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FIJI ARTHROPODS V

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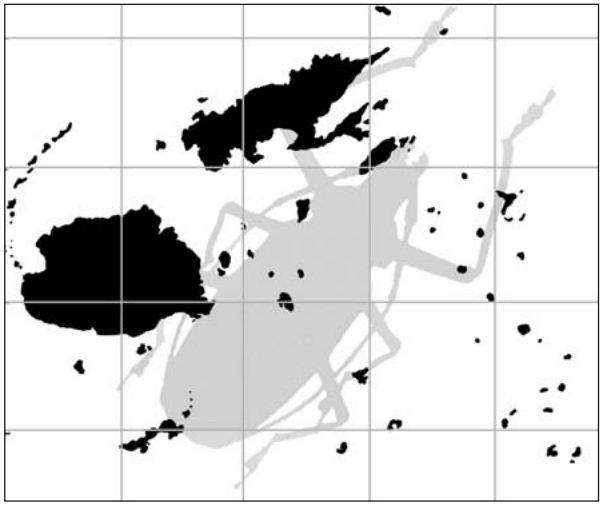

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FIJI ARTHROPODS

Editors' Preface

We are pleased to present the fifth issue of *Fiji Arthropods*, a series offering rapid publication and devoted to studies of terrestrial arthropods of the Fiji Group and nearby Pacific archipelagos. Most papers in this series will be the results of collecting and research on the Fijian fauna deriving from the NSF-funded "Terrestrial Arthropods of Fiji" project. Five co-PIs and 18 specialists (see Fiji Arthropods I, p. 18) form the core team of scientists who have agreed to publish new taxa that result from collecting during this survey. However, as space allows, we welcome papers from any scientist who is currently working on arthropod taxonomy in Fiji.

This issue contains results of discoveries of new species of Diptera in the families Tabanidae (Burger), Pipunculidae (Skevington), and Dolichopodidae (Bickel) as well as a key to families of the Muscoidea (Diptera) by Pont. Manuscripts are currently in press or in preparation on Saldidae, Lauxaniidae, Keroplatidae, Mycetophilidae, Muscidae, Dolichopodidae, and Asilidae and will appear in future issues.

The editors thank the Government of Fiji (especially the Ministries of Environment and Forestry), the National Science Foundation (DEB 0425970), and the Schlinger Foundation for their support of this project. Types of new species deriving from this study and voucher specimens will be deposited in the Fiji National Insect Collection, Suva.

All papers in this series are available free of charge as pdf files downloadable from the following url:

http://hbs.bishopmuseum.org/fiji/fiji-arthropods/

We encourage interested authors to contact us before submitting papers.

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Fiji Arthropods V. Edited by Neal L. Evenhuis & Daniel J. Bickel. *Bishop Museum Occasional Papers* 89: 3–12 (2006).

Description of Three New Species of Tabanidae (Diptera) From the Fiji Archipelago and a Revised Key to the Tabanidae of Eastern Melanesia and Samoa (Excluding New Caledonia)

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Abstract. Three new species of Tabanidae, two species of *Tabanus*: *T. atrostriatus*, **n. sp.**, *T. koroyanituensis*, **n. sp.** and one species of *Cydistomyia*: *C. fijiensis*, **n. sp.** are described from Fiji, and a revised key to the Tabanidae of Eastern Melanesia and Samoa is presented.

INTRODUCTION

Burger (1991) reviewed the Tabanidae of Eastern Melanesia and Samoa, not including New Caledonia, describing three new species, two from Fiji and one from the Solomon Islands, and providing a list of taxa and a key to species. Beginning in 2002, an initiative to document the arthropod diversity of the Fijian Islands (Fijian Bioinventory of Arthropods) was begun, supplemented by surveying from the NSF-funded Fiji Terrestrial Arthropod Survey, and has accumulated and processed 361 specimens of Tabanidae representing 10 species in three genera, including three undescribed species that are described and illustrated in this paper. A revised key to the species of Tabanidae occurring in Eastern Melanesia and Samoa is presented that includes the new species.

MATERIALS AND METHODS

Material examined derives from the extensive Malaise trapping surveys of the Schlinger Foundation and the NSF-funded Fiji Arthropod Survey since 2002. Types and vouchers of all taxa will be repatriated to the Fiji National Insect Collection in Suva.

SYSTEMATICS

Cydistomyia fijiensis Burger, **new species**
(Figs. 1, 2)

Diagnosis. A slender dark brown to black- brown species with narrow gray hind margins on abdominal tergites, enlarged slightly into low median spots.

Description. Holotype female. Length: 9.6 mm. *Head*. Frons narrow, index 6.6, narrowed in the middle, dark brown to black-brown tomentose. Frontal callus narrowly triangular at base, dorsal extension narrow, extending most of distance to vertex, vertex depressed. Subcallus dark brown tomentose. Frontoclypeus brown tomentose, except shining yellow-brown above tentorial pits. Beard sparsely black pilose. Antennae dark brown, flagellum with strong dorsal tooth, apical flagellomeres

1. Contribution No. 2006-034 to the NSF-Fiji Arthropod Survey.

about 1.4 times longer than basal flagellomere. Maxillary palpi dark brown, apical palpomere slender, scarcely enlarged basally. Eyes (relaxed) with a single narrow green stripe across middle of eye on dark background.

Thorax. Thorax, including scutellum dark brown. Pleuron black pilose.

Legs. Femora brown. Tibiae dark brown. Tarsi black-brown.

Wing. Costal cell brown tinted, remainder of wing subhyaline. Fork of vein R_4 and R_5 with very short spur.

Abdomen. Abdomen dark brown to black-brown. Abdominal tergites 1–6 with very narrow pale haired hind margins, slightly enlarged medianly on tergites 2–5 into low gray tomentose spots**.** Sternites 2-5 with narrow pale haired hind margins.

Types. Holotype ♀, FIJI: **Viti Levu:** Naitasiri Province, 4 km WSW Colo-i-Suva Village. 372 m. Mount Nakobalevu, 18°055'S, 178°424'E. 24 Apr–12 May 2004, Malaise, E.I. Schlinger, M. Tokota'a (FBA065296). *Paratypes*: 41♀. 4♀, same data as holotype (FBA065297-065300). 8♀, same data, except 17 Mar–9 Apr 2003 (FBA 097936-097943). 2♀, same data, except 9–30 May 2003 (FBA094152, 094155); 2♀, same data, except 14–28 Jul 2003 (FBA094537, 095259); 4♀, same data, except 12–25 Feb 2003 (FBA101383–101386); 12♀, same data, except 25 Feb–17 Mar 2003 (FBA102769–102770, 102772–102773, 102779–102781, 102784, 103359, 103363– 103364, 103366). **Taveuni:** 3♀, Cakaudrove Prov., Soqulu House in Soqulu Estate, 140 m, 14–21 Nov 2002, Malaise, E.I. Schlinger, M. Tokota'a, 16.833°S, 180°W (FBA099818, 099820, 099822). **Vanua Levu:** 3♀, Macuata Province, Dogotuki, 2.5 km E. of Nasavu River, 7 Jul 2003, Malaise, M.E. Irwin, E.I. Schlinger, M. Tokota'a (FBA078508, 079166–079167); 3♀, Macuata Province, Rokosalase, 26 Mar–9 Apr 2004, M.E. Irwin, E.I. Schlinger, M. Tokota'a, Malaise in forest, 179°01'147"E, 16°31'891"S, 105 m. (FBA046677–046679). Holotype will be deposited in FNIC. Paratypes deposited in FNIC, BPBM, and UNHC.

Remarks. The paratypes are essentially the same as the holotype female, except length of the body varies from 8.8–11.2 mm. This species is most closely related to *Cydistomyia pacifica* (Ricardo), but differs in having a slightly broader frons, much darker brown thorax and black-brown abdomen and black haired beard and pleuron.

Etymology. This species is named for the Fiji Archipelago, from which the type series was collected.

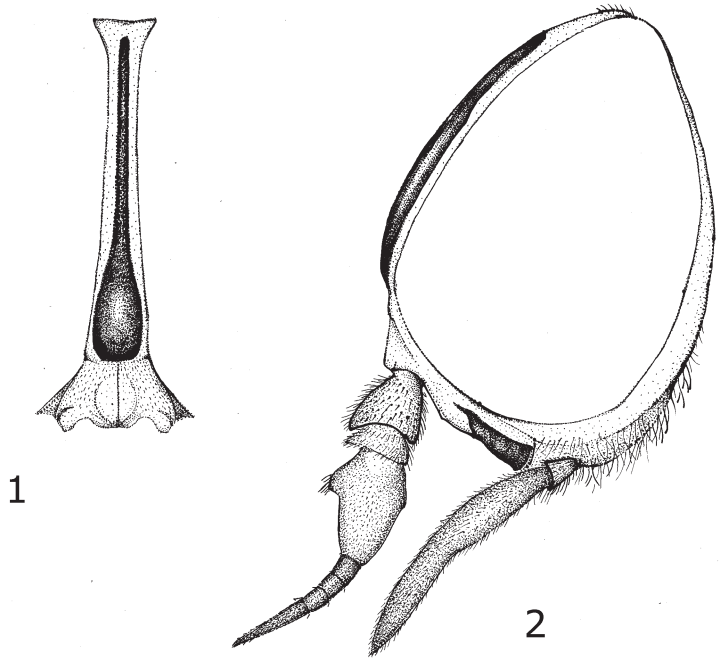
Tabanus atrostriatus Burger, **new species**
(Figs. 3–5)

Diagnosis. A medium-sized black, gray and yellow-brown species, mesoscutum black with gray sublateral stripes, wings hyaline with very faint cloud at fork of veins R_4 and R_5, abdominal tergites with gray hind margins enlarged into median triangles on tergites 2–3 and sternites yellowish with broad black median longitudinal stripe.

Description. Holotype female. Length 13.6 mm. *Head*. Frons relatively narrow, index 7.4, distinctly widened above, width at vertex 1.5 times width at base, gray tomentose with a darkened area medianly, frontal callus narrowly quadrate basally, with narrow dorsal extension. Subcallus yellowish gray tomentose. Frontoclypeus and genae light gray tomentose. Beard white. Antenna with scape and pedicel yellowish, black setose, flagellum black, basal flagellomere with strong dorsal tooth. Maxillary palpi with apical palpomere gray tomentose and black setose, stout basally, sharply pointed apically. Eyes (relaxed) black, without discernible pattern.

Thorax. Mesoscutum blackish with diffuse sublateral and lateral gray stripes. Pleuron light gray tomentose and predominantly white pilose. Scutellum dark gray tomentose.

Legs. Fore coxae gray tomentose and white pilose. Fore and mid femora yellowish, mid femo-



Figs. 1, 2. Female, *Cydistomyia fijiensis*, n. sp. **1**. Frons. **2**. Lateral view of head.

ra blackish at base, hind femora black with yellowish apex. Tibiae yellowish, fore tibiae darkened apically. Fore tarsi black, mid and hind tarsi yellowish basally, darkened apically.

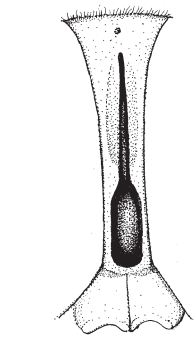
Wing. Hyaline. Fork of veins R_4 and R_5 with faint cloud, without spur.

Abdomen. Tergites with gray posterior margins, expanded into median triangles on tergites 2 and 3. Tergites 1–3 with large yellow-brown sublateral spots, remainder of tergites black. Sternum with broad black median longitudinal stripe, sternites 1–4 yellowish brown laterally, remainder of sternites black.

Types. Holotype ♀, FIJI: **Kadavu:** Kadavu Province, 0.26 km SW Solodamu Village, Moanakaka Forest Reserve, 19°04'39"S, 178°07'15.6"E. 60 m. 11 Apr–2 May 2004, Malaise, E.I. Schlinger, M. Tokota'a.(FBA087991). Holotype will be deposited in FNIC.

Remarks. *T. atrostriatus* is perhaps most closely related to *Tabanus fijianus* Ricardo, but differs in having a narrower frons and frontal callus, lighter gray markings on the mesoscutum and pleuron, wings without strong dark clouds on the crossveins and fork of veins R_4 and R_5, abdominal triangles smaller and gray tomentose, hind margins of tergites with strong gray hind marginal bands, and sternum with a conspicuous broad black median longitudinal stripe.

Etymology. This species is named for the broad black median longitudinal stripe on the abdominal sternum.



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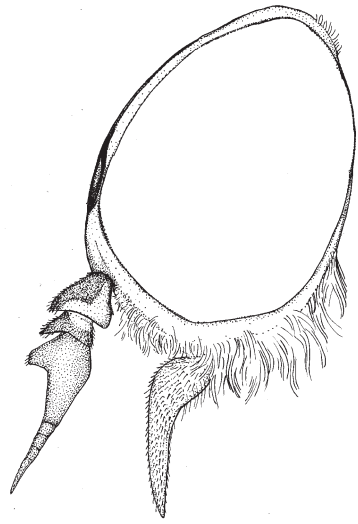

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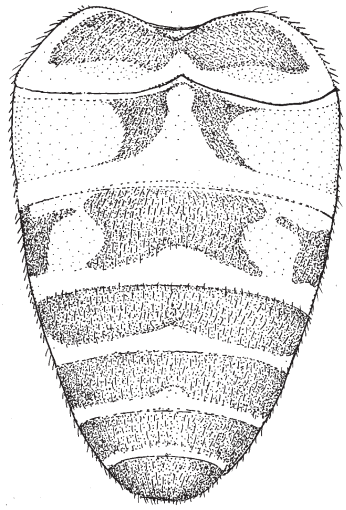

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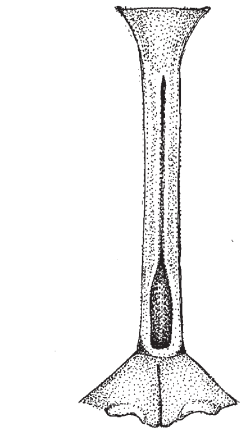
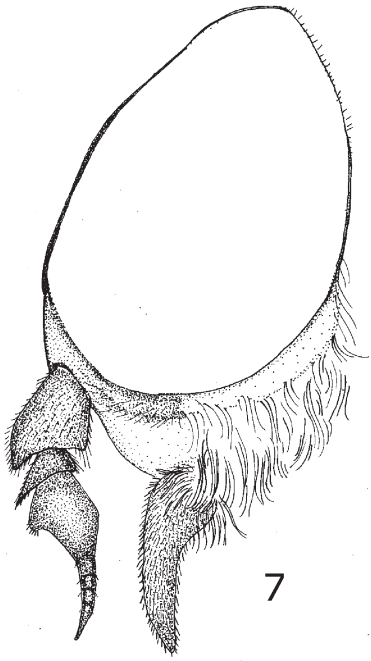
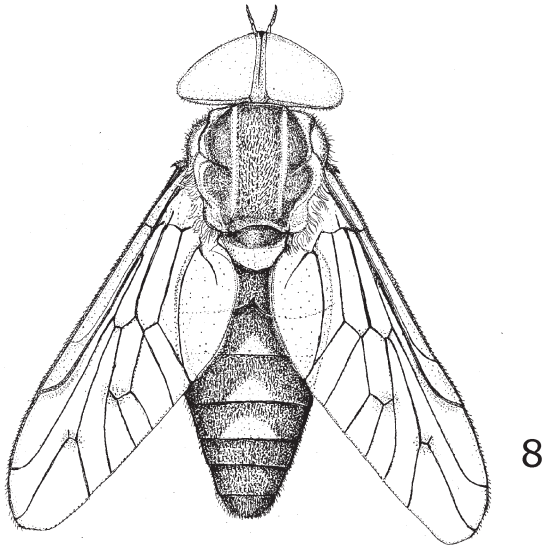
Figs. 3-5. Female, *Tabanus atrostriatus*, n. sp. **3**. Frons. **4**. Lateral view of head. **5**. Dorsal surface of abdomen.







Figs. 6-8. Female, *Tabanus koroyanituensis*, n. sp. **6**. Frons. **7**. Lateral view of head. **8**. Dorsal surface of abdomen.

Tabanus koroyanituensis Burger, **new species**
(Figs. 6–8)

Diagnosis. A medium-sized black and gray species with frontoclypeus, mesopleuron and posterior half of scutellum light gray tomentose and white pilose, and abdominal tergites 2-4 with large light gray triangles.

Description. Holotype female. Length 13.2 mm. *Head*. Frons narrow, index 8, distinctly widened above, about one-third broader at vertex as at base, gray tomentose basally, becoming black at vertex. Frontal callus narrow at base, extending dorsally nearly 3/4 distance to vertex. Subcallus brownish gray tomentose. Upper parafacials dark black-brown and black pilose, forming dark band passing beneath antennae, lower parafacials gray tomentose and white pilose. Beard white. Scape of antenna enlarged and elongate dorsally, black-brown, black setose, flagellum black, basal flagellomere with strong dorsal tooth, 1.4 times longer than tall, apical flagellomeres together equal in length to basal flagellomere. Maxillary palpi with apical palpomere stout basally, strongly tapered apically, light gray tomentose and white pilose basally, becoming blackish and with scattered black setae apically, about 2.6 times longer than broad at base. Eyes (relaxed) with central area dark green with a single transverse purple band.

Thorax. Mesoscutum dark blackish brown, gray tomentose and white pilose laterally, bearing sublateral grayish stripes on anterior half, gradually fading out posteriorly. Scutellum strongly bicolored, black on anterior half, light gray tomentose on posterior half. Pleuron light gray tomentose and white pilose.

Legs. Fore coxae gray tomentose and white pilose on basal half, black and black pilose apically. Femora black and black pilose, mid and hind femora with some white hair basally, tibiae and tarsi black except mid tibiae with obscure brownish tones basally.

Wing. Predominantly hyaline except for obscure smoky coloration along apical margin and on crossveins, fork of veins R_4 and R_5 with short spur and with distinct dark cloud.

Abdomen. Black to brown-black except for the following pale grayish markings: posterior margin of tergite 1, posterior margins of tergites 2–4, large median triangles on tergites 2-4, and posterior margins of sternites 2–4.

Types. Holotype ♀, FIJI: **Viti Levu:** Vuda Province, 1 km E Abaca Village, Koroyanitu National Park, 800 m, Savuione Trail, 17°40'S, 177°33'E, 12–19 Nov 2002, Malaise, E.I. Schlinger, M. Tokota'a (FBA 084132). *Paratype*: FIJI: **Taveuni:** 1♀, Cakadrove Province, Devo Peak Radio Tower, Malaise in rainforest, 31 Oct– 21 Nov 2002. M.E. Irwin, E.I. Schlinger, M. Tokota'a. 16°51'S, 179°58'E, 1200 m (FBA 004572). Holotype and paratype will be deposited in FNIC.

Remarks. The paratype female is essentially the same in size and coloration as the holotype. This species is most closely related to *Tabanus lamiensis* Burger but differs in being larger, having a narrower frons, basal flagellomere not strongly compressed, strong lateral and dorsolateral gray markings on the mesoscutum, strongly bicolored scutellum, abdominal tergites 2-4 with large gray median triangles and anterior half of wing not strongly darkened.

Etymology. This species is named for Koroyanitu National Park, where the holotype female was collected.

