected Brooke & Parrott), and the published description (Lawrence 1981).

Mandible with 1 apical tooth plus 4 internal subapical (scissorial) teeth; tibiotarsus reduced to a small lobe, length equal to width at base; no dorsal anal lobe, lateral lobes with well-defined ovoid pads, margined, smooth and glabrous; 10th abdominal segment dorsally foreshortened, with raster of moderately dense, very short, outwardly directed setae; metatrochanteral stridulatory file (pars stridens) present as a single ridge of about 16 sparse, almost quadrate granules (Lawrence 1981: fig. 4); mesocoxal stridulatory file (pars stridens) present as a fine line of densely packed small transverse granules, ending in a basal oval field of scattered minute granules.

Notes. The original spelling of this genus was emended by Agassiz (1846) to *Rhyssonotus*. Prior use of *Ryssonotus* was well-established (Kirby & Spence 1826), but the emended name has become standard in Australian literature (Moore & Cassis 1992, updated by Calder 2010; Lawrence & Ślipiński 2013). However, outside Australia, use of *Ryssonotus* has prevailed (Thorpe 2001; Holloway 2007; Bouchard *et al.* 2011). As Agassiz' action was an unjustified emendation (International Commission on Zoological Nomenclature 1999, Article 33.2.3) and its use has arguably not prevailed in a global context (Article 33.2.3.1), we follow Holloway (2007) and use *Ryssonotus*, consigning *Rhyssonotus* Agassiz, 1846 to junior objective synonymy (Article 33.2.3).

The name *Lucanus foveolatus* Thunberg, 1806, hitherto considered a probable senior synonym of *R. nebulosus* (Parry 1870; Gourlay 1954; Moore & Cassis 1992), refers to the North American species *Lucanus capreolus* (Linnaeus, 1763) (**new synonym**) and is therefore unlikely to have been collected in Australia (photograph of holotype examined, courtesy UUS).

The type species of *Ryssonotus*, *R. nebulosus*, differs markedly from all other species hitherto placed in this genus. These other species, which do not belong to any genus from elsewhere, for example the potentially related lucanid faunas of New Zealand (Holloway 2007), Africa (Switala *et al.* 2014), and South America (Mizunuma and Nagai 1994; Paulsen 2010a), are removed and placed in a new genus, defined below. The name *Ryssonotus* is retained for *R. nebulosus*, endemic to Australia but widespread on the eastern margin of the continent.

***Ryssonotus nebulosus* (Kirby, 1819)**

(Figs 1, 10, 19, 28, 37, 44, 46, 50, 52, 61, 68)

Lucanus nebulosus Kirby 1819: 410.

Ryssonotus nebulosus, MacLeay 1819: 99; Holloway 2007: 116; Bouchard *et al.* 2011: 234.

Rhyssonotus nebulosus, Agassiz 1846: 329; Moore & Cassis 1992: 16; Mizunuma & Nagai 1994: 206, plate 3; Lawrence & Ślipiński 2013: 201.

Material examined. Holotype (by monotypy): **AUSTRALIA:** 1 / type / Kirby / *nebulosus* K. L. Ta / (BMNH).

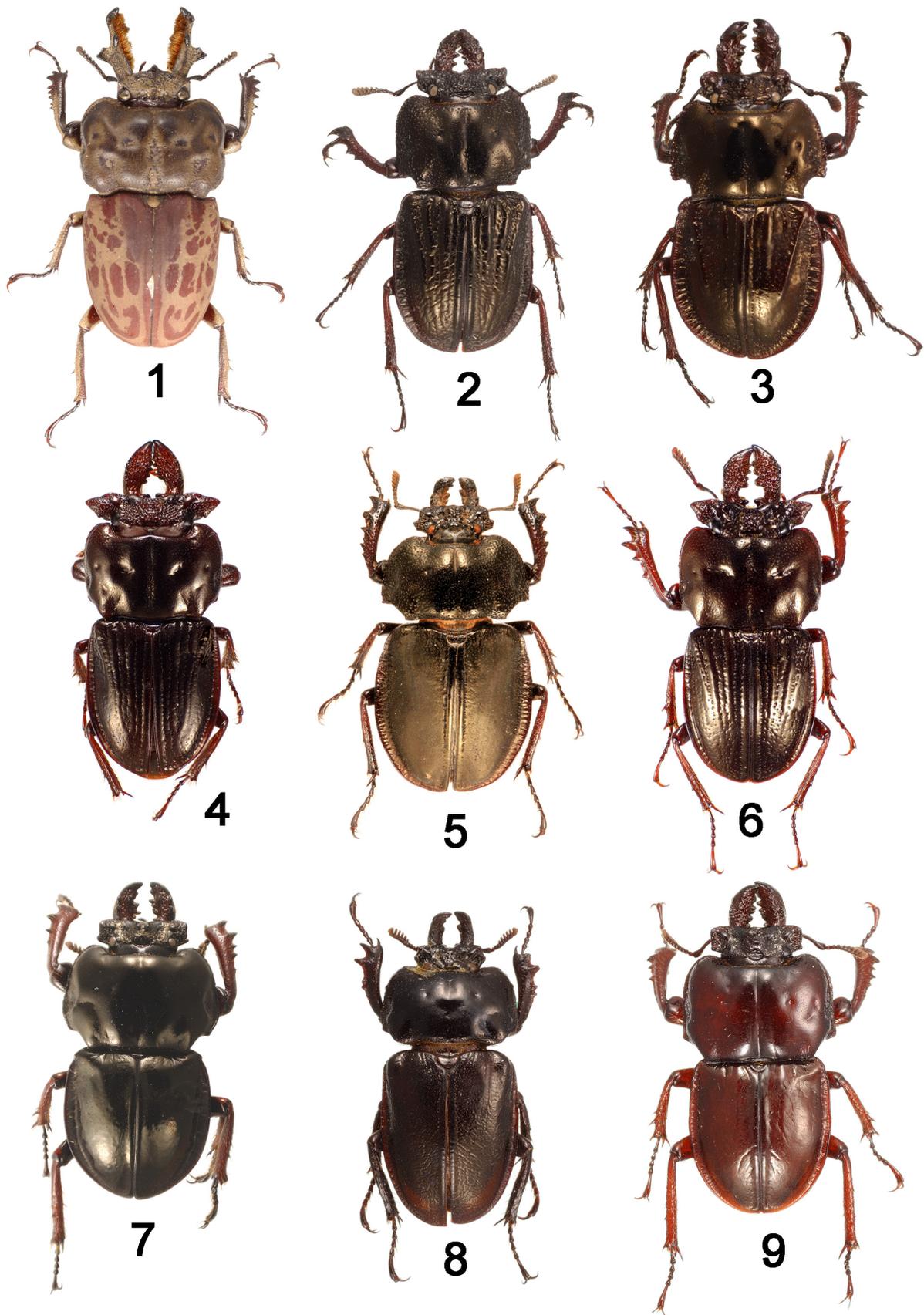
Additional material (abbreviated localities only): **AUSTRALIA:** **Australian Capital Territory:** Canberra (AMS); **New South Wales:** Ashfield (AMS); Avoca Beach (AMS); Barrington (ANIC); Batehaven (ANIC); Bawley Point (AMS, ANIC, JB); Bayview, Sydney (AMS); Beaury Creek State Forest (AMS); Big Scrub Flora Reserve (larva: AMS); Bilinudgel [Billinudgel] (ANIC); Blacktown (AMS); Blue Gum Knob, Chichester (MMM); Bondi (AMS); Bondi Beach (RB); 3.5 mi W Bonville (ANIC); Botany (SAM); Brooklana (AMS); Broulee (ANIC); Bruxner Park (AMS); Bundeena (AMS); Bungabee [Bungabee] State Forest (ANIC); Burrewarra Point (ANIC); Byron Bay (AMS, MMM); Calga (AMS); Cambridge Plateau (ANIC); Caparra (ANIC); Carlingford (AMS, SFS); Carlton (AMS); Castle Cove (SFS); Castlecrag (MMM); Cedar Flat (JB); Cherry Tree State Forest (ANIC); Chichester Knob (SAM); Clarence River (MMM); Coffs Harbour (AMS); Collaroy Plateau (AMS); Congo (ANIC); Cooper Park, Sydney (AMS); Croydon (SFS); Cully [Cullya] (BMNH); Cutlers Pass, Williams River (AMS); Cyder [Clyde] Mountain, near Batemans Bay (AMS); Dingo State Forest (ANIC); Dorrigo (ANIC, MMM, SAM); Eccleston (ANIC); Elanora Heights (AMS); Engadine (AMS); Epping (ANIC); Forrestville (AMS); Fortis Creek State Forest (ANIC); Galston (MMM); Girard SF (ANIC); Glenfield (ANIC); Gloucester (AMS); Gosford (AMS); Grafton (ANIC, MMM, QMB); Gynea (AMS); Hampden Bridge, Kangaroo River (AMS); Hazelbrook (AMS, BMNH, RB); Heathcote (AMS); Helensburgh (AMS); Hornsby (AMS); Hunters Hill (ANIC); Kangaroo Valley (ANIC, JB); Killara (SFS); Kingsgrove (AMS); Kioloa (ANIC); Kurri Kurri (AMS); Kyogle (AMS); Lake Ainsworth, near Lennox Head (ANIC); Lambton (BMNH); Lane Cove (AMS); 3 km N Lansdowne

(AMS, ANIC); League Scrub Flora Reserve (larva: AMS); Lilyvale (AMS); Lismore (AMS); Longueville (ANIC); Manly (BMNH); Meringo (ANIC); Meroo Meadow (AMS); Merricumben [Merricumbene] (SAM); Mimosa Rocks National Park (MMM); Mosman (AMS); Mount Keira (ANIC); Mount Kennedy (JB); Mount Wilson (RB); Narrabeen (AMS, BMNH, MMM, RB); Nelligen (ANIC); Newcastle (AMS); Nowra (BMNH); Otford (AMS); Ourimbah (AMS); Panania (AMS); Pompenbil [Pumpenbill] (ANIC); Pymble (AMS); Richmond Gap (AMS); Richmond Range (ANIC); Richmond River (ANIC, MMM, SAM); Rivertree (QMB); Rocky Creek, Killara (AMS); Royal Camp State Forest (ANIC); Royal NP (AMS); Ryde (AMS); Seal Rocks (AMS); Seven Hills (AMS); Shoalhaven Heads (AMS); Smiths Lake (AMS); South Woy Woy (AMS); Sydney (ANIC, BMNH, MMM, SAM); Tamworth (SFS); Telegraph Point (AMS); Tooloom (QMB); Tuross (AMS); Ulong (AMS); Upper Allyn River (ANIC, JB); Upper Tweed River (ANIC); Upper Wilson River (ANIC); Vaucluse (AMS); Wahroonga (ANIC); Waitara, Sydney (AMS); Wallaga Lake (AMS); Wellington (ANIC); Westleigh (AMS); West Pennant Hills (AMS, SFS); West Pymble (AMS); White Rock, Allyn R. (ANIC); Wiangaree State Forest (ANIC); Wilberforce (AMS); Willi Willi Caves (QMB); Wingham (AMS, JB, MMM); Winston Hills (AMS); 7 mi. W Wisemans Ferry (ANIC); Woy Woy (AMS); Yarratt State Forest (ANIC); Yowie Bay (AMS); **Queensland:** Albert River, Mount Tambourine (SAM); Archer River (AMS); Binna Burra (QMB); Boar Pocket Road, 4 mi. N Gillies Highway (ANIC); Bribie Island (SAM); Brisbane (BMNH, DPIM, MMM, QMB, SAM); Broken River, Eungella (AMS, QMB); Bulburin State Forest (QMB); Bunya Mountains (AMS, QMB); Cash's Crossing (ANIC); Cathu (ANIC); The Caves, near Rockhampton (QMB); Charmillan Creek (QMB); Coomra [Coomera] River (SAM); Curtain Fig (ANIC); Fletcher (AMS, ANIC); Garradunga (DPIM); 20 km E Hampton (QMB); Innisfail (QMB); Kauri Creek (JB); Kirrama Range (ANIC); Kuranda (BMNH); Lake Barrine (JB, QMB); Lake Eacham (ANIC); Longmans Gap (ANIC); Mackay (ANIC); Maryborough (SAM); McDonald NP (ANIC, QMB); 4 km SE Millaa Millaa (JB); Mission Bay (AMS); Montville (QMB); Moreton Bay (BMNH); Mossman Bluff Track (QMB); Mount Carbine (AMS); Mount Coot-tha (ANIC); Mount Fort William (QMB); Mount Glorious (QMB); Mount Hypipamee (ANIC); Mount Lewis Road (QMB); Mount Moffat (QMB); Mount Tambourine (AMS, SAM); Murphys Creek (QMB); Pile Valley, Fraser Island (QMB); 18 km SSW Ravenshoe (DPIM); Redwood Park [Toowoomba] (QMB); Stanthorpe (AMS, QMB, SAM); Summer Hill (AMS); Tansey (DPIM); Taylor Range [The Gap] (SFS); Toowoomba (ANIC, QMB); Tower, The Crater (QMB); Upper Logan (SAM); Whitfield Range (BMNH); Windsor Tableland (ANIC, DPIM); Yarraman (AMS, QMB); Yuccabine Creek (QMB); **Victoria:** Beechworth (MMM); Inglewood (MMM).

Notes. *Ryssonotus nebulosus* is widespread and common in closed forest in eastern Australia, from west-central Victoria (Inglewood) and the south coast of New South Wales (Congo), to Windsor Tableland, north Queensland, as far inland as Mount Moffat, which is 300 km from the Queensland coast. There is a published record for Colosseum, central Queensland (Mjöberg 1916). In urban Brisbane (G. Monteith, personal communication 2004) and Sydney it persists in gardens and parkland. *Ryssonotus nebulosus* is also present in New Zealand, where it was introduced before 1950 (Brockerhoff & Bain 2000).

The adult is an active flier and is attracted to light. The larva inhabits a variety of rotting timbers: there are collection records for *Eucalyptus*, including *E. pilularis* (Myrtaceae), *Jacaranda* (Bignoniaceae), *Salix babylonica* (Salicaceae), and *Toona australis* (Meliaceae), and published records for *Acacia* (Fabaceae), *Eucalyptus*, and *Ligustrum* (Oleaceae), and various un-named rainforest species (Wood *et al.* 1996; Thorpe 2001; Holloway 2007). *Jacaranda*, *Salix*, and *Ligustrum* are exotic genera in Australia. The larva prefers recently dead wood that is infected by white-rot fungi (Wood *et al.* 1996; J. Hasenpusch, personal communication 2004).

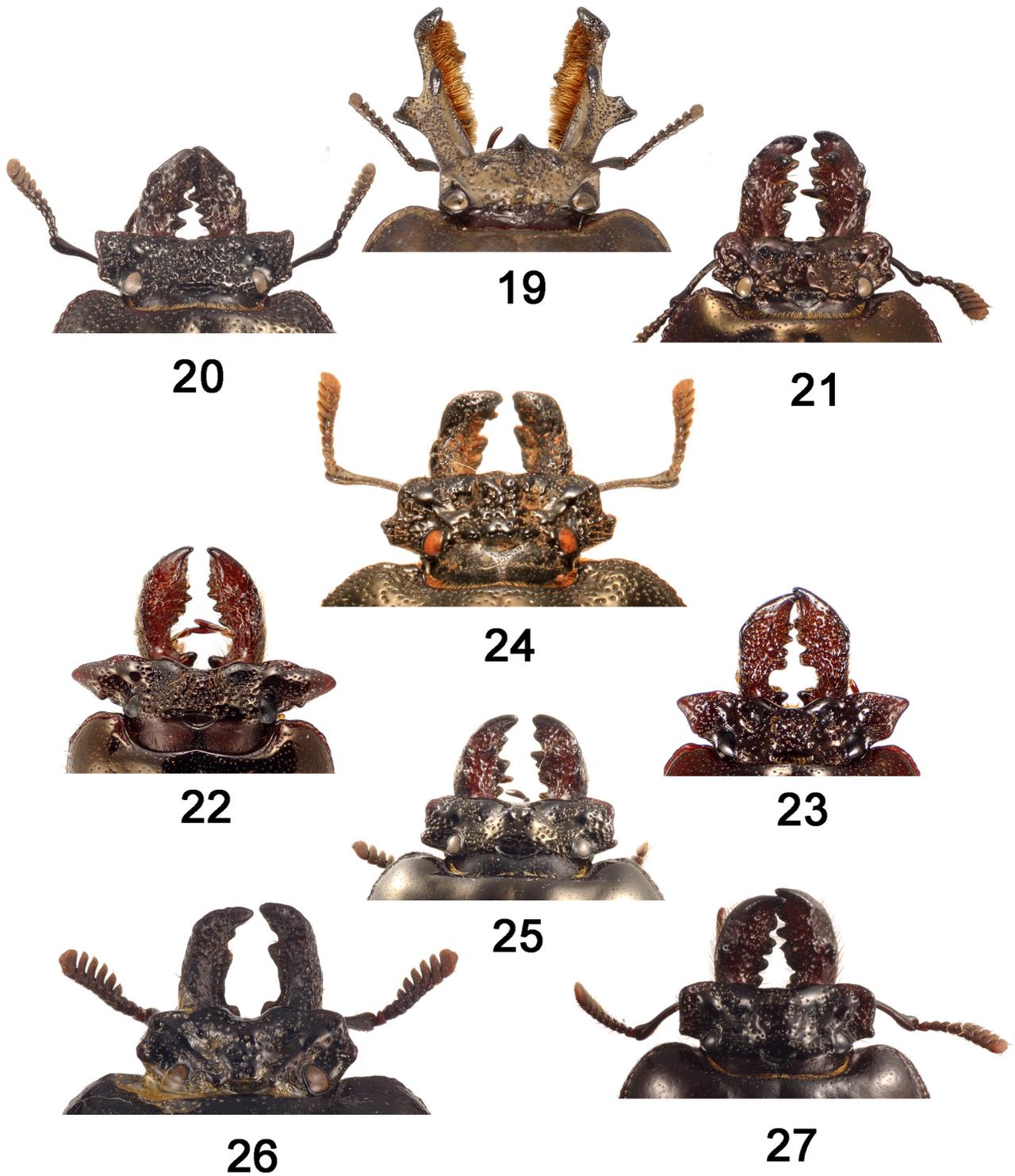
Live adults of *R. nebulosus* are easily distinguished by the velvety mottling of the upper surface, unique in the Australian Lucanidae (Moore 1984, figs 117-8; Mizunuma & Nagai 1994, plate 3), but dead specimens in collections are commonly greasy and uniformly dark brown, hence the name “brown stag beetle” (Naumann 1993). But brown is hardly a distinctive colour among stag beetles, even Australian species (Mizunuma & Nagai 1994). We propose that a more appropriate vernacular name for the living insect is “mottled stag beetle”. There are no obvious morphological differences between specimens from the relatively isolated populations in north Queensland and central Victoria and the main range of the species.



