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TWO NEW SPECIES OF BITING MIDGES AND NEW COLLECTION RECORDS OF THE GENUS *CULICOIDES* (DIPTERA: CERATOPOGONIDAE) FROM SRI LANKA

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Abstract.—Two new species, *Culicoides* ***mathisi*** and *C.* ***roswelli,*** are described from Sri Lanka. Previous records of *C. schultzei* from Sri Lanka are corrected to *C. oxystoma* Kieffer. Seven additional species are reported from Sri Lanka for the first time, bringing the total number of species known from that country to 36.

Recently we published a check list of the *Culicoides* species of Sri Lanka (Giles et al., 1981). In this list, which contains 27 species, we wrongly identified specimens as *C. schultzei* (Enderlein). We have re-examined these specimens and have identified them as *C. oxystoma* Kieffer. Studies of additional Sri Lanka material allow us to record the presence of the following additional ten species, two of which are new, bringing the total count of Sri Lanka *Culicoides* species to 36: *C. arakawai* (Arakawa), *C. clavipalpis* Mukerji, *C. mathisi,* n. sp., *C. oxystoma* Kieffer, *C. pampangensis* Delfinado, *C. paraflavescens* Wirth and Hubert, *C. roswelli,* n. sp., *C. sigaensis* Tokunaga, *C. similis* Carter, Ingram, and Macfie, and *C. subpalpifer* Wirth and Hubert.

For explanation of methods of measurement and of ratios used see Giles et al. (1981). The first values presented are those of the holotype followed by the range of variation of the paratypes in parentheses.

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Culicoides mathisi Giles and Wirth, New Species

Fig. 1

Female holotype.—Wing length 0.92 (0.87–0.97, $n = 7$) mm.

Head: Brownish; eyes bare, contiguous for a distance equal to diameter of 2 facets (Fig. 1f). Antennal segments 3–8 pale with apices darker, 9–15 light brown; verticils well developed on all segments; flagellar segments (Fig. 1a) with lengths in proportion of 34-24-26-28-29-28-27-28-40-44-46-46-66; antennal ratio 1.07 (1.00–1.10, $n = 7$); sensillar coeloconica present on segments 3, (5), 7, 9, 11–15. Palpus (Fig. 1b) brown; lengths of segments in proportion of 14-36-54-23-22; 3rd segment swollen subapically, sensory pit broad and shallow; palpal ratio 2.46

