

Description of a New Species of Australian *Cerdistus* (Asilidae: Asilinae)

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ABSTRACT

A new species of *Cerdistus* was collected from Minnowarra in South Australia. Herein we describe *Cerdistus londti* sp. nov., with the addition of SEM images. Specimens of this species from two localities in South Australia were keyed out and we also include DNA (COI) barcodes for comparison to other species belonging to the *Cerdistus/Neoitamus* complex in Australia.

Key words: New species, *Cerdistus londti*, South Australia.

INTRODUCTION

The genus *Cerdistus* (Diptera: Asilidae, Asilinae) as it is currently taxonomically delimited, was described in 1849 by Loew and has a worldwide distribution. The genus is very diverse and widespread in Australia. The name *Cerdistus* is adopted as a convenience being used in a liberal sense, not in a confined one as Loew used it, since some Australian species have also been described in the genus *Neoitamus* (White, 1917; Hardy, 1926). The genus *Cerdistus*, in Australia, was first taxonomically treated as a group by G.H. Hardy in 1926 and contained 17 species. Nine years later an additional nine species were recognized (Hardy, 1935). In his Asilid catalogue of the Australasian/Oceanian region Daniels (1989) listed 33 valid species of the genus *Cerdistus* and five in the genus *Neoitamus* as occurring in Australia. Since that time a further five species have been described: *Cerdistus judyjane* Lavigne (Lavigne, 2010), *C. hudsoni* Lavigne (Lavigne, 2011), *C. weylandi* Lavigne & McAllister (Lavigne & McAllister, 2011), *C. mcarthuri* Lavigne & McAllister (Lavigne & McAllister, 2012) and *C. ascanii* Lavigne & Stevens (Lavigne & Stevens, 2017a).

During a survey of insects in Minnowarra, South Australia in 2006, as part of the long term Minnowarra Biodiversity Project, several specimens of an undescribed species of *Cerdistus* were collected. These specimens were found to be conspecific with two males previously collected in the Adelaide Hills and one on Mt Lofty, also undescribed. Herein we describe the new species as *Cerdistus londti* sp. nov., which increases the number of *Cerdistus* known from Australia to 39 species.

MATERIAL AND METHODS

Collection details

Malaise traps were set up in an area dominated by Stringybark (*Xanthorrhoea* sp.) near a swamp at Minnowarra, 2.63 km west of Spring Mount (35°26'11"S 138°30'42"E). Specimens of *Cerdistus londti* sp. nov. were collected in the traps during the period, 21.12.2004 to 05.01.2005. Specimens of the new species originally keyed out in an unpublished key to an undescribed species in the genus *Cerdistus*. A male and female recovered from ethanol in the traps was taken to University of Gazi, Ankara, Turkey and SEM photographs were taken of the specimens.

Three specimens of the new *Cerdistus* from two South Australian locations from Minnowarra and Bugle Ranges (SA) were compared to eight closely related *Cerdistus* species (*mcarthuri*, *hudsoni*, *judyjane*, *weylandi*, *vittipes*, *ascanii*, *margitis*), two *Neoitamus* species (*maculatooides*, *socius*), and *Neocerdistus acutangulus*.

All specimens were analysed by the Canadian Centre of DNA Barcoding, Guelph, Canada using the 'barcode region' of the cytochrome c oxidase I (COI) gene (Hebert, Ratnasingham, & deWaard, 2003; Ratnasingham & Hebert, 2007), which has shown to be an ideal addition to taxonomic studies (Porco et al, 2012; Stevens & D'Haese, 2016; D'Haese, Stevens, & Weiner, 2017; Lavigne & Stevens, 2017b). Mitochondrial DNA was extracted from a single leg from each specimen and amplified following standard procedures published elsewhere (Hajibabaei, Janzen, Burns, Hallwachs,

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& Hebert, 2006). Sequences were aligned using SEQUENCHER (Gene Codes ver. 5.1) sequence editor and PAUP* ver. 4.0b10 (Swofford, 2002) was used to calculate sequence divergence values (uncorrected patristic distance using all 3 codon positions) and generate a Neighbor-Joining phylogram (using p-distance) among the haplotypes. Sequences for all species are archived and available in the BOLD public data portal (<http://www.boldsystems.org/index.php/databases>) in the MSAR (Australian Robberflies) project, together with images and metadata (Table 1).

RESULTS AND DISCUSSION

Cerdistus londti sp. nov. is a striking species, when observed in the wild, due to its bright orange and complex genitalia. It readily stands out when resting on perching sites.

Diagnosis

Brownish species with grey pleura; scape and pedicel of antennae orange; thorax with long, strong dorsocentral bristles; femora darkened dorsally; genitalia compact, orange.

