

Synonymy of *Culex (Culex) oswaldoi* with *Culex (Culex) maxi* (Diptera, Culicidae)¹

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ABSTRACT. *Culex (Culex) oswaldoi* is synonymized with *Culex (Culex) maxi*, and the male genitalia of the species is redescribed and illustrated. The study illustrates how positioning and posture can influence the appearance of morphological features and the recognition of species.

While processing mosquitoes from Santa Fe Province, Argentina⁴ for virus isolation attempts, one of us (WLJ) determined from dissected male genitalia that either *Culex (Culex) maxi* Dyar, 1928, or *Cx. (Cux.) oswaldoi* Forattini, 1965, was present in the pooled material. This determination was based on the use of Bram (1967). Genitalia preparations were subsequently sent to the Walter Reed Biosystematics Unit at the National Museum of Natural History (NMNH) where they were compared with the genitalia of the types of *maxi* and *oswaldoi*. Upon preliminary examination, the specimens were found to resemble the former more closely than the latter. However, since the genitalia of *oswaldoi* shared some rather striking similarities with the genitalia of *maxi*, a more detailed examination was undertaken. As the examination proceeded and close attention was given to the degree of clearing and the posture of the phallosome and its parts, it became evident that *oswaldoi* was conspecific with *maxi*. After dissecting and remounting the genitalia of the type of *oswaldoi* and studying all of the material available to us in the NMNH and CDC collections, it became obvious that *oswaldoi* was considered distinct from *maxi* principally because of superficial differences evoked by the posture of the phallosome.

¹ The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the supporting agencies.

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⁴ Specimens were collected in light traps by Dr. Carl J. Mitchell, CDC, Ft. Collins, during cooperative studies with the University of Córdoba, Córdoba, Argentina.

The genitalia of the type of *oswaldoi* were over cleared, but otherwise were in good condition (except for one broken tooth on the left lateral plate of the phallosome) prior to removal from the original slide for dissection. They were originally mounted dorsum up with the phallosome (Fig. 1a) in normal resting position. In this posture, the lateral plates (= median processes of authors) were positioned such that the ventral arms (VA) (= ventral cornu of authors) were hidden from view (see Fig. 1a,c,d),⁵ the dorsal arms (= external processes of authors) were directed posterolaterally and the dorsal processes (DP) (= basal processes of authors) were directed dorsoposteriorly. The ninth tergal lobes (IX-TL) were positioned immediately dorsal to the lateral plates.

The genitalia of the type of *maxi* were cleared normally and mounted dorsum up, but are in rather poor condition. The phallosome (Fig. 1b) is both partially everted and compressed by the weight of the coverslip, and a large part of the aedeagus (Ae) is missing. The lateral plates are spread with their mesal surfaces partially exposed. Thus, the ventral arms are visible, the dorsal arms are tilted dorsad and the dorsal processes are directed dorso-laterally. The ninth tergal lobes appear to be anterior to the phallosome. The genitalia were not removed from the original slide for dissection.

The name *oswaldoi* and a description of the male genitalia of the species were first published by Forattini (1965) who attributed them and the accompanying figures to Bram (1964).⁶ Forattini, however, was not aware that Bram's manuscript was an unpublished Ph.D. dissertation (published later, Bram 1967). Therefore, the name *oswaldoi* is credited to Forattini while the single adult male on which Bram based the species is recognized as the holotype. The type-locality of *oswaldoi* is listed as Macaphyba, Natal, Brazil, but the name of the village is probably a misspelling of Macafba.

The description of *maxi* (Dyar 1928) is based on 2 males collected in northwestern Argentina--from Tucumán and San Pedro. Both specimens are mounted on slides. The specimen from San Pedro was designated the lectotype of *maxi* by Stone and Knight (1957) who claimed that both slides were labelled "type." Actually, only one slide, that bearing the specimen from San Pedro, is labelled "Type." Therefore, we consider this specimen to be the holotype of *maxi* and regard the lectotype designation as invalid.

Dyar (1928) characterized the proboscis, maxillary palpi, tarsi and genitalia of *maxi*, while Forattini (1965) and Bram (1964, 1967) described only the genitalia of *oswaldoi* and *maxi*. Since the proboscis, palpi, and tarsi of *oswaldoi* are exactly as described for *maxi*, Dyar's brief description of these appendages is repeated below with a redescription of the genitalia.

⁵ Note that Bram (1967) labelled the ventralmost tooth of the lateral plate as the "ventral cornu" in his figure 25d.