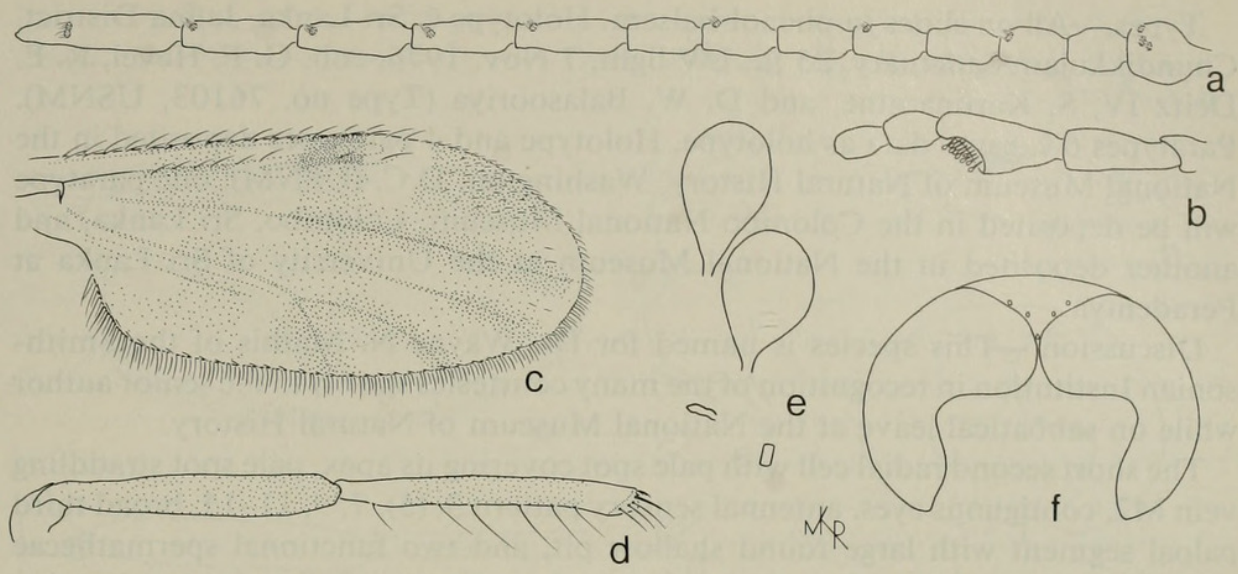

Fig. 1. *Culicoides mathisi,* female. a, Antenna. b, Palpus. c, Wing. d, Hindfemur and hindtibia. e, Spermathecae. f, Eye separation.

(2.45–2.60, $n = 7$). Proboscis brown, moderately long, P/H ratio 0.76 (0.76–0.81, $n = 7$); mandible with 15 (14–16, $n = 7$) well-developed teeth, the proximal and distal teeth in the series slightly larger.

Thorax: Dark brown, pleura paler. Legs (Fig. 1d) brown; femora slightly paler at bases; forefemur with faint subapical pale band, midfemur paler at apex, hindfemur the darkest and concolorous to apex; tibiae with subbasal pale bands; fore- and midtibiae but slightly paler at apices, hindtibia with apical pale band; hindtibial comb with 4 spines ($n = 6$), the second from the spur longest.

Wing (Fig. 1c): Brown with moderately prominent pale spots; pale spot over r-m crossvein extending from about midway in cell M2, expanding laterally in cell Sc and R5 to cover proximal ½ of the 1st radial cell, then narrowing to meet the costa broadly; Rs strong and dark; poststigmatic pale spot in cell R5 quadrate, covering apical ¾ of 2nd radial cell and extending posterad to about ½ the width of cell R5; cell R5 with a faint pale streak emerging from the poststigmatic spot, extending distally and expanding at the wing tip to form a marginal spot; vein M2 straddled in midportion by a pale spot that divides, extends faintly as narrow streaks to apices of cells M1 and M2, expanding apically to form marginal pale spots at wing tip; the 3 apical spots meeting narrowly at the vein apices to form a contiguous pale wing tip; cell M2 with a large pale spot immediately anterad of the mediocubital fork; cell M4 with a large semicircular pale spot at wing margin; anal cell with a large distal spot extending from mediocubital stem to wing margin; base of wing with a large pale area extending about ½ the distance from the arculus to the r-m crossvein and diagonally posterad to about ½ the width of the anal cell. Macrotrichia very sparse on apical ⅖ of wing; costal ratio 0.61 (0.60–0.63, $n = 7$). Halter pale.

Abdomen: Pale brown with 8th and 9th segments darker, cerci pale. Spermathecae (Fig. 1e) 2, slightly unequal, measuring 0.058 by 0.032 mm and 0.051 by 0.033 mm, oval with moderately tapering necks; rudimentary spermatheca and sclerotized ring present.

Male.—Unknown.

Distribution.—Sri Lanka.

Types.—All on slides in phenol-balsam. Holotype ♀, Sri Lanka, Jaffna District, Chundikkulam Sanctuary, 25 ft., UV light, 7 Nov. 1976, coll. G. F. Hevel, R. E. Deitz IV, S. Karunaratne, and D. W. Balasooriya (Type no. 76103, USNM). Paratypes 6 ♀, same data as holotype. Holotype and 4 paratypes deposited in the National Museum of Natural History, Washington, D.C. (USNM); one paratype will be deposited in the Colombo National Museum, Colombo, Sri Lanka, and another deposited in the National Museum at the University of Sri Lanka at Peradeniya.

Discussion.—This species is named for Dr. Wayne N. Mathis of the Smithsonian Institution in recognition of the many courtesies shown to the senior author while on sabbatical leave at the National Museum of Natural History.

