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NOTES AND REDESCRIPTIONS OF SOME *ANOPHELES* SERIES ARRIBALZAGIA HOLOTYPES (DIPTERA: CULICIDAE) IN THE BRITISH MUSEUM (NATURAL HISTORY)

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Abstract.—Notes and redescriptions are given for four holotypes of *Anopheles* (*Anopheles*) Series Arribalzagia in the British Museum (Natural History). *Anopheles mediopunctatus, An. maculipes* and *An. venezuelae* (=*punctimacula*) are described and illustrated and notes given for *An. amazonicus* (=*mattogrossensis*). Dissection of male genitalia of *An. mediopunctatus* shows that this species is probably commonly misidentified throughout South America.

Key Words: *Anopheles*, Arribalzagia, *mediopunctatus, maculipes, venezuelae, punctimacula, amazonicus, mattogrossensis,* taxonomy

Series Arribalzagia (Theobald 1903, as genus) is a neotropical group of *Anopheles* (*Anopheles*) mosquitoes containing 33 nominal species, among which are known or suspected vectors of malaria parasites. In the only objective attempt to define this group Reid and Knight (1961) listed 19 valid names. Two additional species, *An. veruslanei* Vargas and *An. anchietai* Correa and Ramalho, have been added since by their respective authors. Reid and Knight considered all New World *Anopheles* (*Anopheles*) with laticorn pupal trumpets to belong in the Arribalzagia Series.

The following is part of a review of Series Arribalzagia. This review demands revalidation of present species concepts. Below are redescriptions and/or comments on the four nominal species present in the British Museum (Natural History). Two of these, *An. maculipes* (Theobald) and *An. mediopunctatus* (Theobald) are valid species and are described and illustrated in full. The other two, *An. venezuelae* Evans and *An. amazonicus* Christophers are junior synonyms of *An. punctimacula* Dyar and Knab and *An. mattogrossensis* Lutz and Neiva respectively. Since both are adequately described in the literature, there is no need for detailed redescriptions, though *venezuelae* is illustrated. *Anopheles maculipes* and *An. mediopunctatus* have clear priority and there is no doubt as to their status. I have seen the types of *An. punctimacula* and *An. mattogrossensis* and agree that *An. venezuelae* and *An. amazonicus* are indeed junior synonyms.

Anopheles mediopunctatus (Theobald)

(Figs. 1A–E, 2A–D)

Theobald 1903, 3: 60–62 (as *Cycloleppteron*).

Diagnosis.—A yellow and brown to dark brown species with predominantly yellow palpi and 3 small dark spots on the scutum. Wings with broad brown and pale yellowish scales and 3 primary costal dark spots. Legs

