MOSQUITO IDENTIFICATION STUDIES IN A SAVANNA FOREST IN SURINAM

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ABSTRACT. Entomologic studies were carried out during 1972 and 1973 in a savanna forest near Powaka, in order to determine the composition of the culicid fauna. Fifty-one species of mosquitoes were identified in trapping and/or biting collections of adults, with 13 of these species collected also as larvae; an additional 8 species were represented by larvae only. Ten species have not been found previously in Surinam. Also many larvae of *Sayomyia souzai*, a species belonging to the subfamily Chaoborinae, were collected.

INTRODUCTION

In Surinam Bonne and Bonne-Wepster contributed considerably to the systematics of the Culicidae. They published in 1925 their "Mosquitoes of Surinam," that although nowadays obsolete for the greater portion, still comprises a rich source of information for anyone who wants to become seriously involved in mosquito work. After Bonne and Bonne-Wepster there has till recently not been published a single general study on Surinam mosquitoes, although Van der Kuyp (1950) exhaustively dealt with the genus *Anopheles* and Bruyning (1959) published an extensive study on the genus *Wyeomyia*. Other important genera such as *Culex, Psorophora, Haemagogus, Sabethes* and *Limatus,* however, remained untouched. This was the more unsatisfactory as, since the fifties, international attention became more and more focused on arboviruses, and as it became obvious that representatives of these genera play an extraordinary important role in the transmission of these viruses. De Kruyf (1970, 1972) studied population dynamics and these investigations were continued by the author (Panday, 1974).

This paper presents the results of mosquito identification studies in a savanna forest in Surinam, from the first week of October 1972, till the last week of September 1973.

MATERIAL AND METHODS

THE STUDY AREA. The study area was located near Powaka, an Amerindian village, 40 km south of Paramaribo in the savanna belt, and surrounded by open and scrub savannas, forest, and culture plots. The Surinam Forest Department owns a *Pinus* plantation in the neighborhood. The catching station, which was situated in the forest approximately 3 km north of the village, just before the *Pinus* plantation, could be reached only by a jeep trail. The forest surrounding Powaka can be classified as high xerophytic (savanna) forest, which alternates with marsh forest. Physiognomically the savanna forest is in its best developed form a forest with a continuous canopy layer at 10–18 m, consisting of a remarkably large number of thin trees overtopped by a few bigger ones. The ground flora consists of herbs and small ferns; lianas and epiphytes are not numerous (Lindeman, 1953).

The forest surrounding Powaka, however, is of a very disturbed nature, because of logging activities, and therefore there is a rather dense undergrowth characterized by *Bromelia karatas* L. ("bosananas"), *Phenacospermum guianense* (L. C. Rich.) Miq. ("bigi-paloeloe"), *Astrocaryum paramacca* Martius ("paramaka"), various *Cephaelis* spp., *Scleria* spp. ("baboen-nefi") and *Melastomacea* spp. ("mispel"). The canopy stratum is characterized by *Eperua falcata* Aubl. ("walaba"), *Myrcia* spp. ("gujave"), *Inga* spp. ("swit'bonki"), *Pentaclethra macroloba* (Willd.) Kuntze ("kroebara"), whereas *Cecropia* spp. ("bospapaja") distinctly show the disturbed nature of the forest. In those places where creeks cross the forest, the undergrowth is different,

owing to the moist creek-margins, and it consists mainly of *Bactris* spp. ("keskesmaka"), *Ischnosiphon* spp. ("warimbo"), *Euterpe oleracea* Martius ("pina"), *Geonoma* spp. ("tas") and *Rapatea* spp.

