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## Disentangling a taxonomic nightmare: a revision of the Australian, Indomalayan and Pacific species of *Altica* Geoffroy, 1762 (Coleoptera: Chrysomelidae: Galerucinae)

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### Abstract

The genus *Altica* Geoffroy, 1762, is revised for Australia, the west Pacific region and the Indomalayan Archipelago, with 6 valid species: *A. aenea* (Olivier, 1808); *A. birmanensis* (Jacoby, 1896); *A. caerulea* (Olivier, 1791); *A. corrusca* (Erichson, 1842); *A. cyanea* Weber, 1801; *A. gravida* (Blackburn, 1896). The following new synonymy is recognised, in original combinations, senior synonym first: *Galeruca aenea* Olivier = *Haltica ignea* Blackburn, 1889, **syn. nov.**, = *Haltica bicolora* Jacoby, 1904, **syn. nov.**, = *Altica jussiaeae* Gressitt, 1955, **syn. nov.**; *Galeruca caerulea* Olivier = *Haltica elongata* Jacoby, 1884, **syn. nov.**, = *Altica brevicosta* Weise, 1922; *Haltica corrusca* Erichson = *Haltica pagana* Blackburn, 1896, **syn. nov.**; *Haltica birmanensis* Jacoby = *Haltica indica* Shukla, 1960, **syn. nov.** *Altica brevicosta* and *A. birmanensis* are removed from synonymy with *A. cyanea* and *A. indica* is removed from synonymy with *A. caerulea*. The *Altica caerulea* of Maulik and subsequent authors (not Olivier) is a misidentification of two species, correctly named *A. cyanea* and *A. birmanensis*. The *Altica cyanea* of Maulik and subsequent authors (not Weber) is a misidentification, correctly named *A. aenea*. *Altica bicosta* Shukla, 1960, is removed from synonymy with *A. brevicosta* and regarded as a valid species. *Altica splendida* Olivier, 1808, and *Haltica ferruginis* Blackburn, 1889, are transferred to *Sutrea* Baly, 1876, as *S. splendida* (**comb. nov.**) and *S. ferruginis* (**comb. nov.**). The type species of *Sutrea* is designated as *S. elegans* Baly, 1876. *Altica albicornis* Medvedev, 2004, is transferred to *Phygasia* Dejean, 1836, as *P. albicornis* (**comb. nov.**). Lectotypes are designated for *A. australis*, *A. birmanensis*, *A. caerulea*, *A. cyanea*, *A. elongata*, *A. ignea* and *A. pagana*. A neotype is designated for *A. aenea*. *Altica caerulea* is newly recorded from Australia and *A. cyanea* is removed from the Australian fauna. *Altica corrusca* and *A. gravida* are endemic to Australia; all published records of these species from outside Australia refer to the widespread Asian-Pacific species *A. aenea*. The single record of the European *Altica oleracea* (L., 1758) from New Caledonia is regarded as a label error and this species removed from the Pacific fauna. A key, based primarily on genitalic structures, is provided for the six regional species and all are redescribed. Host plant records are reviewed: *A. corrusca* is a minor agricultural pest; *A. aenea*, *A. caerulea* and *A. cyanea* may be useful for biocontrol of weeds.

**Key words:** flea beetle, morphology, pest species, strawberry, rice, biocontrol, *Ludwigia*, *Melastoma*

### Introduction

This paper is an attempt to rationalise 220 years of taxonomic work on six species by 15 workers from nine countries. It describes no new species, recognises only six valid species, and reduces the world's biodiversity by three species. The confusing nomenclatural changes are summarised in Appendix 1.

The alticines, or flea beetles, are a large and diverse group of the Galerucinae, the largest subfamily of Chrysomelidae (leaf beetles). Alticines are characterised solely by possession of a femoral spring mechanism (Furth & Suzuki 1994), a feature which has independently evolved several times within Coleoptera (Furth & Suzuki 1992). Unsurprisingly (for beetles at least), recent molecular research has shown conclusively that the flea beetles are polyphyletic, as the mechanism has been either lost or gained multiple times within Galerucinae (Reid 1992; Duckett, Gillespie & Kjer 2004; Ge *et al.* 2011). However, an internal classification of Galerucinae accommodating this information is still lacking, therefore it remains convenient to refer to three groups within the Galerucinae: (i) polyphyletic Alticini ('alticines') in the traditional sense, defined by presence of the metafemoral

spring; (ii) polyphyletic Galerucini ('galerucines') in the traditional sense, defined by absence of the metafemoral spring; (iii) a small group of taxa which are structurally similar to alticines but lack the metafemoral spring (Reid 1992) ('galerucines incertae sedis'). As the 'alticines' are an artificial clustering of taxa we prefer to use informal terms such as alticines or flea beetles for this group.

The leaf beetle genus *Altica* Geoffroy, 1762, is one of about 40 genera of flea beetles in Australia. It is frequently encountered and easy to recognise amongst other alticine genera in the region (Matthews & Reid 2002). However *Altica* is one of the most difficult genera to deal with taxonomically. We are revising the Australian alticines and have accumulated enough material to review this difficult but prominent genus in Australia, the results of which are presented here. Since the adjacent regional faunas are also poorly understood, we have expanded this study to include the west Pacific and the Indomalayan Archipelago.

*Altica* is almost cosmopolitan. The number of described species remains controversial, as there has been considerable difficulty in defining them, but combining the published regional revisions from the last 50 years gives approximately 235, well under the 300 described species previously estimated (Konstantinov & Vandenberg 1996; Döberl 2010b). Our total would be increased by almost 50 species if the four feebly distinguished Neotropical genera split from *Altica* by Bechyné were reinstated in that genus (see comments by Scherer 1962: 556). At least some of Bechyné's genera have the same biology and larval morphology as *Altica* (McGregor *et al.*, 1996; Takizawa 2005), and all have similar adult morphology (Scherer 1962). However, currently Bechyné's genera remain separated from *Altica*, so the total number of *Altica* species is only about 235. These valid species of *Altica* are distributed as follows: North America 68, 67 unique to region (Riley, Clark & Seeno 2003); Central and South America c. 45 (Scherer 1962; Santisteban 2006); Palaearctic including Arabia and north Africa 73 (Döberl 2010a); Sub-Saharan Africa 39 (Biondi & D'Alessandro 2010; Döberl 2010b); South and Southeast Asia 9, 6 unique to region (Scherer 1969; Kimoto 2001; Medvedev 2004, 2009). For Australia, 7 species are listed, 5 unique to the region (Heikertinger & Csiki 1939). This last is an overestimate; our examination of types and abundant recent material (more than 1800 specimens) reveals only 4 Australian species, two endemic. Australia is similar to the neighbouring biogeographical region to the northwest, Indo-Malaysia, in the low endemism and low diversity of *Altica* species. Further east, only one species occurs in the southwest Pacific and Polynesia (see below) and *Altica* is absent from New Zealand. The true number of species in southeast Asia is difficult to assess as it is clear that different authors use different species concepts (Kimoto 2000; Medvedev 2009) and almost all published inventories involve misidentifications.

*Altica* is a taxonomically 'difficult' genus because structures generally considered invariable in alticines at species level, such as the postantennal calli, penis, ovipositor and spermatheca, show considerable variation (Kevan 1962; Scherer 1969; Phillips 1979; Kangas & Rutanen 1993; LeSage 1995; Döberl 2010b). The presence of parthenogenetic populations or races was proposed to explain some problem species (Phillips 1979) but there is no evidence for this amongst the species considered here (all with equal male:female ratios). However, related species on distinctly different hosts can easily be hybridised in laboratory conditions (Xue *et al.* 2009) and research on the parasitic bacterium *Wolbachia* in *Altica* provides evidence for interspecies hybridisation in the wild (Xue *et al.* 2011; Jäckel, Mora & Dobler 2013). Some populations of *Altica* are apparently in the process of speciating, including the economically important *A. carduorum* Guérin-Méneville, 1858 (Laroche *et al.* 1996). The above studies suggest that it may not be possible to identify all individuals of *Altica* in areas where species overlap. Host plants of different *Altica* species often co-occur. Host information is of limited use in species discrimination in Europe (Kangas & Rutanen 1993). In contrast, hostplants are used for species diagnosis in the absence of morphological differences in North America (LeSage 1995) and a molecular study of one species there has found a link between genetic variation and hosts (Jenkins *et al.* 2009).

*Altica* species are often commonly collected and widespread, providing abundant material in collections. The morphological species concepts in this genus should therefore be based on assessments of dissections of large numbers of male and female specimens from a wide range of sites, as presented here. From our morphological study of *Altica* in the region, we recognise six species in two informal groups. In each group the diagnostic morphological differences are small or partly overlapping but there is little or no overlap of hostplants, which suggests that hosts are important in speciation.

## *Altica* in the Australopapuan, Pacific and Indomalayan regions

The taxonomic history of *Altica* species in Australia is relatively short. *Altica* was much more broadly defined when its first Australian species was described, *A. splendida* Olivier, 1808, and this seems to be misplaced in *Altica* (see below). For much of its history the name *Altica* has been spelt *Haltica*, following Illiger's emendation (1807). Erichson (1842) described *Haltica corrusca* from Tasmania. Blackburn described three species of *Haltica* in 1889 and two species in 1896 and provided a key to seven of the eight species then understood (Blackburn 1896). Weise (1923) placed *H. australis* (Blackburn, 1889) in synonymy with *H. coerulea* Olivier, 1791, which he claimed was also a synonym of *H. cyanea*, Weber, 1801. This synonymy was partly rejected by Heikertinger & Csiki (1939), who recognised *H. cyanea* as a valid species, but a senior synonym of *H. australis*. The unjustified emendation *Haltica* was dismissed in favour of the original *Altica* in 1994 (Opinion 1754; ICZN 1994).

Two of the eight supposed Australian species can be eliminated from *Altica*. The specimen(s) on which *A. splendida* was based is/are missing from the Olivier collection in Paris (A. Mantilleri, *pers. com.*) and were not included in that part of the Olivier collection sold to Edinburgh (R. Lyszkowski, *pers. com.*), but the description and illustration (Olivier 1808, [*Altica*] plate 3, figure 41) suggest that this was a species of *Sutrea* Baly, 1876, several of which are similar sized, yellowish-red with blue or bluish-black elytra. Such species occur along the east coast of Australia, the origin of early material in European collections. There are no Australian species of *Altica* with both black and red or yellow colouration. This species becomes *Sutrea splendida* (**comb. nov.**), although we acknowledge that without type material it may be impossible to identify within that genus. Examination of the type material of *Altica ferruginis* (Blackburn, 1889) shows it is certainly a species of *Sutrea* and it is hereby removed to that genus, as *S. ferruginis* (Blackburn, 1889), **comb. nov.** Significantly, Blackburn later had doubts about the generic placement of his species (Blackburn 1896: 74). Since *Sutrea* lacks a type species, we hereby designate *S. elegans* Baly, 1876, the first described species, distinguished by size and colouration.

The five remaining species names belong to *Altica*, as currently understood.

Blackburn (1896) revised the *Altica* species based on external characters, particularly colour, elytral sculpture and sculpture of the apical male ventrite. In our experience all of these characters are intraspecifically variable in the Australian *Altica* and the more reliable diagnostic features are genitalic, in both males and females, although these also vary. Based on our dissections of more than 150 *Altica* specimens from more than 40 localities throughout the country, we recognise four species in Australia. Two species have southern distributions and appear to be endemic to Australia (and misidentified elsewhere): *A. corrusca* and *A. gravis* (Blackburn, 1896). Our comparison of types shows that *Altica corrusca*, described from Tasmania, is a senior synonym of *A. pagana* (Blackburn, 1896), **syn. nov.**, described from Victoria and Tasmania. The remaining two Australian species are principally tropical in distribution and therefore might reasonably be considered also to occur in New Guinea and/or the Indonesian archipelago.

In regions neighbouring Australia, descriptions of *Altica* species go back to the eighteenth century (Olivier 1791). These early samples appear to have originated from few collecting localities and of course were poorly described as species, therefore the species have been misinterpreted by later authors. For example, the Indian (Maulik 1926; Scherer 1969), southeast Asian (Kimoto 2001; Medvedev 2009) and Chinese (Gressitt & Kimoto 1963) faunas share species with Indomalaya and the Pacific, but from examination of type material we have discovered that many names are misapplied. This could provide an argument for conserving traditional concepts using the International Code for Zoological Nomenclature (1999), but given the extent of misidentification and the inconsistency in use of the nomenclature by various authors, we consider a complete revision of the nomenclature the best option.

Our study of type material shows that all the common *Altica* species in Indo-malaya have been misidentified. The *A. cyanea* of many authors should correctly be named *A. aenea* (Olivier, 1808), previously considered a junior synonym of *A. cyanea*; the name *A. cyanea* Weber, 1801, should correctly be applied to another species in the region, hitherto referred to as *A. caerulea* (or *A. coerulea*); the name *A. caerulea* (Olivier, 1791) should be applied to the species generally known as *A. brevicosta* (Weise, 1922a), as correctly noted by Kimoto (2001) and Mohamedsaid (2004); the species *A. birmanensis* is valid, but has been misidentified or conflated with *A. cyanea*. All these names have many synonyms, as detailed below. *Altica aenea*, *A. birmanensis*, *A. brevicosta* and *A. cyanea* have also been catalogued as a single species (Gruev & Döberl 1997).

In Australia, *Altica aenea* is a senior synonym of *A. ignea* (Blackburn, 1889), **syn. nov.**, described from the

Northern Territory, and *A. australis* (Blackburn, 1889), as indicated by Weise (1923) and Heikertinger and Csiki (1939), although these authors wrongly used the name *A. cyanea*. *Altica caerulea* is a widespread species in northern Australia which was included by Blackburn (1896) under the name *Haltica gravida*.

In the west and central Pacific region five species have been recorded, but our dissections of extensive material show that only a single species is involved. *Altica aenea* is the correct name for this single species, previously misidentified as *A. corrusca* or *A. gravida* (Allard 1891, 1904; Veitch & Greenwood 1921; Bryant & Gressitt 1957; Samuelson 1973). The species *A. bicolora* (Jacoby, 1904), described from New Guinea as a possible colour variety of *A. pagana*, is also a synonym of *A. aenea* (**syn. nov.**). Our examination of types of *Altica jussiaeae* Gressitt, 1955, described from Palau, shows that this too is a junior synonym of *A. aenea* (**syn. nov.**). The fifth species recorded in the region is based on a single nineteenth century specimen of the Palaearctic (Döberl 2010a) species *A. oleracea* (L., 1758), labelled from New Caledonia (Samuelson 1973). We have not examined this specimen, but given that (i) *A. aenea* is abundant on the island (Samuelson 1973), (ii) the identifier is a competent taxonomist, and (iii) *A. oleracea* has only been collected once, this record should be considered a mislabelled specimen.

One further *Altica* species has been described in the Indomalayan Archipelago: *A. albicornis* Medvedev, 2004, from the mountains of Sulawesi. This species was poorly described, but notably the third antennomere is described as longer than any one of 4–10, and the penis lacking ridges but having a single preapical hollow. Fortunately a photograph of the holotype is available (Bos 2014), which shows that the pronotal basal depression is laterally abbreviated by short longitudinal grooves, there is a row of large punctures at the sides of the pronotum and the postantennal calli are adjacent and triangular. All of these features are typical of the genus *Phygasia* Dejean, 1836 (Scherer 1969; Kimoto 2000; Medvedev 2009), to which this species is therefore transferred, as *P. albicornis* (Medvedev, 2004) **comb. nov.**

In summary, only six species exist from Sumatra to Fiji, including Australia. Based on external and internal morphology these can be divided into two informal groups: *A. aenea* species-group, including *A. aenea*, *A. birmanensis*, *A. corrusca*, and *A. cyanea*; and *A. caerulea* species-group, including *A. caerulea* and *A. gravida*. The history of the regional literature concerning *Altica* is summarised in Table 1. Adults of all the species are redescribed below.

**TABLE 1.** Corrected names for biological and distributional literature, concerning *Altica* species from South Asia to the central Pacific.

Reference	published name	probable correct name(s)
Adam & Pescott 1932	<i>pagana</i>	<i>corrusca</i>
Alam & Karim 1980	<i>foveicollis</i>	<i>aenea?</i>
Bryant & Gressitt 1957	<i>corrusca</i> & <i>A. gravida</i>	<i>aenea</i>
Döberl 2010a	<i>cyanea</i>	<i>aenea</i>
	<i>caerulea</i>	<i>birmanensis</i> , <i>A. caerulea</i> & <i>A. cyanea</i>
Elliott <i>et al</i> 2002	<i>pagana</i>	<i>corrusca</i>
French 1913	<i>pagana</i>	<i>corrusca</i>
Gressitt & Kimoto 1963	<i>brevicosta</i>	<i>caerulea</i>
	<i>coerulea</i>	<i>aenea</i> , <i>A. birmanensis</i> & <i>A. cyanea</i>
	<i>cyanea</i>	<i>aenea</i> , <i>A. birmanensis</i> & <i>A. cyanea</i>
Gruev & Döberl 1997	<i>cyanea</i>	<i>aenea</i> , <i>A. birmanensis</i> , <i>A. caerulea</i> & <i>A. cyanea</i>
Gruev & Doberl 2005	<i>coerulea</i>	<i>birmanensis</i> , <i>A. caerulea</i> & <i>A. cyanea</i>
Hawkeswood 1988	<i>corrusca</i>	<i>aenea</i> &/or <i>A. caerulea</i>
Hawkeswood & Furth 1994	<i>corrusca</i>	<i>aenea</i> &/or <i>A. caerulea</i>
Jyala 2002	<i>himensis</i>	<i>himalayensis?</i>
Kimoto 2000	<i>birmanensis</i>	<i>birmanensis</i> & <i>A. aenea</i>

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**TABLE 1.** (Continued)

Reference	published name	probable correct name(s)
	<i>coerulea</i>	<i>caerulea</i> & <i>A. birmanensis</i>
	<i>cyanea</i>	<i>aenea</i>
Kimoto 2001	<i>coerulea</i>	<i>caerulea</i> , <i>A. cyanea</i> & <i>A. birmanensis</i>
	<i>cyanea</i>	<i>aenea</i>
	<i>elongata</i>	<i>caerulea</i>
Kimoto & Takizawa 1973	<i>A. cyanea</i>	<i>A. aenea</i> &/or <i>A. birmanensis</i> &/or <i>A. cyanea</i>
Lee & Cheng 2007	<i>cyanea</i>	<i>aenea</i>
Maulik 1926	<i>coerulea</i>	<i>aenea</i> , <i>A. birmanensis</i> & <i>A. cyanea</i>
	<i>A. cyanea</i>	<i>aenea</i> , <i>A. birmanensis</i> & <i>A. cyanea</i>
Medvedev 2009	<i>brevicosta</i>	<i>caerulea</i>
	<i>coerulea</i>	<i>birmanensis</i>
	<i>cyanea</i>	<i>aenea</i>
Naples & Kessler 2005	<i>cyanea</i>	<i>aenea</i>
Napompeth 1991	<i>foveicollis</i>	<i>aenea</i> ?
Nayek & Banerjee 1987	<i>cyanea</i>	<i>aenea</i>
Rose <i>et al</i> 1985	<i>cyanea</i>	<i>himalayensis</i>
Samuelson 1973	<i>corrusca</i>	<i>aenea</i>
	<i>jussiaeae</i>	<i>aenea</i>
Scherer 1969	<i>brevicosta</i>	<i>caerulea</i> & <i>A. bicosta</i>
	<i>coerulea</i>	<i>birmanensis</i> , probably also <i>A. aenea</i> and/or <i>A. caerulea</i>
	<i>cyanea</i>	<i>aenea</i>
Singh <i>et al.</i> 1986	<i>caerulea</i>	<i>himalayensis</i>
Takizawa 1978	<i>cyanea</i>	<i>aenea</i>
Veitch & Greenwood 1921	<i>gravida</i>	<i>aenea</i>
Vestjens 1979	<i>ignea</i>	<i>gravida</i>
Xiao-Shui 1990	<i>cyanea</i>	<i>aenea</i>
Zhang <i>et al</i> 2006	<i>brevicosta</i>	<i>caerulea</i>
	<i>coerulea</i>	<i>aenea</i> ?
	<i>cyanea</i>	<i>aenea</i>

### Biology of *Altica* species

Adult *Altica* species are relatively weak jumpers (Schmitt 2004) but with their dark metallic colours and conspicuous diurnal swarming behaviour are likely to be strongly chemically protected (Phillips 1977), although there are surprisingly few studies of the defence system (Deroe & Pasteels 1982; Carruthers *et al.* 2011). *Altica* species may be monophagous or polyphagous. They may occur in huge numbers, altering plant succession in dynamic habitats (Bach 1994). Adults also swarm on non-hosts (Vestjens 1979) and may be associated with damage caused by other organisms, causing confusion in host records. For example, we were informed of damage by swarming *Altica* to *Eleocharis* (Cyperaceae) in a swamp on the Murray River, June 2014. The *Altica* was identified by us as *A. aenea*, which appears to feed only on *Ludwigia* (Onagraceae), so we queried the host record. A closer examination of the damage to the *Eleocharis* by the correspondent showed that it had been made by grazing kangaroos or horses; *Altica*-damaged *Ludwigia* was found nearby. The tussocks of *Eleocharis* were relatively elevated compared with nearby vegetation and clearly acted as focal points for the swarms of *A. aenea*.

The general life cycle of *Altica* is atypical for alticines as the larva is an external feeder: eggs are laid in loose clusters on the hostplant; larvae feed on leaves; pupation is in soil; adults feed on leaves of the larval host but may visit floral nectaries of unrelated plants. All life stages of *A. birmanensis* have been photographed (Lee & Cheng 2007) and the larva described (Takizawa 1978). The immature stages of *A. cyanea* described and illustrated by the same authors are probably *A. aenea*, based on the foodplant. Larvae of the two endemic Australian species of *Altica* are undescribed. Larvae of *Altica* species worldwide show little variation and the Australian larvae examined by CAMR are similar to their well-described Holarctic counterparts, as reviewed by Hua *et al.* (2013), with a full complement of dark tubercles and prominent blunt-tipped setae.

The major organisms causing mortality of larvae appear to be Pentatomidae and Tachinidae, but others include Braconidae, Ichneumonidae, Miridae, Sarcophagidae, Nematoda and fungi (Phillips 1977; de Souza Lopes & Achoy 1986; Cox 1996; Schwenke 1999). *Altica* larvae are toxic to some predacious Carabidae (Phillips 1977). Adult specimens often carry *Laboulbenia* fungal parasites and the appendages may be heavily encrusted (photographed in Lee & Cheng 2007: 130; *pers. obs.* CAMR), but the host records provided by Balazuc (1988) may be misidentifications.

The range of host plants of *Altica* species worldwide is enormous (Jolivet 1991; Clark *et al.* 2004), with many northern hemisphere species associated with trees and woody shrubs. A single species occurs on woody shrubs in western Indo-Malaya (*A. cyanea*), but in Australia and the west Pacific, *Altica* species are recorded feeding only on annual and perennial herbs (with one exceptional record). There is a large literature on the biology of *Altica* species in the region covered here, but descriptions of individual species' biology may be based on misidentifications or erroneous synonymy (for example: Hawkeswood 1988; Kimoto 2000; Lee & Cheng 2007). The endemic Australian species have not been studied in detail, but their life histories are unlikely to deviate significantly from south and east Asian species (Dubey 1981; Singh, Rose & Gautam 1986; Nayek & Banerjee 1987; Lee 1992; Kimoto & Takizawa 1994; Shah & Jyala 1998; Jyala 2002; Lee & Cheng 2007; Zhang, Ge & Yang 2007). Note that in most of these studies the *Altica* species is wrongly named (Table 1).

**TABLE 2.** Distribution and host information for *Altica* species in southeast Asia to the central Pacific.

	Pacific, east of New Guinea	Australia	Tasmania	west of New Guinea	Haloragaceae	Onagraceae	Melastomaceae	Polygonaceae
<i>A. aenea</i>	X	X		X		X		
<i>A. birmanensis</i>				X				X
<i>A. corrusca</i>		X	X		X	X		
<i>A. cyanea</i>				X			X	
<i>A. caerulea</i>		X		X		X		
<i>A. gravida</i>		X	X		X			

Worldwide, several *Altica* species have been suggested for biocontrol of pasture or aquatic weeds, for example *A. carduorum* Guérin-Méneville, 1858, on *Cirsium arvense* (Wan *et al.* 1996) and *A. lythri* Aubé, 1843, on *Lythrum salicaria* (Batra *et al.* 1986). Some *Altica* species are pests, including the European *A. ampelophaga* Guérin-Méneville, 1858, on *Vitis* (Picard 1926), and several pest species in North American horticulture (Clark *et al.* 2004). *Altica* species are of slight significance in the Australian region. *Altica corrusca* is a pest of strawberry (*Fragaria*) in Victoria (French 1913; Adam & Prescott 1932) and occasionally a pest of cultivated Onagraceae in gardens. *Altica aenea* (as *A. cyanea*), is a possible biological control agent of onagraceous weeds in irrigated rice (*Oryza*) (Dubey 1981; Nayek & Banerjee 1987; Xiao-Shui 1990; Naples & Kessler 2005). *Altica* species have been collected on *Oryza* (rice), in Australia (label data), Fiji (Bryant & Gressitt 1957) and Timor Leste (label data), but there is no published confirmation in any study of rice pests that plants are damaged, whereas *Ludwigia*, a common weed in rice padi, is a definite host of *Altica* species. We suspect that all records of *Altica* on *Oryza* are of non-feeding individuals. However, *A. aenea* has been recorded causing damage to leaves of a *Citrus* species in Kakadu

National Park, Northern Territory (label data), so the range of plant hosts may widen in outbreak conditions. Despite these occasional exceptions, hostplants are a useful guide for the identification of *Altica* species (Table 2).

Perhaps the most interesting observation on the biology of *Altica* in Australia is the toxicity of adults and larvae of '*A. ignea*' (probably *A. aenea*) to mosquito larvae in the Brisbane area (Hamlyn-Harris 1930). Hamlyn-Harris recorded that naturally released secretions from abundant adults and larvae, dislodged or swimming in the water around their emergent *Ludwigia* hosts, killed *Culex* larvae.

## Methods and abbreviations

There is a considerable body of morphological literature for the alticines, often explicitly dealing with *Altica* (for example, Maulik 1926; Kevan 1962; Scherer 1969; Samuelson 1973; Philipps 1979; Döberl 1986, 2010b; Konstantinov 1987, 1998; Reid 1988, 1992; Kangas & Rutanen 1993; Furth & Suzuki 1994). However, there has been little consistency in the terminology for some structures of the head and female genitalia.