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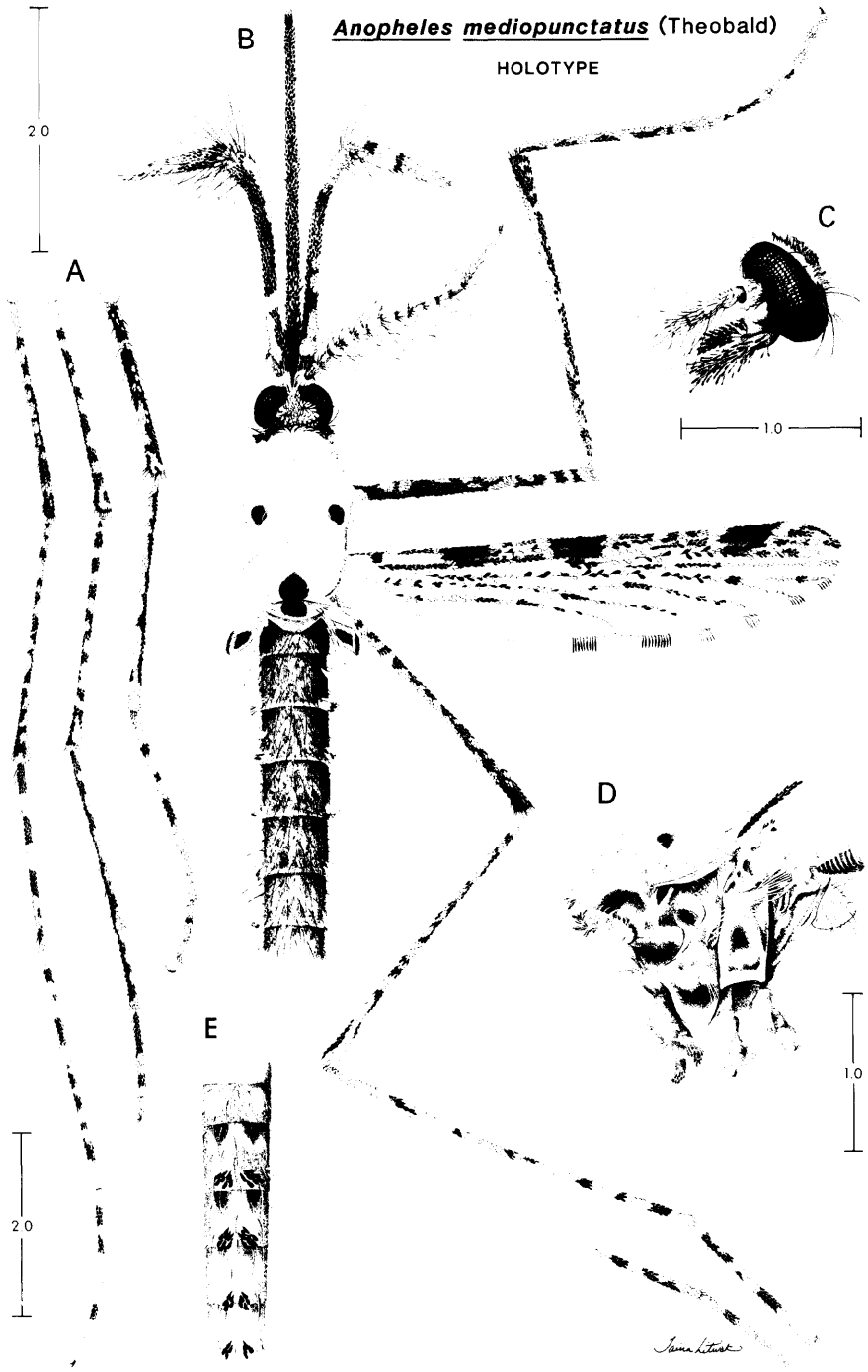

Fig. 1. A–D, holotype *Anopheles mediopunctatus* (Theobald). A, legs, posterior view. B, habitus. C, head lateral view. D, thorax, lateral view. E, venter of abdomen. All scale lines in mm.

