

Redescription of *Culex (Melanoconion) portesi* Senevet & Abonnenc, 1941, with notes on synonymy
(Diptera: Culicidae)¹

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ABSTRACT. Based on an analysis of the original and subsequent descriptions of *Culex (Melanoconion) portesi* Senevet & Abonnenc, 1941 and *Cx. (Mel.) cayennensis* Floch & Abonnenc, 1945, study of topotypic material and re-examination of male paratypes of *cayennensis*, the following actions are taken to stabilize the nomenclature: (1) synonymy of *cayennensis* with *portesi*, and (2) description of all known stages of *portesi*. The taxonomic references, including current synonymy are given. The male genitalia and hitherto unknown pupa and larva from Cayenne (type-locality), French Guiana, are illustrated. Literature on bionomics and medical importance is summarized.

RÉSUMÉ. L'analyse des descriptions d'une part, l'étude de specimens topotypiques et de paratypes d'autre part, permettent de confirmer la synonymie de *Cx. (Mel.) cayennensis* et *Cx. (Mel.) portesi*. Les stades préimaginaux de *Cx. portesi* sont décrits et les affinités de cette espèce avec *Cx. vomerifer* sont discutées. Une analyse bibliographique résume les connaissances sur la bioécologie et l'importance médicale de cette espèce.

INTRODUCTION

Culex (Melanoconion) portesi Senevet & Abonnenc, 1941 was originally described from French Guiana and was subsequently reported from Trinidad and Belém, Brazil (Aitken & Galindo, 1966) and Surinam (Panday, 1975a,b). In Trinidad, Aitken & Galindo noted that it was a common, dominant species in Bush Bush forest, an island in the Nariva swamp on the east coast and that it was a major vector of arboviruses. In French Guiana, its involvement in arbovirus cycles is also well established (Dégallier *et al.*, 1978, 1979).

In spite of its medical importance, the taxonomy of *portesi* has been very inadequately known, and its nomenclature is currently in a state of great confusion. The history of these nomenclatural changes can be summarized as follows:

1941: description of *portesi* by Senevet & Abonnenc (adult male)

1945: description of *Cx. (Mel.) cayennensis* by Floch & Abonnenc (adult male)

¹This work was supported by Research Contract No. DAMD-17-74-C-4086 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Fort Detrick, Frederick, MD 21701 and in part by the Pasteur Institute-O.R.S.T.O.M.'s research program on arboviruses epidemiology and vector bioecology in French Guiana.

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O.R.S.T.O.M. Fonds Documentaire
N° : 1387 ex 4
Cote : B

1947: Floch & Abonnenc synonymized *Cx. cayennensis* with *Cx. portesi*

1953: Lane synonymized *portesi* (and *cayennensis*) with *Cx. (Mel.) vomerifer* Komp, 1932

1965: Floch & Kramer resurrected *portesi* and *cayennensis* from synonymy, provided notes on the differences in the male genitalia of the 3 species, and made unjustified restrictions of the type-localities of the two nominal taxa: "Ile de Cayenne (Cabassou, Montagne Tigre)" for *portesi* and "La Comté (Bief)" for *cayennensis* whereas in the original descriptions, there were no specified type-localities whatever for the holotypes except "Cayenne" for *cayennensis*

1966: Aitken & Galindo examined 4 male paratypes and topotypic material of *cayennensis*, gave arguments to separate *portesi* from *vomerifer* and to confirm the previous synonymy of *cayennensis* with *portesi* by Floch & Abonnenc (1947).

Contrary to the last statement by Aitken & Galindo, both names: *portesi* and *cayennensis* have subsequently been listed as two separate taxa (Fauran & Pajot, 1974; Knight 1978), following Floch & Kramer's paper.

In a recent study by the senior author of numerous adults collected from several localities in French Guiana by J. Clastrier (see Heinemann & Belkin, 1978) and reared specimens recently collected from the same territory by the junior author, it has become evident that only a single species is represented in all of the *portesi-cayennensis* material from French Guiana. In addition, study of a male paratype (no. 285) at the USNM (see Aitken & Galindo, *op. cit.*:199, footnote) and of another male specimen (see thereafter) also cited after the original description of *cayennensis*, enabled us to confirm that it is conspecific with the rest of the *portesi-cayennensis* material.

The male holotypes of *portesi* and *cayennensis* were apparently lost or destroyed (Aitken & Galindo, *op. cit.*; Belkin, 1968:53; Dr. Tabet-Derraz, Pasteur Institute of Algier, *pers. comm.*; Dr. Rhodain, Pasteur Institute of Paris, *pers. comm.*) but the figures in the original description of Sénevet and Abonnenc (1941) are valid and except for specific details, are applicable to the determination of the identity of this species. The male genitalia of the paratypes of *cayennensis* and the description and figure of this species by Floch & Abonnenc (1945) agree in all aspects with Sénevet & Abonnenc's description and figures of *portesi*. We found no differences whatever between the two nominal taxa as noted by Floch & Kramer (1965).

On this basis, we are convinced that both taxa are conspecific and we here synonymize *cayennensis* with *portesi*.

Culex (Melanoconion) portesi Sénevet & Abonnenc
(Figs. 1-2)

Culex (Melanoconion) portesi Sénevet and Abonnenc, 1941:41-4. TYPE. Holotype: male (61, 227 Ab2) with genitalia on slide, exact locality not specified, FRENCH GUIANA (LPFM, considered to be non-existent by Belkin 1968:53).

Culex (Melanoconion) portesi: Floch & Abonnenc (1947:6); Rozeboom and Komp (1950:95); Fauran (1961); Floch & Kramer (1965:3-4); Aitken & Galindo (1966:202); Galindo (1969:87); Fauran and Pajot (1974:106); Panday (1975a:145; 1975b:299); Xavier & Mattos (1975:248); Mattingly (1976⁴:244); Knight and Stone (1977:263); Knight (1978:57); Dégallier & Claustre (1980:141).