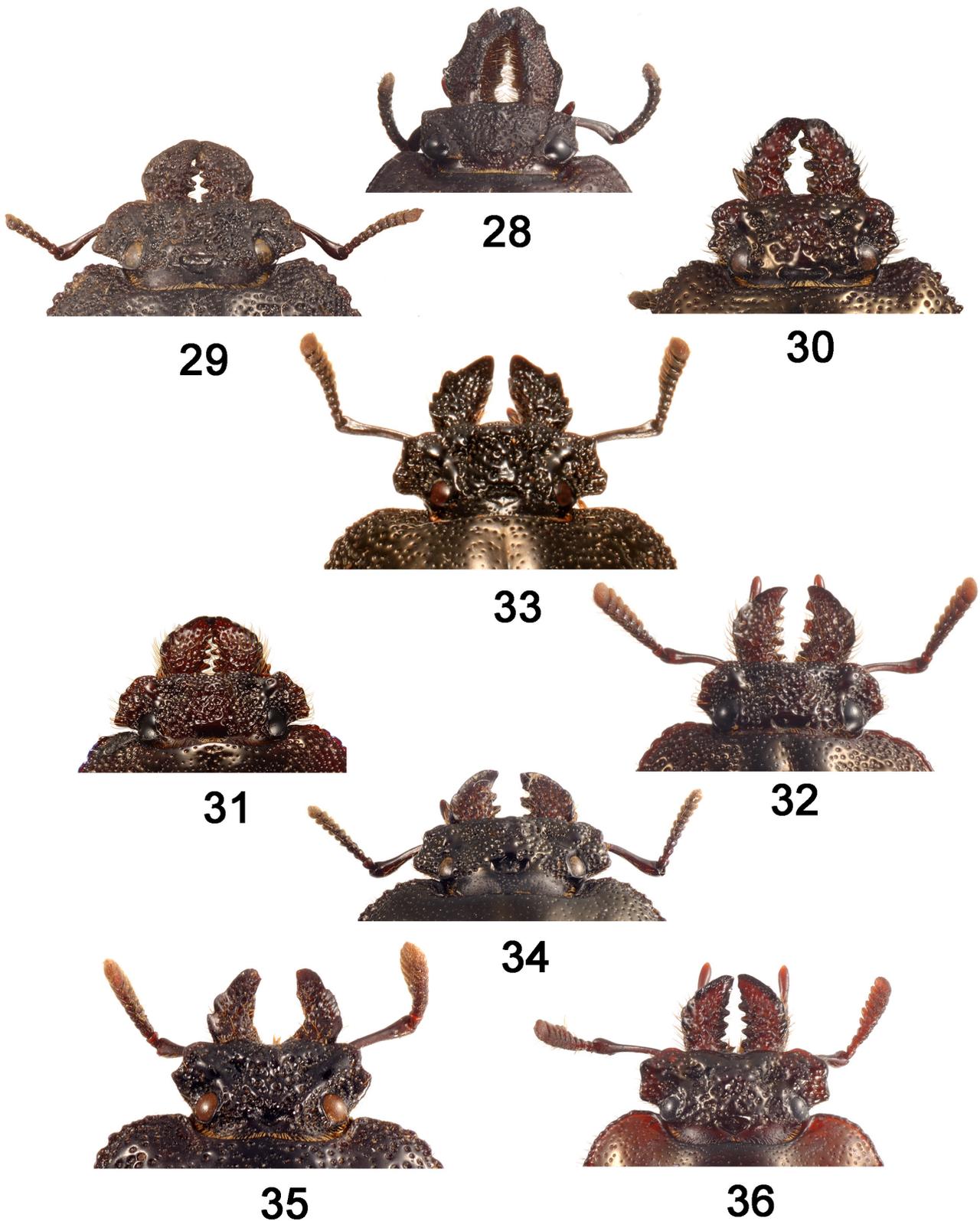
FIGURES 1–9. Habitus, male: 1, *Ryssonotus nebulosus* (Kirby, 1819); 2, *Safrina dekeyzeri* new species; 3, *S. grandis* (Lea, 1915); 4, *S. jaedoni* new species; 5, *S. jugularis* (Westwood, 1863); 6, *S. laticeps* (MacLeay, 1885); 7, *S. moorei* new species; 8, *S. parallela* (Deyrolle, 1881); 9, *S. polita* (Carter, 1921).



FIGURES 10–18. Habitus, female: 10, *Ryssonotus nebulosus* (Kirby, 1819); 11, *Safrina dekeyzeri* new species; 12, *S. grandis* (Lea, 1915); 13, *S. jaedoni* new species; 14, *S. jugularis* (Westwood, 1863); 15, *S. laticeps* (MacLeay, 1885); 16, *S. moorei* new species; 17, *S. parallela* (Deyrolle, 1881); 18, *S. polita* (Carter, 1921).



FIGURES 19–27. Head, dorsal, male: 19, *Ryssonotus nebulosus* (Kirby, 1819); 20, *Safrina dekeyzeri* new species; 21, *S. grandis* (Lea, 1915); 22, *S. jaedoni* new species; 23, *S. laticeps* (MacLeay, 1885); 24, *S. jugularis* (Westwood, 1863); 25, *S. moorei* new species; 26, *S. parallela* (Deyrolle, 1881); 27, *S. polita* (Carter, 1921).



FIGURES 28–36. Head, dorsal, female: 28, *Ryssonotus nebulosus* (Kirby, 1819); 29, *Safrina dekeyzeri* new species; 30, *S. grandis* (Lea, 1915); 31, *S. jaedoni* new species; 32, *S. laticeps* (MacLeay, 1885); 33, *S. jugularis* (Westwood, 1863); 34, *S. moorei* new species; 35, *S. parallela* (Deyrolle, 1881); 36, *S. polita* (Carter, 1921).



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FIGURES 37–38. Male antennal club: 37, *Ryssonotus nebulosus* (Kirby, 1819); 38, *Safrina dekeyzeri* new species.

***Safrina* Reid & Beatson, new genus**

Type species. *Ryssonotus laticeps* Macleay, 1885, this designation.

Etymology. Named in honour of Safrina Thristiawati. The generic name is feminine in gender.

Diagnosis. Ventral setae simple, not multifid; eyes completely divided; antennae geniculate, with 10 antennomeres, antennomeres 1–4 sparsely setose and symmetrical, antennomeres 5–10 at least partly densely setose, asymmetric, forming a loose club; mandibles strongly punctured, inner faces not densely setose; sides of head with prominent genal lobe; upper surface of head tuberculate, with deep pit at base; mentum small, semicircular, punctate and thickly sclerotised; preular area thickened and strongly transversely raised, with grooved sides for retention of maxillary palpi; pronotal disc with foveolate depressions; posterior corners of pronotum deeply concavely excavate, not margined; prosternal process linear, not arched, hidden between procoxae; lateral margins of pronotum crenulate in female; lateral margins of elytra explanate; mesosternal process anteriorly excavate; aedeagal endophallus everted; male paraproct split into two sclerites; proctiger of ovipositor triangular with long apical spine; female paraproct split into two sclerites; vaginal palp reduced to a flat strongly sclerotised plate with long setae at apex; spermatheca present, globular.

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FIGURES 39–43. Lateral views of male head, *Safrina* species: 39, *S. dekeyzeri* new species; 40, *S. grandis* (Lea, 1915); 41, *S. jaedoni* new species; 42, *S. moorei* new species; 43, *S. polita* (Carter, 1921).

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FIGURES 44–45. Ventral part of head and prothorax: 44, male *Ryssonotus nebulosus* (Kirby, 1819); 45, female *Safrina polita* (Carter, 1921).

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FIGURES 46–47. Venter of head: 46, female *Ryssonotus nebulosus* (Kirby, 1819); 47, female *Safrina jugularis* (Westwood, 1863).

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FIGURES 48–49. Venter of female abdomen of *Safrina jugularis* (Westwood, 1863): 48, Brindabella Range, Australian Capital Territory; 49, Mount Wilson, central New South Wales.

Description. Adult. Length: excluding mandibles, 14–26 mm; including mandibles 15–28 mm. Upper surface black to reddish brown, often with metallic green reflection, dull or shiny, smooth or rugose. Body oval with relatively small head. Head with sparse, erect, simple setae; most visible around median tubercles and on genal lobes; dorsal surface of pronotum (except margins) glabrous; elytra glabrous, except minute sparse stubble laterally and apically in *S. jugularis* (Westwood, 1863) and *S. parallela* (Deyrolle, 1881). Ventral setae simple.

Head. Eyes completely divided by canthus, dorsal segment of eye much smaller than ventral, separated by at least height of dorsal segment in lateral view; head strongly punctured; sides of head with prominent genal lobe; head tuberculate between eyes, and with a deep lunate pit at base; antennae geniculate, with 10 antennomeres, antennomeres 1–4 sparsely setose and symmetrical, antennomeres 5–10 densely setose and asymmetric, forming a loose club; mandibles short, length less than width of head, strongly punctured, inner faces setose but without a dense brush, with multiple blunt tubercles (intraspecifically variable and often asymmetric); mentum relatively small, semicircular, punctate and sclerotised; preular area thickened, strongly transversely raised, with convergent sides; gap between preular ridge and base of mandible forming a groove for retention of maxillary palp.

Thorax. Pronotum transverse, quadrangular or broader at base, anterior angles rounded (produced in males), posterior corners strongly concave, forming distinct posterolateral angle; disc with depressed midline (broad and shallow in *S. parallela*) and lateral foveolate depressions (intraspecifically variable and often asymmetric); at least posterior corners and anterior of pronotum without bevelled margin; lateral margins of pronotum usually feebly (male) or strongly (female) crenulate; anterior half of hypomeron smooth with sparse trichobothria; prosternum smooth, with scattered trichobothria, most species almost glabrous; prosternal process a level, unarched, ridge hidden between procoxae, which are almost touching; elytra parallel-sided at basal 2/3 to strongly ovate, narrowly elevated at sutural margin, flat and explanate at lateral margins; scutellum semicircular; wings variable, from fully formed to reduced to a short narrow strip half length of elytra; mesoventrite process anteriorly excavate, without a tubercle between mid coxae; meso- and metathoracic ventral sclerites closely punctured and pubescent; legs gracile; profemora much thicker than other femora, anteriorly ridged, the ridge with a preapical excavation (inner edge of excavation toothed in larger males); tibiae not carinate; number of tibial teeth intraspecifically variable and often asymmetric, protibiae with at least 4 large external teeth, mesotibiae with at least 2 small external teeth, metatibiae with or without external teeth; inner margin of protibia slightly excavate and usually with median teeth; tarsal empodium short, hardly projecting beyond ventral apex of fifth tarsomere, much less than half length of claws.

Abdomen. Ventrites not laterally ridged, without a deep basal groove. Aedeagal endophallus everted, unbranched; male tergite IX (paraproct) membranous at dorsal midline, split into two sclerites (laterotergites); male sternite IX with basal (anterior) elongate lobe and truncate setose apex; dorsal edge of parameres not notched, apices with membranous flange; proctiger of ovipositor triangular with long apical spine (4 species examined); female paraproct split into 2 sclerites; vaginal palp reduced to a flat strongly sclerotised plate with long setae at apex; spermatheca present, globular.

Larva. The following diagnostic description is based on mature specimens (instars unknown) of five species (*S. grandis* (Lea, 1915), *S. jugularis*, *S. laticeps*, *S. moorei* new species, and *S. polita*), identified by their association with adults.

Length 23–40 mm (when roughly straightened); third antennomere produced or truncate at apex; mandible with 1 apical tooth plus 5 internal subapical (scissorial) teeth; mesocoxal stridulatory file present as a fine line of coarse rounded granules, without basal area of finer granules; metatrochanteral stridulatory file present as a single ridge of 15–23 sparse, transverse granules; tibiotarsus not reduced, length about 3 times width at base; 10th abdominal segment dorsally foreshortened, with raster of moderately dense, short setae, at sides laterally directed, at middle posteriorly to inwardly directed, raster with fringe of short to very long setae; no dorsal anal lobe, lateral lobes with large well-defined oval pads, which are margined, smooth, and glabrous.

Notes. *Safrina* is easily distinguished from *Ryssonotus*, differing by at least 13 adult and two larval characters: adult: upper surface without mottled colour pattern (Fig. 2); ventral setae simple, not multifid; head with prominent genal lobes (Fig. 20); eyes separated widely in lateral view (Fig. 39); antennal club with six partly densely setose antennomeres (Fig. 38); inner face of mandibles not densely setose (Fig. 20); posterior corners of pronotum deeply concavely excavate (Fig. 2); prosternal process flat, hidden between coxae (Fig. 45); lateral margins of elytra broadly explanate (Fig. 2); male paraprocts not fused (Fig. 51); proctiger of ovipositor triangular with long apical spine (Fig. 62); female paraproct split into two sclerites; vaginal palp reduced to a flat strongly sclerotised plate

with long setae at apex; spermatheca hard, globular; larva: tibiotarsus elongate, length 3x breadth (Fig. 66); raster with inner setae apically or inwardly directed (Fig. 67).

Safrina and *Ryssonotus* are most similar to *Australognathus* Chalumeau and Brochier, 1995, from North Queensland (Moore 1978; Moore & Monteith 2004); *Sphaenognathus* Buquet, 1838 from South America (Onore 1994); and *Chiasognathus* Stephens, 1831 from South America (Onore 1994; Paulsen & Smith 2010), as intimated by Westwood (1863). The nomenclature of these genera is complex. *Sphaenognathus* and *Chiasognathus* were split into 7 genera based largely on trivial secondary sexual characters (Chalumeau and Brochier 1993, 1995; Molino-Olmedo 2001), which are unlikely to provide a strong phylogenetic signal. Paulsen & Smith (2010) have discussed some of these genera and rejected their validity. However, one of these genera, *Australognathus*, was named for an Australian species of *Sphaenognathus*. Moore & Monteith (2004) discussed the status of *Australognathus* and reduced it to a subgenus, noting that it was based on minor male characters, but that there were biological differences between the two taxa. Paulsen (2010b), in a discussion of the separation of *Chiasognathus* from *Sphaenognathus*, accepted the validity of *Australognathus* as a genus, but without explanation. Most recently, Kim & Farrell (2015) have provided evidence for the ancient divergence of the Australian and South American species in this group, supporting the recognition of *Australognathus* as a valid genus, sister to *Sphaenognathus* + *Chiasognathus*. Kim & Farrell (2015) also discussed the composition of Chiasognathini and noted that Chiasognathini, “Rhyssonotini” [an unavailable name: Bouchard *et al.* 2011], “Pholidotini” [an unavailable name], and “Colophonini” [an unavailable name] formed a monophyletic group. They failed to provide morphological justification for any of their generic groups and made no classificatory changes.

Ryssonotus and *Safrina* are hereby placed with *Australognathus*, *Chiasognathus*, and *Sphaenognathus* in the tribe Chiasognathini, defined by the club of 5 or 6 antennomeres, completely divided eyes, female externally keeled mandibles, female head with blunt median dorsal tubercle in front of an excavation (shallow to absent in *Ryssonotus*), plus other features listed by Moxey (1960). Molecular data support this monophyletic group (Kim & Farrell 2015).

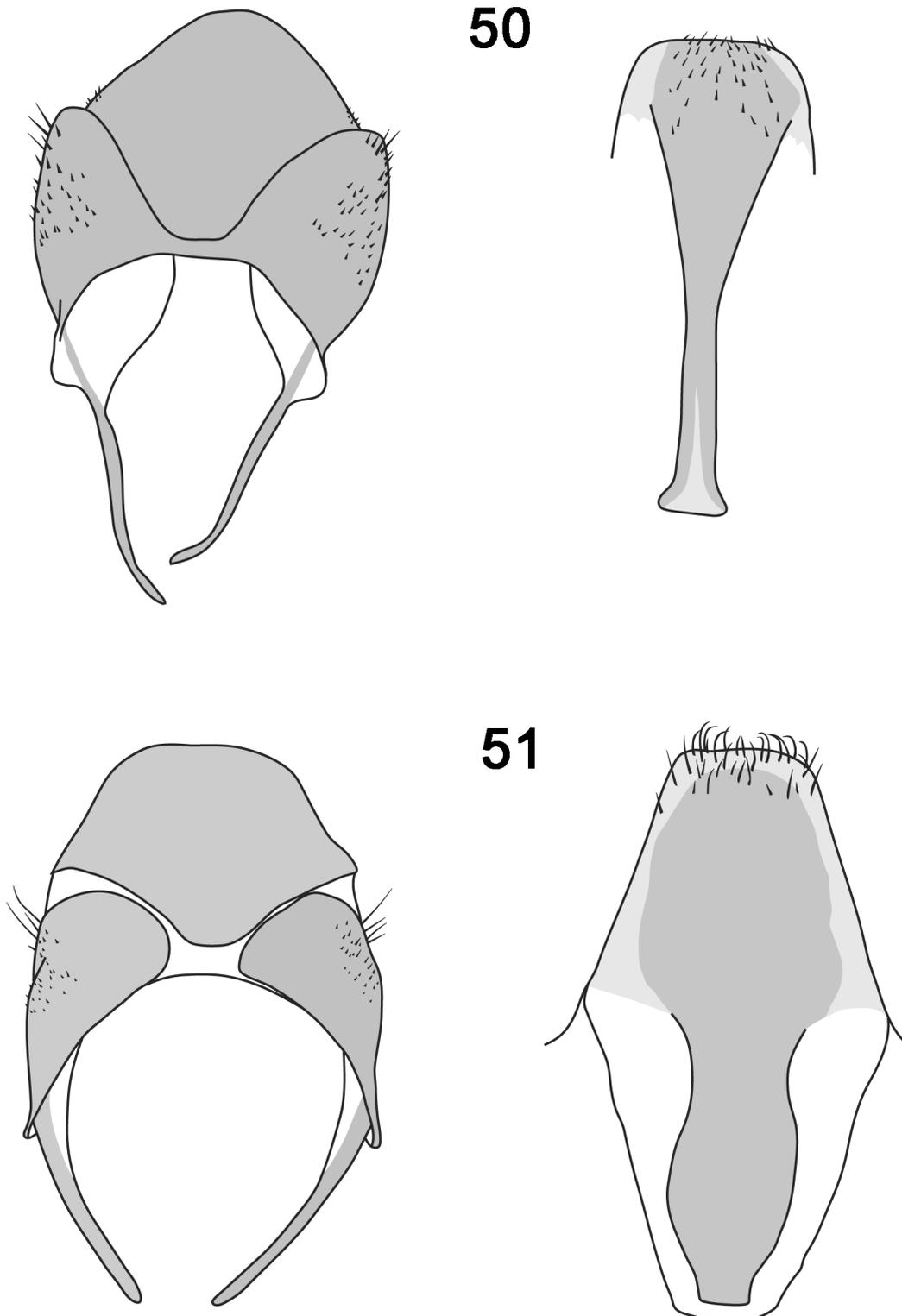
Australognathus, *Chiasognathus*, and *Sphaenognathus* differ from *Safrina* and *Ryssonotus* by: adult: lack of dorsal cephalic tubercles in males, flat pregena, profemora without anterior ridge, long tarsal empodium; larva (Onore 1994): mandibles with fewer internal (scissorial) teeth, pars stridens on metathoracic coxa with a diffuse patch of granules at apex. The larva of *Australognathus munchowae* Moore & Monteith, 2004, is similar to that of *Sphaenognathus*, with two scissorial mandibular teeth, metatrochanteral stridulatory file dense, with > 50 transverse tubercles, tibiotarsus reduced to short lobe and apex of metatrochanter strongly produced (material examined by CAMR in ANIC). Morphology therefore supports molecular analysis in placing *Australognathus*, *Chiasognathus*, and *Sphaenognathus* in a single clade (Kim & Farrell 2015). Without a detailed study of the male and female genitalia and larvae, the precise relationships of these five genera are unclear.

