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NEW SPECIES OF BITING MIDGES FROM THE SOLOMON ISLANDS (DIPTERA: CERATOPOGONIDAE)

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Abstract. Three species of biting midges from the Solomon Is are described and illustrated: *Brachypogon kraussi,* n. sp., *B. tokunagai,* n. sp., and *Dasyhelea forsteri,* n. sp. Another ceratopogonid, *Alluaudomyia bifasciata,* originally described from New Guinea, is recorded for the first time from the Solomon Is.

Previous records of Ceratopogonidae from the Solomon Is are scanty. Macfie (1938) described *Dasyhelea atronotata* Macfie and *D. humilis* Macfie from collections made by R. A. Lever on Tulagi I in 1935 and recorded *Leptoconops* (*Styloconops*) *albiventris* (de Meijere), *Leptoconops* (L.) sp., *Culicoides mollis* Edwards, and *C. orientalis* Macfie from the same collections. It was with considerable interest, therefore, that we examined a small collection made by Noel L. H. Krauss at Kira Kira on San Cristobal in the Solomons in 1976. The collection contained 1 *Dasyhelea* sp., 2 *Brachypogon* spp., and 1 *Alluaudomyia* sp. Three of the 4 species are undescribed, and we take this opportunity to describe and figure them. The *Dasyhelea* species resembles the 2 *Brachypogon* species so closely that it almost escapes attention, and the species probably serves as prey for females of the latter.

Specimens have been mounted in phenol-balsam in the manner of Wirth & Marston (1968). For an explanation of general terminology of Ceratopogonidae see Wirth (1952) and Wirth et al. (1977); terms dealing with male genitalia are those of Snodgrass (1957); terminology of antennal sensilla follows that of Wirth & Navai (1978).

Holotypes of the new species are deposited in the U.S. National Museum of Natural History in Washington, D.C. (USNM). Paratypes are deposited in Bishop Museum, Honolulu (BISHOP); British Museum (Natural History), London (BMNH); Museum National d'Histoire Naturelle, Paris (MNHN); Australian National Insect Collection, Canberra (ANIC); and Canadian National Collection, Ottawa (CNC), as noted.

Brachypogon kraussi Grogan & Wirth, **new species** FIG. 1a–e

Diagnosis. A small species of *Brachypogon* most closely resembling *B. papuensis* (Tokunaga 1964), distinguished from all other members of the genus by the following combination of characters: ♀ with radius curving gradually up to meet costa at an acute angle, M_2 complete nearly to base; antenna with a group of 2–3 sensilla coeloconica on the 1st flagellomere, antennal ratio 1.25–1.28; claws moderately long (nearly as long as 5th tarsomere), slightly unequal with basal inner barbs. Males similar to ♀ with a basal lobe on

