Elevation of Anopheles chiriquiensis from Synonymy with Anopheles parapunctipennis and Designation of Name-bearing Types for Anopheles parapunctipennis and Anopheles parapunctipennis guatemalensis (Diptera: Culicidae)

Richard C. Wilkerson

ABSTRACT. Anopheles (Anopheles) chiriquiensis is retrieved from synonymy with An. (Ano.) parapunctipennis based on differences in wing spotting, extent of pale scaling on the maxillary palpus and color of the halter. Anopheles chiriquiensis has the sector pale spot present on vein C, a condition not previously reported in species of the subgenus Anopheles. A neotype is designated for An. parapunctipennis and a lectotype for An. parapunctipennis guatemalensis. Though the difference between An. parapunctipennis and An. parapunctipennis guatemalensis could be attributed to variation, the latter is retained as a subspecies until more material becomes available.

INTRODUCTION

Anopheles (Anopheles) chiriquiensis Komp, An. (Ano.) parapunctipennis Martini and An. (Ano.) parapunctipennis guatemalensis De León are morphologically similar taxa encountered at higher elevations (>1000 m) in Central America. Anopheles parapunctipennis was described from the State of Chiapas in southern México (Martini 1932) and An. chiriquiensis from Chiriqui Province in western Panamá (Komp 1936). De León (1938) apparently was unaware of the more similar An. parapunctipennis when he described guatemalensis, from western Guatemala, as a variety of An. chiriquiensis. Based on three male genitalia, Dampf (1939) synonymized both An. chiriquiensis, and what he assumed was a variety of An. chiriquiensis, guatemalensis, under An. parapunctipennis. Vargas (1940a) also recognized An. chiriquiensis as a synonym of An. parapunctipennis, but treated guatemalensis as a variety of An. parapunctipennis. Since that time guatemalensis has sometimes been treated as a subspecies of An. parapunctipennis (Vargas 1942, Russell et al. 1943, Lane 1953), but most recently it was listed as a variety (Knight and Stone 1977). In accordance with Article 45g of the International Code of Zoological Nomenclature (1985) it is treated here as subspecies guatemalensis.

The status of these three taxa was investigated during the preparation of a key to Central American anophelines. As a result of this investigation An. chiriquiensis is resurrected from synonymy with An. parapunctipennis. This report provides a summary of the literature and salient adult morphological characters for all three taxa. Insufficient immature specimens were available to corroborate the results.

1 The views of the author do not purport to reflect the views of the supporting agency.
2 Department of Entomology, Walter Reed Army Institute of Research, Washington, DC 20307-5100. Mailing address: Walter Reed Biosystematics Unit, Museum Support Center, Smithsonian Institution, Washington, DC 20560.
MATERIALS AND METHODS

Harbach and Knight (1980, 1981 [1982]) is followed for morphological terminology and Wilkerson and Peyton (1990) for wing spot definitions. Specimens examined for this study are in the National Museum of Natural History (NMNH), Museum Support Center, Smithsonian Institution, Washington, DC, USA and in the Laboratorio de Entomología, Instituto de Salubridad y Enfermedades Tropicales (ISET), México, DF, México. Abbreviations used in the synonymies and material examined are as follow: E = egg, L = larva, P = pupa, δ = male, Φ = female, p = pupal exuviae, G = slide-mounted male genitalia. A life stage followed by an asterisk (*), e.g. P*, indicates that at least some portion of the stage was illustrated in the reference cited.

TAXONOMIC TREATMENT

*Anopheles (Anopheles) chiriquiensis* Komp
(Figs. 1A, 1D, 1E)


*Anopheles chiriquiensis* Komp of Kumm et al. 1940: 410, 419 (Costa Rica, bionomics note, Φ key).

*Anopheles (Anopheles) parapunctipennis* Martini of Komp 1941: 93 (Φ key); Simmons and Aitken 1942: 43, 70 (Φ key, bionomics note); Knight and Stone 1977: 26 (catalog).

*Anopheles (Anopheles) parapunctipennis parapunctipennis* Martini of Vargas 1942: 70 (Φ key); Pelaez 1945: 76 (Φ*, Φ key).