Two genera related to the above are *Cacostomus* Newman, 1840 (= *Eucarteria* Lea, 1914; Reid 1999) in Australia, and *Casignetus* MacLeay, 1819 (= *Pholidotus* MacLeay, 1819) in South America, both placed in a poorly defined tribe Casignetini (Kikuta 1986; Reid 1999), incorrectly named “Pholidotini” in Kim & Farrell (2015). Casignetini genera share several attributes with Chiasognathini (split eyes, rugose mandibles, semicircular mentum, and posterolaterally excavate pronotum), but have several characters that appear to exclude them from this tribe: three antennomere club, non-carinate mandibles, dorsal scale-like pubescence, notched parameres, and two-segmented vaginal palpi (Reid 1999). The larvae of *Casignetus* are similar to Chiasognathini (Costa *et al.* 1988). Casignetini and Chiasognathini are probable sister groups and the morphological evidence for this is supported by molecular analysis (Kim & Farrell 2015). All other extant lucanid genera, including South African *Colophon* Gray, 1832 (Switala *et al.* 2014), appear to differ considerably from the above genera, at least in external morphology.

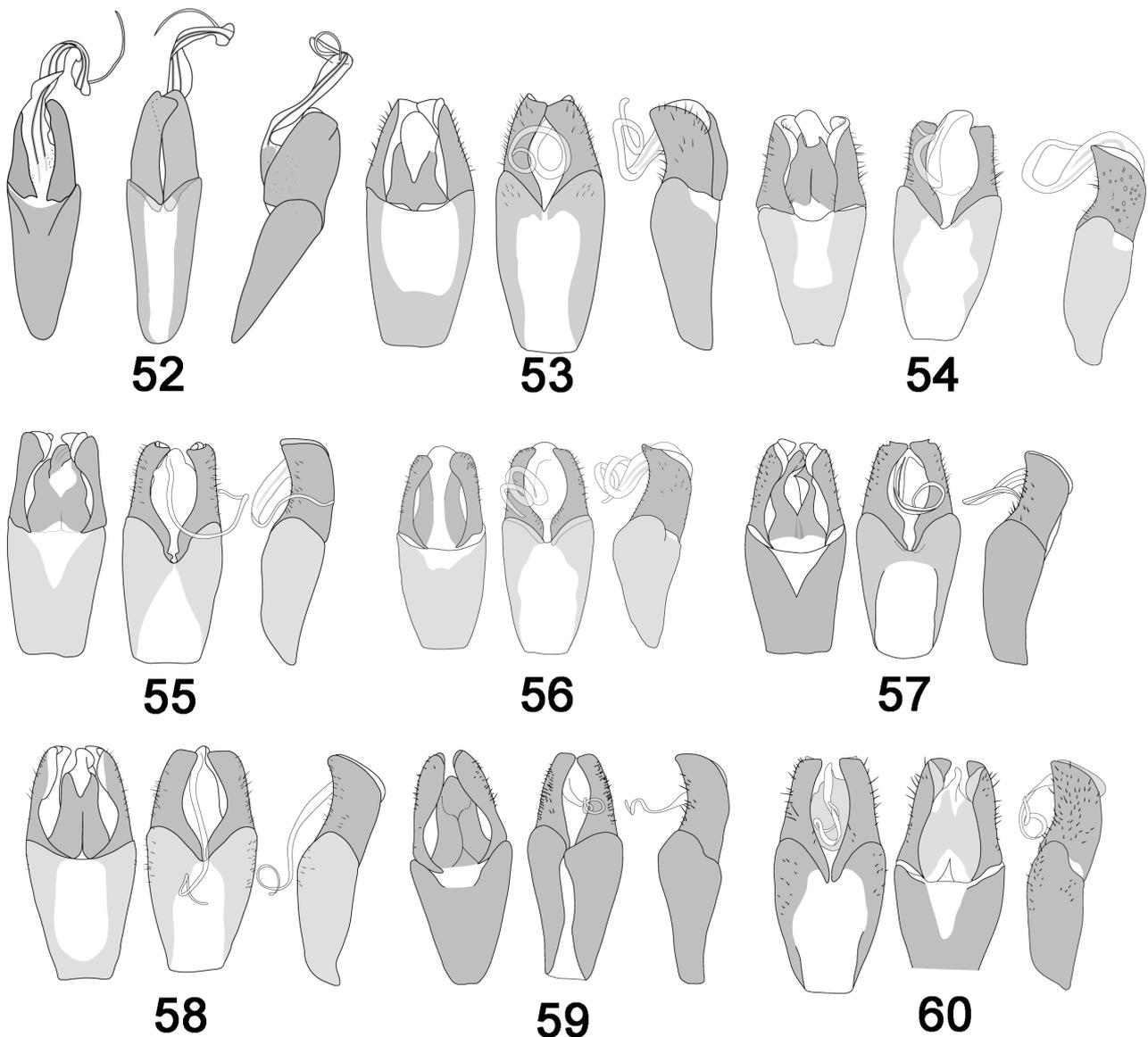
The fossil lucanid *Protognathinus* Chalumeau and Brochier, 2001, described in Chiasognathini, has *Safrina*-like antennae, mandibles, and pronotum, but it has complete eyes, unlike Chiasognathini and most other Lucaninae (Holloway 1969). This fossil appears to lack the morphological attributes that would place it in any known tribe (Paulsen 2010b). *Protognathinus* is best treated as *incertae sedis* in Lucanidae, although it has been suggested that it belongs to Lampriminae (Paulsen 2010b; Kim & Farrell 2015).

Natural history and conservation of *Safrina*. Unlike *Ryssonotus*, the larvae of *Safrina* prefer old dead wood infected with brown-rot fungi (J. Hasenpusch, personal communication 2004). Both adults and larvae occur under and within logs deeply embedded in soil (R. DeKeyser, personal communication, 2014; C.A.M.R., personal

observation). The adults may be sap feeders and are frequently collected in pitfall traps, including the volant species. The species occur in a variety of habitats, from *Eucalyptus* woodland to temperate rainforest, generally at moderate to high elevations. Adults and larvae are recorded from logs and trunks of *Nothofagus* and *Eucalyptus*.



FIGURES 50–51. Male genitalia, paraprocts, proctiger (left) and sternite IX (right): 50, *Ryssonotus nebulosus* (Kirby, 1819); 51, *Safrina laticeps* (MacLeay, 1885).

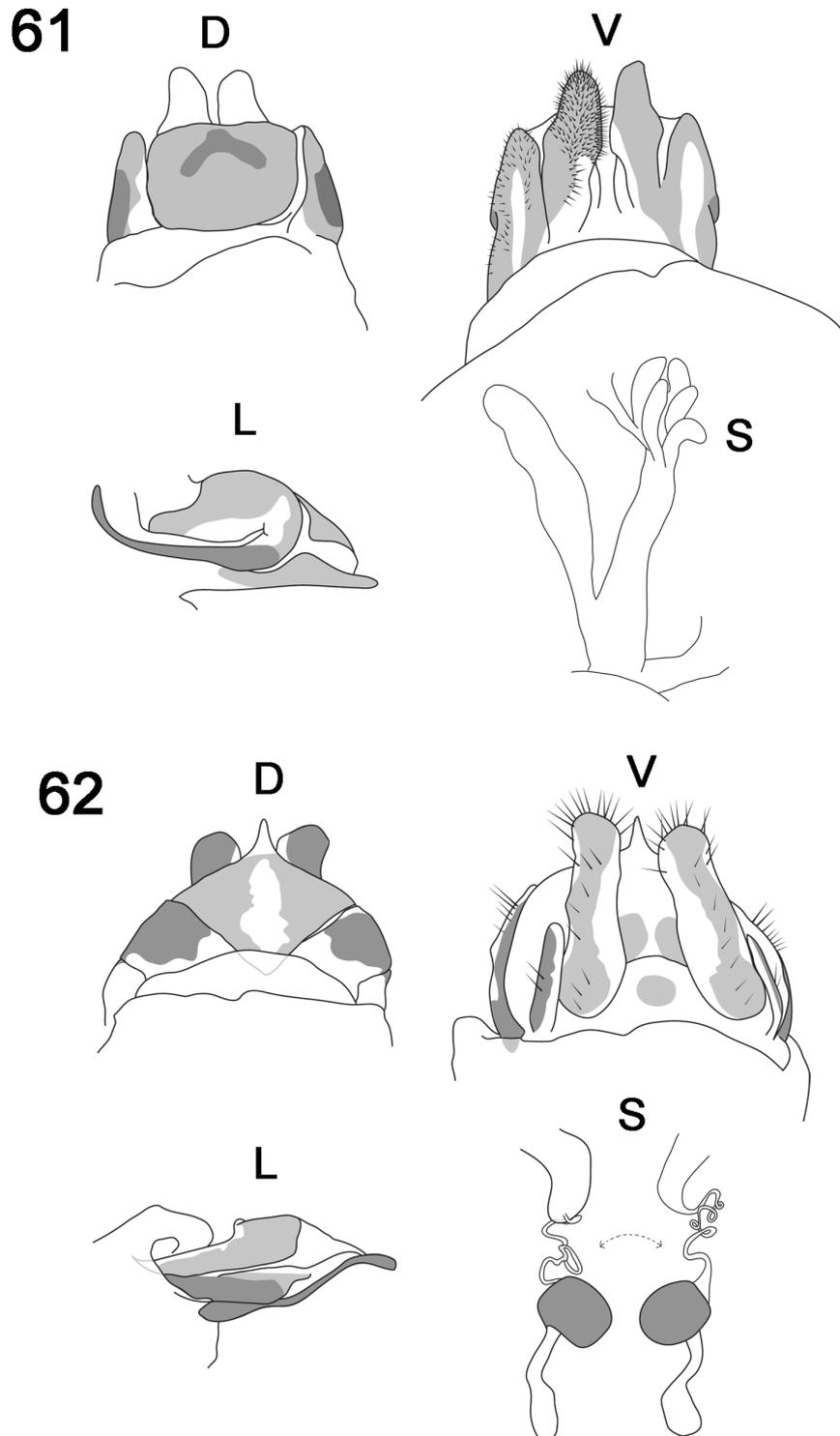


FIGURES 52–60. Aedeagus, dorsal, ventral and lateral: 52, *Ryssonotus nebulosus* (Kirby, 1819); 53, *Safrina dekeyzeri* new species; 54, *S. grandis* (Lea, 1915); 55, *S. jaedoni* new species; 56, *S. jugularis* (Westwood, 1863); 57, *S. laticeps* (Macleay, 1885); 58, *S. moorei* new species; 59, *S. parallela* (Deyrolle, 1881); 60, *S. polita* (Carter, 1921).

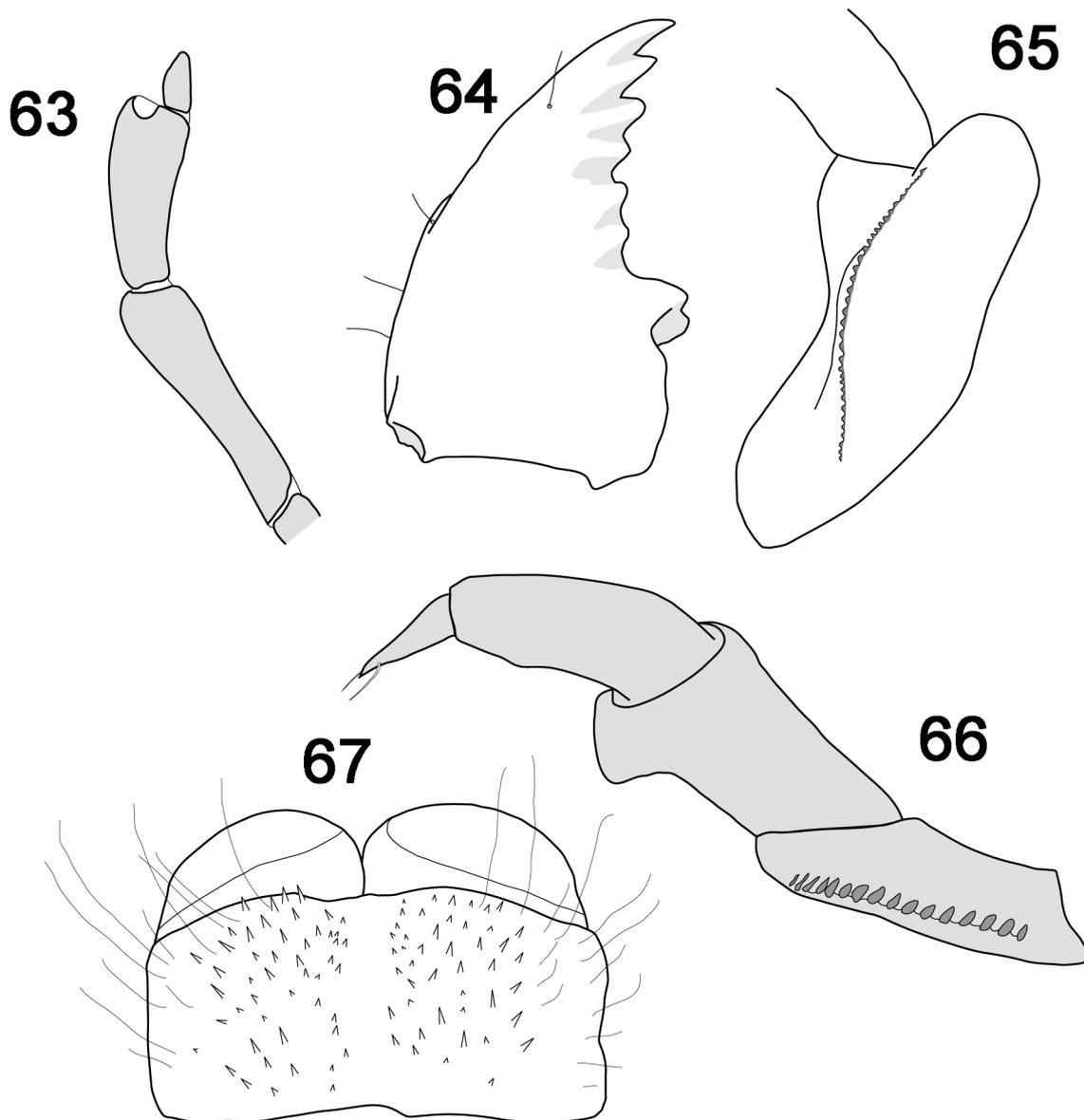
Only one species of *Safrina* can be described as widespread and fairly common, the volant *S. jugularis*, but several populations of this species are small and isolated. The other species are known from few collecting events and several have small ranges. These other species should be considered threatened from habitat loss, changed fire regimes and over-collection. *Safrina* species largely occur in protected or extensive forests, but the rarely collected *S. dekeyzeri* new species has already lost one population due to clearance (B. Moore, personal communication 2004).

Over-collecting is likely to become a significant problem (ironically, this paper may be a factor) as lucanids are popular with collectors, especially in North America, Europe, and Japan. Collecting lucanids is most popular in Japan, where they have special cultural significance from early childhood (J. Morimoto, personal communication 2004) and are traded in commercially significant numbers (Cornell & Honda 2002), which is causing damage to the Japanese lucanid fauna due to poor quarantine procedures (Goka *et al.* 2004). The dealers who satisfy obsessive collectors are not interested in conservation. Two Japanese dealers were successfully prosecuted in Australia in 2003 for illegal collection of more than 1000 specimens of *Lamprima insularis* Macleay, 1885, endemic to a small Pacific island, Lord Howe. During the lengthy preparation of this revision of *Ryssonotus*, the lucanid collecting

community became aware of my work and one Japanese dealer offered "*Rhyssonotus keyzerski*" males for €1500 (AUS\$3000) each and pairs of "*R. costatus*" for €1200 (AUS\$2400) (www.eurofauna.com; seen September 2006). On the same website a male of the recently described *Australognathus munchowae* (Moore & Monteith, 2004), a species only known from protected areas, was offered for €5000 (AUS\$10,000). These large sums place the financial gain of lucanid dealing on a par with illicit drugs (Cornell & Honda 2002). While much of the collecting in Australia is done without permits, even the magnitude and impact of permitted collecting in National Parks is rarely monitored (C.A.M.R., personal observation).



FIGURES 61–62. Female genitalia, dorsal (D), ventral (V), lateral (L) and softparts (S): 61, *Ryssonotus nebulosus* (Kirby, 1819); 62, *Safrina jaedoni* new species. Shading indicates density of sclerotisation, setae omitted except half of ventral view.



FIGURES 63–67. Larval morphology, *Safrina laticeps* (Macleay, 1885): 63, antenna; 64, left mandible; 65, mesocoxa; 66, metathoracic leg; 67, apex of venter.

The taxonomic revision of collectable organisms, which must be done to enable their conservation, also flags rarities for collectors. This is a well-known problem in herpetology, where new species in particular become collectors' targets (Stuart *et al.* 2006). To protect some of the species described below we omit details of collecting localities.

For conservation of *Safrina* species, we recommend: (i) vulnerable species status for *S. dekeyzeri*, *S. moorei*, and *S. politus*, under the Threatened Species Conservation Act 1995 (New South Wales); (ii) modelling of suitable habitat and field survey for all species except *S. jugularis*; (iii) approved rearing programmes to improve knowledge of habitat requirements and to supply collectors' demands; (iv) improved regulation and policing of the insect trade; (vi) closer monitoring of approved collecting.

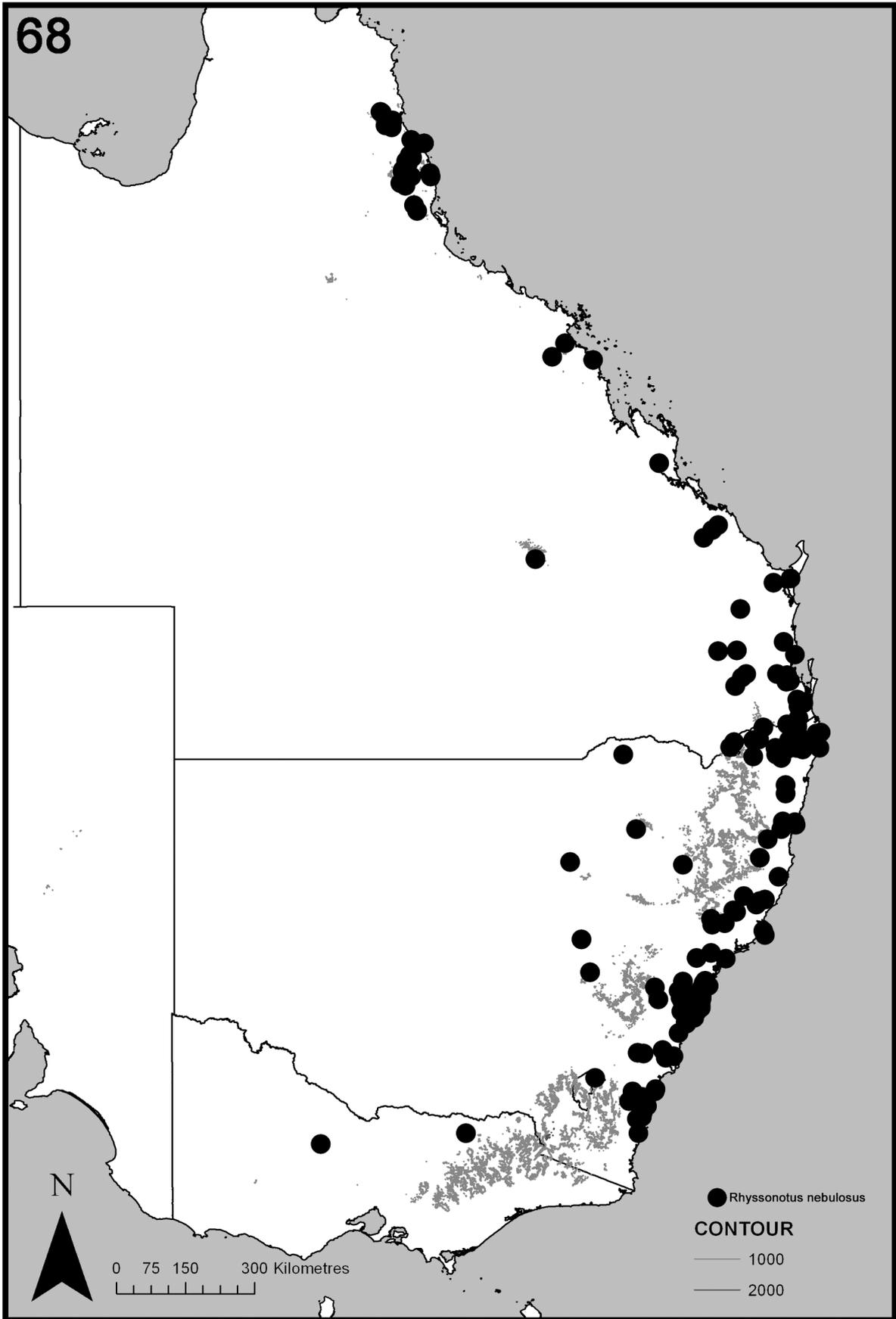


FIGURE 68. Eastern Australia, distribution of *Rhyssonotus nebulosus* (Kirby, 1819).