Revised Key to the Tabanidae of Eastern Melanesia and Samoa

1. Basicosta densely covered with strong setulae similar to those on costa ... (*Tabanus* Linnaeus) 5
– Basicosta bare or nearly so (occasionally a few irregularly scattered setulae may be present) 2

2. Scape of antenna and sometimes subcallus strongly swollen and polished; eyes (relaxed) green with dark transverse stripe; ocellar tubercle present; vein R_4 with long spur ... (*Japenoides* Oldroyd) 18
–. Scape of antenna not polished or strongly swollen; without the above combination of characters 3

3. Scape of antenna relatively long and slender; proboscis slender, labella small; thorax and abdomen metallic blue-green, resembling muscoid flies ... (Solomon Is) .. .. *Chasmia orthellioides* Mackerras
- Scape of antenna not especially elongate; proboscis stouter, labella large; not resembling blue-green metallic muscoid flies 4

4. Frons of ♀ relatively broad, index 3.5 or less; eyes usually distinctly pilose; male with upper enlarged eye facets distinctly pilose ... (*Dasybasis* Macquart) 19
–. Frons of ♀ narrower, index 4 or greater; eyes of both sexes bare ... (*Cydistomyia* Taylor) 20

5. Subcallus shining black; slender 10–12 mm black species with contrasting yellow antennae and white tibiae ... (Solomon Is) ..... **T. ceylonicus** Schiner
–. Subcallus tomentose; tibiae not contrastingly white 6

6. Rather shining black species, with predominantly black shining frons obscuring frontal callus; eyes (relaxed) with transverse brown or purple band 7
–. Not shining black species; frons predominantly tomentose; frontal callus variably developed 8

7. Small (9–10 mm) species; antenna dark brown to black, basal flagellomere strongly compressed, dorsal excision absent; frons narrow, index 8; eyes (relaxed) with purple transverse band on dark green ground ... (Fiji) ..... **T. lamiensis** Burger
–. Larger (14–15 mm) species; antenna yellowish, contrasting sharply with dark body, basal flagellomere more elongate, with well developed dorsal excision; frons medium width, index 5; eyes (relaxed) with brown transverse band ... (Solomon Is.) ..... **T. gilingilensis** Mackerras

8. Stout blackish or brown-black species; vein R_4 of wing with long spur 9
–. More slender, lighter colored species; vein R_4 of wing with or without short spur ... 10

9. Medium sized (14–15 mm) species; frons moderately broad, index 5; frontal callus well developed; basal flagellomere of antenna yellowish brown; beard black; pleural and abdominal hairs entirely black; abdomen without color pattern; eyes (relaxed) with purple, green-bordered band ... (Solomon Is) .... **T. choiseulensis** Mackerras
–. Larger (16–18 mm) species; frons very narrow, index 11.4; frontal callus a narrow, linear line widely separated from eye margins; basal flagellomere of antenna dark reddish brown; beard white; pleuron white pilose; abdominal terga 2–5 with distinct pale yellow-haired bands; eyes (relaxed) dark green, without color pattern ... (Fiji) ..... **T. yoshimotoi** Burger

10. Dark grayish species; basal flagellomere of antenna compressed, black; maxillary palpi short and stout; wings strongly suffused with brown; abdominal terga with narrow pale apical bands and low median triangles ... (Solomon Is.) .... **T. lenticuloides** Mackerras
- Without the above combination of characters 11

11. Abdominal tergites with gray posterior margins expanded into median triangles on tergites 2 and 3, tergites 1–3 with large yellow-brown sublateral spots; sternum with broad black median stripe ... (Fiji) ..... **T. atrostriatus** Burger, **n. sp.**
- Abdominal tergites 1–3 without large yellow-brown sublateral spots; sternum without broad black median stripe 12

12. Mesoscutum with broad sublateral pale stripes (sometimes diffuse); abdomen with very large light gray or yellow triangles on some tergites..... 13
- Mesoscutum without broad sublateral pale stripes, or, if stripes present, they are narrow; abdominal tergites without very large gray or yellow median triangles, if triangles present, they are very small 14

13. Abdominal tergites 2–4 with large light gray median triangles arising from pale hind margins; scutellum strongly bicolored, anterior half black, posterior half light gray .. .(Fiji) ..... **T. koroyanituensis** Burger, **n. sp.**
–. Abdominal tergites 2–5 with large yellow median trangles arising from yellow posterior margins; scutellum not bicolored ... (Fiji) ..... **T. fijianus** Ricardo

14. Pale longitudinal stripes on mesoscutum narrow and indistinct; median triangles on abdominal tergites 2–5 small or absent, at most extending 1/3 length of tergite 2, barely discernible on posterior tergites; basal flagellomere of antenna with weak dorsal tooth ... (Vanuatu) ..... **T. expulsus** Walker
–. Without the above combination of characters 15

15. Dark brown to blackish brown species; frons narrow, index 8; antenna long, subequal to anteroposterior width of head; pleuron pale, strongly contrasting with mesonotum; legs black; wings brownish.....(Samoa)... **T. samoensis** Ferguson
- Without the above combination of characters 16

16. Relatively large (16–18 mm) dark brown to reddish brown species; beard with mixed dark and white hairs; maxillary palpi relatively slender; fore femora dark brown to black; wings predominantly hyaline; abdominal terga with variably developed grayish white median triangles and apical fringes ... (Solomon Is, Vanuatu) ..... **T. rubiventris** Macquart
–. Beard creamy to white; maxillary palpi stouter; femora brown to yellowish; wings usually suffused with brown anteriorly 17

17. Larger (13–16 mm) more tomentose species with relatively large black frontal callus; basal flagellomere of antenna with strong dorsal tooth; wings lightly suffused with brown; eyes (relaxed) with a transverse brown band ... (Solomon Is) ..... **T. gressitti** Mackerras
–. Smaller (12–14 mm) more shining species; frontal callus narrower, light brown basally; basal flagellomere of antenna with obtuse dorsal angle; eyes (relaxed)

without pattern; wings with darker brown suffusion anteriorly ... (Solomon Is, Santa Cruz Is, Vanuatu)..... **T. leveri** Mackerras & Rageau

18. Both subcallus and antennal scape strongly swollen and polished brown; basal flagellomere reddish brown basally, brownish apically; beard pale yellowish to white; maxillary palpi very slender.....(Vanuatu, Fiji) ..... **J. veitchi** (Bezzi)
–. Subcallus tomentose, not swollen; antennal scape polished black. Strongly contrasting with orange pedicel and basal flagellomere; apical flagellomeres black; beard dark brown to black; maxillary palpi stouter basally ... (Solomon Is) .... **J. ratcliffei** (Mackerras & Rageau)

19. Brownish species; flagellum of antenna long and slender, yellowish orange; wings irregularly darkened with brown anteriorly ... (Solomon Is) .... **D. anomala** Mackerras & Rageau
–. Grayish species; flagellum of antenna short, dark brown; wings hyaline.....(Solomon Is) ..... **D. mellicallosa** Mackerras & Rageau

20. Yellowish species with orange or yellowish brown coloration; antenna, palpi, and legs yellow or yellow-brown 21
–. Darker buff gray, brown, or black species..... 22

21. Frons relatively narrow (index 7); frontal callus brown ... (Fiji)..... ..... **C. bezzii** Mackerras & Rageau
–. Frons broader (index 5.3–5.7); frontal callus yellow ... (Solomon Is) .... **C. sol** (Schuurmans Stekhoven)

22. Small (8–9 mm) grayish buff species; hairs on anterior 5 abdominal tergites nearly entirely creamy yellow ... (Solomon Is) ..... **C. chaineyi** Daniels
–. Darker brown to black species; hairs on anterior abdominal tergites not predominantly creamy yellow 23

23. Larger (11–13 mm), yellowish brown to reddish, brown or black species; hairs on abdominal tergites of female mostly black or brownish 24
–. Smaller (8–10 mm), slender brown or black species; abdominal tergites with variable pattern of pale tomentum and hairs 27

24. Frons broad (index 4.5) ... (Solomon Is) ..... **C. lorentzi** (Ricardo)
–. Frons narrow (index 7–9) 25

25. Beard creamy yellow; legs black; abdomen grayish black ... (Fiji) .... **C. limbatella** (Bezzi)
–. Beard black or with mixed black and pale hairs; legs and abdomen light to dark brown 26

26. Thorax very dark brown; abdomen black-brown to black; beard and pleuron black haired ... (Fiji)..... **C. fijiensis** Burger, **n. sp.**
–. Thorax and abdomen medium brown; beard and pleural hairs pale ... (Fiji) .... **C. pacifica** (Ricardo)

27. Frons relatively narrow (index 7); beard black; antenna black, unusually long, apical flagellomeres twice as long as basal flagellomere; maxillary palpi short and stout; proboscis unusually short, scarcely longer than maxillary palpi; vein R_4 without spur ... (Solomon Is) ..... **C. teloides** Mackerras
–. Frons broader (index 5–5.7); beard creamy or white; antenna not entirely black and not unusually long; maxillary palpi relatively elongate and slender; proboscis not unusually short; vein R_4 with spur 28

28. Subcallus shining black; maxillary palpi dark brown to black; legs deep brown to black; abdominal tergites black, with narrow white apical bands ... (Solomon Is) ..... **C. nigrina** Mackerras
–. Subcallus brown, tomentose; maxillary palpi creamy yellow; legs light brown; abdominal tergites brown with narrow yellowish apical bands ... (Solomon Is.) ..... **C. nannoides** Mackerras

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Revision of Fijian *Collinias* Aczél (Diptera: Pipunculidae)

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Abstract: The Fijian species of *Collinias* Aczél are revised and include one described species, *C. vitiensis* Muir and 3 new species: *C. croceus,* **n. sp.**, *C. dolabratus,* **n. sp.** and *C. schlingeri,* **n. sp.** A key to species is provided and diagnostic characters, including male and female genitalia, are illustrated. DNA barcoding data are provided for all Fijian species and several other, mostly undescribed, *Collinias* species from Australia and New Caledonia. A phylogeny for the genus is proposed in light of the barcoding data. *Pipunculus imparilis* Hardy, formerly unplaced to subgenus within *Cephalops*, is transferred to *Collinias,* **n. comb.**

INTRODUCTION

Until the recent inventory of Fijian invertebrates, only one pipunculid species (named from two pipunculid specimens) had been described from Fiji. *Collinas vitiensis* Muir, 1906, was the sole representative of the Fijian pipunculid fauna. From recent collecting efforts, we now know that the pipunculid fauna of Fiji is surprising diverse for a small group of islands. At least 25 species in seven genera (*Cephalosphaera*, *Chalarus*, *Clistoabdominalis*, *Collinias*, *Dasydorylas*, *Microcephalops* and *Tomosvaryella*) are supported by a collection of 1541 specimens (Skevington, unpublished data). The bulk of the family's diversity occurs in the genus *Clistoabdominalis* and almost all are endemic. Surprisingly absent from the islands are the genera *Eudorylas* and *Cephalops*. These globally diverse genera include a few widespread tramp species like *Eudorylas mutillatus* Loew and at least these species have colonized most island groups in South Pacific.

Collinias is a small Old World pipunculid genus containing 6 described species (Table 1). The life history of *Collinias* is unknown but they are likely endoparasitoids of Auchenorrhyncha like most big-headed flies with known life histories (Skevington and Marshall 1997). Only the genus *Nephrocerus* has deviated from this narrow ecological role, attacking adult crane flies (Diptera, Tipulidae) (Koenig & Young 2006, Skevington 2005).

MATERIALS AND METHODS

All Fijian specimens are deposited in BPBM, CNC and FNIC; other museums listed contain comparative material from surrounding regions. Specimens examined in this study were obtained from the following collections [abbreviations follow Evenhuis & Samuelson (2006)]: Australian Museum, Sydney, New South Wales, Australia (AMS), Australian National Insect Collection, Canberra, ACT, Australia (ANIC), Bishop Museum, Honolulu, HI, USA (BPBM), Canadian National Collection of Insects, Ottawa,

1. Contribution No. 2006-035 to the NSF-Fiji Arthropod Survey.

Table 1. Previously described species of *Collinas*.

Species	Range	Type location	Notes
Collinias fulvicaudus De Meyer, 1996	Congo, South Africa	Holotype KBIN	Does not occur in the Australasian/Oceanian Region
Collinias heterostigmus (Perkins, 1905)	Australia, Philippines, Vietnam	Lectotype BPBM 4205	Type photos at: http://tolweb.org/Collinias_heterostigmus/54676.
Collinias imparilis (Hardy, 1968), **n. comb**.	Myanmar and PNG (Bismarck Arch.)	Holotype ZMK	Type photos at: http://tolweb.org/Collinias_imparilis/54677
[This species was formerly unplaced to subgenus within *Cephalops* (De Meyer 1996)]			
Collinias leechi (Hardy, 1972)	Laos	Holotype BPBM 10241	Does not occur in the Australasian/Oceanian Region
Collinias limitaris (Collin, 1929)	American Samoa	Holotype BPBM 2370	Type photos at: http://tolweb.org/Collinias_limitaris/54679
Collinias vitiensis (Muir, 1906)	Fiji, Niue	Holotype BPBM 4218	Type photos at: http://tolweb.org/Collinias_vitiensis/54680

Ontario, Canada (CNC), Hungarian Natural History Museum, Budapest, Hungary (HNHM), University of Guelph Insect Collection, Guelph, Ontario, Canada (DEBU), Greg Daniels personal collection, Brisbane, Queensland, Australia (GDCB), Fiji National Insect Collection, Suva, Fiji (FNIC), Illinois Natural History Survey, Champaign, Illinois, USA (INHS), Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium (IRSNB), Muséum d'Histoire Naturelle, Geneva, Switzerland (MHNG), Museum of Victoria, Abbotsford, Victoria, Australia (MVMA), Queensland Department of Primary Industries, Indooroopilly, Queensland, Australia (QDPC), Queensland Museum, Brisbane, Queensland, Australia (QM), University of Queensland Insect Collection, Brisbane, Queensland, Australia (UQIC), National Museum of Natural History, Washington, D.C., USA (USNM).

Specimen preparation follows Skevington (2003). Drawings were made using a drawing tube mounted on a Nikon Eclipse 80*i* compound microscope or a Leica MZ 16. Measurements were made using a graticule. Scale bars on the figures are all 0.1 mm. At least 5 specimens from each species were used to obtain the recorded values.

All specimens are labeled with a unique reference number, typically in the format J. Skevington Specimen # *n*, CNC Diptera # *n* or FBA *n*. These have been shortened to follow the format JSS*n*, CNCD*n*, and FBA*n* respectively throughout the text. These numbers are used in a database of Pipunculidae specimens that I maintain (available upon request) and in the Fijian Arthropod Database (http: //www.inhs.uiuc.edu/cee/fijimandala/). Material examined is listed in order of increasing latitude within islands. Islands are organized alphabetically. Where square brackets are used in the material examined list, they enclose inferred data or notes that are not present on specimen labels. Species are

described in alphabetical order to facilitate cross-referencing from the key. Badly damaged specimens were not included in type series.

Morphological Terminology and Measurements

Terminology and measurements are the same as those used by Skevington (2003, 2005). Genitalic terminology nomenclature follows Sinclair (2000) and is discussed by Skevington (2001) with specific reference to Pipunculidae. These items are summarized below for the reader's convenience and genitalic structures are labeled on Fig. 1.

Body length was measured as a sum of the distances from the front of the head (excluding antennae) to the tip of the scutellum and from there to the tip of syntergosternite 8. Measurements made in this way minimize variability that is introduced by deflection of the abdomen.

Some wing characters are of taxonomic utility. The ratio of lengths of costal section 4 to costal section 3 is recorded as the costal section ratio (C_4: C_3). This character is variable and of little use but has traditionally been used in pipunculid descriptions so is maintained here. The position of the R-M crossvein relative to cell dm is expressed through the M-sector ratio, that is the ratio of sector 3 of the M vein (distal to R-M) to sector 2 (proximal to R-M) (S_3: S_2).

There is little intraspecific variability in ovipositor shape. Viewing the ovipositor laterally will enable assessment of the degree of curvature of the piercer and the relative lengths of component parts of the piercer and base. Visual assessment of this shape will allow species identification within this genus. Several measurements of the ovipositor that are traditionally used to avoid purely visual comparisons are included here but are generally of little use to separate Fijian *Collinias* species. Ovipositor length (OL) is measured in a straight line from the piercer tip to the point where the ovipositor base articulates ventrally with sternite 6. Piercer length (PL) is measured as a straight line from the proximal edge of the cerci to the tip of the piercer. This is represented as part of the ratio of ovipositor length to piercer length (OL: PL). The length of the ovipositor base (B) is measured as a straight line from the proximal end of the cerci to the point where the ovipositor base articulates ventrally with sternite 6. This is given as part of the ratio of the length of the ovipositor base to piercer length (B: PL). A ratio of body length to ovipositor length (BL: OL) is also given in all descriptions.

Molecular Methods

The taxa sequenced are listed in Appendix 1. All specimens are dried, pinned, labeled and accompanied by a label with a unique number (see above). These specimens are in the collections indicated in Appendix 1. The three left legs were removed from each specimen for sequencing. A 658 base pair fragment of the COI gene (often referred to as *cox1* or CO1 in the 'barcoding' literature) was amplified using the primer pair LepF1 (5′-ATTCAACCAATCATAAAGATATTGG-3′) and LepR1 (5′-TAAACTTCTGGATGTCCAAAAAATCA-3′) (Hebert *et al*. 2004). DNA extraction and sequencing was performed at the Canadian Centre for DNA Barcoding following the protocols outlined in Hajibabaei et al. (2005). The resultant sequences, as well as images and collateral data, can be accessed thorough the Barcode of Life Data Systems (BOLD) (http: //www.barcodinglife.org/) in the public project 'Pipunculidae of Fiji - Jeff Skevington'. In addition, all sequences were deposited in GenBank under the accession numbers DQ337706, DQ349219, DQ349221, and DQ507246 to DQ507276 (Appendix 1).

Data Analysis

No insertions or deletions occur in the dataset so alignment was unambiguous. Phenetic and parsimony analyses were performed with PAUP* (Swofford 2001). Character polarity was based on outgroup comparison (Nixon and Carpenter 1994). *Chalarus* sp. 41A, *Pipunculus houghi* Kertész, *Clistoabdominalis ancylus* Skevington and *Eudorylas alternatus* Cresson were defined as outgroups for all analyses (but not constrained as such). Neighbor joining was used to produce the phenograms (using standard PAUP* defaults). For parsimony analysis, the heuristic search procedure was used with stepwise-addition and 100 random replications. The heuristic search option was used with tree bisection-reconnection branch swapping, MULPARS, and random addition of taxa. Multistate characters were treated as non-additive. All individuals were analyzed separately.

Evidential support for different clades was assessed using the nonparametric bootstrap (BS - 1000 replicates) (Felsenstein 1985).

TAXONOMY

Overview

Collinas Aczél, 1940: 151. Type species: *Pipunculus heterostigmus* Perkins, 1905, by original designation.

Collinias is closely related to *Microcephalops* De Meyer ,1989, within the tribe Microcephalopsini (Rafael & De Meyer 1992). Several diagnostic characters unite these genera: small size, flagellum obtuse or very short acute, not much larger than pedicel, frons broadened in lower part, usually wider than upper portion of face, with large median shining patch, face narrowed, propleural fan present but usually strongly reduced, and discal cell (dm) with straight upper margin (De Meyer 1989; Rafael & De Meyer 1992). One character serves to diagnose *Collinias*: the third costal section has a cross-vein at its base (Fig. 8C) (Rafael & De Meyer 1992). A key to the world genera of Pipunculidae is available in Skevington & Yeates (2001). All of the Fijian *Collinias* species are predominantly yellow (Figs. 2, 4, 6, 8). As there are no other yellow pipunculids in Fiji, they are easy to recognize.

Collinias is an Old World genus, occurring in Africa, SE Asia, Australasia and a few Pacific islands. Their sister genus, *Microcephalops*, is worldwide in distribution. *Collinias* + *Microcephalops* are hypothesized to be the sister of the diverse tribes Eudorylini + Tomosvaryellini (Rafael & De Meyer 1992).

Key to Species of Fijian *Collinias* Aczél

As with all Pipunculidae, male genitalia and female ovipositors are diagnostic and allow definitive identification of *Collinias* species. However, unlike most Pipunculidae, dissection is not needed to separate these species.

1. Scutum mostly yellow (cf. Fig. 2A). Pleuron entirely bright yellow (cf. Fig. 2C) ... 2
–. Scutum entirely dark brown (cf. Fig. 6A). Pleuron light brown to dark brown dorsally, yellow ventrally (cf. Fig. 6B) 3

2. Male with right surstylus appearing finger-like (visible when undissected; Figs. 1A,B). Male sternite 6 with medial thickening (only visible when dissected; Fig. 1D).

Female ovipositor short (0.70–0.80 mm); base with pair of dorsal, distal protuberances (Fig. 1G) ..... ***Collinias croceus*** Skevington, **n. sp**.

–. Male with right surstylus with wide, axe-shaped outer process (visible when undissected) (Figs. 3A,B). Male sternite 6 with short, dark brown, anteromedial ventral protuberance about as long as wide; adjacent to left surstylus (visible without dissection; Fig. 3D) Female ovipositor long (0.87–1.15 mm); base with low medial hump (Fig. 3G) ..... ***Collinias dolabratus*** Skevington, **n. sp**.

