

CIBARIAL ARMATURE AS TAXONOMIC CHARACTERS FOR THE SPISSIPES SECTION OF *CULEX (MELANOCONION)* (DIPTERA: CULICIDAE)¹

OSWALDO PAULO FORATTINI AND MARIA ANICE MUREB SALLUM

School of Public Health, Department of Epidemiology, Av. Dr. Arnaldo, 715, CEP 01255, São Paulo, SP, Brazil

ABSTRACT. Female cibaria of 13 species of mosquitoes of the Spissipes Section of *Culex (Melanoconion)* were examined using light and scanning electron microscopy, and that of *Culex adamesi* were studied using light microscopy. Detailed descriptions of the cibaria are given. *Culex taeniopus* and *Culex nicaroensis* have six palatal papillae, others have four. Numbers of sensilla trichodea in the cibaria varied between species and within the same species: *Culex spissipes* has eight to 12; others have no more than eight. Possible use of cibarial armature to separate species is suggested. Taxonomic implications of the cibarial characters are discussed.

INTRODUCTION

Internal morphological features of the female cibarium of Culicidae were recognized early for species taxonomic differentiation (Sinton and Covell 1927; Barraud and Covell 1928; Christophers and Puri 1931). Cibarial armature is found in some *Anopheles* species, as well as all species of *Culex*, *Galindomyia* and *Deinocerites*. Regarding *Culex (Melanoconion)*, early studies on *Cx. pilosus* (Dyar and Knab), *Cx. erraticus* (Dyar and Knab), and *Cx. peccator* Dyar and Knab were performed by Michener (1944). Recently, several studies have included cibarial morphological characters for taxonomic identification at the species level and for phylogenetic approaches (Chen 1972, 1974; Sirivanakarn 1978; Harbach et al. 1984; Forattini and Sallum 1985, 1987). More recently, preliminary data regarding outlines of cibarial teeth and cibarial dome denticles were presented as auxiliary taxonomic characters.

The present study was designed to investigate the taxonomic value of the female cibarial characters for identification and grouping species in the Spissipes Section (Sirivanakarn 1983) of the subgenus *Melanoconion*. Of 21 species known in the group, it was possible to study the 14 considered below.

MATERIALS AND METHODS

The present study was based on identified specimens deposited in the Entomological Collection of the Department of Epidemiology, School of Public Health, University of São Paulo (FSP/USP). Standard methods for dissecting, preparing and microscopic examination were followed. A Jeol JSM-P15 scanning microscope was utilized to observe details probably impossible to examine under a light microscope. Descriptions, drawings and pictures were directly taken from slide preparations. Except for *Cx. nicaroensis* Duret, at least two specimens of each species were examined.

The terminology utilized for the sensilla trichodea is that of McIver (1982). Other terminology is that of Harbach and Knight (1980).

DESCRIPTIONS

Culex (Melanoconion) spissipes (Theobald)

Cibarial armature (Figs. 1;5A,B;8A,B): Cibarium (Fig.1) length about 230–260 μm ; lateral flange slightly curved; cibarial bar concave, weakly sclerotized, dorsal surface irregularly folded, posterior margin irregular; about 10–14 curved, spatulate and blunt teeth

¹Supported by Grant no. 90/4460–2, Fundação de Amparo à Pesquisa do Estado de São Paulo.

