

THREE NEW SPECIES OF CAMILLIDAE (DIPTERA) FROM THE
SOUTHWESTERN NEARCTIC REGION, THE FIRST SPECIES OF THE
FAMILY DESCRIBED FROM THE NEW WORLD

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Abstract.—The first endemic species of Camillidae are described from the New World and the Nearctic Region. Three new species are described: *Afrocamilla arizona* (southeastern Arizona); *A. bispinosa* (southern California); and *Camilla arnaudi* (Baja California, Mexico). All species are illustrated and a key to the endemic Nearctic species of Camillidae is presented. *Camilla glabra* (Fallén, 1823), previously introduced to Canada from Europe, is likely to be no longer extant in the Nearctic Region. The biology of Camillidae is briefly reviewed.

Key Words: Diptera, Camillidae, *Afrocamilla*, *Camilla*, Nearctic Region

The Camillidae are a small family of drosophilid-like acalyptrate Diptera in the superfamily Ephydroidea (see McAlpine 1989). Prior to this study, the family was thought to be an exclusively Old World group, being widespread in the temperate and tropical parts of the Palearctic and Afrotropical Regions, but not yet recorded from Madagascar. The extant Palearctic fauna comprises 11 species of *Camilla* Haliday, 1838, centred in the Mediterranean subregion and widely distributed through Europe into the northwest of the Russian Federation and Mongolia. Recent work on the Afrotropical fauna (Barracough 1992, 1993) has shown that Camillidae are likely to be widespread in Africa. Three species of *Camilla* (one undescribed) are known only from South Africa. The other three Afrotropical genera, *Afrocamilla* Barracough, 1992, *Katacamilla* Papp, 1978, and *Teratocamilla* Barracough, 1993, were previously thought to be endemic to Africa, albeit widespread (except *Teratocamilla*).

The only published record of Camillidae in the New World was a population of the Palearctic species *Camilla glabra* (Fallén, 1823), reported from Ottawa, Canada (McAlpine 1960), and apparently an accidental introduction from Europe (McAlpine 1987: 1023). There are 25 specimens of *C. glabra* in the Canadian National Collection of Insects (Ottawa), all taken at or near the Central Experimental Farm in Ottawa between 1954 and 1965. The specimens may have been breeding in droppings in a turkey pound located on the Farm; when the turkeys were removed from the farm, the *C. glabra* population also disappeared.

It was surprising, therefore, when we discovered specimens of two congeneric species of Nearctic Camillidae in the Canadian National Collection of Insects. During 1993 several specialists and Diptera collections in North America were consulted about additional camillid specimens, but only one further specimen (belonging to a second genus) was located. Despite the paucity of

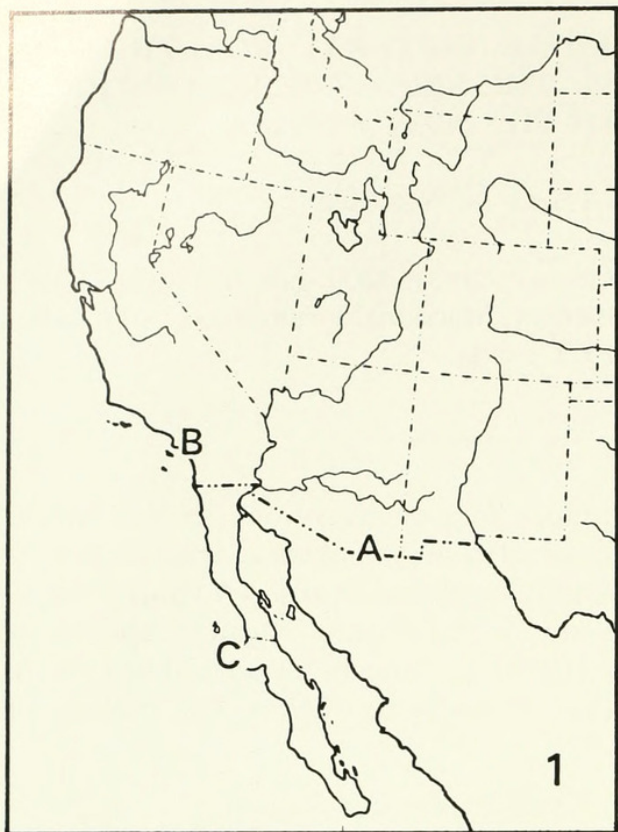


Fig. 1. Type localities of Nearctic Camillidae. *Afrocamilla arizona* (A), *A. bispinosa* (B), *Camilla arnaudi* (C).

material (each species is known from only one specimen), all three species are described, given the zoogeographic implications of their discovery. They represent the first endemic species of Camillidae from the New World. Two species, from Arizona and California, are described in *Afrocamilla*. The third species, from Mexico, is described in *Camilla*. All three species should exit at Camillidae in the key to families (adults) of Nearctic Diptera by McAlpine (1981), although the preapical dorsal bristle on the mid tibia is absent in one species of *Afrocamilla*.