3. Male syntergosternite 8 dark brown dorsally, yellow ventrally. Male surstyli asymmetrical; right surstylus spatulate, very wide distally (visible when undissected; Figs. 5A,B). Male sternite 6 bulbous, protruding beyond sternite 7, with long, broad, dark brown, tongue-shaped anteromedial ventral protuberance adjacent to left surstylus (visible without dissection; Fig. 5B). Ovipositor base distinctively rounded ventrally adjacent to cerci (Fig. 5F) ..... ***Collinias schlingeri*** Skevington, **n. sp**.

— Male syntergosternite 8 entirely dark brown. Male surstyli nearly symmetrical, narrowed and hooked inward at tips (Figs. 7A,B). Male sternite 6 simple, not protruding beyond sternite 7; without modifications (Fig. 7D). Ovipositor base with small dorsal, distal protuberance (Fig. 7G) ..... ***Collinias vitiensis*** (Muir)

Species Accounts

Collinias croceus Skevington**, new species**
(Figs. 1–2)

Diagnosis. Both sexes: Scutum mostly yellow, with brown along posterior edge, brown coloration extending anteriorly part way up dorsocentral line (Fig. 2A). Pleuron entirely bright yellow (Figs. 2B–C). **Male:** Sternite 6 bulbous, protruding beyond sternite 7, with medial thickening (latter visible only when dissected; Fig. 1D). Surstyli grossly asymmetrical (Figs. 1A–B). Left surstylus white, membranous, simple, much shorter than right surstylus, tapering distally, with tip twisted medially (Figs. 1A–B). Right surstylus yellow, sclerotized, robust, appearing finger-like when undissected, with dorsomedial proximal raised ridge, mediolateral protuberance, and narrow, finger-like tip forming twisted dorsally (Figs. 1A–C). Subepandrial sclerite with small cluster of 5 bristles near junction with surstylus (Fig. 1A). Phallic guide longer than projecting phallus, arrow-shaped, with 3 bristles on each side near tip (Fig. 1A). **Female:** Ovipositor short, slightly downcurved, 0.70–0.80 mm (Fig. 1G). Ovipositor base with pair of dorsal, distal protuberances (Fig. 1G).

Description. Lengths: Body: 2.1–2.4 mm; wing: 2.8–3.1 mm.

Male. *Head*. Holoptic. Arista black with yellow base. Flagellum yellow. Pedicel yellow with 2–3 dorsal bristles and 1–2 ventral bristles. Scape yellow with 0–1 dorsal bristle. Labellum and palps yellow. Frons silver-pubescent. Occiput silver-pubescent laterally, sparsely brown-pubescent dorsally.

Thorax. Proepisternum with a fan of 2–4 bristles. Postpronotal lobe yellow. Scutum mostly yellow, with brown along posterior edge, brown coloration extending anteriorly part way up dorsocentral line (Fig. 2A); with dorsocentral rows of short hairs and patches of weak hairs anterolaterally. Scutellum pale brown with weak posterior setae and a few small hairs on disc. Pleuron entirely bright yellow (Figs. 2B–C), only occasionally brown around posterior spiracle; subscutellum yellow or light brown. Halter yellow.

Legs. Coxae, trochanters, femora, and tibiae all yellow; hairs all yellow, sockets black (Figs. 2B–C). Tarsomeres 1–4 yellow, distitarsus brownish. All femora with black ventral spines.

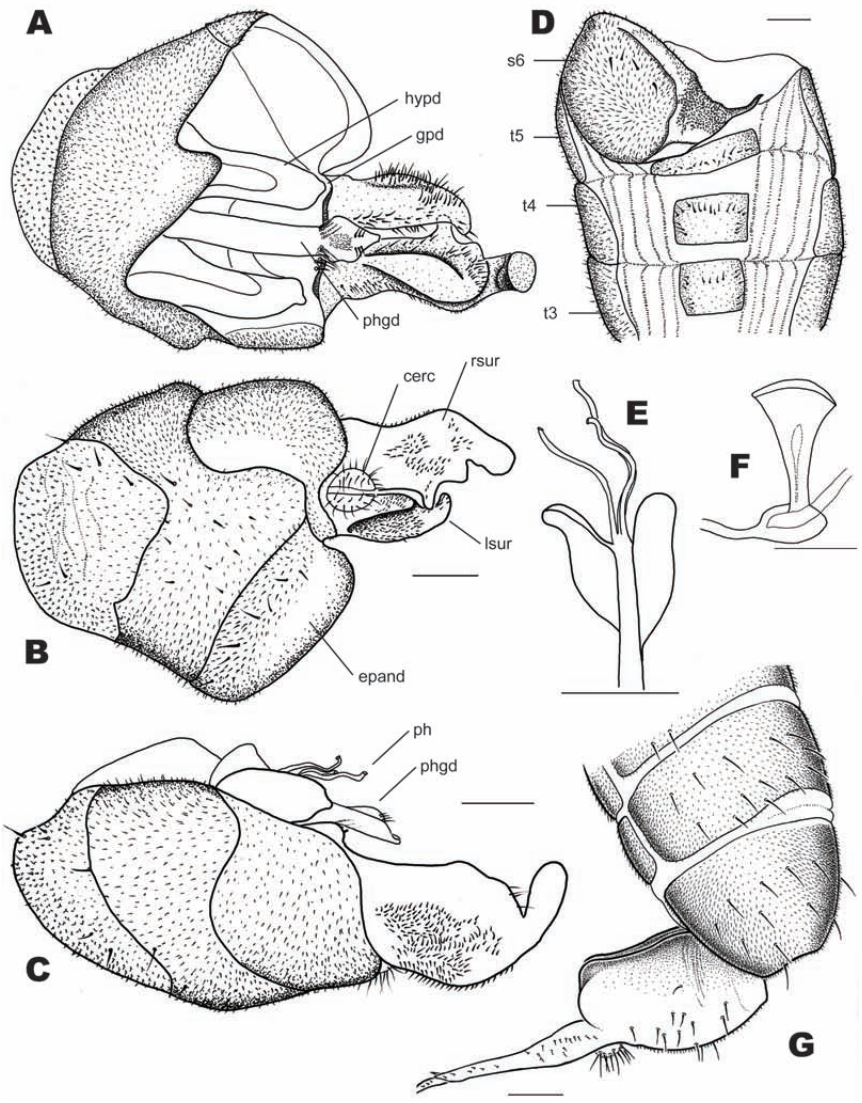

Figure 1. *Collinias croceus*. **A**. dorsal of male terminalia, phallus removed, FBA501397. **B**. ventral of male terminalia, FBA501397. **C**. right lateral of male terminalia, FBA501397. **D**. ventral of male abdomen, terminalia removed, FBA501397. **E**. Phallus of male, FBA501397. **F**. ejaculatory apodeme and sperm pump of male, FBA507511. **G**. left lateral of female ovipositor, FBA36421. Abbreviations: cerc = cerci; epand = epandrium; gpd = gonopod; hypd = hypandrium; lsur = left surstylus; rsur = right surstylus; ph = phallus; ph gd = phallic guide, s = sternite, t = tergite. Scale bars = 0.1 mm.

Wing. Fourth costal section about 3–4 times as long as third, C_4: C_3 2.8–4.6: 1; R-M situated before middle of discal medial cell (dm), S_3: S_2 1.5–1.7: 1. Most of wing uniformly microtrichose except as follows: cell c bare on proximal third, sc bare except at distal tip, r_1 bare in proximal corner, br bare on proximal half, bm bare except near distal corner, cup and a_1 bare on proximal quarter to half.

Abdomen. Tergites 1–4 yellow, in some specimens slightly darkened dorsomedially (Fig. 2A); tergite 1 with 2–4 long lateral hairs. Tergite 5 dark brown dorsally, yellow on lateral edges. Sternites 1–5 yellow. Sternites 6 and 7 yellow; sternite 6 dark brown on anteromedial ventral angle. Sternite 6 bulbous, protruding beyond sternite 7, with medial thickening (latter visible only when dissected; Fig. 1D). Syntergosternite 8 pale to dark brown dorsally, yellow ventrally. Membranous area present, occupying over half of syntergosternite (Figs. 1A–C).

Male genitalia. Surstyli grossly asymmetrical. Left surstylus white, membranous, simple, much shorter than right surstylus, tapering distally, with tip twisted medially (Figs. 1A–B). Right surstylus yellow, sclerotized, robust, appearing finger-like when undissected, with dorsomedial proximal raised ridge, mediolateral protuberance, and narrow, finger-like tip forming twisted dorsally (Figs. 1A–C). Epandrium yellow, slightly wider than long; asymmetrical, right side longer. Subepandrial sclerite with small cluster of 5 bristles near junction with surstylus (Fig. 1A). Hypandrium essentially symmetrical with outer part of gonopod projecting farthest (Fig. 1A). Phallus trifid , simple tubes, subtended by pair of mostly membranous leaf-like structures supported by duct-like sclerotized structures (Fig. 1E). Phallic guide longer than projecting phallus, arrow-shaped, with 3 bristles on each side near tip (Fig. 1A). Ejaculatory apodeme weakly fan-shaped (Fig. 1F).

Female. As male except: Dichoptic. Frons widest medially, ventral third silver-pubescent, dorsal two thirds shining dark brown (Fig. 1D). Facets on front of eyes enlarged. Tergites 5 and 6 dark brown dorsally, yellow laterally. Ovipositor yellow, short, slightly downcurved, 0.70–0.80 mm (Fig. 1G). Ovipositor base with pair of dorsal, distal protuberances (Fig. 1G). OL: PL 1.58–1.72: 1; BL: OL 2.99–3.19: 1; B: PL 0.56–0.70: 1.

Material examined. *Types*: *Holotype* ♂: Fiji, **Viti Levu**, 4 km WSW Colo-i-Suva Village, Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 1, 12.xi.–12.xii.2004, leg. Timoci, FBA501399 (FNIC). *Allotype* ♀: same data, FBA501398 (CNC). *Paratypes*: Fiji: **Viti Levu:** Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA36421 (BPBM); 2 km E Navai V[il]l[a]g[e], old trail to Mt. Tomaniivi, 17°37'16" S, 178°00'00" E, 700 m, Malaise 3, 1♂, 6.iii.–6.v.2005, E. Namatalau, FBA 508452 (CNC); Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40'01" S, 177°33'00" E, 800 m, Malaise 1, 1♂, 18.x.–2.xi.2004, L. Tuimereke, FBA507511 (CNC); 4 km WSW Colo-i-Suva Village, Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 1, 2♀, 1♂ 12.xi.–12.xii.2004, leg. Timoci, FBA501395–501397 (BPBM, FNIC); Mt. Korobaba, 4 km NW Lami Town, 18°6'8" S, 178°22'57" W, 400 m, Malaise 3, 1♀, 1–13.xii.2004, K. Koto, FBA508872 (CNC). *Other Material Examined*: Fiji, Viti Levu, Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, abdomen missing, FBA36420 (CNC).

Etymology. Latin for yellow, golden, saffron-colored, of saffron. In reference to the yellow coloration of these flies.

Remarks. Only ten specimens of this species have been collected so any inferences about behavior or phenology are tentative. The flight period appears to be predominantly between October and December in mountain forests (above 325 m). One specimen (FBA508452) was taken between early March and early May.

Distribution. Known only from Viti Levu.

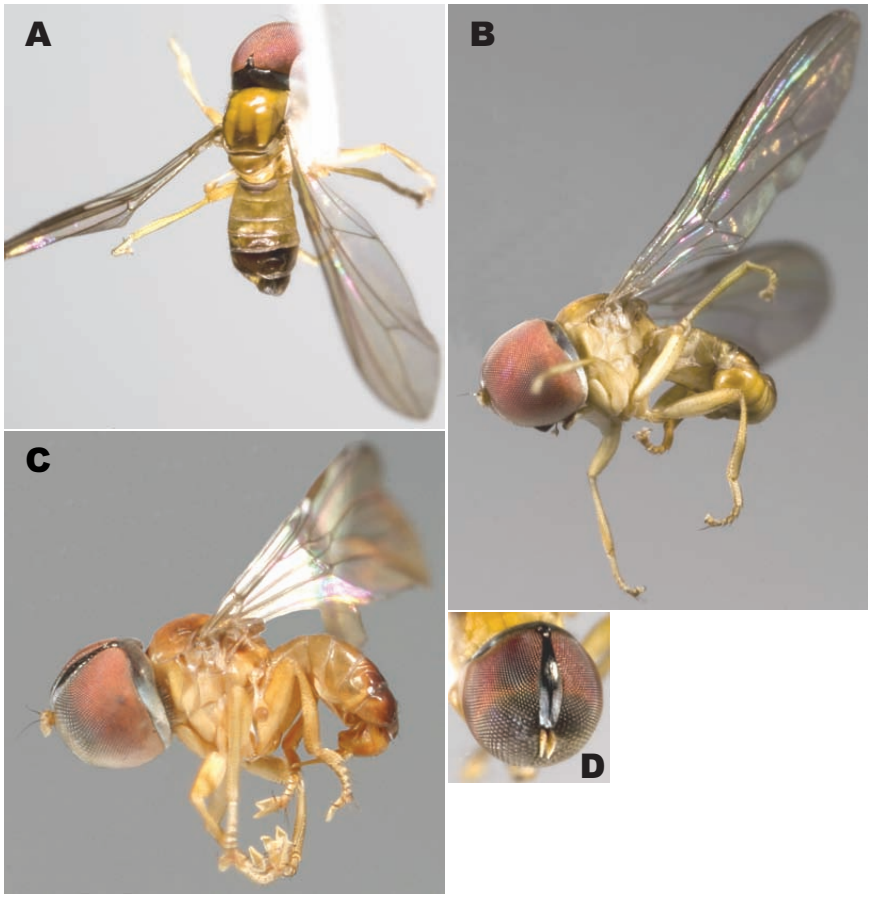

Figure 2. Photographs of *Collinias croceus*. **A**. dorsal of holotype male, FBA501399. **B**. left lateral of male, FBA508452. **C**. left lateral of female, FBA36421. **D**. head of female FBA508872.

Collinias dolabratus Skevington**, new species**
(Figs. 3–4)

Diagnosis. Both sexes: Scutum mostly yellow, with brown along posterior edge, brown colouration sometimes extending anteriorly part way up dorsocentral line (Figs. 4A–B). Pleuron entirely bright yellow (Figs. 4C–D). **Male:** Sternite 6 bulbous, protruding beyond sternite 7, with short, dark brown, anteromedial ventral protuberance (about as long as wide; adjacent to left surstylus, easily visible without dissection; Fig. 3D). Surstyli grossly asymmetrical. Left surstylus white, relatively simple, mostly membranous in ventral view, sclerotized, yellow along ventral medial edge and dorsally, much shorter than right surstylus, tapered into narrow finger, with tip twisted medially (Figs. 3A–B). Right sursty-

lus yellow, sclerotized, robust, with wide, axe-shaped outer process (visible when undissected), raised dorsomedial proximal ridge, and distal medial finger-like protuberance (Figs. 3A–C). **Female:** Ovipositor long, downcurved, 0.87–1.15 mm (Fig. 3G). Ovipositor base with low medial hump (Fig. 3G).

Description. Lengths: Body: 2.1–3.1 mm; wing: 2.5–3.9 mm.

Male. *Head*. Holoptic. Arista black with yellow base. Flagellum yellow. Pedicel yellow with 2–3 dorsal bristles and 1–2 ventral bristles. Scape yellow with 0–1 dorsal bristle. Labellum and palps yellow. Frons silver-pubescent. Occiput silver-pubescent laterally, sparsely brown-pubescent dorsally.

Thorax. Proepisternum with a fan of 5–6 bristles. Postpronotal lobe yellow. Scutum mostly yellow, with brown along posterior edge, brown colouration sometimes extending anteriorly part way up dorsocentral line (Figs. 4A–B); with dorsocentral rows of short hairs and patches of weak hairs anterolaterally. Scutellum pale brown with weak posterior setae and a few small hairs on disc. Pleuron entirely bright yellow (Figs. 4C–D); subscutellum yellow or light brown. Halter yellow.

Legs. Coxae, trochanters, femora, and tibiae all yellow; hairs all yellow, sockets black (Figs. 4C–D). Tarsomeres 1–4 yellow, distitarsus brownish. All femora with black ventral spines.

Wing. Fourth costal section about 3–4 times as long as third, C_4: C_3 3.1–4.6: 1; R-M situated before middle of discal medial cell (dm), S_3: S_2 1.6–2.0: 1. Most of wing uniformly microtrichose except as follows: cell c bare on proximal third, sc bare except at distal tip, r_1 bare in proximal corner, br bare on proximal half, bm bare except near distal corner, cup and a_1 bare on proximal quarter to half.

Abdomen. Tergites 1–4 yellow, in some specimens slightly darkened dorsomedially; tergite 1 with fan of 2–4 long hairs. Tergite 5 dark brown dorsally, yellow on lateral edges. Sternites 1–7 yellow. Sternite 6 bulbous, protruding beyond sternite 7, with short, dark brown, anteromedial ventral protuberance (about as long as wide; adjacent to left surstylus, easily visible without dissection; Fig. 3D). Syntergosternite 8 yellow to dark brown dorsally, yellow ventrally. Membranous area present, occupying over half of syntergosternite, often with membrane ballooning distally (Figs. 3A–C).

Male genitalia. Surstyli grossly asymmetrical. Left surstylus white, relatively simple, mostly membranous in ventral view, sclerotized, yellow along ventral medial edge and dorsally, much shorter than right surstylus, tapered into narrow finger, with tip twisted medially (Figs. 3A–B). Right surstylus yellow, sclerotized, robust, with wide, axe-shaped outer process (visible when undissected), raised dorsomedial proximal ridge, and distal medial finger-like protuberance (Figs. 3A–C); length and shape varies somewhat between specimens. Epandrium yellow, approximately as wide as long; asymmetrical, right side longer. Subepandrial sclerite with loose cluster of 7–12 bristles near junction with surstylus (Fig. 3A). Hypandrium slightly asymmetrical with medial part of gonopod projecting farthest (Fig. 3A). Phallus trifid, simple tubes, subtended by pair of mostly membranous leaflike structures supported by elongate duct-like sclerotized structures (Fig. 3E). Phallic guide longer than projecting phallus, arrow-shaped (Fig. 3A). Ejaculatory apodeme fan-shaped (Fig. 3F).

Female. As male except: Dichoptic. Frons widest medially, ventral third silver-pubescent, dorsal two thirds shining dark brown. Facets on front of eyes enlarged. Tergite 5 entirely yellow to dark brown dorsally, yellow laterally. Tergite 6 dark brown dorsally, yellow laterally. Ovipositor yellow, long, downcurved, 0.87–1.15 mm (Fig. 3G). Ovipositor base with low medial hump (Fig. 3G). OL: PL 1.35–1.65: 1; BL: OL 2.41–3.07: 1; B: PL 0.41–0.68: 1.