Typical conditions for the development of marsh forest are a badly draining soil, or a soil provided with an impermeable layer at slight depth, which causes a rapid waterlogging and inundation in the rainy season. In the dry season, however, after the stock of water has been used up, an excessive desiccation sets in (Beard, 1946). The true marsh forests in Surinam develop over impermeable subsoil (Lindeman, 1953). The marsh forest at Powaka belongs to the *Symphonia globulifera* L.f. ("mataki") type. In these wet habitats *Symphonia globulifera* is always provided with numerous knee-shaped pneumatophores and forms the upper canopy stratum, together with such plants as *Pterocarpus officinalis* Jacq. ("watrabebe"), *Rheedia kappleri* Eyma ("pakoeli") and *Carappa* spp. ("krapa"). The undergrowth is almost the same as in the creekmarsh forest and *Euterpe oleracea* Martius ("pina") occurs in great numbers.

IDENTIFICATION. The mosquitoes were identified using keys or descriptions of Aitken and Galindo (1966), Bonne and Bonne-Wepster (1925), Cova Garcia (1966), Floch and Kramer (1966), Forattini (1962, 1965a and b), Komp (1942) and Lane (1953).

TRAPPING METHODS. Various means were used to collect adult female mosquitoes.

1. The catch from human bait at ground level. All catches were carried out twice a week between 0900 and 1200, by a mechanical aspirator with a transparent tube serving as a reservoir and a flexible tube through which the mosquitoes were sucked in. A complete description of the sucking device is described elsewhere (De Kruyf, 1970).

2. Catches with the Trinidad No. 10 trap (Worth et al., 1962). These traps were always baited with adult white mice and emptied every 24 hours.

3. Catches with the CDC miniature battery-operated light trap (Sudia and Chamberlain, 1962). The Trinidad No. 10 and CDC miniature light traps were operated 2 nights a week, from 1800 until 0600. Male mosquitoes were caught by means of the CDC miniature light trap.

MOSQUITO LARVAE. The search for breeding places was an important aspect of the overall program. Approximately twice a month larval surveys were carried out. In the laboratory aquatic stages were permitted to develop, and the cast larval skins were associated with the reared adult for identification.

RESULTS AND DISCUSSION

Results are presented in Table 1. Notes on certain species are given here. Fifty-one species of mosquitoes were identified in collections of the adults, with 13 of these species collected also as larvae; an additional 8 species were represented by larvae only. Ten species have not been found previously in Surinam. They are *Trichoprosopon compressum compressum, Wyeomyia ulocoma, Coquillettidia albicosta, Aedes oligopistus, Haemagogus leucocaelenus, Culex menytes, C. putumayensis, C. inhibitator, C. breviculus* and *C. erraticus.*

Anopheles nimbus. This species occurs all over Surinam, although it was never found in large numbers (Bonne and Bonne-Wepster, 1925). It was captured by De Kruyf (1970) in the savanna belt on human and chicken bait.

Anopheles punctimacula. This species was caught in the savanna belt on human bait (De Kruyf, 1970). At Powaka females were collected on human bait, with the Trinidad trap and light trap. Larvae were collected from a spathe of the pinapalm (*Euterpe oleracea*), together with larvae of *Culex coronator usquatus, C. brevispinosus* and the Chaoborini species *Sayomyia souzai.*

Anopheles oswaldoi. This is a sylvan species. The larvae are found in patches of water hyacinth and among collections of small bits of floating debris, trapped in

Table 1. Summary of the mosquito species caught in the "Powaka" area by various catching methods. H=Catch on human bait, TT=Catch with the Trinidad trap, LT=Catch with the light trap, Reared Males=The adult male has been reared from collected larvae.