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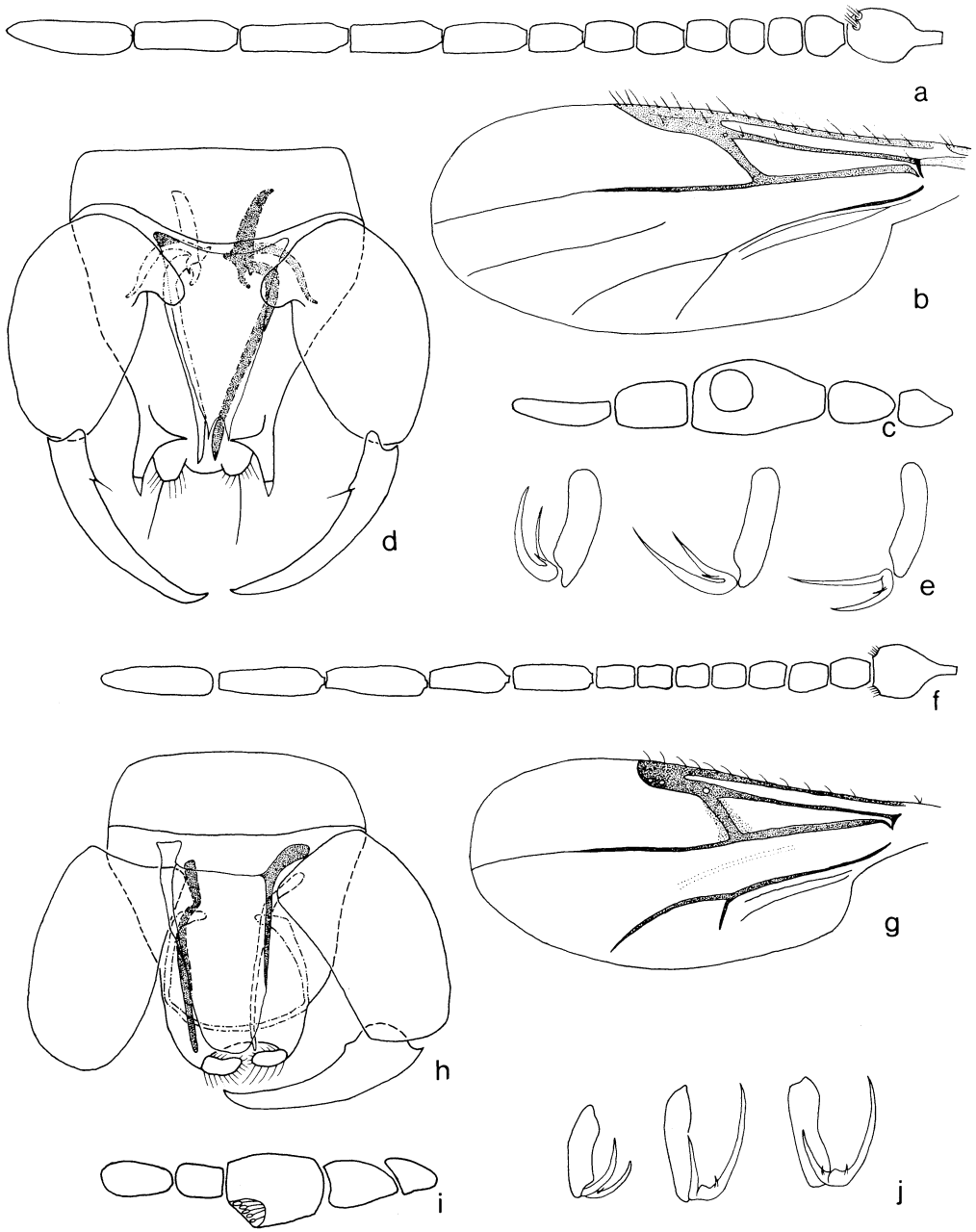

FIG. 1. *Brachypogon kraussi,* a–e; *B. tokunagai,* f–j: a, f, ♀ antenna; b, g, ♀ wing; c, i, ♀ palpus; e, j, ♀ 5th tarsomere and claws (from left to right, fore, mid and hind); d, h, ♂ genitalia.

the inner margin of the basimere; 9th tergum with long slender apicolateral processes bearing pointed tips; claspettes divided, long and slender; aedeagus hyaline, triangular, with very short basal arms and narrow bifid tip.