Culex sp. no. 9: Aitken (1960); Aitken et al. (1963 in Aitken & Galindo, 1966).

Culex (Tinolestes) mojuensis: Belém Virus Laboratory Reports (1954 to 1962, in Woodall, 1967)

Culex B9: Belém Virus Laboratory Reports (since 1962, in Woodall, 1967).

Culex (Melanoconion) cayennensis Floch & Abonnenc, 1945:4. Type locality: Cayenne (Guyane Française). Type material: HOLOTYPE: a male (No. 286) with genitalia mounted on same slide, Cayenne, 17 Janvier 1940 (in PIP, after Belkin, 1968: 14; later reported to be lost by Harrison, 1973:279⁵). PARATYPES: (1) a male with genitalia (No. 285) in USNM, (2) a male (only the slide-mounted genitalia) labelled "Bief (Comté) 26-3-41 (adulte disparu)" deposited in MNHN, Paris. *NEW SYNONYM*.

Culex (Melanoconion) cayennensis: Floch & Kramer (1965⁶:4-5); Belkin (1968:14); Harrison (1973:279); Fauran & Pajot (1974:103); Knight (1978:56).

Culex (Melanoconion) vomerifer: Lane (1953:430); Stone, Knight & Starcke (1959:276); Belkin, Schick & Heinemann (1965:25).

FEMALE. Wing: 2.52 mm. Proboscis: 1.6 mm. Forefemur: 1.2 mm. Abdomen: 1.7 mm. In general, small, brownish to blackish species without distinctive ornamentation on palpus, proboscis, thorax, legs and wing. *Head.* Decumbent in broad central area of vertex narrow, crescent-shaped, dark anteriorly, pale yellowish posteriorly; broad scales pale gray, restricted to sides of eyes; erect scales slender, entirely blackish. Palpus and proboscis dark scaled; palpus about 0.16 of proboscis length. Antenna slightly longer than proboscis, weakly plumose. *Cibarial Armature.* Cibarial teeth 16,17; median 8-10 teeth flattened, columnar with hollow or transparent area on axis at bases; lateral teeth narrower, with or without hollow area at bases; apical margin of teeth truncate with 1,2 distinct or indistinct lateral spicules; cibarial dome broad, oval, strongly imbricate with numerous coarse denticles. *Thorax.* Mesonotal integument dark brown; scales narrow, entirely dark brown to nearly black on all parts of disc, including prescutellar space and scutellar lobes. Pronotum same color as mesonotum; *apn* with a row of

⁴description of egg.

⁵the junior author failed to find this holotype in the collections of PIP, Faculty of Medicine (Paris), ORSTOM (Bondy), MNHN (Paris) and in Mr. Abonnenc's own collection (*pers. comm.*).

⁶not 1966 as cited by Knight (1978:56,80).

about 10 setae on anterior lateral surface; *ppn* with or without a few narrow, dark scales on uppermost surface, posterior part with 4 bristles and variable number of short, weak bristles cephalad. Pleuron pale beige or yellow, contrasting sharply with mesonotum and pronotum, no pattern of dark spots on *stp* and *mep*; *ppl* with 1 strong, dark and 2,3 weak setae; upper corner of *stp* with a row of 5,6 strong and 1,2 weak seta, widely spaced, continuous with a row of 2 strong, dark and 8-10 weak setae on posterior lower border, latter also with a small patch of loosely packed pale scales; 1 lower *mep* bristle present. *Legs*. Coxal integument pale; femora, tibiae and tarsi dark scaled or without any conspicuous ornamentation. *Wing*. Scales on all veins entirely dark and moderately dense; plume scales on R_2 , R_3 abd R_{4+5} broad, ovate. *Abdomen*. All tergites entirely dark on dorsal surface, lateral surface with distinct basolateral pale spots; sternites with distinct basal pale bands on posterior segments.

MALE. In general resembles female except for the following. *Head*. Palpus long, slender, exceeding proboscis by about the full length of segment 5; segment 3 with 5,6 strong apical setae; segments 4,5 weakly to moderately plumose. Antennal flagellum strongly plumose. *Abdomen*. Tergites II-VII with distinct basal transverse pale bands of variable width.

MALE GENITALIA (Fig. 1). *Segment VIII*. Caudal margin of tergite VIII shallowly emarginate and with 2,3 rows of several strong setae. *Segment IX*. Lobes of IX tergite rounded or ovoid, widely separated, densely covered with 40 or more, long, sinuous setae. *Sidepiece*. Short, ovoid, about 0.24 mm in length; scales absent; several strong setae present on lateral outer surface; inner tergal surface with 2 long setae at about middle on convex surface and several minute setae distad to level of subapical lobe; tergomesal margin ventrad of subapical lobe practically bare. *Subapical Lobe*. Proximal and distal divisions represented by large, elongate, columnar processes, projecting mesad; stem of proximal division not divided distally, bearing 1,2 minute setae at base and 2 stout, proximally angulate and apically hooked rods (*a,b*) on apex; stem of distal division not divided, bearing 1 long fine seta (*h*) near base, 1 long hooked rod, 1 short and 1 long blades, 2,3 flat, apically blunt foliiforms and 1 very large, asymmetrical leaf on apex. *Clasper*. Simple, about 0.7 of sidepiece length, median portion gently curved, distal portion tapered into a recurved truncate apex; dorsal margin with a characteristic hump toward base and a distinct crest of several minute spicules on pre-apical portion: seta *a* (spiniform) distally broad, apically rounded or truncate; seta *b* spiniform, seta *c* tiny, rather inconspicuous. *Phallosome*. Lateral plate of aedeagus in lateral aspect with a broad, apically rounded basal hook, distal part with a long, straight, pointed, apical tergal process and a shorter sternal process, latter apically hooked. *Proctiger*. Apical crown dark, comblike, consisting of 8,9 flat, apically blunt spicules; paraproct and cercal sclerite narrow, cercal setae 3, minute; basolateral sclerotization broad, triangular.

