A REVISION OF THE ARGYRITARSIS SECTION OF THE SUBGENUS *NYSSORHYNCHUS* OF *ANOPHELES* (DIPTERA: CULICIDAE)[1]

By

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ABSTRACT. Some of the most important anopheline vectors of malaria in the neotropical faunal region are members of the subgenus *Nyssorhynchus*. In the Argyritarsis Section of *Anopheles* (*Nyssorhynchus*) there are 18 available specific names. This revision recognizes 8 of these nominal taxa as valid biological species, based on the study on 7,659 specimens: 1,355 males, 212 male genitalia, 3,490 females, 1,724 larvae, 878 pupae, among which 607 were individual rearings. Species are described and illustrated, and their systematics, bionomics, medical importance and distribution discussed. Keys to sections of the subgenus *Nyssorhynchus* and to groups and species of the Argyritarsis Section are included. The Argyritarsis Section is divided into the Argyritarsis and Albitarsis Groups. The Argyritarsis Group is separated into 4 distinct subgroups: the Argyritarsis Subgroup comprised of 2 species, and the monotypic Darlingi, Lanei and Pictipennis Subgroups. The Albitarsis Group is separated into 2 distinct subgroups, the Albitarsis Subgroup composed of 2 species, *albitarsis* and *marajoara*, and the monotypic Braziliensis Subgroup. Both subgroups exhibit a number of apomorphic characters, but *braziliensis* appears to possess fewer and is symplesiomorphic for several characters of the Argyritarsis Group. *Anopheles marajoara* and *sawyeri* are

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resurrected from synonymy with *albitarsis* and *argyritarsis* respectively, to specific rank. *Anopheles domesticus* is transfered from a subspecies of *albitarsis* to synonmy with *marajoara*. *Anopheles allopha* is treated as a *nomen dubium*.

INTRODUCTION

The classification of mosquitoes during the early part of this century was in a chaotic state (Zavortink 1968:4). Species and genera were being described at such a rapid rate that the same taxa were often given multiple names. Adding to this confusion, many of the new taxa were inadequately described, and the published descriptions often received poor circulation. The result was that even closely associated species and species groups were not recognized as being related and were scattered among different taxa. Such was the case of the species of the Argyritarsis Section of *Anopheles (Nyssorhynchus)*.

In 1902, Theobald described the genus *Laverania* with the type species *argyrotarsis* [sic] Robineau-Desvoidy, and the genus *Cellia*, the latter in which he included *pulcherrimus* Theobald 1902, *squamosus* Theobald 1901, *bigoti* Theobald 1901 and *pharoensis* Theobald 1901. The genus *Nyssorhynchus* was described by Blanchard in 1902 as a replacement name for *Laverania* Theobald 1902, as this name was preoccupied by *Laverania* Grassi and Feletti 1890. The following year, Theobald (1903) synonymized *Laverania* with *Nyssorhynchus*, but at the same time placed *argyritarsus* and *albipes* Theobald in the genus *Cellia*. Christophers (1915: 371-394), after examining male genitalia, divided the anophelines into the genera *Anopheles*, *Myzomyia* and *Nyssorhynchus*. Root (1923:266) followed Christophers' classification but treated *Nyssorhynchus* as a subgenus. Edwards (1932:43-46), in his classic treatise on the family Culicidae, divided the subgenus *Nyssorhynchus* into 3 groups designated A, B and C. Group A was the Nyssorhynchus Group, which he subdivided into 3 series, Argyritarsis, Tarsimaculatus and Rondoni. The Argyritarsis Series included all those species of the subgenus that had hindtarsomeres 3, 4 and 5 entirely white: *albitarsis* Lynch-Arribalzaga, *argyritarsis* and *darlingi* Root. *Anopheles braziliensis* Chagas was treated as a variation of *albitarsis*, while *allopha* Peryassu and *rooti* Brethes were considered to be conspecific with *argyritarsis*. Groups B and C were Myzorhynchella and Kerteszia, respectively. In 1943, Galvao divided *Nyssorhynchus* into 2 series, the Tarsimaculatus Series and the Argyritarsis Series; he further separated the Argyritarsis Series into 2 complexes, the *argyritarsis* Complex and *albitarsis* Complex. *Anopheles argyritarsis*, *sawyeri* Causey, Deane, Deane and Sampaio and *pictipennis* Philippi were included in the *argyritarsis* Complex, while *albitarsis albitarsis*, *albitarsis braziliensis*, *albitarsis limai* Galvao and Lane, *albitarsis domesticus* Galvao and Damasceno, *albitarsis imperfectus* Correa and Ramos, *pessoai* Galvao and Lane, *marajoara* Galvao and Damasceno, *darlingi* and *lanei* Galvao and Amaral were included in the *albitarsis* Complex. In 1949 Levi-Castillo divided the subgenus *Nyssorhynchus* into 2 groups, Albimanus and Argyritarsis. The Argyritarsis Group included *albitarsis*, *argyritarsis*, *darlingi*, *lanei*, *pessoai*, *sanctielii* Senevet and Abonnenc, *pictipennis* and *sawyeri*. Faran (1980) subdivided *Nyssorhynchus* into the 2 sections, Albimanus and Argyritarsis, and the Group Myzorhynchella Theobald; however his study only concerned species included in the Albimanus Section.

Anopheles argyritarsis, the oldest species in the Argyritarsis Section,

was described by Robineau-Desvoidy in 1827. For the next 50 years this name was applied to essentially all the species of what I consider to be members of the Argyritarsis Section, as well as several species belonging to the Albimanus Section of *Nyssorhynchus*. During the early part of this century, *argyritarsis* was variously misspelled by numerous authors: *argyrotarsis* (Cruz 1901:426), *argyitarsis* (Senevet 1934:68), *argyritarsus* (Fox 1925:38). In 1865 the second species in the Argyritarsis Section, *pictipennis*, was described by Philippi as a species of *Culex* from Chile. *Anopheles albitarsis* was described in 1878 by Lynch-Arribalzaga from Argentina. In 1901, Theobald described a new species, *Anopheles bigotii*, which was later synonymized with *pictipennis* by Dyar (1918:150). The same year Theobald also described *albipes* as a subspecies of *argyrotarsis* [sic]. Two years later Theobald (1903:110) raised *albipes* to specific rank and placed both *albipes* and *argyritarsis* in his new genus *Cellia*.

In 1905 Blanchard treated *albitarsis* and *argyritarsis* as synonyms of *Nyssorhynchus albimanus*. Goeldi (1905:129), Coquillett (1906:11,13), and Dyar and Knab (1906a:176) recognized differences between *albimanus* and *argyritarsis*, and based predominantly on larval characters, treated them as separate species. Later Chagas (1907) described *braziliensis* and Peryassu (1921:70-71) described *allopha* as a species of *Cellia*. Except for Theobald (1910), who regarded *albitarsis* as a synonym of *argyritarsis*, and Dyar (1918:150), who treated *albitarsis* as a synonym of *pictipennis*, the above nominal taxa were considered as distinct species until 1924. Christophers (1924:9), in his catalog of the anophelines, recognized only a single species, *argyritarsis*, now included in the Argyritarsis Section. He considered *pictipennis*, *albitarsis* and *bigotii* as synonyms of *argyritarsis*, and *braziliensis* and *allopha* as varieties of *argyritarsis*. Dyar (1925:193-194) followed, in general, Christophers' classification, listing *pictipennis*, *albitarsis*, *bigotii*, *braziliensis* and *allopha* as synonyms of *argyritarsis*. Bonne and Bonne-Wepster (1925: 516,517) recognized *braziliensis* and *allopha* as distinct species but synonymized *argyritarsis* with *albimanus*. Root (1926b) described *darlingi*, and recognized *argyritarsis* and *albitarsis* as distinct species, while treating *braziliensis* as a variety of *albitarsis*. He synonymized *allopha* with *argyritarsis*, and *pictipennis* and *bigotii* with *albitarsis*. Brethes (1926a:309-311) described *rooti* based on differences he believed existed in the male genitalia between specimens from Tucuman, Argentina, and a description of specimens of *argyritarsis* from Central America by Root (reference not cited, probably Root 1923). Subsequently Dyar (1928:427, 443), in "The mosquitoes of the Americas," recognized *pictipennis*, *albitarsis*, *darlingi* and *argyritarsis*. He treated *braziliensis* as a subspecies of *argyritarsis* in the keys, but listed *braziliensis* as a synonym of *albitarsis* in the text. He also synonymized *bigotii* with *pictipennis* and *allopha* with *albitarsis*. Townsend later (1934:487,494) resurrected *braziliensis* as a distinct species.

Galvao and Lane (1937a) described *pessoai* as a new species, distinct from *albitarsis*. The name *pessoai* was used in place of *braziliensis* until Lane synonymized *pessoai* with *braziliensis* in 1953. In another publication, Galvao and Lane (1937b:227-231) described *limai* as a variety of *albitarsis* based on the morphology of the egg. Lane (1953:242, 244) synonymized *limai* with *albitarsis* (see Discussion section of *albitarsis*). *Anopheles paulistensis* was described as a variety of *darlingi* by Galvao et al. (1937: 37-40). This variety was subsequently synonymized with *darlingi* (Lane 1949:402; see

Discussion section of *darlingi*). Lane (1939:27-29), in his "Catalogo dos mosquitos neotropicos," recognized *albitarsis*, *argyritarsis*, *darlingi*, *lanei*, *pessoai* and *pictipennis*. He listed *allopha* and *braziliensis* as synonyms of *albitarsis*, *rooti* and *lutzi* as synonyms of *argyritarsis*, *paulistensis* as a synonym of *darlingi*, and *bigotii* as a synonym of *pictipennis*. *Anopheles lanei* was described from the state of Sao Paulo, Brazil, by Galvao and Amaral (1938). Four years later Galvao and Damasceno (1942a:424-427) described *marajoara* from Para, Brazil, which later was synonymized with *albitarsis* (Lane 1953:244). Faran and Linthicum (1981:37) resurrected *allopha* to species status. I am now considering *allopha* a *nomen dubium* and resurrecting *marajoara* as the valid species name (see Discussion section of *marajoara*).

Causey, Deane, Deane and Sampaio (1943:11-20) described *sawyeri* from specimens collected in an isolated area in the state of Ceara, Brazil. *Anopheles domesticus*, the last nominal species of the Argyritarsis Section to be described, was named by Galvao and Damasceno (1944) and relegated to a subspecies of *albitarsis* by Lane (1953:245). I consider *domesticus* a synonym of *marajoara*.

In summary, there are 18 available specific names included in the Argyritarsis Section of *Anopheles* (*Nyssorhynchus*). I recognize 8 of these nominal taxa as valid biological species in this revision.

MATERIALS AND METHODS

MATERIALS. Most of the material for this study was collected or acquired by the project "Mosquitoes of Middle America" (MMAP), University of California, Los Angeles. This material was transferred in 1978, to the U. S. National Museum of Natural History (NMNH), Smithsonian Institution, Washington, DC (Belkin et al. 1965, 1967). The NMNH and the School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Maryland, were the only other major sources of material. These latter collections were especially important as they provided the only material for 2 rare species, *lanei* and *pictipennis*. In the Material Examined section for each species, the specimens listed are all deposited at the NMNH, unless otherwise noted by the presence of the abbreviation for the depository in parentheses. Specimens from the MMAP collection for which collection data have been published are listed by code, collection number and type under the correct locality (example: "Bataka, DOM 169, 2L"). All other specimens are listed individually by number and type, along with locality, date and collector. Most collection localities are not given in detail, but only by the nearest town. The number and types of specimens are summarized and listed directly after the country or major political division. The collection records of the "Mosquitoes of Middle America" project have been published in the following series of papers: Belkin, Heinemann and Page 1970; Belkin and Heinemann 1973, 1975a, 1975b, 1976a, 1976b, 1976c; Heinemann and Belkin 1977a, 1977b, 1977c, 1978a, 1978b, 1978c, 1979; Heinemann 1980; Heinemann, Aitken and Belkin 1980. These papers should be consulted for complete data for the following codes: ANT, BAH, BH, BRA, COL, COM, CR, DOM, ECV, FWI, FWIM, FG, FGC, GG, GR, GRR, GUA, GUY, HON, LAR, LU, MAR, MEX, MNT, MX, NI, NIC, PA, PER, TR, TRM, TOB, SAL, SUR, VZ. The original MMAP collection forms are deposited at the NMNH. The following individuals have also provided material for this study: W. H. W. Komp, J. F.

Reinert, D. R. Roberts, F. M. Root, L. E. Rozeboom, J. B. Kitzmiller, R. F. Darsie and R. S. Panday. Additional valuable material was collected by J. H. Arnell, J. N. Belkin, M. E. Faran, T. E. Rogers and myself in the state of Sao Paulo, Brazil, December 1974 to March 1975, and by J. N. Belkin, G. K. Bryce and M. E. Faran in the state of Rio de Janeiro, December 1975 to March 1976. During my visit to Sao Paulo, I examined the paratype of *marajoara* and the holotype of *pessoai* at the Faculdade de Saude Publica (FH). I have also examined a paratype of *sawyeri* and the lectotype of *darlingi* (USNM). In addition, J. N. Belkin has examined the types of *allopha* (syntypes), *braziliensis* (syntypes), *imperfectus* (holotype) and *lanei* (holotype) (Belkin et al. 1971:4,5). The types of the following species have not been examined: *albitarsis* (NE), *argyritarsis* (NE), *domesticus* (LU), *limai* (NE), *paulistensis* (LU) and *pictipennis* (NE). This revision is based on the study of 7,659 specimens: 1,355 males, 212 male genitalia, 3,490 females, 1,724 larvae and 878 pupae, among which 607 were individual rearings (315 larval, 248 pupal and 44 incomplete) and 12 progeny rearings.

TAXONOMIC PROCEDURES. The methods and techniques used in this study were primarily those of comparative morphological systematics as discussed by Belkin et al. (1965:10; 1967:10-11). Whenever possible, I studied the type and/or topotypic material of a particular species and compared this material with specimens of other species of the section which occur sympatrically before attempting to identify additional specimens from other areas.

After the external morphology of the species included in the Section had been studied, the species were grouped on the basis of shared derived characters (synapomorphies). The degree of phylogenetic relationship was determined by the correlation of derived features found in the adult, male genitalia, pupa and larva. I have hypothesized that these groups are monophyletic, presumably descendants of an immediate common ancestor. Character states, whether derived (apomorphic) or ancestral (plesiomorphic), were determined by ingroup and outgroup comparisons as redefined by Wiley (1981). In general, ancestral character states were regarded as those that were usually irregularly scattered among a broad group of related taxa, while a derived character was usually characteristic of only one particular group or species.

DESCRIPTIONS. The form of presentation, terminology and abbreviations used in the descriptions follow Belkin (1962) with modifications of Belkin (1968a:49), and Harbach and Knight (1980). The descriptions are composites of all available specimens. The chaetotaxy of the larvae and pupae was based on at least 10 specimens unless otherwise noted. The chaetotaxy for those setae which are considered to be taxonomically important is described using two sets of figures. The first set of numbers after the seta represents the condition found in at least 75% of the specimens examined. The second set of numbers listed in parentheses represents the entire range of branching observed for a particular seta; only one set of numbers is given if the latter range is the same. In the descriptions, discussion sections and keys, when referring to the larval and pupal chaetotaxy, I have used the letters "b" and "f" as abbreviations for branched and forked respectively. Other new terms and abbreviations are explained in the appropriate section on Taxonomic Characters. All measurements of the larva and pupa, and most of the measurements of the adult were made from slides, with the aid of a calibrated

ocular micrometer in the eyepiece of a compound microscope. Some of the remaining adult measurements were made in a similar fashion using a stereoscopic dissecting microscope. The illustrations were prepared from a single specimen, but the setal branching was corrected to show the modal condition for all the specimens studied.

SYSTEMATICS. The taxonomic history, intra- and interpopulational variation (when data available), phylogenetic affinities and evolutionary trends are discussed for each species. The systematics section for the groups and subgroups has been combined with a discussion of their bionomics and distribution.

BIONOMICS. Information on the bionomics of the species was extracted from data recorded on the field collection forms of the MMAP project; this information has been supplemented with data from the literature. When collection record information was not available, all information used came from the literature.

MEDICAL IMPORTANCE. This section presents a brief summary of the importance of each species in disease transmission. It is only a summary, primarily concerned with malaria transmission.

DISTRIBUTION. For each species, a summary of the known distribution is given. The distribution is also outlined on the distribution maps, Figs. 1 and 2, and listed by region in the "Table of Distribution." The information on species distribution comes from collection records and from reliable references. In the "Table of Distribution" a solid circle indicates that one or more specimens were examined from that region or country; a starred circle denotes a distribution record (or records) from some other source believed to be reliable.

TAXONOMIC CHARACTERS

There are a number of reliable morphological features in the adults, male genitalia and larvae that are pertinent for species identification and for hypothesizing phylogenetic relationships. Unfortunately, the external morphology of the pupa is usually interspecifically very similar (except for *darlingi*) and intraspecifically highly variable; therefore, the key to the pupae is not always reliable. When examining the pupa it is essential that species descriptions and discussions be consulted, and the morphological characters correlated with the information on bionomics and distribution.

The character states of the taxonomically important characters have been difficult to determine because of the great morphological similarity among the species of the Argyritarsis Section. I believe that the morphological similarity observed is a result of homoplasy and secondary loss of structures. The decision as to whether the state of a character is apomorphic or plesiomorphic has been based on the comparison of morphological trends within a taxon with those trends in related taxa. I used species of the Albimanus Section and Myzorhynchella Group of *Nyssorhynchus* for outgroup comparison. In hypothesizing phylogenetic relationships among the species within the Argyritarsis Section, I have correlated each individual apomorphic character in the adult, male genitalia, pupa and larva. It is important to consider the restrictions and limitations in the establishment of such a phylogeny. In correlating character states in different species it is

necessary to assume they are homologous. Modificational or positional changes in existing characters or the formation of new characters are more reliable in establishing relationships than loss or reduction of a character. Correlation of character states among the various life stages is dependent upon the study of associated life stages from individually reared specimens.

While the great amount of intraspecific variation has been emphasized, it is important to realize that I have examined samples of each species from only a limited number of populations; therefore, the range of variation reported should be considered conservative. Likewise, when comparing specimens with the illustrations, the number and length of branches of the setae in the drawings represent only the modal condition and not the branching present in all specimens examined.

ADULTS

The following morphological structures are the most important for differentiation of the adults: (1) presence or absence of scales on first abdominal sternum, (2) dark caudolateral scale tufts of abdomen, (3) banding patterns of legs, especially, dark basal band of hindtarsomere 2, (4) relative lengths of wingspots, especially those on vein C, (5) presence or absence of scales on anterior and upper mesanepimeron (*Mam*) and (6) scales on palpomeres 4,5.

HEAD. The number of light scales on palpomeres 4,5 is the most important taxonomic character. In the plesiotypic condition palpomere 4 is predominantly dark, except at the apex. In the apotypic condition palpomere 4 has scattered white scales on the lateral surface and an apical white band. Palpomere 4 is dark in the Argyritarsis Subgroup while in the Lanei and Pictipennis Subgroups it has some white scales. In the Darlingi Subgroup and the Albitarsis Group this palpomere possesses a greater number of scattered white scales than in the previous taxa. Palpomere 4 of the Oswaldoi Subgroup of the Albimanus Section is mostly light, which represents the most apomorphic condition in the subgenus. Plesiotypically, palpomere 5 is predominantly white; all species of the Argyritarsis Section show this condition except *pictipennis*. The color of the erect scales of the vertex and occipital region varies among the species, but to a lesser extent than the scales of palpomere 4, so that they are of little value in species identification.

THORAX. The thorax possesses few good characters for species identification. Plesiotypically, the scales of the mesonotum are scarce and large. Except for *pictipennis*, all species of the Argyritarsis Section and of the Albimanus Section have numerous small scales on the mesonotum. The presence of a line of light scales along the upper *Mam* is apparently plesiomorphic and is present in all species of the section except for *darlingi*. The only species in the Albimanus Section with these scales usually present is *rangeli* (Faran 1980). Interestingly, *darlingi* is the only species that has a light scale patch on the anterior *Mam*; *triannulatus* is the only species in the Albimanus Section that has this scale patch. The scutellum in the Argyritarsis Group always has more than 12 long, dark setae along the posterior margin of the scutellum, while that of the Albitarsis Group usually has fewer than 12 setae.

LEGS. In most cases the banding pattern of the hindtarsus is more reliable in species determination than is the banding pattern of the fore- and

midtarsus. Foretarsomeres 4 and 5 are always completely dark, never with an apical light band as seen in the Oswaldoi Group of the Albimanus Section. The length of the apical light bands on foretarsomeres 1, 2 and 3 vary and therefore, they generally are not reliable for species determination. Only *pictipennis* can be distinguished by having a moderately long apical light band and a long basal light band on foretarsomere 1. The presence or absence of a light apical band on the midtarsomeres is of no value in species determination. Midtarsomeres 1, 2 and 3 usually have a small apical light band, although these bands may be absent in *argyritarsis* and *albitarsis*. Midtarsomeres 4 and 5 usually are completely dark. Plesiotypically, hindtarsomere 2 probably was dark in the basal 0.5 or more. Reduction in the size of the dark basal band is seen in both the Argyritarsis and Albitarsis Groups. It is particularly reduced in the Argyritarsis Subgroup. In only the Pictipennis and Albitarsis Subgroups is the basal dark band consistently more than one-half the length of the tarsomere.

WING. The terminology of the various wing spots follows Faran (1980:Fig. 5) and Faran and Linthicum (1981:12), and is illustrated in Fig. 4. The most prevalent trend has been in the reduction of the size of the light spots on the costal vein. Usually 7 light spots are present on the costa in the Argyritarsis Subgroup. In *lanei* the humeral and subbasal light spots are fused to form a large basal light spot. All of the light spots are generally present in *darlingi*, except that the basal dark spot is greatly enlarged and the presectoral light spot is reduced. *Anopheles pictipennis* usually lacks the subbasal and presectoral light spots, which results in the formation of a large, basal dark spot. The light spots of the species in the Albitarsis Group are, in general, reduced. This is most pronounced in *albitarsis* where 2 or 3 of the costal light spots are absent and the remaining light spots are very small. The trend toward a reduction in the size of the costal light spots does not occur to any extent in the light spots of the more posterior veins. In the Albimanus Section the trend has been the reverse (except in *rondoni*), that is, for the development of larger light spots.

ABDOMEN. The dark caudolateral scale tufts on the terga of the abdomen are present in the plesiomorphic state on segments II-VII. For segment II this condition occurs in only *darlingi* of the Argyritarsis Group and *braziliensis* in the Albitarsis Group.

MALE GENITALIA

The male genitalia are usually distinctive for the groups and subgroups. Within the 2 groups, the male genitalia are very complex, and are morphologically similar. All species of the subgenus *Nyssorhynchus* are characterized by the ventral claspette being fused to form a single median lobe, and by having a parabasal seta, 2 accessory setae and a single internal seta. Refer to Fig. 9 and Faran and Linthicum (1981:14) for labeled diagrams of male genitalia components. The terms dorsal and ventral as used in this study refer to the morphological tergal and sternal surfaces of the male genitalia before rotation occurs.

Sternum IX. In the Argyritarsis Section the sternum is subtrapezoidal; in the Argyritarsis Group it is moderately long, while in the Albitarsis Group it is moderately short. The apodeme along the anterior margin (anterior apodeme) of the sternum, is usually very well developed in the Oswaldoi Group of the

Albimanus Section but is at most poorly developed in both the Argyritarsis and Albitarsis Groups. The anteromesal and posteromesal margins may be straight or slightly emarginate.

Gonocoxite. The Argyritarsis Group usually has 5 large tergomedial setae, while the Albitarsis Group usually has only 4. The tubercle of the parabasal seta has shown a trend toward reduction in length; the tubercles are moderately long in the Argyritarsis Subgroup, but moderately short in the Albitarsis Subgroup.

Dorsal Lobe of the Claspette (Dorsal Claspette). The morphology of the dorsal claspette is useful for species identification, although it is not important in characterizing the section.

Ventral Lobe of the Claspette (Ventral Claspette). The development of the ventral claspette is useful for species identification when correlated with other characters of the male genitalia. Unlike the Albimanus Section where the ventral claspette best distinguishes the species within the section, the ventral claspette of the Argyritarsis Group is not as differentially developed. The preapical plate and the refringent structure are at most weakly developed and are often absent. The basal lobules, the mesal cleft and the median sulcus are usually well developed. All the species in the Argyritarsis Section lack spicules on the ventral claspette.

Phallosome. In all species in the Argyritarsis Group, the aedeagus has a pair of large, serrated, subapical leaflets. Apotypically, subapical aedeagal leaflets are absent; this is seen in all species of the Albitarsis Group. No species exhibit membranous remnants of the leaflets as found in some species of the Albimanus Section.

PUPAE

The pupae of the section are generally very similar and exhibit a relatively small number of phylogenetically important characters that can be correlated with characters in the adults and larvae. In the species descriptions the 75% range and entire range are given for all of the cephalothoracic, metanotal and important abdominal setae. For the subgroups the pupal descriptions have been omitted because no reliable differentiating characters were observed. Plesiotypically, as in the Argyritarsis Group, the median keel is very strongly developed and heavily pigmented, and the setae of the cephalothorax are heavily pigmented and well developed. Apotypically, as represented by the species in the Albitarsis Group, the median keel is weakly to moderately developed, and the setae of the cephalothorax are lightly to moderately pigmented.

CHAETOTAXY. The most phylogenetically significant setal characters of the pupae are found on the cephalothorax and on the first 2 abdominal segments. Plesiotypically, setae 3,7,9,11-C were probably not branched, as found in the Argyritarsis Group where seta 3-C is usually double, setae 7,11-C are usually single or double, and seta 9-C is usually 1-3 branched. In the apomorphic state, represented by the Albitarsis Group, these setae are more numerously branched. Similarly setae 4-I and 0-II plesiotypically have only a few branches, as in the Argyritarsis Group, while in the Albitarsis Group these setae are numerously branched. The relative lengths of seta 9-II-VII are phylogenetically important in the Albitarsis Group, but of no significance in

the Argyritarsis Group. Seta 9, however, is important for species diagnosis in both groups. The degree of branching of a number of other abdominal setae is important in species determination.

TRUMPET. The trumpet of the Argyritarsis Section does not show any distinct morphological trends, except in *darlingi*, where it is laticorn rather than angusticorn.

PADDLE. The relative lengths of the external buttress, the distance that the apical spicules extend along the inner margin of the paddle, the length of the apical spicules and length of setae 1,2-P are important features in species identification but of no phylogenetic significance.

TERMINAL SEGMENTS. The shape and size of the male genital lobes do not show any phylogenetic relationship; however, the ratio of length to width of the lobes can be used as a diagnostic character for some species.

FOURTH STAGE LARVAE

In the larvae of the Argyritarsis Section there are a number of very good, consistent, phylogenetically important characters that can be correlated with characters in the adults and male genitalia. The degree of setal branching is very important for species identification, even though there is great intrapopulational variation. In the descriptions, I have given the 75% range, and the entire range of branching for all the setae which are of taxonomic significance. Refer to Fig. 6 and Faran and Linthicum (1981:15) for labeled larval diagrams.

HEAD. In the plesiomorphic condition, setae 2,3-C are widely spaced, of unequal length and with short to minute barbs. Apomorphically, setae 2,3-C are closely spaced, of subequal length and usually with long or dendritic branches. The clypeal index describes the relative distances between setae 2-C, and 2-C and 3-C. It is defined as the distance between the insertions of setae 2-C and 3-C on one side of the head divided by the distance separating the insertions of seta 2-C. Setae 2,3-C of all species of the Albitarsis Group are simple with short barbs. Apomorphically, setae 2,3-C have extensive dendritic branches as seen in *lanei* of the Argyritarsis Group. In the plesiomorphic condition, seta 4-C is single and very long as in all species (except *darlingi*) of the Argyritarsis Group. In the apomorphic state, seta 4-C is usually shorter with more than one branch; all species in the Albitarsis Group (except *braziliensis*) have seta 4-C moderately short with 2 or 3 branches. *Anopheles darlingi* and *braziliensis* represent intermediate forms, having this seta either single or branched. Setae 8-10-C, the width of the collar and, to a greater extent, the dark banding pattern of the head are useful for species identification but of no phylogenetic value.

ANTENNA. Seta 1-A in the plesiomorphic condition is short, and in the apomorphic condition it is moderately long.

THORAX. Plesiotypically, seta 1-P is fanlike with thin branches; in the apomorphic state it is palmate with lanceolate branches. In the Argyritarsis Group seta 1-P is fanlike with thin branches in all species. Seta 1-P of species in the Albitarsis Group is palmate with lanceolate branches. Like seta 1-P, seta 3-T is fanlike with thin branches in the plesiomorphic condition (*argyritarsis*) and palmate with lanceolate branches in the apomorphic state (Albitarsis Group). *Anopheles sawyeri* appears to represent an intermediate

form where 3-T is palmate with very weakly developed lanceolate branches. The insertion of seta 2-P on a common sclerotized tubercle with 1-P is an apomorphic character, found only in some of the species in the Albitarsis Group.

ABDOMEN. Plesiotypically, seta 1-I has thin branches as in *argyritarsis* of the Argyritarsis Subgroup and in the monotypic Darlingi Subgroup. There has been a trend toward the development of a palmate seta with lanceolate branches, in the Albitarsis Group. Seta 1-I, palmate with very weakly developed lanceolate branches, in *sawyeri* represents an intermediate condition.

SPIRACULAR LOBE. In the plesiomorphic condition, seen in the Argyritarsis Group, the lateral arms of the median plate of the spiracular apparatus are very weakly developed. The trend has been toward development of lateral arms as is found in the species of the Albitarsis Group. Plesiotypically, the pecten has a number of short and long alternating teeth (Argyritarsis Subgroup). There appears to have been a reduction in the number of long teeth and the formation of a series of short teeth (Albitarsis Subgroup). The pecten dentition of *darlingi* of the Argyritarsis Group and *braziliensis* of the Albitarsis Group shows an intermediate condition, where the number of long teeth has been reduced, but not as much as in the Albitarsis Subgroup.

ABDOMINAL SEGMENT X. The position of seta 1-X is of no taxonomic value. It is always inserted on the saddle. Plesiotypically, as in the Argyritarsis Group, seta 1-X is long, more than 1.5 the length of the saddle. The trend has been for a reduction in the length of this seta.

SYSTEMATICS

The species in the Argyritarsis Section of the subgenus *Nyssorhynchus* are characterized by hindtarsomeres 3, 4 and 5 being entirely white. Based on the correlation of at least 3 external morphological characters in each life stage (adult, male genitalia, pupa and larva) I recognize 2 major groups in the Argyritarsis Section: the Argyritarsis Group composed of 5 species and the Albitarsis Group consisting of 3 species.

The **Argyritarsis Group** is the least apomorphic group, with *argyritarsis* retaining the largest number of plesiomorphic characters. The Argyritaris Group is characterized in the **female** by: (1) palpomere 4 predominantly dark (except *darlingi*), (2) posterior margin of the scutellum with 12-17 well-developed, dark setae, and (3) sternum I bare; in the **male genitalia** by: (1) sternum IX long, (2) apex of the ventral claspette with 2 lobes, and (3) aedeagus with a pair of subapical leaflets; in the **pupae** by: (1) median keel, strongly developed, (2) cephalothoracic setae heavily pigmented, (3) setae 3,9,11-C with 1-3 branches, and (4) setae 4-I and O-II with 2-5 branches; and in the **larvae** by: (1) seta 1-P fanlike with slender lanceolate branches, (2) setae 3-T and 1-I fanlike with thin branches or palmate with weakly developed lanceolate branches, (3) setae 1,2-P never inserted on a common sclerotized tubercle, (4) seta 1-A moderately long, and (5) median plate of the spiracular apparatus without lateral arms. Most of the characters that distinguish the Argyritarsis Group from the Albitarsis Group are plesiomorphic.

The Argyritarsis Group is divided into 4 subgroups: the Argyritarsis Subgroup, and the monotypic **Darlingi**, Lanei and Pictipennis Subgroups. I have separated *darlingi* from the other species in the Argyritarsis Group on the

basis of several correlated characters in all life stages. The **adults** of *darlingi* are unique in possessing a distinct patch of light scales on the anterior mesanepimeron and an enlarged basal dark spot on the costal vein. The **male genitalia** of *darlingi* is unique in having the ventral claspette truncated at its apex. The **pupa** can easily be distinguished from other species in the group by the development of a laticorn trumpet. The moderately widely spaced setae 2-C, the palmate seta 3-T, the dentition of the pecten and the extreme development of seta 13-S clearly separate the **larva** of *darlingi* from those of all other species in the Argyritarsis Group.

Anopheles pictipennis has been examined only in the adult stage but has been separated from the other species in the Argyritarsis Group on the basis of reported differences in the larva and male genitalia as well as the distinct morphology of the adult. The **Pictipennis Subgroup** is characterized in the **female** by: (1) palpomere 5 with a large, basal, dark band, (2) antennal flagellomeres 1-6 with light and dark scales, (3) scutum with large scales, (4) foretarsomere 1 with large basal light spot, and (5) vein C without subbasal and presectoral light spots.

Anopheles lanei has been examined only in the adult stage and male genitalia but is here considered to be distinct from all other species in the section. In the **adult** the **Lanei Subgroup** is unique in having the humeral and subbasal light spots of vein C fused to form a large basal light spot. In the **larva** *lanei* is reported to be distinct in that setae 2,3-C possess dendritic branches.

The **Argyritarsis Subgroup** is comprised of 2 very closely related species, *argyritarsis* and *sawyeri*. The subgroup is characterized in the **female** by: (1) flagellomere 3 without scales, (2) hindtarsomere 2 with less than basal 0.4 dark, (3) vein C with humeral and subbasal light spots never fused, and (4) abdominal segment II without caudolateral scale tufts; in the **male genitalia** by: (1) tergum VIII predominantly covered by slender light scales, (2) length of gonocoxite about 2.8-3.0 of maximum width, (3) aedeagus with leaflets inserted on the widest part of aedeagus, and (4) apex of ventral claspette moderately large and rounded; and in the **larva** by: (1) setae 2-C approximated, (2) seta 1-P fanlike with thin branches, (3) setae 3-T and 1-I palmate with weakly developed lanceolate branches, (4) accessory median tergal plate without lobes on segments III-VII, and (5) pecten with numerous long teeth. Most of the features separating this subgroup from the other species in the Argyritarsis Group are plesiomorphic.

The Argyritarsis Group shares the following plesiomorphic characters with *albimanus* of the Albimanus Section; in the **female** by: (1) penultimate segment of the palpus dark, and (2) abdominal segment II without dark caudolateral scale tufts; in the **male genitalia** by: (1) ventral claspette without spicules and with ventral surface produced into 2 large inflated, bulbous lobes, and (2) very small, circular to oval, weakly sclerotized preapical plate; and in the **larva** by: (1) seta 1-P fanlike with thin branches, and (2) seta 13-I, III, IV large and with few branches.

The **Albitarsis Group** is the more apomorphic group in the section, retaining very few plesiomorphic characters. This group is characterized in the **female** by: (1) presence of scattered white scales on palpomere 4, (2) fewer than 13 large, dark setae on the posterior margin of scutellum, and (3) 2 longitudinal rows of light scales on sternum I; in the **male genitalia** by: (1)

a short sternum IX, (2) apex of the ventral claspette not bilobed, and (3) absence of subapical leaflets on aedeagus; in the **pupa** by: (1) weakly to moderately developed median keel, (2) lightly to moderately pigmented cephalothoracic setae, (3) setae 3,9,11-C with 1-4 branches, and (4) setae 4-I and 0-II with 3-6 branches; and in the **larva** by: (1) setae 1-P, 3-T and 1-I always palmate with lanceolate branches, (2) setae 1,2-P inserted on a common sclerotized tubercle, (3) seta 1-A short, and (4) median plate of spiracular apparatus with lateral arms.

The Albitarsis Group is divided into 2 subgroups, the Albitarsis Subgroup and the monotypic **Braziliensis Subgroup.** *Anopheles braziliensis* has been separated from the species of the Albitarsis Group on the basis of several characters found in all stages. The **adults** of *braziliensis* are unique in having: (1) hindtarsomere 2 with dark band on basal 0.3-0.4, (2) vein C with presectoral light spot, (3) vein R_3 with 3 dark spots, (4) terga II-VI with a median patch of dark scales, and (5) caudolateral scale tufts of the abdomen present on segment II. In the **male genitalia** the truncate apex of the ventral claspette and the distinct basomesal projection of the dorsal seta of the dorsal claspette easily separate *braziliensis* from the Albitarsis Subgroup. The moderately spaced setae 2-C, the alternating long and short teeth of the pecten and the single seta 4-C distinguish the **larva** of *braziliensis* from those of the Albitarsis Subgroup.

The **Albitarsis Subgroup** is characterized in the **female** by: (1) hindtarsomere 2 with basal 0.5-0.9 dark, (2) vein C without a presectoral light spot, (3) vein R_3 with 1,2 dark spots, (4) terga II-IV with numerous light scales, and (5) segment II without caudolateral scale tufts; in the **male genitalia** by: (1) parabasal seta longer than 3.0 length of its basal tubercle, (2) basomesal projection of dorsal seta of dorsal claspette not developed, (3) apex of ventral claspette rounded and not truncate, and (4) preapical plate absent; and in the **larva** by: (1) setae 2-C widely spaced, (2) seta 4-C double or triple, (3) seta 1-P usually with overlapping lanceolate branches, and (4) pecten with numerous adjacent short to moderately long teeth.

The close morphological similarity among species in the Argyritarsis and Albimanus Sections indicates that divergence within the subgenus *Nyssorhynchus* probably has been very recent. The single most important and, perhaps, the only character used to distinguish the two sections is the presence or absence of a dark basal band on hindtarsomere 5. This character seems to be very reliable and indicates a definite split in the subgenus; however, it serves to emphasize the high degree of parallel evolution that has occurred since the divergence of the 2 sections.

BIONOMICS

The immature stages of the Argyritarsis Section are usually found in ground water. They occur in such habitats as ponds, lakes, stream margins, drainage ditches, marshy meadows and pastures, along the margins of reservoirs, swamps, ground pools, animal burrows and tracks, and natural springs. No species in the section is found regularly in brackish water even though some can tolerate high salinity under experimental conditions. They are usually found in full or partial sunlight and rarely in full shade.

Anopheles argyritarsis occurs in ground pools and also occasionally in

artificial containers such as tin cans and animal water troughs. The immature habitats are characterized by having some grassy vegetation and are usually in areas of secondary growth. *Anopheles lanei* is often collected in permanent, clear water with very little vegetation and is rarely found in less permanent habitats. *Anopheles pictipennis* has been found in drying pools containing green algae and watercress in the rock bed of a stream. *Anopheles darlingi* has been collected in ground pools with abundant algae or grass, and some floating vegetation. The immatures are often found in patches of *Ceratophyllum* spp. along the margins of small rivers and canals, in areas of partial or full shade. Unlike the species of the Argyritarsis Group, *albitarsis* is usually found in clear water associated with little or no vegetation or other organic material. *Anopheles marajoara* always has been collected in association with vegetation such as green algae, water hyacinth, *Ceratophyllum* spp. and *Salvinia* spp., and usually in large bodies of water. The immatures of *braziliensis* are found in areas of secondary growth, such as forest clearings, plantations, or cultivated fields, in full sun along grassy margins of pools and ponds with emergent vegetation and flotage.

Most species are usually found at low elevations, with the following exceptions: *argyritarsis* has been collected up to 200 m above sea level; *sawyeri* has been found only on a high inland plateau at 750 m; and *lanei*, having been found at the highest elevation of 1,570 m, is perhaps the species in the section best adapted to live at high elevations. *Anopheles darlingi* is collected rarely at elevations above 100 m.

The adults feed primarily on mammals and infrequently on birds. All the species will feed on man; *darlingi* and *marajoara* show a preference for man and appear to be highly endophilic. The other species in general are exophilic and zoophilic, attacking man only during periods of high adult density. Most species are crepuscular, although *braziliensis* is occasionally active during the day. All species studied fly short to moderately long distances.

MEDICAL IMPORTANCE

Anopheles argyritarsis is generally considered not to be a principal vector of malaria, although it may be important when occurring in large numbers. It has been found naturally infected with malarial parasites but is infrequently found in houses and rarely attacks man. *Anopheles pictipennis* does not seem to be a vector of malaria since where it occurs malaria is very rare. *Anopheles pictipennis* can, however, sustain the development of malaria parasites even though it shows a preference for non-human blood.

Anopheles darlingi is a very efficient malaria vector in northern and northeastern Brazil as well as in numerous other areas of South America. This species is usually highly endophilic and anthropophilic. It may be a vector of human filariasis as it has been shown to be able to transmit *Wuchereria bancrofti* and has been found naturally infected.

Anopheles albitarsis does not seem to be an important vector of malaria. It is usually exophilic and zoophilic and rarely has been found in houses biting man or collected naturally infected with malarial parasites, even in areas where malaria is endemic. *Anopheles albitarsis* is a possible vector of human filariasis; it is capable of being experimentally infected with *Wuchereria bancrofti*, but has never been collected naturally infected.

Anopheles marajoara, although not usually a primary vector of malaria, is a secondary vector and ocasionally acts as a primary vector. This species readily attacks man and is reported to be, at times, very endophilic. It has been found infected with malaria parasites. In some areas *marajoara* has been reported to be exophilic and zoophilic and of little importance in the transmission of malarial parasites.

Anopheles braziliensis, like *marajoara*, is not a primary vector of malaria but is capable of transmitting malaria under the proper ecological conditions. Normally it is exophilic and zoophilic, but in Amazonia when domestic animals are absent, *braziliensis* readily enters houses and feeds on man. Deane, Causey and Deane (1948) collected *braziliensis* infected with malarial parasites and with flagellates.

The vectorial capacity of *sawyeri* and *lanei* are poorly known. Preliminary reports indicate that both species are probably not involved in malaria transmission; the restricted areas where these 2 species are found are free of malaria.

TAXONOMIC TREATMENT
KEYS TO THE SECTIONS OF THE SUBGENUS *NYSSORHYNCHUS* OF *ANOPHELES*

ADULTS

1. Hindtarsomeres 3 and 4 not entirely white; acrostichal and dorsocentral areas at most with scattered scales; wing variable. ....Subgenera *Anopheles*, *Lophopodomyia*, *Kerteszia* and *Stethomyia*

   Hindtarsomeres 3 and 4 entirely white, except in *rondoni*, *nigritarsis* and unusual variants; acrostichal and dorsocentral areas with numerous scales; wings with distinct light and dark spots (Subgenus *Nyssorhynchus*) 2

2(1). Abdominal terga II-VII without obvious scales or caudolateral scale tufts; vein 1A more than 0.5 dark.....Myzorhynchella Group

   At least some of abdominal terga II-VII with obvious scales and caudolateral scale tufts; vein 1A 0.5 or more light (Albimanus and Argyritarsis Sections) 3

3(2). Hindtarsomere 5 with a basal dark band.....**Albimanus Section**

   Hindtarsomere 5 entirely white.....**Argyritarsis Section**

LARVAE

1. Setae 1-III-VII with filiform branches or lanceolate leaflets with notched margins.....Subgenera *Anopheles*, *Lophopodomyia*, *Stethomyia*

   Setae 1-III-VII with smooth-margined lanceolate leaflets (Subgenera *Kerteszia*, *Nyssorhynchus*) 2

2(1). Setae 5-7-C single or forked.....Subgenus *Kerteszia*

   Setae 5-7-C plumose (Subgenus *Nyssorhynchus*) 3

3(2). Setae 6-IV-VI branched.....Myzorhynchella Group

   Setae 6-IV-VI single.....**Albimanus** and **Argyritarsis Sections**

ARGYRITARSIS SECTION

FEMALES (Fig. 4). Small to large, wing 3.0-5.3 mm. Head, palpus, legs and wing with light and dark scales, scales flat and decumbent to elongate and erect, usually forming distinct light and dark spots; proboscis with small, flat, dark scales; hindtarsomeres 3, 4 and 5 always completely white. Thorax and abdomen covered predominantly with decumbent light scales, usually appearing silver or occasionally golden-yellow, especially on abdomen. Integument of scutum, pleuron, and coxae with pruinose areas forming distinct light spots on dark background. **Head:** Interocular space narrow to wide, (0.2-1.1 diameter of pedicel). Ocular setae moderately long, dark golden laterally to cream mesally. Postgenal setae sparse, strongly developed. Dorsal frons and vertex with conspicuous frontal tuft composed of 3-12 pairs of long, slender, white setiform scales. Ocular line with short, white, decumbent scales becoming much longer on frons (3.0 length of scales of vertex). Vertex with numerous, moderately long, erect, slightly forked scales, white medially, yellow laterally. Occiput with numerous, brown (medially) to black (laterally), erect scales. Clypeus broad, bare, darkly pigmented with white pruinosity. Proboscis 1.1-1.6 length of forefemur, usually with 4 pairs of labial basal setae. Maxillary palpus (henceforth referred to as palpus) 0.85-1.10 length of proboscis, with white and black scales; palpomeres 1 and 2 with predominantly dark erect scales and a few scattered white scales; small patches of decumbent white scales at apices of palpomeres 2, 3 and 4, remainder of palpomere 3 with dark decumbent scales; palpomere 4 dark or dark with scattered white scales; palpomere 5 white; palpomere 1 very short, inconspicuous, usually less than 0.08 length of palpus; palpomere 2 moderately long, about 0.9 length of palpomere 3; combined length of palpomeres 4 and 5 usually slightly more than length of palpomere 2 and subequal to that of palpomere 3. **Antenna:** 0.6-0.8 length of proboscis. Pedicel pruinose, with 4-8 small, white, decumbent scales; flagellomere 1 about 2.0 length of flagellomere 2, with short and long white scales; flagellomeres 2-6 with or without short or long white scales; flagellomeres 2-13 subequal, with basal flagellar whorls of 4-8 long, curved setae, setae becoming progressively shorter on distal flagellomeres. **Thorax:** Integument of scutum pruinose with 3 dark, nonpruinose, longitudinal stripes, when viewed at an angle from the anterior and above as follows: (1) broad, median stripe along acrostichal setae extending from anterior promontory to prescutellar bare space, becoming lighter posteriorly in posterior scutal area, darker in prescutellar bare space, and (2) a pair of broad, subdorsal stripes extending posteriorly from prescutal suture to scutellum, becoming lighter posteriorly. Integument of the medial portion of scutellum only slightly pruinose, usually tan, darker medially; integument of lateral portion light brown and not pruinose. Acrostichal, anterior dorsocentral and posterior dorsocentral setae strongly developed, long, usually metallic copper, arranged in a continuous longitudinal line. Supraalar and posterior scutal fossal setae long, well developed with few to many in a continuous line. Scutellum posteriorly with a line of 8-17 strongly developed and 7-14 moderately developed setae, lateral margins usually bare. Scutum with numerous light scales as follows: (1) long, erect, white scales on median and lateral anterior promontory, usually with dark brown, erect scale patch on ventrolateral surface of anterior promontory juxtaposed to dark scales of occiput, (2) line of

numerous small, white, decumbent scales along acrostichal, and anterior and posterior dorsocentral setal lines (except in *pictipennis*), (3) numerous small, white, decumbent scales on fossal and antealar areas, and on posterior median scutal areas, and (4) numerous white, elongate scales on supraalar area. Scutum with conspicuous areas lacking scales as follows: (1) a moderately wide, longitudinal stripe between the acrostichal scales, (2) a moderately wide stripe between acrostichal and anterior dorsocentral scales, extending from erect scales of anterior promontory to decumbent scales of posterior median scutum, integument of stripe pruinose and appearing as a glistening silver surface, and (3) a moderately wide stripe laterad of posterior dorsocentral scales, usually extending from scutal angle to posterior margin of scutum, integument of stripe dark anteriorly and usually pruinose and silver posteriorly. Parascutellum with single, long seta. Scutellum with numerous white, decumbent and erect scales along posterior margin. Paratergite bare, lacking setae and scales. Integument of pleuron pruinose with conspicuous light areas or stripes on various sclerites; antepronotum (*Ap*) normally with moderately wide, longitudinal, light pruinose stripe at level of ventral margin of postpronotum (*Ppn*) and contiguous with similar stripe on subspiracular area (*SA*) and lower postspiracular area (*PA*); *SA* ventrad of this stripe entirely pruinose; proepisternum (*Ps*) often pruinose on upper 0.5; lower mesokatepisternum (*Mks*) with large, light pruinose area often in form of hourglass, and upper *Mks* normally with small, anteromedial, light pruinose spot and occasionally with dorsal, light pruinose spot; from upper *PA* extending posterior to *Mks* with varying scattered, light pruinose areas; mesanepimeron (*Mam*) often with 3, occasionally 4, distinct, light pruinose areas or stripes as follows: (1) upper anterior area with wide, longitudinal to ovoid stripe extending to posterior margin, (2) central area with moderately wide stripe extending to near posterior margin, (3) ventral margin with very distinct, moderately wide, light stripe extending to posterior margin, and (4) posterior margin with stripe dorsoventrally extending entire length of sclerite; metepisternum (*Mts*) predominantly pruinose. Setae on pleural areas generally reduced in number, usually well developed and numerous on *Ap*; moderately developed and numerous on prealar knob (*Pk*) and upper *Mam*; moderately developed and few on proepisternum (*Ps*) and upper and lower *Mks*; reduced and few on prespiracular area (*PsA*). Pleuron with patches of broad to elongate, decumbent to erect, silver to black scales; *Ap* usually with long, erect black scales on anterior surface; *Ps* occasionally with a few dark, erect scales; upper *Mks* with 4-16 broad, decumbent, white scales and occasionally 4-5 brown scales; lower *Mks* with 4-20 broad, decumbent, silver scales; upper *Mam* usually with 3-15 short to long, erect, silver scales along upper *Mam* setae; anterior *Mam* usually without scales (present in *darlingi*); *Ppn*, *SA*, anterior *Mks*, lower *Mam*, and hypostigmal area (*HyA*) bare. **Legs:** Coxae pruinose with patches of light and dark scales. Forecoxa always with row of well-developed setae on anterior and dorsal surface and with white scale patches on dorsal and ventral margins of anterior surface. Midcoxa with patches of setae and white scales on dorsal, anterior and posterior areas. Hindcoxa with patches of setae and white scales on dorsal and ventral edges of posterior margin. Trochanters pruinose, with or without setae and scales. Foretrochanter with short, poorly developed setae and with large patch of white scales covering lower 0.5. Midtrochanter with numerous small setae, usually without scales. Hindtrochanter with numerous

small setae, occasionally with small, white scales. Femora varied in length, often expanded at apex; forefemur distinctly shorter than proboscis; midfemur slightly longer than or equal to hindfemur, noticeably expanded at apex. Forefemur with light and dark scales at base forming light and dark rings; anterior surface mostly dark brown, often with 2, narrow, light stripes along margins extending most of length of segment; posterior surface predominantly with dark scales, with some intermingled light scales; apex usually with pale scales. Midfemur with light and dark scales at base forming light and dark bands; anterior surface with dark scales and with longitudinal white stripe one scale wide, extending almost to apex; apex with 1-3, ovoid, white patches; posterior surface very pale to white. Hindfemur with light and dark scales at base forming at least one white and one dark band; anterior surface dark with narrow band of light scales extending from larger, elongate patch of white scales at apex; posterior surface with white scales. Tibiae subequal, usually with both light and dark golden-brown scales forming longitudinal light and dark stripes, usually with light apex. Tarsi with scales varying from white to golden to black. Foretarsomeres 1, 2 and 3 usually dark, occasionally light apically; tarsomeres 4 and 5 usually black, occasionally brown, or usually with few light apical scales. Midtarsomeres 1 and 2 golden brown, with light apical spots, occasionally with intermingled light scales on tarsomere 1; tarsomeres 3, 4 and 5 dark brown to black, occasionally light apically. Hindtarsomere 1 brown with white stripe one scale wide, extending length of tarsomere, often ending in a light apical spot; tarsomere 2 proximally golden-brown to black with a basal dark area 0.1-0.9 length of tarsomere; tarsomeres 3, 4 and 5 always white. Pretarsi small; claws subequal, all simple, without basal spicules; empodium spiculose; pulvilli short and spiculose. **Wing** (Fig. 4): As figured but extremely variable. Membrane with inconspicuous microtrichia giving appearance of many small dark specks, with hues of brilliant yellow and blue when viewed from an angle in reflected light. Veins C, Sc with broad squame scales; R, M, Cu and A with mixture of squame and long plume scales. All veins with distinct light and dark markings. C, Sc, R, R_1 usually with basal, humeral, subbasal, presectoral, sectoral, subcostal and preapical light and dark spots; often with one or more spots absent, especially sectoral and presectoral. R_s basally with light spot followed by dark spot and then by larger light spot extending to furcation. R_{2+3} with 2 small dark spots; R_2 basally with a light spot, with larger light spots near middle and at apex; R_3 predominantly light, with 2 or 3 small dark spots. R_{4+5} with small dark spot basally and another distally. M light with numerous mixed dark scales. M_{1+2} with 1,2 dark spots and M_{3+4} with one dark spot. Cu with one dark spot. Cu_1 with 1-3 dark spots. Cu_2 with one dark spot. Vein A with 2 large, dark spots. Base of R with few small remigial setae. Cell R_2 longer than R_{2+3}. Apex of vein 1A extending distad of furcation of Cu. Cu with few white scales at base on ventral surface. Fringe dark with 5-8 white and 1-3 tan spots. Alula bare. Upper calypter with row of numerous, long, brown setae. **Halter:** Stem generally pale, distally usually with small, light, erect scales; knob dark with numerous small, dark scales. **Abdomen:** Tergum I laterally with numerous long, brown setae on posterior margin; midline often with erect, white to yellow scales; without caudolateral scale tufts. Terga II-IV with numerous brown setae; medially usually with numerous light scales; laterally with very few scales, largely white and yellow, occasionally darker; caudolateral tufts

often present, with 4-12 large, pale to dark, erect scales extending laterally at an angle of about 30°. Terga V-VII medially with numerous, light, yellow golden to bright silver scales, usually with numerous darker scales laterally; caudolateral tufts usually present. Tergum VIII light or dark, without caudolateral tufts. Sternum I bare (Argyritarsis Group) or with submedian stripe of white scales (Albitarsis Group). Sterna II-VIII usually with numerous dark setae, shorter than those on terga; usually with pair of longitudinal patches of light scales laterad of midline and with small patches of light to dark scales on midline.

FEMALE GENITALIA. Segment VIII: Not retracted into segment VII; length 1.2 of width, slightly narrower and shorter than preceding segments with scattered short (on tergum) to moderately long (on sternum), tan to dark brown setae. Tergum covered by yellow or cream scales, except for stripe of white scales on apicomedial 0.6 of segment and across posterior margin of segment; usually with small dark scale tuft often appearing metallic blue or purple near apex on lateral margin. Sternum predominantly covered by silver-white and yellow-cream scales, except for median longitudinal stripe of dark, metallic, purple scales extending from base to apical margin. **Tergum IX:** Partially retracted under tergum VIII, subtriangular, about 0.2 length of tergum VIII, covered with numerous short spicules. **Cercus:** Moderately long, about 0.5 length of tergum VIII, rounded, pear-shaped, curved dorsally; covered by dark brown scales on dorsal and lateral surfaces and cream scales on apicomedial and ventral surfaces. **Postgenital Lobe:** Covered by short, fine spicules; subtriangular, well developed, about 0.2 length of tergum VIII, conspicuously bilobed, with 2 strong setae about 1.2 length of lobe at apex. **Upper vaginal lip:** Moderately sclerotized. **Insula:** Distinctly conical and conspicuous, with about 10-15 setae. **Upper vaginal sclerite:** Moderately well developed, moderately sclerotized, articulating with tergum IX. **Lower vaginal lip:** Moderately sclerotized. **Spermatheca:** One, strongly sclerotized, covered by small, weakly sclerotized, circular disks; duct very weakly sclerotized. **Bursa inseminalis:** Moderately sclerotized.

MALES (Fig. 4). Essentially similar to females except for sexual characters. **Head:** Clypeus not as broad as in females. Proboscis approximately 1.0-2.1 length of forefemur. Palpus 1.0-1.2 length of proboscis; palpomeres 1 and 2 with numerous erect, bronze to purple scales and light scales; palpomere 3 expanded in apical 0.10-0.15, usually with numerous setae of moderate length, scales predominantly dark with some light scales; palpomeres 4 and 5 greatly expanded, with numerous setae, palpomere 4 laterally with setae extending from base to apex. **Antenna:** About 0.50-0.85 length of proboscis; pedicel 1.5-2.0 diameter of female pedicel, pruinose, with few small, white, decumbent scales; flagellomere 1 elongate, about 1.5 length of individual flagellomeres 2-11, usually densely plumose with setae inserted very near apex, with short and long, light, spatulate scales; flagellomeres 1-5 with setiform scales on anteromesal surface; flagellomeres 2-11 slightly longer than wide, usually densely plumose, with setae on proximal 0.5 of segment; flagellomere 12 greatly elongate, 4.0-4.5 length of individual flagellomeres 2-11, usually more or less densely plumose with setae near basal margin of flagellomere, smaller setae along entire length of flagellomere; flagellomere 13 elongate, 0.4-0.5 length flagellomere 12, sparsely plumose with large setae near base and smaller setae along length. **Legs:** Claw of foreleg distinctly enlarged, triserrate, basal

tooth small, subequal to medial tooth, 0.5 of distal tooth. Claws on midleg slightly larger than on hindleg.

MALE GENITALIA (Fig. 9). **Segment VIII:** Normally not retracted into segment VII, occasionally partially retracted; much narrower than segment VII occasionally tapered medially at proximal end. Tergum with few, short setae and number of long setae along lateral margins, usually either entirely covered with cream scales (Albitarsis Group) or light with medial dark stripe (Argyritarsis Group); never with caudolateral scale tufts. Sternum with scattered, short to moderately long setae, covered either entirely with white scales (Albitarsis Group) or with white scales and apicomedial dark scale patch (Argyritarsis Group). **Segment IX:** Spiculose. Tergum poorly developed, membranous, lateral lobes absent, articulated caudally with base of proctiger and laterally with base of gonocoxites. Sternum well developed, moderately broad, subrectangular, strongly sclerotized especially along margins; laterally margins extending onto dorsal surface as a subtriangular plate; apodeme occasionally present as strongly sclerotized projection of anteromedial margin. **Gonocoxite:** Always spiculose. Well developed, subconical, and mesally distinctly curved. Maximum basal width about 1.6 apical width, length about 2.2-3.0 maximum width. Tergal surface usually mesally covered with large, dark, obovate scales; always with submedial longitudinal row of 4,5 well-developed, long (about 0.7 length of gonocoxite) setae (tergomedial setae); basal 3 setae usually well separated from apical setae; mesal and lateral areas with row of weakly developed, moderately long setae. Tergolateral surface usually with large, white, spatulate scales continuing onto sternal surface. Basal tergomesal margin with single, well-developed parabasal seta; parabasal seta hooked apically, inserted on well-developed, sclerotized, tergomesally-directed tubercle. Base of gonocoxite with strongly sclerotized apodeme (apodeme of gonocoxite) articulating with base of phallosome. Tergomesal surface with 2 accessory setae inserted on 2 well-developed, prominent tubercles about 0.45-0.50 from base of gonocoxite; setae flattened, curved and apically hooked; dorsal seta longer than ventral seta, about 0.30-0.55 length of gonocoxite; ventral seta about 0.6-0.8 length of dorsal seta. Mesal surface with moderately long, slender, internal seta inserted on very small tubercle, about 0.50-0.55 from base of gonocoxite, usually subequal to ventral accessory seta. Apicomesal surface with number of short setae and single, long, subapical seta usually subequal to dorsal accessory seta. Sternal surface usually covered by numerous white scales, often somewhat darker near mesal and lateral margins; median area usually with row of 6-8 short setae and row of 6-8 moderately long setae. Sternomesal surface with numerous, very short to short setae. Sternolateral surface essentially without setae. **Gonostylus:** About 0.85 length of gonocoxite; strongly curved mesally along entire length, moderately slender beyond base; ventromesal margin with 12-16 short setae. Seta b slender, single, inserted basolateral of gonostylar claw. Gonostylar claw moderately sclerotized, short, slender or thick. **Claspette:** Divided into paired dorsolateral lobe and apically fused, mesal, ventral lobe. **Dorsal Lobe of Claspette (Dorsal Claspette):** Paired. Continuous ventrally at base with phallosome and ventral claspette, and laterally with gonocoxite; basal part modified into sclerotized subcylindrical pedicel with rounded semispherical base; base usually curved mesally, occasionally with conspicuous internal apodeme; apex strongly sclerotized and truncate, with 2-3 long, broad

lanceolate setae. Each lanceolate seta inserted in sclerotized tubercle; setae strongly curved mesally; dorsal seta shortest, with a variously developed mesally directed basal projection (basomesal projection); middle (if present) and ventral setae subequal, usually about 0.8-2.0 length of dorsal claspette. **Ventral Lobe of Claspette (Ventral Claspette):** Always entirely bare, without conspicuous spicules; apically with moderately small, moderately sclerotized, fused lobes forming lobed dorsal surface and non-lobed ventral surface. Basally developed as pair of moderately large to large basal lobules connected by inconspicuous spiculose membrane; area connected by membrane termed mesal cleft; membrane apically at fusion of basal lobules may be thickened to form variously developed refringent structure. Preapical plate formed as medial sclerotized area immediately basad of apical median sulcus. Area basad of preapical plate and immediately distad of refringent structure semitransparent, in shape of inverted V or U, known as membranous area. **Phallosome:** Usually extending caudad beyond ventral claspette. Composed of fused central aedeagus, pair of basal parameres and pair of basal pieces. Aedeagus moderately sclerotized just below apex; aedeagal leaflets present (Argyritarsis Group) or absent (Albitarsis Group); subapically with pair of subtriangular lateral sclerotizations (ventromesal subtriangular projections) extending ventromedially from just below apex to form incomplete tube; outer border of apex membranous. Base of aedeagus articulating with well-developed, large, triangular paramere. Basal piece articulating laterally on one side with paramere and on other side with gonocoxite, caudally articulating with base of dorsal claspette. Aedeagus usually equal to or longer than ventral claspette. **Proctiger:** Well developed, strongly sclerotized, spiculose and conical. Apex narrow or broad.

PUPAE. Cephalothorax: Median keel moderately to strongly developed; all setae present with relatively few branches. Setae 1-3-C double or triple (1-4b), moderately long, weakly developed, subequal. Setae 4,5-C 2-4b (1-8) subequal, shorter than 1-3-C but more heavily pigmented. Seta 6-C single or double (1-6b). Seta 7-C single or double (1-4b), well developed and heavily pigmented. Seta 8-C always single, well developed, heavily pigmented, and inserted at level of base of trumpet. Seta 9-C 1-4b (1-5), small, not well pigmented, inserted posterior to base of trumpet. **Trumpet:** In general gradually broadening from base to apex. Base of meatus extending from distinct tubercle; bases widely spaced, slightly nearer to wing base than to median keel. Tracheoid not developed. Meatal cleft usually large. Pinna usually large and variously developed, either angusticorn or laticorn (*darlingi*). **Metanotum:** Setae 10-12-C subequal; 10-C single (1-3b); 11-C 1-5b; 12-C 1-4b. **Abdomen:** Weakly to strongly pigmented, light yellowish brown to dark brown, about concolorous with cephalothorax. Usually with more strongly pigmented area on anteromedial portion of terga II-IX and on posteromedial portion of sterna II-IX. All usual setae present except for 8,10-II and 10-VI. Seta 1-I strongly developed, strongly dendritic. Setae 2,3-I approximated, 2-I usually mesad of 3-I, both cephalolaterad of base of seta 1-I; 2-I 2-4b (1-7), moderately developed; 3-I single (1-5b), moderately to strongly developed, 0.8-1.4 length of 2-I. Seta 4-I 3-5b (1-7), usually short, caudolaterad of 2,3-I. Seta 5-I 1-3b (1-5), long, laterad of 4-I. Seta 6-I single (1-6b), long. Seta 7-I 1-4b (1-5), moderately to strongly developed. Seta 9-I single (1-3b),

long. Seta 0-II-VI 1-7b (1-8), moderately developed; 0-VII 1-5b (1-6), small to moderately large; 0-VIII single (1-3b), small. Seta 1-II small to moderately large; 1-III usually moderately large to large, farther from midline than 1-II; 1-IV-VIII single, long, 1.0-2.0 length of segment. Seta 2-II,III 3-6b (1-7), small to moderately large, cephalolaterad of 1-II,III; 2-IV-VII 1-5b (1-6), moderately long, cephalolaterad or cephalomesad of seta 1-IV-VII. Seta 3-II,III single, double or triple (1-6b), cephalad of caudal margin of segment, between setae 1 and 2; 3-IV 2-5b (1-6), small to moderately large, laterad of imaginary line midway between setae 1-IV and 2-IV; 3-V 1-4b (1-5), moderately developed; 3-VI single or forked (1-4f), inserted very near caudal margin of segment, mesad of 1-VI; 3-VII 1-3b (1-4). Seta 4-II 1-5f (1-6), moderately developed, cephalomesad of 5-II; 4-III-V 1-5f (1-6), small to moderately large, cephalad of 5-III-V; 4-VI,VII 1-3b (1-5), moderately developed, cephalolateral of 5-VI,VII; 4-VIII 1-3f (1-5), cephalomesad of 9-VIII. Seta 5-II 2-6b (1-6) moderately developed, inserted between setae 4 and 6; 5-III-VII on caudal margin of segment between setae 1 and 9; 5-III 1-7b (1-11), moderately large to large, about 0.5 length of segment; 5-IV 1-5b, moderately large to large, about 0.5 length of segment; 5-V-VII single (1-2b), large, about 0.7-1.0 length of segment. Seta 6-II single (1-3b), moderately long to long, immediately cephalad of 7-II; 6-III-VII single or double (1-6b), usually short to long. Seta 7-II 1-4b (1-5), subequal to 6-II; 7-III-VII inserted laterad of oblique sublateral ridge; 7-III-V 1-6b, small to moderately large; 7-VI,VII single (1-4b), moderately large. Seta 8-III-VI 1-4b (1-6), inserted mesad of oblique sublateral ridge. Seta 9-II-VIII spiniform, inserted on caudolateral margin of segment; 9-II minute, unpigmented; 9-III-VIII heavily pigmented; 9-III short but well developed; 9-IV short to medium, slightly curved; 9-V-VIII moderately long to long, thin to thick, usually curved. Seta 10-III-V,VII inserted mesad of seta 7 and near caudal border of segment; 10-III single, double or triple (1-5b); 10-IV,V single (1-3b), short to moderately long; 10-VI absent; 10-VII single, double or triple (1-4b), short. Seta 11-III,IV single (1-2b), short, heavily pigmented; 11-V-VII single (1-2b), short, slender, lightly pigmented. Seta 14-III-VIII inconspicuous, small, inserted immediately adjacent to midline near anterior margin of segment. **Terminal Segments:** Seta 1-IX single (1-3b), minute. Median caudal lobe short, dorsobasally covering genital lobe and cercus. Genital lobe of female 0.75 length of cercus. Genital lobe of male 0.85-1.00 length of segment VIII, mammillated distally. Cercus about 0.6 length of segment VIII. **Paddle:** Ovoid, somewhat truncated distally, always longer than wide. Midrib heavily pigmented along margins, moderately developed, never reaching apex. Buttress distinct, moderately pigmented basally, extending 0.50-0.75 length of paddle. Outer margin of paddle distad of buttress with small to indistinct short, fine spicules. Seta 1-P single (1-2b), well developed; 2-P single or double (1-3b), small, weakly developed.