The short second radial cell with pale spot covering its apex, pale spot straddling vein M2, contiguous eyes, antennal sensory pattern 3, (5), 7, 9, 11–15, broad third palpal segment with large round shallow pit, and two functional spermathecae with long slender necks place *C. mathisi* in the subgenus *Culicoides,* but its wing pattern is quite unlike other species in this taxon in the following respects: In other species of *Culicoides* s. str. the distal pale spot in cell R5 is usually distinct, transverse, and located well proximad of the apex of the wing, whereas in *mathisi* there is only a rather poorly marked pale area at the tip of the cell; in other species with distal pale spots in cells M1, M2, and M4 are usually rounded and more or less removed from the wing margin whereas in *mathisi* these spots have their broadest portion at the extreme wing margin, more like the condition found in the subgenus *Avaritia.* This species appears to belong in a distinct group of its own in *Culicoides* s. str.

Culicoides roswelli Giles and Wirth, New Species

Fig. 2

Female holotype.—Wing length 0.93 (0.80–0.97, $n = 10$) mm.

Head: Dark brown; eyes bare, almost contiguous, interocular space (Fig. 2f) narrowly wedge-shaped. Antenna (Fig. 2a) pale brown, verticils well developed on segments 3–10; flagellar segments with lengths in proportion of 36-20-24-23-24-22-23-27-41-45-46-46-70; antennal ratio 1.25 (1.15–1.29, $n = 7$); sensilla coeloconica present on segments 3–10, usually 2–3 per segment. Palpus (Fig. 2b) pale brown; lengths of segments (of paratype) in proportion of 5-15-27-8-11; 3rd segment markedly swollen from base, sensory pit broad, shallow, located on distal ½; palpal ratio 2.0 (1.59–2.0, $n = 10$). Proboscis brown, short, P/H ratio 0.61 (0.59–0.65, $n = 10$); mandible with 7 (7–9, $n = 10$) well developed teeth increasing in size distally.

Thorax: Dark brown with paler areas on mesonotum; pleuron yellowish brown, darkening posterad. Legs (Fig. 2d) moderately dark brown; femora with broad pale basal bands; fore- and midfemora with broad pale subapical bands; fore- and midfemora with broad pale subapical bands; hindfemur dark to tip; all knee spots blackish; tibiae with broad subbasal pale bands, distal ½ pale; hindtibia slightly darkened at comb, comb with 4 ($n = 10$) spines, the one nearest the spur longest.

Wing (Fig. 2c): Light brown with prominent pale spots; pale spot on r-m crossvein barely covering crossvein proximally, extending from vein M1 anterad and covering $^5/_6$ of 1st radial cell to broadly meet costa, a thin finger of this spot extending distally toward 2nd radial cell and below this a dark projection of vein

