

A review of *Scymnodes* Blackburn, with the description of a new Australian species and its larva (Coleoptera: Coccinellidae)

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Abstract. The genus *Scymnodes* is reviewed both taxonomically and biologically, and its nineteen constituent species placed into two subgenera. *S. (Dolinus)* Weise is made a subjective synonym of *S. (Scymnodes)* Blackburn, *S. (Apolinus)* is proposed as a new name for *Platyomus* Mulsant (nec Schoenherr) and *Rhynchortalia wallacei* Crotch is transferred to *S. (Scymnodes)* as a new combination. *S. (S.) bellus*, sp.n. is described. Its larva is also described and comparisons made with those of *S. (A.) lividigaster* and the platynaspine *Phymatosternus lewisi* (Crotch). Comments are made on the habits of the *S. (S.) bellus* larva, which was observed to feed on ants.

Introduction

Scymnodes is an interesting and potentially important genus both taxonomically and biologically. Biologically it is unusual in that some species are aphid predators (e.g. *S. lividigaster* (Mulsant) and *S. longicornis* Weise), while others (e.g. *S. koebelei* Blackburn) feed on coccids and the one described below appears to attack ants. All species are endemic to Australia and Melanesia and play a significant part in the control of pests in those areas, but so far only one has been a successful biocontrol agent in other countries. Two shipments of *S. koebelei* were sent to California in 1891 and a third taken there in 1892 (Koebele, 1983). These were liberated in the hope of controlling black scale, *Parasaisettia nigra* (Nietner), but nothing is recorded of their fate and the species is unknown in America today. In contrast, *S. lividigaster*, which spread naturally to New Zealand and several south Pacific island groups, was introduced into the Hawaiian Islands in the early 1890s by Koebele to control citrus aphids and

was flourishing there in recent times (Leeper, 1976).

The association (by rearing) of unknown *Scymnodes* adults with a unique type of larva, differing considerably from the described larva of *S. lividigaster*, prompted us to review the generic concept of *Scymnodes* and describe the new species and its larva. The latter appears to be an ant predator and has a number of interesting defensive adaptations, such as the peculiarly armoured dorsum, concealed head and extremely low profile, coupled with an ability to cling firmly to the substrate.

Until recently, *Scymnodes* was placed in the subfamily Coccidulinae (e.g. by Korschefsky, 1931: 84); but Chazeau & Fürsch (1989: 10) formally transferred it to the tribe Scymnini in the subfamily Scymninae, probably following comments made by Pope (1979). There is little doubt that the genus properly belongs to Scymninae, but its precise placement may change when a comprehensive study of the subfamily is undertaken.

Types and voucher specimens of the new species have been deposited in the Australian National Insect Collection (ANIC), C.S.I.R.O. Division of Entomology, Canberra, and in the British Museum (Natural History), London.

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Genus *Scymnodes* Blackburn

Scymnodes Blackburn, 1889: 187, 189; Weise, 1917: 222; Korschefsky, 1931: 84. Type species *Scymnodes difficilis* Blackburn, 1889, by monotypy.

Platyomus Mulsant, 1853: 285 (n.preocc. Schoenherr, 1833 [Curculionidae]); Chapuis, 1876: 211, 215; Blackburn, 1889: 187, 189; 1895: 241 (as senior synonym of *Scymnodes*); Weise, 1917: 222; Korschefsky, 1931: 85 (as senior synonym of *Scymnodes*, but unavailable through homonymy). Type species *Platyomus lividigaster* Mulsant, 1853, by present designation.

Scymnodes (Dolinus) Weise, 1923: 140; Korschefsky, 1931: 85. Type species *Scymnodes (Dolinus) fulvipes* Weise, 1917, by present designation.

Generic diagnosis

Referable to the subfamily Scymninae, *Scymnodes* is chiefly distinguished by its relatively large size (2.5–4 mm long), pubescent dorsum, unproduced anterior prosternal border, well-marked intercoxal prosternal carinae, unexpanded tibiae with a pair of distinct apical spurs (as in Fig. 3) on middle and hind legs, pseudotrimerous tarsi with anterior and middle claws sexually dimorphic (bifid in male, appendiculate in female), unusually large postcoxal plates on metasternum (extending externally almost halfway along its length) and complete postcoxal plates on first of 6 ventrites in both sexes. A few species of *Ortalia* Mulsant and *Rhynchortalia* Crotch are even larger than *Scymnodes*, but have bifid claws on all tarsi in both sexes and, in *Ortalia*, truly trimerous tarsi as well. *Bucolus* Mulsant, *Bucolinus* Blackburn and *Cryptolaemus* Mulsant also contain large species, but are readily distinguished from *Scymnodes* by having at least the median part of the anterior prosternal border produced toward the mouthparts. Additionally, both *Bucolus* and *Bucolinus* have distinctly expanded anterior tibiae and 5 ventrites in the female. The extended postcoxal plates on the metasternum is a feature shared only by *Scymnodes* and *Rhynchortalia*.

Distribution

Australia, New Guinea, Cook Islands, Gilbert Islands, Society Islands, Tubuai [Austral] Islands, Hawaiian Islands [introduced].

