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The Tribe Dufouriini (Diptera: Tachinidae: Dexiinae) recorded from Australia with the description of two new species

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ABSTRACT

Rondania albipilosa sp. nov. and *R. cinerea* sp. nov. are described and *Chetoptilia angustifrons* Mesnil is recorded from Australia, confirming the presence of the tribe Dufouriini in the Australasian Region. Other Australian species of *Rondania* are known, but remain undescribed because insufficient specimens are available to adequately resolve species limits. The distributions of *Chetoptilia* Rondani and *Rondania* Robineau-Desvoidy are extended to Australia. Two host records are noted, that of *Chetoptilia angustifrons* emerging from prepupae of a chrysomelid beetle and *Rondania cinerea* from an adult weevil. The presence of fully developed first instar larvae in the oviducts of specimens of *Rondania albipilosa* and *R. cinerea* indicate ovolarviparity, consistent with other Dexiinae. ❐ *Tachinidae, Dexiinae, Dufouriini, Chetoptilia, Rondania, new species, new record, Australia.*

The Tachinidae form a conspicuous element of the Australian dipteran fauna and are primarily parasitoids of other insects. The subfamily Dexiinae (= Proseninae of earlier authors) is a relatively distinct group of tachinids whose hosts are mainly Coleoptera (beetles). The Dufouriini are currently regarded as a tribe within the Dexiinae (see O'Hara & Wood 2004), but the included genera are poorly understood phylogenetically and have an unusual mix of specialised characters, indicating that the tribe is probably not monophyletic as presently constituted.

Cantrell (1988) and Cantrell & Crosskey (1989) noted the existence of specimens of Dufouriini (as Dufouriinae) from Australia in collections, but did not formally record the taxon from Australia because no species were described. Even today, the tribe is represented in Australian collections by relatively small numbers of specimens (often only of one sex) and the hosts remain unknown for many species.

This study was prompted by examination of a series of eleven adults of *Chetoptilia angustifrons* Mesnil from Queensland that were reared by CJB. Initially we thought that they represented a new species, but Dr D.M. Wood (CNC) recognised their similarity to *C. angustifrons* and loaned a male and female of the latter from the Philippines

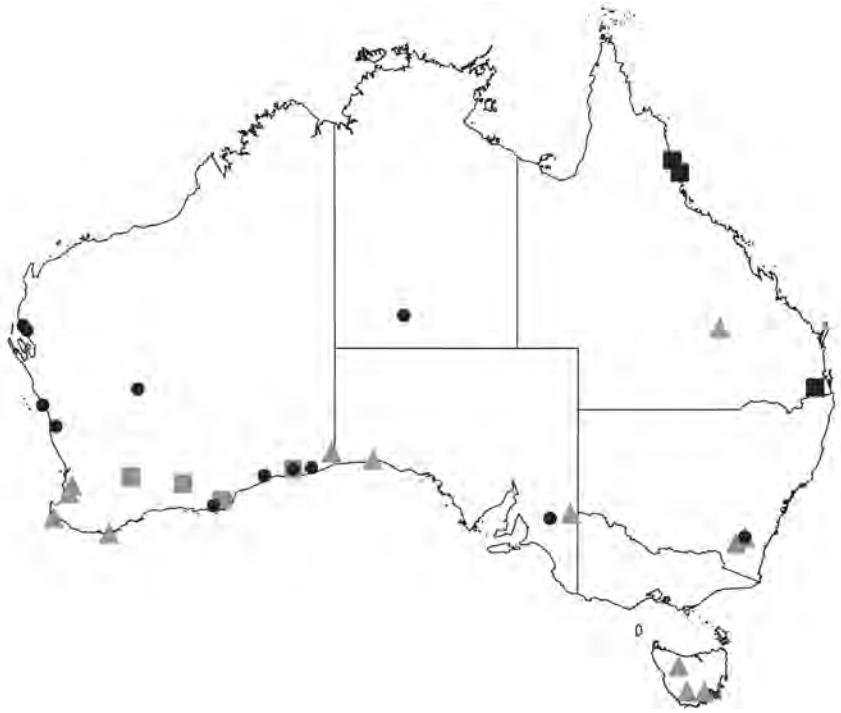

FIG. 1. Locality records for Australian Dufouriini. ■, *Chetoptilia angustifrons* Mesnil; ■, *Rondania albipilosa* sp. nov.; ●, *Rondania cinerea* sp. nov.; ▲, undescribed species of *Rondania*.

for comparison. It was immediately clear that all specimens were conspecific although the two older specimens from the Philippines were rather faded. This allowed the redescription of *C. angustifrons* based largely on Australian specimens.

The second part of this study was based on examination of *ca* 80 specimens of *Rondania* spp. from Australian insect collections (Fig. 1), enabling the description of two new species from southern Australia. However, other Australian species of *Rondania* remain undescribed because we were unable to resolve doubts about species limits from study of the small number of available specimens.

While our aim was to record the presence of the Dufouriini in Australia, we needed to consolidate our knowledge of the tribe by studying representatives of non-Australian genera and comparing them against the Australian taxa. This was achieved largely by referring to published literature, but we also examined specimens of a number of exotic taxa, including *C. angustifrons* from the Philippines, Neotropical *Comyops* van der Wulp and *Ebenia* Macquart and the European species *Dufouria chalybeata* (Meigen), *Eugymnopeza braueri* Townsend, *Rondania cucullata* Robineau-Desvoidy and *R. fasciata* (Macquart).

MATERIAL AND METHODS

Morphological terminology and abbreviations follow Crosskey (1973, 1976), except that ac not acr is used for the acrostichial setae and the

TABLE 1. Regional distribution of world genera of Dufouriini. Abbreviations: Neo, Neotropical; Nea, Nearctic; Palae, Palaearctic; Afro, Afrotropical; Aust, Australasian; Or, Oriental.

Genus	Neo	Nea	Palae	Afro	Aust	Or
Comyops	✓					
Ebenia	✓					
Euoestrophasia	✓					
Jamacaria	✓					
Oestrophasia	✓	✓				
Chetoptilia			✓	✓	✓	✓
Dufouria		✓	✓			
Eugymnopeza			✓			
Microsoma			✓			
Pandelleia			✓	✓		
Plesina			✓	✓		
Rondania		✓	✓		✓	
Mesnilana				✓		
Rhinophoroides				✓		

word seta or setae is omitted in combination with the relevant abbreviation e.g. pra means pre-alar seta.

Morphological abbreviations: ac, acrostichial setae; ad, anterodorsal; A.s., antennal segment; av, anteroventral; dc, dorsocentral setae; fr, frontal setae; ia, intra-alar setae; if, interfrontal area; iv, inner vertical setae; mmp, median marginal pair of setae on abdominal tergites; oc, ocellar setae; orb, orbital setae; ov, outer vertical setae; pd, posterodorsal; pf, parafacials; pfr, parafrontals; pra, pre-alar setae; post-, postsutural; pv, posteroventral; sa, supra-alar setae; stpl, sternopleural setae; T, abdominal tergite; v, ventral.

All measurements are in millimetres. Measurements of body length and V:HW (ratio of width of vertex at level of posterior ocelli to maximum width of head across eyes, both viewed dorsally) are expressed as means with ranges given in brackets; number of specimens measured is also shown.