Material examined. *Types*: *Holotype* ♂: Fiji, Viti Levu, Naitasiri Prov[ince], 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 2, 17.iii.–9.iv.2003, Schlinger, Tokota'a, FBA97785 (FNIC). *Allotype* ♀: same data except: 18°03'18" S, 178°25'26.4" E, 372 m, Malaise 3, 12–25.ii.2003, FBA100927 (CNC). *Paratypes*: Fiji: **Taveuni:** Cakaudrove Prov[ince], 5.3 km SE Tavuki Village, Mt. Devo, 16°50'27.4" S, 179°58'4.1" W, 1064 m, Malaise 3, 1♂, 28.i.–11.ii.2005, P. Vodo, FBA508884 (CNC); Devo Peak Radio Tower, 16°51' S, 179°58' E, 1200 m, Malaise trap FJ-8, rainforest, 1♀, 31.x.–21.xi.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA5454 (CNC);

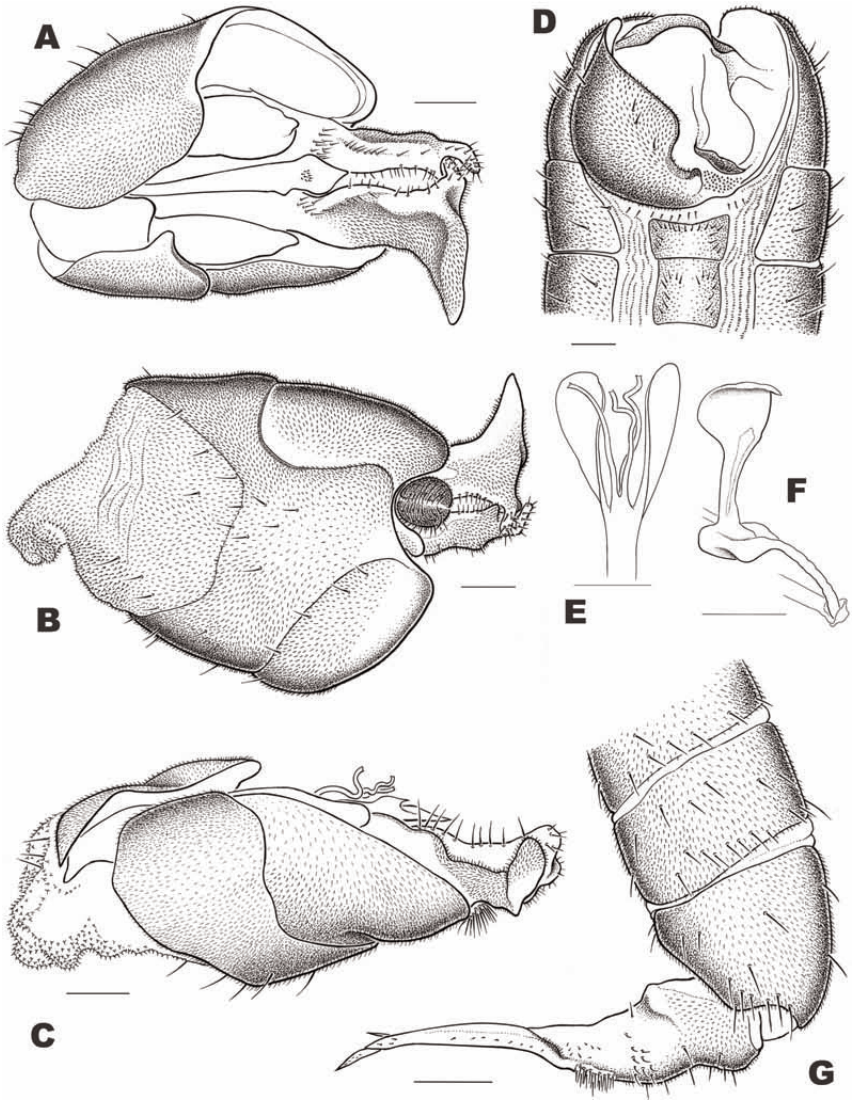

Figure 3. *Collinias dolabratus*. **A**. dorsal of male terminalia, phallus removed, FBA5451. **B**. ventral of male terminalia, FBA5451. **C**. right lateral of male terminalia, FBA5451. **D**. ventral of male abdomen, terminalia removed, FBA5451. **E**. Phallus of male, FBA5451. **F**. ejaculatory apodeme and sperm pump of male, FBA5451. **G**. left lateral of female ovipositor, FBA36422. Scale bars = 0.1 mm.

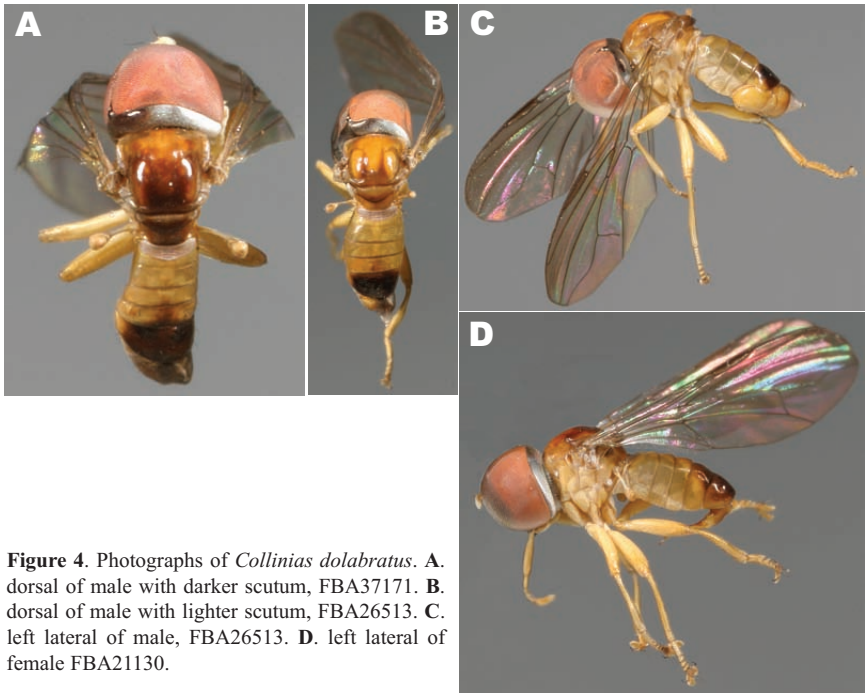

Figure 4. Photographs of *Collinias dolabratus*. **A**. dorsal of male with darker scutum, FBA37171. **B**. dorsal of male with lighter scutum, FBA26513. **C**. left lateral of male, FBA26513. **D**. left lateral of female FBA21130.

3.2 km NW Lavena Village, Mt. Koronibuabua, 16°51'18" S, 179°53'31" W, 235 m, Malaise 1, 1♂, 13.xi.–23.xii.2004, B. Soroalau, FBA508890 (FNIC); 3.2 km NW Lavena Village, Mt. Koronibuabua, 16°51'18" S, 179°53'20" W, 229 m, Malaise 4, 1♂, 19.ii.–4.iii.2005, B. Soroalau, FBA508882 (BPBM); 3.2 km NW Lavena Village, Mt. Koronibuabua, 16°51'22" S, 179°53'20" W, 229 m, Malaise 5, 1♂, 8–21.i.2005, B. Soroalau, FBA508923 (BPBM). **Vanua Levu**: 4 km NW Kilaka Village, Wainibega, 16°48'54" S, 178°59'02" E, 74 m, Malaise 5, 1♂, 20.xii.2004–3.i.2005, P. Hanueli, FBA 508940 (CNC). **Viti Levu**: Nadarivatu, Microwave St[atio]n, [17°35' S, 177°56' E], 1100 m, 1♂, 16–22.viii.1979, S. & J. Peck, JSS16847 (CNC); Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11D, 1♂, 3♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA21130 (CNC, FNIC); 1.8 km E Navai V[il]l[a]g[e], old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'53" E, 700 m, Malaise 4, 1♂, 16.iii.–6.v.2005, 2♀, 16.xi.–28.xii.2004, E. Namatalau, FBA508479, 508838–5088389 (BPBM, CNC); 2 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 178°00'00" E, 700 m, Malaise 3, 1♂, 23.ix.–18.x.2004, leg. E. Namatalau, FBA501362 (BPBM); 2 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 178°00'00" E, Malaise 3, 700 m, 1♂, 18.x.2004–3.ii.2005, E. Namatalau, FBA508464 (CNC); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'21" E, 700 m, Malaise 5, 1♂, 1♀, 22.i.–3.ii.2005, E. Namatalau, , FBA508822–508823 (BPBM); 1.8 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'53" E, 700 m, Malaise 4, 2♂, 3.ii.–16.iii.2005, E. Namatalau, FBA508445–5084456 (BPBM, FNIC); Vuda Prov[ince], Koroyanitu Eco Park, 1 km E

Abaca Village, 17°40'01" S, 177°33'00" E, 800 m, Malaise 1, 1♀, 5–18.x.2004, L. Tuimereke, FBA508830 (CNC); Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise 1, 1♀, 18.x.– 2.xi.2004, L. Tuimereke, FBA507509 (BPBM); Vuda Prov[ince], Koroyanitu N[a]tiona[l] P[ar]k, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 1♂, 21.ix.–7.x.2002, 1♀, 19–26.x.2002, E. Schlinger, Tokota'a, FBA5451 (CNC), FBA88800 (BPBM); Naitasiri Prov[ince], Nakobalevu M[oun]t[ain], 18°03' S, 178°25' E, 340 m, Malaise trap FJ-4D, rainforest, 1♂, 12–24.iii.2003, M. Irwin, E. Schlinger, M. Tokota'a, FBA26513 (BPBM); 4 km WSW Colo-i-Suva Village, Mt. Nakobalevu, 18°03'25" S, 178°25'12" E, 300 m, Malaise 1, 2♂, 1♀, 24.vii.–12.viii.2004, 1♂, 1♀, 24.x.–12.xi.2004, Timoci, FBA501401–501403, 507987, 507989 (BPBM, CNC, FNIC); Naitasiri Prov[ince], 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 2, 1♂, 17.iii.–9.iv.2003, 1♂, 14–28.vii.2003, 1♀, 12–24.ix.2004, 2♂, 1♀, 24.ix.–12.x.2004, Schlinger, Tokota'a, Timoci, FBA507367, 507370, 507375, 508974, 94619, 97268 (BPBM, CNC, FNIC); Naitasiri Prov[ince], 4 km WSW Colo-i-Suva V[il]l[a]ge, Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 372 m, Malaise 3, 1♂, 1♀, 12–25.ii.2003, 2♂, 1♀, 25.ii.–17.iii.2003, 1♂, 24.iv.–12.v.2004, 1♂, 2♀, 14–28.vii.2003, 2♂, 2♀, 12–24.x.2004, 2♂, 4–14.xi.2003, 1♂, 12–30.xi.2004, Schlinger, Tokota'a, Timoci, FBA65359, 95323–95325, 96587–96588, 100926, 100928, 101770–101772, 501358, 501499–501502 (BPBM, CNC, FNIC); 4 km NW Lami Town, Mt. Korobaba, 18°06'07" S, 178°22'59" E, 400 m, Malaise 3, 1♀, 15.xi.–1.xii.2004, leg. K. Koto, FBA501387 (CNC); 4 km NW Lami Town, Mt. Korobaba, 18°06'14" S, 178°22'52" E, 260 m, Malaise 5, 1♂, 1♀, 1–13.xii.2004, leg. K. Koto, FBA501446, 501448 (CNC). *Other Material Examined*: Viti Levu, Naitasiri Prov[ince], 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 2, 1♂, 17.iii.–9.iv.2003, Schlinger, Tokota'a, genitalia missing, FBA97267 (BPBM).

Etymology. From the Latin *dolabratus*, "shaped like an axe". In reference to the axe-shaped right surstylus of the males.

Remarks. This species has been recorded in every month except June so it undoubtedly is multivoltine and flies throughout the year. A skew towards October and November records suggests that they may have their peak abundance in the austral spring. They have been collected in montane woodland and rainforest.

Distribution. Known from 57 specimens from Taveuni, Vanua Levu, and Viti Levu.

Collinias schlingeri Skevington**, new species**
(Figs. 5–6)

Diagnosis. Both sexes: Scutum dark brown (Fig. 6A). Pleuron light brown to dark brown dorsally, yellow ventrally; anepisternum, anepimeron and katatergite entirely brown to yellowish ventrally; meron and katepisternum entirely yellow to brown dorsally (Figs. 5B–C). **Male:** Sternite 6 bulbous, protruding beyond sternite 7, with long, broad, dark brown, tongue-shaped anteromedial ventral protuberance (adjacent to left surstylus, easily visible without dissection; Fig. 5B). Surstyli grossly asymmetrical. Left surstylus white, membranous, simple, much shorter than right surstylus, tapered, with tip twisted medially towards protuberance from right surstylus (Figs. 5A–B). Right surstylus yellow, sclerotized, robust, spatulate, very wide distally (visible when undissected), with ventro-

medial finger-like protuberance and large projecting dorsal ridge adjacent to subepandrial sclerite (Figs. 5A–C). Subepandrial sclerite heavily sclerotized, almost as wide as epandrium. Phallic guide longer than projecting phallus, narrow, arrow-shaped (Fig. 5A). **Female:** Ovipositor long, downcurved, 0.64–0.75 mm (Fig. 5F). Ovipositor base distinctively rounded ventrally adjacent to cerci (Fig. 5F).

Description. Lengths: Body: 2.2–2.7 mm; wing: 2.8–3.3 mm.

Male. *Head*. Holoptic. Arista black with yellow base. Flagellum yellow. Pedicel yellow with 2–4 dorsal bristles and 1–2 ventral bristles. Scape yellow with 0–1 dorsal bristle. Labellum and palps yellow. Frons silver-pubescent. Occiput silver-pubescent laterally, sparsely brown-pubescent dorsally.

Thorax. Proepisternum with a fan of 5–7 bristles. Postpronotal lobe yellow. Scutum dark brown (Fig. 6A); with dorsocentral rows of short hairs and patches of weak hairs anterolaterally. Scutellum dark brown with weak posterior setae and a few small hairs on disc. Pleuron light brown to dark brown dorsally, yellow ventrally; anepisternum, anepimeron and katatergite entirely brown to yellowish ventrally; meron and katepisternum entirely yellow to brown dorsally (Figs. 6B–C). Subscutellum dark brown. Halter yellow.

Legs. Coxae, trochanters, femora, and tibiae all yellow; hairs all yellow, sockets black (Fig. 6B). Tarsomeres 1–4 yellow, distitarsus pale brown to yellow. All femora with black ventral spines.

Wing. Fourth costal section about 3–4 times as long as third, C_4: C_3 3.0–4.2: 1; R-M situated before middle of discal medial cell (dm), S_3: S_2 1.8–1.9: 1. Most of wing uniformly microtrichose except as follows: cell c bare on proximal third to half, sc bare except at distal tip, r_1 bare in proximal corner, br bare on proximal half, bm bare except near distal corner, cup and a_1 bare on proximal quarter to half.

Abdomen. Tergites 1–4 yellow, in some specimens slightly darkened dorsomedially; tergite 1 with 2–3 long lateral hairs. Tergite 5 dark brown dorsally, yellow on lateral edges. Sternites 1–2 yellow to brown; sternites 3–7 yellow. Sternite 6 bulbous, protruding beyond sternite 7, with long, broad, dark brown, tongue-shaped anteromedial ventral protuberance (adjacent to left surstylus, easily visible without dissection; Fig. 5B). Syntergosternite 8 dark brown dorsally, yellow ventrally. Membranous area present, occupying about half of syntergosternite (Figs. 5A–C).

Male genitalia. Surstyli grossly asymmetrical. Left surstylus white, membranous, simple, much shorter than right surstylus, tapered, with tip twisted medially towards protuberance from right surstylus (Figs. 5A–B). Right surstylus yellow, sclerotized, robust, spatulate, very wide distally (visible when undissected), with ventromedial finger-like protuberance and large projecting dorsal ridge adjacent to subepandrial sclerite (Figs. 5A–C). Epandrium yellow, approximately as wide as long; asymmetrical, right side longer. Subepandrial sclerite heavily sclerotized, almost as wide as epandrium with loose cluster of bristles near junction with surstylus. Hypandrium slightly asymmetrical; gonopods blunt-ended with left gonopod slightly wider (Fig. 5A). Phallus trifid , simple tubes, subtended by pair of mostly membranous leaf-like structures supported by duct-like sclerotized structures (Fig. 5E). Phallic guide longer than projecting phallus, narrow, arrow-shaped (Fig. 5A). Ejaculatory apodeme fan-shaped (Fig. 5D).

Female. As male except: Dichoptic. Frons widest medially, ventral third silver-pubescent, dorsal two thirds shining dark brown. Facets on front of eyes enlarged. Tergites 5 and 6 dark brown dorsally, yellow laterally. Ovipositor yellow, long, downcurved, 0.64–0.75 mm (Fig. 5F). Ovipositor base distinctively rounded ventrally adjacent to cerci (Fig. 5F). OL: PL 1.37–1.46: 1; BL: OL 3.13–3.74: 1; B: PL 0.42–0.52: 1.

Material examined. *Types*: *Holotype* ♂: FIJI, **Viti Levu**, Vuda Prov[ince], Koroyanitu N.M.P., Kokabula Trail, 17°40' S, 177°33' E, 400m, Malaise trap FJ-2, montane woodland, 26.x.–5.xi.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA 5452 (FNIC). *Allotype* ♀: FIJI, **Viti Levu**, 4 km WSW Colo-i-Suva Village, Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 372 m, Malaise 3, 12–30.xi.2004, leg. Timoci, FBA 501351 (CNC). *Paratypes*: FIJI: **Gau:** 4.0 km SE Navukailagi Village, 17°58'48" S, 179°16'30" E, 496 m, Malaise 1, 1♂, 27.v–16.vi.2005, U. Racule, FBA507870 (CNC). **Kadavu**: Kadavu

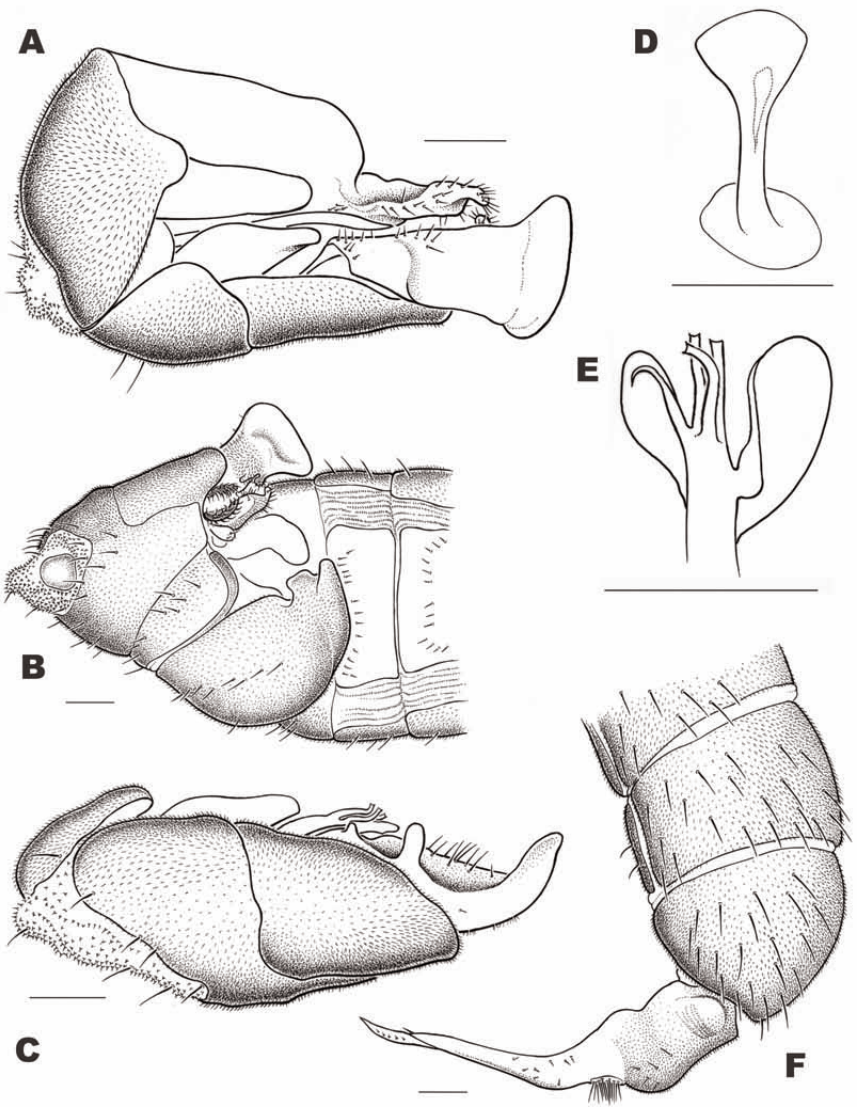

Figure 5. *Collinias schlingeri*. A. dorsal of male terminalia, phallus removed, FBA42. B. ventral of male abdomen, FBA47. C. right lateral of male terminalia, FBA42. D. ejaculatory apodeme and sperm pump of male, FBA42. E. Phallus of male, FBA42. F. left lateral of female ovipositor, FBA37011. Scale bars = 0.1 mm.