Description

Cerdistus londti sp. nov. (Figs. 1, 2)

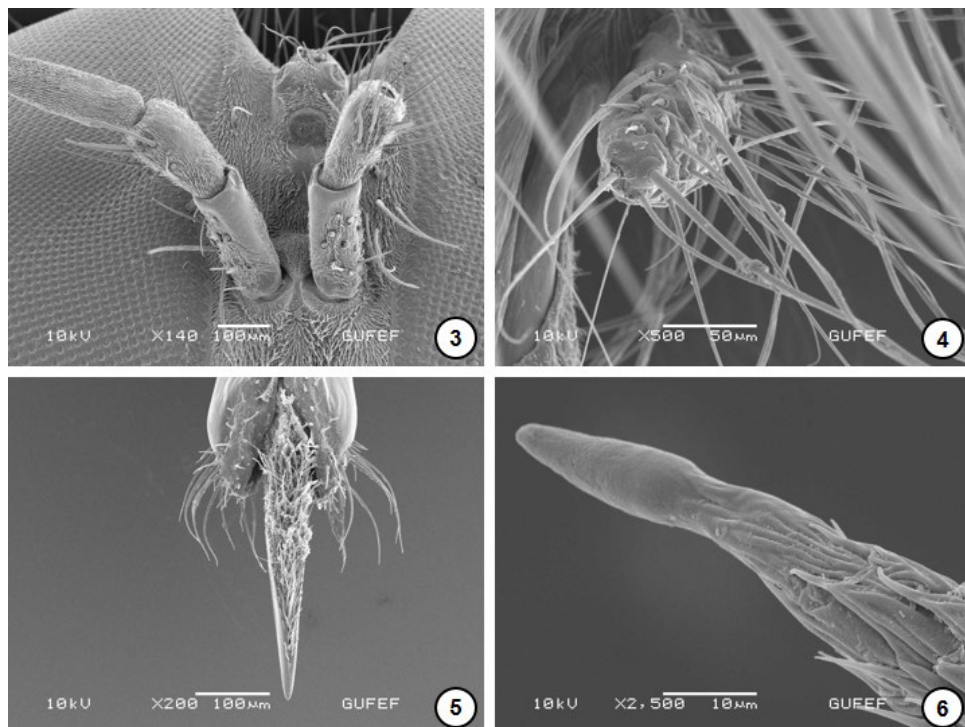
Holotype Male: Body length: 12.5 mm. (Range for species: 12 - 13 mm).

Head: Face golden tomentose, flat. Mystax contains 16-20 slender slightly curved white setae, few black setae above. Facial cover $\frac{1}{4}$. Ocellar tubercle with single short seta beneath each lateral ocellus (Fig. 3). Bristles on occiput black, strongly curved; occiput grey tomentose with dense white slender hairs. Palpus one segmented, shining black, with white abundant setae (Fig. 4). Proboscis shining black, with abundance of microtrichia below (Fig. 5).

Antennae: Basal segment (scape) black (Fig. 3), 2nd segment (pedicel) reddish brown, scape 1/3rd longer than pedicel, 3rd segment linear twice length of pedicel; 4th micro-segment 1/9th length of 3rd segment, style narrow, elongate, 0.83 times length of 3rd segment, tip bare lacking apical spine (Fig. 6). Beard white.



Figs. 1-2. Holotype of *Cerdistus londti* sp. nov. 1. Lateral view of holotype male *C. londti* sp. nov. (SAMA Database No. 29-001066). Photo: G. Weber & R. Lavigne. 2. Dorsal view of holotype male *C. londti* sp. nov. (SAMA Database No. 29-001610). Photo: G. Weber & R. Lavigne.