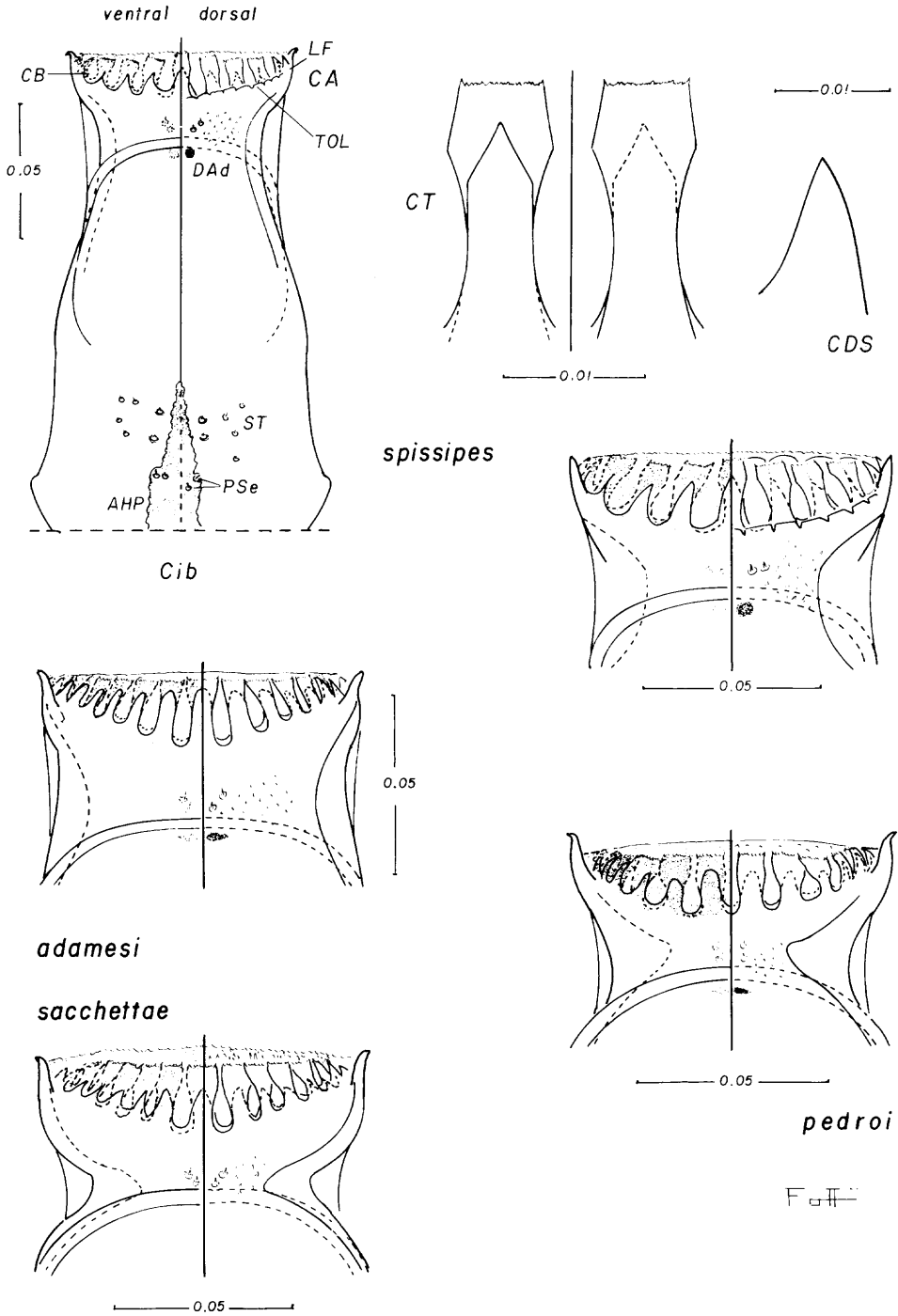


Fig. 1. Female cibaria. AHP—anterior hard palate; CA—cibarial armature; CB—cibarial bar; CDS—cibarial dome spicules; Cib—cibarium; CT—cibarial teeth; LF—lateral flange; PSe—palatal seta; ST—sensilla trichodea; TOL - teeth origin line. Scales in mm.

(Fig. 5A,B); tooth length about 18–23 μ m, teeth arranged in a single row; line of origin irregular; attached to cibarial bar by a trian-

gular expansion, expanded apically; distal parts of teeth free from enclosure; generally appearing as hyaline rods anteriorly and as

transverse folds posteriorly, with irregular serrated distal margin; hollow area of teeth moderately large, nearly triangular, more or less restricted to base. Posterior hard palate nearly rectangular in outline, moderately sclerotized; dorsal apodeme small, irregular; hyaline area between cibarial dome and posterior hard palate heavily spiculate; cibarial dome (Fig. 8A,B) nearly pentagonal, concavo-convex, surface with long, triangular, sharply pointed, posteriorly directed denticles. Palatal setae (Fig. 1) variably separated from one another, situated on lateral edges of anterior hard palate, frequently 2 on each side, occasionally 3 on one side and only one on the other. Sensilla trichodea borne in 2 irregular rows of 4–6 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Iguape County, Palmeiras Farm, A.C. Gomes coll. 19.VI.1989, Sallum det. 1989, caught in CDC-LT, 2♀; Pariquera-Açú County, Experimental Station, E.X. Rabello coll. 9.X.1980, det. 1980, 1♀; coll. 18.III.1982, det. 1982, 1♀; coll. 22.IV.1982, 2♀.

***Culex (Melanoconion) taeniopus* Dyar and Knab**

Cibarial armature (Figs. 2;5C,D;8C): Like *Cx. spissipes*, differing as follows. Cibarium (Fig. 2) length about 250 μm (specimen from Guatemala, 228 μm); dorsal surface and distal margin of cibarial bar with small spicules of different size; about 15–20 teeth (Guatemala, 10 teeth) (Fig. 5C,D); tooth length about 18–20 μm (Guatemala, 15 μm); line of origin not evident; hollow area of teeth small, more or less restricted to base. Palatal setae (Fig. 2) variably separated from one another, borne on lateral edges of anterior hard palate, 6 in total number, 3 on either side; anterior pair of palatal setae situated slightly apart from the rest, smaller in size. Sensilla trichodea arranged in linear series of 2–4 single setae on each side.

Material examined. 7 females: BRAZIL, São Paulo State, Pariquera-Açú County, Experimental Station, Forattini et al. coll. 21.VII.1980, Sallum det. 1981, caught in

Shannon Trap, 1♀; coll. 16.I.1980, human bait, 1♀; Iguape County, Palmeiras Farm, A.C. Gomes coll. 3.V.1989, det. 1989, 4♀. GUATEMALA, locality unknown, 1♀.

***Culex (Melanoconion) adamesi* Sirivanakarn and Galindo**

Cibarial armature (Fig. 1): Like *Cx. spissipes*, differing as follows. Cibarium length 210 μm ; dorsal surface and posterior margin of cibarial bar smooth; 16 teeth; tooth length 15 μm ; line of origin not evident; hollow area of teeth small, restricted to base. Posterior hard palate weakly sclerotized, dorsal apodeme not evident; hyaline area between cibarial dome and posterior hard palate scarcely spiculate; cibarial dome surface with short, triangular, not sharply pointed denticles. Palatal setae separated from one another, 2 on either side. Sensilla trichodea arranged in linear series of 2 or 3 single setae on either side.

Material examined. 2 females: Paratype, PANAMA, Darien, Pucro, Tacacurna River Valley, Gorgas Memorial Laboratory coll. 1963, Sirivanakarn and Galindo det. 1980, 1♀; BRAZIL, Pará State, Belém County, Mocambo, J.M.S. Barata coll. X.1985, Sallum det. 1985, caught in CDC-LT, 1♀.

***Culex (Melanoconion) pedroi* Sirivanakarn and Belkin**

Cibarial armature (Figs. 1;5G,H;8D): Like *Cx. spissipes*, differing as follows. Cibarium length about 200–220 μm ; dorsal surface and distal margin of cibarial bar with small spicules of different size; about 12–15 teeth (Fig. 5G,H); tooth length about 11–16 μm ; line of origin not evident. Posterior hard palate weakly sclerotized; hyaline area between cibarial dome and posterior hard palate scarcely spiculate. Palatal setae widely separated from one another, 2 on either side. Sensilla trichodea arranged in linear series of 2–4 single setae on either side.