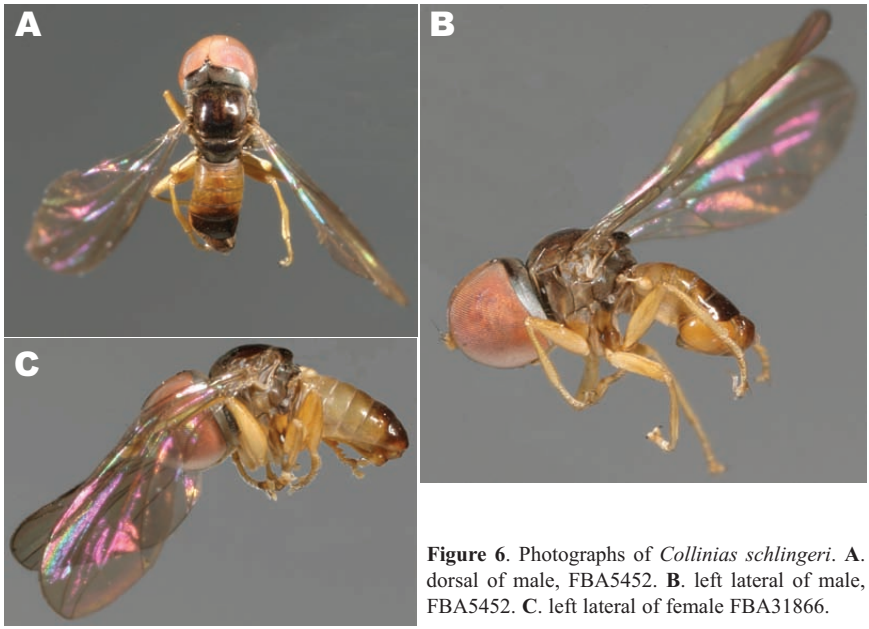

Figure 6. Photographs of *Collinias schlingeri*. **A**. dorsal of male, FBA5452. **B**. left lateral of male, FBA5452. **C**. left lateral of female FBA31866.

Prov[ince], Namalata, 19°02'33.46"S, 178°11'1.26"E, 150 m, Malaise trap FJ-60C, 1♀, 15–28.vii.2004, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA31866 (CNC); Solodamu, 19°04' S, 178°07' E, 128 m, Malaise trap in coastal limestone forest, 7♂, 3♀, 25.viii.–23.x.2003, 1♂, 1♀, 23.x–19.xii.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA42, 44–48, 10761, 15858, 15860, 43365-43366 (BPBM, CNC, FNIC); 0.25km SW Solodamu Village, Moanakaka Bird Sanctuary, Kadavu, 19°04'39" S, 178°07'15.6" E, 60 m, Malaise trap, 5♂, 1♀, 9–15.ii.2004, 3♂, 19.xii.2003–18.i.2004, Schlinger, Tokota'a, FBA65959–659564, 87210–87212 (BPBM, CNC, FNIC). **Lakeba:** 3.2 km NE Tubou Village, 18°13'46" S, 178°52'00" W, 100 m, Malaise 3, 2♂, 7–19.vi.2005, 3♂, 1–13.ix.2005, 1♂, 7–19.x.2005, 1♂, 19.x.–1.xi.2005, 4♂, 3♀, 1–13.xi.2005, 1♀, 1♂, 13–25.xi.2005, date unknown, D. Sauhaleinayau, FBA507715, 507734, 507743–507744, 507758, 507760, 507767–507768, 507862–507864, 508519, 508529, 508565–508566, JSS16988 (BPBM, CNC, FNIC). **Taveuni**: Cakaudrove Prov[ince]: 5.3 km SE Tavuki, Devo Peak, 16°50'35.16" S, 179°58'5.16" E, 1064 m, Malaise, 1♂, 14–21.xi.2002, Schlinger, Tokota'a, FBA53430 (BPBM); Devo Forest Reserve, 16°50' S, 179°59' E, 800 m, Malaise trap FJ-9, 1♂, 10–16.i.2003, M. Irwin, E. Schlinger, M. Tokota'a, FBA40925 (BPBM). **Vanua Levu**: Trans-insular road, above summit, 500-500 m, Malaise trap, 1♀, 6–9.x.1979, S.N. Lal, G.A. & S.L. Samuelson, JSS16987 (BPBM). **Viti Levu**: Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♀, 6.vi.–15.vii.2003, 2♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, Tokota'a, FBA37010-37011, 13985 (BPBM, FNIC); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'20" E, 700 m, Malaise 5, 1♂, 16.iii.–6.v.2005, E. Namatalau, FBA507875 (CNC); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'20" E, 700 m, Malaise 5, 1♀, 22.i.–3.ii.2005, E. Namatalau, FBA508825 (BPBM); 1.8 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'53" E,

700 m, Malaise 4, 2♂, 3.ii.–16.iii.2005, 1♂, 16.iii.–6.v.2005, E. Namatalau, FBA 508447–508448, 508478 (CNC); 3.2 km E Navai Village, Veilaselase Track, 17°37'26" S, 178°00'32" E, 1020 m, Malaise 2, 1♂, 16.iii.–6.v.2005, E. Namatalau, FBA508547 (CNC); Vuda Prov[ince], Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40'01" S, 177°33'00" E, 800 m, Malaise 1, 1♀, 6–20.ix.2004, L. Tuimereke, FBA508900 (CNC); Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise 1, 1♀, 18.x.–2.xi.2004, L. Tuimereke, FBA507510 (BPBM); Koroyanitu N.M.P., Kokabula Trail, 17°40' S, 177°33' E, 400 m, Malaise trap FJ-2, montane woodland, 1♂, 26.x.–5.xi.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA5453 (CNC); Koroyanitu N.P., 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 1♀, 7–12.x.2002, E. Schlinger, Tokota'a, FBA82051 (CNC); Koroyanitu N[a]tiona[l] P[ar]k, 1 km E Abaca Village, Kokabula Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 4♂, 12–19.xi.2002, E. Schlinger, Tokota'a, FBA86604–86607 (BPBM, CNC, FNIC); Koroyanitu P[ar]k, 1 km E Abaca V[il]l[a]g[e], 17°40'01.2" S, 177°33'00.0" E, 800 m, Malaise 1, 9♂, 1♀, 22.iv.–6.v.2003, coll. Schlinger, Tokota'a, FBA100399–100403, 100405–100409 (BPBM, CNC, FNIC); 1.3 km SW Vaturu Dam, 17°44'53" S, 177°40'37" E, 530 m, Malaise 2, 1♀, 26.vii.–7.viii.2004, A Namaga, FBA508880 (BPBM); 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'25" S, 178°25'12" E, 300 m, Malaise 1, 1♀, 24.ix.–12.x.2004, 1♂, 24.x.–12.xi.2004, Timoci, FBA507623, 508988 (BPBM, CNC); 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'21.6" S, 178°25'19.2" E, 325 m, Malaise 2, 1♀, 17.iii.–9.iv.2003, 1♀, 12.x.–12.xi.2004, Schlinger, Tokota'a, Timoci, FBA97784, 507542 (CNC); 4 km WSW Colo-i-Suva Village, Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 372 m, Malaise 3, 1♀, 24.vii.–12.viii.2004, 1♀, 12–30.xi.2004, leg. Timoci, FBA501209, 507399 (BPBM); 4 km NW Lami Town, Mt. Korobaba, 18°06'14" S, 178°22'52" E, 260 m, Malaise 5, 2♂, 1–13.xii.2004, leg. K. Koto, FBA501449, 501451 (BPBM, FNIC). *Other Material Examined*: Kadavu, Solodamu, 19°04' S, 178°07' E, 128 m, Malaise trap FJ-41D, in coastal limestone forest, 1♂, 25.viii.–23.x.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, specimen in poor condition, flattened laterally (likely damaged when still in Malaise sample), FBA43 (BPBM).

Etymology. A patronym for Ev Schlinger, whose efforts to document the fly fauna of Fiji generated a large proportion of the material used in this revision and created the inertia needed to facilitate the current NSF arthropod inventory project.

Remarks. This species has been recorded in every month of the year so it is undoubtedly multivoltine. There is no clear time when they are more common. They have been collected in montane woodland and coastal limestone forest.

Distribution. This is the most widespread of the Fijian *Collinias* and is known from 85 specimens from Gau, Kadavu, Lakeba, Taveuni, Vanua Levu, and Viti Levu.

Collinias vitiensis (Muir)
(Figs. 7–8)

***Pipunculus vitiensis* Muir, 1906: 10.**

Diagnosis. Both sexes: Scutum dark brown (Fig. 8B). Pleuron light brown dorsally, yellow ventrally; anepisternum, anepimeron and katatergite light brown dorsally, yellowish ventrally, to entirely brown; meron and katepisternum entirely yellow to brown dorsally

(Figs. 8A, C). **Male:** Sternite 6 simple, not protruding beyond sternite 7 and without any modifications (Fig. 7D). Syntergosternite 8 entirely dark brown. Surstyli nearly symmetrical, narrowed and hooked inward at tips (Figs. 7A–B). **Female:** Ovipositor short, slightly downcurved, 0.66–0.81 mm (Fig. 7G). Ovipositor base with small dorsal, distal protuberance (Fig. 7G).

Description. Lengths: Body: 2.2–3.0 mm; wing: 2.6–3.5 mm.

Male. *Head*. Holoptic. Arista black with yellow base. Flagellum yellow. Pedicel yellow with 2–3 dorsal bristles and 1–2 ventral bristles. Scape yellow with 0–1 dorsal bristle. Labellum and palps yellow. Frons silver-pubescent. Occiput silver-pubescent laterally, sparsely brown-pubescent dorsally.

Thorax. Proepisternum with a fan of 4–6 bristles. Postpronotal lobe yellow. Scutum dark brown (Fig. 8B), with dorsocentral rows of short hairs and patches of weak hairs anterolaterally. Scutellum pale brown with weak posterior setae and a few small hairs on disc. Pleuron light brown dorsally, yellow ventrally; anepisternum, anepimeron and katatergite light brown dorsally, yellowish ventrally, to entirely brown; meron and katepisternum entirely yellow to brown dorsally (Figs. 8A, C)); subscutellum dark brown. Halter yellow.

Legs. Coxae, trochanters, femora, and tibiae all yellow; hairs all yellow, sockets black. Tarsomeres 1–4 yellow, distitarsus black. All femora with black ventral spines.

Wing. Fourth costal section about 3–4 times as long as third, C_4: C_3 2.6–4.6: 1; R-M situated before middle of discal medial cell (dm), S_3: S_2 1.4–1.7: 1. Most of wing uniformly microtrichose except as follows: cell c sparsely microtrichose, sc bare except at distal tip, r_1 bare in proximal corner, br bare on proximal half, bm bare except near distal corner, cup bare on proximal half, a_1 bare on proximal quarter.

Abdomen. Tergites 1–4 yellow, slightly to moderately darkened dorsomedially; tergite 1 with 2–4 long lateral hairs. Tergite 5 dark brown dorsally, yellow on lateral edges. Sternites 1–2 yellow to brown; sternites 3–5 yellow. Sternites 6 and 7 pale brown to dark brown. Sternite 6 simple, not protruding beyond sternite 7 and without any modifications (Fig. 7D). Syntergosternite 8 entirely dark brown. Membranous area present, occupying less than half of syntergosternite, often with membrane ballooning distally (Figs. 7A–C).

Male genitalia. Surstyli yellow, nearly symmetrical, narrowed and hooked inward at tips (Figs. 7A–C). Epandrium pale to dark brown; slightly wider than long. Subepandrial sclerite with cluster of bristles near junction with surstylus (Fig. 7A). Hypandrium symmetrical to slightly asymmetrical with left gonopod with small distal projection jutting medially (Fig. 7A). Phallus trifid , simple tubes, subtended by pair of mostly membranous leaf-like structures supported by phallus-like sclerotized structures (Fig. 7E). Phallic guide slightly shorter than projecting phallus, simple, with no bristles (Fig. 7A). Ejaculatory apodeme weakly fan-shaped (Fig. 7F).

Female. As male except: Dichoptic. Frons widest medially, ventral third silver-pubescent, dorsal two thirds shining dark brown. Facets on front of eyes enlarged. Tergites 5 and 6 dark brown dorsally, yellow laterally. Ovipositor yellow, short, slightly downcurved, 0.66–0.81 mm (Fig. 7G). Ovipositor base with small dorsal, distal protuberance (Fig. 7G). OL: PL 1.56–1.67: 1; BL: OL 3.09–3.55: 1; B: PL 0.59–0.66: 1.

Material examined. *Types*: Holotype ♂: [Fiji, Viti Levu], Rewa, [18°05' S, 178°20' E], iii.1906, Muir, Allotype ♀: same location, 29.iii.1906, Muir. *Other Material Examined*: **Kadavu**: 1.3 km E Kadavu air strip near Namalata Village, 19°03'36" S, 178°11'13" E, 139 m, Malaise 3, 1♂, 8–10.viii.2004, M. Reece, FBA508891 (CNC); Solodamu, 19°04' S, 178°07' E, 128 m, Malaise trap in coastal limestone forest, 1♂, 23.x–19.xii.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA43364 (BPBM); **Taveuni**: Cakaudrove Prov[ince], Devo Peak Radio Tower, 16°51' S, 179°58' E, 1200m, Malaise trap FJ-8, rainforest, 1♂, 31.x.–21.xi.2002, 1♂, 13–20.xii.2002 (specimen in poor condition, abdomen damaged, ovipositor missing), M. Irwin, E. Schlinger, M. Tokota'a,

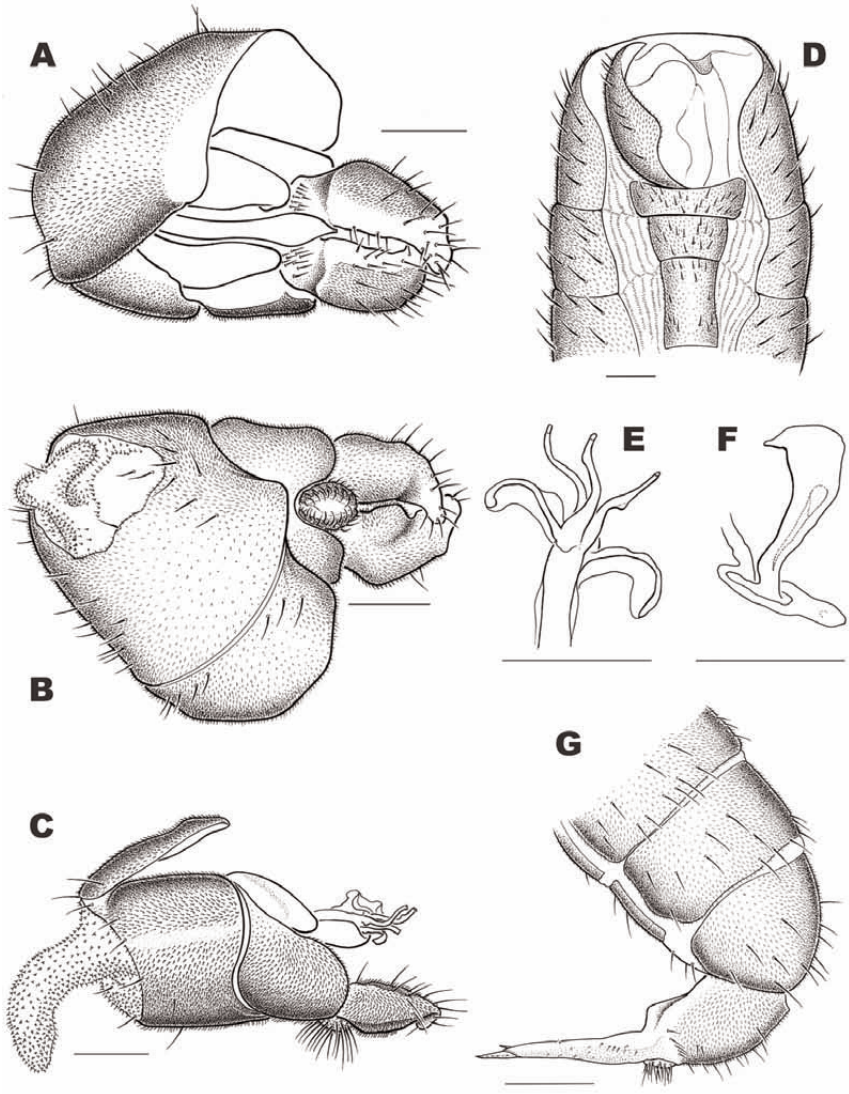

Figure 7. *Collinias vitiensis*. A. dorsal of male terminalia, phallus removed, FBA9672. B. ventral of male terminalia, FBA9672. C. right lateral of male terminalia, FBA9672. D. ventral of male abdomen, terminalia removed, FBA9672. E. Phallus of male, FBA9672. F. ejaculatory apodeme and sperm pump of male, FBA9672. G. left lateral of female ovipositor, FBA19550. Scale bars = 0.1 mm.

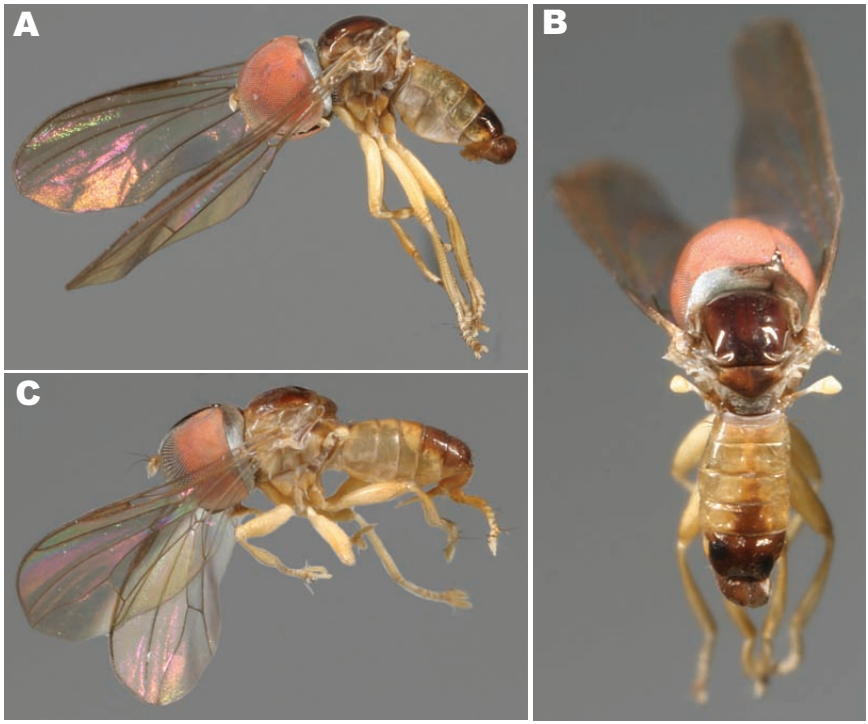

Figure 8. Photographs of *Collinias vitiensis*. **A**. left lateral of male, FBA5455. **B**. dorsal of male, FBA5455. **C**. left lateral of female, FBA26513.

FBA5455, 20401 (BPBM, CNC); **Viti Levu**: Koro Ni O, W of Nadarivatu, 17°34'32" S, 177°56'02" E, ~1030 m, near microwave towers, 1♀, 18.i.2006, J. Skevington, CNCD2296 (CNC); Naitasiri Prov[ince], Eteni, Navai, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♂, 6.vi.–15.vii.2003, E.I. Schlinger, M. Irwin, Tokota'a, FBA13988 (BPBM); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37' S, 177°59' E, 700 m, Malaise 5, 3♂, 23.ix.–18.x.2004, leg. E. Namatalau, FBA501366–501368 (CNC); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'20" E, 700 m, Malaise 5, 1♂, 6–23.ix.2004, E. Namatalau, FBA508854 (BPBM); 0.75 km E Navai Village, old trail to Mt. Tomaniivi (Victoria), 17°37'16" S, 177°59'20" E, 700 m, Malaise 5, 4♂, 6.xi.–13.xii.2004, E. Namatalau, FBA508860–508863 (BPBM, CNC); 1.8 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 177°59'53" E, 700 m, Malaise 4, 2♂, 16.xi.–28.xii.2004, E. Namatalau, FBA508840–508841 (CNC, FNIC); 0.75 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 178°59'20" E, 700 m, Malaise 5, 1♂, 1♀, 22.i.–3.ii.2005, E. Namatalau, FBA508821, 508826 (BPBM, CNC); 2 km E Navai Village, old trail to Mt. Tomaniivi, 17°37'16" S, 178°00'00" E, 700 m, Malaise 3, 1♀, 18.x.2004–3.ii.2005, E. Namatalau, FBA508465 (CNC); 3.2 km E Navai Village, Veilaselase Track, 17°37'26" S, 178°00'32" E, 1020 m, Malaise 2, 1♀, 16.iii.–6.v.2005, 1♀, 6.v.–20.vi.2005, E. Namatalau, FBA508543, 508548 (CNC, FNIC);

Vuda Prov[ince], Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise 1, 1♀, 6–20.ix.2004, L. Tuimereke, FBA508899 (BPBM); Koroyanitu Eco Park, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise 1, 1♂, 1♀, 18.x.–2.xi.2004, L. Tuimereke, FBA507507–507508 (CNC); Koroyanitu N.M.P. Abaca Village, 17°40' S, 177°33' E, 400 m, Malaise trap FJ-3, 1♀, 6–25.v.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA19550 (CNC); Koroyanitu P[ar]k, 1 km E Abaca V[il]l[a]g[e], 17°40'01.2" S, 177°33'00.0" E, 800 m, Malaise 1, 1♂, 22.iv.–6.v.2003, 1♂, 2–16.xi.2004, coll. Schlinger, Tokota'a, FBA501516, 100404 (BPBM, FNIC); 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 300 m, Malaise 1, 2♂, 12–24.x.2004, Timoci, FBA508999, 509002 (CNC, FNIC); 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'22" S, 178°25'19" E, 325 m, Malaise 2, 1♂, 24.ix.–12.x.2004, 1♂, 12.x.–12.xi.2004, Timoci, FBA507360, 507517 (CNC); 4 km WSW Colo-i-Suva V[il]l[a]g[e], Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 372 m, Malaise 3, 1♂, 4–14.xi.2003, Schlinger, Tokota'a, FBA96586 (FNIC); 4 km NW Lami Town, Mt. Korobaba, 18°06'14" S, 178°22'52" E, 260 m, Malaise 5, 1♂, 1♀, 1–13.xii.2004, leg. K. Koto, FBA, 501447, 501450 (FNIC); Lami, [18°07' S, 178°25' E], 1♂, xi.1957, 1♀, ii.1977, N.L.H. Krauss, JSS9672, JSS16986 (BPBM).