**Diagnosis.** Large dark brown and pale yellow species with conspicuous pattern of wing spots. **FEMALE.** Head (Fig. 1E): Frontal tuft with long pale yellowish white scales and setae, scales of the vertex pale yellowish white, remaining head scales dark brown; maxillary palpus (MPIp) dark brown-scaled with pale scales at apex of palpomere 2 and base and apex of palpomere 3, palpomere 4 pale-scaled with dark median band and palpomere 5 entirely pale-scaled or with a narrow dark median band. **Thorax:** Scutum with very broad median silvery pollinose stripe; wing (Fig. 1A) brown-scaled with pale yellowish spots, costa with basal (BP), humeral (HP), sector (SP), subcostal (SCP) and apical (AP) pale spots, sector pale spot present on veins C, Sc and R, pale scales and pale fringe spots (PFS) absent at apices of veins R4+5, M1, M2 and M3+4; coxae, trochanters and bases of femora pale yellowish white, contrasting with dark brown legs and pleura, narrow apical bands of pale scales on all femora and tibiae, broadest band on hindfemur, a few pale scales at apices of hindtarsomeres 1-4; integument of halter (Fig. 1D) pale yellowish white, capitellum with pale yellowish
scales. *Abdomen:* Without scales; integument brown with numerous long yellowish setae, anterior 0.25 of integument of sterna and sometimes terga II–VII pale yellowish.

**Discussion.** Based primarily on recently redefined wing spot nomenclature (Wilkerson and Peyton, 1990) I consider that *An. chiriquiensis* is a valid species. The salient character distinguishing *An. chiriquiensis* from its former senior synonym, *An. parapunctipennis*, is the presence of the sector pale (SP) spot on veins C, Sc and R (Fig. 1A). This spot is absent in *An. parapunctipennis*. In addition, *An. chiriquiensis* has other wing spot differences, more extensive pale scales on the maxillary palpus and an entirely pale halter (see "Results and Discussion" below).

*Anopheles chiriquiensis* is known only from the western slopes of the Volcán de Chiriqui in western Panama. There is a doubtful reference to larvae of this species from northern Costa Rica, Alajuela Province, Zarcero (Komp 1941). The larvae of *An. chiriquiensis* and *An. parapunctipennis* apparently are quite similar and it is not known if Komp verified his identifications by rearing larvae to the adult stage.


*Anopheles (Anopheles) parapunctipennis* Martini (Figs. 1B, 1F, 1G)

Martini 1932: 101. Neotype ♂, here designated, bearing the following data: "C. Las Casas, Chis./VII–1940/Col. M. Macias" (ISET).

*Anopheles parapunctipennis* Martini of Martini 1935: 23 (republication of original description); Dampf 1939: 280 (♂, in part); Vargas 1940a: 66–68 (L key); Castellanos et al. 1949: 34 (Veracruz State, México); Mattingly 1955: 27 (type material not found, Hamburg); Belkin 1968: 10 (type material not found).


*Anopheles (Anopheles) parapunctipennis* Martini of Vargas 1940b: 202 (♀ key); Komp 1941: 95 (L key); Simmons and Aitken 1942: 49, 59, 70 (bionomics note, ♂ and L keys, in part); Belkin et al. 1965: 34 (type information, location unknown); Knight and Stone 1977: 26 (catalog).

*Anopheles parapunctipennis* var. *guatemalensis* De León of Vargas 1941: 112 (♀).

*Anopheles parapunctipennis* parapunctipennis Martini of Russell et al. 1943: 26, 33 (♀ and L keys, in part); Vargas 1949: 233 (P, Oaxaca and Veracruz states, México).
**Anopheles (Anopheles) parapunctipennis parapunctipennis** Martini of
Lane 1953: 158, 159, 163 (♀*, ♂*, L*, ♀ and L keys, in part);
Vargas and Martínez Palacios 1956: 47, 49, 52, 56, 59, 80, 141
(♀*, ♂*, P*, L*, E; ♂, ♀, L, P, E keys, México coll. recs.); Var-

**Diagnosis.** FEMALE. As in *An. chiriquiensis* except for the following. Head:
Maxillary palpus (Fig. 1G) without pale scales at apex of palpomere 2 and base of
palpomere 3, palpomere 4 mostly dark-scaled with pale base and apex and palpomere 5
pale-scaled with dark median band. Thorax: Wing (Fig. 1B) without sector pale (SP)
spot, pale scales and pale fringe spots (PFS) present at apices of veins R₄₊₅, M₁, M₂ and
M₃₊₄; pale bands on legs narrower; halter (Fig. 1F), pedicel with pale yellow integu-
ment, capitellum with dark brown integument and dark brown scales.

**Discussion.** The original description of *An. parapunctipennis* is sketchy and not il-
lustrated. The description is primarily a comparison of the male genitalia of *An. para-
punctipennis* to that of *An. pseudopunctipennis* Theobald. I found the genitalia of
specimens from the type locality of *An. parapunctipennis* to differ, as stated by Martini
(1932), from genitalia of *An. pseudopunctipennis* from Costa Rica. Martini's comments
on the female wing are vague and of little use.

Martini (1932) did not designate type specimens for *An. parapunctipennis* and nei-
ther Mattingly (1955) nor Belkin (1968) were able to locate any original material in
European museums. To ensure nomenclatural stability, a neotype is designated here
from material available from the type locality of San Cristóbol de Las Casas, Chiapas,
México.