Comments

Korschefsky's (1931) designation of *Platyomus lividigaster* as the type species of *Scymnodes* was invalid, *S. difficilis* being the sole originally included species. The error may have some connection with Weise's incorrect assertion (1917) that Chapuis (1876) had designated *lividigaster* as the type species of *Platyomus*, whereas all he had done was to redefine the genus using what he considered to be a 'type' of *lividigaster* named by Mulsant and loaned to him by G. R. Crotch.

As currently constituted, *Scymnodes* includes nineteen nominal species accepted as valid taxa. Two of the nineteen species listed by Korschefsky (1931) do not belong in the genus. *S. forestieri* (Mulsant) was transferred to *Rhizobius* Stephens by Pope (1981) and '*S. prasinus* Boheman' was included in error on the basis of a record in Schilder & Schilder (1928). The record is of a curculionid (Boheman, 1833: 634), still quite correctly called *Platyomus prasinus*. By contrast, *Ortalia wallacei* Crotch (1874), transferred to *Rhynchortalia* Crotch (1874) by Weise

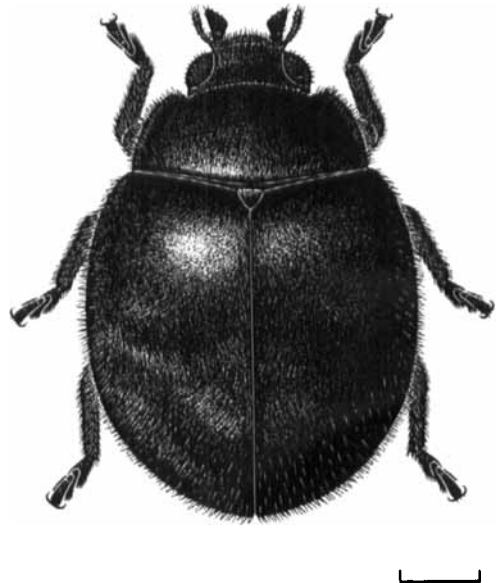


Fig. 1. *Scymnodes bellus*, sp.n., adult ♀

(1901), has proved on examination of the lectotype to belong to *Scymnodes*. These changes, together with the newly described species, retain the total number of included species at nineteen.

The species divide neatly into two groups on a range of characters, including both adult and larval morphology and, apparently, food preferences. One group includes *difficilis*, the other *lividigaster*, newly designated as the type species of *Platyomus* Mulsant. Weise (1923) clearly recognized the existence of the two groups when he erected the subgenus *Dolinus*. However, believing the type species of *Scymnodes* to be *Platyomus lividigaster*, he applied the name *Dolinus* to the group that, unknown to him, included *difficilis*. *Dolinus* Weise is therefore a subjective synonym of *Scymnodes*. The nominate subgenus as interpreted by Weise, effectively a restricted version of *Platyomus* Mulsant nec Schoenherr, has no available synonyms and requires a new name. It is here proposed that it be called *Apolinus* (gender: masculine). The name is an arbitrary combination of letters, but the prefix 'Apo' is intended to suggest the derived nature of the male genitalia.

Subgenus *Scymnodes* (*Scymnodes*) Blackburn

Scymnodes (*Dolinus*) Weise, Syn.n.

- Included species (original genera in parentheses)
baccaeformis (Blackburn, 1895). N. Qld (*Platyomus*)
bellus sp.n. A.C.T., N.S.W.
consimilis (Blackburn, 1895). N.S.W., Qld (*Platyomus*)
difficilis Blackburn, 1889. Tas., W.A., N.S.W., S.A. (*Scymnodes*)
fulvipes Weise, 1923. Qld (*Scymnodes* (*Dolinus*))
fulvohirtus Blackburn, 1895. Qld (*Scymnodes*)
koebelei Blackburn, 1892. N.S.W. (*Scymnodes*).
maculiger Weise, 1923. Qld (*Scymnodes* (*Dolinus*))
obscuricollis (Blackburn, 1895). N. Qld (*Platyomus*)
tristis Weise, 1923. Qld (*Scymnodes* (*Dolinus*))
wallacei (Crotch, 1874). comb.n. New Guinea, Salawati, Misoól, Kei Is., Aru Is. (*Rhynchortalia*).

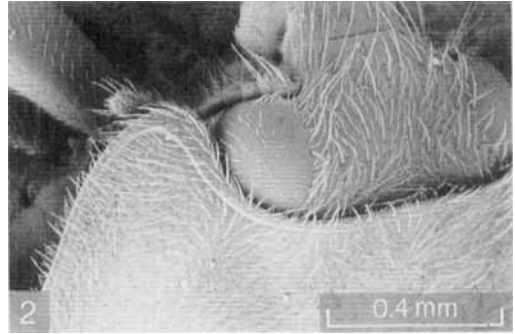


Fig. 2. *S. bellus*, adult ♀, head and pronotum, anterodorsolateral.

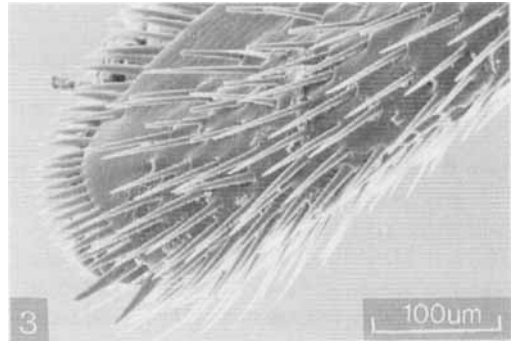


Fig. 3. *Coelophora inaequalis* (Fabricius), adult, mid tibia, inner face of apex.