MATERIALS AND METHODS

Specimens examined are deposited in the following institutions (acronyms in parentheses): California Academy of Sciences, San Francisco, USA (CASC); Canadian National Collection of Insects, Ottawa, Canada (CNCI). Holotype label data are cit-

ed exactly as they appear, with supplementary information in brackets; a slash denotes the end of a line of print and a semicolon separates data on different labels.

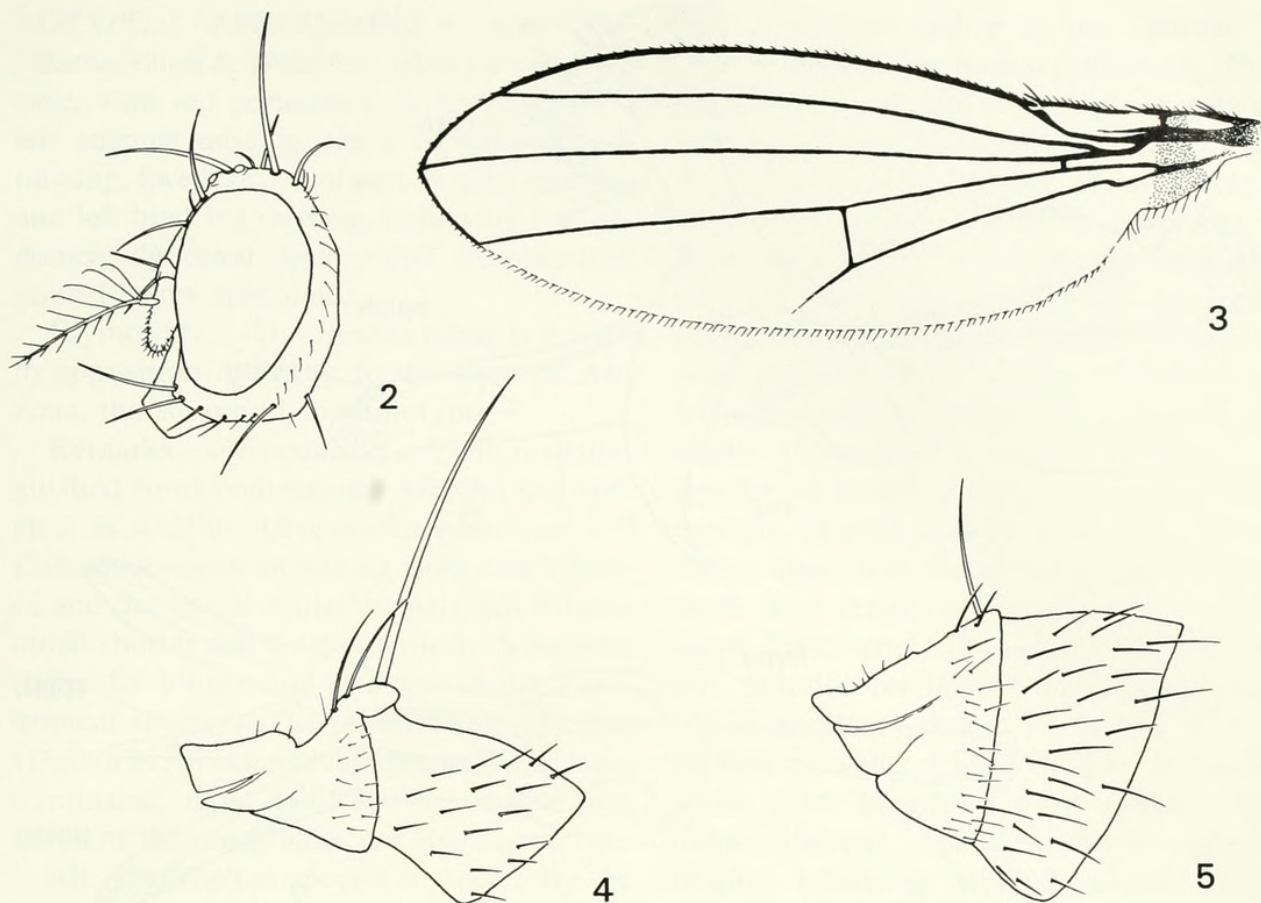
Abdomens were detached at or near their base and macerated in warm to hot 80–85% lactic acid or hot 10% KOH. After examination, dissected terminalia and associated abdominal parts were stored in glycerin in a microvial pinned beneath each source specimen.