PUPA (Fig. 1). Abdomen: 2.3 mm. Paddle: 0.61 mm. Trumpet: 0.35 mm., index 4.4. General outline and complete chaetotaxy as figured. Pigmentation of integument variable from uniformly pale whitish, with or without dark areas on cephalothorax and abdomen. *Cephalothorax*. Seta 1-C usually 4 branched (3,4); 2-C 4 branched; 3-C usually triple (2-4); 5-C 5,6 branched; 6-C usually double (2-3); 7-C double or triple; 8-C usually 6 branched (4-7) 9-C 4,5 branched. *Trumpet*. Short, funnel-shaped, dark pigmented; pinna widened, its

length, including slit about 0.5 of total length. *Metanotum*. Seta 10-C 8-10 branched; 11-C double; 12-C with 1 characteristic long branch and 1 short branch. *Abdomen*. Segment I-III: seta 4-I, strong, 4 branched; 1-II 17-22 branched; seta 1-III 8-12 branched; 3-I-III double, sometimes single; segments IV-VIII: 1-IV 6-12 branched; 1-V usually 8 branched (6-9); 1-VI 3,4 branched; 1-VII usually triple (3-4); 5-IV 6-8 branched; 5-V 4-8 branched; 5-VI 3-5 branched; 6-III-VI 3-5 branched; 9-VII 3,4 branched; 9-VIII usually 4 branched (3-4), placed at caudolateral angle of segment. *Paddle*. Broad, pale whitish; basal buttress and midrib distinct, lightly or strongly infuscate; 1,2-P minute.

LARVA (Fig. 2). Head: 0.72 mm. Siphon: 1.44 mm., index (length/basal width) 8. Saddle: 0.25 mm.; siphon/saddle 5,6. General outline and complete chaetotaxy as figured. *Head*. Pigmentation variable; seta 1-C dark, spiniform, variable in length; 3-C present, minute; 4-C forked into 4,5 branched; 5-C strong, 8-10 branched; 6-C single, very long; 7-C 8-11 branched; 10-C usually triple (2-5); 11-C 6 branched; 12-C 15-22 branched; 13-C 8-12 branched. Mental plate with 6,7 lateral teeth on each side of median tooth. *Antenna*. Shaft entirely dark pigmented; spicules strong, numerous; seta 1-A 20-28 branched; 2,3-A dark, bristlelike, situated apically. *Thorax*. Spiculation absent or very poorly developed. *Prothorax*. Seta 3-P 8-12 branched; 4-P double; 7-P 5-7 branched; 8-P 3,4 branched. *Mesothorax*: Seta 1-M minute, single; 2-M 4,5 branched, 3-M usually double (1-3); 4-M usually 4 branched, sometimes triple; 8-M 5,6 branched; 9-M 5-7 branched. *Metathorax*: 1-T minute, single; 2-T long, 4-6 branched; 3-T 5,6 branched; 4-T triple; 7-T 8-10 branched; 9-T 8,9 branched; 13-T 6-9 branched. *Abdomen*. Segments I-VI: seta 1,2-I,II minute single; 6-I,II triple; 7-I double; 1-III-VI 5,6 branched; 6-III-V 6-8 branched; 6-VI usually 6 branched, sometimes 5 or 7. Segment VII: 1-VII 7,8 branched; 4-VII 3,4 branched; 7-VII 2-4 branched; 10-VII 5,6 branched; 13-VII usually 6 branched (5-8). Segment VIII: 1-VIII 6,7 branched; 2-VIII 4 branched; 3-VIII 7,8 branched; 5-VIII 1,5 branched. Comb scales numerous, 40-50, scales on anterior rows short, small, those on posterior rows elongate and enlarged, all with apical fringe of evenly fine spicules. *Siphon*. Slender, moderately long; pigmentation yellowish with variable amount of brownish tinge; pecten teeth 9-12, with lateral barb of numerous fine denticles; siphonal tufts composed of 4,5 prominent subventral pairs and 2 weak subequal dorsolateral pairs; subventral pairs 4-6 branched, most proximal 4,5 times as long as siphonal width at point of attachment, next 3 distal pairs gradually shorter; 1st dorsolateral pairs triple, situated slightly beyond middle; 2nd dorsolateral pair, single, placed close to apex; seta 2-S hooked, spiniform with 1 accessory submedian spine; median caudal filament of spiracular apparatus well developed, as long as seta 2-S. *Anal Segment*. Saddle same color as siphon, posterior caudal margin without spinelike spicules; seta 1-X 5 branched, sometimes 7,8; 2-X 4,5 branched; 4-X with 6 pairs of branched setae; anal gills slender, as long as saddle.

DISTRIBUTION. Trinidad and Tobago, Guyana, Surinam, French Guiana and Brazil (Belém, Para). 1156 specimens examined; 710 F, 379 M, 9 pupae, 58 larvae; 16 individual rearings (15 larval, 1 pupal).

MATERIAL EXAMINED. TRINIDAD AND TOBAGO. *Nariva*: "Nariva Swamp", Bush Bush Forest, near sea level (Trinidad Regional Virus Laboratory, TRVL). *St. Andrew*, near Gaico, "Turrence Forest" (F. Powdher, T. H. G. Aitken).

GUYANA. *Demerara*, nearest town, Georgetown, Hyde Park (L. E. Rozeboom).

SURINAM. *Para*: Zanderij (P. Bolwerk). *Paramaribo* (D. C. Geijskes).

FRENCH GUIANA. *Ile de Cayenne*: Cayenne, Rémire, Montjoly (E. Abonnenc; T. H. G. Aitken, A. Guerra and R. Martinez); "Forêt de Cabassou", "Forêt du Rorota", Rémire, Matoury (J. Clastrier); *Régina*: Régina, Kaw (J. Clastrier). Gallion, route nationale no. 2 (N. Dégallier).