Institutional abbreviations: ANIC, Australian National Insect Collection, Canberra; CNC, Canadian National Collection of Insects, Ottawa; QM, Queensland Museum, Brisbane; UQIC, University of Queensland Insect Collection, Brisbane; WAM, Western Australian Museum, Perth.

SYSTEMATICS

As stated above, an in-depth study of the Dufouriini was never our intention. However, our literature- and limited specimen-based review of the tribe allowed us to place the Australian species within *Chetoptilia* and *Rondania* with a degree of confidence.

The Dufouriini are known from all major zoogeographic regions except Oceania (Barraclough 2005; Cantrell & Crosskey 1989; Crosskey 1976, 1984; Guimarães 1977 (as Oestrophasiini); Herting 1984; O'Hara & Wood 2004) with the greatest generic diversity in the Palaearctic, Afrotropical and Neotropical regions (Table 1). The genera are diverse in appearance and the tribe is almost certainly not monophyletic as presently constituted. However, all genera for which the hosts are

known parasitise Coleoptera, particularly Chrysomelidae and Curculionidae.

The composition of Dufouriini remains open to debate as several genera remain poorly studied. Based upon our brief overview, we include fourteen genera in the tribe, distributed as shown in Table 1. *Anthomyiopsis* Townsend, *Freraea* Robineau-Desvoidy and *Rossimyiops* Mesnil are no longer regarded as Dufouriines (Herting 1984; O'Hara and Wood 2004; Cerretti *et al*. 2009) and we exclude the problematic genus *Kambaitimyia* Mesnil. The doubtful position of the latter was discussed by Crosskey (1976) when he provisionally included it in the Oriental Dufouriini.

DIAGNOSIS OF AUSTRALIAN DUFOURIINI

The Australian Dexiinae comprise three tribes, Dexiini, Dufouriini and Rutiliini. As inferred above, it is difficult to succinctly characterise the Dufouriini to facilitate their easy recognition and the Australian fauna is no exception. Their muscoid facies and enlarged subscutellum clearly identify them as Tachinidae, but assigning specimens to a subfamily or tribe is often problematic, particularly if host data are lacking. Small size (length 3-5 mm), bare eyes and a long petiolate cell R5 will help to identify *Rondania* as belonging to the Dexiinae, as will the small size (4-5 mm), bare eyes (with enlarged upper facets in the male), metallic blue/green colour and cell R5 open or just closed at the wing margin in *Chetoptilia*. Knowledge that the flies were reared from beetle hosts would help confirm placement in the Dexiinae.

The Dufouriini may be distinguished from the Australian Dexiini and Rutiliini by characters including small size, bare parafacials, lack of a facial carina, bare propleuron, scutellum with 2-3 pairs of marginal setae and their generally non-bristly facies.

Diagnosis. Head: eye bare, strongly approximated or holoptic (with upper eye facets sometimes enlarged) in ♂ but widely separated in ♀ (facets of uniform size); ocellar triangle prominent in ♂ because of eye approximation; facial carina absent; antennal axis at or below level of eye middle; epistome not prominent, but sometimes extending anterior to profrons in profile; facial ridge bare; pf bare; antenna short, usually falling well short of epistome; arista micropubescent to plumose; oc present; orb present in ♀, absent in ♂; iv usually present in both sexes, but often weak and hairlike in ♂; ov variable, often absent or indistinguishable from postocular setulae; fr present in both sexes, usually in irregular rows; vibrissa present, but often not clearly distinguished from other setae on genal margin; palp present, well-developed; mouthparts (mentum plus labellum) normally developed, shorter than head height.

Thorax: prosternum and propleuron bare; chaetotaxy often irregular, with variation in both numbers and strength of setae, particularly dorsally; humeral callus usually with 2 setae; pra absent or weakly present, smaller than first post-ia; usually 2 post-ia; 2(3)+3 dc; 1(2)+2(3) ac; 2 stpl, anterior seta usually weaker; scutellum with 2 or 3 pairs of marginal setae, usually with strong apicals and basals, weaker laterals present or absent; wing with cell R_5 narrowly open, closed at the margin, or petiolate; leg setae often reduced.

Abdomen: T1+2 variable, from weakly excavate to excavate virtually to hind margin; chaetotaxy often irregular, with variation in both numbers and strength of setae; ovipositor a simple eversible tube, typically concealed in *Chetoptilia*, but usually at least partly protruding from preabdomen in *Rondania*.

KEY TO AUSTRALIAN GENERA AND SPECIES OF DUFOURIINI

Users of this key should be aware that there are several undescribed Australian species of *Rondania* (see discussion under *Rondania* below).

1. Arista plumose; cell R_5 narrowly open or just closed at wing margin; bend of M rounded and vein approaching wing margin at an acute angle (Fig. 2A); T1+2 excavate almost to hind margin; thorax, including legs, and abdomen dark, conspicuously shining black or green-black; thorax with thin dusting of silver pollinosity under some angles of light, particularly in ♀; ♂ eyes holoptic and upper eye facets conspicuously enlarged (Fig. 2B); ovipositor not usually visible externally. . . . *Chetoptilia angustifrons* Mesnil.

— Arista bare or pubescent; cell R_5 closed and distinctly petiolate; bend of M evenly rounded and vein approaching R_{4+5} at almost a right angle (Fig. 4A, B); T1+2 excavate at most in basal half; body colour grey-toned often with pale or yellow areas on head, legs or abdomen; ♂ eyes holoptic or dichoptic, with or without enlarged upper eye facets; ovipositor normally visible as a simple tubular structure extending beneath abdomen (*Rondania* spp.) 2

2. Abdomen grey (with darker rings around setal bases) in ♀, in ♂ similar medially and distally but lateral areas of T1+2 to T4 yellow or pale; [thoracic pleura dark-haired; scutellum with 3 pairs of marginal setae, weak laterals present; ♂ eyes narrowly separated by distance approximately equal to that between lateral ocelli; ♀ vertex broader (V:HW > 0.35)] . . . . . .*R. cinerea* sp. nov.

— Abdomen predominantly pale or yellow 3

3. Abdomen yellow, without pattern of dark spots or bands; thoracic pleura pale-haired; scutellum with 2 pairs of marginal setae, laterals absent; [♂ eyes holoptic; ♀ vertex relatively narrow (V:HW < 0.25)] . . . . . *R. albipilosa* sp. nov.

— Abdomen yellow, often shining, with pattern of dark markings, typically small median and lateral spots or transverse bands on T3 to T5, but sometimes limited to median spots; if dark abdominal markings absent, then either scutellum with 3 pairs of marginal setae or pleura dark-haired. . . . .undescribed species of *Rondania*.

Chetoptilia Rondani

Chetoptilia Rondani, 1862: 166; Crosskey, 1976: 176; Herting, 1984: 159.

Chetoptilia is an Old World genus comprising six species: *C. puella* (Rondani) from Europe (type species); *C. plumicornis* Villeneuve from Africa; *C. cyanea* Mesnil and *C. metallica* Mesnil from Madagascar; *C. burmanica* (Baranov) from Asia; and *C. angustifrons* from Asia and Australia. *Chetoptilia* species are characterised by dark metallic colouration, a plumose or pubescent arista, a bare prosternum, three pairs of marginal scutellar setae, cell R_5 open or just closed at the wing margin and T1+2 excavate almost to the hind margin. The eyes are bare (sparsely short-haired at high magnification), holoptic or closely approximated in the male, with the upper facets enlarged.