Morphological terminology mainly follows Barraclough (1992, 1993); abbreviations are not used, except for tergum (T). Bilaterally symmetrical structures are described in the singular. Head/thorax length was measured from the anterior margin of the third antennal segment to the abdominal base. Wing length was measured from the humeral crossvein to the wing-tip.

KEY TO NEARCTIC SPECIES OF CAMILLIDAE

Camilla glabra is likely to be no longer established in North America and is omitted from this key.

1. Palpus dark brown. Scutellum with apical bristles longer and stronger than basal pair. Abdomen with paired median marginal T2 bristles shorter than length of T1+T2 (Fig. 5). T2 unmodified, not exerted above level of T3, and base of T3 not invaginated beneath posterior margin of T2 (Fig. 5) . . . *Camilla arnaudi* n. sp.
- Palpus yellow or yellow-brown. Scutellum with apical bristles noticeably shorter than basal pair. Abdomen with paired median marginal T2 bristles much longer than length of T1 + T2 (Fig. 4). T2 modified, exerted above level of T3, and base of T3 invaginated beneath posterior margin of T2 (Fig. 4) 2
2. Head and thorax predominantly dark brown, mesonotum sparsely pollinose. One vibrissa. Apical scutellar bristles about one-third length of basal pair. Mid tibia without dorsal preapical bristle *Afrocamilla arizona* n. sp.
- Head and thorax predominantly yellow-brown, mesonotum shining. Two vibrissae. Apical scutellar bristles about two-thirds length of basal pair. Mid tibia with dorsal preapical bristle *Afrocamilla bispinosa* n. sp.



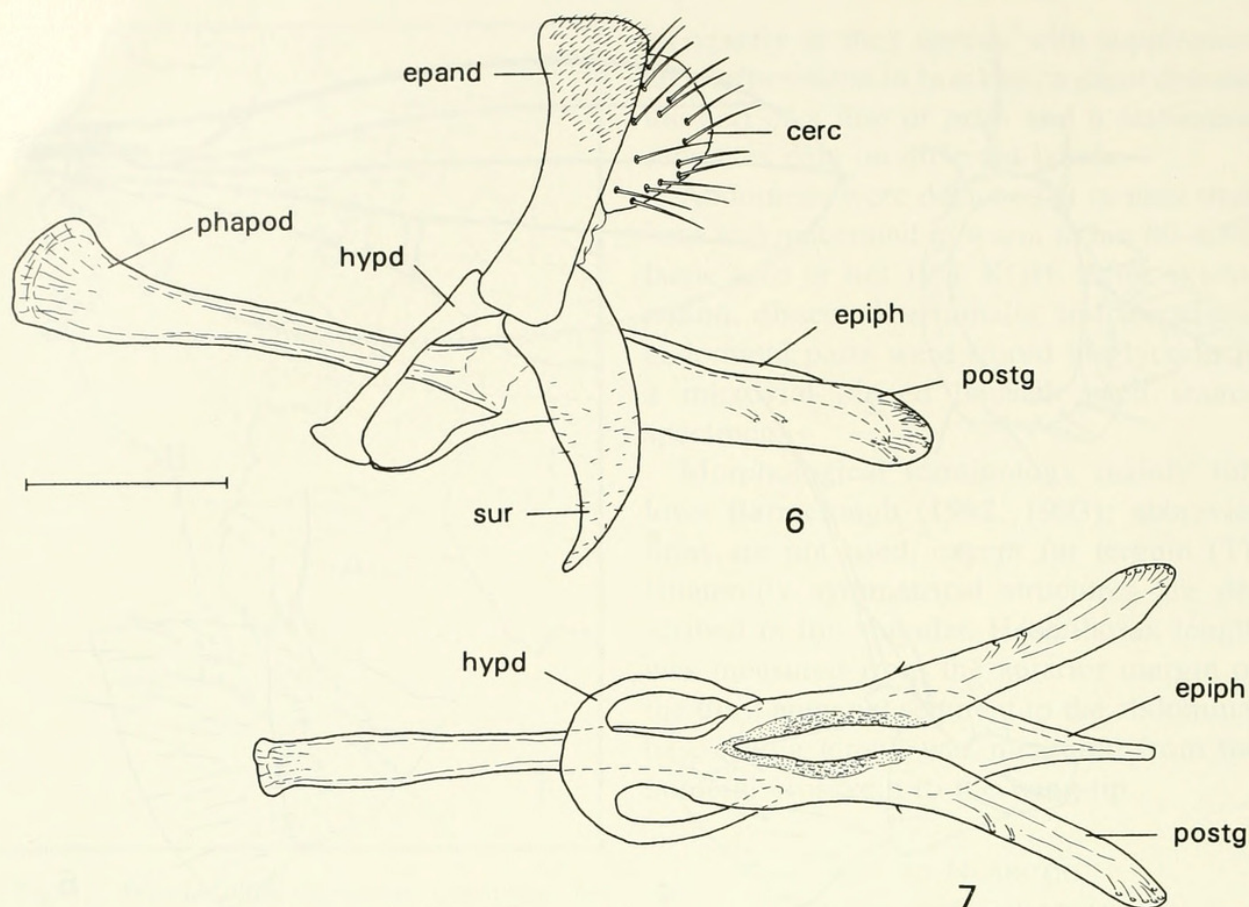
Figs. 2-5. External characters of Nearctic Camillidae. 2, *A. bispinosa*, head (lateral). 3, *A. arizona*, wing. 4, *A. arizona*, abdominal terga 1-3 (lateral). 5, *C. arnaudi*, abdominal terga 1-3 (lateral).