LARVAE. Head: Usually slightly longer than wide, width about 0.9 of length; widest at lateralia. Integument tan to black, predominantly uniformly pigmented. Collar well developed, narrow to moderately wide, heavily sclerotized. Labiogula in shape of isosceles trapezoid, usually wider than long. Dorsomentum well developed, strongly sclerotized, with 3,4 teeth on each side of median tooth. Ventromentum well developed, strongly sclerotized, with 3,4 pairs of teeth. Hypostomal suture not extending to tentorial pit. Median labral plate moderately developed, with small lateral lobe bearing seta 1-C.

Mandible with well-developed, strongly sclerotized tooth bearing a plate with numerous large and small denticles. Maxilla normal. Maxillary brushes with numerous filaments. Seta 1-C strongly developed, moderately long, curving ventromesad. Setae 2-C caudomesad of 1-C, very closely to widely spaced; usually single and simple with or without barbs, occasionally plumose with short to long branches. Seta 3-C usually similar to 2-C, single and simple or plumose with short to long branches occasionally dendritic, always shorter than or subequal to 2-C. Seta 4-C single and simple, forked, branched, or rarely dendritic, 1-4b, varied in length; caudolaterad of seta 2-C. Setae 5-7-C plumose, long; 5-C 16-28b, longest, extending to or beyond the anterior margin of head; 6-C 12-29b, extending to base of seta 3-C, about 0.7 length of 5-C; 7-C 15-32b, short, 0.6 length of 5-C, inserted anterad of insertions of 5,6-C. Seta 8-C 1-7 (1-8) b or f. Seta 9-C 1-8b (1-10). Seta 10-C 2,3b (2-5) (Albitarsis Group) or 1-3b (1-5) (Argyritarsis Group), small. Seta 11-C plumose, with numerous fine branches, laterad of antenna, long. Seta 12-C 2-5 (1-7) b or f, variously developed. Seta 13-C 2-5b (1-9), short, caudad of 11-C. Seta 14-C 2-6b, short, caudad of cibarial bar. Seta 15-C varied, mesad of hypostomal suture. Seta 6-Mx 2-5b, moderately developed. Setae 16,17-C always absent. **Antenna:** In general, same color as head capsule; more heavily pigmented and slightly tapered at apex. Short to moderately long, only apical 0.1 extending beyond anterior margin of head capsule. Dorsal, ventral and mesal surface with spicules. Seta 1-A 3-6 (2-7) b or f, moderately small to moderately large, on dorsomesal (Albitarsis Group) or dorsolateral (Argyritarsis Group) surface, about 0.2-0.5 from base. Setae 2,3-A large, flattened, saberlike, heavily pigmented, strongly sclerotized, not serrate at apex; 3-A inserted dorsomesad or dorsolaterad of 2-A; 2-A about 0.65 length of 3-A. Seta 4-A 1,2b (1-3), usually long (1.5 length of 3-A), slender. Seta 5-A short, about 0.3 length of 6-A, moderately pigmented, spinelike, inserted at apex on mesal margin. Seta 6-A moderately long, about 0.35-0.40 of 2-A, moderately pigmented and spiniform. **Thorax:** Predominantly uniformly pigmented except for dark sclerotized plates on dorsal and ventral surface of meso- and metathorax. Integument without spicules. Setae 9-12-P,M,T inserted on large common tubercle with large, moderately pigmented, lateral spine. **Prothorax:** Seta 1-P plumose or fanlike with thin branches, not inserted on common tubercle with 2-P (Argyritarsis Group) or palmate with unserrated, lanceolate branches inserted on common tubercle with 2-P (Albitarsis Group); 2-P plumose, 11-22b (11-25), long, inserted on large tubercle closer to 3-P than 1-P; 3-P usually single, simple, short, rarely inserted on same tubercle as 1,2-P (Albitarsis Subgroup). Setae 4,5-P plumose, well developed, long, plumose, inserted on separate tubercles; 4-P usually shorter than 5-P. Seta 6-P single and simple, long (subequal to 5-P), inserted laterally on same tubercle as 5-P. Setae 7,8-P plumose, long; 7-P inserted on tubercle ventrolaterad of 6-P; 8-P inserted on very large tubercle laterad of setae 9-12-P. Setae 9,10,12-P single and simple, long; 12-P longest of 9-12-P; 9-P shorter than 10-P; 11-P 2-4b (1-7), shortest, 0.4-0.5 length of 12-P. Seta 13-P plumose, 3-9b moderately developed. Seta 14-P 4-10b (4-12), moderately long, mesad of 9-12-P. **Mesothorax:** Seta 1-M plumose, 23-39b (16-39), moderately long, inserted on large tubercle. Seta 2-M usually single and simple, occasionally forked, short. Setae 3,5-M single (1,2b) and simple, moderately long. Seta 4-M 2-5b (1-5), short. Seta 6-M 2-5f (1-5), moderately long. Seta 7-M 2-5f (1-5),

moderately small. Seta 8-M plumose, 18-26b long, inserted on small tubercle. Setae 9,10-M single and simple, long; 9-M about 0.90-0.95 length of 10-M. Seta 11-M single, minute. Setae 12-M single and simple, moderately short, about 0.2 length of 10-M. Seta 13-M 3-6b (3-7), moderately small. Seta 14-M pectinate, 5-12b (3-12), small, near ventral midline. **Metathorax:** Setae 1,2-T single and simple, short; 1-T about 0.4 length of 2-T. Seta 3-T fanlike with thin branches (Argyritarsis and Pictipennis Subgroups) or palmate with 6-15 (3-15) lanceolate branches (Albitarsis Group and Darlingi Subgroup), lightly pigmented. Seta 4-T 3-5b (2-5), small, approximate to and immediately caudad of 3-T. Setae 5,7,8-T plumose, 17-35b, long, inserted on moderately large tubercles. Seta 6-T 2,3f (1-4), moderately developed. Setae 9,10-T single and simple, long; 9-T shorter than 10-T. Seta 12-T 2,3b (1-3), moderately long. Seta 13-T 2,3b, long. **Abdomen:** Integument without spicules except on spiracular apparatus and segment X, uniformly tan to brown except for strongly pigmented, sclerotized tergal and accessory tergal plates on dorsomedial surface of segments I-VIII. Median tergal plates usually moderately large, strongly sclerotized, on anterior margin of segments I-VIII. Accessory median and submedian tergal plates present caudad of median tergal plate, usually subspherical or ovoid, small, only about 0.05 area of median tergal plates. Accessory median tergal plates on midline in longitudinal line, 0.1 length of segment from anterior margin, single or multiple; always absent on segment I, single or absent on segment II; single (*albitarsis*, *argyritarsis*, *braziliensis*, *darlingi*) or occasionally double (*marajoara*) on segment III; single and without lobes (*argyritarsis*, *albitarsis*, *sawyeri*) or bilobed (*marajoara*, *braziliensis*, *darlingi*) or trilobed (*marajoara*, *braziliensis*) or with 2,3 separate oval plates (*marajoara*) on segments IV-VII. Accessory submedian tergal plates, 0.5 length of segment from anterior margin, usually in pairs, with one on each side of midline; present or absent in Argyritarsis Subgroup; one or 2 pairs in Albitarsis Group and *darlingi*. Chaetotaxy uniform. Seta 0-II-VIII 1-8b (1-10), moderately small. Seta 1-I fanlike with thin branches inserted near apex of short stalk (Argyritarsis Subgroup) or palmate with unserrated, narrow lanceolate, lightly or moderately sclerotized branches inserted at the base (Albitarsis Group) or at end of a short shaft (*darlingi*); 1-II-VII palmate, with 17-30 (10-30) unserrated, narrow to moderately broad, lanceolate branches. Seta 2-I-III 3-9b (1-9), usually small to moderately large; 2-IV,V single (1-3b); 2-VI 1-5b (1-9); 2-VII 1-7b (1-9). Seta 3-I-III,V,VI single; 3-IV 1-4b (1-5); 3-VII usually 3,4b. Seta 4-I-V 2-7b, moderately large; 4-VI,VII single. Seta 5-I-VII 3-9b (4-10), short to long. Seta 6-I-III plumose, 20-27b, long, inserted on distinct tubercle; 6-IV-VI single, long; 6-VII 3-5b. Seta 7-I,II plumose, long, inserted on tubercle with 6-I,II; 7-III-VII 2-7b (1-9). Seta 8-II-VII 2-5b (1-9), small to moderate. Seta 9-I-VII 4-10b (4-12). Seta 10-I-V single, double or triple; 10-VI,VII 1-3b (1-4). Seta 11-I triple (2-6b), large; 11-II-VII 1-3b (1-4). Seta 12-I-V single, double or triple; 12-VI,VII single (1-3b). Seta 13-I-VII 3-13b (1-13). **Segment VIII:** Seta 0-VIII 3-5b, usually very small. Seta 1,4-VIII single, long; 1-VIII subequal to 4-VIII. Seta 2-VIII usually 5-9b, large. Seta 3-VIII usually 4-10b, large. **Spiracular lobe:** Pecten with 13-20 teeth, length variable; teeth usually dorsally curved; teeth saberlike with serrations on basal 0.6 of smaller teeth (except in *darlingi*). Teeth beginning ventrally usually as follows: (1) one long or rarely 2 long (Albitarsis Subgroup), (2) numerous short, occasionally

alternating 1 short, 1 long, (3) terminating with 1-3 long followed by 1,2 short. Anterolateral spiracular lobe varying in length, always bearing setae 6,7-S. Anterior spiracular lobe dorsomesad of insertions of setae 3-5-S. Posterolateral spiracular lobe variably pigmented, bearing setae 8-13-S. Median plate usually strongly pigmented, with (Albitarsis Group) or without (Argyritarsis Group) lateral arms immediately basad of anterior median process; when arms present, usually not extending to spiracular opening. Anterior median process of median plate strongly sclerotized and variable. Seta 1-S 3-7b (3-10), usually large, inserted on caudal surface of posterolateral spiracular lobe near posterodorsal margin of pecten. Seta 2-S 2-9b, usually small, cephalad of pecten. Setae 3-5-S usually single or double when visible, inconspicuous. Seta 6-S usually single, occasionally 2f (*sawyeri*), moderately small. Seta 7-S single (1-3b) (*argyritarsis*) or double (1-3b) (Albitarsis Group, *sawyeri*). Seta 8,9-S 3-6b (2-9) or 1-3b (*darlingi*), moderately large. Seta 10-13-S usually single when visible, small (except for 13-S in *darlingi*), inconspicuous. **Abdominal Segment X:** Saddle incomplete, covering only dorsal 0.5 of segment, strongly sclerotized and moderately pigmented, brown; often with strongly pigmented band along basal margin and apical, subtriangular, dark spot on dorsal midline tapering apically to base of setae 2,3-X. Caudal 0.5 of saddle and anal segment with small, fine spicules, progressively stronger near caudal margin. Seta 1-X always single, well developed, long, usually inserted on saddle. Seta 2-X strongly plumose, 16-28b, long, well developed. Seta 3-X 16b, 1.5 length of 2-X. Ventral brush 4-X, with 8 pairs of long, strongly developed, plumose setae. Anal papillae 1.0-2.0 length of saddle.

KEYS TO GROUPS AND SPECIES

FEMALES

1. Sternum I completely bare, without white scales; palpomere 4 never with scattered light scales; scutellum usually with more than 12 well-developed, dark setae along posterior margin **(Argyritarsis Group)** 2

Sternum I with a submedial stripe of white scales; palpomere 4 sometimes with scattered light scales; scutellum usually with fewer than 12 well-developed, dark setae along posterior margin **(Albitarsis Group)**..... 6

Argyritarsis Group

2(1). Palpomere 5 with basal 0.4 dark; scales on scutum large; foretarsomere 1 with light spot in basal 0.3-0.4; caudolateral scale tufts absent on all abdominal segments **(Pictipennis Subgroup)** ....**4. *pictipennis***

Palpomere 5 entirely light; flagellomere 1 with only light scales, flagellomeres 3-6 without scales; scales of scutum never large; foretarsomere 1 without basal light spot; hindtarsomere 2 dark in less than basal 0.65; vein C usually with at least subbasal light spot present; caudolateral scale tufts at least on abdominal segments III-VII 3

3(2). Anterior mesanepimeron (*Mam*) with a conspicuous patch of light scales; upper mesanepimeron (*Mam*) without light scales; vein C basal dark spot greatly enlarged, 3.0-4.0 length of humeral light spot; palpomere 4 apically with a moderately large patch of white scales **(Darlingi Subgroup)** .....**5. *darlingi***

Anterior mesanepimeron (*Mam*) without a patch of light scales; upper mesanepimeron (*Mam*) with a line of light scales; vein C basal dark spot not greatly enlarged, at most equal to humeral light spot; palpomere 4 without a patch of light scales 4

4(3). Vein C humeral and subbasal light spots fused, forming a very large basal light spot, 10.0 of basal dark spot; caudolateral scale tufts present on abdominal segment II; hindtarsomere 2 with more than basal 0.5 dark **(Lanei Subgroup)** ..... 3. *lanei*

Vein C humeral and subbasal light spots never fused; caudolateral scale tufts absent on abdominal segment II; hindtarsomere 2 with less than basal 0.4 dark **(Argyritarsis Subgroup)** 5

Argyritarsis Subgroup

5(4). Terga II-IV medially with purple scales and laterally with yellow scales; vein C basal dark spot less than or equal to 0.5 of humeral light spot; hindtarsomere 2 with basal 0.15 dark; frontal tuft with 4-7 pairs of long setiform scales; interocular space wide, 0.8 or more diameter of pedicel..... 2. *sawyeri*

Terga II-IV medially with cream scales and some brown scales on apical 0.5 of segments; vein C basal dark spot 0.4-0.8 of humeral light spot; hindtarsomere 2 almost always with more than basal 0.15 dark; frontal tuft with 8,9 pairs of long setiform scales; interocular space moderately wide, 0.8 or less diameter of pedicel ..... 1. *argyritarsis*

Albitarsis Group

6(1). Caudolateral scale tufts well developed on abdominal segment II; vein C with presectoral light spot small hindtarsomere 2 with basal 0.3-0.4 dark (**Braziliensis Subgroup**) .....8. *braziliensis*

Caudolateral scale tufts absent on abdominal segment II; vein C without presectoral light spot (hindtarsomere 2 with basal 0.5-0.9 dark (**Albitarsis Subgroup**)..... 7

Albitarsis Subgroup

7(6). Hindtarsomere 2 dark in basal 0.6-0.9 (0.4-0.9); vein C with 3 or more light spots absent in more than 20% of specimens (subbasal absent in 25%, sectoral absent in 36%, subcostal absent in 19% of specimens) and with all light spots developed in only about 50% of specimens; large species ..... 6. *albitarsis*

Hindtarsomere 2 dark in basal 0.5-0.7 (0.3-0.8); vein C never with 3 or more light spots absent, except in 3% of Bolivian specimens (subbasal absent in 6%, sectoral absent in 14%, subcostal absent in 1% of Bolivian specimens) and with all light spots developed in most specimens (79% of Bolivian specimens); small to moderately large species..... 7. *marajoara*

MALE GENITALIA

(4. *pictipennis* not included)

1. Aedeagus with a pair of curved, serrate, subapical leaflets; ventral claspette apically with 2 well-developed lobes, with a moderately deep to deep median sulcus; dorsal claspette moderately broad at least at apex and base (**Argyritarsis Group**) 2

Aedeagus without subapical leaflets; ventral claspette apically with a single lobe or with 2 small lobes, with a moderately shallow median sulcus; dorsal claspette narrow (**Albitarsis Group**) 5

2(1). Apex of aedeagus longer than wide, ventromesal subtriangular projections encircling entire subpical region forming a distinct collar; ventral claspette with apex moderately wide and truncate, median sulcus small, occasionally indistinct; dorsal seta of dorsal claspette with a well-developed basomesal projection (Fig. 10) (**Darlingi Subgroup**).....5. ***darlingi***

Apex of aedeagus wider than long, ventromesal subtriangular projections never forming a collar; ventral claspette never truncate, median sulcus well developed; dorsal seta of dorsal claspette without a basomesal projection 3

3(2). Ventral claspette with apex expanded laterally into large auriculate lobes directed caudally; gonocoxite moderately short and stout, length about 2.2 maximum width; tergum VIII medially with a narrow stripe of moderately large, dark scales; sternum VIII with 2 dark scale patches on caudal border (Fig. 9) (**Lanei Subgroup**) ..... 3. ***lanei***

Ventral claspette with apex not expanded laterally into large auriculate lobes; gonocoxite moderately long, about 3.0 maximum width; tergum VIII without a stripe of dark scales; sternum VIII without dark scale patches on caudal border (**Argyritarsis Subgroup**) 4

Argyritarsis Subgroup

4(3). Ventral claspette with apex wide, with lobes pointed and directed anterolaterally, median sulcus broadly developed between apices of lobes, mesal cleft about 0.3 length of ventral claspette with vertex not distinctly thickened, refringent structure absent; apex of aedeagus sharply rounded, width of apex equal to length; setae of dorsal claspette 2.0 length of dorsal claspette (Fig. 7)..... 2. ***sawyeri***

Ventral claspette with apex moderately narrow, with lobes smoothly rounded and not directed anterolaterally, median sulcus deep and narrow, mesal cleft about 0.15 length of ventral claspette with vertex thickened to form refringent structure; apex of aedeagus broadly rounded, width of apex 1.5 length; setae of dorsal claspette about 1.3 length of dorsal claspette (Fig. 5) ..... 1. ***argyritarsis***

5(1). Ventral claspette with apex truncate, apex not expanded laterally, preapical plate small; dorsal seta of dorsal claspette with a well-developed basomesal projection; parabasal seta of gonocoxite about 2.5 length of its tubercle; tergum VIII with numerous golden scales, sternum VIII with a patch of golden scales on anterior margin; sternum IX with anteromedial border not emarginate (Fig. 16) **(Braziliensis Subgroup)** ..... **8.** ***braziliensis***

Ventral claspette with apex not truncate, apex rounded and laterally expanded, preapical plate absent; dorsal seta of dorsal claspette without a well-developed basomesal projection **(Albitarsis Subgroup)**..... 6

Albitarsis Subgroup

6(5). Ventral claspette with apex moderately wide, median sulcus absent, refringent structure poorly developed, with well-developed membranous area; dorsal claspette rounded at base; length of sternum VIII more than 0.1 (0.10-0.15) length of gonocoxite (Fig. 12)..... **6.** ***albitarsis***

Ventral claspette with apex moderately narrow, median sulcus present, refringent structure and membranous area not developed; dorsal claspette truncate at base; length of sternum VIII about 0.1 length of gonocoxite (Fig. 14) ..... **7.** ***marajoara***

PUPAE

(3. ***lanei*** and **4.** ***pictipennis*** not included)

1. Seta 9-V long, usually more than 3.0 length of 9-IV, *if* short (3.0 length of 9-IV) *then* trumpet laticorn; seta 3-C double (1-3b) **(Argyritarsis Group)**..... 2

Seta 9-V short, less than or equal to 3.0 length of 9-IV; seta 3-C triple (1-4b) **(Albitarsis Group)**..... 4

2(1). Trumpet laticorn, pinna short; seta 9-II-VII usually short, 9-VII 0.25-0.30 length of segment VII; 11-C 3-5f (2-5) (Fig. 10) **(Darlingi Subgroup)**..... **5.** ***darlingi***

Trumpet angusticorn, pinna usually long; seta 9-II-VII moderately long, 9-VII usually 0.5-0.6 length of segment VII; 11-C single or double (1-3b) **(Argyritarsis Subgroup)** 3

Argyritarsis Subgroup

3(2). Seta 9-VIII weakly curved mesally; 2-I 2f (1-3), weakly to moderately developed; 0-III-V 4,5b (4-6); 1-II 7-10b (6-11) and 1-III 5-7b (4-8); 2-VII 2f (1-3); 5-II 4-6b (Fig. 7)..... 2. *sawyeri*

Seta 9-VIII strongly curved mesally; 2-I 3,4b (1-7), strongly developed; 0-III-V 2,3b (1-6); 1-II,III 3-5b (2-7); 2-VII single (1-3b); 5-II 2,3b (1-6) (Fig. 5)..... 1. *argyritarsis*

4(1). Pinna of trumpet long, about 0.8 length of trumpet; seta 7-C single; 4-V single or double (1-5f); 5-IV single (1-4b) (Fig. 16) (**Braziliensis Subgroup**)..... 8. *braziliensis*

Pinna of trumpet moderately long, 0.65-0.70 length of trumpet; seta 7-C 2b (1-4) ..... (**Albitarsis Subgroup**) 5

Albitarsis Subgroup

5(4). Length of paddle about 1.7 width; seta 2-P single; 9-C single or double; secondary branches of 1-I with scattered dark patches; 2-II 4-6b (2-6); 5-II 2b (1-4); 9-V usually 2.0 length of 9-IV; small to moderately large species (Fig. 14)..... 7. *marajoara*

Length of paddle 1.3 width; seta 2-P 2b (1,2); 9-C 3,4b (1-5); all branches of 1-I uniformly heavily pigmented; 2-II 3b (3-5b); 5-II 3b (3-5); 9-V usually 3.0 length of 9-IV; large species (Fig. 12)..... 6. *albitarsis*

LARVAE

(**3.** *lanei* and **4.** *pictipennis* not included)

1. Seta 1-P plumose or fanlike with thin branches, never palmate with lanceolate branches; 1,2-P never inserted on a common sclerotized tubercle; 3-T, 1-I fanlike with thin branches *or* weakly palmate with narrow lanceolate branches *or* palmate with well-developed lanceolate branches, *if* palmate with well-developed lanceolate branches *then* 13-S very strongly developed, 2.2-2.5 length of saddle; (**Argyritarsis Group**) 2

Seta 1-P always palmate with lanceolate branches; 1,2-P inserted on a common sclerotized tubercle; 3-T, 1-I always palmate, with well-developed lanceolate branches (**Albitarsis Group**) 4

2(1). Seta 13-S very strongly developed, long, about 2.2-2.5 length of saddle; setae 2-C moderately spaced, clypeal index about 1.5; 4-C double (2,3b) (Fig. 11) (**Darlingi Subgroup**) ..... 5. *darlingi*

Seta 13-S not strongly developed, minute; setae 2-C very closely spaced, clypeal index greater than 4.0; 4-C always single (**Argyritarsis Subgroup**) 3

Argyritarsis Subgroup

3(2). Setae 3-T and 1-I very weakly palmate with very narrow lanceolate branches; 8-C single (1,2f); 4-C extending anteriorly to beyond insertion of 2-C a distance of 0.3 the length of 2-C (Fig. 8) .....**2.** ***sawyeri***

Setae 3-T and 1-I fanlike, not palmate, with thin branches; 8-C 2,3b (1-4); 4-C extending anteriorly to level of insertion of 2-C (Fig. 6) ..... **1.** ***argyritarsis***

Braziliensis Subgroup

4(1). Setae 2-C moderately closely spaced, clypeal index about 2.7; 4-C single (1-3b); pecten with median teeth alternating 1 long and 2-4 short (Fig. 17)..... **8.** ***braziliensis***

Setae 2-C widely spaced, clypeal index 0.76-1.33; 4-C 2,3b (1-4); pecten with median teeth mostly subequal (**Albitarsis Subgroup**) 5

Albitarsis Subgroup

5(4). Clypeal index about 1.3 (1.0-1.4); accessory median tergal plates on segments IV-VII usually with 2,3 ovoid plates, occasionally fused into a single plate; 12-C 5b (4-6); 6-T 3b (1-3); 1-I 17-19b (10-26); 3-IV 3b (3,4); 4-III 3,4b (3-5); 5-IV,V 5-7b (4-9); 7-IV 4,5b (3-5); seta 3-C usually 0.65-0.70 length of 2-C (Fig. 15) ..... **7.** ***marajoara***

Clypeal index 0.76-1.10; accessory median tergal plates on segments IV-VII always single; 12-C, 3-5b; 6-T 2b (1,2); 1-I 14,15b (10-15); 3-IV 2b (2,3); 4-III 2b (2,3); 5-IV,V 4b (4,5); 7-IV 3b (2-5); seta 3-C usually 0.8 length of 2-C (Fig. 13) ..**6.** ***albitarsis***

ARGYRITARSIS GROUP

FEMALES. Small to large; wing 3.5 - 5.3 mm. **Head:** Interocular space narrow to wide, 0.2-1.0 diameter of pedicel. Frontal tuft with 3-10 pairs of long, white setiform scales. Vertex with long, erect, silver, spatulate scales becoming darker (almost black) laterally. Lateral ocular setae dark. Clypeus pruinose, very wide (3.0 diameter of pedicel). Proboscis 1.0-1.6 length of forefemur, with numerous copper scales and setae. Palpus subequal to proboscis; palpomeres 1,2 with erect scales predominantly dark, some white; palpomeres 3,4 with decumbent scales predominantly dark, apically usually with few light scales, occasionally with light patch (*darlingi*); palpomere 5 light. **Antenna:** Pedicel pruinose, with few, small, light scales; flagellomere 1 with small, light scales at base, apically always with long, light scales, occasionally with long, dark scales (Pictipennis Subgroup); flagellomere 2 about 0.5 length of flagellomere 1, with or without short light scales; flagellomeres 2-13 subequal, with basal whorls of 6-8 pairs of brown setae decreasing in length on apical flagellomeres; flagellomeres 3-13 without scales (except for flagellomere 3 of *lanei* and flagellomeres 3-6 of *pictipennis*). **Thorax:** Integument pruinose, with 3 areas of darker, less pruinose longitudinal stripes. Median anterior promontory setae light colored. Anterior promontory and anterior acrostichal area with light setiform scales. Scutellum with 12-17 well-developed setae and 7-14 moderately developed (0.6 length of well-developed setae) setae along posterior margin. Pleuron with pruinosity as in section. *Ap* anterodorsally with numerous lanceolate, erect, dark scales juxtaposed to similar scale patches on lateral anterior promontory and postoccipital regions. *Ps* usually with dark, stout setae; dorsally often with light scales. Upper and lower *Mks* with few, dark, well-developed setae and small light patch. *Pk* with 6-10, weakly developed setae, varying from anteriorly light to posteriorly dark, with (Argyritarsis Subgroup) or without (Darlingi Subgroup) scales. Upper *Mam* with 3-15 scales (Argyritarsis and Pictipennis Subgroups) or without scales (Darlingi and Lanei Subgroups). Anterior *Mam* with (*darlingi*) or without scales. **Legs:** Coxae as in section. Fore-, mid- and hindtrochanters with few light scales. Hindtarsomere 2 with more than basal 0.75 dark (Pictipennis Subgroup) or basal 0.35-0.55 dark (Darlingi and Lanei Subgroups) or less than basal 0.4 dark (Argyritarsis Subgroup). **Wing:** Vein C occasionally with enlarged basal dark spot (Darlingi and Pictipennis Subgroups); humeral light spot present or absent (Pictipennis Subgroup); humeral and subbasal light spots not fused or fused to form one large light spot (Lanei Subgroup); presectoral light spot occasionally reduced or absent (Pictipennis Subgroup); subcostal light spot large, usually 2.0 of sectoral light spot, always longer than sectoral light spot. R_3 with 2 (Argyritarsis, Lanei and Pictipennis Subgroups) or 3 (Darlingi Subgroup) dark spots. R_{4+5} usually with apical dark spot subequal to basal dark spot. M with basal dark spot absent (Lanei Subgroup) or basal dark spot 0.5 of M apical dark spot (Argyritarsis Subgroup) or basal dark spot much enlarged, extending to near base and occasionally divided by light spots into 2 or 3 dark spots (Darlingi and Lanei Subgroups). **Abdomen:** Tergum I usually with numerous seta and very few scales. Caudolateral scale tufts distinct, dark, present on segments II-VII (Darlingi Subgroup) or indistinct, cream to light brown and present on segments III-VII (Argyritarsis and Lanei Subgroups) or completely

absent (Pictipennis Subgroup). Tergum VIII from predominantly light to dark, without caudolateral scale tufts. Sternum I completely bare, without white scales. Sterna II-VII usually with numerous dark setae; usually with submedial stripe of short, light scales, occasionally scales reduced in number.

MALES. Essentially as in females except for sexual characters. **Head:** Proboscis about 1.4-2.1 length of forefemur. Palpus 0.9-1.1 length of proboscis; palpomere 2 with small to moderately large (Pictipennis Subgroup) apical light band; palpomere 4 predominantly white (except in Pictipennis Subgroup); palpomere 5 predominantly white, with basal brown band never greater than 0.3 length of palpomere or with medial dark band never greater than 0.35 length of palpomere. **Antenna:** 0.70-0.85 length of proboscis; diameter of pedicel approximately 1.5-2.0 that of pedicel of female; pedicel pruinose, with or without small light scales; flagellomere 1 about 1.5-2.0 length of individual flagellomeres 2-11; flagellomere 2 subequal to that of female, with or without scales; flagellomeres 3-11 subequal to those of female, without scales; flagellomere 12 about 4.0-4.5 length of individual flagellomeres 2-11; flagellomere 13 about 0.40-0.58 length of flagellomere 12. **Legs:** Essentially as in section.

MALE GENITALIA. Segment IX: Sternum varied, subrectangular, usually long, at least 0.2 length of gonocoxite; anterior and posterior borders medially weakly to strongly emarginate. **Gonocoxite:** Tergal surface usually with 5 well-developed, long, tergomedial setae, often with row of shorter setae mesally. **Gonostylus:** Gonostylar claw generally rather short and stout. **Dorsal Claspette:** Pedicel usually moderately broad, at least at apex and base. Apex usually with 2 setae, occasionally with 3 (Darlingi Subgroup); dorsal seta usually shorter, occasionally with basomesal projection; ventral seta usually very long, about 1.1-2.0 length of dorsal claspette. **Ventral Claspette:** Apex ventrally rounded, truncate, always with 2 lobes, each lobe either rounded or pointed, separated by moderately deep to deep median sulcus. **Phallosome:** Aedeagus with apex rounded or pointed, always with pair of curved, serrate subapical leaflets; usually width of aedeagus greater than length; tip of apex membranous or sclerotized; ventromesal subtriangular projections weakly or strongly developed.

PUPAE. Cephalothorax: Median keel strongly developed. Setae moderately long and heavily pigmented. Seta 3-C double (1-3b). Seta 7-C single or double (1-4b). Seta 9-C 1-3b (1-4). **Trumpet:** Pinna angusticorn and long with long meatal cleft, or laticorn and small (Darlingi Subgroup). **Metanotum:** Seta 11-C double (1-3b) (Argyritarsis Subgroup) or 3-5b (2-5) (Darlingi Subgroup). **Abdomen:** Seta 4-I 3-5b (1-7). Seta 0-II 2-4b (1-7). Seta 8-IV single or double (Argyritarsis Subgroup) or triple (2,3b) (Darlingi Subgroup). Seta 9-V long, usually more than 3.0 length of 9-IV (about 3.0 length of 9-IV in Darlingi Subgroup).

LARVAE. Small to large. **Head:** Dark band extending from collar along frontal ecdysial line to seta 8-C (Darlingi Subgroup) or 9-C (Argyritarsis Subgroup), band with recurved caudolateral arm extending toward collar. Dorsomentum with median tooth moderately large, about 1.5 width of adjacent teeth. Collar moderately narrow to moderately wide. Setae 2-C very closely spaced (Argyritarsis Subgroup) or moderately spaced (Darlingi Subgroup) or widely spaced (Pictipennis Subgroup). Seta 3-C shorter than 2-C. Seta 4-C single or double (except 3,4b in Pictipennis Subgroup), long. Setae 8,9-C with

numerous branches (Darlingi Subgroup) or with few branches (Argyritarsis Subgroup), long. Seta 10-C 1-3b (1-5). **Antenna:** Lightly pigmented at base (Argyritarsis Subgroup) or entirely heavily pigmented (Darlingi Subgroup). Seta 1-A moderately long, usually longer than width of antenna, inserted on basal 0.20-0.45 of antenna. **Thorax:** Lightly to moderately pigmented. Setae 1-3-P never inserted on common sclerotized tubercle; 1-P plumose with thin branches (Argyritarsis and Pictipennis Subgroups) or fanlike with thin branches (Darlingi Subgroup), never palmate with lanceolate branches; setae 9,10, 12-P single and long; 11-P double (Darlingi Subgroup), 2-4b (Argyritarsis Subgroup). Seta 1-M plumose, large. Seta 3-T palmate with broad lanceolate branches (Darlingi Subgroup) or weakly palmate with narrow lanceolate branches (*sawyeri*) or fanlike with thin branches (*argyritarsis* and *pictipennis*). **Abdomen:** Median tergal plates weakly (*argyritarsis*) to well developed on segments I-VIII; plate of segment VII large to very large, about 0.40-0.65 width of segment. Accessory median tergal plate present on segments II-VII, single and without lobes (Argyritarsis Subgroup) or single and lobed (Darlingi Subgroup). Accessory submedian tergal plates absent or poorly developed (Argyritarsis Subgroup) or present on segments II-VI as single or double pair (Darlingi Subgroup). Seta 1-I palmate with broad lanceolate branches (Darlingi Subgroup) or very weakly palmate with narrow lanceolate branches (*sawyeri*) or fanlike with thin branches (*argyritarsis*); 1-II-VII palmate, variously developed. Seta 2-I-III 3-8b (1-9). Seta 13-I-VIII 3-10b (3-12). **Spiracular Lobe:** Pecten with 15-19 (14-19) teeth, varied. Median plate of spiracular apparatus without lateral arms. **Abdominal Segment X:** Saddle incomplete. Seta 1-X on saddle; moderately long to long, 1.5-2.5 length of saddle.

DISCUSSION. The species included in the Argyritarsis Group can be distinguished from those of the Albitarsis Group in the **females** by the combination of: (1) palpomere 4 predominantly dark, occasionally with a light mediolateral patch, (2) scutellum usually with 12-17 well-developed, dark setae along posterior margin, and (3) sternum I completely bare, without white scales; in the **male genitalia** by: (1) sternum IX usually long, at least 0.2 length of gonocoxite, (2) gonocoxite with 5 well-developed, long tergomesal setae, (3) gonostylar claw generally moderately short and stout, (4) dorsal claspette usually moderately broad, at least at apex and base, (5) apex of ventral claspette always bilobed ventrally with moderately deep to deep median sulcus, and (6) aedeagus always with pair of curved, serrated, subapical leaflets; in the **pupae** by: (1) median keel strongly developed, (2) setae of cephalothorax heavily pigmented, strongly developed, (3) seta 3-C double (1-3b), (4) seta 9-C 1-3b (1-4), (5) seta 11-C single or double (1-3b) (Argyritarsis Subgroup), or 5b (2-5) (Darlingi Subgroup), (6) seta 4-I 3-5b (1-7), and (7) seta 0-II 2-4b (1-7); and in the **larvae** by: (1) seta 1-A usually moderately long, usually longer than width of antenna, (2) seta 1-P plumose or fanlike, never palmate, (3) setae 1,2-P never sharing common sclerotized tubercle, (4) setae 3-T and 1-I fanlike with thin branches (*argyritarsis*) or weakly palmate with narrow lanceolate branches (*sawyeri*) or palmate with well-developed lanceolate branches (*darlingi*), (5) median plate of spiracular apparatus without lateral arms, and (6) seta 1-X 1.5-2.5 length of saddle.

I have separated the Argyritarsis Group into 4 distinct subgroups: the Argyritarsis Subgroup comprised of 2 species, and the monotypic Darlingi, Lanei and Pictipennis Subgroups. Phylogenetic relationships between the Pictipennis

Subgroup and the other 3 subgroups of the Argyritarsis Group are difficult to hypothesize because only the adult female and male genitalia of *pictipennis* were available for examination. After studying the available material, I believe placement of *pictipennis* in the Argyritarsis Group is warranted. *Anopheles pictipennis* is an unusual form, exhibiting several apomorphic characters not shared by any other species in the Argyritarsis Group (except for a few in (*lanei*). The adult **female** of *pictipennis* has the following characters: (1) palpomere 5 basally has a dark band, (2) flagellomere 1 of the antenna has light and dark scales, and flagellomeres 2-6 have light scales, (3) hindtarsomere 2 basally is dark in more than 0.75 of its length, and (4) the subbasal and presectoral light spots are usually absent on vein C. *Anopheles lanei* appears to be rare and apparently restricted to the state of Sao Paulo, Brazil. It shares the following characters with species of the Albitarsis Group, and only with *pictipennis* of the Argyritarsis Group; in the **female**: (1) flagellomere 3 with distinct light scales, and (2) hindtarsomere 2 dark in more than the basal 0.5. *Anopheles darlingi* is a very distinct species. In all life stages as well as in the male genitalia, *darlingi* is very easily separated from all other species in the Argyritarsis Group. The Argyritarsis Subgroup includes 2 very closely related species, *argyritarsis* and *sawyeri*. Although *sawyeri* is isolated by a small mountain range in the state of Ceara, Brazil, it has remained morphologically very similar to *argyritarsis*. Diagnostic characters must be carefully examined in separating these 2 latter species, and it is advisable to correlate characters in the various life stages whenever possible.

The Argyritarsis Group is restricted to Central and South America, and the Lesser Antilles. *Anopheles argyritarsis* extends farthest north, having been collected in Guerrero, Mexico; it has invaded the Lesser Antilles and is known as far south as northern Argentina. *Anopheles pictipennis* is the only species found on the Pacific side of the Andes south of Colombia.

ARGYRITARSIS SUBGROUP

FEMALES. Moderately large; wing 3.4 - 3.5 mm. Dark scales brown to black. Light scales cream to white. **Head:** Interocular space broad, 0.6-1.0 diameter of pedicel. Frontal tuft with 4-10 pairs of long, white setiform scales. Lateral erect scales of vertex very dark. Palpomere 4 dark; palpomere 5 without a basal dark band. **Antenna:** Pedicel with 4-8 small decumbent scales. Flagellomeres 1,2 basally with few, small, light, decumbent scales basally and apically with longer, erect, setiform, light scales and no dark scales; flagellomeres 3-6 without scales. **Thorax:** Integument of scutum pruinose, with very pronounced dark stripes. Median anterior promontory with numerous silver setae. Scales of scutum small and white, with white to silver, small, setiform scales. *Ap* anterodorsally with numerous erect, brown to dark gray scales. Anterior *Mam* without scales. *Pk* region with 5-10 light and dark setae, usually with some light scales. Upper *Mam* with 3-5 short, light scales. **Legs:** Generally as in section and group. Foretarsomere 1 without basal light spot. Hindtarsomere 2 usually with basal 0.15-0.40 dark. **Wing:** Vein C usually with dark basal spot not greatly enlarged; humeral and subbasal light spots never fused; subbasal and presectoral light spots never completely absent. R_3 always with 2 dark spots. M apical dark spot 0.5 of basal dark

spot. **Abdomen:** Tergal scale pattern usually subtriangular on segments II,III, subrectangular on segments IV-VII, with intermingled cream and yellow scales. Caudolateral scale tufts present on segments III-VII, usually light and indistinct, with 4-6 scales. Tergum VIII basally with light golden scales and apically with dark scales. Sterna as in group.

MALES. Essentially as in females except for sexual characters and as in section and group. **Head:** Proboscis about 1.47-1.65 length of forefemur. Palpus about equal to proboscis. **Antenna:** Length 0.78-0.80 of proboscis.

MALE GENITALIA. Segment VIII: Tergum predominantly covered by narrow light scales, never completely covered with dark scales and without dark stripe. Caudal border of sternum without 2 dark scale patches. **Segment IX:** Sternum with posteromedial and anteromedial borders usually moderately emarginate. **Gonocoxite:** Length 2.8-3.0 maximum width. Tubercle of parabasal seta normally moderately short. Basal apodeme usually about 0.2 length of gonocoxite or shorter. Internal seta usually shorter than or equal to length of ventral accessory seta. **Gonostylus:** Gonostylar claw usually thick, short and stout. **Dorsal Claspette:** Apex usually broad, occasionally narrow (*sawyeri*), with 2 setae. Setae usually longer than length of dorsal claspette; dorsal seta without basomesal projection. **Ventral Claspette:** Apex ventrally always with 2 moderately large lobes and well-developed median sulcus, never truncate. Preapical plate at most weakly developed. **Phallosome:** Less than 0.5 length of gonocoxite. Apex of aedeagus membranous. Ventromesal subtriangular projections very strongly sclerotized, not forming collar. Leaflets inserted at widest part of aedeagus.

LARVAE. Small to moderately large. **Head:** With darkly pigmented areas as follows: (1) broad, dark band extending anteriorly from collar along fronto-clypeal suture to at least level of seta 9-C and always with an arm extending caudolaterally from either 9-C or 8-C to collar; (2) dark band extending along bases of setae 5,6-C and occasionally 7-C, and (3) large, inverted triangular dark area between setae 8-C. Collar narrow to moderately wide dorsomedially. Setae 2-C very closely spaced, clypeal index greater than 4.0. Seta 4-C always single and long. Seta 8-C single, double or triple (1-4b). Seta 9-C 2-4b (1-7). Seta 10-C 1-3b (1-5). **Antenna:** Apical 0.6 heavily pigmented, base lightly pigmented. Dorsal and ventral surfaces without spicules; mesal surface with large spicules. Seta 1-A always inserted in less than basal 0.3 of antenna. Seta 4-A double (1,2b). **Thorax:** Seta 1-P plumose with slender thin branches inserted along length of moderately long shaft. Seta 2-P 17-22b (16-25). Seta 3-T either fanlike with thin branches (*argyritarsis*) or weakly palmate with narrow lanceolate branches (*sawyeri*), never with broad lanceolate branches. **Abdomen:** Median tergal plate on segment VIII moderately large, always less than 0.55 width of segment. Accessory median tergal plates single, without lobes on segments III-VII. Accessory submedian tergal plates absent (*sawyeri*) or poorly developed (*argyritarsis*). Seta 1-I fanlike with thin branches (*argyritarsis*) or very weakly palmate with narrow lanceolate branches (*sawyeri*). **Spiracular Lobe:** Pecten with 16-19 (14-19) teeth, short teeth with spicules; teeth beginning ventrally as follows: 1 long followed by 1-3 short with this latter sequence repeated 4-6 times, terminating with 2,3 long and sometimes 1 short tooth. Seta 2-S usually 4-6b (2-6). Seta 13-S minute. **Anal Segment:** Seta 1-X arising from saddle, long, about 2.0-2.5 length of saddle. Seta 3-X with 4,5 major branches.

DISCUSSION. The 2 species of the Argyritarsis Subgroup can be distinguished from those of the other subgroups in the Argyritarsis Group in the **female** by the combination of: (1) interocular space wide, 0.6-1.0 diameter of pedicel, (2) palpomere 4 without light scales, (3) palpomere 5 without basal dark band, (4) flagellomeres 1,2 only with light scales and flagellomeres 3-6 without scales, (5) anterior *Mam* without scales, (6) upper *Mam* with 3-5 short, light scales, (7) scales of scutum small, white, (8) foretarsomere 1 without basal light spot, (9) hindtarsomere 2 with basal 0.2-0.4 dark, (10) vein C never with: a) basal dark spot greatly enlarged, b) humeral and subbasal light spots fused, or c) subbasal and presectoral light spots completely absent, (11) R_3 always with 2 dark spots, and (12) caudolateral scale tufts present on segments III-VIII; in the **male genitalia** by: (1) tergum VIII predominantly covered by narrow light scales, never entirely covered by dark scales and without narrow dark stripe, (2) sternum VIII without 2 dark scale patches on caudal border, (3) sternum IX moderately emarginate on antero- and posteromedial borders, (4) length of gonocoxite 2.8-3.0 maximum width, (5) dorsal seta of dorsal claspette without basomesal projection, (6) ventrally, apex of ventral claspette always with 2 moderately large lobes and well-developed median sulcus, apex never truncate, (7) phallosome less than 0.5 length of gonocoxite, and (8) aedeagus with: a) membranous apex, b) ventromesal subtriangular projections very strongly sclerotized but not forming collar, and c) leaflets inserted at widest part of aedeagus, and basal piece of aedeagus overlapping paramere and not projecting free; and in the **larva** by: (1) setae 2-C very closely spaced, clypeal index greater than 4.0, (2) seta 4-C always single, (3) seta 1-A always inserted in less than basal 0.3 of antenna, (4) seta 1-P fanlike with thin branches not inserted at apex of a short shaft, (5) setae 3-T and 1-I fanlike with thin branches (*argyritarsis*) or weakly palmate with narrow lanceolate branches, never with broad lanceolate branches, (6) median tergal plate on segment VIII moderately large, always less than 0.55 width of segment, (7) accessory median tergal plates single, without lobes on segments III-VII, (8) seta 13-S minute, and (9) pecten with 5-8 long, spiculated teeth.

The Argyritarsis Subgroup has fewer apomorphic features than any other subgroup in the Argyritarsis Section. The retained plesiomorphic characters are essentially the characters used to distinguish the adults, male genitalia, pupae and larvae of the Argyritarsis Subgroup from those of the other subgroups in the Argyritarsis Group and of the Albitarsis Group. The Argyritarsis Subgroup consists of 2 species, *sawyeri* and *argyritarsis*. *Anopheles argyritarsis* is widely distributed throughout northern Argentina, Uruguay, Paraguay, Bolivia, Brazil, the Guianas, Trinidad, Lesser Antilles, Venezuela, Colombia, Central America and southern Mexico. *Anopheles sawyeri* is known only from the type locality of Serra da Ibiapaba, a plateau near Sao Benedito, Ceara, Brazil. *Anopheles argyritarsis* and *sawyeri* are morphologically very similar, although *sawyeri* can be distinguished from *argyritarsis* in all stages by several constant, correlated features.

Anopheles sawyeri exhibits the following apomorphic characters in the **adult:** (1) purple scale pattern on terga II-IV, (2) vein C of wing with basal dark spot reduced, and (3) on foretarsomere 1 enlarged apical white band; in the **male genitalia:** (1) ventral claspette with laterally expanded lobes at apex and with sclerotized median sulcus, (2) enlarged mesal cleft, (3) sharply

rounded apex of aedeagus, (4) small apodeme on anterior border of sternum IX, and (5) long basal tubercle of parabasal setae; in the **pupa:** (1) reduced sclerotization of median keel, (2) increase in number of branches of several setae, and (3) long buttress of paddle; and in the **larva:** (1) development of lanceolate branches on setae 3-T and 1-I, (2) seta 4-C long extending beyond insertion of 2-C, and (3) seta 3-C long, subequal to 2-C. For *argyritarsis*, the apomorphic characters are in the adult the moderately large dark basal band of hindtarsomere 2, and in the larva, the presence of accessory submedian tergal plates on the abdomen.

1. *Anopheles* (*Nys.*) *argyritarsis* Robineau-Desvoidy
Figs. 1, 3-6

1827. *Anopheles argyritarsis* Robineau-Desvoidy 1827:411. TYPE: Female(s), type locality restricted to vicinity of Rio de Janeiro (Rio de Janeiro), Brazil [NE; type locality restricted by Belkin et al. 1971:5].

1926. *Cellia rooti* Brethes 1926a:309-311. TYPE: Male genitalia on slide in poor condition, without sidepiece, Tucuman, Argentina, [BA], (Belkin et al. 1968b:10).

Anopheles (*Nyssorhynchus*) *argyritarsis* of Root (1922a:322; 1922b:384-392; 1923:264, 271, 277, 279; 1924:461-462, in part; 1926a:50, 67-76, 80, 89-110; 1926b:684, 686, 689, 691, 696, 698-702, 705, 707, 710-711, 713-714, 717; 1927b:600-601; 1932:781-782); Christophers (1924:9, 37-39, 91, in part); Dyar (1925:193, in part; 1928:427, 430-431, 44-445, 486); Davis (1926b:26, 35; 1928b:539-549, 554-563; 1933:278, 280); Shannon and Del Ponte (1927:715-717; 1928:44-45, 51-52, 106-108); Lima (1928:104); Kumm (1929:8-9, in part); Hill (1930:712-713); Schapiro (1930:7-12, 18-20); Shannon and Davis (1930:467, 478, 488-489); Prado (1931:200); Senevet (1931:108, 110; 1932:252; 1937:355, 362; 1938:178-182, 190; 1948a:280-281; 1948b:433-440); Shannon (1931:10, 22; 1933:117-118, 123, 124, 132, 140); Edwards (1932:44, in part); Antunes and Lane (1933:97); Leon (1933:788, 817-819; 1938:411-412; 1952:4, 9); Galvao and Lane (1937a:74-78; 1937b:269, 286; 1937e:214-216, 223-225, 234-237); Komp (1936a:67; 1936b:163; 1941a:659, 664, 667; 1942:3, 5, 7, 15, 24-27, 39, 41, 44, 62-63, 80, 109-110, 132, 149, 150, 168, 179, 182); Lane (1936b:202; 1939:23-25; 1944:263-266; 1949:402, 410, 413, 415; 1953:236, 237, 241, 251-253); Antunes (1937:79-84); Galvao et al. (1937:37, 39, 42, 43); Galvao and Barretto (1939a:112-113; 1939b:144-150, 156); Rozeboom (1938a:95-99, 104, 106; 1938b:293; 1942:235); Pinto (1939:294, 319, 345-346, 348, 355, 358, 360, 363-376, 379, 388, 389, 396, 397, 400, 402, 404, 419, 422-424); Barretto (1940:164-172); Galvao (1940:400, 404, 406, 409, 412, 417, 419, 420, 446, 448-457, 460, 464, 466, 467, 469, 471, 474, 476-478; 1941b:508-509, 514, 516, 517, 520, 527, 542-543, 547, 561, 563; 1943:145-151; 1950:39-40); Kumm et al. (1940:389-392, 408-410, 420); Unti (1940b:502-503, 505; 1941:9; 1943a:68); Kumm (1941:93, 95, 99); Rozeboom and Gabaldon (1941:95, 97); Senevet and Quievreux (1941:248, 263); Correa and Ramos (1942a:38-44; 1942c:314, 319, 322; 1944b:127-129, 133-151; 1947:10, 20, 34); Galvao et al. (1942:60); Oliveira and Verano (1942:353-354, 358-360);

Simmons and Aitken (1942:45, 52, 59, 65, 91-92); Anduze (1943:149-156); Bruce et al. (1943:437-444); Causey, Deane, Deane and Sampaio (1943:11-16); Cerqueira (1943:18); Fonseca and Unti (1943:45-50); Galvis (1943:54, 81, 85, 95-96); Mullen-Diaz (1943:1-8); Neghme (1943c:274-275); Ramos (1943:51-52); Unti and Ramos (1943:24-27, 30-31); Causey, Deane and Deane (1944:2, 5; 1945:243; 1946:26, 31); Galvao, Correa and Grieco (1944:85-102); Wasicky and Unti (1944:90-94, 100-102); Floch and Abonnenc (1945:1-2, 9-16; 1947:1, 7; 1951:3-4, 22, 53); Pelaez (1945: 70-71, 73, 75, 77); Coutinho (1946: 441-457); Deane, L. M. et al. (1946:3, 9, 11; 1948:830, 853-857, 861, 864, 878, 933-965); Deane, M. P. et al. (1946:42, 45, 50); Gabaldon and Cova Garcia (1946a:20; 1946b:78, 86-91; 1952:177, 179-180, 182, 185, 186, 188, 200-206); Bates (1947:155); Coda and Ramos (1947:86, 89); Deane (1947:19); Correa (1948:177-189); Giglioli (1948:71); Pereira Passalacqua (1948:196-207); Ricciardi (1948:534-539); Bates and de Zulueta (1949:134-136, 148-149); Kuyp (1949:67; 1950:14, 40); Levi-Castillo (1949:9-13, 16, 29, 32, 54, 58, 67-89, 93, 96, 99, 102; 1951:78; 1958:870); Manso Soto and Martinez (1949:75, 79); Arnett (1950:106, 110); Martinez (1950:56, 58-59); Vargas and Palacios (1950:1, 5, 8-9, 42, 46, 50, 53, 57, 60, 123-126; 1953:327-330); Carvalho and Rachou (1951:475-477, 480); Rachou and Ferraz (1951:540, 542-543, 547, 554); Rachou and Ricciardi (1951: 424-426, 428-447); Andrade (1953:148-156; 1958a:17-30); Horsfall (1955:172, 181-182); Senevet and Andarelli (1955:339); Bejarano (1956a:9, 17-19; 1957:323-325, 348; 1959a:311; 1967:149-150); Vargas (1956:27, 29, 33; 1958a:1; 1958b:1; 1958c:1, 3; 1975:78, 79); Andrade and Brandao (1957:391-395, 397-416); Schreiber and Memoria (1957:101-103); Carcavallo and Martinez (1959:98-110); Castro and Garcia (1959:600); Castro (1959b:449); Martinez et al. (1959:111); Schreiber and Guedes (1959a:97-98; 1959b:128-129; 1960:355-358; 1961:657-658); Andrade and Leal (1960:147-153); Prosen et al. (1960:104-105); Forattini (1962:325, 414-418, 474, 484, 490); Garcia and Ronderos (1962:137-138, 140, 156); Prosen et al. (1963:64-67, 112, 115, 116, 118-120); Ferreira (1964:333, 337); Garcia and Casal (1965b:6); Bertram (1971:745, 756, 759); Morales-Ayala (1971:139); Kreutzer et al. (1972: 555, 563-564); Kreutzer et al. (1975:354-365), Xavier et al. (1979:2); Clark-Gill and Darsie (1983:211, 245); Peyton et al. (1983:65); Xavier et al. (1983:129).

Anopheles (*Nyssorhynchus*) *argyritarsis argyritarsis* of Rachou (1958:146); Stone et al. (1959:31); Vargas (1959:370, 376, 382); Cerquiera (1961:122); Ferreira (1964:333, 337); Xavier and Mattos (1970:447); Knight and Stone (1977:61).

Anopheles (*Nyssorhynchus*) *argyrotarsis* of Nicholls (1912:251-268).

Anopheles (*Nyssorhynchus*) *argyritarsus* of Kitzmiller (1963:346-348, 350; 1967:135, 137-138, 142).

Anopheles (*Anopheles*) *argyritarsis* of Bonne-Wepster and Bonne (1923:127); Bonne and Bonne-Wepster (1925:533-537).

Anopheles argyritarsis of Neveu-Lemaire (1902:6-8, in part); Dyar and Knab (1906b:161); Busck (1908:59); Darling (1909:2052); Knab (1913:34, 36-37, 42); Urich (1913:526); Howard et al. (1917a:202, 204, 209-210, 228, 231, 349-350; 1917b:253, 289, 293, 918, 922, 964, 966, 971, 975, 978-979, 984); Dyar (1919:86; 1921:149; 1923:184); Evans (1921:447; 1922:214); Bonne (1923:128; 1924:132); Bonne-Wepster (1923:15); Petrocchi (1923:139;

1925:69-72); Muehlens et al. (1925:252-254, 257-258, 261-267, 269); Brethes (1926a:309-311); Covell (1927:12-13, in part); Davis (1927:168-176; 1928a:469-475); Root (1927a:477); Shropshire and Zetek (1927:338); Hill (1928:355-357); Pinto (1930:153, 156; 1944: 258, 260, 262); Curry (1931:648); Hoffman (1932:527); Earle (1934:44; 1936:459-469); Lane (1936a:131); Correa (1938:107); Root and Andrews (1938:565-579); Barretto (1939:117, 120-121, 123); Kumm and Ruiz (1939:437-438, 441-445); Simmons (1939:150-151, 175-176, 180, 285-286); Gabaldon, Lopez and Ochoa-Palacios (1940:33-39); Gabaldon, Ochoa-Palacios and Perez-Vivas (1940:41-56); Vargas (1940b:66, 1941:112; 1948:155-156, 158; 1949:234; 1976:88); Rozeboom (1941:103); Kumm and Zuniga (1942:349-402, 410); Unti and Ramos (1942:93-105); Downs et al. (1943:29); Kumm et al. (1943:373); Russell et al. (1943:26, 29, 31, 37, 41, 43); Unti (1943b:92-102; 1943c:105, 109-113); Galvao and Damasceno (1944:73); Zetek (1944:106, 112-113, 118-120, 122); Castellanos et al. (1949:34-35); Senior-White (1950:5); Charles (1952:948-953, 956, 959-961); Renjifo and Zulueta (1952:600); Zulueta (1952:315, 329); Guedes et al. (1953:157, 165); Vargas and Palacios (1955:82-83, 86-89, 94-98, 100-102, 107-123; 1956:8-9, 11, 48, 51, 54, 58, 70, 123-126, 140, 143-173); Foote and Cook (1959:26, 29); Cova Garcia (1961:29-30, 81-82, 117-118); Forattini (1961:177, 182); Fauran (1962:70, 74, 76; 1963:44-45; 1964:53); Mattos and Xavier (1965:270-271); Fauran and Courmes (1966:105; 1967:71); Stojanovich et al. (1966a:10, 17, 30; 1966b:5-6, 18, 27, 39); Gorham et al. (1967:2, 5, 13, 43, 51; 1971:2-4, 10, 35); Forattini et al. (1970:8-9); Cova Garcia and Sutil (1975a:19; 1975b:210; 1976:28).

Anopheles argyitarsis of Senevet (1934:68).

Anopheles argyritarsus of Fox (1925:38).

Anopheles argyrotarsis in part of Cruz (1901:426); Goeldi (1902:12-15).

Anopheles (Cellia) argyritarsis of Dyar (1918:150); Davis (1926a:9-11, 20; 1926c:134-138); Boyd (1926:30-37).

Nyssorhynchus (Nyssorhynchus) argyritarsis of Chagas et al. (1937:385-389).

Cellia (Anopheles) argyrotarsis of Goeldi (1905:129-133).

Cellia argyritarsis of Coquillett (1906:13; in part); Neiva (1908:455-459); Peryassu (1921:12, 60-66, 68, 70, 78-80, 82-99); Stephens (1921:435); Pinto (1923:77-81); Brethes (1926b:106).

Cellia argyrotarsis of Lutz (1904:1); Theobald (1905a:5-6, 8-9, 14; 1905b:11, 45); Aiken and Rowland (1906:14, in part); Aiken (1907:66, in part; 1909:6, in part); Chagas (1907:19, 21, in part); Peryassu (1908:60, 116-120); Neiva (1909:69-72, 74-77); Darling (1910:181-183, 206, 209, 218); Newstead and Thomas (1910:141, 150); Prout (1910:487); Surcouf and Gonzalez-Rincones (1911:69-72, 298, in part; 1912:273-274); Brethes (1912:17-18; 1916:195, 197); Lutz and Machado (1915:6, 8, 24, 36-37, 48); Neiva and Penna (1916:94-95, 98-99); Lutz et al. (1919:162); Godoy and Pinto (1923:29-33); Lutz and Nunez Tovar (1928:35); Boyd and Aris (1929:366-367, in part); Thompson (1947:78-80).

Cellia argytarsis of Neiva and Pinto (1922b:321).

Laverania argyrotarsis of Theobald (1902:181, 183).

Cellia rooti of Brethes (1926a:309-311; 1926b:106).

Nyssorhynchus albimanus in part of Blanchard (1905:202-204); Autran (1907:10-11).

Anopheles (*Nyssorhynchus*) *braziliensis* in part of Fauran (1961:9-10).

FEMALE (Fig. 4). Wing: 3.5 mm. Proboscis: 2.0 mm. Forefemur: 1.55 mm. Abdomen: 3.25 mm. **Head:** Interocular space moderately wide, 0.6-0.8 diameter of pedicel. Frontal tuft with 8,9 pairs of long, white, setiform scales. Palpus 0.98 length of proboscis; palpomere 3 dark, apically with small light band. **Antenna:** Length 0.72 of proboscis. Pedicel with 6-8 small light scales. Flagellomeres 1,2 with long silver-white scales. **Thorax:** Non-pruinose dark areas of scutum as in section. Scales of scutum silver except for brown scales of lateral anterior promontory. Posterior margin of scutellum with 14-16 well developed, golden-brown setae and 9,10 moderately developed brown setae. Pleuron with light pruinose areas as in section. *Ap* with numerous very dark brown, (almost black) erect scales in juxtaposition to similar scales on lateral anterior promontory and lateral occipital regions. *PsA* with few silver setae. *Ps* anteriorly with well developed, dark setae, without light scale patch. Upper *Mks* always with 3 well-developed, dark setae and with 10-13 spatulate, white scales, occasionally with 4,5 brown scales; lower *Mks* always with 1 well developed dark seta and with 6-9 spatulate, white scales. Upper *Mam* often without scales along upper row of setae. *Pk* medially with usually 4,5 light setae, laterally with 4,5 dark setae, and 4-6 white, elongate scales. **Legs:** Generally as in section. Foretarsomere 1 with ventral light stripe and with apical 0.06-0.08 light; tarsomere 2 with apical 0.25-0.30 light; tarsomere 3 with apical 0.1-0.2 light. Midtarsomeres 1,2 with or without white stripe; tarsomeres 3-5 with dark scales dark brown. Hindtarsomere 1 with light stripe extending length of tarsomere; tarsomere 2 always with less than basal 0.4 dark, rarely with as little as 0.15 dark; tarsomeres 3-5 always entirely light. **Wing:** Dark scales with purple hue. Vein C basal dark spot 0.4-0.8 of humeral light spot; presectoral light spot represented by few light scales or absent. **Abdomen:** Tergum I with few long, setiform, white scales. Terga II-VII with scales predominantly cream, in apical 0.5 some dark medially brown. Caudolateral scale tufts small and light, present on segments III-VII, often reduced on segments III, IV to few dark laterally projecting scales. Sterna as in group.

MALE (Fig. 4). Wing: 3.25 mm. Proboscis: 2.5 mm. Forefemur: 1.55 mm. Abdomen: 3.2 mm. Essentially as in female except for sexual characters and as in section and group. **Head:** Proboscis approximately 1.65 length of forefemur, covered by dark brown, decumbent scales. Palpus subequal to proboscis; palpomere 1 and base of 2 with large, dark brown scales; palpomere 2 dorsomesally, immediately distad of erect scales with numerous, white, decumbent scales, remainder of palpomere 2 with numerous, brown to golden, decumbent scales and with apical white band; palpomere 3 with intermingled light brown and dark brown scales; palpomere 4 dorsally brown, with basal and apical white band, ventrally either bare or with small, brown scales; palpomere 5 dorsally white, basally with brown band, ventrally with brown and white scales. **Antenna:** Length 0.78 of proboscis. Diameter of pedicel 1.7 that of female. Flagellomere 1 about 1.5 length of individual flagellomeres 2-11, with white erect scales; flagellomere 2 subequal to that of female and with white setiform scales; flagellomeres 3-11 equal to those of female, without scales; flagellomere 12 about 4.0 length of individual flagellomeres 2-11; flagellomere 13 approximately 0.5 length of flagellomere 12. **Legs:** Essentially as in

section.

MALE GENITALIA (Fig. 5). **Segment VIII:** Tergum laterally with single row of moderately long setae; with slender white and brown scales. Sternum with posterior margin with single row of long setae; with large, broad, white scales and caudolaterally with patch of cream scales. **Segment IX:** Sternum broadly rectangular, moderately long laterally (about 0.2 length of gonocoxite); medially distinctly emarginate along both anterior and posterior borders (0.13 length of gonocoxite), more strongly sclerotized than laterally. Normally without distinct anterior apodeme. **Gonocoxite:** Length about 2.8 maximum width. Tergal surface with 4,5 tergomedial setae, moderately large apicolateral setae, and single long apicomesal seta. Parabasal seta strongly retrorsely hooked, moderately short, about 2.8 length of its tubercle. Apodeme of gonocoxite about 0.2 length of gonocoxite. Accessory setae moderately long, moderately broad; dorsal seta 0.4 length of gonocoxite; ventral seta about 0.7 length of dorsal seta. Internal seta slender, usually subequal to ventral accessory seta, not strongly curved. **Gonostylus:** Gonostylar claw moderately short, stout, moderately sclerotized, apical 0.5 wider than basal 0.5, about 0.3 length of seta *b*. **Dorsal Claspette:** About 0.25 length of gonocoxite; pedicel moderately broad at base and apex, narrowed medially; apex with apicolateral, hooked sclerotized projection; mesal margin smoothly rounded; base triangular or quadrate. Apex with only 2,3 setae; setae about 1.3 length of dorsal claspette, strongly curved mesad, dorsal seta without basomesal projection. **Ventral Claspette:** About 0.25 length of gonocoxite. Apex moderately narrow and laterally produced into 2 well-developed, striated, smoothly rounded, moderately sclerotized lobes; apically with deep, narrow, unsclerotized median sulcus between lobes. Preapical plate small, weakly sclerotized area between sclerotized ridges basad of apical median sulcus. Basal lobules laterally expanded; mesal cleft short, about 0.15 length of ventral claspette; area at vertex thickened to form distinct refringent structure. **Phallosome:** About 0.45-0.50 length of gonocoxite, about 1.9 length of ventral claspette. Aedeagus with apex broadly rounded, width 1.5 length, membranous at tip; subapically always with pair of moderately sclerotized, dorsoanteriorly projecting, serrated leaflets; leaflets about 0.3 length of aedeagus; ventromesal subtriangular projections widely spaced, not meeting on midline. Paramere normal.