BRAZIL. *Para*: Belém, Instituto de Pesquisas e Experimentação Agropecuarias do Norte (IPEAN), Reserva de Aura at APEG Forest (T. H. G. Aitken and A. Toda). Catu forest (T. H. G. Aitken). Altamira area (J. F. Reinert).

The limits of this distribution westward in Guyana and southward in Brazil are not well known. However, we are perhaps dealing with a species characteristic of the guyanian biogeographical faunal ensemble (Müller, 1972).

TAXONOMIC DISCUSSION. *Cx. portesi* Sénevet and Abonnenc is closely related to *Cx. vomerifer* Komp. The latter was originally described from Panama and was subsequently recorded from French Guiana (Floch and Kramer, 1965) and Trinidad (Aitken and Galindo, 1966). On the basis of the male genitalia and larval characters, both species evidently fall into a distinct complex or subgroup of the *Culex spissipes* group of Galindo (1969). Within this group, their affinity is apparent closest to the other complex which includes *pedroi* Sirivanakarn and Belkin, 1980, *epanastasis* Dyar, 1921 and *crybda* Dyar, 1924, as currently interpreted (Sirivanakarn and Belkin 1980).

The male genitalia of *portesi* and *vomerifer* are extremely similar in nearly every feature except for the lobes of IX tergite which are strikingly different in shape and size and in the number and length of the setae on these lobes. These characters are shown here for *portesi* and were illustrated for *vomerifer* in Rozeboom and Komp (1950:113, Pl. XV, Fig. 89) and Aitken and Galindo (1966:198-208). In the adults, the only characters found to be reliable for separating the two species are the presence of conspicuous dark spots on the sternopleuron (*stp*) and mesepimeron (*mep*) in *vomerifer*, whereas these characters are absent in *portesi*. In the immature stages, comparison of the pupae and larvae from French Guiana and Trinidad revealed no significant difference in the chaetotaxy between the two species.

BIONOMICS. *Culex portesi* is a common inhabitant of lowland swamp forests at an elevation ranging from near sea level to about 30 meters. Thus, it seems to be absent from inland primary forest (Digoutte *et al.*, 1979; Dégallier & Claustre, 1980).

In Trinidad, Surinam, French Guiana and Brazil, adult females were frequently collected in great numbers from human bait, mammal-baited traps and light traps (Aitken *et al.*, 1968; Tikasingh, 1975; De Haas & De Kruijf, 1971; De Kruijf, 1972; Panday, 1975a; Sérié *et al.*, 1968; Dégallier *et al.*, 1978b; Dégallier, 1979; Davies *et al.*, 1971). Although it feeds on a great variety of warm-blooded vertebrates it shows a marked preference for rodents and marsupials (Davies, 1978; Dégallier, unpublished).

Females are nocturnal biters showing peaks of activity just after sunset and again before dawn (Aitken *et al.*, 1968; De Kruijf, 1970; Dégallier *et al.* 1978a). However, the activity cycle may show much variation in relation with the intensity of moonlight (Davies, 1975a; Dégallier *et al.*, 1978a).

Cx. portesi seems to bite at the same rate at ground level and in the canopy (Aitken *et al.*, 1968; De Kruijf, 1970, 1972; Davies *et al.*, 1971; BVL, 1969).

Aitken *et al.* (1968), Davies (1972, 1975), De Kruijf (1972), Panday (1974), Dégallier *et al.* (1978b), BVL (1967) and Davies *et al.* (1971) studied the seasonal pattern of abundance of this species and seasonal variations of the parous rate in relation with the rain. *Cx. portesi* shows maximum density and parous rate at the beginning and at the end of the rainy season. These characteristics, allied with a long gonotrophic cycle (De Kruijf, 1970; Davies, 1972; Dégallier, 1979) and an important longevity (in laboratory colonies: Davies & Martinez, 1970; in the field: Dégallier, unpublished) make this species a very good vector of enzootic or epizootic rodent-associated arboviruses.

Larvae "proved extremely elusive despite special efforts to find them" (Aitken *et al.*, 1968:258). However some larvae were found in "the deep shade of tree buttresses, root caves, and leafy swamp margins in water with pH varying from 4.4 to 5.9" (Aitken *et al.*, *loc. cit.*). Most of the larval specimens examined (except 3 in collection of the Mosquitoes of Middle America Project, Belkin & Heinemann, *pers. comm.*) were obtained from rearing egg rafts laid by wild or colonized females.

Other biological data that have been published include laboratory colony maintenance and life cycle (Takahashi, 1968; Davies & Martinez, 1970), development of ovaries following a blood meal and egg retention capacity under normal conditions (Davies, 1972; Dégallier, 1979), ability to penetrate small apertures and to traverse burrows (Davies, 1975b), and fungal parasitization (Davies *et al.*, 1971).

In conclusion, larval biotopes and population regulation remain very poorly known and need more field studies.

MEDICAL IMPORTANCE. Numerous arboviruses have been isolated from *Cx. portesi* in each part of its recorded range (except Guyana). Some of these arboviruses may be pathogenic to man or domestic animals (Table 1).

Some epidemiological aspects have been studied by Aitken *et al.* (1969) and Dégallier *et al.* (1978b, 1979) but more studies are needed especially concerning the role of *Cx. portesi* as a reservoir during the enzootic cycle.

ACKNOWLEDGMENTS

We sincerely thank John F. Reinert, Thomas H. G. Aitken and Ronald A. Ward for reviewing and editing the manuscript, Curtis Sabrosky (USNM), John N. Belkin (UCLA) and Lofc Matile (MNHM, Paris) for their counsel, and Vichai Malikul for preparing the illustrations. We are grateful to Oliver S. Flint, Jr. for his suggestion in publishing this paper.

We acknowledge Dr. Rhodain (PIP) for allowing us to study the Pasteur Institute's collection of mosquitoes and Dr. Tabet-Derraz (PIA) for his kind cooperation in searching for type material in Algier.