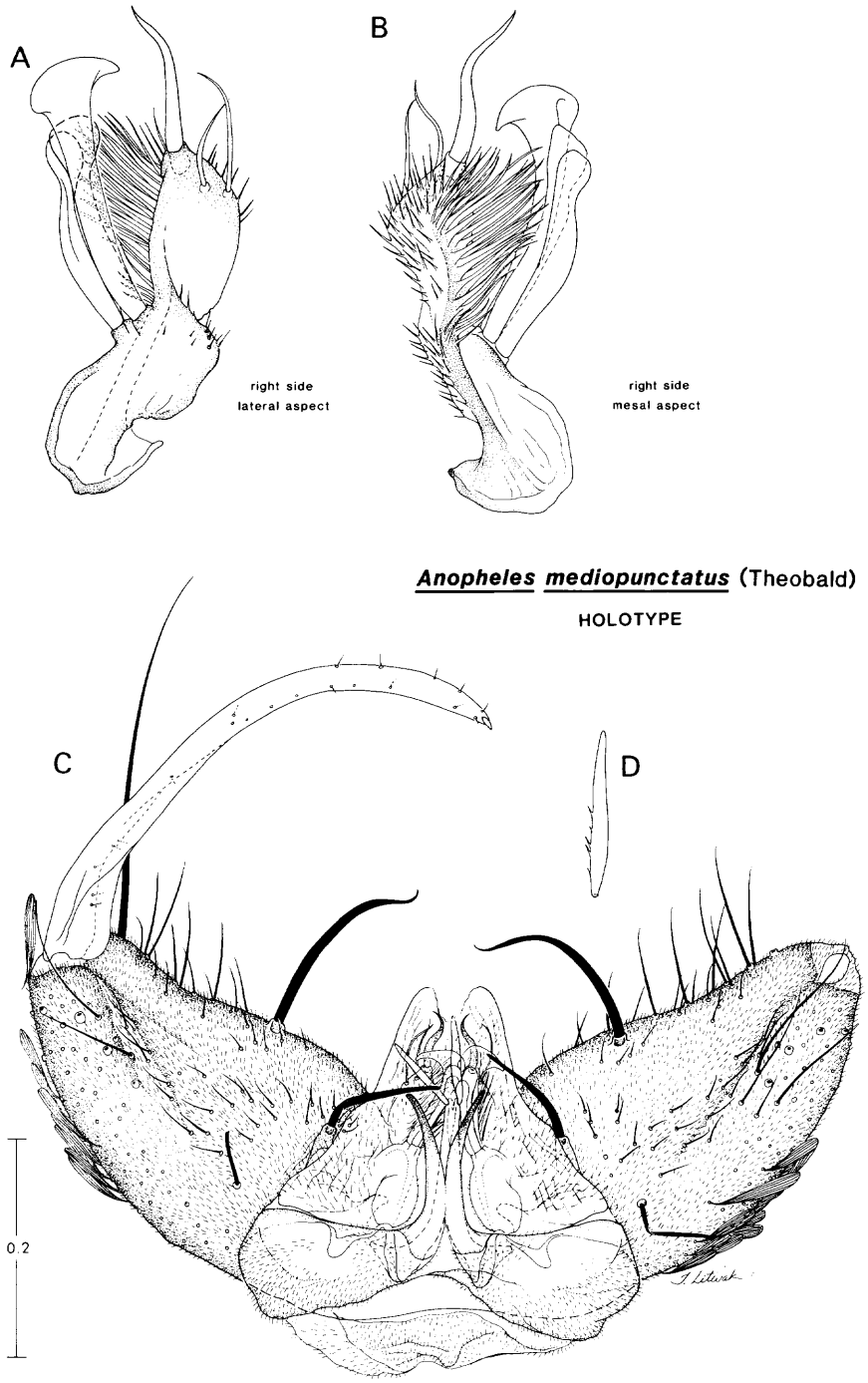

Fig. 2. A–D, holotype *Anopheles mediopunctatus* (Theobald) male genitalia. A, claspette, lateral view. B, claspette, mesal view. C, genitalia before dissection. D, aedeagal leaflet. Scale line in mm.

speckled pale yellowish on brown, tarsomere 5 of all legs pale. Pleuron with a patch of scales on the middle of the mesokatepisternum and several scales on the upper mesanepimeron. Abdomen with posterolateral brown and pale yellow scale patches on terga II–VI.

Label data.—Red circle "Holotype"; handwritten "Cycloleppteron mediopunctatus (Type male) (F.V.T.)"; handwritten "Sao Paulo Dr. Lutz"; cardboard circle to which specimen is attached by a small pin has on its underside some nearly illegible writing "Santos S---ya 14 VI 02 E--- Carva?"

Also affixed to the pin with the specimen is a piece of thin glass attached to a piece of cardboard. Originally this held the male genitalia which is now mounted on a slide with the following labels: Left label, handwritten "male genitalia Cycloleppteron mediopunctatus Theobald," printed "Holotype." Right label, handwritten "Brazil: Sao Paulo Dr. Lutz Santos ?Suanija 14.VI.02 ?ex carva see pinned collection." Also a red circle holotype label. This preparation was remounted for study.

Also received from the British Museum was a slide mount of a wing presumably in Canada balsam. It also has a red circle holotype label but cannot be part of the adult holotype since both wings are present even though part of one is glued to the cardboard to which the specimen is pinned. This one is probably the mount sent by Lutz to Theobald as mentioned in the original description.

Condition of specimen.—Male. Overall in very good condition, not rubbed or faded. Left foretarsomere 5 missing. Left wing broken off at the presector dark spot, the broken portion glued to the cardboard base. Genitalia dissected, slide mounted; abdominal segments I–VI present. A small pin is inserted through sternum I, the tip emerging posteriorly on the scutum. The genitalia were mounted in a water soluble medium of unknown composition. When the media was dissolved the genitalia proved to be very brittle and the weight of the small coverslip caused much damage to the gonocoxites. Further manipulation in order to see the claspettes also resulted in some damage. Published here are drawings before remounting and interpretation of the structures revealed by remounting (Fig. 2A–D).

Description.—Wing length 4.2 mm; width 0.8 mm; proboscis 3.9 mm; Forefemur 2.0 mm.