PUPA (Fig. 5). Abdomen: 4.2 mm. Trumpet: 0.55 mm. Paddle: 0.95 X 0.70 mm. **Cephalothorax:** Moderately to heavily pigmented, tan to dark brown. Median keel strongly developed. Setae 1-3-C 2,3b (1-3); 1-C longest, 2-C shortest. Setae 4,5-C subequal; 4-C 2,3f (1-4); 5-C 2,3b (1-4). Seta 6-C single or double (1-3b), moderately long, slender. Seta 7-C 2b (1-3), heavily pigmented, shorter than 6-C. Setae 8,9-C subequal; 8-C single or double, well developed; 9-C 1-3f (1-4), lightly pigmented, slender. **Trumpet:** Moderately to heavily pigmented especially along border of pinna opposite meatal cleft. Pinna angusticorn, long, about 0.75-0.80 length of trumpet, entire border reticulate; meatal cleft moderately long. Meatus small, 0.20-0.25 length of trumpet, nonreticulate except indistinctly distally. **Metanotum:** Setae 10-12-C moderately developed, heavily pigmented; 10-C usually single, occasionally forked (1-3), subequal to 11-C; 11-C single or double (1-3f); 12-C single or double (1-3f), 2.0 length of 10,11-C. **Abdomen:** Heavily pigmented, tan to dark brown. Seta 1-I with 14-20 (9-26) primary branches, apically extensively

dendritic. Seta 2-I pectinate, 3,4b (1-7), strongly developed. Seta 3-I single (1-5b), subequal to 2-I but more strongly pigmented. Seta 4-I 2-4b (1-7), moderately developed, short. Seta 5-I single (1-5b), long. Seta 6-I single (1-6b), subequal to 5-I, 2.0 length of 7-I. Seta 7-I 2,3f (1-5), forked 0.60 from base. Seta 9-I single (1,2b). Seta 0-II 2,3f (1-7), moderately developed, long; 0-III 3b (2-6); 0-IV,V 2,3b (1-5); 0-VI 1-3b (1-4); 0-VII,VIII single (1-3f), occasionally apically forked. Seta 1-II,III 3-6b (2-7), well developed; 1-IV-VII always single, very long, about 1.50-1.75 length of segment. Seta 2-II 3-5b (2-7); 2-III 3,4b (2-7); 2-IV-VII single (1-3b), moderately long. Seta 3-II,III single (1,2b); 3-IV,V 2-4b (1-6); 3-VI 1,2b (1-3), very slender; 3-VII 1-3b (1-4). Seta 4-II 1-3b (1-6); 4-III 3,4b (1-6); 4-IV 3b (1-5), thin, weaker than 2,3-IV; 4-V 2,3b (1-5); 4-VI, VII single or double (1-3b). Seta 5-II 2,3b (1-6); 5-III 4-6b (3-11), subequal to 1-III; 5-IV 2,3b (1-5), moderately long, 0.5 length of 1-IV; 5-V single, long, about length of segment; 5-VI,VII single, long, about 0.6 length of 1-VII,VIII. Seta 6-II single (1-3b), moderately developed, longer than 7-II; 6-III-VI single; 6-VII single (1-3b). Seta 7-II 2-4b (1-5), moderately developed; 7-III 2-4b (1-5), short; 7-IV 3b (1-5); 7-V 2,3b (1-4); 7-VI,VII single (1-2b). Seta 8-III-VII subequal to seta 7-III-VII; 8-III 2,3b (1-5); 8-IV single or double; 8-V 1-3b; 8-VI single or double (1-3b); 8-VII 1-3b (1-5). Seta 9-II minute, lightly pigmented, moderately pointed; 9-III minute, about equal to 9-II but stouter, moderately pigmented, blunt; 9-IV short, 2.0-2.2 length of 9-III, heavily pigmented, stout, blunt; 9-V moderately long, 3.5 length of 9-IV, heavily pigmented, stout, pointed; 9-VI-VIII subequal, about 1.3 length of 9-V and about 0.5 length of segment, similar in shape to 9-V, mesally strongly curved, heavily pigmented. Seta 10-III 1-3b (1-5); 10-IV,V single (1-3b); 10-VII 1-3b (1-4). **Terminal Segments:** Apex of male genital lobe with short to moderately long, distinct, mammilliform protuberance; mesal and lateral margins of lobe irregularly serrate; length of male genital lobe about 2.8 width, moderately pigmented, brown. **Paddle:** Wide and slightly emarginate at apex, length 1.4 width. Midrib distinct basally, moderately pigmented, more strongly sclerotized on lateral margin than on mesal, sclerotization extending 0.65 length of paddle from base. External buttress extending 0.5 length of paddle from base, with small serrations on apical 0.25. External margin distad of buttress with short (0.014 mm), thin, indistinct spicules. Seta 1-P single, long (0.14 mm), curved laterally; 2-P usually single (1,2b), very thin, weakly developed, about 0.5 length of seta 1-P.

LARVA (Fig. 6). Head: 0.6 mm. Antenna: 0.25 mm. Saddle: 0.3 mm. **Head:** Moderately to heavily pigmented with conspicuous dark area extending from collar anteriorly along frontoclypeal suture to seta 9-C, with curved arm extending caudolaterally from 9-C to collar; with another very dark band exending along base of setae 5-7-C and posteriorly with dark, inverted, subtriangular area between arms of frontoclypeal suture. Collar moderately narrow, about 0.04 mm wide. Dorsomentum well developed, strongly sclerotized, with median tooth and about 4 lateral teeth on each side; median tooth moderately large; first lateral tooth moderately small, second and third teeth subequal, larger than first, fourth tooth smallest, usually indistinct. Setae 2-C very closely spaced, clypeal index 5.5 (4.50-6.25), without conspicuous barbs. Setae 3-C with 5-10 short to moderately long barbs, 0.65 length of 2-C. Seta 4-C always single, very long, extending to base of 2-C. Seta 8-C 2,3b

(1-4). Seta 9-C branched at base 2-4b (1-7), subequal to 8-C. Seta 10-C 1-3b (1-5). Setae 12,13-C 3-6b (1-6). **Antenna:** Heavily pigmented except basomesally. Dorsally and ventrally with few small spicules; mesally with number of moderately large to large spicules, apex with numerous well developed, moderately pigmented spicules. Seta 1-A 3-6b (2-7), branches arising at apex of moderately long shaft, long, 1.5-2.0 width of antenna, inserted 0.20-0.25 from base of antenna. Seta 4-A 2b (1,2), very long. **Thorax:** Lightly to moderately pigmented, generally uniformly colored. Setae 1-3-P inserted on separate tubercles; 1-P fanlike, 9-12b (8-15), branches inserted on small, moderately flattened shaft; 2-P plumose, 14-22b (14-25), moderately long, 2.5 length of 1-P; 3-P always single, about 0.75 length of 1-P. Setae 4-10,12-P as in section. Seta 11-P 2b (1-7), 0.3 length of 12-P. Seta 13-P 3,4b. Seta 14-P 5-8b (5-10). Seta 1-M 25-34b (16-38), inserted on large sclerotized tubercle. Seta 2-M single (1-4f), 0.4 length of 1-M. Setae 3,5-M single. Seta 4-M 2,3b (1-5). Seta 6-M 3-5b. Seta 7-M 3,4f (1-4). Seta 13-M 4-6b (3-7). Seta 14-M 6,7b (5-9). Setae 1,2-T long; 2-T extending to posterior margin of thorax. Seta 3-T fanlike with thin branches, not palmate, 6-9b (3-9). Seta 4-T 3,4b (2-4b). Seta 6-T 2f (1,2). Seta 12-T 2f (1-3). **Abdomen:** Integument more lightly pigmented than thorax. Median tergal plates present on segments I-VIII, moderately sclerotized, small to moderately large; plate on segment I with moderately large anteromedial lobe, about 0.15-0.20 width of segment; plate on segment II usually small, about 0.10-0.15 width of segment; plate on segments III-VII subequal to that of segment I; plate on segment VIII large, about 0.35-0.40 width of segment. Accessory median tergal plates always single and without lobes, present on segments II-VII; plate very small on segment II, becoming larger on more caudal segments; plate on segment III kidney-shaped. Accessory submedian tergal plates when present on segments III-VII, occasionally absent; plates on segments III-V with single pair of plates; segments VI,VII often with 2 pairs of plates. Seta 0-II,III,VII 2-5b (2-6), well developed; 0-IV,V 3,4b (2-5); 0-VI 2,3b (3-5); 0-VIII 2-5b. Seta 1-I not palmate, fanlike with thin branches, 7-10b (5-13), branches at end of short, moderately pigmented shaft; 1-II-VII palmate, with 17-28 narrow lanceolate branches, strongly developed, 1-II smallest, 1-II-VII subequal and large, 1-VII, with widely spaced leaflets. Seta 2-I 3,4f (1-5), small; 2-II plumose 6,7b (3-9), moderately large; 2-III 3-5b (3-6), large; 2-IV,V single; 2-VI 3,4b (1-7), large; 2-VII 3-6b. Seta 3-IV 2,3 (1-3). Seta 4-III 3b (2-5). Setae 5,6 as in section. Seta 7-IV 3,4b (1-6); 7-VII 3-5b (3-9). Seta 8-V 3,4b (2-4). Seta 9-I 4,5b (2-6); 9-IV 4-6b (4-8); 9-V 5-7b (3-8). Seta 10-VI 1-3b (1-4). Seta 13-I 3,4b (2-6); 13-II 5,6b (3-8); 13-III-V,VII 3,4b (2-5); 13-VI 6,7b (2-8). **Spiracular Lobe:** Pecten with 16-19 (14-19) teeth, pigmented spicules on base of short teeth; beginning ventrally as follows: 1 long, 1-4 short, 1 long, 2,3 short, 1 long, 2,3 short, 1 long 1,2 short (occasionally latter 1 long and 1,2 short repeated), terminating with 2 long and occasionally 1 short. Median plate of spiracular apparatus without lateral arms, anteromedial process strongly sclerotized and moderately rounded. Seta 1-S 5b (3-7), large. Setae 3-5-S single, small. Seta 6-S single or double. Seta 7-S single or double. Seta 8-S 4,5b (2-6). Seta 9-S 3-5b (3-7). **Abdominal Segment X:** Saddle incomplete, tan. Integument with very fine, short spicules, longer at caudal margin. Seta 1-X always inserted on saddle near ventrolateral margin, long, about 2.0 length of saddle. Seta 2-X pectinate,

large. Seta 3-X pectinate with 5 large branches. Ventral brush with well developed, plumose setae; dorsalmost pair smallest. Anal papillae moderately short to moderately long.

DISCUSSION. *Anopheles argyritarsis* can be distinguished from *sawyeri*, the only other species in the Argyritarsis Subgroup, in the **female** by the combination of: (1) interocular space moderately wide, about 0.6-0.8 diameter of pedicel, (2) frontal tuft with 8,9 pairs of long, white setiform scales, (3) foretarsomere 1 with apical 0.06-0.08 white, (4) hindtarsomere 2 always with less than basal 0.40 dark, rarely as little as 0.15 dark, (5) vein C basal dark spot 0.4-0.8 of humeral light spot, and (6) terga II-IV medially with predominantly cream scales and some dark brown scales on apical 0.5; in the **male genitalia** by: (1) sternum IX without distinct anterior apodeme, (2) apodeme of gonocoxite about 0.2 length of gonocoxite, (3) parabasal seta of gonocoxite moderately short, about 2.8 length of its tubercle, (4) setae of dorsal claspette about 1.3 length of dorsal claspette, (5) ventral claspette with: a) apex moderately narrow, b) apical lobes directed laterally, smoothly rounded, c) median sulcus deep and narrow, and d) mesal cleft about 0.15 length of ventral claspette, vertex thickened to form distinct refringent structure, and (6) apex of aedeagus broadly rounded, width 1.5 length; in the **pupa** by: (1) median keel strongly developed, (2) setae 0-III-V 2,3b (1-6), (3) setae 1-II 3-5b (2-7), (4) seta 1-III 3-5b (2-7), (5) seta 2-I pectinate, 3,4b (1-7), strongly developed, (6) seta 2-VII single (1-3b), (7) seta 5-II 2,3b (1-6), (8) seta 9-V 3.5 length of 9-IV, (9) seta 9-VIII strongly curved mesally, and (10) external buttress extending 0.5 length of paddle; and in the **larva** by: (1) collar of head capsule moderately narrow, about 0.035 mm, (2) seta 3-C 0.65 length of seta 2-C, (3) seta 4-C extending just to insertion of 2-C, (4) seta 8-C 2,3b (1-4), (5) accessory submedian tergal plates occasionally absent, and (6) setae 3-T, 1-I fanlike, with thin branches, not palmate.

The populations of *argyritarsis* examined do not exhibit a high degree of interpopulational variation. This variation is usually less than that found within a particular population. The only constant differences occur between specimens from south of the equator (Brazil, Argentina and probably Paraguay, Uruguay) and those from north of the equator (Colombia, Venezuela, Central America and the Lesser Antilles). The male genitalia of northern populations tend to have the apical lobes of the ventral claspette slightly more produced posterolaterally. The pupae of northern populations often exhibit greater branching of setae on both the cephalothorax and abdomen. Although variable, setae 8,9-C, 8-9-VII and 2-S of the larvae usually have a greater number of branches.

The slight morphological variation in *argyritarsis* is also reflected in the stability of the banding patterns of the larval salivary gland polytene chromosomes. Schreiber and Memoria (1957) examined the larval salivary gland chromosomes of several species in *Nyssorhynchus* and reported a high degree of polymorphism in *strodei* and *darlingi*, some polymorphism in *noroestensis* and none or very little polymorphism in *argyritarsis*. Kreutzer et al. (1975) examined the salivary gland chromosomes of specimens from Panama, Brazil, Venezuela and Colombia, and concluded that, in comparison to *darlingi*, *argyritarsis* had "relatively conservative karyotypes." They found only 2 chromosomal inversions in natural populations; one aberration was a heterozygous paracentric inversion of the X chromosome and the other was a

paracentric inversion of arm 3L present in both the homozygous and heterozygous condition. The 3L arm inversion was present at a higher frequency in southern populations than in northern ones; 40 of the 42 inversions found were from the state of Rio de Janeiro, Brazil, while the remaining 2 were found in Colombia. No inversions were found in specimens from Venezuela or Panama. Although chromosomes of 247 specimens from Brazil were examined, only 71 specimens were examined from Colombia, Venezuela and Panama. Nevertheless, the geographic distribution of the chromosomal variation tends to be analogous to the geographic distribution of morphological variation.

Anopheles sawyeri is the sister species of *argyritarsis*. All stages of *sawyeri* closely resemble *argyritarsis*, so that great care must be taken in separating these two species. Other species of the Argyritarsis Group exhibit some similarity to *argyritarsis*. *Anopheles darlingi* appears to be more highly apomorphic although it shares a number of characters with *argyritarsis*. The apomorphic condition of *argyritarsis*.

Using *argyritarsis* as the hypothetical standard, part of the chromosomal evolution of *darlingi* can be followed by tracing possible banding pattern changes of *argyritarsis* caused by inversions. Based on an examination of chromosomal banding patterns, the reverse would be just as likely, i.e., the genesis of *argyritarsis* from *darlingi*. Kreutzer et al. (1975) have been able to illustrate the probable derivation of *argyritarsis* 2L arm from the second chromosome of *darlingi*. According to these authors, except for the X chromosome and the center sections of 2R and 3L arms, the chromosomal banding patterns of *darlingi* and *argyritarsis* differ only in the sequence of the bands. This observation and the distinct X chromosome in all anopheline species examined, tends to emphasize the possible importance of the X chromosome in species evolution and the relatively lesser importance of autosomal inversions. Schreiber's laboratory in Belo Horizonte has indicated that South American *Nyssorhynchus* tends to exhibit a progressive decrease in the amount of X-heterochromatic material. Generally, heterochromatic material is considered to be composed of repetitive DNA and is also considered to be selectively advantageous. The loss of this material could possibly have important consequences to an emerging species. Loss of heterochromatic material is apparently an apomorphic character and would tend to precipitate species specialization as a result of decreased genetic flexibility. The center of origin for *argyritarsis* appears to be northern South America. This species has evidently spread northward into Central America and into the Lesser Antilles. The southern expansion was equally widespread.

Anopheles argyritarsis was described by Robineau-Desvoidy in 1827. In 1901 Theobald described *albipes* as a subspecies of *argyrotarsis* [*sic*]. Shortly afterwards Blanchard (1905:202) synonymized *albimanus* with *argyritarsis*. In 1903 Theobald raised *albipes* to specific rank and placed both *argyritarsis* and *albipes* in his new genus *Cellia*. Goeldi (1905:129) and Coquillett (1906:11,13) treated *argyritarsis* separately from *albimanus*. Dyar and Knab (1906a:176) separated *albimanus* and *argyritarsis* on the basis of larvae from Rincon Antonio, Oaxaca, Mexico. Christophers (1924:37,38) considered *marajoara* and *braziliensis* as variations of *argyritarsis*. He recognized only 3 species in the Nyssorhynchus Group: *albimanus*, *tarsimaculatus* and *argyritarsis*. In 1926, Brethes described *Cellia rooti* as distinct from *argyritarsis* based on differences between specimens from Tucuman, Argentina and Root's descriptions

of the male genitalia of *argyritarsis* from Central America. Root (1923:276-277) described the parabasal seta of *argyritarsis* as being essentially as it is in *albimanus*. I have examined material from the type locality of *rooti* in Tucuman, Argentina, comparing it with the description by Brethes, and concur that *rooti* is synonymous with *argyritarsis*.

BIONOMICS. The immature stages of *argyritarsis* have been found in the following habitats by MMAP: stagnant ponds, swamps and marshes, drainage ditches, rain puddles and pools, wet meadows, forest springs, streams and pools, plantation and domestic springs, animal tracks, artificial containers such as tin cans and animal water troughs, rock holes and river margins. These sites were primarily in full sun or partial shade, rarely in deeply shaded areas. They contained some type of grassy vegetation and, to a lesser extent, green algae. The water was clear or turbid, not obviously polluted or brackish. The sites were most often in areas of secondary growth as in plantations, fields, pastures and sunny forest clearings.

Reports by other workers are generally in agreement with the MMAP collection records. Kumm et al. (1940:385-422) stated that in Costa Rica the larvae of *argyritarsis* were most often found in ground pools, ditches, borrow pits, swamps, seepages and hoofprints, and to a much lesser extent in pools along the margins of streams. They did not find larvae in bromeliads, tree holes or brackish water habitats. Root and Andrews (1938:566-579) found *argyritarsis* predominantly in side pools and along the margins of streams in Grenada. They did not find immatures in lagoons, canals and mangrove swamps.

When compared with the 2 other anophelines surveyed in Grenada ["*tarsimaculatus*" (*aquasalis* Curry, 1932) and *pseudopunctipennis* Theobald, 1901], *argyritarsis* was collected less frequently in permanent water and more often in moving, cooler water at higher elevations. With respect to the type of larval shelter encountered, 91.8% of the immatures were collected among grasses, sedges and other emergent aquatic vegetation.

Anopheles argyritarsis has been collected by MMAP in association with 5 other species of the subgenus *Nyssorhynchus*: *albimanus* and *aquasalis* (as "*tarsimaculatus*") of the Albimanus Section, and *albitarsis*, *braziliensis* and *darlingi* of the Argyritarsis Section. In the Lesser Antilles, *Anopheles argyritarsis* was most often associated with the following species: *Culex* (*Cux.*) *coronator*, *Cx.* (*Cux.*) *nigripalpus*, *Cx.* (*Mel.*) *atratus* and to a lesser extent with *Cx.* (*Cux.*) *declarator*, *Cx.* (*Cux.*) *quinquefasciatus* and *Cx.* (*Mel.*) *madininensis*. The following species have been found with *argyritarsis* in small, isolated ground pool habitats: *Anopheles* (*Ano.*) *pseudopunctipennis*, *An.* (*Nys.*) *albimanus*, *An.* (*Nys.*) *marajoara*, *An.* (*Nys.*) sp., *Aedes* (*Och.*) *fluviatilis*, *Ae.* (*Och.*) *tortilis*, *Culex* (*Cux.*) *coronator*, *Cx.* (*Cux.*) *declarator*, *Cx.* (*Cux.*) *dolosus*, *Cx.* (*Cux.*) *nigripalpus*, *Cx.* (*Cux.*) *thriambus*, *Cx.* (*Mel.*) *bastagarius*, *Cx.* (*Mel.*) *chrysonotum*, *Cx.* (*Mel.*) *conspirator*, *Cx.* (*Mel.*) *elevator*, *Cx.* (*Mel.*) *erraticus*, *Cx.* (*Mel.*) *iolambdis*, *Cx.* (*Mel.*) *pilosus*, *Psorophora* (*Gra.*) *cingulata*, *Uranotaenia* (*Ura.*) *geometrica*, *Ur.* (*Ura.*) *pulcherrima*, *Ur.* (*Ura.*) *trapidoi* and *Dixa* sp. The following species have been found with *argyritarsis* in ponds, lakes, marshes and meadows: *An.* (*Ano.*) *mediopunctatus*, *An.* (*Nys.*) *braziliensis*, *An.* (*Nys.*) *darlingi*, *Ae.* (*Och.*) *epactius*, *Ae.* (*Och.*) *shannoni*, *Cx.* (*Cux.*) *declarator*, *Cx.* (*Cux.*) *nigripalpus*, *Cx.* (*Mel.*) *chrysonotum*, *Cx.* (*Mel.*) *educator*, *Cx.* (*Mel*) *pilosus*, *Haemogogus* (*Hag.*) *chalcospilans*, *Ps.* (*Gra.*) *confinnis* and *Ur.* (*Ura.*) *lowii*. The following

species have been found with *argyritarsis* in streams and ditches: *An.* (*Ano.*) *eiseni*, *An* (*Nys.*) *albimanus*, *An.* (*Nys.*) sp., *Ae.* (*Och.*) *taeniorhynchus*, *Cx.* (*Cux.*) *corniger*, *Cx.* (*Cux.*) *coronator*, *Cx.* (*Cux.*) *declarator*, *Cx.* (*Cux.*) *habilitator*, *Cx.* (*Cux.*) *nigripalpus*, *Cx.* (*Cux.*) *quinquefasciatus*, *Cx.* (*Mel.*) *atratus*, *Cx.* (*Mel.*) *bastagarius*, *Cx.* (*Mel.*) *batesi*, *Cx.* (*Mel.*) *chrysonotum*, *Cx.* (*Mel.*) *idottus*, *Cx.* (*Mel.*) *jocasta*, *Cx.* (*Mel.*) *madininensis*, *Ps.* (*Gra.*) *cingulata*, *Ur.* (*Ura*) *typhlosomata* and *Dixella* sp. *Culex* (*Cux.*) *coronator* and *Cx.* (*Cux.*) *quinquefasciatus* have been collected with *argyritarsis* in artificial containers. *Culex* (*Mel.*) *jocasta* and *Ps.* (*Gra. cingulata* have been found with *argyritarsis* in springs. *Anopheles* (*Nys.*) *strodei* was found in a hoofprint with *argyritarsis*, *Cx.* (*Cux.*) *coronator*, *Ur.* (*Ura.*) *typhlosomata* and *Ur.* (*Ura.*) *calosomata*. *Culex* (*Cux.*) *coronator*, *Cx.* (*Cux.*) *corniger*, *Cx.* (*Cux.*) *declarator* and *Ur.* (*Ura.*) *lowii* have been collected with *argyritarsis* in a rock hole.

Anopheles argyritarsis, like other species in the subgenus *Nyssorhynchus*, occurs predominantly at low to intermediate elevations. Root and Andrews (1938:570-571) stated that *argyritarsis* was rarely (2.5%) found at sea level while *aquasalis* (as "*tarsimaculata*") and *pseudopunctipennis* were predominantly found at this level. They found *argyritarsis* up to about 200 m above sea level. According to Root (1926b:701), *argyritarsis* is mainly a highland and interior species in Brazil, although it is also present in the foothills of the coastal plain. Galvao (1940:451) reported that the larvae, unlike *strodei*, cannot survive in water with large fluctuations of pH and temperature. Barreto (1939:116-132) found that *argyritarsis* occurred more often downstream of a dam than upstream. He concluded that *argyritarsis* has a low tolerance for pH and temperature changes, since downstream the variation in the pH was very small as compared to the large pH variation upstream, and downstream the temperature fluctuated between 24.5 and 26.8°C as compared to a fluctuation from 17.5 to 33.0°C upstream.

The adults are evidently crepuscular, being most active in the evening and in the very early morning hours. Davis (1926b:23) found that marked adults of *argyritarsis* tend to remain inside a shelter in which they had been released. In Colombia, Zulueta (1952:314-329) collected *argyritarsis* in tall grasses. Kumm et al. (1940:388-392) found that only 0.4% of the anopheline adults captured in Costa Rica were *argyritarsis* while over 20% of the larvae were *argyritarsis*. The majority of the *argyritarsis* adults were collected from horses and only 1 of 35 captured was from inside a house. In contrast, over 25% of the *albimanus* specimens were collected inside houses. Galvao et al. (1937:43) reported that in the state of Sao Paulo, Brazil, only a single specimen of *argyritarsis* was captured inside a house, and that was during April.

MEDICAL IMPORTANCE. *Anopheles argyritarsis* is not considered to be an important vector of malaria in either South and Central America or the Lesser Antilles. Root and Andrews (1938:578) concluded that in Grenada *argyritarsis* was not a vector of malaria since it was abundant in areas where there was no malaria, but it was not found in areas with high malaria prevalence.

Several workers have fed *argyritarsis* on *Plasmodium* spp. gametocyte carriers and failed to obtain infection (Darling 1910; Benarrochi 1931). Similarly, a number of workers have examined the salivary glands and midguts of field-caught *argyritarsis* and have failed to find any natural *Plasmodium* spp. infections (Stephens 1921; Davis 1927; Benarrochi 1931; Godoy and Pinto 1923;

Earle 1936).

However, many others have found *argyritarsis* naturally infected with *Plasmodium* spp. According to Pinto (1939:372-374), Patterson in 1911, and Neiva and Barbara in 1917 demonstrated the transmission of *Plasmodium vivax* by *argyritarsis* in Argentina. Davis (1926c:119-138) stated that the studies of Boyd "leave no shadow of doubt" that *argyritarsis* is a principal vector in the low littoral "Baixada" in the state of Rio de Janeiro, Brazil, because he reported that over 8% of the *argyritarsis* examined were infected. Boyd (1926) found mature oocysts and sporozoites in *argyritarsis*. He also stated that in the province of Sant'Ana, Rio de Janeiro, 3.6% of the midguts of *argyritarsis* examined had oocysts. According to Horsfall (1955:182), Davis and Boyd, in 1926, in Brazil, examined 313 gut dissections and found 10 positive for oocysts. This reference is evidently incorrect, because the study actually involved the determination of human infections.

According to Galvao (1940:453), some investigators agree that *argyritarsis* is often found inside houses. Shannon and Davis (1930:467-505) referred to *argiritarsis* as semidomestic, because the larvae have been collected in artificial containers such as flower pots, and the adults have been captured at various places within houses. In contrast, Galvao et al. (1937:43), reported that *argyritarsis* is very rarely found in houses in Pereira Barreto and Lussanvira, Sao Paulo, Brazil. Pinto (1939) stated that in Palmeiros, Sao Paulo, Brazil, *argyritarsis* is very rarely found in houses and appears to be indifferent to humans.

The apparent contradiction in the above reports regarding the natural infection of *argyritarsis* with malaria parasites and whether it is endophilic is primarily due to the very poor taxonomic understanding of the Argyritarsis Section in the past. Until 1926, when Root described *darlingi*, and for several years thereafter, *darlingi* was repeatedly misidentified as *argyritarsis*. *Anopheles darlingi* has since been shown to be a very efficient malaria vector. It is quite probable that the reports of *argyritarsis* being naturally infected, as well as endophilic, actually pertain to *darlingi*.

DISTRIBUTION (Fig. 1). *Anopheles argyritarsis* is the most widespread species in the Argyritarsis Section. It commonly occurs at elevations up to 100 m, often in the interior plains but also along the coastal foothills. *Anopheles argyritarsis* occurs as far north as the state of Guerrero in the Sierra Madre del Sur of Mexico, and throughout most of Central America. It is the only species in the section to extend into the Lesser Antilles, throughout the Windward Islands north to Montserrat. In South America, *argyritarsis* is found in Colombia, Venezuela, the Guianas, Brazil, Bolivia, Paraguay, Uruguay and the northern provinces of Argentina.

Material Examined: 2,651 specimens: 681 males, 64 male genitalia, 862 females, 372 pupae, 672 larvae; 295 individual rearings: 163 larval, 112 pupal, 20 incomplete; (2 progeny rearings).

ANTIGUA (2 specimens: 2M). **Parish and locality not specified:** Nov 1929, KO 112-18, 2M.

ARGENTINA (126 specimens: 30M, 4M gen, 29F, 10P&p, 53L&1; 4 ind rear: 4p). **Buenos Aires:** Buenos Aires, J. Petrocchi, 1F. **Formosa:** Riacho Pilaga, 10 Mi NW, 10 Aug 1920, A. Wetmore, 1F. **Jujuy:** Calilegua, 5 May 1926, R. C. Shannon, 3F. **Misiones:** Iguazu, 4-10 Oct 1927, R. C. Shannon, 2M, 1F. **Salta:** Quebrada Itiyuro, 10 Nov 1965, C. Casal, GA 38, 1 pF, 10L; same data, ARG 39,

3pF, 41, 17L. **Tucuman:** Manatial, Mar 1926, 19L, 11; same locality, 18 Mar 1926, R. C. Shannon, No. 14, 1M; same locality and collector, 20 Mar 1926, No. 22, 1M, 1F; same locality and collector, 21 Mar 1926, No. 25, 4M, 2F; same locality and collector, 2 Apr 1926, No. 26, 6M, 1F; same locality and collector, 25 May 1926, No. 61, 5M, 2F,; Medinas, 15 Jun 1926, R. C. Shannon, 1M. Monteros, 2 Mar 1926, R. C. Shannon, 4F; same locality and collector, 19 May 1926, 1M, same locality and collector, 15 Jun 1926, 1M; same locality, Jun 1940, 4F, 6M, 4M gen, same locality, Jul 1940, 3M, 2F. Santa Barbara, 12 Jun 1926, 1L. **State not specified:** Concepcion, 16 Jun 1926, 2L. San Pedro, 17 Apr 1927, R. C. Shannon, 2F. Locality not specified, Mar 15 1926, 6p.

BELIZE (2 specimens: 1M, 1M gen). **Cayo:** Cayo, BHL 40, 1M, 1M gen.

BOLIVIA (37 specimens: 21M, 1M gen, 15F). **La Paz:** Apolo, 15 Jan 1946, S. Blatman, 3M, 3F. Chulumani, 12 Feb 1939, 4M, 2F. Coripata, Feb 1939, KO-H-18-23, 1M. Coscoma, HO-H-18-26, 1M; same locality, Sep 1945, H. Carr, Bol 22, 9M, 1M gen, 7F; same locality and date, 2M, 1F. **Santa Cruz:** Charagua, 16 May 1944, KO 112-33, 1F. San Antonio de Parapeti, 9 May 1944, KO 112-34, 1F. **Tarija:** Locality not specified, 12 Feb 1939, S. Blatman, 1M. **Department not specified:** Aiguile, 8 June 1946, Bol 35, 2F. Locality not specified, 3F (2908).

BRAZIL (298 specimens: 31M, 132F, 50P&p, 85L&l; 40 ind rear: 231, 17p). **Bahia:** Aratu, 20 May 1943, D. MacCreary, 1M, 15L. Bonfim, 26 Jan 1930, 1F. Itaperuna, 17 Jun 1925, F. Root, 1L, 1P. Piraja, 2F; same locality, 2M, 5F; same locality, 27 Dec 1928, N. C. Davis, same locality, Apr 1930, 1F, 3P, 5L; Paripe, 29 Jan 1929, N. C. Davis, 1F, 2L. Salvador, 2 Dec 1971, J. Fowler, BRS 711206, 1L; same locality and collector, 6 Dec 1971, BRS 711206, 4L; same locality and collector, 23 Feb 1972, 4L; same locality and collector, 29 Feb 1972, BRS 720229, 3L; same locality and collector, 3 Mar 1972, 1L; same locality and collector, Mar 1972, BRS 105, 3L; same data, BRS 106, 3L; same data, BRS 109, 1L; same data, BRS 123, 3L; same data, BRS 159, 2L; same data, BRS 165, 2L; same data, BRS 168, 3L; same data, BRS 171, 1L; same data, BRS 405-21, 11pM; same data, BRS 498, 1L; same data, BRS 720303, 1L. Locality not specified, 22 Apr 1929, R. C. Shannon, 2p. **Matto Grosso:** Chapada, Ponce, No. 224, 1M. Maracaju, 2M, 5F. **Para:** Belem, 1944, L. Causey, 2M; same locality and date, D. Causey, 1M. Tabrjarar, 11 Dec 1943, 1L. Locality not specified, Apr 1930, N. C. Davis, 1F. **Rio de Janeiro:** Niteroi, BRA 290, 21pM, 121pF, 1pM, 2pF; BRA 291, 1pM, 1pF. Rio de Janeiro, 2M, 36F; same locality, M. F. Boyd, 1M 29F; BRA 260, 11pM, 11pF, 2pF. Seropedica, BRA 231, 1pM. Surui, BRA 269, 41pM, 11pF, 1pM, 8pF. **Rio Grande do Norte:** Natal, 5 Nov 1943, 2M, 1F; same locality, 5 Dec 1943, 1M; same locality, 23 Jan 1945, J. McLarty, 1F; same locality 6 Feb 1945, 2F; same locality, 31 Mar 1945, 1F. Natal, 4 mi on rd to Macaiba, 18 Dec 1943, 1M, 1F. Natal, Pitimbu River, 26 Dec 1943, 1M; Natal, 7 mi on rd to San Jose, 27 Jan 1944, 1M; Natal, Lagoa Sequi, 18 Sep 1944, H. T. Dalmat, 1F; same locality, 6 Feb 1945, J. McLarty, 4F. **Sao Paulo:** Locality not specified, A. Lutz, 1F. **Sergipe:** Estancia, Dec 1929, R. C. Shannon, 10F. **State not specified:** Casupiranguinha river, 23 Jan 1945, McLarty, 1F . Mendes, 2 Mar 1945, 1P. Piraja, BRR 4, 1F. Ptimbu river, 9 Sep 1944, No. 2.9, 2.12, 2.19, 4p; same locality, 18 Sep 1944, 1F; same locality and date, 2p, 1L; same locality, 19 Sep 1944, 2L. San Jose, 13 Oct 1944, 1p. Locality not specified, 23 Oct, No.. 137, 1L.

COLOMBIA (266 specimens: 62M, 11M gen, 80F, 55P&p, 58L&l; 15 ind rear: 111, 4p). **Atlantico:** Barranquilla, 1923, L. H. Dunn, 2M, 3F. **Caldas:** La

Dorada, 25 Jun 1943, KO 112-6, 1M, 1F. **Meta:** Cumaral, COB 45, 11pF, 11pM, 1M gen. Pt. Lopez, COM 547, 1F. Restrepo, 21 Aug 1935, W. H. Komp, KO 112-19, 1F; same locality and collector, KO 112-20, 1F; same locality, COB 51, 11pM, 1M gen. Villavicencio, 1944, M. Bates, CV 86, 1M, 2M gen; same data, CV 91-8, 1M, 1M gen; same locality, 12 May 1947, L. Rozeboom, CV 377, 17F, 12M; same locality, 2F, 1M, 3L, 6p; same locality, CVP-15, 10F, 8M, 1L, 51, 15p (progeny rearing); same locality, CV-P-41, 17F, 16M, 11L, 15p (progeny rearing); same locality, COB 39, 1F; COB 66, 11pF; COB 70, 1F; COB 71, 1M, 1M gen, 21pM, 61pF, 9F, 14L; same locality, 1 Jul 1974, J. Kitzmiller, COZ 12, 2F, 2M; same locality, 18 July 1974, COZ 25, 1F; same locality 25 July 1964, COZ 32, 4F; same locality, 25 July 1974, COZ 33, 1L. **Narino:** Funes, Pasto, COB 21, 11pM, 1M gen, COB 19, 4M, 3M gen, 7F, 2P, 2p, 31. **Santander:** Lebrisa, COB 26, 3M, 21p, 1M gen, 2F, 5L.

COSTA RICA (437 specimens: 111M, 9M gen, 120F, 71P&p, 126L&1; 67 ind rear: 321, 31p, 4inc.). **Alajuela:** Capellades, 1938, W. H. Komp, KO 112-13, 1M. Ciruelas, 14 Nov 1920, A. Alfaro, 10M, 5F; same locality, CR 16, 2pM, 3pF; CR 17, 4pM, 21p, 1M, 1M gen, 7L, 61pF, 3M, 2F, 1P, 6p, 171. Eloyo, W. Komp, KO 112-23, 3M, 8F. San Antonio, 9 July 1925, L. Rozeboom, CRR 10, 2M, 1F; same locality and collector, CRR 11, 1M; same locality and collector, CRR 52, 7F, 20M. San Mateo, CR 568, 11pM, 1pF, 1M gen; CR 570, 1M, 2L, 11; CR 572, 1M, 1P; same locality, 3 July 1925, L. Rozeboom, CRR 9, 1F; same locality and collector, 18 July 1925, CRR 29, 1M; same locality and collector, CRR 30, 2M, 2F. San Ramon, CR 340, 11pM, 1M gen; CR 342, 31pM, 11pF, 2M gen, 4L; CR 353, 2pM, 1M gen, 1P, 2L. Volcan Poas, W. H. Komp, KO 112-9, 2F; same locality and collector, KO 112-16, 2M, 4F. Locality not specified, L. Rozeboom, CR 55, 1M, 1F. **Cartago:** Atirro, 14 Oct 1920, A. Alfaro, 3F; same locality, CR 382, 51pM, 11pF, 7L, 1pM, 1pF; CR 383, 21pF, 4pM, 1pF, 1M gen; CR 384, 1pM, 1pF, 4L, 1M gen; CR 385, 2 1pF, 4 L. Paraiso, CR 84, 3M, 6F, 1 1pM, 4 1pF, 1M gen, 8 p, 41L. Turrialba, 30 July 1925, L Rozeboom, CRR 33, 7M, 7F. **Guanacaste:** Cerro Maravilla, 4 Apr 1921, A. Alfaro, 2M, 2F. **Limon:** Aquiares, 28 Feb 1921, A. Alfaro, 2M, 3F. **Puntarenas:** Esparta, CR 574, 1F, 11p, 1P, 1L. **San Jose:** Essasu, 7 Feb 1921, A. Alfaro, 2F; same locality and collector, 16 Feb 1927, La Ese, CR 32, 41pF, 1pF, 21p, 2F. Orotina, 20 Dec 1920, A. Alfaro, 3F. Rio Tiribi, 1921, A. Alfaro, 2M, 1F. San Isidro de General, CR 37, 11pM, 1M gen. **Province not specified:** locality not specified, 23 Nov 1920, A. Alfaro, 1F; same collector, 28 Dec 1920, 1F; same collector, 5 Jan 1921, 1M; same collector, Mar 1921, 1F. Birris, 12 Mar 1921, A. Alfaro, 5M, 2F. Rio Cirvelas, 18 Apr 1921, A. Alfaro, 2M, 2F. Locality not specified, CRM 12, 3M; CRM 13, 2F; CRM 14, 1M; CRM 15, 1F, 1M; CRM 16, 11F, 5M; CRM 17, 1F; CRM 22, 1F; CRM 27, 1M; CRM 30, 1F; CRM 32, 6F.

DOMINICA (230 specimens: 34M, 1M gen, 33F, 58P&p, 104L&1; 46 ind rear: 381, 3p, 5inc). **St. David:** Bataka, DOM 169, 2L; DOM 170, 11pM, 11pF, 3M, 2F, 5p, 4L, 21. Castle Bruce, DOM 210, 1L; DOM 143, 21pM, 31pF, 21p, 2L; DOM 144, 2L; DOM 145, 41pM, 51pF, 2F, 2p, 4L. Rosalie, DOM 71, 11pF. DOM 74, 3L; DOM 75, 11pM, 1M, 1M gen, 1F, 2p; DOM 117, 1L. **St. George:** Laudat, DOM 180, 1pM, 2L; DOM 55, 2L. **St. John:** Portsmouth, DOM 106, 11pF, 1M, 2L; DOM 107, 11pM, 5 1pF, 21p, 2M, 2p, 4L. **St. Patrick:** Geneva, DOM 62, 21pM, 1pM, 1pF, 11p, 9L; DOM 65, 11pM, 1pF; DOM 66, 6L. **St. Paul:** Massacre, DOM 31, 1L; DOM 32, 11pF, 1P, 2L; DOM 42, 31pM, 31pF. Pont Casse, DOM 124, 21pF, 1L. **Parish not specified:** Bath Estate, May 1944, 2M. Clarke Hall, 31 Jan 1965, W. W. Wirth,

1M; same locality and collector, 31 Mar 1965, 1M; Grand Bay, 13 March 1964, D. F. Bray, 1F. Sylvania, 26 May 1944, L. Charles, KO 112-26, 6M, 1F, 5L. Wesley, 2 Jun 1944, L. Charles, 6L.

EL SALVADOR (18 specimens: 10M, 8F). **San Miguel:** Laguna El Jocotal, SAL 12, 1F. **San Salvador:** locality not specified, Nov 1940, F. P. Figueroa, Bishop No. 23628, 3M, 5F. **Province not specified:** El Tiote, W. H. Komp, KO 112-4, 3M. Guacotecti, W. H. Komp, KO 105-14, 1M; same locality and collector, KO 112-3, 3M, locality not specified, 2F.

GRENADA (169 specimens: 68M, 3M gen, 69F, 8P&p, 21L&l; 9 ind rear: 91). St. Andrew: Grand Etang, GR 56, 1L; GR 57, 1F. **St. David:** La Sagesse, LAR 45, 4M, 4F. **St. George:** La Borie, GR 73, 1F. Providence, GR 74, 1M, 3F, 2L. St. Georges, GR 11, 11pF; GR 13, 1L; GR 16, 1L; GR 17, 31pM, 21pF, 2M gen; GR 92, 1L; GRR 16, 46M, 42F. Vendome, GR 93, 21pF; GR 94, 1L; GR 97, 1M, 1M gen, 1F, 2L. **St. John:** Grand Roy GR 29, 1F. St. Patrick, GR 104, 1L; GR 105, 2M; GR 106, 1L; GR 107, 2L. **Parish not specified:** Locality not specified, 15 Jul 1929, GRR 42, 1F; GRR 46, 1M; Aug 1929, GRR 136, 1F; Aug 29, GRR 141, 10M, 9F.

GUYANA (2 specimens: 1M, 1M gen). **East Demerara - West Coast Berbice:** Hyde Park, 29 Jul 1941, 1M, 1M gen.

GUATEMALA (6 specimens: 4M, 1M gen, 1F). **Guatemala:** Guatemala City, 3M, 1F. Locality not specified, W. H. Komp, GUAK 30, 1M, 1M gen.

HONDURAS (38 specimens: 20M, 18F). **Colon:** Truxillo (Trujillo), 8 Jul 1943, K. R. Maxwell, 4M, 1F; same locality, Jan 1944, W. H. Komp, KO 112-29, 4M, 6F; same locality and collector, 27 Sep 1945, 1M, 1F. **Tegucigalpa:** Buenos Aires, 13 Jul 1945, 4M, 3F. Francisco Marazan, 13 July 1945, W. H. Komp, KO 112-21, 4M, 3F; same data, 112-28, 3M, 4F.

MARTINIQUE (28 specimens: 3M, 1F, 24L). **Fort de Frs:** 3M, 1F, 24L). **Fort de France:** Locality not specified, 10 Apr 1971, J. Fize, MAR 22, 24L. **Le Lamentin:** Le Lamentin, 8 Aug 1929, LAR 27, 3M, 1F.

MEXICO (50 specimens: 13M, 34F, 3L). **Guerrero:** Chilpancingo, MEX 139, 1L. **Oaxaca:** Matias Romero, MEX 712, 2L. Locality not specified, F. Knab, 2M (276d, 278a), 2F (276c, 277d). **Veracruz:** Cordoba, F. Knab, 6M (No. 417.16, 417.22, 427.1, 427.3, 434.3, 439.5), 20F (417.1, 417.2, 417.3, 417.4, 417.14, 417.15, 417.18, 417.23, 417.28, 418.4, 420.2, 420.3, 420.4, 420.5, 427.2, 427.28, 428.6, 439.3, 439.4, 439.5). Tierra Blanca, Boyd, No. 313, 1M, 5F. **State not specified:** Rin Antonio, 1M, 4F. Terra Llanca, Boyd, 3M, 3F.

MONTSERRAT (71 specimens: 6M, 6F, 19P&p, 40L&l; 12 ind rear: 81, 2p, 2inc). **St. Anthony:** Plymouth, MNT 2, 1 1pM; same data, MNT 4, 2L. **St. Georges:** Farm Village, MNT 131, 11pF 11p, 4p, 4L; MNT 129, 11p. **St. Peter:** Happy Hill Village, MNT 14, 1pF, 6L; MNT 15, 2L; MNT 117, 4L. Salem, NT 55, 2 1pM, 31pF, 1pM, 2M, 1F, 4p, 13L.

PANAMA (703 specimens: 243M, 24M gen, 254F, 66P&p, 116L&l; 70 ind rear: 241, 40p, 6inc.). **Canal Zone:** Albrook AFB, 28 Dec 1948, S. Carpenter, 630506-90, 5L; same locality and collector, 26 Jan 1949, PC 4, 2M. Ancon, 1921, J. B. Shropshire, 3M, 4F; same locality, Jan 1944, W. H. Komp, KO 112-5, 8F, 5M. Chiva Chiva, PA 763 A, 41pM, 21pF, 1M gen. Comacho, 13 Mar 1922, J. B. Shropshire, 1F; same locality and collector, 19 Apr 1922, 1M, 2F. Zulebra, 20 Jun 1924, J. Zetek, 1F; same locality, 1 May 1925, D. Baker, 2M; same locality, 6 June 1925, J. Zetek, 1M. Corozal, 2 Dec 1921, J. B. Shropshire, 1F; same locality and collector, May 1922, 9M, 2F; same locality, 6 May 1942, W. H. Komp, KO 112-15, 2F; same collector, 16 Jan 1943, W. H. Komp, KO 112-17, 5M,

12F. Diablo, 28 Nov 1921, J. B. Shropshire, 3M, 2F; same locality and collector, 14 Jan 1922, 1F. Empire, 17 Oct 1921, J. B. Shropshire, 7M, 5F; same locality and collector, 20 Oct 1921, 2M, 4F; same locality and collector, 18 Nov 1921, 6M, 11F; same locality and collector, 11 Feb 1922, 2M, 1F; same locality, A. H. Jennings, 1M, 1F; same locality, 18 Mar 1925, D. Baker, 1F. France Field, 8 Aug 1923, J. B. Shropshire, GM, 4F; same locality and collector, 26 July 1924, 5M, 1F; same locality and collector, 11 Nov 1924, 2M. Fort Amador, 11 Jan 1948, S. Carpenter, PC 2, 1F, 1M. Fort Clayton, 17 Feb 1950, 11; same locality, 10 Jan 1949, S. Carpenter, 8L. Fort Davis, C. S. Ludlow, 1F. Fort Kobbe, 21 July 1949, S. Carpenter, 3L, 31. Fort Sherman, 8 Aug 1925, D. Baker, 1M; same locality, 3 Dec 1963, G. Lucero, CZ 91, 11F. Gatun, A. H. Jennings, 3M. Gold Hill, 28 Oct 1921, J. B. Shropshire, 1F; same locality and collector, 9 Dec 1921, 1M; same locality and collector, 24 Dec 1921, 3M, 8F; same locality and collector, 31 Dec 1921, 1M, 1F; same locality and collector, 13 Jan 1922, 1F; same locality and collector, 11 Feb 1922, 1M, 3F; same locality and collector, 17 Feb 1922, 2M, 1F. La Pita, 16 Jan 1922, J. B. Shropshire, 2M, 5F; same locality and collector, 26 Jan 1922, 1M, 1F; same locality and collector, 6 May 1922, 15M, 3M gen; same locality and collector 740513-41, 1M; same locality and collector, 6 May 1922, 650913-5, 1M gen. Majagual, 1922, J. B. Shropshire, 2M, 1F. Mandingo, 7 Dec 1921, J. B. Shropshire, 1M, 1F; same locality and collector, 25 March 1922, 1M. Miraflores, C. H. Bath, 1M, 1F; same localilty, 14 Dec 1921, J. B. Shropshire, 1M; same locality and collector, 7 Jun 1922, 4F; same locality, W. H. Komp, KO 112-30, 2M, 1F. Mindi, 18 Jan 1922, J. B. Shropshire, 1F. Molte Lirio, 17 Dec 1921, J. B. Shropshire, 1M. Mt. Hope, 14 Jan 1922, J. B. Shropshire, 1M. Otro Lado, 2 Nov 1924, J. Zetek, 3M. Paraiso, 1 May 1922, J. B. Shropshire, 2M, 1F. Paja, 1 Mar 1922, J. B. Shropshire, 2M; same locality and collector, 8 March 1922, 4M, 5F. Paraiso, 1 May 1922, J. B. Shropshire, 2M, 1F. Pedro Miguel, Jun 1918, J. Zetek, 4M, 4F. Rio Chilibre, W. H. Komp, KO 112-35, 1F. Summit, 28 Oct 1921, J. B. Shropshire, 6M, 7F. Locality not specified, 1909, A. H. Jennings, 4M; Feb 1943, W. H. Komp, KO 112-4, 13M, 8F; same collector and date, KOH-18-20, 11M, 5F; same collector, Jan 1944, KO 112-7, 1M, 1F; same collector, KO 112-8, 15M, 24F; same collector, KO 112-9, 2F; same collector, Jan 1944, KO 112-10, 1M, 2F; same collector, KO 112-11, 2M; same collector, KO 112-12, 2M, 2F; same collector, KO 112-14, 13M, 8F. **Panama:** Bejuco, Pueblo Nuevo, 7 Dec 1936, L. Rozeboom, 3M, 4F, 51; same locality and collector, 9 Dec 1936, 4M, 1M gen, 17F; same locality and collector, 14 Dec 1936, 5M, 1M gen, 6F, 11; same locality, 2M, 2M gen. Cero Azul, PA 55, 1pM; PA 56, 11pM, 6pM, 11pF, 11P, 2M gen; PA 59, 21pM, 2M gen; PA 82, 1pM, 1pF, 1M gen; PA 83, 11pM, 21pF, 5pM, 2pF, 31p, 4M gen; PA 96, 11pM, 11pF, 1M gen; PA 99, 1pF; PA 102, 11p, 2L; PA 104, 11pF, 4L. Cero Campana, PA 460, 1pM, 1pF, 1M gen; PA 470, 3L; PA 491, 1M, 1M gen; PA 492, 1F; PA 493, 1pM, 11p, 1M gen, 2L, PA 544, 11pM, 1pF. Chame, PA 527, 2L. La Chorrera, 31 May 1944, ASM 29-4, 101; same locality, 14 May 1944, ASM 29-1, 11; same locality and date, ASM 29-4, 11; same locality, 21 Aug 1944, ASM 9-1, Student Officers, ASM 123-1, 41; same locality, 6 Nov 1944, Student Officers, ASM 268-1, 31, same locality, 1 Dec 1944, Wood, ASM 326-1,11; same locality, 10 Jan 1945, Martinez, ASM 371-4, 1L; same locality, 6 Mar 1945, Student Officers, ASM 428, 12M, 12F; Pacora, PA 760, 41pF, 3pF, 3pM, 1M gen, 2L, 21; PA 761, 31pF, 61pM, 1pF, 1M gen, 1P, 6L. Panama City, PA 801, 11pM, 1F, 2M. Tocumen Airport, 18 Dec 1963, Henriquez, CZ

95, 1M. **Province not specified:** Locality not specified, ASM 60-57-1, 11; same locality and collector, ASM 60-58-1, 11.

PARAGUAY (25 specimens: 7M, 18F). Asuncion, 28 Nov 1939, 7M, 18F.

SAINT LUCIA (26 specimens: 2M, 3F, 5p, 16L&1; 4 ind rear: 41). **Anse La Raye:** Anse La Raye, Chantin, LU 135, 21pF. **Castries:** Castries, La Toc, LU 5, 3L; Castries, L'Hermitage, LU 57, 11pM; Castries, Soucis, LU 8-1, 4L. **Laborie:** Laborie, LU 122, 11pM; LU 90, 2L; LU 89, 1pF; LU 91, 1L. **Parish not specified:** Thomazo, May 1973, G. Unrau, 1L.

SAINT VINCENT (38 specimens: 12M, 2M gen, 13F, 8p, 31; 8 ind rear: 31, 5p). **Charlotte:** Colonarie, VT 522, 11pM, 11pF, 7F, 3M, 1M gen. **St. George:** Kingstown, VT 71, 1pM, 1M, 1M gen; VT 72, 11pM, 2pF, 1pM, 2F, 1M, 2M gen. Stubbs, VT 79, 1F. **St. Patrick:** Barrouallie, VT 31, 1pM.

TRINIDAD (1 specimen: 1F). **St. George:** Arima, 12 Sep 1965, T. Aitken, TR 1324-100, 1F.

VENEZUELA (88 specimens: 10M, 6M gen, 27F, 22P, 23L&1; 20 ind rear: 111, 6p, 3inc.). **Aragua:** Maracay, Jul 1928, L. Rozeboom, VZR 48, 1F; same locality, VZ 130, 1pM, 1M gen; same locality, Mar 1929, L. Rozeboom, VZR 165, 1M; same locality, Apr 1929, L. Rozeboom, VZR 169, 4F; same locality, Jun 1929, L. Rozeboom, VZR 179, 10F. Turnero, VZ 27, 2pF, 1p; VZ 103, 1pM, 1M gen; VZ 290, 31pM, 41pF, 11p, 2M, 2M gen, 1F, 4P, 3p, 4L. **Carabobo:** Valencia, 4 Aug 1927, L. Rozeboom, VZR 22, 1F. **Cojedes:** San Carlos, VZ 115, 21p, 5L. Tinaquilla, VZ 119, 2pM, 2M gen, 9L; same locality, VZR 237, 3F; same locality, VZR 238, 1F; same locality, VZR 243, 1M.

2. *Anopheles* (*Nys.*) *sawyeri* Causey, Deane, Deane and Sampaio

Figs. 1, 3, 7, 8

1943. *Anopheles* (*Nyssorhynchus*) *sawyeri* Causey, Deane, Deane and Sampaio 1943:11-20. TYPE: *Holotype* female, plateau of Serra da Ibiapaba, near Sao Benedito (Ceara), Brazil (USNM) (Belkin et al. 1971:5). Reduced to subspecific status by Lane 1949:402. RESURRECTED FROM SYNONYMY with *argyritarsis* (Robineau-Desvoidy 1827).

Anopheles (*Nyssorhynchus*) *sawyeri* of Galvao (1943:145-151); Russell et al. (1943:49); Causey et al. (1944:1-2, 5, 7; 1946:26, 31); Deane, L.M., Causey and Deane (1946:9, 11; 1948:830, 832, 857, 933, 965); Deane, M. P. et al. (1946:42, 45, 50); Senevet (1948a:280); Vargas (1948:155-156; 1959:370, 382); Gabaldon and Cova Garcia (1952:177, 196, 199, 202-206); Horsfall (1955:171); Stone and Knight (1956:280).

Anopheles sawyeri of Russell et al. (1943:37, 41, 49).

Anopheles (*Nyssorhynchus*) *argyritarsis sawyeri* of Lane (1949:402; 1953:236-237, 239, 252-253); Levi-Castillo (1949:11, 16, 29, 54-58, 67-89, 93, 96, 99, 102; 1951:78); Rachou (1958:146); Stone, et al. (1959:32); Forattini (1962:417-418); Ferreira (1964:333, 337); Knight and Stone (1977:61).

Anopheles argyritarsis sawyeri of Foote and Cook (1959:26,29).

Anopheles (*Nyssorhynchus*) *argyritarsis* var. *sawyeri* of Senevet (1958:128-129).

FEMALE. Wing: 3.4 mm. Proboscis: 2.1 mm. Forefemur: 1.5 mm. Abdomen: 3.1 mm. **Head:** Interocular space wide, 0.8-1.0 diameter of pedicel. Frontal tuft with 4-7 pairs of long, white setiform scales. Palpus about 0.85 length of proboscis; palpomere 3 with white apical band. **Antenna:** Length 0.64 of

proboscis. Pedicel with 4-6 small, white scales. Flagellomere 1 with several long, silver scales; flagellomere 2 with white setiform scales. **Thorax:** Nonpruinose dark areas as in section. Scales of scutum white except for light brown scales on lateral anterior promontory. Scutellum posteriorly with about 15 well-developed, brown setae and 6-8 poorly developed, white setae. Pleuron with light pruinose areas as in section. *Ap* with brown scales juxtaposed to scales of lateral anterior promontory and lateral occipital region of head. *Psa* with 4,5 silver setae. *Ps* anteriorly with several well-developed, stout, dark setae, without light scale patch. Upper *Mks* with 3 brown setae and patch of 8-10 white scales; lower *Mks* with 1 dark seta and 4,5 long, spatulate, white scales. Upper *Mam* with row of 4-7 brown setae, usually without row of scales. *Pk* medially with 4,5 white setae, laterally with 1,2 dark setae and 5-8 white scales. **Legs:** Generally as in section. Foretarsomere 1 with ventral light stripe, apical 0.1-0.2 light; tarsomere 2 with apical 0.2-0.3 light; tarsomere 3 with apical 0.1-0.2 light. Midtarsomeres 1,2 with white stripe extending length of tarsomere; tarsomeres 3-5 with dark scales dark blue. Hindtarsomere 1 usually with light stripe; tarsomere 2 with basal 0.15 dark; tarsomeres 3-5 entirely white. **Wing:** Dark scales dark brown on costal margin and light brown posteriorly. Vein C basal dark spot less than or equal to 0.5 of humeral light spot; presectoral light spot small, occasionally absent. **Abdomen:** Tergum I with numerous brown setae and without scales. Terga II-IV medially with mixture of blue to purple scales, laterally with yellow scales. Terga V-VI predominantly with intermingling of yellow and cream scales, with small scattered patches of blue scales. Tergum VII with cream scales on basal 0.3, dark purple scales on apical 0.7 of segment. Caudolateral scale tufts present on tersa III-VII, usually reduced to small groups of light brown scales. Sterna as in group.

MALE. Wing: 3.75 mm. Proboscis: 2.75 mm. Forefemur: 1.9 mm. Abdomen: 3.5 mm. Essentially as in female except for sexual characters, and as in section and group. **Head:** Proboscis 1.5 length of forefemur, covered by numerous dark, decumbent scales. Palpus subequal to proboscis; palpomere 1 with numerous erect brown scales and several cream scales; palpomere 2 brown with apical white band; palpomere 3 predominantly brown to dark brown, always with a basal and apical white band; palpomere 4 dorsally brown or golden with basal and apical white band, ventral surface bare; palpomere 5 dorsally white, with basal brown band about 0.2 length of palpomere, ventrally bare. **Antenna:** length about 0.8 of proboscis. Diameter of pedicel about 1.6 that of female. Flagellomere 1 about 1.8-2.0 length of individual flagellomeres 2-11, with long, erect, white scales; flagellomere 2 subequal to that of female and occasionally with setiform white scales; flagellomeres 3-11 subequal to those of female, without scales; flagellomere 12 about 4.1 length of individual flagellomeres 2-11; flagellomere 13 0.40-0.45 length of flagellomere 12. **Legs:** Essentially as in section.

MALE GENITALIA (Fig. 7). **Segment VIII:** Tergum laterally with single row of moderately long to long setae; with slender, light scales. Sternum with single row of long setae along posterior margin; covered by large, obovate, white or cream scales. **Segment IX:** Sternum rectangular, narrower than preceding sternum, moderately long (about 0.2 length of gonocoxite); posteromedial border strongly emarginate; anteromedial border moderately emarginate, with distinct, nonspiculose, dark, slender apodeme. **Gonocoxite:**

Length about 3.0 maximum width. Tergal surface usually with 5 tergomedial setae, 1,2 apicolateral setae and single apicomesal seta immediately basad of gonostylus. Parabasal seta strongly retrorsely hooked, moderately long, about 3.0-3.5 length of its tubercle. Apodeme of gonocoxite about 0.15 length of gonocoxite. Accessory setae moderately long, very broad; dorsal seta about 0.4 length of gonocoxite; ventral seta about 0.8 length of dorsal seta. Internal seta slender, about 0.85-0.90 length of ventral accessory seta, weakly curved. **Gonostylus:** Gonostylar claw short, about 0.3 length of seta *b*. **Dorsal Claspette:** Short, about 0.15-0.20 length of gonocoxite; pedicel narrowed at base, moderately broad at apex; apex usually with apicolateral, curved or hooked, sclerotized projection; mesal margin not strongly curved; base rounded. Apex with 2 setae; setae about 2.0 length of dorsal claspette, curved mesally, dorsal seta with or without weakly developed basomesal projection. **Ventral Claspette:** About 0.3 length of gonocoxite, occasionally appearing shorter due to orientation of apical lobes. Apex wide, striated, strongly bilobed, lobes directed anterolateraly, pointed; median sulcus broadly developed between apices of lobes, narrow and semicircular at base. Preapical plate lightly sclerotized area between 2 sclerotized ridges, often with distinct striation. Basal lobules expanded; mesal cleft about 0.3 length of ventral claspette; vertex not distinctly thickened, refringent structure absent. **Phallosome:** About 0.45 length of gonocoxite and 1.4 length of ventral claspette. Aedeagus with apex sharply rounded, width equal to length; subapically with pair of moderately sclerotized, curved, serrate leaflets; leaflets about 0.25-0.30 length of aedeagus; ventromesal subtriangular projections lightly sclerotized and not meeting on midline.

PUPA. (Fig. 7) Abdomen: 3 mm. Trumpet: 0.5 mm. Paddle: 0.8 X 0.5 mm. **Cephalothorax:** Moderately to heavily pigmented, brown. Median keel weakly developed. Setae 1-3-C 2b (1-3); 1-C 2b, long; 2-C 2b or 2f, short; 3-C 2b or 2f, long. Setae 4,5-C subequal; 4-C 2,3f (1-4); 5-C 2,3b (1-4). Seta 6-C single (1-3b), long. Seta 7-C 2,3b (1-4), stout. Setae 8,9-C subequal; 8-C always single, well developed, strongly pigmented; 9-C 1-3f (1-5), slender. **Trumpet:** Uniformly pigmented. Pinna angusticorn, 0.7-0.8 length of trumpet, moderately pigmented, entire border reticulate; meatal cleft short to moderately developed. Meatus small, 0.2-0.3 length of trumpet, with very faint or no reticulations. **Metanotum:** Setae 10-12-C moderately developed, heavily pigmented; 10-C single, strongly developed; 11-C single or double (1-3b), thinner than 10-C; 12-C single, long, 2.0 length of seta 10-C, lightly pigmented. **Abdomen:** Strongly pigmented especially on caudal margin of segments I-III. Seta 1-I with 16-25 primary branches, apically extensively dendritic; seta 2-I pectinate, 2f (1-3) weakly to moderately developed. Seta 3-I single (1-5b), moderately developed and pigmented, longer than 2-I. Seta 4-I 3-5f, weak. Seta 5-I single (1-3b), long. Seta 6-I single, subequal to 5-I, 2.0 length of 7-I. Seta 7-I single or double. Seta 9-I single. Seta 0-II 3-5b (1-5), short; 0-III-V dendritic, 4,5b (4-6); 0-VI 1-3b; 0-VII,VIII single. Seta 1-II 7-10b (6-11), large; 1-III 5-7b (4-8), subequal to 1-II; 1-IV-VII always single, 1.5 length of segment. Seta 2-II 5b (4-6); 2-III branched 0.2 from base, 4b (4-6); 2-IV single (1,2b); 2-V single or double, long, extending to caudal margin of segment; 2-VI single (1,2b) long, subequal to 2-V; 2-VII 2b (1-3), long, branched 0.2 from base. Seta 3-II,III single (1,2b), moderately long, subequal to 1-II,III; 3-IV 2b (1-4), moderately long; 3-V-VII single

(1,2b). Seta 4-II single (1,2f); 4-III single or double (1-3f); 4-IV 3-5f (2-6), short; 4-V-VII single. Seta 5-II 4-6b; 5-III 5b (4-6); 5-IV 3b (2,3), moderately long, about 0.5 length of 1-IV; 5-V-VII single, long, about equal to length of segment. Seta 7-II 2b (1-3), shorter than 6-II, moderately developed; 7-III,IV 2-4f (1-5), short; 7-V-VII single (1,2b), long, 1.5-2.0 length of 7-III,IV. Seta 8-III usually 2,3f, subequal to 7-III; 8-IV single, longer than 7-IV; 8-V single, subequal to 7-V; 8-VI single or double (1-3b); 8-VII single. Seta 9-II minute, slender, sharply pointed, lightly pigmented; 9-III subequal to 9-II, slightly stouter, rounded at apex, moderately pigmented; 9-IV short, 1.4 length of 9-III, strongly pigmented, straight, fusiform; 9-V moderately long, slender and sharply pointed, strongly pigmented, about 5.0 length of 9-IV, moderately strongly curved mesad; 9-VI,VII subequal, similar in shape to 9-V, about 7.0 length of 9-IV, 1.4 length of 9-V, 0.6 length of segment; 9-VIII subequal and similar to 9-VI,VII, weakly curved mesad. Seta 10-III single (1,2b); 10-IV,V single; 10-VII single. **Terminal Segments:** Apex of male genital lobe with moderately long, distinct, mammilliform protuberance; mesal margin of lobe with irregular serrations; length of male genital lobe about 2.4 width; moderately pigmented. **Paddle:** Wide and apically slightly emarginate, length 1.6 width. Midrib much more heavily sclerotized on lateral margin than on mesal margin, sclerotization extending to 0.60 of paddle length, apically weakly developed. External buttress extending 0.65 length of paddle from base, with small serrations on apical 0.25. External margin distad of buttress with short (0.025 mm), distinct, thin spicules, apically less numerous. Seta 1-P single, long (0.15 mm), curved laterally in distal 0.5; 2-P single, extremely thin, moderately long, 0.6-0.7 of seta 1-P.