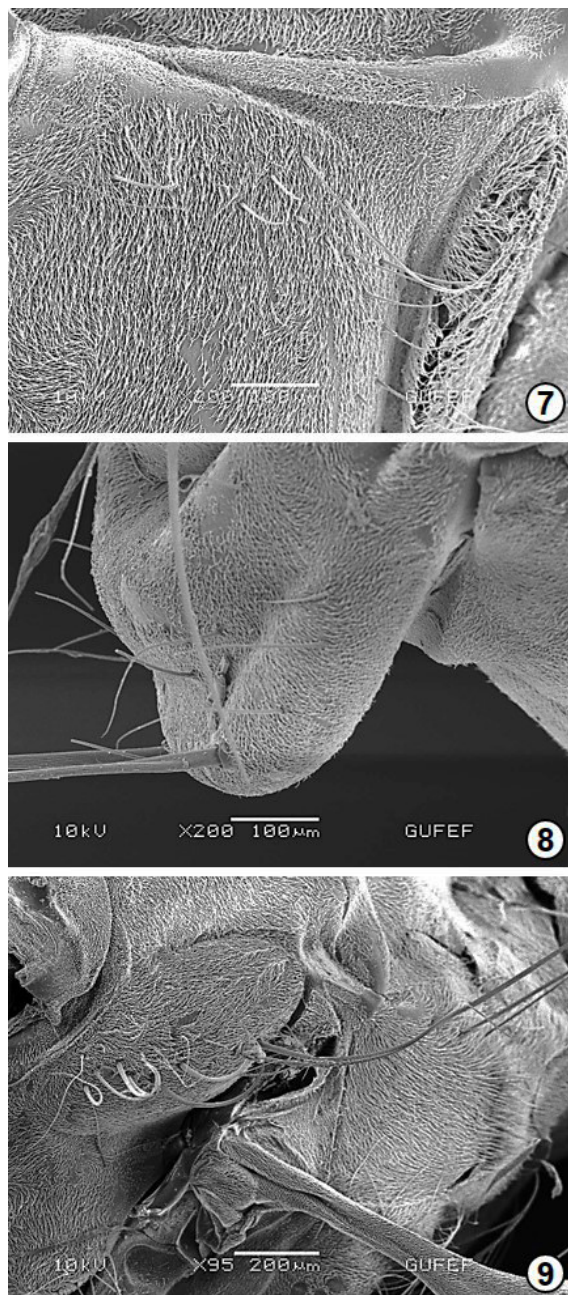


Figs. 3-6. Head of *C. londti* sp. nov. 3. SEM of ocellar tubercle of *C. londti* sp. nov. showing structure and location of setae plus illustrating bare area on inner surface of scape. 4. SEM of one segmented palp showing abundance of apical setae. 5. SEM of underside of proboscis showing abundance of microtrichia and bare tip. 6. SEM of style illustrating bare tip.

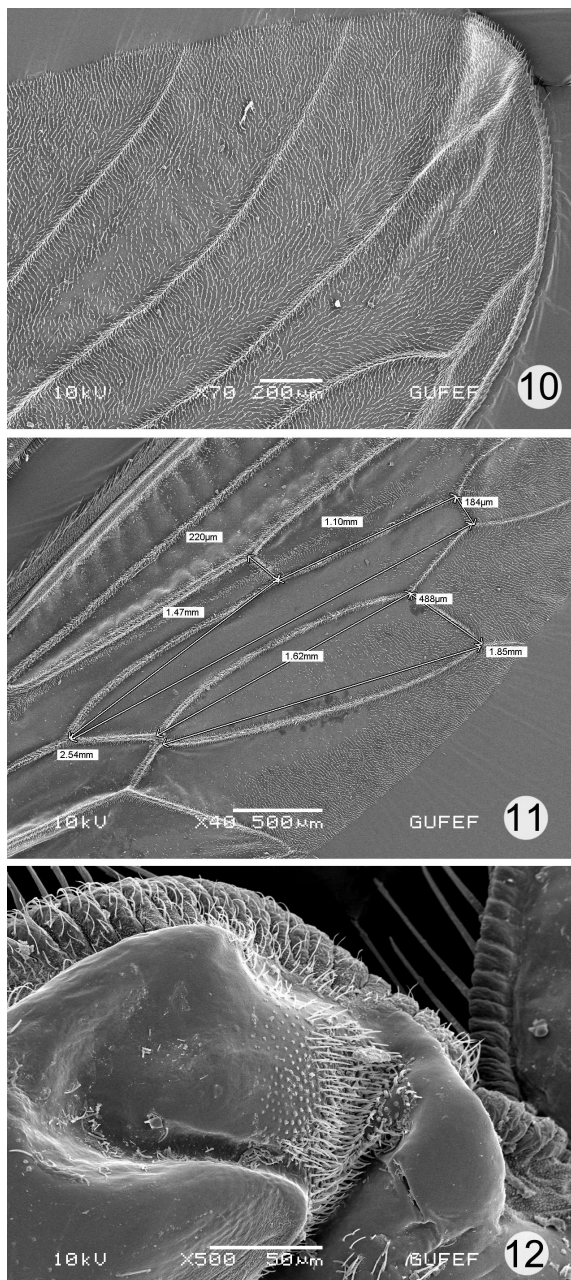
Thorax: Greyish-brown tomentose dorsally and grey tomentose laterally with dark brown bare areas dorsally (Fig. 2). Postsutural area of scutum with dorsocentro bristles. Humerus greyish brown tomentose with patch of white setae/hair. Anepisternum grey tomentose with few white hairs on both anterior and dorsal margins (Fig. 7). Anepimeron with white hairs on dorsal margin. Dorsocentral bristles long, black extending anteriorly to just beyond the transverse suture. Scutellar disk, grey tomentose with 2 marginal white bristles (Fig. 8); and scattered medium length white hairs on disk. Mesonotal bristles stout, black: 2 black presutural bristles, 1 supra-alar bristle (1 white, 1 black), 1 white post-alar bristle. Anatergite grey tomentose only without patch of setae. Katatergite (metapleural) bristles 10-12, cream colored, extremely long (Fig. 9). Metanepisternum (hypopleural) bristles stout, 2-4, white.

