Contributions of the American Entomological Institute

Volume 17, Number 1, 1979

MOSQUITO STUDIES (Diptera, Culicidae)

XXXV. The new sabethine genus *Johnbelkinia* and a preliminary reclassification of the composite genus *Trichoprosopon*. By Thomas J. Zavortink

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XXXV. THE NEW SABETHINE GENUS *JOHNBELKINIA* AND A PRELIMINARY RECLASSIFICATION OF THE COMPOSITE GENUS *TRICHOPROSOPON*[1]

By

Thomas J. Zavortink[2]

CONTENTS

[1]Contribution in part from project "Mosquitoes of Middle America" supported by U. S. Public Health Service Research Grant AI-04379 and U. S. Army Medical Research and Development Command Research Contract DA-49-193-MD-2478.

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INTRODUCTION

In their study of American sabethine mosquitoes, Lane and Cerqueira (1942) placed all the New World species of the tribe Sabethini without obvious specializations in structure or coloration of the adult stage into the single genus *Trichoprosopon.* Within this genus they recognized seven subgenera almost exclusively on the basis of features of the adults. The delimitation and internal classification of the genus proposed by Lane and Cerqueira have been followed in large part by all subsequent authors treating species of the group, and they are followed with only minor alterations in the recent world catalog of mosquitoes by Knight and Stone (1977: 312-316). As the larvae and pupae of a greater number of species of *Trichoprosopon* have been discovered and examined carefully, it has become evident that these stages provide a wealth of excellent taxonomic characters, and equally obvious that the existing classification for the genus is inadequate and artificial. Since *Trichoprosopon* appeared to be in need of restudy, and since it is the most generalized group of American Sabethini, it seemed appropriate that it be revised before the more specialized or derived groups in the tribe, and thus I undertook a study of the genus.

As a result of my study of *Trichoprosopon,* I believe the species presently included in the genus belong to four separate phyletic lines. Since it appears that some of these lines may be more closely related to mosquitoes presently placed in other genera than they are to each other, I choose at this time to recognize each of the four lines as a distinct genus. The present paper is the first in a series treating these genera. It includes an introduction to the study as a whole; an outline of my proposed reclassification of the group, with keys to the segregrate genera and subgenera and a list of the nominal species in each; and a revision of the smallest genus and the only one requiring a new name.

I am indebted to many persons whose assistance and cooperation made this study possible. I am especially grateful to John N. Belkin for encouragement throughout the duration of this study, for informative discussions on sabethine taxonomy, for reading and criticizing this manuscript, for notes on type specimens in Brazilian museums, and for opening his home to me during my visits to Los Angeles.

I also thank J. Hal Arnell, Sandra J. Heinemann and Peter F. Mattingly for stimulating discussions related to this study; Curtis W. Sabrosky and E. L. Peyton for help and consideration during my visit to the Smithsonian Institution; Sharon L. Belkin for drawings of type specimens deposited in South America; Sandra J. Heinemann and William A. Powder for preparation of much of the material studied; Nobuko Kitamura and L. Margaret Kowalczyk for preparation of the preliminary drawings and final illustrations; Thomas S. Acker for use of his microscope with phase contrast and Normarski interference optics; Norma M. Washington for typing rough drafts of the manuscript; and Sandra J. Heinemann for preparing the text copy for lithoprinting.

And I thank the following for generously loaning me mosquitoes in their care or for providing information about type specimens: John N. Belkin, Sandra J. Heinemann and William A. Powder, University of California, Los Angeles; Curtis W. Sabrosky, Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington, D. C.; Ronald A. Ward and E. L. Peyton, Medical Entomology Project, Smithsonian Institution, Washington, D. C.; Peter F. Mattingly, British Museum (Natural History), London; Paul H. Arnaud, Jr., California Academy of Sciences, San Francisco; Alfonso Diaz Najera, Instituto de Salubridad y Enfermedades Tropicales, Mexico

City; Miguel Garcia, Instituto Nacional de Microbiologia, Buenos Aires; Pedro Galindo, Gorgas Memorial Laboratory, Panama, R. P.; L. L. Pechuman, Cornell University; Pedro W. Wygodzinsky, American Museum of Natural History, New York; Oswaldo P. Forattini and Maria das Dores Cotrim, Faculdade de Saude Publica, Universidade de Sao Paulo; S. L. Tuxen, Universitetets Zoologiske Museum, Kobenhavn; R. Krause, Staatliches Museum für Tierkunde, Dresden; Oswaldo Cruz, Filho, Instituto Oswaldo Cruz, Rio de Janeiro; George W. Byers, University of Kansas; Ferenc Mihalyi, Természettudomanyi Múzeum Allattara, Budapest; Charles L. Hogue, Los Angeles County Museum of Natural History; and D. C. Geijskes, Stichting Surinaams Museum, Paramaribo.

MATERIAL AND METHODS

The majority of the specimens examined during this study were borrowed from the University of California at Los Angeles [UCLA], and were collected for the project "Mosquitoes of Middle America" (Belkin, Schick *et al.* 1965). Additional specimens were borrowed from or studied at the United States National Museum of Natural History [USNM], including the primary types of *cerqueirai, culicivora, dicellaphora, homotina, lampropus, leucopus, mogilasia, moralesi, rapax, schedocyclia, shropshirei, townsendi, trichopus, trichorryes, ulopus, vonplesseni* and *wilsoni;* the British Museum (Natural History) [BM], including the primary types of *espini, fluviatilis, frontosa, lunata, nivipes, pallidiventer* and *perturbans;* the California Academy of Sciences [CAS]; the Medical Entomology Project [MEP]; the Instituto de Salubridad y Enfermedades Tropicales [ISET]; the Instituto Nacional de Microbiologia [INM]; the Gorgas Memorial Laboratory [GML]; Cornell University [CU]; the Los Angeles County Museum of Natural History [LACM]; the American Museum of Natural History [AMNH]; the Faculdade de Saude Publica, Universidade de Sao Paulo [FH]; the Instituto Oswaldo Cruz [IOC]; the Stichting Surinaams Museum [SSM]; the Universitetets Zoologiske Museum [ZMC], in particular the holotype of *longipes;* and the Staatliches Museum für Tierkunde [SMT], in particular the holotype of *subsplendens.*

The taxonomic procedures used in this study are the classical comparative morphological ones that I outlined elsewhere (Zavortink 1974). The form of presentation, terminology and abbreviations used in the descriptions follow Belkin (1962a) for the most part; terminology for the legs, however, is from Schick (1970). The extent of the light tarsal markings is measured from the apex of the segments, so "Tarsus 4-III white scaled in apical 0.1-0.4" means the white scales of hind tarsal segment 4 are found in a narrow to broad band in the apical 0.1 to apical 0.4 of the segment. In the original citations, an asterisk marks those taxa for which the type specimen has been seen. Only the most important literature relative to the genus being treated is listed following the generic citation or synonymy, but all references seen are cited under each species. Descriptions of species and drawings are based on topotypic material whenever possible. The descriptions are usually composite, that is, based on more than one specimen. Drawings were usually prepared from a single specimen and then corrected to show the modal condition of several specimens for the taxonomically important features. Besides the usual illustrations of the fourth instar larva, pupa and whole genitalia of each species and an adult representative of each group, several other drawings are included. For each species these are the larval mandible, or maxilla, or both; claws of the adult male; lateral aspect of the basal mesal

lobe and proctiger of the male genitalia; and dorsal and ventral aspects of the aedeagus or phallosome. In addition, for some species younger instar larvae or notable extremes in variation in any stage or structure are illustrated. On the distribution maps, solid symbols indicate localities from which I have examined specimens and hatched symbols indicate reliable literature records. The Official Standard Names Gazetteers of the United States Board on Geographic Names have been used in compiling the distribution lists.

Collection data of collections made expressly for the project "Mosquitoes of Middle America" are being published in a series of papers. For general information the first publication of this series should be consulted (Belkin and Heinemann 1973). For more information on collections cited in this paper, the following publications of the series should be consulted: for Costa Rica, Heinemann and Belkin 1977a; for Guatemala, Honduras and Nicaragua, Heinemann and Belkin 1977b; for Mexico, Heinemann and Belkin 1977c; for Panama and the Canal Zone, Heinemann and Belkin 1978a; for Venezuela and the Guianas, Heinemann and Belkin 1978b; and for Colombia, Heinemann and Belkin 1978c.

Throughout the text, the word "larva" refers to the fourth instar larva unless preceded by an adjective indicating otherwise and the word "trichoprosopon" is used for convenience to refer to all the species included in this study, *i.e.* the ones included in the single genus *Trichoprosopon* by Lane and Cerqueira (1942:484-529).

SYSTEMATICS

TAXONOMIC HISTORY. The previously described nominal species included in the genus *Trichoprosopon* by Lane and Cerqueira (1942:484-529) have had a long and varied history of generic placement. This is due in part to the large number of independent workers in the early twentieth century, in part to changing generic concepts and in part to strictly nomenclatural matters. Three species that came to reside in *Trichoprosopon* were described in the nineteenth century: *longipes* Fabricius 1805 and *digitatus* Rondani 1848 in the genus *Culex* and *perturbans* Williston 1896 in *Aedes.*

The period of greatest descriptive activity was the first decade of the twentieth century, with Theobald describing five species of trichoprosopons, Lutz four, and Dyar and Knab nine. Three of Theobald's species were the types of new genera proposed by him. These combinations were: *Trichoprosopon nivipes* Theobald 1901, *Goeldia fluviatilis* Theobald 1903 and *Runchomyia frontosa* Theobald 1903. His other two species were *Wyeomyia lunata* Theobald 1901 and *Phoniomyia magna* Theobald 1905. One of Lutz's species, *pallidiventer* Lutz 1904, was the type of his new genus *Hyloconops*; his other three species were *Trichoprosopon splendens* Lutz 1904, *Trichoprosopon compressum* Lutz 1905 and *Hyloconops longipalpis* Lutz 1905. Most of Dyar and Knab's species were described in the genus *Lesticocampa*: *leucopus, rapax, ulopus* and *vonplesseni* in 1906; *culicivora* in 1907; and *schedocyclia* in 1908. When Dyar and Knab proposed the genus *Lesticocampa* in 1906, they stated the type species was *Wyeomyia lunata* Theobald 1901; but the species before them was actually *rapax* (see Dyar and Knab 1906a:137 and Howard, Dyar and Knab 1915:165, 166). Other species described by these authors were *Phoniomyia homotina* Dyar & Knab 1906, *Joblotia mogilasia* Dyar & Knab 1907 and *J. trichorryes* Dyar & Knab 1907. The genus *Joblotia* Blanchard 1901 had been proposed as a replacement for Theobald's *Trichoprosopon*, which was erroneously thought to be

preoccupied. Several other generic names applied to species of *Trichoprosopon* were published during this period; *Rhynchomyia* Lutz 1904 as an unjustified emendation of *Runchomyia* Theobald 1903; *Binotia* Blanchard 1904 as a replacement for *Runchomyia* Theobald 1903, which Blanchard also believed was preoccupied; and *Isostomyia* Coquillett 1906. This latter name is of particular interest, for it is also based on a misidentified type species. Coquillett stated the type to be *Aedes perturbans* Williston 1896, but the specimens before him were actually *Culex conservator* Dyar & Knab 1906 (see Dyar and Knab 1906b:221-222; Howard, Dyar and Knab 1915: 187, 219-220, 310; and Edwards 1930:301; 1932:217). An important synonymy established during this decade was that of *Trichoprosopon nivipes* with *Culex digitatus* by Dyar and Knab (1907:206, 207).

During the decade from 1910 to 1919, several additional specific names and one generic name were proposed. The names were: *Lynchiaria paranensis* Brethes 1910, *Lesticocampa dicellaphora* Howard, Dyar & Knab 1913, *L. lampropus* Howard, Dyar & Knab 1913, *L. espini* Martini 1914, *Trichoprosopon wilsoni* Ludlow 1918, *L. trichopus* Dyar 1919 and *L. moralesi* Dyar & Knab 1919. In the third volume of their classical study of mosquitoes, Howard, Dyar and Knab (1915) placed the Central American species of this group known to them in three genera, *Wyeomyia, Lesticocampa* and *Joblotia.* Although they were unacquainted with the West Indian *Isostomyia perturbans* (Williston), they believed it probable that *Isostomyia* was a synonym of *Lesticocampa.* Fabricius's *longipes* was first associated with this group of mosquitoes in this work (as *Lesticocampa longipes*).

In the decade of the twenties, only a single species, *Trichoprosopon shropshirei* Ludlow 1920, was described. However, changes in the classification of this group appeared in several works during this time. Bonne-Wepster and Bonne (1921:12-18) established the synonymy of *Isostomyia, Binotia, Runchomyia, Hyloconops* and *Lesticocampa* with *Goeldia* Theobald 1903. The following year Dyar (1922:99) synonymized *Lynchiaria* with this genus. In their reclassification of American Culicidae, Dyar and Shannon (1924:482-483) placed all the trichoprosopons known to them in three genera, *Isostomyia, Goeldia* and *Joblotia. Isostomyia* included the species with short palpi in both sexes, *Joblotia* the species with hairs [setae] on the clypeus, and *Goeldia* the unspecialized species. Finally, in his "Mosquitoes of the Americas," Dyar (1928:90-109) treated every previously described nominal species of this group in the same three genera, *Isostomyia, Goeldia* and *Joblotia.*

In the 1930's several names were proposed for South American taxa. These were: *Joblotia splendens* var. *subsplendens* Martini 1931, *Goeldia leucopus* var. *hyperleuca* Martini 1931, *Isostomyia brevipes* Lima 1931, *Goeldia (Isogoeldia) luederwaldti* Lane 1936 and *Goeldia lanei* Antunes 1937. Several additional changes were made in the supraspecific classification. Edwards (1930:301) proposed *Ctenogoeldia* as a subgenus of *Goeldia*, with *Lesticocampa dicellaphora* as the type species. Edwards did not accept the usage of *Isostomyia* for a sabethine, and proposed *Isogoeldia* with *Aedes perturbans* as the type for the remaining species with short palpi in both sexes. He also treated *Isogoeldia* as a subgenus of *Goeldia.* In his world catalog of mosquitoes, Edwards (1932:70-73) placed the species with hairs [setae] on the clypeus in *Trichoprosopon,* and all remaining species in *Goeldia.* Within the latter genus, he recognized three subgenera, *Ctenogoeldia* for the species with short palpi in both sexes and silver scales on the scutellum, *Isogoeldia* for the less ornamented species with short palpi in both sexes, and *Goeldia*. He (Edwards 1932:71) considered it possible that the subgenus *Goeldia* should be further divided into additional subgenera. In his catalog of neotropical Culicidae, Lane (1939:158-166) adopted

Edwards' classification of *Trichoprosopon* and *Goeldia*.