LARVA (Fig. 8). Head: 0.6 mm. Antenna: 0.25 mm. Saddle: 0.3 mm. **Head:** Heavily pigmented, with conspicuous dark brown bands; with dark area extending anteriorly from collar along frontoclypeal suture beyond seta 9-C, with caudolateral extension from seta 8-C to collar; with subtrapezoidal dark area between arms of frontoclypeal suture; third dark area along insertion of setae 5,6-C. Collar moderately sclerotized, moderately wide, about 0.05 mm. Dorsomentum well developed, with median tooth and 4 lateral teeth on each; median tooth and first 2 pairs of lateral teeth subequal; third pair smaller than preceding teeth; fourth pair small and inconspicuous, near base of plate. Setae 2-C very closely approximated, clypeal index about 5.0, without barbs, occasionally forked. Setae 3-C with small barbs, 0.8 length of 2-C. Seta 4-C always single, very long, extending to or beyond basal 0.3 of 2-C. Seta 8-C single (1,2f), moderately long. Seta 9-C branched 0.2 from base, 2,3b (1-3), subequal to 8-C. Seta 10-C 2 b. Setae 12,13-C 3-5b. **Antenna:** Basal 0.4 very lightly pigmented, almost colorless, apical 0.6 moderately to heavily pigmented. Dorsally and ventrally with few very short spicules; mesally with numerous short spicules in basal 0.5; apex with numerous well-developed, strongly pigmented spicules. Seta 1-A 2-4f (2-6), long, about 1.5 width of antenna, inserted 0.2 from base. Seta 4-A 2f, long. **Thorax:** Lightly pigmented. Seta 1-3-P not sharing common tubercle, always inserted independently; 1-P fanlike with 11-15 long, thin branches inserted on a moderately short shaft; 2-P plumose, 17-20b (16-21), about 1.6 length of 1-P; 3-P single, about 0.5 length of 2-P. Setae 4-10,12-P as in section. Seta 11-P 3,4b about 0.5 length of 12-P. Seta 13-P 4b (2-4). Seta 14-P 6-7b, well developed. Seta 1-M with 15-40 branches inserted on long flattened shaft.

Seta 2-M single, long, about 0.45-0.50 length of 1-M. Seta 4-M 2,3b. Seta 13-M 3-5b. Seta 1,2-T long; 2-T extending caudally beyond posterior margin of thorax. Seta 3-T very weakly palmate, with 9-13 long, slender, nonpigmented, lanceolate branches inserted near base of short shaft. Seta 4-T 3-5b. Seta 6-T 3b (2,3). Seta 12-T 2b. **Abdomen:** Integument usually pigmented as on thorax. Median tergal plates present on segments I-VIII; plate on segment I with conspicuous anteromedial lobe; plate on segment II about 0.75 of that on segment I, with similar anteromedial lobe; plate on segments III-VII subequal to plate on segment I; plate on segment VIII very large, about 0.5 width of segment. Accessory median tergal plates on segments II-VII always single, without conspicuous lobes, larger caudally; segments II,III with kidney-shaped plates; segments IV-VII with globular or spherical plates. Accessory submedian tergal plates usually absent on all segments. Seta 0-II,III 4-6b, small; 0-IV,V 4b (3,4); 0-VI double; 0-VII single. Seta 1-I very weakly palmate, with 10-13 lightly to moderately pigmented, very slender, lanceolate branches; 1-II-VII palmate, with 22-26 (20-26) moderately broad, widely spaced, lanceolate branches. Seta 2-I 2-5b, small to moderately large; 2-II 6-8b, large; 2-III 4,5b, large; 2-IV,V single; 2-VI 3b (3,4); 2-VII 3-5b. Seta 3-IV 4b (3,4). Seta 4-III 4b (3,4). Seta 7-IV 2-5b; 7-VII 4-6b. Seta 8-V 2b (2,3). Seta 9-I 7,8b (6-9); 9-IV,V 8,9b (7-9). Seta 10-VI single (1,2b). Seta 13-I 4b; 13-II 3-4b (2-4); 13-III 5b (4,5); 13-IV 4,5b, moderately long, 13-V 5b (4-6), very large; 13-VI 8-10b (6-12); 13-VII 3,4b, large. **Spiracular Lobe:** Pecten with 16-19 teeth, short teeth with small spicules on dorsal margin; teeth beginning ventrally as follows: 1 long; 1-3 short, 1 long, this sequence repeated 4-6 times, terminating with 2,3 long. Median plate of spiracular apparatus without lateral arms, anteromedial process strongly sclerotized, slightly rounded. Seta 1-S 3-5b (3-6), large. Setae 3-5-S 1b. Seta 6-S 2f, moderately long. Seta 7-S 2b (2,3b). Setae 8,9-S 4b (2-4), moderately large. **Abdominal Segment X:** Saddle incomplete, heavily pigmented along margins. Integument with fine spicules. Seta 1-X always inserted on caudoventral area of saddle near ventral margin, about 2.4 length of saddle. Seta 2-X pectinate; 3-X with 4-6 large branches. Ventral brush with 8 pairs of well-developed plumose setae. Anal papillae subequal to saddle length.

DISCUSSION. *Anopheles sawyeri* can be distinguished from *argyritarsis*, the only other species in the Argyritarsis Subgroup in the **female** by the combination of: (1) interocular space wide, about 0.8-1.0 diameter of pedicel, (2) frontal tuft with 4-7 pairs of long, setiform scales, (3) foretarsomere 1 with apical 0.1-0.2 white, (4) hindtarsomere 2 with basal 0.15 dark, and (5) terga II-IV medially with blue to purple scales and laterally with yellow and cream scales; in the **male genitalia** by: (1) sternum IX with distinct, but slender anterior apodeme, (2) apodeme of gonocoxite about 0.15 length of gonocoxite, (3) parabasal seta of gonocoxite usually moderately long, about 3.0-3.5 length of its tubercle, (4) setae of dorsal claspette about 2.0 length of dorsal claspette, (5) ventral claspette with: a) apex wide, b) apical lobes directed anterolaterally, pointed, c) median sulcus broadly developed between apices of lobes, narrow and semicircular at base, and d) mesal cleft about 0.3 length of ventral claspette, vertex not distinctly thickened, refringent structure absent, and (6) apex of aedeagus sharply rounded, width equal to length; in the **pupa** by: (1) median keel weakly developed, (2) seta 0-III-V 4,5b (4-6), (3) seta 1-II 7-10b (6-11), (4) seta 1-III 5-7b (4-8), (5) 2-I 2f

(1-3), weakly to moderately developed, (6) seta 2-VII 2b (1-3), (7) seta 5-II 4-6b, (8) seta 9-V 5.0 length of 9-IV, (9) seta 9-VIII weakly curved mesally, and (10) external buttress extending 0.65 length of paddle from base; and in the **larva** by: (1) collar of head capsule moderately wide, about 0.05 mm, (2) seta 3-C 0.8 length of seta 2-C, (3) seta 4-C extending to or beyond basal 0.3 of seta 2-C, (4) seta 8-C single (1,2f), (5) accessory submedian tergal plates usually absent, and (6) setae 3-T and 1-I very weakly palmate, with slender lanceolate branches.

The most reliable characters for differentiating *sawyeri* from *argyritarsis* in the larva are the presence of weakly developed palmate setae on the metathorax (3-T) and the first abdominal segment (1-I), and the unbranched seta 8-C on the head capsule. The following characters of the male genitalia are also quite reliable for species identification, but seeing them on a specimen is dependent upon the proper position of the genitalia on the slide: (1) setae of dorsal claspette about 2.0 length of dorsal claspette, (2) ventral claspette with moderately broad, laterally pointed lobes, and (3) apex of aedeagus sharply rounded, its width equal to its length. Characters of the adult female and pupa are not always reliable for species determination and therefore, identification of this stage should be done with care. I have examined the holotype and 12 paratype specimens and have found these to exhibit only moderate intrapopulational variation.

As has been discussed in the subgroup discussion, *sawyeri* is apparently most closely related to *argyritarsis*. I believe divergence between the two species is of recent origin. *Anopheles sawyeri* has been reported only from Serra da Ibiapaba Plateau area, Ceara, Brazil; *argyritarsis*, apparently, has never been collected in the latter region, although it does occur in some parts of Ceara.

Most of the characters used to separate the two species are apomorphic in *sawyeri*. There is a tendency for populations of *argyritarsis* south of the equator to differ from the northern populations and evidently to differ also from the plesiomorphic state. I think that *sawyeri* arose as a geographically isolated population of the slightly more apomorphic southern population of *argyritarsis* and subsequently evolved even more apomorphic character states.

Anopheles sawyeri was described by Causey, Deane, Deane and Sampaio (1943:11-16) from characters of the egg, larva, pupa, adult coloration and male genitalia. The authors stated, "So far the new species has been encountered only in this area [Serra da Ibiapaba], although extensive regions of Northeast Brazil have been surveyed." The adults of *argyritarsis* were differentiated from *sawyeri* by the possession of more numerous white scales on the costal vein of *argyritarsis*. This character seems to be reliable for *argyritarsis* populations from Ceara and Rio de Janeiro, Brazil; however, examination of populations of this species in northern Argentina reveals that the amount of white on the costal vein is conspicuously reduced, similar to that of *sawyeri*. Differentiation of the egg of *sawyeri* was based on its general shape, the hexagonal pattern on the dorsal surface and the broad frills at each end. I have not examined eggs of either *argyritarsis* or *sawyeri*. Differentiation of the larva of *sawyeri* by Causey et al. (1943) was based on the shape of the lanceolate branches of the palmate seta on segments II-VII. These authors did not note the presence of the weakly-developed palmate setae on the metathorax or the first abdominal segment. Their differentiation of the pupae was based

]n the relative lengths of setae 9-IV and 9-V, with *sawyeri* having 9-IV less than 0.2 the length of 9-V and *argyritarsis* having 9-IV more than 0.2 the length of 9-V. Lane (1949:402) reduced *sawyeri* to a subspecies of *argyritarsis*. I am elevating *sawyeri* to specific status based on the numerous correlated characters of the adult female, male genitalia, pupa and larva discussed above.

BIONOMICS. The immatures of *sawyeri* have been collected only in mountainous forest pools in Ceara (Serra da Ibiapaba), Brazil (Deane, M. P. et al. 1946:45). Causey et al. (1944:2) collected 315 adult females on horse bait from the above region. The eggs were reared from the above females and the life stages described. The holotype female and paratype males and females, larvae, and larval and pupal skins were obtained in this manner. Adults were always sparse and were never collected inside houses.

MEDICAL IMPORTANCE. *Anopheles sawyeri* is not believed to be a vector of malaria since the type locality, the only place where it has been collected, is apparently free of malaria (Causey, Deane, Deane and Sampaio 1943:11).

DISTRIBUTION (Fig. 1). *Anopheles sawyeri* is known only from the type locality. Females were collected on horse bait on the plateau of Serra da Ibiapaba near Sao Benedito in the state of Ceara, Brazil.

Material Examined: 11 specimens: 1 male, 2 females, 3 pupae, 5 larvae.

BRAZIL (11 specimens: 2F, 1M, 3p, 5L). **Ceara:** Sao Benedito, L. Causey, 1F (holotype), 1F, 1M, 3p, 5L.

LANEI SUBGROUP

3. *Anopheles* (*Nys.*) *lanei* Galvao and Amaral
Figs. 1, 3, 9

1938. *Anopheles* (*Nyssorhynchus*) *lanei* Galvao and Amaral 1938:8-16. TYPE: *Holotype* female (86-1, 22), Emilio Ribas, near Campos do Jordao (Sao Paulo), elev. ca. 1,570 m, Feb-Mar, 1938 (FH).

Anopheles (*Nyssorhynchus*) *lanei* of Lane (1939:44, 49; 1944:265; 1949:403, 410, 413, 415; 1953:236, 238, 249-251); Pinto (1939:294, 345-346, 348, 355, 385, 387-389, 405); Galvao (1940:400, 406, 409, 411, 417, 419-420, 449-450, 467, 474-475; 1941b:514, 516-517, 520, 559; 1943:142-151); Correa and Ramos (1942a:38-39; 1944b:127, 129, 137); Unti and Ramos (1942:95-96, 104-105; 1943:27-28, 30); Fonseca and Unti (1943:45-50); Russell et al. (1943:37, 41, 46); Unti (1943a:110); Vargas (1948:155-156; 1959:370-381); Levi-Castillo (1949:11, 16, 29, 54-58, 67-89, 93, 96, 99, 102; 1951:78); Gabaldon and Cova Garcia (1952:177, 191, 199, 202-206); Horsfall (1955:-171); Andrade and Brandao (1957:391); Bejarano (1957:348; 1959a:313); Rachou (1958:146); Senevet (1958:131); Castro (1959a:173); Stone et al. (1959:33); Forattini (1962:325, 407, 419-420, 474, 483, 489); Garcia and Ronderos (1962:137, 139-140); Ferreira (1964:337); Knight and Stone (1977:63).

Anopheles lanei of Unti and Ramos (1942:95-96, 102, 104-105); Russell et al. (1943:37, 41, 46); Unti (1943b:96-102); Galvao and Damasceno (1944:75); Forattini (1961:177, 182); Gorham et al. (1967:2, 5, 13, 45, 56); Forattini et al. (1970:13).

Anofeles lutzi lanei of Unti (1940b:505).

FEMALE. Wing: 5.3 mm. Proboscis: 2.75 mm. Forefemur: 2.5 mm. Abdomen: 5.5 mm. **Head:** Interocular space moderately wide, 0.3-0.5 diameter of pedicel. Frontal tuft with 6,7 pairs of long, white setiform scales. Ocular area with short, white decumbent scales. Proboscis about 1.1 length of forefemur. Palpus 0.95 length of proboscis; palpomere 1 with numerous long, erect, brown scales; palpomeres 2,3 with purple-tinted brown scales and small, apical, white band; palpomere 4 without white scales; palpomere 5 white, without basal dark band. **Antenna:** Length 0.7 of proboscis. Pedicel pruinose with several decumbent white scales. Flagellum with light elongate scales on flagellomeres 1-3. Flagellomeres 4-6 without scales. **Thorax:** Nonpruinose dark areas of scutum as in section. Scales of scutum white except for brown scales of lateral anterior promontory. Scales of scutum much longer than in other species of group. Scutellum posteriorly with 15-17 well-developed, dark brown setae and 10-14 white to light brown, moderately-developed setae. Pleuron with light pruinose areas as in section. *Ap* with numerous, dark brown, erect scales. *PsA* with 4-6 silver setae. *Ps* with well-developed dark setae; without white scales. Upper *Mks* with 1-3 well-developed, dark setae; 4,5 decumbent, white scales. Lower *Mks* with 2 moderately-developed, brown setae, 4-6 white, decumbent scales. Upper *Mam* with white scales along row of light setae. Anterior *Mam* without scales. *Pk* rubbed, setae and scales not seen. **Legs:** Generally as in section. Forefemur and foretibia without enlarged light scale areas. Foretarsomere 1 with cream scales on ventral surface, without basal light spot and with apical white band; tarsomere 2 with apical 0.4 white; tarsomere 3 with apical 0.4-0.6 white; tarsomeres 4,5 entirely dark. Midtarsomeres 1,2 with apical white band; tarsomere 3 apically with light scales; tarsomeres 4,5 entirely dark. Hindtarsomere 1 light brown, apically with white band; tarsomere 2 with basal 0.55 dark; tarsomeres 3-5 always entirely white. **Wing:** Dark scales of vein C and to lesser extent R1, R_2, R_{4+5} with dark blue tint; dark scales of other veins brown. Light scales of wing silver. Vein C basal dark spot reduced to few scales, never greatly enlarged; humeral and subbasal dark spots absent; humeral and subbasal light spots fused, more than 10.0 length of basal dark spot; presectoral light spot absent; sectoral dark spot reduced; sectoral light spot large. R3 with 2 dark spots. M predominantly light, without basal dark spot, with apical dark spot just basad of furcation. **Abdomen:** Tergum I without light scales. Terga II-VII with numerous white and cream scales. Tergum VIII with numerous golden scales. Caudolateral tufts inconspicuous, especially on segments II, III, present on segments II-VII as light brown patches of erect scales. Sterna as in group.

MALE. No specimens available.

MALE GENITALIA (Fig. 9). **Segment VIII.** Tergum with row of well-developed, long setae along lateral margin; medially with narrow dark stripe of moderately large dark scales and laterally with light scales. Sternum with strongly developed row of setae, and 2 patches of dark scales along caudal border. **Segment IX:** Sternum rectangular, spiculose, moderately long (about 0.2 length of gonocoxite); antero- and posteromedial borders moderately emarginate. Apodeme not developed. **Gonocoxite:** Length about 2.2 maximum width. Tergal surface with 5 large tergomedial setae, apicolateral seta and single apicomesal seta. Parabasal seta retrorsely hooked, about 3.1 length of

its tubercle. Apodeme of gonocoxite about 0.15-0.18 length of gonocoxite. Accessory setae long; dorsal setae 0.55 length of gonocoxite, ventral seta about 0.6 length of dorsal seta; both setae apically hooked. Internal setae equal in length to ventral accessory setae, curved mesad. **Gonostylus:** Gonostylar claw moderately short, about 0.35 length of seta *b*, moderately sclerotized, apically flattened. **Dorsal Claspette:** About 0.2 length of gonocoxite; pedicel moderately broad, narrowed in middle; apex broad with usually 2 setae; base strongly curved laterad. Setae about 1.65 length of dorsal claspette; dorsal seta without basomesal projection. **Ventral Claspette:** About 0.20-0.25 length of gonocoxite, without spicules; apex with pair of very large caudolaterally-directed auriculate lobes separated by large median sulcus, apex not truncate. Preapical plate indistinct. Basal lobules laterally expanded at base, separated by broad median cleft. Refringent structure not developed. **Phallosome:** About 0.4 length of gonocoxite, about 1.7 length of ventral claspette. Aedeagus with apex always sclerotized, width 1.2 length; ventromesal subtriangular projections weakly sclerotized, indistinct, widely spaced, never forming collar; aedeagus always with pair of subapical, moderately sclerotized, laterally curving leaflets about 0.3 length of phallosome, leaflets always inserted distad of widest part of aedeagus.

PUPA, LARVA. No specimens available.

DISCUSSION. The monotypic Subgroup Lanei can be distinguished from all other subgroups in the Argyritarsis Group in the **female** by the combination of: (1) interocular space moderately wide, 0.3-0.5 diameter of pedicel, (2) palpomere 4 without white scales, (3) palpomere 5 without basal dark band, (4) flagellomeres 1-3 only with light scales and flagellomeres 4-6 without scales, (5) anterior *Mam* without scales, (6) upper *Mam* with white scales, (7) scales of scutum long and light except for lateral anterior promontory, (8) foretarsomere 1 without basal light spot, (9) hindtarsomere 2 with basal 0.55 dark, (10) vein C with: a) basal dark spot reduced to few scales, b) humeral and subbasal light spots fused, more than 10.0 length of basal dark spot and c) presectoral light spot absent, (11) R_3 with 2 dark spots, and (12) caudolateral scale tufts present on segments II-VII; in the **male genitalia** by: (1) tergum VIII medially with longitudinal dark stripe, laterally with light scales, (2) sternum VIII with 2 patches of dark scales along caudal border, (3) sternum IX with antero- and posteromedial borders moderately emarginate, (4) length of gonocoxite about 2.2 of maximum width, (5) dorsal seta of dorsal claspette without basomesal projection, (6) apex of ventral claspette with pair of very large caudolaterally directed lobes separated by large median sulcus, apex not truncate, (7) phallosome about 0.4 length of gonocoxite, and (8) aedeagus: a) apex always sclerotized, b) ventromesal subtriangular projections weakly sclerotized, indistinct, widely spaced, and c) leaflets inserted distad of widest part of aedeagus.

Because the pupal and larval stages were not available for study, the following diagnosis of these stages was taken from Galvao and Amaral (1938:8-16), Galvao (1940:474-475; 1943:157, 160) and Lane (1953:249-251). The characters reported for the immature stages of *lanei* which distinguish it from the other species of the Argyritarsis Group are as follows: in the **pupa:** (1) seta 9-II-VII short and well developed, (2) seta 1-P (apical seta of the paddle) single, short and thick, and (3) seta 2-P (subterminal seta of the paddle) single, slender and long; and in the **larva:** (1) seta 3-C conspicuously

dendritic, (2) setae 2-C widely spaced, clypeal index 1.3, (3) seta 4-C 3,4b, and (4) seta 1-II not palmate, but fanlike with thin branches. Galvao and Amaral described the eggs as having an exochorion with "granulations," forming a discrete regular pattern between the floats and frills, in general very similar to the eggs of *strodei*. However, it is possible that the eggs, as in other species in the subgenus, may be highly polymorphic.

Interpopulational variation cannot be discussed because *lanei* has only been collected in its type locality in the Serra da Mantiqueira near Campos do Jordao, Sao Paulo, Brazil. Similarly, I cannot discuss intrapopulational variation because I have examined only one female adult paratype and 2 male genitalia on slides (which were not labelled but marked as being from larvae with branched clypeals and presumed to be *lanei*). Belkin et al. (1971:5) report that the holotype female (86-1, 220) and allotype were deposited in the Departamento de Parasitologia, Faculdade de Medicina (FMSP), Sao Paulo, Sao Paulo. On a visit to the Faculdade de Higiene e Saude Publica, Sao Paulo in January 1975 where material from the FMSP has been transferred, I could not find either the holotype or allotype of *lanei*.

As indicated in the discussion of the Argyritarsis Group, *lanei* exhibits the following combination of apomorphic characters that are essentially those characters used to distinguish it from other species in the group: in the **female:** (1) extremely large size, wing length 4.0-5.2 mm, (2) vein C with humeral and subbasal light spots fused to form large, light, basal spot, (3) white scales on wing, and (4) yellow scales on tergum VIII; in the **male genitalia:** (1) ventral claspette with large apical lobes directed caudolaterally and (2) aedeagus apex entirely sclerotized; and in the **larva:** (1) seta 3-C with dendritic branches and (2) seta 1-II of abdomen not palmate, fanlike with thin branches.

BIONOMICS. *Anopheles lanei* is a rare species that has been collected only on a few occasions. It has been found in or near the type locality, Emilio Ribas, Sao Paulo, Brazil. The larvae of *lanei* were originally collected by Galvao and Amaral (1938:13) in clear permanent water at 1,570 m. According to Galvao (1940:475), the larvae have been collected from a pond connected to a river, the pond being very clear and devoid of vegetation and other insects. The species appeared to be zoophilic since it did not invade the dwellings of humans only 50 m from the larval breeding site. The species feeds only rarely on man and in the presence of a horse, does not attack man at all (Galvao 1940:475). The specimens were captured during February and March, 1938. The species seems to be restricted to higher, cooler elevations of the Serra da Mantiqueira typified by the flora associated with *Araucaria*. Galvao (1940:475) states that *lanei* might be encountered in the "zonas dos pinheirais" of Parana, Brazil. However, Correa and Ramos (1942a:38) do not list *lanei* as occurring south of the state of Sao Paulo. Correa and Ramos (1944b:129, 137) list *lanei* from only the city of Campos do Jordao in the state of Sao Paulo. Unti and Ramos (1942:96-106) stated that Unti captured *lanei* in a house at 2000 hr when the outside ambient temperature was 0° C. The adult female was feeding on a person in the village of Homem Morto, and the house was near domestic animals such as cows and horses. Unti and Ramos (1943:28) found immatures of *lanei* in clear water in springs, streams, ditches and marshes with *argyritarsis*, *strodei* and *lutzi*. They also collected *lanei* on a burro.

MEDICAL IMPORTANCE. Because of the restricted distribution and the

relative scarcity of *lanei*, its ability to transmit malaria has not been studied. All indications are that *lanei* is not involved in malaria transmission. Reports indicate that *lanei* is zoophilic and exophilic and it apparently feeds on domestic animals more commonly than on man.

DISTRIBUTION (Fig. 1). *Anopheles lanei* is known from only near its type locality, the Serra da Mantiqueira in the state of Sao Paulo at elevations between 1,500 and 1,750 m. The species has been collected in February and March and often in cold weather.

Material Examined: 3 specimens: 1 female, 2 male genitalia.

BRAZIL (3 specimens: 1F, 2M gen). **Sao Paulo:** Campos do Jordao, (paratype), 1F, 2M gen.

PICTIPENNIS SUBGROUP

4. *Anopheles* (*Nys.*) *pictipennis* (Philippi)

Figs. 1, 3

1865. *Culex pictipennis* Philippi 1865:596. TYPES: 2 males; Santiago (Santiago) July 1859; Aconcagua province, Chile, Sept 1863 (NE; Belkin et al. 1968:21).

1852. *Culex variegatus* E. Blanchard 1852:333. TYPE: Lectotype female, Arquero (Arqueros?), Chile (MNHP; designation of Belkin, 1968b:10). Name rejected because it is a junior primary homonym of *Culex variegatus* Schrank, 1791 [Arts. 59, 60 ICZN].

1901. *Anopheles bigotii* Theobald 1901:135. TYPE: Holotype female, Chile, 1894, J. M. F. Bigot (NE; Belkin et al. 1968:21). Synonymy with *pictipennis* by Dyar (1918:150).

1905. *Culex chilensis* R. Blanchard 1905:289. Nom. nov. for *variegatus* Blanchard, non Schrank 1781 (Belkin 1968b:10).

Anopheles (*Nyssorhynchus*) *pictipennis* of Root (1922a:322; 1922b:388); Dyar (1928:427, 431, 440-441); Galvao and Lane (1937a:76); Komp (1936a:67); Lane (1939:32; 1944:266; 1949:403, 413-414; 1953:236, 239, 254-255); Galvao and Amaral (1940:150); Galvao (1941b:507, 514, 560-564, 571-572; 1943:142-151); Neghme (1943c:273-276); Lane and Neghme (1946:83-93); Vargas (1948:155-156; 1959:370, 383); Levi-Castillo (1949:13, 16, 29, 54-58, 67-89, 93, 96, 99, 102); Gabaldon and Cova Garcia (1952:177, 201-206); Horsfall (1955:170-171); Bejarano (1957:308); Senevet (1958:131); Castro (1959a:174); Stone et al. (1959:34); Forattini (1962:474, 491); Garcia and Ronderos (1962:136-138, 141); Knight and Stone (1977:64).

Anopheles pictipennis of Knab (1913:37); Dyar (1919:86, in part; 1921:149, in part); Edwards (1930:106-107); Martini (1931a:120; 1931b:218); Neghme (1943a:265-269; 1943b:269-271); Russell et al. (1943:36, 38, 48); Stuardo (1946:51); Forattini (1961:169-170, 178, 183); Forattini et al. (1970:17); Gorham et al. (1971:2-4, 17, 39).

Anopheles (*Cellia*) *pictipennis* of Dyar (1918:150, in part).

Anopheles (*Myzorhynchella*) *pictipennis* of Edwards (1932:43-45).

Culex pictipennis of Hunter (1900:281); Dyar (1924:130).

Culex bigotii of Theobald (1910:69).

Anopheles albitarsis of Covell (1927:8, 9, in part).

Anopheles (*Nyssorhynchus*) *argyritarsis* of Christophers (1924:9, 37-39, 91, in part); Dyar (1925:193, in part).
Anopheles punctipennis of Knab (1913:37).
Psorophora (*Grabhamia*) *chilensis* of Edwards (1932:126).
Psorophora chilensis (Nomen dubium) of Stone et al. (1959:131).

FEMALE. Wing: 4.35 mm. Proboscis: 2.6 mm. Forefemur: 2.6 mm. Abdomen: 4.1 mm. **Head:** Interocular space wide, 1.0 diameter of pedicel. Frontal tuft with 4,5 well-developed, short and stout, silver setiform scales dorsally extending onto frons along row of decumbent white scales; dark scales of head brown, erect and spatulate. Ocular area without scales. Proboscis 1.0 length of forefemur. Palpus 0.95 length of proboscis; palpomeres 2-4 predominantly with brown scales, apically with small white band; palpomere 5 with basal 0.4 dark, remainder entirely white. **Antenna:** Length 0.6 of proboscis. Pedicel with 5-8 broad white scales. Flagellomere 1 basally with small white scales, apically with long light and dark scales; flagellomeres 2-5 with distinct white scales; flagellomere 6 with very small white scales. **Thorax:** Nonpruinose dark areas of scutum essentially as in section except for pair of broad subdorsal dark stripes extending from scutal angle to scutellum, widened to include much of scutal fossal area. Scales of scutum silver except for cream scales of posterior median scutal area and several brown scales on median anterior promontory; scales of acrostichal line in single row, with scales larger and less numerous than in other species of section. Scutellum with approximately 16 well developed, brown setae and 7-10 moderately developed, brown setae along posterior margin. Pleuron with light pruinose areas essentially as in section. *Ap* anteroventrally with 8-12 brown, erect scales. *PsA* without visible setae. *Ps* with several weakly developed setae, anteroventrally with white scales. Upper *Mks* with 1 moderately developed, light seta and 10-16 large, spatulate, white scales. Lower *Mks* with 5-8 broad, light, squame scales. Upper *Mam* with row of approximately 15 short and long, white scales extending along line of setae. Anterior *Mam* without scales. *Pk* area with several poorly developed, light setae and 4-6 white scales. **Legs:** Generally as described in section. Forefemur and foretibia with enlarged light scale areas. Midtibia with wide longitudinal light stripe. Foretarsomere 1 with basal light spot in 0.3-0.4 of proximal half of tarsomere, apical 0.15-0.20 with light band; tarsomere 2 darker than preceding tarsomere, apical 0.25-0.30 with light band; tarsomere 3 dark except for few apical light scales; tarsomeres 4 and 5 dark. Midtarsomere 1 dark, with intermingled light and dark scales on basal 0.2 of tarsomere, apical 0.15 with light band; tarsomere 2 dark, apical 0.15 with light band; midtarsomeres 3-5 dark. Hindtibia with wide light stripe extending length of segment. Hindtarsomere 1 with intermingled light and dark scales on basal 0.3, apical 0.15 with light band; tarsomere 2 always with more than basal 0.75 dark. **Wing:** Dark scales dark brown with purple tint. Light scales white. Vein C basal dark spot large, 2-3 of humeral light spot, never greatly enlarged; humeral and subbasal light spots not fused; subbasal and presectoral light spots absent; sectoral light spot normally developed. R_3 with 2 dark spots. M predominantly dark with 1 large medial light spot, small basal light spot and occasionally small apical light spot. Other veins as in section except for unusually large dark spots. **Abdomen:** Tergum I without light scales. Terga II-VIII with numerous, large, cream

scales. Caudolateral scale tufts absent. Sterna essentially as in Group.

MALE. Wing: 4.0 mm. Proboscis: 2.75 mm. Forefemur: 2.0 mm. Abdomen: 3.9 mm. Essentially as in section. **Head:** Proboscis approximately 1.4 length of forefemur, with dark brown, appressed scales and brown, decumbent scales, and small, apical, light band. Palpus almost equal to proboscis; palpomere 1 with brown, erect scales; palpomere 2 basally brown, apical 0.15-0.25 with light band; palpomere 3 with basal 0.6-0.7 light brown, apical 0.25-0.35 white with apical golden band 1-3 scales wide; palpomere 4 dorsally dark brown, basally with white band, apically with few cream scales; palpomere 4 ventrally bare; palpomere 5 usually bare, occasionally with brown scales. **Antenna:** Approximately 0.85 length of proboscis. Pedicel pruinose, diameter about 1.8 that of female. Flagellomere 1 about 1.5 length of individual flagellomeres 2-11, dorsomesally with numerous short and long white scales extending to apex of flagellomere 2; flagellomere 12 approximately 4.0 length of individual flagellomeres 2-11; flagellomere 13 approximately 0.5 length of flagellomere 12. **Legs:** Claws as in section.

MALE GENITALIA. No specimens available. The following description is based on the descriptions and illustrations of Lane and Neghme (1946:83-93), and Lane (1953:254-255). **Gonocoxite:** Conical, broad. Parabasal seta moderately short and thick; curved cephalad; arising from short tubercle. Accessory seta thick, pointed, slightly curved caudad, without retrorse hook. Internal seta slender, straight; located distad of accessory setae; in one specimen 1 internal seta on one gonocoxite, double on other. **Dorsal Claspette:** With 2 large, curved setae at apex; with third smaller, more slender, straight seta arising immediately basad of apex. **Ventral Claspette:** Entirely covered with fine spicules. **Phallosome:** Aedeagus broad, apex blunt and weakly sclerotized; with pair of very large, sclerotized, subapical, laterally extending leaflets usually striated and serrated on lateral margin. **Proctiger:** Laterally covered with fine spicules; apex membranous.

PUPA. No specimens available, although 3 pupal skins were available to Lane and Neghme (1946).

LARVA. No specimens available. The following description is based upon the descriptions and illustrations of Lane and Neghme (1946), and Theobald (1901:135; 1910:69; as *bigotti*). **Head:** Head capsule with dark areas and spots. Setae 2-C widely spaced, clypeal index 0.83. Setae 2-4-C 3,4b, large. Seta 11-C plumose, inserted at base of antenna. Seta 12-C apparently 2b. Seta 15-C apparently 6b. **Antenna:** Heavily pigmented, with spicules. Seta 1-A inserted in basal 0.16. **Thorax:** Setae 1-3-P not inserted on common tubercle; 1-P fanlike, with 8 thin branches, not plumose; 2-P plumose; 3-P single. Seta 3-T not palmate. **Abdomen:** Tergal plates present between segments. Seta 1-III-VII, with lanceolate branches all inserted on one side of shaft. Seta 6-III strongly developed, 7-III weakly developed. **Spiracular Lobe:** Pecten with 15 teeth as follows: 7 long, followed by several, usually alternating pairs of 1 long and 1 short.

DISCUSSION. The monotypic Subgroup Pictipennis can be distinguished from all other subgroups in the Argyritarsis Group in the **female** by the combination of: (1) interocular space wide, 1.0 diameter of pedicel, (2) palpomere 4 predominantly with brown scales, (3) palpomere 5 with basal 0.4 dark, (4) flagellomere 1 with light and dark scales and flagellomeres 2-6 with white scales, (5) anterior *Mam* without scales, (6) upper *Mam* with row of

approximately 15 short and long, white scales, (7) scales of scutum larger than in other species in section and silver except for cream scales of posterior median scutal area, (8) foretarsomere 1 with basal light spot in 0.3-0.4 of proximal half of tarsomere, (9) hindtarsomere 2 always with more than basal 0.75 dark, (10) vein C with: a) basal dark spot large, 2.0-3.0 of humeral light spot, b) humeral and subbasal light spots not fused, and c) subbasal and presectoral light spots absent, (11) R3 with 2 dark spots, and (12) caudolateral scale tufts of abdomen absent. Interpopulational and intrapopulational variation cannot be discussed as I have examined only 3 adult specimens. Because of the many autapomorphic characters of *pictipennis* resulting in a distinct morphological "gap" between this species and the remainder of taxa in the Argyritarsis Group, I am recognizing a distinct monotypic subgroup, Pictipennis, for this species.

Lane and Neghme (1946) marked specimen 6,001 in the collection, at the Faculdade de Saude Publica [FH], Sao Paulo, as allotype of *pictipennis*. During a visit to the FH in January 1975, I could not locate this specimen. According to Belkin et al. (1968:21) the types of *pictipennis* and its synonym *bigotii* are "non-existent."

Anopheles pictipennis and the species of the Albitarsis Group are synapomorphic for the following characters; in the **female** by: (1) palpomere 5 basally with dark band, (2) flagellomeres 2-6 of antenna with light scales, (3) hindtarsomere 2 dark on more than basal 0.75, and (4) subbasal and presectoral light spots of vein C reduced or absent; and in the **larva** by: (1) seta 1-A inserted near the base of antenna and (2) setae 2-C widely separated, clypeal index about 0.8.

In addition to sharing several apomorphic characters with the Albitarsis Group, *pictipennis* has retained the following plesiomorphic characters shared with the Myzorhynchella Group of *Nyssorhynchus*; in the **female** by: (1) reduction in number of thoracic and abdominal scales, and (2) palpomeres usually predominantly dark; in the **male genitalia** by: (1) leaflets of aedeagus very broad, striated and serrated, and (2) dorsal claspette with 2 large setae and spinelike, subapical seta; and in the **larva** setae 1-P widely separated and fanlike with filamentous branches. These plesiomorphic characters led previous workers (notably Edwards 1932:45) to consider *pictipennis* part of the "Group B (Myzorhynchella)" of *Nyssorhynchus*.

Philippi described *pictipennis* as a species of *Culex* in 1865 from a male collected in July 1859 in Santiago, Chile and a male collected in September 1863 in Aconcagua Province, Chile. Theobald (1901:135-137) described another species, *Anopheles bigotii*, from a single female in Bigot's collection from Chile. Knab (1913:36-37) synonymized *bigotii* with *albitarsis* and placed *pictipennis* [as "*punctipennis* Phillipi (*Culex*)"] in a list of those species of *Anopheles* which he did not recognize. Dyar (1918:150) treated *pictipennis* as distinct and synonymized *bigotii* and *albitarsis* with *pictipennis*. This apparently resulted from Knab's (1913) synonymy of *albitarsis* and *bigotii* with *pictipennis*, as Dyar did not have *pictipennis* before him at the time of his synonymy. Later Dyar (1925:193-194) listed *pictipennis* along with *albitarsis*, *bigotii*, *braziliensis* and *allopha* as synonyms of *argyritarsis*. Dyar subsequently (1928:440-444) recognized *pictipennis* as distinct. I agree with Dyar (1918) and subsequent authors who synonymized *bigotii* with *pictipennis*. I recognize the latter species as very distinct from *argyritarsis* and *albitarsis*

and other species in the subgenus.

The nominal species *variegatus* was described by E. Blanchard in 1852 as a *Culex*; however, the name was preoccupied by *Culex variegatus* Shrank 1781. For this reason R. Blanchard proposed the name *chilensis* in 1905 as a replacement name for *variegatus* E. Blanchard, 1852. Belkin (1968b:10-11) examined the original specimen of *Culex variegatus* E. Blanchard, 1852 in NMHP and designated the specimen as the lectotype. He also synonymized the lectotype with *Anopheles pictipennis* Phillipi, 1865. In accordance with Articles 59 and 60 of the International Code of Zoological Nomenclature, *variegatus* E. Blanchard, 1852 is permanently rejected as a junior primary homonym and replaced by *chilensis* R. Blanchard, 1905. The nominal species *pictipennis* Philippi, 1865 has priority over *chiliensis* R. Blanchard, 1905.

BIONOMICS. *Anopheles pictipennis* evidently occurs only in Chile and possibly in Argentina. There have been only a few studies dealing with either the taxonomy or bionomics of *pictipennis*. Philippi (1865:596-597) originally found an adult male in his home in 1859 in Santiago. The larvae probably came from permanent or semipermanent waters (Belkin et al. 1968:21). According to Dyar (1928:441), Edwards and Shannon found the larvae of *pictipennis* in drying pools in the rocky bed of a stream, among green algae and watercress at Llai-Llai (possibly Llai-Llay) in Aconcagua province, Chile. Edwards (1930:106) reported that Father F. Joffuel had collected specimens at Marga-Marga, Aconcagua, Chile. He also wrote that *Anopheles* does not occur in South America south of about 35° latitude. Edwards and Shannon (in Dyar 1928) examined numerous ground pools but could not find any anopheline larvae in Patagonia.

Neghme (1943b:269-271) reported the occurrence of autogenous and stenogamous strains of *pictipennis*. The strains were derived from larvae collected in nature and reared in the laboratory on a rich infusion of protozoa and yeast, and from eggs oviposited by field-caught females. These larvae developed in the dark in a room maintained at 23.5 to 27°C with a relative humidity of 38 to 52%. The adults were fed a 10% glucose solution. From 4 males and 3 females (which were 2 to 4 days old) Neghme obtained 72 eggs on the first day of oviposition and 84 eggs on the next. Neghme (1943a:267) reported that *pictipennis* is predominantly zoophilic. In Santiago, this species infrequently feeds on man, but is highly attracted to domestic animals.

MEDICAL IMPORTANCE. Russell et al. (1943:48) reported that the relation of *pictipennis* to malaria was unknown. In Chile malaria is endemic in the northern part of the province of Tarapoca, between 18° 25' and and 20° 35' S latitude. There *Anopheles pseudopunctipennis* is the only anopheline encountered. Malaria is rare in the central part of Chile, in the provinces of Santiago and Valparaiso. Before 1943, only 3 cases of malaria had been reported from that region (Neghme 1943a).

Neghme (1943a:265-268) investigated the susceptibility of *pictipennis* to *Plasmodium vivax*. He fed 23 mosquitoes on human gametocyte carriers that had been artificially infected with *P. vivax* malaria. The mosquitoes were kept for 7 to 19 days at a temperature of 20 to 27° C and at a relative humidity of 55 to 88%. He found that 8 of the 23 mosquitoes or 34.7% became infected. Two of the mosquitoes had oocysts on their midgut and six had sporozoites in their salivary glands. Neghme concluded that "although *A. pictipennis* can be infected with human malaria parasites, its preference for animal blood and its relative scarcity might explain why there is not malaria endemicity in that

region of Chile, where this anopheline mosquito is the only one found."

DISTRIBUTION (Fig. 1). *Anopheles pictipennis* has been reported by Russell et al. (1943:48) from Brazil, Chile and Argentina. I cannot confirm reports of *pictipennis* outside of Chile on the basis of my survey of the literature.

Anopheles pictipennis is evidently restricted to the central part of Chile, between the 32nd and 34th parallels, in the provinces of Aconcagua, Valparaiso and Santiago and is apparently the only anopheline in this area. Although *pictipennis* may exist in western Argentina, its presence in Brazil seems unlikely.

Material Examined: 4 specimens: 1 male, 3 females.

CHILE (4 specimens: 1M, 3F). **Santiago:** Santiago, 1 Jan 1927, 1M, 3F.

DARLINGI SUBGROUP

5. *Anopheles* (*Nys.*) *darlingi* Root

Figs. 1, 3, 10, 11

1926. *Anopheles* (*Nyssorhynchus*) *darlingi* Root 1926b:706-709. TYPE: *Lectotype* male, Caxiribu, near Porto das Caixas (Rio de Janeiro), Brazil, 12 Mar 1925 (USNM, designation by Stone 1943:30; Belkin et al. 1971:5).

1937. *Anopheles* (*Nyssorhynchus*) *darlingi* var. *paulistensis* Galvao, Lane and Correa 1937:37-40. TYPE: Adults, eggs, Novo Oriente, 3 km from Lussanvira, near Pereira Barreto (Sao Paulo), Brazil, Apr-May, 1937 (LU).

Anopheles (*Nyssorhynchus*) *darlingi* of Root (1926b:686, 690, 692-700, 702, 706-711, 714, 716-717; 1932:779, 781); Davis (1928b:549); Dyar (1928:427, 430, 445-446, 487); Lima (1928:108); Hill (1930:712); Senevet (1931:108, 111; 1932:251; 1934:68; 1937:360, 362-363, 381; 1948a:287; 1948b:433-440; 1958:130); Shannon (1931:10, 22; 1933:117-119, 124-126, 128-132, 140); Edwards (1932:44); Antunes and Lane (1933:97); Galvao and Lane (1937a:75, 77-78; 1937e:213, 215-216, 231, 234-236; 1941:10-11); Komp (1936a:67; 1941a:659-670; 1941b:793; 1942:3, 5, 7, 24-27, 34, 37, 39, 41, 44, 60-67, 80, 112-115, 132, 152-153, 168, 179, 182); Antunes (1937:79); Rozeboom (1938a:97; 1942:237-238, 254-255); Galvao (1938a:51; 1940:400, 403, 405-406, 409, 413, 416, 420, 428, 430, 441, 449-450, 453, 457-458, 463-471, 476; 1941b:509, 514-515, 517, 520, 542; 1943:142-151); Lane (1939:25; 1944:263-265; 1949:402, 410, 413, 414; 1953:235-236, 238-239, 247-249); Pinto (1939:294, 320, 345-346, 348, 354-355, 361, 366, 370, 374-388, 421, 423); Correa (1941:40-54; 1943:121-125, 130-132); Gabaldon et al. (1941:3, 22); Unti (1941:7; 1943a:68; 1943c:110); Causey et al. (1942:122-126); Correa and Ramos (1942a:37-44, 46-47; 1942b:379-387; 1942c:320-322; 1944b:127-129, 135-151; 1947:16); Floch and Abonnenc (1942a:2; 1942b:2; 1947:2, 5-7); Galvao and Damasceno (1942b:123); Galvao et al. (1942:51-111); Simmons and Aitken (1942:45, 52, 60, 62, 93-94); Unti and Ramos (1942:94-95, 99-103; 1943:30); Barretto and Coutinho (1943:320-323); Bruce et al. (1943:437-440); Cerqueira (1943:18; 1961:123-124); Coda (1943:186, 188-190, 198); Coutinho (1943:70; 1946:442-457); Cova Garcia (1943:467-472); Galvis (1943:54, 78, 81-83, 85, 95-96); Ross and Roberts (1943:29-30); Causey et al. (1944:1-2, 5, 7; 1946:26, 31); Galvao, Lane and Unti

(1944:37); Pelaez (1945:70-71, 73, 75, 77); Schiavi (1945:70); Deane, L. M. et al. (1946:2, 3, 5-6, 8-9, 11, 15; 1948:830, 833-853, 867-868, 874, 892, 933-965); Deane, M. P. et al. (1946:22, 45, 50); Gabaldon and Cova Garcia (1946a:19, 21, 24-32; 1946b:78-79, 125; 1952:177, 182, 186, 189, 202-206); Bates (1947:155-158); Deane (1947:5, 19-27, 29-35); Penido et al. (1947:713-736); Correa (1948:177-189); Deane and Damasceno (1948:501-508); Giglioli (1948:71-85); Pessoa (1948:12-13); Pereira Passalacqua (1948:196-203); Ricciardi (1948:535-539); Vargas (1948:155-156, 158; 1959:370, 376, 382); Bates and Zulueta (1949:134-136, 139, 140, 148, 149); Levi-Castillo (1949:9-11, 16, 29, 32, 54, 58, 67, 89, 93, 96, 99, 102; 1951:78; 1958:870); Correa et al. (1950:280-281); Kuyp (1950:14); Vargas and Martinez Palacios (1950:5, 9, 42, 46, 50, 53, 57, 58, 126-130); Carvalho and Rachou (1951:474-485); Pinotti (1951:664, 666-667, 673, 682); Rachou and Ricciardi (1951:424-426, 428-447); Leon (1952:4, 6, 7); Andrade (1953:148); Rachou et al. (1954:178, 180-188); Horsfall (1955:172, 182-184); Senevet and Andarelli (1955:339); Bejarano (1956a:9, 20-21; 1957:308, 318, 325-326, 348; 1959a:305, 312, 322-326, 328; 1959b:189-196; 1973:11-18); Stone and Knight (1956:277); Andrade and Brandao (1957:391-395, 397-416); Rachou (1958:146-147, 150-161, 163-166, 168-171, 178); Carcavallo and Martinez (1959:98-100); Castro (1959b:449-450, 453); Martinez et al. (1959:111); Schreiber and Guedes (1959a:97-98; 1959b:128-129; 1960:355-358; 1961:657-658); Stone et al. (1959:32); Andrade and Leal (1960:147-153); Fauran (1961:10); Forattini (1962:325, 371, 381, 405, 414, 474, 483, 495, 535, 541, 543-555, 575-579); Garcia and Ronderos (1962:136-137, 139-140, 156-158); Kitzmiller (1963:345-347, 350, 352; 1967:135, 137, 142; 1977:117); Prosen, Carcavallo and Martinez (1963:67, 112, 115-116, 120); Ferreira (1964:333, 335, 337-339, 341-342, 345, 346); Deane et al. (1968:338); Xavier and Mattos (1970:443); Morales-Ayala (1971:139); Kreutzer et al. (1972:555-565; 1975:354, 356, 358-364); Knight and Stone (1977:62). Xavier et al. (1979:3); Clark-Gill and Darsie (1983:210, 245, 246); Peyton et al. (1983:65); Xavier et al. (1983:129).

Anopheles darlingi of Covell (1927:25); Hill (1928:355-357); Pinto (1930:154; 1944:258, 261); Davis and Kumm (1932:93-95); Kumm (1932:1-6); Komp (1935:204-216); Correa (1938:105); Kumm and Novis (1938:507); Barretto (1939:116-122); Gabaldon, Lopez and Ochoa Palacios (1940:33); Gabaldon, Ochoa Palacios, Perez-Vivas (1940:41-56); Cova Garcia and Marcano (1941:57-58); Kumm and Ram (1941:556-559); Rozeboom (1941:103-104); Unti and Ramos (1942:94-95, 99-103, 105); Floch and Abonnenc (1943a:1-7; 1943b:1-7; 1946:3,5); Kumm et al. (1943:373-376); Russell et al. (1943:26, 29, 32, 36, 45); Unti (1943c:110); Galvao and Damasceno (1944:74-75; 1947:273-292); Causey, Deane, Costa and Deane (1945:148-149); Kenney (1946:223-227); Giglioli (1947:159-164); Ernani et al. (1947:738-744, 750-751, 761-762); Stage and Giglioli (1947:73-77); Costa and Basseres (1948:1001, 1003-1008); Zulueta and Bates (1948:350-360); Senior-White (1950:4); Renjifo and Zulueta (1952:600-611); Zulueta (1952:314-329); Guedes et al. (1953:157-165); Floch (1954:3-7); Vargas and Martinez Palacios (1955:82-83, 88, 107-108; 1956:8, 10, 12, 46, 51, 54, 58, 59, 126-129, 141, 143-177); Foote and Cook (1959:11, 13-20, 23-32, 118); Gabaldon and Guerrero (1959:433); Cova Garcia (1961:30-31, 82-83, 118-119); Forattini (1961:170, 177); Mattos and Xavier (1965:272); Stojanovich

et al. (1966a:11, 16, 32; 1966b:3-5, 19, 26, 40); Gorham et al. (1967:1, 4, 5, 11, 44, 53; 1971:1-4, 10, 37); Serie et al. (1968:198, 203-204, 210); Forattini et al. (1970:11); Elliott (1972:755-763); Fauran (1973:116-117, 138, 141); Cova Garcia and Sutil (1975a:20; 1975b:210; 1976:28); Vargas (1976:88).

Anopheles darlingi darlingi of Vargas (1941:110, 116, 118, 122-123); Kuyp (1949:67-68).

Anopheles (*Nyssorhynchus*) *darlingi paulistensis* of Galvao and Lane (1937e:212-213, 215-216, 219-220, 232-237); Galvao et al. (1937:37-40, 42-45); Barretto (1939:116-132); Galvao (1940:413, 419, 436, 452, 454, 456, 465-471); Vargas (1941:110); Neghme (1943c:274); Kuyp (1949:67-68).

Anopheles darlingi var. *paulistensis* of Galvao (1938b:102); Galvao and Barretto (1939a:110-112); Rozeboom (1942:237-238).

Anopheles darlingi paulistensis of Barretto (1939:116-132); Russell et al. (1943:5).

Anopheles (*Nyssorhynchus*) *darlingi typicus* of Galvao et al. (1937:39-40).

Nyssorhynchus darlingi of Townsend (1934:486, 495-496).

Nyssorhynchus (*Nyssorhynchus*) *darlingi* of Chagas et al. (1937:385-389).

Anopheles (*Nyssorhynchus*) *argyritarsis* in part of Christophers (1924:9-37, 39-91).

Cellia argyritarsis in part of Aiken and Rowland (1906:14); Aiken (1907:66; 1909:6); Coquillett (1906:13).

Anopheles argyritarsis (as *argyrotarsis*) in part of Cruz (1901:426).

FEMALE. Wing: 3.5 mm. Proboscis: 2.0 mm. Forefemur: 1.4 mm. Abdomen: 3.0 mm. **Head:** Interocular space narrow, 0.2-0.3 diameter of pedicel. Frontal tuft with 5,6 pairs of long, white, setiform scales. Palpus 0.95 length of proboscis; palpomeres 1,2 as in section; palpomere 3 with blue-tinted brown scales and several white scales; palpomere 4 brown, apically with moderately large light patch; palpomere 5 basally without dark band, remainder white. **Antenna:** Length 0.8 of proboscis. Pedicel with 4-6 small, broad, white scales. Flagellomere 1 with some white scales; flagellomeres 2-13 without scales. **Thorax:** Nonpruinose dark areas of scutum as in section. Scales of scutum yellow to white except for silver scales on median anterior promontory and light brown scales on lateral anterior promontory. Scutellum posteriorly with 12-13 well developed, dark brown setae and 7-9 moderately developed, dark setae. Pleuron with light pruinose areas as in section. *Ap* anteriorly with numerous light brown, erect scales. *PsA* with row of 4,5 silver setae. *Ps* with well developed, dark setae and few white scales. Upper *Mks* with 3,4 dark setae and 6-8 white, spatulate scales. Lower *Mks* with 1 weakly developed seta and 4-6 tightly bunched, white scales. Upper *Mam* without light scales along row of setae. Anterior *Mam* usually with 2-5 small, light, decumbent scales. *Pk* with 6-8 light and dark, weakly developed setae; without light scales. **Legs:** Generally as in section. Foretarsomere 1 predominantly dark, basally without light spot, with apical 0.08-0.10 light; tarsomere 2 with apical 0.3 light; tarsomere 3 with apical 0.4-0.5 light; tarsomeres 4,5 dark. Midtarsomeres 1,2 apically with small light band; tarsomeres 3,4 apically with some pale scales; tarsomere 5 dark. Hindtarsomere 1 light brown, apically with small white band; tarsomere 2 with basal 0.35-0.55 dark; tarsomeres 3-5 entirely white. **Wing:** Dark scales of vein C, R_1 and some parts of R_s, R_2, R_3 and R_{4+5} appearing blue;

dark scales of other veins brown. Light scales white. Vein C basal dark spot greatly enlarged, 3-4 of humeral light spot; humeral and subbasal light spots not fused; subbasal light spot present, presectoral light spot present or absent, never large. R_3 usually with 3 black spots. M with intermingled light and dark scales usually forming several light and dark spots; if spots present then usually with large basal dark spot. **Abdomen:** Terga II-VIII with few to several cream and brown scales forming triangular (segments II-IV) or rectangular (segments V-VIII) pattern. Caudolateral scale tufts on segments II-VII; each tuft usually with 6-8 dark, erect scales. Sterna as in section and group.

MALE. Wing: 3.0 mm. Proboscis: 2.5 mm. Forefemur: 1.5 mm. Abdomen: 3.25 mm. Essentially as in female except for sexual characters and as in section and group. **Head:** Proboscis 1.6-1.7 length of forefemur, basally with numerous, dark, decumbent scales and apically with small, dark brown, decumbent scales. Palpus subequal to length of proboscis; palpomere 1 with brown erect scales; palpomere 2 with brown, decumbent scales, apically with small light band; palpomere 3 dorsally white, ventrally and laterally with intermingled blue and copper scales, apically with white band; palpomere 4 dorsally with intermingled white and cream scales, ventrally with copper scales, basally with dark band (0.2 length of segment) of purple scales; palpomere 5 dorsally white, occasionally with dark band of purple to brown scales on medial 0.25-0.35 of palpomere or with basal 0.2-0.3 dark, ventrally either bare or with bronze scales. **Antenna:** Length approximately 0.7 of proboscis. Pedicel as in group. Flagellomere 1 with white, erect scales, about 1.60-1.75 length of individual flagellomeres 2-11; flagellomere 12 4.0-4.4 length of individual flagellomeres 2-11; flagellomere 13 about 0.4-0.5 length of flagellomere 12. **Legs:** Claws as in section.

MALE GENITALIA (Fig. 10). **Segment VIII.** Tergum laterally usually with single row of moderately long setae; with numerous, slender, light brown or golden scales, caudally scales often appearing purple. Sternum caudally usually with single row of long setae; medially with numerous, moderately broad, obovate, cream to yellow scales; basomedially with light brown patch of scales; caudally without 2 dark scale patches. **Segment IX:** Sternum rectangular, about 0.2 length of gonocoxite; posteromedially weakly to moderately emarginate, anteromedially not emarginate, usually with small anterior apodeme. **Gonocoxite:** Length approximately 2.75 maximum width. Tergal surface usually with 5 tergomedial setae, a single, long, apicolateral seta and a single, apicomesal seta, subequal to internal seta. Parabasal seta strongly retrorsely hooked, about 2.6 length of its moderately long tubercle. Apodeme of gonocoxite about 0.3 length of gonocoxite. Accessory setae long and broad; dorsal seta 0.45 length of gonocoxite; ventral seta about 0.7 length of dorsal seta. Internal seta slightly longer than ventral accessory seta, apically curved mesad. **Gonostylus:** Gonostylar claw basally broad, apically tapered, about 0.5 length of seta *b*. **Dorsal Claspette:** About 0.25 length of gonocoxite, pedicel moderately broad, without an apicolateral, sclerotized projection or hook; strongly curved mesad at base. Apex with 2,3 setae; setae normally equal to or slightly longer than dorsal claspette; dorsal seta short, with well-developed, bulbous, basomesal projection; ventral seta long, normally developed. **Ventral Claspette:** About 0.25-0.30 length of gonocoxite; bare. Apex moderately wide, distinctly truncate, not bilobed, laterally expanded;

dorsally very strongly striated. Median sulcus small, occasionally indistinct. Preapical plate small, weakly sclerotized, with numerous, longitudinal striations. Basal lobules expanded laterally, semicircular along margin. Refringent structure absent, membranous area developed. **Phallosome:** At least 0.5 length of gonocoxite, about 1.9-2.0 length of ventral claspette. Aedeagus with apex longer than wide, weakly sclerotized; ventromesal subtriangular projections strongly sclerotized, nearly meeting on midline, encircling entire subapical region like a collar; always with pair of curved, subapical, sclerotized, dorsolaterally projecting, serrated leaflets, inserted at widest part of aedeagus. Paramere subtriangular.

PUPA (Fig. 10). Abdomen: 3.0 mm. Trumpet: 0.3 mm. Paddle: 0.80 X 0.45 mm. **Cephalothorax:** Heavily pigmented. Median keel lightly to moderately developed. Setae 1-3-C 2b (1-4); 1-C longest; 2-C shortest; 3-C long. Setae 4,5-C subequal; 4-C 2,3f (1-5); 5-C 3,4b (2-4). Seta 6-C single (1,2b), long, slender. Seta 7-C 2b (1-3). Setae 8,9-C subequal; 8-C always single, well developed; 9-C single (1,2f), slender, moderately pigmented. **Trumpet:** Heavily pigmented, brown to black, especially dark along border margin of pinna opposite meatal cleft. Pinna laticorn, about 0.7 length of trumpet; entire border reticulate; meatal cleft long. Meatus small, 0.3 length of trumpet; reticulate, indistinct proximally. **Metanotum:** Setae 10-12-C moderately developed and heavily pigmented; 10-C always single; 11-C 3-5f (2-5); 12-C 2b (1-4). **Abdomen:** Heavily pigmented on anterior margins of segments II-IV. Seta 1-I with 19-22 (16-28) primary branches, apically extensively dendritic. Seta 2-I 2,3b (2-5), well developed. Seta 3-I single, (1-4b), subequal to 2-I. Seta 4-I 3-5b (3-6), branched 0.3 from base, moderately developed, subequal to 2,3-I. Seta 5-I 1-3b, moderately long, 2.0 length of 4-I. Seta 6-I single (1,2b), subequal to 5-I. Seta 7-I 3b (1-3), about 0.5 length of 6-I. Seta 9-I single (1,2b). Seta 0-II 3,4b (3-5), moderately developed; 0-III 6,7b (5-8); 0-IV-V 5,6b (4-7); 0-VI 5,6b (4-7); 0-VII 5b (4-6); 0-VIII single (1,2b). Seta 1-II,III 5-7b (4-11), well developed; 1-IV-VII always single, long, about 1.0-1.5 length of segments. Seta 2-II 4-6b (3-7); 2-III 4-6b (2-6); 2-IV 3b (2-5); 2-V 2b (1-3); 2-VI 2,3b (1-3); 2-VII 3b (2-4). Seta 3-II,III single (1-3b), subequal; 3-IV 3,4b (3-5); 3-V 2,3f (1-5), long; 3-VI single (1-3b), slender, long; 3-VII 2b (1-5). Seta 4-II 3,4b (2-4); 4-III 3f (1-6); 4-IV-V 2,3b (1-3); 4-VI,VII single (1,2b). Seta 5-II 4b (2-5); 5-III 5b (4-11), subequal to 1-III; 5-IV-VII single (1,2b), long, 0.6-0.7 length of segment. Seta 6-II-VII single (1-3b), slender, lightly pigmented, moderately short. Seta 7-II 1,2f (1-3), forked 0.4 from base; 7-III 1-3f (1-4); 7-IV 3,4b (1-4); 7-V single or double (1-4b); 7-VI,VII single, long, 2.0-3.0 length of 7-III,IV. Seta 8-III-V subequal to 7-III-V; 8-III 2,3b (2-4); 8-IV,V 2,3b; 8-VI,VII about 0.5 length of 7-VI,VII; 8-VI 2,3b (1-3); 8-VII 3-5b. Seta 9-II minute, indistinct, nonpigmented; 9-III distinct, very small, lightly pigmented; 9-IV short, 1.75-2.0 length of 9-III, heavily pigmented; 9-V moderately short, about 3.0 length of 9-IV, pointed; 9-VI about 1.3 length of 9-V, curved mesad; 9-VII about 1.3 length of 9-VI, similar to 9-VI in shape; 9-VIII subequal to 9-VII, 0.25-0.30 length of segment, weakly curved. Seta 10-III 1-3b; 10-IV single; 10-V,VII single (1,2b). **Terminal Segments:** Male genital lobes basally broad, narrowed from base to apex. Apex of lobes with short to moderately long, distinct, pointed, mammilliform protuberance; mesal margin with small serrations; length of male genital lobe about 2.2 maximum width at base; moderately pigmented.

Paddle: Moderately wide, apically slightly emarginate, length about 1.75 width. Midrib more heavily sclerotized on lateral margin than on mesal, sclerotization extending 0.8 length of paddle from base, distally poorly developed. External buttress extending 0.5 length of paddle from base, lightly pigmented, with small serrations on distal 0.15. External margin distad of buttress with moderately long (0.03 mm), thin spicules. Seta 1-P single (1,2b); 2-P single.

LARVA (Fig. 11). Head: 0.6 mm. Antenna: 0.25 mm. Saddle: 0.25 mm. **Head:** Moderately pigmented with heavily pigmented narrow band extending along frontoclypeal suture from collar to seta 8-C, with 2 pairs of small (0.25 mm), oval, dark discs caudomedial of seta 8-C and small, inverted, subtriangular, dark area between setae 8-C. Collar about 0.05 mm wide. Dorsomentum well developed, with median tooth and 3,4 lateral teeth on each side; median tooth 1.5 of adjacent lateral teeth; first 3 lateral teeth subequal and evenly spaced; fourth very small, indistinct. Setae 2-C moderately spaced, clypeal index about 1.5, often without conspicuous barbs. Seta 3-C with short to moderately long barbs, 0.85 length of 2-C. Seta 4-C 2b (2,3), long, usually extending beyond base of 2-C. Seta 8-C 4-7b (2-8), large. Seta 9-C 6-8b (3-10), subequal to 8-C. Seta 10-C 2,3b (2-4). Setae 12,13-C 2-5b (2-7). **Antenna:** Uniformly heavily pigmented. Dorsally with numerous, very small, slender spicules; ventrally with numerous, small, slender spicules on basal 0.5 and number of moderately long, pigmented spicules on distal 0.5; mesally with strongly developed spicules on distal 0.5. Seta 1-A 4,5b (3-6), usually equal to or longer than width of antenna and inserted 0.35-0.45 from base. Seta 4-A single or double, long. **Thorax:** Moderately pigmented. Setae 1-3-P not inserted on common sclerotized tubercle; 1-P 7-12b (7-15), fanlike with thin branches inserted near apex of very short, lightly pigmented shaft; 2-P plumose, 13-15b (12-20), about 2.4 length of 1-P, branches inserted on long shaft; 3-P single, about 0.4 length of 1-P. Setae 4-10,12-P as in section. Seta 11-P 2b, about 0.6 length of 12-P. Seta 13-P 4-6b (3-9). Seta 14-P 5-9b (5-12). Seta 1-M 24-28b (17-28), inserted on lightly sclerotized tubercle. Setae 2,3,5-M single (1-2b). Setae 4,6-M 2,3b (2-4). Seta 7-M 3,4b (2-5). Seta 13-M 5,6b (3-7). Seta 14-M 5-7b (3-11). Setae 1,2-T single, moderately long. Seta 3-T palmate with 8-12b (6-12) moderately broad, transparent, lanceolate branches. Seta 4-T 3,4b (2-5). Seta 6-T 2b (1-4). Seta 12-T 2b (1-3). **Abdomen:** Integument usually pigmented as on thorax. Median tergal plates present on segments I-VIII, weakly to moderately sclerotized and moderately large; plate on segment I about 0.25 width of segment; plate on segment II smallest; plates on segments III-VII subequal to segment I; plate on segment VIII very large, about 0.60-0.65 width of segment. Accessory median tergal plates present on segments II-VII, always single, often with distinct lobes; plate on segment II not lobed, very small; plates on segments III-VII usually bilobed, moderately large. Accessory submedian tergal plates present on segments I-VII; 1 pair usually on segments I-IV; 1 or 2 pairs on segments V-VII. Seta 0-II-VII 5-7b (3-7), usually small. Seta 1-I palmate with 8-14 (8-29) moderately broad lanceolate branches inserted at apex of short shaft; 1-II-VII with 17-25 (10-28) widely spaced, narrow to moderately broad, well-developed, lanceolate branches; 1-II,VII small; 1-III-VI large, subequal. Seta 2-I 3,4b (2-5); 2-II 4-7b (3-9); 2-III 3-5b (2-7); 2-IV,V single; 2-VI 2,3b (1-3); 2-VII 5-7b. Seta 3-IV,VII 2,3f (1-5). Seta 4-III 3b (2-5). Seta 5-III

7,8b (5-9); 5-IV,V 4,5b (3-5); 5-VI 7,8b (4-8). Seta 6-I-VIII as in section. Seta 7-VII 4-7b (3-9), large. Seta 8-II-VI 2,3b (1-4); 8-VII 4,5b (3-9). Seta 9-I-VII 5,6b (4-7). Seta 10-II 2,3b; 10-VI 3b (1-3b); 10-VII 3b. Seta 13-I-II 5,6 (1-8); 13-III 7-10b (6-12); 13-IV,V 4,5b (3-6); 13-VI 6-8b (5-10); 13-VII 3,4b. **Spiracular Lobe:** Pecten with 15-17 (14-17) teeth, short teeth without spicules; teeth beginning ventrally usually as follows: 3 repetitions of 1 long, 2-4 short, terminating with 1 long and 1 or 2 short. Median plate of spiracular apparatus without lateral arms, anteromedial process usually strongly sclerotized. Seta 1-S 4,5b (4-10), large. Seta 2-S 3b (2-4), small to moderately large. Setae 3-5-S single and small. Setae 6,7-S single (1-3b). Seta 8-S 2,3b (1-3). Seta 9-S single or double (1-3b). Seta 13-S single and simple, very strongly developed, very long (2.2-2.5 length of saddle), inserted on a large sclerotized tubercle. **Abdominal Segment X:** Saddle incomplete, moderately pigmented. Integument with very fine, short spicules, longer at caudal margin. Setae 1-X inserted on saddle, about 1.5 length of saddle. Seta 2-X pectinate, large. Seta 3-X with 4 large branches. Ventral brush normal. Anal papillae moderately long.