Chetoptilia angustifrons Mesnil (Figs 1, 2, 3A-B)

Chetoptilia angustifrons Mesnil, 1953: 164; Crosskey, 1976: 176.

Material. Philippines, 1♂, Luzon, Manila, xi.1914 (CNC); 1♀, Luzon, Limay, 21.iv.1913, G. Boettcher (? type, abdomen missing) (CNC). [Both specimens from the L. P. Mesnil collection labelled *Paraptilops angustifrons* Mesn.]. AUSTRALIA, QUEENSLAND, 4♂, 1♀, Ellis Beach, 16°44′S, 145°39′E, 28.iv.1998, C.J. Burwell and C.M. Rodriguez, ex prepupa of *Aspidimorpha deusta* on *Ipomaea pes-caprae* (Convolvulaceae); 3♂, 2♀, Bramston Beach, 17°21′S, 146°01′E, 3.v.1998, C.J. Burwell and C.M. Rodriguez, ex prepupa of *Aspidimorpha deusta* on *Ipomaea pes-caprae* (Convolvulaceae); 1♂, 16 km N of Boonah, 27°54′S 152°41′E, 14–15.xii.1996, C.J. Burwell, ex prepupa of *Cassida* sp. on *Polymeria calycina* (Convolvulaceae). All QM except as indicated.

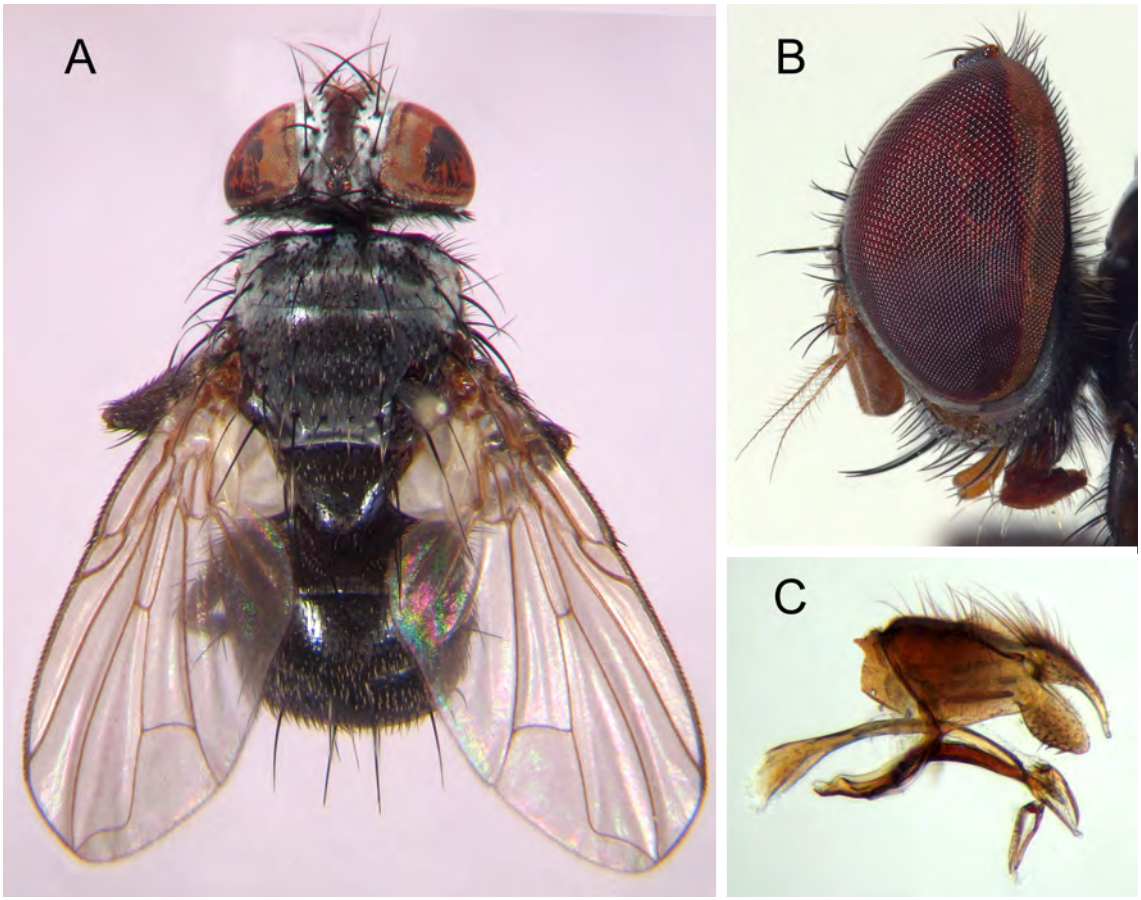

FIG. 2. *Chetoptilia angustifrons* Mesnil. A, ♀, dorsal view; B, ♂ head, lateral view; C, ♂ terminalia, lateral view.

DIAGNOSIS. Small flies, shining green-black, but prescutum and scutum with fine dusting of silver pollinosity in female; tibiae and tarsi somewhat duller; antenna and palp dull yellow/orange; arista plumose; face dull silver pollinose; eyes bare (sparsely short-haired at high magnification); ♂ eyes holoptic, ♀ eyes widely separated; occiput pale-haired except for some dark setulae adjacent to postocular row; T1+2 to T5 lacking discal setae; ovipositor fully retracted in all available specimens.

Re-description. *Male.* Body length 4.62 (4.1 – 4.8) (n=9). Head: eyes holoptic, facets enlarged in slightly more than upper half, with clear line of demarcation between upper and lower facets (Fig. 2B); if area triangular, reddish-brown; pf, pfr and face faintly silver pollinose; ocellar triangle prominent; oc weak, hairlike, proclinate; 4-5 pairs of irregular fr between lunula and eye convergence; orb absent; iv convergent, often crossed at tips; ov not much stronger than postocular setulae; antenna yellow, inserted at or below level of middle of eye, short, not reaching

epistome; arista yellow, plumose; epistome not prominent; vibrissa inserted at level of epistome, a few fine hairs above; facial ridge bare; pf bare; gena black-haired; mentum relatively short, not as long as palp, latter yellow with darker bases; occiput dark, pale-haired except for some dark setulae adjacent to postocular row.

Thorax shining black; small pra present, much weaker than first post-ia; 1+2 ia; 2(?3)+3 dc; 1(?2)+2 ac; propleuron and prosternum bare; 2 stpl, anterior seta weaker; humeral callus with 2 setae; scutellum with 3 pairs marginal setae (strong crossed apicals and slightly weaker basals and laterals); fore tibia with 1 pv; mid tibia without submedian v but with 1 submedian ad and 2 weaker pd; hind tibia with irregular ad and pd rows; wing with cell R_5 open or just closed at wing margin; m-cu weakly sinuate, shorter than length of M from insertion of m-cu to bend; 2nd costal sector haired ventrally; basal node of R_{4+5} with a few fine dark setulae on both wing surfaces; veins yellow; wing membrane clear, but upper and lower calypter opaque, smoky-coloured.