Material examined. 5 females: BRAZIL, São Paulo State, Pariquera-Açú County, Experimental Station, Forattini et al. coll. 25.IV.1978, Sallum det. 1980, caught in

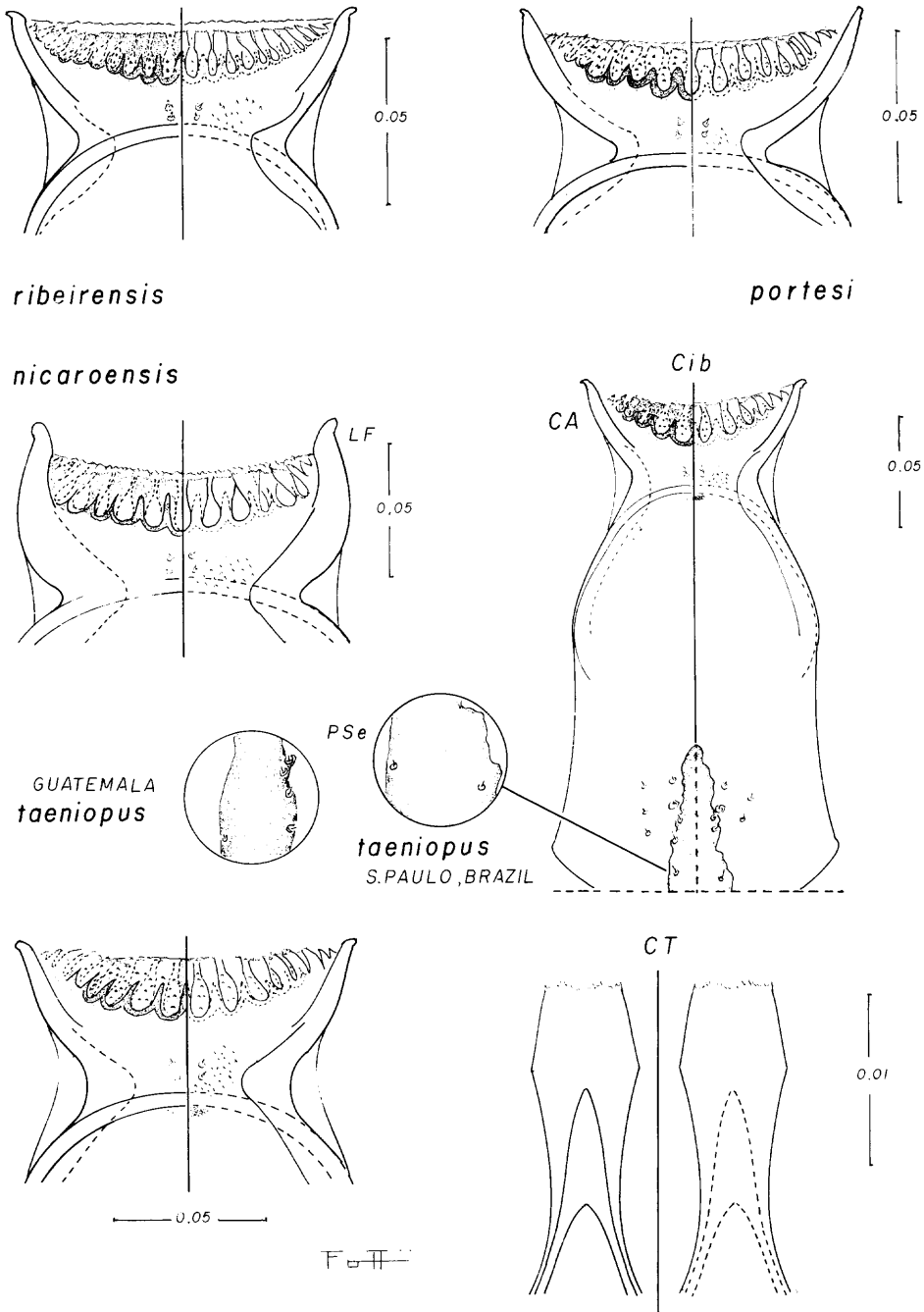


Fig. 2. Female cibaria. CA—cibarial armature; Cib—cibarium; CT—cibarial teeth; LF—lateral flange; PSe—palatal seta. Scales in mm.

CDC-LT, 1♀; coll. 13.VII.1978, 1♀; coll. 4.XII.1978, 1♀; Iguape County, Biguá Road, coll. 6.X.1982, det. 1982, 1♀; Cananéia County, Itapoã Farm, E.X. Rabello coll. 20.IV.1982, caught in Shannon Trap, 1♀.

***Culex (Melanoconion) ribeirensis* Forattini and Sallum**

Cibarial armature (Figs. 2; 5E,F; 9A,B): Like *Cx. spissipes*, differing as follows. Cibarium

length about 220–250 μm ; dorsal surface and distal margin of cibarial bar with small spicules of different size; about 15–22 teeth (Fig. 5E,F); tooth length about 16–20 μm ; line of origin not evident; hollow area of teeth small, restricted to base. Posterior hard palate weakly sclerotized; dorsal apodeme most often not evident, occasionally small, irregular; cibarial dome (Fig. 9A,B) surface with short, triangular, not sharply pointed denticles. Palatal setae borne on lateral edges of anterior hard palate, 2 on either side. Sensilla trichodea arranged in linear series of 2–4 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Iguape County, Palmeiras Farm, A.C. Gomes coll. 18.IV.1989, Sallum det. 1989, caught in CDC-LT, 6♀.