Wings: Multiple cells filled with microtrichae especially apically (Fig. 10), Discal cell bare, x-vein almost in middle of discal cell (Fig. 11). Sensory pegs/microtrichia at junction of base of wing with thorax (Fig. 12). Halteres light brown.

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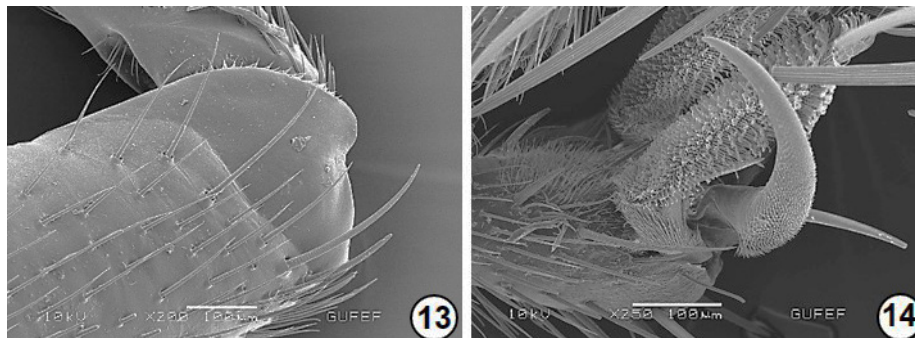
Figs. 7-9. Thorax of *C. londti* sp. nov. 7. SEM of anepisternum showing white hairs on dorsal and lateral margins amongst microtrichia. 8. SEM of scutellum showing two striated marginal setae and scattered hairs. 9. SEM of katatergite with 8 metaplural setae.



Figs. 10-12. Wing of *C. londti* sp. nov. 10. SEM of apex of wing illustrating the dense cover of microtrichia. 11. SEM of position of discal cross-vein on wing and the absence of microtrichia in the discal cell. 12. SEM of patch of sensory pegs/microtrichia at junction of base of wing with thorax.

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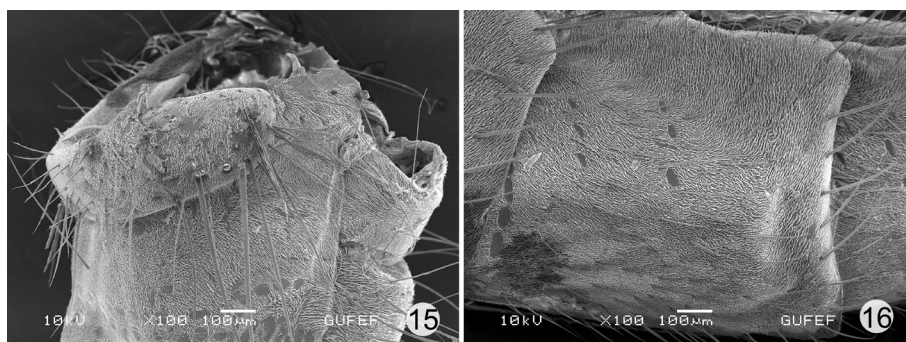
Legs: Legs bare of tomentum, shining; bristles primarily white, except those at apex of tibiae and on tarsi, black. Femora bicolored, dark brown on anterior surface, light brownish orange posteriorly, covered dorsally with dense tiny black setae, apex bare (Fig. 13), tibia orange, darkened at apex, with light brown setae; first tarsal segment bicolored, orange basally. Claws black with brown base, covered with microtrichia (Fig. 14); pulvilli cream coloured; empodia short, brown, 2/3rd length of claws.



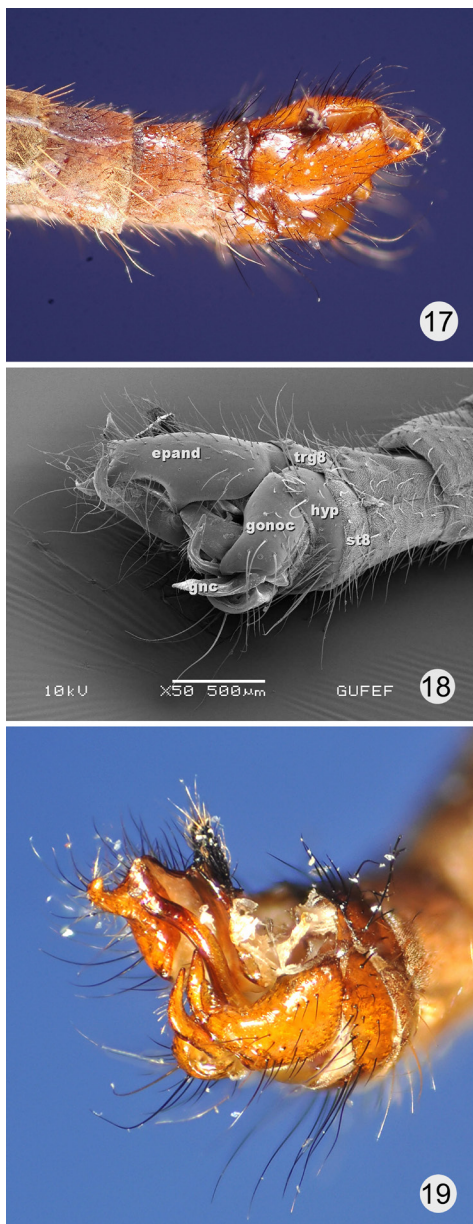
Figs. 13-14. Leg of *C. londti* sp. nov. 13. SEM showing bare area at apex of femur. 14. SEM showing the microtrichia covering the claw.