Holotype ♀. Wing length 0.59 mm; breadth 0.28 mm. *Head.* Dark brown; proboscis, palpus and flagellum lighter in color. Eyes pubescent; slightly separated. Clypeus with a pair of central bristles. Antennal flagellum (FIG. 1a) with a group of 2–3 subapical sensilla coeloconica on 1st flagellomere; all flagellomeres with a subbasal whorl of sensilla chaetica and a subapical whorl of long, slender sensilla trichodea; sensilla basiconica apparently absent from all flagellomeres; flagellomeres with lengths in proportion of 20-11-10-10-11-12-13-14-22-23-27-26-31; antennal ratio 1.28. Palpus (FIG. 1c) with lengths of segments in proportion of 9-13-22-13-18; 3rd segment with moderately large deep pit but the expected capitate sensilla are not visible; palpal ratio 1.57; 5th segment rather long and slender. Mandible with 10–12 teeth that are large and curved at apex but becoming gradually smaller and straighter toward base. *Thorax.* Dark brown and somewhat dull due to fine reticulate pattern on all portions except tarsi. Legs rather stout with sparse setae that are slightly more numerous on tibiae than on femora; tarsi with usual pair of apical spines on tarsomeres 1–4 on mid leg and tarsomeres 2–4 of fore and hind legs; hind 1st tarsomere with dense palisade setae; 4th tarsomeres subcylindrical with 1–2 long apical sinuate setae on ventral side; 5th tarsomeres (FIG. 1e) slightly arched, rather long and slender, about 2× the length of 4th tarsomeres, claws moderately long, almost the length of 5th tarsomeres, slightly unequal with basal inner barbs. Wing (FIG. 1b) hyaline, surface covered with microtrichia only, macrotrichia restricted to costa and a few on radius; anterior veins medium brown, posterior veins paler; radial cells absent, a vestigial y-shaped suture remains marking the coalescence of the radius and costa; radius curving gradually up to meet costa at an acute angle; M_1 slightly convex anteriorly in mid portion, well developed and thick proximally, becoming faint distally and obsolete at extreme tip; M_2 very faint, complete nearly to base with tip obsolete; mediocubital fork slightly distad of r-m crossvein, veins moderately well developed except on extreme distal portions where they become obsolete; anal veins very faint; costal ratio 0.62. Halter brown. *Abdomen.* Light brown; pleura paler. Eighth sternum lightly sclerotized with a shallow posterior cleft; arms of 9th sternum broad at base, tapering to a slender recurved tip that is posteriorly directed; 10th sternum with a deep anterior arch, posterior margin with rounded tip and bearing a single pair of long subapical setae. A single spermatheca that is ovoid but slightly crushed with a very short narrow neck; length 0.052 mm.

Allotype ♂. Wing length 0.56 mm; breadth 0.25 mm. Slightly smaller than holotype ♀, with generally similar coloring and features and with the usual sexual differences, as follows: Head with eyes more broadly separated, about the width of 4 facets; flagellum with moderately dense plume golden brown in color, flagellomeres 2–11 fused. Tarsi paler than in ♀, with 4th tarsomeres longer and more cylindrical, the apical sinuate setae restricted to fore legs; claws small, equal, simple, tips bent abruptly nearly 90° and visible as bifid at 1000×. Genitalia as in FIG. 1d. Ninth sternum with straight base about 3× broader than long, posterior margin convex posteriorly; 9th tergum tapering gradually distally and then becoming nearly parallel where the long, slender apicolateral processes begin, the latter with pointed tips; cerci rather long, each with broad quadrate tip bearing a single long seta and numerous smaller setae. Basimere slightly bulbous, nearly 2× as long as wide with a basal lobe on inner margin; telomere slightly shorter than basimere, with a large subbasal seta on inner margin, tapering slightly distally to a pointed tip. Aedeagus triangular, surface bare, about 1.5× longer than broad; basal arm very short, resulting in extremely low basal arch, more heavily sclerotized than distal portion; distal portion lightly sclerotized, tapering gradually to slender bifid tip. Claspettes apparently divided; each with basal portion composed of 3 heavily sclerotized arms as figured; distal portion slender and more lightly sclerotized and extending beyond tip of aedeagus.

Holotype ♀, allotype ♂ (USNM no. 76108), 2♂,9♀ paratypes, SOLOMON IS: San Cristobal I: Kira Kira, XII.1976, 0–100 m, N.L.H. Krauss. Paratypes in BISHOP, BMNH, MNHN, ANIC, and CNC.

Discussion. This species is named in honor of the collector, Noel L. H. Krauss, in recognition of his many contributions to our knowledge of the insect fauna of the Pacific.

This species most closely resembles *B. papuensis* (Tokunaga), which has a similar radiocostal junction on its wing but which differs, as follows: larger, female wing length 0.75 mm; the female claws are much shorter, and those of the fore leg are of equal size; the wing is infuscated, and the male genitalia differ markedly by the aedeagus with long basal arms, fused claspettes of much different configuration, and the 9th tergum lacking apicolateral processes.