***Culex (Melanoconion) portesi* Senevet and Abonnenc**

Cibarial armature (Figs. 2;5I;6A;8E): As described for *Cx. spissipes* except as follows. Cibarium length about 190–200 μm ; dorsal surface and distal margin of cibarial bar with small spicules, irregular in size; about 16–19 teeth (Figs. 5I;6A); tooth length about 15–17 μm ; line of origin not evident. Posterior hard palate weakly sclerotized; dorsal apodeme not evident; hyaline area between cibarial dome and posterior hard palate scarcely spiculate. Palatal setae widely separated from one another, most often borne on lateral edges of anterior hard palate, rarely closely set on one side, 2 on either side. Sensilla trichodea arranged in linear series of 1–3 single setae on each side.

Material examined. 5 females: BRAZIL, Pará State, Belém County, Mocambo, J.M.S. Barata coll. 8.X.1985, Sallum det. 1985, caught in CDC-LT, 5♀.

***Culex (Melanoconion) sacchettae* Sirivanakarn and Jakob**

Cibarial armature (Figs. 1;6B,C;8F): As described for *Cx. spissipes* except as follows. Cibarium length about 200–220 μm ; dorsal surface of cibarial bar with small clustered spicules, irregular in size, posterior margin

irregularly serrulate with many different-sized spicules; about 12–15 teeth (Fig. 6B,C); tooth length about 14–17 μm ; line of origin not evident; teeth attached to cibarial bar, about posterior half free from enclosure. Posterior hard palate weakly sclerotized; dorsal apodeme not evident; hyaline area between cibarial dome and posterior hard palate scarcely spiculate. Sensilla trichodea arranged in linear series of 3,4 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Cananéia County, Itapoã Farm, Forattini et al. coll. I. 1981, Forattini and Sallum det. 1987, human bait, 2♀; coll. XII.1981, Sallum det. 1981, 1♀; coll.II.1981, Shannon Trap, 1♀; Iguape County, Palmeiras Farm, coll. VI.1989, det. 1989, caught in CDC-CO₂, 2♀.

***Culex (Melanoconion) vomerifer* Komp**

Cibarial armature (Figs. 6D,E;8G): As described for *Cx. spissipes* except as follows. Cibarium length about 200–210 μm ; dorsal surface and distal margin of cibarial bar with small spicules irregular in size; about 18–20 teeth (Fig. 6D,E); tooth length about 13 μm ; line of origin not evident. Posterior hard palate weakly sclerotized; dorsal apodeme not evident; hyaline area between cibarial dome and posterior hard palate scarcely spiculate. Palatal setae widely separated from one another, borne on lateral edges of anterior hard palate, 2 on either side. Sensilla trichodea arranged in linear series of 2–4 single setae on each side.

Material examined. 5 females: BRAZIL, Pará State, Belém County, Mocambo, J.M.S. Barata coll. 8.X.1985, Sallum det. 1985, caught in CDC-LT, 5♀.

***Culex (Melanoconion) delpontei* Duret**

Cibarial armature (Figs. 3;7A,B;9E,F): Like *Cx. spissipes* but with the following primary differences. Cibarium length about 210–230 μm ; dorsal surface of cibarial bar smooth, posterior margin with irregular sclerotized folds; about 22–26 thin, laminar teeth (Fig. 7A,B); tooth length about 13–14 μm ; each tooth with 2 recognized parts, anterior and