In their reclassification of American Sabethini, Lane and Cerqueira (1942:484-529) united the genera *Trichoprosopon* and *Goeldia*, and recognized seven subgenera within the resulting composite genus. These were: *Trichoprosopon*, for the species with hairs [setae] on the clypeus; *Limamyia*, a monotypic subgenus based on *Isostomyia brevipes; Vonplessenia*, another monotypic subgenus, based on *Lesticocampa vonplesseni; Ctenogoeldia*, for the species with silver scales on the scutellum; *Isogoeldia*, for the dull species with short male palpi; *Shannoniana*, for *fluviatilis*, the type, and related species, with this name to be used in place of *Goeldia*, which was now known to be preoccupied; and *Hyloconops*, for the remaining species. Lane and Cerqueira also described 10 new species in 1942, *obscurum* and *soaresi* in *Trichoprosopon sensu stricto*; *walcotti* in the subgenus *Ctenogoeldia*; and *castroi, edwardsianus, evansae, humboldti, reversus, similis* and *theobaldi* in the subgenus *Hyloconops*. Stone (1944:335-341) used the name *Runchomyia* in place of *Hyloconops* and described two additional taxa, *Trichoprosopon (Runchomyia) cerqueirai* and *T. (T.) digitatum* var. *townsendi*.

The year 1953 was the last in which studies significant to the history of *Trichoprosopon* appeared. Levi-Castillo (1953:63-70) described two new species from Ecuador, *andinus* in the nominate subgenus and *cotopaxensis* in the subgenus *Hyloconops*. Lane (1953:813-861), in his "Neotropical Culicidae," followed his earlier work with Cerqueira in the treatment of *Trichoprosopon*, except that *Rhunchomyia* (sic) was used in place of *Hyloconops* and the taxonomic changes suggested by Stone (1944) were incorporated. Unfortunately, some errors were introduced into Lane's 1953 treatment of *Trichoprosopon* in English from the original 1942 reclassification by Lane and Cerqueira in Portuguese. Included among these are the reversing of the species names on the drawings of the male genitalia of *humboldti* and *lunatum*.

In their synoptic catalog of mosquitoes, Stone, Knight and Starcke (1959:73-77) followed Lane's 1953 treatment of *Trichoprosopon*, except that *Isostomyia* was used in place of *Isogoeldia*.

Neither the generic limits nor the internal classification of *Trichoprosopon* proposed by Lane and Cerqueira (1942:484-529) have been challenged before, and these authors' treatment of *Trichoprosopon* is followed in the new world catalog of mosquitoes by Knight and Stone (1977:312-316) except for a single change in subgeneric placement made by Belkin (1968b:34, 35). However, the stage for major changes in sabethine taxonomy was set by Belkin (1962a:486) when he pointed out that "The internal classification of the tribe is in a chaotic condition. It has been based almost entirely on very superficial external adult characters and, to a lesser extent, on male genitalia. Larval and pupal characters have been neglected almost entirely; it is becoming increasingly evident, however, that they will be of greatest value in arriving at a natural classification of the group." Later, writing specifically about *Trichoprosopon*, Belkin (1968b:34, 35) stated that the subgeneric classification of Lane and Cerqueira was "artificial and unsatisfactory" because these authors "completely disregarded excellent characters in the immature stages." Because he had not studied the entire genus thoroughly, Belkin made only one subgeneric change at that time, the transfer of *pallidiventer* from the subgenus *Runchomyia* to *Trichoprosopon sensu stricto*.

The American trichoprosopons have always been considered to be generically distinct from the generalized Old World sabethines now placed in the genera *Tripteroides* and *Maorigoeldia*. However, according to Lee (1946:223-224), *Trichoprosopon* and *Tripteroides* are very close and there is little to separate them. He points out

that the range of variation of adult and male genitalic characters in *Tripteroides* falls within the broader range of variation of *Trichoprosopon.* Furthermore, he notes that there is parallel development in larval features in both groups. Lee argues for separating the genera, though, on the basis of the presence of a pectin in the larva of *Tripteroides* and its absence in *Trichoprosopon,* and on the basis of the allopatric distributions of the groups. Belkin (1962a:495-496) apparently disagreed with Lee's assessment of variation in these genera, for he considered *Tripteroides* and *Trichoprosopon* to be amply distinct in all stages.

TAXONOMIC CHARACTERS. The trichoprosopons are a very difficult group taxonomically. The species in a particular complex are often distinguished by characteristics so minor they would not be considered significant in other genera. This is true not only in the case of the adults, but frequently also in the case of the male genitalia and immatures. Another factor contributing to the difficulty of the group is that in some instances species easily distinguished in one stage are indistinguishable in another. Because the differences between the species may be so subtle or may be limited to only some stages, accurate identification requires excellent quality material consisting of adults of both sexes with associated larval and pupal exuviae.

Adult characters. Most taxonomic characteristics are found in the distribution of setae on various parts of the body, particularly the sclerites of the pleuron; various details of the scales, especially on the thorax; and the markings of the legs and abdomen. Important **setal characters** are: presence or absence of setae on clypeus and *ppn*; number of setae on coxa I; position of setae on *stp* and *mep*; presence or absence of setae on *psp*, and their number and strength when present; and presence or absence of setae on upper calypter of wing, and details of their distribution when present. Setae are sometimes developed in unexpected places; one undescribed species of *Shannoniana* has long, hooked setae on the abdominal sternites. Important characteristics related to the **scales** include: size, shape, color, and strength and color of iridescence of scales on dorsum of head and thorax; and distribution, color, strength and color of iridescence, density, and direction of imbrication of scales on pleuron. Some of the pleural scale characteristics are very difficult to use, either because they require excellent optics to be seen, as in the case of the direction of imbrication, or because the differences are comparative or relative and difficult to describe objectively, as in the case of subtle differences in color and density. The **markings of the legs**, particularly the distribution of light scales on the tibiae and tarsi, are extremely important, but do present some problems. These light markings may be conspicuous and clearly demarked, or they may be rather inconspicuous and poorly set off, or visible at only some angles of observation or present on only one surface of the leg. Also, the development of the light tarsal markings may be extremely variable in some species. **Markings of the abdomen** include: shape of light patches on tergites and presence or absence of dark scales on sternites, and intensity of pigmentation and distribution of these dark scales when present. The sternal markings are often difficult to use because the sternites may be completely hidden by the tergites, or because the markings themselves may be weakly developed and poorly demarked or visible at only some angles of observation.

Other features that may be important in distinguishing species include: length of palpus in both sexes; length of proboscis; length of thorax, for it is shortened or lengthened in some species; intensity of pigmentation of scutal integument and parts of pleural integument; relative lengths of particular leg segments; and development of outstanding scales on legs. Additional characteristics of the male include: plumosity of flagellum and size, shape and dentition of claws of legs I and II.

Male genitalic characters. There are many excellent characters in the male genitalia, especially in minute details of tergite IX and the aedeagus. Both whole mounts and carefully made dissections must be studied in order to see all the important characteristics. Except in *Shannoniana*, where the male genitalia of many species are virtually identical, most species can be separated on the basis of the genitalia.

Briefly, characters I have found to be of value are as follows: for **tergite VIII**: presence or absence of strong setae; for **tergite IX**: development of basal apodeme, number, size, and shape of lobes, shape of separation between lobes, number and curvature of rows of setae on lobes, and number, length, strength, and shape of setae; for the **sidepiece**: length, shape, distribution and development of setae, and presence or absence of spicules on tergal surface; for the **basal mesal lobe**: distinctness and shape of lobe, and number, length, strength and curvature of its setae; for the **clasper**: length, strength, shape, and length, shape and dentition of spiniform; for the **aedeagus**: size, shape, details of tergal arms, and development of a beak, crest, flanges, teeth or spicules apically; and for the **paraproct**: number, size and shape of teeth, and number and distribution of cercal setae.

I think it is worth mentioning here that I believe the various components of the phallosome of the culicids have been misinterpreted and confused, and should be carefully restudied in all major groups of the family. Not only would a better understanding of the structure and functioning of the genital apparatus result from such a study, but probably also a better understanding of the relationships of the higher taxa. Briefly, I am of the opinion that the "aedeagus" of most sabethines and of some other mosquitoes, as for example the aedines I studied previously (Zavortink 1972), is homologous to the opisthophallus of *Maorigoeldia argyropus* (Walker 1848) (Belkin 1962a:492, 493; 1968a:8, 9, 107, 108), and not the aedeagus of that primitive mosquito. It is probably only the "sternal plates" of the "aedeagus" of some sabethines that are derived from the true aedeagus. Since my opinions on genitalic homologies are based, admittedly, on limited casual observations, I choose to continue using the existing terminology until such time as a careful comparative study can be completed.

Pupal characters. There are many excellent taxonomic characters in the pupae and, with only a few exceptions, the pupa of every species is distinctive. In fact, in *Shannoniana* and *Runchomyia sensu stricto*, pupae of related species may be remarkably different. There are too many characters relating to chaetotaxy to be mentioned here; it must suffice to say that the strength, length, number of branches, and position of many of the dorsal setae are important in distinguishing species or groups. Other important characters are: pigmentation of integument; presence or absence of dorsal sensillum; shape and pigmentation of trumpet; shape of tergite VIII; size of male genital lobe; and size, shape, serration, spiculation and development of midrib of paddle.

In many of the species of this study, and in many other New World and Old World sabethines, seta 1-C of the pupa is long, double, sigmoidally curved and has the branches hooked at the apex. This specialized seta is apparently used to anchor the pupa to objects below the surface of the water (Iyengar and Menon 1948:41, 42). At this time it is not known if this specialization has arisen repeatedly, or if it has evolved only once and therefore indicates a close relationship for those groups that possess it. Belkin (1962b:359) erroneously shows seta 1-C as unmodified in *Malaya solomonis* (Wharton 1947).

I have not seen seta 14-III-VII in the pupa or larva of any specimens examined during this study, and I think it can be safely concluded that it is not developed in these mosquitoes.

Larval characters. The number of excellent taxonomic characters in sabethine larvae is truly incredible. There are numerous structural features of the head capsule, mouthparts and terminal segments that are, I believe, of great phylogenetic significance. And, there are literally countless setal characters that are important in delimiting both species and groups.

Setae on the thorax and siphon are sometimes very obviously specialized morphologically, but the biological significance of these specializations is largely unknown. Iyengar and Menon (1948:39-41) observed that the larva of *Malaya genurostris* Leicester 1908 (as *Harpagomyia genurostris*) attaches itself to the side of its habitat with specialized siphonal setae, and supports itself with these same setae and setae of the lateral prothoracic groups when it rests on its back at the bottom. It is unfortunate that so few observations have been made on living mosquitoes that the functional significance of almost all characters used in classifying the group is unknown. In order to erect a natural classification, it is essential that systematists be able to distinguish among similarities due to relationship, parallelism and convergence, and such distinctions can be made only when the functional significance of the characters in question is known.

It will also be necessary to study the younger instar larvae of the sabethines before a natural classification of the tribe can be achieved. There are often remarkable shifts in position and changes in development of setae from one instar to the next in a particular species. It is clear in groups like *Shannoniana*, where the fourth instar larvae of most species differ conspicuously in many setal characteristics, that many of the specific differences of the mature larvae result from only differing degrees of neoteny in the various species. In groups like this, major changes in larval morphology may evolve very quickly in response to relatively few changes in genes controlling development, so that the amount of morphological divergence in the fourth instar larvae is not an accurate reflection of overall genetic divergence.

In at least *Johnbelkinia ulopus* there is a remarkable change in the development of the maxilla from one instar to the next. In the second instar larva (fig. 7), the maxilla is much longer than the head and has no apical spines; in the third instar (fig. 6), it is shorter than the head and has both a rigid and an articulated apical spine.

Structural features of the **head capsule** that are important taxonomically are: development of the foramen magnum, which may be circular and bounded by a distinct collar or slitlike and without a collar, and course of the maxillary suture, which may be straight or curved, and which may or may not extend to posterior tentorial pit. The phylogenetic significance of the development of the foramen magnum is unknown; the slitlike character state was first noticed only recently (Belkin, Heinemann and Page 1970:19) and its distribution in the family is unknown. I have observed that the slitlike foramen magnum occurs also in some Old World sabethines and in *Aedeomyia squamipennis* (Lynch Arribalzaga 1878). Structural features of the **mouthparts** that are important are: modification of mandible for grasping; modification of maxilla for grasping; form of maxillary palpus; and articulation of maxilla with head capsule. The modifications of the maxilla seem to be particularly numerous and significant. In some sabethines the maxilla is more or less normal, whereas in others it is variously modified, either extremely elongate or with strong apical spines, apparently for grasping. In some groups the maxillary palpus is an elongate, cylindrical structure completely free from the body of the maxilla; in others the palpus is partly to nearly completely adnate to the body of the maxilla. In *Shannoniana* there is a very strong articulation between the maxilla and head capsule far ventrad of the palpus that is not developed in the other groups studied.

Important structural features of the terminal segments include: presence or absence of comb scales, and their shape, number and arrangement when present; shape, length and spiculation of siphon; development of accessory midventral setae on siphon; and presence or absence of a pecten on siphon. The trichoprosopons have generally been regarded to lack a true pecten. However, the fringe of long spicules on the ventral surface of the siphon in *Runchomyia* represents the pecten. In *R. magna* the first instar larva has a normal pecten of enlarged teeth in a pair of ventrolateral rows; the second instar larva has a single ventral row of elongate, filamentous teeth; and the third and fourth instars have a single ventral row of very numerous, long, filamentous spicules. Further, in fourth instar larvae of *R. lunata* and *R. perturbans* the distal elements of the pecten are normally developed teeth in separate rows.

Other larval characters that I have found useful are: pigmentation of sclerotized parts of body; shape of mental plate; shape, length and dentition of mandible and maxilla; and presence or absence of dorsal sensillum.

For the setae, the strength, length, type of development, number of branches, pigmentation, position and presence or absence of an alveolar plate may all be important in particular cases. Specializations in setae 4-P and 2,6-S often provide good taxonomic characters. Seta 8-M, which is a large multiple seta in most mosquito larvae, is completely absent in all species of *Trichoprosopon*, and weakly developed in all species of *Shannoniana*.