Head: Integument of postgena, occiput, vertex, interocular space, pedicels and clypeus dark brown, with a light covering of silvery pollinosity, more dense and apparent at the vertex. Frontal tuft of long pale yellowish white setae; tuft continuous onto the vertex. Five or 6 slender pale yellowish white appressed, ocular scales present. Vertex and occiput with numerous erect pale brown spatulate, truncate scales; 8 to 10 long, pale brown ocular setae present on each side; about 8 long pale brown postgenal setae and a few long pale brown labial basal setae present. Antennal pedicel with 6 to 7 scattered slender pale yellowish scales on its outer surface; 14 antennal flagellomeres present; flagellomere 1 with 6 or 7 slender pale yellowish white scales on its mesal and dorsal surfaces and a few dark brown scales and setae on its lateral surface; flagellomeres 2–12 quite plumose, the setae pale yellowish brown; flagellomeres 13 and 14 elongated, 13 about twice length of 14, with sparser much shorter setae than remainder of antenna. Palpi dark brown in ground color; dark scales dark brown, pale scales pale yellow but darkening to nearly golden yellow on palpomere 5; basal scales broad and erect, the scales of palpomere 5 long slender and appressed; setae at tip of palpomeres 4 and 5 mostly pale yellow but with some brown setae mostly at the tip of palpomere 4. Proboscis dark brown, covered with slender mostly appressed dark brown scales and short dark setae; scattered pale yellowish brown scales intermixed on basal half; the scales at the base broader, more numerous and erect.

Thorax: Scutal integument with 3 prom-

inent dark brown spots, 2 on either side just posterior to the ends of the prescutal sutures and one at the posterior margin of the scutum which continues onto the scutellum. Scutum otherwise pale brown to brown in ground color covered with silvery blue pollinosity and scattered slender pale yellowish to pale brown setae; a few slender scales present between the scutal angle and the wing base; denser pale narrow scale-like setae present anteriorly; small darker spots which lack pollinosity are scattered over the surface of the scutum corresponding to setal insertions. Ground color of pleuron brown to dark brown, the pale areas made so by a covering of silvery pollinosity, the dark areas by dark brown pollinosity; antepronotum with a dense patch of dark brown spatulate scales anteriorly and a few pale scales posteriorly; antepronotal setae numerous, pale yellowish brown; upper proepisternum with 3–4 pale setae, below and anterior to these 1–2 small pale scales present; pleural setae and scales pale yellow and pale yellowish white, respectively; mesokatepisternum with upper intermixed scales and setae, a small median dense patch of scales, and a few setae below; upper mesanepimeron with a patch of long setae and just below these 2 broad scales. Forecoxa with an upper anterior patch of small yellow scales, intermixed with and continuing below these scales are about 12 long dark setae; laterally a small dense patch of white scales below and a few scattered pale yellow scales above; posteriorly is a dense patch of long dark brown scales with a few dark setae intermixed. Foretrochanter mostly with small appressed yellow scales and a few short pale setae, the posterior scales dark brown. Mid- and hindcoxae and trochanters with white scale patches except for a small patch of pale yellow scales and pale yellow setae mesally on the trochanters. Other leg segments as figured, the dark areas dark brown, the light areas pale yellow. Tarsomere 5 pale on all legs. Wing scales mostly broad, the dark scales mostly dark brown; with 3 main dark costal spots underlain by dark integument; white scales present on either side of the 3 main dark spots, remainder of wing a mixture of white and pale yellowish scales; pale yellowish scales predominate on veins R_{4+5}, M_{1+2}, M_1, M_2 and much of CuA. A slight notch present where costa and subcosta intersect. Humeral crossvein with dark scales above and below. Halteres dark brown with white scales on the dorsal aspect of the pedicel and around the dorsal margins of the scooped out capitellum.

Abdomen: Mottled dark brown to pale brown, with long and abundant, pale yellowish brown setae. Posterolateral margins of terga II–VI with small patches of broad dark brown and pale yellowish scales; the pale scales mostly dorsal to the dark scales; ventrally with a scattering of quite broad pale yellowish scales and paired patches of dark brown scales apically on either side of the midline of sterna III–V. Segments VII+ not present and the apical portion of sternum VI has been disturbed.

Male genitalia (Fig. 2A–D).—Fig. 2C is the genitalia as observed before dissection. The dorsal and ventral lobes of the claspettes were obscured and are illustrated separately (Fig. 2A, B). Dorsal lobe with 3 modified setae corresponding to the clubbed setae of other anophelines; 2 of these are shorter and rounded at the apex, the third is modified into a hook-like structure. Apex of ventral lobes with strong sinuous setae which appear to be in a symmetrical conformation; just below the apex are 2 smaller but prominent setae on the mesoventral aspect; numerous long strong spicules along the dorsomesal aspect for most of the length of the lobe. Lobes of tergum IX prominent, slightly arched outward from each other. With one pair of aedeagal leaflets, leaflets with small aciculae on their inner margins at the base. Gonocoxite with 2 primary setae which may correspond to the parabasals of other *Anopheles* (*Anopheles*), or one parabasal and one internal seta; the most basal seta originates on a prominently raised base; a primary long seta apparently present subapically on the dorsal aspect.