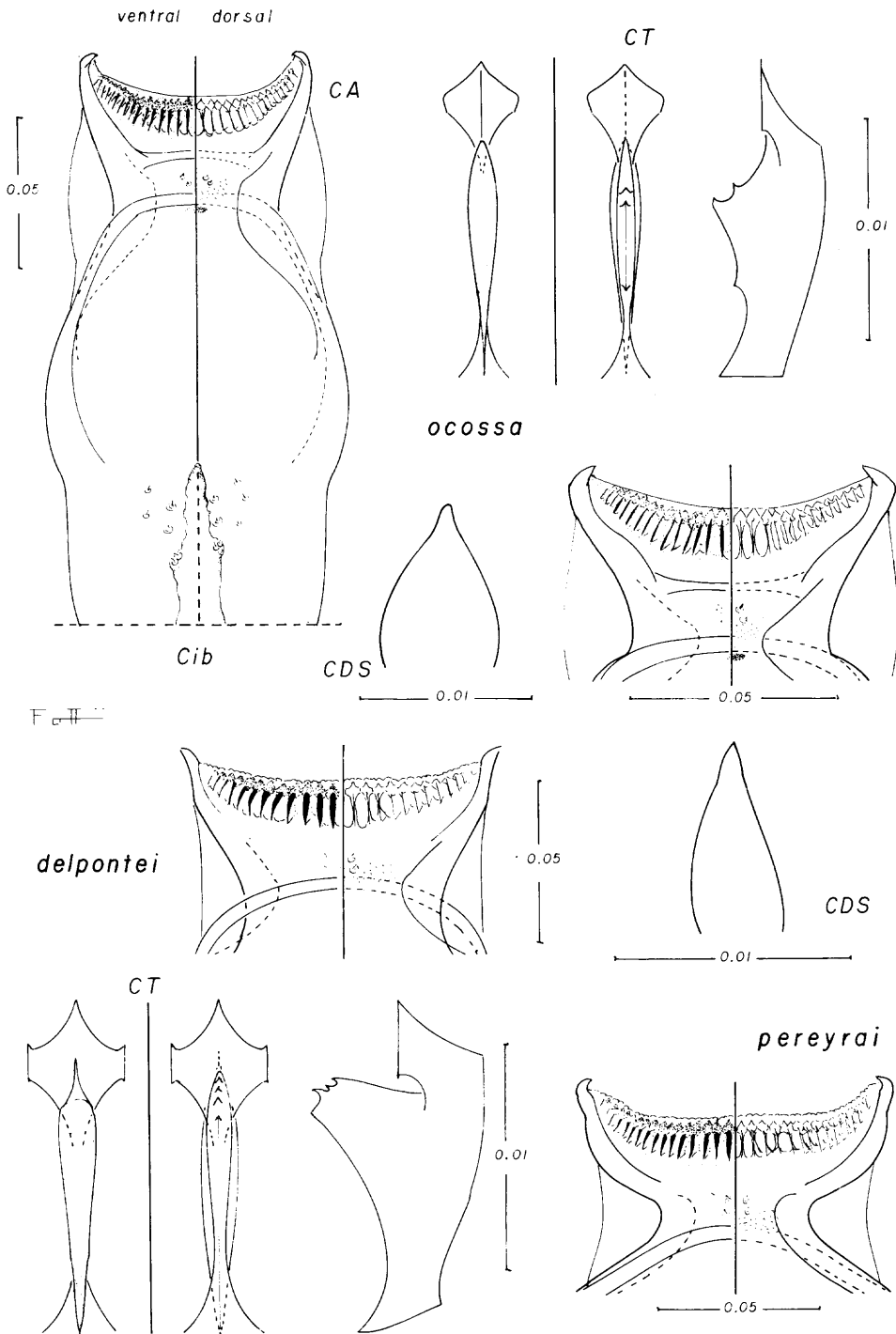


Fig. 3. Female cibaria. CA—cibarial armature; CDS—cibarial dome spicules; Cib—cibarium; CT—cibarial teeth. Scales in mm.

posterior (Fig. 3); the first a thin sagittal plate, the second a transverse plate, lozenge or roughly hexagonal in outline; minute spicules

may be seen at margins of both parts; line of origin of teeth not evident; hollow area of teeth absent. Dorsal apodeme not evident;

hyaline area between cibarial dome and posterior hard palate scarcely spiculate; cibarial dome (Fig. 9E,F) nearly circular, surface with long, blade-like, triangular, pointed denticles. Palatal setae widely separated from one another, located on lateral edges of anterior hard palate, 2 on either side. Sensilla trichodea a linear series of 2,3 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Iguape County, Biguá Road, Forattini et al. coll. X.1982, Sallum det. 1982, caught in CDC-LT, 3♀; Palmeiras Farm, A.C. Gomes coll. 18.IV.1989, det. 1989, 3♀.

Culex (Melanoconion) pereyrai Duret

Cibarial armature (Figs. 3;7C,D;9G): Like *Cx. delpontei*, differing as follows. About 27–30 cibarial teeth (Figs. 3;7C,D); tooth length about 12–14 μm . Palatal setae variably separated from one another, usually 4 in total number, occasionally 2 setae on one side and only one on other side. Sensilla trichodea a linear series of 2–4 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Iguape County, Biguá Road, Forattini et al. coll. X.1982, Sallum det. 1982, caught in CDC-LT, 1♀; Palmeiras Farm, coll. 19.VI.1989, det. 1989, 1♀; A.C. Gomes coll. 23.I.1990, det. 1990, collected as larva from the Peropava River edge, 1♀; Pariquerá-Açú County, Experimental Station, coll. 30.XI.1989, det. 1989, collected as larva from a pool of the Jacupiranga River, 3♀.

Culex (Melanoconion) ocosa Dyar and Knab

Cibarial armature (Figs. 3;7E,F;9C,D): Like *Cx. delpontei*, differing as follows. Cibarium (Fig. 3) length about 190–200 μm ; cibarial bar with a distinct transversal cuticular thickening in median portion, dorsal surface and posterior margin smooth; about 25–28 teeth (Fig. 7E,F). Dorsal apodeme small, irregular; cibarial dome (Fig. 9C,D) nearly circular, surface with leaf-like, sharply pointed denticles. Palatal setae (Fig. 3) variably separated from one another, located on lateral edges of anterior hard palate, occasionally 3 setae on one side and only one on other side, 4 in all. Sensilla

trichodea a linear series of 1–3 single setae on each side.

Material examined. 5 females: BRAZIL, São Paulo State, Pariquerá-Açú County, Experimental Station, E.X. Rabello coll. 10.XII.1981, Sallum det. 1982, caught in CDC-LT, 3♀; Iguape County, Palmeiras Farm, Forattini et al. coll. 18.IV.1989, 2♀.

Culex (Melanoconion) faurani Duret

Cibarial armature (Figs. 4;7G-I;9H,I): Like *Cx. spissipes* but with the following primary differences. Cibarium (Fig. 4) length about 200–210 μm ; dorsal surface of cibarial bar smooth, posterior margin with numerous different-sized spicules; about 29 narrow, long teeth with sides more or less parallel, apically truncate and finely serrate (Fig. 7G-I); tooth length about 19–23 μm , teeth arranged in a close-set row; line of origin almost straight; hollow area absent. Posterior hard palate weakly sclerotized; dorsal apodeme not evident. Cibarial dome (Figs. 4;9H,I) nearly circular, surface with numerous blade-like denticles. Palatal setae (Fig. 4) usually grouped in 2 separated pairs, situated close to lateral edges of anterior hard palate, occasionally 2,3 setae on one side and only one on other side. Sensilla trichodea a linear series of 2,3 single setae on each side.

Material examined. 5 females: BRAZIL, São Paulo State, Iguape County, Biguá Road, E.X. Rabello coll. 4.X.1982, Sallum det. 1982, caught in CDC-LT, 3♀; Rabello coll. 6.X.1982, 2♀.