DISCUSSION. The monotypic Darlingi Subgroup can be distinguished from all other subgroups in the Argyritarsis Group in the **female** by the combination of: (1) interocular space narrow, 0.2-0.3 diameter of pedicel, (2) palpomere 4 apically with moderately large, light patch, (3) palpomere 5 basally without dark band, (4) flagellomere 1 with some white scales and flagellomeres 2-13 without scales, (5) scales of scutum yellow to white except for silver scales on median anterior promontory and light brown scales on lateral anterior promontory, (6) upper *Mam* without light scales, (7) anterior *Mam* usually with 2-5 small, light, decumbent scales, (8) foretarsomere 1 basally without light spot, (9) hindtarsomere 2 with basal 0.35-0.55 dark, (10) vein C with: a) basal dark spot greatly enlarged, 3.0-4.0 of humeral light spot, b) humeral and subbasal light spots not fused, and c) subbasal light spot present and presectoral light spot present or absent, (11) R_3 usually with 3 black spots, and (12) caudolateral scale tufts present on segments II-VII; in the **male genitalia** by: (1) tergum VIII with numerous, slender, light brown or golden scales, caudally scales often appearing purple, (2) sternum VIII caudally without 2 dark scale patches, (3) sternum IX posteromedially weakly to moderately emarginate, anteromedially not emarginate, (4) length of gonocoxite 2.75 maximum width, (5) dorsal seta of dorsal claspette with well-developed, bulbous, basomesal projection, (6) apex of ventral claspette distinctly truncate, not bilobed, with median sulcus small, (7) phallosome at least 0.5 length of gonocoxite, and (8) aedeagus with: a) apex weakly sclerotized, b) subapical, ventromesal subtriangular projections strongly sclerotized, nearly meeting on midline, encircling entire subapical region like a collar, and c) leaflets inserted at widest part of aedeagus; and in the **larva** by: (1) setae 2-C moderately spaced, clypeal index about 1.5, (2) seta 4-C 2b (2,3), (3) seta 1-A inserted 0.35-0.45 from base, (4) seta 1-P fanlike with thin branches inserted near apex of very short shaft, (5) seta 3-T palmate with broad, lanceolate branches, (6) median tergal plate on segment VIII very large, about 0.60-0.65 width of segment, (7) accessory median tergal plate single and bilobed on segments III-VII, (8) seta 1-I with branches inserted at apex of a short shaft, (9) seta 13-S very strongly developed, about 2.2-2.5 length of saddle, and (10) pecten usually with 4 long teeth and without spicules on short

teeth.

The **pupa** of *darlingi* can be distinguished from all other species in the Argyritarsis Group by the following characters: (1) pinna of trumpet laticorn, (2) seta 11-C 3-5b (2-5), (3) abdomen heavily pigmented, (4) seta 8-IV 2,3b, (5) seta 9-II-VII usually very short, (6) seta 9-VIII about 0.25-0.30 length of segment VIII, and (7) paddle moderately wide, spicules distad of buttress about 0.03 mm long.

Anopheles darlingi is a highly derived species; this species is easily recognized in all stages by several autapomorphic characters. In the adult, the white scale tuft on the anterior *Mam* (possibly plesiomorphic) and the greatly enlarged basal dark spot of vein C immediately identify *darlingi*. The only other species of *Nyssorhynchus* that possesses a white scale patch on the anterior *Mam* is *triannulatus*, a member of the Albimanus Section. In the male genitalia, the 3 setae on the apex of the dorsal claspette and the truncated apex of the ventral claspette, in combination with the presence of subapical leaflets on the aedeagus and its subapical collar, immediately identify *darlingi*. Other species of the Argyritarsis Group have the apex of the dorsal claspette with only 2 setae and the apex of the ventral claspette is never truncate. All species in the Albitarsis Group have 3 apical setae on the dorsal claspette but never subapical leaflets on the aedeagus. The presence of a subapical collar is unique in the Argyritarsis Section. Species of the Albimanus Section always have 3 setae on the apex of the dorsal claspette, but rarely have they well-developed subapical leaflets on the aedeagus. In the pupa, the presence of a laticorn trumpet and the short seta 9-II-VIII on the abdomen typify *darlingi*. No other species in the Argyritarsis Section has a laticorn trumpet and as short a seta 9 as does *darlingi*. In the larva, seta 13-S is exceedingly long, inserted on a large, conspicuous basal tubercle, which is unique for the subgenus.

The populations of *darlingi* examined for this study show little interpopulational variation among the diagnostic characters. The characters given above are very constant, even for the Guatemalan and Honduran populations, which are apparently isolated from the South America populations by a considerable distance. Interpopulational variation is at most equal to intrapopulational variations for these particular characters.

The relative constancy of the diagnostic characters and reduced interpopulational variation observed throughout the range of *darlingi* is somewhat at odds with recent investigations on the amount of inversion polymorphism found in the salivary gland chromosomes of *darlingi*. Kreutzer et al. (1972:555-565) examined the salivary gland chromosomes of *darlingi* from Manaus, Alixia, and Itacoatiara in the state of Amazonas, Brazil, and from Araraquara in the state of Sao Paulo, and found 9 paracentric inversions in the X chromosome and in all 4 autosomal arms. In the state of Amazonas, 90% of the chromosomes examined were heterozygous for one or more inversions, particularly for the Manaus population; however a limited number of inversions were observed in the state of Sao Paulo. The authors believe, "The Amazonas populations from near the center of the range of the species show an elevated polymorphism and the Araraquara sample, near the southern border of the geographic distribution, appears to show fixation of certain arrangements with reduced polymorphism." It seems somewhat paradoxical that a species which has such a limited amount of interpopulational morphological variation would concurrently exhibit such a

degree of inversion polymorphism. In order to have a paracentric inversion established, like those found in *darlingi*, one must presume that those individuals with the inverted chromosomal material are strongly selected for because of their superior fitness. This presumption is because all crossover (within the inversion) products of heterozygous paracentric inverted chromosomes are either acentric or dicentric and fail to move properly to the poles during meiosis, which therefore results in a reduction in the number of viable offspring. It is possible for an organism to eliminate this reduction in offspring in heterozygously inverted parents, by either somehow eliminating crossing-over altogether or by selectively eliminating crossover products. The ability to selectively eliminate crossover products from the gametes has been reported in *Sciara impatiens* (Carson 1945:95-113) as well as in several species of *Drosophila*; however, this has never been reported for any species of mosquito. In any case, the virtual elimination of crossover would result in a reduction in genetic variability by excluding all recombination resulting from crossing-over. Whether crossing-over occurs or not, it seems clear that the heterozygous inverted individual must have a strong selective advantage over the noninverted individual. Kreutzer et al. (1972:562) recognize the advantage of heterozygously inverted individuals and suggest that chromosomal polymorphism in *darlingi* is one factor which allows: (1) its widespread distribution, (2) its ecological ubiquity, and (3) its vector capacity under a wide range of conditions. Since the taxonomy of *Nyssorhynchus* has been confused and reliable keys to the identification of its species scarce, it is possible that the chromosomes reported for *darlingi* in the state of Amazonas may possibly have been those of another species or perhaps of a mixture of 2 or 3 morphologically similar species. The keys to the adults of Gorham et al. (1967:11), which are mentioned by Kreutzer et al. (1972:565), are based to some extent on wing spot characters now known to vary among individuals. An alternate explanation for the large amount of chromosomal polymorphism is that, during particularly stressing periods, the number of inversions present in a population might increase as a direct result of some environmental factor such as humidity or temperature. Inversions have been found to vary in frequency according to the time of year that sampling occurred (Mettler and Gregg 1969:153). Inversions are generally considered to reduce genetic variability and hence to be a poor adaptation for long range fitness. However, they tend to increase viability and rigor and therefore are adaptive for short range survival. The inversions of the populations of *darlingi* in the state of Amazonas may have survival value during a particularly stressful dry season.

Anopheles darlingi was described by Root (1926b:706-709) from numerous specimens collected near Porto das Caixas, Rio de Janeiro, Brazil, from a patch of *Ceratophyllum* sp. in a small side bay of a river. Root thought that *darlingi* closely resembled *albitarsis*, and that it probably had been confused with *albitarsis as Cellia argyritarsis*. In Root's description, the adult is compared to *albitarsis* with respect to tarsal scalation and wing spotting. The differences between *darlingi* and *albitarsis*, and *darlingi* and *argyritarsis* were noted for the male genitalia, larva and pupa. Root did not give a complete description of each stage because he believed that the species in the *Nyssorhynchus* group were very similar. Galvao et al. (1937:37-40) described a variety of *darlingi* which they named *paulistensis* based on characters of the adult, male genitalia and the eggs of specimens collected near Pereira Barreto,

Sao Paulo, Brazil, and on additional specimens from the state of Amazonas, Brazil. These authors evidently did not examine Root's material. In the adult, *paulistensis* was reported as having more dark scales on hindtarsomere 2 than Root had reported for *darlingi*, and the caudolateral tufts of the abdomen were said to be on segments II to VII. The variations in the number of dark scales on hindtarsomere 2 are not unusual for *darlingi*, and Root failed to mention the caudolateral tufts in his discussion. In the male genitalia, *paulistensis* was described as having distinctly serrated leaflets near the apex of the aedeagus. Root mentioned that the leaflets of *darlingi* did not have obvious serrations. The presence or absence of serrations on the leaflets of the aedeagus is difficult to determine in some slide preparations, therefore the distinction here is questionable. Furthermore, Komp (1941a:659-670) pointed out that Root's statement concerning the aedeagal leaflets is misleading in that the leaflets of *darlingi* are distinctly serrated. Regarding the eggs, Lane (1953:249) stated that the eggs figured and described by Root do not represent reality and concluded that a distinction between the eggs of *paulistensis* and *darlingi* is not valid. Rozeboom noted (1942:237-238) that no investigator since Root had seen the "little white stars" of the exochorion of the eggs, and that it was doubtful that he ever saw them. I agree with Lane (1949:402) that the variety *paulistensis* was based on differences not actually existing or, at most, differences representing only normal variation in *darlingi*. Galvao and Barretto (1939a:110-112) showed that there is considerable variation in the eggs of *darlingi*.

BIONOMICS. The immatures of *darlingi* have been found in the following locations by MMAP: clear streams with a mud bottom and grassy vegetation; clear ponds with a mud bottom, algae and floating vegetation; and clear swamps with abundant grassy vegetation. Most of the immatures were collected in partial shade. All the sites contained grassy or floating vegetation and sometimes green algae. The water was always clear, never turbid or polluted. The sites were usually in areas of secondary growth, such as plantations or cultivated fields.

Root (1926b:708) found *darlingi*, in the type locality, in patches of *Ceratophyllum* sp. in small side bays and along the edges of small rivers and canals with a fast current. In other places he found the larvae in mats of surface vegetation in areas with no current, and once in a large, muddy road pool. Pinto (1939:380) states that Davis collected larvae in debris along the margin of a pool in Parana, Brazil, and that Shannon collected *darlingi* in large swamps and marshes, always in areas open to sunlight in Bahia, Brazil. Barretto (1939) found that the larvae occur in quiet water along the margin of still bays of large rivers. There he found that *darlingi* comprised 62.5% of the anophelines. The larvae were found associated with *Cupressus glauca* growing along the margins of reservoirs. The pH where *darlingi* was found was 7.1, while the water in an area near the dam, which contained no *darlingi* or organic detritus, had a pH of 5.8-6.8. Barretto observed that the immatures were at times in the shade of trees and rarely in direct sun. He also found larvae in small collections of water such as springs, wells, mud puddles, animal footprints and roadside ditches. These locations were usually in the sun during most of the day; the temperature of the water varied between 23.2 and 27.0°C along the coast, and between 17.5 and 33.0°C in the interior in the state of Sao Paulo, Brazil. Davis and Kumm (1932:93-95) collected only 12

larvae along the margins of the Jacuipe River near Salvador, Bahia, Brazil. Shannon (1933:117-143) found only a few larvae of *darlingi* in the Amazon Basin and concluded that the immature sites of this species are large bodies of still water along the tributaries of the Amazon. Galvao et al. (1937:37-45) found very few larvae of *darlingi* (as *darlingi paulistensis*) in Novo Oriente, Sao Paulo, Brazil, despite the large number of adults found in houses. Stage and Giglioli (1947:73-76) reported that along the coast of British Guiana, *darlingi* is found in large bodies of fresh water such as irrigation canals, rice fields, flooded cane fields and pastures on the coast, while in the interior it is found in seepage swamps, forest streams and rain pools. They also stated that in grasslands of the interior *darlingi* is found in ponds, lakes and streams along larger rivers. It was not found in highly acidic, brown, water characteristic of ground pools inside forests. Pinotti (1951:663-682) reported that *darlingi* in Brazil occurs in reservoirs associated with *Pistia stratiotes* and *Eichhornia* spp., and that these floating plants serve to transport larvae during flooding. Kumm and Ram (1941:559) found *darlingi* along the shaded, grassy margins of ponds where floatage was abundant. Galvao (1940:470-471) reported that *darlingi* is very difficult to rear in the laboratory. When the pH of the water was below 6.6 the larvae died. Bates (1947:155-158) reared *darlingi* in a water medium supplemented with bread crumbs and clay.

Anopheles darlingi has been collected by MMAP in association with 2 other species of the Argyritarsis Section, *braziliensis* and *argyritarsis*, and with *An.* (*Ano.*) *mediopunctatus*. Root (1926b:708) found the larvae of *darlingi* with *albitarsis* and "*tarsimaculatus*."

Anopheles darlingi is evidently a mosquito which requires high humidity and rainfall and seems to be susceptible to dry seasons. This species is found predominantly along large river valleys and is not present in much of northeastern Brazil where the dry season is long and drought often occurs Deane, L. M. et al. 1946:2). Root (1926b:708) observed that *darlingi* did not become abundant until rather late in the breeding season, and that the increase coincided with the onset of cooler weather. During May in Porto das Caixas, Rio de Janeiro, Brazil, Root observed that *darlingi* was as abundant in houses as *marajoara* (as *albitarsis*) and that in houses in Sant'Anna it was more common than *marajoara* (as *albitarsis*) or "*tarsimaculatus*". He concluded that *darlingi* was definitely an endophilic species. Gomes de Faria (in Pinto 1930) reported numerous specimens of *darlingi* in houses in the state of Sao Paulo, Brazil. Many workers have verified that when a bait animal is used as a control outside houses, more specimens of *darlingi* are still found in houses than on the bait animal. When compared to *An. pseudopunctipennis*, *punctimacula*, *strodei*, "*tarsimaculatus*" and *triannulatus*, *darlingi* is by far the commonest anopheline found in houses (Benarrochi 1931; Davis 1931; Davis and Kumm 1932; Shannon 1933). Galvao et al. (1937) recorded the percentages of anophelines found in houses in Novo Oriente, Sao Paulo, Brazil, and observed that in March, 100% of the anophelines in houses were *darlingi*, in February 91%, in April 82% and in May 80%.

Deane and Damasceno (1948:501-508), state that the postfeeding resting sites in houses are vertical surfaces; 99% of the adults clung to walls in houses in Brazil and most were within 2 m of the floor. Giglioli (1948) collected some *darlingi* under tables and other furniture. Recent behavioral studies (Roberts et al. 1987:433-441) at Floresta, Amazonas, Brazil, a field

site along the Ituxi River, indicate that *darlingi* feeds readily indoors and outdoors. Preliminary results indicate a bimodal peak in the biting activity of *darlingi*, the largest peak occurring about 30 minutes after sunset and another smaller peak just before sunrise. A few females have been observed to feed throughout the day and night both inside and outside the house. The majority of engorged and unengorged females were consistently found resting on the ceiling inside their study house, although a large minority were collected resting on the walls. In 2 nights of human biting collections at a site 10 m from the house, *darlingi* was the only mosquito collected; whereas at a site 20 m from the house 7 other mosquito species were caught, 5 of which were other anophelines. Essentially only *darlingi* was biting man in and immediately around the house. Charlwood and Wilkes (1979) also observed a pronounced peak in biting activity of *darlingi* at dawn and dusk (by nulliparous females). The adults of *darlingi* can disperse as far as 200-1,500 m (Davis and Kumm 1932; Deane 1947). Zulueta and Bates (1948) reported that females would not oviposit on water which had an interrupted surface, but preferred to oviposit on open, nondisrupted water. Essentially all reports in the literature indicate that *darlingi* prefers human hosts to domestic animals. This may be true, but essentially all the adult female *darlingi* caught by MMAP have been lured to and collected from domestic animal bait, mainly burros.

MEDICAL IMPORTANCE. According to L. M. Deane et al. (1946:2), *darlingi* is the most efficient indigenous malaria vector in northern and northeastern Brazil. Horsfall (1955:183) stated "...observers agree that this [*darlingi*] is the most satisfactory component in the insect portion of the reservoir for human plasmodia in Neotropica." *Anopheles darlingi* is evidently a very serious malaria vector throughout its range because of its domestic habit and its high susceptibility to *Plasmodium* spp.

Almost all examinations of *darlingi* in nature have yielded either malarial oocysts on the midgut or sporozoites in the salivary glands (Davis 1931; Davis and Kumm 1932; Shannon 1933; Correa and Ramos 1942b; Correa 1943; Floch and Abonnenc 1943b; Kenney 1946; Floch 1954). According to Pinto (1939:383), Gomes de Faria examined the midguts and salivary glands of samples of *darlingi* collected in the state of Sao Paulo, Brazil during 1926, and found only one of the 223 midguts and salivary glands examined positive for *Plasmodium* spp. Davis (1931:43-51) studied the prevalence of *Anopheles* in houses in Belem, Para, Brazil. He found no oocysts or sporozoites in "*tarsimaculatus*", but in *darlingi* observed that, of 200 specimens dissected, 22.3% had oocysts on the midgut and 5% had sporozoites in the salivary glands. Overall, 22% of the specimens of *darlingi* examined were infected. Davis and Kumm (1932:93-95) studied malaria transmission in the state of Bahia, Brazil, and observed that 69 of 240, or 28.7%, of *darlingi* were infected with malaria parasites. About 27% of the midguts examined had oocysts, and 7.4% of the salivary glands had sporozoites. Kenney (1946:223-227) reported that a phenomenal 222 of 250 females of *darlingi* examined (88.8%) during a malaria epidemic in British Guiana had oocysts on the midgut. Charlwood and Wilkes (1979) applied the Polovodova aging technique to females of *darlingi* collected in Aripuana, Mato Grosso, Brazil, and reported that 1.5% of the females had oviposited at least 4 times and were old enough to be potential vectors of malaria. Arruda et al. (1986:873-881) detected *P. falciparum* sporozoites in from 2.7% to 4.2% of *An. darlingi* specimens collected in Para, Brazil. They also found that from 0.9%

to 1.3% of all specimens tested contained *P. vivax* sporozoites.

Anopheles darlingi probably contributes to the endemic malaria of the extreme southern part of Mexico and the northern part of Central America. It is evidently the primary vector of malaria in the southeastern jungle of Venezuela and on the coast and in the southeastern savanna plateau of Venezuela (Foote and Cook 1959:23). Inland in Venezuela, *darlingi* is a vector when *albimanus* is absent. *Anopheles darlingi* is an important vector in southeastern Colombia as well as along the northern coastal area. In Ecuador, east of the Andes, *darlingi* is probably the principal vector in the jungle and savanna lowlands of the Amazon basin. East of Peru, *darlingi* is a vector but little is known of its role in malaria transmission in Peru itself. In the plains of northern Bolivia *darlingi* is an efficient vector of epidemic malaria. In Brazil and the Guianas *darlingi* is widespread in the lowlands away from the coast and is, according to Foote and Cook (1959:29), the most efficient vector of New World malaria. They state that malaria would become a relatively unimportant disease in South America if *darlingi* disappeared.

Several investigators think that *Anopheles darlingi* is a vector of human filariasis. Davis (1931:43-51) collected 200 specimens of *darlingi* from houses in Belem, Para, Brazil, and among less than half the specimens dissected, 14 had filarial larvae in the head and proboscis. Giglioli (1948:71-85) reported that *Wuchereria bancrofti* readily invades the tissues of *darlingi* in Brazil and British Guiana. The mosquitoes were given an infective blood meal and after 13 days, 74% showed infection and 9% had mature worms in their proboscis. In Brazil Causey, Deane, da Costa and Deane (1945) found *darlingi* naturally infected with filarial worms in nature.

DISTRIBUTION (Fig. 1). *Anopheles darlingi* is widely distributed. It is usually found at lower elevations along large rivers of the interior, but may be found in coastal areas and occasionally at higher elevations. *Anopheles darlingi* occurs as far north as Mexico. Vargas and Palacios (1950:5; 1955) have reported *darlingi* from the state of Chiapas near the Gulf of Mexico at an elevation of 60 m or less. *Anopheles darlingi* is also found in Belize, El Salvador, Guatemala and Honduras. It has not been reported from Costa Rica, Nicaragua and Panama. In South America, *darlingi* has been reported from Argentina, Bolivia, Brazil, Colombia, Ecuador, the Guianas, Peru and Venezuela. The discontinuity in the distribution of *darlingi* in Central America is not understood. The species may have been introduced into northern Central America and not into the rest of Central America. Or possibly, *darlingi* is present in the remainder of Central America but has never been collected there.

Material Examined: 1,355 specimens: 229 males, 38 male genitalia, 786 females, 128 pupae, 174 larvae; 13 individual rearings (13 larval); 6 progeny rearings.

ARGENTINA. Salta: Santa Victoria, Apr 1946, 1F.

BELIZE (72 specimens: 6M, 1M gen, 63F, 2L). **Cayo:** Stann Creek, KO 114-2, 35F; same locality, KO 114-4, 1F; same locality, KO 114-5, 2M, 1M gen; same locality, March 1931, 4F, 2L (JH); Stann Creek, 23 mi. from, 3M, 18F. **Province not specified:** Dog Creek, Nov 1939, 1M. Sierra de Aqua, June 1946, 4F. Silk grass camp, 19 Mar 1940, 1F.

BOLIVIA (48 specimens: 48F). **Beni:** Guayaramenin, 13 May 1946, 4F; same locality, 19 Apr 1947, 6F; same locality, 23 Jun 1947, 6F. Riberalta, 26 March

1939, KO 114-18, 1F. Santa Rosa, 1943, KO 114-23, 1F. **Pando:** Guara Pari, Rio Abuna, 24 Jan 1944, Carr, No. 3124, 1F. Museo, Rio Abuna, 23 Jan 1944, Carr, No. 3121, 3F. Resaca, KO 114-22, 4F. Rio Abuna, 23 Jan 1944, KO 114-26, 3F. San Gabriel, Rio Abuna, 27 Jan 1944, Carr, No. 3123, 6F. San Pablo, Rio Abuna, 30 Jan 1944, Carr, No. 3125, 10F. **Santa Cruz:** Chavez, 11 May 1944, KO 114-32, 2F; same locality, 12 May 1944, KO 114-24, 1F.

BRAZIL (150 specimens: 21M, 14M gen, 115F). **Amazonas:** Manaus, Jun 1931, R. C. Shannon, 2F. **Bahia:** Nazareth, Mar 1931, R. C. Shannon. **Mato Grosso:** Solabra, 1939, 1F. Locality not specified, May 1931, R. C. Shannon, 11F. **Para:** Belem, det. Damasceno, 1M gen; same locality, 10 Apr 1941, 2F, 3M. Curralinho, 1936, det. Cerqueira, 1F. Fordlandia, Jun 1931, R. C. Shannon, 42F. Locality not specified, Apr 1930, N. C. Davis, 1F. **Rio de Janeiro:** Porto das Caixas, 5 Feb 1925, No. 11, 1M (JH); same locality, 17 March 1925, 12F, 8M, 1M gen (No. 53, 54, 56) (JH); same locality, 29 March 1926, 4M (No. 62, 94, 121), (JH); same locality, 2 March 1925, F. Root, No. 4, 1F (Lectotype); same locality, 15 Apr 1925, 2F, 4M (No. 68); same locality, 9 Jun 1925, 1M. Locality not specified, M. F. Boyd, 3F. **Rondonia:** Guajara Mirim, May 1931, R. Shannon, 2F. Porto Velho, Rio Madena, May 1931, R. C. Shannon, 28F. **Sergipe:** Locality not specified, Dec. 1929, R. C. Shannon, 4F. **Sao Paulo:** Palmeiras, SPM 89S, 6M gen (JH); same locality (No. 2), 2F, (JH); Porto Ferreira, Correa det, SPM 89-S-7, 6M gen (JH). Porto Martins, 1F (JH).

COLOMBIA (566 specimens: 96M, 14M gen, 174F, 128P&p, 154L&l; 13 ind rear: 131; 6 progeny rearings). **Meta:** Villavicencio, 7 May 1947, CVP-12, 10F, 51, 11p; same locality and date, CVP-13, 35F, 16M, 5L, 7p; same locality and date, CVP-14, 31F, 18M, 3M gen, 14L, 15p (progeny rearing); same locality and date, CVP-19, 13F, 8M, 2M gen, 13L, 13p (progeny rearing); same locality and date, CVP-20, 2F, 1M, 11, 3p (progeny rearing); same locality and date, CVP-21, 18F, 4M, 1M gen, 15L, 15p (progeny rearing); same locality and date, CVP-11, 20F, 16M, 2M gen, 14L, 14p (progeny rearing); same locality and date, CVP-33, 22F, 11M, 1M gen, 15L, 15p (progeny rearing); same locality, 9 May 1947, CV 370, 11pF; same locality, 14 May 1947, CV 379, 2F, 1M, 1M gen; same locality, 23 May 1947, CV 391, 1F, 2M, 2M gen; same locality, CV 727, 3F, 3M, 21pM (4), 31pF (1,2,3), same locality, 7 May 1947, P-12 B, 1M, 1M gen (JH); same locality, 23 May 1947, 1L (JH); same locality, 16 June 1947, 52L (JH); same locality, 1947, No. P-126, 4M (112A, 379.4, 14-V) (JH); same locality, P-53, C-550-15, 1F, 1M (JH); same locality, 18 Jun 1965, COB 39, 11pM, 1F, 1M gen; same locality, COB 53, 2F; same locality, COB 66, 3F, 3M, 1M gen, 31pF, 31pM; same locality, 7 Jun 1975, J. Kitzmiller, COZ 48, 1F. Pto. Lopez, 10 Sep 1971, COM 597, 1F; same locality, 16 Jun 1977, 5L. **Vaupes:** Miraflores, 2 Jul 1975, COZ 62, 16p. Locality not specified, Sep 1943, 1F. **Department not specified:** Jul 1975, J. Kitzmiller, No. 32, COZ 72, 5F; 23 Jun 1927, McConnell, 1F.

EL SALVADOR (1 specimen: 1F). Locality not specified, SAL 12, 1F.

FRENCH GUIANA (11 specimens: 2M, 9F). **Guyane:** Sinnamary, 24 Oct 1967, J. Clastrier, FGC 3272, 6F (1,2,3,4,5,8,9). Locality not specified, Abonnenc, FGA 111, 1M; FGA 213, 2F; 29 June 1943, det. S. E Yolles, 1F; 1943, 1M.

GUATEMALA (6 specimens: 2M, 3F, 1L). **Peten:** Cimarion, 1L. Desempeno, KO 114-9, 1F. Santa Teresa, 2F, 2M.

GUYANA (349 specimens: 96M, 9M gen, 244F). **East Berbice - Corentyne:** New Amsterdam, Aiken, 1F. **East Demerara - West Coast Berbice:** Georgetown, Nov 1942, KO 114-1, 15F; same locality, 1945, KO 114-16, 48F, 33M, 5M gen; same

locality, 1945, KO 114-17, 60F, 19M, 3M gen; same locality, 1945, KO 114-20, 40F, 38M; same locality, 2 Oct 1945, KO 114-29, 1F; same locality, 22 Sep 1945, KO 114-31, 1F; same locality, 1945, 2M, 13F. **Mazaruni - Potaro:** Omai, K. S. Wise, 7F. **Province not specified:** Lusignon, 29 Sep 1945, KO 114-34, 1M, 1M gen. Locality not specified, Mep acc No. G-21, 25, 2F; 1936, GUYK-6, 52F; 1940, G Bevier, 4F; 12 Jul 1941, Giglioli, 1M, 2F.

HONDURAS (2 specimens: 2L). Locality not specified, Hon 115, 2L.

MEXICO (1 specimen: 1L). **Chiapas:** Aroyo Anaite, 1L.

PERU (49 specimens: 1M, 48F). **Department not specified:** Nazareth, Apr 1931, R. C. Shannon, 1M, 48F.

SURINAME (21 specimens: 1M, 20F). **Nickerie:** Coeroeni river, 29 Jan 1961, D. Geijskes, SUR 9, 1F. Sipaliwini river, 10 Feb 1961, D. Geijskes, SUR 10, 1F; same locality and collector, 15 Feb 1961, SUR 11, 1F; same locality, 19 Feb 1961, D. Beijskes, SUR 12, 1F. **Paramaribo:** Locality not specified, 1916, J. Bonne-Wepster, 9F. **Suriname:** Kabel Station, 26 June 1946, E. V. D. Kuyp, 1M, 1F; same locality and collector, 27 Jun 1946, 6F.

VENEZUELA (78 specimens: 4M, 60F, 14L). **Aragua:** Maracay, 14 May 1927, H 51, 1F; same locality, 17 May 1927, H 51, 1M. **Sucre:** Caripito, 5 Sep 1936, 1M; same locality, 13 Jul 1945, 1F; same locality, Jul 1945, 4F. **Province not specified:** Loreto, 20 March 1931, 1F. Nazareth, Apr 1931, 48F. Lagunas, KO 113-6, 3F; same locality, 13 Sep 1936, 1F. Cachipo, 31 Aug 1936, 2M, 1F. Naricauf, May 1941, 7L; Patanemo, 2 July 1941, 1L. Acariqua, Aug 1941, 5L. Locality not specified, 1L.

ALBITARSIS GROUP

FEMALES. Small to moderately large; wing: 3.0 - 4.2 mm. **Head:** Interocular space narrow to wide, about 0.3-1.1 diameter of pedicel. Frontal tufts with 4-7 pairs of long, white setiform scales. Vertex with numerous, long, erect, light scales becoming much darker laterally. Lateral orbital setae dark. Clypeus pruinose, wide (2.0-3.0 diameter of pedicel). Proboscis 1.4-1.6 length of forefemur, with numerous very narrow, brown scales. Palpus subequal to proboscis; palpomeres 1,2 with long, erect, scales predominantly dark, apically light; palpomeres 3,4 predominantly dark, with scattered light scales; palpomere 5 light. **Antenna:** Pedicel pruinose, with 4-8 small, white scales; flagellomere 1 basally with few, small, light scales and apically with numerous, long, light scales; flagellomere 2 about 0.5 length of flagellomere 1, with short or long light scales; flagellomeres 2-13 subequal, usually with basal whorls of brown setae, whorls decreasing in length on apical flagellomeres; flagellomeres 3-5 occasionally with light setiform scales (*marajoara*); flagellomeres 6-13 without scales. **Thorax:** Integument pruinose, usually with 3 areas of darker, less pruinose, longitudinal stripes. Median anterior promontory with silver setae and silver, erect, setiform scales, occasionally lighter than more yellow mesonotal scales (Albitarsis Subgroup). Scutellum with 8-13 well developed, dark setae and 6-8 weakly developed, light setae along posterior margin. Pleuron with pruinosity as in section. *Ap* lobes widely separated, anterodorsally with numerous erect, light brown to black, lanceolate scales in juxtaposition to similar scales on lateral anterior promontory and postoccipital regions. *Ps* anterodorsally with few light scales (Braziliensis Subgroup) or without scales (Albitarsis Subgroup). Upper and

lower *Mks* with small patch of light scales; upper patch with 2,3 long, black setae; lower patch with 1 dark seta. *PK* area with several light setae, 1-4 dark setae and numerous broad, spatulate, light scales. Upper *Mam* with 3,4 short, broad scales and 1,2 long, long setiform scales. Anterior *Mam* never with scales. **Legs:** Coxae and trochanters as in section. Hindtarsomere 2 occasionally with as much as basal 0.9 dark (*albitarsis*) or as little as basal 0.3 dark. **Wing:** Vein C with basal dark spot never large, often small; humeral light spot always present, never fused with subbasal light spot; subbasal light spot, if present, about 0.5 of humeral light spot; presectoral light spot absent (Albitarsis Subgroup) or represented by few light scales (Braziliensis Subgroup); subcostal light spot subequal to sectoral light spot. R3 with 1,2 (Albitarsis Subgroup) or 3 (Braziliensis Subgroup) dark spots. R4+5 with small, apical dark spot 0.4-0.6 of basal dark spot. M always with basal dark spot of varied length; predominantly with dark scales (Braziliensis Subgroup) or cream to yellow scales (Albitarsis Subgroup). **Abdomen:** Tergum I with numerous setae and few, light, broad or setiform scales. Tergum II with dark caudolateral tufts and few dark scales (Braziliensis Subgroup) or without caudolateral tufts and with numerous light scales (Albitarsis Subgroup). Tergum III usually with caudolateral tufts, occasionally light in color and small (Albitarsis Subgroup); medially scales either light and numerous (Albitarsis Subgroup) or dark and few (Braziliensis Subgroup). Terga IV-VII with caudolateral tufts and numerous scales. Tergum VIII without caudolateral tufts, with numerous light scales, occasionally with bright white scales (Braziliensis Subgroup). Sternum I always with submedial stripe of white scales extending length of segment. Sterna II-VIII with submedial stripe of short, light scales.

MALES. Essentially as in females except for sexual characters. **Head:** Proboscis about 1.5 length of forefemur. Palpus 1.1-1.2 length of proboscis; palpomere 2 apically with small white band; palpomere 4 predominantly white or at least apically with large, white spot; palpomere 5 predominantly white, and basally with a dark band never greater than 0.3 length of palpomere. **Antenna:** Length about 0.75-0.80 of proboscis. Diameter of pedicel 1.6-2.0 that of pedicel of female; pedicel pruinose, with 3-5 small white scales. Flagellomere 1 approximately 1.50-1.75 length of individual flagellomeres 2-11; flagellomeres 2-11 subequal to those of female, without scales; flagellomere 12 about 4.0-4.2 length of individual flagellomeres 2-11; flagellomere 13 about 0.5 length of flagellomere 12. **Legs:** Essentially as in section.

MALE GENITALIA. Segment IX: Sternum rectangular; usually short, about 0.1 length of gonocoxite; often posteromedial border moderately to strongly emarginate; anteromedial border usually only weakly emarginate. **Gonocoxite:** Tergal surface usually with 4, occasionally 5, well developed, long, tergomedial setae. **Gonostylus:** Gonostylar claw moderately long and slender. **Dorsal Claspette:** Pedicel narrow, rarely broad. Apex always with 3 setae; dorsal seta usually shorter, occasionally with basomesal projection; ventral setae usually subequal to length of dorsal claspette. **Ventral Claspette:** Ventrally apex rounded (Albitarsis Subgroup) or truncate (Braziliensis Subgroup), with single, large lobe or occasionally bilobed with each lobe separated by moderately shallow median sulcus. **Phallosome:** Aedeagus with apex rounded, without pair of subapical leaflets; always wider than long; ventromesal subtriangular projections strongly developed.

PUPAE. Cephalothorax: Median keel weakly to moderately developed, setae moderately long and lightly to moderately pigmented. Seta 3-C 3b (1-4). Seta 7-C 2b (1-4) or single (Braziliensis Subgroup). Seta 9-C 1-4b. **Trumpet:** Pinna angusticorn and long with long meatal cleft. **Metanotum:** Seta 11-C 1-4b. **Abdomen:** Weakly (*marajoara*) or moderately (*albitarsis, braziliensis*) pigmented. Seta 4-I 5b (1-7) (Albitarsis Subgroup) or 4b (2-6) (Braziliensis Subgroup). Seta 0-II 3-6b (3-8). Seta 8-IV 1-3b (1-4). Seta 9-V short, less than or equal to 3.0 length of 9-IV.

LARVAE. Small to moderately large. **Head:** With distinct dark band extending from collar along frontal ecdysial line to seta 9-C, and occasionally to 3-C (Braziliensis Subgroup). Dorsomentum with median tooth always larger than adjacent teeth. Collar moderately wide to wide. Setae 2-C widely spaced (Albitarsis Subgroup) or moderately closely spaced (Braziliensis Subgroup). Seta 3-C shorter than 2-C. Seta 4-C 1-3b (1-4), short to moderately long. Setae 8,9-C 2b (1-3) (Braziliensis Subgroup), short to moderately long, or weakly plumose (Albitarsis Subgroup). Seta 10-C 2,3b (2-5). **Antenna:** Uniformly heavily pigmented. Seta 1-A short, usually less than width of antenna, inserted on basal 0.3 of antenna. **Thorax:** Moderately to heavily pigmented. Seta 1,2-P usually inserted on a common, strongly sclerotized tubercle; 1-P always palmate with lanceolate branches. Setae 9,10,12-P single and usually long. Seta 11-P 2b (2,3) and usually short. Seta 1-M plumose with numerous branches inserted on an an elongate, flattened shaft. Seta 3-T palmate, brushlike with narrow (*marajoara, braziliensis*) or broad (*albitarsis*), lanceolate branches. **Abdomen:** Median tergal plates moderately developed on segments I-VIII, about 0.2-0.4 width of segment. Accessory median tergal plates on segments II-VI, or on II-VIII (*albitarsis*), variably developed, 1-3 on each segment or single with 2 or 3 lobes. Accessory submedian tergal plates present on segments II-VII as single pair, occasionally double pair. Seta 1-I palmate with lightly to moderately pigmented, narrow to broad, lanceolate branches; 1-II-VII palmate with broad, widely spaced, lightly to moderately pigmented, lanceolate branches. Seta 2-I-VII 1-7. 13-I 4,5b, large; 13-II-VII 4-13b. **Spiracular Lobe:** Pecten with 13-20 teeth. Median plate of spiracular apparatus with lateral arms extending to spiracular opening, directed caudolaterad. **Abdominal Segment X:** Saddle incomplete. Seta 1-X inserted on saddle, short to moderately long, 1.25-1.50 length of saddle.

DISCUSSION. The species included in the Albitarsis Group can be distinguished from those in the Argyritarsis Group in the **females** by the combination of: (1) palpomere 4 predominantly dark, with scattered light scales, (2) scutellum with 8-13 well-developed, dark setae along posterior margin, and (3) sternum I always with submedian stripe of white scales extending length of segment; in the **male genitalia** by: (1) sternum IX usually short, 0.1 length of gonocoxite, (2) gonocoxite with 4 (occasionally 5) well-developed, long tergomedial setae, (3) gonostylar claw of gonostylus moderately long and slender, (4) dorsal claspette narrow, (5) ventrally apex of ventral claspette with single, large lobe or occasionally bilobed with each lobe separated by moderately shallow median sulcus, and (6) aedeagus without pair of subapical leaflets; in the **pupa** by: (1) median keel weakly to moderately developed, (2) setae of cephalothorax lightly to moderately pigmented, (3) seta 3-C 3b (1-4), (4) seta 9-C 1-4b, (5) seta 11-C 1-4b, (6) seta 4-I 5b (1-7) (Albitarsis Subgroup) or 4b (2-6) (Braziliensis Subgroup), and (7) seta 0-II 3-

6b (3-8); and in the **larva** by: (1) seta 1-A short, usually less than width of antenna, (2) seta 1-P always palmate with lanceolate branches, (3) setae 1,2-P usually inserted on common sclerotized tubercle, (4) setae 3-T and 1-I always palmate with lanceolate branches, (5) median plate of spiracular apparatus with lateral arms, and (6) seta 1-X 1.25-1.50 length of saddle.

I have separated the Albitarsis Group into 2 distinct subgroups, the Albitarsis Subgroup composed of 2 species, *albitarsis* and *marajoara*, and the monotypic Braziliensis Subgroup. Both subgroups exhibit a number of apomorphic characters, but *braziliensis* appears to possess fewer and is symplesiomorphic for several characters of the Argyritarsis Group.

The Albitarsis Subgroup includes 2 very closely related species. Their external morphology is similar in all stages, with normal variation resulting in some overlap of diagnostic characters. It is important to correlate all available stages whenever possible when identifying these species. The 2 species are most easily separated in the adult female, but reliable characters are also found in other stages. Species distribution may aid in separating these 2 species, but should not be entirely relied upon as distribution is incompletely known in some geographic areas. The 2 species may be sympatric in southern Brazil, or possibly Paraguay. The Albitarsis Group is widespread, extending from Argentina throughout most of South America east of the Andes and into Central America in Panama, Costa Rica and Guatemala. It does not occur in the Antilles.

ALBITARSIS SUBGROUP

FEMALES. Moderately large to large, wing 3.5 - 4.2 mm. **Head:** Palpomeres 3,4 with scattered, light scales and apically with light spot. **Antenna:** Pedicel dorsally with 4 small, obovate scales. Flagellomere 1 basally with short, light scales and apically with very long light scales; flagellomeres 2-5 with slender, light setiform scales. **Thorax:** Integument pruinose, dorsomedially with yellow scales, anterior median promontory and supraalar regions with white scales. Scutellum with 10-13 large setae and fewer small, weakly developed setae along posterior margin. Pleuron with pruinosity as in section. *Ps* anterodorsally and anteroventrally without light scales. Upper *Mam* rarely with more than 4 light scales. **Legs:** Foretarsus and midtarsus as in section. Hindtarsomere 2 dark in basal 0.5 to 0.9. **Wing:** Vein C with subbasal light spot absent (some *albitarsis*) or present (*marajoara*, some *albitarsis*), when present usually 0.4-0.6 of preceding subbasal dark spot; presectoral light spot absent; sectoral light spot absent or present. R_s with 2 small, dark spots (*albitarsis*, some *marajoara*) or with 1 large, dark spot (some *marajoara*). R_3 with 1,2 dark spots. M predominantly with light cream to yellow scales and a few dark scales. **Abdomen:** Tergum II without caudolateral scale tufts; terga III-VII with light caudolateral scale tufts; terga II-VII usually with numerous light scales forming subtriangular (II-IV) to subrectangular (V-VII) pattern. Tergum VIII without caudolateral scale tuft, with numerous light scales covering entire surface. Sternum as in group.

MALES. Essentially as in females except for sexual characters. **Head:** Proboscis 1.5 length of forefemur. Palpus subequal to proboscis. **Antenna:** Length about 0.75-0.80 of proboscis.

MALE GENITALIA. Segment VIII: Tergum laterally with single row of long setae, with long yellow and cream scales. Sternum anteriorly without patch of golden scales, with white scales; posteriorly with single row of scales. **Segment IX:** Sternum anteromedially weakly emarginate and somewhat thickened. **Gonocoxite:** Parabasal seta more than 3.0 length of its tubercle. **Gonostylus:** Gonostylar claw long and slender, not thickened or flattened. **Dorsal Claspette:** Dorsal seta without well developed basomesal projection. **Ventral Claspette:** Ventrally apex not truncate, rounded and laterally expanded. Preapical plate absent. **Phallosome:** Aedeagus with apex rounded, tip membranous.

LARVAE. Small to large. **Head:** Lightly pigmented, dark brown areas extending from collar along frontal ecdysial line to seta 9-C, not extending anteriorly to 3-C; inverted subtriangular dark spot occasionally developed (*marajoara*). Collar moderately wide. Setae 2-C widely spaced, clypeal index 0.76-1.33. Seta 4-C 2,3b (1-4), moderately long. Seta 8-C 4-6b (3-7). Seta 9-C 3-6b (3-7). **Antenna:** Mesally with long spicules. Seta 1-A moderately long, always longer than width of antenna. **Thorax:** Seta 1-P with pointed, lanceolate branches that overlap with branches of opposite 1-P. Seta 2-P always with single median shaft, 3.0 length of 2-P. Seta 11-P at least 0.5 length of 12-P. Seta 13-P 3,4b (2-5). **Abdomen:** Median tergal plates larger than 0.3 width of segment. Accessory median tergal plates single to triple (*albitarsis*, some *marajoara*) and occasionally bilobed or trilobed (with some *marajoara*). Accessory submedian tergal plates with 1,2 pairs. Seta 10-II single or double (1-3b). **Spiracular Lobe:** Pecten with 15-20 teeth; teeth beginning ventrally as 2 long followed by varying combination of numerous short to moderately long teeth, terminating dorsally with 2 long or with 1,2 long and 1 short tooth. Seta 2-S 6-9b (4-9).

DISCUSSION. Species of the Albitarsis Subgroup are distinguished from the Braziliensis Subgroup by the following characters: in the **adult** by: (1) hindtarsomere 2 with basal 0.5-0.9 dark, (2) vein C with presectoral light spot absent, (3) R_3 with 1,2 dark spots, (4) terga II without caudolateral scale tufts, and (5) scales of terga II-IV usually with numerous light scales forming a subtriangular pattern; in the **male genitalia** by: (1) tergum VIII with long yellow to cream scales, (2) sternum VIII anteriorly without patch of golden scales, (3) sternum IX anteromedially weakly emarginate, (4) parabasal seta of gonocoxite more than 3.0 length of its tubercle, (5) dorsal seta of dorsal claspette without well developed basomesal projection, (6) ventrally apex of ventral claspette not truncate, rounded and laterally expanded, and (7) preapical plate absent; and in the **larva** by: (1) integument of head with dark brown areas not extending anteriorly to seta 3-C, (2) setae 2-C widely spaced, clypeal index about 0.76-1.33, (3) seta 4-C 2,3b (1-4), (4) seta 1-P with pointed, lanceolate branches that overlap with branches of opposite 1-P, (5) seta 13-P 3,4b (2-5), (6) median tergal plates larger than 0.3 width of segment, (7) accessory median tergal plates single to triple (*albitarsis*, some *marajoara*) and occasionally bilobed or trilobed (some *marajoara*), and (8) pecten teeth beginning ventrally as 2 long followed by varying combination of short to moderately long.

The Albitarsis Subgroup is the most apomorphic subgroup in the Argyritarsis Section. Essentially all the characters which distinguish it from the Argyritarsis Group and the Braziliensis Subgroup are apomorphic. Because

the 2 species of the Albitarsis Subgroup (*albitarsis* and *marajoara*) are very similar in all stages, it is imperative that all diagnostic characters be considered in distinguishing these 2 species.

The subgroup is distributed throughout Argentina, Bolivia, Brazil, Colombia, Costa Rica, Guatemala, the Guianas, Panama, Paraguay, Trinidad, Uruguay and Venezuela. *Anopheles albitarsis* is apparently restricted to Argentina, Uruguay, and some parts of southern Brazil and Paraguay. *Anopheles marajoara* evidently does not occur in Argentina and its presence in Uruguay is doubtful. The species may be sympatric in the interior of southern Brazil, in the states of Sao Paulo, Parana and Rio Grande do Sul and possibly in Paraguay. I suspect that *albitarsis* may occur north of Paraguay, in Bolivia and elsewhere northward along the Paraguay and Parana rivers. I have only seen specimens of *marajoara* from Bolivia. It is in the areas of possible sympatry that the keys must be used with great care. The more derived species in the subgroup is *albitarsis*.

6. *Anopheles* (*Nys.*) *albitarsis* Lynch-Arribalzaga

Figs. 2, 3, 12, 13

1878. *Anopheles albitarsis* Lynch-Arribalzaga 1878:150-151. TYPE: Female, Baradero (Buenos Aires), Argentina (NE; original material lost; redescription by Umana et al. (1959:609-618) from type locality does not constitute a neotype designation, this material also lost (Belkin et al. 1968:10).

1937. *Anopheles* (*Nyssorhynchus*) *albitarsis* var. *limai* Galvao and Lane 1937e:211-238. TYPE: Eggs, adults, Pinheiros and Butantan, Sao Paulo (Sao Paulo), Brazil (NE; only slides of stomachs in FMSP, Belkin et al. 1971:4) Synonymized by Lane 1953:242, 244.

1943. *Anopheles* (*Nyssorhynchus*) *albitarsis imperfectus* Correa and Ramos 1943:246-248. TYPE: *Holotype* female (22), Vera Cruz, Sao Paulo, Brazil, G. R. Ramalho (FH; Belkin et al. 1971:4) Synonymy by Lane 1953:242, 244.

Anopheles (*Nyssorhynchus*) *albitarsis* of Lynch-Arribalzaga (1891:137-138); Root (1926a:50, 67-76, 80, 89-110, in part; 1926b:685, 686, 693, 695, 697-700, 702-708, 710-711, 713-714, 716-717; 1932:779, in part); Paterson and Shannon (1927:1275, 1279); Shannon and Del Ponte (1927:715-718, 721-723; 1928:45, 52-53, 108, 109); Davis (1928b:539-549, 554, 563); Dyar (1928:427, 430, 443-444, 486, in part); Lima (1928:105, in part); Kumm (1929:8,9, in part); Hill (1930:712, in part); Prado (1931:200); Shannon (1931:10, 22, in part); Edwards (1932:44, in part); Antunes and Lane (1933:96); Davis (1933:278, 280, 284, in part); Senevet (1934:45-47, 68, in part; 1948b:433-440; 1958:128, in part); Galvao and Lane (1937a:67, 72-73, 75, 77; 1937c:25-27; 1937d:65-69; 1937e:212, 214-216, 222, 234, 237, in part); Komp (1936a:67, 69, in part; 1941b:793, in part), Galvao et al. (1937:37, 41-45); Galvao and Barretto (1939a:111, in part; 1939b:144-150, 156, in part); Galvao (1938a:51, 53; 1940:400, 403, 405-406, 409, 413, 415, 418, 420, 428, 430, 439, 441, 446-449, 452-453, 469, 471-472, 476, 477-478, 1941b:514-515, 518, 520, 527, 561, in part; 1950:39, 41, in part); Lane (1939:21-23, in part; 1944:263-266, in part; 1949:402, 410, 413, 415, in part; 1953:235-236, 238, 240-246, in part); Pinto (1939:294,

345, 362, 369, 371, 375, 379, 388, 395-397, 400, 402, 404, 422, 423-425, in part); Barretto (1940:164-172); Unti (1940a:380-381, in part; 1940b:502-503, 505, in part; 1941:3, 4, 9, in part; 1943a:68, 69-72); Rozeboom and Gabaldon (1941:96-97, in part); Causey et al. (1942:122-126, in part); Correa and Ramos (1942a:38-39, 41-43; 1942b:386; 1942c:314-333; 1944a:105; 1944b:126-128, 135-151; 1947:10, 20, 34, in part); Rozeboom (1942:238, 246-247, in part); Simmons and Aitken (1942:45, 53, 61, 84-87, in part); Cerqueira (1943:18, in part); Coda (1943:189-190, 198, in part); Correa (1943:121, 122, 128-132, in part); Fonseca and Unti (1943:43, 45-52, in part); Mullen-Diaz (1943:1-8); Neghme (1943c:274, in part); Ramos (1943:51-52, in part); Ross and Roberts (1943:31-32, in part); Souza-Araujo (1943:171, 175-176, in part); Causey, Deane and Deane (1944:1-2, 5, 6, in part; 1945:243, in part); Galvao, Lane and Unti (1944:37, in part); Wasicky and Unti (1944:90-94, 100-102, in part); Schiavi (1945:69-75); Deane, L. M. et al. (1946:3-5, 9, 11, 15, in part; 1948:830, 837-838, 847-849, 851-853, 858-868, 878, 933-965, in part); Coda and Ramos (1947:86, 88, in part); Coda (1948:156, in part); Correa (1948:177-189, in part); Manso Soto and Martinez (1948:45-47; 1949:75-79); Pereira Passalacqua (1948:196-203, in part); Pessoa (1948:12-13, in part); Levi-Castillo (1949:9-11, 16, 28, 32, 54-58, 67-89, 93, 96, 99, 102, in part; 1951:78-79, in part); Pinotti (1951:664, 668-669, 673, 682, in part); Rachou and Ferraz (1951:540, 542-543, 547-554, in part); Rachou and Ricciardi (1951:424-426, 428-447, in part); Rachou et al. (1954:178, 181-188, in part); Horsfall (1955:172, 177-178, in part); Bejarano (1956a:9, 20; 1956b:289, 291; 1957:307, 318-323, 348, in part; 1959a:305, 310, 320-323; 1959b:190-196; 1967:149-150, in part; 1973:13, 15); Andrade and Brandao (1957:391-395, 397-416); Andrade (1958b:117-125, in part); Rachou et al.(1958:417, 421, 423-424, in part); Carcavallo and Martinez (1959:98-110); Castro (1959b:449-450, 453); Martinez et al. (1959:111); Umana et al. (1959:609-618); Schreiber and Guedes (1960:355-358, in part; 1961:657-658, in part); Prosen et al. (1960:102, 104); Forattini (1962:324, 371, 376-380, 391, 474, 483, 490, 535, 537-538, 548-550, 579, in part); Garcia and Ronderos (1962:136, 138-140, 155-156); Prosen et al. (1963:64-76, 112, 115-116, 118-120, in part); Garcia and Casal (1965a:5-9; 1965b:5-6, 9); Belkin et al. (1968:10); Morales-Ayala (1971:139, in part).

Anopheles albitarsis of Knab (1913:35-36, in part); Brethes (1916:195, 198, 200-201; 1926a:308-309); Petrocchi (1923:139; 1925:69-70, 72); Muehlens et al. (1925:249, 252-258, 263-267, 269); Covell (1927:8-9, in part); Davis (1927:168-176; 1928a:462-466); Pinto (1930:154, 156, 157, in part; 1932:287, in part; 1944:258-259, 261, 263); Davis and Kumm (1932:93-95, in part); Clark (1934:642); Lane (1936a:131, in part); Root and Andrews (1938:574, in part); Barretto (1939:116, 120, 121, 123, in part); Simmons (1939:151, 176-180, 301, in part); Unti and Ramos (1942:94-95, 98-102, 104-105); Russell et al. (1943:26, 30-31, 36, 41-43, in part); Unti (1943b:92-102); Costa and Basseres (1948:1001, 1003-1008); Guedes et al. (1953:157-165, in part); Foote and Cook (1959:13, 20-32, 113, in part); Forattini (1961:170, 177, 182, in part); Mattos and Xavier (1965:269-270, in part); Stojanovich et al. (1966a:13, 17, 28; 1966b:3-6, 21, 27, 38); Gorham et al. (1967:2-4, 13, 45, 49, in part; 1971:2-4, 10, 38, in part); Forattini et al. (1970:7, in part).

Anopheles (*Nyssorhynchus*) *albitarsis albitarsis* of Galvao (1943:142-151, in part); Galvao and Damasceno (1944:73-83, in part); Rachou (1958:146-147, 150, 157-161, 163-165, 168, 171, 178); Stone et al. (1959:30-31, in part); Vargas (1959:370, 376, in part); Cerqueira (1961:121, part); Ferreira (1964:333, 335, 337-339, 343-346); Knight and Stone (1977:607).
Anopheles albitarsus in part of Dyar and Knab (1906b:161).
Nyssorhynchus albitarsis of Townsend (1934:486, 495, in part).
Nyssorhynchus (*Nyssorhynchus*) *albitarsis* of Chagas et al. (1937:385-389, in part).
Anopheles (*Nyssorhynchus*) *albitarsis limai* of Galvao and Lane (1937e:211-217, 219-220, 222-231, 234-237); Galvao (1940:412, 418, 430, 451, 459-463, 473; 1943:142-151); Rozeboom (1942:239); Deane, L. M. et al. (1946:4).
Anopheles albitarsis limai of Galvao and Barretto (1939a:112); Russell et al. (1943:51); Galvao and Damasceno (1944:75-77, 79, 80-83).
Anopheles (*Nyssorhynchus*) *limai* of Rozeboom (1942:239).
Anopheles (*Nyssorhynchus*) *albitarsis imperfectus* of Galvao (1943:142-151).
Anopheles (Nyssorhynchus) *argyritarsis* of Christophers (1924:9, 37-39, 91, in part); Root (1924:461-462, in part); Dyar (1928:193, in part).
Cellia argyritarsis in part of Coquillett (1906:13).
Anopheles (*Cellia*) *pictipennis* in part of Dyar (1918:150).
Anopheles pictipennis in part of Dyar (1919:86).
Nyssorhynchus albimanus of Autran (1907:10-11).

FEMALE. Wing: 4.2 mm. Proboscis: 2.4 mm. Forefemur: 1.65 mm. Abdomen: 4.35 mm. **Head:** Interocular space wide, 1.1 diameter of pedicel. Frontal tuft with about 7 pairs of long, white, setiform scales. Clypeus wide, 2.5 diameter of pedicel. Proboscis about 1.4 length of forefemur. Palpus 0.95 length of proboscis; palpomeres 1,2 predominantly with long, erect, dark brown scales; palpomere 2 apically with white scales; palpomere 3 brown, dorsomesally with white stripe, apically with narrow white band; palpomere 4 brown with numerous scattered white scales, dorsomesally with white stripe; palpomere 5 with silver scales only. **Antenna:** Length 0.7 of proboscis. Pedicel apically with line of small, decumbent scales. Flagellum as in group and subgroup. **Thorax:** Nonpruinose dark areas of scutum as in section. Broad scales of acrostichal, dorsocentral and median scutal areas yellowish. Broad scales of scutal fossal region and posterolateral part of prescutellar area white. Elongate scales of anterior promontory mesally white and laterally dark brown. Elongate scales of antealar and supraalar areas white. Scutellar setae and light scales as in subgroup. Pleural pruinosity as in section. *Ap* anterodorsally and anteroventrally with long, erect, dark brown scales with violet or purple hue. *PsA* with few black setae and slender white setae. *Ps* anterodorsally rarely with scales. Upper *Mks* with 2-3 well developed, dark setae and 10-12 broad, white, decumbent scales. Lower *Mks* with 1 well developed, dark seta and 6-8 white, squame scales. Upper *Mam* with 3,4 short, white scales and 2 long, white setiform scales. *Pk* with 3,4 dark setae, 4,5 light setae and 5-8 scales. **Legs:** Foretarsus and midtarsus as in section. Hindtarsomere 2 with basal 0.6-0.9 (0.4-0.9) dark; tarsomeres 3-5 white. **Wing:** Dark scales light brown to dark brown. Light scales white or cream. Vein C basal black spot poorly developed (0.2 of humeral light spot) or absent; occasionally (3%, 8/244) remainder of light spots absent, forming a very long, completely dark

area; more often (22%, 53/244) 3 or more light spots absent; subbasal light spot present or absent (25%, 62/244); presectoral light spot always absent; sectoral light spot present or absent (36%, 88/244); subcostal light spot present or absent (19%, 47/244). Rs with 2 small, dark spots and R_3 with 1,2 dark spots. **Abdomen:** Scales of tergum I few, white to cream. Scales of terga II-VIII numerous, cream. Caudolateral scale tufts of abdominal segments III-VIII usually tan to brown. Sterna as in group.

MALE. Wing: 4.5 mm. Proboscis: 3.0 mm. Forefemur: 2.0 mm. Abdomen: 4.8 mm. Essentially as in female except for sexual characters. **Head:** Proboscis 1.5 length of forefemur with numerous brown scales. Palpus 1.0 length of proboscis; palpomere 1 and base of palpomere 2 predominantly black and purple with some erect, white, spatulate scales and few bronze scales; palpomere 2 apically with 2,3 rows of light scales and small white band; palpomere 3 with numerous brown or purple scales and scattered cream scales, basally with small, light band, apically with light spot; palpomere 4 intermingled with patches of dark blue to dark brown scales, white scales and golden scales; palpomere 5 with basal 0.3 dark brown, remainder of palpomere white. **Antenna:** Length 0.8 length of proboscis. Diameter of pedicel 2.0 that of female, pedicel pruinose, with 4-6 small, white scales. Flagellomere 1 without scales, about 1.6 length of individual flagellomeres 2-11; flagellomere 12 about 4.1 length of individual flagellomeres 2-11, plumose only at base; flagellomere 13 about 0.5 length of flagellomere 12, basally with few setae. **Legs:** Claws of foreleg enlarged and triserrate, as in section.

MALE GENITALIA (Fig. 12). **Segment VIII:** Tergum laterally and sternum posteriorly with row of long setae; tergum and sternum with only light scales; sternum with large, moderately broad, silver scales and anteromedially with small patch of narrow, cream scales; tergum with moderately narrow, yellow scales; sternum 0.10-0.15 length of gonocoxite. **Segment IX:** Sternum rectangular, moderately long, about 0.12 length of gonocoxite; medially posterior border emarginate, anterior border weakly emarginate. **Gonocoxite:** Length about 3.0 maximum width. Tergal surface usually with 4 long, tergomedial setae, single apicolateral seta and single apicomesal seta. Parabasal seta moderately retrorsely hooked, about 3.0-5.0 length of its strongly sclerotized tubercle. Apodeme of gonocoxite about 0.15 length of gonocoxite. Accessory setae moderately long; dorsal seta about 0.30-0.35 length of gonocoxite; ventral seta about 0.7 length of dorsal seta. Internal seta subequal to ventral accessory seta, not retrorsely hooked. **Gonostylus:** Gonostylar claw moderately long, slender, moderately sclerotized, about 0.6 length of seta *b*. **Dorsal Claspette:** About 0.25 length of gonocoxite; pedicel narrow and curved, mesally with convex edge, base rounded. Apical setae subequal to dorsal claspette; moderately broad, with striated median rib; dorsal seta strongly curved mesally, without well developed basomesal projection. **Ventral Claspette:** About 0.35 length of gonocoxite; ventrally apex moderately wide with strongly striated, single, rounded lobe expanded laterally. Median sulcus and preapical plate absent. Basal lobules laterally expanded. Refringent structure V-shaped, poorly developed, weakly sclerotized, without lateral arms. Posterior membranous area elongate, well developed. **Phallosome:** About 0.45-0.50 length of gonocoxite, about 1.4 length of ventral claspette. Aedeagus with apex rounded, wider than long; ventromesal subtriangular projections meeting on midline; without leaflets. Posteriormost

end of paramere with small rounded or pointed protuberance.

PUPA (Fig. 12). Abdomen: 4.5 mm. Trumpet: 0.5 mm. Paddle: 1.0 X 0.75 mm. **Cephalothorax:** Moderately pigmented, light brown to greenish brown. Median keel moderately developed. Setae 1-3-C 3b (1-3); 1-C forked, usually longest; 2-C branched, usually shortest; 3-C branched, long. Setae 4,5-C subequal; 4-C 3b (1-3); 5-C usually 3b. Seta 6-C 2f (2-6), long, slender. Seta 7-C 2b (1-3) with one branch slender and 2.0 length of other branch, 1.50-1.75 length of 6-C. Setae 8,9-C subequal, moderately developed, heavily pigmented; 8-C single; 9-C 3,4b (1-5). **Trumpet:** Heavily pigmented, brown to dark brown, border of pinna dark brown. Pinna angusticorn, long, 0.65 length of trumpet, entire border reticulate; meatal cleft long, extending 0.3 length of trumpet. **Metanotum:** Setae 10-12-C moderately developed; 10-C single; 11-C 1-3f (1-4); 12-C 3f (1-4), 1.5 length of 10,11-C, heavily pigmented. **Abdomen:** Moderately pigmented, tan to dark brown. Seta 1-I with about 15 (14-22) primary branches, apically extensively dendritic, all branches uniformly heavily pigmented. Seta 2-I 3,4b, moderately developed. Seta 3-I single (1,2b), subequal to 2-I, stout. Seta 4-I 4,5b (3-6), moderately developed. Seta 5-I 2,3b (1-3), long. Seta 6-I single (1,2b), long, more than 2.0 length of 7-I. Seta 7-I 3b (1-4), branched 0.3 from base. Seta 9-I single (1-3b), long. Seta 0-II-IV 5,6b (4-6), moderately developed; 0-V-VII 3,4b (3-5), 0-VIII single (1,2b). Seta 1-II 5-7b (4-12); 1-III 4,5b (4-13); 1-IV-VII single, long, about 1.5 length of segment. Seta 2-II 3b (3-5); 2-III 4b (1-5); 2-IV 2,3b (1-3); 2-V,VI 2b (1-3); 2-VII single (1-3b). Seta 3-II,III single; 3-IV,V 2-4b (2-5); 3-VI single; 3-VII 3b (1-4). Seta 4-II,III 2,3b (1-6); 4-IV 1-4b; 4-V 3b (2-4); 4-VI single (1-3b); 4-VII 2b (1-3). Seta 5-II 3b (3-5), moderately long and thin; 5-III 6,7b (4-8); 5-IV 2b (1-4); 5-V-VII single, shorter than length of segment. Seta 6-II single, long, 1.5 length of 7-II; 6-III-VII single (1,2b). Seta 7-II 3b (1-5); 7-III-V 1-3b (1-4); 7-VI,VII single. Seta 8-III-VII 2-4b (1-5), subequal to 7-III-VII. Seta 9-II minute, unpigmented; 9-III more than 2.0 length of 9-II, lightly pigmented; 9-IV about 2.0 length of 9-III, heavily pigmented, apically blunt; 9-V thinner basally than 9-IV, about 3.0 length of 9-IV; 9-VI thicker than 9-V, 4.0 length of 9-IV; 9-VII 1.2 length of 9-VI; 9-VIII curved, smaller than 9-VII. Seta 10-III 1-3b; 10-IV,V single; 10-VII single or double (1-3b). **Terminal Segments:** Apex of male genital lobe with short, distinct, mammilliform protuberance; 0.50-0.75 mesal margin of lobe irregularly serrated; length of male genital lobe about 3.2 width, moderately pigmented, light brown. **Paddle:** Wide and apically emarginate, length 1.3 width. Midrib more strongly sclerotized on lateral margin than on mesal. External buttress extending 0.7 length of paddle from base, with minute serrations on apical 0.25; distinct and moderately pigmented. External margin distad of buttress with short (0.01 mm), slender, indistinct spicules. Seta 1-P single, moderately long (0.09 mm); 2-P 2b (1,2), subequal to 1-P.