Brachypogon tokunagai Grogan & Wirth, **new species** FIG. 1f–k

Diagnosis. Wing length 0.55 mm; breadth 0.28 mm. *Head.* Dark brown; pedicel of antenna very dark; flagellum and palpus lighter in color. Eyes pubescent; contiguous the length of 2 facets. Clypeus with 2 pairs of submarginal bristles. Antennal flagellum (FIG. 1f) with a pair of subapical sensilla coeloconica, each sensilla on opposite sides of the 1st flagellomere; all flagellomeres with a subbasal whorl of sensilla chaetica and a subapical whorl of long, slender sensilla trichodea; sensilla basiconica apparently absent from all flagellomeres; flagellomeres with lengths in proportion of 22-12-12-12-11-12-12-13-24-24-28-29-31; antennal ratio 1.28. Palpus (FIG. 1i) with lengths of segments in proportion of 8-14-15-8-15; 3rd segment with very large deep pit bearing several large capitate sensilla; palpal ratio 1.31; 5th segment rather long and stout. Mandible with 8 teeth that are large and slightly curved at apex but become gradually smaller and straighter toward base. *Thorax.* Dark brown and somewhat dull due to fine reticulate pattern on all portions except tarsi. Legs rather stout with sparse setae that are slightly more numerous on tibiae than on femora; trochanters light brown; tarsi with usual pair of apical spines on tarsomeres 1–4 of mid leg but they are rather small and weak; hind 1st tarsomere with dense palisade setae; 4th tarsomeres subcylindrical with 1–2 long apical sinuate setae on ventral side; 5th tarsomeres (FIG. 1j) slightly arched, rather long and slender, 2× the length of 4th tarsomeres; claws long, longest talon on mid and hind legs the length of 5th tarsomeres, unequal with basal inner barbs. Wing (FIG. 1g) infuscated, surface covered with microtrichia only, macrotrichia restricted to costa and a few on distal portion of radius; anterior veins dark brown, posterior veins slightly paler; radial cells absent; radius and costa coalescing distad of r-m crossvein; radius curves upward abruptly at tip; r-m crossvein very thick with darker infuscation extending onto surrounding membrane; M_1 well developed, very thick proximally, becoming thinner distally but extending to wing tip, vein curved slightly convex anteriorly in midportion; M_2 absent; a pale area in membrane midway between M_1 and mediocubitus; mediocubital fork slightly distal to r-m crossvein, M_{3+4} curving anteriorly at base and becoming obsolete at tip, Cu_1 obsolete on distal 1/2; anal veins very faint; costal ratio 0.60. Halter pale. *Abdomen.* Dark golden brown; pleura darker purplish. Eighth sternum broad with straight base and a broad, deep posterior cleft; 9th sternum with very slender arms with pointed recurved tips; 10th sternum with shallow anterior arch, a pair of subapical setae and broadly rounded tip. A single spermatheca that is collapsed but in other specimens is ovoid, with apical perforations, and a short narrow neck; length 0.052 mm.

Allotype ♂. Wing length 0.53 mm; breadth 0.25 mm. Slightly smaller than holotype ♀, with similar features and coloration, and with the usual sexual differences, as follows: eyes just barely contiguous; flagellum with moderately dense plume golden brown in color, flagellomeres 2–11 fused. Tarsi paler with 4th tarsomeres longer and more cylindrical; claws small, equal, simple, tips bent abruptly nearly 90° and visible as bifid at 1000×. Genitalia as in FIG. 1h. Ninth sternum with nearly straight base, about 3× broader than long, posterior margin slightly convex; 9th tergum tapering abruptly basally then more gradually distally to a broad rounded apex, apicolateral processes absent, cerci curving inward and covered with moderately long setae. Basimere slightly curved, 2× as long as broad with long setae at apex of mesal side; telomere 0.8 the length of basimere, with a subbasal tubercle on inner mesal side, tapering gradually distally to broad pointed tip. Aedeagus triangular, surface bare, 1.5× longer than broad, basal arch only 1/5 of total length; basal arm moderately long, heavily sclerotized and recurved slightly; distal portion hyaline with broad rounded tip. Claspettes divided, heavily sclerotized, each side composed of a long slender arm that is stout basally, gradually tapering to a fine point.