Discussion.—*Anopheles mediopunctatus* is the oldest name in a group of what may prove to be several closely related species. The names presently considered as junior synonyms of *An. mediopunctatus* are *Cyclolepidopteron rockefelleri* Peryassu, *An. costai* Da Fonseca and Da Silva Ramos and *An. costalimai* Coutinho. *Anopheles bonnei* Da Fonseca and Da Silva Ramos is considered valid. I cannot speculate on the identities of the above nominal species without further study and material. *Anopheles mediopunctatus* and the other or others in this group all share complex male genitalic structures which feature very long 9th tergal lobes, highly modified dorsal and ventral lobes and unusual placement of the parabasal and internal spines.

One of the characters commonly used to distinguish *mediopunctatus* is the presence of white scales on the first sternum. This character cannot be seen in the holotype since the first sternum was destroyed by a mounting pin.

Examination of approximately 40 male terminalia from specimens which key to *An. mediopunctatus* from many localities in South America yielded none that are true *mediopunctatus*. It now seems likely that there are many misidentifications of this species in the literature and in museums.

Anopheles maculipes (Theobald)
(Fig. 3A–E)

Theobald 1903, 3: 81–83 (as *Arribalzagia*).

Diagnosis.—A brown to dark brown species with 3 faint dark spots on the scutum, speckled legs and posterolateral abdominal scale tufts. Wing with 3 distinct costal dark spots and slender dark brown and pale yellow scales.

Label data.—Red circle "Holotype"; handwritten "Anopheles maculipes (Type) Theobald" and "Sao Paulo Brazil Dr. Lutz."

Condition of specimen.—Female. In fair condition, both front legs missing, midtarsomere 5 missing on left, hindtarsomere 5 missing on both sides, right hindtarsomere 4 missing. Abdomen flattened out and twisted around but intact. Last 4 flagellomeres of left antenna missing. Specimen is mounted on a small pin through prosternal area, emerging in the middle of the scutum; pin is affixed to a cardboard circle.

Description.—Wing length 4.5 mm; width 1.5 mm; proboscis 2.3 mm; palp 2.19 mm (1, 0.13; 2, 0.53; 3, 0.78; 4, 0.45; 5, 0.3); abdomen approximately 3.35 mm.

Head: Occiput and clypeus with dark brown integument covered with concolorous pollinosity. Posterior and lateral vertex with erect slender spatulate and mostly truncate brown scales; frontal tuft with elongate and some spatulate whitish-yellow scales and setae; inner margin of eye at the vertex with small recumbent white scales; several pale scales on gena below where eyes meet; postgenal setae brown; 5 to 6 brown ocular setae per side. Clypeus as figured, original description says of "peculiar form" but what Theobald meant is not clear. Antennal pedicel dark brown with slender white scales on dorsolateral third; flagellomere 1 with slender white scales, most on inner surface. Palp clothed with numerous slender brown erect and semierect spatulate scales with basal rings of white scales at juncture of palpomeres 2,3: 3,4 and 4,5; tip of 5 with a few white scales; 3 with a few white scales which suggest a pair of ill-defined median patches. Proboscis with erect brown scales at its base and recumbent brown scales and short semierect setae along its length, evidence of a few small pale scales just before labellum.

Thorax: Thorax somewhat rubbed, integument yellowish brown to reddish brown, covered with silvery pollinosity and sparsely clothed with pale yellowish setae. Scutum with 2 small dark spots just posterior to the ends of the prescutal sutures and one dark spot at the posterior margin of the scutum which continues onto the scutellum; scutum with scattered, mostly small spots which lack pollinosity and correspond to the insertion