Abdomen shining black; T1+2 excavate almost to hind margin, without mmp; T3 with mmp; T4, 5 with marginal row of setae; T3-5 subequal in length dorsally. Terminalia as in Fig. 2C.

Female. (Fig. 2A) Body length 4.3 (4.2 – 4.4) (n=3); V:HW 0.25 (0.24 – 0.26) (n=4). Similar to male except as noted. Head: eyes broadly separated, all facets of uniform size, if area matt reddish-brown, pf, pfr and face faintly silver pollinose; gena and area between eye margin and postocular row of fine setulae lightly silver pollinose; 4–6 irregular fr; 2 pro-, 1 reclinate orb; oc strong, proclinate; iv strong, crossed; ov weaker, diverging; A.s.3 relatively longer, its tip almost reaching epistome. Thorax: prescutum and scutum with fine dusting of silver pollinosity; mid tibia with submedian v; upper and lower calypter translucent white. Abdomen: ovipositor not visible externally in specimens examined.

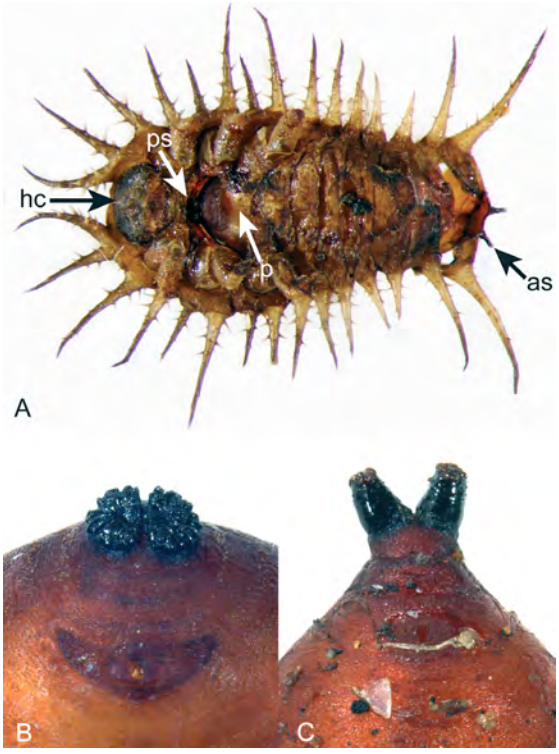

FIG. 3. Puparia. A, *Chetoptilia angustifrons* Mesnil, dorsal view showing puparium in remains of beetle host prepupa; B, C, ventral view of posterior part of puparium showing non-functional posterior larval spiracles: B, *Chetoptilia angustifrons* Mesnil C, *Rondania cinerea* sp. nov. as, anterior (larval) spiracles; hc, head capsule of beetle prepupa; p, puparium; ps, posterior (larval) spiracles.

Puparium. Oblong, brown, with black non-functional posterior larval spiracles raised above puparial cuticle (Fig. 3B), in end view larval spiracles semicircular, narrowly separated, each comprising about 12 elongate slits arranged in a crescent; non-functional anterior larval spiracles projecting anteriorly on diverging cuticular protuberances, each spiracle with a narrow

black base and bearing about 10 terminal minute openings. Puparial respiratory horns absent.

The puparium lies within remains of host prepupa (Fig. 3A), with both the anterior and posterior ends of the puparium erupting through the ventral cuticle of the host prepupa. The posterior end projects from between the bases of the fore and mid legs of the host prepupa so that the posterior (larval) spiracles on the puparium are located just behind the head capsule of the beetle. The anterior end of the puparium projects between the 5th and 6th or the 6th and 7th abdominal segments of the host prepupa, and the anterior (larval) spiracles are clearly exposed.

Remarks. *Chetoptilia angustifrons* possesses all the generic characters noted above and was reared from a chrysomelid leaf beetle larva; this host association is also typical of the genus. Based on literature (Baranov 1938; Mesnil 1953, 1968; Tschnorsnig and Herting 1994; Villeneuve 1942) the plumose arista separates *C. angustifrons* from *C. cyanea* and *C. metallica* from Madagascar and *C. burmanica* from Myanmar, all of which have a pubescent arista. The holoptic eyes in the male and lack of discal setae on T5 distinguish *C. angustifrons* from the European *C. puella* and *C. plumicornis* from Africa.

As noted above, the north Queensland specimens of *C. angustifrons* were reared from *Aspidimorpha deusta*, a hispine chrysomelid beetle which occurs in northern Australia, New Guinea, Timor, Indonesia and Malaysia (Borowiec 1992; Boroweic & Świętojańska 2008), suggesting the fly may have a wider distribution than presently known. Like *C. angustifrons*, *A. deusta* has been recorded from the Philippines (Leyte Island; Medvedev 1995), although Medvedev suggested the beetle had been introduced. Consequently, the identity of the host of *C. angustifrons* in the Philippines requires confirmation.

Rondania Robineau-Desvoidy

Rondania Robineau-Desvoidy, 1850: 192; Herting, 1984: 160.

Rondania is primarily an Old World genus, comprising nine species including *R. albipilosa* sp. nov. and *R. cinerea* sp. nov. described below from Australia; *R. cucullata* Robineau-Desvoidy (type species), *R. dimidiata* (Meigen), *R. dispar* (Dufour), *R. fasciata* (Macquart) and *R. rubens* Herting from mainland Europe; plus *R. insularis* (Bigot) (Canary Islands). The sole New World representative is *R. dorsalis* (Coquillett) from North America. We examined specimens of *R. cucullata* and *R. fasciata* in addition to the Australian species. Several undescribed Australian species of *Rondania* are also known, but cannot be named at present because insufficient specimens are available to accurately resolve species limits.

Rondania is characterised by grey and yellow/orange colouration; a pubescent or bare arista; cell R_5 closed at the wing margin or petiolate and T1+2 excavate only basally.

All Australian specimens of *Rondania* examined were collected below the Tropic of Capricorn (23°26.5´S), mostly from mainland Australia but with a few records from Tasmania (Fig. 1). *Rondania cinerea* sp. nov. is a distinctive species with a grey pollinose abdomen, described from the type series collected in southern Western Australia, supplemented by specimens collected in Canberra and a few intervening localities. *Rondania albipilosa* sp. nov. is a smaller species with pale-haired thoracic pleura; it is known only from Western Australia, where the distributions of both species overlap to some extent in the Esperance to Madura region.