Species	Females			Males		Reared
	H	TT	LT	LT	Larvae	Males
ANOPHELINI						
Anopheles nimbus (Theobald)	+	+	+	−	−	−
Anopheles punctimacula Dyar and Knab	+	+	+	−	−	−
Anopheles oswaldoi (Peryassu)	+	−	+	−	−	−
SABETHINI						
Trichoprosopon digitatum digitatum (Rondani)	+	+	+	−	+	+
Trichoprosopon compressum compressum Lutz*	+	−	−	−	+	+
Wyeomyia aphobema Dyar	+	−	+	−	+	+
Wyeomyia medioalbipes (Lutz)	+	−	−	−	−	−
Wyeomyia aporonoma Dyar and Knab	+	+	−	−	−	−
Wyeomyia confusa (Lutz)	+	−	−	−	−	−
Wyeomyia melanocephala Dyar and Knab	+	+	+	−	+	+
Wyeomyia occulta Bonne-Wepster & Bonne	+	−	−	−	+	+
Wyeomyia pseudopecten Dyar and Knab	+	−	−	−	−	−
Wyeomyia roucouyana Bonne-Wepster and Bonne	+	+	+	−	−	−
Wyeomyia ulocoma Theobald*	+	−	−	−	−	−
Wyeomyia spp.	+	+	+	−	−	−
Limatus durhamii Theobald	+	+	+	−	+	+
Limatus flavisetosus Castro	+	+	+	−	+	+
Sabethes cyaneus (Fabricius)	−	+	−	−	−	−
CULICINI						
Coquillettidia albicosta (Peryassu)*	+	+	+	−	−	−
Coquillettidia venezuelensis (Theobald)	+	+	+	+	−	−
Coquillettidia spp.	−	−	−	+	−	−
Mansonia titillans (Walker)	+	+	+	+	−	−
Mansonia pseudotitillans (Theobald)	−	+	+	+	−	−
Uranotaenia leucoptera (Theobald)	−	−	−	+	−	−
Uranotaenia geometrica Theobald	+	−	+	+	−	−
Uranotaenia pulcherrima Arribálzaga	−	−	+	+	−	−
Uranotaenia pallidoventer (Theobald)	−	−	+	−	−	−
Orthopodomyia fascipes (Coquillett)	−	+	−	−	−	−
Psorophora albipes (Theobald)	+	+	+	−	−	−
Psorophora lutzi (Theobald)	+	+	+	−	−	−
Psorophora ferox (Humboldt)	+	+	+	−	+	+
Psorophora cingulata (Fabricius)	+	−	+	−	−	−
Psorophora spp.	−	−	+	−	−	−
Aedes scapularis (Rondani)	+	−	−	−	−	−
Aedes serratus (Theobald)	+	+	+	+	+	+
Aedes oligopistus Dyar*	−	−	−	+	−	−
Aedes taeniorhynchus (Wiedemann)	+	+	+	−	−	−
Aedes hortator Dyar and Knab	+	−	−	−	−	−
Aedes terrens (Walker)	+	+	+	−	−	−
Aedes arborealis Bonne-Wepster and Bonne	+	+	+	−	−	−
Aedes spp.	−	−	+	−	−	−
Haemagogus leucocaelenus (Dyar and Shannon)*	+	−	−	−	−	−
Haemagogus janthinomys Dyar	+	+	+	−	−	−
Culex allostigma Howard, Dyar, and Knab	−	−	+	−	−	−
Culex corniger Theobald	−	−	−	−	+	+
Culex bonneae Dyar and Knab	−	−	−	−	+	+
Culex coronator usquatus Dyar and Knab	−	−	−	−	+	+
Culex brevispinosus Bonne-Wepster and Bonne	−	−	+	+	+	+
Culex mollis Dyar and Knab	+	+	+	+	+	+
Culex taeniopus Dyar and Knab	−	+	+	+	+	+
Culex spissipes (Theobald)	+	+	+	−	−	−
Culex menytes Dyar*	−	−	−	+	−	−

* The species marked with an asterisk are new for Surinam.