***Afrocamilla arizona* Barraclough and Wheeler, new species**

Figs. 3-4, 6-7

Description (based on ♂ holotype, ♀ unknown).—*Size*: Head/thorax length 1.2 mm; wing length 2.2 mm. *Color*: Head mainly dark brown to black; cheek, proboscis, palpus, antenna, upper facial region and lower parafacial yellow or yellow-brown; sparse silver pollinosity on occiput and face. Thorax dark brown, pleuron slightly paler, humeral callus and propleuron mostly yellowish; yellow to pale brown pollinosity present on mesonotum, sparse on posterior section of pleuron, dense on scutellum. Both fore legs missing; mid leg yellow, apical half of femur and basal third of tibia brown; hind leg yellow, femur partly brown-tinged on middle and tibia brown on basal two-fifths. Wing membrane mostly slightly smoky, but with pale brown transverse basal fascia, which is narrow anteri-

orly and expanded to about twice this width at posterior margin. Veins pale yellow. Abdomen dark brown to black with metallic reflections, pale at extreme base; T1 and T2 with sparse brown pollinosity. *Head*: Eye margin smoothly rounded anterodorsally in profile. Width of face and parafacials, at mid-height, subequal to length of antenna. Antenna with arisal vestiture barely discernible, but apparently shorter than in *A. bispinosa* (see below). Upper orbital plate inconspicuous anteriorly, width here about $0.6\times$ that of ocellar triangle. Postocellar bristles relatively well developed, length about $1.5\times$ that of ocellar triangle. Ocellar triangle not unusually elevated above upper eye margin in profile, distance less than length of second antennal segment. Proclinate fronto-orbital bristle present, anterior reclinate fronto-orbital about $0.25\times$ length of proclinate bristle. One vibrissa present. Cheek height in profile about $0.25\times$ length



Figs. 6–7. *Afrocamilla arizona*. 6, male terminalia (lateral). 7, hypandrium and phallic complex (ventral, distiphallus omitted). Scale bar = 0.1 mm. Abbreviations: epand—epandrium; hypd—hypandrium; cerc—cercus; sur—surstylus; phapod—phallapodeme; epiph—epiphallus; postg—postgonite.

of third antennal segment. *Thorax*: Apical scutellar marginal bristles weakly developed, about one-third length and strength of basal marginals. Fore femora missing (femoral armature unknown). Mid tibia without dorsal preapical bristle. Wing not unusually slender; without any slightly longer ventral spinules differentiated on costa between R_1 and R_{2+3} . *Abdomen*: T2 modified, exerted above level of T3, and base of T3 invaginated beneath posterior margin of T2; T2 with paired median marginal bristles much longer than length of T1 + T2 (Fig. 4). Spiracles 1–5 in membrane near lateral margins of terga. *Male postabdomen*: T6 reduced to slender lateral vestiges, narrowly separated dorsally, spiracle 6 in tergum near ventral margin. Epandrium narrow, rectangular in profile, anterior margin concave (Fig. 6). Cerci well developed, closely approximated, about $1.5\times$ higher than broad,

with short setae. Hypandrium narrow laterally, broader anteromedially, convex anteriorly, pregonites connected to anterior region of hypandrium via a broad ventral strip (Figs. 6–7). Epiphallus and postgonites relatively closely approximated in profile, epiphallus elongate, very narrow along much of length and tapered apically in profile (Fig. 6); postgonite unusually elongate and of uniform width along much of length, smoothly rounded apically in profile (Fig. 6). Surstylus approximately as long as height of epandrium, broad basally, narrowed and curved anteriorly at apex (Fig. 6).