⁶ Bram, R.A. 1964. The classification of the *Culex* subgenus *Culex* in the New World (Diptera: Culicidae). Unpublished Ph.D. Dissertation, University of Maryland, College Park. 186 pp.

Culex (Culex) maxi Dyar

Culex (Culex) maxi Dyar 1928:386 (♂). TYPE. Pin with 2 legs on point and following labels: "2360//[red label] Type No./[number in pencil crossed out, appearing to be 40703 but second digit obscure] U.S.N.M.//Culex/maxi/Dyar [on upper side of label]/Culex (968) fatigans [on underside of label]//Lectotype/AS + KLK/1957." Adult mounted on slide with following handprinted labels: Label on left with "Lectotype/AS + KLK/1957/Holotype-/Harbach, Peyton/and Jakob 1983"; label on right with "Culex/(Culex)/maxi/Dyar/Type/San Pedro, Arg./June 11, 1927/M. Kisliuk, Jr./2360."

Culex (Culex) oswaldoi Forattini 1965:167(♂). HOLOTYPE. Male on pin with following labels: "Natal, Brazil/Macaphyba [= Macafba]/VII. 23. 43/MacCreary, colr. [sic]//Reared Quarry hole//Serial No. 12//RB62 290//Culex (C.) oswaldoi n.sp. Bram/HOLOTYPE." Genitalia on slide with following labels: Label on left with "Natal, Brazil/Macaphyba/VII-23-43/MacCreary, Colr. [sic]/reared quarry hole/Serial No. 12/RB62 290"; label on right with "Culex (Culex)/oswaldoi Bram/Holotype." **NEW SYNONYMY.**

MALE. "Tarsi dark, with minute white rings at the joints; proboscis with a white band beyond the middle; palpi with white rings at middle of the long joint and bases of the last two" (Dyar 1928:386).

MALE GENITALIA (Figs. 1,2; Table 1). Much as in *Culex paramaxi* Duret, 1968, differing mainly in the character of the subapical lobe. *Tergum IX* (Fig. 2c): Ninth tergal lobe small, with regular or irregular row of 4-20 unevenly-spaced setae. *Gonocoxopodite* (Fig. 2a): Gonocoxite not enlarged, apex with conspicuous cluster of long setae on dorsolateral margin; subapical lobe prominent, distinctly rounded, usually with 6(4-8) long, stout, tapered setae, 3 usually stouter than the others. Gonostylus stout, curved and narrowed distally, with 2 small, slender setae on distal 0.5 of concave dorsal surface; gonostylar claw short, troughlike. *Phallosome* (Fig. 1a,b): Lateral plate (Figs. 1c-f; 2d-f) with 2-5 large teeth, 0-4 smaller ones, and a flat lateral lobe, base of lobe continuous with base of thumblike dorsal process, lobe larger in specimens from Brazil than Argentina; ventral arm curved dorsomesad, ventral surface bluntly dentiform, dorsal surface somewhat concave, slightly longer than teeth in Argentine specimens, slightly shorter than teeth in Brazilian specimens; dorsal arm flattened, slightly sinuous, tapered distally, and with indistinct ridge along dorsomesal margin. *Proctiger* (Fig. 2b): Paraproct with long, curved basal lateral arm and prominent ventral acetabulum (Fig. 2g), acetabulum appearing as lobe at base of dorsal process of lateral plate when the intact genitalia are viewed in dorsal aspect; crown dark, with numerous short needlelike spicules. Cercal sclerite elongate, broadest anteriorly; 1-5 cercal setae. Tergum X straplike, joining base of paraproct ventrally.

Since Bram (1967) is the most recent revision of the New World *Culex* (*Culex*), the synonymy of *oswaldoi* with *maxi* must include comments on Bram's treatment of these species. Bram separated *maxi* from *oswaldoi* in couplet 12

of his key based on male genitalia. From this couplet and his descriptions of the genitalia, it is apparent that Bram did not consider differences in the posture of the phallosome when he considered these as distinct species. Couplet 12 includes 3 diagnostic elements. The first characterizes the ventral arm as "large and distinct" in *oswaldoi* and "small and dentiform" in *maxi*. As noted above, the ventral arm was obstructed from view in the original preparation of the genitalia. Bram considered the ventralmost tooth of the lateral plate to be the ventral arm. In his description of *oswaldoi* (p. 86), Bram states that the ventral arm is "dentiform." This is contradictory, for the tooth is clearly not dentiform (Fig. 1c,d; see Fig. 25d in Bram).