The following head structure nomenclature is largely based on Samuelson (1973) as modified by Reid (1988), but incorporates the more recent idea of naming various facial grooves (Konstantinov 1998). Compared with its sister-group, Chrysomelinae, the anterior of the galerucine head capsule is compressed towards the midline, by the migration of the antennal sockets in that direction. In Chrysomelinae the antennal insertions are strongly anterolateral and there are no tubercles or median ridges (Reid 2014). In most Galerucinae, typified by *Altica*, the *frontoclypeal suture* is not clearly indicated but is suggested by slight grooves or differential sculpture and there is a *frontoclypeal median ridge* extending anteriorly from between the antennae (Figs 8–14). The frontoclypeal median ridge is probably entirely derived from the clypeus but since the frontoclypeal suture is generally effaced it makes most sense to refer to the ridge as frontoclypeal. It is not frontal. Posterior to the antennae there is usually a pair of *postantennal calli*, which are flattened tubercles, often poorly delimited but always divided along the midline. On each side, between the callus and antennal socket and the eye, there is a raised area more or less continuous with the convexity of the eye, the *orbit*, which merges anteroventrally with the gena. Dorsally the orbit may be separated from the vertex by a *supraorbital sulcus* which may fork at its junction with the postantennal callus to produce a *supracallar sulcus* and a *laterocallar sulcus*, but all of these sulci are often poorly defined or absent. The word 'supracallinal' (Konstantinov 1998) is incorrectly formed from callus. Posterior to the junction of these calli there is one or more large setose punctures, the *supraorbital trichobothria*, in which the puncture is sharply defined and the seta is inserted on a raised stub. The antennal sockets have narrow elevated margins but are often set in a depression, an *antennal fossa* between the clypeus, callus and orbit.

Sternite VIII of the female of most, if not all, Galerucinae has an elongate basal median projection, the *spiculum ventrale*, a common feature in Phytophaga generally (Leschen & Beutel 2014). In *Altica* and many other alticines (Reid 1988, 1992) this projection is a strongly sclerotised narrow rod, with the sclerotisation extending towards the apical edge of sternite VIII, but separated from the weakly sclerotised and setose apical margin by the relatively unsclerotised membranous remainder of the sternite (Figs 30–31). This isolated rod, part of which is the true spiculum ventrale and part of which is the rest of sternite VIII, has been named the *tignum*, although in Galerucinae there is a continuum of variation from a well-defined isolated rod to uniform sclerotisation of sternite VIII, including a short flat spiculum (Reid 1992; Reid & Nally 2008). In *Altica* the tignum is distinct and provides useful characters for separation of species, including the paired branches at the point of contact between spiculum and sternite 8 proper, and the shape of tignum distal to this.

Several measurements are useful for species discrimination, especially of the head and female genitalia. On the head, we have used: eye length, greatest diameter of the slightly oval eye; genal length, narrowest distance between lower margin of eye and buccal cavity; interocular distance, shortest distance between the eyes across the frontoclypeus; head width, greatest width of the head including eyes; neck width, width of the head posterior to the supraorbital sulcus. These provide ratios as follows: EG = eye length to genal length; IE = interocular distance to eye length; HG = head width to genal length; HN = head width to neck width; NE = neck width to eye length. Ratios are expressed to the nearest 0.05. Other simple measurements include body length, length and width of vaginal palpi (measured from where they are joined at the base of the inner edge), length of tignum, length of penis. All measurements in this study were made with an eyepiece micrometer. Measurements are expressed to the nearest 0.05mm.

Abbreviations of collections: Australian Museum, Sydney (AMS); Australian National Insect Collection,

Canberra (ANIC); Bishop Museum, Hawai'i (BMH); California Academy of Science, San Francisco (CAS); Department of Agriculture, Northern Region, Broome (DAB); Department of Agriculture, Northern Region, Darwin (DAD); Museum of Comparative Zoology, Harvard (MCZ); Natural History Museum, Paris (MHNP); Museum of Victoria, Melbourne (MVM); Museum of Zoology, Bogor (MZB); Natural History Museum of Denmark, Copenhagen (NHMD); Natural History Museum, London (NHML); National Museum of Scotland, Edinburgh (NMSE); Queensland Museum, Brisbane (QMB); Queensland Department of Primary Industries, Mareeba (QPDIM); Royal Ontario Museum, Ontario (ROM); Royal South Australian Museum, Adelaide (SAM); University of Queensland Insect Collection, Brisbane (UQIC, now in QMB); Zoologische Museum, Berlin (ZMB). Other abbreviations: ck, creek; rd, road; fr, flora reserve; hs, homestead; hwy, highway; ICZN, International Committee for Zoological Nomenclature; id(s), island(s); mi, miles; mt, mount; mtn(s), mountain(s); np, national park; nr, near; r, river; ra, range; rf, rainforest; sf, state forest; sta, station; vy, valley; xing, crossing.

More than 1850 specimens of *Altica* were examined for this study. To save space, label data is reduced to basic locality (with co-ordinates if given), plus host if available, for the commonest species *A. aenea* (almost half of all specimens). Many collection sites are old place names in New Guinea. We found Anonymous (2010) particularly useful for determining their locations. Biological information from the label data is summarised in the notes under each species. Dissected males and females are indicated by an asterisk (\*) in the lists of material examined.

## Systematics

### *Altica* Geoffroy 1762: 244

Type species. *Chrysomela oleracea* Linneus, 1758, by subsequent designation (Latreille 1810; Riley, Clark & Seeno 2003; Döberl 2010a).

= *Haltica* Illiger 1807: 59 (unjustified emendation of *Altica*: ICZN 1994)

= *Graptodera* Chevrolat 1836: 388.

Type species: *Chrysomela oleracea* L., 1758, by subsequent designation (Chevrolat 1845; Bousquet & Bouchard 2013).

Authorship of *Altica* is attributed to Geoffroy, not Müller (Opinion 1754, ICZN 1994). The complete generic synonymy of *Altica* is listed by Riley, Clark & Seeno (2003) and Döberl (2010a), but only two secondary synonymic names have been used in the Australian region as noted above: one invalid, the other an objective synonym.

**Generic diagnosis.** The following diagnostic description is based on the Australian, Indomalayan and Pacific species.

Moderately large amongst regional alticine genera, length 4.2–7.3 mm. Black (legs may be entirely red or reddish in teneral specimens, and one mature specimen of *A. aenea*), dorsal surface with metallic blue, purple, green, coppery or bronze hues (sometimes without metallic reflection in *A. corrusca* & *A. grävada*), venter and legs less strongly metallic; antennae varying from entirely dark to basal segments orange to red; mandibles with apical band of reddish-orange to dark brown. Body elongate-ovate, length 2–2.5x width; elytra rounded at sides, width at humeri 1.5–1.6x width pronotum and c. 1.8x width head. Dorsal puncturation generally sparse and shallow, interspaces >> puncture diameters. Dorsum mostly glabrous, except patches of short setae present at sides and anterior of head, a pair of trichobothria at anterior of vertex, and a trichobothrium at each corner of pronotum; elytra with minute setae, adpressed to surface, only visible at high magnification. Prothoracic venter mostly glabrous, with setae at posterior edge of prosternum and prosternal process; mesoventrite process glabrous, but remainder of mesothoracic venter, metathoracic venter, abdomen and legs almost entirely densely pubescent.

**Head.** Face with slightly convex profile; eyes laterally prominent, with straight or feebly concave inner margins; minute inter-ommatidial setae present; vertex smooth, without median groove, but often with small medial swelling at posterior of postantennal calli; sulci at upper margins of calli and posterior part of orbit absent or shallow but posterior margin of orbit abruptly elevated; orbit broad and convex between eye and postantennal calli, as wide or almost as wide as antennal socket, tapering in width to gena; frons with pair of well-defined large and triangular to quadrangular postantennal calli which almost touch posteriorly; frontoclypeal median ridge prominent, separating calli at base and extending anteriorly to elevated clypeal anterior margin; lateral margins of

frontoclypeal area, anterior to antennal sockets, not elevated; interantennal space 0.8–1.5x socket diameters, sockets approximately level with middle of eyes and separated from them by 0.5–1x socket diameters, antennal fossa separated from calli and antennal sockets by a punctate groove or depression; posteriorly not defined by a groove, anteriorly not extending to interantennal space; antennae 11-segmented, length 0.5–1x body length; all antennomeres elongate, 1  $\leq$  2x length 2, 2 shortest, ovoid, 3 much longer than 2, 4 usually equal longest with 11; labrum with 2–5 pairs of discal setae, distribution often asymmetric, apical margin truncate to slightly concave; mandible with three apical teeth and angulate internal margin; apical maxillary palpomere conical, as long as but narrower than preapical; gena 0.1–0.2x eye length, with or without transverse setose ridge between eye and buccal cavity.

*Thorax.* Prothorax distinctly broader than head and much narrower than elytra (c.0.7x width elytra at humeri), broadest at base or middle; sides of pronotum slightly convex; anterior and sides of pronotal disc often shallowly depressed or dimpled, sometimes asymmetrically; arcuate patch of deep glandular punctures clustered near anterior angles, with most punctures on anterior part of arc; pronotum transversely depressed anterior to basal margin, the depression sinuous, usually sharply defined and almost reaching lateral margins where it merges with narrow lateral explanation; area between transverse groove and basal margin (*basal field*), usually sculptured differently from pronotal disc; pronotum without two short longitudinal grooves cutting across basal field, but sometimes shallowly depressed between transverse depression and basal margin; anterior and posterior angles each with trichobothrium, anterior angles rounded, slightly swollen (pronotal callus) with setae preapically inserted on callus, posterior angles 90° or slightly projecting laterally; pronotum with distinct raised border present basally and laterally, but absent anteriorly; hypomeron without groove near lateral margin; prosternal process slightly convex, elongate, slightly expanded at tip, transversely grooved at base; procoxal cavities broadly open, gap as long as hypomeral process or wider; scutellum triangular to semi-ovate; elytra convex in cross-section, covering abdomen, subparallel or slightly expanded from humeri to  $<2/3$  length, non-striate, without transverse posthumeral depression; epipleuron distinct, entirely laterally visible, gradually narrowed from base to apex, with upper margin continuous to elytral apex; fully winged, wing with single vein in medial field, leading off elongate basal cell; mesoventrite not covered by metaventrite, with paired cavities at anterior edge (procoxal rests); mesoventrite process exposed, quadrate to elongate, apex bilobed, surface usually longitudinally ridged; metendosternite with triangular basal stalk (apical angle about 70°) and thin arms with unlobed apices; mid coxae separated by much less than width of coxa; pro- and mesofemora almost parallel-sided, metafemur larger, greatest width c. 1.2x width mesofemur, dorsal margin evenly convex, ventral margin almost straight; metafemoral endosclerite large, almost half length metatibia, with basal stalk at least as long as tightly coiled spring; tibiae without apical excavation on outer edge; anterior tibia expanded to apex, more so in male; metatibia not prolonged beyond tarsal insertion (insertion apical), without rows of spines; each tibia of both sexes with one small simple apical spur, inserted on inner side of apex, spur half apical tibial width or less; length hind tarsus c. 0.7x length hind tibia; first hind tarsomere slightly shorter than 2+3; third tarsomere deeply bilobed; apical metatarsomere not arched or inflated; tarsal claws appendiculate, appendage right-angled, or almost so, and shorter than half claw length. *Abdomen.* Pygidium rounded at apex, without longitudinal median sharp-edged groove; abdominal ventrites free, not fused; surface ventrite I evenly convex, without median ridges; ventrites II–IV not laterally bordered or keeled; male ventrite V of male with median flat convexly margined lobe; apex female ventrite V evenly convex; penis symmetrical, apex entire, base without recurved lobes; endophallus with two long strongly sclerotised rods, in basal half of penis in repose; tegmen Y-shaped; ovipositor with well-developed strongly sclerotised but thin rod-like tignum on mostly membranous sternite 8; vaginal palpi one-segmented, with internal apodeme as long as or longer than everted portion of palp; spermathecal receptaculum C-shaped, collum U-shaped, with base of ‘U’ slightly kinked to strongly convoluted, insertion point of spermathecal gland swollen as a round or transversely ovate appendage to base of collum.

**Notes.** *Altica* is easily recognised in the regional fauna by the diagnostic characters listed above, especially colour, procoxal cavities, ventral pubescence, thoracic sculpture, elytral sculpture and leg morphology. The structurally most similar genera are: *Agasicles*, in which the single species (exotic) in this region is striped black and yellow; and *Sutrea*, which has strongly expanded hind femora, lacks a well-defined pronotal transverse groove, and has the hind tibial spur inserted outside the base of the tarsus. In Australia, *Sutrea* species are never uniformly metallic.

The features used by many authors to discriminate species of *Altica* were reviewed by Kangas & Rutanen

(1993), following Kevan (1962) and others. They included: colour, puncturation, microreticulation, facial sculpture, mandibles, elytral sculpture, relative size of tarsomeres, penis, vaginal palpi, spiculum ventrale, spermatheca. The authors found each to be of limited use, as none was comprehensively diagnostic for the 12 species in Finland. The authors also found occasional abnormal specimens which defied identification from external characters. The most recent review of *Altica* morphology (Döberl 2010b) has added new characters: development of the pronotal groove, shape of external face of tibia, and structure of the apical lobe of male ventrite V (named the *hemicyclus* by Döberl).

The characters listed by Kangas & Rutanen (1993) and Döberl (2010b) were applied to the Australian and regional specimens, as well as a few other characters based on the experience of CAMR with galerucine genera (for example, Reid 1988, 2003; Reid & Nally 2008). A limited range of dorsal colours was shown by the six *Altica* species studied, with a predominant hue in each, but some variation present. For example, 59 of 76 *A. corrusca* examined were dark blue, but 11 were dark green, 3 dark purple, 2 bicoloured with blue anterior and green elytra, and one bicoloured asymmetrically with one elytron green and one dark purple. The colour of the first antennomere was useful: all examined mature specimens of *A. caerulea*, *A. corrusca* and *A. gravida* had the first antennomere black or with at most a small red apical spot, all specimens of *A. aenea* had at least the apical quarter of the antennomere dark red to orange; but in *A. cyanea* both colour states were present. Eye size and head width were useful (Tables 3–4). Facial sculpture provided some useful information, particularly the development of the postantennal calli, median longitudinal carina and anterior clypeal ridge, but it was difficult to define accurately, and was intraspecifically variable. Antennomere shapes and ratios were not significant; all the *Altica* species typically had antennomere 4 longer than 3, and 3 longer than 2, but with rare anomalous specimens (for example, one specimen out of 30 *A. corrusca* examined showing antennomere 3 slightly longer than 4). The number of labral setae was frequently asymmetric and not useful. The labral tormae in single specimens of each *Altica* species showed differences but were also asymmetric therefore we suspect this character is variable (Figs 15–18). The mandibles of single specimens of each *Altica* species were virtually identical. Puncturation of the *Altica* species was found to be interspecifically similar and intraspecifically variable, with each species showing a wide range of puncture sizes and densities. Microsculpture on the dorsal surface was an important discriminant for *A. caerulea* and *A. gravida*. The presence or absence of a longitudinal fold on the elytra was not universal within a species, difficult to characterise, and variable in strength (including some specimens with multiple longitudinal folds). The degree of convexity of the external surface of the mid tibia was useful, although difficult to define. Relative length of tarsomeres was almost constant. The male ventrite V apical lobe (*hemicyclus*) showed no obvious interspecific variation, in contrast to African species (Döberl 2010b) and was generally hard to see, being obscured by setae. The shape of the vaginal palpi provided discrimination of the species into two groups. Primary sexual characters were most useful as species discriminants, but the spermatheca was too variable for species diagnosis. The best character for discriminating males was the shape and surface sculpture of the penis. The best character for discriminating females was the shape of the tignum.

### Key to Australian, Indomalayan and southwest Pacific species of *Altica* Geoffroy

Note: specimens of *Altica aenea*, *A. birmanensis*, *A. corrusca* and *A. cyanea* are only reliably separated by careful examination of the genitalia, and some females of *A. aenea* and *A. birmanensis* may not be distinguishable at all. Host plants and distribution may provide useful diagnostic information (Table 2).

1. Eyes relatively smaller (Figs 8–10, 12–13), EG <7.5 (usually <7), IE >1.15 (usually >1.25), HG <16 (7.5–15.3); elytra (Figs 1–3, 5–6) without lateral ridges, or with short keel (usually weak) from humerus to middle; dorsum usually deep blue, less commonly bronze, purplish, dark green or with blue pronotum and green elytra; penis (Figs 23–24, 27–28) shorter, 1.5–2.15mm, without ridges on venter; vaginal palpi (Figs 30, 47–51, 54–57) less elongate, length  $\leq 1.5 \times$  width (elytra & hypomeron not microreticulate) . . . . . 2
- Eyes relatively larger (Figs 11, 14), EG >7 (usually >8), IE <1.25 (usually <1.15), HG >16 (17–22.2); prominent longitudinal ridge (sometimes additional ridges in females), usually present on elytra (Figs 4, 7) from humerus to 2/3 length of elytron, rarely absent; dorsum usually bronze-green to greenish-blue, rarely purplish or dark blue; penis (Figs 25–26, 29) longer, 2.25–2.5mm, strongly transversely or obliquely ridged on dorsum and venter; vaginal palpi (Figs 31, 52–53, 58–61) more elongate, length  $\geq 1.5 \times$  width (first antennomere usually entirely dark; outer face of midtibiae flat; habitat in wetlands) . . . . . 5

- 2(1) External face of midtibia at midpoint convex, often with longitudinal keel as well; penis (Figs 23, 24, 28) usually longer, 1.65–2.15mm, straighter in lateral view, shallowly transversely ridged on middle of dorsal surface (except *A. aenea* in New Ireland); tignum (Figs 32–36, 39–42) with prominent lateral arms (north & east Australia, New Guinea, south and east Asia, west and central Pacific) . . . . . 3
- External face of midtibia at midpoint flat with thin median ridge; penis (Fig. 27) usually shorter, 1.5–1.7mm, more curved in lateral view, without transverse ridges on either face; tignum (Figs 30, 39–40) with broad base and short or absent lateral arms (length 4.2–6.1mm; antennae black, rarely reddish at apex of first antennomere; male eyes relatively small, male EG 3.0–3.3, male HG 7.4–8.6; apex penis not kinked in lateral view; hostplants variable but including non-littoral genera; south-east Australia) . . . . . *corrusca* (Erichson)
- 3(2) Eyes generally larger and more convex (Figs 8–9), male IE 1.20–1.55, female IE 1.2–1.5, female EG 3.5–6.85, female NE 1.93–2.23 (small-eyed forms present in both sexes but infrequent); at least apical quarter of first antennomere orange to reddish-brown, or rarely dark brown (some NW Victorian specimens); anterior of clypeus generally smoother, edge less strongly raised; apicoventer of penis (Fig. 23) with short pair of depressions (0.2–0.25x penis length), apex of penis abruptly bent in lateral view (only slightly so in some New Guinea specimens); tignum usually shorter, 0.85–0.95mm (length 4.6–6.4mm; hostplant *Ludwigia*, in wetlands and the littoral zone; north and east Australia to 37°S, southeast Asia and west Pacific) . . . . .
- Eyes generally smaller (Figs 10, 13), less convex, male IE 1.32–1.85, female 1.4–1.8, female EG 2.9–3.8, female NE 2.33–2.70; first antennomere variable, black or with orange apex; anterior of clypeus generally more rugose or strigose, edge more strongly raised; apicoventer of penis (Figs 24, 28) with longer pair of depressions (0.25–0.3x length), apex of penis straight or almost so in lateral view; tignum usually longer, 0.94–1.35mm (length 5.0–7.3mm; hostplant *Polygonum* or *Melastoma*; absent from Australia and Pacific Islands) . . . . . *aenea* (Olivier)
- 4(3) Anterior of clypeus more rugose (Fig. 13), anterior edge usually sharply ridged; elytra (Fig. 6) without short keel behind humerus; apicoventral depressions of penis (Fig. 28) separated by a sharp ridge, usually also internally finely ridged; vaginal palpi (Fig. 56–57) short, almost ovate, with rounded to truncate apex and straight or convex inner margin; tignum (Fig. 42) with base expanded, broader than stem of apex, and broad triangular lateral arms; host *Melastoma* (length 5.0–6.1mm; heathland, disturbed ground, Malay Peninsula to Java and Borneo) . . . . . *cyanea* Weber
- Anterior of clypeus smoother (Fig. 10), anterior edge flatter; elytra (Fig. 3) usually with short keel behind humerus; apicoventral depressions of penis (Fig. 24) smooth, separated by broad flat ridge (ridge may be medially depressed at apex); vaginal palpi (Figs 50–51) short, almost conical, with obliquely truncate apex and concave inner margin; tignum (Figs 35–36) with thin acute base, narrower than stem of apex, and small triangular or thin lateral arms; host *Polygonum* (length 5.0–7.3mm; wetlands, edge of rainforest, ditches; southeast Asia to Timor and New Guinea) . . . . . *birmanensis* (Jacoby)
- 5(2) Elytra and prothoracic hypomeron duller, microreticulate (Fig. 7); penis (Fig. 29) slightly expanded from middle to apex, apicoventral grooves smooth-edged, lateral ventral ridges fewer, more oblique, subtending <90° at midline; tignum (Figs 43–46) with base broader than shaft and without lateral spurs; palpal apodeme (Figs 58–61) broader, at least 1/3 width base of vaginal palp (length 5.6–7.2mm; usually entirely dark bronze-green; host *Myriophyllum*, in wetlands; Australia, except southwest) . . . . .
- Elytra and hypomeron shining, without microsculpture (but often soiled) (Fig. 4); penis (Figs 25–26) parallel-sided or broadest before apex, apicoventral depressions laterally sharp-edged, lateral ventral ridges more numerous, usually less oblique, subtending approximately 90° at midline; tignum (Figs 37–38) with base as narrow or narrower than shaft, with or without short lateral spurs; palpal apodeme (Figs 52–53) narrower, <1/3 width base of palp (length 5.6–7.0mm; entirely dark blue [typical colour in Indonesia], purplish, or dark green, or bicoloured [common in Australia], with contrasting pronotum and elytra; host *Ludwigia*, in wetlands; north & east Australia to 29°S, southeast Asia to New Guinea) . . . . . *caerulea* (Olivier)

***Altica aenea* (Olivier, 1808) stat. rev.**

(Figs 1, 2, 8, 9, 15, 23, 32–34, 47–49, 62–64, 77)

*Galeruca aenea* Olivier 1808: 646, plate 4, fig. 56 (type locality: Java).

*Haltica aenea*: Heikertinger & Csiki 1939: 247 (as synonym of *A. cyanea* sensu auctt.).

*Altica aenea*: Gressitt & Kimoto 1963: 890 (as synonym of *A. cyanea* sensu auctt.).

*Haltica australis* Blackburn 1889: 1493 (type locality: Northern Territory); Weise 1923: 109 (synonym of *A. cyanea* sensu auctt.).

*Altica australis*: Gressitt & Kimoto 1963: 890 (as synonym of *A. cyanea* sensu auctt.); Scherer 1982: 480 (valid species).

*Haltica ignea* Blackburn 1889: 1494 (type locality: Northern Territory) **syn. nov.**

*Haltica bicolora* Jacoby 1904: 182 (type locality: southeast New Guinea) **syn. nov.**

*Altica jussiaeae* Gressitt 1955: 34 (type locality: Palau) **syn. nov.**

*Altica caerulea* sensu Weise 1923, nec Olivier 1791; Weise 1923: 109.

*Altica cyanea* sensu auctt. nec Weber, 1801; Maulik 1926: 422.

*Altica corrusca* sensu auctt. nec Erichson 1842; Bryant & Gressitt 1957.

**Material examined** (c. 850, \* = specimen dissected). Types: *Altica aenea* (Olivier): Neotype (this designation, see Notes below): ♂/ Java Bogor 26.xii.1964/ J Stusak collector BISHOP/ (BMH); *Altica australis* (Blackburn):

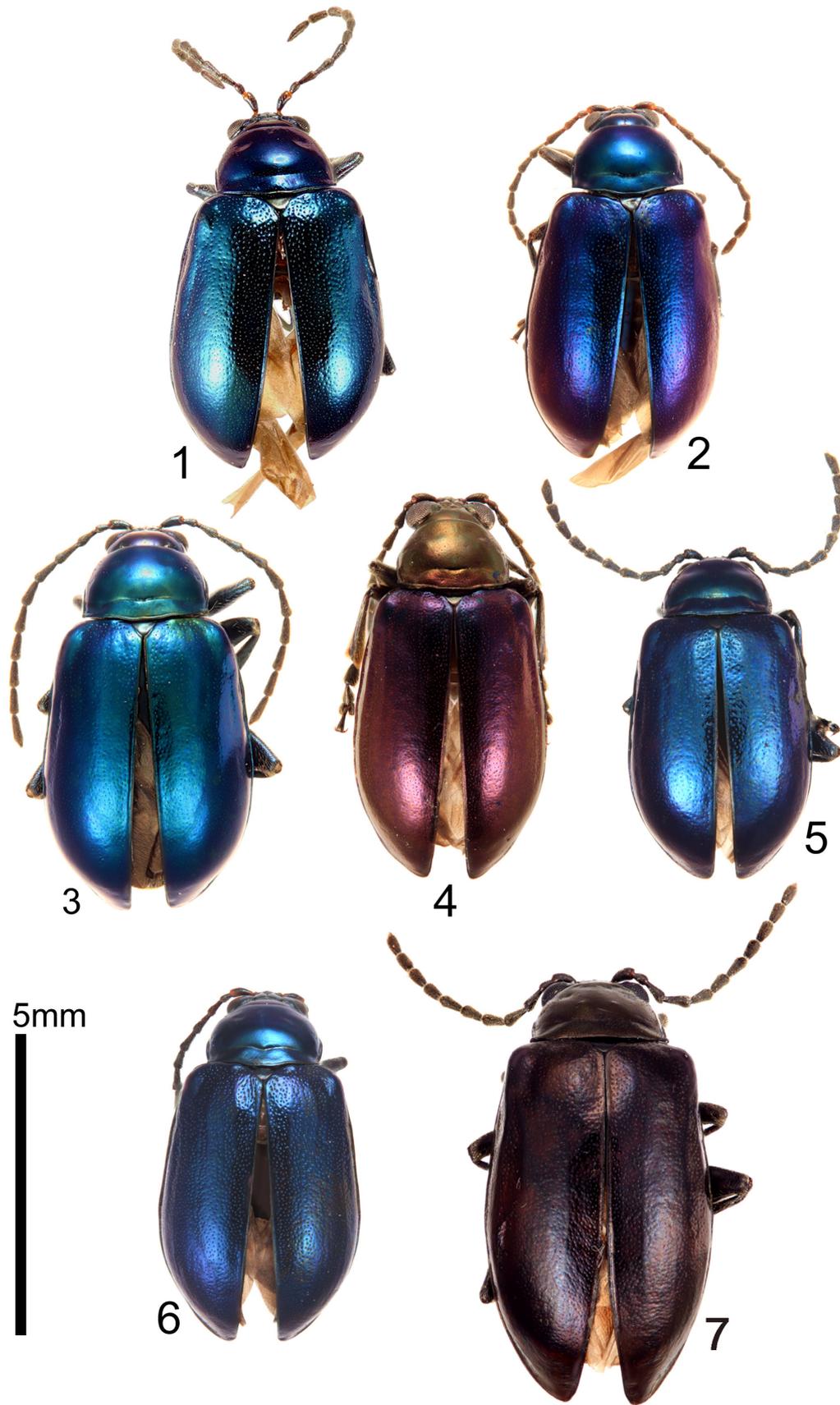
Lectotype (this designation): LH specimen of 2 on card/ N. Territory/ *Haltica australis* Blackb. cotype/ *Haltica australis* Bk N.T. cotype 18152/ (SAM); Paralectotypes (4): 1 same data as lectotype, RH specimen on card (SAM); 2[on shared pin]/ N. Territory J.P. Tepper/ *Haltica australis* Blackb. type/ *Haltica australis* Bk N. Territory type I.3015/ (SAM); 1/ 2514 NT/ *Haltica australis* Blackb. cotype/ (SAM); ***Altica ignea* (Blackburn)**: Lectotype (this designation): LH specimen of 2 on card/ TY/ N. Territory J.P. Tepper/ *Haltica ignea* Blackb. type/ *Haltica ignea* Blackb. N. Territory type I.3017/ (SAM); Paralectotypes (3): 1 same data as lectotype, RH specimen on card (SAM); 2[on card]/ N. Territory/ 2515/ Qu 2515/ *Haltica ignea* Blackb. cotype/ *Haltica ignea* Blackb. N. Territory cotype 18153/ (SAM); ***Altica jussiaeae* Gressitt**: Paratypes (4): ♂/ Yap I., Yap Gr. Caroline viii.1952 NLH Krauss/ paratype *A. jussiaeae*/ (BMH); ♀/ Yap I, Caroline Is, 28–30.iii.1954/ JW Beardsley collector/ paratype *Altica jussiaeae* L Gressitt (BMH); ♂\*/ Bebelthuap, Ngaremeskang, 25m, 20.xii.1952/ Caroline Is Pac. Sci. Bd. JL Gressitt/ paratype *Altica jussiaeae* L Gressitt (BMH); ♂/ Peleliu I, north central Pelew Is, viii.1945/ collected by HS Ducoff/ at light/ paratype *Altica jussiaeae* L Gressitt (BMH).