LARVA (Fig. 13). Head: 0.6 mm. Antenna: 0.3 mm. Saddle: 0.4 mm. **Head:** Moderately pigmented, greenish to tan; with distinct dark brown bands extending along base of setae 5-7-C, between setae 8-C and along frontal ecdysial line to seta 9-C. Collar dark, moderately wide, width 0.05 - 0.08 mm. Dorsomentum well developed, strongly sclerotized; first and second pairs of teeth subequal and smaller than median tooth; third pair inconspicuous and small; all teeth moderately pointed. Setae 2-C with inconspicuous short barbs. Setae 3-C with

10-14 thin, short barbs, about 0.8 length of 2-C. Clypeal index 0.76-1.10. Seta 4-C 3b (2-4), moderately long, not extending to base of 2-C. Setae 8,9-C weakly plumose, 5,6b (3-7). Seta 10-C 3b (2,3). Seta 12-C 3-5b. Seta 13-C 3,4b. **Antenna:** Uniformly dark brown. Dorsally and ventrally with some small dark spicules; mesally with numerous, moderately large, dark, stout spicules. Seta 1-A plumose, with 4-6 branches, short, inserted 0.3 from base. Seta 4-A 2b (2,3), very long. **Thorax:** Moderately to heavily pigmented, tan. Setae 1-3-P inserted on a common, heavily pigmented, strongly sclerotized tubercle; 1-P palmate, with 14-16 (14-19) narrow, lanceolate branches that overlap with branches of opposite 1-P; 2-P plumose, with flattened shaft, 14-19b, long; 3-P single and simple. Setae 4-8-P as in section. Setae 9,10,12-P single and simple, long. Seta 11-P 2b (2,3), about 0.6 length of 12-P; seta 13-P 3,4b (2-5). Seta 14-P 6-10b (5-12), large. Seta 1-M 26-29b (23-32). Seta 2-M single (1,2b). Setae 3-14-M as in section. Seta 3-T palmate, 10-14b, with lanceolate branches lightly pigmented, broad. Setae 4-T 3,4b (2-5). Seta 6-T 2b (1,2). **Abdomen:** Integument as on thorax. Median tergal plates strongly sclerotized, large, 0.3-0.4 width of segment; plate on segment I strongly convex along anterior margin; plates on segments II-VIII moderately convex along anterior margin, subrectangular or subtrapezoidal. Accessory median tergal plates always single, on segments II-VII, larger on caudal segments, with distinct lobes. Accessory submedian tergal plates on segments I-VII; one pair on segment I; 2 pairs on segments II-VII, anterior pair globose or ovoid, posterior pair laterally flattened. Seta 0-II-IV 6-8b (5-10), well developed. Seta 1-I palmate, 14,15 (10-15), lanceolate branches moderately pigmented; 1-II-VII 17-24b (10-25), lanceolate branches more heavily pigmented than those of 1-I. Seta 2-I 3b (3,4), small; 2-II,III 3b (2-4), large; 2-IV,V single, long; 2-VI,VII 3b (2-4). Seta 3-IV 2b (2,3). Seta 4-III 2b (2,3). Setae 6,8,9-I-VIII as in section. Seta 5-IV,V 4b (4,5), large. Seta 7-IV 3b (2-5). Seta 10-II 2b (1,2). Seta 13-II,VI 12,13b (11-13); 13-I,III-V,VII 4-9b. **Spiracular Lobe:** Pecten with 15-19 teeth, with a moderately pigmented row of spicules on basal half of dorsal surface of short and moderately long teeth; teeth beginning ventrally usually as follows: 2 long, 7-12 short to moderately long, 1 long, 2-6 short to moderately long, terminating with 1 long and 1 short or 1,2 long. Median plate of spiracular apparatus with lateral arms extending to below mesal edge of spiracular opening. Seta 1-S 5-7b, extremely large. Seta 2-S plumose, 6-8b, small. Setae 3-6-S single and small. Seta 7-S single (1,2f). Seta 8-S 4-6b (3-6), moderately large. Seta 9-S 6b (6,7), subequal to 8-S. **Abdominal Segment X:** Saddle incomplete, normally uniformly light brown, occasionally mottled with darker pigmentation, medial dorsal caudal process strongly sclerotized. Seta 1-X inserted on saddle, very long, about 1.5 length of saddle. Seta 2-X strongly plumose, large. Seta 3-X pectinate, with 3,4 well-developed branches. Ventral brush with 8 pairs of well-developed, plumose setae. Anal papillae subequal, about 1.0-1.3 length of saddle.

DISCUSSION. *Anopheles albitarsis* can be distinguished from *marajoara*, the only other species in the Albitarsis Subgroup; in the **female** by the combination of: (1) large size (wing: 4.2 mm), (2) interocular space wide, 1.1 diameter of pedicel, (3) frontal tuft with about 7 pairs of setiform scales, (4) clypeus wide, 2.5 diameter of pedicel of antenna, (5) hindtarsomere 2 with basal 0.6-0.9 dark, (6) vein C occasionally with all light spots, except humeral light spot, absent, forming very long, entirely dark area or 3 or more light spots

absent in more than 20% of specimens (subbasal absent in 25%, sectoral absent in 36%, subcostal absent in 19% of specimens), and (7) caudolateral scale tufts of abdominal segments III-VIII usually tan to brown; in the **male genitalia** by: (1) sternum VIII 0.10-0.15 length of gonocoxite, (2) gonocoxite usually with 4 long tergomedial setae, (3) dorsal claspette with base rounded, (4) ventrally apex of ventral claspette moderately wide, (5) without median sulcus, and (6) refringent structure poorly developed and usually posterior membranous area well developed; in the **pupa** by: (1) large size (abdomen: 4.5 mm), (2) seta 9-C 3,4b (1-5), (3) all branches of seta 1-I uniformly heavily pigmented, (4) seta 2-II 3b (3-5), (5) seta 5-II 3b (3-5), (6) seta 9-V about 3.0 length of seta 9-IV, (7) length of male genitalia lobe (gonocoxite) about 3.2 width, (8) length of paddle 1.3 width, and (9) seta 2-P usually 2b (1,2); and in the **larva** by: (1) clypeal index 0.76-1.10, (2) seta 3-C about 0.8 length of 2-C, (3) seta 12-C 3-5b, (4) seta 6-T 2b (2,3), (5) accessory median tergal plates on segments IV-VII always single, (6) seta 1-I 14,15b (10-15), (7) seta 3-IV 2b (2,3), (8) seta 4-III 2b (2,3), (9) seta 5-IV,V 4b (4,5), and (10) seta 7-IV 3b (2-5).

As noted in the subgroup discussion, the adults and larvae of *albitarsis* are usually the easiest stages to distinguish from those of *marajoara*, and the male genitalia and the pupae are the most difficult. It is best to correlate all the characters given in the key among the different stages whenever possible. Unlike *marajoara*, the populations of *albitarsis* I examined exhibit relatively little interpopulational variation. The amount of intrapopulational variation observed in *albitarsis* is also limited relative to *marajoara*. The number of light spots on the costal vein is variable, but only 52% (126/244) of the specimens of *albitarsis* show the full development of all costal light areas often exhibited by specimens of *allopha* (79%, 195/248, of Bolivian specimens). The proportion basally dark on hindtarsomere 2 varies between 0.6 and 0.9. Problems involving species identification because of character overlap between *albitarsis* and *marajoara* are usually due to the variation in specimens of *marajoara* in the southernmost part of its range. Bolivian specimens of *marajoara* exhibit reduced pale spots of the costal vein. However, 3 or more spots are absent in only 3% of these specimens. The amount of dark scales on hindtarsomere 2 in Bolivian *marajoara* specimens may overlap that which is found in *albitarsis*. The overlap of character states can be reduced by examining more specimens.

Anopheles albitarsis seems very closely related to *marajoara*. Although *albitarsis* has not diverged dramatically from *marajoara* on the basis of morphology, the 2 species have diverged to a greater extent with respect to their ecological niches. *Anopheles albitarsis* is an inland species, able to withstand the harsher environmental conditions of a non coastal temperate environment.

Rozeboom (1942:238) stated, "Biologically *A. albitarsis* Lynch-Arribalzaga exhibits strong evidence of sub-specific variations." Many workers have reported that *albitarsis*, as used here, is not endophilic and not involved in the transmission of malaria. Davis (1928b:539-563) reported that *albitarsis* (*albitarsis*) in northwestern Argentina is much less endophilic than it (*marajoara*) appears to be in Brazil. Galvao and Lane (1937d:65-69) reported that *albitarsis* (as *albitarsis limai*) is not associated with malaria and rarely enters houses, although it does bite man outside and is highly susceptible to

infection with *Plasmodium vivax*. In contrast, workers dealing with *marajoara* report a tendency for this species to be endophilic and important in the transmission of malaria. Kumm (1932:1-6) stated that *marajoara* (as *albitarsis*), collected in houses in Bahia, Brazil, had a natural infection rate of 5.8%. On numerous occasions, *Anopheles marajoara* (as *albitarsis domesticus*) has been reported to be endophilic and a malaria vector (Correa et al. 1950).

The type material of *albitarsis* is nonexistent, but I have examined material from the type locality of Baradero, Buenos Aires, Argentina. I have concluded that *albitarsis* is present only in Argentina, Paraguay and southern Brazil. This species is distinct from *marajoara* which occurs northward throughout South America and Central America. Most of the past confusion regarding these 2 taxa resulted from overemphasis of an unreliable and highly variable character, the structure of the exochorion of the egg. Root's (1926b:699-700) description of the egg of the coastal species from Rio de Janeiro, Brazil, caused particular problems as it became regarded as the "typical" *albitarsis*, distinct from *braziliensis*. I believe that Root described the egg of *marajoara* and not that of *albitarsis*. Galvao and Lane (1937e:227-231, 233-238) noticed that their earlier description (1937b:269-288) of the egg of *albitarsis*, from the vicinity of the city of Sao Paulo, Brazil, did not agree with the description and figures given by Root. On the basis of these differences, as well as in the size of the black basal band on hindtarsomere 2, Galvao and Lane described the variety *limai* with a type locality of Pinheiros and Butantan, Sao Paulo, Brazil. Galvao and Lane were correct in noting a difference between Root's *albitarsis* and their own specimens. I agree with Lane's (1953:242, 244) synonymy of *limai* with *albitarsis*. Material which I have examined from the type locality of *limai* is conspecific with *albitarsis* and not the same as *marajoara*. I disagree with Lane's (1953:242, 244) synonymy of *marajoara* with *albitarsis*. After examining the holotype, I am considering *marajoara* not conspecific with *albitaris*.

Lynch-Arribalzaga (1878:150-151) described *albitarsis* based on the adult female. Although the diagnosis was brief, it definitely fits the specimens that I have examined from the type locality of Baradero, Buenos Aires, Argentina. Dyar (1928:443) listed *Cellia braziliensis* Chagas and *Cellia marajoara* Peryassu as synonyms of *albitarsis*. Subsequently *braziliensis* was resurrected to specific status by Townsend (1934:486-499).

Anopheles imperfectus was described by Correa and Ramos (1943:246-248) as a subspecies of *albitarsis* from females collected feeding on a horse in Vera Cruz, Sao Paulo, Brazil. Belkin et al. (1971:4) reported the holotype to be in the Faculdade de Higiene e Saude Publica, but during January 1975, I was unable to locate this specimen. After examination of material from near the type-locality, I have concluded that Lane's (1953:242-244) synonymy with *albitarsis* is correct. However, I disagree with Lane's evaluation of differences between *albitarsis* and *imperfectus*. Lane reported, "*A. albitarsis imperfectus* shows a variation similar to that found in *A. triannulatus* and *A. albimanus*" [Faran (1980) placed *triannulatus* and *albimanus* in different groups within the Albimanus Section]. I consider *domesticus*, described by Galvao and Damasceno (1944:73-87) as a subspecies of *albitarsis*, to be conspecific with *marajoara* and not a subspecies of *albitarsis*.

BIONOMICS. The immatures of *albitarsis* have been found by MMAP in streams and in pools along stream margins. The water was usually clear but

occasionally stagnant and foul. The larvae were always found in streams that were exposed to full sunlight and had grassy vegetation along their edges. The larvae of *albitarsis* were not collected in association with any other species.

Pinto (1939:360) found the larvae of *albitarsis* and *argyritarsis* in the state of Sao Paulo, Brazil, in rock holes along the margins of streams. Barretto (1940) found *albitarsis* larvae in Palmeiras, Sao Paulo, along the margins of a reservoir that had clear water with little organic material and was partially shaded; the larvae were found with *strodei* and *argyritarsis*. Although the pH of the reservoir fluctuated between 6.1 and 7.4, the majority of the larvae were found where the pH ranged between 6.8 and 7.4. Galvao (1940:460) collected *albitarsis* (as *albitarsis limai*) and *strodei* on the outskirts of Sao Paulo, Brazil, in the diggings of a brick factory where vegetation was absent and the water was very turbid, and in grassy rain pools by the Rio Pinheiros, Sao Paulo, in clear water. In Pereira Barrreto, Sao Paulo, Galvao found larvae of *albitarsis* in a large swamp with erect emergent plants and in a marshy area of a river with a very weak current.

The adults of *albitarsis*, unlike the adults of *marajoara*, do not appear to be endophilic; females are zoophilic and seem little attracted to man. Davis (1928b:539-563) found that *albitarsis* in Argentina is much less domestic than *marajoara* (as *albitarsis*) in Brazil. Galvao and Lane (1937e:227, 231, 237) state that *albitarsis* (as *albitarsis limai*) will readily bite man at an open camp after sundown, much like *strodei*, but they stated that in Lussanvira, Sao Paulo, *albitarsis* was found in houses up to 0.7% of the time while *darlingi* was collected in houses from 79.9 to 100% of the time. *Anopheles albitarsis*, unlike *braziliensis*, was never observed biting during the day. Barretto (1939) found that *albitarsis* (as *albitarsis limai*) in Palmeiras, Sao Paulo, was infrequent in houses; *albitarsis* represented only 5.2% of the captures in houses, 2% of the captures on a horse in a Magoon trap and 15% of the captures on a moving horse.

MEDICAL IMPORTANCE. *Anopheles albitarsis* does not seem to be of any importance in the transmission of human malaria. However, there are some reports of low natural infection rates in *albitarsis*. Galvao (1940:461) reports that Gomes de Faria in the state of Sao Paulo, found one of 169 dissected specimens with oocysts. Galvao et al. (1937:41) in the same areas found that while the larvae of *albitarsis* represented 31.2% of the anopheline larvae collected near houses, females represented only 0.7% of the anophelines caught inside houses. However, they collected some specimens of *albitarsis* on human bait outside houses. Telles (1939:7-18) in Una, Sao Paulo, found *albitarsis* and *darlingi* in houses at an altitude of 900 m. Russell et al. (1943:43) state that *albitarsis* may be a vector in northeastern Argentina.

Anopheles albitarsis has been incriminated as a possible vector of the human filarial worm, *Wuchereria bancrofti*. Davis (1928a:457-460) reported that *albitarsis* in Argentina has been experimentally infected with the microfilariae of *Mansonella ozardi* Manson (as *M. tucumana* Bigheri and Araoz). The microfilariae were seen in the thoracic muscles and later in the head and proboscis of the mosquito.

DISTRIBUTION (Fig. 2). *Anopheles albitarsis* is apparently restricted to the southernmost temperate regions of South America. To the north *albitarsis* is found in the state of Sao Paulo and some parts of Paraguay. The species occurs along the coast and in the interior of southern Brazil, Uruguay and

northern Argentina, south to Buenos Aires. There is a possibility it extends north along the Rio Parana and Rio Paraguay but this has not been confirmed. Although usually collected in lowlands, *albitarsis* has been found at an elevation of 900 m.

Material Examined: 192 specimens: 22 males, 21 male genitalia, 91 females, 14 pupae, 44 larvae; 14 individual rearings (12 larval, 2 incomplete).

ARGENTINA (113 specimens: 15M, 3M gen, 66F, 9p, 20L&1; 8 ind rear: 81). **Buenos Aires:** Baradero, 12 Oct 1968, ARG 497, 41pM, 2M gen, 4L, (102, 103, 106, 107), 41pF (100, 101, 105, 108). Buenos Aires, J. Petrocchi, 1F. La Plata, 18 Apr 1920, 1F; Otamendi, Garcia, AG 479, 4L (1,2). **Chaco:** Resistencia, H. Parker, No. 1037, 2F; [From 223] **Entre Rios:** Concordia, 6 F. **Jujuy:** Ledesma, 30 March 1927, 1F. **Misiones:** Iguazu, 18 Jun 1927, R. C. Shannon, 7F; Iguazu Falls, 22 Jun 1927, R. C. Shannon, 4F; Puerto Bemberg, 20 Jun 1927, R. C. Shannon, 7F. **Salta:** Embaracion, 20 Apr 1927, R. C. Shannon, 16F; same locality, 1p, 2L; Salta, Apr 1960, 3F. **Santiago de Estero:** Santiago del Estero, 4 June 1927, 1L; **Tucuman:** Concepcion, 26 March 1926, 6F. Manantial, 2 May 1926, Davis, 1M; Medinas, 9 Mar 1926, R. C. Shannon, 1F; Monteros, 19 May 1926, R. C. Shannon, 6M, 1M gen, 3F; same locality, July 1940, 4F, 3M; Locality not specified, 1M.

BRAZIL (18 specimens: 2M, 14M gen, 1p, 11; 1 ind rear: 1 incomplete). **Rio Grande do Sul:** Porto Alegre, 2 April 1943, 11p. **Sao Paulo:** Porto Ferreira, SPM 898, 7M gen; same locality, A. Aquiar det., 2M gen (89S-2), 2M gen (89S-3), 3M gen (89S-7) (JH). Porto Forrelin, No. 2, 1M (JH). Pinheiros, 1M.

PARAGUAY (61 specimens: 5M, 4M gen, 25F, 4p, 23L&1; 5 ind rear: 41, 1 incomplete). **Capital:** Asuncion, F. Soper, 3M, 4M gen (JH). Asuncion, SW, 8 Oct 1942, 1M. **Central:** Aregua, PGY 164, 4F; PGY 168, 1F. Lago Ypacarai, PGY 101, 11, 3L; PGY 103, 21pF, 1L; PGY 106, 2L; PGY 109, 11pM; PGY 117, 12L, PGY 119, 1F. Ypacarai, PGY 142, 11pF. **Chaco:** Locality not specified, Petrocchi, 2F. **La Cordillera:** San Bernardino, Fiebrig, 6F. **Department not specified:** Supucay, May 1939, 2F. Locality not specified, 6F.

7. *Anopheles* (*Nys.*) *marajoara* Galvao and Damasceno
Figs. 2, 3, 14, 15

1942. *Anopheles* (*Nyssorhynchus*) *marajoara* Galvao and Damasceno 1942a:424-427. TYPE: Males, females, larvae, Ilha do Marajo (Para), Brazil (FMSP 958) TYPE LOCALITY restricted to vicinity of Cachoeira do Arari (Para), Brazil by Belkin et al. 1971:4. Synonymy with *albitarsis* by Lane (1953:242, 244). RESURRECTED FROM SYNONYMY.

1944. *Anopheles* (*Nyssorhynchus*) *albitarsis domesticus* Galvao and Damasceno 1944:73-87. TYPE: Males, females, eggs, Cachoeira do Arari, Ilha do Marajo (Para), Brazil (LU; Belkin et al. 1971:4). Considered as subspecies by Lane (1953:244-245). NEW SYNONYMY.

Anopheles (*Nyssorhynchus*) *marajoarao* of Galvao (1943:142-151); Senevet (1948b:433-440).

Anopheles (*Nyssorhynchus*) *allopha* of Root (1922a:322); Clark-Gill and Darsie (1983:210, 245); Peyton et al. (1983:65, 70); Xavier et al. (1983:128, 129).

Anopheles (*Anopheles*) *allopha* of Bonne and Bonne-Wepster (1925:517).

Cellia allopha of Peryassu (1921:12, 70-71, 78, 80, 82-99); Neiva and Pinto

(1922b:356); Pinto (1923:77-81).

Anopheles (*Nyssorhynchus*) *albitarsis albitarsis* in part of Stone et al. (1959:31); Knight and Stone (1977:60); Xavier et al. (1979:2).

Anopheles (*Nyssorhynchus*) *albitarsis* in part of Root (1926a:50, 67-76, 80, 89-110; 1926b:685-686, 688, 693, 695, 697-700, 702-708, 710-711, 713-714, 716-717; 1932:779); Dyar (1928:427, 430, 443-444, 486); Lima (1928:105); Kumm (1929:8-9); Hill (1930:712); Shannon and Davis (1930:488-489); Shannon (1931:10, 22, 1933:117-118, 125, 128-131, 140); Davis (1933:278, 280, 284); Senevet (1934:45-47, 68; 1937:360-363, 381; 1948a:281-282, 284; 1948b:433-440; 1958:128); Galvao and Lane (1937a:67, 62-73, 75-78; 1937e:212, 214-216, 223, 234-237; 1941:10-11); Komp (1936a:67, 69; 1941b:793; 1942:3, 5, 7, 24-28, 39, 41, 43, 64, 81, 111-112, 132, 151, 168, 179, 182; 1956:40); Rozeboom (1937:950-951; 1938a:95-98, 104-106; 1938b:289-293, 298-301; 1942:238, 246-247); Galvao (1938a:51, 53; 1941b:514, 515, 518, 520, 527, 561; 1950:39, 41); Galvao and Barretto (1939a:111; 1939b:144-150); Pinto (1939:294, 328, 329, 345-362, 369-371, 375, 379, 388, 395-397, 400, 402, 404, 422, 424); Lane (1939:21-23; 1944:263-266; 1949:402, 410, 413, 415; 1953:235-236, 238, 240-246); Kumm et al. (1940:389, 408, 419); Unti (1940a:380-381; 1940b:502-503, 505; 1941:3-4, 9); Rozeboom and Gabaldon (1941:96-97); Causey et al. (1942:122-126); Coutinho (1942b:52; 1943:70; 1946:444-457); Floch and Abonnenc (1942a:2; 1942b:2; 1945:9); Galvao and Damasceno (1942b:123); Galvao et al. (1942:60); Simmons and Aitken (1942:45, 53, 61, 84-87); Bruce et al. (1943:438, 440); Cerqueira (1943:18); Coda (1943:189-190, 198); Fonseca and Unti (1943:43, 45-52); Galvis (1943:54, 78, 83-86, 95, 97); Neghme (1943c:274); Ramos (1943:51-52); Ross and Roberts (1943:31-32); Russell et al. (1943:26, 30-31, 36, 41-43); Souza-Araujo (1943:171, 175-176); Unti and Ramos (1943:24-26, 30-31); Causey, Deane and Deane (1944:1-2, 5-6; 1945:243; 1946:26, 31); Galvao et al. (1944:37); Wasicky and Unti (1944:90-94, 100-102); Deane, L. M. et al. (1946:3-5, 9, 11, 15; 1948:830, 837-838, 847, 849, 851-853, 858-868, 878, 933-965); Deane, M. P. et al. (1946:42, 45, 50); Gabaldon and Cova-Garcia (1946a:20; 1946b:78-83; 1952:177, 181, 187, 200-206); Arnett (1947:198-199; 1950:106, 110); Coda and Ramos (1947:86, 88); Correa and Ramos (1947:10, 20, 34); Deane (1947:19, 27-29); Coda (1948:156);Correa (1948:177-188); Giglioli (1948:71-72, 83); Periera Passalacqua (1948:192-203); Pessoa (1948:12-13); Vargas (1948:155-156, 158-159; 1959:370, 376); Bates and Zulueta (1949:134, 137, 148-149); Levi-Castillo (1949:9-11, 16, 28, 32, 54-58, 67-89, 93, 96, 99, 102; 1951:78-79); Kuyp (1950:40); Carvalho and Rachou (1951:474-485); Oliveira et al. (1951:184, 195, 197-202, 205-207); Pinotti (1951:664, 668-689, 673, 682); Rachou and Ferraz (1951:540, 542-543, 547-554); Rachou and Ricciardi (1951:424-426, 428-447); Rachou et al. (1954:178, 181-188); Horsfall (1955:172, 177-178); Vargas (1956:29, 33; 1958a:1; 1958b:1; 1958c:13; 1975:78-79); Bejarano (1957:307, 318-323, 348; 1967:149-150); Andrade (1958b:117-125); Rachou et al. (1958:417, 421, 423-424); Umana et al. (1959:609-618); Andrade and Leal (1960:147-153); Schreiber and Guedes (1960:355-358; 1961:657-658); Forattini (1962:324, 371, 376-380, 391, 474, 483, 490, 535, 537-538, 548-550, 579); Prosen et al. (1963:64-67, 112, 115-116, 118, 120); Deane et al. (1968:338); Morales-Ayala (1971:139); Kreutzer et al. (1975:354); Kitzmiller

(1977:117-118, 120); Xavier et al. (1979:2); Xavier et al. (1983:128, 129).

Anopheles albitarsis in part of Cruz (1901:426); Neveu-Lemaire (1902:6-9); Knab (1913:35-36); Covell (1927:8-9); Hill (1928:355-357); Pinto (1930:154, 156-157; 1932:287; 1944:258-259, 261-262); Davis and Kumm (1932:93-95); Kumm (1932:1-6); Clark (1934:642); Curry (1934:647, 649); Galvao (1938b:102; 1938c:133-134); Root and Andrews (1938:574); Barretto (1939:116, 120-121, 123); Simmons (1939:151, 176-180, 301); Gabaldon et al. (1940:41-56); Rozeboom (1941:103); Vargas (1941:118, 122-123; 1976:87); Downs et al. (1943:19-20, 29, 31, 33, 35-37, 40-42); Floch and Abonnenc (1943a:1-3, 7; 1946:2-4); Unti (1943a:105, 109-112); Zetek (1944:112-113, 118-120, 122); Causey, Deane, Costa and Deane (1945:146-149); Ernani et al. (1947:740); Stage and Giglioli (1947:74-75); Senior-White and Lewis (1951:152); Renjifo and Zulueta (1952:600-602); Guedes et al. (1953:157-265); Foote and Cook (1959:13, 20-32, 113) Cova Garcia (1961:31-32, 83-84, 120-121); Forattini (1961:170, 177, 182); Mattos and Xavier (1965:269-270); Gorham et al. (1967:2-3, 5, 13, 45, 49; 1971:2, 3, 4, 10, 38); Forattini et al. (1970:7); Cova Garcia and Sutil (1975a:21; 1975b:210; 1976:30).

Anopheles albitarsis albitarsis of Galvao and Damasceno (1944:73-83, in part); Xavier and Mattos (1970:443).

Anopheles albitarsus in part of Dyar and Knab (1906b:161).

Cellia albitarsis of Aiken (1907:66).

Nyssorhynchus albitarsis of Townsend (1934:486, 495, in part).

Anopheles (Nyssorhynchus) albitarsis domesticus of Barretto and Coutinho (1943:320, 323); Galvao (1943:142-151); Galvao, Correa and Grieco (1944:85-102); Schiavi (1945:69-75); Deane, L. M. et al. (1946:4-5); Correa et al. (1950:280); Lane (1953:325, 344-347); Rachou (1958:146, 168-171, 178); Stone et al. (1959:31); Vargas (1959: 382); Cerqueira (1961:121); Ferreira (1964:333, 337, 339, 343-346); Morales-Ayala (1971:139); Xavier et al. (1979:2).

Anopheles albitarsis domesticus of Coutinho (1942a:163-164); Galvao and Damasceno (1944:78-83); Deane (1947:34-35).

Anopheles (Nyssorhynchus) domesticus of Chagas et al. (1937:385, 389).

Anopheles (Nyssorhynchus) braziliensis in part of Fauran (1961:9-10).

Nyssorhynchus albimanus in part of Blanchard (1905:202-204).

Cellia argyritarsis in part of Coquillett (1906:13).

Cellia argyrotarsis in part of Surcouf and Gonzalez-Rincones (1911:69-72, 298).

Anopheles (Nyssorhynchus) argyritarsis in part of Dyar (1925:193); Edwards (1932:44).

Anopheles (Cellia) pictipennis in part of Dyar (1918:150).

FEMALE. Wing: 3.5 mm. Proboscis: 2.1 mm. Forefemur: 1.3 mm. Abdomen: 3.2 mm. **Head:** Interocular space moderately wide, 0.6-0.7 diameter of pedicel. Frontal tuft with 3-5 pairs of long, white, setiform scales. Clypeus moderately wide, 2.0 diameter of pedicel. Proboscis about 1.6 length of forefemur. Palpus 0.95 length of proboscis; palpomeres 1,2 with numerous long, erect, purplish-black scales; apex of palpomere 2 with narrow white band; palpomere 3 with scattered white scales, especially at apex; palpomere 4 with light brown and white scales; palpomere 5 white. **Antenna:** Length 0.7 of

proboscis. Pedicel lightly pruinose, with row of small, white scales. Flagellum as in group and subgroup. **Thorax:** Nonpruinose dark areas of scutum as in section. Broad squame scales of acrostichal, dorsocentral, median scutal and most of scutal fossal area iridescent golden. Broad scales of posterior and lateral prescutellar bare space predominantly yellow or golden, occasionally silver. Elongate scales of anterior promontory mesally white or yellow and laterally dark brown. Elongate scales of antealar and supraalar areas mostly white. Scutellum with setae as in section, with white to yellow scales. Pleural pruinosity as in section. *Ap* anterodorsally and anteroventrally with numerous, dark brown and few, cream scales. *PsA* with numerous silver, slender setae; without scales. Upper *Mks* usually with 2 well-developed, dark setae and 8-12 oval, yellow to cream, decumbent scales. Lower *Mks* with 1 well developed, dark seta and 6-8 broad to elongate silver scales. Upper *Mam* with 3,4 short and long silver setiform scales. *Pk* with 1,2 dark setae, 2,3 light setae and 4-6 scales. **Legs:** Foretarsus and midtarsus as in section. Hindtarsomere 2 with basal 0.5-0.7 (0.3-0.8) dark; tarsomeres 3-5 always entirely white. **Wing:** Dark scales brown to purple. Light scales cream to white. Vein C basal black spot always present but usually small (0.2 of following humeral light spot); never with all light spots absent, spots occasionally represented by few light scales or absent, especially in specimens from Bolivia; rarely with 3 or more light spots absent (3% of Bolivian specimens); subbasal light spot usually present, absent in 6% (15/248) of Bolivian specimens; presectoral light spot usually absent; sectoral light spot usually present, absent in 14% (34/248) of Bolivian specimens; subcostal light spot always present except in 1% of specimens from Bolivia. R_s with 2-3 small to moderately large dark spots, R_3 with 1-3 dark spots. **Abdomen:** Scales of tergum I few, cream. Scales of terga II-VIII cream or beige on proximal segments and shiny almost golden on distal segments. Tergum VIII with large, white scales. Caudolateral scales tufts of abdominal segments III-V dark brown, black on segments VI-VIII. Sterna as in group.

MALE. Wing: 2.7 mm. Proboscis: 2.4 mm. Forefemur: 1.6 mm. Abdomen: 2.9 mm. Essentially similar to female except for sexual characters. **Head:** Proboscis approximately 1.5 of forefemur with dark brown scales. Palpus 1.0-1.1 length of proboscis; palpomeres 1 and 2 predominantly with erect black and purple-tinted scales; palpomere 3 with dark scales, few cream scales at base and stripe of cream scales extending onto expanded apex to form triangular light patch; palpomere 4 with numerous, light brown setae and light brown to golden and white scales; palpomere 5 basally with small ring of brown scales, remainder white. **Antenna:** Length 0.8 of proboscis. Diameter of pedicel 2.0 that of female, pedicel pruinose, with several, white, decumbent scales. Flagellomere 1 with long, light scales, about 1.65 length of flagellomeres 2-11; flagellomere 12 about 4.0 length of individual flagellomeres 2-11, with setae only at base; flagellomere 13 approximately 0.5 length of flagellomere 12, basally with sparse setae. **Legs:** Claws of foreleg enlarged and triserrate, as in section.

MALE GENITALIA (Fig. 14). **Segment VIII:** Tergum laterally with long setae; with slender, elongate, cream scales, except for medial stripe of silver scales. Sternum posteriorly with a row of long setae; with numerous, moderately broad, silver scales; narrower than tergum (0.1 length of gonocoxite). **Segment IX:** Sternum subrectangular, moderately narrow at midline,

0.08-0.10 length of gonocoxite; medially posterior border distinctly emarginate, anterior border indistinctly emarginate. **Gonocoxite:** Length about 2.5-2.7 maximum width. Tergal surface usually with 4,5 long tergomedial setae, 1,2 apicolateral setae at base of gonostylus and single apicomesal seta. Parabasal seta about 4.0 length of its moderately sclerotized tubercle, not strongly hooked distally. Apodeme of gonocoxite about 0.15 length of gonocoxite. Accessory setae long; dorsal seta about 0.35-0.40 length of gonocoxite; ventral seta about 0.75-0.80 length of dorsal seta. Internal seta subequal to ventral accessory seta, curved mesad. **Gonostylus:** Gonostylar claw long and slender, moderately sclerotized, 0.55-0.70 length of seta *b*. **Dorsal Claspette:** About 0.20-0.25 length of gonocoxite; pedicel narrow with mesal projection about 0.3 from base; base truncate, not rounded. Apical setae subequal to dorsal claspette; setae broad, with median rib striated; without basomesal projection of dorsal seta; strongly curved mesad. **Ventral Claspette:** About 0.35 length of gonocoxite; ventrally apex moderately narrow with strongly striated, single, rounded lobe expanded laterally with median sulcus. Preapical plate absent. Basal lobules laterally expanded. Refringent structure and posterior membranous area not developed. **Phallosome:** About 0.5 length of gonocoxite, about 1.6 length of ventral claspette. Aedeagus with apex rounded, wider than long; ventromesal subtriangular projections meeting on midline; without leaflets. Paramere varied, small or large.

PUPA (Fig. 14). Abdomen: 3.8 mm. Trumpet: 0.45 mm. Paddle: 0.85 X 0.50 mm. **Cephalothorax:** Moderately pigmented, tan to dark brown. Wing pad occasionally (Panama specimens) with moderately dark stripes. Median keel weakly to moderately developed. Setae 1-3-C subequal; 1,2-C 3f (1-4); 3-C 2,3b (1-4). Seta 4-C 2,3b (1-4), more slender and longer than 5-C. Seta 5-C moderately developed, 3-5b. Seta 6-C 2b (1-3), slender, long. Seta 7-C 2b (1-4), with one branch slender and 2.0 length of other branch, 1.50-1.75 length of 6-C. Setae 8,9-C subequal, moderately developed, moderately pigmented; 8-C single; 9-C single or double. **Trumpet:** Moderately pigmented, tan to brown, border of pinna dark brown. Pinna angusticorn, long, about 0.7 length of trumpet, border indistinctly reticulate; meatal cleft long, extending about 0.3 length of trumpet. **Metanotum:** Setae 10-12-C moderately developed; 10-C single (1-3b); 11-C 2,3f (2-4); 12-C 2,3b (1-4), moderately pigmented, 1.5 length of 10,11-C. **Abdomen:** Lightly to moderately pigmented, tan to brown. Seta 1-I with 15-20 (9-26) primary branches, apically extensively dendritic, primary branches strongly pigmented, secondary branches with scattered dark patches. Seta 2-I pectinate, 3,4b (1-6), moderately developed. Seta 3-I single (1-2b), subequal to 2-I but stouter. Seta 4-I 5b (2-7), moderately developed. Seta 5-I 2f (1-4), long. Seta 6-I single (1,2b), very long, 2.0 length of 7-I. Seta 7-I 3b (1-6), branched 0.25 from base. Seta 9-I single (1,2b), long. Seta 0-II-V 5,6b (3-8), moderately developed; 0-VI-VII 3,4b (3-7), 0-VIII single (1,2b). Seta 1-II 5-8b; 1-III 4-7b (4-9); 1-IV-VII single, long, 1.5 length of segment. Seta 2-II 4-6b (2-6); 2-III 4-6b (4-9); 2-IV 2,3b (1-5); 2-V-VI 2b (1-3b); 2-VII single or double. Seta 3-II,III single (1,2b); 3-IV 3-5b (1-6); 3-V 2,3b (1-4); 3-VI single or double (1-4f); 3-VII single, double or triple. Seta 4-II,III 3-5f (1-6); 4-IV 3-5b (1-5); 4-V 3b (1-4); 4-VI 1-3b (1-6); 4-VII single or double (1-3f). Seta 5-II 2,3b (1-4), short and thin; 5-III 5,6b (2-7); 5-IV 2-5b (1-7); 5-V-VII single, 1.2 length of segment. Seta 6-II single (1,2b), long, 2.0 length of 7-II; 6-III-VII single or double (1-4b). Seta 7-II

2-4b (2-7); 7-III 2,3b (1-6); 7-IV 3-6b (1-6); 7-V 2-4b (1-5); 7-VI,VII single (1,2b). Seta 8-III-VII subequal to seta 7-III-VII; 8-III 3,4b (2-6); 8-IV 2,3b (1-4); 8-V,VI 1,2b (1-3); 8-VII 2,3b (2-5). Seta 9-II small, unpigmented; 9-III less than 2.0 length of 9-II, moderately pigmented (not pigmented in Bogota, Colombia specimens); 9-IV about 1.6 length of 9-III, moderately pigmented, pointed; 9-V thinner basally than 9-IV, about 2.0 length of 9-IV; 9-VI as thick as 9-V, about 3.0 length of 9-IV; 9-VII about 1.5 length of 9-VI; 9-VIII subequal to 9-VII. Seta 10-III single or double (1-3b); 10-IV,V single (1,2b); 10-VII 2b (1,2). **Terminal Segments:** Male genital lobe with distinct, apical, mammilliform protuberance; mesal margin of lobe irregularly serrated, especially near base; length of lobe 2.6 width; lightly to moderately pigmented. **Paddle:** Very similar to that of *albitarsis* in size and shape, length 1.7 width. Midrib more strongly sclerotized on lateral margin than on mesal. External buttress extending 0.7 length of paddle from base, with small serrations on apical 0.25-0.30; distinct and moderately pigmented. External margin distad of buttress with short (0.01 mm), slender, indistinct spicules. Seta 1-P single (1,2b), moderately long; 2-P single, subequal to 1-P.

LARVA (Fig. 15). Head: 0.6 mm. Antenna: 0.3 mm. Saddle: 0.35 mm. **Head:** Moderately pigmented, greenish brown; with dark brown band along base of setae 5-7-C, subtriangular dark spot between setae 8-C and continuous dark band extending cephalad along frontal ecdysial line to seta 9-C. Collar dark, moderately wide, about 0.08 mm wide. Dorsomentum well developed, strongly sclerotized; first and second pairs of teeth subequal, smaller than median tooth; third pair inconspicuous, small; teeth apically rounded. Setae 2-C with short barbs, occasionally barbs absent. Setae 3-C with 5-12 short to moderately long barbs, 0.65-0.75 length of 2-C. Clypeal index 1.3 (1.0-1.4). Seta 4-C 2,3b (1-4), moderately long, extending to base of 2-C. Seta 8-C weakly plumose, 4-6b. Seta 9-C 3-5b (3-6). Seta 10-C 3b (2-5). Seta 12-C 5b (4-6). Seta 13-C 4,5b (2-9). **Antenna:** Lightly pigmented, tan. Dorsally bare, ventrally with several moderately large, dark spicules; mesally with numerous, large, dark spicules. Seta 1-A dendritic, 3-5b (2-7), short, inserted 0.33 from base. Seta 4-A double (1-3b), long. **Thorax:** Moderately pigmented, usually tan with dark brown or black areas. Setae 1-3-P usually inserted on a moderately sclerotized common tubercle, occasionally seta 3-P inserted on a separate tubercle; 1-P palmate with 14-19 (14-22) moderately narrow, lanceolate branches that overlap with branches of opposite 1-P; 2-P plumose, 18-20b (16-24), long; 3-P single and simple. Setae 4-8-P as in section. Setae 9,10,12-P single, simple and long. Seta 11-P 2f (1-2), about 0.5-0.6 length of 12-P. Seta 13-P 3-6b. Seta 14-P 4-6b (4-10), large. Seta 1-M 31-36b (26-39). Seta 2-M single, occasionally forked. Setae 3-14-M as in section. Seta 3-T palmate, 13-15b (9-19), lanceolate branches moderately pigmented, narrow. Seta 4-T 3,4b (2-5). Seta 6-T 3b (1-3). **Abdomen:** Integument as on thorax. Median tergal plates strongly sclerotized, moderately large, 0.30-0.35 width of segments; plates on segment I strongly convex along anterior margin; plates on segments II-VIII weakly convex along anterior margin, ovoid. Accessory median tergal plate on segment II single, anteriorly arched, ovoid; plate on segment III usually single, occasionally with 2 rounded plates, anterior plate about 1.4 diameter of posterior; plates on segments IV-VII usually 2,3, ovoid, anterior plate subequal, 1.1-2.0 diameter of posteriormost on segments IV-VI, subequal on segments VII, VIII, occasionally plates fused into one large plate

and this plate bilobed or trilobed. Accessory submedian tergal plates on segments I-VII; usually one pair on segments I-VII; occasionally 2 pairs on segments IV,VII, anterior pair pear-shaped, about 1.5 length of laterally flattened posterior pair. All accessory submedian tergal plates variable except for characters used in keys, occasionally absent on any particular segment. Seta 0-II-IV 5-7b (3-11), well developed. Seta 1-I palmate with 17-19 (10-26) lanceolate branches, lightly pigmented; 1-II-VII 20-32b, lanceolate branches lightly pigmented. Seta 2-I 3b (2-4), small; 2-II 3-5b (3-6), moderately large; 2-III 3-5b, large; 2-IV,V single (1-3b), long; 2-VI 3b (1-4), moderately large; 2-VII 5-7b (4-7), subequal to 2-VI. Seta 3-IV 3b (3,4). Seta 4-III 3,4b (3-5). Setae 6,8,9-I-VIII as in section. Seta 5-IV,V 5-7b (4-9), large. Seta 7-IV 4,5b (3-5). Seta 10-II single or double (1-3b). Seta 13-I-VII 4-8b (3-10). **Spiracular Lobe:** Pecten with 15-20 teeth with lightly pigmented spicules on basal 0.5 of short and moderately long teeth; teeth beginning ventrally usually as follows: 2 long, 5-11 short to moderately long, 1 long, 2-7 short to moderately long and 1 long and occasionally 1 short, never terminating with 2 long. Lateral arm of median plate of spiracular apparatus pointed, extending caudolaterally to margin of spiracular opening. Seta 1-S 6,7b (4-9), large. Seta 2-S plumose, 5-9b (4-9), small. Setae 3-5-S single, small. Seta 6,7-S 2b (1,2). Seta 8-S 3,4b (2-5). 9-S 5,6b (4-9), longer than 5. **Abdominal Segment X:** Saddle incomplete, uniformly light brown, with strongly sclerotized, triangular, median dorsal caudal process. Seta 1-X inserted on saddle, moderately long, about 1.25 length of saddle. Seta 2-X pectinate, large. Seta 3-X pectinate, with 4-6 well developed branches. Ventral brush with 8 pairs of well-developed, plumose setae. Anal papillae subequal, equal to length of saddle.

DISCUSSION. *Anopheles marajoara* can be distinguished from *albitarsis*, the only other species in the Albitarsis Subgroup, in the **female** by the combination of: (1) small to moderately large size (wing: 3.5 mm), (2) interocular space moderately wide, 0.6-0.7 diameter of pedicel, (3) frontal tuft with 3-5 pairs of setiform scales, (4) clypeus moderately wide, 2.0 diameter of pedicel, (5) hindtarsomere 2 with basal 0.5-0.7 dark, (6) vein C never with all light spots absent, spots occasionally represented by few scales, 3 or more spots rarely absent, absent in 3% of specimens from Bolivia (subbasal absent in 6%, sectoral absent in 14%, subcostal absent in 1%), and (7) caudolateral scale tufts of abdominal segments III-V dark brown and black on segments VI-VIII; in the **male genitalia** by: (1) sternum VIII 0.1 length gonocoxite, (2) gonocoxite with 4,5 median tergomedial setae, (3) dorsal claspette with base truncate, not rounded, (4) ventrally apex of ventral claspette moderately narrow, (5) median sulcus present, and (6) refringent posterior and transparent membranous area not developed; in the **pupa** by: (1) moderate size (abdomen: 3.8 mm), (2) seta 9-C single or double, (3) secondary branches of seta 1-I with scattered dark patches, (4) seta 2-II 4-6b (2-6), (5) seta 5-II 2b (1-4), (6) seta 9-V about 2.0 length of seta 9-IV, (7) length of male genital lobe (gonocoxite) 2.6 width, (8) length of paddle 1.7 width, and (9) seta 2-P single; and in the **larva** by: (1) clypeal index 1.3 (1.0-1.4), (2) seta 3-C 0.65-0.70 length of 2-C, (3) seta 12-C 5b (4-6), (4) seta 6-T 3b (1-3), (5) accessory median tergal plates on segments IV-VII usually with 2,3 ovoid plates, occasionally these fused into one large plate, (6) seta 1-I 17-19b (10-26), (7) seta 3-IV 3b (3,4), (8) seta 4-III 3,4b (3-5), (9) seta 5-IV,V 5-7b (4-9), and (10) seta 7-

IV 4,5b (3-5).

The specimens from populations of *marajoara* I examined exhibit interpopulational variation. The most consistent geographical variations appear to be in the adult; however, reared larval and pupal material from the entire geographic range of *marajoara* has not been available for study. The adults from southern Brazil show a increase in the number of dark scales on hindtarsomere 2 and the number of dark scales on vein C. Adults from Bolivia exhibit an increase in the number of dark scales on hindtarsomere 2 and some reduction in pale spots on C, as in description. Reduction in pale spots is not as much as that seen for *albitarsis*. In Bolivian specimens 79% exhibit full development of all costal light areas. However, for these specimens, a number of specimens should be examined to verify species identification. In the larva there is the tendency for specimens from Colombia to have fewer setal branches than specimens from Panama, Venezuela and Brazil. Rosa-Freitas et al. (1987:141) found that larval populations in Guajara-Mirim (Rondonia) and Rio Branco (Acre), Brazil have seta 3-C branched. The variation observed in the adults of southern Brazil make it difficult to distinguish adults of *marajoara* and *albitarsis* in areas where both species occur; however, if care is exercised when using the keys the species can be differentiated. The variation observed in the larvae from Colombia should cause no problem in separating *marajoara* from *albitarsis* since *albitarsis* is evidently not found in northern South America.

Kreutzer et al. (1976:473-481) and Kitzmiller (1977:117-120) on the chromosomal banding patterns of *marajoara* (as *albitarsis*) from Brazil, Colombia and Venezuela have yielded some interesting results. These workers have identified 3 chromosomal types. Two of these types are found sympatrically in southern and eastern Brazil. The populations involved are evidently not interbreeding, judging by the absence of inversion heterozygotes. The third type is allopatric, being found in Colombia and Venezuela. All 3 types have been distinguished on the basis of 22 inversions in the X chromosome and the autosomes.

As mentioned in the subgroup discussion, *albitarsis* is most closely allied to *marajoara*. The great morphological similarity of these species is evident in all stages and there is little doubt of a common origin. Outside of the Albitarsis Group, *marajoara* shows affinities toward *braziliensis* and to a lesser extent to the species of the Argyritarsis Group. Kreutzer et al. (1972:564), in some preliminary examinations of salivary gland chromosomes, found that there were definite similarities at the ends of all autosomal arms of *albitarsis* to *darlingi* and to some extent *argyritarsis*. The central portions of the autosomes were not as similar. These authors did not describe where their *albitarsis* was collected, but I presume it was the "typical brazilian" form and was in fact *marajoara*.

I now recognize 2 species in what has been considered as *albitarsis*. I examined the holotype of *marajoara* at the Faculdade de Higiene e Saude Publica in Sao Paulo during January 1975, and have concluded that it is not conspecific with *albitarsis*. *Anopheles allopha* was described by Peryassu (1921:70-71) as a species of *Cellia*. The description is very brief and describes only the adult and male genitalia. For this reason, Root (1926b:700) questioned his synonymy of *marajoara* with *argyritarsis*. Although Root did not examine the type material of Peryassu, he found that material identified by Peryassu as *allopha*

actually contained specimens of *argyritarsis*, *albitarsis* and *darlingi*. *Anopheles allopha* was listed by Dyar (1928:443) as a synonym of *albitarsis* and has been so treated up to 1981 when Faran and Linthicum (1981:37) resurrected *allopha* to species status. They had examined material from the type locality and considered *allopha* not to be conspecific with *albitaris*. Lourenco-de-Oliveira and Deane (1984:509) presented a case for treating *allopha* as a *nomen nudum*. Later, Lourenco-de-Oliveira examined the syntype material of *allopa*, reported by Belkin et al. (1971:4), in the Museo Nacional, Rio de Janeiro. He found that 4 of the 7 specimens labelled as *Cellia allopha* were either missing or badly damanged and 3 were actually *argyritarsis* (1987, personal communication). I no longer consider *allopha* as the valid name of the presently discussed species. I am considering *marajoara* as the valid name of the species described here, since the syntypes of *allopha* do not represent this species and *marajoara* is the next available name for this species. For the present, I am considering *allopha* as a *nomen dubium*.

Although *marajoara* was synonymized with *albitarsis* in the past, the presence of a form throughout most of northern South America and Central America that was distinct from *albitarsis* was generally accepted. Galvao and Damasceno (1942a) described *marajoara* based on adults and larvae from Ilha do Marajo, Para, Brazil, as being very closely related to *albitarsis*. Lane (1953:243-244) synonymized *marajoara* with *albitarsis*. Rozeboom (1942:239) pointed out that the differences observed in *albitarsis* are part of a continuous series of variations and that some of these differences are worthy of taxonomic recognition. However, according to Rozeboom there are differences in the biology of the species not yet explained. Galvao and Damasceno (1944:73-87) described *domesticus* as a subspecies of *albitarsis* from Ilha do Marajo, Para, Brazil. Coutinho (1942a:163-164) regards it as a dangerous malaria vector. Furthermore, Galvao and Damasceno report that the species from Sao Paulo, Brazil, and Argentina (*albitarsis*) are the same and distinct from the species in northern Brazil (*marajoara*). Rios et al. (1984:461) studied specimens from 18 states or territories in Brazil and could not correlate morphological and behavioral characters to justify the existence of two subspecies, an endophilic vector of malaria (as *albitarsis domesticus*) and an exophilic and non-vector (as *albitarsis albitarsis*). Klein and Peyton (1987, personal communication) have reported the existence of morphologically and behaviorally distinct forms of *marajoara* (as *albitarsis*) with different malaria vectorial capacities in the state of Rondonia, Brazil and in the department of Beni, Bolivia. They report that some forms of *marajoara* may well represent a new species from this region. Specimens of these populations have not been studied in this revision. However, adult specimens of *marajoara* studied from Bolivia, particularly in the area of Rincon del Tigre, are difficult to distinguish from *albitarsis*.

BIONOMICS. The immatures of *marajoara* have been found in the following sites: large ground pools, small stream pools, swampy shores of lakes, turbid marshy depressions in a swamp, small road puddles and small ponds. Most of the immatures were found exposed to full sunlight, rarely in partial shade and never in deep shade. Most of the sites contained either grassy or herbaceous vegetation, usually both. The water was usually clear but occasionally turbid, and most of the sites had a muddy bottom. As happens for species of the Argyritarsis Section, most immature breeding sites are in areas of secondary

growth, such as open savannas or along roads.

Root (1926b:704) found the larvae of *marajoara* (as *albitarsis*) associated with aquatic vegetation such as green algae, water hyacinth, *Ceratophyllum* spp., *Salvinia* spp. and *Azolla* spp. and usually not in bare, muddy pools. He observed that *marajoara* had a preference for large bodies of water like large ponds, marshes, and side bays and overflows of rivers. To a lesser extent the larvae were in floatage and in small pools and puddles. According to Kumm et al. (1940:408) and Arnett (1950:99-115) larvae are found among algal filaments and emergent vegetation in ponds in direct sunlight. Rozeboom (1937:950-951) collected the larvae from the southwestern arm of Gatun Lake in Panama in patches of *Chara* sp., *Naias* spp. and *Utricularia* spp. According to Foote and Cook (1959:113), larvae have been found in Trinidad in rice fields and in Venezuela in lakes with *Pistia stratiotes* and *Eichornia* spp. Deane et al. (1948:860-862) reported that the immatures sites are in many types of water but mainly in marshes, in grassy spots along the margins of rivers and in lagoons rich in organic matter. They also reported, in the drier areas of northeast Brazil, a variation of the typical *albitarsis* (probably not *marajoara*) occuring in fresh water as well as in places with a sodium chloride content of 7%. Forratini (1962:378) stated that Cova Garcia has found the larvae in brackish water. Pinto (1939:360) reported that in the state of Rio Grande do Norte, Brazil, the larvae of *marajoara* (as *albitarsis*) are found in small streams, springs and in the drinking water of animals with the plant *Pistia stratiotes*, and in association with *argyritarsis*, "*tarsimaculatus*", *triannulatus* and *gambiae*. Godoy and Pinto (1923:29) showed that *marajoara* (as *albitarsis*) is easily reared in the laboratory.

Anopheles marajoara has been collected by MMAP with 3 other species of the Argyritarsis Section, *darlingi*, *argyritarsis* and *braziliensis*. It has also been found with *rangeli* and *strodei* of the Albimanus Section, and with *Aedeomyia* (*Ady.*) *squamipennis*, *Aedes* (*Och.*) *scapularis*, *Coquillettidia* (*Rhy.*) *juxtamansonia*, *Culex* (*Cux.*) *coronator*, *Cx.* (*Cux.*) *laticlasper*, *Cx.* (*Cux.*) *thriambus*, *Cx.* (*Mel.*) *bastagarius*, *Cx.* (*Mel.*) *chrysonotum*, *Cx.* (*Mel.*) *erraticus*, *Mansonia* (*Man.*) *humeralis*, *Psorophora* (*Gra.*) *cingulata*, *Ps.* (*Gra.*) *confinnis*, *Uranotaenia* (*Ura.*) *geometrica* and *Ur.* (*Ura.*) *lowii*.

The adults can be either feral or domestic. In the state of Bahia, Brazil, Davis and Kumm (1932) reported that *marajoara* (as *albitarsis*) represented 62% of all anophelines caught feeding on a bait animal (horse). In Rio Grande do Norte, Brazil, they did not find a single infected specimen of *marajoara* (as *albitarsis*), *argyritarsis*, "*tarsimaculatus*" or *triannulatus* inside houses, even though the larvae of *marajoara* and *argyritarsis* were more numerous near the houses than were the larvae of *gambiae* whose females were found infected in houses. Curry (1934:644-651) and Rozeboom (1937:950-951; 1938b:298; 1942:239) stated that *marajoara* (as *albitarsis*) ignores man and does not enter houses in Panama; this apparently is also true in Venezuela, British Guiana and Trinidad (Rozeboom 1942:239). *Anopheles marajoara* is domestic and readily enters houses in some parts of Brazil. According to L. M. Deane et al. (1946:4-5), in many parts of eastern Rio Grande do Norte, Paraiba, Pernambuco, Alagoas and Amazonia, *marajoara* (as *albitarsis domesticus*) can be captured in large numbers in houses both day and night. The reasons for the different behavior of *marajoara* in different geographic areas are not understood; possibly the difference reflects the ecological habitat in which the species

lives and is not related to subspecific variation.

According to Horsfall (1955:177) the females feed on whatever animal is available. He states that Hill examined 7 females and found that 2 had fed on man and 4 on horses. Downs et al. (1943:29) stated that animals larger than man were preferred by *marajoara*. Regarding flight range, the adult female is able to fly 560 to 1,500 m (Godoy and Pinto 1923; Correa et al. 1950) from its breeding sites.

MEDICAL IMPORTANCE. *Anopheles marajoara* is not a primary vector of malaria throughout most of its range. It apparently can transmit malaria and should be more thoroughly studied as a potential vector (Pinotti 1951).

There is no doubt that *marajoara* will readily attack man under the proper conditions; although, only along the coast of Brazil does *marajoara* enter houses and become a potential malaria vector. *Anopheles marajoara* has been experimentally infected and has been found infected with malaria parasites in nature. Godoy and Pinto (1923) infected *marajoara* (as *albitarsis*) with *Plasmodium vivax*, *P. malariae* and *P. falciparum*. They also found *marajoara* (as *albitarsis*) naturally infected with sporozoites in the state of Rio de Janeiro. According to Galvao (1940:461), Boyd observed that 6.2% of the *marajoara* which were dissected had oocysts and 2.8% had sporozoites in Baixada Flumeninense, Rio de Janeiro.

Although *marajoara* can be infected, the percentage of individuals that are found naturally infected is well below the figure observed for *darlingi*, an established vector. L. M. Deane et al. (1946:5) found *marajoara* was more abundant inside houses than outdoors on Marajo Island, Para, Brazil. However, all of the 224 *marajoara* dissected were negative for *Plasmodium* spp., while sporozoites were found in *darlingi*. Only 2 of 1,493 *marajoara* examined by these authors were infected with malaria parasites. Arruda et al. (1986:873-881) failed to detect *P. falciparum* sporozoite antigen in over 2,000 *An. marajoara* (as *albitarsis*) specimens tested from Para, Brazil and suggested the possibility that this species might be refractory to *P. falciparum* infection. They did, however, find that from 2.2% to 4.5% of the specimens contained *P. vivax* sporozoite antigen, a greater frequency than that found in *An. darlingi*.

In some places *marajoara* has been regarded as having little to do with malaria transmission. Rozeboom (1938b:298) believes its reluctance to attack man in Panama is the principal reason it is not a malaria vector. He has suggested the possibility that *marajoara* was introduced into Panama and is resistant to infection by the Panamanian strain of *P. falciparum*. L. M. Deane et al. (1946:4) observed that *marajoara* (as *albitarsis*) constituted 97.6% of the anophelines captured outdoors and only 4.3% of those in houses in Ceara, Brazil. They reported that shortly after 1938, when *Anopheles gambiae* Giles was incriminated as the vector in a malaria epidemic in Ceara, 24% of the population had gametocytes in their blood. At that time 314 specimens of *marajoara* were dissected and all were negative for *Plasmodium* spp.

DISTRIBUTION (Fig. 2). *Anopheles marajoara* is predominantly a tropical species normally found at low elevations, although it has been reported up to an elevation of 400 m in the Serra do Cabral, Minas Gerais, Brazil. This species is common on the coast and in the interior. It occurs in Central America in Costa Rica and Panama. Forattini (1962:378) reports that *marajoara* occurs in Honduras. The southernmost extent of its distribution is not known; it is not known if it occurs in southern Brazil and Paraguay. Elsewhere in

South America, *marajoara* occurs in Bolivia, Colombia, the Guianas, Trinidad and Venezuela. West of the Andes, *marajoara* extends at least as far south as the Department of Valle Del Cauca, Colombia.

Material Examined: 2,903 specimens: 339 males, 64 male genitalia, 1,503 females, 330 pupae, 667 larvae; 267 individual rearings (127 larval, 132 pupal, 8 incomplete); 4 progeny rearings.

BOLIVIA (295 specimens: 16M, 3M gen, 276F). **Beni:** El Socorro Marsh, Aug 1945, KO 113-32, 1M, 1M gen; same locality, 17 Aug 1945, KO 113-42, 1F, 1M, 1M gen. Lorena, 24 Jan 1943, Torres, KO 113-38, 4F (3072). San Ignacio, 17 Sep 1943, KO 113-35, 1F (3052). San Joaquim, 7 Jun 1964, 1F; same locality, 8 Jun 1964, 1F; same locality 12 Jun 1964, 2F; same locality, 1M, 1F. Santa Clara, 27 Oct 1043, 5F (KO 113-33), 8M (KO 113-28). Todos, 9 May 1944, KO 113-41, 4F (38). Trinidad, Aug 1946, E. Soracho, Bol 48, 12F; same locality, May 1946, D. Cullar, KOH 20-2, 6F. **Santa Cruz:** Chavez, 11 May 1944, KO 113-37, 4F (315); same locality, 12 May 1944, KO 113-30, 9F (3158). La Cruz, 13 Aug 1943, KO 113-31, 1M, 1M gen, 5F (3049); Loma Alta, 19 Jan 1944, KO 113-40, 12F (3094). **State not specified:** Rosario, Nov 1921, W. M. Mann, 53F. Locality not specified, Carr, 1F (2749-B), 3F (2767-B), 1F (2768-B), 15F (2770-9), 12F (2770-C), 9F (2792-A), 2F (2793-A), 4F (2793-B), 1F (2780-C), 1F (2794-A), 2F (2802), 2F (2824), 1F (2825), 3F (2828), 1F (2829), 1F (2850), 1F (2851), 1F (2853), 2F (2860), 3F (2861), 1F (2863), 1F (2864), 3F (2865), 1F (2867), 3F (2869), 1F (2870), 1F (2872), 1F (2873), 4F (2875), 3F (2876), 1F (2879), 9F (2881), 5F (2882), 5F (2883), 2F (2884), 10F (2888), 4F (2889), 4F (2892), 2F (2893), 2F (2894), 4F (2895), 1F (2897), 4F (2898), 2F (2899), 1F (2906), 1M 2997), 1F (S.F.A. 2997), 1F (S.F.A. 3014), 1F (S. F. A. 3040a), 7F (S.F.A. 3040B), 3F (S. F. A. 3040-C); W. Komp KOH-20-3, 3M, 1F.