LITERATURE CITED

- Aitken, T. H. G. 1960. A survey of trinidadian arthropods for natural virus infections (August, 1953 to December, 1958). *Mosq. News* 20(1):1-10.
- Aitken, T. H. G. and P. Galindo. 1966. On the identity of *Culex (Melanoconion) portesi* Senevet & Abonnenc, 1941 (Diptera, Culicidae). *Proc. Entomol. Soc. Wash.* 68:198-208.
- Aitken, T. H. G., C. B. Worth and E. S. Tikasingh. 1968. Arbovirus studies in Bush Bush forest, Trinidad, W. I., September 1959-December 1964. III. Entomologic studies. *Am. J. Trop. Med. Hyg.* 17:253-268.
- Aitken, T. H. G., L. Spence, A. H. Jonkers and W. G. Downs. 1969. A 10-year survey of Trinidadian arthropods for natural virus infections (1953-1963). *J. Med. Entomol.* 6:207-215.
- Belkin, J. N. 1968. Mosquito Studies (Diptera, Culicidae). IX. The type specimens of New World mosquitoes in European Museum. *Contrib. Am. Entomol. Inst. (Ann Arbor)* 3(4):1-69.
- Belkin, J. N., R. X. Schick and S. J. Heinemann. 1965. Mosquito Studies (Diptera, Culicidae). V. Mosquitoes originally described from middle America. *Contrib. Am. Entomol. Inst. (Ann Arbor)* 1(5):1-95.
- Berge, T. O. 1975. International catalogue of arboviruses including certain other viruses of vertebrates. 2nd edition, Atlanta: 789 p.
- B. V. L. 1967. Annual Report. Belem Virus Laboratory, Belem, Para, Brazil, 150 p.
- B. V. L. 1969. Annual Report. Belem Virus Laboratory, Belem, Para, Brazil, 194 p.
- Causey, O. R., C. E. Causey, O. H. Maroja and D. G. Macedo. 1961. The isolation of arthropod-borne viruses, including members of two hitherto undescribed serological groups, in the Amazon region of Brazil. *Amer. J. Trop. Med. Hyg.* 10:227-249.
- Davies, J. B. 1972. Studies on the life history and habits of *Culex (M.) portesi* with relation to its involvement as a vector of arboviruses. in Venezuelan encephalitis: Proceed. Workshop Symp. Ven. Enceph. Virus, P. A. H. O. Scient. publ. no. 243:258-260.
- Davies, J. B. 1975a. Moonlight and the biting activity of *Culex (Melanoconion) portesi* Senevet & Abonnenc and *C. (M.) taeniopus* D. & K. (Diptera, Culicidae) in Trinidad forests. *Bull. Entomol. Res.* 65(1):81-96.

- Davies, J. B. 1975b. Studies on *Culex (Melanoconion) portesi* and *Culex (Melanoconion) taeniopus* mosquitoes in Trinidad. Thesis, University of London, 257 p.
- Davies, J. B. 1978. Attraction of *Culex portesi* Senevet & Abonnenc and *Culex taeniopus* Dyar & Knab (Diptera: Culicidae) to 20 animal species in a Trinidad forest. I. Baits ranked by numbers of mosquitoes caught and engorged. Bull. Entomol. Res. 68:707-719.
- Davies, J. B., P. S. Corbet, M. T. Gillies and A. W. R. McCrae. 1971. Parous rates in some Amazonian mosquitoes collected by three different methods. Bull. Entomol. Res. 61:125-132.
- Davies, J. B., and R. Martinez. 1970. Observation on the population dynamics, behavior and maintenance of a laboratory colony of *Culex (Melanoconion) portesi* Senevet and Abonnenc, 1941 (Diptera: Culicidae). J. Med. Entomol. 7:179-188.
- Dégallier, N. 1979. Le cycle gonotrophique de *Culex portesi* Senevet and Abonnenc en Guyane française. Cah. O.R.S.T.O.M. ser. Ent. med. Parasitol. 17(1):13-17.
- Dégallier, N. and J. Claustre. 1980. *Culicidae (Diptera, Nematocera)* de Guyane Française: notes faunistiques et taxonomiques. Rev. fr. Ent. (N.S.) 2(3):138-146.
- Dégallier, N., F. X. Pajot, R. Kramer, J. Claustre, S. Bellony and F. Lepont. 1978a. Rythmes d'activité des Culicidés de la Guyane française (Diptera, Culicidae). Cah. O.R.S.T.O.M. sér. Ent. med. Parasitol. 16(1):73-84.
- Dégallier, N., J. P. Digoutte et F. X. Pajot avec la coll. tech. de R. Kramer, J. Claustre, S. Bellony, G. Chatenay et E. Alfré. 1978b. Epidémiologie de deux arbovirus du complexe VEE en Guyane française: données préliminaires sur les relations virus-vecteurs. Cah. O.R.S.T.O.M. sér. Ent. Med. et Parasitol. 16(3):209-221.
- _____. 1979. Epidémiologie de *Bunyavirus* (Arbovirus) des groupes C et Guama en Guyane française: données préliminaires et comparaison avec le virus du complexe VEE. Cah. O.R.S.T.O.M. sér. Ent. méd. Parasitol. 17(1):3-11.
- De Haas, R. A. and H. A. M. de Kruijf. 1971. Isolation of Guama-group viruses in Surinam during 1967 and 1968. Trop. geogr. Med. 23:268-271.
- De Kruijf, H. A. M. 1970. Aspects of the ecology of mosquitoes in relation to the transmission of arboviruses in Surinam. Thesis. Drukkerij Bronder, Offset N.V., Rotterdam.
- De Kruijf, H. A. M. 1972. Aspects of the ecology of mosquitoes in Surinam. Stud. Fauna Suriname other Guyanas. 13(51): 1-56.
- Digoutte, J. P. 1974. Rapport annuel d'activités du groupe de Recherche U79, I.N.S.E.R.M. Institut Pasteur de la Guyane française, année 1973.