**Material examined.** MEXICO. Chiapas. Neotype ♂, VII-1940, C. Las Casas,
Chis. (San Cristóbol de Las Casas, Chiapas, México), M. Macías (ISET); 4♂, 1♀ and 3
unassociated ♂ genitalia, same locality as neotype, 2♂, IX-1940, M. Macías (ISET), 1♂,
VII-1940, M. Macías, G 740627-87 (NMNH), 1♂, 17-IX-1956, V. Molina and A.
Rodríguez (ISET), 1♀, VII-1940, M. Macías G. (ISET), 3♂ genitalia, VIII-1940, "2712"
and "2715", M. Macías, and VII-1940 no other data. Veracruz. 1♀ X-1950, 2♀ 18-X-
1956, Acajete, V. Molina and A. Rodríguez (ISET). Oaxaca. 1♀, X-1942, Ixtlan, M.
Macías (ISET). GUATEMALA. 1♀ without data except "Guatemala" and box label
"Komp leg" (NMNH).

**Anopheles (Anopheles) parapunctipennis guatemalensis** De León
(Fig. 1C)

De León 1938: 416, (as *An. (Ano.) chiriquiensis var. guatemalensis*)
Cumbre del Aire, Department of Totonicapán, Guatemala (♂*,
♀*, L*). Lectotype ♀, here designated, bearing the following
data: "Sanidad Publica: Guatemala. - A.C.-/Anopheles
(Anopheles) A. Chiriquiensis (?? Komp)/"Cumbre del aire" Dpto
Totonicapán.-/Dr. J. Romeo De León.- Malariologo de S.P."
(NMNH).
Anopheles parapunctipennis Martini of Dampf 1939: 280 (♂, in part, synonymy).

Anopheles parapunctipennis var. guatemalensis De León of Vargas 1940a: 66-68 (L key, new combination).

Anopheles (Anopheles) parapunctipennis var. guatemalensis De León of Vargas 1940b: 202 (♀ key); Belkin et al. 1965: 28 (type information); Knight and Stone 1977: 26 (catalog).

Anopheles (Anopheles) parapunctipennis guatemalensis De León of Vargas 1942: 71 (♀ key); Simmons and Aitken 1942 (49, 59, 70, biometrics note, ♂ and ♀ keys, in part); Lane 1953: 158, 159, 166 (♀ and L keys, in part).

Anopheles parapunctipennis guatemalensis De León of Russell et al. 1943: 26, 29, 34 (♀ and L keys, in part).

Diagnosis. FEMALE. As in An. parapunctipennis except subcostal pale (SCP) spot present on vein C but not R₁.

Discussion. No primary type specimen was designated by De León and the type depository (Entomoteca de Sandidad Publica de Guatemala, Guatemala City, Guatemala) no longer exists (Knight and Stone 1977). Chuck Porter (personal communication, 1990) reported that he did not recall seeing pinned specimens when he inspected De León’s collection for slide-mounted material. However, some De León original material, partly without individual labels, was found by the author in the NMNH collection. All of the adult specimens are mounted on pieces of cardboard similar to those in Fig. 18 of the original description. The handwriting on the label in the unit tray containing these specimens seems to match the handwriting on a map published with the original description. There is therefore justification in assuming that the unlabeled material in the unit tray is also part of the syntype series. Three of the specimens carry their own labels but the lectotype was chosen from among those without labels since it best matches the characters given in the original written description. None of the males, but all of the females, have vein R₁ dark at the subcostal pale (SCP) spot. This character separates An. parapunctipennis guatemalensis from the nominotypical subspecies and is the only difference I see to distinguish the two.

The original description contains some interesting discrepancies. De León states (translated from Spanish): “the lateral hairs [seta 6] of the abdominal segments are branched, which can be noted on the hairs of the third segment, in this structure it differs from the larva of Chiriquiensis [sic] in which this hair is simple.” Figure 8 of De León clearly shows a simple aciculate seta just as in An. chiriquiensis. Figure 13 is labeled "Wing of Anopheles Guatemalensis [sic]" but it shows vein R₁ pale at the subcostal pale spot (as in An. parapunctipennis), not pale only at its base and apex as stated in the written description. Finally, Fig. 18 appears to be a male of An. parapunctipennis guatemalensis not An. xelajuensis De León as labeled.

Material examined (all in NMNH). GUATEMALA. Totonicapán. Lectotype ♀ and 6 ♀, 3 ♂ (2 with genitalia dissected, WRBU preps. 88/493, 88/494) paralectotypes all in unit tray with label as above (presumably in De León's handwriting), 3 ♀ also bear individual labels with additional information of "10,500 p/s/m" (feet above sea level), 1 slide-mounted unassociated ♂ genitalia, and 2 slide-mounted whole larvae labeled as above but also with "1937". In addition, 3 ♀, 4 ♂, "Esquipulas 4,000 ft." (could be Dept.
of Chiquimula, Retalhuleu or San Marcos). Also 2 larval exuviae, the labels presumably in De León's handwriting, "Maria Tecun, IV-1941, De León".