Comments

In this group the antennae are 10-segmented and the eyes are sharply and deeply emarginate near the antennal insertions (Fig. 2). The anterior and lateral pronotal margins have a thickened border separated from the disc by a groove (Fig. 2). The postcoxal plates of the first ventrite are almost always asymmetrically curved and approach very closely to the posterior border of the ventrite. Separate parameres are always present on the male genitalia (although not always as large as in *S.(S.)bellus*) (Fig. 4). Larvae known to belong to the subgenus (of *koebelei*, *consimilis* and *bellus* (Figs 6–10)) are all flattened and protected by specialized setae, but produce no visible waxes, at least on the dorsal surfaces. Food records are scarce, but some species are known to feed on coccoids and aleurodids and *S.(S.)bellus* larvae have been observed feeding on ants (see below). Koebele

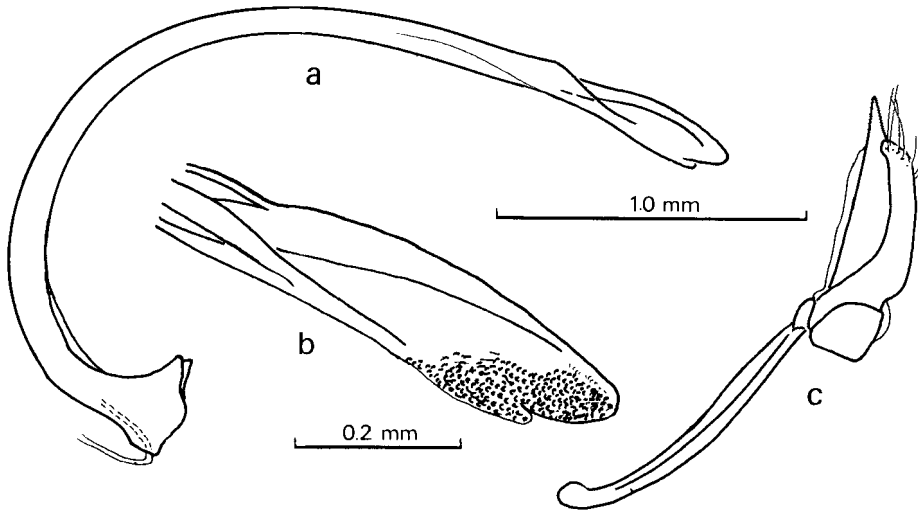


Fig. 4. *S. bellus*, ♂ genitalia: a, siphus; b, apex of siphus; c, phallobase and trapes.

(1893) noted *S.(S.)koebelei* as preying on *Eriococcus leptospermi* Maskell (Eriococcidae) and three species of Diaspididae (*Chionaspis eugeniae* Maskell, *Aspidiotus cynaripiae* Maskell and *Fiorinia* sp.). Label data have added another diaspidid, *Chrysomphalus ficus* (Ashmead) (= *aonidium* (Linnaeus)) and an unidentified aleurodid to the host list for *S.(S.)koebelei*.

Subgenus *Scymnodes* (*Apolinus*) nom.n.

Platyomus Mulsant

Included species (original genera in parentheses)

chapuisi Weise, 1923. Australia (*Scymnodes* (*Scymnodes*))

cribratus (Blackburn, 1895). N. Qld (*Platyomus*)

lividigaster (Mulsant, 1853). A.C.T., N.S.W., Qld; Cook Is., Hawaiian Is., New Zealand, Society Is., Tubuai (Austral) Is., Gilbert Is. (*Platyomus*)

longicornis Weise, 1917. New Guinea (*Scymnodes*)

papuanus Weise, 1917. Kai Is. (*Scymnodes*)

punctiger Weise, 1917. New Guinea (*Scymnodes*)

spilotus Weise, 1923. Qld (*Scymnodes* (*Scymnodes*))

terminalis (Blackburn, 1895). Qld (*Platyomus*)

Comments

In this group the antennae are 11-segmented, and the eyes only shallowly emarginate near the antennal insertions. The pronotum has simple, narrowly reflexed lateral borders, the upturn continuing along the anterior border behind the eyes. The postcoxal plates of the first ventrite are more or less evenly curved and do not extend close to its hind border. The male genitalia are very unusual in that the parameres are entirely fused with the elongate median lobe (phallobase) and are discernible only as two groups of setae arising at about a third from the basal ring. Information concerning larval morphology is limited to *S.(A.)lividigaster*, whose larva is coccinelline in overall shape, but has a double row of long protuberances (senti) along each side (Koebele, 1893; Richards, 1980) and produces at least two types of visible wax from the dorsal and ventral surfaces (Pope, 1979). *S.(A.)lividigaster* is almost always recorded (e.g. Koebele, 1893; Richards, 1980; Anderson, 1981) as an aphid predator, and data labels on adult specimens indicate the same feeding habits for *S.(A.)longicornis* Weise.

Scymnodes (*S.*)*bellus* sp.n. (Figs 1–4, 5a)

Adult description

Length 3.75–4 mm; breadth 2.75–3 mm.