Remarks. This species has been recorded in every month so it undoubtedly is multivoltine and flies throughout the year. There is no clear time when they are more common. They have been collected in rainforest and coastal limestone forest. Muir (1906) noted that he collected a male and female from the boughs of trees and postulated that they attack arboreal leafhoppers. The single female that I collected was hovering between clumps of shrubs on a hilltop.

Distribution. *Collinias vitiensis* is known from 38 specimens from Kadavu, Taveuni, and Viti Levu.

Barcoding and Phylogenetics

Barcoding

It has been proposed that the mitochondrial gene cytochrome c oxidase I (*cox1* – also referred to as COI in some literature) can be used as the core of a global identification system for animals (Hebert *et al*. 2003). We have been testing this technique for its utility within Pipunculidae, and despite mixed results, it is clearly a useful tool that will provide substantial benefits during revision of some lineages (Skevington *et al*. 2006). As a result of the potential value of this extra dataset to alpha level taxonomy, we have been sequencing *cox1* for Fijian Pipunculidae. Sequence data from 658 base pairs of mitochondrial cytochrome c oxidase I (*cox1*) were analyzed for all Fijian species of *Collinias* as well as for 7 putative species of Australian and New Caledonian *Collinias* (Fig. 9). Additional population sampling was carried out to test for local variation within this gene and to test morphological species concepts.

Minor variations, particularly in external color and in surstyli shape, were noted within putative species of *Collinias*. An attempt was thus made to separate these variable species into groups (labeled as *Collinias* sp. 1A, 1B, etc.). Morphology alone was inadequate to explain whether or not these groups should be partitioned into separate species or amalgamated as single species. In this case, *cox1* data provided excellent resolution to the problem. Putative morphological species were readily separated using the barcoding data, with 5.8–28.3% pairwise variation (average 14.3% different between species within

Collinias). Clustering was definitive as within species variation was less than 1.6%, and in all but two instances was less than 1.0% (Appendix 2). Results for the morphological variants were very interesting and equally useful. I had partitioned Species 1 (an undescribed species that is widespread in Australia) into two potential morphospecies (Species 1A from the Australian mainland and Species 1B from Tasmania). The morphological differences are subtle (surstyli shape) and without geographic separation it would be very difficult to ascribe specimens to either type. Barcoding data suggests that there is no difference between these populations and supports treating them as a single species. Similarly, Species 11 from Fiji (Species 11A and B now amalgamated into *C. dolabratus* and Species 11C now *C. croceus*) showed some variation in surstyli shape and thorax colour throughout its range. I could not confidently break these specimens into populations but attempted to split them up into 11A, B, and C based mostly on colour (darker thorax = B). *Collinias* Species 11C represented a single female that had a different ovipositor shape but otherwise appeared identical to 11A. Barcoding data supported the existence of two species here. *Collinias* species 11A and B are conspecific (less than 0.8% pairwise variation within the 7 sampled specimens) (= *C. dolabratus*). *Collinias* species 11C is different (5.8–6.4% different from *Collinias* 'species' 11A and B) (= *C. croceus*). Since this molecular work was carried out, males for *C. croceus* were discovered. Their genitalia are strikingly different (Fig. 1) but they are clearly closely related to *Collinias dolabratus*.

Conversely, 2 pairs of putative *Collinias* species, 5A and 5B, and 6A, and 6B, are clearly different species (8.8–9.3 % pairwise variation between 5A and 5B and 9.0–10.0% between 6A and 6B; Appendix 2). My New Caledonian morphological species concepts are based on very few individuals (species 5A: 3 males, 2 females, 5B: 2 females, 6A: 1 male, 6B: 2 males, 4 females). No doubt additional material would have helped to solidify the morphological concepts for these species, but the barcoding data clearly separates them and makes the process of morphospecies identification simple in these cases. In addition, I had been unable to associate the sexes of the New Caledonian species and the barcoding data also facilitated this.

Note that we were unable to extract DNA from seven *Collinias* specimens that we attempted to sequence (*C. sp. 1A* JSS6433, *C. sp. 1A* debu243052, *C. sp. 2A* FBA34883, *C. heterostigmus* JSS6426, *C. schlingeri* FBA44, *C. vitiensis* FBA13988, and *C. vitiensis* FBA43364). The addition of data from these specimens would have added to our knowledge of population genetics for these species, but was not deemed to be crucial to this study. Additional specimens of these species were not available for sequencing at the time the molecular work was completed.

In summary, the barcoding data for *Collinias* has helped to solidify the species concepts for all of the Australasian and Oceanian species.

Phylogeny

In this instance, the *cox1* signal is clearly beneficial for morphospecies diagnosis but how does it fair in phylogeny estimation? The neighbor joining tree presented above is a useful tool for indicating clusters of similar taxa and their genetic distances but it is not a particularly useful tool for phylogeny estimation (see DeSalle *et al*. (2005) for a discussion of this). To avoid the pitfalls of phenetic analyses, I estimated the phylogeny based on *cox1* data using parsimony analysis. The consensus tree (based on 5 most parsimonious trees) was poorly resolved due to the presence of outgroup taxa within the ingroup on one most parsimonious cladogram. This is logically inconsistent so successive weighting was

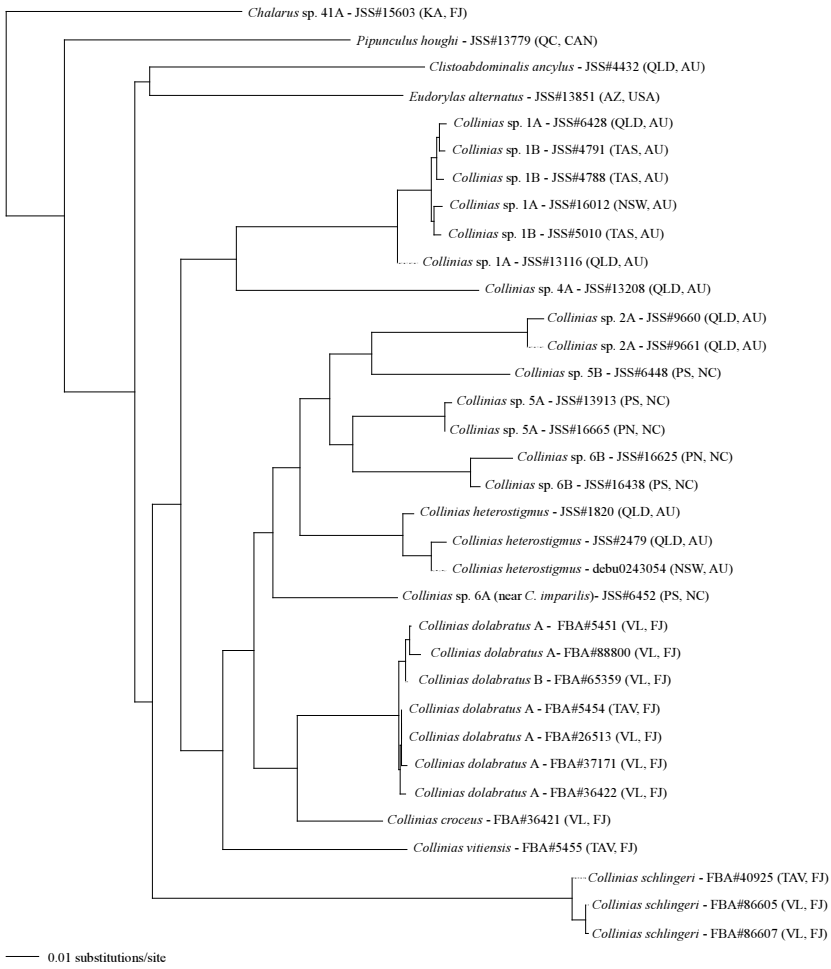

Figure 9. Neighbor joining tree for *cox1* for *Collinias* species, showing relative branch lengths. Abbreviations: AU = Australia; AZ = Arizona, USA; CAN = Canada; FJ = Fiji; KA = Kadavu; NC = New Caledonia; NSW = New South Wales, Australia; PN = Province Nord, New Caledonia; PS = Province Sud, New Caledonia; QLD = Queensland, Australia; TAS = Tasmania, Australia; TAV = Taveunia, Fiji; USA = United States of America; VL = Viti Levu, Fiji.

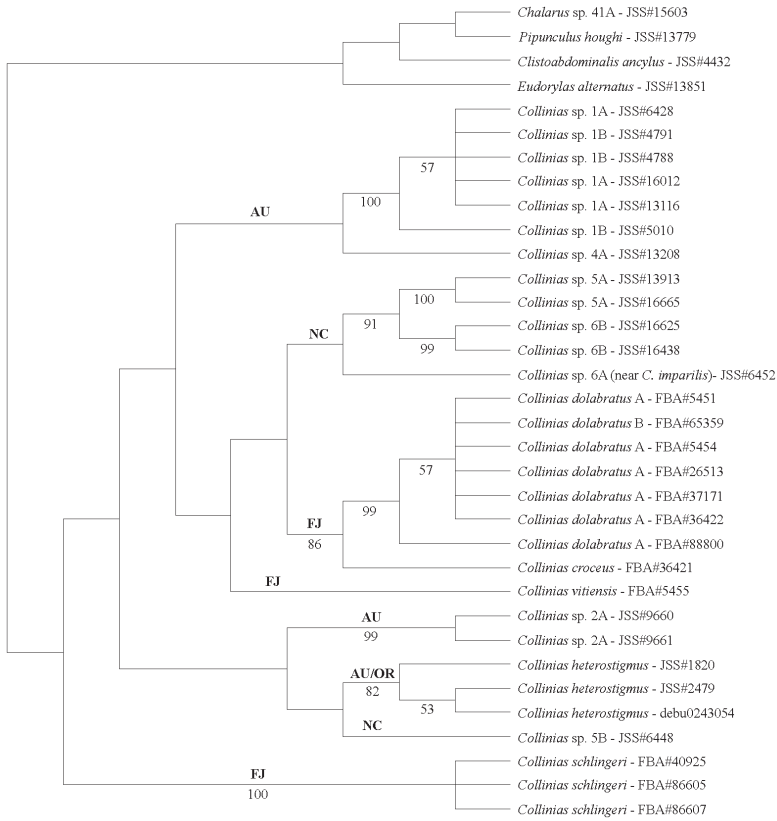

Figure 10. Strict consensus of the 3 successively weighted trees for *cox1* for *Collinias* species. Tree statistics for most parsimonious trees: length = 592, consistency index excluding uninformative characters = 0.48; retention index = 0.70; rescaled consistency index = 0.38. Abbreviations above the lines refer to the geographical distribution of clades (AU = Australia; FJ = Fiji; NC = New Caledonia; OR = Oriental). Numbers below the lines are bootstrap values (based on 1000 replicates).

performed to examine the effect on the outgroup. A consensus of the three most parsimonious successively weighted trees is presented in Fig. 10. These 3 trees are the same as three of the five unweighted most parsimonious trees and remove the problem of outgroup position. The consensus of these three trees presented in Fig. 10 is viewed as the best current hypothesis for *Collinias* relationships.

Without morphological data or additional molecular data to test this hypothesis, I consider this a very rough working hypothesis for the relationships of *Collinias* species.

Despite this, I think that there are some trends that are worth noting. Most of the Fijian species appear to be related and share a lineage with all but one of the New Caledonian species. *Collinias schlingeri* appears not to be related to the other Fijian taxa. This is unlikely as *C. schlingeri*, *C. croceus* and *C. dolabratus* are superficially similar and certainly share more morphological traits with each other than with other species of *Collinias* (e.g. bulging shape of sternite 6, grossly asymmetrical surstyli). I suspect that when I complete my work on *Collinias* and present a complete phylogeny, all of the Fijian and New Caledonian species will form a clade. Additional genes and/or morphology will clearly be required to resolve the position of *C. schlingeri*. Fig. 9 illustrates clearly that *C. schlingeri* is on a long branch. Examination of pairwise comparisons (Appendix 2) also supports this notion, with up to 28% divergence of *C. schlingeri* from other *Collinias* taxa. This is considerably higher than pairwise divergences between other *Collinias* species (most are under 20%) and even higher than typical pipunculid intergeneric pairwise distances. The latter are typically in the 13–21% range (based on analysis of 139 individuals of 66 species in 12 genera) (Skevington, unpubl. data). It is unclear why *C. schlingeri* has such high COI divergences, but if it is closely related to *C. dolabratus* and *C. croceus* as I suspect, it must have undergone a higher mutational rate than typically observed. This rate difference has not resulted in base composition changes (not significantly different from the 31: 36: 17: 16 A: T: C: G mean ratio observed within all *Collinias* species).

Future research on *Collinias* phylogenetics will need to consider these aspects (adding additional genes and/or morphology) as well as the addition of more taxa. Adding New Guinean and Oriental species into the analysis will be necessary to get a true concept of the phylogeny of this genus. *Microcephalops* species should also be included in the analysis. As stated above, *Microcephalops* is closely related to *Collinias* and may even be paraphyletic with respect to *Collinias*. It was not included in the current study simply because the goal was to explore species limits and diagnosis of *Collinias* species. The phylogeny presented is only a byproduct of this research that presents enticement for further study. Further research on the relationships of these two genera and their component species will facilitate our understanding of biogeography and evolution of this interesting lineage of flies.

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APPENDIX 1 – MOLECULAR VOUCHER DATA

Chalarus sp. 41A Skevington manuscript #, Fiji, Kadavu, Solodamu, 19°04' S, 178°07' E, 128 m, Malaise trap FJ-41B, in coastal limestone forest, 1♂, 25.viii.–23.x.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, JSS15603, GenBank#DQ507246 (BPBM); *Clistoabdominalis ancylus* Skevington, Australia, Queensland, Mount Glorious; bordering Maiala National Park, [27°19'54" S, 152°45'29" E, Malaise trap], montane rainforest, 1♂, 1.viii.–30.ix.1996, T. Hiller, JSS4432, GenBank#DQ349221 (UQIC); *Collinias croceus* Skevington, Fiji, Viti Levu, Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA36421, GenBank#DQ507276 (BPBM); *Collinias dolabratus* Skevington, Fiji, Taveuni, Cakaudrove Prov[ince], Devo Peak Radio Tower, 16°51' S, 179°58' E, 1200m, Malaise trap FJ-8, rainforest, 1♀, 31.x.–21.xi.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA5454, GenBank#DQ507270 (CNC); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Vuda Prov[ince], Koroyanitu N.M.P., Savuione Trail, 17°40' S, 177°33' E, 450m, Malaise trap FJ-1, montane woodland, 1♂, 21.ix.–7.x.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA5451, GenBank#DQ507269 (CNC); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Naitasiri Prov[ince], Nakobalevu M[oun]t[ain], 18°03' S, 178°25' E, 340 m, Malaise trap FJ-4D, rainforest, 1♂, 12–24.iii.2003, M. Irwin, E. Schlinger, M. Tokota'a, FBA26513, GenBank#DQ507271 (BPBM); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11B, 1♀, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA36422, GenBank#DQ507272 (CNC); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Naitasiri Prov[ince], Navai Village, Eteni, 17°37' S, 177°59' E, 700 m, Malaise trap FJ-11C, 1♂, 24.x.–8.xi.2003, E.I. Schlinger, M. Irwin, M. Tokota'a, FBA37171, GenBank#DQ507273 (CNC); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Naitasiri Prov[ince], 4 km WSW Colo-i-Suva V[il]l[a]ge, Mt. Nakobalevu, 18°03'18" S, 178°25'26.4" E, 372 m, Malaise, 1♂, 24.iv.–12.v.2004, Schlinger, Tokota'a, FBA65359, GenBank#DQ507275 (CNC); *Collinias dolabratus* Skevington, Fiji, Viti Levu, Vuda Prov[ince], Koroyanitu N[a]tiona[l] P[ar]k, 1 km E Abaca Village, Savuione Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 1♀, 19–26.x.2002, E. Schlinger, Tokota'a, FBA88800, GenBank#DQ507274 (BPBM); *Collinias schlingeri* Skevington, Fiji, Taveuni, Cakaudrove Prov[ince], Devo Forest Reserve, 16°50' S, 179°59' E, 800 m, Malaise trap FJ-9, 1♂, 10–16.i.2003, M. Irwin, E. Schlinger, M. Tokota'a, FBA40925, GenBank#DQ507266 (BPBM); *Collinias schlingeri* Skevington, Fiji, Viti Levu, Vuda Prov[ince], Koroyanitu N[a]tiona[l] P[ar]k, 1 km E Abaca Village, Kokabula Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 1♂, 12–19.xi.2002, E. Schlinger, Tokota'a, FBA86605, GenBank#DQ507267 (BPBM); *Collinias schlingeri* Skevington, Fiji, Viti Levu, Vuda Prov[ince], Koroyanitu N[a]tiona[l] P[ar]k, 1 km E Abaca Village, Kokabula Trail, 17°40' S, 177°33' E, 800 m, Malaise trap, 1♂, 12–19.xi.2002, E. Schlinger, Tokota'a, FBA86607, GenBank#DQ507268 (BPBM); *Collinias vitiensis* (Muir), Fiji, Taveuni, Cakaudrove Prov[ince], Devo Peak Radio Tower, 16°51' S, 179°58' E, 1200m, Malaise trap FJ-8, rainforest, 1♂, 31.x.–21.xi.2002, M. Irwin, E. Schlinger, M. Tokota'a, FBA5455, GenBank#DQ507265 (CNC); *Collinias* sp. 1A Skevington manuscript #, Australia, New South Wales, Kosciuszko N[ational] P[ark], 3.2km WSW Thredbo, near Dead Horse Gap, 36°31'15" S, 148°16'06" E, 1496 m, Malaise trap, over narrow stream, flowering annuals, burnt mossy bogs, 1♂, 1–11.i.2004, C&M&N Lambkin, NT Starick, JSS16012, GenBank#DQ507249 (ANIC); *Collinias* sp. 1A Skevington manuscript #, Australia, Queensland, Bribie Island, QDPI Fisheries site, 27°03' S, 153°11' E, Malaise trap, heathland-*Acacia* regrowth, 1♀, 7–14.xii.1997, S. Winterton, N. Power, D. White, JSS6428, GenBank#DQ507247 (UQIC); *Collinias* sp. 1A Skevington manuscript #, Australia, Queensland, Brisbane Forest Park, Scrub Creek, 27°25'41" S, 152°50'18" E, Malaise trap, 1♂, 28.ix.–15.x.2002, J. Skevington, J.M. Cumming, JSS13116, GenBank#DQ507248 (CNC); *Collinias*, sp. 1B Skevington manuscript #, Australia, Tasmania, Chauncy Vale Wildlife Sanctuary Near Bagdad, 42°36'51" S, 147°15'23" E, Malaise trap, 1♂, 27.xii.1998–1.i.1999, J.&A. Skevington, JSS5010, GenBank#DQ507252 (UQIC); *Collinias* sp. 1B Skevington manuscript #, Australia, Tasmania, Cradle Mountain National Park, 41°37'38" S, 145°56'44" E, Malaise trap in flowering heath, 1♀, 22.xii.1998–8.i.1999, J.&A. Skevington, JSS4788, GenBank#DQ507250 (UQIC); *Collinias* sp. 1B Skevington manuscript #, Australia, Tasmania, Cradle Mountain National Park, 41°37'38" S, 145°56'44" E, Malaise trap in flowering heath, 1♂, 22.xii.1998–8.i.1999, J.&A. Skevington, JSS4791,