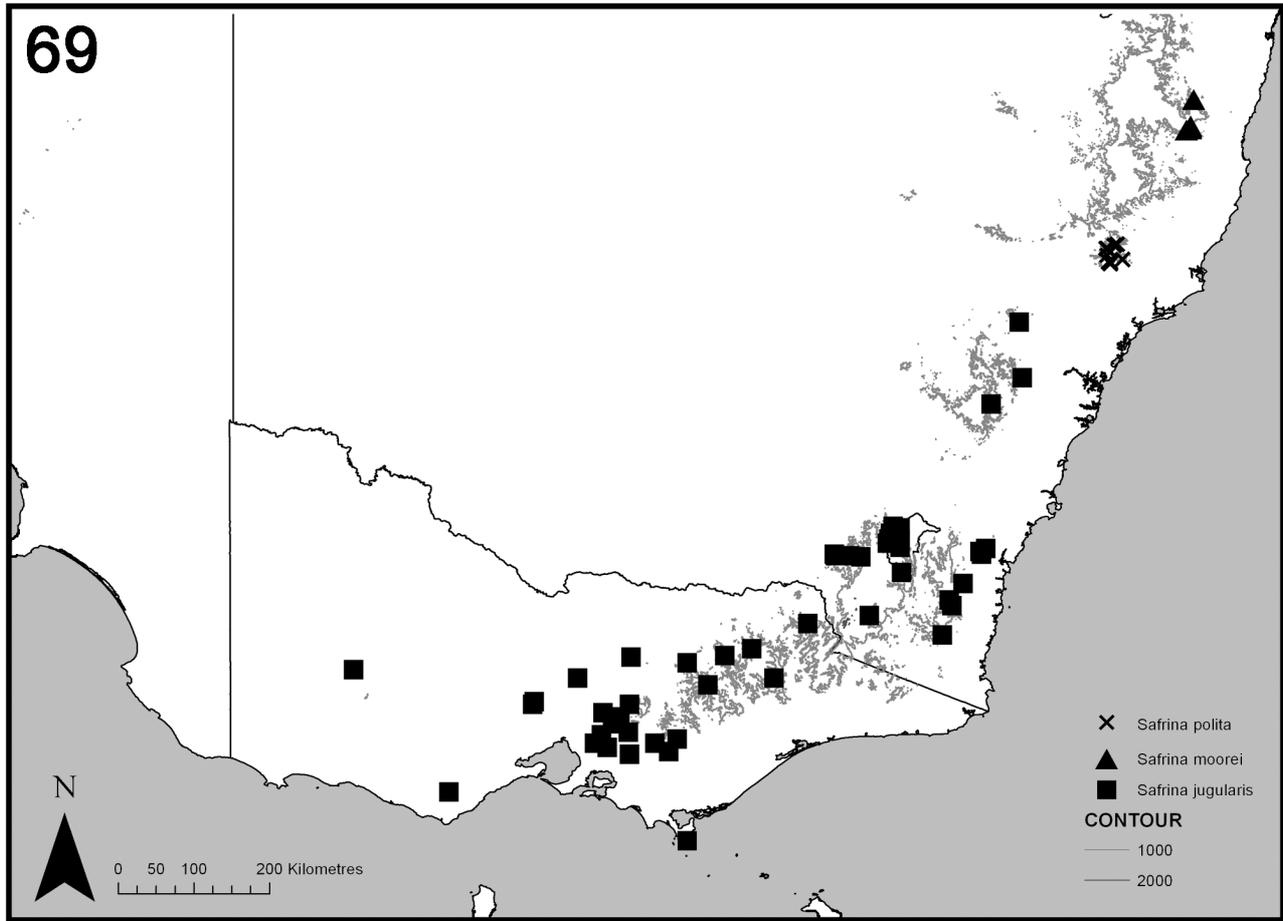


FIGURE 69. South-eastern Australia, distributions of: ■ = *S. jugularis* (Westwood, 1863); ▲ = *S. moorei* new species; x = *S. polita* (Carter, 1921).

Key to the adults of *Ryssonotus* and *Safrina*

- 1 Antennal club with 6 antennomeres, antennomeres 2–4 without dense setae, in contrast to densely setose antennomeres 5–10 (Fig. 38); head with lateral genal lobes (Fig. 20); prosternal process flat, hidden between procoxae (Fig. 47); lateral margins of elytra explanate (Fig. 2); inner face of mandibles not densely setose (Fig. 20); upper surface of head and pronotum shiny, without mottled colour pattern (Fig. 2); ventral setae simple (genus *Safrina*) 2
- Antennal club with 5 antennomeres, antennomeres 2–5 without dense setae (Fig. 37); head without genal lobes (Fig. 19); prosternal process arched and visible between procoxae (Fig. 44); lateral margins of elytra narrow, not explanate (Fig. 1); inner face of mandibles densely setose (Fig. 19); entire upper surface dull, mottled (Fig. 1); ventral setae multifid
..... *Ryssonotus nebulosus* (Kirby, 1819)
- 2(1) Males (Figs 2–9, 20–27): pronotum usually parallel-sided or almost so; head more transverse, or with prominent anterior angles of the genal lobe; mandibles longer, lateral margin angulate, usually with dorsal tubercles; lateral pronotal margins complete or feebly crenulate; inner face of protibia usually with 2 or 3 teeth, rarely without (*S. parallela*); upper surface less strongly punctured and/or microsculptured 3
- Females (Figs 11–18, 29–36): pronotum broadest at or near hind angles and sides curved; head less transverse, genal lobe usually broadest at base; mandibles shorter, lateral margin curved, without dorsal tubercles, or small tubercle present at base of outer carina; lateral pronotal margins strongly crenulate; inner face of protibia without teeth, or with 1 small tooth; upper surface more strongly punctured and/or microsculptured 10
- 3(2) Mandibles without basal tooth on upper side of internal face (Fig. 26); elytral suture and first interval raised as a smooth and shiny ridge, usually contrasting with dull, microsculptured unridged disc (Figs 5, 8) 4
- Mandibles with basal internal tooth (Fig. 23); elytral disc shiny, or ridged, or both, without strongly contrasting sculpture of first interval (Figs 2–4, 6–7, 9) 5
- 4(3) Elytral disc smooth, finely punctured and not strigose (Fig. 5); preular ridge hemispherical or triangular in anterior view; inner face of protibia toothed; elytra distinctly rounded at sides, less elongate; ventrites 2–4 each with a dense band of yellow setae (Figs 48–49) *Safrina jugularis* (Westwood, 1863)

- Elytral disc irregularly strigose, with mixed large and small punctures (Fig. 8); preular ridge slightly convex; inner face of protibia without teeth; elytra less rounded at sides, more elongate; ventrites 2–4 without dense yellow setae (length 15–22 mm) *Safrina parallela* (Deyrolle, 1881)
- 5(3) Mandibles without large pre-apical dorsal tooth (Fig. 39); without elytral ridges, or several present, but poorly defined (Fig. 2); shape of head variable 6
- Mandibles with large pre-apical dorsal tooth (Fig. 40); basal half of elytron with two ridges, one sharp and oblique from humerus to disc and the other on interval 5 (Fig. 3); head approximately parallel-sided (Fig. 21) (length 19–25 mm) *Safrina grandis* (Lea, 1915)
- 6(5) Sides of head strongly expanded laterally as a triangular or trapezoid lobe with acute apex (Figs. 22–23); upper outer margins of mandibles strongly keeled, at most weakly tuberculate (Fig. 41); elytra shallowly striate with convex intervals (Figs. 4, 6) (pregular swelling with 0–2 setose punctures on each face) 7
- Head approximately parallel-sided or broadest at base (Figs. 20, 25, 27); upper margins of mandibles with tubercles; elytra smooth or irregularly ridged (Figs. 2, 7, 9) 8
- 7(6) Lateral extension of head trapezoid, lateral margin concave or notched (Fig. 23); gap at base of parameres in ventral view broader (Fig. 57) (length 16–20 mm) *Safrina laticeps* (Macleay, 1885)
- Lateral extension of head elongate triangular, with indentation on posterior margin (Fig. 22); gap at base of parameres in ventral view narrower (Fig. 55) (length 18–21 mm) *Safrina jaedoni* new species.
- 8(6) Upper surface of mandibles with 3–4 similar sized, rounded, tubercles (Fig. 44); elytral disc smooth and shiny, contrasting with dull explanate margins, sparsely and finely punctured, without convex areas (Fig. 7) (length 15–22 mm) *Safrina moorei* new species.
- Upper surface of mandibles with 1 large tubercle on outer ridge, occasionally a smaller second tubercle elsewhere (Figs. 39, 43); elytral disc at least vaguely ridged, disc, and explanate margins not contrasting in microsculpture (Figs. 2, 9) 9
- 9(8) Basal half of elytron with intervals 3 and 5 raised, also an oblique ridge from humerus to disc, these ridges irregularly transversely grooved (Fig. 2); sides of pronotum strongly and closely punctured, some punctures separated by a diameter or less; upper surface black; upper mandibular tubercle more lateral, on an irregular elongate ridge (Figs. 20, 39) (length 15–24 mm) *Safrina dekeyzeri* new species.
- Basal half of elytron without distinct ridges, but at least interval 3 convex, remainder of elytron smooth and shiny, sparsely and finely punctured (Fig. 9); sides of pronotum finely and sparsely punctured; upper surface dark red with green reflection; upper mandibular tubercle isolated, not part of ridge (Figs. 27, 43) (length 16–25 mm) *Safrina polita* (Carter, 1921)
- 10(2) Elytral disc flat, dull, densely microsculptured, in contrast to convex and shiny first elytral interval (Figs 14, 17); anterior face of preular ridge densely punctured (Fig. 47) 11
- Elytral disc either shiny or ridged or both (Figs. 11, 16); anterior face of preular ridge impunctate or sparsely punctured (interspaces much greater than puncture diameters) (as Fig. 45) 12
- 11(10) Elytra with irregular shallow strigose grooves (Fig. 17); posterior angles of genal lobe sharp, connected to eyes by straight margin at 45° to axis (Fig. 35); length 15–20 mm *Safrina parallela* (Deyrolle, 1881)
- Elytra smooth, non-strigose (Fig. 14); posterior angles of genal lobe produced at 90° and blunt (Fig. 33); length 22–26 mm *Safrina jugularis* (Westwood, 1863)
- 12(10) Elytra without carina from shoulder to disc (Fig. 16); pronotum finely and sparsely punctured, punctures sparse on midline, not coalescent on disc; outer margin of mandible with basal tooth (Fig. 34) 13
- Carina from elytral shoulder to disc, with elytral interval 7 convex (Fig. 11); pronotum strongly and closely punctured, punctures of basal third of median groove usually separated by less than diameters, some discal punctures coalescent; mandible with or without basal tooth 14
- 13(12) First, third, and fifth elytral intervals convex at base, entirely shiny (Fig. 18); pronotal punctures larger; lateral pronotal crenulation less regular; dorsum dark red with green reflection *Safrina polita* (Carter, 1921)
- Elytra smooth and explanate margins dull, contrasting with disc (Fig. 16); pronotal punctures finer; lateral pronotal crenulation more regular, sharper; dorsum black with green reflection *Safrina moorei* new species.
- 14(12) Lateral margins of pronotum strongly crenulate, some tubercles sharp (Figs 11–12); first, third, fifth, and seventh elytral intervals convex at base, the last forming a sharp oblique carina from shoulder to disc (Figs 11–12) 15
- Lateral margins of pronotum weakly crenulate, tubercles blunt (Figs 13, 15); all elytral intervals slightly convex at base, odd numbers slightly more so, seventh not sharply carinate (Figs 13, 15) 16
- 15(14) Black; elytra irregularly transversely wrinkled and dull, densely microreticulate except shiny ridges (Fig. 11); side of head broadest at base of genal lobe, evenly rounded to anterior of lobe (Fig. 29); pronotal disc more strongly and closely punctured, interspaces 2–5x puncture diameters; tooth at base of outer mandibular carina smaller or absent (Fig. 29) *Safrina dekeyzeri* new species.
- Black or dark brown, with green reflection; elytra not transversely wrinkled, shiny, without dense microsculpture (Fig. 12); side of head biconvex, anterior angle of genal lobe laterally produced (Fig. 30); pronotal disc more sparsely and finely punctured, interspaces 4–8x puncture diameters; tooth at base of outer mandibular carina larger (Fig. 30) *Safrina grandis* (Lea, 1915)
- 16(14) Pronotal disc smoother, basal median groove less densely punctured, with smooth areas between punctures (Fig. 13); apex of elytral disc smoother [teneral specimens rugose], with smaller punctures *Safrina jaedoni* new species.
- Pronotal disc rougher, basal median groove more densely punctured, punctures close or coalescent (Fig. 15); apex of elytral disc rugose, with larger punctures *Safrina laticeps* (Macleay, 1885)

Key to mature larvae of *Ryssonotus* and *Safrina* (larvae of *S. dekeyzeri*, *S. jaedoni*, and *S. parallela* unknown; diagnostic attributes for *Safrina* species based on three or less specimens of each species)

- 1 Mandible with 4 scissorial teeth; tibiotarsus reduced to short lobe, length = width at base; raster setae outwardly directed *Ryssonotus nebulosus* (Kirby, 1819)
- Mandible with 5 scissorial teeth (Fig. 64); tibiotarsus not reduced, length about 3x width at base (Fig. 66); mid raster setae posteriorly or inwardly directed (Fig. 67) (*Safrina*) 2
- 2(1) Apex of third antennomere truncate or almost so; middle of raster with elongate spines or setae 3
- Apex of third antennomere, at large oval sensilla, produced as a rounded lobe beyond base of fourth antennomere; middle of raster with dense short spines, posteriorly and inwardly directed (apex of metatrochanter rounded, stridulatory file not reaching apex) *S. jugularis* (Westwood, 1863)
- 3(2) Apex of metatrochanter angulate and stridulatory file reaching apex at this point, with 17–23 tubercles 4
- Apex of metatrochanter rounded and stridulatory file not reaching apex, with 15–17 tubercles (mesocoxal stridulatory file with 35–37 small granules or tubercles; fourth antennomere length to width ratio about 2.3) *S. laticeps* (Macleay, 1885)
- 4(3) Mesocoxal stridulatory file with 33–36 small granules or pegs; fourth antennomere more elongate, length to width ratio 2.6–3.3 5
- Mesocoxal stridulatory file with c.26–30 small granules or pegs; fourth antennomere less elongate, length to width ratio 2.1–2.3 *S. grandis* (Lea, 1915)
- 5(4) Inner edge of left mandible with deep excavation between bilobed apex of mola and middle of mola; inner margin of antennomere 3 deeply concave *S. polita* (Carter, 1921)
- Inner edge of left mandible without excavation between bilobed apex of mola and middle of mola; inner margin of antennomere 3 shallowly concave *S. moorei* new species.

***Safrina dekeyzeri* Reid & Beatson, new species**

(Figs. 2, 11, 20, 29, 38–39, 53, 70)

Material examined. Types: AUSTRALIA: HOLOTYPE: ♂, New South Wales, Warra State Forest, 1170 m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); PARATYPES (27): **New South Wales:** ♀, Armidale, under bark, *Eucalyptus*, 24.iii.1964, K. D. Fairey (AMS); Forest Land State Forest, 22.ii.2007, R. de Keyzer & A. Polak (RDK); ♂, Basket Swamp National Park, 20.ii.2002, R. de Keyzer & A. Polak (RDK); 2♂, ♀, Basket Swamp National Park, 20.ii.2002, R. de Keyzer & A. Polak, ‘collected as larva and reared, adult emerged Jan 2003’ (AMS, RDK); 4♂, Basket Swamp National Park, 21.ii.2003, R. de Keyzer (AMS, RDK); 2♂, Basket Swamp National Park, 14.ii.2004, R. de Keyzer (RDK); 5♂, Basket Swamp National Park, 16.ii.2005, R. de Keyzer (AMS, RDK); ♀, Ben Lomond, 9.i.1963, B. P. Moore (BPM); ♀, Boonoo SF, 1070 m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♀, near Glen Elgin, 19.ii.1998 C. J. Müller (AMS); ♀, 26 mi[les] E Glen Innes, euc[alypt] & oak forest/oak & euc dry scl[ophyll], 25.xi.1976, F. T. Fricke (AMS); **Queensland:** ♂, ♀, Eukey, 16.iii.1935, E. Sutton (QMB); 2♂, pailing yard, via Wyberba, 7–9.iv.1953, E. Sutton (QMB); ♀, Wyberba, 14.iii.1960, E. Sutton (QMB); ♀, Wyberba Mountain[?] Pk, 13.iv.1941, E. Sutton (QMB).

Diagnosis. Male. Black and parallel-sided; head rectangularly expanded beyond eyes; upper surface of mandibles with elongate tubercle on outer edge 1/3 from base and without preapical dorsal tooth on inner edge; mandible with basal tooth on upper part of internal edge; preangular swelling almost impunctate, with 2–4 large punctures; elytra costate in basal half, with 3 ridges and transverse wrinkles, not dull and densely microreticulate. Female. Black; head broadest at posterior angles of genal lobe, then evenly convex to mandibles; anterior face of preangular swelling impunctate; pronotal disc strongly and fairly closely punctured, interspaces 2–5x diameters; pronotal hind angles acute; elytra microreticulate, costate in basal half, including ridge from shoulder to disc, and transversely wrinkled.

Description. Male. Length 15–24 mm. Black or almost so, usually with faint greenish tinge on elytra, and ridges of elytra pure black in contrast to dark brown remainder (under strong light), tibiae rarely dark red. Body approximately parallel-sided (head, pronotum, and basal 2/3 of elytra). Head with sparse dorsal setae, more conspicuous at sides, pronotum glabrous to margins.

Head: almost straight sided, parallel-sided, or slightly expanded to apex or slightly concave at sides; head strongly transverse, width much more than 2.5x length; dorsum strongly rugosely punctured, but irregularly so, with smooth interspaces; anteromedian prominence usually bituberculate; anterior margin shallowly concave; dorsally visible part of mandibles slightly longer than head, symmetrical or almost so; mandibles with low elongate dorsal tubercle, 1/3 from base of outer edge, up to 2 additional small tubercles distal to this; mandibular preapical

dorsal tubercle absent on inner edge and ventral inner edge with 4–5 usually similarly sized and spaced triangular tubercles before upturned apex; base of inner face of mandible with large bilobed tubercle (connected ventral and dorsal tubercles); pregenal swelling evenly convex, impunctate except 2–4 large lateral punctures.