The second character in couplet 12 concerns the teeth of the lateral plate. *Culex oswaldoi* is characterized as having "about four teeth" and *maxi* as having "about eight." From the dissected lateral plates of *oswaldoi* (Fig. 1c,d), it is obvious there are 3 and 4 teeth on the left and right lateral plates, respectively, and as noted earlier, one tooth on the left plate is broken off. The type of *maxi* has 6 and 5 teeth on the left and right plates, respectively (Fig. 1b).⁷ None of the specimens examined from either Argentina or Brazil has more than 7 teeth on a lateral plate. The modal number of teeth is 4, hence, *oswaldoi* is more or less an average specimen in this respect.

The third character in the couplet deals with the attitude of the dorsal process. That of *oswaldoi* is said to be "directed posteriorly" and that of *maxi* "directed anteriorly." Bram was apparently confused by direction as well as posture, for the dorsal process of *oswaldoi* was actually directed dorso-posteriorly (Fig. 1a) while that of *maxi*, owing to the abnormal attitude of the lateral plates, is directed dorsolaterally (Fig. 1b).

The most apparent difference between the type-specimens of *oswaldoi* and *maxi* went undetected by Bram. This is the difference in the size of the flat lateral lobe (LL, Figs. 1; 2e,f) of the lateral plate. Specimens of the *oswaldoi* form, i.e., specimens from Brazil, have a large lateral lobe (Figs. 1a,c,d; 2f). This is true of the specimen from Bahia, Brazil, which Bram used to illustrate the genitalia of *maxi* (his Fig. 22c,d). This specimen differs from the holotype of *oswaldoi* only in that each lateral plate has 5 teeth and an easily visible ventral arm. There are other specimens in the NMNH from Macaiba (the type-locality of *oswaldoi*), Recife and Piadade, Brazil, which Bram determined were *maxi* (see Table 1). All of these are of the *oswaldoi* form, further indicating that Bram disregarded the posture of the phallosome when he recognized *oswaldoi* as a new species. Several of the Brazilian specimens recognized as *maxi* by Bram were previously determined as this species by John Lane during studies on the Neotropical Culicidae (Lane 1953).

Clearly, the synonymy of *oswaldoi* with *maxi* illustrates the importance of carefully considering the positioning and posture of diagnostic features when making species determinations. We advocate the dissection and/or positioning of structures in a manner consistent with either normal resting position or published figures. Caution should also be exercised when making biometric

⁷ Right and left sides are reversed in Fig. 1b.

measurements of structures which vary considerably with positioning and/or posture when mounted for study, e.g., the length and width of the pupal trumpet and the measurement of DV/D from genitalia of *Culex pipiens* Linnaeus and related species.

Acknowledgments

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Abbreviations Used in Figures

- a - acetabulum
 Ae - aedeagus
 BLA - basal lateral arm (= basal arm of Bram 1967)
 BP - basal piece
 CSc - cercal sclerite
 CSe - cercal setae
 DOA - dorsal arm (= external process of Bram 1967)
 DP - dorsal process (= basal process of Bram 1967)
 GC - gonostylar claw
 Gs - gonostylus
 LL - lateral lobe
 Par - paramere
 PpC - paraproct crown
 Ppr - paraproct (= tenth sternite of Bram 1967)
 SL - subapical lobe (= apical lobe of Bram 1967)
 VA - ventral arm (= ventral cornu of Bram 1967)
 IX-TL - [position of] ninth tergal lobe
 X-Te - tergum X