BRAZIL (1,308 specimens: 155M, 7M gen, 614F, 253P&p, 279L&l; 235 ind rear: 1151, 120p). **Amazonas:** Rio Maderia, May 1931, R. C. Shannon, 1F (JH). **Bahia:** Bom fim, 26 Jan 1930, 8F, **Caravalles,** 6 May 1944, MacCreary, 50F. Salvador, 1972, J. Fowler, BRS 85, 1L; same data BRS 100 3L; same data, BRS 106, 1L; same data, BRS 110, 1L; same data, BRS 111, 3L; same data, BRS 112, 3L; same data, BRS 113, 3L; same data, BRS 120, 6L; same data, BRS 121, 3L; same data, BRS 141, 2L; same data, BRS 142, 1L; same data, BRS 143, 3L; same data, BRS 144, 1L; same data, BRS 145, 3L; same data, BRS 151, 2L; same data, BRS 163, 3L; same data, BRS 164, 2L; same data, BRS 186, 1L; same data, BRS 225, 4L; same data, BRS 260, 1p; same data, BRS 311, 16L; same data, BRS 312, 2L; same data, BRS 324, 1L; same data, BRS 720221, 3L; same data, BRS 720229, 7L; same data, BRS 720303, 4L. Locality not specified, 26 March 1929, R. C. Shannon, 9L, 2p; 27 May 1929, 1F (JH); same locality, 27 March 1931, H. Kumm, 11F (JH). **Ceara:** Fortaleza, 1 Aug 1943, 1L; same locality, P. MacCreary, 24 Aug 1943, 8F, 4M. Ico, Causey, 1F. Locality not specified, 1M gen (JH). **Goias:** Santo Theresa, 22 Nov 1918, Peryassu, 1M (JH). **Para:** Altamira Area, 7 Jun 1976, Moramy, 4F (M-1). Boa Vista, Townsend, 28F. Fordlandia, June 1931, 14F (JH); same locality and date, R. C. Shannon, 1F. Itupiranga, 1 Jun 1976, Moramay, 1pF (1200-102); Maraba, 9 Apr 1976, Moramay, 11pM (1152-002), 3pM (1152-100,101,102), 11pF (1152-1), 4pF (1152-103,104,105,106); same locality and collector, 22 Apr 1976, 11pF (1154-1); same locality and collector, 9 Jun 1976, 21pF (1162-1,2); same locality and collector, 15 Jun 1976, 11pM (1164-1), 3pM (1164-101,103,104), 1pF (1164-102). Maraba Area, 3 Mar 1976, Moramay, 1F (A-1); same locality and collector, 22 Apr 1976, 1pM (1155-102), 4F (M-2); same

locality and collector, 27 Apr 1976, 1F (M-2); same locality and collector, 28 Apr 1976, 15F (M-3); same locality and collector, 29 Apr 1976, 1F (M-4); same locality and collector, 3 May 1976, 8F (M-5); same data, 1pM (1025-100); same locality and collector, 4 May 1976, 12F (M-6); same locality and collector, 5 May 1976, 9F (M-7); same locality and collector, 6 May 1976, 12F (M-8); same locality and collector, 7 May 1976, 9F (M-9); same locality and collector, 7 Jun 1976, 2F (M-1); same locality and collector, 8 Jun 1976, 6F (M-2); same locality and collector, 10 Jun 1976, 1F (M-4); same locality and collector, 11 Jun 1976, 2F (M-5); same locality and collector, 15 Jun 1976, 4F (M-7); same locality and collector, 16 Jun 1976, 3F (M-8); same locality 22 Jun 1976, 4F (M-10); same locality, 25 Jun 1976, 1F (M-13); same locality, 28 Jun 1976, 1F (M-1); same locality and collector, 29 Jun 1976, 6F (M-1); same locality and collector, 30 Jun 1976, 4F (M-2); same locality and collector, 1 Jul 1976, 4F (M-3); same locality and collector, 2 Jul 1976, 3F (M-4); same locality and collector, 3 Jul 1976, 5F (M-5,6,10); same locality and collector, 5 Jul 1976, 4F (M-6); same locality and collector, 6 Jul 1976, 1F (M-7); same locality and collector, 7 Jul 1976, 1F (M-8); same locality and collector, 8 Jul 1976, 5F (M-9); same locality and collector, 9 Jul 1976, 9F (M-10); same locality and collector, 10 Jul 1976, 6F (M-11); same locality and collector, 4 Aug 1976, 2F (A13); same locality and collector, 6 Aug 1976, 1F (A15); same locality and collector, 8 Sep 1976, 2F (A1); same locality and collector, 9 Sep 1976, 1F (A1); same locality and collector, 16 Sep 1976, 1F (A1); same locality and collector, 18 Oct 1976, 1F; same locality and collector, 19 Oct 1976, 34F (-1); same locality and collector, 20 Oct 1976, 3F (-1); same locality and collector, 21 Oct 1976, 32F (-1); same locality and collector, 8 Nov 1976, 12F (-1); same locality and collector, 9 Nov 1976, 16F (-2); same locality and collector, 10 Nov, 1976, 6F (-2); same locality and collector, 11 Nov 1976, 20F (-2); same locality and collector, 12 Nov 1976, 18F (-2); same locality, 24 Sep 1975, D. R. Roberts, 1F (C-18); same locality and collector, 18 May 1976, 3F (R-1); same locality and collector, 19 May 1976, 3F (R-2); same locality and collector, 20 May 1976, 9F (R-3); same locality and collector, 22 May 1976, 1F (R-5); same locality and collector, 23 May 1976, 2F (R-6). Maraba, Kiv 13-M-A, 18 Jun 1976, Moramay, 1pM (1176-103). Maraba, Kiv 86, 18 Sep 1976, Maramay, 2pM (1251-101,102), 1pF (1251-100); same locality and collector, 22 Sep 1976, 11pM (1253-3) 11pF (1253-2), 2pM (1253-101-105); same locality and collector, 23 Sep 1976, 5pM (1254-102,103,106,107, 109), 1pF (1254-101); same locality and collector, 24 Sep 1976, 11pF (1255-1), 1pM (1255-101), 4pF (1955-102,103,104,106); same locality and collector, 25 Sep 1976, 31pF (1256-1,2,4), 2pM (1256-101,102); same locality and collector, 26 Sep 1976, 11pM (1257-4), 1pF (1257-2), 5pF (1257-100,101,102,103,104); same locality and collector, 1 Oct 1976, 11pM (1260-6), 11pF (1260-2); same locality and collector, 7 Oct 1976, 21pM (1261-3,4), 11pF (1261-2), 2pM (1261-101,104), 3pF (1261-100,105), same locality, 8 Oct 1976, 31pM (1262-2,3,4), 61pF (1262-2,4,8,9,10), 4pM (1262-100,104,105,109), 3pF (1262-102,103,107); same locality and collector, 11 Oct 1976, 11pM (1263-3), 11pF (1263-1), 1pM (1263-100), 1pF (1263-101). Maraba, Km 68-L-18, 22 Jul 1976, Moramay, 1pF (1172-101). Palestina, 5 Mar 1975, Pio, 2F (172-1, 172-100); same locality and collector, 10 Mar 1975, 1F; same locality, 9 Jun 1975, D. R. Roberts, 11pM (500-102), 1pF (500-104); same locality and collector, 3 Mar 1976, 1F; same locality, 12 Feb 1976, Moramay, 1pF (101-102); same locality and collector, 14 Feb 1976, 11pF (1002-1); same

locality and collector, 27 Apr 1976, 1pF (1155-103); same locality and collector, 18 May 1976, 11pF (1022-8); same data, 21pM (1023-1,4), 21pF (1023-2,3), 1pF (1023-105); same locality and collector, 5 Jun 1976, 41pF (1038-1,234); 1pF (1038-102); same locality and collector, 29 Jun 1976, 11pM (1033-1), 2pM (1033-101,102), 2pF (1033,100,104); same locality and collector, 30 Jun 1976, 11pM (1034-2); 21pF (1034-1,3); 2pM (1034-101, 102), 1pF (1034-100); same locality and collector, 1 Jul 1976, 11pM (1035-1), 41pF (1035-4,5,6,7), 3pM (1035-102,103,105), 3pF (1035-101,104,106); same locality and collector, 2 Jul 1976, 11pM (1036-2), 21pF (1036-1,3), 4pM (1036-103,105,108,109), 2pF (1036-101,102); same locality and collector, 3 Jul 1976, 61pM (1037-2,5,6,7,8,9), 21pF (1037-1,3), 6pM (1037-100,101,102,103,105,106); same locality and collector, 5 Jul 1976, 1pM (1038-101); same locality and collector, 8 Jul 1976, 11pM (1041-10), 31pF (1041-6,7,9); same locality and collector, 26 Jul 1976, 1pM (1044-120); same locality and collector, 18 Aug 1976, 21pF (1045-1,2); same locality and collector, 18 Aug 1976, 21pF (1046-2,3), 1pM (1046-101); same locality and collector; 17 Sep 1976, 11pM (1250-1), 41pF (1250-3,4,5,6), 2pM (1250-100,102); same locality and collector, 21 Sep 1976, 21pM (1252-6,13), 11pF (1252-16), 2pM (1252-100,104); same locality and collector, 27 Sep 1976, 61pF (1258-1,2,3,4,9,10), 2pF (1258-102,103); same locality and collector, 29 Sep 1976, 21pM (1259-5,8), 2pF (1259-101,102). Palestina, S. Joaodo Araguaia, 9 Mar 1976, Moramay, 11pM (1011-3), 11pM (1012-2), 21pF (1012-4,4); same locality and collector, 11 Mar 1976, 11pM (1014-2); same locality and collector, 12 Mar 1976, 1pM (1015-101), 2pF (1015-3,102); same locality and collector, 13 Mar 1976, 21pM (1016-2,3) 1pM (1016-101), 21pF (1016-1,2); same locality and collector, 16 Mar 1976, 21pM (1018-2,4), 2pM (1018-102,103), 1pF (1018-101); same locality and collector, 17 Mar 1976, 41pM (1019-1,2,4,5), 2pM (1019-102, 1020-100), 11pF (1020-1); same locality and collector, 18 Mar 1976, 11pM (1021-4), 1pM (1021-102), 71pF (1021-1,2,3,5,6,7,8), 1pF (1021-100); same locality and collector, 19 Mar 1976, 1pM (1022-103), 2pF (1022-100,102); same locality and collector, 22 Mar 1976, 1pM (1025-101); same locality and collector, 25 Mar 1976, 11pM (1028-1), same locality and collector, 26 Mar 1976, 11pM (1029-1), 21pF (1029-2,3); same locality and collector, 29 Mar 1976, 1pM (1030-101); same locality and collector, 30 Mar 1976, 3pM (1031-106,107,109); same locality and collector, 31 Mar 1976, 1pM (1032-102), 1pF (1032-107). Santa Anna, 5 Feb 1925, No. 13, 2M (JH); same locality, 19 Feb 1925, No. 24, 1M, (JH). Locality not specified, Apr 1930, Davis, 1F. **Pernambuco:** Alderia Velha, 28 June 1943, 2L; Recife, 1L. **Rio de Janeiro:** Ilha do Fundao, BRA 299, 41pM, 61pF, 3pM, 5pF. Porto da Caixes, 19 Feb 1925, 2F; same locality, 3 March 1925, No. 36, 1F, 2L (JH); same locality, 17 March 1925, 2M gen, (53, 83) (JH); same locality, 15 Apr 1925, 2M (67), 1F (76) (JH); same locality, 29 May 1925, No. 94, 2M, 3F (JH). Rio de Janeiro, M. Boyd, 7M, 2F. **Rio Grande do Norte:** Macaphyba "Old Quarry" near Natal, 20 July 1943, 4L; same locality, 25 July 1943, 3L; same locality, 25 July 1943, P. MacCreary, 21. Macaiba, on Pitumbu River, 25 June 1943, 1L; same locality, 6 Sep 1944, 1L; same locality, 9 Sep 1945, 4L, 3p; same locality, 19 Sep 1945, 2L (11-2, 11); same locality, 25 Sep 1944, 2L, 1p (14-2); same locality, 23 Oct 1944, No. 22, 17L (1,2,3,4,5,6,7,8,9, 10,14,17, 19,20,22,26). Natal, 2 May 1943, P. MacCreary, 1F; same locality and collector, 4 May 1943, 1F; same locality and collector, 28 May 1943, 2F; same locality and collector, 22 June 1943, 1F; same locality and collector, 30 June 1943, 1M, 1M gen; same locality and collector,

2 July 1943, 1F; same locality and collector, 23 July 1943, 2F; same locality and collector, 31 July 1943, 1F; same locality and collector, 17 Dec 1943, 1F; same locality and collector, 19 Dec 1943, 2F; same locality, 15 Nov 1943, 1M; same locality, 15 Dec 1943, 1F; same locality, 17 Dec 1943, 2F; same locality, 18 Dec 1943, 1M, 1F; same locality, 19 Dec 1943, 1F. same locality, 1944, det. Dalmat, 8F; same locality, 2 Mar 1945, 2p. Natal, Pitumbu River, 23 Oct 1944, det. H. T. Dalmat, 4M, 3F; Natal, Casupiranguinha River, 1 Nov 1944, det. H. T. Dalmat, 1M, 1F; Natal, Lagoa Sequi, 6 Feb 1945, det. H. T. Dalmat, 2M, 1F; Natal, Casupirangi, 15 Mar 1945, det. H. T. Dalmat, 1M, 1F. Piranga, on Rio Cajupiranga, Nov 1943, P. MacCreary, 2L; same locality, 1 Nov 1944, No. 23, 9L (2,4,5,13,18); same locality and date, No. 25, 2L (3,11). San Jose de Mipibu Swamp Area, 13 Oct 1944, No. 20, 7L (4,10,11,12,13), 1p (10); same locality, 20 Mar 1945, 1L. San Jose de Mipibu Valley, 20 Mar 1945, 11. Locality not specified, Causey, 2F, 2M, 1M gen (JH). **State not specified:** Piraja, 1L. R. Pium, Sep 1926, 4L (7,11-2,15-1). M. F. Boyd, 1M, 2M gen (JH).

COLOMBIA (364 specimens: 75M, 25M gen, 157F 49p, 58L&l; 12 ind rear: 101, 2 inc rear; 4 progeny rearings). **Meta:** Aguas Claras, COB 53, 31pM, 61pF, 1M gen, 11L; COB 60, 2F; COB 71, 11pF, 2F. Villavicencio, 30 May 1941, CV 267, 1M; same locality, 1944, M. Bates, CV 93, 6F, 5M 3M gen; same locality, CV 727, 4M, 1M gen, 9F, 6L; same locality, 7 May 1947, CVP-23, 1M, 1M gen, 2F, 2p, 2L (progeny rearing); same locality, 9 May 1947, CVP-24, 12M, 2M gen, 19F, 14p, 141 (progeny rearing); same locality, 1947, CVP-29, 4M, 2M gen, 17F, 14p, 81 (progeny rearing); same locality, 1947, CVP-30, 4M, 1M gen, 2F, 7p, 51 (progeny rearing); same locality 11 June 1947, 424.17, 11p (JH); same locality, 22 Dec 1947, Lopez, C-485-2, 11p (JH); same locality, 11 July 1974, COZ 69, 3M, 1M gen; same locality 25 July 1974, COZ 36, 17M, 28F, 6M gen. Villavicencio, 8 km SW, on road to San Martin, 25 July 1974, J. Kitzmiller, COZ 32, 1M, 2F, 1M gen. Villavicencio, 10 km on road to Puerto Porfia, COZ 18, 3F. Villavicencio, 10 km SE, on road to Puerto Lopez, 26 July 1974, J. Kitzmiller, COZ 34, 21F, 8M, 3M gen. Villavicencio, near air base at Finca, 26 July 1974, COZ, 21F, 3M, 1M gen. **Department not specified:** Pontia Dero, 22 Sep 1974, 3F (485, 485.2, 424, 17) (JH); same locality, July 1975, J. Kitzmiller, COZ 264, 1F, 2M, 1M gen; same data, COZ 79, 10F, 6M, 1M gen.

COSTA RICA (20 specimens: 7M, 2M gen, 9F, 2L). **Alajuela:** Volcan Poas, W. Komp, KO 113-10, 1M; same locality and collector, KO 113-16, 1M, 1M gen, 2F; same locality, 1F (1069), 2M (1069), 1L (1068), 1L (1069) (JH); same locality, 2M (1069), 1F (1069), 3F; **Puntarenas:** Buenos Aires, W. Komp, KO 113-8, 2F, 1M, 1M gen. San Vito, CR 657.

FRENCH GUIANA (12 specimens: 1M, 11F). **Guyane:** Cayenne, 15 Apr 1943, 8F; same locality, 11 May 1943, 3F; same locality, E. Abonnenc, FGA 113, 1M.

GUYANA (153 specimens: 16M, 137F). **Berbice:** Corentyne, Village 63, 4 Oct 1962, T. Aitken, BG (M) 10, 1F; same locality and collector, 11 Oct 1962, BG (M) 64, 1F. **East Demerara-West Coast Berbice:** Georgetown, 1942, KO 113-1, 1F, 1M; same locality, Sep 1945, KO 113-36, 2F; same locality, Sep 1945, KO 113-39, 1F. **District and locality not specified:** Sep 1949, L. Rozeboom, BGR 8, 19F; MEP Acc. No. 621, 4F (G-22,23,26,27); 1936, Giglioli, GUYK 7 53F; 1940, G. Bevier, 1M, 9F; GUYK 2, 1F; GUYK 4, 3M, 12F; GUYK 4, 15F; same locality, GUYK 19, 1F; same locality, GUYK 29, 1F; same locality, GUYK 31, 1F; same locality, GUYK 31, 1F; same locality, GUYK 37, 11M; same locality, GUYK 38, 14F.

PANAMA (477 specimens: 47M, 14M gen, 88F, 20P&p, 308L&l; 17 ind rear: 12p,

5inc). **Canal Zone:** Fort Clayton, 24 Apr 1944, P. Adams, 1l. Gatun Lake, Apr 1923, R. C. Shannon, 1F; same locality, 4 May 1934, Curry, PAX 38, 3M, 2M gen 3F; same locality, 2 Aug 1934, L. Rozeboom, 8L (JH); same locality and collector, 24 Apr 1935, 2L; same locality and collector, 26 Apr 1935, 2L (JH); same locality and collector, 5 Aug 1935, 3p, 9L, (JH); same locality and collector, 9 Aug 1935, 11M, 11M gen, 3F (JH); same locality and collector, 23 Aug 1935, 2L (JH); same locality and collector, 6 Sep 1935, 7L (JH); same locality and collector, 24 Sep 1935, 8L (JH); same locality, Apr 1935, V-33, 7M, 32F; same locality, 19 Apr 1936, PAX, 4M, 1F; same locality, 21 Apr 1939, Mendoza, PAX 105, 1M, 4F; same locality and collector, 18 May 1939, 4F; same locality, KO 113-3, 6M, 6F. **Chiriqui:** El Hato del Volcan, PA 636, 1pM, 11pF, 162L; PA 637, 22L; PA 639, 9L. **Province not specified:** Las Guacas, 4 May 1935, 1M. Pueblo Nueva, 4 Dec 1936, L. Rozeboom, 1L. Rio Pescado, 9 Oct 1935, L. Rozeboom, 39L (JH); same locality and collector, 12 Oct 1935, 5M; same locality and collector, 4 May 1936, 19L (JH); same locality and collector, 16 July 1936, 5L (JH); same locality and collector, 11 Dec 1936, 8M, 5F; same locality and collector, 11 Dec 1936, 15F (JH); same locality and collector, 12 Nov 1936, 3L (JH); same locality and collector, 7 May 1937, 3F (JH). Locality not specified, 9 Nov 1934, L. Rozeboom, 11p (JH); same locality and collector, 12 Nov 1935, 21p (JH); same locality and collector, 14 Nov 1935, 21p (JH); same locality and collector, 1935, 1M gen (JH); same locality and collector, 3 Jan 1936, 2L (JH); same locality and collector, 7 Aug 1936, 2L (JH); Chagres (River), 27 Apr 1945, det. Arnett, 476-1, 1F (JH).

TRINIDAD (34 specimens: 4M, 1M gen, 15F, 4P&p, 10L&1, 3 ind rear: 21, 1inc). **St. George:** Arima, 1.5 miles South, 12 Sep 1965, T. Aitken, TR 1324, 21pF, 11p, 1p, 6L. Picaro, Nov 1936, 8F. **County not specified:** California, Oct 1945, 1M, 4F. San Juan, July 1941, No. 27-7, 1M gen (JH). Locality not specified, 4 Sep 1941, Coll. 55, 1F, 3M (JH).

VENEZUELA (168 specimens: 8M, 154F, 6L&1). **Aragua:** El Sombrero, 27 July 1927, No. 134, 2F, 2M (JH); same locality, 10 Aug 1927, No. 155, 4L. Maracay, 23 July 1927, No. 1441, 1M (JH); same locality, 10 May 1927, 1L (JH). Valencia, 22 July 1927, No. 134, 2F, 2M (JH); same locality, No. 134, 1L (JH). **Cojedes:** Tingquilla, VZR 237, 1M. **Guarico:** Camaguay, Dec 1927, VZR 37, 22F; same locality, VZR 225, 1F, 2M; same locality, VZR 231, 11F; same locality, VZR 232, 12F; same locality, VZR 235, 24F; same locality, VZR 236, 13F; same locality, VZR 238, 18F; same locality, VZR 244, 27F; same locality, VZR 245, 21F. **Locality not specified:** VZR 224, 1F.

COUNTRY NOT SPECIFIED (72 specimens: 10M, 12M gen, 42F, 4P&p, 4L&1; 4 ind rear: 4 inc rear). **State not specified:** Locality not specified, 3F (381-32, 381-57, 538-36), 2M (353-1) (JH); same locality, 12M gen, 9F, 10L, 41p (JH); same locality, 29 Aug 1931, KO 113-27, 1F; same locality, KO 113-15, 29F, 8M.

BRAZILIENSIS SUBGROUP

8. *Anopheles* (*Nys.*) *braziliensis* (Chagas)

Figs. 2, 3, 16, 17

1907. *Cellia braziliensis* Chagas 1907:18-21. TYPE: Syntypes 6 females, margins of Rio das Velhas, Minas Gerais, Brazil, 11 July 1907. (IOC). TYPE LOCALITY restricted to vicinity of Lassance, by Belkin et al.

1971:5.

1936. *Anopheles* (*Nyssorhynchus*) *pessoai* Galvao and Lane 1937a:67-79. TYPE: *Holotype* female (82,25), left bank of Rio Pinheiros, Pinheiros, Sao Paulo (Sao Paulo), Brazil, G. R. Ramalho (FH).

Anopheles (*Nyssorhynchus*) *braziliensis* of Root (1922a:322, 1922b:388; 1923:271, 277, 279; 1924:457; 1926a:51, 67-76, 80, 89-110); Lane (1953:235, 237, 241); Komp (1956:40); Rachou (1958:146-149, 168, 178); Senevet (1958:130); Stone et al. (1959:32); Andrade and Leal (1960:147-153); Forattini (1962:325, 377, 381-382, 393, 475, 483, 490, 549); Garcia and Ronderos (1962:137-138, 140, 157); Prosen et al. (1963:64, 67, 112, 115, 116); Ferreira (1964:333, 335, 337, 338-340, 346); Belkin et al. (1971:51); Kreutzer et al. (1975:354; 1976:473-481); Knight and Stone (1977:62); Xavier et al. (1979:3); Xavier et al. (1983:129).

Anopheles (*Nyssorhynchus*) *brasiliensis* of Galvao and Barretto (1939b:144-150, 156); Rozeboom (1942:238); Kuyp (1949:67; 1950:42, 44, 46, 48); Cerqueira (1961:123); Fauran (1961:9-10, in part); Xavier and Mattos (1970:443).

Anopheles braziliensis of Knab (1913:36); Galvao and Damasceno (1944:73-74); Cova Garcia (1961:32-33, 84-85, 121-122); Forattini (1961:170, 177, 182); Mattos and Xavier (1965:271-272); Stojanovich et al. (1966b:5-6, 18, 27, 40); Gorham et al. (1967:2, 4-5, 13, 43, 52; 1971:2, 10, 36); Fauran (1973:137-138, 141); Cova Garcia and Sutil (1975a:19; 1975b:210; 1976:30).

Anopheles brasiliensis of Senior-White and Lewis (1951:152); Serie et al. (1968:198-200, 203-204, 207, 209-210); Forattini et al. (1970:10).

Anopheles (*Anopheles*) *braziliensis* of Bonne and Bonne-Wepster (1925:516).

Anopheles (*Cellia*) *braziliensis* of Dyar (1918:150); Davis (1926a:9-12, 20).

Cellia braziliensis of Neiva (1908:455-459); Peryasssu (1908:61, 118-120).

Cellia brasiliensis of Neiva (1909:70); Surcouf and Gonzalez-Rincones (1911:69, 75, 298); Neiva and Penna (1916:95, 98), Lutz (1921:161); Peryassu (1921:12, 63-66, 78-80, 82-99); Neiva and Pinto (1922a:321; 1922b:356; 1923:235); Godoy and Pinto (1923:29-33); Pinto (1923:77-81); Galvao (1940:456).

Anopheles (*Nyssorhynchus*) *albitarsis braziliensis* of Vargas (1959:370, 382).

Anopheles (*Nyssorhynchus*) *albitarsis brasiliensis* of Senevet (1931:108, 110, 1932:252; 1934:68; 1948b:433-440); Galvao and Lane (1937a:75-78; 1937b:269, 286); Komp (1936a:69); Galvao (1943:142-151).

Anopheles albitarsis braziliensis of Russell et al. (1943:50).

Anopheles (*Nyssorhynchus*) *albitarsis* var. *braziliensis* of Root (1927b:599).

Anopheles (*Nyssorhynchus*) *albitarsis* var. *brasiliensis* of Root (1926b:685-686, 688, 690-691, 693-695, 698-699, 701-702, 704-705, 717); Shannon and Del Ponte (1927:723); Lima (1928:106); Shannon and Davis (1930:467, 489); Shannon (1933:117, 140); Galvao and Lane (1937e:214, 215, 227, 234, 235, 237); Galvao (1940:405, 456, 458-460, 463, 471); Komp (1942:25); Cerqueira (1943:18).

Anopheles albitarsis var. *brasiliensis* of Covell (1927:9).

Anopheles (*Nyssorhynchus*) *argyritarsis* var. *braziliensis* of Christophers (1924:10,38,91).

Nyssorhynchus braziliensis of Townsend (1934:487, 495, as *brasiliensis*).

Anopheles (*Nyssorhynchus*) *pessoai* of Galvao and Lane (1937c:25-27; 1937e:214-217, 228-229, 233-237); Galvao and Barretto (1939a:112, 1939b:144-150, 156); Lane (1939:26; 1944:264; 1949:403, 410, 413, 415); Galvao (1940:400,

405-407, 412, 415, 418, 420, 446, 449-453, 457-458, 467, 471, 474, 476; 1941a:94; 1941b:509, 514-515, 518, 520; 1943:142-145); Unti (1940b:490; 1941:4); Correa and Ramos (1942c:317, 319-320, 322; 1943:247; 1944b:127, 129, 136-137, 141, 144-145, 147). Galvao et al. (1942:56); Komp (1942:26, 28); Fonseca and Unti (1943:45); Galvis (1943:54, 78, 85, 87, 95, 97); Unti and Ramos (1943:24-27, 30); Causey et al. (1944:2, 5-6; 1946:26, 31); Floch and Abonnenc (1944:2; 1947:2, 6; 1951:5, 7, 22, 53, 68-69); Coutinho (1946:450-457); Deane, L. M. et al. (1946:5-6, 9, 11, 15; 1948:830, 837-838, 847, 849, 851, 868-874); Deane, M. P. et al. (1946:42, 45, 50); Gabaldon and Cova Garcia (1946b:79; 1952:177, 194, 198, 202-206); Bates (1947:155); Deane (1947:19); Correa (1948:177-181, in part); Giglioli (1948:73); Pereira Passalacqua (1948:196-203); Senevet (1948a:280-287; 1948b:433-440; 1958: 131); Kuyp (1949:67); Levi-Castillo (1949:10-11, 16, 20, 32, 54-58, 67-89, 93, 96, 99, 102: 1951:78); Carvalho and Rachou (1951:477, 480); Pinotti (1951: 664); Rachou and Ricciardi (1951:424-426, 428-447); Horsfall (1955:170, 171); Andrade and Brandao (1957:391-395, 397-416).

Anopheles pessoai of Simmons and Aitken (1942:45, 53, 96); Russell et al. (1943:36, 41, 48); Unti (1943b:96-102; 1943c:105, 109-112); Galvao and Damasceno (1944:75); Causey, Deane, Costa and Deane (1945:146); Floch and Abonnenc (1946:1-3, 5); Vargas (1948:155-156); Zulueta (1950:328-329, 334, 336-339; 1952:314, 322-329); Renjifo and Zulueta (1952:600, 602, 610); Guedes et al. (1953:157-165); Forattini et al. (1971:17).

Anopheles (*Nyssorhynchus*) *argyritarsis* of Dyar (1925:193, in part).

Anopheles (*Nyssorhynchus*) *albitarsis* of Dyar (1928:427, 430, 443-444, 486, in part); Edwards (1932:44, in part); Pinotti (1951:664, 668-669, 673, 682, in part); Bejarano (1957:307, 318-323, 348, in part); Umana et al. (1959:609-618, in part).

Anopheles albitarsis of Simmons (1939:151, 176-180, 301, in part).

Anopheles (*Nyssorhynchus*) *lutzi* of Root (1923:271, 277, 279).

FEMALE. Wing: 3.0 mm. Proboscis: 2.05 mm. Forefemur: 1.4 mm. Abdomen: 3.1 mm. Small to moderately large. **Head:** Interocular space narrow to moderately wide, 0.4-0.6 diameter of pedicel. Frontal tuft with 3,4 pairs of long, white, setiform scales. Clypeus wide, 3.0 diameter of pedicel. Proboscis about 1.4 length of forefemur. Palpus 0.95 length of proboscis; palpomeres 1,2 with long, erect, golden-brown scales; palpomere 3 with golden scales, apically with some white scales; palpomere 4 brown; palpomere 5 white. **Antenna:** Length 0.71 of proboscis. Pedicel with 6 small scales. Flagellomeres 1-3 with white scales, flagellomeres 4,5 without white scales. **Thorax:** Nonpruinose dark areas of scutum as in section. Scales of scutum silver except for dark brown scales on lateral anterior promontory. Scutellum along posterior margin with 10,11 well developed setae and 6,7 moderately developed setae. Pleuron pruinosity as in section. *Ap* anteriorly and anteroventrally with long, dark brown scales. *PsA* with some slender, white setae, without black setae. *Ps* pruinose, anterodorsally and anteroventrally with patch of silver scales. Upper *Mks* with 2 moderately developed, light setae, 2 well developed, dark setae, 9-11 silver scales. Lower *Mks* with 1 well developed, brown seta, 6-8 broad, white scales. Upper *Mam* with 5-7 long, erect, white scales. *Pk* with 1 dark seta, 2,3 light setae, 6-8 scales. **Legs:**

Foretarsomere 1 with ventral stripe of light scales, apical 0.08-0.10 light; tarsomere 2 with apical 0.4-0.6 light; tarsomere 3 with apical 0.5-0.8 light; tarsomeres 4,5 entirely brown. Midtarsomere 1 predominantly with golden scales, apical 0.05-0.10 light; tarsomere 2 with apical 0.07-0.10 light; tarsomere 3 usually dark, occasionally white on apical 0.05-0.10. Hindtarsomere 1 usually dark, occasionally with small, apical, light spot (0.05 length of segment); tarsomere 2 with basal 0.3-0.4 dark; tarsomeres 3-5 white. **Wing:** Dark scales brown, light scales white. Vein C basal dark spot small to moderately large, 0.3-1.0 of humeral light spot; subbasal light spot always present; presectoral light spot reduced, represented by few scales; sectoral light spot subequal to subcostal light spot; subcostal light spot present. Rs predominantly dark. R_3 with 3 dark spots. M predominantly light with some dark spots. **Abdomen:** Terga II-VII with distinct caudolateral scale tufts of 4-6 large, dark scales. Scales of tergum I long, cream, setiform. Scales of terga II-IV sparse, mostly golden, usually with medial patch of dark scales appearing purple, surrounded by golden and cream scales. Scales of terga V-VII numerous, usually with some golden and many cream; usually without medial patches of dark purple scales. Tergum VIII only with silver scales. Sterna as in group.

MALE. Wing: 2.75 mm. Proboscis: 2.4 mm. Forefemur: 1.7 mm. Abdomen: 3.8 mm. Essentially similar to female except for sexual characters. **Head:** Proboscis 1.5 length of forefemur, with dark brown scales. Palpus subequal to proboscis; palpomere 1 with dark brown, erect scales; palpomere 2 proximally with dark, erect scales, distally with white, erect scales, apically with small, white bands; palpomere 3 with brown scales, with intermingled purple and white scales, and apical, white band; palpomere 4 with white, golden-brown and blue scales; palpomere 5 with white scales and basal brown band. **Antenna:** Length about 0.75 of proboscis. Diameter of pedicel 1.6-1.8 that of female; pedicel pruinose, with small white scales. Flagellomere 1 with short and long, white scales, about 1.5 length of individual flagellomeres 2-11; flagellomeres 2-11 subequal to those of female, only flagellomere 2 with long, slender, white scales; flagellomere 12 about 4.0 length of individual flagellomeres 2-11; flagellomere 13 about 0.5 length of flagellomere 12. **Legs:** Essentially as in section.

MALE GENITALIA (Fig. 16). **Segment VIII:** Tergum with 2 rows of long setae, with numerous long, slender, golden scales, laterally with some silvery scales. Sternum narrower than tergum, with 2,3 rows of long setae distad, with numerous, moderately broad, silvery scales, anteriorly with patch of golden scales. **Segment IX:** Sternum rectangular, moderately long, about 0.12 of length of gonocoxite; posteromedial border weakly emarginate; anteriomedial border not emarginate, inconspicuously thickened. **Gonocoxite:** Length about 2.6 maximum width. Tergal surface with 4 long, tergomedial setae, 2 long, apicolateral seta and single, very long (1.2 length of internal seta) apicomedial seta. Parabasal seta strongly retrorsely hooked, about 2.5 length of its tubercle. Apodeme of gonocoxite about 0.15 length of gonocoxite. Accessory setae very long, hooked caudad; dorsal seta about 0.4 length of gonocoxite; ventral seta about 0.6 length of dorsal seta. Internal seta subequal to ventral accessory seta, curved mesad. **Gonostylus:** Gonostylar claw moderately long, weakly curved mesad; narrowed proximad and distad, broad and flattened about 0.5 length from base. Seta *b* moderately long, about 1.7 length of gonostylar claw. **Dorsal**

Claspette: About 0.25-0.30 length of gonocoxite; pedicel moderately narrow and curved mesad; base truncate. Apical setae about 0.8 length of dorsal claspette; dorsal seta with well-developed basomesal projection. **Ventral Claspette:** About 0.3 length of gonocoxite; moderately narrow; ventrally apex truncate and heavily striated, with pair of small, apicolateral lobes, laterally lobes not expanded. Median sulcus moderately developed. Preapical plate small, sclerotized, distinct. Basal lobules laterally weakly expanded; mesal cleft narrow and long (about 0.8 length of ventral claspette). Refringent structure weakly developed. **Phallosome:** About 0.6 length of gonocoxite, about 1.4 length of ventral claspette, usually distally extending beyond ventral claspette. Aedeagus without leaflets; apex rounded, membranous at tip, length subequal to width; ventromesal subtriangular projections not meeting on midline. Posteriormost end of paramere weakly hooked, with pointed protuberance.

PUPA (Fig. 16). Abdomen: 2.8 mm. Trumpet: 0.35 mm. Paddle: 0.6 X 0.5 mm. **Cephalothorax:** Moderately to heavily pigmented, light brown to brown. Wing cases moderately dark to dark with longitudinal stripes. Median keel lightly to moderately developed. Seta 1-C 2,3b (1-3), lightly pigmented; 2-C 2f (2-4), subequal to 1-C, lightly pigmented except at base; 3-C 2,3b (1-4), subequal to 1,2-C, lightly pigmented. Setae 4,5-C subequal, moderately pigmented; 4-C 3b (3,4); 5-C 3b (2-5). Seta 6-C 2f (1-3). Seta 7-C single, very long (2.0-2.5 of 6-C). Setae 8,9-C subequal; 8-C single, stout, moderately to heavily pigmented; 9-C 2-4b (1-4), weak, heavily pigmented. **Trumpet:** Moderately pigmented, light brown, pinna heavily pigmented. Pinna angusticorn, long, about 0.8 length of trumpet. **Metanotum:** Setae 10-12-C weakly to moderately developed; seta 10-C single (1,2b), well developed, moderately pigmented; 11-C 3,4b (1-4), lightly pigmented; 12-C 3,4b (2-4), moderately developed, moderately pigmented; 10,12-C subequal and 1.5 length of 11-C. **Abdomen:** Moderately pigmented, light brown to dark brown. Seta 1-I with 14-18 (14-23) primary branches, apically extensively dendritic, base of primary branches lightly pigmented, secondary branches with moderately strong dark spots. Seta 2-I pectinate, 3,4b (2-5). Seta 3-I single, longer than 2-I, lightly pigmented. Seta 4-I 4f (2-6), moderately developed. Seta 5-I single (1-3b), long, lightly pigmented. Seta 6-I single, 1.5-2.0 length of 7-I, long, lightly pigmented. Seta 7-I 3,4b (2-4). Seta 9-I single (1,2b), very long. Seta 0-II-III 3-5b (3-6), poorly developed; 0-IV,VI 3b (2,3); 0-V 4b (3,4); 0-VII 4b (1-5). Seta 1-II 4,5b (4-8), moderately developed; 1-III 3,4b (1-6), moderately developed; 1-IV single, equal to length of segment; 1-V-VII single, 1.5 length of segment. Seta 2-II 3,4b (2-6); 2-III 2,3b (1-4); 2-IV,V single or double (1-3b); 2-VI,VII 2b (1-3). Seta 3-II,III single; 3-IV 3,4b (1-4); 3-V 2,3b (1-5); 3-VI single (1-3b); 3-VII single or double. Seta 4-II 3,4b (1-4); 4-III-VI single or double (1-5f); 4-VII single (1-4b). Seta 5-II,III 3-5b (2-6), weakly developed; 5-IV single (1-4b), weakly to moderately developed; 5-V-VII single, strongly developed, subequal to length of segment. Seta 6-II single (1,2b); 6-III,IV single or double (1-6b); 6-V-VII single (1-3b). Seta 7-II 2,3b (1-4), 0.5-0.6 length of 6-II; 7-III single; 7-IV,V 1-3b (1-5); 7-VI,VII single (1-3b). Seta 8-III-VII subequal to 7-III-VII; 8-III 2,3b (1-4); 8-IV single or double (1-3b); 8-V-VII single (1-3b). Seta 9-II minute, 0.5-0.6 length of 9-III; 9-III short 0.5 length of 9-IV, straight, moderately pigmented; 9-IV 0.35-0.40 length of 9-V, stout, moderately pigmented; 9-V long,

2.5-2.8 length of 9-IV, thinner than 9-IV; 9-VI 3.0 length of 9-IV, about 0.8 length of 9-VIII, moderately curved; 9-VII,VIII subequal, heavily pigmented. Seta 10-III single or double (1-3b); 10-IV,V,VII single (1,2b). **Terminal Segments:** Apex of male genital lobe with short, distinct, mammilliform protuberance; mesal margin of lobe irregularly serrate; length of male genital lobe 3.2 width; lobe lightly to moderately pigmented. **Paddle:** Moderately wide, apically emarginate, length 1.2 width. Midrib equally sclerotized on lateral and mesal margins. External buttress extending 0.65 length of paddle from base, with small to moderately large serrations on apical 0.25; distinct and moderately pigmented. External margin distad of buttress with moderately long (0.02 mm), slender spicules. Seta 1-P single, moderately long; 2-P single or double, smaller than 1-P.

LARVA (Fig. 17). Head: 0.55 mm. Antenna: 0.3 mm. Saddle: 0.25 mm. **Head:** Moderately pigmented, tan with distinct dark brown band extending anteriorly from collar along frontal ecdysial line to seta 8-C, continued anteriorly to 3-C as wide (0.04 - 0.06 mm) dark band with arms extending medially between setae 8-C to form inverted subtriangular dark area; with pair of oval dark spots anterior to setae 8,9-C and lateral of large dark band. Collar moderately narrow, 0.03 - 0.05 mm wide. Dorsomentum well developed, median tooth about 1.4 times width of adjacent teeth; third pair of teeth subequal to second; fourth pair of teeth indistinct and small. Setae 2-C moderately closely spaced, clypeal index about 2.7. Seta 3-C 0.6 length of 2-C, with 8-10 small, distinct barbs. Seta 4-C single (1-3b), long, usually extending to anterior margin of head. Seta 8-C 2b (1-3). Seta 9-C 2f (1-3). Seta 10-C 2,3b (1-3), moderately large. Seta 11-C strongly pectinate. Seta 12-C usually 5b. Seta 13-C 4b (2-5). **Antenna:** Heavily pigmented. Dorsally with small spicules, ventrally with small and moderately large spicules. Seta 1-A 3f (2-6), short, length less than width of antenna, inserted 0.2-0.3 from base. Seta 4-A 2f (1-3). **Thorax:** Integument mottled with large, medial dark brown area. Setae 1-3-P often inserted on large, strongly sclerotized, common tubercle or 1,2-P inserted on common tubercle; 1-P with 14-19 (13-20) moderately narrow, truncate, lanceolate branches not overlapping with branches of opposite 1-P; 2-P plumose with 19-22 branches inserted on moderately long, flattened, single or rarely double shaft; 3-P single. Setae 4-8-P as in section. Setae 9,10,12-P single, long; 11-P 2b (1,2), less than 0.5 length of 12-P. Seta 13-P 5-9b. Seta 14-P 5-8b (5-9), moderately large. Seta 1-M 24-31b (23-32), distal branches shorter than proximal. Setae 2-14-M as in section. Seta 2-T long, extending to posterior margin of thorax. Seta 3-T palmate and brushlike, 10-12b (7-19) lanceolate branches narrow. Seta 4-T 3b (2,3). **Abdomen:** Integument with medial area heavily pigmented. Median tergal plates strongly sclerotized, well developed, 0.2-0.3 width of segments; plate on segment I large, oval, laterally with pair of rounded protuberances, anteromedially with large, truncate, protuberance; plate on segment II thin, saucer-shaped, anteriorly with single, round protuberance; plates on segments III-VII subequal, ovoid, anteriorly with small, anterior protuberance; plate on segment VIII kidney-shaped, moderately sclerotized, large, 1.5 width of plate on VII, 0.3 width of segment. Accessory median tergal plates on segments II-VII single, long and bilobed or trilobed on apical segments. Accessory submedian tergal plates with 1 pair of globular or ovoid discs on segments I,II; with 2 pairs of discs on segments III-VII. Seta 0-II-VI branched, large;

0-II-IV 5-8b. Seta 1-I 13-15b (11-20), lanceolate branches broad, moderately pigmented; 1-II-VII 19-26b (13-29), lanceolate branches moderately pigmented; branches on III-VI long; branches on II,VII subequal and moderately long. Seta 2-I 3,4b (2-4), small; 2-II,III 3-5b (2-6); 2-IV,V single (1,2b); 2-VI,VII 3-5b (3-9). Seta 3-I,III,V,VI single; 3-IV single or double (1-4b); 3-VII 2,3b (2-4). Seta 4-I-IV 3-6b (2-6); 4-V 3,4b (2-4); 4-VI-VII single. Seta 5-I 3b (2-5); 5-II,III 6-9b (4-10); 5-IV,V 4-6 (2-9); 5-VI 4-8b; 5-VII 6-8b (6-10). Setae 6,7-I-VIII as in section. Seta 8-II,IV-VI 3,4b (2-6); 8-III,VII 3-5b (3-8). Seta 9-I 4-6b (4-9); 9-II-V 6-8b (5-12); 9-VI 6-10b (5-11); 9-VII 4-6b (4-7). Seta 10-I,III-VII single; 10-II 2b. Seta 11-I 3b (2-6); 11-II,V single; 11-III,IV,VI,VII 2b (1-4). Seta 12-I,III-V 2,3b (1-3); 12-II,VI,VII single (1-3b). Seta 13-I-VII 3-6b (3-10). **Spiracular Lobe:** Pecten with 13-16 teeth, with conspicuous row of spicules on basal half of dorsal surface of short teeth; teeth, beginning ventrally usually as follows: 1 long; 2,3 short; 1 long; 2-4 short; 1 long; 2,3 short; terminating with 2,3 long or combination of 2,3 long and 1 short. Median plate of spiracular apparatus with very short lateral arms. Seta 1-S 4-6b (3-6) large. Seta 2-S 4-6b (4-7). Setae 3-5-S single. Setae 6,7-S single or double. Seta 8-S 3-5b (2-7). Seta 9-S 4-6b (3-9). Setae 10-13-S single. **Abdominal Segment X:** Saddle uniformly light brown. Seta 1-X long, about 1.45 length of saddle. Seta 2-X plumose. Seta 3-X with 5 major branches. Ventral brush well developed. Anal papillae subequal, long, 3.0 length of saddle.

DISCUSSION. The monotypic subgroup Braziliensis can be distinguished from the species of the Albitarsis Subgroup in the **female** by the combination of: (1) hindtarsomere 2 with basal 0.3-0.4 dark, (2) vein C with presectoral light spot reduced, represented by few scales, (3) R3 with 3 dark spots, (4) terga II with distinct caudolateral scale tufts, and (5) scales of terga II-IV usually with medial patch of dark scales surrounded by golden and cream scales; in the **male genitalia** by: (1) tergum VIII with numerous golden scales, (2) sternum VIII anteriorly with patch of golden scales, (3) sternum IX anteromedially not emarginate, (4) parabasal seta of gonocoxite about 2.5 length of its tubercle, (5) dorsal seta of dorsal claspette with well-developed basomesal projection, (6) ventrally apex of ventral claspette truncate, laterally not expanded, and (7) preapical plate small; and in the **larva** by: (1) integument of head with distinct dark brown area anteriorly extending from collar to seta 3-C, (2) setae 2-C moderately closely spaced, clypeal index about 2.7, (3) seta 4-C single (1-3b), (4) seta 1-P with truncate lanceolate branches not overlapping with branches of opposite 1-P, (5) seta 13-P 5-9b, (6) median tergal plates 0.2-0.3 width of segment, (7) accessory median tergal plates single and bilobed or trilobed on apical segments, and (8) pecten with teeth beginning ventrally alternating 1 long and 2-4 short.

The **pupa** of *braziliensis* can be distinguished from that of all other species in the Albitarsis Group by the following characters: (1) seta 7-C single, very long, 2.0-2.5 of 6-C, (2) pinna of trumpet long, about 0.8 length of trumpet, (3) seta 4-V single or double (1-5f), (4) seta 5-II 3-5b (2-6), weakly developed, (5) seta 5-IV single (1-4b), and (6) external margin of paddle distad of buttress with moderately long (0.02 mm), slender spicules.

The adults, male genitalia and larvae of *braziliensis* can easily be distinguished from those of other species in the Albitarsis Group. In general, *braziliensis* appears to be morphologically very similar throughout its range.

As with all species of the Argyritarsis Section examined, the larval and pupal chaetotaxy varies somewhat; however, the interpopulational variation is usually no greater than the intrapopulational with the possible exception of the development of the branches of seta 1-P in the larva. Not all individuals exhibit the blunt-tipped branches usually found for seta 1-P. However, the branches are always widely spaced and do not overlap. Seta 4-C usually is single and long, but populations from Brazil frequently exhibit apical branching. The teeth of the pecten are remarkably uniform and quite reliable for species identification.

Anopheles braziliensis is most closely allied to the Albitarsis Subgroup, sharing several apomorphic characters with this subgroup. The following characters are synapomorphic with the Albitarsis Subgroup: in the **female:** (1) palpomere 4 with scattered white scales, (2) scutellum with fewer than 12 well developed setae on posterior margin and (3) sternum I always with 2 longitudinal rows of white scales; in the **male genitalia:** (1) sternum IX short, less than 0.15 length of gonocoxite, (2) gonostylar claw moderately long, (3) dorsal claspette moderately narrow, and (4) aedeagus without subapical leaflets; in the **pupa:** (1) median keel weakly to moderately developed, (2) setae of cephalothorax lightly to moderately pigmented, and (3) setae 3, 7, 9, 11-C, 4-I, and 0-II branched; and in the **larva:** (1) seta 1-A usually shorter than width of antenna, (2) seta 1-P always palmate with lanceolate branches, 1-3-P usually inserted on a common tubercle, (3) setae 3-T and 1-I always palmate with lanceolate branches, well developed, (4) median plate of spiracular apparatus with lateral arms, and (5) seta 1-X relatively short.

The following characters are autapomorphic for *braziliensis*: in the **adult:** (1) R_3 with 3 dark spots, and (2) scales of terga II-IV sparse; in the **male genitalia:** (1) tergum VIII with golden scales, and (2) sternum VIII anteriorly with patch of golden scales, distally with 2,3 rows of long setae; in the **pupa:** (1) pinna of trumpet long, and (2) paddle with moderately long spicules distad of buttress; in the **larva:** (1) head with dark band extending anteriorly to seta 3-C, and (2) branches of seta 1-P truncate.

Anopheles braziliensis was described as a species of *Cellia* by Chagas (1907: 18-21) from specimens taken in the valley of the Rio das Velhas near Lassance, Minas Gerais, Brazil (Root 1926b:704-705). The description was based on adult females that were considered to be related to *argyritarsis* (as *Cellia argyrotarsis*). Based on this description and on material from the type locality, I am confident that the *braziliensis* described here is conspecific with the species described by Chagas. *Anopheles braziliensis* was treated as a species of *Cellia* until Root (1923:277) placed it in *Anopheles* (*Nyssorhynchus*). Shortly thereafter, Root (1926b:704-705) reduced *braziliensis* to a variety of *albitarsis*. He believed that the larva and male genitalia were identical with those of *albitarsis*, but that the external features of the adult more closely resembled those of *argyritarsis*. This interpretation was followed by Lima (1928:106-108) and Dyar (1928:444), who, without comment, synonymized *braziliensis* with *albitarsis*. Subsequently Townsend (1934:487,494) returned *braziliensis* to specific status.

Galvao and Lane (1937a:67-79) described *pessoai* as a new species from specimens collected along the Rio Pinheiros, Sao Paulo, Brazil. The authors reported that the species is very closely related to *braziliensis* on the basis

of the scales on the mesonotum, wings and terga of the adult, and the male genitalia and larvae. Their judgment was based on the second description of *braziliensis* given by Chagas, the male genitalia slides in the Faculdade de Medicina da Universidade de Sao Paulo collected by Pinto (as *albitarsis braziliensis*), and their own material collected in the states of Rio de Janeiro and Sao Paulo. In January 1975, I examined a female and larval paratype of *pessoai* at the Faculdade de Higiene e Saude Publica, Sao Paulo, but was unable to locate the holotype female (82,25) (Belkin et al. 1971:5). After examination of the paratypes, I agree with Lane (1953:245) in synonymizing *pessoai* with *braziliensis*. Evidently, Galvao and Lane (1937a) were misled by the description of *braziliensis* because their description of *pessoai* is apparently identical with that of *braziliensis*, except for small discrepancies probably due to individual variation. It is also possible that the material of Pinto that they examined was actually not *braziliensis*. Based on their discussion of the differences between *pessoai* and what they considered to be *braziliensis*, I believe that they were actually referring to either *marajoara* or *albitarsis* and not *braziliensis*.

BIONOMICS. The immatures of *braziliensis* have been found in the following sites by MMAP: clear ponds and clear, stagnant swamps with mud bottoms, ponds, and a flooded borrow pit along a stream with stagnant water. Most of the immatures were exposed to the full sun or in partial shade, but never in heavily shaded areas. All the sites had some type of vegetation; the margins of the habitats were grassy usually with emergent vegetation, floatage and/or algae. Most sites were in areas of secondary growth in pastures and clearings in the forest.

Root (1926b:705) collected *braziliensis* (as *brasiliensis*) at Lassance, Minas Gerais, Brazil, in large and small pools, ponds, marshes and seepage areas with considerable vegetation. Galvao (1940:473) reported that in the city of Sao Paulo, Brazil, the first larvae of *braziliensis* (as *pessoai*) were found in November, reaching a peak in February and March. He found the larvae in well lighted shallow pools that had abundant emergent vegetation and algae. Atypically, the larvae were collected along the margins of the Rio Pinheiros in Butantan, Sao Paulo. In Lassance, Minas Gerais, Brazil, Shannon and Davis (1930:489) found *braziliensis* (as *brasiliensis*) at the head of a spring-fed swamp. They also reported that Komp, in the state of Monagas, Venezuela, collected larvae in a lake characterized by abundant vegetation. Deane et al. (1948:869-870) reported that in northeastern Brazil the larvae of *braziliensis* (as *pessoai*) are mainly collected in clear, slow moving water associated with grasses and algae, usually exposed to sunlight.

Anopheles braziliensis has been collected by MMAP with 2 other species of the Argyritarsis Section, *argyritarsis* and *darlingi*. It has also been found associated with *Aedeomyia* (*Ady.*) *squamipennis*, *Aedes* (*Och.*) *scapularis*, *Anopheles* (*Ano.*) *mediopunctatus*, *Culex* (*Cux.*) *coronator*, *Cx.* (*Mel.*) *chrysonotum*, *Cx.* (*Mel.*) sp. and *Uranotaenia* (*Ura.*) *pulcherrima*. According to Forratini (1962:381) *braziliensis* has also been collected with the following anophelines: *An.* (*Ano.*) *peryassui*, *An.* (*Nys.*) *oswaldoi*, *An.* (*Nys.*) *strodei*, and *An.* (*Ste.*) *kompi*. In northeastern Brazil, Deane et al. (1948:869-870) found *braziliensis* with *An.* (*Ano.*) *mediopunctatus*, *An.* (*Ano.*) *peryassui*, *An.* (*Ano.*) *shannoni*, *An.* (*Nys.*) *argyritarsis*, *An.* (*Nys.*) *nuneztovari*, *An.* (*Nys.*) *strodei* and *An.* (*Ste.*) *nimbus*. Shannon and Davis (1930:489) found *braziliensis*

with *An.* (*Ano.*) *peryassui* and *An.* (*Nys.*) "*tarsimaculatus*".

Anopheles braziliensis is exophagous in some places, rarely enters houses and prefers to feed on animals. Elsewhere, it is frequently seen in houses and is found infected with malarial parasites. In northeastern Brazil, Deane et al. (1948:871) report that only 15 of the 527 (2.9%) adults of *braziliensis* (as *pessoai*) captured were inside houses. In Ceara and Paraiba, Brazil, they found that 0.4% of the anophelines collected inside houses were *braziliensis* (as *pessoai*), while it represented over 20.0% of the anophelines found outside. The same authors reported that in the Amazonia *braziliensis* (as *pessoai*) was often found inside houses where it constituted 50 to 100% of the anophelines captured. *Anopheles braziliensis* will feed readily on man or domestic animals. It has been suggested that the 2 different behavior patterns observed for *braziliensis* might be a result of the lifestyle of the people who live in the different areas. The people in northeastern Brazil always have numerous domestic animals near their houses while the people in Amazonia do not. Deane et al. (1948:872) suggested that *braziliensis* feeds on domestic animals in the northeast and does not have to enter houses as it does in Amazonia. Where *braziliensis* is common it is found in large numbers both at night and during the day. Deane et al. (1948:873) investigated the activity period of *braziliensis* (as *pessoai*) and concluded that maximum activity occurred in the evening. Nevertheless, they often observed *braziliensis* feeding in the middle of the day when sunlight is most intense.

MEDICAL IMPORTANCE. *Anopheles braziliensis* has not been reported as a primary vector of human malaria; however, it may serve as a secondary vector. According to Root (1926b:705), epidemiologically it would appear to be a dangerous malaria carrier. He based this observation on the fact that *braziliensis* was reported to be very abundant at Lassance, Minas Gerais, Brazil where malaria was very prevalent. As previously mentioned, *braziliensis* may, under the right conditions (in the absence of domestic animals), enter houses in great numbers and may become involved in malaria transmission. L. M. Deane et al. (1946:6; 1948:874) examined 122 specimens of *braziliensis* (as *pessoai*) from Tamucuri, Para, Brazil, and found only one had sporozoites in the salivary glands. In this particular area, conditions were optimal for *braziliensis* to transmit malaria. The prevalence of endemic malaria was very high and malaria was probably maintained by *darlingi*; the inhabitants showed a high gametocyte rate and domestic animals were very rare. *Anopheles braziliensis* was observed breeding very close to houses, and the adults subsequently were found inside houses. Apparently when conditions are such that *braziliensis* enters houses, it may on occasion transmit malaria. Arruda et al. (1986:873-881) examined over 200 *An. braziliensis* from areas in Para, Brazil where both *P. vivax* and *P. falciparum* were present in a high percentage of blood films of the local populations and failed to detect sporozoites of either species of malaria. Deane et al. (1948:874) found 10 mosquitoes infected with flagellates of the family Trypanosomatidae.

DISTRIBUTION (Fig. 2). *Anopheles braziliensis* is distributed throughout northern South America east of the Andes except on the coast. It extends south, east of the Andes, to the state of Sao Paulo, Brazil, into Beni, Bolivia. It occurs throughout Colombia, Venezuela, the Guianas and Trinidad. It is not found on any of the islands in the Antilles nor does it occur in Central America.

Material Examined: 540 specimens: 82 males, 23 male genitalia, 242 females, 31 pupae, 162 larvae; 17 individual rearings (3 larval, 14 incomplete).

BRAZIL (117 specimens: 34M, 6M gen, 59F, 3P&p, 15L&l; 1 ind rear: 1 inc rear). **Amapa:** Amapa, 23 March 1944, 7F; same locality, 24 March 1944, 3F. **Amazonas:** Manaos, R. C. Shannon, 2F (JH); same locality, June 1931, 4F. **Bahia:** Caravellas, 6 May 1944, 2F (33). Piraja, 9 Mar 1929, R. C. Shannon, 1M (JH). Locality not specified, 27 Mar 1931, H. Kumm, 12F (JH); same locality, L. Rozeboom, BRR 1, 19F. **Minas Gerais:** Lassance, 12 May 1925, F. Root, 1M (81), 1F (425.2) (JH). **Para:** Amapa, 23 Mar 1944, Fordlandia, June 1931, R. C. Shannon, 1F (JH). **Pernambuco:** Recife (Ibura Field Station), Dec 1944, D. Lucen, 1M, 1M gen, 2F. **Rio Grande do Norte:** Natal, 18 June 1943, MacCreary, 11; same locality, 22 June 1943, 2M; same locality, 24 June 1943, 1M; same locality, 25 June 1943, 11; same locality, 26 June 1943, 2M; same locality, 27 June 1943, 1M; same locality, 28 June 1943, 21; same locality, 30 June 1943, 11; same locality, 3 July 1943, 51; same locality, 8 July 1943, 3M, 2M gen; same locality, 9 July 1943, 1M gen; same locality, 14 July 1943, 1F; same locality, 15 July 1943, 1M gen; same locality, 24 July 1943, 1F, same locality, 26 July 1943, 1F, same locality, 29 July 1943, 1L, same locality, 31 July 1943, 1M gen; same locality, 5 Aug 1943, 1M; same locality, 15 Nov 1943, 1F; same locality, 27 Nov 1943, 1F; same locality, 20 Dec 1943, 1M, 1M gen; same locality, 22 Dec 1943, 1M; same locality, 23 Jan 1944,, 1M; same locality, 24 Jan 1944, 1F; same locality, Jul 1944, H. T. Dalmat, 2F; same locality, 22 Feb 1945, 1M, 1p; same locality, 27 Feb 1945, 11p; same locality, 2 Mar 1945, 1M, 1p; same locality, 12 May 1945, 2L. **Sao Paulo:** Buntantan, 1938, A. L. Galvao, A-63, 1M (JH). Sao Paulo, 1M, 1F (83, 25). **State not specified:** Maquary, R 936, 3F (JH). Locality not specified, L. Rozeboom, 13M (377.17, 377.44, 377.23, 377.18, 425.13, 425.11, 425.10, 425.7, 409.1, 425.6, 425), 5F (377.13, 377.4, 425.1, 409.2, 425) (JH); same locality, 9F (JH); same locality, M. Boyd, 1M (JH).

BOLIVIA (2 specimens: 2F). **Beni:** Guayaramerim, 13 May 1946, W. Komp, KO H-19-25, 2F.

COLOMBIA (285 specimens: 24M, 14M gen, 85F, 27P&p, 135L&l; 15 ind rear: 31, 12 inc rear). **Meta:** Remolinos, COB 59, 11pM, 21pF, 7L. Restrepo, August 1928, KO 117-10, 1F. Villavicencio, 2 May 1947, L. Rozeboom, CV 377, 6M, 2M gen, 6F; same locality and collector, 14 May 1947, CV 379, 3F, 1L; same locality and collector, 23 May 1947, CV 391, 1F; same locality and collector, 30 May 1947, CV 403-B, 39F; same locality and collector, 9 July 1947, CV 448, 1F, 2p, 7M gen (425.7, 425.10, 425.11, 522.3, 689.1, 689.2) (JH); same locality, 12 May 1947, 41p (377.19, 377.17, 377.46, 377.13), 1L; same locality, 14 May 1947, 1L (389); same locality, 2 June 1947, 61p (425.1, 425.2, 425.6, 425.7, 425.10, 425.11); same locality, 6 June 1947, 21p (409.1, 409.2); same locality, August 1947, 6L (Lot 689); 4 August 1975, J. Kitzmiller, COZ 103, 53L; same locality, 8 July 1965, COB 66, 11pM, 1M gen. **Department not specified:** Lassance, 12 May 1925, 1L (82). Yurimena, 12 Dec. 1947, Rockefeller Lab, C-522, 3M, 2M gen, 7F, 11p (522.3) (JH); same locality, 30 May 1948, Rockefeller, 403-B, 5F (JH). Locality not specified, July 1975, J. Kitzmiller, COZ 64, 3F, 5M; same collector, COZ 77, 4M, 7F, same collector, COZ 79, 4M, 2M gen, 5F; same collector, COZ 82, 1F; same collector, 4 Aug 1975, COZ 103, 55L.

FRENCH GUIANA (11 specimens: 11F). **Guyane:** Rochambeau, Aug 1945, 7F.

Parish and locality not specified: 29 Aug 1943, 4F.

GUYANA (25 specimens: 2M, 23F). **East Demerara-West Coast Berbice:** Rosignol, KO 113, 20F, 2M. **Province not specified:** North Rupununi, 28 Aug, Bello, BG 59-1, 3F.

SURINAME (15 specimens: 11F, 1p, 3L&l; 1 ind rear: 1 inc). Marowijne: Moengo, Sep 1944, Guicherit, 3F. **District not specified:** Kropie Roadside, Swamp, 25 Sep 1974, A. Benitez, 2L. Locality not specified, 29 Aug 1943, S. Yolles 4F; same locality, J. Clastrier, FGC 3416, 4F; same locality, 1943, 11p.

TRINIDAD (49 specimens: 20M, 2M gen, 27F). **Piarco,** 1946, 1M, 1F. **County not specified:** Paradise, 12 Aug 1936, KO 113-15, 15M, 23F. Locality not specified, 6 Jan 1944, Yolles, 3M, 1M gen, 3F; same collector, 7 Jan 1944, 1M; same collector, 1 Dec 1944, 1M, 1M gen; 6 Jan 1944, Byrd, 1F.

VENEZUELA (36 specimens: 2M, 1M gen, 24F, 9L). **Barinas:** 1943, D. Triate, 1M, 4F. **Monagas:** Jusepin, 30 Oct 1944, E. Winton, 1M, 1M gen, 4F, 6L. Temblador, 17 Dec 1944, E. Winton, 8F. **State not specified:** Casbito, 13 Sep 1936, 1F. El Reballedo, 13 Jul 1945, 1F; Rachambeau, Aug 1945, 6F; 1949, 2L; 1950, 1L.