Thorax: pronotum almost parallel-sided (less so in small specimens), posterolateral angles not projecting; lateral margins bluntly and irregularly crenulate; pronotal disc finely and sparsely punctured, with pair of foveolate depressions anterior to middle, sides strongly and closely punctured, some punctures separated by a diameter or less; pronotal disc shiny, minutely, and evenly microreticulate; scutellum semicircular with a few small apical punctures; elytra almost parallel-sided in basal 2/3, broadest 1/3–2/3 from base; basal half of elytron with intervals 1, 3 and 5 raised, plus an oblique ridge from humerus to disc; elytra mostly shiny, ridges and basal half mostly non-microreticulate, with large punctures in irregular striae mixed with sparse small punctures, the whole surface transversely grooved or wrinkled; elytral sides broadly explanate, twice width of base of metatibia, with transverse grooves or wrinkles; wings fully developed, apices folded back to base of elytra; external margin of protibia with 2 large and 2–4 minor teeth; internal edge of protibia with 1–2 prominent teeth; metatibia with 1–2 small external teeth.

Abdomen: ventrites dull, microreticulate, I impunctate except for intercoxal process, but finely rugulose, II–V closely and coarsely punctured, II–IV with minute recumbent setae, V with longer semi-erect setae; apex ventrite V truncate. Genitalia: apical half of phallobase with scattered minute setae, phallobase medially unsclerotised on both dorsal and ventral surfaces, dorsal surface weakly convex; parameres conspicuously and moderately closely setose, apices blunt in lateral view; ventral sclerite of penis entire, apex with v-shaped notch; endophallus tightly coiled in repose, with two loops.

Female. As male, except: length 16–22 mm; body not parallel-sided, pronotum and elytra with rounded sides; head distinctly broadest at posterior angles; without obvious anteromedian prominence; dorsally visible part of mandibles about as long as head; mandibles with or without elongate dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled; pronotal disc more strongly and densely punctured; sides strongly and sharply crenulate; internal edge of protibia without teeth; apex ventrite V rounded.

Larva. Unknown.

Etymology. Named for Roger de Keyzer who collected most of the type specimens.

Distribution and natural history. This rarely collected species occurs in open New England Blackbutt woodland (*Eucalyptus andrewsii*) at high altitude on the Dividing Range, from Armidale to Stanthorpe. Adults have been collected from January to April, occurring under half-buried eucalypt logs (R. de Keyzer, personal communication 2014).

Notes. The material described above represents two populations separated by 1° latitude (about 120 km) on the Dividing Range. Males of these populations appear to be inseparable but the single southern female differs from the four northern females by possession of a basal tooth on the upper surface of the mandible. This may not be significant, as these apparently isolated populations were recently connected, by suitable habitat now cleared. The southernmost site at Ben Lomond has also been destroyed by forest clearance (B. Moore, personal communication 2004). The only known specimen from this site was illustrated by Moore (1984: fig. 124), misidentified as *Rhyssonotus costatus*.

***Safrina grandis* (Lea, 1915), new combination.**

(Figs 3, 12, 21, 30, 40, 54, 70)

Rhyssonotus grandis Lea 1915: 650; Moore & Cassis 1992: 16; Mizunuma & Nagai 1994: 206, plate 3, fig. 34.1 (misidentified as *R. politus*).

Rhyssonotus costatus Carter 1929: 65; Moore & Cassis 1992: 16; **new synonym.**

Material examined. Types: *Rhyssonotus grandis* Lea: HOLOTYPE: ♂ "*grandis* Lea type Comboyne / *Rhyssonotus grandis* Lea N. S. Wales type" (SAM); *Rhyssonotus costatus* Carter: HOLOTYPE: ♀ "Holotype male [sic], Dorrigo, W. Heron, KG7365, *Rhyssonotus costatus* Cart." (AMS).

Other material (27): New South Wales: 3♂, ♀, Banda Loop Road, Willi Willi National Park, 14.ii.2005, R de Keyzer, *Nothofagus* forest (RDK); 2♂, 3♀ Banda Loop Road, Willi Willi National Park, 28 Feb 2002, R de Keyzer, *Nothofagus* forest (RDK); 2♂, 2♀, Banda Loop Road, Willi Willi National Park, 17 Feb 2003, R de Keyzer,

Nothofagus forest (RDK); 4♂, ♀, Banda Loop Road, Willi Willi National Park, 31 Jan–1 Feb 2003, R de Keyzer, *Nothofagus* forest (RDK); ♂, Banda Loop Road, Willi Willi National Park, 14.ii.2002, R de Keyzer, *Nothofagus* forest, collected as larva and reared adult emerged late Jan 2003 (RDK); 2 ♂, ♀, Barrington Tops State Forest, 26.i.1996, R. de Keyzer (RDK); ♂, Barrington Tops State Forest, 11.ii.1999, G. Williams (GWT); ♂, Barrington Tops State Forest, 1180m, 21.ii.2002, C. Reid (AMS); 6♂, 3♀, Barrington Tops State Forest, 8.ii.2004, R. de Keyzer (RDK); ♀, Bellangry, 6.ii.1976 (AMS); 3♂, 2♀, 0.5 km N Berrico Trig, Chichester State Forest, 15.ii.2003, R de Keyzer in *Nothofagus* forest (RDK); ♀, Brooklana, E. Dorrigo, ii.1930, W. Heron (ANIC); pair of elytra only, Dorrigo [Carter] (ANIC); ♀, Chichester State Forest, 940 m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♀, Chichester State Forest, 940 m, 300 m, M. Gray & G. Cassis (AMS); 2 mature larvae, Chichester State Forest, 940 m, 22.ii.2003, R. de Keyzer (AMS); ♂, ♀, Cobark Forest Park, Barrington Tops State Forest, 31°53'55"S 151°36'30"E, 26.i.1996, R de Keyzer (RDK); 6♂, 5♀, old Cobark Forest Park, camping & picnic area, Barrington Tops National Park, 8.ii.2004, R de Keyzer (RDK); 4♂, old Cobark Forest Park, camping & picnic area, Barrington Tops National Park, 13.ii.2005, in *Eucalyptus* woodland (RDK); ♀[fragments], Dilgry Circle Road, 1.8 km N Moppy Rest area, Barrington Tops State Forest, 24.iii.2001, in *Nothofagus* forest, R de Keyzer (RDK); 3♂, ♀, Dilgry Circle, *Nothofagus* forest near Dilgry Falls, Barrington Tops State Forest, 1.ii.2003, R de Keyzer (RDK); ♂, 4♀, Dilgry Circle, *Nothofagus* forest near Dilgry Falls, Barrington Tops State Forest, 28.ii.2002, R de Keyzer (RDK); ♀, Dingo State Forest, 10.iii.1984, G. Williams & G. O'Dea (GWT); ♀, Dorrigo, W. Heron (SAM); ♀, Mount Boss State Forest, 13.i.1969, C.M.M. (ANIC); ♂, Mount Boss State Forest, 1010m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♀, Mount Boss State Forest, 1100m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♂, Mount Boss State Forest, 1040m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♂, ♀, Mount Boss State Forest, 1120m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♂, North Brother Mountain summit, 487 m, under rotting log in wet sclerophyll forest, 29.iii.2016, G. & T. Williams (photograph); ♂, ♀, Plateau Beech, picnic area, Werrikenbe National Park, 18.ii.2003, R. de Keyzer, *Nothofagus* forest (RDK); ♂, Ramornie State Forest, 220 m, 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS) [possible label error]; ♂, ♀, Rowleys Lookout Road, near carpark, Tapin Tops National Park, 28.iii.2004, R. de Keyzer (RDK); 1 mature larva, Willi Willi National Park, 1.ii.2003, R. de Keyzer (AMS).

Diagnosis. Male. length 19–25 mm. Dark brown to black, with dark green reflection, at least on elytra, legs dark red; prothorax and elytra rounded at sides; head biconvex at sides; mandibles with prominent basal dorsal tooth and larger pre-apical dorsal tooth; basal half of elytron with two ridges, one sharp and oblique from humerus to disc and the other on basal half of interval 5.

Female: length 17–22 mm. Colour as male; distinct tooth at base of outer mandibular carina; pronotum relatively strongly and closely punctured, punctures of basal third of median groove usually separated by less than diameters, some discal punctures coalescent; lateral margins of pronotum strongly crenulate, some tubercles sharp; elytra not transversely wrinkled, shiny, without dense microsculpture; first, third, fifth, and seventh elytral intervals convex at base, the last forming a sharp oblique carina from shoulder to disc; explanate margin of elytra broad, twice width of base of metatibia, with deep lateral channels.

Description. Male. Length 19–25 mm. Dark reddish brown to black, with dark green reflection, at least on elytra, tibiae reddish brown with darker teeth. Body elongate-ovate: pronotum generally broadest close to base, sides of elytra rounded. Head with sparse dorsal setae, more conspicuous at sides, pronotum glabrous to margins. Head: sides biconvex, posterior angles usually more acute and more prominent than bluntly rounded anterior angles; strongly transverse, width much more than 2.5x length; dorsum strongly punctured with smooth interspaces; anteromedian prominence usually bituberculate; anterior margin feebly concave; dorsally visible part of mandibles 1.5–2.0x longer than head, almost symmetrical; mandibles with prominent elongate dorsal tubercle, 1/3 from base of outer edge, and often 1, rarely 2, additional tubercles distal to this; mandibular preapical dorsal tubercle large and erect (height greater than width) on inner edge; ventral inner edge with 4–5 rounded teeth, usually similarly sized but often asymmetrically partly fused, before upturned apex; base of inner face of mandible with large bilobed ventral tubercle and small separated dorsal tubercle; preular swelling sharply convex, height \geq longitudinal length, with 1–10 setose punctures on each face.

Thorax: pronotum contracted anteriorly from posterolateral angles or almost parallel-sided in basal half; lateral margins bluntly and irregularly crenulate; pronotal disc finely and sparsely punctured, with pair of foveolate depressions anterior to middle, sides more strongly and closely punctured in lateral depressions and angles; pronotal disc shiny, but minutely and evenly microreticulate; scutellum transversely half ovate, closely and

strongly punctured; elytra rounded at sides, broadest 1/3–1/2 from base; basal half of elytron with intervals 1 and 3 raised, plus an oblique ridge from humerus to disc; elytra mostly shiny, ridges and basal half mostly non-microreticulate, with scattered large punctures in irregular striae mixed with sparse small punctures, the surface mostly smooth except for inner edge of oblique ridge transversely grooved or wrinkled; elytral sides broadly explanate, 1.5–2.0x width of base of metatibia, with transverse grooves or wrinkles; wing reduced, half elytron width, with apex bent at 45° and not reaching elytral apex; external margin of protibia with 2 large and 2–4 minor teeth; internal edge of protibia with 2–3 prominent teeth; metatibia with 0–2 small external teeth.

Abdomen: ventrites dull, microreticulate; ventrite I strongly and closely punctured and rugulose, II–V closely and coarsely punctured, I–IV with short recumbent setae, V with longer erect setae; apex of ventrite V shallowly notched. Genitalia: phallobase without evident setae, medially unsclerotised on both dorsal and ventral surfaces, dorsally relatively flat; parameres conspicuously and closely setose, apices acute angled in lateral view; ventral sclerite of penis entire, endophallus with single coil.

Female. As male, except: length 18–21 mm; head more strongly and rugosely punctured, obscuring anteromedian prominence; dorsally visible part of mandibles about as long as head; mandibles with small elongate dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled, preapical dorsal tubercle absent; sides of pronotum more strongly punctured, lateral margins strongly and sharply crenulate, hind angles often acutely produced laterally; internal edge of protibia without or with 1 minute tooth; apex ventrite V truncate.

Larva (based on 3 mature specimens from Barrington Tops, length 30–35 mm when crudely straightened out): inner edge of left mandible shallowly excavated between apex and middle of mola; apex of antennomere 3 truncate, inner margin shallowly concave; antennomere 4 length to width ratio 2.1–2.3; mesocoxal stridulatory file evenly curved, with 26–30 small granules; metatrochanteral stridulatory file with 18–22 transverse tubercles, reaching apex of trochanter, which is angulate; metafemur angularly produced at apex; metatibiotarsus elongate, length to width ratio 3.0–3.5; raster with long apical and lateral setae, narrowly glabrous median strip, and elongate posteriorly directed setae on either side of midline.

Distribution and natural history. *Safrina grandis* occurs in cool temperate and eucalypt forest and subalpine woodland on the eastern slopes of the Dividing Range of central and northern New South Wales, from Chichester State Forest to Ramornie State Forest. The published record for Ben Lomond (Moore 1984; Moore & Cassis 1992) is a misidentification (see *S. dekeyzeri*). On the Barrington Tops massif, *S. grandis* occurs in subalpine woodland rather than the cool temperate rainforest characteristic of sympatric *S. polita* (G. Williams, personal communication 2004; C.A.M.R., personal observation), however on Werrikimbe Plateau this is the only species and it is present in both habitats. Adults are active from January to March. Larvae were present in February under *Eucalyptus* logs at Barrington Tops and under *Nothofagus* logs at Werrikimbe. A larva probably belonging to this species has been collected in cool temperate rainforest in the northern part of the Richmond Range.

Notes. There are no convincing differences between the populations of shiny green, costate *Safrina* on the northern ranges of New South Wales, although they seem widely separated. These populations include the species described as *S. grandis* by Lea (a male) and as *S. costatus* by Carter (a female, misidentified as a male), which are hereby synonymised (**new synonymy**). The males in all these populations have the same diagnostic mandibular teeth (Fig. 40).

***Safrina jaedoni* Reid & Beatson, new species**

(Figs 4, 13, 22, 31, 41, 55, 62, 70)

Material examined. Types: AUSTRALIA: HOLOTYPE: ♂, Kroombit Tops, 65 km SW Gladstone, 1000–1100 m, open forest, 22–26.ii.1982, Monteith, Thompson, & Yeates (QMB); PARATYPES (17): 10♂, 6♀, same data as holotype (AMS, DPIM, QMB); 1♂, Kroombit Tops, 65 km SW Gladstone, 1000 m, ex *Eucalyptus* log in open forest, 22–26.ii.1982 (AMS).

Diagnosis. Male. Length 18–21 mm. Dark brown to black, with (usually) or without dark green reflection, legs reddish brown; prothorax almost parallel-sided, elytra slightly rounded at sides; head with genal lobe greatly laterally projecting as an elongate triangle with a notch on posterior margin; mandibles without pre-apical dorsal tooth, basal internal dorsal and ventral teeth separated; basal half of elytron without ridges, with 5 striae.

Female: length 17–20 mm. Colour as male; with or without distinct tooth at base of outer mandibular carina;

pronotum relatively strongly and sparsely punctured, punctures of basal third of median groove separated by more than diameters, discal punctures not coalescent; lateral margins of pronotum feebly crenulate; elytra not or weakly transversely wrinkled, dull with dense microsculpture; elytral intervals 1–5 weakly convex at base, without carina from shoulder to disc; explanate margin of elytra narrow, 1.0–1.5x width of base of metatibia, without or with shallow lateral grooves.

Description. (Note: all available specimens teneral or at least recently emerged). Male. Length 18–21 mm. Dark reddish brown to black, usually with dark green reflection, legs reddish brown. Body sub-parallel sided: pronotum generally broadest at middle third, often slightly broader than elytra, sides of elytra slightly rounded. Head closely setose around median tubercles, with sparse setae elsewhere, pronotal disc glabrous.

Head: sides greatly laterally produced, as an acute-angled approximately isosceles triangle, height 1.0–1.5x width of base, notched on posterior edge; strongly transverse, width more than 4x length; dorsum strongly punctured with smooth interspaces; 2 separate anteromedian tubercles, on slightly elevated median prominence; anterior margin deeply concave; dorsally visible part of mandibles 1.5–2.0x longer than head, almost symmetrical; mandibles without dorsal tubercle, 1/3 from base of outer edge, externally keeled on middle third; mandibular preapical dorsal tubercle absent or small and inconspicuous on inner edge; ventral inner edge with 3–4 angulate teeth, usually similarly sized but often asymmetrically partly fused, before upturned apex; base of inner face of mandible with large separated dorsal and ventral tubercles; preangular swelling sharply convex, height \geq longitudinal length, without setose punctures on each face.

Thorax: pronotum usually almost parallel-sided in basal half, sometimes slightly contracted from posterolateral angles to apex, posterolateral angles not laterally projecting; lateral margins not crenulate, but with 0–7 minute nicks; pronotal disc finely and sparsely punctured, with or without pair of foveolate depressions anterior to middle, sides more strongly and closely punctured, densely in lateral depressions; pronotal disc shiny, but minutely and evenly microreticulate; scutellum transversely half ovate, sparsely but strongly punctured; elytra slightly rounded at sides, broadest 1/3–1/2 from base; basal half of elytron with intervals 1–5 convex, 3 slightly more so than others, without an oblique ridge from humerus to disc; elytra shiny, but finely microreticulate except extreme base; elytral disc striate, with 5 fine sparsely punctured grooves reaching apical half, intervals with or without shallow transverse grooves, remainder of elytra smooth, with scattered punctures; elytral sides explanate, width 1.0–1.5x width of base of metatibia, smooth or almost so; wing fully developed, apex sharply folded to within basal third of elytra; external margin of protibia with 2 large and 2–3 minor teeth, inner margin with 0–2 prominent teeth; metatibia with 1–2 small external teeth.

Abdomen: basal 3/4 of ventrites I–IV dull, microreticulate, apical 1/4 shiny without surface sculpture; ventrite I rugulose, finely and closely punctured on intercoxal process and sides, II–V closely but finely punctured, I–III glabrous except sides and intercoxal process, IV with sparse and minute recumbent setae, V with long erect setae on apical half; apex of ventrite V truncate. Genitalia: phallobase almost glabrous, but with scattered minute setae, medially unsclerotised on dorsal surface, apex of venter with triangular less strongly sclerotised depression, dorsal surface weakly convex; parameres with short but moderately close setae, apices blunt in lateral view; ventral sclerite of penis entire, apex with V-shaped notch; endophallus in repose with 1 large loop.

Female. As male, except: length 17–20 mm; head more strongly and rugosely punctured, anterior truncate; genal lobe laterally produced as a short asymmetric triangle or trapezoid, broadest at posterior then approximately convexly curved to anterior of head; dorsally visible part of mandibles about as long as head; mandibles with or without small elongate dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled, preapical dorsal tubercle absent; sides of pronotum more strongly punctured, punctures often confluent, lateral margins evidently notched or bluntly crenulate, hind angles obtuse; internal margin protibia without teeth; apex ventrite V shallowly notched; proctiger of ovipositor triangular with long apical spine.

Larva: unknown.

Etymology. Named after Jaedon Marr.

Distribution and natural history. *Safrina jaedoni* is the northernmost species of *Safrina* and is endemic to Kroombit Tops, an area of approximately 100 km² above 800 m altitude, well known as an isolated area of rainforest (McDonald & Sharpe 1986; Monteith 1987). *Safrina jaedoni* was illustrated as *R. laticeps* on the cover of the Queensland Naturalist for 1986 and similarly in Mizunuma & Nagai (1994: 206, plate 3).