Male. Body broadly oblong-oval, convex; en-

tirely black above except for testaceous mouthparts and antennae; elytral epipleura, pro-, meso- and metasterna black; abdomen with ventrite 1 black between and on postcoxal plates, elsewhere testaceous, ventrites 2–5 testaceous; legs black except for dark testaceous tarsi. Head with anterior clypeal border shallowly emarginate, eye canthus long, sharply indenting border of eye (Fig. 2), frons with minimum interocular distance about 3.5 eye widths, punctures distinctly larger than eye facets, usually separated by one diameter or less, intervals smooth, shining; eyes pubescent; antennae no longer than minimum width of head between eyes, club 3-segmented, segment 3 as long as 4 + 5. Pronotum about 2× as broad as median length, broadest at hind angles, slightly narrowed to produced, moderately sharp anterior angles; anterior border very slightly arcuate medially; anterior, lateral and posterior margins all with an external border separated from disc by a distinct groove (Fig. 2), borders widened around and within anterior angles to become more than 2× as broad as elsewhere; punctures of disc and elsewhere of similar size and spacing to those on head, intervals smooth, shining, pubescence long, semi-erect, forming a whorled, symmetrical pattern. Elytra about as long as greatest combined breadth, widest at about a third from bases, obtusely rounded thence to apicosutural angles; pubescence of longer, upstanding and shorter, subrecumbent setae, both whorled to form a distinct symmetrical pattern (Fig. 1); disc and margins with punctures of two sizes, smaller punctures similar to those of pronotum, others about 2× as large, separation about equal to diameter of smaller punctures, intervals smooth. Prosternal intercoxal process with carinae convergent anteriorly; mesosternum with anterior border emarginate, basal width a little greater than median length; metasternum with punctures shallow and sparse, except anterolaterally and within postcoxal plates, intervals smooth; elytral epipleura at most about a seventh as broad as metathorax, without an oblique subhumeral ridge. Abdomen with postcoxal plates of first ventrite almost or quite reaching posterior border of ventrite, punctures on plates about as large as those elsewhere on ventrite, those of disc often separated by less than half a diameter; fifth ventrite with median length about = 3 + 4, apical border strongly and broadly emarginate

medially; apical border of sixth ventrite also emarginate. Legs with tibiae distinctly angled near femoral junction; claws of middle and anterior tarsi bifid, of posterior tarsi appendiculate. Genitalia as in Fig. 4.

Female. Very like male but with all tarsal claws appendiculate, apex of fifth abdominal ventrite truncate, that of sixth arcuate. Genitalia as in *S. consimilis* (Fig. 5c) but with differently shaped spermatheca (Fig. 5a, cf. 5b).

Comments

S. bellus appears to be most closely related to *S. consimilis* (Blackburn), which is smaller in size with reddish elytral apices, elytral punctures of one size only, and an oblique groove on each pronotal hypomeron running backward and outward from near its junction with the anterior angle of the prosternum.

Type material

Holotype ♂ AUSTRALIA: labelled 'Piccadilly Circus, Brindabella Range, A.C.T. [Australian Capital Territory], 24.x.1982/J. F. Lawrence coll. under *Eucalyptus* bark/emerged 20 Dec.' (ANIC).

Paratypes. AUSTRALIA: 1♂, same data as holotype (ANIC). 1♀, same locality and collection date as holotype, but emerged 25.xii.1982 (ANIC). 1♀, same locality and collection date as holotype, but emerged 1.i.1983 (ANIC). 1♂, same locality and collection date as holotype, but no emergence date (BMNH). 1♂, Taralga [New South Wales] (*Broom*) 99–130 (BMNH).

Remarks

All specimens from the type locality were collected as larvae from under the bark of living *Eucalyptus* spp. and reared to the adult stage in the laboratory.

Larva

Length of last instar about 6 mm. Body (Figs 6, 7) broadly ovate and strongly flattened, with head completely concealed beneath prothorax when at rest. Upper surfaces heavily sclerotized, tuberculate and clothed with flattened, star-shaped (usually pentagonal or hexagonal) stipitate scales (Figs 8–10). Outer edges clothed with expanded, club-like setae (Fig. 9). Head transverse, moderately sclerotised above, with widely separated and only slightly curved frontal arms (ecdysial lines). Frontoclypeal