TABLE 1

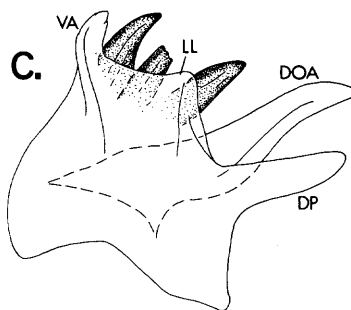
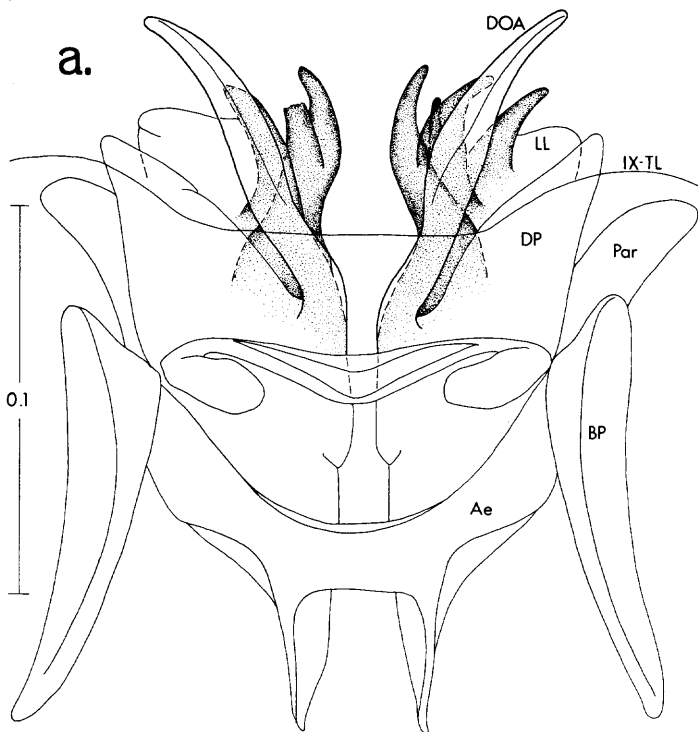
Table 1. Male genitalia characters in specimens of *Culex mazi* from Argentina and Brazil.

Specimen	No. of setae on IXth tergal lobes	No. of cercal setae	No. of setae on subapical lobes	No. of large teeth on lateral plates	No. of small teeth on lateral plates	Total no. of teeth on lateral plates	Locality	Latitude longitude
ARGENTINA								
<i>mazi</i> (holotype)*	8/7	3/5	6/6	4/5	2/0	6/5	San Pedro	24 14S 64 52W
<i>mazi</i> (paratype)*	5/6	3/-	6/6	3/3	1/0	4/3	Tucumán	26 49S 65 13W
57.II.16P*	5/7	2/2	6/4	3/3	1/1	4/4	"	"
4504	5/5	2/2	6/7	2/3	2/1	4/4	Santa Fe	31 38S 60 42W
4503	5/6	3/3	6/6	3/2	2/3	5/5	"	"
830311- 7	6/4	-/2	5/6	3/3	1/0	4/3	Empalme San Carlos	31 33S 60 49W
A-9	10/10	3/2	6/6	3/2	1/2	4/4	"	"
830323- 1	4/7	3/2	7/6	2/4	3/1	5/5	Calchaqui	29 54S 60 18W
- 4	18/20	5/3	6/6	3/2	2/3	5/5	"	"
- 6	6/5	2/2	6/6	2/3	2/0	4/3	"	"
830506- 3	7/7	3/3	7/7	3/5	2/0	5/5	"	"
830415- 4	10/8	4/2	7/7	4/3	1/1	5/4	Humboldt	31 25S 61 05W
- 5	6/7	-/3	6/5	3/3	1/1	4/4	"	"
- 8	6/8	3/2	6/6	3/2	1/2	4/4	"	"
-12	15/15	-/1	7/7	4/4	1/1	5/5	"	"
-14	8/5	4/3	7/6	4/4	0/0	4/4	"	"
-19	6/7	3/-	6/5	2/2	1/1	3/3	"	"
-22	7/8	3/2	6/6	2/3	0/0	2/3	"	"
-23	10/9	3/3	6/7	3/3	2/3	5/6	"	"
-27	8/5	3/4	6/6	3/3	1/2	4/5	"	"
830527- 9	8/9	3/4	7/6	3/3	1/2	4/5	"	"
-10	8/11	2/4	6/6	2/2	1/1	3/3	"	"
-12	13/14	2/2	7/6	3/2	1/1	4/3	"	"
-13	6/7	2/2	6/6	2/2	2/1	4/3	"	"
-14	8/10	4/3	6/6	4/3	2/1	6/4	"	"
-17	7/9	4/4	6/6	3/4	1/0	4/4	"	"
-19	10/11	2/3	6/6	4/3	1/2	5/5	"	"
-20	6/7	2/4	6/6	2/2	4/1	6/3	"	"
-39	8/9	0/1	6/6	3/4	3/3	6/7	Galvez	32 02S 61 13W
- 2	5/4	3/3	7/7	2/3	1/0	3/3	Recreo	31 30S 60 44W
- 3	7/8	2/2	6/7	3/4	1/1	4/5	"	"
- 5	5/5	3/-	6/6	2/2	1/2	3/4	"	"
BRAZIL								
<i>osaxidoi</i> (holotype)	5/-	2/2	6/6	3/3	0/1	3/4	Macaiba	5 51S 35 21W
107*	10/14	2/-	7/7	2/2	3/1	5/3	"	"
RB62 737*	5/6	2/2	7/7	2/4	1/1	3/5	Recife	8 03S 34 54W
" 738*	7/7	2/-	7/6	3/3	0/1	3/4	"	"
" 739*	7/6	2/2	7/8	3/2	0/1	3/3	"	"
" 740*	7/6	3/-	6/7	4/3	0/0	4/3	"	"
" 767*	5/6	3/3	6/6	3/3	2/1	5/4	Fiedade	?
" 209*	7/8	2/2	6/6	3/3	2/2	5/5	Bahia	12 59S 38 31W
23 [a]	5/7	3/2	6/7	3/2	0/1	3/3	Pirangi	5 55S 35 13W
23 [b]	13/10	1/1	8/8	2/2	0/1	2/3	"	"
Mode (Range)	7(4-20)	2(1-5)	6(4-8)	3(2-5)	1(0-4)	4(2-7)		