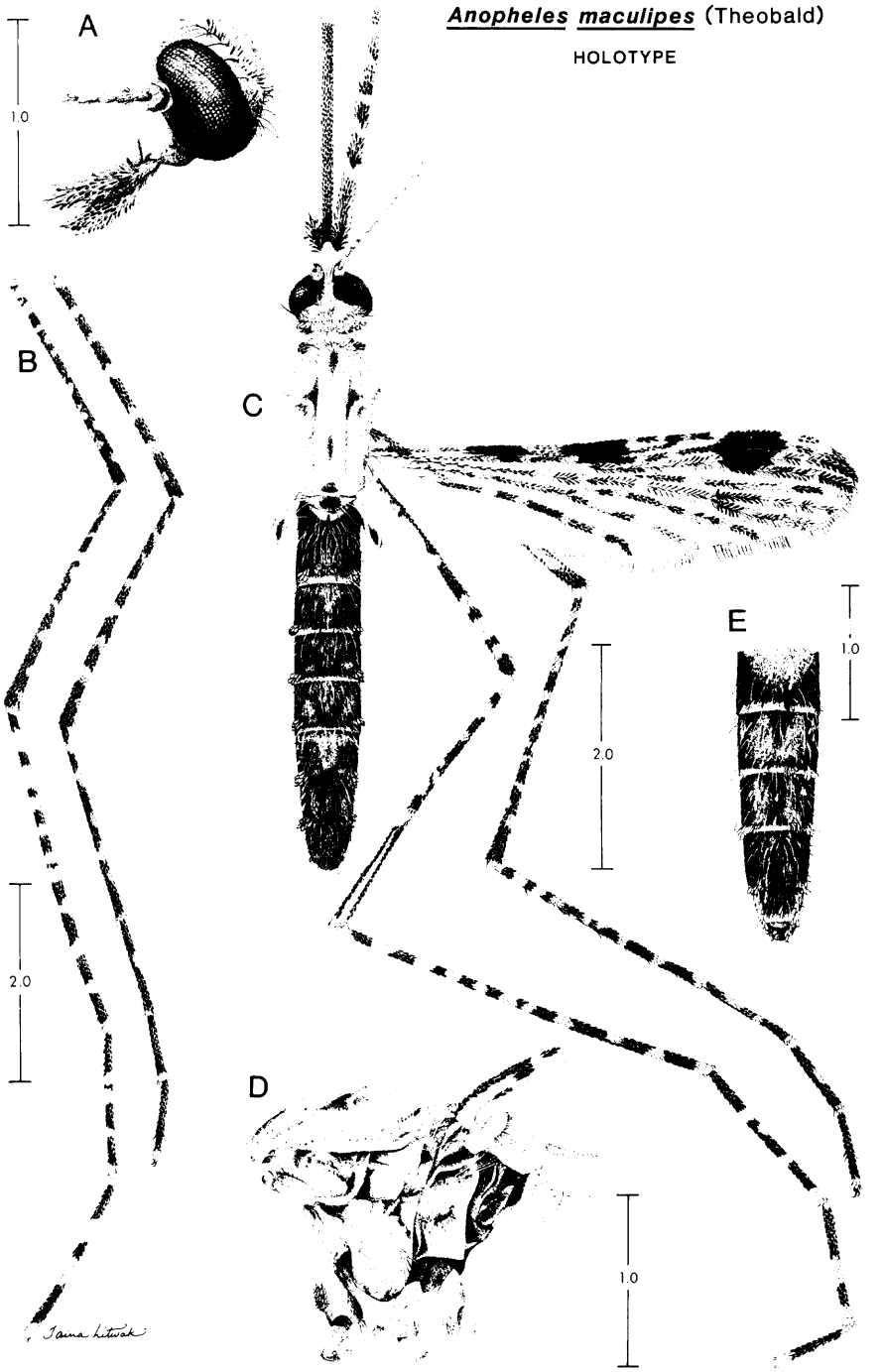

Fig. 3. A–E, holotype *Anopheles maculipes* (Theobald). A, head, lateral view. B, legs, posterior view. C, habitus. D, thorax, lateral view. E, venter of abdomen. All scale lines in mm.

of scattered setae. Antepronotum with a dense tuft of brown scales anteriorly, the remainder with approximately 25 long yellowish to brown setae. Mesopostnotum with a small median posterior dark streak. Pleuron. Proepisternum with 3 long upper setae and a slender white scale; 4 pale spiracular setae present; mesokatepisternum with 6 long upper setae and 3 lower setae and 6 lower white scales; prealar knob with 10 long setae; upper mesanepimeron with 4 long setae. Legs. Forecoxa with an anterior dense patch of small brown scales and long brown setae and an apical patch of white and brown scales. Midcoxa with 2 outer and one inner white scale patches. Hindcoxa with a single white scale patch. Mid- and hindfemora and tibiae brown scaled with speckling of yellowish scale patches. Midtarsomere 1 speckled, midtarsomere 2 with a single yellowish spot, the remaining tarsomeres brown except tip of midtarsomere 5 which is yellowish; tips of hindtarsomeres 1–4 pale scaled; hindtarsomere 1 with about 6–9 yellowish white spots some of which form rings; hindtarsomere 2 with 2–3 spots, one forming a median ring on left side; hindtarsomeres 3 and 4 brown except for broad white apices as noted above. Wing scales brown, dark brown on the presector, middle and preapical dark marks of costa, the remainder yellowish except for some white patches interspersed. No notch where costa and subcosta intersect. Humeral crossvein with scales above and below. Halteres with a yellowish stem, capitellum dark brown ventrally but mostly white-scaled dorsally except for the dark bare center of the depressed area.