Confidently defining the species limits of the two *Rondania* species described below is complicated by a number of specimens which closely resemble those of the type series but differ in abdominal colour pattern, having more extensive dark markings. Consequently we have taken a conservative approach and excluded these specimens from the type

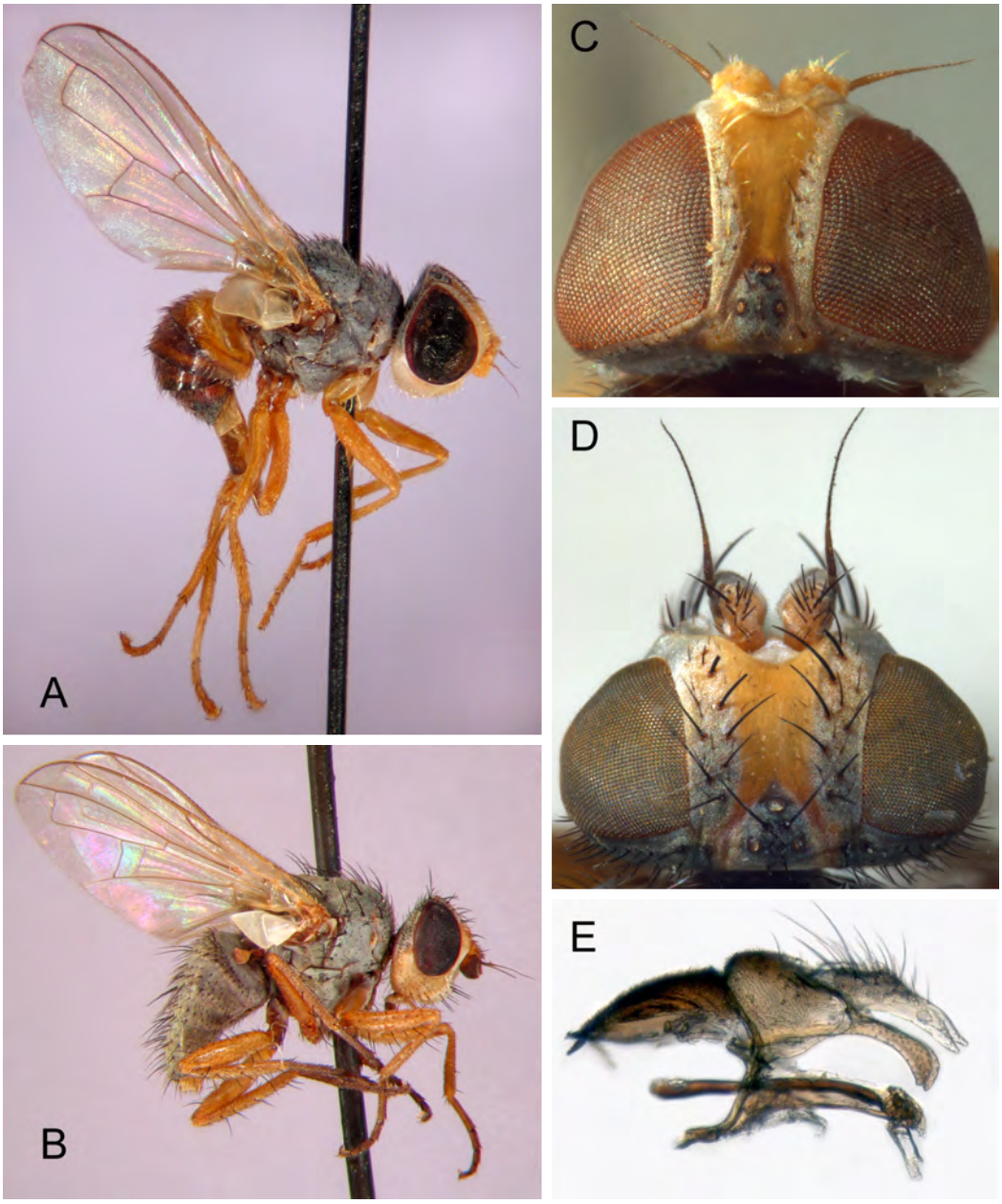

FIG. 4. *Rondania* spp. nov. A, C, *R. albipilosa* sp. nov.: A, ♀ lateral view; C, ♀ head, dorsal view; B, D, E, *R. cinerea* sp. nov.: B, ♀ lateral view; D, ♀ head, dorsal view; E, ♂ terminalia, lateral view.

series, but briefly discuss them in the remarks sections of the descriptions. Similar variations in abdominal colour pattern are also found in a number of the undescribed Australian species, as well as variation in the length of the petiole of cell R_5. Whether colour patterns and petiole length are highly variable intraspecifically, or these specimens are specifically distinct is uncertain and may only be resolved by the acquisition of additional material.

Rondania albipilosa sp. nov.
(Figs 1, 4A, C)

Etymology. Latin *albus*, white and *pilus*, hair; referring to the pale-haired pleura in this species.

Material. Holotype ♀: Western Australia, The Humps, 19 km N Hyden, 32°19´S, 118°57´E, 10.i.1986, G. and A. Daniels, mv lamp (QM). PARATYPES: WESTERN AUSTRALIA, 4♀, same data as holotype (UQIC); 1♀, 57 km S of Norseman, 32°38´S, 121°32´E, 31.xii.1985, G. and A. Daniels, mv lamp (UQIC); 1♂, 2♀, 8 miles (13 km) SW Mt Ragged, 33°27´S, 123°28´E, 22.iii.1968, I.F.B. Common and M.S. Upton (ANIC). OTHER MATERIAL: WESTERN AUSTRALIA, 1♀, Madura, 31°56´S, 126°58´E, 20.iii.1968, I.F.B Common & M.S. Upton (abdomen in glycerine) (ANIC).

Diagnosis. Small flies; head, legs and abdomen yellow, thorax grey pollinose on prescutum and scutum, but scutellum dark shining, without pollinosity; pleura grey pollinose, pale-haired; chaetotaxy difficult to discern on prescutum and scutum of ♀, except for posterior dc and ac; scutellum with 2 pairs of marginal setae; ♂ eyes holoptic, ♀ eyes narrowly separated.

Description. *Female.* (Fig. 4A, C) Body length 2.8 (2.4 – 3.0) (n=4); V:HW 0.215 (0.20 – 0.23) (n=9). Head: generally pale; if area relatively narrow, matt yellow; pfr and pf yellow with thin silver pollinosity; ocellar triangle dark; upper occiput dark except centrally; eye bare; oc proclinate; 2 proclinate orb; 5-6 pairs fr; small iv present, convergent but not crossed; ov not discernible from postocular setulae; antenna yellow-orange, arista somewhat darker; setae and hairs of head generally pale, including weak vibrissa, but upper fr, orb, oc and iv darker.

Thorax densely grey pollinose on prescutum and scutum, but scutellum dark shining, without pollinosity; pair of thin medial dark vittae on prescutum; chaetotaxy difficult to discern on prescutum and scutum except for posterior dc and ac; scutellum with 2 pairs of marginal setae (apicals and basals); stpl 0+1; dorsal setae and hairs dark, those on pleura pale; legs yellow, mostly pale-haired; fore femur with pd and pv setal rows; mid tibia without submedian v seta; hind femur with ad setal row; cell R_5 closed, petiole at least as long as length of M from bend to its junction with R_{4+5}; row of approximately 5 dark setulae on R_{4+5} between node and r-m crossvein; m-cu joining M much closer to r-m than bend.

Abdomen yellow-brown, without pollinosity, dark-haired, without discernible setae; basal half of T1+2 excavate; narrow dark bands on posterior margins of T4 and T5 in some specimens; pale tubular ovipositor exserted and recurved beneath body in many specimens, sometimes extending beyond head; T5 longer than T4.

Male. Body length 4.0 (n=1). Similar to ♀ except as noted. Head: eyes holoptic, facets enlarged in slightly more than upper halves; if area triangular due to eye convergence; ocellar triangle and vertex dark; ocellar triangle prominent, with weak proclinate oc; 7-8 pairs of weak fr between level of lunula and eye convergence; antenna yellow, but arista and dorsal edge of A.s.3 somewhat darker; A.s.1 and 2 with black setulae dorsally; poorly differentiated vibrissa and setae along margin of oral cavity black; epistome and profrons coincident in profile; gena with black hairs anteriorly, otherwise pale-haired; palp and mentum yellow.