Abdomen: Tergites yellowish grey pollinose. Two to three exceptionally long white setae dorsolaterally on tergite 1 (Fig. 15). Row of setae on apical margin of tergites 2-5. Sternites yellowish-grey pollinose, with sparsely scattered white hairs; Two parallel diagonal rows of bare spots on sternites 5-6 (Fig. 16).

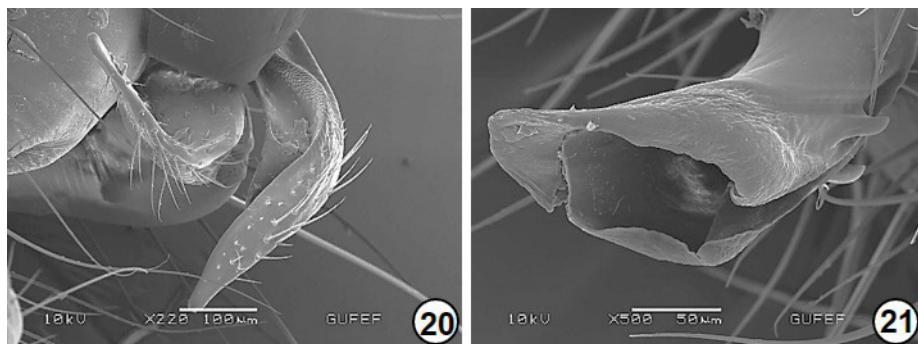
Terminalia (Figs. 2- 4 - paratype SAMA 29-001601): Orange without pubescence. Lower margin of epandria extended forward into inwardly curved digits (Figs. 17-19). Epandrium with double row of long black curved setae on dorsal surface, otherwise bare. Hypandrium rectangular with backward directed black setae (Fig. 18). Gonocoxite 1/2 length of epandria with patch of long black slender downwardly directed setae. Gonostylus orange, triangular with sharp apex (Fig. 20). Aedeagus elongate, darkened at apex, opening of aedeagus with subapical paired protrusions (Fig. 21). Cerci, black, with short white hair apically.



Figs. 15-16. Abdomen of *C. londti* sp. nov. 15. SEM showing the exceptionally long white setae dorsolaterally on tergite 1. 16. SEM showing the two parallel diagonal rows of bare spots on sternites 5-6.



Figs. 17-19. Male genitalia of *C. londti* sp. nov. 17. Close-up of lateral view of genitalia of *C. londti* sp. nov. showing structure of epandria with crossing tips. Photo: G. Weber & R. Lavigne. 18. SEM of male terminalia of *C. londti* sp. nov. illustrating shape of hypandrium and gonocoxite, epand, epandrium; gonoc, gonocoxite; gnc, gonostylus; hyp, hypandrium; trg8, tergite 8; st8 sternite 8. 19. Partially dissected male terminalia of *C. londti* sp. nov. showing shape of hypandrium and gonocoxite (SAMA Database 29-001560). Photo: A. McArthur & R. Lavigne.

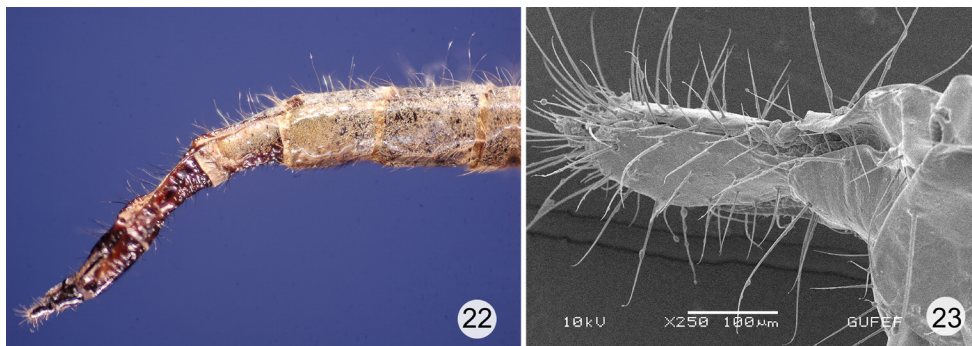
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Figs. 20-21. Male genitalia of *C. londti* sp. nov. 20. SEM showing the setae on the outer surface of the gonostylus. 21. SEM of the opening of the aedeagus with paired protrusions subapically.