Non-type material: **Australia: Australian Capital Territory**: Lake Burley Griffin, feeding on *Ludwigia pepaliodes* [sic] *montevensis* (ANIC); 2♂\*/ Weston (ANIC); **New South Wales**: ♂\*/ Allyn R, Chichester SF, 32°08S 151°27E (ANIC); Ashfield (AMS); Barrington Tops, i. 1925, SU Zool Exp. (ANIC); Berkshire Park, leaves *Jacksonia scoparia* (AMS); Bondi (AMS); 1k N Bruinswick Heads (ANIC); Caparra (ANIC); Chiswick, nr Armidale (ANIC); Congo, 35°58S 150°09E (ANIC); Dorrigo (AMS); 26mi NE Grafton (ANIC); Griffith (ANIC); Harrington (ANIC); Kurrajong (AMS); ♂\*♀\*/ Lansdowne, 31°45S 152°31E (AMS); Lightning Ridge (ANIC); ♂\*/ Llandilo, 29.99912S 146.0346E (AMS); Macleay R (ANIC); Maroota, *Ludwigia longifolia* (ANIC); Moree (AMS, ANIC); Mt Annan Botanic Gardens (AMS); Mullimbimby (AMS); 28k S Narooma, infesting *Haloragis exalata* (AMS); Sydney (ANIC); Tea Tree Ck (ANIC); Tooloom Plateau, 28°29S 152°24E (ANIC); Tweed R (AMS, ANIC); Upper Kangaroo R nr Yeola, in rotten wood (ANIC); ♂\*/ Williamtown, ex *Alternanthera filoxeroides* (ANIC); Windsor (AMS); **Northern Territory**: Berrimah (ANIC); ♂\*/ 33k SW Borroloola, 16°16S 136°05E (ANIC); 1k NE Cahills Xing, 12°25S 132°58E (ANIC); Cutta Cutta (AMS); Daly R, 13°41S 130°33E, beaten off *Mimosa* (ANIC); Daly R Mission, 13°31S 138°41E and 13°45S 138°41E (ANIC); Douglas R, 13°45S 131°34E (ANIC); 2♂\*/ E Alligator R, 12°26S 132°57E (AMS, ANIC); ♂\*/ Ferguson R, 14°48S 131°03E & 19°14S 131°50E (ANIC); Gregory NP, 16°07S 130°26E (ANIC); Holms Jungle (ANIC); Jabiru, 12°41S 132°50E (ANIC); Kakadu NP, 13°35S 132°36E (ANIC); ♂\*, Kakadu, S Alligator Resort, 12:40:34S 132:28:41E (AMS, DAD); Keep R NP, 15°45S 129°10E (ANIC); ♂\*♀\*/ Nourlangie Rock, defoliating *Ludwigia* (AMS); 18k E Oenpelli, 12°17S 133°13E (ANIC); Port Darwin (AMS); Sixty Mile (ANIC); Virginia, 12:31:19S 131:13:33E, ex *Ludwigia* (DAD); Yellow Waters, 12°54S 132°31E, *Ludwigia* (ANIC); **Queensland**: Archer R, 13°26S 142°29E (AMS, ANIC); 14mi NW Ayr (CAS); Babinda (ANIC, BMH); Bald Mtn via Emu Vale (UQIC); Ban Ban Ra. (ANIC); Banks Id (AMS); Batavia Downs HS, 12°40S 142°40E (ANIC); 23k NE Bauhinia Downs, 24°24S 149°23E (ANIC); Benaraby (ANIC); ♂\*/ Bertie Ck Xing, 11°50S 142°30E (ANIC); Biggenden (ANIC); Brisbane (QMB); Broken R, 21°10S 148°30E (AMS); ♂\*/ Brookfield (AMS); ♂\*/ Bucasia (ANIC); Bundaberg (BMH); Bunya Mtns (QMB); Burnett R, 24°46S 152°25E (ANIC); Burnett R Gorge, Bundaberg (ANIC); Cairns (AMS, ANIC, BMH, QMB, UQIC); 2♂\*/ Cardstone (AMS); ♂\*/ Carnarvon Gorge NP, 25°3S 148°14E (AMS); Cathedral Fig (ANIC); 15k SW Charleville, 26°32S 146°12E (ANIC); ♀\*, Cloncurry (AMS); Cockatoo Ck Xing, 11°39S 142°27E (ANIC); Condamine (AMS); 12mi WNW Cooktown (ANIC); 21k NW Cooktown, 15°25S 145°03E (ANIC); Coorumba (AMS); Crater Lakes NP, SW Biggenden (ANIC); Cunnamulla (AMS); Dallarnil (ANIC); Danbulla FR, 17°10S 145°39E (ANIC); Deeral (BMH); Dunk Id (ANIC); Eidsvold (ANIC); Eubenangee (ANIC); 6k E Kamma (ANIC); Edge Hill, nr Cairns (ANIC); Fanning R, 18°45S 146°27E (AMS); Finch Hatton Gorge, on *Ludwigia peploides* (ANIC); Garradunga (AMS); Gayndah (AMS); Goondi Hill Swamp (ANIC); Gordonvale (AMS, BMH); 6mi W Gordonvale (CAS); Green Hills (ANIC); Hambleton (BMH); Hann R, 15°14S 144°55E (ANIC); Hell Hole Gorge NP, 25°34S 144°11E (ANIC); 14k NW Hope Vale Mission, 15°16S 144°49E (ANIC); ♂\*/ Ingham (ANIC); Innisfail (ANIC); Iron Ra NP, 12°43S 143°18E (AMS, ANIC, UQIC); Joalah NP, 27°56S 153°12E (ANIC); 3k NNE Julatten, 16°35S 145°22E (ANIC); Kowonyama, Mitchell R (ANIC); Kuranda (AMS, UQIC); ♂\*/ 2m N Kuranda (ANIC); Lake Barrine, 17°15S 145°38E (ANIC); Lakefield NP, 14°44S 144°07E (ANIC); Langi Lagoon, 13°27S 142°42E (ANIC); Lockerbie, Cape York (UQIC); McIlwraith Ra (AMS); Mer Id (BMH); 21k SE Millaa Millaa (ANIC); Milman, 30k N Rockhampton (ANIC); 3♂\*♀\*/ Mission Beach (AMS); Millaa Millaa (AMS); 9k NNW Moonie, 27°39S 150°19E (ANIC); Mt Crosby (AMS); Mt Glorious (ANIC); 10k N Mt Molloy, 16°39S 145°14E (ANIC); ♂\*/ Mt Morgan (AMS); Mt Nebo (ANIC); 2k ENE Mt Tozer, 12°44S 143°43E (ANIC); 3k ENE Mt Tozer, 12°44S 143°44E (ANIC); 9k ENE Mt Tozer, 12°43S 143°17E (ANIC);

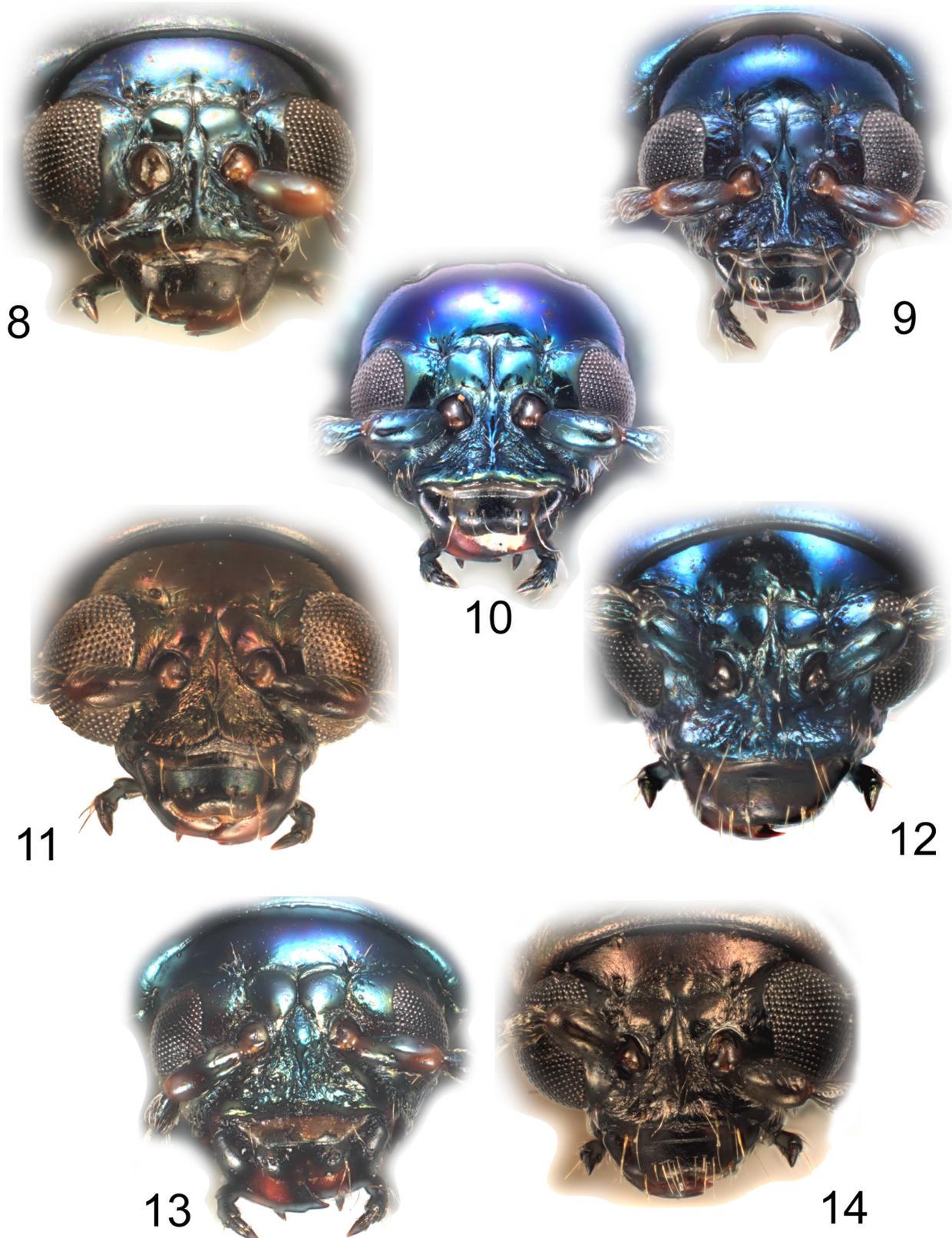
Mourilyan (ANIC); Munduberra (AMS); Mungkan Kandju NP, 13°39S 142°41E (ANIC); Palmerston NP @ 1000' on Tully Rd (ANIC, UQIC); 32k S Ravenshoe, 17°38S 145°29E (ANIC); Stonehenge, W Qld (UQIC); Tamborine (ANIC); 13k NW Taroom, 25°32S 149°45E (ANIC); Tinarro (ANIC); Tin Ck, Cook Hwy (ANIC); Toowoomba (ANIC); Townsville, reared on *Ludwigia* (AMS, ANIC); 10k NE Tully, 17°50S 145°59E (AMS); 12k S Tully, 18°02S 145°54E, on *Psidium guineense* (AMS); Ward R via Charleville (UQIC); ♂\*/ West Claudie R (AMS); White Mtns NP, 20°27S 144°49E (ANIC); Yeppoon (ANIC); **South Australia:** ♂\*/ no locality (AMS); Murray R (AMS); **Victoria:** 3♂\*, ♀\*, Barmah NP, 35°53'24"S 145°02'24"E infesting *Ludwigia peploides*, (AMS), 2♂\*/ ditto, aggregating on *Eleocharis* (AMS); Lake Hattah (ANIC); ♂\*/ Shepparton (AMS); **Western Australia:** ♂\*/ Carson Escarpment, 14°49S 126°49E (ANIC); Croosing Falls, Kununurra, defoliating *Ludwigia perennis* (DAB); Fitzroy R (ANIC); ♂\*/ 12k S Kalumburu Mission, 14°25S 126°38E (ANIC; DAB); 14k SE Kalumburu Mission, 14°25S 126°40E (ANIC); 4k W King Cascade, 15°36S 126°15E (ANIC); Kings Sound (ANIC); Kununurra, ex *Acacia* (DAB); N end Lake Argyle (AMS); ♂\*/ Mitchell Plateau, 14°52S 125°50E (ANIC); Wyndham (ANIC); **Fiji:** ♂\*/ Kadavu (AMS); Koronivia, Viti Levu, one specimen labelled "in rice crop" (ANIC, BMH); ♂\*/ Ovalau (BMH); Vambea, Ono (BMH); Tamavua, Suva (ANIC); **India:** ♂\*/ Jhansi-Chatarpur (ANIC); Rishikesh (ANIC); **Indonesia:** **Java:** Bawean Is (BMH); Bogor (BMH); ♀\*/ Buitenzorg (BMH); **Kalimantan:** Pontianak, Kalimantan Barat (BMH); **Maluku:** Ambon (BMH); Aru Ids (ANIC); Solea, Seram (AMS); **Sulawesi:** ♀\*/ Palolo, Palu (AMS); **Sumatra:** ♂\*/ Bengkulu (AMS); ♂\*/ Kalianda, *Ludwigia* (AMS); Tanjung Morawa (BMH); **Timor:** Balical[unknown], Timor Barat (BMH); Naibonat, West Timor, 10°08'S 123°41E (AMS); **West Papua:** Baliem (BMH); Bokondini (BMH); Enarotadi (BMH); Eramboe (BMH); Guega, W Swart Vy (BMH); ♂\*, Kebar Vy, W Manokwari (BMH); Kulima (BMH); Manokwari (BMH); Merauke (BMH); Moanemani, Kamo Vy (BMH); ♂\*, Sarmi, W to Hollandia (BMH); ♂\*, Sibil Sterrengeb (BMH); ♂\*, Tigi Lake (BMH); Wamena (BMH); **Malaysia:** Bau distr., Sarawak (BMH); Frasers Hill (AMS); Kedah (BMH); ♂\*/ Pahang (BMH); Tenompok, Sabah (BMH); 10k SW Tenom, Sabah (BMH); **Nepal:** ♂\*/ Modi Khola R (ANIC); **New Caledonia:** Bourail (ANIC); La Foa R (AMS); Loyalty Ids, Fayaoue (BMH); Nossirah [Nassiran] (BMH); ♂\*/ Yahoue (BMH); **Papua New Guinea:** Aiyura (BMH); ♂\*/ Amboin (ANIC); Baiyer R (BMH); Banz (BMH); Bosavi (ANIC); Brown R (BMH); Bulolo (BMH); Bultemen [unknown], ex sweet potato (AMS); Cape Rodney (BMH); Daragi [Dorogari] (BMH); Daru Id (BMH); Deria, Amazon Bay (ANIC); ♂\*, Eliptamin Vy (BMH); Feramin (BMH); Fly R (AMS); Finschafen (BMH); Garaina (BMH); Goroka (BMH); Hargen [unknown] (AMS); Huon Peninsula (BMH); Ihu (AMS); ♂\*, Kainantu (BMH); Kerema (BMH); Kiunga, Fly R (BMH); Kokoda (BMH); 2♂\*, Komalabu, New Ireland (AMS); Koroba (BMH); Korgua (BMH); Lae (BMH); ♂\*, 11k NW Lae (AMS); ♂\*, 19k NE Lae (BMH); Lindenhafen, New Britain (BMH); Lufa (BMH); Madang (BMH); ♂\*, 25k SSW Madang (ANIC); Maprik (BMH); Markham R (BMH); Milne Bay (BMH); Moorhead (BMH); Mt Hagen (ANIC); Mt Kaindi (BMH); Mt Kerowagi (BMH); Mt Lamington (AMS); Mt Missim (BMH); ♂\*, Murua R (BMH); Musgrave R, Astrolabe (BMH); M'Waka [unknown] (ANIC); Niokamban [unknown], ex snake beans (DAB); ♂\*, Nondugl, NE Highlands (BMH); Normanby Id (BMH); Okapa (BMH); Olsobip (BMH); ♂\*, Omsis (AMS); Oriomo R (BMH); Oro Bay (BMH); Orokolo (ANIC); Palmer & Black R junction (BMH); Popondetta (BMH); Port Glasgow (BMH); Port Morseby (AMS, BMH); 40k N Port Morseby (AMS); Redscar Bay (BMH); ♂\*, Rouku, Morehead R (ANIC); Star Mtns (BMH); Swart Vy (BMH); Telefomin (BMH); 2♂\*, May R, Upper Sepik Distr. (BMH); ♂\*, Torricelli Mtns (BMH); ♂\*/ Varirata NP (AMS); Wau (ANIC, BMH); Wharton Ra (AMS); Woitape (BMH); 2♂\*, Woodlark Id (BMH); **Philippines:** Tanay (AMS); **Solomon Islands:** ♂\*/ Bougainville Is (ANIC); 3♂\*/ Guadalcanal, Honiara, *Ludwigia* (AMS); ♂\*/ Guadalcanal, Gold Ridge, *Ludwigia* (AMS); San Cristobal (BMH); **Timor Leste:** ♂\*/ Ira Sequero (AMS); 2♂\*/ Los Palos (AMS); **Vanuatu:** Aneilyum (BMH); Efate (BMH); Espiritu Santo (BMH); ♂\*/ Santo (BMH); **Vietnam:** ♂\*/ Bach Ma NP (ROM); ♂\*/ 2k S Ngoc Linh (ROM); Sa Pa (ROM).

**Description.** Length: male 4.6–5.8 mm, female 4.5–6.4 mm.

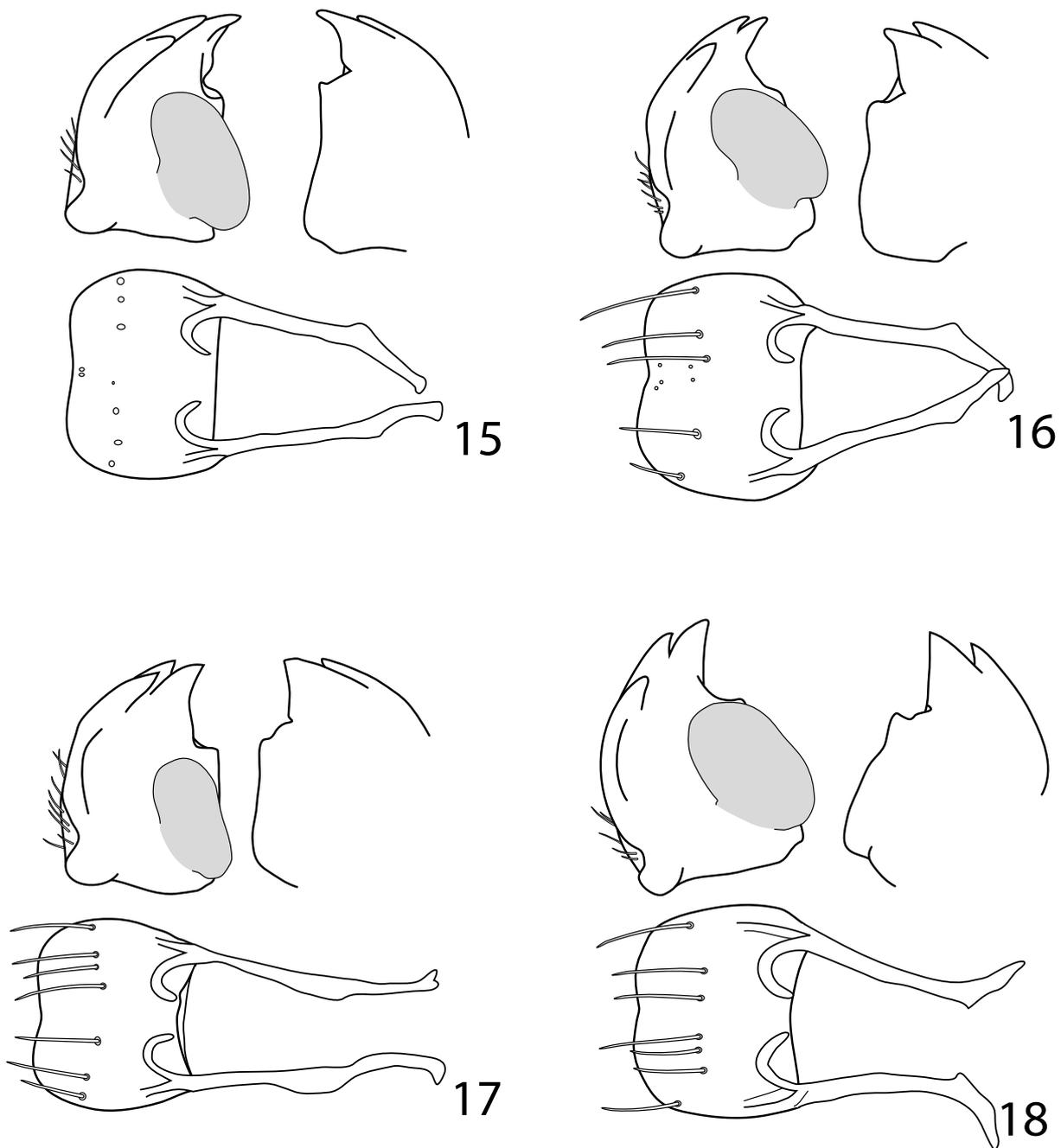
**Colour:** dorsum black, usually with dark blue reflection (especially Indomalaya) but east of Timor and in Australia also commonly dark green, coppery-green, dark bronze, purple, or bicoloured (pronotum contrasting with elytra, or elytral suture and margins contrasting with disc), bicoloured form predominant in east New Guinea, Solomons, New Caledonia & Fiji, rarely non-metallic black; venter and legs black with duller reflection, one dissected male from Sepik River, New Guinea, with entirely red legs, one male from Sumatra with asymmetrically coloured red and black tarsi, teneral specimens often with reddish tibiae and tarsi; first antennomere with apical quarter red (dark brown in some NW Victorian specimens) to wholly red, often antennomeres 2–4 also reddish-brown, remainder of antennae black to brown.



**FIGURES 1–7.** Habitus *Altica* species: 1, *A. aenea* (Olivier) (Australia); 2, *A. aenea* (Sumatra); 3, *A. birmanensis* (Jacoby); 4, *A. caerulea* (Olivier); 5, *A. corrusca* (Erichson); 6, *A. cyanea* Weber; 7, *A. gravida* (Blackburn).



**FIGURES 8–14.** Head *Altica* species: 8, *A. aenea* (Olivier) (Australia); 9, *A. aenea* (Sumatra); 10, *A. birmanensis* (Jacoby); 11, *A. caerulea* (Olivier); 12, *A. corrusca* (Erichson); 13, *A. cyanea* Weber; 14, *A. gravida* (Blackburn).



**FIGURES 15–18.** Mouthparts *Altica* species: right mandible, internal and external views, labrum: 15, *A. aenea* (Olivier); 16, *A. caerulea* (Olivier); 17, *A. corrusca* (Erichson); 18, *A. gravida* (Blackburn).

**Head:** ratios (Tables 3 & 4): **male:** EG 3.30–7.00; IE 1.18–1.53; HG 9.00–15.33; HN 1.07–1.18; NE 2.00–2.50; **female:** EG 3.50–6.83; IE 1.20–1.49; HG 8.70–15.33; HN 1.06–1.19; NE 1.93–2.23; pubescence: a few small setae at inner edge of posterior of orbit, longitudinal row of long setae at sides of frontoclypeal ridge, 2–3 pairs of long setae behind clypeal anterior margin; transverse row of short setae between eye and buccal cavity; face impunctate except minute punctures at bases of setae; vertex with or without microreticulation; postantennal calli smooth, not microsculptured; eyes moderately large and laterally prominent, small-eyed individuals present but infrequent; postantennal calli slightly elongate to transverse, with acute triangular anterior angles and rounded to truncate bases, usually adjacent at base only; frontoclypeal ridge lanceolate, varying from broad and almost flat

to narrow and convex, anteriorly terminating in a short keel before clypeal margin; anterior edge of clypeus generally smooth, weakly raised, sides of clypeus microreticulate, slightly rugose.

**TABLE 3.** Head ratios of male *Altica* species (<sup>1</sup> = 10 specimens; <sup>2</sup> = 5 specimens).

	eye length to genal length ratio (EG)	interocular to eye length ratio (IE)	head width to genal length ratio (HG)	head width to neck width ratio (HN)	neck width to eye length ratio (NE)
<i>A. aenea</i> <sup>1</sup>	3.30–7.00	1.18–1.53	9.00–15.33	1.07–1.18	2.00–2.50
<i>A. birmanensis</i> <sup>1</sup>	2.75–5.14	1.32–1.76	7.73–12.14	1.05–1.13	2.05–2.73
<i>A. corrusca</i> <sup>1</sup>	3.00–3.32	1.58–1.61	7.50–8.50	1.06–1.10	2.36–2.42
<i>A. cyanea</i> <sup>2</sup>	2.80–4.00	1.57–1.82	7.80–10.00	1.00–1.08	2.35–2.66
<i>A. caerulea</i> <sup>2</sup>	7.50–10.00	0.94–1.11	17.00–20.80	1.17–1.22	1.70–1.79
<i>A. gravida</i> <sup>2</sup>	8.33–9.40	1.04–1.21	18.83–20.80	1.22–1.30	1.70–1.95

**TABLE 4.** Head ratios of female *Altica* species (<sup>1</sup> = 10 specimens; <sup>2</sup> = 5 specimens).

	eye length to genal length ratio (EG)	interocular to eye length ratio (IE)	head width to genal length ratio (HG)	head width to neck width ratio (HN)	neck width to eye length ratio (NE)
<i>A. aenea</i> <sup>1</sup>	3.50–6.83	1.20–1.49	8.70–15.33	1.06–1.19	1.93–2.23
<i>A. birmanensis</i> <sup>1</sup>	2.62–4.22	1.48–1.93	7.15–10.89	1.03–1.09	2.33–2.70
<i>A. corrusca</i> <sup>1</sup>	3.00–4.00	1.51–1.72	8.18–10.25	1.06–1.14	2.25–2.58
<i>A. cyanea</i> <sup>2</sup>	3.40–4.00	1.55–1.63	8.80–9.80	1.03–1.06	2.33–2.50
<i>A. caerulea</i> <sup>2</sup>	9.20–10.00	1.00–1.04	17.67–22.50	1.19–1.24	1.76–1.78
<i>A. gravida</i> <sup>2</sup>	7.50–10.00	1.08–1.22	20.40–21.00	1.19–1.28	1.90–2.00

**Thorax:** pronotum evenly convex anteriorly or with pair of shallow depressions behind anterior margin; varying from entirely non-microsculptured to distinctly microreticulate at anterior and basal field and faintly so on disc; non-glandular puncturation variable, from present only as sparse small punctures at basal field, to anterior edge with sparse punctures, basal field with close strigose large punctures (separated by 2–3 diameters) and disc minutely and sparsely punctured (separated by 4–5 diameters at least); hypomeron anteriorly transversely strigose, without microreticulation; prosternum smooth and shining; elytra shining, without microreticulation, usually strongly and closely but irregularly punctured, interspaces mostly 0.5–2x diameters, discal punctures often partly aligned in short rows, sometimes smaller and sparser; elytral laterally smooth behind humeri or weakly keeled to middle; scutellum triangular, microreticulate or shining and smooth; femora densely microsculptured and pubescent; outer face mid tibia with prominent keel for most of length, usually on a convex surface; male first protarsomere distinctly longer than broad, female 1.5–1.7x longer than broad.