- _____. 1976. *Idem*, année 1975.
- Digoutte, J. P., F. X. Pajot and N. Dégallier. 1979. Pathologie. III. Les arboviroses et leurs vecteurs *in*: Atlas des Départements Français d'Outre-Mer. 4. La Guyane. éd. C.N.R.S.-O.R.S.T.O.M., Paris.
- Fauran, P. 1961. Catalogue annoté des Culicidés signalés en Guyane Française. Arch. Inst. Pasteur Guyane fr. Inini, Publ. no. 465, 60 p.
- Fauran, P. and F. X. Pajot. 1974. Complément au Catalogue des Culicidae signalés en Guyane Française (Amérique du Sud). Mosq. Syst. 6:99-110.
- Floch, H. and E. Abonnenc. 1945. Description de *Culex* nouveaux de la Guyane Française. Inst. Pasteur Guyane Ter. Inini, Publ. no. 112. 6 p.
- _____. 1947. Distribution des Moustiques de Genre *Culex* en Guyane française. Inst. Pasteur Guyane Ter. Inini, Publ. 146. 9 p.
- Floch, H. and R. Kramer. 1965. Sur *Culex (Melanoconion) vomerifer* Komp 1932, *Culex (Melanoconion) portesi* Senevet et Abonnenc 1941 et *Culex (Melanoconion) cayennensis* Floch et Abonnenc 1945, en Guyane Française. Arch. Inst. Pasteur, Guyane Française et l'Inini. Publ. 497, 5 p.
- Galindo, P. 1969. Notes on the systematics of *Culex (Melanoconion) taeniopus* Dyar and Knab and related species, gathered during arbovirus investigations in Panama (Diptera, Culicidae). Mosq. Syst. Newslett. 1:82-89.
- Harrison, B. A. 1973. Notes on some mosquito types deposited in France. Mosq. Syst. 5:277-279.
- Heinemann, S. J. and J. N. Belkin. 1978. Collection records of the project "Mosquitoes of Middle America". 11. Venezuela (VZ); Guianas: French Guiana (FG, FGC), Guyana (GUY), Surinam (SUR). Mosq. Syst. 10(3):365-459.
- Jonkers, A. H., D. Metselaar, A. H. P. de Andrade and E. S. Tikasingh. 1967. Restan virus, a new group C arbovirus from Trinidad and Surinam. Amer. J. Trop. Med. Hyg. 16(1):74-78.
- Jonkers, A. H., L. Spence, W. G. Downs, T. H. G. Aitken and E. S. Tikasingh. 1968a. Arbovirus studies in Bush Bush Forest, Trinidad, W. I., September 1959-December 1964. V. Virus isolations. Amer. J. Trop. Med. Hyg. 17(2):276-284.
- Jonkers, A. H., L. Spence, W. G. Downs, T. G. H. Aitken and C. B. Worth. 1968b. Arbovirus studies in Bush Bush Forest, Trinidad, W. I., September 1959-December 1964. VI. Rodent-associated viruses (VEE and agents of group C and Guama): isolations and further studies, Amer. J. Trop. Med. Hyg. 17(2):285-298.
- Knight, K. L. 1978. Supplement to a catalog of the mosquitoes of the world. The Thomas Say Found. Entomol. Soc. Am., Vol. 6, 107 p.

