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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*Dasydorylas*, *Microcephalops* and *Tomosvaryella*) are supported by a collection of 1541 specimens (Skevington, unpublished data).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,

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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.

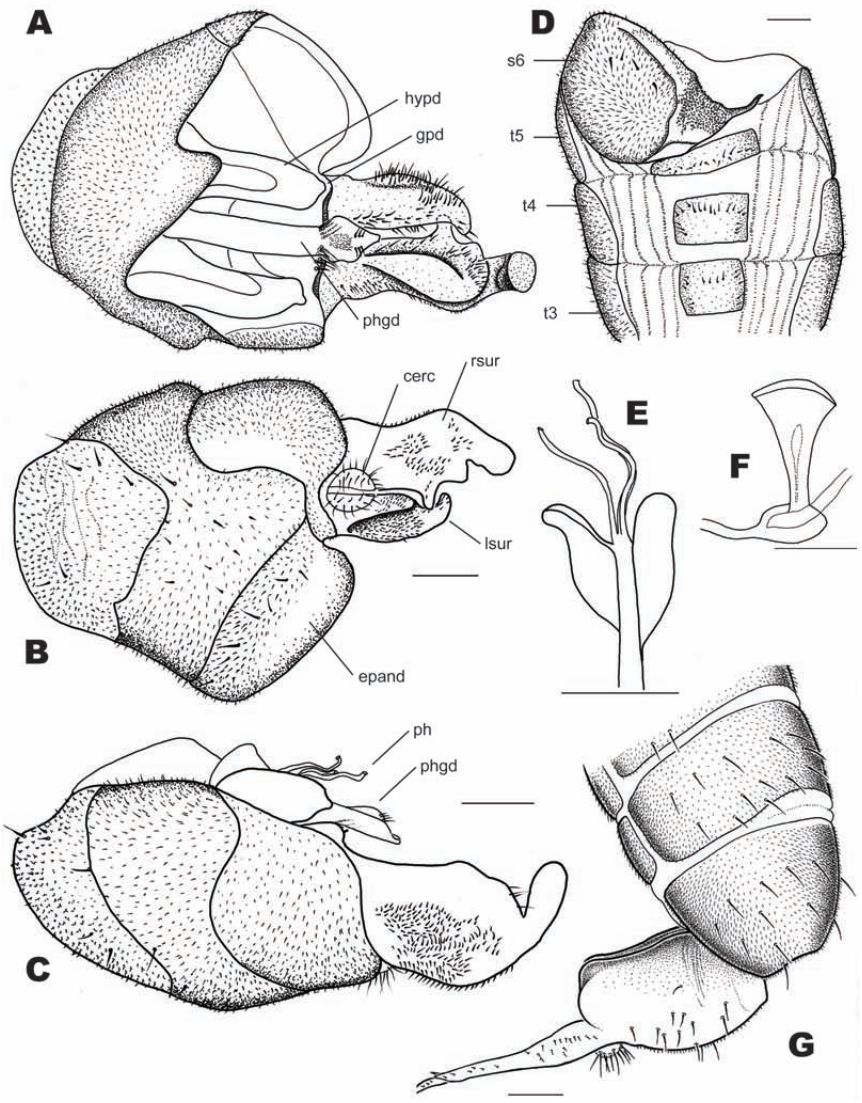

Figure 1. *Collinias croceus*. **A**. dorsal of male terminalia, phallus removed, FBA501397. **B**. ventral of male terminalia, FBA501397. **C**. right lateral of male terminalia, FBA501397. **D**. ventral of male abdomen, terminalia removed, FBA501397. **E**. Phallus of male, FBA501397. **F**. ejaculatory 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.