The immatures of the Sabethini seem to be particularly favorable material for observing the nerve connections between setae of one instar or stage and the developing subsequent instar or stage, and I have been able to unquestionably homologize many larval and pupal setae in all major groups of this study. Setae that I have been able to homologize in each group will be listed in the revision of that group. At this time, though, I would like to indicate one correction that needs to be made in a previously published illustration. In the larva of *Malaya solomonis* illustrated by Belkin (1962b: 360), the labels on setae 3 and 4 on segments III and IV should be reversed. Tracing of the nerves in *Runchomyia magna*, the larvae of which is similar to that of *M. solomonis*, shows the first seta mesad of seta 1 to be seta 4, not seta 3, on these segments.

PROPOSED CLASSIFICATION. Forty-five of the 48 nominal species included in *Trichoprosopon* at the onset on my study (see Knight and Stone 1977:312-316) and 19 undescribed related species known to me at this time fall into six distinct groups apparently representing four separate phyletic lines. Of the three remaining nominal species, one belongs in the genus *Wyeomyia*, and two are considered to be *nomina dubia.*

The four phyletic lines are most clearly demarked from each other in the larval stage, but they are amply distinct in the adult and pupal stages, and usually also in the male genitalia. Because of the distinctness of these lines, and because some may have close affinities with mosquitoes presently placed in other genera, I am recognizing each as a separate genus at this time. The four genera, some of the more important features for distinguishing them from each other, their possible affinities and the previously described nominal species belonging to each are summarized below.

I consider my reclassification of this group to be tentative only, and subject to change when more information is available. Biologists, including even some systematists, often lose sight of the fact that a biological classification is a scientific hypothesis, and, like all other hypotheses, it may need to be changed or discarded when new data are discovered. The tribe Sabethini is a large one that has been poorly collected and little studied in both the New and Old Worlds, so that many additional data of taxonomic value await discovery, and as they are discovered, changes in the classifica-

tion of the group will be inevitable. A classification, again like any other hypothesis, has heuristic value, so that its very existence should stimulate further research that may ultimately bring about its modification or demise.

Genus ***Johnbelkinia.*** This is the smallest segregate genus, with but three taxonomic species, all of which were placed previously in *Trichoprosopon (Runchomyia).* The **larvae** are distinguished by a long row of multibranched accessory midventral setae on the siphon; **adults** by the combination of a long proboscis and light markings on tarsi II and III; **pupae** by presence of a dorsal sensillum on only segments IV and V; and **male genitalia** by a large patch of very dense, strongly developed setae on sidepiece. The affinities of *Johnbelkinia* are unknown, as I have seen no sabethines from either the New World or the Old World that are similar. Nominal species belonging to this genus are: *Lesticocampa culicivora* Dyar & Knab 1907, *Trichoprosopon (Hyloconops) edwardsianus* Lane & Cerqueira 1942, *Lesticocampa leucopus* Dyar & Knab 1906, *Culex longipes* Fabricius 1805, *Lesticocampa trichopus* Dyar 1919 and *Lesticocampa ulopus* Dyar & Knab 1906.

Genus ***Trichoprosopon.*** This is the largest genus, with 21 taxonomic species, several of which are undescribed. The group includes not only the species with setae on the clypeus that have always been included in it, but also species lacking such setae that have been placed in the subgenera *Limamyia, Vonplessenia* and *Runchomyia.* **Larvae** of the group are distinguished by the unmodified maxilla and absence of seta 8-M; **adults** by a short proboscis in concert with absence of a postmedian light band on tibia III; and **pupae** by weak and short seta 5-II-VII. The **male genitalia** are not much differentiated from those of *Shannoniana* or *Runchomyia sensu stricto.* This genus seems not to have any close relatives. Nominal species belonging to *Trichoprosopon* are: *Trichoprosopon (Trichoprosopon) andinus* Levi-Castillo 1953, *Isostomyia brevipes* Lima 1931, *Trichoprosopon (Hyloconops) castroi* Lane & Cerqueira 1942, *Trichoprosopon compressum* Lutz 1905, *Culex digitatus* Rondani 1848, *Trichoprosopon (Hyloconops) evansae* Lane & Cerqueira 1942, *Lesticocampa lampropus* Howard, Dyar & Knab 1913, *Goeldia lanei* Antunes 1937, *Joblotia mogilasia* Dyar & Knab 1907, *Trichoprosopon nivipes* Theobald 1901, *Trichoprosopon (Trichoprosopon) obscurum* Lane & Cerqueira 1942, *Hyloconops pallidiventer* Lutz 1904, *Trichoprosopon (Hyloconops) similis* Lane & Cerqueira 1942, *Trichoprosopon (Trichoprosopon) soaresi* Lane & Cerqueira 1942, *Trichoprosopon splendens* Lutz 1904, *Joblotia splendens* var. *subsplendens* Martini 1931, *Trichoprosopon (T.) digitatum* var. *townsendi* Stone 1944, *Joblotia trichorryes* Dyar & Knab 1907, *Lesticocampa vonplesseni* Dyar & Knab 1906 and *Trichoprosopon wilsoni* Ludlow 1918.

Genus ***Shannoniana.*** This is a large genus, with 15 species. Most of these are undescribed, and I suspect scores more await discovery in the field. The previously described species were all correctly associated in the subgenus *Shannoniana* by Lane and Cerqueira (1942:502-506). **Larvae** are distinguished by the modified maxilla and its unusual articulation with the head capsule; **adults** by the postmedian light band on tibia III; **pupae** by absence of a dorsal sensillum on any segment in combination with a well developed seta 5 on at least segments III-V; and **male genitalia** by large preapical teeth on the aedeagus in combination with a pair of lobes on IX-T. I believe *Shannoniana* is closely related to the subgenus *Rachisoura* of *Tripteroides* from the Australian zoogeographical region. There are several striking similarities in structure of the larval head capsule in these groups, including the virtually identical development and articulation of the maxilla. Belkin (1962a:529) earlier noted the striking similarity between *Rachisoura* and some *Trichoprosopon.* Included nominal species are: *Goeldia fluviatilis* Theobald 1903, *Hyloconops longipalpis* Lutz 1905,

Lesticocampa moralesi Dyar & Knab 1919 and *Lesticocampa schedocyclia* Dyar & Knab 1908.

Genus ***Runchomyia.*** This is a complex and poorly known group comprising at least 11 species in three subgenera, *Runchomyia sensu stricto, Ctenogoeldia* and *Isostomyia*. My treatment is possibly too conservative, and the subgenera perhaps deserve generic rank. The **larvae** of *Runchomyia* are distinguished by the slitlike foramen magnum and a filamentous pecten on the siphon; **adults** by long proboscis together with dark tarsi; and **pupae** by presence of a dorsal sensillum on segments III-V. The **male genitalia** of *Runchomyia* exhibit a wide range of variation; those of *Ctenogoeldia* and *Isostomyia* are unusual and unlike any other New World sabethines, but those of the nominate subgenus are generalized and can not be distinguished as a group from those of *Trichoprosopon*. The affinities of *Runchomyia* are problematic at this time. The Old World *Malaya* and *Topomyia*, the New World *Sabethes, Limatus* and *Phoniomyia*, and most of the New World *Wyeomyia* have the slitlike foramen magnum, so the affinities most likely lie with these groups. The resemblance in adult ornamentation, male genitalia and chaetotaxy of the immatures between *Runchomyia (Ctenogoeldia) magna* and some species of *Malaya* is great enough to suggest a relationship. The three subgenera of *Runchomyia* are distinguished by characters given in the key that follows. Included species are: for *Runchomyia sensu stricto*: *Trichoprosopon (Runchomyia) cerqueirai* Stone 1944, *Runchomyia frontosa* Theobald 1903, *Trichoprosopon (Hyloconops) humboldti* Lane & Cerqueira 1942, *Lesticocampa rapax* Dyar & Knab 1906, *Trichoprosopon (Hyloconops) reversus* Lane & Cerqueira 1942 and *Trichoprosopon (Hyloconops) theobaldi* Lane & Cerqueira 1942; for subgenus *Ctenogoeldia*: *Lesticocampa dicellaphora* Howard, Dyar & Knab 1913, *Phoniomyia homotina* Dyar & Knab 1906, *Phoniomyia magna* Theobald 1905 and *Trichoprosopon (Ctenogoeldia) walcotti* Lane & Cerqueira 1942; for subgenus *Isostomyia*: *Lesticocampa espini* Martini 1914, *Wyeomyia lunata* Theobald 1901, *Lynchiaria paranensis* Brethes 1910, *Aedes perturbans* Williston 1896 and *Trichoprosopon (Joblotia) shropshirei* Ludlow 1920.

Excluded Species. I have examined a female specimen of *Goeldia (Isogoeldia) luederwaldti* Lane 1936:6-8 from the FH collection. This specimen agrees with the original description of *luederwaldti* and was determined as that species by Lane himself. Since I find this specimen to be similar to, and perhaps even the same as, *Wyeomyia (Dendromyia) personata* (Lutz 1904), this nominal species should be transferred to *Wyeomyia.*

Nomina Dubia. The holotype of *Goeldia leucopus* var. *hyperleuca* Martini 1931: 201 has been lost (see Belkin 1971:31), and it is not certain from the brief original description what known taxonomic species Martini had before him. Therefore I think it best to consider the name a *nomen dubium*. I have seen the single female specimen from Restrepo, Colombia, in the FH collection that Lane and Cerqueira (1942:526-527) and Lane (1953:858) treated as *Trichoprosopon hyperleucus*, and I consider it to be *Johnbelkinia ulopus*. Martini's description of *hyperleuca* does not quite fit known specimens of *ulopus,* and since the type was collected about 1600km south of the known range of that species along the eastern slope of the Andes, I am hesitant to simply synonymize *hyperleuca* with *ulopus.*

The location of the holotype male of *Trichoprosopon (Hyloconops) cotopaxensis* Levi-Castillo 1953:66-68 is unknown, and in all probability the specimen is nonexistent. The original description of *cotopaxensis* in based on specimens representing at least two, and most likely three, different species. The male genitalia described and illustrated by Levi-Castillo are *Johnbelkinia ulopus* and the pupa illustrated is *Tricho-*

prosopon digitatum (see next paragraph). According to the description, the legs of the adult were dark, but both *ulopus* and *digitatum* have conspicuous light markings on the legs, which indicates that yet a third species was involved. The lengths given for the palpi of both the male and the female are too great for *ulopus*, and the habitat (bamboo stump) in which the pupae of the type series were collected is not one normally utilized by *ulopus*. Two dark-legged trichoprosopons, *Runchomyia magna* and *Trichoprosopon andinum*, are known from coastal Ecuador, and a third, *T. pallidiventer*, might logically occur there, but Levi-Castillo's description seems not to be based on any of these. The culicid fauna of the Pacific lowlands of Ecuador is the most highly endemic in South America, and *cotopaxensis* may be a distinct species unknown elsewhere. Since this can not be determined without the holotype male, I consider the name to be a *nomen dubium.*

Levi-Castillo described numerous new species of mosquitoes from Ecuador in the period 1944-1955; included were two trichoprosopons, *Trichoprosopon cotopaxensis* and *T. andinus*, described in 1953. The holotypes of most of his species were deposited in the Centro Ecuatoriano de Investigaciones Entomologicas in Guayaquil, but the location of the types of some of his species, including the two trichoprosopons, was never known. In the late 1950's Alan Stone wrote Levi-Castillo several times, each time asking for the location of the types of *andinus* and *cotopaxensis* (and others). These letters were never answered. In the summer of 1961 Richard F. Darsie, Jr., visited Levi-Castillo in Ecuador, and obtained from him 564 slide preparations of mosquitoes. Included among these were supposed to be the slides of types. Darsie did not obtain any adult mosquitoes, as these were allegedly packed away. The slides obtained by Darsie were subsequently sent to the USNM. In 1961 Stone wrote to Levi-Castillo and asked if he could provide more information about the slides, as more than half were unlabeled, and suggested that he consider depositing his adults in the USNM also. Although Levi-Castillo responded the following year, he did not provide any additional information about the slides or the whereabouts of his adult collection. I have located 54 slides of trichoprosopons in Levi-Castillo's material at the USNM. Only three species are represented, *T. digitatum, T. andinum* and *J. ulopus.* The material of *ulopus* consists of five slides of dissected male genitalia. Four are totally unlabeled. The fifth bears two standard slide labels, one pasted over the top of the other. The upper label states simply "T. / cotopaxensis." The lower can be deciphered by holding the slide up to a bright light, and it states "Trichoprosopon / (T.) obscurum / Valencia / Los Rios." Levi-Castillo's genitalia preparations are among the worst I have ever seen. The genitalia are so irregularly fragmented, and the pieces so disoriented and squashed, that they are almost unrecognizable. One result, though, is that each slide is unique, with its own peculiar set of artifacts. On this basis, I believe it can be stated with certainty that the genitalia illustration in the original description of *cotopaxensis* was prepared from the slide of *ulopus* labeled *T. cotopaxensis.* For *digitatum* there are 29 slides, mostly of dissected male genitalia, and mostly unlabeled. There are, however, four slides of pupal skins. Of these, only one pupa has the abdomen intact and bearing most of its setae; this slide is labeled "Trichopro / sopon / V.P." I believe the pupal illustration accompanying the original description of *cotopaxensis* was made from this slide of *digitatum.* The specimen has the float hairs (setae 1-I) rotated caudad and partly covering segment II, seta 6-VI forked near the middle on the left side, the paddles slightly overlapped and is female, and the illustration accurately reflects these peculiarites.

BIONOMICS

Under natural conditions the immature stages of all trichoprosopons occur in liquids associated with plants. Specific habitats include rot holes in trees, fallen fruits and nuts, bamboo stumps, punctured bamboo internodes, fallen leaves and palm spathes, leaf axils of many kinds of living plants and flower bracts of species of *Calathea* and *Heliconia*. Most species are specific to one or a few similar habitats, but others are more catholic. In most cases the breeding sites hold a relatively large quantity of fluid that is largely or entirely accumulated rain water. However, some of the leaf axil breeding sites do not contain open water, but only a thin mucilaginous film that may be of plant origin between the appressed leaf bases.

In all species of trichoprosopons the larval mouthparts are modified. In the genus *Trichoprosopon* it is the mandible that is enlarged, while in the genera *Johnbelkinia, Shannoniana* and *Runchomyia* it is the maxilla. The modifications of the mouthparts have generally been considered to be for predation, and indeed several species have been reported as being predaceous, especially on *Wyeomyia*, or cannibalistic. However, according to Galindo, Carpenter and Trapido (1951:133) many sabethine larvae that have been reported to be predaceous are only facultatively so, and do not as a rule feed on other mosquito larvae. These authors also state "the larvae of these sabethines are not predaceous in the same sense as *Toxorhynchites, Psorophora (Psorophora)* spp. and *Culex (Lutzia)* spp. since they do not swallow the prey, but usually grab it by the mid-abdomen, breaking it in two, and apparently sucking the body juices." Assem (1959:36-37), writing about New Guinean species of *Tripteroides (Rachisoura),* reports that the modified maxillae of these larvae are used as clasping organs to hold large food particles as well as in aggressive behavior between larvae. As for the latter, he reports that larvae may fight until the death of one, which is then consumed by the other. However, not all such fights end in cannibalism, since one duel he observed lasted two hours before ending in a draw with both larvae surviving.