Holotype ♀, allotype ♂ (USNM no. 76109), 6♂,13♀ paratypes, SOLOMON IS: San

Cristobal I: Kira Kira, XII.1976, 0–100 m, N.L.H. Krauss. Paratypes in BISHOP, BMNH, MNHN, ANIC, and CNC.

Discussion. This species is named in honor of Masaaki Tokunaga, in recognition of his invaluable contributions to our knowledge of the ceratopogonid fauna of the Pacific.

This species most closely resembles *Brachypogon insulicolus* (Tokunaga) (in Tokunaga & Murachi 1959) from the Caroline Is, but in the latter species the wing is milky white with infuscation over the radius and costa. The fore and hind claws of the latter species are simple, the spermatheca is pyriform and the antennal ratio is 1.05. The male of *B. insulicolus* is unknown.

Brachypogon petersi (Tokunaga) from New Guinea also resembles *B. tokunagai* in having a similar wing, but in the former species vein M_2 is present on the distal ½ of the wing. It also differs in having the fore femur pale on the apical ½ and the male flagellum with only flagellomeres 2–7 fused. The male genitalia have short apicolateral processes, the aedeagus has short basal arms, and the claspettes are more complex basally. Only the male of *B. petersi* is known.

Dasyhelea forsteri Grogan & Wirth, **new species** FIG. 2

Diagnosis. A very small species of *Dasyhelea* distinguished by the following combination of characters: ♀ very small (wing length 0.52 mm or less); wing with proximal portions of median, radius and costal veins reduced to small sclerotized tubercles (FIG. 2b); flagellum short (antennal ratio 0.79–0.90), flagellomeres unsculptured, the distal 5 bearing hastate sensilla basiconica; spermatheca single. Males similar to ♀, with the usual sexual differences; genitalia with basimeres and telomeres not extending beyond margins of 9th tergum; claspettes symmetrical, divided: aedeagus reduced to a slender crescent-shaped arch which lies beneath a truncate distomedian extension of the 9th sternum; antenna with flagellomeres sculptured, the distal 3 bearing hastate sensilla basiconica similar to those of ♀.

Holotype ♀. Wing length 0.52 mm; breadth 0.26 mm. *Head.* Dark brown; flagellum and palpus slightly lighter in color. Eyes pubescent; barely contiguous for the length of 1–2 facets. Frons with 2 pairs of central submarginal setae. Antenna with pedicel much darker than flagellum; flagellum (FIG. 2a) with proximal 8 flagellomeres subglobose, distal 5 flagellomeres slightly more elongated; all flagellomeres with a subbasal whorl of sensilla chaetica; proximal 8 flagellomeres with a subapical whorl of slender sensilla trichodea; distal 5 flagellomeres with scattered hastate sensilla basiconica; lengths of flagellomeres in proportion of 19-15-16-17-17-17-17-17-18-18-18-21-31; antennal ratio 0.79. Palpus 4-segmented with lengths of segments in proportion of 16-19-10-20; 2nd segment (primitive 3rd) without definite pit but bearing about 3 capitate sensilla on mesoventral side; palpal ratio 2.22. Mandible reduced, nonfunctional. *Thorax.* Dark golden brown and somewhat glossy. Legs lighter in color including tarsi; femora and tibiae moderately slender, covered with sparse setae that are more numerous on tibiae; fore tibia with 2–3 large subapical setae and a small subapical comb of short setae distal to large setae; hind tibial comb with 5 large setae; tarsomeres 1–3 of mid legs with single subapical weak spine; hind 1st tarsomere without definite palisade setae but with rather dense patch of central setae; hind tarsal ratio 2.33; 4th tarsomeres cylindrical; 5th tarsomeres slightly longer than 4th, claws very small, simple, with tips curved nearly 90°, empodium vestigial. Wing (FIG. 2b) moderately broad, hyaline, microtrichia absent; anterior veins brown, posterior veins paler; radial cells obsolete, radius and costa fused on distal portions; proximal portions of media, radius and costal veins reduced to small sclerotized tubercles; posterior arm of intercalary fork present; media petiolate, forking at level where r-m crossvein joins radius; mediocubital fork at level of juncture of radius and costa; anal veins very pale; costal ratio 0.54. Halter light brown. *Abdomen.* Light brown. Eighth sternum rather short with a very shallow caudomedian excavation; 9th sternum with relatively short arms that are foot-shaped apically; 10th sternum short with anterior arch and a single pair of large subapical setae. Spermatheca single, collapsed, spheroid, neck not discernible, length 0.026 mm.