Table 1 (Continued)

Species	Females H	Females TT	Females LT	Males LT	Larvae	Reared Males
CULICINI (Continued)						
Culex portesi Senevet and Abonnenc	+	+	+	+	—	—
Culex putumayensis Matheson*	—	—	—	+	—	—
Culex inhibitator Dyar and Knab*	—	—	+	+	—	—
Culex eastor Dyar	—	—	—	+	—	—
Culex coppenamensis Bonne-Wepster and Bonne	—	—	—	+	—	—
Culex breviculus Senevet and Abbonenc*	—	—	—	+	—	—
Culex erraticus (Dyar and Knab)*	—	—	—	+	+	+
Culex bonnei Dyar	—	—	—	—	+	+
Culex infoliatus Bonne-Wepster and Bonne	—	—	—	—	+	+
Culex urichi (Coquillett)	—	—	—	—	+	+
Culex pleuristriatus Lutz	—	—	—	—	+	+
Culex spp.	+	+	+	—	—	—
CHAOBORINI						
Sayomyia souzai Lane*	—	—	—	—	+	+

* The species marked with an asterisk are new for Surinam.

emergent or trailing vegetation along the river banks, and they are also commonly found in bush creeks, swamps, and other water under heavy shade (Fleming, 1963). Bruyning (1952) collected numerous larvae in shaded swamps along the rivers Tapanahony and Paloemeu, however, only 1 female was captured on human bait. At Powaka females were caught on human bait and with the light trap. Van der Kuyp (1950) collected this species also in the coastal area, although in very small numbers.

Trichoprosopon digitatum digitatum. Larvae were found in fallen spathes of *Euterpe oleracea.* They were accompanied by larvae of *Limatus durhamii, L. flavisetosus, Culex urichi* and *C. bonnei.*

Trichoprosopon compressum compressum. Larvae were collected from the leaf axils of *Phenacospermum guianense,* in association with larvae of *Wyeomyia melanocephala, W. occulta* and *Culex urichi.*

Wyeomyia aphobema. Larvae are common in the leaf axils of Bromeliaceae as well as in treeholes (Bruyning, 1959). Larvae were collected from the inflorescence of *Phenacospermum guianense* together with larvae of *Wyeomyia occulta.*

Wyeomyia melanocephala. Larvae were collected several times from the leaf axils of *Phenacospermum guianense,* in association with larvae of *Trichoprosopon compressum compressum, Wyeomyia occulta* and *Culex urichi.*

Wyeomyia occulta. Larvae were collected several times from the inflorescence and leaf axils of *Phenacospermum guianense,* in association with larvae of *Trichoprosopon compressum compressum, Wyeomyia aphobema, W. melanocephala* and *Culex urichi.*

Limatus durhamii. Larvae were collected several times from spathes of *Euterpe oleracea,* in association with larvae of *Trichoprosopon digitatum digitatum, Limatus flavisetosus, Culex mollis, C. urichi* and *C. bonnei.*

Limatus flavisetosus Castro. Larvae were collected several times from the spathes of *Euterpe oleracea,* in association with larvae of *Trichoprosopon digitatum digitatum, Limatus durhamii, Culex mollis, C. urichi* and *C. bonnei.*

Sabethes cyaneus. De Kruyf (1970) caught this species on human bait and with the Trinidad trap.

Coquillettidia venezuelensis (Theobald). Special effort was made to locate the breeding places, however, without success.

Uranotaenia geometrica Theobald. This species is common throughout Surinam.

Orthopodomyia fascipes (Coquillett). Females were captured with the Trinidad trap. Probably they feed on birds (Forattini, 1965).

Psorophora ferox. Larvae were collected from a temporary rainpool, in association with larvae of *Culex mollis* and *Aedes serratus.*

Aedes serratus. Larvae were collected from temporary rainpools and spathes of *Euterpe oleracea,* in association with larvae of *Psorophora ferox, Culex mollis, C. brevispinosus* and *C. urichi.*

Aedes taeniorhynchus. Sometimes enormous swarms are seen in the coastal area.