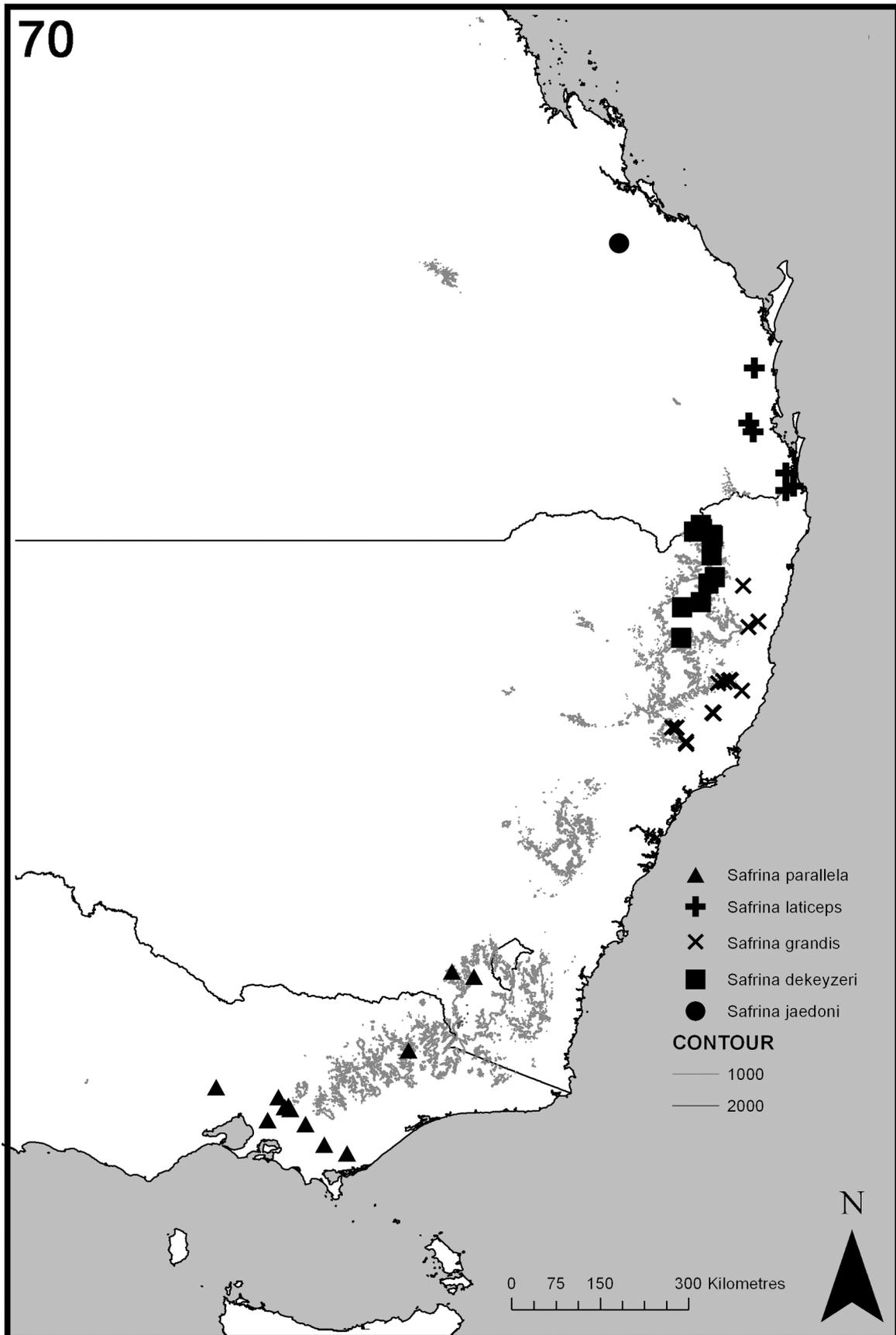


FIGURE 70. Southeastern Australia, distributions of: ■ = *S. dekeyzeri* new species; × = *S. grandis* (Lea, 1915); ● = *S. jaedoni* new species; + = *S. laticeps* (MacLeay, 1885); ▲ = *S. parallela* (Deyrolle, 1881).

The material examined for this study was collected on a single visit in February 1982 by staff of the Queensland Museum, when all the specimens were found in a single hollow log of only 10–12 cm diameter, on the ground, in woodland not rainforest (G. Monteith, personal communication 2015). This habitat is similar to that of its sister species, *S. laticeps*.

Notes. *Safrina jaedoni* and *S. laticeps* are similar and might be considered conspecific. We believe the consistent differences in male mandibles and genitalia validate their status, backed by slight comparative differences in female dorsal sculpture. The two species are geographically separated by 275 km of mostly lowland dry woodland.

***Safrina jugularis* (Westwood, 1863) new combination.**

(Figs 5, 14, 24, 33, 47, 48–49, 56, 69)

Rhyssonotus jugularis Westwood 1863: 429; Boileau 1913: 216; Moore & Cassis 1992: 16; Mizunuma & Nagai 1994: 206, plate 3

Material examined. Non-types (abbreviated localities only): **Australian Capital Territory:** Blundell's Creek (ANIC); 1.5 km N Grassy Creek, Boboyan Road (ANIC); Lee's Creek (AMS, ANIC); Lee's Spring (ANIC); 3 mi. N Mount Aggie (ANIC); Mount Blundells (AMS); Mount Franklin (ANIC); Picadilly Circus (ANIC); 4 km SE Smokers Gap (JB); Tidbinbilla (AMS); Uriarra Forest (ANIC); **New South Wales:** Badja State Forest (AMS); Brown Mountain (AMS); Clyde Mountain (JB, RDK); Deua National Park (AMS); Jenolan (SAM); Landers Creek Falls (RDK); Monga National Park (RDK); Monga State Forest (AMS); Mount Coricudgy (RDK); Mount Wilson (AMS, ANIC, RDK); Narabeen (MMM); Pilot Hill, Batlow (ANIC); 3 mi. SE Pilot Hill, Batlow (ANIC); Sawpit Creek (JB); Wadbilliga National Park (AMS); Yarrangobilly (ANIC); **Victoria:** no data (MMS, SAM); Black Spur (MMM); Buckland River (JB); Buxton (ANIC); Castella (RDK); Cobungra (JB); Emerald (BMNH); Ferntree Gully (ANIC); Healesville (MMM, ANIC); Kawarren, Otway Range (SAM); Macedon (BMNH, MMM, SAM); Mount Baw Baw (ANIC); Mount Beauty (ANIC); Mount Difficult (SAM); Mount Evelyn (MMM); Mount Howitt (MMM); Mount Macedon (AMS, ANIC); Mount St Leonard (RDK); Mount Wilson Training School (MMM); Nariel (MMM); Strathbogie (MMM); Tallarook (ANIC); Tanimbuk [Tonimbuk] (ANIC); Thomson River Gorge (ANIC); Toorango River Valley (ANIC); Upper Tanjil River (ANIC); Warburton district (ANIC); 30 km S Whitfield (ANIC).

Diagnosis. Male. Length 20–28 mm. Head, pronotum, elytra, and venter black or almost so, elytra often slightly paler, dorsum with faint green reflection; legs variable from black to reddish brown with femora darker; elytra rounded at sides; head with narrow genal lobes, posterior angles of genal lobe laterally prominent and angulate, anterior angles rounded or obtuse; mandibles usually with basal dorsal tooth, without pre-apical dorsal tooth; elytral disc smooth, without obvious ridges or striae, entirely dull and densely microsculptured in contrast to shiny first interval and extreme base.

Female. Length 19–26 mm; colour and shape as male, but more rounded; elytral disc smooth, with sparse small punctures; preular swelling sharply convex and strongly arcuate; inner face of protibia with 1 or without teeth; first elytral interval convex and shiny, not microsculptured, in contrast to dull, densely microsculptured flat elytral disc; outer margin of upper surface of mandible with complete keel.

Description. Male. Length 20–28 mm. Head, pronotum, elytra, and venter black or almost so, elytra often slightly paler, dorsum with faint green reflection; legs variable from black to reddish brown with femora darker. Body elongate-ovate: pronotum narrower than elytra, broadest at or near hind angles, sides of elytra rounded.

Head: with short laterally projecting genal lobes (longer than broad), posterior angles of genal lobe laterally prominent and angulate, anterior angles rounded or obtuse, to anterior margin of head; head transverse, width 2.3–3.0x length; dorsum strongly punctured, with punctures clustered in grooves or pits and smooth elevated interspaces, not or faintly microreticulate; head longitudinally elevated medially, elevation usually anteriorly bituberculate with tubercles adjacent; anterior margin medially shallowly concave; dorsally visible part of mandibles 1.0–1.3x longer than head, almost symmetrical, apices almost truncate; mandibles with small elongate dorsal tubercle, 1/3 from base of outer edge, of variable size (reduced to a small swelling on outer ridge in 2 specimens), without additional tubercles distal to this, but outer edge keeled; mandibular preapical dorsal tubercle absent; middle of ventral inner edge with 1–4 fused or part-fused large teeth, apical part of these anteriorly

angulate, before upturned apex; base of inner face of mandible with large acute ventral tubercle, dorsal tubercle absent; preregal swelling sharply convex and strongly arcuate, height > longitudinal length, with dense and coarse setose punctures on anterior face, often fewer on posterior.

Thorax: pronotum contracted anteriorly from posterolateral angles or slightly anterior to them; posterolateral angles variable, from rounded to acute angled (80°); lateral margins bluntly and irregularly crenulate; pronotal disc finely to strongly, sparsely punctured, with or without small pair of foveolate depressions anterior to middle, sides more strongly and closely punctured in lateral depressions and posterolateral angles, and punctures confluent in patches; pronotal disc shiny, but minutely and evenly microreticulate (note: many specimens with dull pronotal disc because of wear); scutellum approximately semicircular, usually closely and strongly punctured; elytra rounded at sides, broadest 1/3–1/2 from base; elytron with interval 1 strongly raised for almost 2/3 of length, otherwise surface smoothly convex, without ridges; elytral disc without striae, dull and densely microreticulate, in contrast to shiny, faintly microreticulate, base of elytra and elevated part of interval 1; elytra with sparse small punctures on disc, a row of large punctures or irregular pits at edge of interval 1 and a row of smaller punctures at inner margin of explanate border; base of elytra with 1–4 short deep elongate grooves; elytral sides explanate, width 1–2x width of base of metatibia, with transverse grooves or wrinkles and densely microsculptured and dull, like disc; wing fully developed, sharply folded at apex of elytra; external margin of protibia with 2 large and 1–6 minor teeth; internal margin protibia with 2–6 prominent median teeth; metatibia with 0–1 small external teeth.

Abdomen: basal 3/4 of ventrites I–IV dull, microreticulate, finely punctured, at least II–IV with apical band of dense long golden setae and recumbent setae at base, bands sparse and more recumbent at sides of ventrites, apical 1/4 of ventrites shiny and impunctate; setal bands denser and wider in specimens from southern New South Wales and Victoria, thinner and narrower in specimens from Blue Mountains, New South Wales (and with impunctate patches lateral to setal bands); at least apical half ventrite V with erect long golden setae; apex of ventrite V truncate or shallowly concave. Genitalia: phallobase almost glabrous, but with 2–3 widely spaced setae on apical half, medially unsclerotised on dorsal surface, less than apical quarter of venter less strongly sclerotised, dorsal surface strongly convex; parameres with conspicuous close setae, apices produced in lateral view; ventral sclerite of penis split along middle by hyaline strip; endophallus in repose tightly coiled, with 2–3 small loops.

Female. As male, except: length 19–26 mm; head narrower, width about 1.8x length, mandibles shorter, dorsally visible part slightly shorter than head; tubercles on anteromedian prominence often obscure or absent; mandible outer edge keeled, apex acute, inner edge with small teeth; sides of pronotum usually slightly more densely and strongly punctured, lateral margins with crenulations usually more convex; elytral sculpture similar to male; protibia internal margin with or without 1 small but prominent tooth; abdominal ventrites II–V without long golden setae, II–IV with minute recumbent setae, V with longer erect setae; apex ventrite V rounded; proctiger of ovipositor triangular with long apical spine.

Larva (based on 1 specimen, about 45 mm long when crudely straightened out, from Brindabella Range): inner edge of left mandible deeply excavated between apex and middle of mola; apex of antennomere 3 produced as a rounded lobe, almost reaching middle of antennomere 4, inner margin shallowly concave; antennomere 4 length to width ratio 2.2–2.3; mesocoxal stridulatory file sinuate at apex, with 31–33 small granules; metatrochanteral stridulatory file with about 16 transverse tubercles, not reaching apex of trochanter, which is rounded; metafemur with evenly curved broad lobe at apex; metatibiotarsus elongate, length to width ratio 4.0–4.5; raster with long lateral setae, narrowly glabrous median strip, and short posteriorly and inwardly directed spines on either side of midline.

Distribution and natural history. *Safrina jugularis* is fully winged and capable of flight. This is a frequently collected species of the tall, wet, sclerophyll and subalpine forest of mainland southeast Australia, from central New South Wales (Blue Mountains) south along the ranges to west-central Victoria (Grampians and Otway Range). The specimen from Narabeen, a coastal suburb of Sydney, is almost certainly mislabelled (the MMM collection has many locality label errors: C.A.M.R., personal observation). There is a published record for Mount Drummer in the extreme southeast of Australia (Moore & Cassis 1992). Larvae have been collected with adults in the Brindabella Range and in the Blue Mountains.

Specimens of *Safrina jugularis* show more wear than other species, with old breaks of mandibular tips and teeth on the protibiae, and heavily scratched heads and pronota. Adults may therefore be comparatively long lived.

Notes. The northernmost populations, in the Blue Mountains, are relatively isolated in small pockets of wetter forest. Males from these populations differ from southern males by having more protibial teeth on average,

narrower bands of yellow setae and larger impunctate patches on the abdominal sternites (compare Figs. 48 and 49). The isolated westernmost population, in the Grampians, is represented by a single male in the material on hand. This specimen has the posterolateral angles of the pronotum relatively elevated but otherwise conforms to the species concept described above. There do not appear to be consistent genitalic or mandibular differences between the above populations therefore they are treated here as one species.

Boileau (1913), in a note overlooked by Moore & Cassis (1992), discovered that the holotype was a male, not a female, as described by Westwood (1863).

***Safrina laticeps* (Macleay, 1885) new combination.**

(Figs 6, 15, 23, 32, 51, 57, 63–67, 70)

Rhyssonotus laticeps Macleay, 1885: 201; Moore & Cassis 1992: 16.

Material examined. Type. HOLOTYPE: ♂, Australia [printed label and Masters' handwritten label], on permanent loan from Macleay Museum, University of Sydney (ANIC).

Other material (69): Queensland: 2 ♂, 2 ♀, Cooran Plateau, as larva, ex core dead standing *Eucalyptus*, 12.xii.90, em[erged] 21.iv.1991, M. De Baar (MDB, QMB); ♂, Cooran Tableland, via Gympie, ex larva, xi.1996, G. B. Monteith (QMB); 2♂, ♀, Cooran Tableland, via Gympie, ex larva, 10.ii.2004, A Polak, collected as larva & reared adult emerged April 2004 (ANIC); ♂, Mount Glorious, 24.iii.1968, G. J. Toop (BPM); 2 ♀, Mount Glorious, as larva, 15.v.1981, B. P. Moore (BPM); 16 ♂, 15 ♀, Mount Glorious, 630 m, ex core dead standing *Eucalyptus* trunk, 24.iii.1989, M. De Baar, A. Hiller (BPM, MDB, QMB, RDK); 2♂, 2♀, Mount Glorious, 630 m, ex core dead standing *Eucalyptus* trunk, 26.iii.1989, A. Hiller (RDK); ♂, ♀, 20 km N Mount Glorious, 24.iii.1989, M. De Baar (DPIM); ♂, Mount Tambourine, i.1893, C. J. Wild (QMB); 3 ♀, Springbrook, 2.iii.1990, 20.iv.1991, 28.iv.1991, M. De Baar (MDB); 4 ♂, 2 ♀, Upper Tallebudgera Creek, ex old bloodwood log, 10.iii.1997, D. J. Cook (QMB).

Diagnosis. Male: length 16–20 mm. Black or almost so, often with faint dark green reflection, legs reddish brown; prothorax almost parallel sided, elytra slightly rounded at sides; head with genal lobe greatly laterally projecting as a tapering trapezoid with long anterior edge and short posterior, the outer edge concave or notched; mandibles without pre-apical dorsal tooth, basal internal dorsal and ventral teeth separated or fused or ventral tooth small; basal half of elytron without ridges, with 5 striae.

Female: length 15–19 mm. Colour as male; with (rarely) or without distinct tooth at base of outer mandibular carina; pronotum relatively strongly and sparsely punctured, punctures of basal third of median groove separated by diameters or less, discal punctures not coalescent; lateral margins of pronotum distinctly to feebly crenulate; elytra weakly or strongly transversely wrinkled, dull with dense microsculpture; elytral intervals 1–5 convex at base, without carina from shoulder to disc; explanate margin of elytra narrow, approximately equal width of base of metatibia, without or with shallow lateral grooves.

Description. Male. Length 16–20 mm. Black or almost so, usually with faint dark green reflection, legs reddish brown. Body sub-parallel sided: pronotum generally broadest at middle third, often slightly broader than elytra, sides of elytra slightly rounded. Head conspicuously setose around median tubercles, with sparse setae elsewhere, pronotal disc glabrous.

Head: sides greatly laterally produced, as a tapering trapezoid with acute apex, long anterior edge and short posterior, the outer edge concave or notched, width of lobe 0.6–1.2x length at base; strongly transverse, width 3.5–4.0x length; dorsum strongly punctured with smooth interspaces; 2 separate anteromedian tubercles, on median prominence; anterior margin deeply concave; dorsally visible part of mandibles 1.5–2.0x longer than head, almost symmetrical; mandibles without dorsal tubercle, 1/3 from base of outer edge, externally keeled on middle third; mandibular preapical dorsal tubercle absent; ventral inner edge with 3–7 angulate or rounded teeth, usually similarly sized but often asymmetrically partly fused, before upturned apex; base of inner face of mandible with large separated dorsal and ventral tubercles, or these tubercles fused, or ventral much smaller; preular swelling sharply convex, height \geq longitudinal length, with 0–2 setose punctures on each face.

Thorax: pronotum usually almost parallel-sided in basal half, sometimes slightly contracted from posterolateral angles to apex, posterolateral angles not laterally projecting; lateral margins shallowly crenulate, or almost even with a few minute nicks; pronotal disc finely and sparsely punctured, with or rarely without, pair of

foveolate depressions anterior to middle, sides more strongly and closely punctured, especially in lateral depressions and at posterolateral angles; pronotal disc shiny, but minutely and evenly microreticulate; scutellum transversely half ovate, sparsely to closely strongly punctured; elytra slightly rounded at sides, broadest 1/3–1/2 from base; basal half of elytron with intervals 1–5 convex, 3 and 5 usually slightly more so than others, without an oblique ridge from humerus to disc; elytra shiny, but finely microreticulate except extreme base; elytral disc striate, with 5 fine sparsely punctured grooves reaching apical half, intervals with or without shallow transverse grooves, remainder of elytra fairly smooth, but with scattered punctures, often in rows, and usually with irregular fine grooves; elytral sides explanate, width approximately equal width of base of metatibia, smooth or almost so; wing fully developed, apex sharply folded to within basal third of elytra; external margin of protibia with 2 large and 2 (or rarely 3) minor teeth, inner margin with 0–1 prominent teeth; metatibia with 1–2 small external teeth.

Abdomen: ventrites dull, microreticulate; ventrite I rugulose, finely and closely punctured on intercoxal process and sides, II–V closely but finely punctured, I–IV apparently glabrous (but with sparse and minute recumbent setae) except sides and intercoxal process, V with long erect setae on apical half; apex of ventrite V truncate to shallowly concave. Genitalia: phallobase glabrous, without setae, medially unsclerotised on dorsal surface, apex of venter with triangular less strongly sclerotised depression, dorsal surface convex; parameres with short but moderately close setae, apices blunt in lateral view; ventral sclerite of penis entire, apex with v-shaped notch; endophallus in repose with 1–2 short coils.