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FIGURES

Fig. 1

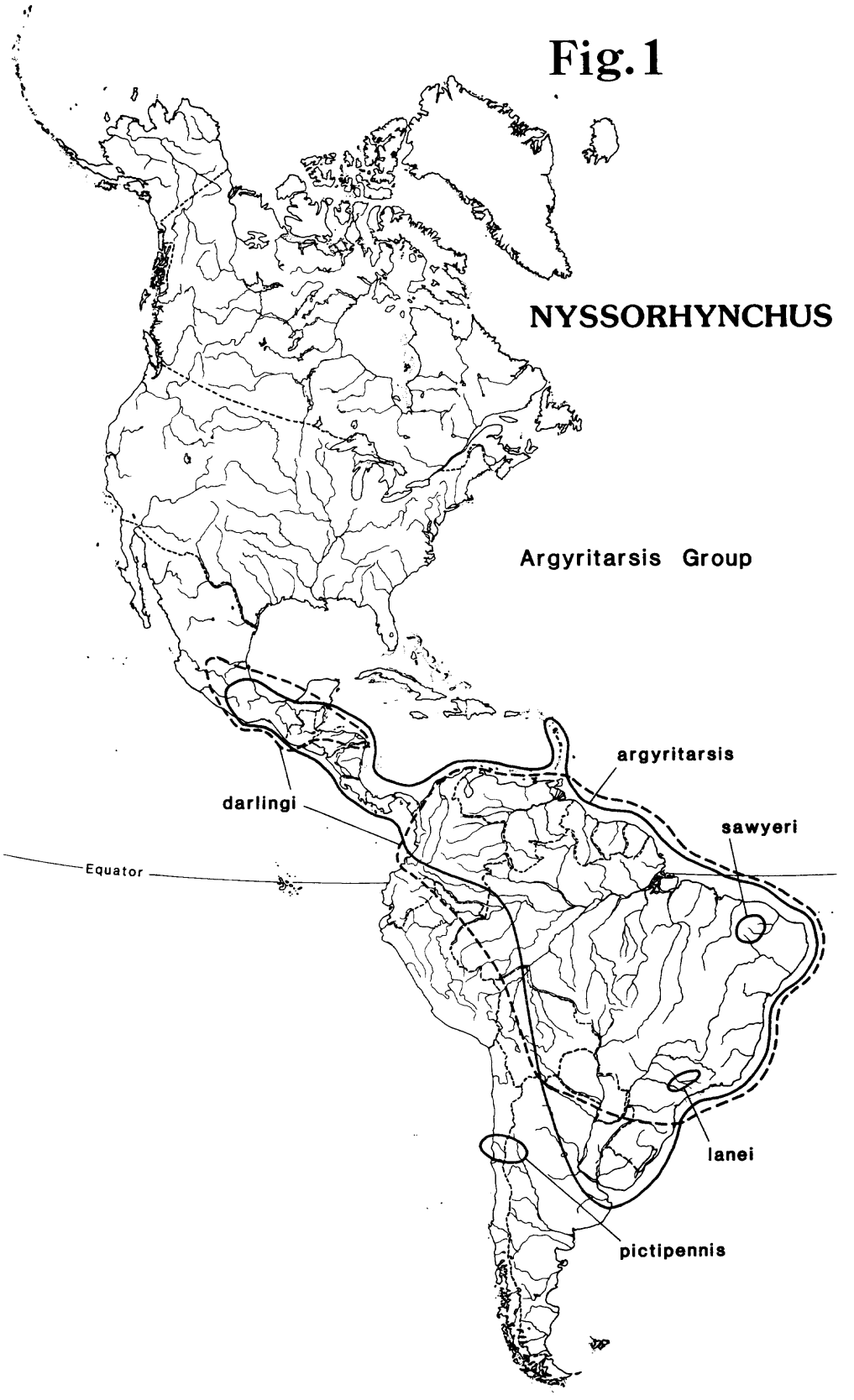
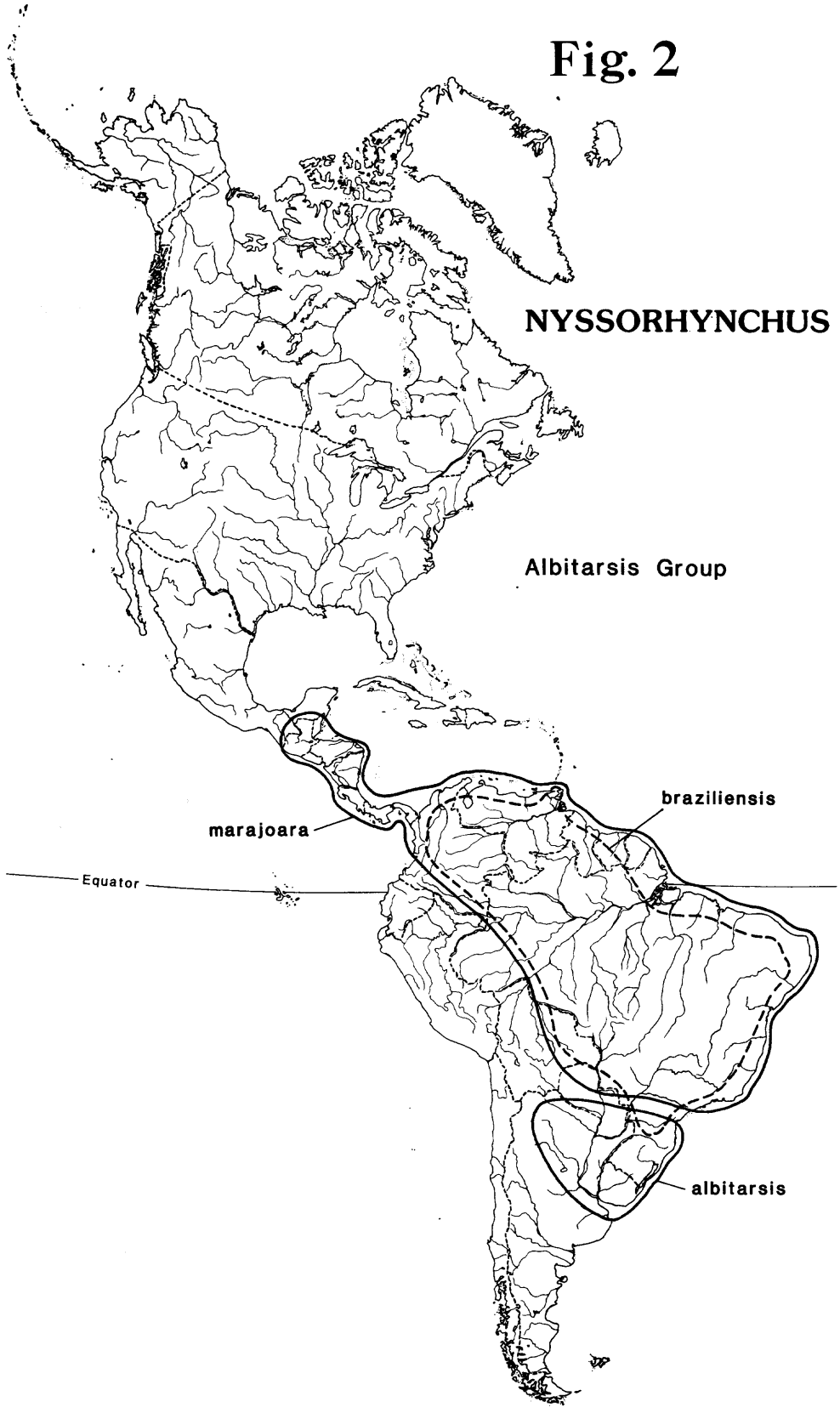

NYSSORHYNCHUS
Argyritarsis Group
argyritarsis
darlingi
sawyeri
Equator
lanei
pictipennis

Fig. 2


NYSSORHYNCHUS
Albitarsis Group
braziliensis
marajoara
Equator
albitarsis

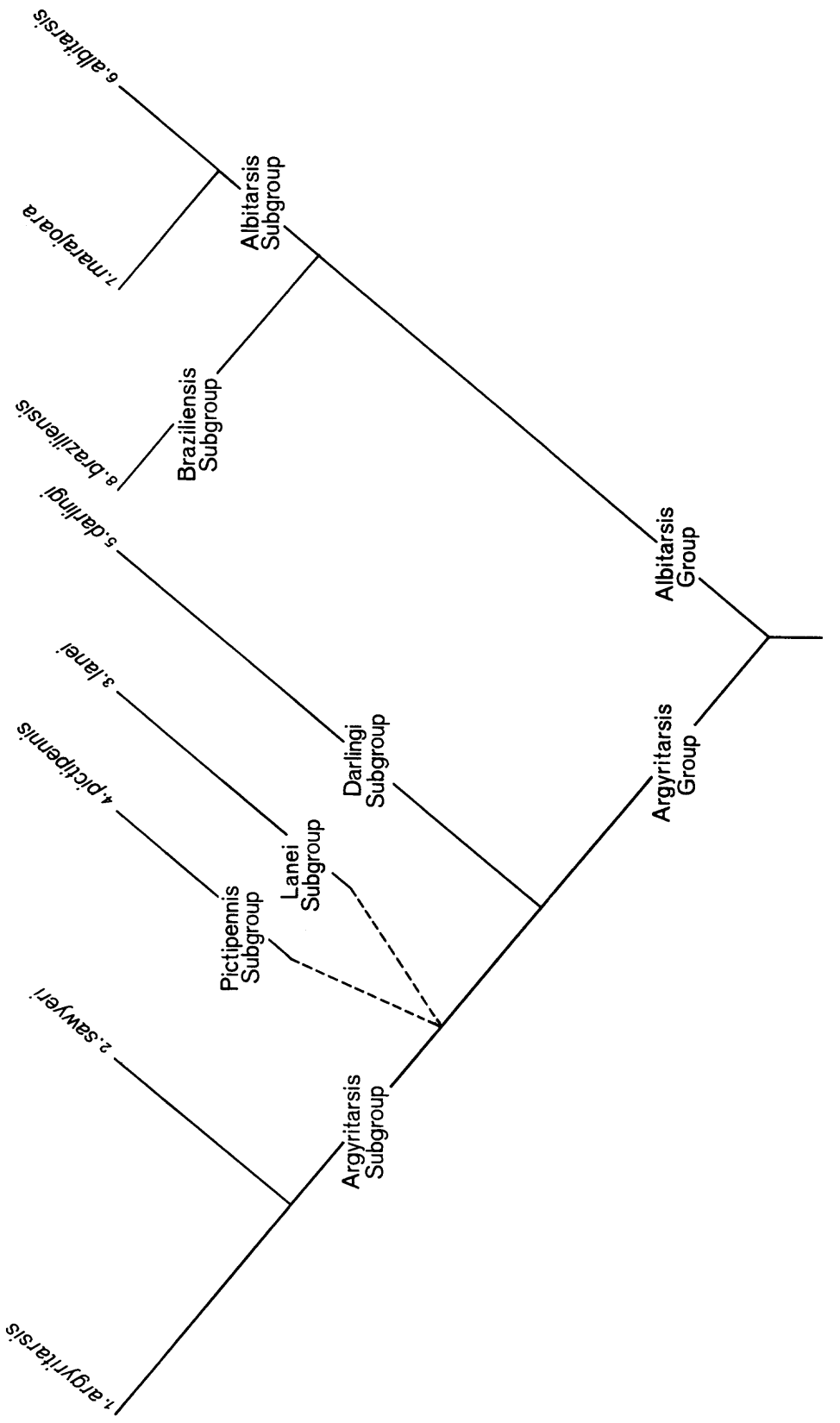


Fig.3 Hypothesized phylogenetic tree of the Argyritarsis Section

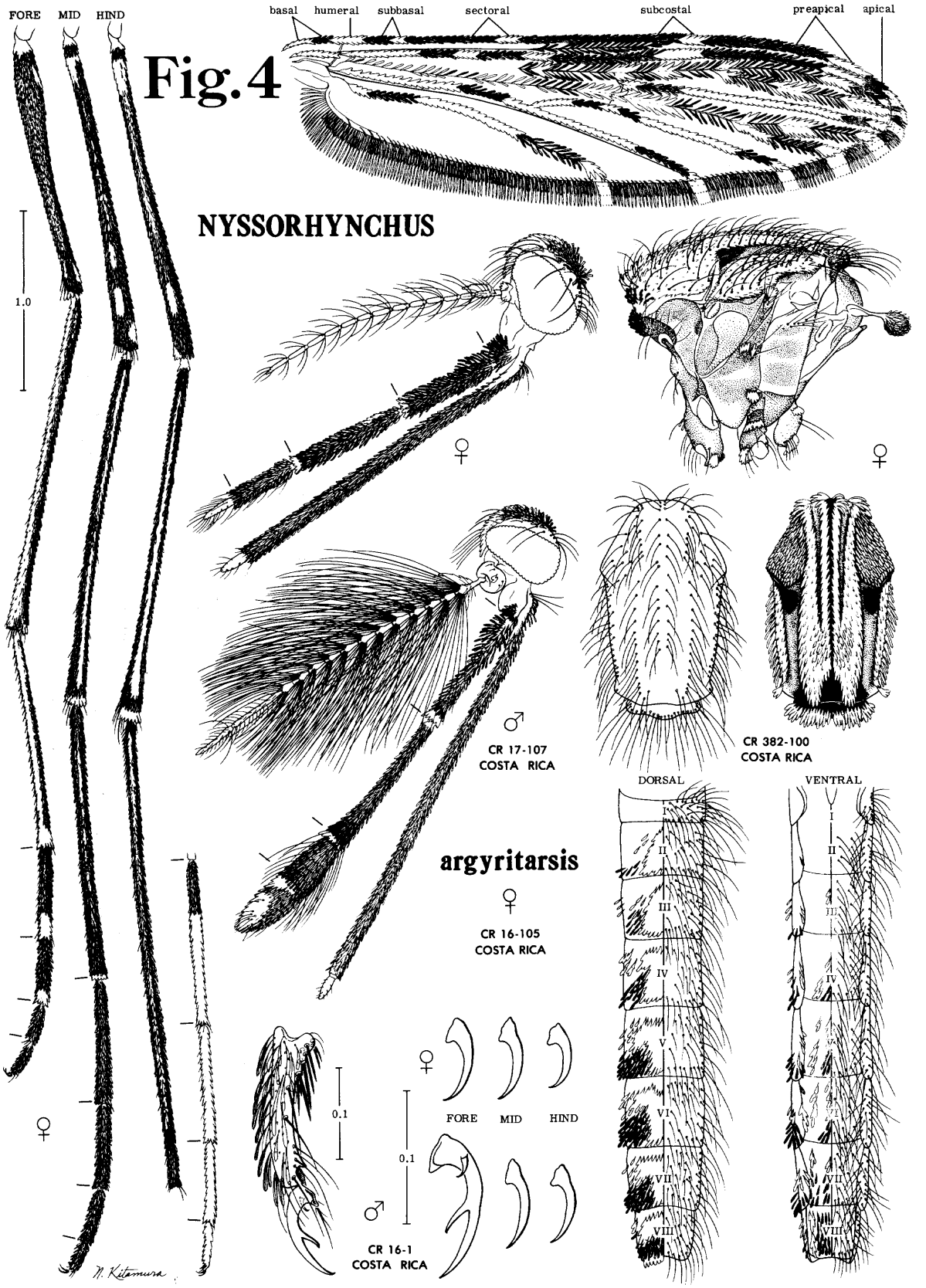
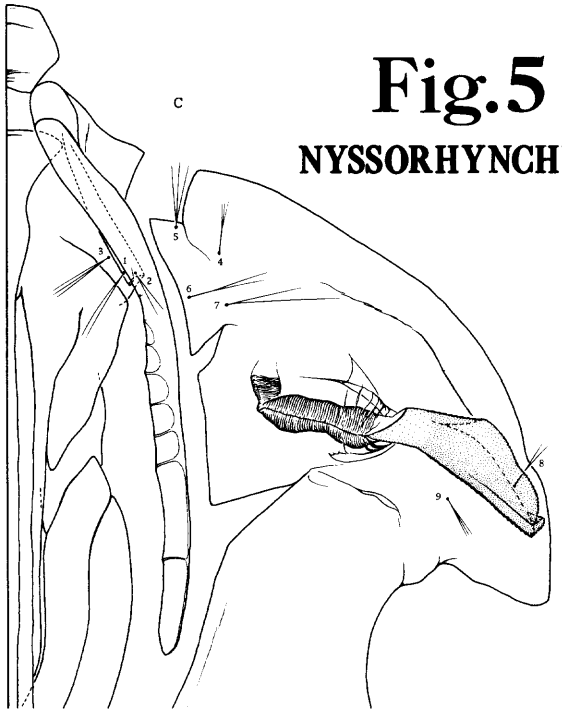
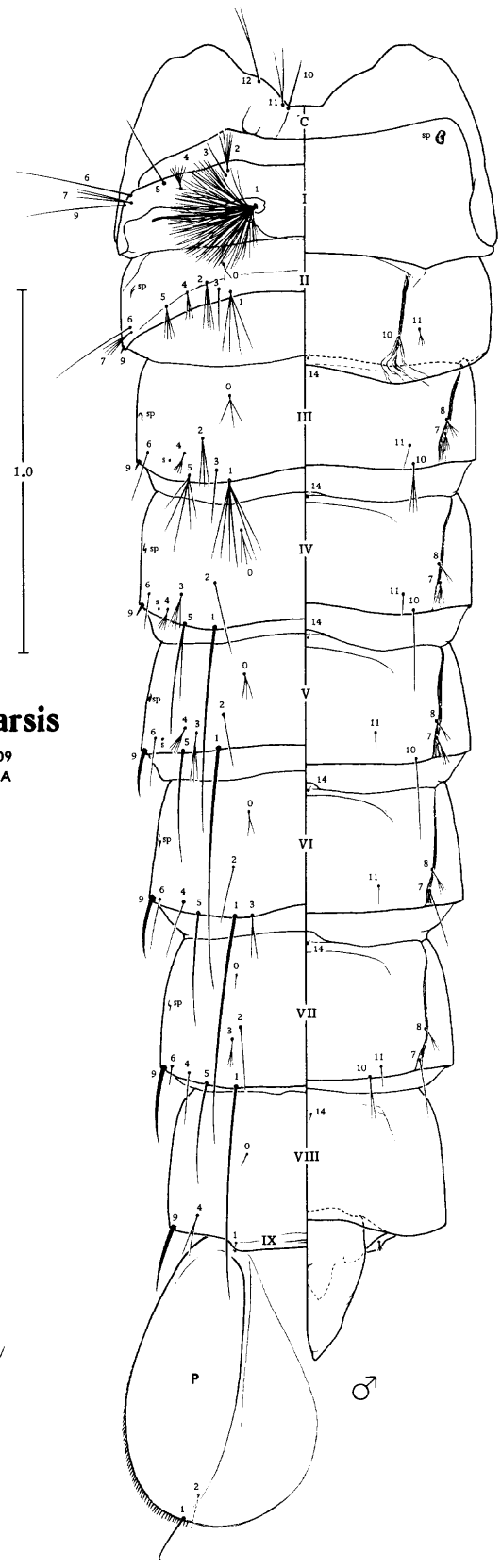

FORE
MID
HIND
basal
humeral
subbasal
sectoral
subcostal
preapical
apical
Fig. 4
NYSSORHYNCHUS
1.0
♀
♂
CR 17-107
COSTA RICA
CR 382-100
COSTA RICA
argyritarsis
♀
CR 16-105
COSTA RICA
DORSAL
VENTRAL
I
II
III
IV
V
VI
VII
VIII
0.1
0.1
♀
♂
FORE
MID
HIND
CR 16-1
COSTA RICA
M. Kitamura

Fig.5

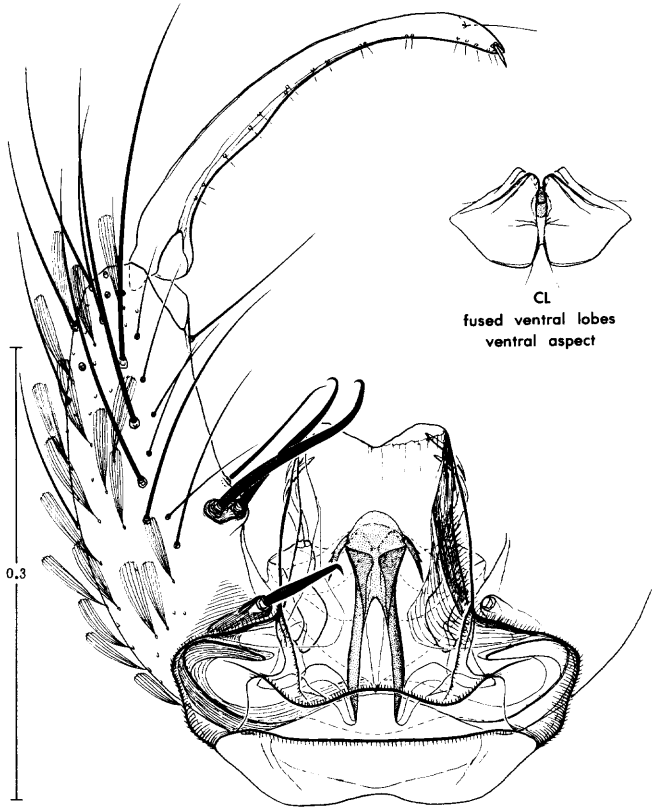
NYSSORHYNCHUS





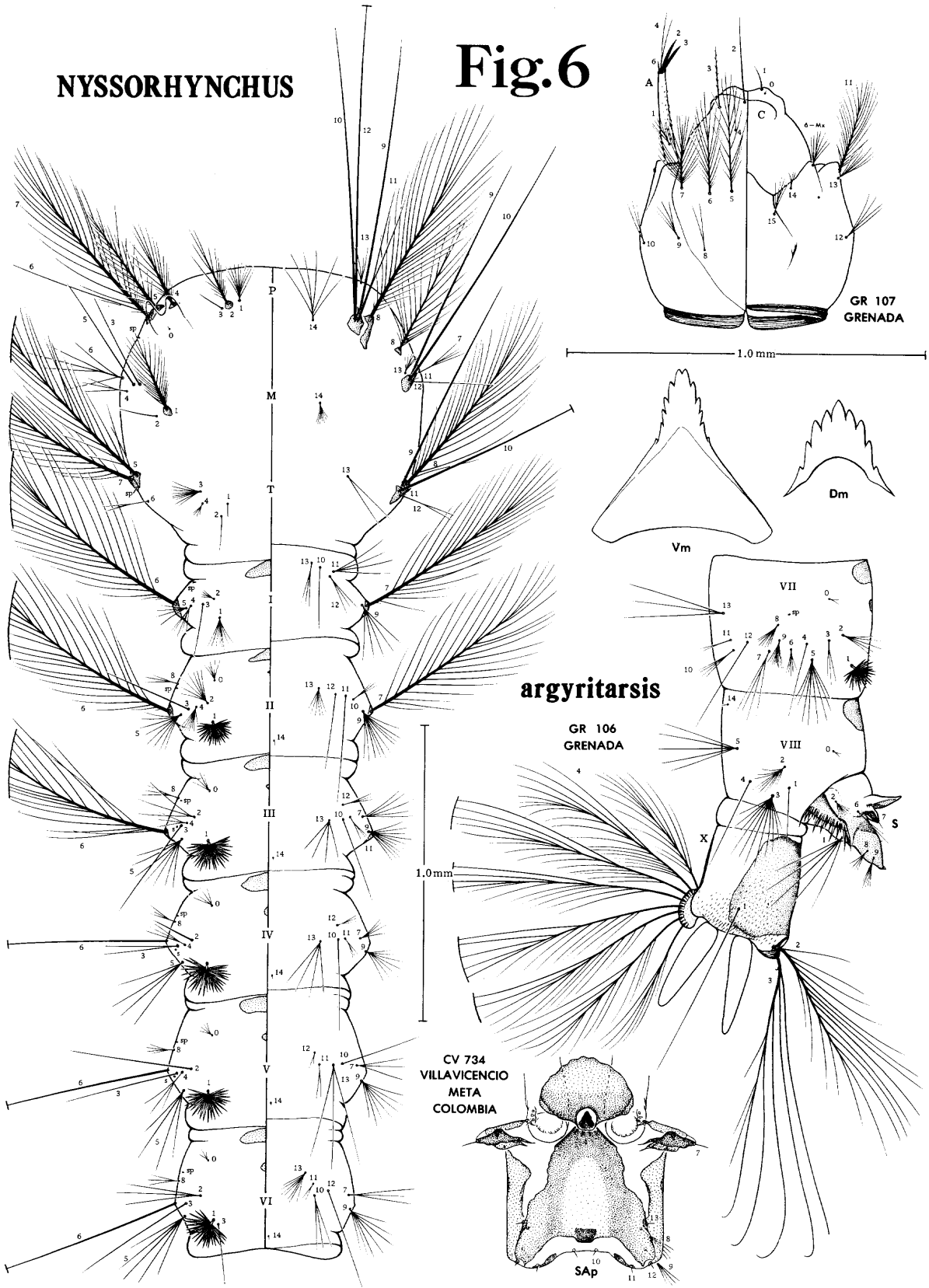
argyritarsis

GR 17-109
GRENADA



CL
fused ventral lobes
ventral aspect

Fig.6


NYSSORHYNCHUS
P
M
T
I
II
III
IV
V
VI
1.0mm
A
C
6—Mx
GR 107
GRENADA
1.0 mm
Vm
Dm
argyritarsis
GR 106
GRENADA
VII
VIII
X
S
CV 734
VILLAVICENCIO
META
COLOMBIA
SAp

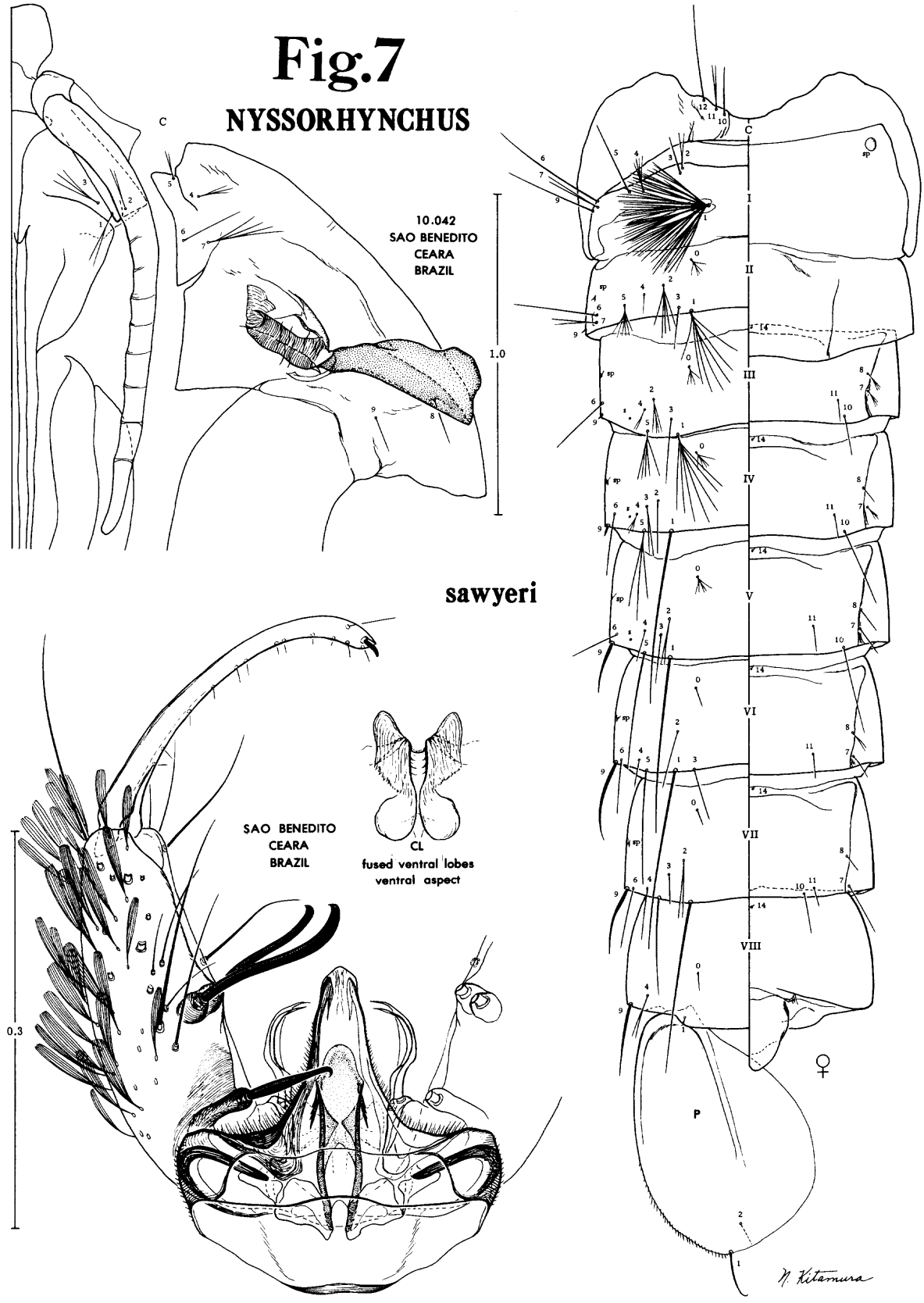
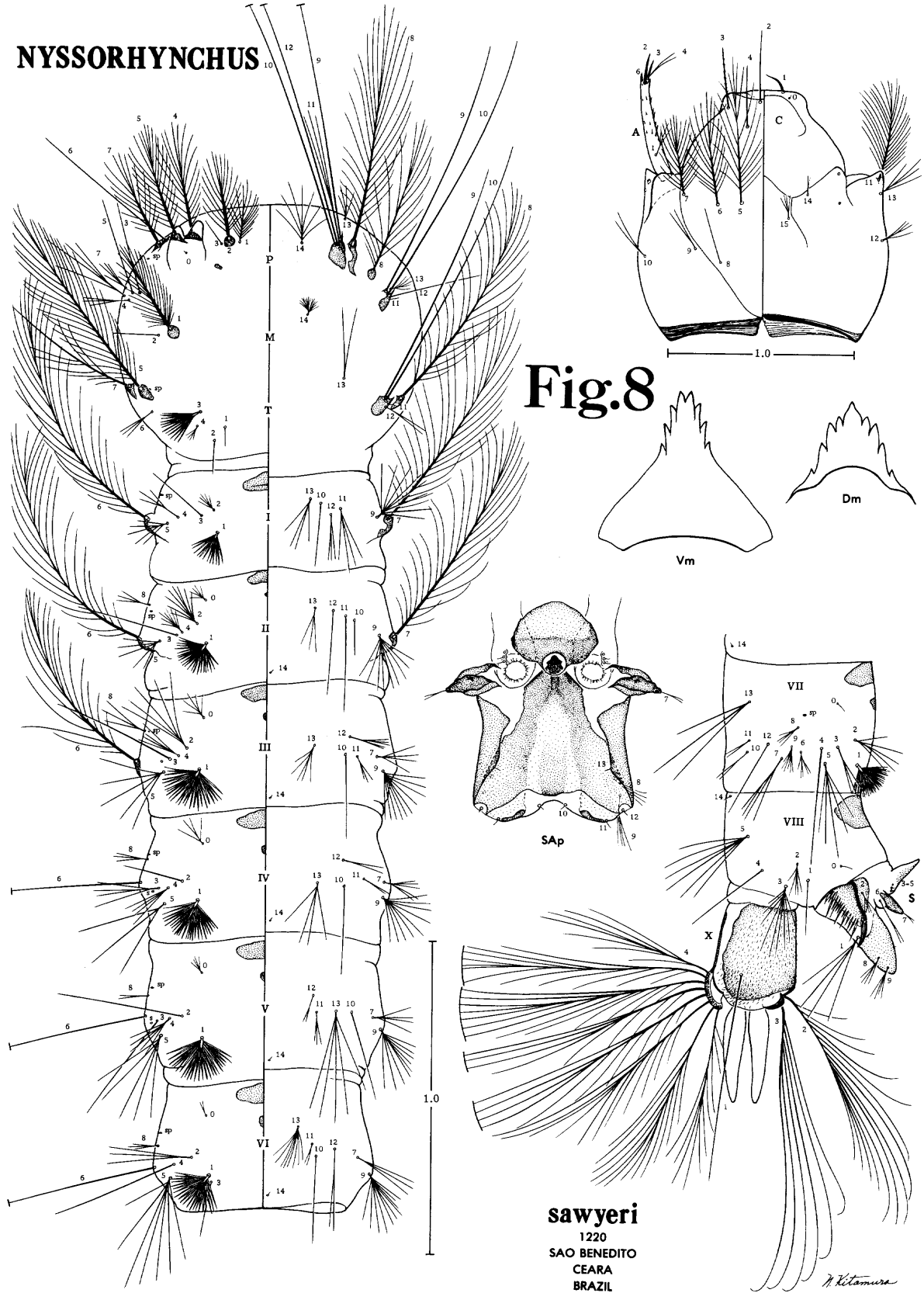


Fig.7
NYSSORHYNCHUS
sawyeri
10.042
SAO BENEDITO
CEARA
BRAZIL
1.0
SAO BENEDITO
CEARA
BRAZIL
CL
fused ventral lobes
ventral aspect
0.3
C
I
II
III
IV
V
VI
VII
VIII
P
N. Kitamura


NYSSORHYNCHUS
P
M
T
I
II
III
IV
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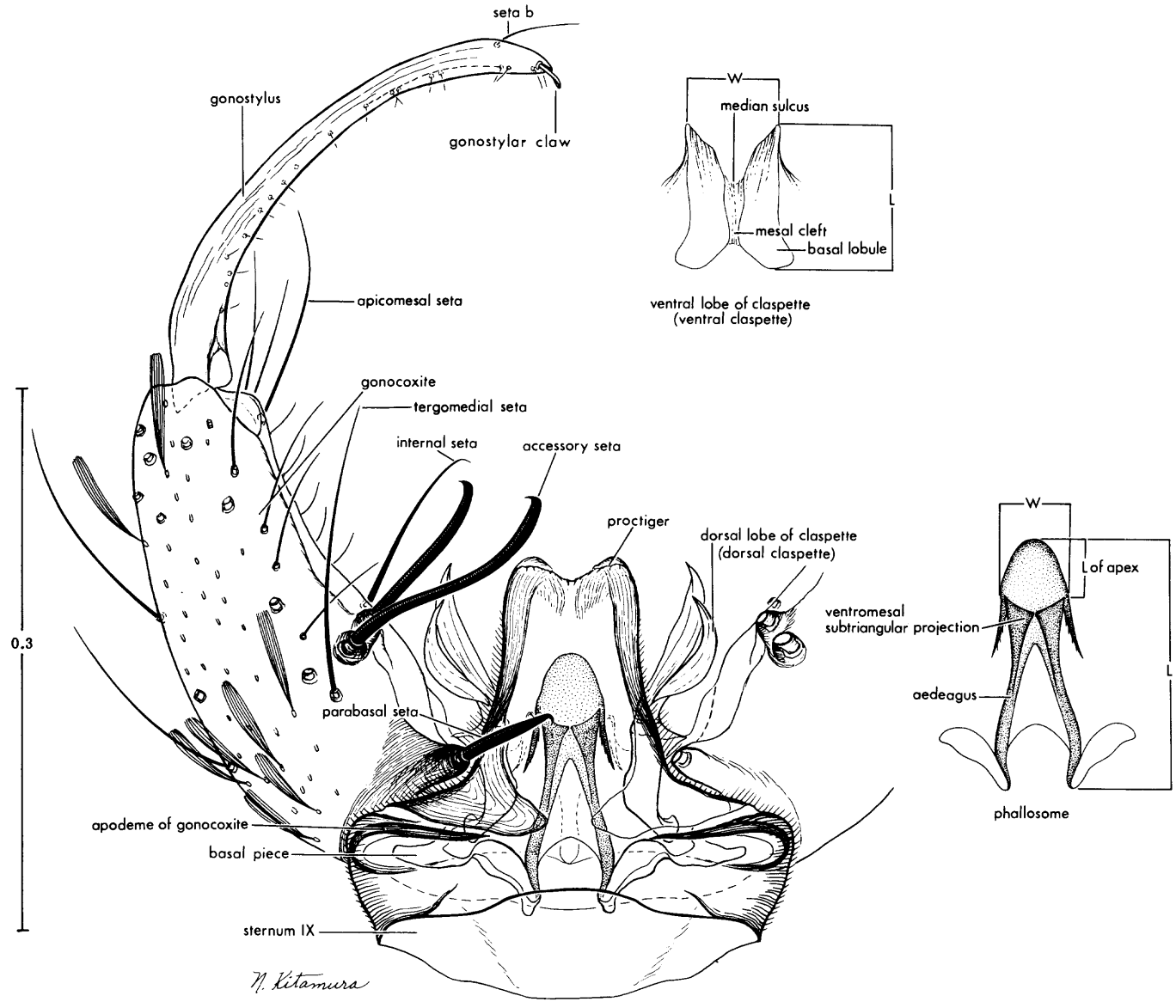
VI
VII
VIII
X
S
A
C
1.0
Vm
Dm
SAp
sawyeri
1220
SAO BENEDITO
CEARA
BRAZIL
H. Kitamura

Fig.8

Fig. 9
NYSSORHYNCHUS

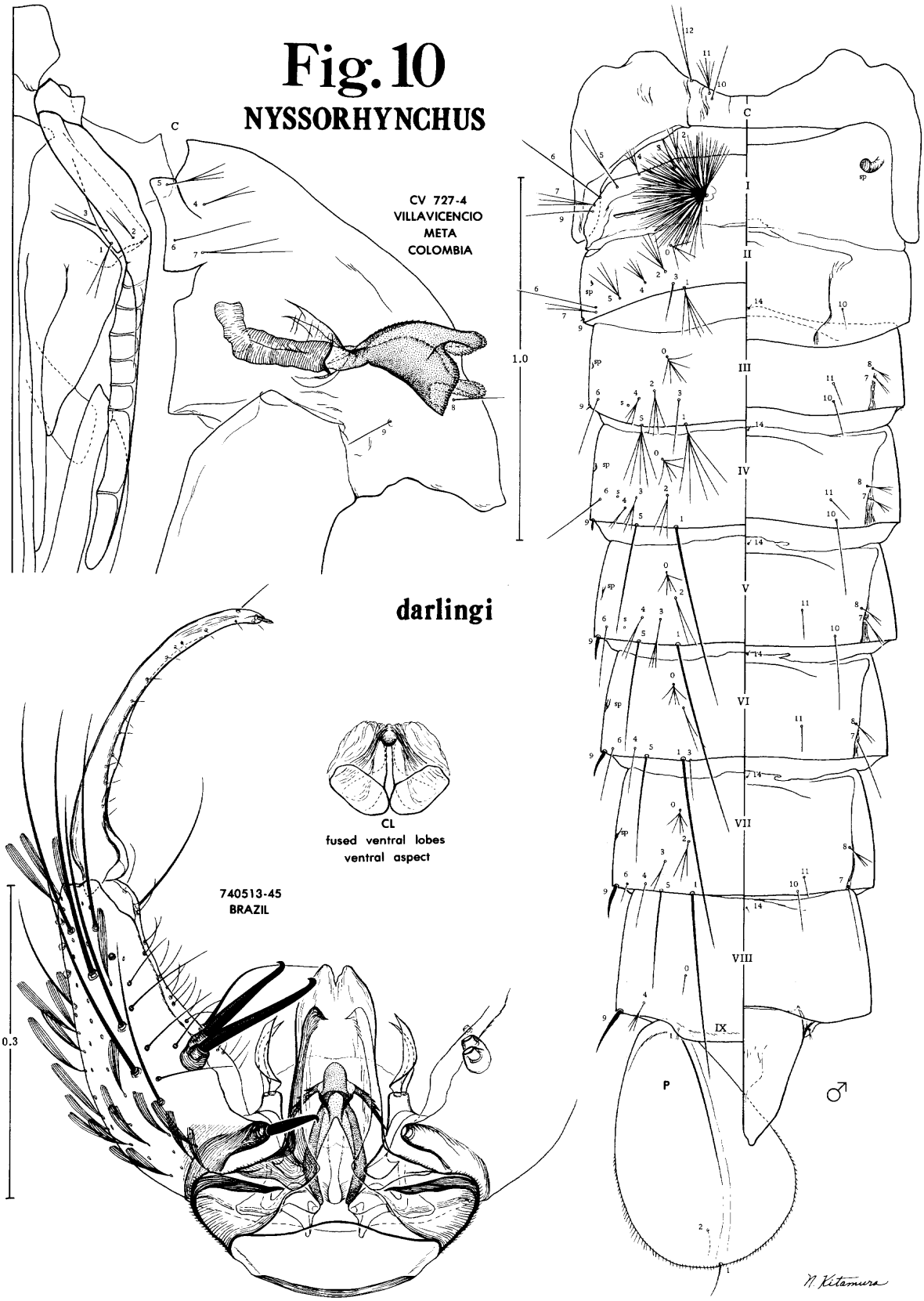


lanei

ESTANCIA
SERGIPE
BRAZIL

Fig. 10

NYSSORHYNCHUS



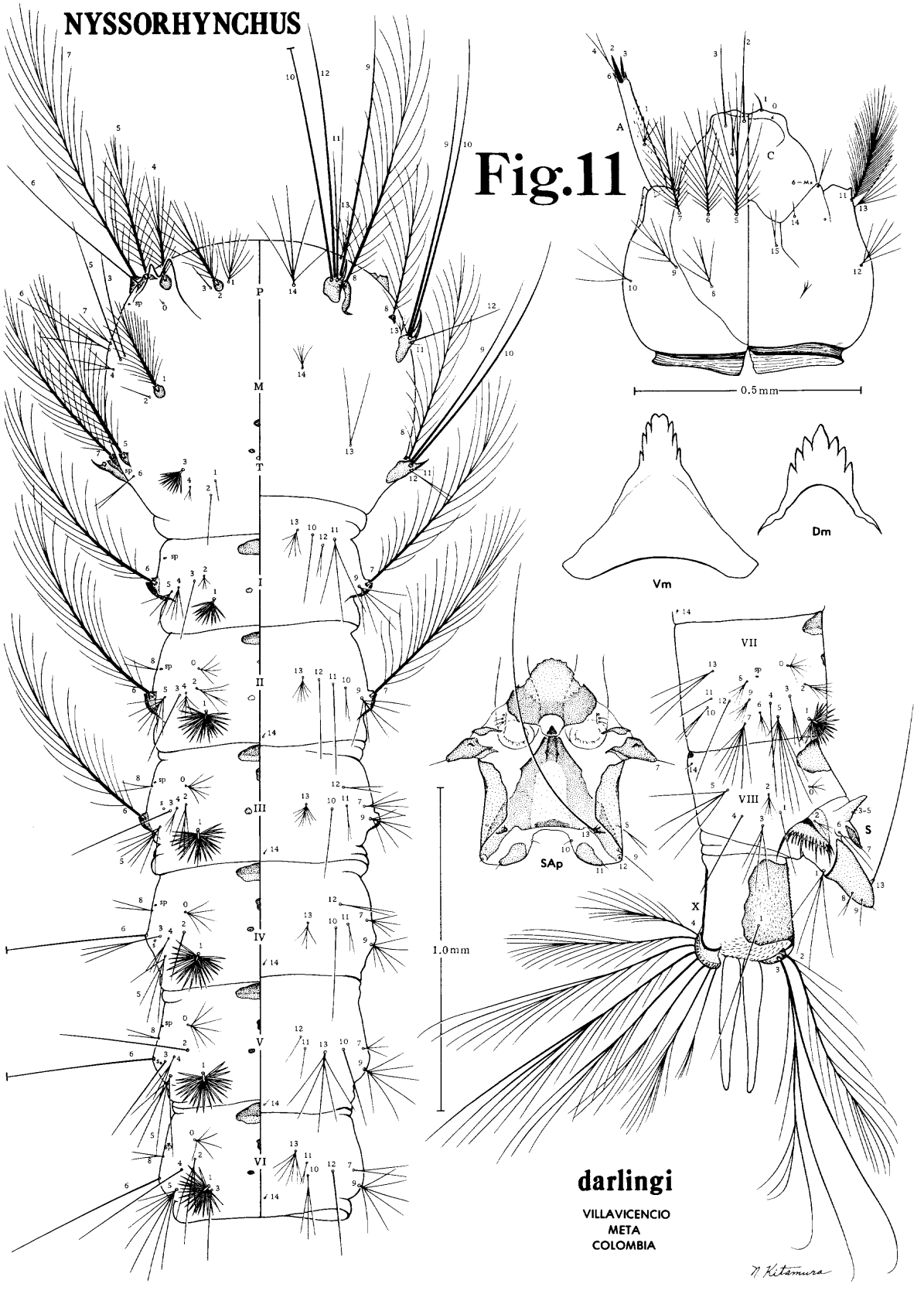
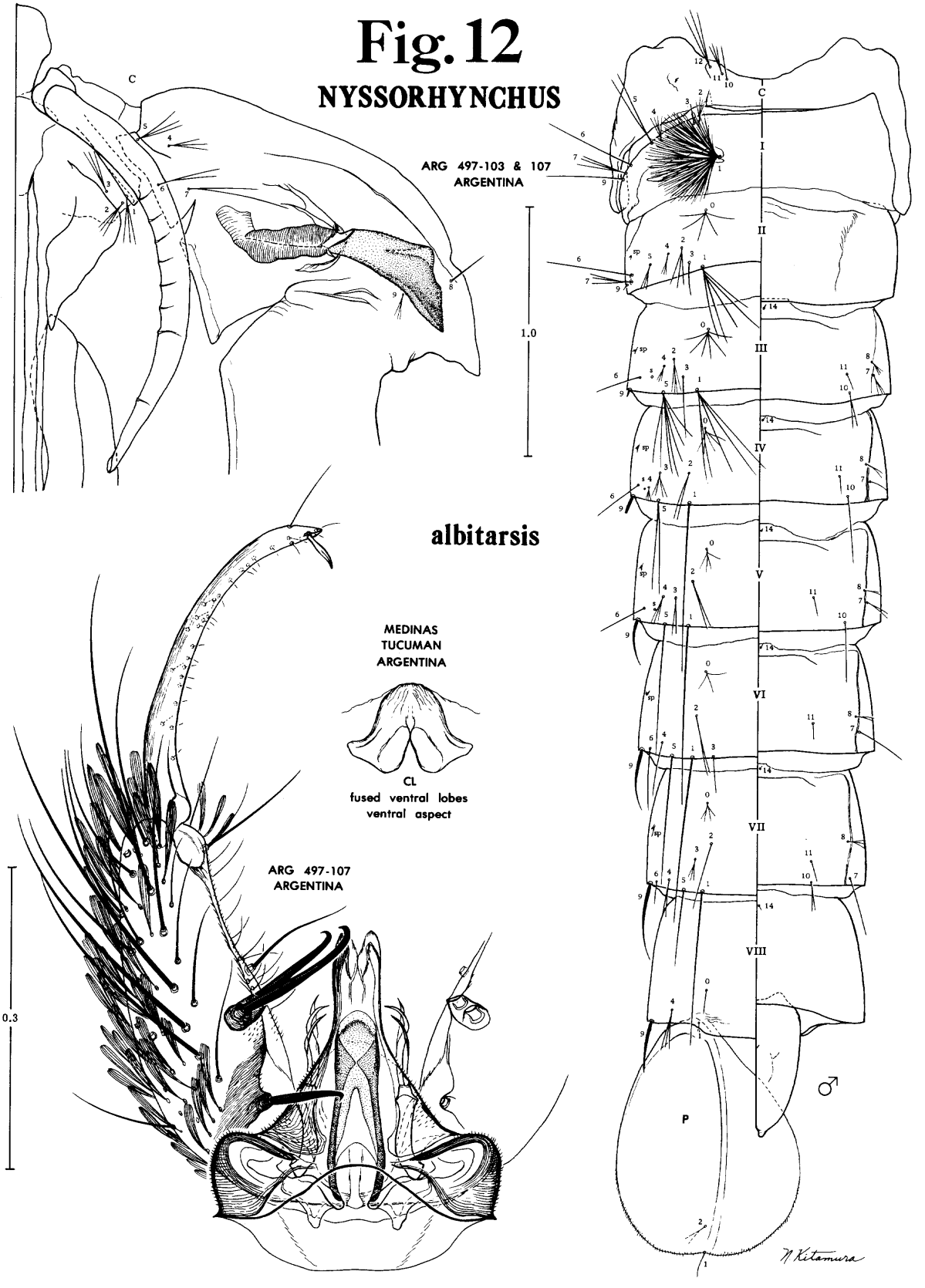

NYSSORHYNCHUS
Fig.11
A
C
0.5mm
Vm
Dm
SAp
VII
VIII
X
S
1.0mm
darlingi
VILLAVICENCIO
META
COLOMBIA
M. Kitamura

Fig. 12

NYSSORHYNCHUS



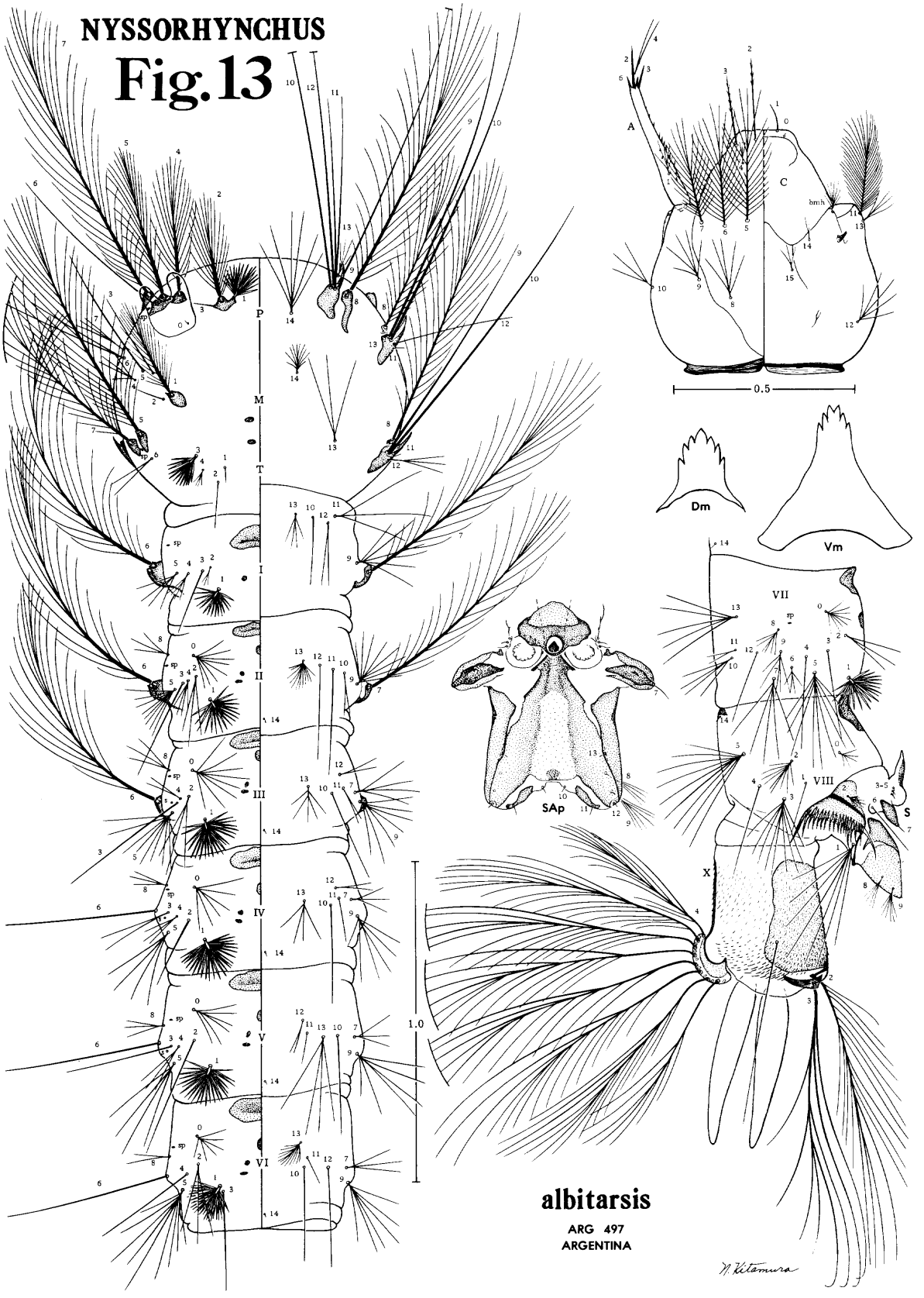
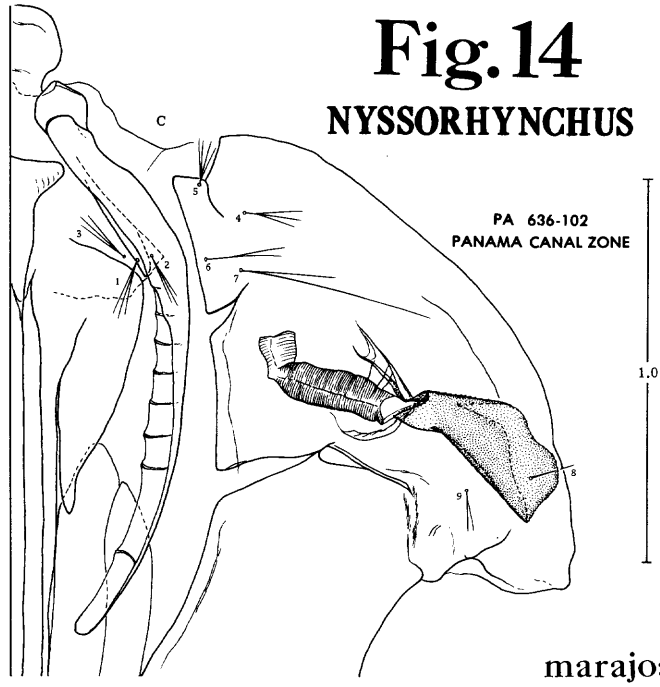
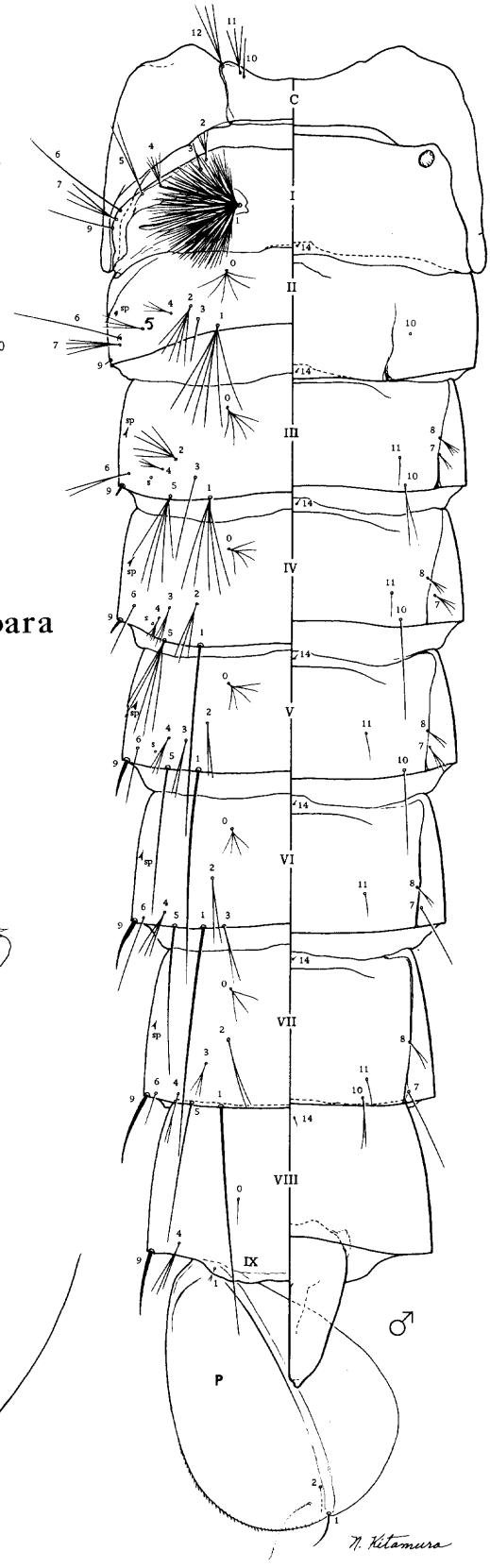

NYSSORHYNCHUS
Fig.13
P
M
T
I
II
III
IV
V
VI
VII
VIII
X
S
A
C
bmh
0.5
Dm
Vm
SAp
1.0
albitarsis
ARG 497
ARGENTINA

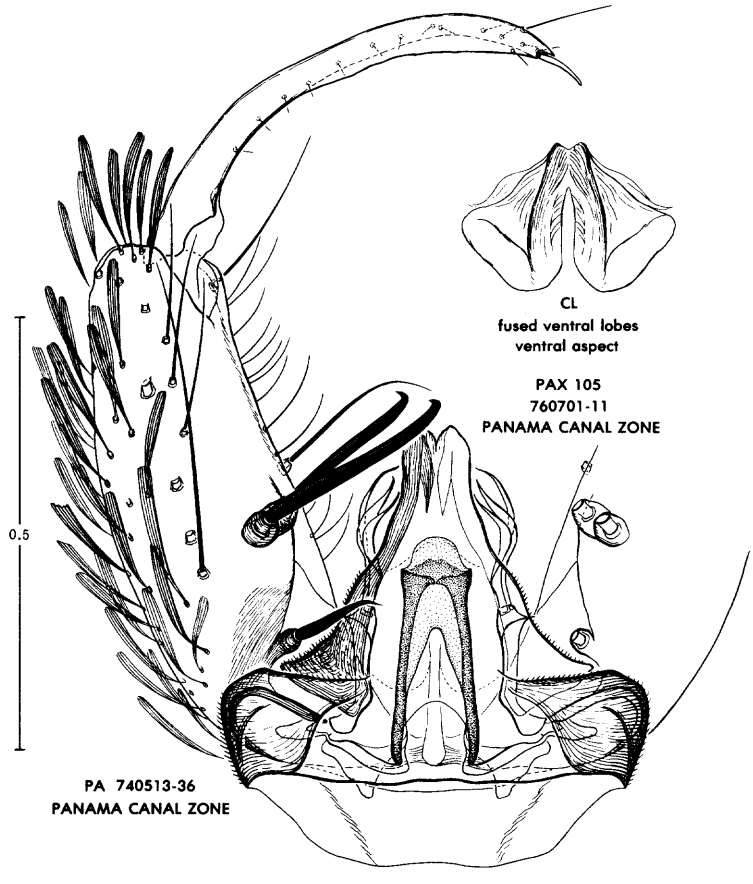
Fig. 14

NYSSORHYNCHUS



marajoara





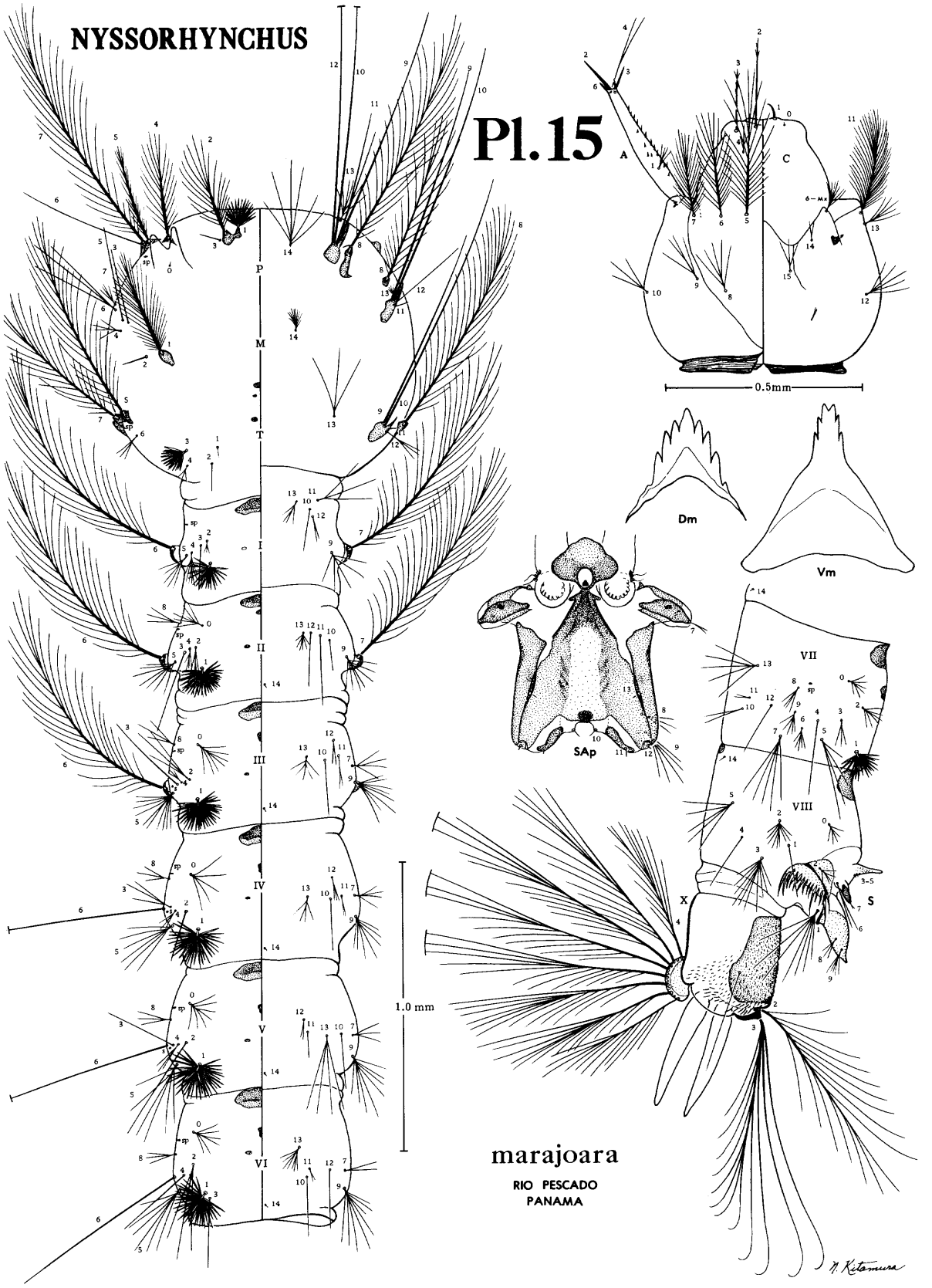
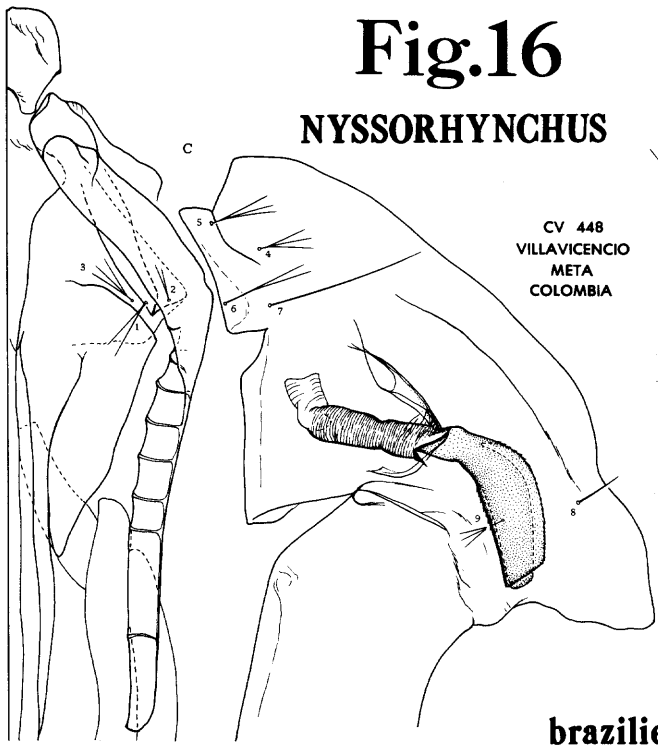
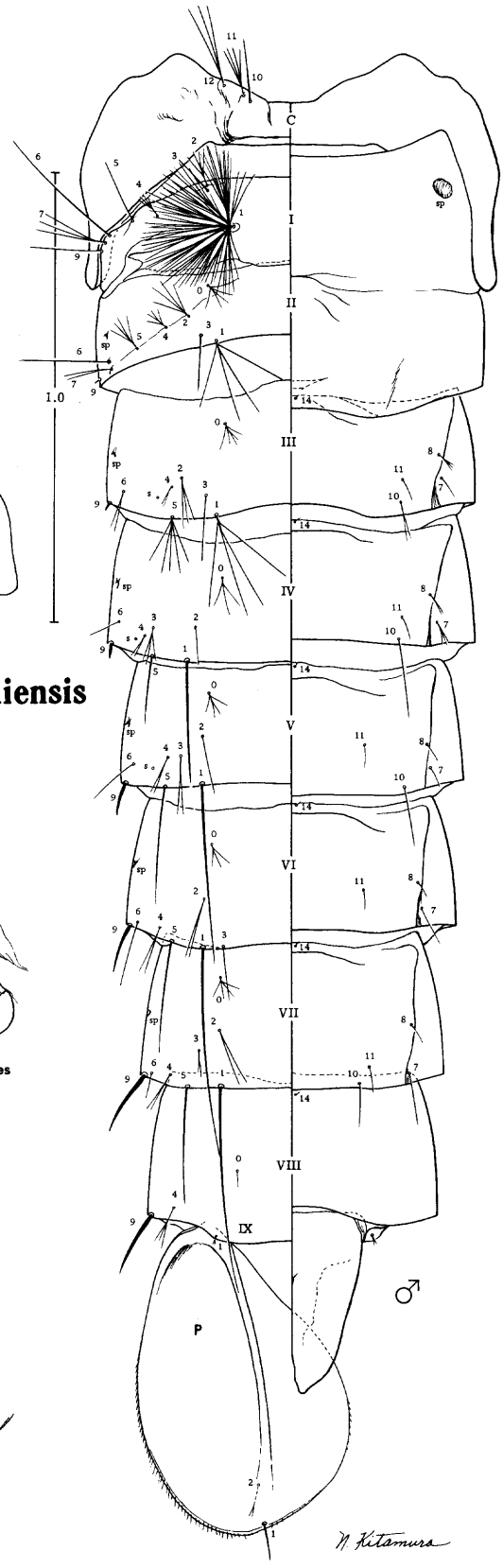

NYSSORHYNCHUS
Pl.15
A
C
0.5mm
Dm
Vm
SAp
P
M
T
I
II
III
IV
V
VI
VII
VIII
X
S
1.0 mm
marajoara
RIO PESCADO
PANAMA
N. Kitamura

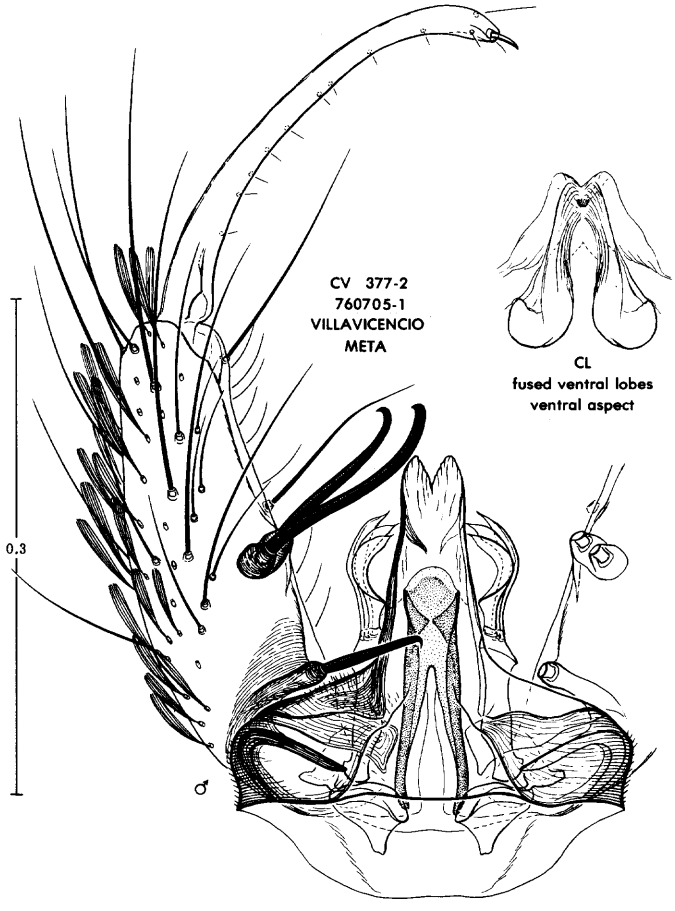
Fig.16

NYSSORHYNCHUS





braziliensis



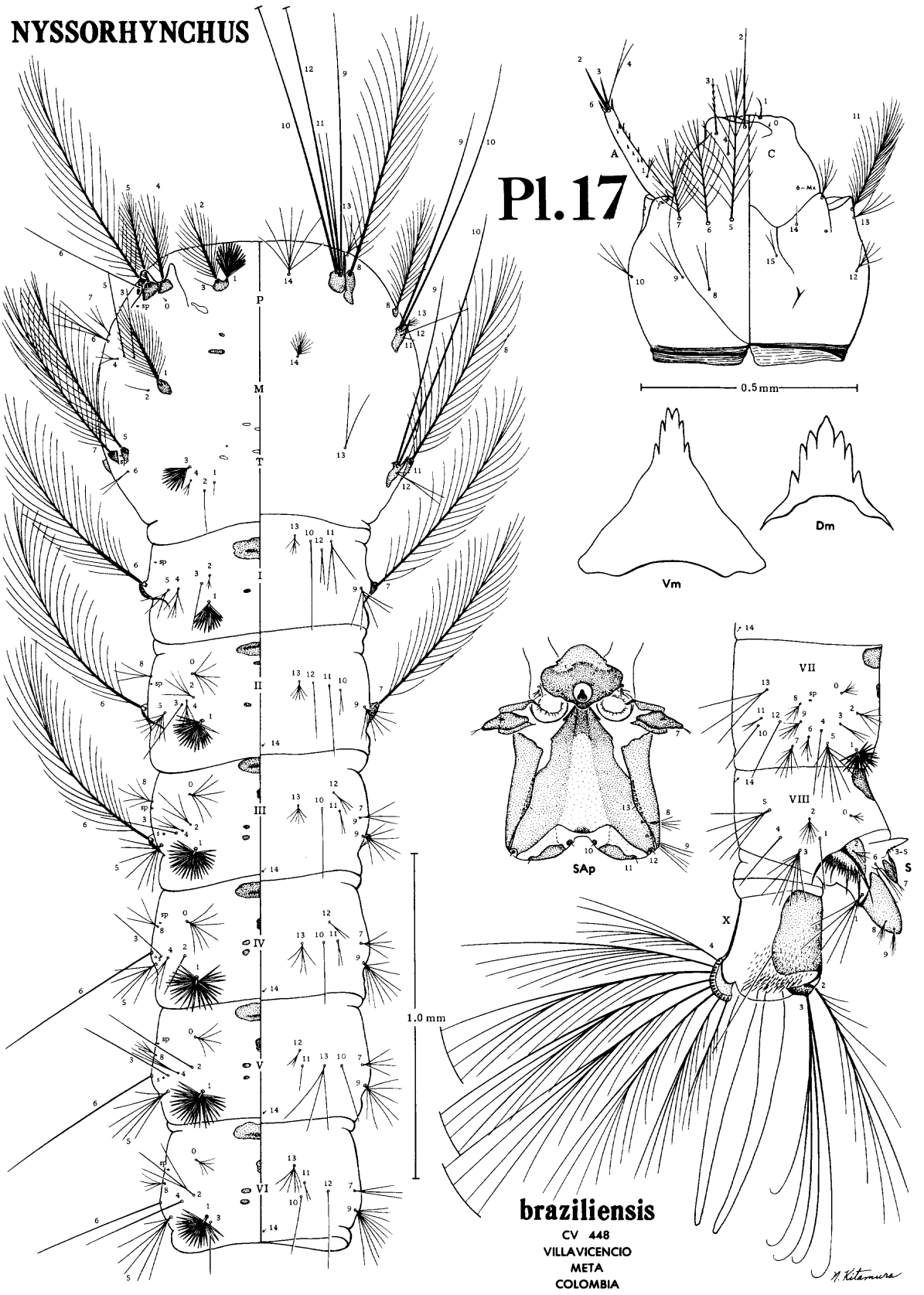

NYSSORHYNCHUS
Pl.17
A
C
0.5mm
Vm
Dm
SAp
VII
VIII
X
S
P
M
T
I
II
III
IV
V
VI
1.0 mm
braziliensis
CV 448
VILLAVICENCIO
META
COLOMBIA

TABLE OF DISTRIBUTIONS

DISTRIBUTION \ SPECIES	1 *argyritarsis*	2 *sawyeri*	3 *lanei*	4 *pictipennis*	5 *darlingi*	6 *albitarsis*	7 *marajoara*	8 *braziliensis*
MEXICO	●				●			
GUATEMALA	●				●			
BELIZE	●				●			
EL SALVADOR	●				●			
HONDURAS	●				●			
NICARAGUA	✪							
COSTA RICA	●						●	
PANAMA — West	✪						✪	
PANAMA — Central	●						●	
PANAMA — East	✪						✪	
ECUADOR — Pacific					?			
ECUADOR — Amazon					✪			
PERU					●			
COLOMBIA — Pacific	●				✪		✪	✪
COLOMBIA — Caribbean	●				✪		✪	✪
COLOMBIA — Orino-Amazon	●				●		●	●
VENEZUELA — Caribbean	●				●		●	●
VENEZUELA — Orinoco	✪				✪		✪	●
LESSER ANTILLES — Leeward	●							
LESSER ANTILLES — Windward	●							
TRINIDAD	●						●	●
GUIANAS	●				●		●	●
BRAZIL — Amazon	●				●		●	●
BRAZIL — Northeast	●	●			●		●	●
BRAZIL — South	●		●		●	●	●	●
PARAGUAY	●				●	●		
ARGENTINA	●				●	●		
BOLIVIA	●				●		●	●
URUGUAY	✪							
CHILE				●				

CONSPECTUS OF TAXONOMIC CHANGES

Resurrected From Synonymy

marajoara Galvao and Damasceno 1942, From synonymy with *albitarsis* (Lynch-Arribalzaga 1878), to specific rank, p. 198

sawyeri Causey, Deane, Deane and Sampaio 1943, From synonymy with *argyritarsis* (Robineau-Desvoidy 1827), to specific rank, p. 155

New Synonymy

domesticus Galvao and Damasceno 1944, From subspecies of *albitarsis* (Lynch-Arribalzaga 1878), to synonymy with *marajoara* (Galvao and Damasceno 1942), p. 198

Nomen Dubium

allopha (Peryassu, 1921) to *nomen dubium*, p. 206