Type material.—Holotype ♂ (CNCI), “Ramsey Canyon [31°27'N, 110°17'W] / Huachuca Mts. [Mountains] / 13.m[iles].s[outh]. Sierra Vista / Cochise Co[unty]. ARIZ[ona], U.S.A.] / Mar. 7–11.1967 / R. F. Sternitzki [sic = Sternitzky]” [all hand-written]; “HO-

LOTYPE ♂ / AFROCAMILLA / ARIZONA / Barraclough & Wheeler" [Red ink on white card, with red perimeter]. In fair condition: left antenna missing, some cephalic bristles missing, fore legs, distal part of right mid leg, and left hind leg missing. Left wing and abdomen dissected and stored in microvial pinned below specimen.

Etymology.—The species name is a noun in apposition referring to the state of Arizona, the source of the holotype.

Remarks.—*Afrocamilla arizona* is distinguished from both named Afrotropical species, as well as *Afrocamilla bispinosa* and *Camilla arnaudi* in having only one vibrissa and the apical scutellar marginal bristles much shorter and weaker than the basal pair (typically longer and stronger in the Afrotropical species). The presence of only one vibrissa in *Afrocamilla* is unusual. The male terminalia, most notably the length and shape of the postgonite, are also distinctive.

All Afrotropical species dissected by the senior author have the hypandrium quite different in shape in ventral view (cf. McAlpine 1987: 1024: Fig. 2) to that of *A. arizona*. In *A. arizona* the hypandrium is much narrower and also more smoothly rounded anteriorly.

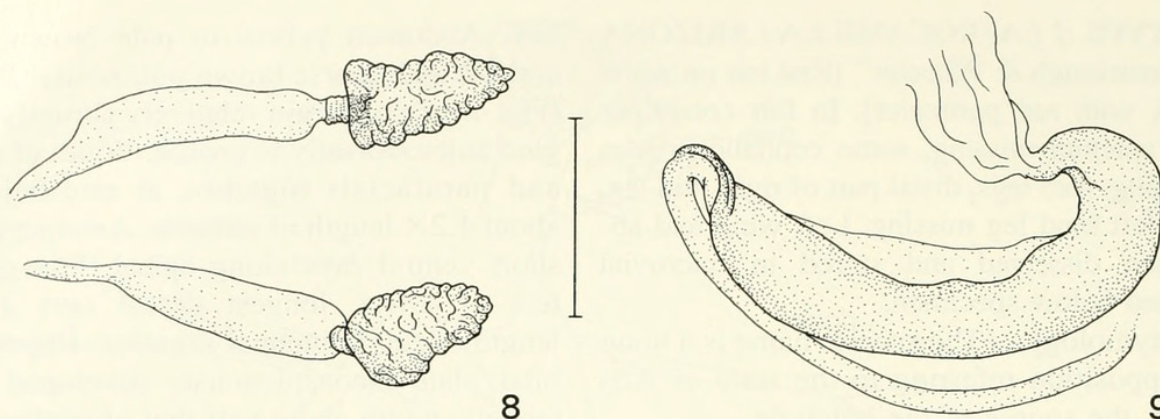
***Afrocamilla bispinosa* Barraclough and Wheeler, new species**

Figs. 2, 8–9

Description (based on ♀ holotype, ♂ unknown).—**Size:** Head/thorax length 1.3 mm; wing length 1.8 mm. **Color:** Head mainly yellow-brown, face and much of occiput paler; proboscis, third antennal segment and arista brown to dark brown; sparse pale yellow pollinosity on face and occiput. Thorax yellow to yellow-brown, legs paler, particularly coxae and trochanters which are pale yellow; sparse pollinosity present on anterior margin of mesonotum and posterior part of pleuron, denser, silver pollinosity on scutellum. Wing membrane mostly hyaline, but with pale yellow transverse basal fascia, which is uniformly narrow across base of wing. Veins pale yellow.

low. Abdomen yellow to pale brown; T1 and T2 with sparse brown pollinosity. **Head** (Fig. 2): Eye margin relatively abruptly angled anterodorsally in profile. Width of face and parafacials together, at mid-height, about $1.2\times$ length of antenna. Antenna with short ventral rays along apical three-quarters of arista, longest dorsal rays $1.1\times$ length of third antennal segment. Upper orbital plate inconspicuously developed anteriorly, width about half that of ocellar triangle. Postocellar bristles relatively well developed, length about $1.3\times$ that of ocellar triangle. Ocellar triangle unusually elevated above upper eye margin in profile, distance more than length of second antennal segment. Proclinate fronto-orbital bristle present, anterior reclinate fronto-orbital about $0.25\times$ length of proclinate bristle. Two vibrissae present. Cheek height in profile about $0.4\times$ length of third antennal segment. **Thorax:** Apical scutellar marginal bristles relatively well developed, about two-thirds length and strength of basal marginals. Fore femur with 2 well-developed anteroventral spines on apical third, length about $0.6\times$ maximum femoral diameter; posterodorsal and posteroventral bristles irregularly developed. Mid tibia with dorsal preapical bristle. Wing probably rather slender (folded in holotype); with 7–8 slightly longer ventral spinules differentiated on costa between R_1 and R_{2+3} . **Abdomen:** T2 modified, exserted above level of T3, and base of T3 invaginated beneath posterior margin of T2; T2 with paired median marginal bristles much longer than length of T1 + T2 (as in Fig. 4). T5 about half length of T4; segments 5 and 6 with spiracles small, just discernible. **Female postabdomen:** Two sclerotized spermathecae present, small, rugose, broader at base, sclerotized portion of spermathecal duct short, membranous portion of spermathecal duct expanded (Fig. 8). Ventral receptacle C-shaped, narrowed at mid-length and at each extremity, with slender, tubular, non-sclerotized appendage at one end (Fig. 9).