Thorax finely silver pollinose dorsally on prescutum and scutum; 4 narrow dark vittae on prescutum and scutum; dorsal setae dark;

pleura grey pollinose, pale-haired; thoracic setae stronger than in ♀: humeral callus with 2 setae; pra absent; 1 sa; 1 weak post-ia near suture separating postalar calli; 2+4 dc, posterior strongest; 2+?3 ac; legs yellow with black hairing; hind tibia with sparse ad and pd setal rows.

Remarks. The following females in ANIC are similar to those of *R. albipilosa* but have more pronounced dark markings on the abdomen as indicated below. The taxonomic significance of these variant abdominal colour patterns is undetermined. MATERIAL. WESTERN AUSTRALIA, 1♀, 1 km NNW Eucla Pass, 31°05´S, 128°52´E, 10.iv.1983, E.S. Nielsen and E.D. Edwards - thin dark marginal bands on T1+2-5; 1♀, 7 km S by E of Albany, 35°05´S, 117°54´E, 18.iv.1983, E.S. Nielsen and E.D. Edwards – posterior portion on T3 and all T4 and T5 dark. SOUTH AUSTRALIA, 1♀, 14 km WNW Renmark, 34°07´S, 140°37´E, 7.xi–13.xii.1995, K. R. Pullen, flight intercept/pitfall trap – small median and lateral dark spots on T3, T4 and scutellum lightly dusted with silver pollinosity.

The female of *R. albipilosa* has a distinctive facies, characterised by its relatively small size (<3.0mm), extensive pale coloration and reduced thoracic chaetotaxy. Although the male has more normally developed thoracic chaetotaxy, it otherwise generally resembles the female. This combination of characters sets it apart from *R. cucullata* which is larger, robustly setose and has extensive grey colouration. Other exotic species of *Rondania* also more closely resemble *R. cucullata* as discussed below under *R. cinerea* sp. nov.

Rondania cinerea sp. nov.
(Figs 1, 3C, 4B, D, E)

Etymology. Latin, *cinereus*, ash-coloured, grey; referring to the grey body colour.

Material. Holotype ♀: Western Australia, 19 miles (30 km) N by E of Mundrabilla HS, 31°51´S, 127°51´E, 16.x.1968, Britton, Upton, Balderson (ANIC). PARATYPES: WESTERN AUSTRALIA, 3♀, same data as holotype; 1♀, Mt Boyatup, 74 miles (118 km) E of Esperance, 33°44´S, 123°02´E, 23.iii.1968, I.F.B. Common and M.S. Upton; 1♀, 28 miles (45 km) W of Madura, 31°56´S, 126°58´E, 30.iv.1968, I.F.B. Common and M.S. Upton; 1♀, Drummond's Cove, Geraldton, 28°46´S, 114°16´E, 26.ix.1972, N. McFarland, at light; 2♀, 5 km ENE Caiguna, 32°15´S, 125°32´E, 11.iv.1983, E.S. Nielsen and E.D. Edwards; 3♀, 30 km SE by S Carnarvon, 25°07´S, 113°50´E, 29.iv.1971, Upton and Mitchell; all in ANIC; 5♂, 20 km N Eneabba, 29°49´S, 115°16´E, 21-23.ix.2002, G. and M. Wood, in WAM. OTHER MATERIAL: WESTERN AUSTRALIA, 6♀, 30 km SE by S Carnarvon, 25°07´S, 113°50´E, 29.iv.1971, Upton and Mitchell; 2♂, Sandstone, 27°59´S, 119°18´E, emerged 22.vii.1976 ex adult weevil *Acantholophus niveovittatus* collected 30.vi.1976, A.M. and M.J. Douglas. NORTHERN TERRITORY, 1♂, Tempe Downs, 24°23´S, 132°25´E, 11.ix.1963, P. Ranford. SOUTH AUSTRALIA, 1♀, Blanchetown, 34°21´S, 139°37´E, 26.xii.1966, Z. Liepa. AUSTRALIAN CAPITAL TERRITORY, 1♀, Canberra, 35°17´S, 149°13´E, 17.xi.1929, I.M. Mackerras; 11♂, Canberra, 12.xi.1936, W.J. Rafferty; 5♀, Canberra (Black Mtn), collected 7.ii.1957, 20.ii.1960, 12.xii.1960, 7.xi.1961 and 3.v.1967, I.F.B. Common, light trap. All in ANIC.

Diagnosis. Small flies; thorax and abdomen grey (latter pale laterally in ♂); head and legs yellowish in ♀, dark in ♂; pleura dark-haired; setae on prescutum and scutum of ♀ normally developed (not reduced as in *R. albipilosa*) and scutellum with 3 pairs of marginal setae; ♂ eyes narrowly separated, ♀ eyes broadly separated.

Description. *Female.* (Fig. 4B, D) Body length 3.6 (3.0 – 4.5) (n=21); V:HW 0.39 (0.37 – 0.40) (n=21). Head yellow; eyes bare, broadly separated, pfr not much narrowed dorsally; if area dull yellowish; pfr, pf and gena with yellow ground colour and silver pollinosity; vertex silver pollinose, upper part with dark ground colour and hairing, lower part yellow with pale hairing; A.s.1 and 2 yellow, A.s.3 darker, especially on outer surface; arista dark, bare; antenna short, falling short of epistome by a distance approximately equal to length of A.s.3; epistome slightly more pronounced than profrons in profile; palp yellow; mentum

somewhat darker; oc prominent, proclinate; 4-5 pairs irregular fr; 2 pro-, 1 reclinate and laterally divergent orb; iv convergent but not crossed; ov smaller than iv, divergent; vibrissa relatively strong, row of weaker bristles below (along genal margin) and 1 above vibrissal insertions; gena dark-haired.

Thorax grey, with darker rings around setal bases, black-haired; humeral callus with 2 setae; pra absent; 1(?2)+2 ia; 2+3 dc; 2(3)+3 ac; scutellum with 3 pairs of marginal setae, strong crossed apicals, strong basals and weak laterals; legs yellow, tarsi somewhat darker; fore femur with pd and pv setal rows; mid tibia with 2 ad and 1 submedian v setae; hind femur with ad setal row; hind tibia with 2-3 ad, 1 av and 2 pd setae; wing veins yellow; cell R_5 closed, petiole at least as long as the length of M from the bend to its junction with R_{4+5}; node of R_{4+5} with 4-5 small black setulae; m-cu joining M closer to bend than r-m.

Abdomen grey, with darker rings around setal bases and shifting silver/bronze pollinosity; T1+2 excavate in basal half, with mmp; T3 and T4 with marginal row of setae; T5 with ill-defined rows of discal and marginal setae; pale tubular ovipositor partly protruding beyond tip of T5 in some specimens.