**Abdomen:** abdominal ventrites densely microsculptured and pubescent; **male:** penis 1.65–1.95mm long; in dorsal view almost entirely parallel-sided to the rounded apex, which has a short projecting truncate lobe; almost straight in lateral view, with tip (truncate lobe) kinked, least so in some New Guinea specimens; shallowly transversely ridged on middle of dorsal surface (ridges effaced in two dissected males from New Ireland); venter without transverse or oblique ridges, two short apicoventral depressions present, 0.2–0.25x penis length, ovate, smooth surfaced and laterally smooth edged, separated by a broad flat ridge; **female:** tignum 0.85–0.95mm long; tignum with narrow acutely tipped base, narrower than base of apical part, long lateral arms, elongately triangular to threadlike, and broad triangular or spatulate apex; spermathecal collum of variable length and thickness and containing 1–3 twists.

**Distribution and biology.** *Altica aenea* is widespread in tropical Australia, but generally near-coastal, from north Western Australia (Derby) to the east coast, then south to Shepparton, Victoria, and as far west as the southern Murray River, South Australia. Outside Australia, *A. aenea* is found from India and Nepal east through southeast Asia to the west Pacific Islands of Palau, Fiji, New Caledonia and Vanuatu. In New Guinea and south-east Asia this species occurs from sea level to 2000 m.

Based on label data of the specimens examined, *Altica aenea* primarily feeds on *Ludwigia* species throughout its range. A short description of the biology of *A. corrusca* in north Queensland (Hawkeswood 1988), noting that it occurred widely on *Ludwigia*, is almost certainly based on *A. aenea*, but may also include *A. caerulea*. Published records of *A. corrusca* from the Pacific are misidentifications of *A. aenea* and all record it on *Ludwigia* (Bryant & Gressitt 1957; Samuelson 1973). The record of *A. gravida* on *Ludwigia* in Fiji (Veitch & Greenwood 1921), assigned to *A. corrusca* by Bryant & Gressitt (1957), must also be *A. aenea*, as only this species of *Altica* occurs on Fiji (Bryant & Gressitt 1957; BMH; *pers. obs.*, CAMR). However, Vestjens' (1979) study of the biology of *A. ignea* was a misidentification of *A. gravida* (q.v.). The description and illustration of immature stages of *A. cyanea* from Taiwan (Takizawa 1978; Lee & Cheng 2007) is based on a blue species of *Altica* feeding on *Ludwigia*, almost certainly *A. aenea*.



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**FIGURES 19–22.** *Altica* species: 19, *A. gravida* (Blackburn), prothoracic venter; 20, *A. corrusca* (Erichson), thoracic venter; 21, *A. gravida*, pterothoracic venter; 22, *A. gravida*, male abdominal venter.

The most frequently recorded host species is *Ludwigia peploides*, a significant weed in the USA (Harms & Grodowitz 2012) as well as in Asian rice fields. *Altica aenea* (as *A. cyanea*) has been proposed as a biological control agent of *Ludwigia* species in ricefields (Dubey 1981; Nayek & Banerjee 1987; Xiao-Shui 1990). These authors note that larvae are predated by pentatomid bugs. The *A. foveicollis* proposed as a biocontrol agent of

*Ludwigia* in Bangladesh and Thailand (Alam & Karim 1980; Napompeth 1991) is probably also a misidentification of *A. aenea*.

23



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**FIGURES 23–26.** *Altica* species, male genitalia (penis in ventral, dorsal and lateral view): 23, *A. aenea* (Olivier); 24, *A. birmanensis* (Jacoby); 25, *A. caerulea* (Olivier); 26, *A. caerulea*, lectotype of *A. elongata* (Jacoby).



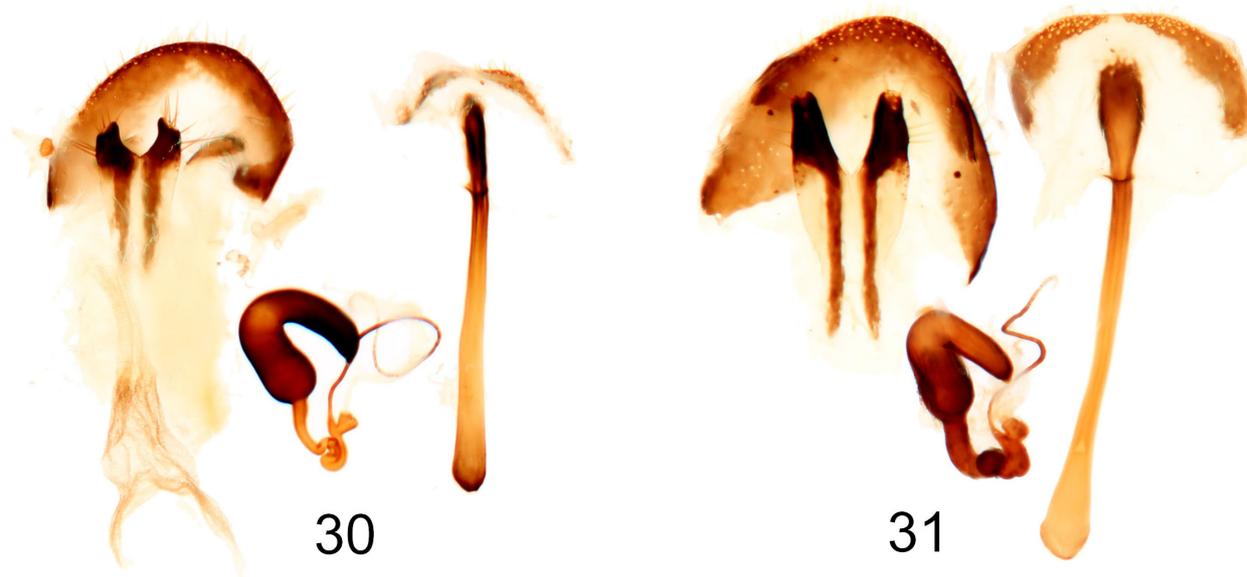
**FIGURES 27–29.** *Altica* species, male genitalia (penis in ventral, dorsal and lateral view): 27, *A. corrusca* (Erichson); 28, *A. cyanea* Weber; 29, *A. gravida* (Blackburn).

Rarely, *A. aenea* may feed on other hosts. Two specimens were collected on *Citrus* (Rutaceae) in Australia causing “medium damage to leaves” (Kakadu National Park, June 2007, coll. S Anderson). There are no other regional records of *Altica* species on citrus (Jolivet 1991) but two North American species of *Altica* are recorded from this host (Clark *et al.* 2004). There are also specimens of *A. aenea* from Fiji labelled “growing leaf tips of rice” (BPBM), however we suspect that the label refers to non-feeding specimens or is a mislabelled sweep of rice with *Ludwigia* present. Nayek & Banerjee (1987) tested *A. aenea* on rice and found that it failed to feed. Other plant associations from label data are singletons, probably representing casual, non-feeding, occurrences or visits to non-host nectaries, or mislabelling: *Alternanthera* (Amaranthaceae) *Jacksonia*, *Mimosa*, *Vigna* (Fabaceae), *Psidium* (Myrtaceae).

In Australia *Altica aenea* has been collected in every month of the year, without a strong seasonal pattern. It is commonly collected at light.

**Taxonomic notes.** *Altica aenea* was feebly described and illustrated by Olivier (1808) based on material from Java: having size and shape of *A. caerulea* but distinguished by being bronze-green with brown first antennomere. Olivier described it in *Galeruca* Geoffroy, 1762, not *Haltica* or *Altica* (Gruev & Döberl 1997, 2005). In the last 100

years this species has been consistently treated as a junior synonym of *A. cyanea*, which was a misidentification (q.v.). *Altica aenea* becomes the oldest available name for the commonest and most widespread *Altica* species throughout the region, with *A. australis* (Blackburn, 1889) or *A. ignea* (Blackburn, 1889) as the next oldest names. No type material has been found in the two locations where it is likely to exist, MHNP & NMSE. The combination of absence of type material and poor original description makes use of the name *A. aenea* problematic. However, as *A. aenea* has consistently been treated as a junior synonym of *A. cyanea* s. auctt., we think it is worth keeping the name *A. aenea* for this species by fixing its identity with a neotype. The neotype chosen is from the type locality, Java, with the key feature, the reddish-brown first antennomere.



**FIGURES 30–31.** *Altica* species, female genitalia (vaginal palpi, spermatheca and sternite VIII): 30, *A. corrusca* (Erichson); 31, *A. graviga* (Blackburn).

Gruev & Döberl (1997) listed *A. aenea* as one of eight synonyms of *A. cyanea*. *Altica birmanensis* is valid (q.v.). *Altica janthina* is correctly placed as a junior synonym of *A. cyanea* (q.v.). *Altica brevicosta* is a junior synonym of *A. caerulea* (q.v.). The remaining names are discussed below.

*Altica australis* (Blackburn, 1889), was described from the Northern Territory and compared only with a single European species. Weise (1923), followed by Heikertinger & Csiki (1939), placed it in synonymy with his concept of *A. cyanea*, which was misidentified as a senior synonym of *A. aenea*. However, Scherer (1982) seems to have considered *A. australis* a valid species. We have examined type material (in SAM) and concur with the synonymy of *A. australis* with *A. aenea*.

*Altica ignea* (Blackburn, 1889), was also described from the Northern Territory and was compared with *A. australis*, differing by presence of a lateral elytral ridge and coppery colour. However the type material (SAM) shows that this is also an example of *A. aenea* (**syn. nov.**), with the short lateral elytral ridge that occasionally occurs in this species.

*Altica bicolora* (Jacoby, 1904) **comb. nov.** was described from New Guinea as a possible colour variety of *A. pagana* (= *A. corrusca*, see above). Jacoby noted it was distinguished by the contrast between bluish pronotum and greenish elytra, impunctate pronotum and semiregular puncturation of the elytra. He described the penis as “long and slender, its apex rounded, with a small dent at the middle, the surface with the margins surrounding the orifice, thickened, the latter itself feebly ridged at the middle” (Jacoby 1904: 482). This is a reasonable description of how the penis of *A. aenea* differs from that of *A. corrusca*, and also distinguishes it from *A. caerulea*, the other bicoloured species in New Guinea. The other features he noted are either within the range of variation of *A. cyanea* (colour, elytral sculpture) or misleadingly described (Jacoby overlooked the ‘punctures’, really glandular openings, present near the anterior margins of all *Altica* species). In collections available to us there are specimens of *Altica* from New Guinea and the Solomon Islands with the same colours and general morphology as described for *A. bicolora*. These specimens were collected on *Ludwigia*, the host of *A. aenea*. We have dissected male and female

specimens from these samples and all belong to *A. aenea* as defined here. *Altica aenea* is therefore a subjective senior synonym of *A. bicolora* (**syn. nov.**).

The last synonym of *A. aenea* listed by Gruev & Döberl (1997), *Altica nepalensis* Chujo, 1966, was placed in synonymy with *A. cyanea* by Kimoto & Takizawa (1973), but their *A. cyanea* is evidently a composite of *A. aenea*, *A. birmanensis* and *A. cyanea*. Without type material we cannot determine the correct synonymy of this species name, but our studies of collections show that *A. aenea* certainly occurs in Nepal.

*Altica jussiaeae* was described as a distinct species from the west pacific islands of Palau and Micronesia (Gressitt 1955), less than 900 kilometres north of New Guinea. Morphologically it falls well within the range of *A. aenea* and it shares the same host plant (*Ludwigia*). The four type specimens of *A. jussiaeae* examined are unusually coloured for *A. aenea*, black with faint bronze metallic hue and with antennomeres 2–4 reddish, but this colour pattern is found in *A. aenea* specimens from elsewhere. The male and female genitalia are identical to those of *A. aenea*, which we therefore make a subjective senior synonym of *A. jussiaeae* (**syn. nov.**).

*Altica foveicollis* (Jacoby, 1889), described from northeastern India, was synonymised with *A. aenea* (as *A. cyanea*), as a colour variety, by Kimoto (2000; Döberl 2010a). However, photographs of a syntype in the Jacoby collection (Perkins *et al.* 2010) show that *A. foveicollis* is densely microsculptured, with costate and finely punctured elytra. Furthermore, if the male genitalia of *A. foveicollis* illustrated by Scherer (1969: 130) belong to correctly identified material, this appears to be a species distinct from *A. aenea*. Therefore we conclude that *Altica foveicollis* is unlikely to be a synonym of *A. aenea*. Naples & Kessler (2005) report different host species of *Ludwigia* for *A. aenea* (as *A. cyanea*) and *A. foveicollis*, which may be significant.

Another potential synonym of *A. aenea* is *A. subaurichalcea* (Weise, 1922b), described from specimens collected at light on the Mekong Delta, Vietnam, and therefore likely to be a common species in the region. Weise's description is poor (1922b: 156), but he noted that the penis is almost identical ("täuschend ähnlich") to that of '*A. cyanea*' (probably referring to *A. aenea*). We have seen material of both *A. aenea* and *A. cyanea* from south Vietnam, plus specimens of a small golden-green species with similar penis to *A. aenea* (in ROM). *Altica subaurichalcea* was synonymised with *A. birmanensis* by Kimoto (2000; as *A. subaurantica* [sic]) and Döberl (2010a), synonymised with *A. coerulea* by Gruev & Döberl (2005), and ignored by Medvedev (2009) in his review of Vietnamese alticines. Based on the material we have examined and the original description, *A. subaurichalcea* is either a synonym of *A. aenea* or a valid species, but it is not a synonym of *A. birmanensis* or *A. caerulea*.

Two males from New Britain (Papua New Guinea) have the dorsal transverse ridges of the penis effaced, but otherwise show typical morphological features of *A. aenea*. Females associated with these specimens have genitalic characteristics typical of *A. aenea*. Rather than erect a new species for this population, we consider it to be a variant within the species *A. aenea*.

Specimens of *Altica aenea*, *A. birmanensis*, *A. corrusca* and *A. cyanea* are only reliably separated by careful examination of the genitalia but the host plants and ranges provide useful diagnostic information. In southeast Asia, *A. corrusca* is absent and the other three species appear to have different preferred hosts: *A. aenea* on Onagraceae (*Ludwigia*), *A. cyanea* on Melastomaceae (*Melastoma*) and *A. birmanensis* on Polygonaceae (*Polygonum*).

### ***Altica birmanensis* (Jacoby, 1896) stat. rev.**

(Figs 3, 10, 24, 35, 36, 50, 51, 65, 66, 78)

*Haltica birmanensis* Jacoby, 1896 (type locality: Burma); Maulik 1926: 422 (junior synonym of *A. cyanea*).

*Altica birmanensis*: Gressitt & Kimoto 1963: 890 (as junior synonym of *A. cyanea*). Takizawa 1978 (valid species, as *A. birmensis*); Medvedev 2009: 24 (junior synonym of *A. cyanea*).

*Altica birmaensis* [misspelling]: Scherer 1969: 129 (as junior synonym of *A. cyanea*).

*Altica birmensis* [misspelling]: Kimoto 1971: 80.

*Haltica indica* Shukla 1960: 80 (type locality India) **syn. nov.**

**Material examined** (88, \* = specimen dissected). Type: ***Altica birmanensis* (Jacoby)**: Lectotype (this designation): ♂/ Birma/ *Haltica birmanensis* Jac./ Type 18718/ Jacoby 2<sup>nd</sup> coll./ (MCZ).

Non-type material : **Indonesia: Bali**: ♂\*, 4/ Bali, Bedugul, 21.vii.1977, GGE Scudder (BMH); 1/ Bedugul, 8.28144S 115.16285E, 1277m, ex *Polygonum chinense*, 15.ii.2012, L Halling (MZB); **Java**: ♀\*, ♀/ Cibodas NP [sic], 1500m, hand picking off foliage, 26.vii.1990, C Reid (ANIC); ♀\*/ Dieng Plateau, above Telago Warna,

2150m, on low shrub, ii.1991, C Reid (ANIC); 2♂\*, 3♂, 8♀/ Gede-Panggrango NP, trail head to Cibeureum waterfalls, 26.viii.1989, ROM 893014 DC Darling (ROM); ♂\*, ♀/ Gede-Panggrango NP, c6k SW Cipanas, on climbing *Polygonum*, rf, 1450–1600m, 14–16.x.1991, C Reid, D Subasli (ANIC); ♂\*, 2♀\*, 13/ West Java, Lake Lembang, 1500m, xii.1953, Dressler (BMH); ♂\*/ Malang, vii.1953 Dressler (BMH); ♂\*/ Java, Mt Bromo, at crater, 2000m, 5.v.1984, E Helm (ANIC); ♂\*, 2♂, 2♀/ Y. Salak, Tjiowal, 14.i.1966, J Stusak (BMH); **Sulawesi**: ♂\*, 3/ Celebes, 30k NW Rantepao, Bulu-Bulu, 1800m, beating sheet, 9–15.v.1966, R Straatman (BMH); 1, ditto, 1600m (BMH); **Sumatra**: ♂\*/ North Sumatra, Brastagi, 12.vi.1990, R de Keyzer, GA Clarke (AMS); ♂\*, 3/ West Sumatra, Bengkulu Prov., nr Curup, Bukit Kaba Mt, 3°29'S 102°36'E, 1000–1200m, 30.i–3.ii.2000, J Bezdek (Bezdek); **West Papua**: 1♂\*/ Neth. Ind.- Amer. New Guinea Exp. Baliem Camp 1600m, 16.xii.1938, LJ Toxopeus (BMH); **Taiwan**: ♂\*, ♀/ 25°05'N 121°33'E, Taipei, Shulin, 4.iv.1987, DCF Rentz, YM Chiang (ANIC); **Timor Leste**: ♂\*, 4♂, 6♀/ 2.7k N Aileu, 8°42'28"S 125°33'46", coffee/*Paraserianthes*, 950m, 1.vi.2012 C Reid, TL2012/101/587 *Polygonum ?nepalense* (AMS); ♂\*, 3♀/ Kablaki Mtn, Same-Dili Rd, 8°56'19"S 125°37'22"E, rainforest/coffee 1150m, 18.vi.2011, C Reid site 40 (AMS); ♂\*, ♂, ♀/ 1k SSW Maubisse, R Sara, Same Rd, 8°50'25"S 125°35'36"E, coffee/*Casuarina* 1360m, 1.vi.2012 C Reid, TL2012/099/585, *Polygonum ?nepalense* (AMS); ♂\*, 3♂/ Ermera, 1200–1500m, 29.xii.1963, J Sedlacek (BMH); **Vietnam**: 2♂\*, 2♂, ♀/ Vinh-Phu, Tam Dao Hill sta., 3–31.v.1996, B Hubley, DC Darling, M Hanson ROM 961002 (ROM).

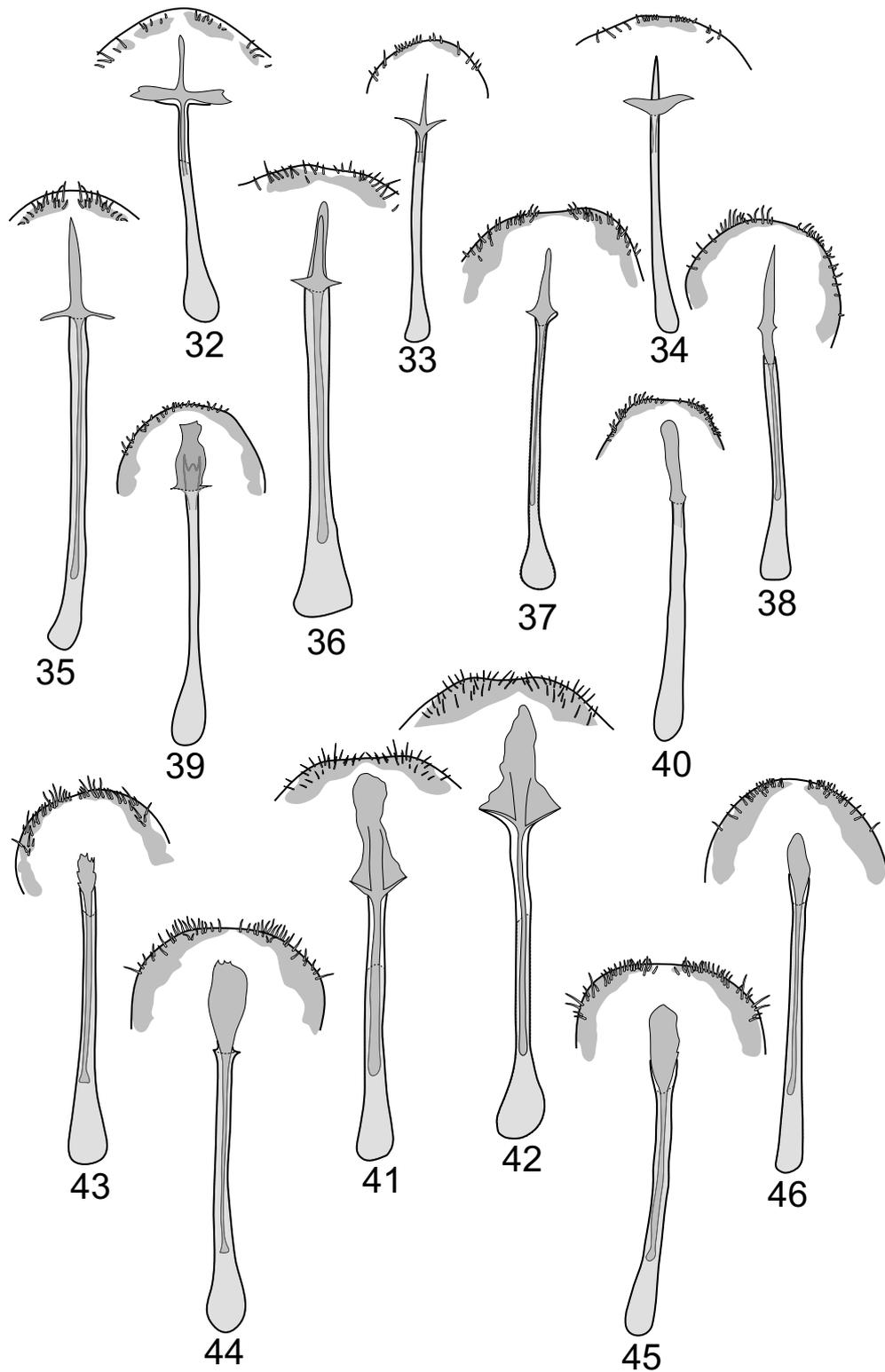
**Description.** A variably sized species, often relatively large: length: male 5.2–7.1mm; female 5.0–7.3mm.

**Colour:** dorsum usually bright deep blue, rarely bronze, purplish, dark green or bicoloured with blue pronotum and green elytra; first antennomere variable, black or with red apex, or red base and apex; remainder of antennae black; venter and legs entirely black with duller metallic reflection than dorsum.

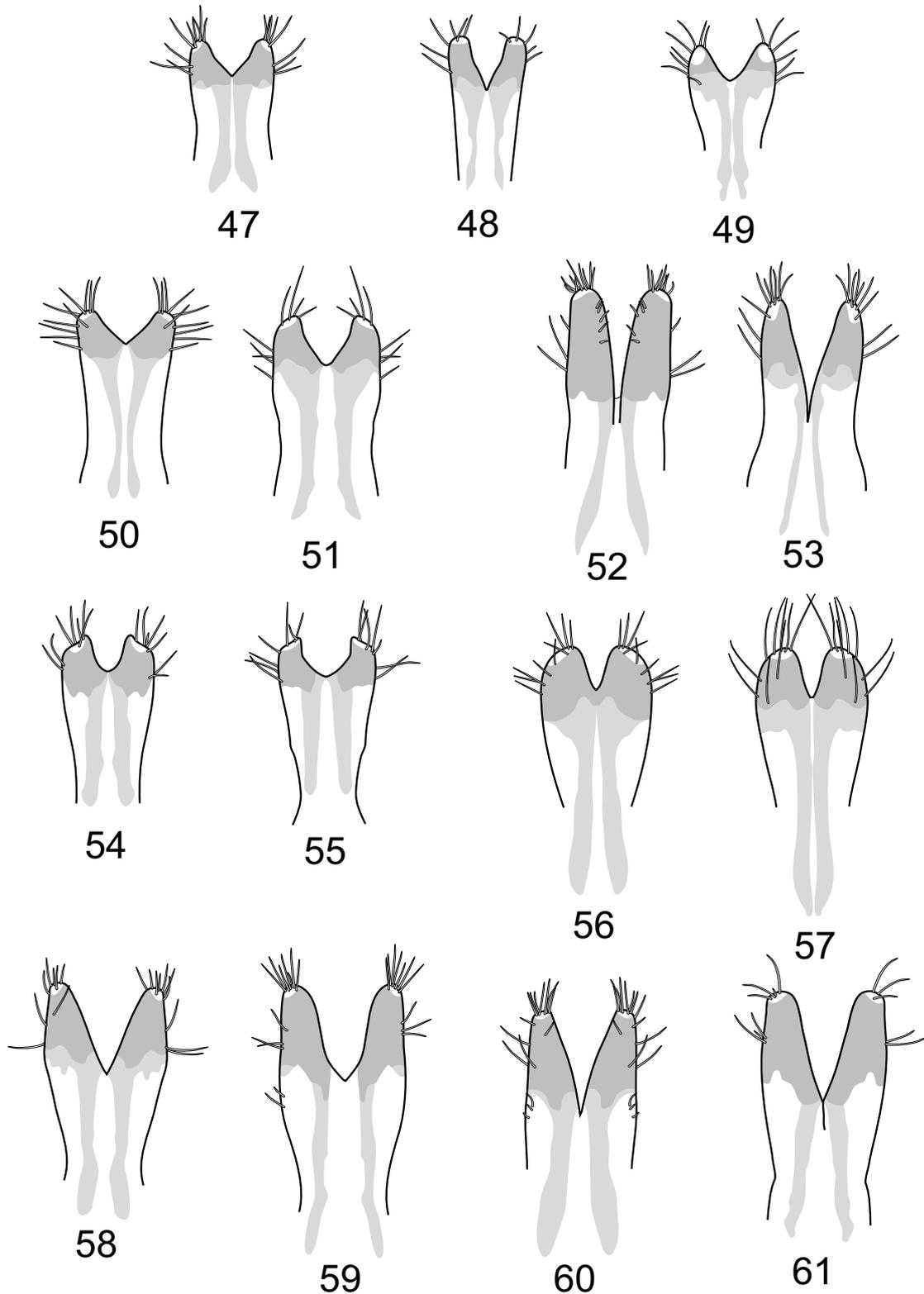
**Head:** ratios (Tables 1&2): **male:** EG 2.75–5.14; IE 1.32–1.76; HG 7.73–12.14; HN 1.05–1.13; NE 2.05–2.73; **female:** EG 2.62–4.22 IE 1.48–1.93; HG 7.15–10.89; HN 1.03–1.09; NE 2.33–2.70; pubescence: few small setae at inner edge of posterior of orbit, longitudinal row of short setae at sides of frontoclypeal ridge, 3–4 pairs of long setae behind clypeal anterior margin; transverse row of long setae between eye and buccal cavity; face impunctate except strong punctures at bases of orbital setae; vertex without microreticulation; postantennal calli smooth, not microreticulate; eyes small and relatively flat; postantennal calli almost quadrate, with acute triangular anterior angles and truncate bases, calli usually adjacent for most of length; frontoclypeal ridge lanceolate, smooth and broad at base, entirely convex, anteriorly terminating in a narrow keel before clypeal margin; anterior edge of clypeus generally smooth, strongly to weakly raised, sides of clypeus microreticulate, obliquely strigose.