Abdomen: Integument of abdomen dark brown with paler dorsolateral areas; with covering of yellowish-brown pollinosity. Dorsum with numerous, sometimes long, pale yellowish setae, without scales except for a few pale brown scales posterolaterally on terga II–VIII, most numerous on terga VIII where they are narrower and not concentrated in patches as the other terga. Ventrally only sterna IV–VIII plainly visible, with sparse yellowish-brown setae and scattered scales in an irregular pattern as follows: irregular lines of white scales midventrally and small lateral clumps on V–VII; small patches of brown scales posterolaterally on IV–VI; a large tuft of brown scales midapically on VII; sternum I bare.

Discussion.—This species was the first member of the nominal taxa Arribalzagia to be described, *Anopheles mediopunctatus,* also an Arribalzagia, was described in the same publication in a different genus. In his description of the genus, Theobald (1903: 81) says it is closely related to old world *Myzorhynchus.* Subsequent speculation (Reid and Knight 1961) has also suggested this. Comment on this relationship is beyond the scope of the present paper. Theobald in characterizing Arribalzagia says "No scaly ventral apical tuft can be detected," but this apical tuft can easily be seen on the type of *An. maculipes* described here.

Anopheles amazonicus **Christophers**

Christophers 1923: 71–78, Plate IV.

Anopheles amazonicus is a junior synonym of *An. mattogrossensis.* The original description is quite adequate, therefore only notes and further comments will be presented here.

Label data.—Pink circle "Type female"; red circle "Holotype"; "Holotype of Anopheles amazonicus Christophers"; "Anopheles (Myzorhynchella) nigra(?) Theob."; "A.A. Clark R. Amazon June 1915"; School of Trop. Med. Liverpool University label "Anopheles amazonicus Christophers Amazon."

Condition of specimen.—Female. In fairly good condition except slightly rubbed. Small pin through mesanepimeron. Right antenna present only to 4th flagellomere. About half the fringe scales of the right wing are missing. Left midleg missing. Tarsomeres 3–5 on right midleg missing. Right hindleg missing. Left hindleg with all tarsomeres missing.