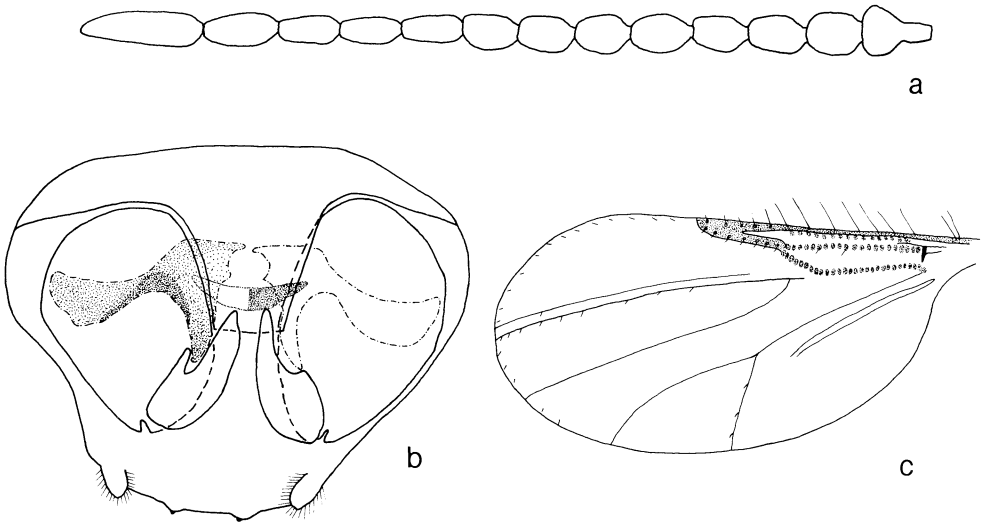

FIG. 2. *Dasyhelea forsteri*: a, ♀ antenna; b, ♀ wing; c, ♂ genitalia.

Allotype ♂. Wing length 0.55 mm; breadth 0.25 mm. Similar in size, form and coloration to holoytpe ♀, with usual sexual differences. Eyes broadly separated; flagellum with dense brown plume, flagellomeres 1–12 sculptured on proximal halves, distal 4 flagellomeres elongated, distal 3 bearing hastate sensilla basiconica; flagellomeres with lengths in proportion of 29-15-15-15-16-16-17-17-18-25-29-26-42; antennal ratio 0.77; wing with costal ratio 0.46. Genitalia reduced, as in FIG. 2c. Ninth sternum moderately short, base nearly straight with spiculate truncate caudomedian extension; 9th tergum rather broad, tapering rather abruptly at mid length, then gradually to the rounded apex, bearing 2 tubercles whose setae apparently are broken off; cerci rather short and covered with dense setae. Basimere reduced, not extending beyond 9th tergum, almost straight, tapering slightly distally; telomere about ½ the length of basimere, stout basally, curving abruptly at base and gradually tapering to slightly pointed tip. Aedeagus reduced to a slender crescent-shaped arch that lies underneath the caudomedian extension of the 9th sternum. Claspettes symmetrical, divided; basal arm moderately heavily sclerotized, broadening distally; distal portion more lightly sclerotized, tapering to broad rounded tip.