**Thorax:** pronotum usually with pair of shallow ovate depressions behind anterior border; shining, entirely non-microsculptured; non-glandular puncturation variable, from present only as small sparse punctures at middle of basal field, to anterior and basal field with sparse (separated by at least 2 diameters) larger punctures at sides, but disc always minutely and sparsely punctured; hypomeron without microreticulation, smooth, except anterior angles finely transversely strigose and sometimes with sparse punctures; prosternum finely transversely grooved, shining, or process duller, slightly rugose; scutellum triangular with curved sides to semi-ovate, microreticulate or apical half shining and smooth; elytra shining, without microreticulation (except extreme apices), strongly and closely but irregularly punctured, interspaces mostly 0.5–1.5 diameters, sometimes with smooth elongate intervals on disc; elytra usually distinctly keeled from behind humeri to half elytral length or less, keel low, broadly rounded in cross-section; femora densely microsculptured and pubescent; outer face mid tibia with prominent keel for most of length, on a convex surface, but apical quarter usually flat; male first protarsomere distinctly longer than broad, female 1.5–1.7x longer than broad.

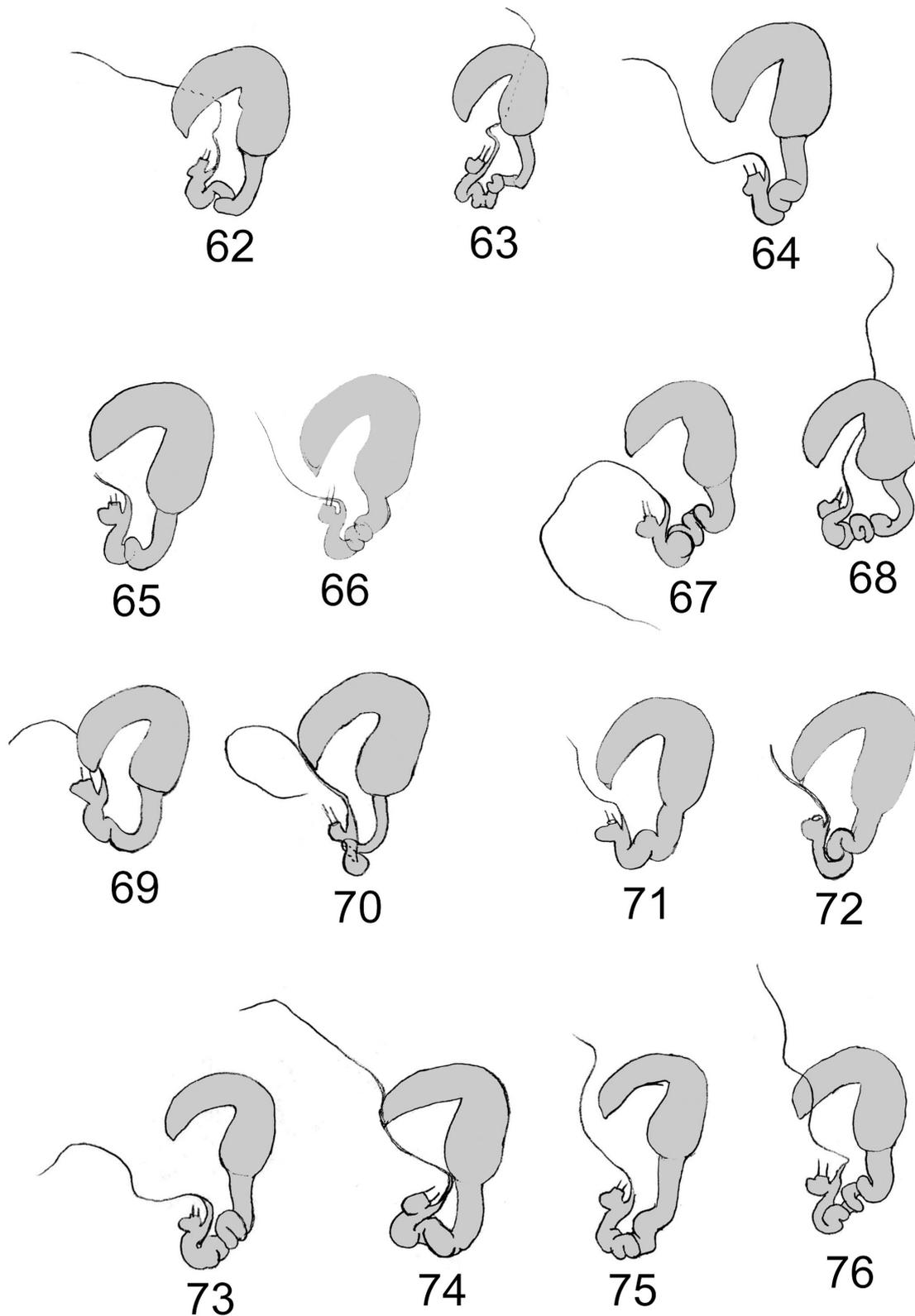
**Abdomen:** abdominal ventrites densely microsculptured and with recumbent pubescence; **male:** penis 1.7–2.15mm long; in dorsal view parallel-sided to the right-angled apex, which has a rounded to narrowly truncate tip; dorsal surfaces slightly curved in lateral view, ventral surface almost straight, with extreme tip recurved; shallowly transversely ridged on middle of dorsal surface; venter without transverse or oblique ridges, two long apicoventral depressions present, 0.25–0.3x penis length, ovate, smooth surfaced and laterally smooth edged, separated by a broad flat ridge (ridge may be medially depressed at apex); **female:** tignum 0.94–1.34mm long, basal part narrow with pointed tip, lateral arms narrowly triangular to threadlike, and apex broadly triangular or spatulate; spermathecal collum of variable length and thickness and containing 1–2 twists; vaginal palpi short and almost conical, length: width ratio 1–1.5, with obliquely truncate apex and concave inner margin; palpal apodemes 2–4x length palpi, 0.2–0.5x width palpi.



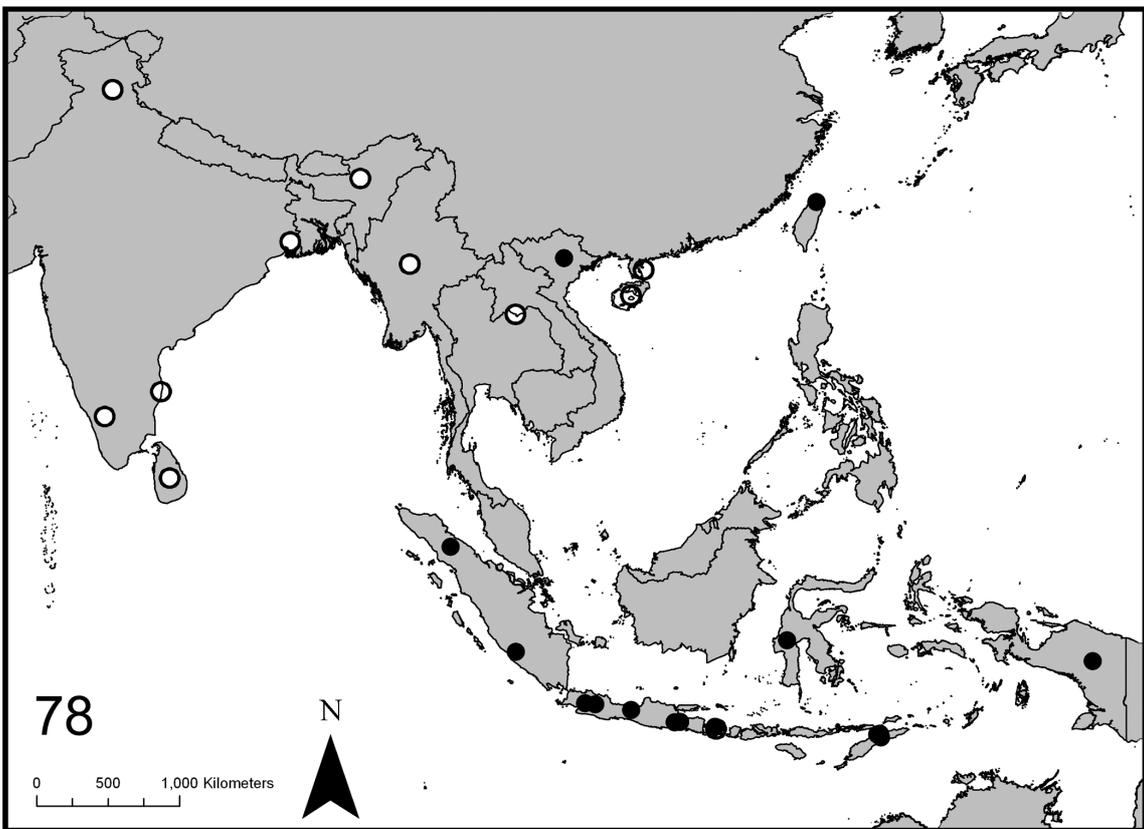
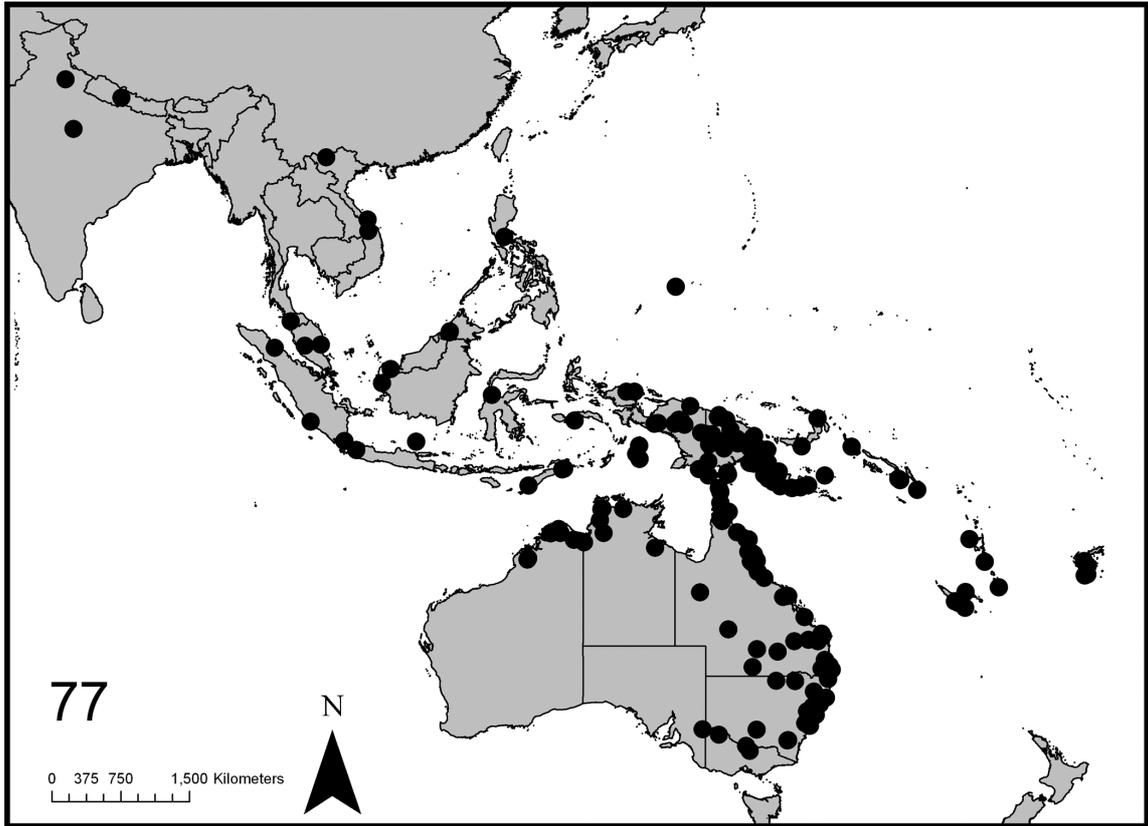
**FIGURES 32–46.** *Altica* species, female sternite VIII: 32, *A. aenea* (Olivier) (Northern Territory, Australia); 33, *A. aenea* (New South Wales, Australia); 34, *A. aenea* (North Queensland, Australia); 35, *A. birmanensis* (Jacoby) (West Java); 36, *A. birmanensis* (Vietnam); 37, *A. caerulea* (Olivier) (Northern Territory); 38, *A. caerulea* (Torres Straits); 39, *A. corrusca* (Erichson) (New South Wales); 40, *A. corrusca* (Tasmania, Australia); 41, *A. cyanea* Weber (lectotype, Sumatra); 42, *A. cyanea* (West Java); 43, *A. grvida* (Blackburn) (Victoria, Australia); 44, *A. grvida* (eastern New South Wales); 45, *A. grvida* (eastern New South Wales); 46, *A. grvida* (western New South Wales). Drawn to scale.



**FIGURES 47–61.** *Altica* species, vaginal palpi: 47, *A. aenea* (Olivier) (Northern Territory, Australia); 48, *A. aenea* (New South Wales, Australia); 49, *A. aenea* (north Queensland, Australia); 50, *A. birmanensis* (Jacoby) (West Java); 51, *A. birmanensis* (West Java); 52, *A. caerulea* (Olivier) (Northern Territory); 53, *A. caerulea* (Torres Straits); 54, *A. corrusca* (Erichson) (New South Wales); 55, *A. corrusca* (Tasmania); 56, *A. cyanea* Weber (lectotype, Sumatra); 57, *A. cyanea* (West Java); 58, *A. gravida* (Blackburn) (Victoria, Australia); 59, *A. gravida* (eastern New South Wales); 60, *A. gravida* (eastern New South Wales); 61, *A. gravida* (western New South Wales). Drawn to scale.



**FIGURES 62–76.** *Alica* species, spermathecae: 62, *A. aenea* (Olivier) (Northern Territory, Australia); 63, *A. aenea* (New South Wales, Australia); 64, *A. aenea* (north Queensland, Australia); 65, *A. birmanensis* (Jacoby) (West Java); 66, *A. birmanensis* (Sulawesi); 67, *A. caerulea* (Olivier) (Northern Territory); 68, *A. caerulea* (Torres Straits); 69, *A. corrusca* (Erichson) (New South Wales); 70, *A. corrusca* (Tasmania); 71, *A. cyanea* Weber (lectotype, Sumatra); 72, *A. cyanea* (West Java); 73, *A. gravida* (Blackburn) (Victoria, Australia); 74, *A. gravida* (eastern New South Wales); 75, *A. gravida* (eastern New South Wales); 76, *A. gravida* (western New South Wales). Drawn to scale.



**FIGURE 77.** Distribution of *Altica aenea* (Olivier).

**FIGURE 78.** Distribution of *Altica birmanensis* (Jacoby), open circles = probably correct literature records.

**Distribution and biology.** *Altica birmanensis* occurs from India in the west, Vietnam and Taiwan in the north, to Timor and New Guinea in the east. The Indian record is based on Shukla (1960). Scherer (1969) correctly illustrated the penis (under *A. caerulea*), but listed the host as *Ludwigia*, which suggests that his account confused *A. birmanensis* and other species, possibly *A. aenea* and/or *A. caerulea*. The New Guinea record is based on a single dissected male collected in 1938 in the Baliem Valley, West New Guinea. This male is typical of *A. birmanensis*, with black antennae and small eyes. All other *Altica* specimens examined from New Guinea clearly belong to either *A. aenea* (many dissected, *q.v.*) or the more easily distinguished *A. caerulea*. *Altica birmanensis* is absent from Australia and islands east of New Guinea.

*Altica birmanensis* has been found feeding on Polygonaceae (Sanchez *et al.* 2011) of the genera *Polygonum* (*P. chinense*) and *Persicaria* (*P. nepalensis?*) in Bali, Java and Timor (*pers. obs.* CAMR; label data, AMS). Published records of hosts for probably correctly identified *Altica birmanensis* include *Persicaria* in eastern Indonesia (Mohamedsaid 2009) and *Polygonum* in Taiwan (Takizawa 1978; Lee & Cheng 2007). Gressitt & Kimoto (1963) confused *A. aenea*, *A. birmanensis* and *A. cyanea* therefore their host records are not reliable. *Altica birmanensis* and *A. cyanea* have been collected together (Dieng, Java).

**Taxonomic notes.** *Altica birmanensis* was described from Burma and only poorly differentiated from “*A. cyanea*” sensu Jacoby (now *A. aenea*): bright blue with the elytron laterally grooved and the penis “very nearly identical to that of *cyanea*” (Jacoby 1896: 255). *Altica birmanensis* was synonymised with *A. cyanea* sensu auctt. (= *A. aenea*) by Maulik (1926), an action followed by many other authors (Gressitt & Kimoto 1963; Scherer 1969; Medvedev 2009), although Gressitt & Kimoto (1963: 889) illustrated the penis of *A. birmanensis* as *A. caerulea*(!). Kimoto (1971) identified *A. birmanensis* as the correct name for the species he had previously called *A. caerulea*. Although this action re-established *A. birmanensis* it is clear that Kimoto’s species concepts were confused, for example his southeast Asian key separated *A. cyanea* sensu auctt. (= *A. aenea*) and *A. birmanensis* on the presence or absence of a lateral elytral groove, without mentioning the diagnostic genitalic characters (Kimoto 2000: 256) (Table 1). Examination of the male syntype of *A. birmanensis* in MCZ (Perkins *et al.* 2010) shows that this is not *A. cyanea* sensu auctt. (*A. aenea*) but a species close to the true *A. cyanea*.

*Altica birmanensis* and *A. cyanea* are treated as valid species here. However they differ morphologically only slightly, as described in the key, and it could be argued that they represent variation within a single species. The distribution and host plant data (albeit limited) support our treatment of *A. birmanensis* and *A. cyanea* as valid species.

*Altica birmaensis* (Scherer 1969) and *A. birmensis* (Kimoto 1971) are incorrect emendations of the original name, which was based on the place name Birmania (Italian for Burma).

Our confirmation of synonymy of the name *A. indica* is based on the original description and illustrations (Shukla 1960).

### ***Altica caerulea* (Olivier 1791)**

(Figs 4, 11, 16, 25, 26, 37, 38, 52, 53, 67, 68, 79)

*Galeruca caerulea* Olivier 1791: 590 (type locality: East Indies).

*Graptodera coerulea* [misspelling]: Allard 1891: 230.

*Haltica coerulea* [misspelling]: Maulik 1926: 423.

*Altica coerulea* [misspelling]: Gressitt & Kimoto 1963: 890 (misidentification, as junior synonym of *A. cyanea*); Kimoto 1966: 35 (valid species)

*Altica coelurea* [misspelling]: Kimoto 1972: 47.

*Haltica elongata* Jacoby 1884: 28 (type locality: Sumatra); **syn. nov.**

*Altica elongata*: Kimoto 2001: 159.

*Altica brevicosta* Weise 1922a: 110 (type locality: Luzon, Java, Canton, Darjeeling); Kimoto 1972: 47 (jun. syn. *A. caerulea*); Medvedev 2009: 22 (valid species); Döberl 2010a: 493 (jun. syn. *A. caerulea*).

*Altica brevicostata* [misspelling]: Kimoto 1965: 490.

*Haltica brevicosta*: Chen 1933: 51.

**Material examined** (263, \* = specimen dissected). Types: ***Galeruca caerulea* Olivier**: Lectotype (this designation): ♂/ Dufresne 1936-50 217/ *Galeruca coerulea* 14/ *Haltica coerulea* Oliv. ?cotype/ (NMSE); Paralectotype: female/ Dufresne 1936-50 216/ *Galeruca coerulea* 14/ *Haltica coerulea* Oliv. ?cotype/ (NMSE);

*Altica elongata* (Jacoby): Lectotype (this designation): ♂ [mounted on point, with penis already removed and glued on separately]/ Soeroel[angoen = Surulangun] 4.78 [written in black ink on faded bluish-grey paper label with printed square]/ Sumat. exped. [black ink on white card]/ 1<sup>st</sup> Jacoby coll./ F.C. Bowditch collection/ F.C. Bowditch collection/ label(s) same as type specimen/ (MCZ); Paralectotypes (2): ♂/ Silago 7.77/ [blue square label]/ Sumat. exped. / 1<sup>st</sup> Jacoby coll./ F.C. Bowditch collection/ Type 18717/ *Altica elongata* Jac./ Jan–Jul 2004 MCZ image database/ label(s) same as type specimen/ (MCZ); ♀ [slightly teneral]/ Misauw [?] 7.78/ Sumat. exped. / [blue square label]/ 1<sup>st</sup> Jacoby coll./ (MCZ).

Non-type material: **New South Wales:** ♀/ Bruinwick Heads, at light, 9.iii.1981, BJ Day (AMS); 3/ Tweed R, Lea (AMS); **Northern Territory:** 4/ Adelaide R, 13°15S 131°06E, 17.x.1972, MS Upton (ANIC); 2/ Birraduk Ck, 18k NE Oenpelli, 12°17S 133°13E, 4.vi.1973, Upton & Feehan (ANIC); 3♂\*, 2♂, 2♀/ Blackmore R, nr Tumbling Waters, 12°46S 130°57E, 25.viii.1970, JV Peters (AMS); 2♀/ 46k SSW Borroloola, 16°28S 136°09E, 23.iv.1976, JE Feehan (ANIC); 1/ Burnside, 23.iii.1929, TG Campbell (ANIC); 3/ Cahills Xing, E Alligator R, 12°26S 132°58E, at light, 29.v.1973, EG Matthews (ANIC); 12/ 1k N Cahills Xing, E Alligator R, 12°25S 132°58E, 8.xi.1972, MS Upton (ANIC); 2, ditto, 11.xi.1972 (ANIC); 9/ 5k NNW Cahills Xing, E Alligator R, 12°23S 132°57E, 28.v.1973, EG Matthews (ANIC); 1, ditto, 8.vi.1973, Upton & Feehan (ANIC); 5/ 7k NNW Cahills Xing, E Alligator R, 12°23S 132°56E, 27.v.1973, EG Matthews (ANIC); 2/ Cooper Ck, 19k SE Mt Borradaile, 12°06S 133°04E, 9.xi.1972, MS Upton (ANIC); 2/ Daly R Mission, 17.viii.1974, J Hutchinson (ANIC); 4, ditto, 13°45S 138°41E, 8–24.vi.1974 (ANIC); 4, ditto, 24.ix.1974 (ANIC); ♂\*/ Darwin, 1926, GF Hill (ANIC); 1, ditto, 1925 (ANIC); 3/ Delamere, 17.ix.1968, M Mendum (ANIC); 3, ditto, 6.vii.1968 (ANIC); 3 ditto, 28.vi.1968 (ANIC); 1, ditto, 12.ix.1968 (ANIC); ♂\*, 3♂, 2♀/ E Alligator R, Oenpelli, 20.x.1948, JE Bray (AMS); 2♂, ditto, 21.x.1948 (AMS); 1/ E Alligator Ranger Sta., 12°26S 132°57E, at light, 15.viii.1990, MS Upton (ANIC); 2/ Elizabeth R, 21.iii.1968 BP Moore (ANIC); 3/ Ferguson R, 14°19S 131°50E, 25.vi.1968, M Mendum (ANIC); ♂\*, 1/ Goose Lagoon, 11k SSW Borroloola, 16°10S 136°15E, at light, 17.iv.1975, J Feehan (ANIC); 2♂\*, 2♀/ Howard Springs, 16mi S Darwin, 22.viii.1970, JV Peters (AMS); 1/ Jabaluka Lagoon, 14k N Mudginberry HS, 12°28S 132°52E, 13.xi.1972, MS Upton (ANIC); 4/ 1k ENE Jarmarm, Keep R Xing, Keep R NP, 15°45S 129°06E, at light, 25–27.v.2001, T Weir & P Bouchard (ANIC); 6/ 5.5k NNE Jarmarm, Keep R NP, 15°44S 129°09E, at light, 27.v.2001, T Weir & P Bouchard (ANIC); 1/ 8k NE Jarmarm, Keep R NP, 15°45S 129°10E, spring, at light, 9.vi.2001, A. Calder (ANIC); 3/ 9k S Jarmarm, Keep R NP, 15°51S 129°06E, at light, 30.v.2001, T Weir & P Bouchard (ANIC); 1/ Katherine, 17–18.viii.1973, LP Kelsey (ANIC); 1, ditto, 16.viii.1973 (ANIC); 10/ Koongarra, 12°52S 132°50E, 6–10.iii.1973, MS Upton (ANIC); 1, ditto, 24.v.1973, EG Matthews (ANIC); 4/ Lakefield NP, Bizant, Python Waterhole, 14°44S 144°07E, at light also eating leaves of aquatic plants at edge of waterhole, 28.x.1992, T Weir & P. Zborowski (ANIC); 2/ Magela Ck, 1k NNW Mudginberry HS, 12°36S 132°52E, 25.v.1973, Matthews & Upton (ANIC); 6/ Magela Ck, 2k N Mudginberry HS, 12°35S 132°52E, 14.xi.1972, MS Upton (ANIC); 7, ditto, 25.v.1973, Matthews & Upton (ANIC); 2/ Mumbulloo Sta., Katherine, 10.vii.1929, TG Campbell (ANIC); 2/ Nabarlek Dam, 15k SW Nimbunah Rock, 12°20S 133°19E, at light, 2.vi.1973, EG Matthews (ANIC); 1/ Nankeen Billabong, 11k WSW Cannon Hill, 12°26S 132°51E, 3.viii.1981, P. Outridge (ANIC); 1/ Narbarlek, 12°19S 133°19E, 19.xi.1983, M Webb (ANIC); 1/ Newcastle Waters, 4.vi.1929, TG Campbell (ANIC); 1/ Nourlangie Ck, 8k E Mt Cahill, 12°52S 132°47E, at light, 22.v.1973 EG Matthews (ANIC); 3/ 6k SSW Oenpelli, 12°22S 133°01E, 6.vi.1973, Upton & Feehan (ANIC); 1/ 18k E Oenpelli, 12°17S 133°13E, 1.vi.1973, Matthews & Upton (ANIC); 1/ Sixty Mile, found on rice, 11.iv.1956, ID Crawford (ANIC); ♂/ S Alligator Motor Inn, 28.xii.1987, M Moulds (AMS); ♂\*/ 1.5k E Stuart Hwy on Warawange Rd, Darwin, at light, 24.vii.1979, LP Kelsey (ANIC); 19/ Tindal, 14°31S 132°22E, light trap, 1–20.xii.1967, WJM Vestjens (ANIC); 1/ 6.4k SSW Victoria R, along Wickham R, 18.vi.1973, LP Kelsey (ANIC); ♀\*/ Victoria R roadhouse, Gregory NP, 15°36S 131°07E, woodland by river, 9.iv.2008, G Williams & W Pulawski (AMS); 1/ West Baines R, at xing, 28.v.1968, M Mendum (ANIC); **Queensland:** 3/ Ayr, 19°35S 147°24E 15.x.1970, WB Muir (ANIC); 1/ Bin Bin Ra., via Discot, 4.xii.1974, H. Frauca (ANIC); 2/ Brisbane (AMS); 5, ditto, Blackwood (AMS); 1, ditto, OW Tiegs (QMB); 1, ditto, 17.i.1912, H Hacker (QMB); 2, ditto, 11.ii.1912 (QMB); 4, ditto, 3.iii.1914 (QMB); 1, ditto, xi.1919, H Pottinger (QMB); 1/ Bucasia, 13.ii.2004, K Sandery (ANIC); 1, ditto, 22.i.2004 (ANIC); 1, ditto, 4.iii.2006 (ANIC); ♂\*/ Bundaberg, 9.ix.1927, G Bates (ANIC); ♂\*/ Byfield, 5.xii.1975, D Fricke (AMS); 1/ Cairns/ paratype/ *Oides cairnsensis* Lea Queensland cotype/ on permanent loan from Macleay Museum University of Sydney/; ♀/ Cairns distr., JA Anderson (QMB); 1/ Cape York Peninsula, C French (AMS); ♂\*/ Cardstone, i–ii.1972, D Perkins (AMS); 1/ Cloncurry, 1920 (AMS); ♂\*, 3m, 4f/ Delta Downs Sta, 13.xi.1981, D Walford-Huggins (AMS); 1/ E