Female. As male, except: length 17–20 mm; head more strongly and rugosely punctured, anterior truncate; genal lobe laterally produced as a short asymmetric triangle or trapezoid, broadest at posterior then approximately convexly curved to anterior of head; dorsally visible part of mandibles about as long as head; mandibles with (rarely) or without small elongate dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled, preapical dorsal tubercle absent; sides of pronotum more strongly punctured, punctures often confluent, lateral margins evidently notched or bluntly crenulate, hind angles obtuse; internal margin protibia without teeth; apex ventrite V truncate to shallowly concave.

Larva (based on 1 specimen, about 25 mm when crudely straightened, from Cooran Plateau): inner edge of left mandible deeply excavated between apex and middle of mola; apex of antennomere 3 truncate, inner margin shallowly concave; antennomere 4 length to width ratio about 2.3; mesocoxal stridulatory file evenly curved, with about 35 small granules; metatrochanteral stridulatory file with about 16 transverse tubercles, not reaching apex of trochanter, which is rounded; metafemur angularly produced at apex; metatibiotarsus elongate, length to width ratio about 3; raster with long apical and lateral setae, narrowly glabrous median strip, and elongate posteriorly or slightly inwardly directed spines or short setae on either side of midline.

Distribution and natural history. *Safrina laticeps* is widespread in southern Queensland, from Mount Tambourine north to Cooran Plateau. This species occurs in dry eucalypt forest and is particularly active in late summer, from March to April. Adults have been found most frequently in hollow eucalypt logs or trunks, where they can be locally numerous. Larvae have been collected in a hollow *Eucalyptus* tree, in December and April (AMS; QMB).

***Safrina moorei* Reid & Beatson, new species**

(Figs 7, 16, 25, 34, 42, 58, 69)

Material examined. Types: HOLOTYPE: ♂, New England National Park, 1300 m, [pitfall trap], 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); PARATYPES (36): **New South Wales:** 2♂, ♀, same data as holotype (AMS); ♂, 2♀, New England National Park, 1300 m, [pitfall trap], in *Nothofagus* forest 21.ii.2003, R. de Keyzer (AMS, RDK); 5♂, ♀, New England National Park, 1300 m, [pitfall trap], 26–27.ii.2002, R. de Keyzer (AMS, RDK); ♂, New England National Park, 1350 m, [pitfall trap], 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♂, bordering New England National Park & Styx River State Forest, 1350 m, [pitfall trap], 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); ♀, [New England National Park], 1130 m, [pitfall trap], 4.ii–9.iv.1993, M. Gray & G. Cassis (AMS); 3♂, ♀, [New England National Park], 1480 m, under logs, *Nothofagus* forest, 23–25.ii.2002, C. Reid (AMS); 2♀, New England National Park, as larva, 10.i.1963 B.P. Moore (AMS); ♂, New England National Park, 26.i.1997, R. De Keyzer (AMS); ♀, New England National Park, 9–12.iv.1998, R. De Keyzer (AMS); 4♂, 2♀, Mount Hyland Nature Reserve, 11.ii.2004, R. de Keyzer & C. Reojewski (AMS, RDK); 2♂, 2♀, Mount Hyland Nature Reserve,

15.ii.2005 R. de Keyzer (AMS, RDK); 2♂, ♀, Mount Hyland Nature Reserve, 9.ii.2006 (RDK). **Non-types:** 1 mature larva, New England National Park, 20.i.2002, R. de Keyzer (AMS);

Diagnosis. Male: length 15–22 mm. Head, pronotum, elytra, and venter black or almost so, elytra rarely slightly paler; most specimens with mandibles and lateral margins of head and pronotum reddish brown; legs reddish brown, femora usually darker, 1 specimen with entirely black legs; elytra strongly rounded at sides; head with short laterally projecting genal lobes, posterior margins prominent and angulate, anterior margins rounded; mandibles with 2 prominent basal dorsal teeth, and prominent but not strongly projecting pre-apical dorsal tooth; elytron smooth, without obvious ridges or striae.

Female: length 14–22 mm. Colour as male; with distinct tooth at base of outer mandibular carina; pronotal disc finely and sparsely punctured, punctures of basal third of median groove absent or separated by more than diameters, discal punctures not coalescent; lateral margins of pronotum irregularly crenulate, tubercles small, usually blunt; elytra shiny with dense, minute microsculpture, but explanate margins densely microsculptured and dull; first elytral interval convex, remainder of elytron smoothly convex; explanate margin of elytra about width of base of metatibia, with or without deep lateral channels.

Description. Male. Length 15–22 mm. Head, pronotum, elytra, and venter black or almost so, elytra rarely slightly paler; most specimens with mandibles and lateral margins of head and pronotum reddish brown; legs reddish brown, femora usually darker, 1 specimen with entirely black legs. Body elongate-ovate: pronotum broader than or equal to width of elytra, usually broadest close to base, rarely almost parallel-sided at middle half, sides of elytra rounded.

Head: with short laterally projecting genal lobes (longer than broad), posterior angle of genal lobe more prominent (often a narrow acute angled projection) than obtusely angled anterior curving to anterior margin of head; transverse, width about 3x length; dorsum strongly punctured with smooth but finely microreticulate interspaces; anteromedian prominence strongly elevated, bituberculate, tubercles adjacent; anterior margin medially shallowly concave; dorsally visible part of mandibles 1.3–1.6x longer than head, almost symmetrical; mandibles with prominent elongate dorsal tubercle, 1/3 from base of outer edge, with similar-sized tubercle distal to this (both often on slight elevation); mandibular preapical dorsal tubercle present, not strongly elevated (similar to other dorsal tubercles); ventral inner edge with 3–5 usually angulate teeth, usually larger at middle, often asymmetrically partly fused, before upturned apex; base of inner face of mandible with large slightly bilobed ventral tubercle and small dorsal tubercle; preangular swelling truncate not sharply convex nor arcuate, height \leq longitudinal length, with 4–6 setose punctures on anterior face, 0–2 on posterior.

Thorax: pronotum contracted anteriorly from middle, or almost parallel-sided in middle half, posterolateral angles rounded, not projecting; lateral margins entirely shallowly and bluntly crenulate; pronotal disc finely and sparsely punctured, without or with small pair of foveolate depressions anterior to middle, sides more strongly and closely punctured in lateral depressions and posterolateral angles, but interspaces larger than puncture diameters; pronotal disc shiny, but minutely and evenly microreticulate; scutellum transversely half ovate, middle usually depressed, impunctate or with small punctures at middle; elytra rounded at sides, broadest 1/3–1/2 from base; elytron with interval 1 raised, otherwise surface smoothly convex, without ridges; elytra without striae, generally smooth and shiny, but minutely microreticulate, with sparse small punctures and sometimes faint irregular grooves; elytral sides explanate, width 1.0–1.5x width of base of metatibia, with or without transverse grooves or wrinkles but densely microsculptured and dull in contrast to disc; wing reduced, one fifth elytron width, straplike, not reaching middle third of elytral length; external margin of protibia with 2 large and 2–4 minor teeth; internal margin protibia with 2–3 prominent median teeth; metatibia with 1–2 small external teeth.

Abdomen: ventrite I dull, II–V relatively shiny, but all microreticulate; ventrite I strongly and closely punctured and rugulose, II–III closely and coarsely punctured at sides, almost impunctate medially, IV–V closely and coarsely punctured; I–IV with minute recumbent setae (easily overlooked) throughout punctured areas, V with longer erect setae; apex of ventrite V distinctly concave. Genitalia: apical half phallobase with scattered short setae, phallobase medially unsclerotised on both dorsal and ventral surfaces, dorsal surface convex; parameres conspicuously and moderately closely setose, apices blunt in lateral view; ventral sclerite of penis entire, apex with v-shaped notch; endophallus mostly uncoiled, small loop at apex.

Female. As male, except: length 14–22 mm; head more strongly and rugosely punctured, obscuring tubercles on anteromedian prominence; dorsally visible part of mandibles about as long as head; mandibles with small acute dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled, preapical dorsal tubercle absent; sides of pronotum more strongly punctured, lateral margins more conspicuously crenulate; elytral sculpture generally

slightly coarser; protibia internal margin with or without 1 prominent tooth; apex ventrite V rounded; proctiger of ovipositor triangular with long apical spine.

Larva (based on 1 specimen, about 30 mm long when crudely straightened, from New England National Park): inner edge of left mandible shallowly concave between apex and middle of mola; apex of antennomere 3 truncate, inner margin shallowly concave; antennomere 4 length to width ratio about 3.2; mesocoxal stridulatory file evenly curved, with about 35 small granules; metatrochanteral stridulatory file with about 21 transverse tubercles, reaching apex of trochanter, which is angulate; metafemur angularly produced at apex; metatibiotarsus elongate, length to width ratio about 4.3; raster with long apical setae, narrowly glabrous median strip, and elongate posteriorly directed setae on either side of midline.

Etymology. Named after the late Barry Moore (died November 2015), a lucanid taxonomist and the collector of the first specimen discovered.

Distribution and natural history. *Safrina moorei* is only known from New England National Park and Mount Hyland Nature Reserve, northern New South Wales, two localities separated by 45 km on the eastern edge of the New England tablelands. These are temperate and cool-temperate rainforests at high elevations, 1130–1480 m. Adults and larvae have been collected from January to April and occur together under logs that are deeply embedded in soil.

***Safrina parallela* (Deyrolle, 1881) new combination.**

(Figs 8, 17, 26, 35, 59, 70)

Rhyssonotus parallelus Deyrolle, 1881: 238; Moore & Cassis 1992: 17; Mizunuma & Nagai 1994: 313, plate 152 (photograph of ♀ syntype).

Material examined. Non-types: (31). 3, no data, Bomans coll. (BMNH); ♂, no data (MMM); 2♂, 1♀, no data, colls Simson & Blackburn (SAM); **New South Wales:** ♂, Bago Forest, Batlow, 11.iii.1957, T. G. Campbell (ANIC); ♂, junction Yarrongobilly Caves Road and Snowy Mountains Highway, 15.ii.1997, M. Moulds (AMS); **Queensland:** 1, no further data, Fry coll. (BMNH); **Victoria:** 1, no further data, Nevison coll. (BMNH); ♂, Victoria (MMS); ♂, Victoria, E. W. Ferguson coll. (ANIC); ♂, Australian Alps, 1920, J. E. Dixon (MMM); ♂, Australian Alps, ii.1940, C. Oke (MMM); ♂, Australian Alps, i.1940, no collector (MMM); ♀, Australian Alps, no date (MMM); ♀, Balook, C. Oke (MMM); ♂, Belgrave, C. Oke (MMM); ♂, Glen Wills, 22.ii.1953, F. E. Wilson (MMM); ♂, Macedon, 4.iii.1950, F. E. Wilson (MMM); 3, Macedon, no date, no collector (MMM, SAM); 2♂, Mount Bencairn, 16.ii.1950, B. Given (MMM); ♀, ex larva, Mount Donna Buang, 700 m, 20.x.1992 adults emerged i.1995, leg G. J. Krake (RDK); ♂, Mount St Leonard, Healsville, 900 m, 20.iii.1995, G.J. Krake (RDK); ♀, Thorpdale, Gippsland, ii.1889 (MMM); ♀, Upper Tarago River, 30.i.1979, G. May (ANIC); ♀, Warburton, 16.ii.1920 (MMM).

Diagnosis. Male. Elytral disc irregularly strigose, with mixed large and small punctures; preular ridge slightly convex; inner face of protibia without teeth; form narrower; length 15–18 mm; head distinctively shaped, with posterior angle of genal lobe apically acute and at 45° to eye, anterior angle rounded; mandibles without basal tooth on upperside of internal face; elytral suture (interval 1) raised as a smooth and shiny ridge, contrasting with dull, microsculptured unridged disc.

Female. Elytral disc irregularly strigose, with mixed large and small punctures; preular ridge slightly convex; inner face of protibia without teeth; form narrower; length 15–18 mm; first elytral interval convex and shiny, not microsculptured, in contrast to dull, densely microsculptured flat elytral disc; anterior face of preular ridge densely punctured; outer margin of upper surface of mandible with complete keel, no basal tooth, inner margin concave, without teeth.

Description. Male. Length 15–22 mm. Head, pronotum, elytra, and venter black or almost so, elytra sometimes slightly paler, dorsum with or without faint green reflection; legs variable, black or reddish brown with darker femora. Body elongate, relatively parallel sided: pronotal width narrower than or equal to elytra (largest specimen), broadest at or near hind angles, sides of elytra almost parallel sided in basal half.

Head: with short laterally projecting genal lobes (longer than broad), posterior of genal lobe obliquely angled from eye to middle of lobe, which has short angular projection, then rounded to anterior of head; head transverse, width 2.3–2.6x length; dorsum strongly punctured, punctures sparse to clustered in grooves or pits, with smooth

elevated interspaces, not or faintly microreticulate; anteromedian prominence present or absent, not bituberculate, with or without single tubercle; anterior margin medially deeply to shallowly concave; dorsally visible part of mandibles 1.0–1.5x longer than head, almost symmetrical, apices almost truncate; mandibles without dorsal tubercles or with slight angular swelling on outer ridge about 1/3 from base, outer edge keeled; preapical dorsal tubercle absent; middle of ventral inner edge with 1 large asymmetric tooth (a second small preapical tooth present in 1 specimen), apically angulate, before upturned apex; base of inner face of mandible with large right-angled, ventral tubercle, dorsal tubercle absent; preular swelling moderately convex and moderately arcuate, anterior face much shorter than posterior, height \geq longitudinal length, with close coarse setose punctures on anterior face, much fewer on posterior.

Thorax: pronotum contracted anteriorly from posterolateral angles or slightly anterior to them; posterolateral angles variable, from rounded to acute angled (80°); lateral margins bluntly and irregularly crenulate; pronotal disc finely and sparsely punctured (almost impunctate in 2 specimens), with or without small pair of foveolate depressions anterior to middle, sides more strongly and closely punctured in lateral depressions and posterolateral angles, but punctures not confluent; pronotal disc shiny, but minutely and evenly microreticulate; scutellum approximately semicircular, shiny and impunctate or with 1–2 punctures; elytra almost parallel sided at basal half, broadest 1/3–1/2 from base; elytron with interval 1 weakly raised for at least 3/4 of length, otherwise surface without ridges; elytra variably microsculptured, usually apical third densely microreticulate and relatively dull and basal third relatively shiny and shallowly microreticulate, usually basal half of elevated first interval shiny; elytral disc without striae, but entirely irregularly strigose or wrinkled, with fairly dense mixed large and small punctures on disc, and a row of large punctures at edge of basal half of interval 1; base of elytron with 1–4 short deep elongate grooves; elytral sides narrowly explanate, width 0.5–1.0x width of base of metatibia, relatively smooth, with shallow transverse grooves, microsculptured as disc; wing fully developed, sharply folded at apex of elytra; external margin of protibia with 2 large and 1–3 minor teeth; internal margin protibia without median teeth; metatibia with 0–3 minute external teeth.

Abdomen: ventrites relatively shiny, shallowly microreticulate, almost punctured throughout, punctures relatively large, but absent at apical half of middle of ventrites II–III; ventrite I with short erect setae, II–IV with short recumbent setae, V with short erect setae; apex of ventrite V truncate or shallowly concave. Genitalia: phallobase apparently glabrous, but with minute scattered stubble on apical half, medially narrowly unsclerotised on dorsal surface, less than apical quarter of venter less strongly sclerotised, dorsal surface strongly convex; parameres with conspicuous close setae, apices blunt in lateral view; ventral sclerite of penis split along middle by hyaline strip; endophallus in repose mostly straight, apex with 1–2 small loops.

Female. As male, except: length 18–20 mm; head narrower, width about 2.0–2.2x length, mandibles shorter, dorsally visible part slightly shorter than head; 2 tubercles on anteromedian prominence sometimes distinct; mandible outer edge keeled, apex acute, inner edge strongly concave, without obvious teeth; sides of pronotum usually slightly more densely and strongly punctured, lateral margins with crenulations usually more convex; elytral sculpture similar to male; protibia internal margin as male; abdominal ventrites II–V sparsely punctured, with short semi-erect setae, V with longer erect setae; apex ventrite V rounded; proctiger of ovipositor triangular with long apical spine.

Larva. Unknown.

Distribution and natural history. *Safrina parallela* is a rarely-collected but relatively widespread species, confined to closed forest at low to high altitude in widely separated localities in southeast Australia. It appears to be broadly sympatric with *S. jugularis*, a similar species. Published records from Mount Macedon and Mount Kosciusko (Moore & Cassis 1992) have not been checked but are likely to be correct. The larva is unknown.

***Safrina polita* (Carter, 1921) new combination**

(Figs 9, 18, 27, 36, 43, 45, 60, 69)

Rhyssonotus politus Carter, 1921: 301; Moore & Cassis 1992: 17; Mizunuma & Nagai 1994: 206, plate 3 fig. 34.2.

Rhyssonotus politus: Holloway 2007: 115.

Material examined. Types: PARATYPES (7): 4 ♂, 3 ♀, Barrington, J. Hopson, ex Carter coll. (AMS, BMNH, MMM, SAM).

Other material (51): New South Wales: ♀, no locality, J. Hopson (AMS); ♂, ♀, Barrington, i.1925, H. J. Carter (BMNH); 5 ♂, 4 ♀, Barrington Tops, H. J. Carter (ANIC, BMNH, DPIM, MMM, QMB); 2♂, 2♀, Barrington Tops, J. Hopson (ANIC, SAM); ♂, Barrington Tops, C. Oke (MMM); ♂, ♀, Barrington Tops, 25.i.1922, Nicholson (ANIC, BMNH); 4 ♂, 1 ♀ Barrington Tops, i.1925, SU Zoo. Exp. (ANIC, MMM, MMS); ♂, Barrington Tops, H. J. Carter (MMM); ♂, Barrington Tops, 20.i.1927, T. G. Campbell (AMS); 2 ♂, Barrington Tops, 5000', 17.i.1947, L. Hopson, R. Caven (AMS); ♀, Barrington Tops, 9–10.ii.1965, G. Monteith (QMB); ♀, Barrington Tops, 6.iii.1975, J. Sedlacek (RDK); ♂, Barrington Tops, 1550 m, 23.ii.1983, J. Doyen (ANIC); ♂, Barrington Tops State Forest, 76 km W Gloucester, under log in *Nothofagus* gully, 21.i.1981, G. Williams (BPM); ♀, Barrington Tops National Park, 2.iii.1993, R. de Keyzer, G. Clark (RDK); ♂, Barrington Tops National Park, 3.iii.1993, R. de Keyzer, G. Clark (RDK); 6 ♂, 3♀, Barrington Tops National Park, 27.i.1996, R. de Keyzer (RDK); ♀, Barrington Tops National Park, 27.i.1996, R. de Keyzer *Nothofagus moorei* (RDK); ♀, Barrington Tops National Park, 6.iii.1975, J Sedlacek (RDK); 2♂, Beech Forest, Gloucester Falls picnic area, Barrington Tops National Park, 32°05'20"S 151°35'30"E, 27 i.1996, R. de Keyzer (RDK); ♀, Burruga Swamp, Barrington Tops National Park, 2.iii.1993, R. de Keyzer, G. Clark (RDK); 3♂,♀, Devils Hole, Barrington Tops National Park, 23.i.2004, R. de Keyzer *Nothofagus* (RDK); ♂, ♀, Devils Hole, Barrington Tops National Park, 16.ii.2003 in *Nothofagus* forest (RDK); 3♂, 2♀, Devils Hole, Barrington Tops National Park, 31°55'S 151°29'E, 27.i.1996 (RDK); ♀, Devils Hole Camping area, Barrington Tops Reserve, 25.iii.2001, *Nothofagus* forest R. de Keyzer (RDK); 2♀ [1 fragmentary], Devils Hole Camping area, Barrington Tops Reserve, *Nothofagus* forest, under logs, 20–22.ii.2002, C. Reid (AMS); 1 mature larva, Mount Barrington, Barrington Tops, 27.x.2002, R. de Keyzer (AMS); ♂, 2♀, ditto, xii.2001, emerged xii.2002, S Hoy & A Polak (RDK); ♀, via Mount Barrington, Barrington Tops National Park, *Nothofagus* forest, 13.i.2002, R. de Keyzer (RDK); ♂, Chichester State Forest, 970 m, 4.ii–9.iv.1993, M. Gray, G. Cassis (AMS); ♂, 2 ♀, Chichester State Forest, 940 m, 4.ii–9.iv.1993, M. Gray, G. Cassis (AMS); ♂, O'Grady's Hut, Williams River, 4600', 13.i.1947, L. Hopson (AMS); ♀, O'Grady's Hut, Williams River, 4600', 16.i.1947, L. Hopson (AMS); ♀, 2 km W Polblue Swamp, Barrington Tops National Park, *Nothofagus moorei*, 31°57'S 151°24'12"E 27.i.1996, R. de Keyzer (RDK); ♀, junction Quarry Road & Barrington Tops Forest Road, Barrington Tops National Park, 28.ii.2002, R. de Keyzer (RDK); ♀, Stewarts Brook State Forest, 4.ii–9.iv.1993, M. Gray, G. Cassis (AMS).