GenBank#DQ507251 (UQIC); *Collinias* sp. 2A Skevington manuscript #, Australia, Queensland, Enoggera Reservoir, 27°27' S, 152°55' E, 100 m, 1♂, 18.v.2000, J. Skevington, JSS9660, GenBank#DQ507253 (UQIC); *Collinias* sp. 2A Skevington manuscript #, Australia, Queensland, Enoggera Reservoir, 27°27' S, 152°55' E, 100 m, 1♀, 18.v.2000, J. Skevington, JSS9661, GenBank#DQ507254 (UQIC); *Collinias* sp. 3A Skevington manuscript #, Australia, New South Wales, Royal Natl. Pk., Scientists' Cabin Trail, [34°04' S, 151°04' E], creek bed, 1♀, 25.xii.2003, S.A. Marshall, debu243054, GenBank#DQ507257 (DEBU); *Collinias* sp. 3A Skevington manuscript #, Australia, Queensland, Carnarvon National Park, Mount Moffatt Summit, 25°03'35" S, 148°02'38" E, 1097 m, hand collected, hilltop, 1♀, 2.xii.1997, J. Skevington & C. Lambkin, JSS1820, GenBank#DQ507255 (UQIC); *Collinias* sp. 3A Skevington manuscript #, Australia, Queensland, Carnarvon National Park, Mount Moffatt Section, Mount Moffatt Summit, 25°03'35" S, 148°02'38" E, 1097 m, hand collected, hilltop, 1♂, 22.i.1998, J.&A. Skevington & S.Winterton, JSS2479, GenBank#DQ507256 (UQIC); *Collinias* sp. 4A Skevington manuscript #, Australia, Queensland, Brisbane, Griffith Univ[ersity], Nathan C[ampus], [27°28' S, 153°01' E], 1♂, 23.x.2002, B. Merz, JSS13208, GenBank#DQ507258 (HNHM); *Collinias* sp. 5A Skevington manuscript #, New Caledonia, [Province Sud], Pic du Grand Kaori, 22°17' S, 166°54' E, 250 m, Malaise trap, 1♀, 21.xi.2001–29.i.2002, G. Monteith, JSS13913, GenBank#DQ507259 (QM); *Collinias* sp. 5A Skevington manuscript #, New Caledonia, Prov[ince] Nord, Pouembout Tièa Forest, [21°07' S, 164°57' E], 1♂, 4–7.xii.2000, M.E. Irwin, JSS16665, GenBank#DQ507260 (CNC); *Collinias* sp. 5B Skevington manuscript #, New Caledonia, Prov[ince] Sud, 9.7 km NW Sarraméa, 21°35'12" S, 165°46'53" E, 500 m, Malaise along *Melaluca* path, 1♀, 20.i.1996, M.E. Irwin, D.W. Webb, E.I. Schlinger, JSS6448, GenBank#DQ507261 (INHS); *Collinias* sp. 6A Skevington manuscript #, New Caledonia, Prov[ince] Sud, M[oun]t Khogis, 17 km NNE Nouméa, 22°10'34" S, 166°30'17" E, 425 m, Malaise across path in rainforest, 1♂, 25.i.1996, M.E. Irwin, D.W. Webb, E.I. Schlinger, JSS6452, GenBank#DQ507262 (INHS); *Collinias* sp. 6B Skevington manuscript #, New Caledonia, [Province Sud], Cap Ndoua, site 2, 22°23' S, 166°55' E, 50 m, beating vegetation, rainforest, 1♂, 29.xi.2004, P. Grimbacher, JSS16438, GenBank#DQ507264 (QM); *Collinias* sp. 6B Skevington manuscript #, New Caledonia, Province Nord, Presqu'île de Pindaï, 2.5 km WSW Népouï, 21.383° S, 164.974° E, 45 m, 6 m Malaise trap, 1♀, 13–26.xi.2000, E.I. Schlinger, M.E. Irwin, L.J. Boutin, JSS16625, GenBank#DQ507263 (CNC); *Eudorylas alternatus* (Cresson), United States, Arizona, Coconino Co., 2.5 miles S Tusayan, "10X" Campground, 35°56'16.3" N, 112°07'48.7" W, collected in *Pinus edulis* & *Pinus ponderosa* forest, 1♂, 11.iv.2003, R. Rakitov, JSS13851, GenBank#DQ349219 (CNC); *Pipunculus hough*i Kertész, Canada, Quebec, Vaudreuil Co., Summit of Mount Rigaud, 45°27'59" N, 74°19'35" W, [hilltop], 1♂, 13.vi.2001, J. Skevington, JSS13779, GenBank#DQ337706 (CNC).

APPENDIX 2. — UNCORRECTED PAIRWISE DISTANCES FOR *cox1* DATA

	Ch. sp. 41A 15603	*P. houghi* 13779	*Cli. ancylus* 4432	*Eu. alternatus* 13851	*Co.* sp. 1A 6428	*Co.* sp. 1A 13116	*Co.* sp. 1A 16012	*Co.* sp. 1B 4788	*Co.* sp. 1B 4791	*Co.* sp. 1B 5010	*Co.* sp. 2A 9660
Ch. sp. 41A 15603											
P. houghi 13779	0.1770										
Cli. ancylus 4432	0.2145	0.1794									
Eu. alternatus 13851	0.1912	0.1953	0.1614								
Co. sp. 1A 6428	0.1636	0.2020	0.2023	0.1973							
Co. sp. 1A 13116	0.1655	0.1882	0.1755	0.1752	0.0035						
Co. sp. 1A 16012	0.1615	0.1941	0.1965	0.1846	0.0033	0.0060					
Co. sp. 1B 4788	0.1608	0.1987	0.1934	0.1866	0.0033	0.0089	0.0088				
Co. sp. 1B 4791	0.1605	0.2024	0.2001	0.1988	0.0034	0.0070	0.0068	0.0068			
Co. sp. 1B 5010	0.1503	0.1817	0.1982	0.2068	0.0048	0.0102	0.0049	0.0094	0.0048		
Co. sp. 2A 9660	0.1819	0.1728	0.1892	0.1590	0.1536	0.1303	0.1531	0.1604	0.1537	0.1526	
Co. sp. 2A 9661	0.1716	0.1790	0.1813	0.1571	0.1289	0.1182	0.1279	0.1283	0.1290	0.1290	0.0000
Co. heterostigmus 1820	0.2249	0.1898	0.1893	0.1540	0.1715	0.1089	0.1705	0.1707	0.1715	0.1714	0.0793
Co. heterostigmus 2479	0.1838	0.2006	0.1936	0.1852	0.1207	0.1203	0.1179	0.1214	0.1174	0.1264	0.1390
Co. heterostigmus 243054	0.1844	0.1991	0.1689	0.1525	0.1269	0.1133	0.1292	0.1223	0.1186	0.1304	0.0937
Co. sp. 4A 13208	0.1894	0.2076	0.2326	0.2055	0.1299	0.1233	0.1283	0.1275	0.1343	0.1329	0.2041
Co. sp. 5A 13913	0.1962	0.1968	0.1751	0.1676	0.1365	0.1267	0.1348	0.1308	0.1353	0.1284	0.1105
Co. sp. 5A 16665	0.1919	0.1973	0.1741	0.1626	0.1359	0.1222	0.1338	0.1299	0.1347	0.1282	0.1077
Co. sp. 5B 6448	0.2166	0.1868	0.1931	0.1654	0.1951	0.1279	0.1950	0.1946	0.1951	0.1968	0.0913
Co. sp. 6A 6452	0.1850	0.1849	0.1663	0.1792	0.1346	0.1176	0.1349	0.1388	0.1351	0.1451	0.1290
Co. sp. 6B 16625	0.2061	0.2084	0.1872	0.1834	0.1458	0.1429	0.1493	0.1455	0.1445	0.1437	0.1477
Co. sp. 6B 16438	0.1989	0.1842	0.1614	0.1604	0.1493	0.1315	0.1520	0.1479	0.1481	0.1465	0.0986
Co. vitiensis 5455	0.1738	0.2027	0.2048	0.1905	0.1441	0.1369	0.1405	0.1396	0.1393	0.1346	0.1366
Co. schlingeri 40925	0.2234	0.2546	0.2348	0.2003	0.1713	0.1762	0.1730	0.1758	0.1720	0.1622	0.2328
Co. schlingeri 86605	0.2188	0.2346	0.2648	0.2087	0.1975	0.2057	0.1976	0.2061	0.1973	0.1971	0.2015
Co. schlingeri 86607	0.2274	0.2643	0.2446	0.2139	0.1835	0.1894	0.1856	0.1886	0.1843	0.1621	0.2328
Co. dolabratus A 5451	0.2136	0.2031	0.1572	0.1622	0.2228	0.1305	0.2227	0.2224	0.2229	0.2237	0.1310
Co. dolabratus A 5454	0.2030	0.1891	0.1605	0.1653	0.1437	0.1292	0.1394	0.1392	0.1428	0.1392	0.1349
Co. dolabratus A 26513	0.2038	0.1932	0.1606	0.1627	0.1439	0.1291	0.1428	0.1438	0.1430	0.1395	0.1379
Co. dolabratus A 36422	0.2025	0.1901	0.1575	0.1670	0.1503	0.1342	0.1506	0.1544	0.1473	0.1388	0.1365
Co. dolabratus A 37171	0.1999	0.1888	0.1625	0.1678	0.1408	0.1275	0.1370	0.1368	0.1397	0.1344	0.1414
Co. dolabratus A 88800	0.2129	0.2038	0.1568	0.1541	0.2225	0.1253	0.2224	0.2221	0.2225	0.2233	0.1257
Co. dolabratus B 65359	0.1994	0.1903	0.1605	0.1633	0.1442	0.1290	0.1398	0.1395	0.1433	0.1403	0.1327
Co. croceus 36421	0.1964	0.1819	0.1477	0.1546	0.1269	0.1272	0.1310	0.1303	0.1255	0.1363	0.1350

	Co. sp. 2A 9661	*Co. hetero-stigmus* 1820	*Co. hetero-stigmus* 2479	*Co. hetero-stigmus* 243054	*Co.* sp. 4A 13208	*Co.* sp. 5A 13913	*Co.* sp. 5A 16665	*Co.* sp. 5B 6448	*Co.* sp. 6A 6452	*Co.* sp. 6B 16625	*Co.* sp. 6B 16438
Ch. sp. 41A 15603											
P. houghi 13779											
Cli. ancylus 4432											
Eu. alternatus 13851											
Co. sp. 1A 6428											
Co. sp. 1A 13116											
Co. sp. 1A 16012											
Co. sp. 1B 4788											
Co. sp. 1B 4791											
Co. sp. 1B 5010											
Co. sp. 2A 9660											
Co. sp. 2A 9661											
Co. heterostigmus 1820	0.0787										
Co. heterostigmus 2479	0.1267	0.0149									
Co. heterostigmus 243054	0.0781	0.0089	0.0000								
Co. sp. 4A 13208	0.1117	0.1094	0.1417	0.1425							
Co. sp. 5A 13913	0.1077	0.0803	0.0960	0.0982	0.1516						
Co. sp. 5A 16665	0.1039	0.0759	0.0994	0.0965	0.1503	0.0018					
Co. sp. 5B 6448	0.0882	0.0708	0.1640	0.0699	0.1282	0.0928	0.0884				
Co. sp. 6A 6452	0.1201	0.0806	0.1029	0.0963	0.1572	0.0795	0.0769	0.1007			
Co. sp. 6B 16625	0.1161	0.0997	0.1348	0.1317	0.1619	0.0803	0.0768	0.0939	0.0999		
Co. sp. 6B 16438	0.0866	0.0936	0.1380	0.1155	0.1550	0.0700	0.0644	0.0932	0.0895	0.0162	
Co. vitiensis 5455	0.1457	0.0992	0.1086	0.1047	0.1408	0.1348	0.1367	0.1425	0.1308	0.1585	0.1519
Co. schlingeri 40925	0.2360	0.2836	0.1968	0.2036	0.2419	0.2009	0.1970	0.2585	0.1880	0.2055	0.2027
Co. schlingeri 86605	0.2337	0.2806	0.2443	0.2463	0.2509	0.2212	0.2124	0.2585	0.2092	0.1834	0.1854
Co. schlingeri 86607	0.2357	0.2836	0.2189	0.2214	0.2486	0.2182	0.2140	0.2589	0.2019	0.2156	0.2091
Co. dolabratus A 5451	0.1315	0.0934	0.1145	0.0988	0.2037	0.1032	0.0986	0.1202	0.0903	0.1204	0.1115
Co. dolabratus A 5454	0.1376	0.0998	0.0948	0.1007	0.1541	0.1075	0.1046	0.1259	0.0899	0.1280	0.1180
Co. dolabratus A 26513	0.1415	0.1002	0.0952	0.1045	0.1636	0.1105	0.1130	0.1335	0.0895	0.1326	0.1284
Co. dolabratus A 36422	0.1399	0.0990	0.0944	0.1036	0.1746	0.1059	0.1090	0.1319	0.0888	0.1277	0.1253
Co. dolabratus A 37171	0.1420	0.1006	0.0989	0.1070	0.1518	0.1137	0.1127	0.1339	0.0918	0.1311	0.1256
Co. dolabratus A 88800	0.1260	0.0919	0.1144	0.0935	0.2033	0.0975	0.0931	0.1146	0.0885	0.1196	0.1103
Co. dolabratus B 65359	0.1333	0.0959	0.0987	0.1023	0.1570	0.1090	0.1026	0.1215	0.0875	0.1255	0.1160
Co. croceus 36421	0.1457	0.0881	0.0811	0.0965	0.1454	0.0988	0.0981	0.1307	0.0853	0.1086	0.1161

	Co. vitiensis 5455	*Co. schlin-geri* 40925	*Co. schlin-geri* 86605	*Co. schlin-geri* 86607	*Co. dola-bratusA* 5451	*Co. dola-bratusA* 5454	*Co. dola-bratusA* 26513	*Co. dola-bratusA* 36422	*Co. dola-bratusA* 37171	*Co. dola-bratusA* 88800	*Co. dola-bratusB* 65359
Ch. sp. 41A 15603											
P. houghi 13779											
Cli. ancylus 4432											
Eu. alternatus 13851											
Co. sp. 1A 6428											
Co. sp. 1A 13116											
Co. sp. 1A 16012											
Co. sp. 1B 4788											
Co. sp. 1B 4791											
Co. sp. 1B 5010											
Co. sp. 2A 9660											
Co. sp. 2A 9661											
Co. heterostigmus 1820											
Co. heterostigmus 2479											
Co. heterostigmus 243054											
Co. sp. 4A 13208											
Co. sp. 5A 13913											
Co. sp. 5A 16665											
Co. sp. 5B 6448											
Co. sp. 6A 6452											
Co. sp. 6B 16625											
Co. sp. 6B 16438											
Co. vitiensis 5455											
Co. schlingeri 40925	0.2169										
Co. schlingeri 86605	0.2077	0.0000									
Co. schlingeri 86607	0.2164	0.0000	0.0000								
Co. dolabratusA 5451	0.1171	0.2044	0.2012	0.2052							
Co. dolabratusA 5454	0.1038	0.1936	0.1842	0.2050	0.0040						
Co. dolabratusA 26513	0.1100	0.1938	0.1850	0.2052	0.0041	0.0000					
Co. dolabratusA 36422	0.1092	0.1932	0.1845	0.2045	0.0039	0.0020	0.0020				
Co. dolabratusA 37171	0.1069	0.1974	0.1939	0.2094	0.0041	0.0017	0.0018	0.0039			
Co. dolabratusA 88800	0.1172	0.2049	0.2019	0.2057	0.0038	0.0084	0.0083	0.0083	0.0084		
Co. dolabratusB 65359	0.1069	0.1901	0.1766	0.2012	0.0000	0.0017	0.0018	0.0040	0.0034	0.0041	
Co. croceus 36421	0.1032	0.1979	0.2095	0.2139	0.0639	0.0589	0.0585	0.0597	0.0602	0.0581	0.0605

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Parentia (Diptera: Dolichopodidae) from Fiji: a Biogeographic Link with New Caledonia and New Zealand

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Abstract. *Parentia cagiae* n. sp. is described from coastal habitat near Sigatoka, Viti Levu, Fiji. The genus *Parentia* (Dolichopodidae: Sciapodinae) includes some 70 described species primarily from temperate Australia, New Zealand, and New Caledonia. *Parentia cagiae* has strong affinities with the New Caledonian and New Zealand fauna, and is considered to be a Gondwanan element in Fiji.

INTRODUCTION

The subfamily Sciapodinae (Diptera: Dolichopodidae) in Fiji is proving to be much more diverse than expected. Prior to the Fiji Terrestrial Arthropod Survey, twelve species had been recorded from the Fijian archipelago, nine apparently endemic. As a result of widespread trapping, some 60 undescribed species have been collected, bringing the Fijian total to more than 70 species. This paper is the second in a series that will address the biodiversity of the Fijian sciapodines; also see Bickel (2005).

A species of *Parentia* Hardy collected in a Malaise trap sample from lowland Viti Levu is one of the big surprises, as the genus is characteristic of southern Australia, New Zealand and New Caledonia. The presence of what might be regarded a Gondwanan genus in Fiji is of particular biogeographic significance, especially since most of the Fijian insect fauna is assumed to have strong tropical Papuan – Melanesian affinities, having arrived via stepping stone dispersal from the west (see Evenhuis & Bickel, 2005).

MATERIALS AND METHODS

This study is based on material housed at the Fiji National Insect Collection (FNIC), currently stored at the Bishop Museum, Honolulu (BPBM). The left lateral view of the hypopygium or male genital capsule is illustrated. In describing the hypopygium, 'dorsal' and 'ventral' refer to morphological position prior to genitalic rotation and flexion. Thus, in the lateral view of the hypopygium, the top of the page is morphologically ventral, while the bottom is dorsal. The CuAx ratio is the length of the m-cu crossvein/ distal section CuA. The position of features on elongate structures such as leg segments is given as a fraction of the total length, starting from the base. The relative lengths of the podomeres should be regarded as representative ratios and not measurements. The ratios for each leg are given in the following formula and punctuation: trochanter + femur; tibia; tarsomere 1/ 2/ 3/ 4/ 5. The following abbreviations and terms are used: MSSC - Male secondary sexual character(s), non-genitalic characters found only on the male body; I, II, III: pro- , meso-, metathoracic legs; C, coxa; T, tibia; F, femur; ad, anterodorsal; av, anteroventral; dc, dorsocentral setae; pd, posterodorsal; pv, posteroventral; t, tarsus; $t_{1–5}$, tarsomeres 1 to 5.

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TAXONOMY

Genus *Parentia* Hardy

Parentia (Dolichopodidae: Sciapodinae) is defined by leg III tarsomeres 3-5 padlike (MSSC) and a suite of character states found on most species: modified costal setae (MSSC), the arcuate vein M_2, TIII callus or posterior groove (MSSC), elongate phallus, and forked cercus. *Parentia* is known from Australia (with one Australian species, *P. vulgaris* Bickel, apparently introduced or dispersed to Norfolk Island), New Zealand, New Caledonia, and now Fiji.

Parentia is the dominant sciapodine genus in New Zealand with 27 species (Bickel, 1992). Most New Zealand species occur in mixed podocarp and *Nothofagus* forests, although some are associated with coastal vegetation. Australia has 21 *Parentia* species, found mostly in sclerophyll eucalypt forest, heath, and semiarid habitats along the cool southern half of the continent (Bickel, 1994). However, New Zealand species of *Parentia* show much greater morphological diversity than the Australian fauna, with additional male secondary sexual characters (MSSC), such as apical aristal flags, and more variable expression of characteristic leg and wing MSSC.

Seventeen *Parentia* species are known from New Caledonia (Bickel, 2002), and occur in rainforest, *maquis* vegetation, and coastal habitats. The fauna is divided into the *Parentia agama, lydiae* and *do* species Groups, based on shared male characters: presence of modified costal setae, leg modification and setation, and hypopygial structure.

The single Fijian species described here shares characters with species in of the New Caledonian *lydiae Group*, and species in the New Zealand *malitiosa Group*. This relationship will be discussed below.