Type material.—Holotype ♀ (CNCI),



Figs. 8–9. *Afrocamilla bispinosa*. 8, spermathecae. 9, ventral receptacle (lateral). Scale bar = 0.05 mm.

“[U.S.A.: California] San Dimas Can[yon]. [34°08'N, 117°46'W] / Los Angeles Co[unty]. / II-2-1958 / Reared III-10-58”; “Collector / R.E. Ryckman”; “HOLOTYPE ♀ / AFROCAMILLA / BISPINOSA / Barraclough & Wheeler” [Red ink on white card, with red perimeter]. In fairly good condition, right wing mostly missing and two fronto-orbital bristles detached. Abdomen dissected and stored in microvial pinned below specimen.

Etymology.—The species name refers to the two anteroventral spines on the fore femur (L. *bi* = two, *spinosa* = spine).

Remarks.—Although this species possesses the three major character states defining *Afrocamilla* (basal wing fascia, elongate T2 median marginal bristles, T2 apex and base of T3 modified), it differs from all known African species in two significant characters. The first of these, the presence of two anteroventral spines on the fore femur, is possibly unique in *Afrocamilla* (the fore legs of the unique holotype of *A. arizona* are missing) and also distinguishes *A. bispinosa* from *Camilla arnaudi*. Intra-generic variation in femoral armature does occur in other camillid genera (e.g. *Katacamilla*). The second character is the well-sclerotized spermathecae. In all African material examined by the senior author the spermathecae are less strongly sclerotized than the ventral receptacle.

In addition to the above characters *Afrocamilla bispinosa* is distinguished from

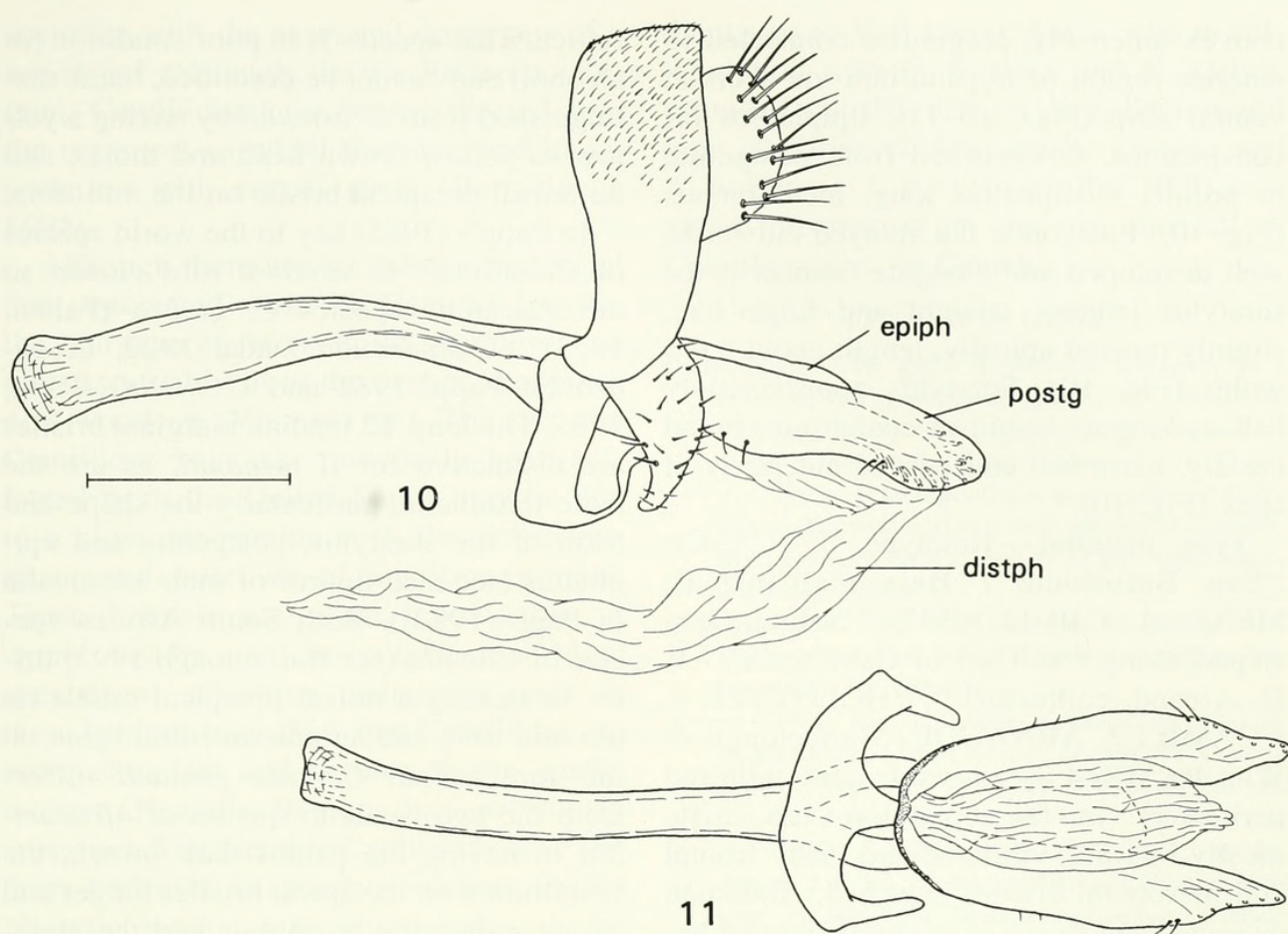
all other species of the genus by the dorsal preapical bristle on the mid tibia. *A. bispinosa* is an unusually pale species, although the senior author has seen a comparable South African species, apparently not closely related. The color of *A. bispinosa* appears to be fully developed.