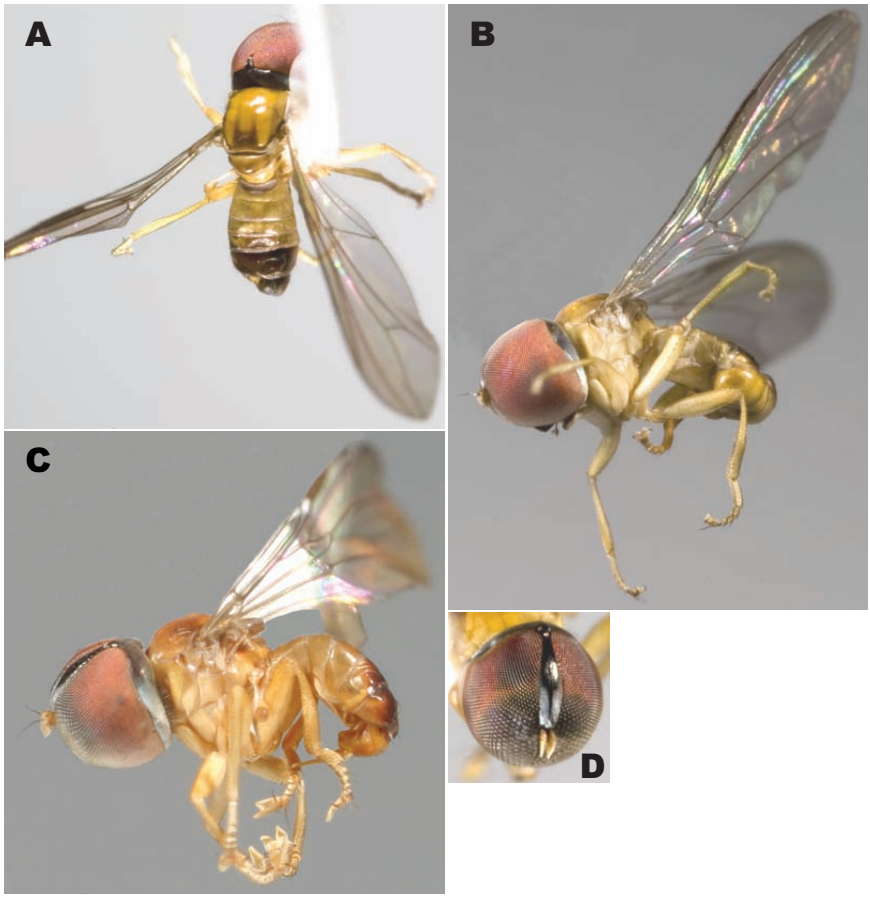

Figure 2. Photographs of *Collinias croceus*. **A**. dorsal of holotype male, FBA501399. **B**. left lateral of male, FBA508452. **C**. left lateral of female, FBA36421. **D**. head of female FBA508872.

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);