In light of the above, the supposed predatory behavior of all trichoprosopons needs to be reexamined. It should be stressed also that, in so far as possible, observations should be made under natural conditions. I collected large numbers of *Runchomyia magna* larvae from individual *Calathea* bracts in Venezuela; only this one species of mosquito was present in these bracts at this stage in their development. When these same larvae were placed together in vials in the laboratory, many were subsequently found dead, having been bitten in two. The simple environment within a vial is in such stark contrast to the complex one within a *Calathea* bract, where there are countless cavities and crevices among the flowers and their parts, that I am not prepared to argue that this species is normally cannibalistic on the basis of my observations in the laboratory.

Very little is known about the biology or ecology of adult trichoprosopons. Several species are attracted to and bite man and other mammals, and several are known to be diurnal.

As already mentioned, the trichoprosopons are a difficult group taxonomically, and misidentification of the species has been very common. This difficulty in accurately identifying the species has undoubtedly hindered the gathering and reporting of biological information about them. The improved classification and keys in the present revision should facilitate identification of the species, and thereby stimulate studies of their biology.

KEYS TO GENERA AND SUBGENERA FORMERLY PLACED IN *TRICHOPROSOPON*

ADULTS

1. Proboscis 0.85-1.20 length of femur I; row of lower *stp* setae extending dorsad to above level of lower edge of *mep* 2
Proboscis 1.20-1.40 length of femur I; row of lower *stp* setae usually not extending dorsad to level of lower edge of *mep* 3

2(1). Tibia III without postmedian light band; laterotergite without scales basad and sparsely scaled distad, its lower margin visible; *pcx* without scales . . . . . ***Trichoprosopon***
Tibia III with broad complete or incomplete postmedian light band; laterotergite densely scaled, its lower margin hidden; *pcx* with scales . . . . . ***Shannoniana***

3(1). Tarsi II, III partly light scaled; scutal scales moderately broad and flat *and* scales of vertex and occiput with brilliant silver and azure blue reflections . . . . . ***Johnbelkinia***
Tarsi II, III dark scaled; scutal scales narrow and curved *or* scales of vertex and occiput without silver reflections and with only weak to moderate green or blue reflections ***(Runchomyia)*** 4

4(3). Scutal scales moderately broad to broad and flat; scales of vertex without silver reflections and with only weak to moderate green or blue reflections; *ppn* without posterior seta . . . . . subgenus ***Isostomyia***
Scutal scales narrow and curved; scales of vertex with brilliant silver and azure blue reflections; *ppn* with 1 or more posterior setae 5

5(4). Scales on base of midlobe of scutellum with brilliant silver reflections . . . . . subgenus ***Ctenogoeldia***
Scales on midlobe of scutellum without silver reflections . . . . . subgenus ***Runchomyia***

MALE GENITALIA

1. Sidepiece without distinctly separated basal mesal lobe (in part ***Runchomyia***) . . . . . subgenus ***Ctenogoeldia***
Sidepiece with distinctly separated basal mesal lobe 2

2(1). Basal mesal lobe developed as an elongate, weakly or strongly sclerotized plaque (in part ***Runchomyia***) . . . . . subgenus ***Isostomyia***
Basal mesal lobe developed as a more or less crescentic or semicircular lobe, the apical part of which may be strongly produced 3

3(2). Basal tergal area of sidepiece with large, very dense patch of strongly developed, moderately long to long setae; IX-S largely membranous, only base and sides sclerotized, distal margin of sclerotized portion strongly concave . . . . . ***Johnbelkinia***

Basal tergal area of sidepiece without patch of specialized setae; IX-S largely or entirely sclerotized, more or less semicircular or crescentic, distal margin strongly convex throughout or with median apical emargination . . 4

4(3). Aedeagus with large preapical teeth *and* IX-T with pair of distinctly separated submedian lobes bearing a single or partly double row of apically curved and/or flattened setae . . . . . ***Shannoniana***

Aedeagus without large preapical teeth *or* IX-T with single broad median lobe, sometimes notched in middle, bearing several rows of straight or nearly straight spiniform setae medially 5

5(4). With the following combination of characters: sidepiece moderately long to long; aedeagus without large teeth, serrations or spicules apically but with narrow sharp apical beak; spiniform short to moderately long; paraproct with 2-6 strong apical teeth; *and* apex of submedian tergal arm of aedeagus narrow (in part ***Runchomyia***) . . . . . subgenus ***Runchomyia***

Without the above combination of characters: *either* sidepiece short; *or* aedeagus with large teeth, marginal serrations, or small spicules apically; *or* aedeagus without narrow apical beak; *or* spiniform long; *or* paraproct with 1 strong apical tooth; *or* apex of submedian tergal arm of aedeagus broad . . . . . ***Trichoprosopon***

PUPAE

1. Seta 5-III-VI weakly developed and very short . . . . . ***Trichoprosopon***

Seta 5-IV and usually also 5-III,V or 5-V,VI moderately to strongly developed and moderately long to long 2

2(1). Seta 5-C weakly developed and short; seta 3-III at the same level as or cephalad of 4-III, far from caudal margin of tergite; dorsal sensillum absent on tergites III-V . . . . . ***Shannoniana***

Seta 5-C moderately to strongly developed and moderately long to long; seta 3-III caudad of 4-III, near caudal margin of tergite; dorsal sensillum present on tergites III-V or IV,V 3

3(2). Inner part of paddle spiculose; seta 5-II,III moderately to strongly developed and moderately long to long *and* seta 6-VII moderately to strongly developed, 3-18b, and usually cephalad and laterad of 9-VII; dorsal sensillum present on tergites IV,V . . . . . ***Johnbelkinia***

Inner part of paddle glabrous; seta 5-II,III weakly developed and short *or* seta 6-VII weakly developed, single or double, and caudad and mesad of 9-VII; dorsal sensillum present on tergites III-V (***Runchomyia***) 4

4(3). Paddle strongly produced apically *or* seta 5-V,VI weakly developed and short; caudolateral angle of tergite VIII strongly to very strongly produced, extending at least 0.50 distance to apex of segment IX . . . . . subgenus ***Isostomyia***

Paddle oval to triangular *and* seta 5-V,VI moderately to strongly developed and moderately long to long; caudolateral angle of tergite VIII not or only slightly produced, not extending more than 0.25 distance to apex of segment IX 5

5(4). Seta 5-C much longer and stronger than 7-C *and* 3-10b; seta 6-I moderately strong, weaker than 3-I and/or 6-II . . . . . subgenus ***Ctenogoeldia***

Seta 5-C subequal in length and strength to 7-C *or* at least 40b; seta 6-I strongly developed, as strong as or stronger than 3-I and 6-II . . . . . subgenus ***Runchomyia***

LARVAE

1. Head capsule with normal circular foramen magnum bounded by distinct collar; siphon without pecten 2

Head capsule with short to long transverse slitlike foramen magnum not bounded by distinct collar; siphon with filamentous pecten (***Runchomyia***) 4

2(1). Maxilla normal, not modified for grasping, never extremely long or with strong apical spines; maxillary suture extending to posterior tentorial pit; seta 8-M absent . . . . . ***Trichoprosopon***

Maxilla modified for grasping, either extremely long or with strong apical spines; maxillary suture not extending to posterior tentorial pit; seta 8-M present 3

3(2). Siphon without accessory midventral setae; maxilla with strong articulation with head capsule far ventrad of palpus; seta 8-M weakly developed . . . . . ***Shannoniana***

Siphon with long row of multibranched accessory midventral setae; maxilla without strong articulation with head capsule far ventrad of palpus; seta 8-M strongly developed . . . . . ***Johnbelkinia***

4(1). Seta 3-X 2-8b; seta 6-S strongly developed, rigid, hooked at apex . . . . . subgenus ***Isostomyia***

Seta 3-X single; seta 6-S weakly developed, flexible, nonhooked 5

5(4). Maxilla with rigid apical spine shorter than articulated apical spine; most comb scales arising from single large plate; seta 5-T strongly developed, moderately long . . . . . subgenus ***Ctenogoeldia***

Maxilla with rigid apical spine longer than articulated apical spine; comb scales free; seta 5-T weakly developed, short . . subgenus ***Runchomyia***

TAXONOMIC TREATMENT

JOHNBELKINIA Zavortink, gen. n.

TYPE SPECIES: **Culex longipes* Fabricius 1805, French Guiana.

Trichoprosopon (Runchomyia) in part of Stone, Knight and Starcke (1959:76-77); Knight and Stone (1977:313-314).
Trichoprosopon (Rhunchomyia) in part of Lane (1953:855-858, 860); Cerqueira (1961a:459-464).
Trichoprosopon (Hyloconops) in part of Lane and Cerqueira (1942:525-527, 528).
Goeldia (Goeldia) in part of Dyar (1923a:84-85, 86); Edwards (1932:72); Lane (1939:161, 162-163).
Goeldia in part of Bonne-Wepster and Bonne (1921:17-18; 1922:38); Dyar and Shannon (1924: 482-483); Bonne and Bonne-Wepster (1925:141-146, 152); Dyar (1925:128-130; 1928:96-98).
Lesticocampa in part of Dyar and Knab (1906a:137-138); Theobald (1910:558, 622); Howard, Dyar and Knab (1915:168-174).

FEMALES. Medium sized to large mosquitoes. Moderately ornamented; scales of vertex and occiput with brilliant silver or azure blue reflections; pleural scales metallic silver; dark scales largely moderately iridescent.

Head: Eyes contiguous above antennae. Frontal tuft absent. Orbital setae numerous, middle pair elongate. Vertex and occiput densely covered with broad flat scales with brilliant silver or azure blue reflections; occiput with row of dark erect scales posteriorly. Lateral scales dense, broad, flat, silver. Clypeus moderate-sized, prominent; brown to dark brown, shiny; without setae or scales. Proboscis not modified; slender, long, usually 1.20-1.40 length of femur I; dark scaled. Palpus 0.16-0.20 length of proboscis; apparently 2-segmented; dark scaled. Antenna 0.55-0.70 length of proboscis; torus without scales; flagellar segment 1 with small scales dorsally.

Thorax: Scutal integument brown to dark brown. Acrostichal and dorsocentral setae present on anterior promontory; supraalar setae numerous; a few anterior dorsocentral setae and prescutellar setae sometimes present. Scutellum with 4 long setae on midlobe, usually 3 on lateral lobe. Postnotum with numerous setae. Scutum without extensive bare areas. Scutal scales dense; most moderately broad, flat, straight, some narrower, curved; brown, dull to moderately iridescent; broader, always iridescent posteriorly. Scutellar scales broad, flat, brown, moderately iridescent. Postnotum with or without scales. Paratergite bare. *Apn* lobes moderately large, not approximated dorsally. Meron small, its upper edge in line with base of hindcoxa. Pleural integument light straw yellow to tan and usually partly brown. *Apn* with anterior row of strong setae. *Ppn* with 1,2 strong posterior setae. *Ppl, sp* and upper *mep* with setae. *Pra* setae 2-5. *Stp* setae restricted to lower part, below level of lower edge of *mep*. *Psp* sometimes with weak, fine setae. *Apn* scales dense, broad, colorless to smoky, translucent, usually with metallic silver or pale gold reflections. *Ppn* scales dense, broad, flat, colorless to dark; with metallic gold reflections, some upper moderately blue and purple iridescent. *Acx, ssp, psp,* all but lower anterior margin of *stp* and entire *mep* with dense, broad, flat, transparent, metallic silver scales; *ppl* with a few similar scales; *pcx*, meron, metapleuron and metameron without scales.

Legs: Long; femora I-III progressively shorter; tibiae I-III progressively shorter; tarsus I-III longer than tibia III. Leg III with or without conspicuous outstanding scales on tibia and tarsus. Coxae with dense, broad, flat, metallic silver scales. Femo-

ra dark scaled with short to long streak of pale scales on lower or posterior surface. Tibiae entirely dark scaled. Tarsi dark scaled with light scales on 2 or 3-4 or 5-II and 3 or 4-5-III. Claws simple; small on I, II; very small, often appearing single on III.

Wing: Dark scaled. Scales broad; wide spreading dorsally on Rs, R_{2+3}, R_2, R_3 and M. Vein 1A ending far distad of branching of Cu. Alula with a few narrow marginal scales distad. Upper calypter without setae or with short row of setae basad.

Haltere: Dark scaled.

Abdomen: Tergite I completely scaled. Laterotergite without scales basad, its lower margin visible. Setae conspicuous on tergite I and distal segments. Tergites I-VII dark scaled with broad lateral patch of lustrous creamy to pale gold scales from base to apex, the patches broader apically on distal segments. Sternites II-VII completely scaled, scales entirely lustrous creamy to pale gold or dark in median line from base to apex of all segments.

FEMALE GENITALIA. As illustrated; not studied in detail.

MALES. Essentially as in females except for sexual characters. **Head**: Clypeus small. Palpus long, 0.70-0.85 length of proboscis; 5-segmented; slender; setae few; dark scaled. Antenna 0.53-0.70 length of proboscis; torus moderately enlarged, with a few very small setae and scales medially; flagellum sparsely to moderately plumose, segments 12,13 only slightly longer than in female. **Legs**: Anterior claw enlarged on I or I,II; with submedian swelling or distinct tooth on I. **Abdomen**: Tergites with setae laterally.

MALE GENITALIA. Large, exserted. **Segment VIII**: Unmodified. **Segment IX**: Tergite strongly developed, with pair of distinctly separated, prominent, divergent submedian lobes. Setae of each tergite lobe 4-7 (3-8), moderately to very strongly developed, long, curved laterad apically, arising in a single or partly double curved row. Sternite strongly developed; basal and lateral parts strongly sclerotized, forming V- or U-shaped sclerite, disc membranous; without setae. **Sidepiece**: Main articulation apparently with apex of lateral sclerotization of sternite IX; apodeme of sidepiece moderately strong, nearly perpendicular to long axis of genitalia. Moderately long to long, conical, slightly curved mesad apically. Mesal surface not membranous. Basal tergal area with large, very dense patch of strongly developed, moderately long to long setae. Apical tergolateral, lateral and sternal surfaces with numerous strongly developed, long setae; apical tergomesal area bare. Lateral and sternal surfaces densely scaled. **Basal Mesal Lobe**: Well developed, distinctly separated from sidepiece. Crescentic to nearly semicircular, or with conical body and long narrow dorsal strip. With numerous strongly developed setae. **Clasper**: Simple. Moderately long to long, curved mesad apically, uniformly slender beyond base or swollen apically. Spiniform short. **Phallosome**: Simple. Aedeagus with lateral sclerotizations weakly connected, apical tergal arms not joined; lateral sclerotizations not approximated sternally; apex of submedian tergal arm narrow, simple; broadest near base; index 1.7-2.5; without large preapical teeth or sclerotized apical beak. Sternal aedeagal plates absent. Gonopore apical. **Proctiger**: Strongly developed. Paraproct with moderately large apical teeth. Cercal sclerite present, elongate, or absent. Cercal setae numerous, fine.