The holotype was reared by R. E. Ryckman from material collected in southern California (Fig. 1). There is no further information associated with the specimen but it may have been reared from the nest of a wood rat (*Neotoma* sp., Cricetidae) (V. F. Lee, personal communication).

***Camilla arnaudi* Barraclough and Wheeler, new species**

Figs. 5, 10–11

Description (based on ♂ holotype, ♀ unknown).—**Size:** Head/thorax length 1.4 mm; wing length 2.5 mm. **Color:** Head dark brown, cheek and anterior margin of frons slightly paler and antenna (except arista) partly yellowish; pollinosity silver to pale brown, most evident on occipital region. Thorax dark brown, dense, golden pollinosity present on scutellum. Legs yellow to yellow-brown, tarsi slightly darker. Wing hyaline, veins pale yellow. Abdomen dark brown to black with metallic appearance; brown pollinosity present on T1 and T2. **Head:** First antennal segment concealed, not visible in profile or frontal view. Third antennal segment smoothly and evenly rounded apically, dorso-apical section



Figs. 10–11. *Camilla arnaudi*. 10, male terminalia (lateral). 11, hypandrium and phallic complex (ventral). Scale bar = 0.1 mm. Abbreviations: distph—distiphallus; epiph—epiphallus; postg—postgonite.

without noticeably longer pubescence. Arista with inconspicuous ventral rays along apical two-thirds to three-quarters, length of these at most subequal to width of arista at base, longest dorsal rays subequal in length to width of third antennal segment in profile. Width of face and parafacials together, at mid-height, just less than length of antenna. Two vibrissae (both missing in type), peristomal bristles mostly missing. Vibrissal angle not prominent, about coincident with anterior extent of profrons in profile. Facial region somewhat excavate, epistomal margin upturned towards antennal bases. Cheek height in profile about $0.9 \times$ length of third antennal segment. Occiput with upper half extensively excavate. *Thorax*: Anterior sternopleural bristle not evident (sternopleurals detached). Scutellar marginal bristles of similar strength, apical bristles slightly longer than basal bristles. Fore fe-

mur with small anteroventral spine (femur crumpled, length of spine relative to femoral diameter not measurable). Mid tibia with dorsal preapical bristle. Wing moderately broad, not pointed apically. Costal vestiture between R_1 and R_{2+3} relatively short and sparse, longer spinules not differentiated. *Abdomen*: T2 with paired median marginal bristles, these distinctly longer and stronger than other tergal bristles, length $0.6\text{--}0.7 \times$ length of $T1 + T2$ (Fig. 5). Spiracles 1–5 in membrane near lateral margins of terga. *Male postabdomen*: T6 reduced to 2 slender sclerites, narrowly separated dorsally, spiracle 6 in tergum near ventral margin. Epandrium narrow, width at junction with surstylus about two-thirds that at dorsal margin (Fig. 10). Cerci well developed, closely approximated, about $1.5 \times$ higher than broad, with short setae. Hypandrium narrow laterally, broader anteriorly,

convex anteriorly, pregonites connected to anterior region of hypandrium via a broad ventral strip (Figs. 10–11). Epiphallus inconspicuous, downcurved from postgonite in profile. Distiphallus long, membranous (Fig. 10). Postgonite not splayed outwards, well developed and elongate (almost twice surstylus length), straight and finger-like, slightly tapered apically, length about $5.0 \times$ width (Fig. 10). Surstylus approximately half as long as height of epandrium, broad basally, narrowed and curved anteriorly at apex (Fig. 10).