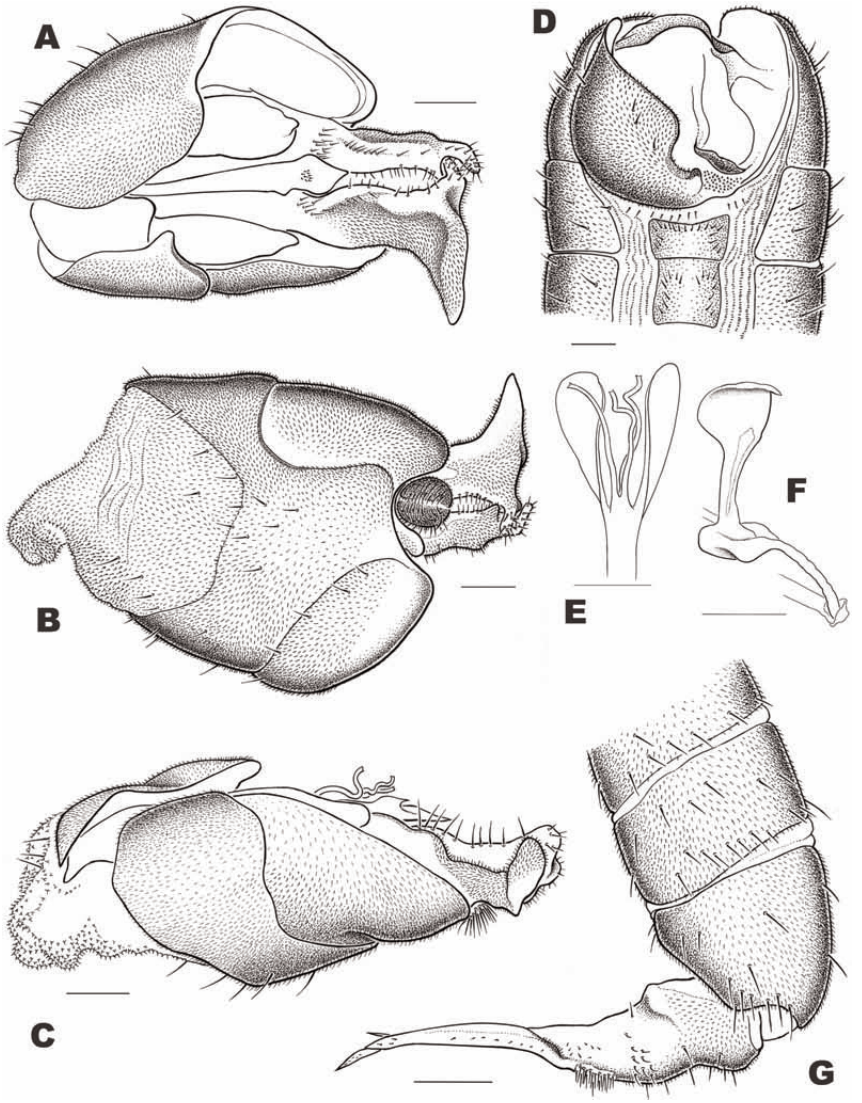

Figure 3. *Collinias dolabratus*. **A**. dorsal of male terminalia, phallus removed, FBA5451. **B**. ventral of male terminalia, FBA5451. **C**. right lateral of male terminalia, FBA5451. **D**. ventral of male abdomen, terminalia removed, FBA5451. **E**. Phallus of male, FBA5451. **F**. ejaculatory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

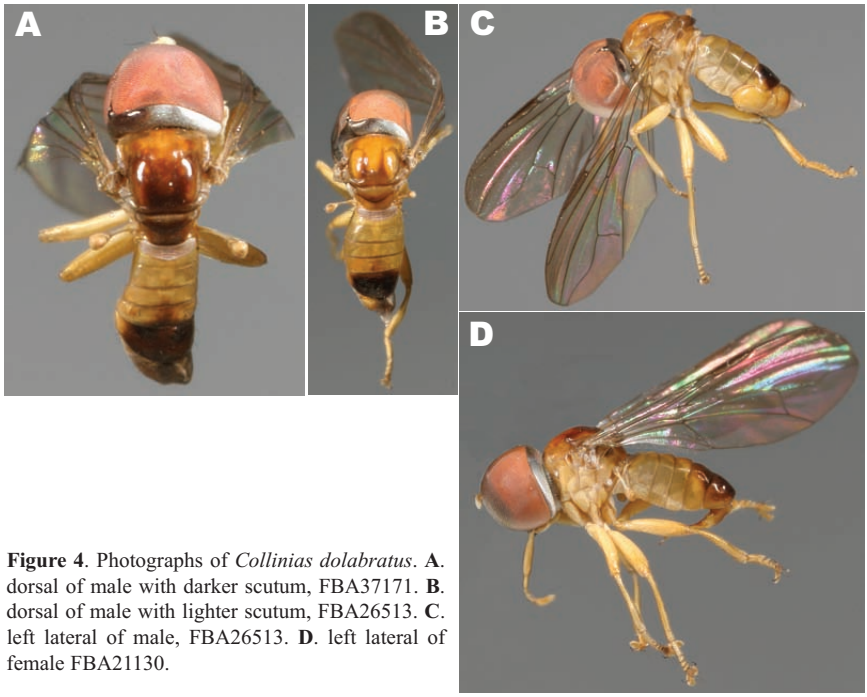

Figure 4. Photographs of *Collinias dolabratus*. **A**. dorsal of male with darker scutum, FBA37171. **B**. dorsal of male with lighter scutum, FBA26513. **C**. left lateral of male, FBA26513. **D**. left lateral of female FBA21130.