Material examined: Holotype Male, S AUST: Mt Lofty/ 34°59'S 138°43'E/ 29 Dec 1973-6th Jan 1974/ 10th Aust. Boy Scout Jamboree. 2nd label: Acc. No.: SAMA Database No./ 29-001066.

Paratypes Male, S AUST: Quinyambie Stn./ Coonanna Bore/ 29°50'50"S 140°46'55"E/ 25.10.2008-01.11.2008/at Light / Camp/ Waterhouse Svy. 2nd label: Acc. No.: SAMA Database No. 29-002568. Male, S AUST: Bugle Ranges, 8 km S, Mt Barker/ 35°07'40"S 138°51'40"E/ 02/12/94/ insect net/ Ma/llee scrub R.J. Lavigne 2nd label: Acc. No.: SAMA Database No. 29-000321. Male, S AUST: Bugle Ranges, 8 km S, Mt Barker/ 35°07'40"S 138°51'40"E/ 01/02/02/ aluminum pan trap/ R.J. Lavigne 2nd label: Acc. No.: SAMA Database No. 29-001156. Male, S AUST: 2.63 km W Spring Mount/ Minnawarra/ 35°26'11"S 138°30'42"E/ 21.12.2005-04.01.2006/ malaise trap/ "Stringybark, Xanthorrhoe: above swamp/ Museum SEG Svy/ MIN002. 2nd label: Acc. No.: SAMA Database No. 29-001560; female: same data, except SAMA Database No. 29-001561 and SAMA Database No. 29-001564. Three males, same data except SAMA Database No. 29-001562, SAMA Database No. 29-001563 & SAMA Database No. 29-001565. Two males, S AUST: 2.29 km SW Spring Mount/ Minnawarra/ 35°27'01"S 138°31'09"E/ 21.12.2005-04.01.2006/ malaise trap/ "Stringybark, Bursaria spinosa, grasses"/ Museum SEG Svy/ MIN008. 2nd label: Acc. No.: SAMA Database No. 29-001566 & SAMA Database No. 29-001567; Male, S AUST: 1.8 km NW Spring Mount/ Minnawarra/ 35°25'56"S 138°31'26"E/ 21.12.2005-04.01.2006/ malaise trap/ "Stringybark, Xanthorrhoe, grasses on stony hilltop"/ Museum SEG Svy/ MIN009. 2nd label: Acc. No.: SAMA Database No. 29-001568. Male (8), S AUST: 1.96km NW Spring Mount, Minnawarra/ 35°25'46"S 138°31'26"E/ 21.12.2005-04.01.2006/ malaise trap/ "Stringybark, low shrubs, grasses"/ Museum SEG Svy/ MIN004. 2nd label: Acc. No.: SAMA Database No. 29-001570. Males (7), same data as 29-001570 except SAMA Database No. 29-001601, SAMA Database No. 29-001603, SAMA Database No. 29-001607, SAMA Database No. 29-001608, SAMA Database No. 29-001610, SAMA Database No. 29-001611, SAMA Database No. 29-001613. Female, S AUST: 1.96km NW Spring Mount, Minnawarra/ 35°25'46"S 138°31'26"E/ 21.12.2005-04.01.2006/ malaise trap/ "Stringybark, low shrubs, grasses"/ Museum SEG Svy/ MIN004. 2nd label: Acc. No.: SAMA Database No. 29-001569. Females (13) same data as 29-001569 except SAMA Database No. 29-001571, SAMA Database No. 29-001572, SAMA Database No. 29-001573, SAMA Database No. 29-001602, SAMA Database No. 29-001604, SAMA Database No. 29-001605, SAMA Database No. 29-001606, SAMA Database No. 29-001609, SAMA Database No. 29-001612, SAMA Database No. 29-001614, SAMA Database No. 29-001615, SAMA Database No. 29-001616, SAMA Database No. 29-001617.

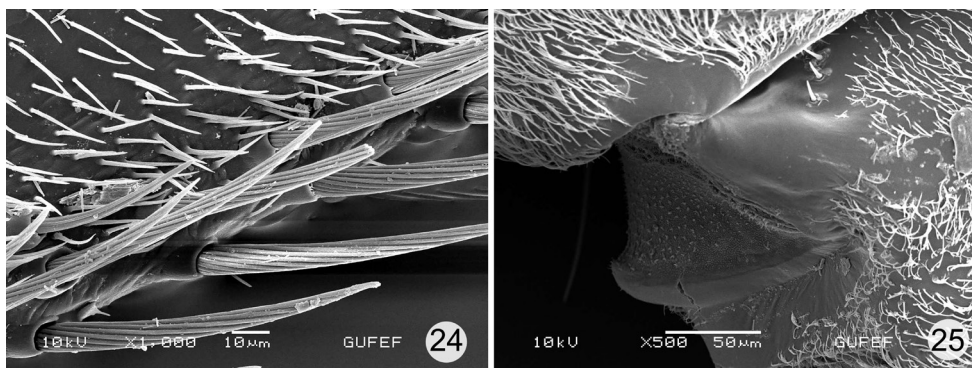
Female: Similar to male, except all post ocular bristles white; abdomen 7 segmented; Ovipositor: shining brown, tip with multiple setae (Fig. 22). Tip of ovipositor with multiple hairs (Fig. 23).