Type material.—Holotype ♂ (CASC): “San Bartolome / Baja Calif[ornia]. MEX[ico]. / III-12-1953”; “Sefton Orca Exped[ition]. / to Gulf of Calif[ornia]. / P. H. Arnaud, coll[ector].”; “HOLOTYPE ♂ / CAMILLA ARNAUDI / Barraclough & Wheeler” [Red ink on white card, with red perimeter]. In fair condition, left arista mostly missing, vibrissae and many frontal and mesonotal bristles detached. Abdomen dissected and stored in microvial pinned below specimen.

Etymology.—This species is named for the collector of the holotype, Dr. P. H. Arnaud, Jr.

Remarks.—At first examination, this species appeared to be an unusually robust *Afrocamilla*. However, dissection of the abdomen showed T2 and T3 to be unmodified, and the wing does not have a transverse basal fascia. The T2 median marginal bristles are unusually well developed for *Camilla*, but are substantially shorter and weaker than in *Afrocamilla*, in which they are usually longer than the length of T1 + T2. It is likely that there is correlation between the development of these bristles and the modification of T2 and T3, as the bristles and associated musculature in the modified T2 and T3 are probably used to move the folded wings (Barraclough 1992). We are not aware of any other named *Camilla* species with similarly developed bristles. However, the senior author has seen 1 ♂ and 1 ♀ of a cavernicolous *Camilla* species from the northern Cape Province of South

Africa. That species is in poor condition (in alcohol) and cannot be described, but is distinguished from *C. arnaudi* by having a yellow to yellow-brown head and thorax and no dorsal preapical bristle on the mid tibia.

In Papp's (1985) key to the world species of Camillidae, *C. arnaudi* runs closest to the Palearctic species *C. glabra* (Fallén, 1823), *C. flavicauda* Duda, 1922, *C. sabroskyi* Papp, 1982 and *C. mathisi* Papp, 1985. The long T2 median marginal bristles are distinctive for *C. arnaudi*, as are the male terminalia, particularly the shape and form of the surstylus, postgonite and epiphallus (see also figures of male terminalia in Papp (1982)). Both South African species of *Camilla* (see Barraclough 1993) differ in lacking a dorsal preapical bristle on the mid tibia and an anteroventral spine on the fore femur. *Camilla arnaudi* differs from the two Nearctic species of *Afrocamilla* in having the palpus dark brown, the scutellum with the apical bristles longer and stronger than the basal pair and the abdomen with the paired median marginal T2 bristles shorter than the length of T1 + T2.

The large distiphallus in this species may be apparent only in specimens cleared in lactic acid. The distiphallus is often overcleared or lost in specimens cleared in KOH.

DISCUSSION

Information about the biology of Camillidae has been limited for many years, but has recently been supplemented by further data by Barraclough (1992, 1993). In southern Africa, Camillidae have been reared from the droppings of the rock hyrax, *Procavia capensis* (Pallas) (Procaviidae), and have been shown to have a close association with the latrines of this small mammal in the subregion, and a *Procavia* species in Kenya (Barraclough, unpublished data). Southern African Camillidae have also been collected near droppings of Chiroptera or in areas inhabited by bats (Barraclough, unpublished data). It appears that African Camillidae are coprophagous and live in as-

sociation with the nests and droppings of a variety of mammals. In the Palearctic Region, Camillidae have been collected near the entrances to rabbit burrows, and in association with rodent nests (Barracough 1992).

Although there are no definite biological data associated with the Nearctic species, the holotype of *Afrocamilla bispinosa* was reared, possibly from the nest or droppings of a wood rat (*Neotoma* sp.). The fact that Camillidae have not previously been collected from the United States may be due to a close association with the droppings, nests and burrows of small mammals. These habitats are often inaccessible or overlooked by many insect collectors. More specialized collecting techniques used in these habitats may show that Camillidae are more abundant and diverse in the southwestern Nearctic Region than previously supposed. The fact that Camillidae have not been collected in greater numbers in the Nearctic Region may also be due to the phenology of the species. The types of all three species were collected in late winter and early spring (February/March), a time when there is generally much less collecting effort in North America.

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