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

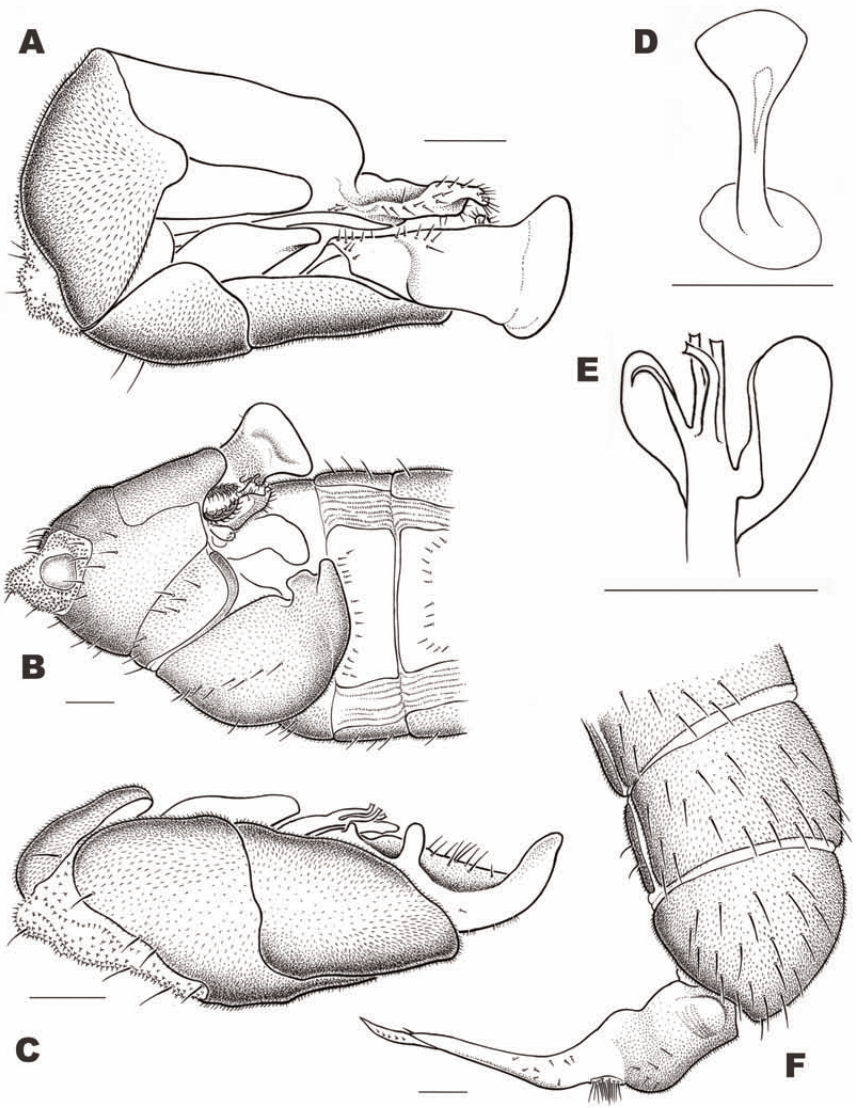

Figure 5. *Collinias schlingeri*. A. dorsal of male terminalia, phallus removed, FBA42. B. ventral of male abdomen, FBA47. C. right lateral of male terminalia, FBA42. D. ejaculatory apodeme and sperm pump of male, FBA42. E. Phallus of male, FBA42. F. left lateral of female ovipositor, FBA37011. Scale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

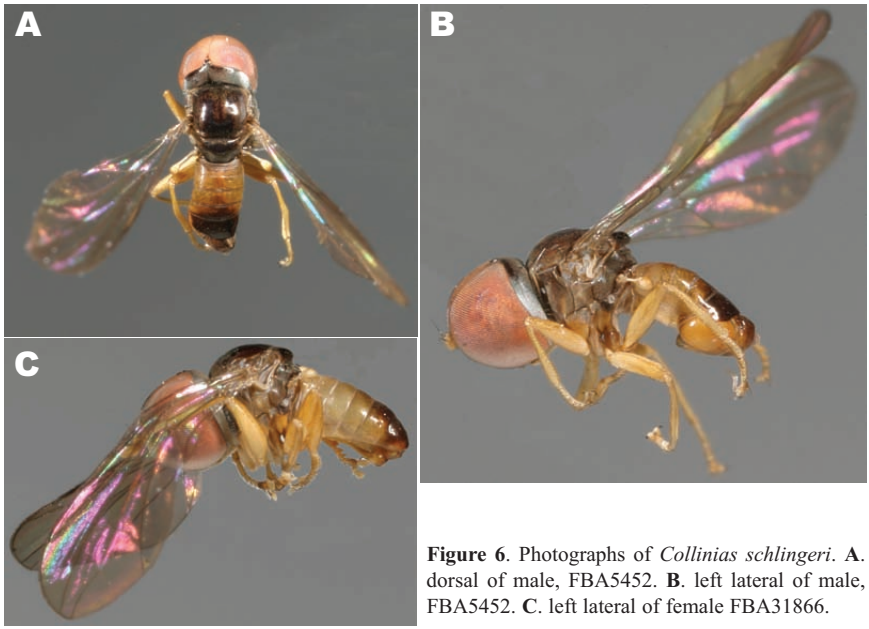

Figure 6. Photographs of *Collinias schlingeri*. **A**. dorsal of male, FBA5452. **B**. left lateral of male, FBA5452. **C**. left lateral of female FBA31866.