Male. Body length 3.7 (3.2 – 4.0) (n=15). Similar to ♀ except as noted: Head: ground colour mainly dark, with silver pollinosity; antenna pale yellow, although A.s.3 and arista darker; frons very constricted, narrowest part approximately as wide as distance between lateral ocelli; eye facets enlarged dorsally, with clear line of demarcation visible in well-preserved specimens; weak iv and ov, converging but not crossed; row of fine postocular setulae. Thorax: legs dark. Abdomen pale laterally on T1+2-4, pale area just extending to T5. Terminalia as in Fig. 4E.

Puparium. Oblong, brown, tapering posteriorly towards non-functional larval posterior spiracles, these set on diverging shining black cylindrical bases, narrowly separated medially (Fig. 3C); each spiracle comprises about 12 small slits, arranged in a crescent. Anterior larval spiracles missing from 2 available puparia. Puparial respiratory horns absent.

Remarks. The following males in WAM are similar to *R. cinerea*, but have yellow abdomens with median dark markings on T3-5 and a more rounded bend in M1. The terminalia of one male were briefly examined and showed differences in the shape of the cerci and surstyli compared with *R. cinerea*, suggesting they are a distinct species. MATERIAL. WESTERN AUSTRALIA, 2♂, 20 km N Eneabba, 21-23.ix.2002, G. and M. Wood.

Rondania cinerea has a facies most closely resembling *R. cucullata*, but may be distinguished by the petiolate cell R_5 (open or just closed at wing margin in *R. cucullata*). *Rondania dimidiata* (Meigen) and *R. dispar* (Dufour), however, have a petiolate cell R5, but the petiole is relatively short in both species, at most a third the length of M from the bend to its junction with R_{4+5}. The petiole in *R. cinerea* is at least as long as the length of M from the bend to its junction with R_{4+5}. *Rondania fasciata* (Macquart) has a long petiole like *R. cinerea*, but is distinguished by its extensive yellow abdominal markings. [*R. cinerea* was not compared against literature descriptions of *R. insularis* (Bigot) (Canary Islands), *R. rubens* Herting (Spain), or *R. dorsalis* (North America).]

BIOLOGY

The Tachinidae exhibit several reproductive strategies, mainly oviparity or ovolarviparity where the egg develops *in utero* to a first-instar larva contained within the chorion. As soon as these are laid, the larvae break out and begin to search for a host. In some cases, females actually deposit their eggs on the host. The Dexiinae appear to be exclusively ovolarviparous (Cantrell 1988). In the course

of this study, we noted the presence of fully developed first instar larvae in the oviducts of specimens of *Rondania albipilosa* and *R. cinerea*. Because of their small size, these larvae were not mounted for closer examination, but they confirm that the Australian Dufouriini are ovolarviparous like other Dexiinae.

Published records indicate that Dufouriini are parasitoids of beetles, primarily leaf beetles (Chrysomelidae) and weevils (Curculionidae) (see Baranov 1938; Cox 1994; Guimarães 1977, Kovaric & Reitz 2005, Parker *et al*. 1950; Tschorsnig & Herting 1994). Most records are of flies emerging from adult beetles. However, Cerretti & Mei (2001) recorded *Eugymnopeza braueri* Townsend parasitising adult *Blaps gibba* Laporte (Tenebrionidae) and give detailed descriptions of the life history of *E. braueri* in Italy. The two known host records for the Australian Dufouriini are discussed below.

Chetoptilia angustifrons is a solitary endoparasitoid of tortoise beetles (cassidoid Hispinae: Chrysomelidae) and has been reared from two species, *Aspidimorpha deusta* (Fabricius) and an undescribed species of *Cassida* L. Tortoise beetle larvae are external leaf feeders and most, including the above species, retain their cast larval exuviae upon a pair of supra-anal processes, forming a dorsal shield. The 5th and final instar has a dorsal shield comprising the exuviae of the four previous instars. In addition to the exuviae, many tortoise beetles, including both the known hosts of *C. angustifrons*, incorporate their own faecal material into the dorsal shield. Prior to pupation, 5th instar tortoise beetle larvae usually glue the ventral surfaces of their anterior abdominal segments to the substrate and undergo a prepupal stage of one to a few days.

Mature larvae of *C. angustifrons* pupariate within the dead remains of their host (Fig. 3A). The specimens of *C. angustifrons* from north Queensland emerged from prepupae of *A. deusta* attached to the leaves of its host plant *Ipomoea pes-caprae* (L.) (Convolvulaceae), a common trailing perennial growing above the strandline of sandy beaches. The male reared from the *Cassida* species in southeast Queensland also emerged from a prepupa, attached to leaf of the beetle's host plant, *Polymeria calycina* R. Br. (Convolvulaceae). The position of the fly puparium within the host prepupa was described above. The reverse orientation of the puparium facilitates the eclosion of the adult fly as the posterior abdominal segments of the beetle prepupa are slightly elevated above the substrate to enable the reflection of the dorsal shield over the dorsum of the prepupa.

No information is available on the ovipositional behaviour of *C. angustifrons*, nor on which life stage of the beetle host is initially attacked. However, it is interesting to note that the larvae of both known hosts incorporate faecal material into their dorsal shields in all instars. In contrast, the larvae of several species of Australian *Cassida* (often placed within the subgenus *Taiwania* Spaeth) have dorsal shields that are largely devoid of faecal material; only the first instars deposit a small blob of faeces on the supra-anal processes (Hawkeswood *et al*. 1997; CJB unpub. data). Two of these species, *Cassida diomma* Boisduval and *C. compuncta* (Boheman) are common in south-eastern Queensland, and despite CJB having reared a large number of field collected larvae, prepupae and pupae of both species, *C. angustifrons* has not been found attacking either (CJB unpub. data). Perhaps adult females of *C. angustifrons* use chemical odours emanating from the faeces incorporated into the dorsal shields as host finding cues.

Most extralimital species of *Chetoptilia* for which host records are known also attack tortoise beetles (cassidoid Hispinae). However, the life stage from which the adult fly emerges varies, with species recorded from larvae, pupae and adult beetles: *C. plumicornis* from an unidentified

cassidoid larva in Uganda (Villeneuve 1942); *C. cyanea* from a pupa of *Aspidimorpha apicalis* (Klug) in Madagascar (Mesnil 1968) and *C. burmanica* from overwintering adults of *Craspedonta leayana* (Latrielle) in Myanmar (Garthwaite 1939). The only known exception to this pattern of cassidoid hosts is found in the type species of the genus, *C. puella*, a parasitoid of adult weevils (*Bytiscus betulae* L., Curculionidae) (Tschorsnig & Herting 1994).

Rondania cinerea attacks adults of the weevil *Acantholophus niveovittatus* (Curculionidae: Amycterinae). Two males in ANIC emerged from adult *A. niveovittatus* collected beneath *Spinifex* in Western Australia by Athol Douglas (see Zimmerman 1993: 214). However, no indication is given as to whether the specimens emerged from the same or separate adult weevils. The fly puparia are devoid of host remains and it is assumed that the mature fly larvae leave the host to pupariate in a similar manner to *R. cucullata* (see below). *Acantholophus* is a widespread and diverse genus known from all Australian states and territories and with more than 50 described species (Zimmerman 1993).