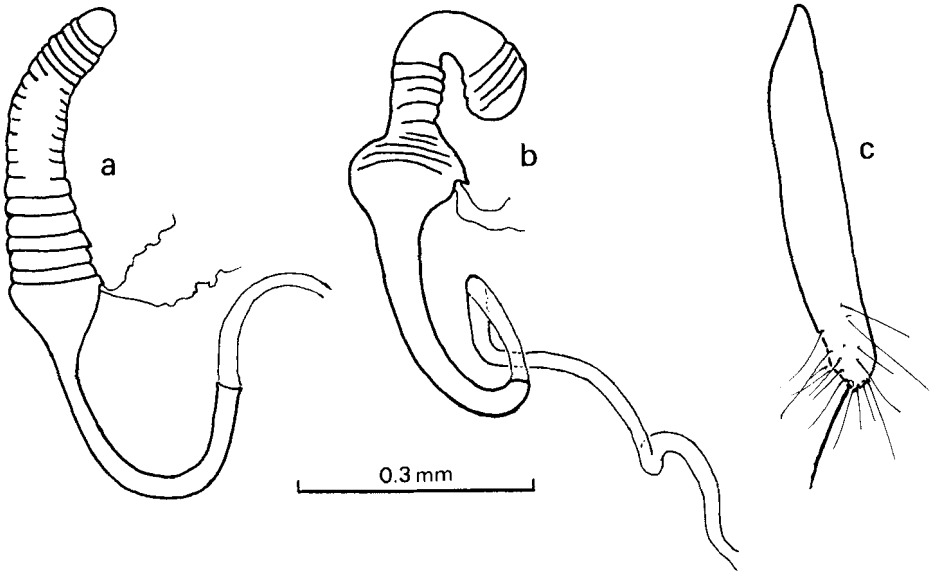


Fig. 5. *Scymnodes* spp., female genitalia: a, *S. bellus*, spermatheca; b, *S. consimilis* spermatheca; c, *S. consimilis*, coxite.

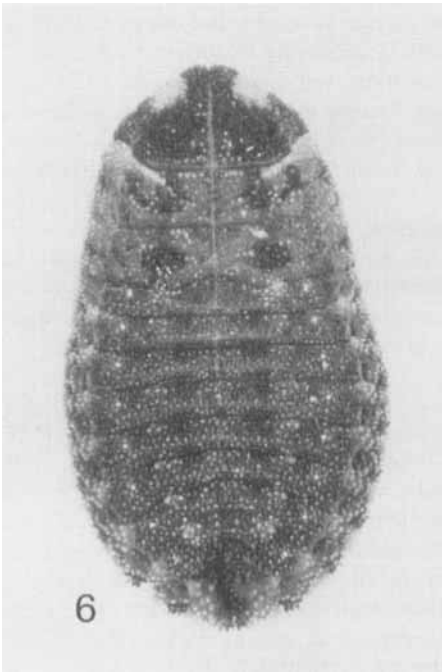


Fig. 6. *S. bellus*, larva, dorsal; length = 6.3 mm.

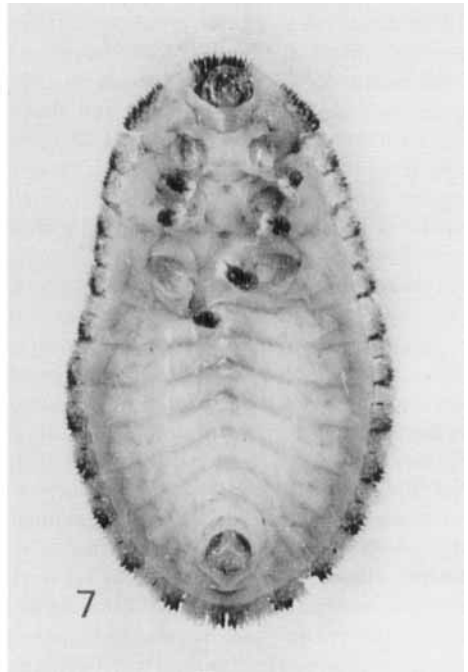


Fig. 7. *S. bellus*, larva, ventral.

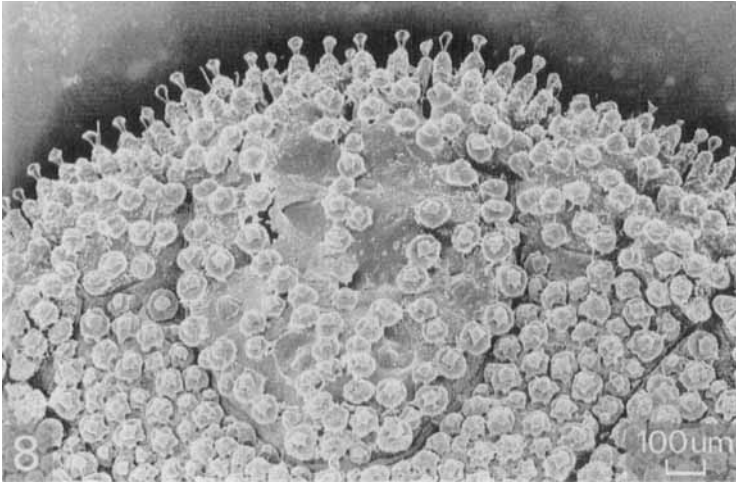


Fig. 8. *S. bellus*, larva, abdominal apex (terga 8 and 9), dorsal.

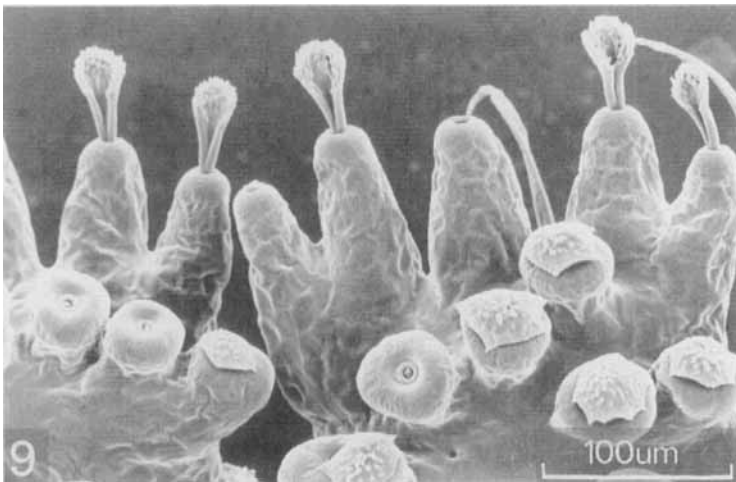


Fig. 9. *S. bellus*, larva, lateral portion of abdominal tergum, showing stipitate scales (several broken off) and lateral tubercles with clavate setae.