PUPAE. **Cephalothorax**: Seta 1-C strongly developed, long, double, sigmoidally curved. Seta 5-C moderately to strongly developed, long, usually 4-6b (3-7); stronger and longer than 7-C.

Trumpet: Moderately long, narrow; pinna short; appearing slightly urceolate in dorsal aspect, nearly cylindrical beyond basal curve in lateral aspect.

Abdomen: Tergite VIII with posterior edge straight laterad, caudolateral angle not produced. Dorsal sensillum present on tergites IV,V only. Seta 1-I strongly devel-

oped, moderately long to long, dendritically branched; seta 1-II moderately to strongly developed, moderately long, usually 2-5b or f (1-9); seta 1-III,IV weakly to moderately developed, short, usually single or double (1-3b). Seta 2-II-VII usually near caudal edge of tergite, laterad of seta 1-II, mesad of seta 1-III-VII. Seta 3-I-III strongly developed, long, usually single (1,2b), near caudal edge of segment and caudad of level of seta 4 on II,III. Seta 5-II-VI strongly developed, long, single on II, single or double on III, usually double (2-6b) on IV-VI; seta 5-VII weakly developed, short, single or double. Seta 6-I,II strongly developed, long, usually 2,3b (1-3) on I, usually single (1,2b) on II; 6-VII moderately to strongly developed, 3-18b, usually cephalad and laterad of seta 9-VII. Seta 7-I moderately strong, moderately long, 2-5b; seta 7-II usually ventral. Seta 9-VII 15-24b (13-26); seta 9-VIII 14-24b (12-28).

Paddle: Large, subequal in length to or longer than seta 9-VIII, oval, apical part acute. Midrib distinct, straight or curved laterad. Inner and outer margins usually with small submarginal spicules, apex with larger submarginal and marginal spicules. Surface of inner part and mesal portion of outer part with numerous small spicules.

LARVAE. **Head**: Foramen magnum circular, bounded by distinct collar. Posterior tentorial pit removed from collar. Maxillary sutures straight or nearly so, parallel, not extending to posterior tentorial pits. Labial sclerite broad; anterior margin concave, with short, sharp spicules, moderately produced laterally. Mental plate very short; apical margin deeply emarginate laterad of central teeth and tripartite. Mandible short. Maxilla modified for grasping, elongate, with short nonarticulated spine and long, distally toothed articulated spine; without strong articulation with head capsule far ventrad of palpus or basomesal tuft of elongate spicules. Maxillary palpus adnate to body of maxilla basally, apical 0.3-0.5 free, short, conical. Distinct sclerotized palpifer absent. Seta 1-C strongly developed, stout. Seta 5-C laterad of 6-C. Setae 8-10-C weakly developed, 3-5b (3-7). Seta 14-C weakly developed, usually single (1-3f), near anterior ventral margin of head capsule. Seta 15-C weakly developed, 2-11f, very near anterior margin of labial sclerite. Seta 6-MP short, peglike, arising at very base of body of maxilla.

Thorax: Seta 0-P moderately developed, 11-27b, not closely associated with 2,3-P or 4-P. Seta 1-P single, closely associated with 2,3-P and slightly laterad of them. Seta 4-P strongly developed, long, usually 14-21b (11-22), displaced laterad, on common tubercle with 5-7-P. Seta 5-T weakly developed, short. Seta 6-P strongly developed, long, usually 3,4b (2-5). Seta 7-P strongly developed, long, usually 18-27b (15-28). Seta 8-M strongly developed, long, usually 6-10b (3-12). Setae 7,13-T not arising from sclerotized bars connected to tubercle of 9-12-T.

Abdomen: Dorsal sensillum present on IV,V only. Seta 1-I-VII without alveolar plate; 1-I,II,VI weakly developed; 1-III-V,VII moderately developed; 1-III mesad of 4-III; 1-IV laterad of 4-IV. Seta 2-I-VII mesad of seta 1 of same segment. Seta 3-VII moderately developed, moderately long, usually 2,3b (1-4), without alveolar plate. Seta 5-I,VI,VII and sometimes V weakly developed, usually 3-7b (2-8); 5-II-IV or V moderately developed, usually 3-8b (2-11). Seta 6-I-III strongly developed, long, usually 6-14b (4-16); 6-IV-VI strongly developed, long, single or double on IV, single on V,VI.

Segment VIII: Strongly produced dorsocaudally, forming long cylindrical portion beneath siphon. Comb scales weakly pigmented, usually 33-57 (9-76), free, in large, irregular, oblique patch; each scale small, narrow, evenly fringed or with apical spine. Setae 1-5-VIII displaced dorsad. Seta 3-VIII weakly developed, short, 4-13b. Seta 5-VIII moderately developed, moderately long, 3-9b.

Siphon: Long, slender, index 6.6-10.2, straight or curved dorsad distally. Con-

spicuously spiculose; spicules short, simple, becoming stronger on apical portion of siphon. Pecten absent. Seta 1-S moderately developed, usually single (1,2b), arising near middle of siphon. Accessory midventral setae (1a-S) 20-37, not distinctly paired, in long row extending entire length of siphon; moderately developed; medial setae usually 4-7b (3-11). Seta 2-S strong, laterally compressed, apex curved and pointed; arising on tubercle beyond body of siphon. Accessory dorsolateral setae (2a-S) 4-7 pairs; weakly developed, 1-3b. Seta 6-S weakly developed, flexible, nonhooked.

Anal Segment: Saddle small, dorsal. Seta 2-X usually 10-16b (7-17). Seta 3-X usually 3-9b (2-10). Seta 4-X usually 5-15b (3-17); without sclerotized bar connecting alveoli of this pair of setae.

DISCUSSION. The genus *Johnbelkinia* is distinguished from the other groups formerly placed in *Trichoprosopon* as follows: in the **adult** by the combination of: (1) a long, slender proboscis, which is 1.20-1.40 length of femur I, (2) brilliant silver or azure blue reflections of scales on vertex and occiput of head, (3) moderately broad and flat scutal scales, (4) restriction of *stp* setae to area below level of lower edge of *mep* and (5) partly light scaled tarsi II and III; in the **male genitalia** by: (1) a large, very dense patch of strongly developed setae in basal tergal area of sidepiece, (2) apical gonopore of aedeagus, (3) absence of sternal aedeagal plates, (4) weakly connected lateral sclerotizations of aedeagus, apical tergal arms not joined and (5) combination of strongly developed, V- or U-shaped IX-S and bare apical tergomesal area of sidepiece; in the **pupa** by: (1) presence of a dorsal sensillum on only segments IV,V, (2) oval, acute paddle with a distinct midrib and spicules on surface, (3) combination of a strongly developed, long, 2,3b (1-3) seta 6-I, a strongly developed, long, single (1,2b) seta 6-II and a moderately to strongly developed, 3-18b seta 6-VII that is usually cephalad and laterad of seta 9-VII and (4) combination of a moderately to strongly developed, long, 4-6b (3-7) seta 5-C, a strongly developed, long seta 5-II-VI that is single on II, single or double on III, and usually double (2-6b) on IV-VI and a strongly developed, long, usually single (1,2b) seta 3-II,III; and in the **larva** by (1) usually large patch of comb scales, (2) long row of multiple, accessory midventral setae on siphon, (3) tripartite mental plate, (4) strongly developed, long, usually 6-14b (4-16) seta 6-I-III, (5) straight, parallel maxillary sutures that do not extend to posterior tentorial pits, (6) combination of a strongly developed, long, 6-10b (3-12) seta 8-M and absence of a pecten on siphon, (7) combination of a circular foramen magnum with a distinct collar and a grasping maxilla without a strong articulation with head capsule far ventrad of palpus and (8) maxillary palpus adnate to grasping maxilla for 0.5-0.7 of its length.

The affinities of *Johnbelkinia* are unknown. The larva resembles *Shannoniana* and *Tripteroides (Rachisoura)* in development of the collar and maxillary sutures, but it resembles *Runchomyia* in structure of the maxilla and in chaetotaxy. The larva has additional unique features not found in any of these other groups, like the usually large patch of comb scales and the resemblance of seta 6-III to 6-I,II. The male genitalia are very unusual and, as far as is known, are unlike those of any other sabethine mosquitoes. The adults resemble some species of *Trichoprosopon* in ornamentation, but resemble *Runchomyia* again in development of the proboscis and in position of the *stp* setae.

I am recognizing three species, *leucopus, longipes* and *ulopus,* in this genus. These species are strongly differentiated in the male genitalia and adult stage, but only weakly differentiated in the immature stages. Dyar (1928:96-98) recognized the same three species, but with the names *Goeldia leucopus, G. trichopus* and *G. longipes,* respectively, and recognized also their close relationship. Lane and Cerqueira

(1942:525, 526, 528) and Lane (1953:855-858, 860) recognized the same species, but with the names *Trichoprosopon leucopus, T. edwardsianum* and *T. longipes*, respectively. Even though the same three taxonomic species have been recognized in this group for more than half a century, misidentifications are extremely common. There has been a particularly great amount of confusion in identification of males; the genitalia illustrated as *Trichoprosopon leucopus* by Lane (1953:fig. 849) are actually *ulopus*, and the genitalia illustrated as *longipes* by Lane (1953:fig. 847) are the true *longipes*, not Lane's *longipes*, which is *ulopus*.

Several of the characters used by previous authors to separate species in this group of mosquitoes are not reliable. Howard, Dyar and Knab (1915:163) used differences in length of the female palpus to separate *Lesticocampa longipes* and *culicivora*. However, this character is of no value, as there are no significant differences in palpal length among the species of *Johnbelkinia*. Dyar himself (1923a:84) had also come to this same conclusion. Dyar (1928:95) used white scaling of tarsus II to separate *Goeldia trichopus* and *longipes*. This character is so variable, even at one locality, that it can not be used to distinguish the species of *Johnbelkinia*. However, it is of limited value in characterizing the species, and in general tarsus II is darkest in *leucopus* and lightest in *longipes*. The presence or absence of outstanding scales on tarsus III has been used by several authors. Again, this character is too variable to be used alone to separate the species; part of the variation is biological and part is artifactual, being related to the age and degree of rubbing of the specimens. The outstanding scales are least conspicuous, in fact absent, in *leucopus* and most conspicuous in *longipes*. In *ulopus*, they vary from being absent to nearly as conspicuous as in *longipes*. Lane and Cerqueira (1942:488) used the presence or absence of prescutellar setae to separate *Trichoprosopon longipes* and *edwardsianus*. This character is of very limited value, as previously pointed out by Cerqueira (1961a:459-460). Both prescutellar setae and dorsocentral setae are more often developed in males than in females, and both are more often developed in *longipes* and *leucopus* than in *ulopus*.

The following setae of *ulopus* larvae and pupae have been unquestionably homologized by tracing the appropriate nerve from a larval seta to a developing pupal seta in one or more of eight specimens showing such connections from collections BRA 49, COL 152, CR 541, CR 556, PA 41 and PA 596.

Thorax:	Larval seta 1-T = pupal seta 10-C
	Larval seta 2-T = pupal seta 11-C
	Larval seta 3-T = pupal seta 12-C
Abdominal segment I:	Setae 2, 3, 4, 5, 6, 7, 9
Abdominal segment II:	Setae 1, 2, 3, 4, 5, 6, 7, 9, 11
Abdominal segment III:	Setae 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Abdominal segment IV:	Setae 1, 2, 3, 4, 5, 7, 9; also "S"
Abdominal segment V:	Setae 3, 4, 5, 6, 7, 9
Abdominal segment VI:	Setae 3, 4, 5, 7, 8
Abdominal segment VII:	Setae 3, 4, 6, 7, 8, 10, 11

In numbering setae on the prothorax of the larva, I consider the more lateral of the setae between 1-3-P and 5-7-P to be 4-P and the more mesal one to be 0-P, regardless of which is more posterior. Setae 5-7-P have been assigned numbers on the basis of their sequence from the midline of the body only, so 5-P is most mesal, 7-P most lateral, and 6-P between these. This interpretation of these prothoracic setae is in agreement with Belkin, Heinemann and Page's (1970:191-229) for *Wyeomyia*, but at odds with Belkin's (1962b:360) for *Malaya solomonis*. Since these setae have no

demonstrated pupal homologies, neither interpretation can be shown to be correct or incorrect.

Because misidentification of the species has been so common in this group, it is frequently difficult or impossible to decide which zoological species actually formed the basis for observations reported in the literature. I have tried to infer which species various authors had before them when I compiled the lists of citations, but I have undoubtedly made many mistakes in doing this. In some cases there are no criteria for deciding, and so these citations are listed with a question mark under more than one species. Except for the localities listed by Cerqueira (1961b), the distributions attributed to the species in this paper are based solely upon specimens examined by me.

This genus is dedicated to John N. Belkin, one of the world's leading culicidologists, who happens also to be my mentor and friend.

A total of 1978 specimens, including 302 males, 658 females, 627 larvae, 391 pupae and 349 individual rearings (182 larval, 135 pupal, 32 incomplete), has been examined for this revision of *Johnbelkinia.*

BIONOMICS. The immatures of *Johnbelkinia* are normally found in leaf axils and flower bracts of tropical plants, usually of the families Araceae, Marantaceae and Strelitziaceae, but also of the Bromeliaceae, Musaceae and Palmae. The larvae have been reported to be predaceous on those of *Wyeomyia*. Adults are sylvan and predominantly diurnal. Females bite humans and various other mammals.

MEDICAL IMPORTANCE. Relatively large numbers of female *Johnbelkinia* have been attracted to human subjects in studies conducted in various parts of Middle and South America, so the species are apparently strongly anthropophilic. Arboviruses have been isolated from *ulopus* in Trinidad and Colombia. Since these mosquitoes are known to harbor viruses, and are attracted to and bite humans, they are of potential importance as vectors of disease. Species of this genus have also been found carrying the eggs of the human bot fly, *Dermatobia hominis* (Linnaeus, Jr., 1781).