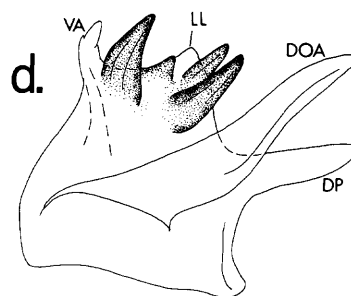
*Specimens examined and determined to be *mazi* by Bram (1967). Those from Brazil with a RB prefix were prepared by Ralph Bram.

Fig.1

phallosome (dorsal)



lateral plate (lateral)

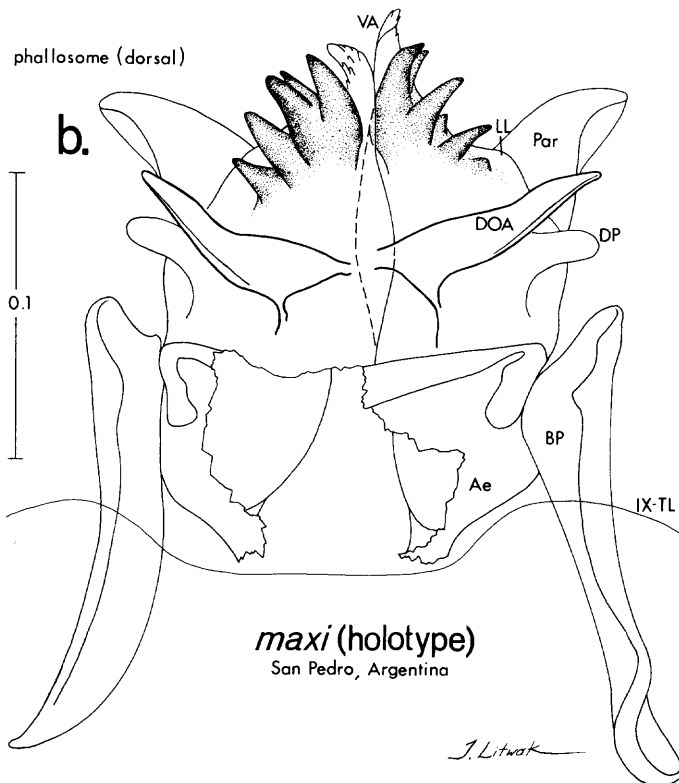


lateral plate (mesal)

oswaldoi (holotype)

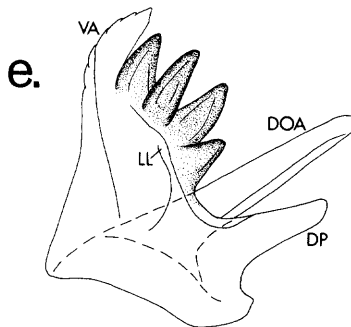
Macaíba, Brazil

phallosome (dorsal)

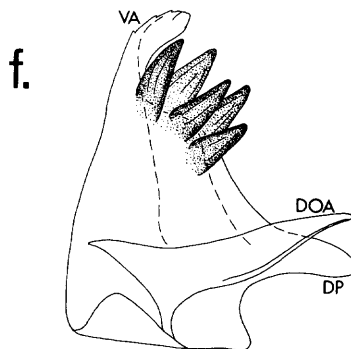


maxi (holotype)

San Pedro, Argentina



lateral plate (lateral)
No. 830506-3



lateral plate (mesal)
No. 830415-14

Fig. 2