suture absent. Labrum very lightly sclerotized except for paired strips of cuticle extending from near midline to posterolateral angles, and with several small peg-like structures at apex. Antennae (Fig. 12) moderately well-developed, about $0.2\times$ as long as head width. Segments 1 and 2 subequal and about $1.6\times$ as long as wide. Segment 3 minute, with seta and several sensilla at apex; sensorium on segment 2 conical and much longer than segment 2. Mandible (Fig. 13) with apex simple and acute, but slightly

concave mesally and with slight subapical elevation; molar lobe blunt, hyaline, with 3 or 4 transverse ridges bearing microtrichia. Outer edge of mandible at base with 1 large and 1 small seta. Maxillary mala with heavily sclerotized, rod-like inner edge, anterior edge lightly sclerotized, with 2 large setae, a stylus, and 3 peg-like organs, 1 laterad and 2 mesad of stylus. Maxillary palp 3-segmented, with well-developed palpifer. Segment 1 strongly transverse and slightly shorter than segment 2, which is

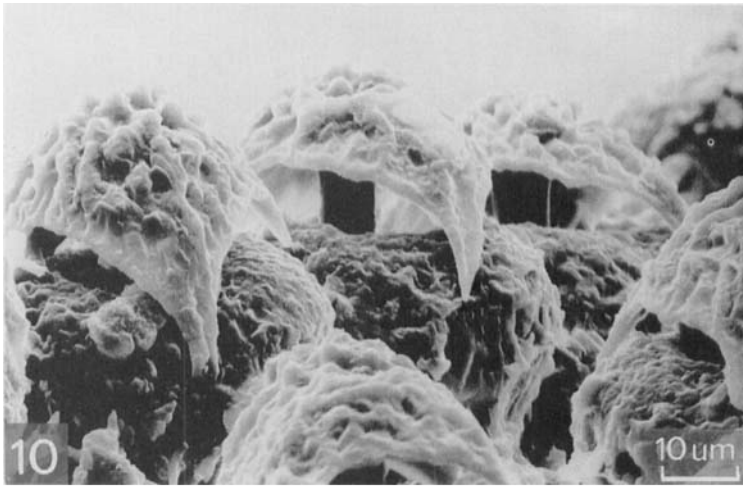


Fig. 10. *S. bellus*, larva, stipitate scales on dorsal surface.

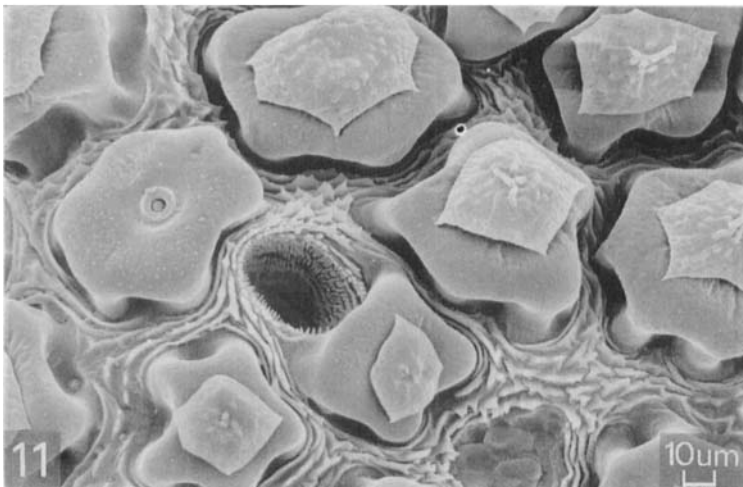


Fig. 11. *S. bellus*, larva, abdominal spiracle and pigmented area.

slightly transverse; segment 3 as long as first 2 together and about twice as long as wide. Labial palps (Fig. 12) 2-segmented and separated by less than their basal diameter; basal segment very strongly transverse, apical segment about as long as wide. Prementum with a seta and peg-like organ just in front of mesal edge of each palp. Postmentum bearing 6 wax glands (Fig. 12). Hypopharynx (Fig. 13) with numerous short rows of posteriorly projecting microtrichia; internally with transverse bridge joining

2 longitudinal rods extending anteriorly and forked at apex. Protergum semicircular, broadly rounded anteriorly, abruptly notched at posterior angles, moderately curved posteriorly. Colour dark brown, with paired white 'eye spots' anterolaterally and lighter, more yellowish-brown at posterior angles. Mesotergum and metatergum strongly transverse, as are abdominal terga 1–8, 6 and 7 slightly curved posteriorly, 8 strongly so. Tergum 9 elongate-oval with truncate posterior edge. Segment 10