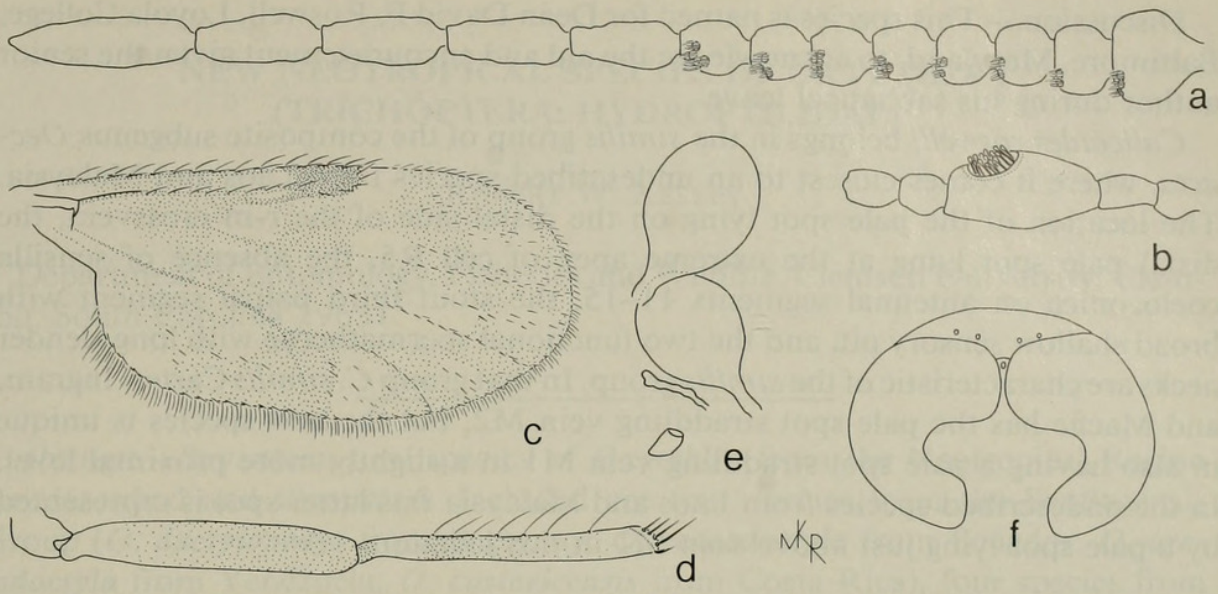

Fig. 2. *Culicoides roswelli,* female. a, Antenna. b, Palpus. c, Wing. d, Hindfemur and hindtibia. e, Spermathecae. f, Eye separation.

Rs extending basally into the spot; a very dark stigma extending to tip of 2nd radial cell; poststigmatic pale spot in cell R5 quadrate and extending faintly posterad to merge with pale spot over the r-m crossvein; cell R5 with a large more or less semicircular distal spot meeting wing margin, emarginate proximad and not reaching vein M1 caudad; a pale spot straddling vein M1 posterad of the poststigmatic spot to merge with a pale streak in cell M1, and merging posterad with pale spot straddling midportion of vein M2; cells M1 and M2 each with rounded distal pale spot attaining wing margin; cell M2 with a pale spot behind medial fork and a large pale spot lying in front of mediocubital fork; midway in cell M4 a large pale spot extending from vein M3 + 4 to wing margin; base of wing with pale area extending posterad from costa, covering the arculus and extending distally along anterior side of mediocubital stem; anal cell with a large pale area covering anal lobe and small round pale spot in distal portion. Macrotrichia abundant along veins and on membrane on distal ½ of wing; costal ratio 0.56 (0.54–0.58, $n = 10$). Halter pale.

Abdomen: Brown, 10th segment and cerci pale. Spermathecae (Fig. 2e) 2, oval with long slender necks; slightly unequal, measuring 0.067 by 0.039 mm and 0.062 by 0.035 mm; rudimentary spermatheca and sclerotized ring present.

Male.—Unknown.

Distribution.—Sri Lanka.

Types.—All on slides in phenol balsam. Holotype ♀, Sri Lanka, Anuradhapura District, Hunuwilagana near Wilpattu, 200 ft., UV light, 28 Oct–3 Nov 1976, coll. G. F. Hevel, R. E. Deitz IV, S. Karunaratne, and D. W. Balasooriya (Type no. 76118, USNM). Paratypes, 31 ♀, same data as holotype. Holotype and 29 paratypes deposited in USNM; 1 paratype will be deposited in the Colombo National Museum, Colombo, Sri Lanka and another deposited in the National Museum at the University of Sri Lanka at Peradeniya. Paratype ♀, Sri Lanka, Kegalle District, Kitulagala Resthouse, 3–5 Feb. 1979, UV trap, coll. K. V. Krombein, P. B. Karunaratne, T. Wijesinhe, S. Siriwardane, and T. Gunawardane (deposited in USNM).

Discussion.—This species is named for Dean David F. Roswell, Loyola College, Baltimore, Maryland, to acknowledge the aid and encouragement given the senior author during his sabbatical leave.

Culicoides roswelli belongs in the *similis* group of the composite subgenus *Oecacta,* where it comes closest to an undescribed species from Laos and Malaysia. The location of the pale spot lying on the distal side of the r-m crossvein, the distal pale spot lying at the extreme apex of cell R5, the absence of sensilla coeloconica on antennal segments 11–15, the stout third palpal segment with broad shallow sensory pit, and the two functional spermathecae with long slender necks are characteristic of the *similis* group. In that group *C. similis* Carter, Ingram, and Macfie has the pale spot straddling vein M2, but the new species is unique in also having a pale spot straddling vein M1 in a slightly more proximal level. In the undescribed species from Laos and Malaysia this latter spot is represented by a pale spot lying just above vein M1 in this location.

Literature Cited

Giles, F. E., W. W. Wirth, and D. H. Messersmith. 1981. Two new species of biting midges and a check list of the genus *Culicoides* (Diptera: Ceratopogonidae) from Sri Lanka. Proc. Entomol. Soc. Wash. 83: 537–543.