Culex (Melanoconion) nicaroensis Duret

Cibarial armature (Figs. 2;6F,G): Like *Cx. spissipes*, differing as follows. Cibarium length 209 μm ; lateral flange (Fig. 2) large, well developed; cibarial bar moderately sclerotized, dorsal surface smooth, posterior margin irregular; 14 teeth (Figs. 4;6F,G); tooth length 15 μm ; line of origin not evident; hollow area of teeth small, more or less restricted to base. Dorsal apodeme not evident. Palatal setae widely separated from one another, borne on lateral edges of anterior hard palate, 5 in all, 3 on one side and 2 on other. Anterior

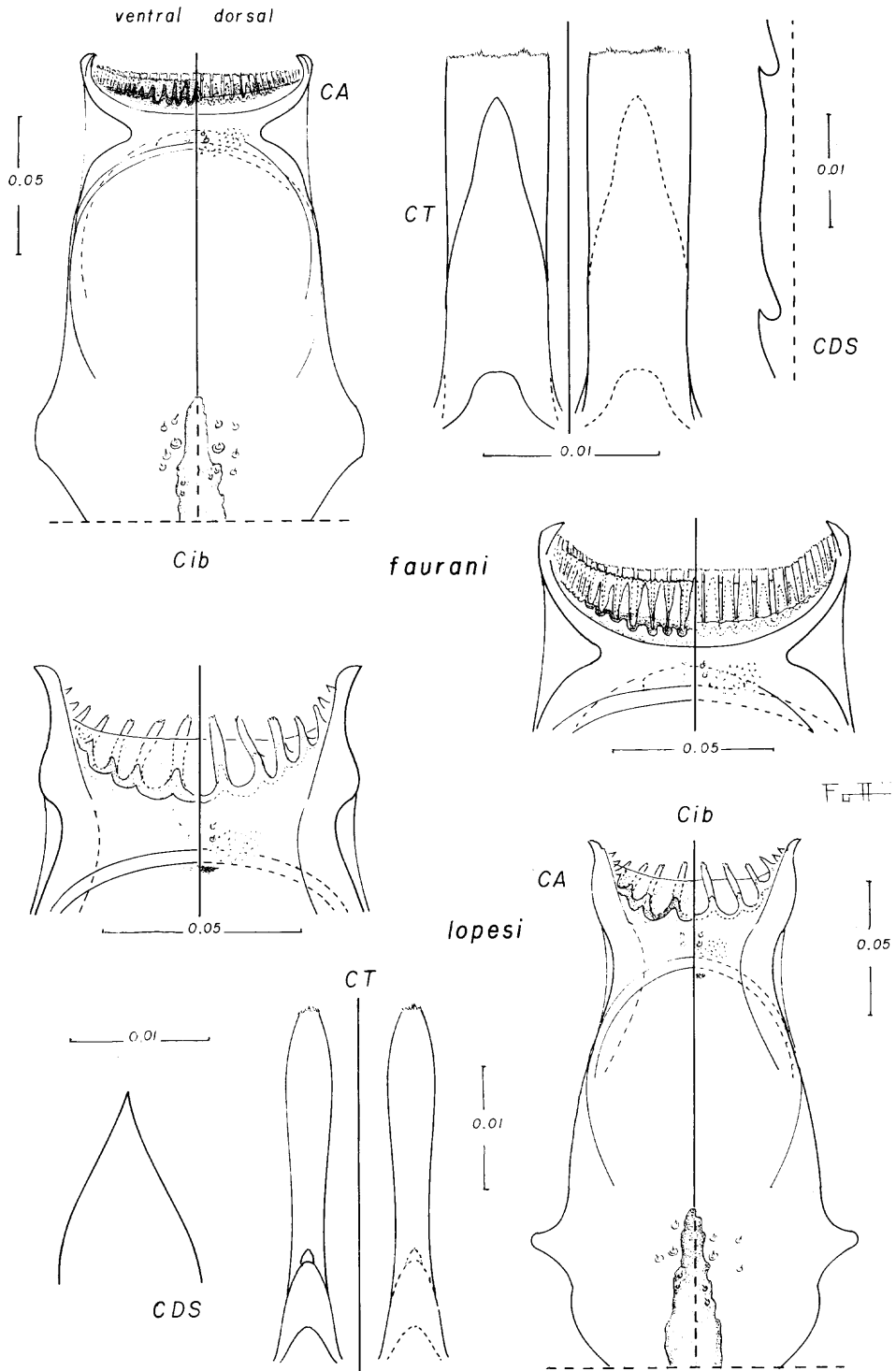


Fig. 4. Female cibaria. CA—cibarial armature; CDS—cibarial dome spicules; Cib—cibarium; CT—cibarial teeth. Scales in mm.



Fig. 5. Female cibarial armature. A,B, *Culex spissipes*; C,D, *Cx. taeniopus* (from São Paulo); E,F, *Cx. ribeirensis*; G,H, *Cx. pedroi*; I, *Cx. portesi*.

pair of palatal setae situated apart from the rest, smaller in size. 3,5 sensilla trichodea arranged in 2 irregular rows on each side.

Material examined. One female: CUBA, Guajaibon, Habana, O. Fuente coll. 8.VI.1989, Sallum det. 1991.

***Culex (Melanoconion) lopesi* Sirivanakarn and Jakob**

Cibarial armature (Figs. 4;6H,I;8H): Like *Cx. spissipes*, differing as follows. Cibarium

(Fig. 4) length about 220–260 μm ; cibarial bar concave, rather narrow, weakly sclerotized; dorsal surface and posterior margin smooth; about 11–15 long, thin, relatively pointed and rod-shaped teeth (Figs. 4;6H,I); tooth length about 23–30 μm , teeth widely separated from one another, distal margin of each finely serrate; line of origin almost straight; attached to cibarial bar by a triangular expansion, about posterior half free from enclosure; hollow area of teeth small, restricted to base. Sensilla tri-