Extralimital species of *Rondania* for which host records are known, are also parasitoids of adult Curculionidae (Tschorsnig & Herting 1994). Female *Rondania* use their reflexed tubular ovipositor to lay eggs directly onto the adult host. *Rondania dimidiata* lays its eggs in the mouthparts of adults of *Brachyderes incanus* L. (De Fluiter & Blijdorp 1935). *Rondania cucullata* lays its eggs near the anal opening of adults of *Cleonus mendicus* Gyll., the mature larvae leaving the host to pupariate in soil (Menozzi 1939). *Eugymnopeza braueri* Townsend, a parasitoid of the ground beetle *Blaps gibba* Laporte (Coleoptera: Tenebrionidae), also lays its eggs in the mouthparts of adult beetles, but pupariates within the dead host beetle (Cerretti & Mei 2001).

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LITERATURE CITED

Baranov, N. 1938. Neue indo-australische Tachinidae. *Bulletin of Entomological Research* **29**: 405-414.

Barraclough, D.A. 2005. *Rhinophoroides minutus*, a new genus and species of rare nocturnal Dufouriini (Diptera: Tachinidae: Dexiinae) from South Africa. *African Entomology* **13**: 380–384.

Borowiec, L. 1992. A review of the tribe Aspidimorphini of the Australian Region and Papuan Subregion (Coleoptera: Chrysomelidae: Cassidinae). *Genus* **3**: 121-184.

Borowiec, L. & Świętojańska, J. 2008. Cassidinae of the World – an interactive manual (Coleoptera: Chrysomelidae). http://www.biol.uni.wroc.pl/cassidae/katalog%20internetowy/index.htm.

Cantrell, B.K. 1988. The comparative morphology of the male and female postabdomen of the Australian Tachinidae (Diptera) with descriptions of some first-instar larvae and pupae. *Invertebrate Taxonomy* **2**: 81-221.

Cantrell, B.K. & Crosskey, R.W. 1989. Tachinidae. Pp. 733-784. *In*, Evenhuis, N.L. (Ed), *Catalog of the Diptera of the Australasian and Oceanian Regions*. Bishop Museum Special Publication 86. (Bishop Museum Press: Honolulu and E. J. Brill: Leiden).

Cerretti, P. & Mei, M. 2001. *Eugymnopeza braueri* (Diptera, Tachinidae) as parasitoid of *Blaps gibba* (Coleoptera, Tenebrionidae), with description

of the preimaginal instars. *Italian Journal of Zoology* **68**: 215-222.

Cerretti, P., De Biase, A. & Freidberg, A. 2009. Systematic study of the genus *Rossimyiops* Mesnil (Diptera: Tachinidae). *Zootaxa* **1984**: 31-56.

Cox, M.L. 1994. The Hymenoptera and Diptera parasitoids of Chrysomelidae. Pp. 419-468. *In*, Jolivet, P.H., Cox, M.L. & Petitpierre, E. (Eds), *Novel aspects of the biology of Chrysomelidae*. (Kluver Academic Publishers).

Crosskey, R.W. 1973. A taxonomic conspectus of the Tachinidae (Diptera) of Australia, including keys to the supraspecific taxa and taxonomic and host catalogues. *Bulletin of the British Museum (Natural History), Entomology, Supplement* **21**: 1–221.

1976. A taxonomic conspectus of the Tachinidae (Diptera) of the Oriental Region. Bulletin of the British Museum (Natural History), Entomology, Supplement 26: 1–357.

1984. Annotated keys to the genera of Tachinidae (Diptera) found in tropical and southern Africa. *Annals of the Natal Museum* **26**: 189-337.

De Fluiter, H.J. & Blijdorp, P.A. 1935. De grauwe Dennensnuitkever Brachyderes incanus L. *Tijdschrift Plantenziekten* **41**: 143-211.

Garthwaite, P.F. 1939. Biology of *Calopepla leayana* Latr. (Chrysomelidae, Col.) and the possibilities of control. *Indian Forest Records (New Series) Entomology* **5**: 237-277.

Guimarães, J.H. 1977. A review of the tribe Oestrophasiini Brauer & Bergenstamm (Diptera, Tachinidae). *Papéis Avulsos de Zoologica, São Paulo* **30**: 215-238.

Hawkeswood, T.J., Takizawa, H. & Jolivet, P.H. 1997. Observations on the biology and host plants of the Australian tortoise beetle, *Cassida compuncta* (Boheman), with a description of the larva, pupa and adult (Insecta: Coleoptera: Chrysomelidae). *Mauritiana* **16**: 333-339.

Herting, B. 1984. Catalogue of Palearctic Tachinidae (Diptera). *Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie)* **369**: 1–228.

Kovarik, P.W. & Reitz, S.R. 2005. *Oestrophasia* (*Cenosoma*) *sabroskyi* (Diptera: Tachinidae), a parasitoid of *Artipus floridanus* (Coleoptera: Curculionidae): taxonomy and bionomics. *Annals of the Entomological Society of America* **98**: 245-251.

Medvedev, L.N. 1995. Chrysomelidae (Coleoptera) from Leyte Island, Philippines. *Stuttgarter Beiträge zur Naturkunde Serie A (Biologie)* **526**:1-22.

Menozzi, C. 1939. Parassiti e predatori del *Conorrhynchus mendicus* Gyll. (Coleoptera-Curculionidae), dannoso alla bietola da zucchero in Italia, e loro importanza nella lotta biologica contro questo fitofago. *Verhandlungen VII International Kongress of Entomology*, vol. IV. Friendländer & Sohn, Berlin, pp. 2561-2575.

Mesnil, L.P. 1953. Nouveaux tachinaires d'Orient (2e partie). *Bulletin and Annals of the Entomological Society of Belgium* **89**: 146-178.

1968. Quelques remarquables Tachinaires de Madagascar (Dipt. Tachinidae). *Verhandlungen der Naturforschenden Gesellschaft in Basel* **79**: 44-55.

O'Hara, J.E. & Wood, D.M. 2004. Catalogue of the Tachinidae (Diptera) of America north of Mexico. *Memoirs on Entomology, International* **18**. (Associated Publishers: Gainesville, Florida). 410 pp.

Parker, H.L., Berry, P.A. & Silveria, A. 1950. Vegetable weevils and their natural enemies in Argentina and Uruguay. *United States Department of Agriculture Technical Bulletin* **No. 1016:** 1-28.

Robineau-Desvoidy, J.B. 1850. Essai Myiodaires. Myiodaires des environs de Paris (Suite). *Annales de la Société Entomologique de France* 2: 183- 209.

Rondani, C. 1862. Species italicae ordinis Dipterorum in genera characteribus definita, ordinatum collectae, methodo analytica distinctae, et novis vel minus cognitis descriptis. (Part 4 Muscidae: Phasiinae-Dexiinae-Muscinae-Stomoxidinae.) *Dipterologiae italicae prodromus* **5**, 239pp.

Tschorsnig, H.-P. & Herting, B. 1994. The tachinids (Diptera: Tachinidae) of Central Europe: identification keys for the species and data on distribution and ecology. *Stuttgarter Beiträge zur Naturkunde Serie A (Biology)* **506**: 1-170.

Villeneuve, J. 1942. Descriptions de Myodaires supérieurs nouveaux (Dipt. Tachinidae. *Bulletin de la Société entomologique de France* **47**: 50–55.

Zimmerman, E.C. 1993. *Australian weevils. Volume III.* (CSIRO Publications, Melbourne). 854 pp.