Diagnosis. Male. Length 16–25 mm. Head dark brown to black, pronotum and elytra reddish brown with slight green reflection, legs dark red; elytra strongly rounded at sides; head with short laterally projecting genal lobes, edges straight (parallel-sided) or slightly biconcave; mandibles with prominent basal dorsal tooth, without pre-apical dorsal tooth; elytron relatively smooth, without ridges or striae.

Female. Length 17–22 mm. Colour as male; with or without (rarely) distinct tooth at base of outer mandibular carina; pronotal disc finely and sparsely punctured, punctures of basal third of median groove absent or separated by more than diameters, discal punctures not coalescent; lateral margins of pronotum irregularly crenulate, tubercles small, usually blunt; elytra usually smooth, sometimes irregularly wrinkled, shiny, but with dense minute microsculpture; first elytral interval convex, usually also 3rd at base, without oblique carina from shoulder to disc; explanate margin of elytra about width of base of metatibia, with or without deep lateral channels.

Description. Male. Length 16–25 mm. Head dark brown to black, pronotum and elytra reddish brown with slight green reflection, venter and legs reddish brown. Body elongate-ovate: pronotum broader than elytra, broadest close to base or mostly parallel sided or broadest anteriorly, sides of elytra rounded.

Head: head with short laterally projecting genal lobes (longer than broad), edges straight (head parallel sided) or slightly biconvex, posterior angles rarely more prominent than bluntly rounded anterior angles; transverse, width about 2.5x length; dorsum strongly punctured with smooth interspaces; anteromedian prominence strongly elevated, usually bituberculate; anterior margin roughly straight to shallowly concave; dorsally visible part of mandibles 1.4–1.7x longer than head, almost symmetrical; mandibles with prominent elongate dorsal tubercle, 1/3 from base of outer edge, without additional tubercles distal to this; mandibular preapical dorsal tubercle absent; ventral inner edge with 3–7 rounded teeth, usually larger at middle, often asymmetrically partly fused, before upturned apex; base of inner face of mandible with large bilobed ventral tubercle and small dorsal tubercle; pregular swelling sharply convex, height \geq longitudinal length, with 0–2 setose punctures on each face.

Thorax: pronotum contracted anteriorly from posterolateral angles, which may be laterally projecting, or almost parallel-sided in middle half or slightly expanded anteriorly; lateral margins not or feebly crenulate, usually with irregular fine nicks in margin; pronotal disc finely and sparsely punctured, with pair of foveolate depressions

anterior to middle, sides more strongly and closely punctured in lateral depressions and angles but interspaces larger than puncture diameters; pronotal disc shiny, but minutely and evenly microreticulate; scutellum transversely half ovate, middle depressed, impunctate or with small punctures at middle; elytra rounded at sides, broadest 1/3–1/2 from base; elytron with interval 1 raised, usually also base of 3, without oblique ridge from humerus to disc; elytra without striae, generally smooth and shiny, but minutely microreticulate, with sparse small punctures and sometimes faint wrinkling or irregular grooves; elytral sides explanate, width about equal to width of base of metatibia, with or without transverse grooves or wrinkles; wing reduced, third elytron width, straplike and not reaching apical third of elytra; external margin of protibia with 2 large and 0–4 minor teeth; internal margin protibia with 1–3 prominent median teeth; metatibia with 1–3 small external teeth.

Abdomen: ventrite I dull, II–V relatively shiny, but all microreticulate; ventrite I strongly and closely punctured and rugulose, II–V closely and coarsely punctured, I–IV with short recumbent setae throughout, V with longer erect setae; apex of ventrite V truncate to shallowly concave. Genitalia: phallobase with scattered short setae on apical half, medially unsclerotised on dorsal surface, apex of venter with triangular less strongly sclerotised depression, dorsal surface weakly convex. Parameres with prominent close setae, apices blunt in lateral view; ventral sclerite of penis entire, apex with v-shaped notch; endophallus in repose tightly coiled with 2 small loops.

Female. As male, except: length 16–23 mm; head more strongly and rugosely punctured, obscuring tubercles on anteromedian prominence; dorsally visible part of mandibles about as long as head; mandibles with or without small, elongate, dorsal tubercle, 1/3 from base of outer edge, remainder of outer edge keeled, preapical dorsal tubercle absent; sides of pronotum more strongly punctured, lateral margins more conspicuously crenulate; elytral sculpture often slightly coarser; protibia internal margin with minute tooth or without teeth; apex ventrite V rounded.

Larva (based on 1 specimen, about 35 mm when crudely straightened, from Barrington Tops): inner edge of left mandible deeply excavated between apex and middle of mola; apex of antennomere 3 truncate or slightly produced, inner margin strongly concave; antennomere 4 length to width ratio about 2.7; mesocoxal stridulatory file evenly curved, with about 35 small granules; metatrochanteral stridulatory file with 21–22 transverse tubercles, reaching apex of trochanter, which is angulate; metafemur angularly produced at apex; metatibiotarsus elongate, length to width ratio about 3.3; raster with long apical setae, narrowly glabrous median strip, and elongate posteriorly directed setae on either side of midline.

Distribution and natural history. *Safrina polita* is confined to the wet closed forest of the high central plateau of Barrington Tops, central New South Wales, where it is fairly common. It occurs in cool temperate rainforest dominated by *Nothofagus moorei* on gullies and edges of the plateau, as distinct from the open woodland sites characteristic of sympatric *S. grandis*. *Safrina polita* has been collected under logs of *Nothofagus moorei*. Adults are active from January to March and larvae were present under *Nothofagus* logs in February.

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References cited

- Agassiz, J.L.R. (1846) *Nomenclatoris zoologici index universalis, continens nomina systematica classium, ordinum, familiarum et generum animalium omnium, tam viventium quam fossilium, secundum ordinem alphabeticum unicum disposita, adjectis homonymiis plantarum, nec non variis adnotationibus et emendationibus*. Jent & Gassmann, Solothurn, viii + 383 pp.
- Boileau, M.H. (1913) Note sur lucanides conserves dans les collections de l'Université d'Oxford et du British Museum. *Transactions of the Entomological Society of London*, 1913, 213–272, pl. 9.
- Bouchard, P., Bousquet, Y., Davies, A.E., Alonso-Zarazaga, M.A., Lawrence, J.F., Lyal, C.H.C., Newton, A.F., Reid, C.A.M., Schmitt, M., Ślipiński, S.A. & Smith, A.B.T. (2011) Family group names in Coleoptera (Insecta). *Zookeys*, 88, 1–972. <http://dx.doi.org/10.3897/zookeys.88.807>
- Brockerhoff, E.G. & Bain, J. (2000) Biosecurity implications of exotic beetles attacking trees and shrubs in New Zealand. *New Zealand Plant Protection*, 53, 321–327.
- Calder, A.A. (2010) Family Lucanidae. Australian Faunal Directory, Department of Environment. Available from: <http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/taxa/LUCANIDAE/complete> (accessed 22 March 2016)
- Carter, H.J. (1921) Australian Coleoptera: notes and new species. *Proceedings of the Linnean Society of New South Wales*, 46, 301–323. <http://dx.doi.org/10.5962/bhl.part.14020>
- Carter, H.J. (1929) Australian Coleoptera: notes and new species. VI. *Proceedings of the Linnean Society of New South Wales*, 54, 65–79.
- Chalumeau, F. & Brochier, B. (1993) Un nouveau genre de Chiasognathinae Australien. *Bulletin Sciences Nat*, 79, 16–17.
- Chalumeau, F. & Brochier, B. (1995) Les Chiasognathinae: genres, sous-genres et synonymies (Coleoptera: Lucanidae). *Bulletin Sciences Nat*, 83, 18–24.
- Chalumeau, F. & Brochier, B. (2001) Une forme fossile nouvelle de Chiasognathinae : *Protognathinus spielbergi* (Coleoptera, Lucanidae). *Lambillionea*, 101, 593–595.
- Cornell, A. & Honda, N. (2002) Beetlemania. *Australian Financial Review Magazine*, 30 August 2002, 39–44.
- Costa, C., Vanin, S.A. & Casari-Chen, S.A. (1988) *Larvas de Coleoptera do Brasil*. Universidade de Sao Paulo, Sao Paulo, 165 pp. <http://dx.doi.org/10.5962/bhl.title.100233>
- Deyrolle, H. (1881) Description de cinq lucanides nouveaux. *Annales de la Société entomologique de France*, Series 6, 1, 237–240, pl. 5.
- Ferrier, S., Gray, M.R., Cassis, G.A., & Wilkie, L. (1999) Spatial turnover in species composition of ground-dwelling arthropods, vertebrates and vascular plants in north-east New South Wales: implications for selection of forest reserves. In: Ponder, W. & Lunney, D. (Eds.), *The Other 99%: the Conservation and Biodiversity of Invertebrates*. Royal Zoological Society of New South Wales, Mossman, New South Wales, pp. 68–76.
- Goka, K., Kojima, H. & Okabe, K. (2004) Biological invasion caused by commercialization of stag beetles in Japan. *Global Environmental Research*, 8, 67–74.
- Gourlay, E.S. (1954) Records of introduced Coleoptera and notes on the 1953–54 collecting season. *The New Zealand Entomologist*, 1 (4), 6–10. <http://dx.doi.org/10.1080/00779962.1954.9722723>
- Gray, M.R. & Cassis, G.A. (1994) Results of ground dwelling invertebrate fauna surveys of north-east NSW forests. *North-east Forests Biodiversity Study Report 3c*. NSW National Parks & Wildlife Service, Hurstville, Australia.
- Holloway, B.A. (1969) Further studies on generic relationships in Lucanidae (Insecta: Coleoptera) with special reference to the ocular canthus. *New Zealand Journal of Science*, 12, 958–977.
- Holloway, B.A. (2007) Lucanidae (Insecta: Coleoptera). *Fauna of New Zealand*, 61, 1–254.
- International Commission on Zoological Nomenclature (1999) *International Code of Zoological Nomenclature, 4th Edition*. International Trust for Zoological Nomenclature, London, xxix + 306 pp.
- Kikuta, T. (1986) On the higher taxa of the stag beetle family Lucanidae. In: Aoki, J. (ed.), *Papers on Entomology Presented to Professor Takeshiko Nakane in Commemoration of his Retirement*. Japanese Society of Coleopterology, Tokyo, pp. 131–138.
- Kim, S.I. & Farrell, B.D. (2015) Phylogeny of world stag beetles (Coleoptera: Lucanidae) reveals a Gondwanan origin of Darwin's stag beetle. *Molecular Phylogenetics and Evolution*, 86, 35–48. <http://dx.doi.org/10.1016/j.ympev.2015.02.015>
- Kirby, W. (1819) A century of insects, including several new genera described from his cabinet. *Transactions of the Linnean Society of London*, 12, 375–453. <http://dx.doi.org/10.1111/j.1095-8339.1817.tb00239.x>
- Kirby, W. & Spence, W. (1826) *An Introduction to Entomology, or Elements of the Natural History of Insects. Volume 3*, with plates. Longman, Hurst, Rees, Ormi, & Brown, London, 720 pp.
- Lawrence, J.F. (1981) Notes on larval Lucanidae (Coleoptera). *Journal of the Australian entomological Society*, 20, 213–219. <http://dx.doi.org/10.1111/j.1440-6055.1981.tb01035.x>
- Lawrence, J.F. & Ślipiński, S.A. (2013) *Australian beetles: morphology, classification and keys*. Commonwealth Scientific and Industrial Research Organisation Publishing, Collingwood, Victoria, viii + 561 pp.

- Lea, A.M. (1915) Descriptions of new species of Coleoptera. Part X. *Proceedings of the Linnean Society of New South Wales*, 39, 650–694, pl. 76.
- Linnaeus, C. (1763) *Centuria insectorum rariorum quam consent experimentiss Fac. Med. in Regia Academia Upsaliensi, praeside nobilissimo atque celeberrimo D:o Doct. Carolo von Linné, publico examini submittit Boas Johansson, Upsaliae* [= Uppsala], [6] + 32 pp.
- MacLeay, W.J. (1885) Two new Australian Lucanidae. *Proceedings of the Linnean Society of New South Wales*, 10, 199–202. <http://dx.doi.org/10.5962/bhl.part.17915>
- MacLeay, W.S. (1819) *Horae Entomologicae: or Essays on the Annulose Animals. Vol. 1. Part 1.* Bagster, London, 159 pp, 3 pls.
- McDonald, W.J.F. & Sharpe, P.R. (1986) The plant communities and flora of Kroombit Tops. *The Queensland Naturalist*, 27, 3–10.
- Mizunuma, T. & Nagai, S. (1994) *The lucanid beetles of the world.* Mushi-Sha, Tokyo, 337 pp.
- Mjöberg, E. (1916) Results of Dr E. Mjöberg's Swedish scientific expeditions to Australia 1910-1913. 9. Cicindelidae, Gyridae, Lucanidae, Paussidae. *Arkiv för Zoologi*, 10 (10), 1–16. <http://dx.doi.org/10.5962/bhl.part.1499>
- Molino-Olmedo, F. (2001) Cladística del género *Chiasognathus* Stephens, 1831 y *Sphaenognathus* Buquet, 1838 con proposición de subgeneros nuevos (Coleoptera: Lucanidae). *Revista Chilena Entomologica*, 28, 79–85.
- Monteith, G.B. (1987) Insects from Kroombit Tops, Queensland, with some results of a site survey of Coleoptera. *The Queensland Naturalist*, 27, 27–34, frontpiece.
- Moore, B.P. (1978) A new Australian stag beetle (Coleoptera: Lucanidae) with Neotropical affinities. *Journal of the Australian entomological Society*, 17, 99–103. <http://dx.doi.org/10.1111/j.1440-6055.1978.tb01751.x>
- Moore, B.P. (1984) A guide to the beetles of south-eastern Australia. Fascicle 6. Australian Entomological Press, Greenwich, New South Wales, pp. 85–100.
- Moore, B.P. & Cassis, G. (1992) Lucanidae. *Zoological Catalogue of Australia*, 9, 4–19.
- Moore, B.P. & Monteith, G.B. (2004) A second Australian species of the Gondwanan stag beetle genus *Sphaenognathus* Buquet (Coleoptera: Lucanidae). *Memoirs of the Queensland Museum*, 49, 693–700.
- Moxey, C.F. (1960) A redescription of the tribe Chiasognathini, with the descriptions of a new species and a new subspecies of the genus *Sphaenognathus* Buquet (Coleoptera: Lucanidae). *Entomological News*, 73, 197–203.
- Naumann, I.D. (1993) *CSIRO Handbook of Australian insect names. 6th Edition.* Commonwealth Scientific and Industrial Research Organisation Publications, Melbourne, viii + 200 pp.
- Onore, G. (1994) Description of the immature stages of six species of *Sphaenognathus*, with comparative notes on phylogeny and natural history (Insecta: Coleoptera: Lucanidae). *Annals of Carnegie Museum*, 63, 77–99.
- Parry, F.J.S. (1870) A revised catalogue of the lucanoid Coleoptera, with remarks on the nomenclature, and description of new species. *Transactions of the entomological Society of London*, 1870, 53–118.
- Paulsen, M.J. (2010a) The stag beetles of southern South America (Coleoptera: Lucanidae). *Bulletin of the University of Nebraska State Museum*, 24, 1–148.
- Paulsen, M.J. (2010b) Book review. Chalumeau, E. & Brochier, B. (2007) *The Chiasognathinae of the Andes.* Published by Taita Publishers, Hradec Králové, Czech Republic. 324 pp., 43 color plates, 25 maps. *The Coleopterists Bulletin*, 64, 392–393.
- Paulsen, M.J. & Smith, A.B.T. (2010) Revision of the genus *Chiasognathus* Stephens of southern South America with the description of a new species (Coleoptera, Lucanidae, Lucaninae, Chiasognathini). *Zookeys*, 43, 33–63. <http://dx.doi.org/10.3897/zookeys.43.397>
- Raphael, S. (1970) The publication dates of the Transactions of the Linnean Society of London, Series 1, 1791–1875. *Biological Journal of the Linnean Society*, 2, 61–76. <http://dx.doi.org/10.1111/j.1095-8312.1970.tb01688.x>
- Reid, C.A.M. (1999) A new generic synonym in the Australian Lucanidae (Coleoptera). *Coleopterists Bulletin*, 53, 175–177.
- Reid, C.A.M. (2016) Lucanidae Latreille, 1804. In: Lawrence, J.F. & Ślipiński, S.A. (Eds.), *Australian Beetles, Vol. 2.* Commonwealth Scientific and Industrial Research Organisation Publishing, Melbourne. [in press]
- Stuart, B.L., Rhodin, A.G.J., Grismer, L.L. & Hansel, T. (2006) Scientific description can imperil species. *Science*, 312, 1137. <http://dx.doi.org/10.1126/science.312.5777.1137b>
- Switala, A.K., Sole, C.L. & Scholtz, C.H. (2014) Phylogeny, historical biogeography and divergence time estimates of the genus *Colophon* Gray (Coleoptera: Lucanidae). *Invertebrate Systematics*, 28, 326–336. <http://dx.doi.org/10.1071/IS13054>
- Thorpe, S. (2001) Notes on the establishment in Auckland of the Australian stag beetle *Ryssonotus nebulosus* (Kirby), a new host plant record for it, and a practical identification key to the genera of New Zealand stag beetles (Coleoptera: Lucanidae). *The Weta*, 23, 22–24.
- Westwood, J.O. (1863) Descriptions of some new exotic species of Lucanidae. *Transactions of the Entomological Society of London*, Series 3, 1, 429–437, pl. 14. <http://dx.doi.org/10.1111/j.1365-2311.1863.tb01289.x>
- Wood, G.A., Hasenpusch, J. & Storey, R.I. (1996) The life history of *Phalacrognathus muelleri* (Macleay) (Coleoptera: Lucanidae). *Australian Entomologist*, 23, 37–48.