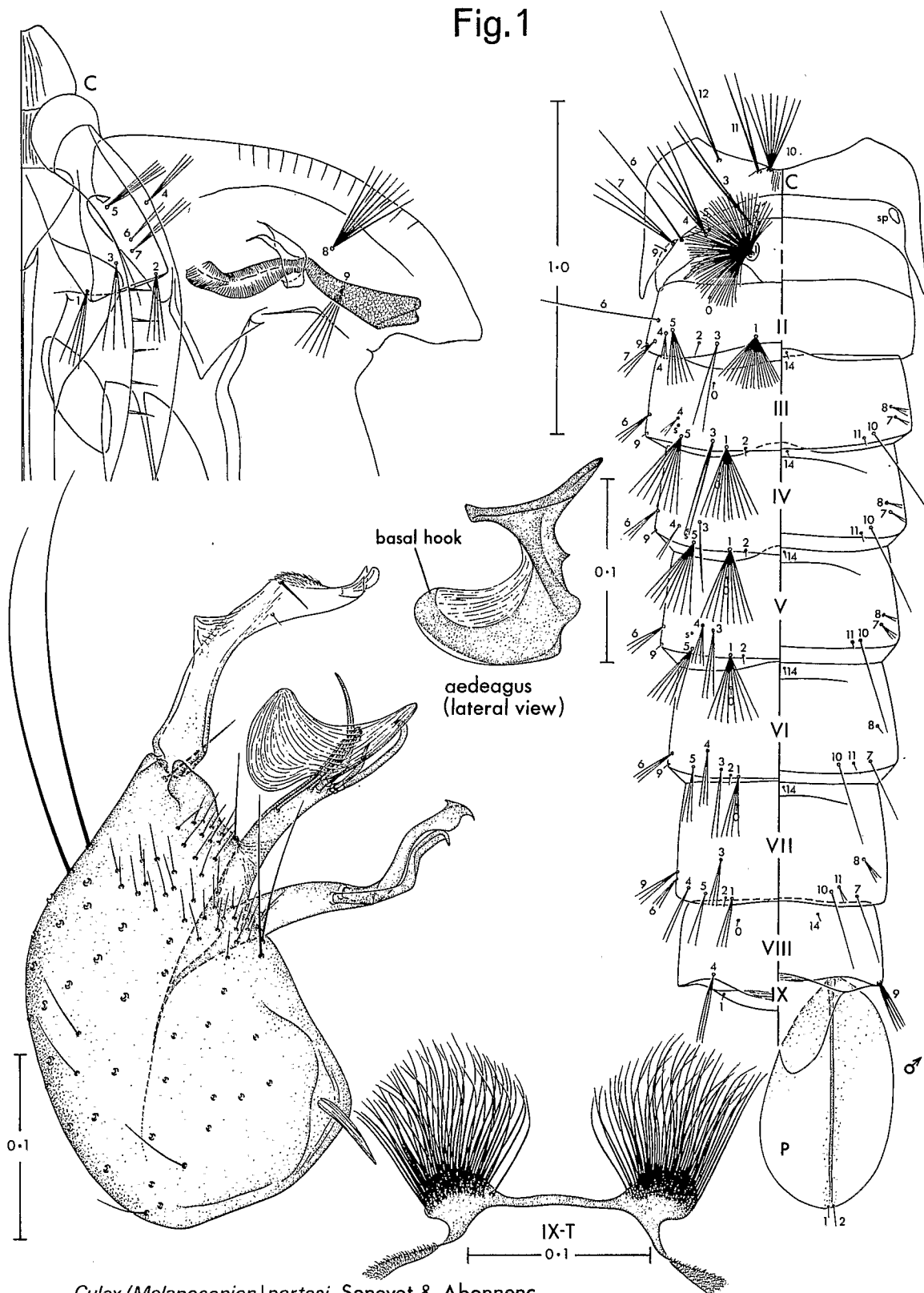
- Knight, K. L. and A. Stone. 1977. A catalog of the mosquitoes of the world. (Diptera: Culicidae). The Thomas Say Found., Entomol. Soc. Am., Vol. 6, xi + 611 p.
- Komp, W. H. W. 1932. A new *Culex*, *Culex vomerifer*, from Panama (Dipt., Culicidae). Psyche. 39:79-82.
- Lane, J. 1953. Neotropical Culicidae. Vol. 1. Sao Paulo, Univ. Sao Paulo, 548 p.
- Mattingly, P. F. 1976. Mosquito Eggs. XXVIII. *Culex* subgenera *Melanoconion* and *Mochlostyrax*. Mosq. Syst. 8:223-231.
- Müller, P. 1972. Centre of Dispersal and Evolution in the Neotropical Region. Stud. Neotr. Fauna. 7:173-185.
- Panday, R. S. 1974. Mosquito ecology in relation to the transmission of pathogens in Surinam. Thesis, Paramaribo, 203 p.
- Panday, R. S. 1975a. Mosquito identification studies in a savanna forest in Surinam. Mosq. News 35:141-146.
- _____. 1975b. Mosquito identification studies in a typical coastal area in northern Surinam. Mosq. News 35:297-301.
- Panday, R. S. and J. P. Digoutte. 1979. Tonate and Guama-group viruses isolated from mosquitoes in both a savannah and coastal area in Surinam. Trop. geogr. Med., 31(2):275-282.
- Rozeboom, L. E. and W. H. W. Komp. 1950. A review of *Culex* of the subgenus *Melanoconion* (Diptera, Culicidae). Ann. Am. Entomol. Soc. 43:75-114.
- Sénevet, G. and E. Abonnenc. 1941. Les moustiques de la Guyane Française. Le genre *Culex*. - 2. Nouvelle espece du sous-genre *Melanoconion*. Arch. Institut Pasteur d'Algerie. 19:41-44.
- Sérié, C. 1970. Rapport sur le fonctionnement technique de l'Institut Pasteur de la Guyane française pendant l'année 1969. Arch. Inst. Pasteur Guyane Inini. 21, Publ. no. 527: 518 p.
- Sérié, C., J. Clastrier, J.-C. Jacobi and C. Labarbe with tech. coll. of R. Kramer, G. Chatenay and J. Democrite. 1968. Un an de recherches arbovirologiques en Guyane Française. Arch. Inst. Pasteur Guyane fr. Inini. 21, publ. no. 517:67-75.
- Shope, R. E., O. R. Causey, A. H. P. Andrade & M. Theiler. 1964. The Venezuelan equine encephalomyelitis complex of group A Arthropod-borne viruses, including Mucambo et Pixuna from the Amazon region of Brazil. Amer. J. Trop. Med. Hyg. 13:723-727.
- Sirivanakarn, S. and J. N. Belkin. 1980. The identity of *Culex* (*Melanoconion*) *taeniopus* Dyar and Knab and related species with notes on the synonymy and description of a new species (Diptera, Culicidae). Mosq. Syst. 12(1):7-20.