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,

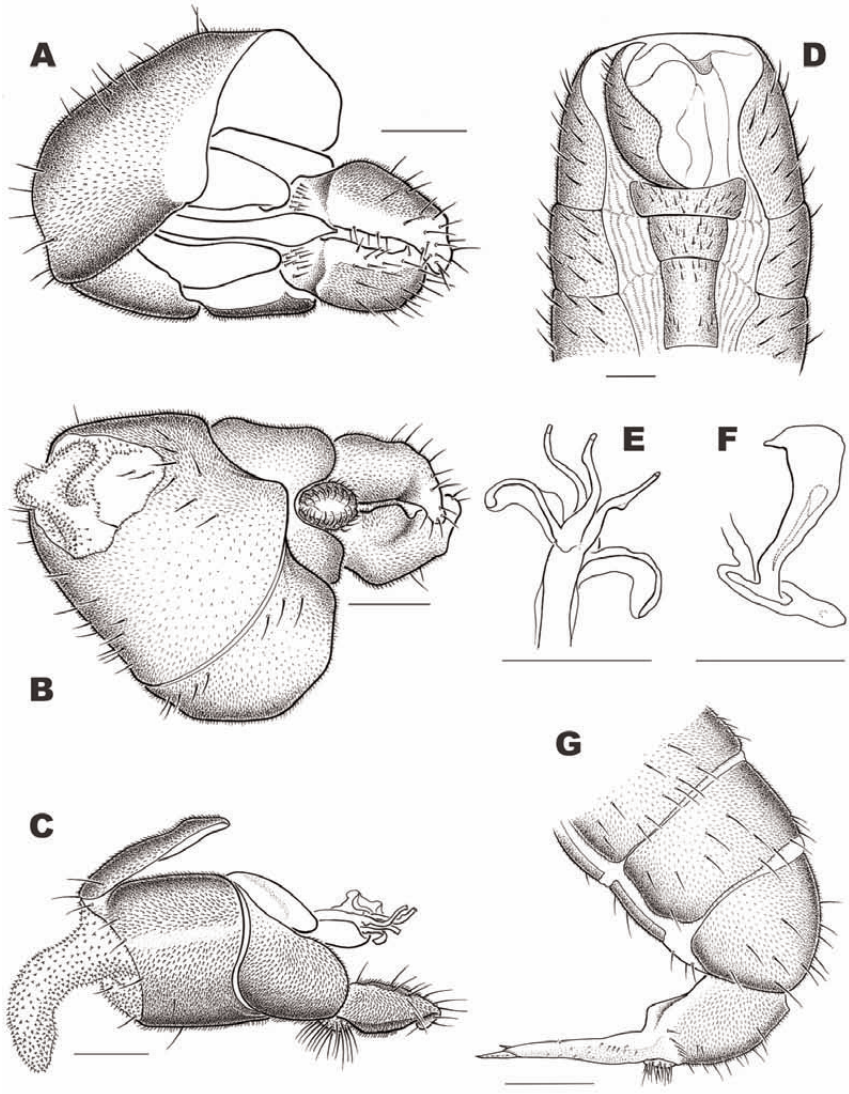

Figure 7. *Collinias vitiensis*. A. dorsal of male terminalia, phallus removed, FBA9672. B. ventral of male terminalia, FBA9672. C. right lateral of male terminalia, FBA9672. D. ventral of male abdomen, terminalia removed, FBA9672. E. Phallus of male, FBA9672. F. ejaculatory apodeme and sperm pump of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