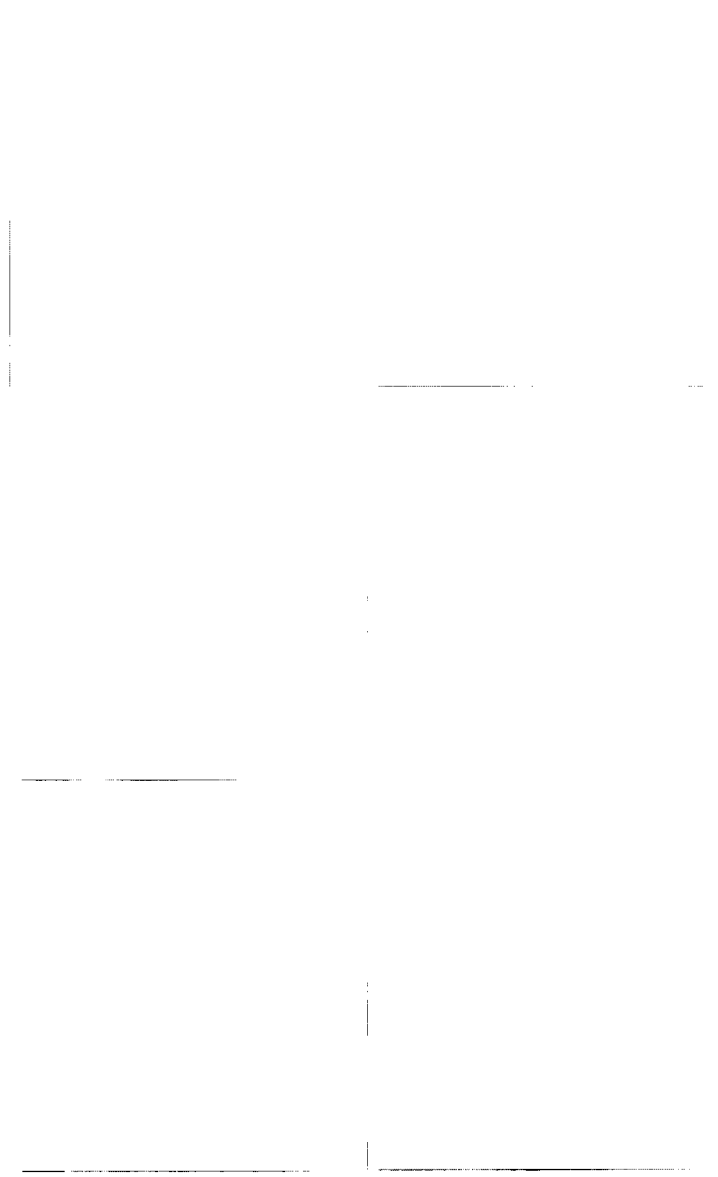


Fig. 6. Female cibarial armature. A, *Culex portesi*; B,C, *Cx. sacchettae*; D,E, *Cx. vomerifer*; F,G, *Cx. nicaroensis*; H,I, *Cx. lopesi*.

chodea arranged in linear series of 1–4 single setae on each side.

Material examined. 6 females: BRAZIL, São Paulo State, Pariquera-Açú County, São Paulo Avenue, Forattini et al. coll. XI.1980, Forattini and Sallum det. 1987, caught in New Jersey light trap, 1♀; Experimental Station, coll. I.1981, caught in CDC-LT, 1♀; coll. III.1982, 1♀; coll. VI.1982, 1♀; Iguape County, Biguá Road, E.X. Rabello coll. 6.X.1982, Sallum det. 1982, 2♀.

DISCUSSION

As a result of comparative study it was possible to find evidence to confirm that cibarial features have potential taxonomic significance, at least for some species of the Spissipes Section. Considering the structures described above, it is possible to discuss some aspects of the female cibarium as follows.

Sensilla. An anterior pair of palatal setae, besides the two posterior ones normally found



Fig. 7. Female cibarial armature. A,B, *Culex delpontei*; C,D, *Cx. pereyrai*; E,F, *Cx. ocoosa*; G-I, *Cx. faurani*.

on the anterior hard palate, was observed in *Cx. taeniopus* and *Cx. nicaroensis*. After considering variation in the placement of the two posterior pairs, it seems that the most anterior pair is characteristic of these species, and were not observed in the other species studied here.

The sensilla trichodea were observed as four to six pairs in *Cx. spissipes*, while the number varied from one to four pairs in the other species. Concerning the campaniform sensilla and dorsal and ventral setae, no significant differences were found.

Cibarial armature. As previously mentioned, several types of cibarial teeth are recognized by shape and general outline. Spatulate-shaped teeth, i.e., the posterior part is wide and the anterior part is narrow, are observed in *Cx. adamesi*, *Cx. nicaroensis*, *Cx. pedroi*, *Cx. portesi*, *Cx. ribeirensis*, *Cx. sachettae*, *Cx. spissipes*, *Cx. taeniopus* and *Cx. vomerifer*. Nevertheless, by other details of the cibarial armature, it is possible to distinguish some of these species. In *Cx. spissipes* there are irregular folds on the cibarial bar

Fig. 8. Female cibarial dome. A,B, *Culex spissipes*; C, *Cx. taeniopus*; D, *Cx. pedroi*; E, *Cx. portesi*; F, *Cx. sacchettae*; G, *Cx. vomerifer*; H, *Cx. lopesi*.

and the teeth have a distinct, irregular line of origin. As mentioned above, *Cx. taeniopus* and *Cx. nicaroensis* may be distinguished from the others by the anterior pair of palatal setae, but differ from one another in that the cibarial bar of *Cx. taeniopus* bears numerous spicules while in *Cx. nicaroensis* there are only small folds similar to those found in *Cx. spissipes*.