Barrata, 23k N Ayr, Casuarina, 15.xi.1970, WB Muir (ANIC); 2/ Funnel Ck, 21°47S 148°55E, at light, 12.xii.1968, Britton & Misko (ANIC); 1/ Giru, at light, 20.xi.1981, B Lowery (ANIC); 1/ Ingham, 28.i.1968, JG Brooks (ANIC); ♀\*/ Moa I, Torres Strait, 25.ii.1975 H Heatwole (AMS); 4/ Marmor x.1924, HJ C[arter] (ANIC); 1/ Moreton Bay (AMS); 1/ Mossman, 29.iii.1967, MS Upton (ANIC); 1/ Nassau R., NW Dunbar Sta., 18.xi.1983 A Walford-Huggins (ANIC); 2♂, 4♀, 2/ Normanby R, 9.ix.1930, Wassell (AMS); 4/ Normanton, x.1924, HJ C[arter] (ANIC); 1/ Old Laura Sta., at mv light, 4.iv.1983, A Walford-Huggins (ANIC); 1/ One Tree Hill, Brisbane, 17.i.1923, A Musgrave (AMS); ♀/ Pistol Gap, Byfield, 22°50S 150°40E, at light, 10.i.1970, Britton, Holloway & Misko (ANIC); ♂\*, 31/ R[ockhamp]ton, ii.1968, AN, ex CGL Gooding coll. (ANIC); 1/ Townsville, FH Taylor (ANIC); 1, ditto, 6.ix.1975 PG Kelly (ANIC); 1, ditto, light trap, 26.iv–10.v.1968, P. Ferrar (ANIC); ♂\*/ Wide Bay (AMS); **Western Australia:** ♂\*/ Carson Escarpment, 14°49S 126°49E, 9–15.viii.1975, Common & Upton (ANIC); 3/ Kimberley Res. Sta, via Wyndham, 23.x.1956, ECB Langfield (ANIC); 2/ Kununurra, 21.ii.1984, T. Postle (ANIC; DAB); 1/ Wyndham, light trap, 21.vi.2004, T Vinnicombe (DAB); **Indonesia: Kalimantan:** ♂\*, 3♀/ 38k N Balikpapan, Borneo, 2–15.iii.1992, Darling, Rosichon & Sutrisno (ROM); **Sumatra:** ♀\*/ Kalianda, Sumatra, yellow *Epilobium*[sic], ii.2010, C Reid (AMS); **Malaysia: Sarawak:** ♂\*/ Miri Lambir, uv light, 28–29.iv.1998 (AMS); 1, ditto, 16–17.vi.1999 (AMS); 1, ditto, 18–19.ii.1999 (AMS); **Papua New Guinea:** ♂\*, 2/ Aroa Estate, W Redscar Bay, 1m, 30.ix.1958, JL Gressitt (BMH); 1/ Laloki, nr Port Morseby, 2.ix.1959, JL Gressitt (BMH); **Timor Leste:** ♂\*, ♀/ Maliana, sweep of *Oryza sativa*, 19.iii.2009, A. Ximines (AMS); ♀/ 1.8k NW Quelicai, 8°35'37"S 126°33'51"E, dry rf patch, c680m, TL2012/018/034, mv lamp, 3.vi.2012 (AMS).

**Description.** Relatively large, length male 5.6–6.7mm, female 5.7–7.0mm.

**Colour:** dorsum entirely dark blue (typical colour in Indomalaya, rare in Australia), dark green or dark purple, or bicoloured with green head and pronotum and purple elytra (typical colour in Australia, not seen in Indomalayan specimens); antennae black, apex of first antennomere occasionally dark brown; legs and venter black, usually slightly bronzed.

**Head:** ratios (Tables 3 & 4): **male:** EG 7.50–10.00; IE 0.94–1.11; HG 17.00–20.80; HN 1.17–1.22; NE 1.70–1.79; **female:** EG 9.20–10.00; IE 1.00–1.04; HG 17.67–22.50; HN 1.19–1.24; NE 1.76–1.78; pubescence: a few minute hairs at posterior of orbit, longitudinal row of short setae at sides of frontoclypeal ridge, transverse row of longer setae behind clypeal anterior margin; transverse row between eye and buccal cavity; face impunctate except minute punctures at bases of setae; face microreticulate, often faintly so, postantennal calli usually smooth & non-reticulate; eyes large and laterally prominent; postantennal calli slightly elongate, with acutely triangular anterior angles and rounded bases; frontoclypeal median ridge lanceolate, weakly convex, anteriorly terminating in a narrow keel before clypeal margin; anterior clypeal margin slightly elevated and thickened but not finely ridged; sides of clypeus not rugose;

**Thorax:** pronotum relatively dull and microreticulate; pronotum almost impunctate, apart from glandular punctures, with scattered minute punctures on basal field; hypomeron and elytra smooth & shining, except extreme apex of elytra microreticulate; prosternum smooth and shining; scutellum triangular, microreticulate or shining and smooth; mesoventrite strigose and dull, remaining thoracic ventrites densely microsculptured and pubescent; elytra finely and densely irregularly punctured, interspaces mostly 1–1.5x puncture diameters; sides of elytra usually keeled from behind humeri to apical third, but keel may be faint or rarely absent; femora densely microsculptured and pubescent; outer face mid tibia with thin keel at base, flat in apical half; male first protarsomere ovate, slightly longer than broad, female 1.5x longer than wide;

**Abdomen:** abdominal ventrites densely microsculptured and pubescent; **male:** length penis 2.25–2.5mm; in dorsal view slightly expanded from base to near apex, then slightly contracted before almost truncate tip, with short right-angled median lobe; shallowly transversely ridged on middle of dorsal surface; fairly straight in profile, with tip slightly curved; with dense oblique ridges on most of venter, absent from midline, base and apex; ridges subtending approximately 90° at midline; two short apicoventral depressions present, c.0.2x penis length, elongate, laterally sharp-edged, internally finely strigose, separated by broad flat ridge; **female:** vaginal palpi long and almost conical, length: width ratio 2–3, with rounded apex, and straight or convex inner margin; palpal apodemes 1.2–1.3x length palpi, 0.15–0.3x width palpi; tignum with narrow acutely tipped base, short triangular lateral arms, and broad triangular or spatulate apex; spermathecal collum of variable length and thickness and containing 3–4 twists.

**Distribution and biology.** *Altica caerulea* is widespread in tropical Australia, from west Northern Territory (Daly River) to the east coast, then south to northern New South Wales (Byron Bay). It is mostly coastal in south

and central Queensland but occurs far inland in the northern tropics. Outside Australia, *Altica caerulea* is widespread, from northeast India through the Philippines and Sunda Islands to New Guinea. Published records which are probably this species include Laos, Sri Lanka and Thailand (Scherer 1969).

Much of the Australian material of *A. caerulea* appears to have been collected by light trapping, and there are no host observations except the enigmatic “eating leaves of aquatic plants at edge of waterhole” (ANIC). Overseas, in Sumatra CAMR has collected *A. caerulea* on *Ludwigia* (as ‘yellow *Epilobium*’), and this is probably the host in Australia. Hawkeswood’s erroneous records of *A. corrusca* on *Ludwigia* in north Queensland (Hawkeswood 1988) may therefore represent *A. caerulea* and/or *A. aenea* (q.v.). The specimens collected on rice (*Oryza*) in the Northern Territory and Timor Leste (label data), do not record feeding. These specimens were swept, so the probable host *Ludwigia*, a common weed in rice padi, may have been present but overlooked. Records for *A. caerulea* on *Rumex* (Polygonaceae) and *Impatiens* (Balsaminaceae) in the Himalayas (e.g. Singh *et al.* 1986) refer to *A. himalayensis* (Chen, 1936) (Shah & Jyala 1998; Jyala 2002; Döberl 2010a). If *A. caerulea* only feeds on *Ludwigia* it is also a potential biocontrol agent of this weed.

In Australia, *A. caerulea* is similar to *A. gravida*, but the two species appear to be almost allopatric. Despite being widespread they have never been collected together and only old material has been recorded from the same general locality (‘Brisbane’). The two species have different hostplants but both hosts are restricted to wetlands and similarly widespread (Anonymous 2014), so in theory the two *Altica* species should co-occur. We suspect that the different distributions of *Altica caerulea* and *A. gravida* reflect the preference of the former for permanent wetlands and the latter for temporary wetlands.

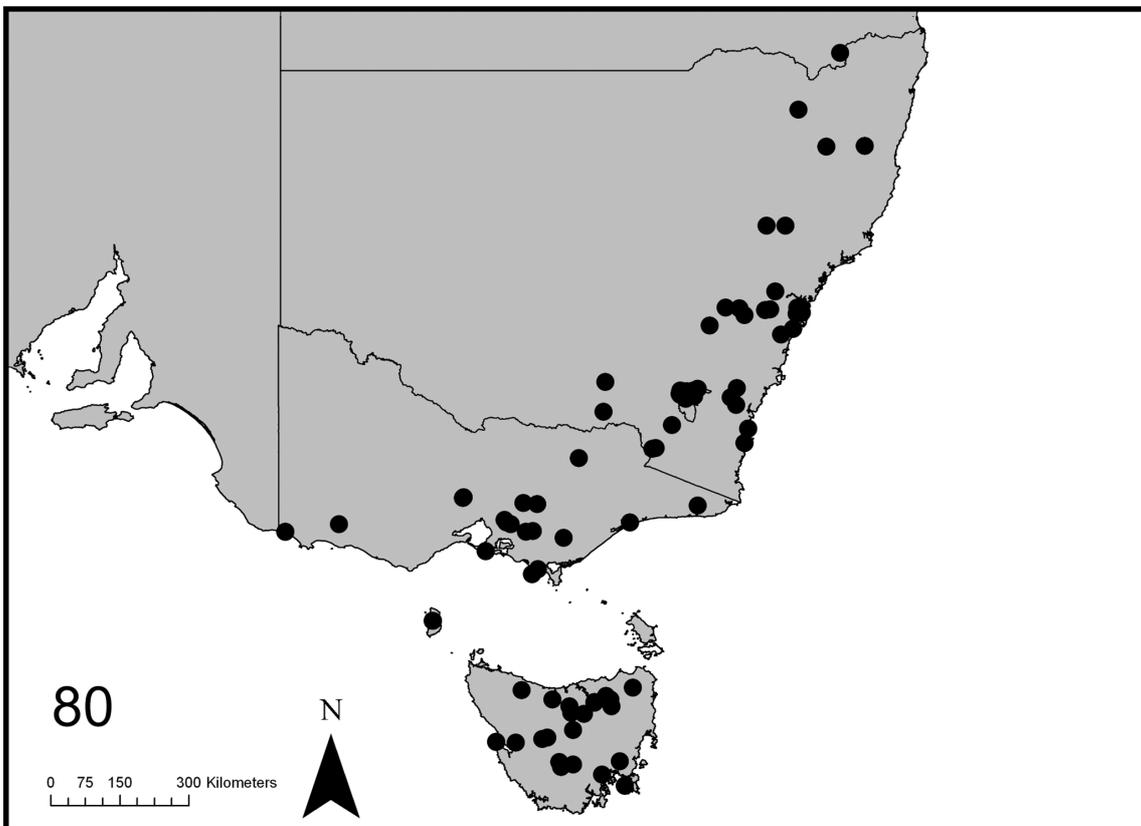
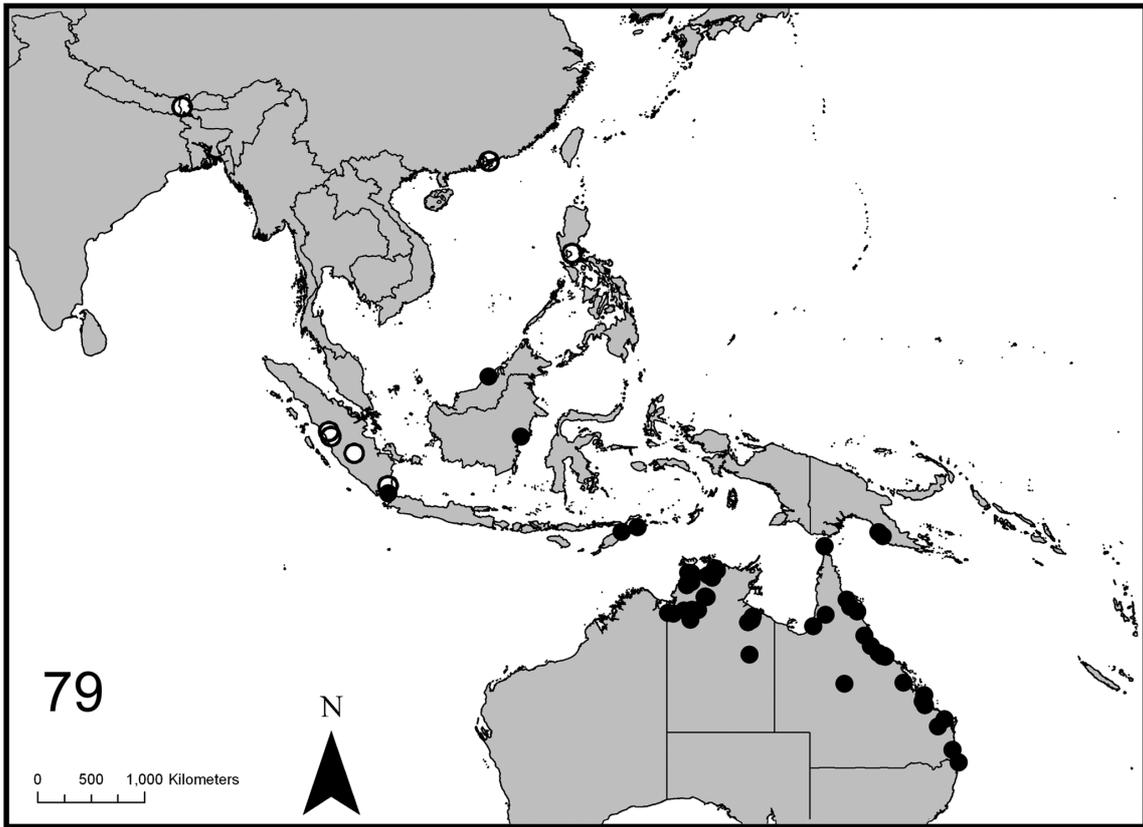
In Australia, *Altica caerulea* has been collected in every month, with no clear collection peaks but with greater frequency in the dry season, from March to November. It is commonly collected at light.

**Taxonomic notes.** The species name of *A. caerulea* has been misspelled since Maulik (1926) and the species has been misidentified at least since the revision of Chinese species by Gressitt & Kimoto (1963). This is not surprising since Olivier’s description only refers to colour and the types have been considered lost. *Altica caerulea* was described from the East Indies, based on an unknown number of specimens (Olivier 1791). Part of the Olivier collection was sold to the Royal Scottish Museum, Edinburgh (now NMSE) in the early 19<sup>th</sup> century and *Galeruca caerulea* is listed amongst this material. Two syntypes are present. To clarify the identity of this species we nominate the dissected male as a lectotype of *Altica caerulea*. Although the penis of the lectotype is deformed at the base and apparently shortened (length 1.93mm: R. Lyszkowski, *pers. com.*, May 2013), it shows clearly that this is the species hitherto treated under the name *A. brevicosta* (Gressitt & Kimoto 1963; Scherer 1969), quite different from *A. caerulea* *sensu auctt.*, for example Scherer (1969), which is a mixture of *A. birmanensis* and *A. cyanea*. However, Kimoto (1972) and Döberl (2010a) correctly synonymised *A. caerulea* and *A. brevicosta*.

*Altica elongata* is an older name than *A. brevicosta* but has not been recognised since its description. This description, ironically accompanied by the remark that “earlier descriptions were inadequate for species recognition” (Jacoby 1884: 28), is itself inadequate for species recognition. Jacoby notes that *A. elongata* is probably the largest species of the genus, and mentions its colour, antennal segment ratio and some slight details of the body surface sculpture. Jacoby’s species was described from a remarkable (for the time) seven different localities in Sumatra, both lowland and highland, from the NW to SE of the island, suggesting a common widespread species. Our examination and dissection of Jacoby’s type material shows that this is a synonym of *A. caerulea* (= *A. elongata*, **syn. nov.**). Since species in this genus are difficult to recognise and the taxonomic decisions are subjective, we take the opportunity of fixing the identity of *A. elongata* by nominating a lectotype.

*Altica brevicosta* was also described from abundant material, with a wide distribution including south China, the Philippines and Java (Weise 1922a). Weise’s description is unusually detailed, with a clear description of the penis. This confirms the synonymy of *A. brevicosta* and *A. caerulea* by Kimoto, who examined Weise’s type material but not Olivier’s. An unpublished Weise manuscript name listed as a synonym of *A. brevicosta* by Biondi (1992) is not available.

*Altica bicosta* (Shukla, 1960) was described from northwest Indian material and later synonymised with *A. brevicosta* by Scherer (1969), who did not examine types. The original description is poor but the illustration of the dorsal view of the penis suggests that this may be a different species, not *A. brevicosta* (*A. caerulea*). We therefore remove *A. bicosta* from synonymy with *A. brevicosta* and *A. caerulea* and suggest it be treated as a valid species pending revision of the Indian fauna. Scherer’s treatment of *A. brevicosta* seems to involve more than one species therefore we omit his records from our map (Fig. 79).



**FIGURE 79.** Distribution of *Altica caerulea* (Olivier), open circles = probably correct literature records.  
**FIGURE 80.** Distribution of *Altica corrusca* (Erichson).

One specimen listed in the material examined carries the label “*Oides cairnsensis* Lea cotype” in Lea’s handwriting (MMS). This name has never been published and is unavailable. Lea probably realised his mistake but forgot to remove the type designation label.

### ***Altica corrusca* (Erichson, 1842)**

(Figs 5, 12, 17, 20, 27, 30, 39, 40, 54, 55, 69, 70, 80)

*Haltica* (*Graptodera*) *corrusca* Erichson 1842: 235 (type locality: northwest Tasmania).

*Haltica corusca* [misspelling]: Fogg 1859: 334.

*Altica corusca*: Bryant & Gressitt 1957: 77 (misidentification and misspelling).

*Altica corrusca*: Scherer 1982: 479.

*Haltica pagana* Blackburn 1896: 74 (type locality Tasmania, Victoria); **syn. nov.**

**Material examined** (301, \* = dissected). **Types:** *Altica corrusca* (Erichson): Lectotype (designated by Scherer 1982, with original labels illustrated on page 479): ♂/ *corrusca* Er Van Diemensland Schayer/ Terra van Diem Schayer/ 55784/ Lectoholotypus [sic] *Haltica* (*Graptodera*) *corrusca* Erichson det Dr G. Scherer 10.80/ (ZMB); Paralectotypes (3): ♂, 2 ♀/ Terra van Diem Schayer nr 55784/ Lectoparatypus [sic] *Haltica* (*Graptodera*) *corrusca* Erichson det Dr G. Scherer 10.80/ (ZMB); *Altica pagana* (Blackburn): Lectotype (this designation): ♂/ T5854 Tasm/ Type/ *Haltica pagana* Blackb./ Blackburn coll. 1910-236/ (NHML); Paralectotypes (3): 1/ Austral. ex Black. type/ Jacoby coll.1908-28a/ (NHML); 1 [upsidedown on card]/ Tas 5854/ *Haltica pagana* Blackb. cotype/ Tasmania/ *Haltica pagana* Blk. Vic. Tas. cotype I.4037/ (SAM); 1/ Al [Alps] 5854/ *Haltica pagana* Blackb. cotype/ Victorian Alps Blackburn/ (SAM).

Non-type material: **Australia:** 2/ ex coll. Nat. Mus. (ANIC); **Australian Capital Territory:** 1/ 2500’ 1.iii.1932 (QMB); 1/ Ainslie, 2.xii.1948, Carne (ANIC); 1/ Black Mtn, 15.x.1971, R Kohout (ANIC); 1/ Blundells, 27.i.1930 IM Mackerras (ANIC); 1, ditto, 24.viii.1930, WK Hughes (ANIC); ♂\*, 3/ Brindabella Ra, Blundells Ck Rd, 16.xi.1972, RJ Kohout (ANIC); 1/ Bruce’s Nursery, 21.ii.1929 (ANIC); 1/ Buleen Ra, x.1982, M. Carson (ANIC); 3/ nr Bulls Head, Old Mill Rd, 28.ix.1967 CJ Shepherd (ANIC); 1/ Condor Ck, Canberra, 15.vii.1929 GF Hill (ANIC); 1/ Coree Ck, 12.ii.1930 JW Evans (ANIC); 2/ Cotter, flowers, 28.xi.1964, WJM Vestjens (ANIC); 1/ Cotter Dam, 500m, 8.xii.1962, ES Ross & DQ Cavanero (CAS); ♂, 3/ Cotter R. (ANIC); 1, ditto, 29.i.1973, S&M Misko (ANIC); 1, ditto, 7.xii.1962, DK McAlpine (AMS); 1/ Kambah Pool, weeds on waters edge, 26.xii.1964, WJM Vestjens (ANIC); 1/ Monash, 35°24S 149°06E, ex dog dung, 12.xii.1995, W Dressler (ANIC); 1/ Mt Coree, 1157m, 25.xii.1973, E&S Britton (ANIC); 1/ Murrays Corner, Cotter Rd, *Leptospermum*, 6.i.1974, W Allen (ANIC); 3/ Paddys R, 14.xi.1967, R Barker (ANIC); 1/ 4k SW Picadilly Circus, 29.xi.1972, Misko, Allen & Klingenberg (ANIC); 1/ Stromlo, 29.i.1973, S&M Misko (ANIC); 1/ Tidbinbilla, 10.iii.1967 WJM Vestjens (ANIC); 4, ditto, rushes, 6.x.1964 (ANIC); 4, ditto, 18.iii.1967 (ANIC); 4, ditto, 18.iii.1967 (ANIC); ♂/ Yarralumla Nursery, on *Epilobium*, 29.ix.1969, F. Grossbechler (ANIC); **New South Wales:** 1/ no locality, Sloane (AMS); 1/ Allyn R, Colchester SF, 32°08S 151°27E, 10–11.xi.1981, T Weir (ANIC); 4♀/ Appin, xii.1935, E.C. (AMS); 1♀/ Armidale, C.F.Deuquet (ANIC); 4/ Barrington Tops, i.1925 (ANIC, AMS); 1, ditto, via Salisbury, 9–10.ii.165, G Monteith (UQIC); 9/ Braidwood, 26.x.1960 (ANIC); 1/ nr Cutlers Pass, Williams R, 23–30.x.1926, Musgrave & Campbell (AMS); 10/ Dainers Gap, 15.ii.1960 (ANIC); 1♂\*, 4♀ / Dignam’s Ck, 26k S Narooma, GD A96 55 767035 5973637, infesting *Haloragis exalata*, 2006, coll? (AMS); 2♀ / Duckmolei, i.1934, J. C. Wiburd (AMS); 1♂\*/ East Lindfield, infesting *Oenanthera*, 11.vi.2001, M. McGahey (AMS); 1♀ / Eastwood, 23.viii.1964, D. A. Doolan (AMS); 1♂\*, 1♂, 1♀ / Eucumbine R, i.1931, H.J. C[arter] (ANIC); 2/ 4mi S Glencoe, 1280m, 29.xi.1962, ES Ross & DQ Cavanero (CAS); 1/ Hartley, 20.ix.1956, DK McAlpine (AMS); 3♀ / Hazelbrook, i.1935, B. & G. Stoyles (AMS); 1♀, ditto except 26–28.i.1934 (AMS); 1♂\*, 1♀\*, 3♀ / Heathcote (centre), on emergent plants, pond in garden, iv.2007, C. Reid (AMS); 1♀ / Hornsby Heights, 10.iii.1974 (AMS); 1♀ / Inverell, 7.xi.1950 (AMS); 1♀\*/ Jenolan area, x.1970, P. Zborowski (AMS); 4/ vic Jenolan Caves, JC Wiburd (AMS); 1/ 14k E Kiandra, Snowy Mtns Hway, 2.xii.1979, LP Kelsey (ANIC); 1/ Kosciusko (ANIC); 3, ditto, 5700–6000’ (QMB); 1♀, ditto, 5000’, iii.1889, Helms (AMS); 1/ Kosciusko NP, nr Charlotte’s Pass, 1880m, *Sphagnum* moss, 20.ix.1978, S&J Peck (ANIC); 2/ Kurrajong Heights, 25.ix.1951, M Blunden (AMS); 1/ Medlow, i.1933, KK Spence (AMS); 2♂, 1♀ / Megalong Vy, Euroka (AMS); 1/ 5k S Monga, on *Epilobium*, rainforest swamp, iii.1991, C. Reid (ANIC); 2/ Mongarlowe R, nr Charleyong, 26.i.1968, Z. Liepa (ANIC); 5/ Mt Costigan, Tuena, 5.xii.1961