Haemogogus leucocaelenus. Zavortink (1972) removed *leucocaelenus* and related species from *Aedes* and placed them in *Haemagogus,* resurrecting the subgenus *Conopostegus* for them. Hal Arnell (1974), who revised the genus *Haemagogus,* is in full agreement with Zavortink's inclusion of the subgenus *Conopostegus* in *Haemagogus.*

Haemagogus janthinomys Dyar. Hal Arnell (1973) stated that *H. janthinomys* is apparently indistinguishable from *H. capricornii* except in the male genitalia. He found that these two species are specially distinct from each other, and he saw no justification for recognizing *falco* or *petrocchiae* as subspecies, distinct from typical *janthinomys.*

Culex corniger. Larvae were collected from a temporary rainpool in association with larvae of *Culex mollis.*

Culex bonneae. Larvae were collected from spathes of *Euterpe oleracea,* in association with larvae of *Culex mollis* and *C. erraticus,* from a temporary rainpool, together with larvae of *C. mollis* and from a treehole, in association with larvae of *C. mollis* and *C. coronator usquatus.*

Culex coronator usquatus. Larvae were collected from temporary rainpools, in association with larvae of *Anopheles punctimacula, Culex mollis, C. taeniopus, C. brevispinosus* and *Sayomyia souzai,* from a treehole, in association with larvae of *Culex mollis* and *C. bonneae.*

Culex brevispinosus. Larvae were collected from a treehole, from temporary rainpools in association with larvae of *Anopheles punctimacula, Aedes serratus, Culex mollis, C. coronator usquatus, C. taeniopus, C. pleuristriatus* and *Sayomyia souzai,* from spathes of *Euterpe oleracea,* together with larvae of *Anopheles punctimacula, Aedes serratus, Culex mollis, C. coronator usquatus, C. urichi, C. infoliata* and *Sayomyia souzai.*

Culex mollis. Larvae were collected from temporary rainpools in association with larvae of *Psorophora ferox, Aedes serratus, Culex coronator usquatus, C. taeniopus, C. brevispinosus, C. corniger* and *C. bonneae,* from spathes of *Euterpe oleracea,* together with larvae of *Limatus durhamii, L. flavisetosus, Culex brevispinosus, C. erraticus, C. bonneae,* and *C. infoliata.*

Culex taeniopus. Larvae were collected from a temporary rainpool, together with larvae of *Culex mollis, C. brevispinosus* and *C. coronator usquatus.*

Culex portesi. Although the adults occurred in great numbers, no larvae of this species were found. Davies and Martinez (1970) stated that the immature stages of *Culex portesi* have proved extremely difficult to find in the field. Such larvae as have been recovered, have been found in leaf-choked groundpools, or along the margins of permanent swamps, but never in sufficient numbers to account for the enormous adult populations that may sometimes be encountered.

Culex putumayensis. Larvae live in permanent or semipermanent waters (Belkin, et al., 1971).

Culex erraticus. Larvae were collected from a spathe of *Euterpe oleracea,* in association with larvae of *Culex mollis* and *C. bonneae.*

Culex bonnei. Larvae were collected from spathes of *Euterpe oleracea,* in association with larvae of *Limatus durhamii, L. flavisetosus, Culex mollis, C. urichi* and *C. infoliata.*

Culex infoliata. Larvae were collected from spathes of *Euterpe oleracea* in association with larvae of *Culex mollis, C. brevispinosus, C. urichi* and *C. bonnei.*

Culex urichi. Larvae were collected on numerous occasions. Once they were found in the leaf axils of *Phenacospermum guianense,* in association with larvae of *Trichoprosopon compressum compressum, Wyeomyia melanocephala* and *W. occulta.* All other times they were collected from spathes of *Euterpe oleracea,* in association with larvae of *Trichoprosopon digitatum digitatum, Limatus durhamii, L. flavisetosus, Aedes serratus, Culex mollis, C. brevispinosus, C. bonnei* and *C. infoliata.*

Culex pleuristriatus. Larvae were collected from a temporary rainpool, in association with larvae of *Culex brevispinosus.*

Sayomyia souzai. This species from the subfamily Chaoborinae has not been reported previously from Surinam. Larvae were collected from a spathe of *Euterpe oleracea,* in association with larvae of *Anopheles punctimacula, Culex coronator usquatus* and *C. brevispinosus,* from temporary rainpools, together with larvae of *Anopheles punctimacula, Culex coronator usquatus* and *C. brevispinosus.*

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