Parentia cagiae Bickel**, new species**

(Figs 1a, b, c)

Description. Male: body length: 3.9 mm; wing: 3.4 x 1.3 mm.

Head: frons metallic blue-green without pruinosity; frons with strong vertical seta; pair strong diverging ocellars, and 3 pairs of short setae posteriad on ocellar tubercle; dorsalmost two pairs of postorbital setae strong, on vertex behind verticals; face and clypeus shining metallic blue-green; face slightly bulging; clypeus slightly converging ventrally, and not extending beyond base of eyes; palp black with 2 strong apical setae; proboscis yellow; antenna black; pedicel with corona of black setae, longer dorsally and ventrally; first flagellomere short, rounded; arista dorsal, length more than twice head height; ventral postcranium with pale setae.

Thorax: dorsum metallic blue-green; pleura metallic green with some grey pruinosity; setae black; 3 pairs long ac present, but irregularly paired; 2 long posterior dc with 4 weaker anterior dc present (MSSC); lateral scutellar setae about 2/3 length of medians.

Legs: coxae, trochanters, femora, and tibiae black, sometimes with metallic reflection; tarsi dark brown; CI and CII with long whitish anterior setae; CIII with long black lateral seta subtended by 3 long white setae; I: 4.7; 4.3; 2.5/ 0.8/ 0.6/ 0.4/ 0.5; FI with ventral hairs from base to 2/3, white basally, black from 1/2 to 2/3; TI bare; tarsus I unmodified; II: 5.2; 5.4; 3.5/ 1.7/ 1.2/ 0.8/ 0.7; FII with short pale ventral hairs along length, and with short black pv setae along distal half; TII with short ad - pd seta pair at 1/5, and with row of short, almost erect black ad setae along entire length (MSSC), and with short subapical setae; III: 6.0; 7.8; 2.7/ 1.6/ 1.0/ 0.8/ 0.6; FIII with short white ventral setae along basal half; TIII slightly flattened, with distinct posterior groove from 1/5 to 2/3 (MSSC); $IIIt_{3-5}$ slightly flattened and ventrally padlike (MSSC).

Figure 1. *Parentia cagiae* n. sp. **a**. hypopygium, left lateral; **b**. male wing, dorsal; **c**. male wing, detail of costa, dorsal.

Wing: (Fig.1b); costa with av row of curved, thick and almost crocheted setae (Fig. 1c) from base to just before join of R_{2+3} (MSSC); M_2 bowed with relation to M_1; m-cu straight; CuAx ratio: 2.2; lower calypter brown with fan of black setae; halter black (MSSC).
Abdomen: metallic green with bronze reflections; with short whitish setae laterally, and black setae along tergal margins; hypopygium (Fig. 1a); epandrium black; cerci elongate, yellowish;
epandrium subtriangular; hypandrial arm extending beyond apex of hypandrial hood; phallus relatively short; 2 short epandrial setae present; surstylus with ventral lobe bearing short setae and median peduncle bearing short setae and short dorsal lobe; cercus elongate and setose, and forked , with digitiform projection at right angle near 2/5 cercus length, with setae as figured.
Female: similar to male except lacks MSSC, otherwise as noted: female face flat and slightly wider than male; all dc strong; leg colouration similar; femora ventrally bare; TI with short dorsal at 1/4; TII without ad row of setae, but with strong ad and weak pd setal pair at 1/5, with some short av setae, and with some strong subapical setae; TIII without posterior groove, but with ad setae at 1/4 and some short dorsal setae; $IIIt_{3-5}$ unmodified; costa without modified setae
M_2 also bowed with relation to M_1; female halter yellow.
Types. Holotype ♂, paratype ♀, FIJI: **Viti Levu**, Sigatoka Prov., Sigatoka Sand Dunes, 1.1 km SSW Volivoli Village, 18°10'09.7"S, 177°29'04.9"E, 55 m, 6–16.iv.2004, mixed

littoral forest on sand, Malaise trap, S. Niusoria, [holotype, FBA 063836 (FNIC), paratype, FBA 063837 (FNIC)].

Remarks: *Parentia cagiae* is known from two specimens collected in the same Malaise trap sample in coastal forest on stabilized sand dunes along the southern coast of Viti Levu. This Sigatoka Sand Dunes area has had four traps operating over three years and has generated more than 5,000 specimens of Dolichopodidae. I have looked through the samples a second time and have not found additional specimens of *P. cagiae*. They have black legs and are easily spotted, as all other Sciapodinae in these samples have some tibiae yellow. Possibly *P. cagiae* is not common at the Sigatoka site, and the capture of only two specimens may be the result of a temporary population expansion from adjacent habitats.

Parentia cagiae can be distinguished from all other described *Parentia* by male tibia II having a short ad - pd seta pair at 1/5, and a row of short, almost erect black ad setae along entire length (MSSC).

Etymology. *Parentia cagiae* is named in honor of Akanisi Caginitoba ("Cagi") for her enthusiasm and skill in managing the Fiji Terrestrial Arthropod Survey in Suva.

SYSTEMATIC POSITION

Parentia cagiae has strong affinities with *Parentia* species described from New Caledonia and New Zealand. In New Caledonia, the *lydiae* Group comprises species with modified male costal setae, and a callus or posterior groove on male tibia III (Bickel, 2002). All species have elongate cerci, and have basitarsus I unmodified. The nature of the costal setal modification is often diagnostic for species. The *lydiae* Group comprises eight species, and although the Fijian *P. cagiae* could certainly be included in this group, it differs from its New Caledonian congeners in having a forked cercus, while all other species have an elongate unbranched cercus (see Bickel 2002, figs. 5 and 6).

The New Zealand *Parentia malitiosa* Group includes ten species and is similar to the New Caledonian *lydiae* Group, except it has a forked cercus and distinctive MSSC, such as supernumerary setae, on some species. The forked cercus of some *malitiosa* Group species is similar to that of the Fijian *P. cagiae* (e.g., compare Fig. 1a with that of the New Zealand *P. calignosa,* Bickel 1992, fig. 12).

Although *Parentia* has not been analyzed phylogenetically, I suspect that based on descriptive similarities, such an analysis would demonstrate that the New Caledonian *lydiae* Group, New Zealand *malitiosa* Group and the Fijian species *P. cagiae* form a clade.

BIOGEOGRAPHY

The relationship of *Parentia cagiae* to New Caledonian and New Zealand congeners has significant biogeographic implications. New Caledonia and New Zealand are considered to be remnants of a Gondwanan supercontinent, with biotas that often show vicariant distributions in other Gondwanan areas.

For a Fijian taxon to be Gondwanan, it must have direct phylogenetic links to a decidedly Gondwanan taxon from Australia, New Caledonia, or New Zealand, and not indirectly via the Melanesian Archipelago. For example, although an ancestrally Gondwanan genus may occur in New Guinea and have dispersed and radiated, reaching Fiji via the

Melanesia Arc, it could not be considered directly Gondwanan. By these measures, *P. cagiae* is probably a Gondwanan element on Fiji, with affinities to the New Caledonian and New Zealand faunas.

Fiji has a complex geological history (summary and references in Evenhuis & Bickel, 2005), but the age of its continuous subaerial exposure would have influenced the colonization and radiation of terrestrial biota. Most authors suggest an early to mid-Miocene (10-14Ma) emergence for Viti Levu. In light of Fiji's relatively young age, vicariant relationship with distant landmasses seems unlikely, especially since there is no evidence for a land bridge or "stepping stone" archipelagoes linking Fiji to New Caledonia or New Zealand.

Kroenke (1996) suggested a biogeographical role for the 'Eua Ridge, now underlying the Tongan island of 'Eua. From the mid- Eocene (about 40 Ma), the 'Eua Ridge, once part of the eastern end of New Caledonia, detached and rafted northeastward driven by sea floor spreading. At 25 Ma (mid-Oligocene), the 'Eua Ridge was directly north of proto-New Zealand, and by 6–5 Ma (latest Miocene-early Pliocene), part of the 'Eua Ridge collided with the Fijian Platform. Kroenke suggested that such an accreted terrane could have facilitated the transfer of a depauperate New Caledonian biota to Fiji. However, this hypothesis remains highly speculative, especially since 'Eua is a small low island positioned far to the east of Fiji, beyond the Lau Group. As well, such terranes often involve crustal fragments that are unlikely to act as subaerial "Noah's Arks" in transferring terrestrial biota. Dispersal, probably from New Caledonia, is a more likely process to account for Gondwanan *Parentia* on Fiji, especially in light of the rather recent age of known subaerial exposure on Viti Levu.

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A Key to the Genera of the Muscoidea (Diptera) Recorded from the Fiji Islands

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INTRODUCTION

The Muscoidea of the Fiji Islands were the subject of a monograph by Bezzi (1928), who recorded 9 described species of Muscidae from the islands and described 11 new species of Muscidae and 1 of Fanniidae, based almost exclusively on material from the then Imperial Institute of Entomology and deposited in the collection of the Natural History Museum, London (U.K.). However, no key for the identification of either genera or species was given. Malloch (1928a, 1928b) also described some new species from the Fiji Islands. Emden (1942) re-assigned some of the described Coenosiini to different genera, and Pont (1970) gave notes on the location of the types of Bezzi's species. A new species was described by Vockeroth (1972). All these records and descriptions were summarised by Pont (1989).

The purpose of the present paper is to provide a key to the genera of the Muscoidea now known from the Fiji Islands, together with brief notes on the known species in each genus. Currently the Anthomyiidae are represented by 1 genus and 1 unnamed species; the Fanniidae by 2 genera and 4 species; and the Muscidae by 18 genera, 27 described species, and at least 10 unnamed/undescribed species. Of the 27 described species, several appear to have been introduced into Fiji but have failed to establish.

SYSTEMATICS

Key to the Fijian genera of the Muscoidea

1 Vein A_1 reaching wing-margin. Hind tarsomere 1 with a distinct but short subbasal ventral seta. Scutellum with a group of soft pale hairs on ventral surface at tip ..... **ANTHOMYIIDAE**
[One genus and and probably one species in Fiji: *Anthomyia* Meigen.]

–. Vein A_1 not reaching wing-margin. Hind tarsomere 1 without a ventral seta near base. Scutellum almost never with soft pale hairs ventrally 2

2. Hind tibia with a strong median dorsal seta in line with the dorsal preapical seta. Subcosta diverging from vein R_1 at a point very close to the base of both veins, running in a smooth curve to costa. Vein A_1 very short, and if extended meeting an imaginary extension of vein A_2 before wing-margin **FANNIIDAE** 3

–. Hind tibia without a strong median true dorsal seta, occasionally with a seta to the posterior side of dorsal placed well in apical half of tibia. Subcosta very close

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to vein R_1 for most of its length, diverging from it only near apex of subcosta, its course sinuous rather than smooth (except in *Hydrotaea*, where its course is as in Fanniidae). Vein A_1 longer, if extended not meeting an imaginary extension of vein A_2 before wingmargin **MUSCIDAE** 4

3. 1 strong presutural dorsocentral seta, preceded by a rudimentary anterior one that is hardly distinct from the ground-setulae. Antennal scape and pedicel, lower frontal vitta, palpus, tip of scutellum and legs (except tarsomeres) yellow. ♂: head dichoptic, no head dimorphism between the sexes ..... **Euryomma** Stein

[One species, *E. peregrinum* (Meigen), throughout the tropics and subtropics of the world.]

–. 2 strong presutural dorsocentral setae. Antennae, frontal vitta, palpus, scutellum and legs (except knees and occasionally fore tarsomeres) black. ♂: head holoptic, with considerable head dimorphism between the sexes .... **Fannia** Robineau-Desvoidy

[Three species: *F. canicularis* (Linnaeus), the little house fly, cosmopolitan; *F. albitarsis* Stein, introduced, native of South America; *F. pusio* (Wiedemann), introduced, native to the New World.]

4. Anepimeron partly setulose 5
–. Anepimeron bare 11

5. Proboscis adapted for piercing: elongate, strongly sclerotised and non-retractile, tapering from a broad base to a slender apex and with labella atrophied 6
–. Proboscis not adapted for piercing: moderately or weakly sclerotised and retracted into head, not tapering strongly to apex, and with labella well-developed and often fleshy 7

6. Palpus about one-third as long as labium. Meron and disc of proepisternal depression setulose. Notopleuron with numerous setulae ..... **Stomoxys** Geoffroy

[Two species: *S. calcitrans* (Linnaeus), cosmopolitan; *S. indicus* Picard, an Oriental species.]

–. Palpus about three-quarters as long as labium. Meron and disc of proepisternal depression bare. Notopleuron without setulae .... **Haematobia** LePeletier & Serville

[Allegedly two species: *H. exigua* de Meijere, the buffalo fly, widespread Indo-Australasian; *H. irritans* (Linnaeus), the horn fly, Palaearctic and introduced into the New World and Hawai'i.]

7. Lower calypter broad, truncate posteriorly, its posterior margin following scutellar margin before diverging away 8
–. Lower calypter narrow, tongue-like, its posterior margin at right-angles to scutellum right from its base 10

8. Large coal-black species with deep yellow wing-bases, body-length at least 11 mm. Anterior katepisternal seta absent. Base of vein R_{4+5} bare .. **Mesembrina** Meigen

[One species, *M. meridiana* (Linnaeus), introduced from Europe in 1932 for housefly control but not established.]

–. Differently coloured and smaller species, body-length rarely even 9 mm. Anterior katepisternal seta present. Base of vein R_{4+5} setulose at least on ventral surface 9

9. Metallic green, blue or violet species. Supra-squamal ridge setulose along its entire length. Greater ampulla, subcostal sclerite and face above mouth-edge setulose. Mid tibia with a strong posteroventral seta beyond middle ..... **Neomyia** Walker
[Two species, both endemic: *N. simmondsi* (Bezzi) and *N. greenwoodi* (Bezzi).]

–. Not metallic green species. Supra-squamal ridge bare. Greater ampulla, subcostal sclerite and face bare. Mid tibia without a posteroventral seta ..... **Musca** Linnaeus
[Two species, both introduced: *M. domestica* Linnaeus, the common house fly, cosmopolitan; *M. vetustissima* Walker, the Australian bush fly.]

10. Parafacial with one or more irregular rows of fine hairs for most or all of its length. Palpus moderately to strongly broadened in apical part. Vein R_{4+5} wholly bare. Prosternum bare. Posterior spiracle with several setulae at posterior end, but without a row of setulae along lower margin. ♂ frons about one-third of head-width ..... **Lispe** Latreille
[Three species have been seen, but their specific identities not yet established.]

- Parafacial bare. Palpus slender or very slightly broadened in apical part. Vein R_{4+5} setulose at least on ventral surface. Prosternum setulose. Posterior spiracle with a row of black setulae along lower margin. ♂ frons at most one-sixth of head-width ..... **Dichaetomyia** Malloch
[Three species, two of which are endemic: *D. vicaria* (Walker), an Australasian species, *D. elegans* Malloch and *D.*n.sp. (Evenhuis & Pont., in prep.).]

11 Node at base of vein R_{4+5} with 1 or more setulae on dorsal as well as ventral surfaces 12

- Node at base of vein R_{4+5} bare on dorsal surface, bare or setulose on ventral surface 14

12. Lower calypter broad, truncate posteriorly, its posterior margin following scutellar margin before diverging away. Several pairs of presutural and postsutural acrostichal setae present. Meron with a few setulae above hind coxa and, sometimes, below spiracle. ♀: frontal vitta with many setulae and a pair of crossed setae ..... **Passeromyia** Rodhain & Villeneuve
[Two species, their larvae parasitic on nestling birds: *P. indecora* (Walker), otherwise known only from Australia, and *P. veitchi* Bezzi, endemic (Pont, 1974).]

–. Lower calypter narrow, tongue-like, its posterior margin at right-angles to scutellum right from its base. Without acrostichal setae except for 1 pair before scutellum. Meron entirely bare. ♀: frontal vitta bare 13

13. Prosternum bare. Mid femur with an anterior preapical seta. Hind tibia with a dorsal and an anterodorsal preapical seta. Pre-alar seta short but distinct. Arista long plumose. Body, antenna, palpus and legs yellow ..... **Myospila** Rondani
[One species, *M. effeminata* Vockeroth, endemic (Vockeroth, 1972).]

–. Prosternum setulose. Mid femur without an anterior preapical seta. Hind tibia with only the dorsal preapical seta, the anterodorsal absent. Pre-alar seta wholly absent. Arista at most short-plumose. Body, antenna, palpus and legs black ..... **Limnophora** Robineau-Desvoidy
[Three species seen, one of which is *L. mesolissa* Bezzi, Australasian in distribution.]

14. Prosternum setulose. Scutellum with numerous setulae on sides and at ventral angle. Arista bare ..... **Synthesiomyia** Brauer & Bergenstamm
[One species: *S. nudiseta* (Wulp), a widespread filth fly in the Old and New World tropics and subtropics.]

–. Prosternum bare. Scutellum bare on sides and at ventral angle (except in *Muscina*, which has a long-plumose arista) 15

15. Head subquadrate in lateral view, with the antenna long and inserted just below level of upper eye-margin. Presutural dorsocentral setae short and weak, hardly distinguishable from the ground-setulae. Fore femur with 0–2 posteroventral setae, situated near apex ..... **Atherigona** Rondani
[At least five species are known to occur: *A. orientalis* Schiner, throughout the Old and New World tropics and subtropics; *A. oryzae* Malloch, mainly Indo-Australsaian in distribution; *A. hendersoni* Malloch, a Pacific species; and *A. poecilopoda* Bezzi and *A. splendens* Bezzi, both probably endemic to Fiji.]

–. Head variable in shape, but never subquadrate, and antenna inserted well below level of upper eye-margin. Presutural dorsocentral setae distinct and strong, longer than the ground-setulae. Fore femur with a complete row of posteroventral setae 16

16. Katepisternal setae arranged at the points of an imaginary equilateral triangle, the lower one equidistant from the upper two. Lower proepimeral seta directed forwards and downwards 17

–. Katepisternal setae not arranged at the points of an imaginary equilateral triangle, the anterior one more distant from the posterior 1–3. Lower proepimeral seta directed upwards 20

17. Head with only one pair of reclinate orbital setae. Hind tibia with 1 anterodorsal seta. 1 presutural dorsocentral seta ..... **Coenosia** Meigen
[One species, awaiting identification.]

–. Head with 2 pairs of reclinate orbital setae. Hind tibia with 2 anterodorsal setae. 1 or 2 presutural dorsocentral setae 18

18. Mid tibia with 2 submedian posterior setae. Frontal triangle small and confined to the area of the ocelli, not nearly reaching lunula. Fore tibia with a strong submedian posteroventral seta. Arista very long plumose on basal half and bare on apical half, the longest individual hairs twice width of antennal flagellomere .... **Pygophora** Schiner
[One species: *P. ctenophora* Bezzi, endemic.]

–. Mid tibia with 1 submedian posterior seta. Frontal triangle large or at least long and narrow, more or less reaching lunula. Fore tibia without a submedian posteroventral seta. Arista shorter plumose, the longest individual hairs equal to width of antennal flagellomere and continued evenly to tip of arista 19

19. Lower calypter normal in size, projecting beyond upper one. Scutellum with the basal setae absent. Wing milky-white along posterior and apical margins, brown along anterior margin, and elsewhere pale smoky-brown. Hind tibia with only 1 short submedian posterodorsal seta ..... **Orchisia** Rondani
[One species: *O. costata* (Meigen), throughout warm regions of the Old World.]

–. Lower calypter reduced, linear, not projecting beyond upper one. Basal scutellar seta half as long as apical one. Wing completely clear. Hind tibia with 2 posterodorsal setae ..... **Parvisquama** Malloch
[Two described species, *P. tripuncta* (Malloch) and *P. dolichocera* (Bezzi), both endemic, and several undescribed species.]

20. Subcosta very close to vein R_1 for most of its length, diverging from it only near apex of subcosta, its course sinuous rather than smooth. Vein M curved forward towards vein R_{4+5} in apical part. Arista plumose. Scutellum at tip and all tibiae yellow ..... **Muscina** Robineau-Desvoidy
[One species: *M. stabulans* (Fallén), a cosmopolitan filth-fly.]

–. Subcosta diverging from vein R_1 at a point very close to the base of both veins, running in a smooth curve to costa. Vein M running straight to the wing-margin. Arista pubescent. Body and legs wholly dark ..... **Hydrotaea** Robineau-Desvoidy
[One species: *H. spinigera* (Stein), an Old World tropical filth fly.]

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FIJI ARTHROPODS V

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