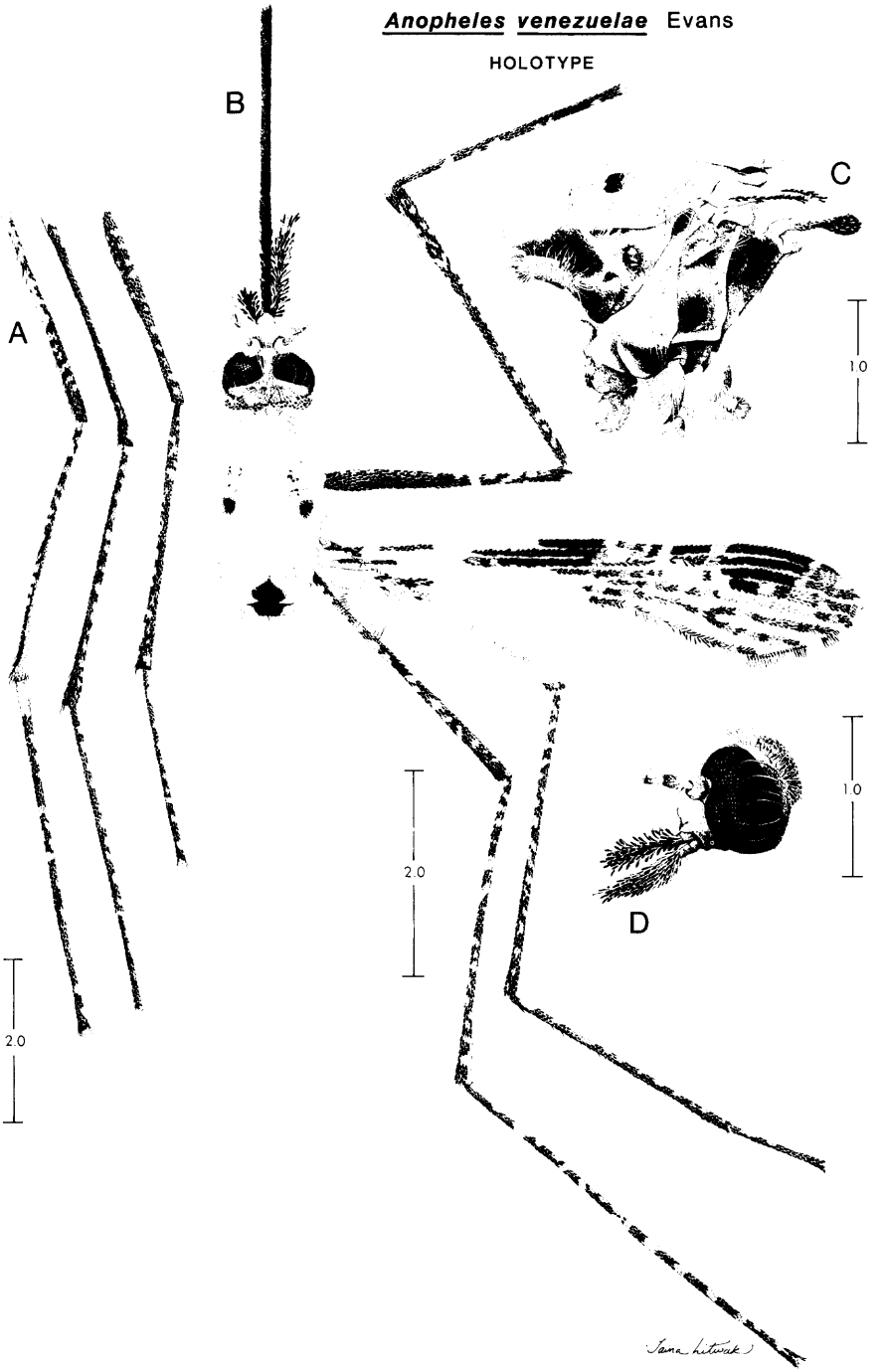

Fig. 4. A–D, holotype *Anopheles venezuelae*. A, legs, posterior view. B, habitus. C, thorax, lateral view. D, head, lateral view. All scale lines in mm.

Discussion.—The original description agrees well with the holotype specimen with a few small differences or additions as follow. Palpi have a few white scales at junctures of palpomeres 2,3; 3,4 and 4,5. Antennal flagellomere 1 with narrow pale scales mostly on the inner aspect but some outer scales also present, no dark scales as stated in the original description. Upper middle of mesanepimeron with 3 setae, the upper mesanepimeron with a patch of long setae. Abdominal sternum 1 with a few small pale setae. The white scales mentioned in the original description on the venter of the abdomen are actually yellowish. The median tuft of scales on sternum VII has yellow scales anteriorly and dark brown scales posteriorly.

Anopheles amazonicus was synonymized with *An. mattogrossensis* by Shannon (1933: 135) after comparison by Evans of several specimens of presumed *An. mattogrossensis* with the type of *An. amazonicus*. I have also seen the holotype of *An. mattogrossensis* and fully agree. *Anopheles mattogrossensis* has several characters unique among the Arribalzagia: Upper middle of mesanepimeron with setae; midventral pale scale patches on the abdomen and small setae on sternum 1. In addition *mattogrossensis* lacks leg speckling, no dark spots on the notum, and posterolateral scale tufts, all typical of most other Arribalzagia.

Anopheles venezuelae **Evans**
(Fig. 4A–D)

Evans 1922: 213–222, Plate XI, in subgenus *Arribalzagia.*

Anopheles venezuelae is a junior synonym of *An. punctimacula.*

Label data.—School of Trop. Med., Liverpool University label "A. venezuelae Evans La Cabrero Estado Carabobo 1921 Dr. M Nunez Tovar"; "Holotype of Anopheles venezuelae Evans det. J. Chainey 1975."

Condition of specimen.—Female. The specimen is incomplete but the remaining portions are in good condition. Missing: Abdomen; right wing and part of left wing, most of left wing is affixed to plastic base into which is pinned the specimen; flagellomeres 3–5 missing on both sides; palpomeres 2–5 missing on both sides though half of 2 on left is present; left and right foretarsomeres 2–5, left midtarsomeres 2–5, right midtarsomeres 3–5, left and right hindtarsomeres 2–5.

Discussion.—*Anopheles venezuelae* was described from a single specimen in 1922. When Evans received more material it became apparent that the characters that she used to distinguish it from *An. punctimacula* were no more than normal variation. In 1923 Evans sunk *An. venezuelae* under *An. punctimacula.* I have seen the type of *An. punctimacula* and studied in great detail material of all stages from throughout its range and agree with her assessment.

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The views of the author do not purport to reflect the position of the Department of the Army or the Department of Defense.

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