FA Cook (ANIC); 4/ Mt Irvine, 14.vi.1944, ELG Troughton (AMS); 1♂\*/ Mt Kosciusko, i.1937, H. J. Carter (AMS); 3, ditto, no date, coll Helms (BMH); 1♂\*/ Pt Lookout Rd, 16.ii.1981, R. H. Mulder (AMS); 7/ Prison Farm, Glen Innes, 1969–1970 (ANIC); 3/ Ross Hill, Inverell, 11.iv.1956, N Riley (AMS); 4♀ / Scone, on *Godetia*, x.1928, E.B. (AMS); 1/ Stuarts Brook SF, 31°57S 151°25E, on wood in swamp, 18.i.1992, T Gush (ANIC); 1/ Sydney, KK Spence (AMS); 2/ Tomalla Rd, below Tubrabucca, 19.x.1956, DK McAlpine (AMS); 4♀ / Tuross, 17–22.i.1936, K. C. McKeown (AMS); 4/ Springwood, taken on garden *Fuschia* (ANIC); 1♀ / Upper Colo R., x.1922, J. R. Kinghorn (AMS); 1♀ / Wagga, 10.ii.1931, W.D. (AMS); **Queensland**: 2♀ / Stanthorpe, E. Sutton (AMS); **South Australia**: 1/ no data (AMS); **Tasmania**: 1/ Blessington, ii.1939 B. Plumley (ANIC); 5♀ (AMS); 5/ Bust-me-Gall Ck, 12.4k W Buckland, 200m, 11.ii.1980, Newton & Thayer (ANIC); 1/ 2k S Cambridge, 11.xi.1975, KR Norris (ANIC); 1/ 90k S Coleraine, 28.ii.1981, EB Britton (ANIC); 6♀ / Cushion Ck Cave, Florentine Vy, 7.xi.1966, T. Goede (AMS); 4/ Eaglehawk Neck, 12.i.1934, AJ Turner (QMB); 1♂\*, 11/ Florentine Vy, 42°38S 146°28E, 7.ix.1993, AR Clarke (ANIC); 1♂, 9/ Florentine Vy, 42:37S 162:27E, swarming on *Acaena anseri*[-*nifolia*] foliage, *Euc. regnans* plantn, 3.ii.1992, C. Reid (ANIC); 1♀ / Great Lake, 23.i.1928, G. P. Whitley (AMS); 1, ditto, on bush, 7.i.1981, S Fearn (ANIC); 4/ 12k S Grotty, 24.i.1985 GG Burns (ANIC); 1♂\*, 1♀ / Harallay Ba[y], *Epil. & Olearia* 16.xi.[18]86 Tepper, K29787 [collected King Island] (AMS); 3/ Kermadie Falls tk, Geeveston, 7.iii.2003 J Balderson (ANIC); 1/ Lake St Clair, 42°08S 146°13E, roadside sweep, 16.ii.1997, P Greenslade (ANIC); 2/ Launceston (QMB); 4, ditto, 25.i.1914 (QMB); 1, ditto, Launceston, xi.1933, RH Bevin (ANIC); 1♂\*, 3♀ / Lenah Vy, Hobart, 25.i.1928, G.P. Whitley (AMS); 3, ditto, 10.x.1981, J Lesek (ANIC); 1/ Liffey Vy, 12.xi.1981, S Fearn (ANIC); 1♀ / Macquarie Heads, ex *Senecio*, 2.i.1990, G. Cassis (AMS); 2♀, ditto except ex compost (AMS); 1/ Miena, Great Lake, 41°59S 146°43E, under rocks edge of lake, 10.xii.1993 W Horning (ANIC); 10/ Mt Arthur (QMB); 4/ Mt Barrow, nr Launceston, 16.i.1948, Key, Carne & Kerr (ANIC); 2, ditto, on *Acaena sanguisorba*, 28.iii.1969, BP Moore (ANIC); 1♀ / Mt Field NP, 42:40S 146:43E, 160m, 8–13.xi.2010, C & E. Reid (AMS); 2/ Mt Rufus, 42°10S 146°07E, 800m, under bark, 26–28.i.1980, Lawrence & Weir (ANIC); 1♀ / 3k E National Park, 42:40S 146:44E farmland, 155m, 8–13.xi.2010, C. Reid (AMS); 3/ Nubeena, Lea (ANIC); 1/ Quambys Bluff, nr Deloraine, 12.i.1948, Key, Carne, Kerr (ANIC); 1/ 16mi SW Scottsdale, 16.i.1948, Key, Carne & Kerr (ANIC); 1/ Sheffield, 8.i.1977, PG Kelly (ANIC); 4♂\*, 1♀\*, 4♀ / 6k S Tayana, route C405, riparian vegetation, 23.ii.1994, C. Leask (AMS); 1/ S Tayene, ck along rd, yellow pan, 1.ii.1989, D Bickel (ANIC); 1/ Tewkesbury, 4.i.1948, Key & Carne (ANIC); 1/ 2k ENE Tim Shea, 42°43S 146°29E, 600m, 1.ii.1980, Lawrence & Wear (ANIC); 3/ Waratah, Lea (AMS); 1, ditto, 21.ii.1971, BP Moore (ANIC); 6/ nr Weldborough, 41°09S 147°53E, roadside, 11.xi.1993, J Trueman, W Lee (ANIC); 1/ Willowdale, Deloraine, 14.xii.1984, S Fearn (ANIC); 1/ 14k SSW Wilnot, 41°30S 146°05E, yellow pan, 31.i.1983, Naumann & Cardale (ANIC); **Victoria**: 2, no locality (ANIC); 2, ditto, coll. Helms (BMH); 1/ Bernhard, Mt Hotham, 1375m, 13.xii.1962, ES Ross & DQ Cavanero (CAS); 2/ Broadford, ix.1903, Helms (BMH); 1/ Cann R, i.1971, J Strong (ANIC); 6/ Cape Liptrap, 11.viii.1972 (ANIC); 4/ Cockatoo, GF Hill (ANIC); 1♂\*/ Eurobin, 20.iii.1965, C. Smithers (AMS); 1/ Fern Tree Gully, H Blackwood (AMS); 1/ Flinders, ii.1930 MB Sproule (ANIC); 1/ Icey Grb [?], 16.iii.1958 CGL Gooding (ANIC); 1/ Kalista, xi.1950, AB (ANIC); 1/ Kallista, 26.xii.1941, Smith (ANIC); 1/ Macedon, i.1916, JC Dixon (ANIC); 6, ditto, 16.viii.1923, OH Swezey (BMH); 2/ Marysville, R Blackwood (AMS); 1♀, ditto, 31.xii.1930 A. Musgrave (AMS); 1♀ / Melb[ourne], xi.1925 (AMS); 2/ Mirimbah, 1.i.1964, PG Kelly (ANIC); 1/ Moonderra area, xi.1970, M Coulson (ANIC); 1/ Mt Cobungra, xii.1933, A Musgrave (AMS); 1/ Mt Hotham, Blackburn (AMS); 1/ Mt Macedon, 10.xi.1972, M Schwartz (ANIC); 2/ Nelson, Blackburn (ANIC); 8/ Olinda, 5.xi.1967, B Hardie (ANIC); 1♂/ Rokeby, 15.ii.1958, C.G.L. Gooding (ANIC); 1/ S Gippsland, 26–30.x.1930 WK Hughes (ANIC); 4/ Stockmans Reward, 25.xi.1962, PG Kelly (ANIC); 10/ Traralgon, 6.xi.1958 A Whyte (ANIC); 1/ Tyres R, 5.ii.1966 M Coulson (ANIC); 1/ Upper Tarago R, 6.vi.1969, B. May (ANIC); 1♂\*, 1♀ / Wannon R, nr Jimmy's Ck, Grampians, 10.xii.1977, D.K. McAlpine & M. A. Schneider (AMS); 6/ Waratah Bay, x.1969 G May (ANIC); 1/ Yarra, 7.i.1966 PG Kelly (ANIC).

**Description.** Relatively small, length: male 4.2–5.8mm, female 4.7–6.1mm.

**Colour:** entirely black with metallic reflection, dorsum usually bright dark blue, less frequently purplish-blue, dark green, dark bronze, purple or non-metallic, rarely bicoloured (blue anterior and green elytra, or asymmetrically with one elytron green and one dark purple), venter and legs with duller reflection; antennae black, or first antennomere with apex reddish-brown (rarely also second).

**Head:** ratios (Tables 3 & 4): **male:** EG 3.00–3.32; IE 1.58–1.61; HG 7.50–8.50; HN 1.06–1.10; NE 2.36–2.42; **female:** EG 3.00–4.00; IE 1.51–1.72; HG 8.18–10.25; HN 1.06–1.14; NE 2.25–2.58; pubescence: a few small setae

at inner edge or posterior of orbit, longitudinal row of short setae at sides of frontoclypeal ridge, 3–4 pairs of long setae behind clypeal anterior margin; transverse row of long setae between eye and buccal cavity; face impunctate except minute punctures at bases of setae and occasionally extra punctures on orbit; vertex with or without microreticulation; postantennal calli smooth, microreticulate at base, to mostly microreticulate; eyes small but laterally prominent; postantennal calli elongately to transversely triangular, with acute to blunt triangular anterior angles (70–90°) and almost truncate bases; frontoclypeal ridge lanceolate, smooth to rugose, varying from broad and almost flat to narrow and convex, anteriorly terminating in a short keel before clypeal margin; anterior edge of clypeus generally smooth, weakly raised, sides of clypeus microreticulate, slightly rugose.

**Thorax:** pronotum often laterally depressed or transversely depressed behind anterior border; shining, entirely non-microsculptured; pronotum minutely and sparsely punctured on disc, punctures slightly closer at anterior margin, usually denser and larger on basal field (separated by 2–5 diameters); hypomeron almost entirely smooth, without microreticulation; prosternum smooth and shining; scutellum triangular but with slightly curved sides, microreticulate or shining and smooth; elytra shining, without microreticulation, usually strongly and closely but irregularly punctured, interspaces mostly 0.5–2x diameters, discal punctures often partly aligned in short rows; elytral laterally smooth behind humeri or weakly to strongly keeled to middle, rarely with traces of other longitudinal ridges on disc; femora densely microsculptured and pubescent; outer face mid tibia with prominent median keel for most of length, on a concave (male) to flat (female) surface; male first protarsomere distinctly longer than broad, female c. 1.5x longer than broad.

**Abdomen:** abdominal ventrites densely microsculptured and pubescent; **male:** penis 1.5–1.7mm long; in dorsal view almost entirely parallel-sided to the angulate apex, which has a short projecting right-angled but rounded lobe; dorsal and ventral surfaces curved in lateral view, with tip weakly bent; dorsal surface smooth, without ridges; venter without transverse or oblique ridges, two long apicoventral depressions present, 0.25–0.3x penis length, elongate, smooth surfaced and laterally smooth edged, separated by a broad shallowly convex ridge which continues basally beyond the grooves; **female:** tignum 0.95–1.1mm long, basal part with blunt tip and irregularly expanded sides, broader than base of apical part, minute lateral arms, triangular to threadlike, tip of apical part slightly to broadly expanded; spermathecal collum of variable length and thickness and containing 1–2 twists; vaginal palpi short and almost conical, length: width ratio 0.8–1, with obliquely truncate or concave apex, and concave inner margin; palpal apodemes 3–4x length palpi, 0.3–0.5x width palpi.

**Distribution and biology.** *Altica corrusca* is endemic to southeast Australia including Tasmania, as far north as the Queensland border (Stanthorpe) and as far west as the South Australian border (Mount Barker) and Grampian Mountains (Victoria), but is absent from low elevation areas of the Murray-Darling basin. The record of *A. corrusca* feeding on *Ludwigia* in north Queensland is likely to refer to *A. aenea* (Hawkeswood 1988), however records of *A. corrusca* on *Rosa* and *Clarkia* from central Queensland may possibly refer to this species (Hawkeswood & Furth 1994).

*Altica corrusca* has been regularly identified outside Australia (Allard 1891, 1904; Bryant & Gressitt 1957; Samuelson 1973; Kamnerdratana 1982) but these are all misidentifications. Our studies of Pacific material show that only *A. aenea* (q.v.) is present there, but mainland southeast Asian records of *A. corrusca* may belong to the similar species *A. aenea* or *A. cyanea* or possibly other species.

*Altica corrusca* is polyphagous and occasionally a pest. Its native hosts include *Acaena* (Rosaceae) (*A. ovina* and *A. sanguisorbae*: French 1913; *A. anserinifolia*: pers. obs. CAMR), *Epilobium* (Onagraceae) and *Haloragis* (Haloragaceae), in montane grassland, eucalypt forest and riparian margins. *Altica corrusca* does not feed on emergent species of Onagraceae, such as *Ludwigia* and is the only species of *Altica* that occurs far from water. David De Little (pers. com., 2013) reared larvae through to adults on *Acaena* from material collected at Ringwood, Tasmania. Three larvae collected in Ridgley, Tasmania, on *Epilobium*, were also reared to adults by De Little (pers. com., 2013).

In the early 20<sup>th</sup> century, *Altica corrusca* (as *A. pagana*) was a serious strawberry (*Fragaria*, Rosaceae) pest in Victoria, damaging leaves and flower buds (French 1913; Adam & Pescott 1932). It is still occasionally a pest in Victoria (D. Madge, pers. com. 2014). Label records show that *A. corrusca* also attacks a range of exotic horticultural plants in Onagraceae, including *Oenothera*, *Fuchsia* and *Clarkia*.

The recorded presence of *A. corrusca* on *Acacia* (Elliott *et al.* 2002) and label records of singletons on *Leptospermum* (Myrtaceae) and *Senecio* (Asteraceae) probably represent accidental associations or adults attracted to non-host flowers. We suspect that the specimen recorded from dog dung is mislabelled.

*Altica corrusca* has been collected in every month except May. Most collection events are in October to March (80%), especially November (20%) and January (26%). The dip in collections in December (11%) may indicate that there is a short summer generation in some areas.

**Taxonomic notes.** *Altica corrusca* has been misspelled 'corusca' by most authors since Fogg (1859), with the notable exception of Blackburn (1896). However, Scherer (1982) examined Erichson's type material, designated a lectotype and corrected the spelling.

Blackburn (1896) described *A. pagana* from Victoria and Tasmania, separating it from *A. corrusca* primarily by having the "apical ventral segment of male bituberculate", despite not having seen Erichson's type material. We have been unable to find any consistent visible differences in the male last ventrites of the *Altica* species under review, although they occur in African species (Döberl 2010b). Comparison of the type material shows that *A. corrusca* is a senior synonym of *A. pagana* (**syn. nov.**). Blackburn (1896) did not indicate how many specimens he examined but the species was based on material from two type localities. We have seen four syntypes in the Blackburn collections (in NHML & SAM) and hereby designate a male lectotype to fix the identity of this species.

### *Altica cyanea* Weber, 1801

(Figs 6, 13, 28, 41, 42, 56, 57, 71, 72, 81)

*Altica cyanea* Weber 1801: 57 (type locality Sumatra).

*Haltica cyanea*: Illiger 1807: 115.

*Galleruca cyanea* Fabricius 1801: 497 (objective junior homonym, type locality Sumatra).

*Haltica ianthina* Illiger 1807: 115 (nom. nov. pro *cyanea* Fabricius 1801, nec Weber 1801).

*Altica caerulea* partim sensu auctt. nec Olivier, 1791; Gressitt & Kimoto 1963: 889.

**Material examined** (20, \* = dissected specimen). Type material: *Altica cyanea* Weber: Lectotype (this designation): ♀\*/*cyanea*/ (NHMD).

Non-type material: **Indonesia: Java:** ♀\*, ♀/ Buitenzorg, vi.1907 (BMH); 2♂\*/ Java, Dieng Plateau, above Telago Warna, 2150m, on low shrub, ii.1991, C Reid (ANIC); ♂\*, ♀\*/ West Java E entrance to Gunung Halimun NP, ix.1999, C Reid (AMS); **Sumatra:** 2♂\*, ♀/ West Lampung, 3k S Krui, *Melastoma*, old coastal palm plantn, 19.xii.2001, C Reid (AMS); **Malaysia:** ♀\*, 4/ North Borneo or Sarawak, 1958-9, TC Maa (BMH); 1/ British North Borneo [Sabah], Tenompok, 48k E Jesselton, 1460m, 26-31.i.1959, TC Maa (BMH); ♂\*, ♂, ♀\*, ♀, ditto, 19.ii.1959 (BMH).

**Description.** Length: male 5.1–5.8mm, female 5.2–6.1mm.

**Colour:** dorsum usually deep blue, rarely purplish or bicoloured, either with green pronotum and blue elytra or the mostly blue elytra narrowly green laterally; base of head often reddish (teneral specimens?); first antennomere dark brown with red apical third and base; remainder of antennae black or antennomeres 2 & 3 reddish-brown; venter and legs entirely black, or legs partially reddish-brown (teneral specimens?), with duller metallic reflection than dorsum.

**Head:** ratios (Tables 3 & 4): **male:** EG 2.80–4.00; IE 1.57–1.82; HG 7.80–10.00; HN 1.00–1.08; NE 2.35–2.66; **female:** EG 3.40–4.00 (*A. cyanea* lectotype: 3.40); IE 1.55–1.63 (*A. cyanea* lectotype 1.62); HG 8.8–9.80 (*A. cyanea* lectotype 8.8); HN 1.03–1.06 (*A. cyanea* lectotype 1.04); NE 2.33–2.50 (*A. cyanea* lectotype 2.50); pubescence: several small setae at posterior of orbit, longitudinal row of short recumbent setae at sides of frontoclypeal ridge, 1 long pair and several short setae behind clypeal anterior margin; transverse row of long setae between eye and buccal cavity; face impunctate except small punctures at bases of orbital setae; vertex without microreticulation; postantennal calli smooth, not microreticulate; eyes small and relatively flat; postantennal calli usually almost quadrate, with bluntly triangular anterior angles and truncate to convex bases, these usually transversely subdivided, with secondary triangular areas; calli variably adjacent, from most of length to base only; frontoclypeal ridge lanceolate, broad and smooth or finely rugose at base, entirely convex, anteriorly terminating in a narrow keel before clypeal margin or keel absent; anterior edge of clypeus dull and finely rugose, strongly raised, often as a prominent transverse ridge, sides of clypeus microreticulate and finely rugose.

**Thorax:** pronotum with or without pair of shallow ovate depressions behind anterior border; shining, entirely non-microsculptured or apical half and basal field microreticulate; non-glandular puncturation variable, from small sparse punctures only laterally, to anterior and basal field with sparse (separated by at least 2 diameters) larger

punctures, but disc always finely and sparsely punctured; hypomeron without microreticulation, smooth, except anterior angles finely transversely strigose and sometimes with sparse punctures; prosternum anteriorly smooth and shining, process finely transversely grooved and dull, slightly rugose; scutellum triangular with curved sides, to semiovalate, microreticulate or shining and smooth; elytra shining, microreticulation absent or at extreme apices only, strongly and closely but irregularly punctured, interspaces mostly 0.5–2 diameters, sometimes with smooth elongate intervals on disc; elytra with small deep depression laterally behind humerus, but without distinct keel; femora densely microsculptured and pubescent; outer face mid tibia convex, usually with prominent keel for most of length, apical fifth sometimes flat; male first protarsomere distinctly longer than broad, female 1.6–1.7x longer than broad.

**Abdomen:** abdominal ventrites densely microsculptured and with recumbent pubescence; **male:** penis 1.95–2.15mm long; in dorsal view parallel-sided to the rounded apex, which has a protruding short truncate lobe; dorsal and ventral surfaces slightly curved in lateral view, with extreme tip recurved; shallowly transversely ridged on middle of dorsal surface (only 2 ridges on specimen from Dieng, Java); venter without transverse or oblique ridges, two long apicoventral depressions present, 0.30–0.35x penis length, ovate, internally finely ridged or smooth surfaced, laterally smooth edged, separated by a narrow sharp ridge; **female:** tignum 1.04–1.28mm long, basal part broad and irregularly outlined, lateral arms large and broadly triangular and apex broadly spatulate; spermathecal collum of variable length and thickness and containing 1–2 twists; vaginal palpi short and broad, almost ovate, length: width ratio 0.6–1.2, with rounded to truncate apex and straight or convex inner margin; palpal apodemes 3–5x length palpi, 0.5–0.5x width palpi.

**Distribution and biology.** *Altica cyanea* appears to be endemic to Sundaland (Peninsular Malaysia, Sumatra, Borneo and Java) and is absent from Australia and islands east of Java. Manfred Döberl has kindly provided additional records of *A. cyanea* based on his dissections and all fit this limited distribution on the Sunda shelf: **Malaysia:** Endau Rompin NP, Johore; Taiping, Perak; **Indonesia:** Cibodas & Cipanas, Java; Tebing Tinggi, North Sumatra; Payakumbuh, West Sumatra.

*Altica cyanea* has been found feeding on *Melastoma* (Melastomaceae) in Sumatra and Java (*pers. obs.*; label data, AMS). Published records of hosts for probably correctly identified *A. cyanea* include only *Melastoma* (Kamarudin & Shah 1978; Ooi 1987). Mohammedsaid (2004) has also listed *Melastoma* as the host of *A. cyanea* but his entry for this species is a conflation of *A. cyanea* and *A. aenea*. *Melastoma malabathricum* is a weed in forestry plantations and *A. cyanea* has been proposed as a biocontrol agent for it (Kamarudin & Shah 1978). *Altica cyanea* and its closest relative *A. birmanensis* have been collected together in Java (Dieng Plateau).

**Taxonomic notes.** *Altica cyanea* Weber, 1801, was described from material collected by the Danish naturalist Daldorff in Sumatra. In the same year Fabricius named *A. cyanea* from the same material (Fabricius 1801), without acknowledging Weber's prior use of the name. Weber's publication appeared at least by August and probably before March, 1801 (Evenhuis 1997; Y. Bousquet, *pers. comm.* 2014), whereas Fabricius' publication is not datable within 1801 and therefore should be dated 31 December 1801 (ICZN: Art. 21). Weber was Fabricius' pupil and it is possible that pupil and master used the same name for the same insect without realising that each was going to publish it. Daldorff was a Danish Naval officer in the Danish East Indian Company, based in Tranquebar on the east coast of India (Daldorff 1797), and is known to have visited Bencoolen [Bengkulu], the principle British trading port on the west coast of Sumatra in 1800 (Heyne 1814). Therefore Daldorff's material was probably from Bengkulu. Weber's description was minimal: blue, but including a greenish variety, elytra punctate, similar and related to *A. oleracea* [from Europe] but more elongate, and with dense short grey pubescence on the venter. This description fits any of the three species of *Altica* known from Sumatra in collections. Fabricius' description was also minimal: blue, shining, antennae and legs black, similar to *A. tamaricis* [from Europe] but slightly larger and abdomen black. Illiger in Berlin also had material from Daldorff and based on comparison of Weber and Fabricius's descriptions with his material decided that two species were involved. He therefore renamed Fabricius' junior homonym, using his emendation of the genus name: *Haltica ianthina* Illiger, 1807.

Weber's early beetle types were retained in Fabricius' collection, housed in NHMD (Horn & Kahle 1937) and there should be at least two syntypes, since a colour variety was mentioned. However, Gressitt claimed to have examined the syntypes of *A. cyanea* in the Royal Scottish Museum (now NMSE) in Scotland in the 1950s (Gressitt & Kimoto 1961, 1963). Scherer (1969) also listed RSM as repository of the types but without any evidence that he had seen the material (Scherer 1969). A search of the NMSE collections has revealed that there are two syntypes of *Altica caerulea* Olivier, 1791 (*q.v.*), but no Weber or Daldorff material (Richard Lyszkowski, *pers. comm.* 2013).

We think Gressitt muddled his notes when travelling around collections in Europe, and this error was simply copied by Scherer. There is a single specimen in NHMD, labelled as a type of *Galeruca cyanea* Fabricius, 1801, collected by Dahldorff in Sumatra and there is a single early specimen in ZMB standing as a type of *Haltica ianthina* Illiger, 1807. The handwritten label on the first appears to be by Fabricius.

Documentation is lacking for the origins of these specimens in NHMD and ZMB, therefore at least three scenarios are possible: (i) these are the two syntypes of Weber, one relabelled by Fabricius and the other relabelled by Illiger; (ii) the specimen in Copenhagen is one of Weber's syntypes, relabelled or also used by Fabricius, and the specimen in Berlin is not a type; (iii) Weber's syntypes are missing and only Fabricius' specimen remains. In the interests of reducing ambiguity for this species, we consider it reasonable to suppose that the same specimen was used by pupil (Weber) and master (Fabricius) and that this is the specimen in NHMD. Furthermore that the specimen in Berlin is from the same collection of material (by Daldorff) but has no type status. We designate the NHMD specimen a lectotype of *Galeruca cyanea* Weber, 1801, to cement this argument.

*Altica cyanea* has been confused with both *A. birmanensis* and *A. caerulea* for most of the last 100 years. Maulik (1926) synonymised *A. cyanea* and *A. birmanensis*, followed by Scherer (1969) and Medvedev (2009), although the two last authors based their arguments on misidentifications. Kimoto separated the species on the presence or absence of a lateral elytral groove (and keel) without mentioning genitalic characters (Kimoto 2000: 256). This character is useful but the genitalia are the only reliable diagnostic features. *Altica cyanea* is found wholly within the range of *A. birmanensis*, which suggests the possibility that it is a divergent population within that species. Further work is needed to determine the status of these species.

#### ***Altica gravida* (Blackburn, 1896) comb. nov.**

(Figs 7, 14, 18, 19, 21, 22, 29, 31, 43–46, 58–61, 73–76, 82, 83)

*Haltica gravida* Blackburn 1896: 75 (type locality: Murray River district, in South Australia).

*Altica ignea* sensu Vestjens, 1979, nec Blackburn 1889.

**Material examined** (312; \*= dissected). Types: ***Altica gravida* (Blackburn)**: lectotype (this designation): ♂/ T M.R.[Murray River]/ Type/ *Haltica gravida* Blackb./ Blackburn coll. 1910-236/ (NHML); paralectotypes (3): 1/ 1544/ Austral. ex Black. type/ Jacoby coll.1908-28a/ (NHML); 1/ MR 1544/ *Haltica gravida* Blackb. cotype/ S. Australia Blackburn/ *Haltica gravida* Bl. SA NSW cotype I.4038/ (SAM); 1/ A1544/ *Haltica gravida* Blackb. cotype/ Adelaide/ (SAM).