Holotype ♀, allotype ♂ (USNM no. 76110), 1♀ paratype, SOLOMON IS: San Cristobal I: Kira Kira, 0–100 m, XII.1976, N.L.H. Krauss. Paratype in BISHOP.

Discussion. The species is named in honor of Mr Leo Forster, a marvelous technician at the Biosystematics Research Institute, Canada Department of Agriculture, Ottawa, who has skillfully mounted some of the minute ceratopogonids from this collection.

This species appears to be rather unique because of the unusual reduced media, radius and costal veins and the reduced male genitalia. *Dasyhelea robustiforceps* Tokunaga, 1962 from the Ryukyu Is has similarly reduced male genitalia that differ by having distal extensions on the aedeagus, rounder nontapering 9th tergum, the distal margin of the 9th sternum sinuous, and the claspettes fused, with the distal portion slender and rodlike. The female of Tokunaga's species differs from that of *D. forsteri* in having 2 spermathecae, a larger wing (wing length 0.78 mm) with a single small radial cell, normal veins, and dense macrotrichia.

Dasyhelea raripilosa Tokunaga, 1940 from the western Caroline Is, has male genitalia that somewhat resemble those of *D. forsteri* but differ in having an H-shaped aedeagus, fused claspettes with a slender rodlike distal portion, and a narrower 9th tergum that tapers gradually distally. The female of this species has a wing length nearly 2× that of *D. forsteri,* and the wing has dense macrotrichia and a small radial cell.

Dasyhelea palauensis Tokunaga, 1940 from the Mariana, Caroline, Marshall and Gilbert islands has male genitalia similar to those of *D. forsteri,* but it differs by having asymmetrical claspettes, the aedeagus with distal extensions, and a narrower shorter 9th tergum. Females of this species have a wing length nearly 2× that of *D. forsteri,* the wing with a small radial cell, and an ovoid spermatheca with a distinct neck that bends at a right angle.

Alluaudomyia bifasciata Tokunaga

Alluaudomyia bifasciata Tokunaga, 1963: 220 (♀, ♂; New Britain, New Guinea; fig. ♂ genitalia, ♀ spermathecae).—Debenham, 1971: 146 (♂, New Guinea; description; fig. ♂ wing, genitalia).

A single male of this species was taken by Krauss on San Cristobal along with the specimens of *Brachypogon* and *Dasyhelea.* It agrees with the descriptions and illustrations of Tokunaga (1963) and Debenham (1971) except that the claws have distinct basal inner barbs. This feature was not described by either Tokunaga or Debenham and may have been overlooked. However, we have not examined the allotype male or the male from New Guinea examined by Debenham, so we are uncertain as to whether these specimens have claws with basal inner barbs. This characteristic is unusual in male ceratopogonids and particularly so in *Alluaudomyia,* since females of this genus also lack basal inner barbs on their claws. If the other 2 known males possess this character, it would prove to be a diagnostic feature to distinguish this species from other similar species of *Alluaudomyia.*

We have been informed by Francis G. Howarth (in litt.) of the Bishop Museum that the holotype female of this species has been lost. However, it is not necessary to designate a neotype for this species as the allotype and other paratypes are still extant.

Acknowledgments. We are grateful to Francis G. Howarth of the Bishop Museum for the loan of the following types for comparisons: *Ceratopogon maai* Tokunaga, *C. papuensis* Tokunaga, and *C. novaguineae* Tokunaga.

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ERRATA

Vol. 21

p. 310, lines 4, 5 & 6 down: *violascens* should read *violacescens*
p. 311, line 1 down: same as preceding

Vol. 22

p. 35, line 4 up: Opthalmophila should read Ophthalmophila
p. 45, line 6 up: *longicauda* should read *longicaudata*
p. 55, line 16 down: same as preceding
p. 72, line 23 down: same
p. 75, lines 7–8 down: *taluticu* should read *tahitica*
line 14 up: B/B/NBB/5B should read B/B/NNB/5B