In *Cx. adamesi* the cibarial bar is smooth, but it is spiculate in *Cx. ribeirensis*, *Cx. pe-*

droi, *Cx. sacchettae*, *Cx. vomerifer* and *Cx. portesi*. In *Cx. sacchettae*, the spicules are numerous and clustered on the dorsal surface and distal margin, and the teeth are greatly enlarged posteriorly. The other four species have spicules evenly distributed on the cibarial bar. The maximum number of teeth is 15 in *Cx. pedroi*, but this represents the minimum number in *Cx. ribeirensis*, *Cx. vomerifer* and *Cx. portesi*. The cibarial length is greater in *Cx. ribeirensis* than in *Cx. vomeri-*

Fig. 9. Female cibarial dome. A,B, *Culex ribeirensis*; C,D, *Cx. ocoassa*; E,F, *Cx. delpontei*; G, *Cx. pereyrai*; H,I, *Cx. faurani*.

fer and *Cx. portesi*. Differentiation between the latter two species is more difficult, and the greater spiculosity of the cibarial bar in *Cx. vomerifer* can only be appreciated if specimens of the two species are examined simultaneously.

Teeth having a rigid parallelogram outline are found in *Cx. faurani*. As a whole, the cibarial teeth with their distinct line of origin have the appearance of a picket fence. Another type is found in *Cx. lopesi*, whose teeth

are rod-shaped and widely separated.

Cibarial teeth with a linear outline are found in *Cx. ocoassa*, *Cx. pereyrai* and *Cx. delpontei*. Teeth with two distinct parts, anterior and posterior, are recognized: the first one as a thin sagittal plate; the second as a small transverse plate, lozenge or hexagonal in outline. *Culex ocoassa* is easily recognized by having the anterior sagittal plate with a different outline, as well as a cuticular transverse thickening in the ventral surface that is

placed anterior to the cibarial bar. Differentiation between *Cx. delpontei* and *Cx. pereyrai* is difficult, based only on the relative number of teeth which is greater in *Cx. pereyrai* (27–30) than in *Cx. delpontei* (22–26).

Cibarial dome. Some differences between the shape of the denticles are recognized as taxonomic characters. Nevertheless, the real significance of these structures remains to be determined through more comprehensive studies to be made at the subgenus level. In any case, some features regarding the denticles may be recorded as follows.

Triangular and sharply pointed denticles were found in almost all the species examined. Denticles with a rather blunt apex were found in *Cx. ribeirensis*, and in *Cx. ocosa* the denticles are shorter with a leaf-like outline and a triangular but blunt apex. A similar triangular apex is found in *Cx. delpontei* and *Cx. pereyrai*, but the denticles have a laminar appearance and are longer and narrower than in *Cx. ocosa*. A completely different condition is observed in *Cx. faurani*, where the denticles are narrow and blade-like with regular incisions on the edge.

General comments. The "*Culex spissipes* Group" of Galindo (1969) includes a number of species which seem to be related on the basis of their male genitalia, larval characters and feeding habits. Agreeing with the relatedness of these species, Sirivanakarn (1983) renamed the group the "Spissipes Section" and subdivided it into smaller groups or subgroups, mainly based on adult and immature characters. It now seems possible to use cibarial anatomy to characterize the groups within the Spissipes Section. Even though some species were lacking in the present study, it seems likely that the absence of a line of origin of the cibarial teeth is characteristic of the Taeniopus, Paracrybda, Ocosa and Nicaroensis Groups. According to Sirivanakarn (1978) and Sirivanakarn and Heinemann (1980), it is probably characteristic of the Jubifer Group as well.

Cibarial teeth were considered by Sirivanakarn (1978), who recognized several types. In his "Melanoconion type, subtype spissipes" he included *Cx. crybda*, *Cx. pedroi*, *Cx. portesi*, *Cx. spissipes*, *Cx. taeniopus* and *Cx.*

vomerifer, his "Ocosa type" included *Cx. ocosa* and *Cx. panecossa*, and his "Jubifer type" included only *Cx. jubifer*. It is important to note that this study largely confirms Sirivanakarn's (1983) subdivision of the Spissipes Section. Adding to the characters proposed by him, the Spissipes Group may be recognized by having the cibarial teeth mainly spatulate in outline, the cibarial bar with folds, 8–12 sensilla trichodea, and by the presence of a line of origin of the teeth. The cibarial teeth in species of the Taeniopus Group are similar in outline to those of the Spissipes Group. Nevertheless, the absence of a line of origin of the teeth and the presence of fewer sensilla trichodea (2–8) support separate group recognition. Based on cibarial features it seems impossible to differentiate the Paracrybda Subgroup from the Pereyrai Subgroup of the Paracrybda Group. In the case of *Cx. delpontei* and *Cx. pereyrai*, the adults and male genitalia are very similar, so it seems that these subgroups should be combined, retaining the Paracrybda Group without subdivisions and including *Cx. paracryba*, *Cx. pereyrai* and *Cx. delpontei* in it. Concerning the Ocosa Group, similar cibarial features were observed in *Cx. ocosa*, *Cx. delpontei* and *Cx. pereyrai* even though there are conspicuous differences in the male genitalia. For this reason, and because the immature stages of *Cx. delpontei* and *Cx. pereyrai* are unknown this group should be retained. The cibaria of *Cx. faurani* and *Cx. lopesi* reflect the distinctiveness of the Faurani and Lopesi Groups, and the Nicaroensis Group is easily recognized by the curved and developed aspects of the lateral flange.

Finally, it seems important to note some differences observed between *Cx. taeniopus* from Guatemala and *Cx. taeniopus* from São Paulo, Brazil. The former has only 10 cibarial teeth, while the São Paulo strain has 15–20. Besides, as was described before, the teeth and cibaria are shorter in the Guatemala strain, and the cibarial bar is more conspicuously spiculate. In addition, the palatal setae in the Guatemala strain are five in number, four unilaterally placed and one smaller and anteriorly placed, but at the same level as the more anterior one of the other group. If dif-

ferences in addition to these exist, it could suggest that the two strains are, in reality, two different species.

ACKNOWLEDGMENT

We are grateful to Daniel Marucci for taking the scanning electron micrographs.

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