Non-type material: **Australia Capital Territory**: 1/ ANU Campus, 26.xii.1979, M. Carver (ANIC); 2/ Black Mtn, light trap, 10.xi.1966, IFB Common (ANIC); 2/ Canberra 29.i.1958, WJM Vestjens (ANIC); 1, ditto 24.xii.1956 (ANIC); 1, ditto 15.xii.1956 (ANIC); 1, ditto, 24.xii.1957 (ANIC); 1, ditto, 13.i.1957 (ANIC); 1, ditto, 1.i.1957 (ANIC); 1, ditto, 11.xii.1956 (ANIC); 2, ditto, ex *Myriophyllum*, 1.xi.1977, R. Nipperas (ANIC); 1/ Cotter R., in flight, 7.xii.1976, DP carne (ANIC); 10/ Kambah Pool, on ground swarming, 24.xii.1973, DP Carne (ANIC); 1/ Kingston, 11.xii.1956, C. Wellspring (ANIC); 1/ Lake Burley Griffin, feeding on *Ludwigia peploides montevidensis*, 1.iii.1985, N. Starrick (ANIC); 1/ Lee's Spring, 18.ii.1922, G. J. Hill (ANIC); 1/ Mt Coree, 1157m, 25.xii.1973, E&S Britton (ANIC); 1/ Pine Island, 10.xii.1973, S. Misko (ANIC); 2/ Red Hill, 23.xi.1968, K. Pullen (ANIC); **New South Wales**: ♂, 1/ Apsley Falls, 31:03S 151:46E, at light, 18.xii.1968, Britton & Misko (ANIC); 1/ Billabong Ck, 1k W Wanganella, 1.v.1978, Z. Leipa (ANIC); 1/ Blayney, 5.iii.1930, Salter (AMS); 1/ 10mi W Blayney, nr Bathurst, 11.i.1967, B Cantrell (UQIC); ♀/ Bluegate, nr Yanco, 28.ix.1932, K.C.McKeown (AMS); 2♀/ Blue Mtns, H. W. Brown (AMS); ♀, 1/ Bogan R, J. Armstrong (ANIC); ♂\*, 10m, 9f/ Braidwood, Jinden, 27.xii.1974, R. J. M[ulder] (AMS); 1/ Caparra, mv light, 14.iv.1991, SG Watkins (ANIC); 1, ditto, 16.x.1991 (ANIC); ♀/ Carss Park, 24.viii.1954, R. H. M[ulder] (AMS); 1/ Cattle Ck Rd, SW Captains Flat, 26.xii.1926, W Allen (ANIC); ♂/ Clyde River, K. K. Spence coll. (AMS); 2/ Collector Swamp, on wing at dusk, 10.iv.1966, BP Moore (ANIC); ♂/ Condobolin, 6.xi.1972, D. A. Doolan (AMS); 1/ Congo, nr Moruya, at light, euc scrub by coast, 16–17.iii.1985, C. Reid (ANIC); 2/ Cowal North, Lake Cowal, 10.iii.1971, WJM Vestjens (ANIC); 1/ Denistone, on *Acacia* blossom, 5.i.1975, DP Carne (ANIC); 1/ nr Euabalong, at light, 27.xi.2001, G Hangay (ANIC); 5/ Euberta, Wagga Wagga, 6.xi.1935, JA Green (AMS); 1/ 2.4k NE Eugowra, 33°26S 148°22 E, 24.v.1972, Z. Liepa (ANIC); ♀/ Euralie-Narrandera Rd, 9–19.x.1932, K.C.McKeown (AMS); ♂\*, ♀\*/ Fowlers Gap, 8.xii.1974, D. Lester (AMS); 1, ditto, arid zone res. sta., 20.i.1980, K. Miller (ANIC); ♂, ♀/ Gloucester, 17.x.1977, D. A. Doolan

(AMS); 2♂/ Gogeldrie, 23.ii.1927, W. B. McKey (AMS); ♂\*, 2♂/ ditto, except “damaging rice”; 1/ 5k NE Griffith, *Myriophyllum*, 24.ii.1992, G. Saintly (ANIC); ♀/ Grosses Plains Ck, @Moonbah Stay, 36.49065S 148.55431E, 27.xi.2011, DM & SJ (AMS); ♂/ Gundaroo, Wattle Vy, at light 6.ii.1979, B. P. Moore (ANIC); ♂/ Gundaroo Rd, iii.1970, B. P. Moore (ANIC); ♀/ Jenolan SF, 23.xii.1972, D. A. Doolan (AMS); 2/ Khancoban, below Khancoban Dam, 36°13S 148°06E, 300m, at light, 13.ii.1987, A Newton & M Thayer (ANIC); 2/ Lake Albert, nr Wagga, 20.iv.1971, Z. Liepa (ANIC); ♂\*, 25/ Lake Cowal, 33°41S 147°22E, on *Myriophyllum*, 16.ix.1971, W. J. M. Vestjens (ANIC); 3, ditto, no coordinates or host, 15.ii.1971 (ANIC); ♂\*, ♂, ♀/ ditto, except 11.xi.1972, D. A. Doolan (AMS); 14/ Leeton, weeds & rice, 4.iii.1927, KC Mckeown (AMS); ♀/ Leichhardt, Sydney, xii.1977, F. T. Fricke (AMS); 1/ Leura, i.1932 (AMS); ♂/ Marrickville, 16.xii.1955, R. J. M[ulder] (AMS); 2/ Menindee lakes, Burkes camp, 28.ix.1978, Z. Liepa (ANIC); 1/ Moonbil Lookout, 30°58S 151°06E, 760m, 11.xii.1974, Common & Edwards (ANIC); ♀/ Mt Coricudgy, 20.xii.1985, G. Hangay (AMS); 4/ Mt Costigan, Tuena, 5.xii.1961, FA Cook (ANIC); 1/ Mt Kaputar, 3000’, at light, 6.ix.1962, ex coll. UNE (ANIC); 12/ Mt Kaputar NP, 30°17S 150°10E, 1362m, 5.xii.1974, IFB Common & ED Edwards (ANIC); ♂\*/ Mount Tomah, 14.x.1977 (AMS); 1/ Myal Ck Xing @ Delungra & Binga Binga Rd, 25.i.2000, G Hangay (ANIC); ♀\*/ Myall Lakes NP, 32:37:56S 152:12:27E, ex *Acacia longifolia* var *sophorae*, ML101/04B[eat], 15.xi.1996, L. Wilkie (AMS); ♀/ One Tree Waterhole, 145 miles N B[roken] Hill, 23.ix.1955, R. D. Mackay (AMS); 2, ditto except 24.ix.1955 (AMS); ♀/ Pilliga Scrub, Bongle Gulley, N. Baradine, 5.xii.1978, R.D.K. (AMS); 1/ Pilot Hill, Bago Forest, Batlow, 1.iii.1957, TG Campbell (ANIC); 1/ Quandong, 52k SE Broken Hill, 26.ix.1975, Z. Liepa (ANIC); 1/ Quibray Bay, 22.i.1983, S Watkins (ANIC); ♂\*/ Roto-Matakana district, 19.i.1990, A. Sundholm & J. Bugeja (AMS); ♀/ Roundhill Res., 28.i.1969, J.V. Peters (AMS); ♀/ Snowy R, Buchan-Jindabyne Rd, 30.xii.1977 (AMS); ♂/ Tamworth, xi.1967, G.W. A. (ANIC); ♂\*, ♀\*/ Tuglo, 48k N Singleton, 6.i.1978 (AMS); 1/ Trangie, at light, 23.x.1976, D. Whale (ANIC); ♂\*/ Upper Allyn, nr Eccleston, mv lamp, 25.ii.1970, D. K. McAlpine (AMS); ♀/ N of Warren, 26.iv.1975, D. Lester (AMS); ♀/ 30mi S Warren, 25.iv.1975, G Gowing (AMS); 1/ Wauchope, 31°27S 152°44E, at light, 4.i.1970, Britton & Misko (ANIC); 1/ Willandra Br., 11k N Mossgiel, 33°16S 144°34E, dry swamp, at light, 21.xii.1970, Britton, Misko & Pullen (ANIC); 3/ Williamstown, ex *Alternanthera philoxeroides*, 26.x.1977, M. Julien (ANIC); 2/ Windamingle, nr Wentworth, 29.iv.1951, A Dyce (ANIC); 3/ Windsor, HJ Carter (ANIC); ♂\*/ Wingham, Stockard home, Combined St, incand. light, 8.ix.1991, J. Stockard (ANIC); 3/ Wits Ck Xing, Queanbeyan R, S Captains Flat, 19.xi.1977, S&W Allen (ANIC); **Northern Territory:** ♂/ 30k WNW Alice Springs, 23:32S 133:38E, 7.x.1978, M. S. Upton (ANIC); ♂\*, ♂, 2/ 39k E Alice Springs, 23:41S 134:15E, 5.x.1978, Upton & Barrett (ANIC); 6/ 53k NE Alice Springs, 23°35S 134°22E, 6.x.1978, Upton & Barrett (ANIC); ♂\*/ 15k SW Alroy Downs HS, 19°24S 135°58E, 10.iv.1976, Key & Balderson (ANIC); ♀, 8/ Bessie Spring, 8k ESE Cape Crawford, 16:40S 135:51E, 26.x.1975, M. S. Upton (ANIC); 4/ 22k WSW Borroloola, 16°08S 136°06E, at light, 16.iv.1976, J Feehan (ANIC); 1/ 4k S Jarmarm, Keep R. NP, 15°48S 129°06E, GPS, at light, 29.v.2001, T Weir & P Bouchard (ANIC); ♂\*, 4/ McArthur R., 48k SSW Borroloola, 16°27S 136°05E, 29.x.1975, MS Upton (ANIC); ♂\*/ Timber Ck, at light, 22.v.1976, K&E Carnaby (ANIC); ♂, 6/ Todd River, 9k NE Alice Springs, 23:38S 133:53E, 10.x.1978, Upton & Barrett (ANIC); 1/ 3.5k SW Victoria R. Downs Sta., in flood channel Wickham R., at light, 13.viii.1979, LP Kelsey (ANIC); **Queensland:** ♀/ Biggenden, xii.1973, H. Frauca (ANIC); 1/ foothills, Bluff Ra., via Biggenden, 15.ix.1974, H Frauca (ANIC); ♀/ summit Bluff Rg., 16.viii.1974, H. Frauca (ANIC); 1/ 62k SW Boulia, 23°02S 139°18E, 16.x.1978, Upton & Barrett (ANIC); 1/ Brisbane, iii.1969, J. Liddy (ANIC); 1/ Burnett R., N Eudsvold, 24°46S 152°25E, at light, 10.i.1970, Britton, Holloway & Misko (ANIC); ♂\*/ Cheltenham, 21:03S 144:56E, 17.xi.1986, R. Bejsak (AMS); ♂\*/ Coast Range, nr Biggenden, 1.vi.1977, H. Frauca (ANIC); 1/ Cunnamulla, iii.1942, N Geary (AMS); 1, ditto, x.1941 (AMS); 1/ Elizabeth Gorge, viii.1974, JAG Brooks (ANIC); ♂/ Gilruth Plains, 9.i.1964, W. J. M. Vestjens (ANIC); 6/ Hell Hollow Gorge NP, Powell Ck, 25°34S 144°41E, at light, 22–25.x.1997, T Weir (ANIC); 1/ Joalah NP, Tamborine Mtn, 27°56S 153°12E, 18–21.x.1978, Lawrence & Weir (ANIC); 2♂\*, 3♂, 3♀/ Lake Muncoonie, floodplain, 20.ix.1977 (AMS); 1/ Mackay, ii.1964, JE Dunwoody (UQIC); 6/ 25k N Monto, 24°41S 150°58E at light, 13.xii.1990, T Gush (ANIC); ♂\*/ Normanton, 20.v.1976, K. & E. Carnaby (ANIC); ♀/ Southport, xii.1932, L. W. (ANIC); 2/ Surat (AMS); ♂\*, ♂/ Wallaville, T.L. Bancroft/ *Altica coerulea* Ol. det G. Scherer 1969/ (ANIC); **South Australia:** ♂/ Angorichina Ck, below hostel, 22.x.1978, E.B.Britton (ANIC); ♀/ Angorichina Hostel, 7k E Parachilna, 23.x.1978, E. B. Britton (ANIC); ♀/ 12k NW Cameron’s Corner, at light, 22.x.1974, P. Meyer (ANIC); ♀/ Innaminka, 23.iv.1980, I. D. Buddle (AMS); 1/ Lake Eyre S, 18.ix.1978, Upton & Barrett (ANIC); 4/ R Murray, AH Elston (AMS); 1/ Tea Tree Gully, Ainsley’s Hill Reserve, ex *Leptospermum*, 6.xii.1977, R. Patterson (ANIC); **Tasmania:** ♂, ♀/ Devonport, 22.xi.1977, G&G Palmer (ANIC); ♂/ Hobart, Boat Harbour, 21.xi.1977, G. & G. Palmer (ANIC); **Victoria:** ♀/

Barmah NP, Little Rushy Swamp, 35:53:24S 145:02:24E, infesting *Myriophyllum papillosum*, 25.ii.2014 K Ward (AMS); 1/ Buchan, 17.ii.1974, GG Burns (ANIC); 1/ Kiata, 21.x.1976, GG Burns (ANIC); ♀/ Lake Hattah, light trap, 9–15.iii.1969, G. W. Anderson (ANIC); 1/ Macedon, on *Quercus fastigata*, 1977 (ANIC); ♂\*, 1f/ Mt Buffalo NP, 36:46:28S 146:47:40E, path to Dixons Falls, sweeping above falls, c1475m, 28.xi–2.xii.2011, C. Reid (AMS); 3/ Murray R., ex coll. National Museum (ANIC); 1/ Manns Beach, ii.1957, DF Coulson (ANIC); 2/ Murrabit, xi.1946, EH (ANIC); 1/ Noojee, 31.i.1986, GG Burns (ANIC); 1/ Tullamarine, 22.iii.1975 (ANIC); 1/ Wahgunyah, 7.xii.1950, JH Callaby (ANIC); ♂\*, ♀\*/ Yamberloona, Trawool, Seymour, at light, 17.ix.1981 (AMS); **Western Australia:** ♂\*, ♀, 8/ Drysdale River, 15:02S 126:55E, 3–8.viii.1975, I.F.B. Common & M.S. Upton (ANIC); ♂\*, 1/ Carson Escarpment, 14°49S 126°49E, 9–15.viii.1975, IFB Common & MS Upton (ANIC); ♂/ Fitzroy Crossing, 18.iv.1976, K. & E. Carnaby (ANIC); ♂\*, ♀/ Halls Ck, 19.iv.1976, K. & E. Carnaby (ANIC); ♀, 2/ Wyndham, 20.iv.1976, K. & E. Carnaby (ANIC).

**Description.** Relatively large, length male 5.6–6.5mm, female 5.7–7.2mm.

**Colour:** dorsum entirely dark bronze-green, purplish-black, black, or bicoloured, with greenish or purplish head and pronotum and purplish or greenish elytra; antennae black, apex of first antennomere occasionally dark brown; legs and venter black, usually slightly bronzed;

**Head:** ratios (Tables 3 & 4): **male** EG 8.33–9.40; IE 1.04–1.21; HG 18.83–20.80; HN 1.22–1.30; NE 1.70–1.95; **female** EG 7.50–10.00; IE 1.08–1.22; HG 20.40–21.00; HN 1.19–1.28; NE 1.90–2.00; pubescence: a few short setae at inner edge of orbit, longitudinal row of short setae at sides of frontoclypeal ridge, transverse row of long setae behind clypeal anterior margin; transverse row between eye and buccal cavity; face impunctate except minute punctures at bases of setae; face strongly microreticulate, postantennal calli usually microreticulate; eyes large and laterally prominent; postantennal calli slightly elongate, with broadly triangular anterior angles and rounded bases; frontoclypeal median ridge lanceolate, weakly convex, anteriorly terminating in a narrow keel before clypeal margin; anterior clypeal margin slightly elevated and thickened but not finely ridged; sides of clypeus slightly rugose;

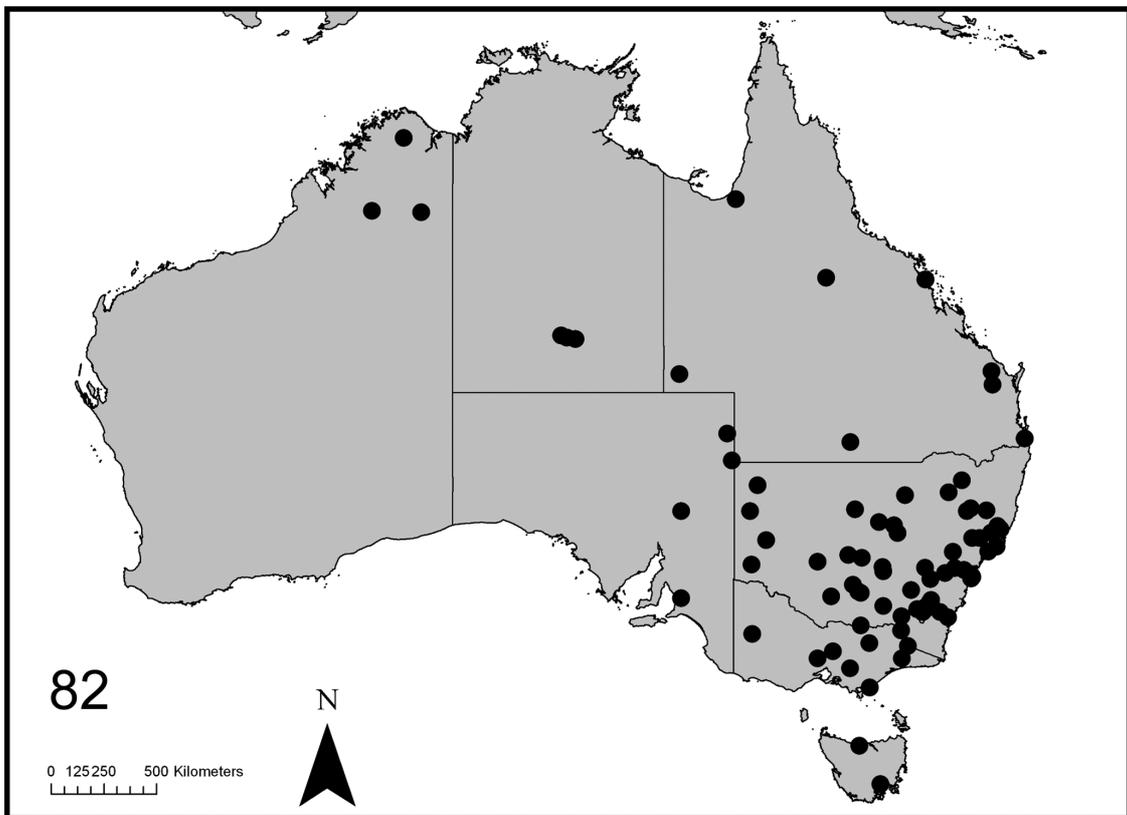
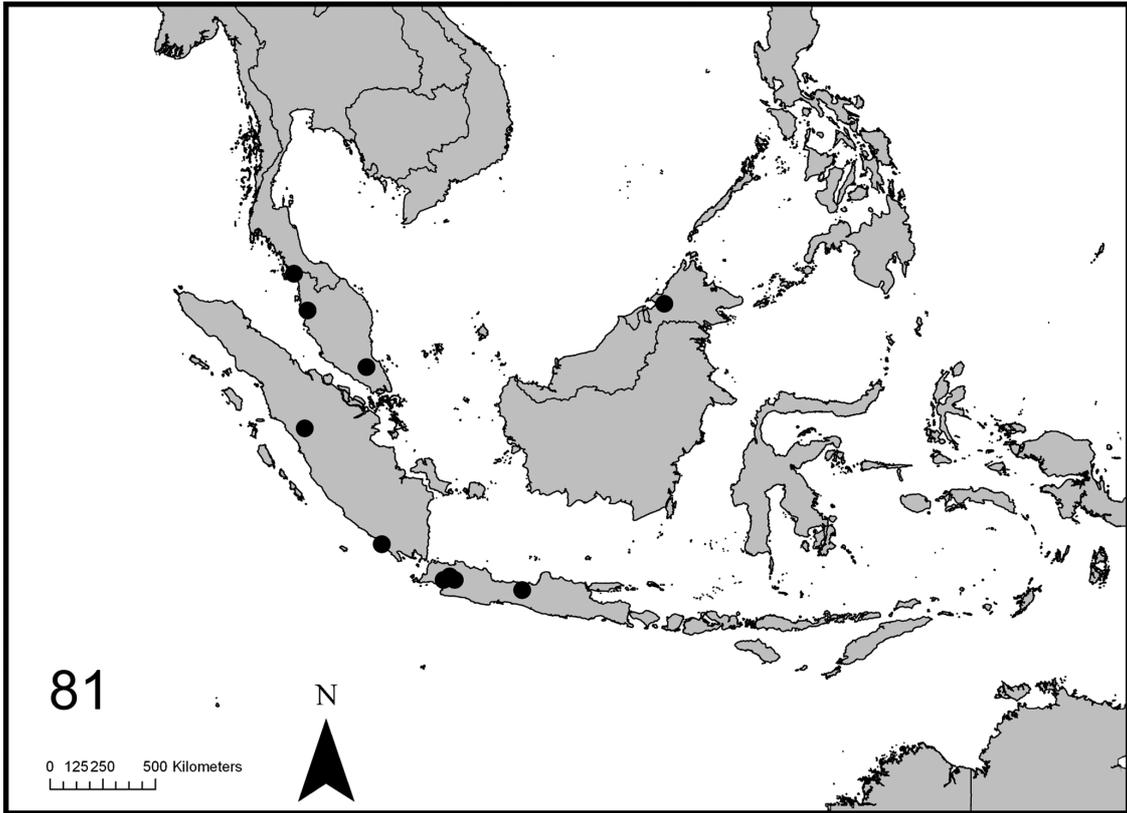
**Thorax:** pronotum dull and microreticulate; pronotum distinctly finely punctured throughout (punctures usually distinctly smaller than elytral punctures), separated by 2–4 diameters on disc, slighter denser in basal field; hypomeron entirely transversely strigose and shallowly microreticulate; scutellum triangular, densely microreticulate; elytra entirely microreticulate, sometimes shallowly so on disc; prosternum smooth and shining; mesoventrite strigose and dull, remaining thoracic ventrites densely microsculptured and pubescent; elytra finely and fairly sparsely irregularly punctured, interspaces mostly 2–4x puncture diameters; sides of elytra keeled from behind humeri to apical third, sometimes keel absent in males, often with 1–3 additional keels on disc in females; femora densely microsculptured and pubescent; outer face mid tibia with thin keel at base, flat in apical half; male first protarsomere ovate, slightly longer than broad, female 1.5x longer than wide;

**Abdomen:** abdominal ventrites densely microsculptured and pubescent; **male:** length penis 2.25–2.35mm; in dorsal view slightly expanded from base to almost right-angled apical lobe; shallowly transversely ridged in small patch of middle of dorsal surface; fairly straight in profile, with tip abruptly curved; with dense oblique ridges on apical half of venter, absent from midline and apex, ridges subtending approximately 75–90° at midline; two short apicoventral depressions present, c.0.2x penis length, elongate, laterally smooth-edged, internally finely strigose, separated by broad flat ridge; **female:** vaginal palpi long and almost conical, length: width ratio 1.6–2, with rounded apex, and straight, concave or convex inner margin; palpal apodemes 1.2–1.4x length palpi, 0.3–0.5x width palpi; tignum with irregularly expanded blunt tipped base, broader than base of apical part, lateral arms absent, and slightly to broadly expanded apex; spermathecal collum of variable length and thickness and containing 3–4 twists.

**Distribution and biology.** *Altica gravida* is endemic to Australia, where it is abundant and widespread in the southeast, especially the Murray-Darling basin, but also including Tasmania. It is scarcer further north but occurs far inland through the centre of Australia as far as the Kimberleys (north Western Australia).

*Altica gravida* is apparently absent from most of the tropical coastal region, unlike the similar *A. caerulea*.

*Altica gravida* is an aquatic plant oligophage, feeding on *Myriophyllum* species (Haloragaceae), but not all species of that genus. Vestjens (1979) made detailed observations on the biology of *A. gravida* at Lake Cowal, NSW, misidentified as *A. ignea* (the correct identity has been confirmed by our examination of his specimens in ANIC, see list above). Large numbers of adults were present from August to June, including several huge swarms totalling up to 780,000 individuals. Adults fed only on *Myriophyllum verucosum*, but aggregations occurred on



**FIGURE 81.** Distribution of *Altica cyanea* Weber.  
**FIGURE 82.** Distribution of *Altica gravida* (Blackburn).



## 83

**FIGURE 83.** *Altica graviga* (Blackburn): larval defoliation of *Myriophyllum papillosum*, Barmah National Park, Victoria (photo: K Ward)

nearby plants, including *Eragrostis* (Poaceae) and *Muehlenbeckia* (Polygonaceae). Larvae occurred from October to May, only feeding on *Myriophyllum*. Larvae and adults of *A. graviga* have also been reared on *Myriophyllum* at Barmah, Victoria, but only on *M. papillosum*, not on co-occurring *M. crispatum* (K. Ward, *pers. com.* 2013; Fig. 83). *Myriophyllum* occurs throughout Australia, avoiding only the driest deserts of Western Australia (Anonymous 2014). The absence of *A. graviga* from high rainfall coastal sites may indicate that it requires temporary water bodies which evaporate, leaving the hostplants on drying mud. Perhaps this indicates a difference in pupation site between *A. graviga* and *A. caerulea*. Vestjens' study suggests that specimen label data indicating presence on *Ludwigia* and *Alternanthera* represent strays from the host *Myriophyllum* (which occurs in the same habitat), although one specimen from Canberra was labelled "feeding on *Ludwigia*". Label records of singletons on *Acacia* (Fabaceae), *Leptospermum* (Myrtaceae) and *Quercus* (Fagaceae) may represent accidental associations or adults attracted to nectaries or pollen of non-host flowers (Samuelson 1994). Specimens of *A. graviga* are also labelled "damaging rice" (material collected by W. B. McKey, 1927), but this has never been published (Daniels 2004) or confirmed by other observations. We suspect that McKey collected *A. graviga* in a wet rice field with *Myriophyllum* present, and that the damage to *Oryza* was from some other agent. Confusingly, Veitch & Greenwood (1921) recorded *A. graviga* on rice in Fiji and this is presumably why it is listed as a dangerous pest by quarantine agencies in Australia and New Zealand. However this record was corrected by Bryant & Gressitt (1957), although wrongly; the correct name for the Fijian species is *A. aenea* (q.v.).

Vestjens (1979) sampled 11 bird species feeding at the shoreline of Lake Cowal where *A. graviga* was

abundant, but found that only the generalist predator *Gymnorhina tibicen* (Australian Magpie) had *Altica gravida* (both adults and larvae) in its stomach (Barker & Vestjens 1990).

*Altica gravida* has been collected in every month except July, but only 10% of collections were made in May to August and 60% in October to January, which appears to be the peak activity period. This species is attracted to light.

**Taxonomic notes.** *Altica gravida* was described from “Murray River district etc”, South Australia, based on an unknown number of specimens. We have seen four syntypes in the Blackburn collections (in NHML & SAM) and hereby designate a male lectotype to fix the identity of this species.

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## APPENDIX 1. Summary of nomenclatural changes.

*ALTICA* Geoffroy 1762: 244

*aenea* (Olivier 1808: 646); **stat. rev.**

= *australis* (Blackburn 1889: 1493); **syn. nov.**

= *bicolora* (Jacoby 1904: 482); **syn. nov.**

= *cyanea* sensu Maulik 1926: 422

= *coerulea* [sic] sensu Weise 1923: 109

= *corrusca* sensu Bryant & Gressitt 1957

= *jussiaeae* Gressitt, 1955, 34; **syn. nov.**

*birmanensis* (Jacoby 1896: 254); **stat. rev.**

= *birmaensis* [sic]; Scherer 1969: 129

= *birmensis* [sic]; Kimoto 1971: 80

= *indica* (Shukla 1960: 80); **syn. nov.**

= *caerulea* sensu Gressitt & Kimoto 1963: 289 partim

*caerulea* (Olivier 1791: 590)

= *coelurea* [sic]; Kimoto 1972: 47

= *coerulea* [sic]; Kimoto 2000: 258

= *elongata* (Jacoby 1884: 28); **syn. nov.**

= *brevicosta* Weise 1922a: 110; **stat. rev.**  
***corrusca*** (Erichson 1842: 235)  
= *corusca* [sic]; Fogg 1859: 334  
= *pagana* (Blackburn 1896: 74); **syn. nov.**  
***cyanea*** Weber 1801: 57  
= *cyanea* (Fabricius 1801: 497)  
= *ianthina* (Illiger 1807: 115)  
= *coerulea* [sic] sensu Gressitt & Kimoto 1963: 889 partim  
***gravidata*** (Blackburn 1896: 75)

***PHYGASIA*** Dejean 1836: 387 (*vide* Bousquet & Bouchard 2013)

***albicornis*** (Medvedev 2004: 2); **comb. nov.**

***SUTREA*** Baly 1876: 435

Type species: *Sutrea elegans* Baly, 1876, this designation.

***ferruginis*** (Blackburn 1889: 1494); **comb. nov.**

***splendida*** (Olivier 1808: 691); **comb. nov.**