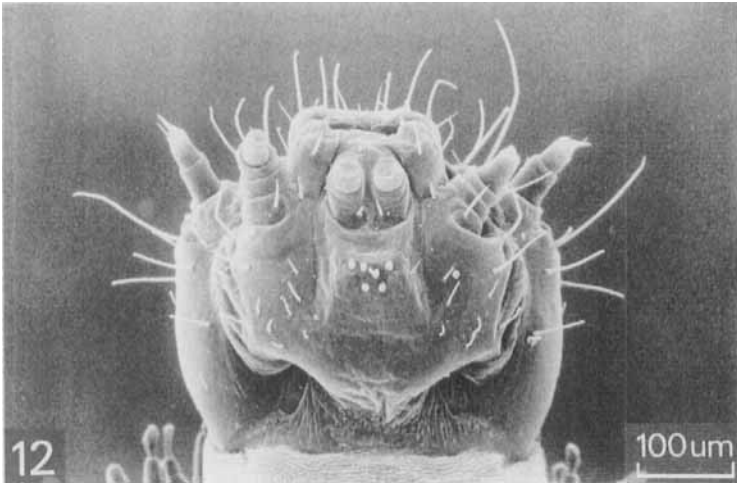


Fig. 12. *S. bellus*, larva, head, ventral, showing labial wax glands.

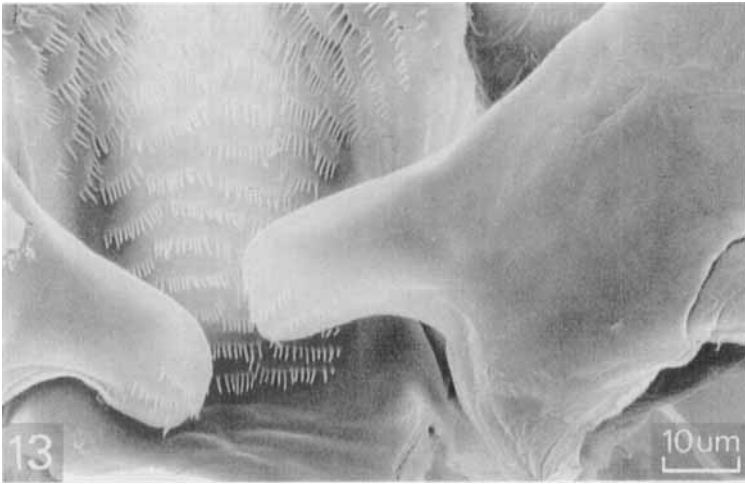


Fig. 13. *S. bellus*, larval mandibular bases and hypopharynx (shadow indicating internal bridge).

short, cylindrical, well sclerotized ventrally except near midline. Mesothorax light greyish-brown, yellow laterally, with paired dark brown maculae and paired white spots (not as obvious as those on prothorax). Metathorax with similar but smaller and more widely separated maculae and with similar yellow lateral edges. Segments 2–8 lightly pigmented with yellow lateral edges. Edges of all thoracic and 9 abdominal terga lobed and with variable numbers of setiferous tubercles. Tubercles may be separate or clus-

tered on lobes, with numbers of tubercles increasing and lobes or clusters of tubercles becoming less divisible into units in later instars. Grouping as follows in an early instar, starting at middle of pronotum and extending to middle of tergum 9: prothorax 4-1-1-1-3, mesothorax 3-1, metathorax 3-1, abdomen 2-2-2-2-2-2-2-2-(2-2). An intermediate instar had the following groupings: prothorax 5-2-2-3-4, mesothorax 5-3, metathorax 5-3, abdomen 3-(1-3)-(1-3)-(1-3)-(1-3)-(1-3)-(1-3)-(1-3)-(3-2). A late instar had

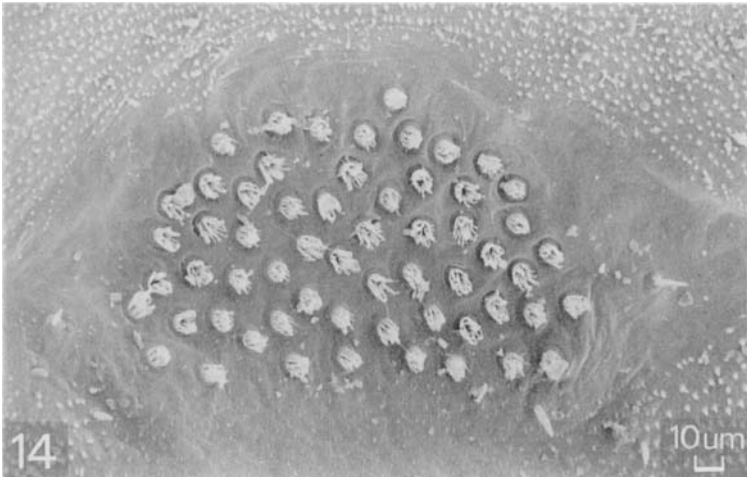


Fig. 14. *S. bellus*, larva, ventral wax glands between sterna 6 and 7.