RESULTS AND DISCUSSION

The species considered here, along with *An. (Ano.) hectoris* Giaquinto-Mira, can be distinguished in the adult female from other species of the subgenus *Anopheles* in Central America by the following combination of characters: legs mostly dark with at most small bands of pale scales at articulations of leg segments and tarsomeres; coxae, trochanters and bases of femora pale yellowish white with pale white or pale yellow scales and setae, contrasting with dark brown pleura and legs; scutum with broad silvery pollinose stripe; wings with conspicuous spotting, costa with basal (BP) and/or humeral pale (HP) spot(s), subcostal pale (SCP) spot and preapical and/or apical pale (AP) spots. *Anopheles hectoris* differs by having the entire broad middorsal silvery pollinose stripe of the scutum overlain by slender white fusiform scales and by having the sector pale (SP) spot present on vein R only.

In the adult female stage *An. chiriquiensis* can be separated from *An. parapunctipennis* and *An. p. guatemalensis* as follows (Figs. 1A, 1B, ID-G). *Anopheles chiriquiensis*: sector pale (SP) spot present on veins C, Sc and R; pale scales and pale fringe spots (PFS) absent at apices of veins R_{4+5}, M_{1}, M_{2} and M_{3+4}; maxillary palpus with pale scales on apex of palpmere 2 and base of palpmere 3, all of palpmere 4 and 5 pale-scaled except for dark median band on palpmere 4 and sometimes on 5; halter entirely pale yellowish with pale yellowish scales on capitellum. *Anopheles parapunctipennis*: sector pale spot absent; pale scales and pale fringe spots present at apices of veins R_{4+5}, M_{1}, M_{2} and M_{3+4}; maxillary palpus with pale scales on apex of palpmere 3, base of palpmere 4, apex of palpmere 4 and base and apex of palpmere 4 and 5; halter, integument of pedicel pale yellowish, integument of capitellum dark brown with dark brown scales. *Anopheles parapunctipennis guatemalensis* differs, in the female only, from the nominotypical subspecies by having the subcostal pale (SCP) spot present on the costa, but not on vein R_{1} (Fig. 1C).

The presence of the sector pale (SP) spot on vein C in *An. chiriquiensis* is apparently unique among species of the subgenus *Anopheles*. In a survey of all spotted-wing species of this subgenus, Wilkerson and Peyton (1990) found no other species with this character.

Wing characters used by others to separate *An. parapunctipennis parapunctipennis* from *An. parapunctipennis guatemalensis* usually have included the pattern of spots on veins R_{4+5} and 1A (Vargas 1940a, Simmons and Aitken 1942, Vargas 1942, Russell et al. 1943, Lane 1953). The material before me of the three taxa treated here shows no consistency in the spotting on these veins.

These three taxa cannot be distinguished at this time using male genitalia. The clubbed setae of the dorsal lobe of the claspette are quite variable. There can be either two separate setae, two partly fused setae or a single fused seta. In one specimen they were nearly fused on one side and completely separate on the other. Two examples of *An. chiriquiensis* examined have the setae fused, quite slender and capitate, but in the lectotype they are broader. Likewise the two pairs of aedeagal leaflets vary. All have a distinctive first pair which are weakly serrate, but some have less serration at the base
and more toward the apex while others also have serrated edges on the second smaller pair. It is possible that these characters will prove useful after a careful study of more material.

Larvae of all three taxa are unusual among species of the subgenus *Anopheles* because seta 6–III is not branched, but long and aciculate. Komp (1936) noted this for *An. chiriquiensis*, as did De León (1938, Fig. 8) for *An. parapunctipennis guatemalensis*, and Vargas and Martínez Palacios (1956) for *An. parapunctipennis parapunctipennis*.

In addition to striking morphological differences, *An. chiriquiensis* apparently is found only in a limited geographical area in western Panamá, quite far from the known distribution of *An. parapunctipennis*. The type localities of *Anopheles parapunctipennis* and ssp. *guatemalensis* are about 250 km apart.

I believe that a careful study of more material will show that ssp. *guatemalensis* is a synonym of the nominotypical form. Until such time, it should be retained as a subspecies.

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**REFERENCES CITED**


chiriquiensis
♀ PN 95-104

p. parapunctipennis
♂ Neotype

p. guatemalensis
♀ Lectotype

chiriquiensis
♀ PN 95-104

p. parapunctipennis
♀ X-1950, Acajete, Mex.