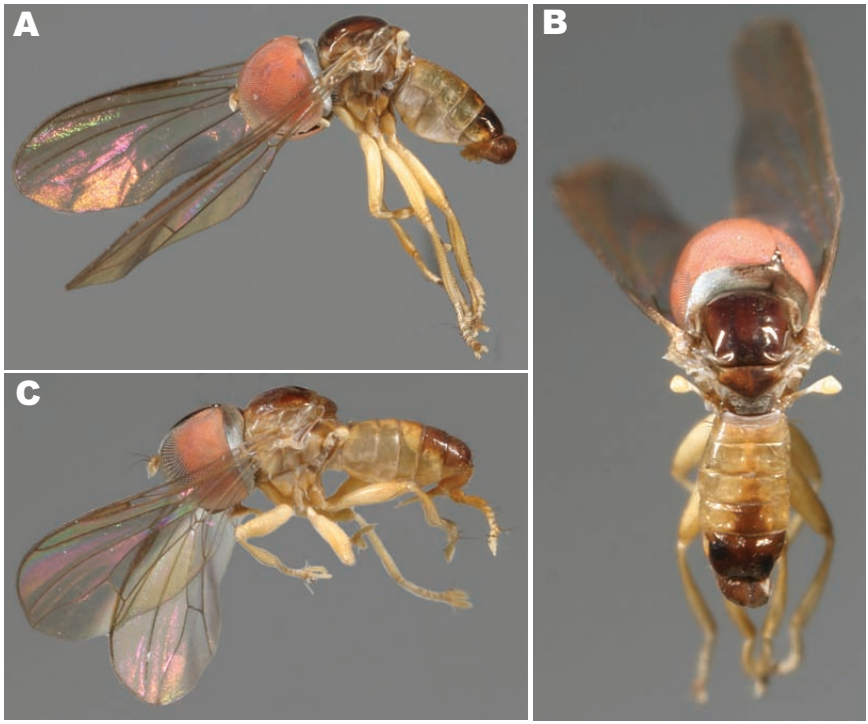

Figure 8. Photographs of *Collinias vitiensis*. **A**. left lateral of male, FBA5455. **B**. dorsal of male, FBA5455. **C**. left lateral of female, FBA26513.