DISTRIBUTION. The genus *Johnbelkinia* is widespread in tropical America, from southern Mexico to coastal Ecuador, eastern Bolivia and central coastal Brazil. It is apparently absent from all islands of the West Indies except Trinidad and Tobago.

KEYS TO SPECIES

ADULTS

1. Upper calypter usually without setae, rarely with 1 seta; scutal scales usually moderately iridescent blue, blue-green, purple, yellow-green or green . . . . . ***1. ulopus***

   Upper calypter with short row of setae basally; scutal scales usually dull brown or weakly iridescent copper, bronze, gold, green, blue or purple . 2

2(1). Tarsus 4-III completely white scaled; leg III with conspicuous outstanding scales on distal part of tibia and on tarsus 1-3 or 4; integument of *mep* and meron light . . . . . ***2. longipes***

   Tarsus 4-III white scaled in apical 0.1-0.4; leg III without outstanding scales; integument of *mep* and meron strongly darkened . . . . . ***3. leucopus***

MALE GENITALIA

1. Basal mesal lobe crescentic to nearly semicircular and with setae that are directed caudad and curved or weakly sinuous at apex; sidepiece with densest region of basal tergal setae distad of level of apex of basal mesal lobe . . . . . *1. ulopus*
Basal mesal lobe with long narrow dorsal strip and conical body bearing setae that are directed dorsad and very strongly curled at apex; sidepiece with densest region of basal tergal setae proximad of level of apex of basal mesal lobe 2

2(1). Tergite IX lobe much longer than wide; clasper constricted basally and slightly to conspicuously swollen apically; apical tergal arm of aedeagus with patch of 4-11 small, strongly sclerotized, dorsal preapical teeth and serrulate or striate, laterally curved, sclerotized apical process . . *2. longipes*
Tergite IX lobe about as long as wide; clasper without basal constriction and uniformly slender beyond base; apical tergal arm of aedeagus without dorsal preapical teeth or sclerotized apical process . . . . . *3. leucopus*

PUPAE

(*3. leucopus* unknown)

1. Sternite II-VII uniformly very weakly pigmented, or median part of anterior margin of II-IV only slightly more intensely pigmented than remainder of ventral surface . . . . . *1. ulopus*
Sternites II-IV (II-VII) with median part of anterior margin moderately pigmented, conspicuously darker than the very weakly pigmented remainder of ventral surface . . . . . *2. longipes*

LARVAE

(*3. leucopus* unknown)

1. Seta 4-X usually 5-9b (3-12), rarely with alveolar plate; seta 6-I usually 6-10b (4-14); most comb scales usually with even fringe or with 1 or 2 apical elements of fringe enlarged into small spines . . . . . *1. ulopus*
Seta 4-X usually 10-15b (6-17), with alveolar plate; seta 6-I usually 11-14b (7-14); most comb scales usually with moderately large apical spine . . . . . *2. longipes*

1. Johnbelkinia ulopus (Dyar & Knab)

Figs. 1, 3-7

1906. *Lesticocampa ulopus* Dyar and Knab 1906a:137-138. *TYPE: *Holotype* female, Bluefields [Zelaya], Nicaragua, W. F. Thornton [USNM, 10004]. Synonymized with *longipes* by Howard, Dyar and Knab (1915:172-174). NEW COMBINATION AND NEW STATUS.

1907. *Lesticocampa culicivora* Dyar and Knab 1907:207. *TYPE: *Holotype* female (11.30), Tabernilla, Canal Zone, Panama, reared from larva from flower bracts of *Heliconia*, 28 Apr 1907, A. Busck [USNM, 10849]. Synonymized with *longipes* by Dyar (1923a:84-85). TRANSFERRED SYNONYMY.

Trichoprosopon (Runchomyia) ulopus of Belkin, Schick and Heinemann (1965:42); Valencia (1973:14).

Lesticocampa ulopus of Busck (1908:75-76); Theobald (1910:622); Stone and Knight (1957:119).

Trichoprosopon (Runchomyia) culicivora of Belkin, Schick and Heinemann (1965:45, 58).

Goeldia culicivora of Bonne-Wepster and Bonne (1921:17; 1922:38).

Lesticocampa culicivora of Busck (1908:76); Theobald (1910:558); Martini (1914:65, 66); How-ard, Dyar and Knab (1915:168-170); Stone and Knight (1957:119).

Trichoprosopon (Runchomyia) longipes of Stone, Knight and Starcke (1959:76-77, in part); Faur-an (1961:14-15, in part); Stone (1963:121); Forattini (1965:169, 170, 172, 173, 174-175, 176, 217, 291, in part); Cova Garcia, Sutil and Rausseo (1966a:66, 68, in part; 1966b:67, 131, 384-385, in part); Barreto-Reyes and Lee (1969:415); Belkin, Heinemann and Page (1970:14, 16, 18, 19, 191); Kruijf (1972:50); Diaz Najera and Vargas (1973:124); Knight and Stone (1977: 314, in part).

Trichoprosopon (Rhunchomyia) longipes of Lane (1953:855-857, in part); Barreto-Reyes (1955: 80); Trapido, Galindo and Carpenter (1955:531, 535, 537, 538, 539); Trapido and Galindo (1955:670); Floch (1956:35, 221, in part); Trapido and Galindo (1957:122, 125, 131); Cerque-ira (1961a:460; 1961b:154); Diaz Najera (1961:204); Morales and Vidales (1962:5, 10, 11); Diaz Najera (1966:63); Xavier and Mattos (1970:452; 1975:256; 1976:403).

Trichoprosopon (Rhynchomyia) longipes of Diaz Najera (1963:192).

Trichoprosopon (Hyloconops) longipes of Lane and Cerqueira (1942:525, in part); Anduze (1943: 191); Lane (1945:133); Anduze, Pifano and Vogelsang (1947:12); Anduze (1947:351); Arnett (1949:244); Galindo, Carpenter and Trapido (1951:129).

Trichoprosopon longipes of Galindo, Trapido and Carpenter (1950:549, 554); Horsfall (1955:317); Galindo (1958:436); Aitken (1960:4, 8); Maia (1963:91); Spence, Anderson *et al.* (1964:114); Porter (1967:39); Barr and Barr (1969:196); Forattini, Rabello and Cotrim (1970:79).

Goeldia (Goeldia) longipes of Dyar (1923a:84-85; 1923b:174); Edwards (1932:72, in part); Lane (1939:162-163, in part); Floch and Abonnenc (1947:2-3, in part).

Goeldia longipes of Bonne-Wepster and Bonne (1921:17; 1922:38); Evans (1923:110); Bonne-Wep-ster and Bonne (1923:124, in part); Dyar and Shannon (1924:483); Bonne and Bonne-Wepster (1925:144-146, in part); Dyar (1925:128-129; 1928:96-97, in part); Dunn (1929:500); Lima (1931:66-67); Edwards (1934:632); Komp (1936:60, in part); Lane (1936:7); Antunes (1937a: 72-73, in part; 1937b:72); Patino Camargo (1937:242, in part); Boshell-Manrique (1938:415, in part); Kumm, Komp and Ruiz (1940:397); Anduze (1941:9); Floch and Abonnenc (1942b:2-3, in part); Floch (1955:315, in part); Horsfall (1955:319).

Lesticocampa longipes of Howard, Dyar and Knab (1915:172-174).

Goeldia trichopus of Bonne (1923:128-129); Bonne and Bonne-Wepster (1923:124, in part; 1925: 141-143, in part); Shannon (1931:7).

Trichoprosopon (Runchomyia) leucopus of Stone, Knight and Starcke (1959:76, in part); Cova Garcia, Sutil and Rausseo (1966a:67, 68, in part); Barreto-Reyes and Lee (1969:415); Diaz Na-jera and Vargas (1973:124); Knight and Stone (1977:314, in part).

Trichoprosopon (Rhunchomyia) leucopus of Lane (1953:857-858, in part); Trapido and Galindo (1955:670); Trapido, Galindo and Carpenter (1955:531, 535, 537, 538, 539); Diaz Najera (1961:204; 1966:63).

Trichoprosopon (Hyloconops) leucopus of Vargas and Martinez-Palacios (1953:300); Vargas (1956: 33); Diaz Najera (1963:192).

Trichoprosopon leucopus of Forattini (1965:172).

Goeldia (Goeldia) leucopus of Dyar (1923a:86, in part).

Goeldia leucopus of Bonne and Bonne-Wepster (1925:152, in part); Dyar (1925:129, in part; 1928: 97-98, in part).

Lesticocampa leucopus of Howard, Dyar and Knab (1915:170-172, in part).

Trichoprosopon (Runchomyia) hyperleucum of Stone, Knight and Starcke (1959:76, in part); Knight and Stone (1977:313, in part).
Trichoprosopon (Rhunchomyia) hyperleucus of Lane (1953:858).
Trichoprosopon (Hyloconops) hyperleucus of Lane and Cerqueira (1942:526-527).
Trichoprosopon hyperleucum of Forattini, Rabello and Cotrim (1970:79).
Lesticocampa rapax of Dyar and Knab (1906:137, in part).
?Trichoprosopon (Runchomyia) longipes of Martinez and Prosen (1953:31); Morales-Ayala (1971: 139).
?Goeldia longipes of Bonne (1923:129).
?Trichoprosopon (R.) edwardsianus of Suarez (1963:239).
?Trichoprosopon (Hyloconops) trichopus of Anduze, Pifano and Vogelsang (1947:12).
?Goeldia (Goeldia) trichopus of Chagas, da Cunha *et al.* (1938:198, 202); Floch and Abonnenc (1947:3).
?Goeldia trichopus of Kumm and Novis (1938:503, 512); Floch and Abonnenc (1942a:3; 1942b:3).
?Trichoprosopon (Runchomyia) leucopus of Fauran (1961:14); Stone (1961:33); Morales-Ayala (1971:139); Kruijf (1972:50).
?Trichoprosopon (Rhunchomyia) leucopus of Trapido and Galindo (1957:122, 124, 125, 128, 131, 134, 135, 138); Xavier and Mattos (1975:256).
?Trichoprosopon (Hyloconops) leucopus of Anduze (1947:351); Anduze, Pifano and Vogelsang (1947:12).
?Trichoprosopon leucopus of Galindo and Trapido (1957:146).
?Goeldia (Goeldia) leucopus of Floch and Abonnenc (1947:3).
?Goeldia leucopus of Anduze (1941:9); Floch and Abonnenc (1942a:3; 1942b:3).

FEMALE (fig. 3). Wing: 4.20mm. Proboscis: 4.02mm. Femur I: 3.27mm. Abdomen: about 3.9mm. **Thorax**: Scutal scales usually moderately iridescent blue or blue-green, sometimes purple, yellow-green or green. Postnotum usually without scales. Pleural integument strongly darkened on *ssp, psp, stp, mep* and meron, or only weakly to moderately darkened on *ssp* and *psp*, or *ssp, psp* and *stp*. **Legs**: Leg III with or without outstanding scales; if present, varying from inconspicuous and restricted to tarsus 2-III to conspicuous and extending from apical 0.5 of tarsus 1-III to apex of 3-III. Tarsus II with streak of white scales on anterior and dorsal surfaces starting between base of 2-II and apical 0.6 of 3-II and extending to apex of 4-II or 5-II; scales on ventral and posterior surfaces of same segments dark, tanish, partly white or entirely white. Tarsus III white scaled from apical 0.0-0.5 of 3-III or apical 0.2-1.0 of 4-III to apex of 5-III. **Wing**: Upper calypter usually without setae, rarely with 1 seta. **Abdomen**: Sternites II-VII entirely light scaled or with some scales moderately to strongly darkened.

MALE (fig. 3). Essentially as in female except for sexual characters. **Head**: Flagellum sparsely plumose, middle segments with about 14-18 bristles. **Legs**: Anterior claw I enlarged, with submedian crestlike swelling; anterior claw II enlarged, simple.

MALE GENITALIA (figs. 4, 7). **Segment IX**: Tergite lobe about as long as wide. Setae of lobe 5-7 (4-8), moderately to strongly developed, flattened apically, with long, filamentous apical prolongation. Sternite U-shaped. **Sidepiece**: Slender. Densest region of basal tergal setae distad of level of apex of basal mesal lobe. Basal sternomesal setae 2-5, short to long, curved at apex; strongly developed medial sternomesal setae 1-7. **Basal Mesal Lobe**: Crescentic to nearly semicircular; setae directed caudad, curved or weakly sinuous at apex. **Clasper**: Moderately long to long; without basal constriction; uniformly slender beyond base; with several fine setae apically. Spiniform straight, stout or slender. **Phallosome**: Aedeagus weakly pigmented; distal lateral margin partly concave in dorsal aspect; distal end of submedian tergal arm nearly parallel with mate; apical tergal arm without dorsal preapical teeth or

sclerotized apical process. **Proctiger**: Paraproct with 4 or 5 (3-6) moderately large, dorsally curved apical teeth and with serrulate or crenulate, moderately sclerotized apical lamella mesad of apical teeth that does not project beyond teeth. Cercal sclerite present, elongate.

PUPA (fig. 4). Abdomen: 4.7mm. Trumpet: 0.55mm. Paddle: 0.68mm. **Cephalothorax**: Very weakly pigmented. **Trumpet**: Very weakly to weakly pigmented, sometimes becoming slightly darker distad. **Abdomen**: Very weakly pigmented; sternites II-VII uniformly pigmented or median part of anterior margin of II-IV only slightly more intensely pigmented than remainder of ventral surface. **Terminal Segments**: Male genital lobe moderately large, its width usually less than 0.50 (0.41-0.54) of segment VIII. **Paddle**: Very weakly pigmented. Index usually 1.22-1.42 (1.11-1.84).

LARVA (fig. 5). Head: 1.30mm. Siphon: 1.21mm. Anal Saddle: 0.28mm. **Head**: Very weakly pigmented, collar darker. Mental plate with 10-12 (10-13) teeth on each side of median tooth. **Antenna**: Often with a few to numerous small spicules medially. **Abdomen**: Seta 6-I usually 6-10b (4-14); seta 6-II usually 8-11b (5-15); seta 6-III usually 7-10b (5-12). **Segment VIII**: Comb scales usually 37-57 (21-76); most comb scales of patch usually with even fringe or with 1 or 2 apical elements of fringe enlarged into small spines. **Siphon**: Very weakly pigmented, becoming slightly darker distad. Straight or weakly to moderately curved dorsad distally. Seta 1-S inserted 0.42-0.61 distance from base of siphon. Accessory midventral setae (1a-S) usually 23-28 (20-30). **Anal Segment**: Saddle very weakly pigmented, indistinct. Seta 3-X usually 3-6b (2-8). Seta 4-X moderately to strongly developed, usually 5-9b (3-12), rarely with alveolar plate.