Figs. 22-23. Ovipositor of female *C. londti* sp. nov. 22. Lateral view of female *C. londti* sp. nov. ovipositor (SAMADatabase No. 29-001569). Photo: G. Weber & R. Lavigne. 23. SEM of tip of ovipositor of *C. londti* sp. nov. female.

Brief comments on microtrichia

Microtrichia occur on all parts of the body of *Cerdistus londti* and are typically minute scattered curved unsocketed hairlike structures as opposed to macrosetae which are longer, broader, striated, socketed and often confined to veins (Fig. 24). Additionally, modified minute spine-like or amorphous structures are seen at points of articulation, such as at leg junctions (Fig. 25). An unusual feather shaped microtrichia was found only on the female *C. londti* above insertion point of hind wing (Fig. 26). We are unable to ascertain its function.



Figs. 24-25. Microtrichia and macrotrichia. 24. SEM illustrating the difference between microtrichia and macrotrichia. 25. SEM illustrating the modified minute spine-like or amorphous structures seen at points of articulation at coxal junction with thorax.

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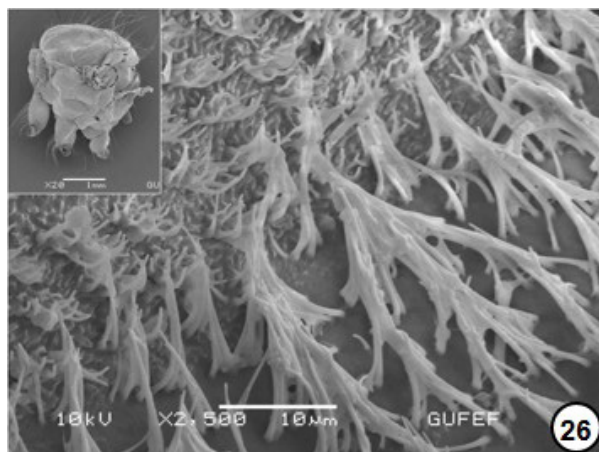


Fig. 26. SEM of patch of unusual feather shaped microtrichia found beneath the post alar wall on female thorax; insert shows location.

Etymology

This species, *Cerdistus londti*, is named in honour of Dr. Jason Londt in recognition of his over forty years of work on Afrotropical Asilidae. He has published many excellent papers describing some 45 new genera and more than 580 new species.

Depository

The holotype and 32 paratypes of *C. londti* sp. nov. are deposited in the South Australia Museum (SAMA) Entomology Collection in Adelaide.

Distribution

Thus far, *Cerdistus londti* sp. nov. has been collected only in four locations in southern South Australia, three from a limited area near Kangaroo Island: Minnawarra Conservation Park, Mt Lofty Conservation Park, Bugle Ranges and the fourth from Coonanna Bore, 435 miles northeast of Kangaroo Island close to the New South Wales border. The vegetation, Malee scrub, is common to all locations.

Molecular (DNA) barcode

The three specimens of *Cerdistus londti* sp. nov. were compared with other species that belong to the *Cerdistus/Neoitamus* complex in Australia (Table 1). The neighbor-joining tree and minimal sequence divergence (0-0.7%) supports the close intraspecific relationship among the three specimens of *C. londti* sp. nov. (a, b, c) and indicate that they all represent a single species (Fig. 27). Sequence divergence between species reveal divergences between 10.1% (*C. weylandi* and *N. maculoides*) to 19.4% (*C. vittipes* and *N. socius*) (Table 1). Sequence divergence of between 14.3% between *C. londti* sp. nov. and its nearest neighbours *C. weylandi* and adds further support to the species diagnosis of *C. londti* sp. nov. (Fig. 27).

Table 1. Collection data for each *Cerdistus*/*Neoitamus* species, and *Neocerdistus* as outgroup, selected for sequencing. Species relates to those used in Fig. 27. All sequences can be obtained using the 'code' in the BOLD public data portal (<http://www.boldsystems.org/index.php/databases>).