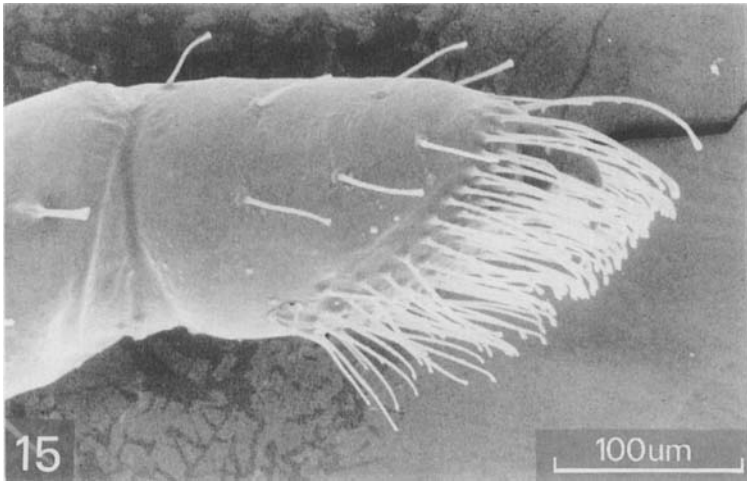


Fig. 15. *S. bellus*, larval tibia and tarsungulus (the latter partly concealed by numerous clavate setae).

the following: prothorax 7-3-3-4-7, mesothorax 7-5, metathorax 5-5, abdomen 4-(3-4)-(3-4)-(3-4)-(3-4)-(3-4)-(3-5)-(3-5)-(4-3). Thus, the early instar had 19 lobes and 38 setiferous tubercles, the intermediate instar 26 and 63, and the late instar 26 and 108, on each side. Defence gland openings located at anterior edges of abdominal terga 1–8 about half way between midline and lateral edge; each opening with sclerotized rim. Spiracles on abdomen located posterad and laterad of glands, annular with peritreme densely

lined with projections (Fig. 11). A flattened, darkly pigmented area composed of several 'cells' just posteromesad of each spiracle (Fig. 11). Thoracic spiracles located at anterior end of mesothorax, in fold between prothorax and mesothorax and usually concealed by the abutment of the protergum and mesotergum. Legs (Fig. 15) moderately lightly sclerotized, except for tibia, which is more heavily sclerotized and densely clothed with long spatulate setae (more than 100), which project distally beyond edge of

tarsungulus. Tibia slightly shorter than femur. Procoxae, mesocoxae and metacoxae separated by about 2, 3 and 4 coxal diameters, respectively. Prothorax with well-developed cervical area, which is inverted when head is retracted. Abdominal sterna 3–8 each with median group of wax glands (Fig. 14) beginning at anterior edge of sternum and extending posteriorly; sternum 3 with about 20 glands and the patches becoming larger, so that sterna 7 and 8 have 50 or more. A few glands scattered on sterna 9 and 10.

Larval material examined

AUSTRALIA: 25, Piccadilly Circus, Brindabella Range, Australian Capital Territory 24.x.1982 and 7.xi.1982, under bark of living *Eucalyptus* sp. (Lawrence); 3, same locality, 19.x.1982 (Doyen); 3, same locality, 13.i.1983 (Lawrence); 1, same locality, iii.1984, flight intercept/trough trap (Lawrence, Weir & Johnson); 1, same locality and collectors, iv. 1984; 3, Blundell's Creek Road, Brindabella Range, A.C.T., 30.iii.1984, under bark of living *Eucalyptus* sp. (Lawrence).

Comments

This larva differs considerably from that of *S. (Apolinus) lividigaster* in being ovate, strongly flattened and dorsally clothed with flattened scales; in having shorter, stouter legs with abundant clavate setae at the tibial apex; in the type and distribution of ventral wax-producing papillae; and in the presence of distinct, sclerotized, paired gland openings on abdominal terga 1–8. The head and mouthparts do not differ greatly in the two larval types, although in *bellus* the antennae are somewhat longer with segments 1 and 2 subequal (1 strongly transverse in *lividigaster*), the labial palps are much shorter and broader, and the postmentum bears a group of wax-producing papillae lacking in *lividigaster*. The larva of *bellus* resembles that of the Japanese *Phymatosternus lewisi* (Crotch) (described by Sasaji & Tsubokawa, 1983) in general form and in the presence of flattened dorsal scales, obvious sclerotized gland openings, and numerous clavate setae at the tibial apex; in *Phymatosternus*, however, the head is visible from above, the scales are more scattered on the surface and the maxillary palps have only two segments. *Phymatosternus* is currently placed in the tribe Platynaspini, subfamily Chilicorinae (Chazeau & Fürsch, 1989).

Notes on larval biology

A number of these peculiar, flattened larvae were found beneath the bark of living eucalypts in the Brindabella Range, A.C.T. They moved very little and their flattened form (Fig. 6) and dorsal coloration made them very difficult to see against the background of the bark. Several larvae were taken into the laboratory, and all adult specimens from the type locality resulted from eclosion of these specimens. In their natural habitat, larvae were usually found with small ants of the genus *Iridomyrmex* Mayr, which were abundant beneath the bark. Furthermore, on several occasions in both field and laboratory, larvae were observed gripping these ants in their mandibles. The larvae remained motionless and appeared to be chewing on the body of the ant. It is not known whether this species is a specialist ant predator, but there was little other food available to them. It is possible that they also feed on coccoids, which were present but not common on some of the trees. Myrmecophagy is extremely uncommon among Coccinellidae, although the South African *Ortalia pallens* Mulsant (Scymninae: Ortaliini) has been observed to feed on a species of *Pheidole* (Harris, 1922).

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