SYSTEMATICS. *Johnbelkinia ulopus* may be distinguished by the following characters: in the **adult** from *longipes* and *leucopus* by: (1) usual absence of setae on upper calypter of wing and (2) moderately iridescent blue, blue-green, green, purple or yellow-green scales on scutum; in the **male genitalia** from *longipes* and *leucopus* by: (1) crescentic to nearly semicircular shape of basal mesal lobe, (2) caudally directed setae of basal mesal lobe that are curved or only weakly sinuous at apex and (3) location of densest region of basal tergal setae distad of level of apex of basal mesal lobe; in the **pupa** from *longipes* by: (1) uniformly or nearly uniformly very weakly pigmented sternites and (2) smaller male genital lobe that is usually less than 0.50 width of segment VIII; and in the **larva** from *longipes* by: (1) usually fewer branches, 5-9 (3-12), in seta 4-X, (2) usual absence of an alveolar plate for seta 4-X, (3) usually fewer branches, 6-10 (4-14), in seta 6-I and (4) shape of comb scales, which are usually evenly fringed or have one or two apical elements of fringe enlarged into small spines. *Johnbelkinia ulopus* may be further distinguished from *longipes*, with which it is sympatric in parts of South America, by the following additional **adult** characters: (1) less plumose flagellum in male, (2) submedian crestlike swelling on anterior claw I of male, (3) enlarged anterior claw II of male, (4) usually lighter abdominal sternites in female and (5) usual absence of outstanding scales on tibia III and basal 0.5 of tarsus 1-III.

There is a considerable amount of variation in this species, with much of it being geographical. In the adults, the integument of *mep* and the meron is strongly darkened in specimens from Nicaragua, Costa Rica, Panama, Colombia and the Pacific versant of Ecuador; tarsus II is darkest in specimens from Nicaragua, Costa Rica, western Panama and the Atlantic versant of Colombia; leg III is without outstanding scales or with only inconspicuous to moderately conspicuous outstanding scales in specimens from Nicaragua, Costa Rica and western Panama; and tarsus III is darkest, with seg-

ment 4 dark in the basal 0.3-0.6, in specimens from Nicaragua, Costa Rica, western Panama and Colombia. Specimens from north of the area indicated in Central America and south and east of the areas indicated in South America have a lighter integument on *mep* and the meron, more extensively light scaled tarsi II and III, and usually more conspicuous outstanding scales on leg III. All four of the variations mentioned reach their most extreme expression in Nicaragua, Costa Rica and western Panama, precisely the area in which *ulopus* is sympatric with *leucopus,* a species with strongly darkened integument on *mep* and the meron, with the darkest tarsi II and III known in the genus, and without outstanding scales on leg III. This appears to be another example of species being more similar in their area of sympatry than elsewhere. I have reported similar observations in the genera *Orthopodomyia* (Zavortink 1968:12-13) and *Aedes* (Zavortink 1972:22, 51). Now, as in the past, I consider the most reasonable explanation for this phenomenon to be introgressive hybridization.

In the male genitalia, the basal sternomesal setae of the sidepiece are 3 or 4, moderately strong, short and do not arise on a swelling in specimens from Nicaragua, Costa Rica, western Panama, Trinidad and French Guiana; these setae are more strongly developed and longer in specimens from central and eastern Panama and Venezuela; and are 4-7, strongly developed, long and arise on a swollen lobe in specimens from the Pacific versant of Colombia and Ecuador. The medial sternomesal setae of the sidepiece are usually 4-7 in all areas mentioned above except the Pacific versant of Colombia and Ecuador, where they are absent or reduced to 1. The clasper is relatively long in all known populations except the one in Pacific coastal Ecuador, where it is shortened. Setae of the basal mesal lobe, which are usually relatively short and only curved at the apex, are longer and weakly sinuous at the apex in specimens from the Pacific part of Colombia and Ecuador. The two extremes in variation in the male genitalia are illustrated, the topotypic Nicaraguan population in Fig. 4, and the Pacific Ecuadorian population in Fig. 7. I consider the Nicaraguan form to be the more primitive, because of its disjunct distribution in Central America and northeastern South America, and the Ecuadorian to be the most derived. This interpretation is subject to change, though, when the genitalia become known for the northern Central American populations and the more southern South American populations. It is perhaps significant that the Nicaraguan form, with short basal sternomesal setae, 4-7 medial sternomesal setae, and short and slightly curved basal mesal lobe setae, is known from areas where *ulopus* occurs with or near *leucopus* or *longipes*, both of which have longer basal sternomesal setae, 0-4 medial sternomesal setae and longer, sinuous basal mesal lobe setae. Such morphological divergence in areas of sympatry suggests character displacement. I believe it fully possible that both character displacement and introgressive hybridization could occur, in different characters of course, between the same species.

In the larva, many specimens from Trinidad, Tobago and the Guianas have an enlarged spine at the apex of the comb scales, an alveolar plate at the base of seta 4-X and more than the usual number of branches in setae 6-I and 4-X. In these features, these larvae resemble *longipes,* which occurs throughout much of this same region. Again, introgressive hybridization is a possible explanation for this pattern of variation.

The third instar larva of *ulopus,* illustrated in Fig. 6, differs from the fourth instar in several notable features. The maxilla is relatively longer, the prothorax has a large sclerotized plate anterolaterally, setae 5,6-P are very strongly developed and the terminal abdominal segments are spiculose. The second instar larva, parts of which are shown in Fig. 7, has some even more remarkable features. The maxilla is extremely

long and lacks apical spines and the spicules of the siphon are enlarged, resemble pecten teeth and are restricted to a broad stripe of several rows on each side. This instar resembles the third in development of the prothoracic plate, strength of 5,6-P and presence of spicules on the body. As in the case of the second instar larva of *Runchomyia magna,* setae 8-M and 7-T are absent.

Several artifacts are shown in the illustration of the male genitalia of *ulopus* from coastal Ecuador (Fig. 7). In the undissected genitalia the appearance of the aedeagus and proctiger is unusual because the phallosome in partly everted. In the case of the dissected parts, the lateral aspect of the proctiger is unusual because this piece is partly rotated.

BIONOMICS. The immatures of *ulopus* are represented in more than 125 collections made for the project "Mosquitoes of Middle America." Eighty percent of these collections are from leaf axils, 17% from flower bracts of *Heliconia* and 3% total from treeholes, fallen cacao fruits and fallen palm spathes. Of the more than 100 collections from leaf axils, 62% are from axils of plants in the family Araceae (variously listed on the record forms as *Colocasia, Dieffenbachia, Montrichardia, Xanthosoma,* alispata, elephant ear, taro or Araceae), 25% are from Strelitziaceae (listed as *Heliconia* or platanillo), 8% are from Marantaceae (listed as *Calathea* or Marantaceae), 3% are from Bromeliaceae (listed as bromeliad) and 2% are from Musaceae (listed as wild banana). Galindo, Carpenter and Trapido (1951:129) reported the larvae (as *longipes*) from many of these same habitats and also from the leaf axils of *Caladium* (Araceae) and the flower bracts of *Calathea.* Bonne's report (1923:129) of *longipes* larvae from the leaf bases of *Heliconia* and *Ravenala* (probably *Phenakospermum guianense,* Strelitziaceae) may refer to *ulopus* in part.

Larvae of *ulopus* have been reported as being predaceous, particularly on the larvae of *Wyeomyia,* by Busck (1908:75-76, as *ulopus* and *culicivora*), Howard, Dyar and Knab (1915:168-170, as *culicivora*) and Galindo, Carpenter and Trapido (1951: 129, as *longipes*). Additional reports of predation on *Wyeomyia* by larvae of *longipes* by Bonne (1923:129) and Bonne-Wepster and Bonne (1925:144-146) may refer to *ulopus* in part.

Most adults collected for the project "Mosquitoes of Middle America" were obtained resting, particularly in forested areas, between the hours of 0700 and 1300 or in biting-landing collections with human bait between the hours of 0800 and 1800. A few have been obtained in Shannon, light or "mouse-baited" traps.

Edwards (1934:632) reported the capture of an adult [male] of *ulopus* (as *longipes*) from the flowers of *Matayba inelegans* in Guyana and Bonne (1923:128-129) reported the capture of a male (as *trichopus*) in a house in Surinam. Barreto-Reyes and Lee (1969:415) noted this species (as *longipes* and *leucopus*) carrying the eggs of *Dermatobia hominis* in Colombia. Antunes's report (1937a:72-73) that one of 150 adults of *longipes* caught at Restrepo, Colombia, carried the eggs of *D. hominis* and that the species had a "special predilection" for biting the noses of horses refers in part to *ulopus.* The reports of Floch and Abonnenc (1947:2-3) that *longipes* adults are sometimes found in agglomerations in the forest in French Guiana and of Kumm and Novis (1938:503, 512) that *longipes* females have been taken in traps baited with agoutis and "other wild animals" in Brazil may refer in part to *ulopus.*

Large numbers of *ulopus* have been reported (as *longipes* and *leucopus*) as being attracted to human subjects during the day and predominantly at ground level in studies conducted in western Panama and Costa Rica by Trapido, Galindo and Carpenter (1955:531, 535, 537, 538, 539), in western Panama by Trapido and Galindo (1957:122, 124, 125, 128, 131, 134, 135, 138), in Honduras by Trapido and Galin-

do (1955:670), in Nicaragua by Galindo and Trapido (1957:146) and in Colombia by Barreto-Reyes and Lee (1969:415). Although the single specimen previously determined as *leucopus* from the Gorgas Memorial Laboratory collection that I examined was actually *ulopus*, it is possible that *leucopus* is represented in the material collected in some of the studies by Galindo and associates.

Aitken (1960:4, 8) reported the isolation of the arbovirus TR8349 from *ulopus* (as *longipes*) in Trinidad and Spence, Anderson *et al.* (1964:114) reported the isolation of Triniti virus from a mixed pool of trichoprosopons that included two *ulopus* (as *longipes*) that had been captured at human bait in the Arena Forest of Trinidad, 31 May 1955, between 1745 and 1915 hours. Barreto-Reyes and Lee (1969:415) also reported the isolation of arbovirus from this species (as *longipes* and *leucopus*) in Colombia.

DISTRIBUTION. *Johnbelkinia ulopus* extends from Veracruz and Oaxaca in southern Mexico southward into the northern half of South America. In South America, I have seen specimens from near the Pacific coast in Colombia and Ecuador, near the Caribbean coast in Colombia and Venezuela, and along the Atlantic coast in Trinidad, the Guianas and the Brazilian states of Para and Bahia. Inland, I have seen specimens from only Boyaca and Meta, Colombia, but Cerqueira (1961b:154) records this species (as *longipes*) from the Brazilian states of Amazonas and Mato Grosso. Lane (1953:857) recorded *ulopus* (as *longipes*) from Cuba, and this record has been repeated by others (Stone, Knight and Starcke 1959:76; Porter 1967:39). I have not seen the specimen upon which this record is based, and, like Belkin, Heinemann and Page (1970:191), I believe this record is doubtful. Material examined: 1681 specimens; 276 males, 477 females, 578 larvae, 350 pupae; 311 individual rearings (153 larval, 129 pupal, 29 incomplete).

BRAZIL. **Bahia:** Ilheus, July 1930, N. C. Davis, R. C. Shannon, 1F [USNM]. **Para:** Belem, IPEAN, Mocambo Forest, 1970, T.H.G. Aitken (BRA 49), 1L [UCLA]. Curralinho, Nov 1935, 1F; Jan 1936, 1F; date unspecified, 1F, 1L [USNM]; date unspecified, H. W. Kumm, 5F [BM]. Curralinho, Campinho, H. W. Kumm, 1F [BM]. Curralinho, Furo Pruana, 1F [USNM]. Curralinho, Rio Canaticu, 1F [USNM]. Curralinho, Rio Pariacasinho, 2F [USNM]. Vigia, Vigia, June 1935, 1F [BM].

COLOMBIA. **Boyaca:** Chiquinquira, Pauna, Feb 1937 (COR 1346), 1F; ?Feb 1937 (COR 1347, 1350), 2F [UCLA]. ?Muzo, 1936 or 1937 (COR 1249, 1252, 1254, 1255, 1256, 1257, 1259, 1260), 19F [UCLA]. **Meta:** ?Chipadera, Nov 1936 (COR 107), 1F [UCLA]. Restrepo, Dec 1941, P.C.A. Antunes, 1F [FH]. Villavicencio, Bosque Ocoa, 14 June 1944 (COK 44), 1F [UCLA]. Locality unspecified, 20 Nov 1936 (COR 119), 2F; 20 Oct 1936 (COR 128), 1F; 21 Oct 1936 (COR 130), 8F; 23 Oct 1936 (COR 133), 1F; 27 Nov 1936 (COR 161), 1F; 4 Dec 1936 (COR 164, 165), 2F [UCLA]. **Narino:** Gorgona I., July 1924, L. E. Cheesman, 1F [BM]. **Norte de Santander:** Villamizar, Zulia River, L. H. Dunn, 1F [USNM]. **Valle del Cauca:** Buenaventura (20km S), Rockefeller Foundation Virus Field Station (W), 24 Mar 1966, V. H. Lee (COL 152), 1 lpM (152-10), 3 pM (152-100-102), 5L [UCLA]. Darien, New Calima Dam (200m W), 31 Aug 1965, J. N. Belkin, V. H. Lee (COL 120), 1 lpF (120-10), 1 pF (120-100), 1P [UCLA]. **Locality unspecified:** (COR 487, 491, 521, 523), 6F [UCLA].

COSTA RICA. **Alajuela:** Higuito, near San Mateo, P. Schild, 3M, 5F [USNM]. Orotina, 1F [USNM]. **Cartago:** La Suiza, P. Schild, 1M [USNM]. Turrialba, 5 Aug 1963, C. L. Hogue, 1F [UCLA]; 5 June 1951, O. L. Cartwright, 5F [USNM]; June 1954, P. A. Buxton, 1F [BM]. **Limon:** Limon (8km S), Beverly (W), 15 Dec 1971, D. and K. Schroeder (CR 556), 1 lpM (556-10), 6 lpF (556-11, 14-18), 1 lp (556-12), 3 pM (556-101, 103, 104), 2P, 3L [UCLA]. Limon (8km S), Bomba (1.8km E), 3 Oct 1971, D. and K. Schroeder (CR 466), 3 lpM (466-11, 14, 15), 3 lpF (466-10, 12, 13), 2 pM (466-100, 101), 2L [UCLA]. Liverpool, H. W. Kumm, 1F [BM]. Pandora, 29, 30 Apr 1964, F. S. Truxal, 1F [LACM]. Siquirres, 1F [USNM]. Zent (8km E), 17 Dec 1971, D. Schroeder (CR 565), 1 lpM (565-10), 1 lpF (565-11), 4 pM (565-100-102, 104) [UCLA]. Zent,

about half way to Boston, 12 Dec 1971, D. and K. Schroeder (CR 541), 1 lpM (541-15), 3 lpF (541-11, 14, 16), 2 lp (541-12, 13), 1 pM (541-102), 3 pF (541-100, 103, 104), 2L [UCLA]. **Puntarenas**: Golfito (near), 9 July-1 Aug 1972, A. Menke, F. Truxal (CR 172), 1M [UCLA]. Osa Peninsula, Rincon, 1 July 1963, C. L. Hogue (CR 140), 1 lpF (140-301) [UCLA].