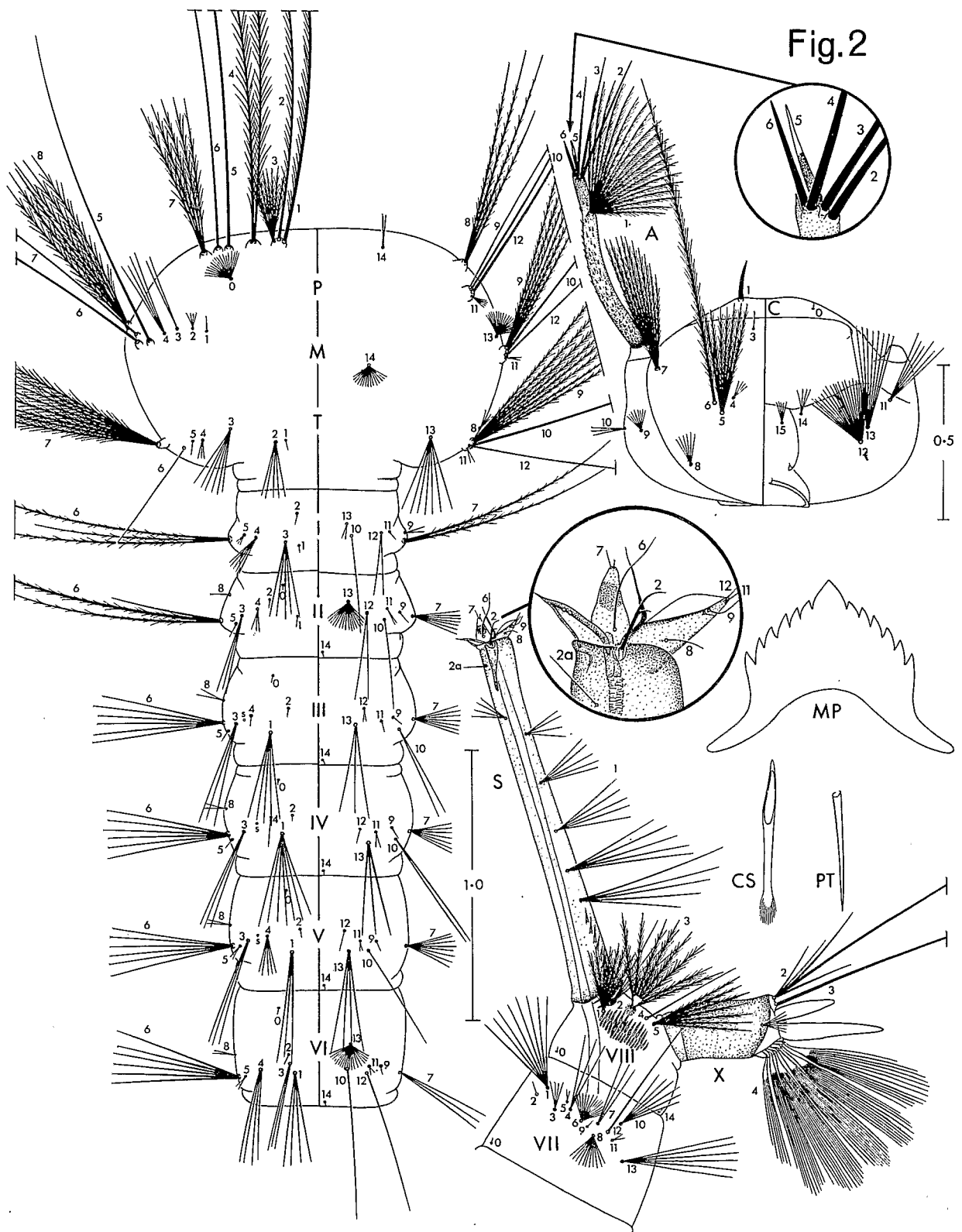
- Spence, L., C. R. Anderson, T. H. G. Aitken and W. G. Downs. 1962. Bimiti virus, a new agent isolated from trinidadian mosquitoes. Amer. J. Trop. Med. Hyg. 11:414-417.
- Stone, A., K. L. Knight and Starcke. 1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). The Thomas Say Found., Entomol. Soc. Am. Vol. 6, 358 p.
- Takahashi, M. 1968. Laboratory rearing of *Culex (Melanoconion) portesi* Senévet and Abonnenc. Mosq. News 28:82-4.
- Tikasingsh, E. S. 1975. Diel activity of some trinidadian mosquitoes as related to transmission of arboviruses. J. Trinidad Field Natur. Club:31-35.
- Toda, A. and R. E. Shope. 1965. Transmission of Guama & Oriboca viruses by naturally infected mosquitoes. Nature 208(5007):304.
- Woodall, J. P. 1967. Virus research in Amazonia. Atas do Simposio sobre a biota amazonica. 6 (Patologia):31-63.
- Xavier, S. H. and S. da Silva Mattos. 1975. Geographical distribution of *Culicinae* in Brazil. III. State of Para (Diptera, Culicidae). Mosq. Syst. 7(3):234-268.

TABLE 1. Virus isolations from *Cx. portesi*

VIRUS V.E.E.	GROUP A	COUNTRY Trinidad	REFERENCES Jonkers <i>et al.</i> , 1968b [confirmed later to be tonate by Dr. Digoutte (pers. comm.)]
Mucambo	A	Trinidad Brazil French Guiana Surinam	Jonkers <i>et al.</i> , 1968b Shope <i>et al.</i> , 1964 Sérié, 1970 Berge, 1975
Tonate	A	Surinam French Guiana	Panday and Digoutte, 1979 Digoutte, 1974
Cabassou	A	French Guiana	Digoutte, 1976
Caraparu	C	Brazil Trinidad French Guiana	Causey <i>et al.</i> , 1961 Jonkers <i>et al.</i> , 1968b, Aitken <i>et al.</i> , 1969 Sérié, 1970
Murutucu	C	Brazil French Guiana	Causey <i>et al.</i> , 1961 Sérié, 1970; Digoutte, 1974
Oriboca	C	Brazil Trinidad French Guiana	Berge, 1975; Toda and Shope, 1965 Jonkers <i>et al.</i> , 1968b, Aitken <i>et al.</i> , 1969 Sérié, 1970; Digoutte, 1976
Itaqui	C	Brazil	Shope <i>et al.</i> , 1961
Marituba	C	Brazil	BVL, 1967
Restan	C	Trinidad	Jonkers <i>et al.</i> , 1967
Catu	Guama	Brazil French Guiana Trinidad	Causey <i>et al.</i> , 1961 Digoutte, 1976 Jonkers <i>et al.</i> , 1968b
Bimiti	Guama	Trinidad Brazil French Guiana Surinam	Spence <i>et al.</i> , 1962 BVL, 1967 Digoutte, 1976 Berge, 1975
Guama	Guama	Trinidad French Guiana Trinidad Surinam	Causey <i>et al.</i> , 1961 Sérié, 1970; Digoutte, 1976 Jonkers <i>et al.</i> , 1968b De Haas and De Kruijf, 1971
Moju	Guama	Brazil	Woodall, 1967
Guajara	Capim	Brazil	Woodall, 1967
Turlock	Turlock	Brazil	Berge, 1975
Maguari	Bunyamvera	French Guiana	Dr. Digoutte, pers. comm.
Cotia	Poxvirus	French Guiana	Berge, 1975

Fig.1

*Culex (Melanoconion) portesi* Senevet & Abonnenc



Culex (Melanoconion) portesi Senevet & Abonnenc

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