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

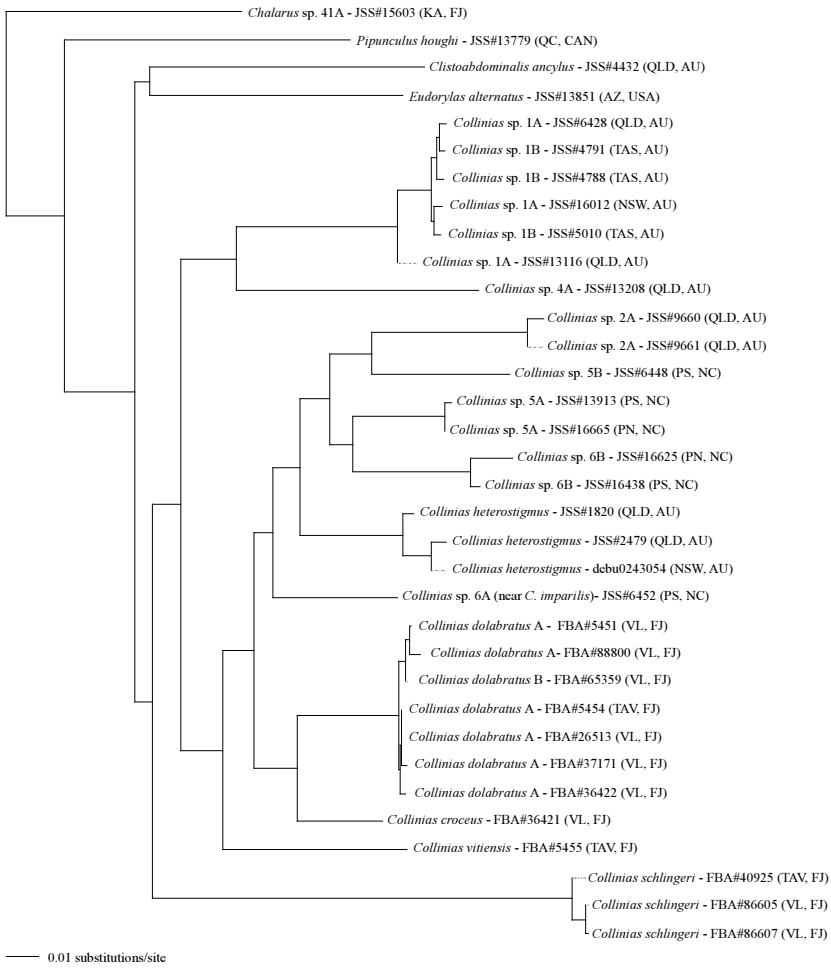

Figure 9. Neighbor joining tree for *cox1* for *Collinias* species, showing relative branch lengths. Abbreviations: AU = Australia; AZ = Arizona, USA; CAN = Canada; FJ = Fiji; KA = Kadavu; NC = New Caledonia; NSW = New South Wales, Australia; PN = Province Nord, New Caledonia; PS = Province Sud, New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

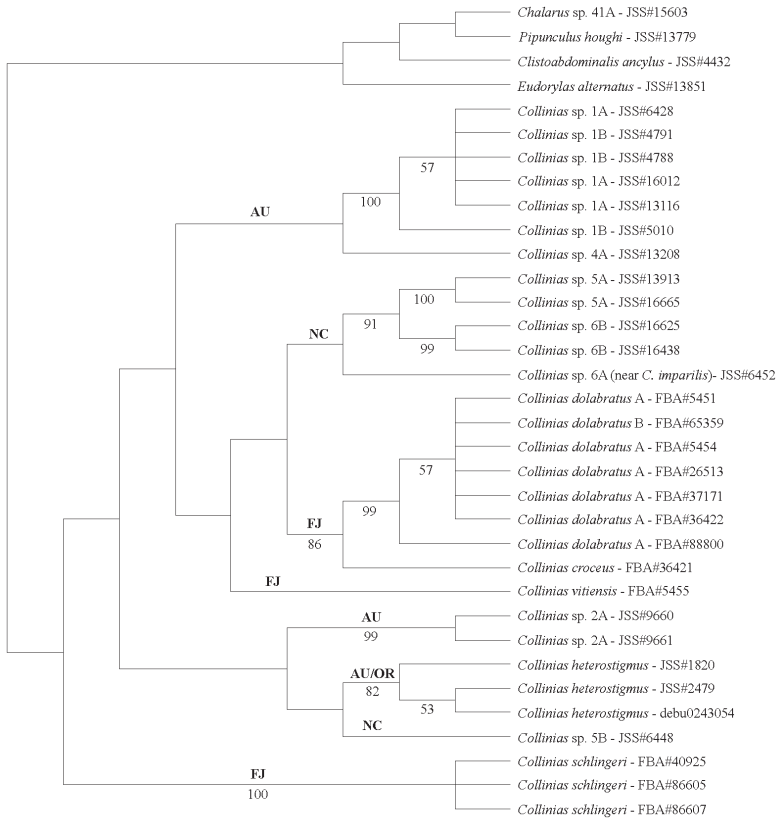

Figure 10. Strict consensus of the 3 successively weighted trees for *cox1* for *Collinias* species. Tree statistics for most parsimonious trees: length = 592, consistency index excluding uninformative characters = 0.48; retention index = 0.70; rescaled consistency index = 0.38. Abbreviations above the 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. schlingeri* 40925	*Co. schlingeri* 86605	*Co. schlingeri* 86607	*Co. dolabratus A* 5451	*Co. dolabratus A* 5454	*Co. dolabratus A* 26513	*Co. dolabratus A* 36422	*Co. dolabratus A* 37171	*Co. dolabratus A* 88800	*Co. dolabratus B* 65359
Ch. sp. 41A 15603											
P. haughi 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. dolabratus A 5451	0.1171	0.2044	0.2012	0.2052							
Co. dolabratus A 5454	0.1038	0.1936	0.1842	0.2050	0.0040						
Co. dolabratus A 26513	0.1100	0.1938	0.1850	0.2052	0.0041	0.0000					
Co. dolabratus A 36422	0.1092	0.1932	0.1845	0.2045	0.0039	0.0020	0.0020				
Co. dolabratus A 37171	0.1069	0.1974	0.1939	0.2094	0.0041	0.0017	0.0018	0.0039			
Co. dolabratus A 88800	0.1172	0.2049	0.2019	0.2057	0.0038	0.0084	0.0083	0.0083	0.0084		
Co. dolabratus B 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