Species	Code	BOLD sequence code	Collection date	Location	GPS
<i>Neoitamus maculatoides</i>	MS_CER_N101c	MSAC1459-14	23.03.2008	Vivonne Bay, heathlands W of Point Ellen, KI, SA	35.993°S, 137.183°E
<i>Neoitamus socius</i>	MS_CER_29-002880	MSAC1285-14	07.07.1995	Czech Republic, Southern Moravia	49.362°N, 016.406°E
<i>Cerdistus vittipes</i>	MS_CER_29-001079	MSAC1258-14	09.10.1991	W Eyre Pen, Lake Newland CP, SA	33.400°S, 134.867°E
<i>Cerdistus weylandi</i>	MS_CER_29-001839	MSAC1266-14	18.05.2005	Monarto Zoological Park, SA	35.106°S, 139.137°E
<i>Cerdistus mcarthuri</i>	MS_CER_29-001857	MSAC1268-14	01.12.2000	Gluepot Reserve, SA	33.733°S, 139.983°E
<i>Cerdistus judyaneii</i>	MS_CER_29-002573	MSAC1278-14	25.10.2008	Coonanna Bore, Quinyambie Str., SA	29.847°S, 140.782°E
<i>Cerdistus hudsoni</i>	MS_CER_29-003368	MSAC1286-14	27.11.2007	Perth, Kensington Bushland, WA	31.983°S, 115.883°E
<i>C. ascanii</i>	MS_CER_N048c	MSAC1390-14	27.01.2008	Belair National Park, SA	35.010°S, 138.656°E
<i>Cerdistus margittis</i>	MS_CER_29-001712	MSAC1262-14	22.10.1996	Cheesman Peak, SA	27.333°S, 130.217°E
<i>Cerdistus armatus</i>	MS_CER_29-002500	MSAC1276-14	13.01.1971	Coorong Nat. Pk., SA	36.000°S, 139.500°E
<i>Cerdistus londti</i> sp. nov.	MS_CER_N009a	MSAC1316-14	12.02.1994	Bugle Ranges, SA	35.150°S, 138.883°E
<i>Cerdistus londti</i> sp. nov.	MS_CER_N009b	MSAC1317-14	21.12.2005	Minnawarra, SA	35.429°S, 138.524°E
<i>Cerdistus londti</i> sp. nov.	MS_CER_N009c	MSAC1318-14	21.12.2005	Minnawarra, SA	35.429°S, 138.524°E
<i>Neocerdistus acutangulus</i>	MS_CER_29-001955	MSAC1270-14	23.03.1993	ILLamurta Spr CP, NT	24.314°S, 132.686°E

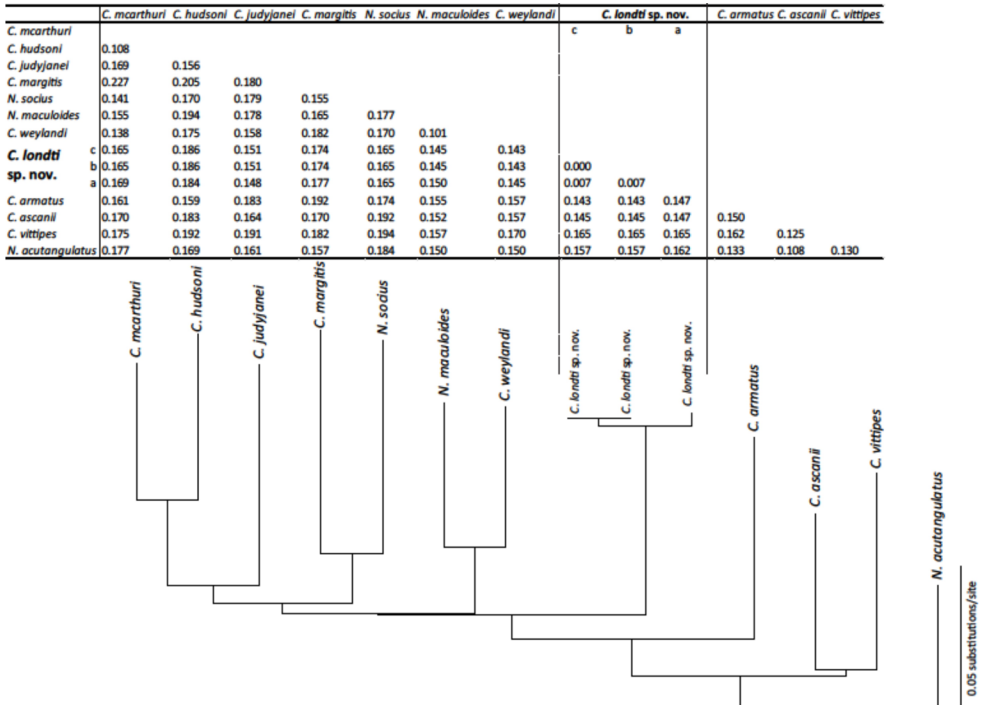


Fig. 27. Neighbor-Joining tree and sequence divergence (uncorrected P-distance) for *Cerdistus*/*Neoitamus* complex compared to *C. londti* sp. nov.

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