ECUADOR. **Bolivar**: Balzapamba, F. Campos, 1M [USNM]. **Canar**: Cochancay, km 86 Hwy 8, 13 Feb 1966, J. N. Belkin, E. J. Gerberg (ECU 164), 1 lpF (164-20), 1M; same data (ECU 165), 1 lpF (165-11), 1L [UCLA]. **Los Rios**: Pichilingue, 15-19 Oct 1944, E. J. Hambleton, 1F [USNM]. Valencia, 1M [USNM]. **Locality unspecified**: Aug 1938, Hanson, 1F; 26 July 1938, 1M [UCLA]; 4M [USNM].

FRENCH GUIANA. **Guyane**: Cayenne, foret de Cabassou, 28 Nov 1967, J. Clastrier (FGC 3287), 1F; 18 July 1968, J. Clastrier (FGC 429-1), 1M; 12 July 1968, J. Clastrier (FGC 3911), 1F [UCLA]. Cayenne, foret de la Chaumiere, 13 Mar 1968, J. Clastrier (FGC 3318), 1 pF (3318-10) [UCLA]. Remire, near Lac du Rorota, 8 Mar 1967, R. X. Schick (FG 110), 1 lpF (110-10), 1 pM (110-100) [UCLA]. **Inini**: Saul, upper Fleuve Mana, near Placer Souvenir, 29 June 1952 (FGA 189), 4F [UCLA]. Saut Bief, Apr 1940, 3F [UCLA]. **Locality unspecified**: J. Clastrier, 1F [UCLA].

GUYANA. **Demerara**: Georgetown, 1.5km N of Central Horticultural Station on road from Atkinson Field, 10 Nov 1967, R. X. Schick, P. Rauch, R. Hansell (GUY 53), 2 lpF (53-10, 24) [UCLA]. **Essequibo**: Essequibo River, Moraballi Creek, 23 Aug 1929, 1M [BM]. Issororo, G. E. Bodkin, G. M. Vevers, 1F [BM]. **Locality unspecified**: Nov 1909, L. D. Cleare, 1F [BM].

HONDURAS. **Atlantida**: Tela, Lancetilla, Tela Railroad Co. grounds, 13 Aug 1964, A. Quinonez (HON 26), 1 lpF (26-11), 1L; 17 Aug 1964, A. Quinonez, V. P. Cowsill (HON 44), 2 pF (44-100, 101), 7L [UCLA].

MEXICO. **Chiapas**: El Jardin Jerico, Pijijiapan, 8 Dec 1961, J. Rene Zurita, 1F [ISET]. Palenque, 5 Sept 1959, J. Rene Zurita, 3F [ISET]; 19 July 1970, D. and K. Schroeder (MEX 580), 2F [UCLA]. **Oaxaca**: Valle Nacional (above), 12 May 1963, 1F [USNM]. **Tabasco**: Teapa, ?Samun, 8 Dec 1954, M. Figueroa, 1F [ISET]. **Veracruz**: Cardenas, Texistepec, 24 Mar 1960, R. Zurita, 1F [ISET]. Moloacan, 26 Nov, 10 Dec 1959, J. Lopez B., 3F; 5 Jan 1960, J. R. Zurita, 1F [ISET]. St. Lucrecia, 21 June 1905, F. Knab, 1F [USNM].

NICARAGUA. **Zelaya**: Bluefields, W. F. Thornton, 8F (includes *ulopus* holotype) [USNM]. Bluefields, Bluefields Airport, 15 July 1964, A. Quinonez (NI 49), 1 lpF (49-20), 1 lp (49-21), 2L [UCLA]. Bluefields, Cemetery (1.5km W), 23 Nov 1971, D. and K. Schroeder (NIC 82), 2F [UCLA]. Bluefields (4km S), Punta Masaya, 27 Nov 1971, D. and K. Schroeder (NIC 113), 1F; same data (NIC 116), 1 lpM (116-21), 1 lpF (116-20) [UCLA]. Bluefields, Rio Escondido, 17 July 1964, A. Quinonez (NI 52), 2 pM (52-103, 107); same data (NI 54), 1P, 3L; same data except 18 July 1964 (NI 56), 3 lpF (56-15, 18, 19), 1 pM (56-103), 1 pF (56-112), 1 lp (56-16), 1P, 4L [UCLA].

PANAMA AND CANAL ZONE. **Bocas del Toro**: Almirante, 30 Apr 1963, A. Quinonez (PA 289), 2 lpF (289-107, 108), 2 pM (289-101, 103), 2 pF (289-104, 106), 1 lp (289-102), 2P, 4L [UCLA]. Almirante (15km SW), 2 May 1963, A. Quinonez (PA 303), 1 pM (303-102), 1 pF (303-101), 1P, 2L [UCLA]. Almirante, Crematory, 27 Apr 1963, A. Quinonez (PA 265), 1 pF (265-114) [UCLA]. Almirante, farm near, 14, 15 Apr 1964, A. Quinonez (PA 665), 1L [UCLA]. Almirante, 1½ mile swamp, 4 May 1963, A. Quinonez (PA 310), 1F [UCLA]. Almirante, Milla 2, 9 May 1963, A. Quinonez (PA 342), 1F [UCLA]. Almirante, Oil Tank, 27 Apr 1963, A. Quinonez (PA 261), 1 lp (261-103), 2P, 3L [UCLA]. Almirante (1-4km W), Quebrada Nigua, 27 Apr 1963, A. Quinonez (PA 256), 1 lpF (256-105), 3 pM (256-103, 104, 110), 1 pF (256-109), 1 lp (256-112), 1L [UCLA]. Almirante, Repressa, 15 Apr 1964, A. Quinonez (PA 667), 1M [UCLA]. Chiriqui Grande, Mata de Cacao, 17 Apr 1963, A. Quinonez (PA 220), 7M; same data (PA 221), 1 pM (221-101), 5L; same data (PA 224), 1 lp (224-105); same data except 21 Apr 1963 (PA 246), 1M, 1F [UCLA]. Chiriqui Grande, Punta de Pena, 14 Apr 1963, A. Quinonez (PA 193), 2 lpF (193-101, 102), 5L, 1P [UCLA]. Isla Colon, Bocas del Toro (2km N), Big Creek, 10 Apr 1964, A. Quinonez (PA 655), 1 lpF (665-102), 1P, 1L; same data except 11 Apr 1964 (PA 657), 1 lpF (657-112), 1 pM (657-113), 2 pF (657-107, 114), 1L [UCLA]. Punta de Pena, Chiriquicito, 14 Apr 1963, A. Quinonez (PA 192), 1 pM (192-101), 4L; same data except 19 Apr 1963 (PA 232), 1 lpF

(232-101), 3L, 1P; same data except 22 Apr 1963 (PA 249), 3F; same data except 22 Apr 1963 (PA 250), 1F; same data except 23 Apr 1963 (PA 251), 1M, 5F; same data except 23 Apr 1963 (PA 252), 2F [UCLA]. Punta de Pena (3km S), El Guabo, 14 Apr 1963, A. Quinonez (PA 196), 1 lpM (196-121), 1P; same data (PA 199), 2 lpF (199-101, 103), 1 pM (199-102), 2F, 1P; same data (PA 201), 1 lpM (201-103), 1 lpF (201-105), 2 pF (201-101, 102), 1 lp (201-106), 7L, 3P; same data except 15 Apr 1963 (PA 202), 2 pM (202-101, 102), 1L; same data except 16 Apr 1963 (PA 208), 1F [UCLA]. Punta de Pena, Kaysan, 16 Apr 1963, A. Quinonez (PA 214), 2L; same data except 18 Apr 1963 (PA 227), 1 lpM (227-103), 1 pM (227-102), 1 pF (227-101), 5L; same data except 19 Apr 1963 (PA 239), 1 pM (239-102), 1 lp (239-101), 2L; same data except 20 Apr 1963 (PA 244), 5M, 2F [UCLA]. Locality unspecified, 25 Sept 1903, P. Osterhout, 1M, 1F [USNM]. **Canal Zone**: Ancon, 15 Jan 1916, L. H. Dunn, 1M [USNM]. Balboa, Corozal Dam site, 18 Sept 1943 (KO 30-21), 1F [UCLA]. Balboa, Orchid Gd., 3 Jan 1943, 1M [USNM]. Buenos Aires, Santa Rosa, 19 July 1972, J. H. Arnell, R. Hinds (PA 1135), 1 lp (1135-11), 1L [UCLA]. Camp Gaillard, 3 Jan-26 Dec 1925, D. Baker, 3M, 9F; 1 Jan 1925, J. B. Shropshire, 2F; thru C. S. Ludlow, 1M [USNM]. Cano Saddle, Gatun Lake, 10, 15 Aug 1923, H. G. Dyar, R. C. Shannon, 1M, 1F; May-Sept 1923, R. C. Shannon, 4F [USNM]. Chilibre, Juan Mina, 20 July 1972, J. H. Arnell, R. Hinds (PA 1138), 1F [UCLA]. Chilibre, Rio Chilibre, 21 Jan 1963, A. Quinonez (PA 26), 1 lpF (26-106) [UCLA]. Corozal, 19 Aug 1913, 6 Dec 1919, J. Zetek, 1M, 1F; 24 Jan 1925, D. Baker, 1F [USNM]. Culebra, Nov 1924, 19 Dec 1925, D. Baker, 1M, 5F; 1918, L. H. Dunn, 2M, 1F; 14 Jan 1923, 24 Nov 1924, J. B. Shropshire, 1M, 3F; 30 Dec 1920, thru C. S. Ludlow, 1M [USNM]. Empire, 29 Nov 1925, D. Baker, 1M, 1F; 6 Jan, 10 Dec 1923, J. B. Shropshire, 2M, 2F; 1918, L. H. Dunn, 1M [USNM]. Fort Clayton, 17 Jan 1925, D. Baker, 1F [USNM]; 5 Nov 1944, K. E. Frick, 1M [CAS]; 5 Mar, 13 Jan, 2M, 6F [USNM]. Fort Clayton (4km N), Chiva Chiva, 10 Nov 1965, A. Quinonez (PA 765), 1F, 1P, 1L; same data (PA 766), 1P [UCLA]. Fort Clayton, Chiva Chiva, 3.4 km N of Hwy C2 on Hwy C21, 12 Nov 1965, R. X. Schick, A. Quinonez (PA 776), 4 lpM (776-10, 11, 13, 20), 1 lp (776-14), 1L [UCLA]. Fort Davis, 10 Oct 1924, 18 Mar, 25 July 1925, D. Baker, 1M, 2F; 23 Dec, thru C. S. Ludlow, 1M, 2F; 23 Dec, 4M, 4F [USNM]; 12 Mar, 28 May 1951, 3F [UCLA]. Fort Randolph, 2F [USNM]. France Field, 20 Aug 1923, H. G. Dyar, R. C. Shannon, 1F; 18 Jan 1925, D. Baker, 1M, 1F [USNM]. Frijoles, Barro Colorado Island, 3 Dec 1965, A. Quinonez (PA 851), 1 lpM (851-10); same data (PA 853), 2 lpM (853-10, 12), 1F, 1P, 1L; same data except 4 Dec 1965 (PA 862), 1 lpM (862-15) [UCLA]. Gamboa, 22 Jan 1963, J. Labastid (CZ 4), 1 lpF (4-101); same data (CZ 5), 1 lpF (5-101); same data (CZ 6), 1 lpM (6-102), 2 lpF (6-103, 105), 3 pM (6-106, 115, 126), 1 pF (6-107), 1 P, 3L; same data (CZ 9), 1 lpF (9-101), 3L; same data (CZ 10), 1 pM (10-103), 1L; 24 Jan 1963, M. Keenan (CZ 11), 1 pF (11-102), 4L [UCLA]. Gamboa (15km NW), Frijoles, 1 Dec 1965, R. X. Schick, A. Quinonez (PA 843), 1 lpM (843-13), 1 lpF (843-12), 1 pM (843-100), 2 lp (843-10, 11); same data (PA 846), 1 lpM (846-10), 1 pM (846-101), 1 pF (846-100), 1M, 1P [UCLA]. Gamboa, Summit, 12 Jan 1943 (KO 23-9), 1M [UCLA]. Gatun, 11 Mar 1908, June 1909, A. H. Jennings, 2F; 10 Dec 1921-Sept 1924, J. B. Shropshire, 2M, 5F; 21 Aug 1913, J. Zetek, 1M; 20 Sept, 6 Dec 1924, D. Baker, 1M, 2F; 24 Oct 1921, 29 Oct, 7 Jan, 2M, 3F [USNM]. Gorgona, 7 Feb 1908, A. H. Jennings, 1M, 1L [USNM]. La Pita, 26 Jan 1922, J. B. Shropshire, 1M [USNM]. Las Cascadas, 2 Feb 1908, Bath, 1M [USNM]. Lion Hill, A. Busck, 2F [USNM]. Majagual, 20 Jan, 3 Feb 1923, J. B. Shropshire, 1M, 3F [USNM]. Margarita, 27 Jan 1923, J. B. Shropshire, 1F [USNM]. Miraflores, 10 Oct 1921, J. B. Shropshire, 1M, 3F [USNM]. Monte Lirio, 10 Dec 1921, J. B. Shropshire, 1F [USNM]. Nuevo Emperador (2km NE), Hwy K16 1.1km NW of Hwy K19, 23 Nov 1965, A. Quinonez (PA 831), 2 lpM (831-10, 11), 1 lpF (831-12), 1L; Nuevo Emperador (5km E), Hwy K10 3.5km NW of Hwy K15, 23 Nov 1965, A. Quinonez (PA 822), 1 lpF (822-10), 1 pM (822-100), 1P, 1L; Nuevo Emperador (5km NE), junction of Hwys K10 and K19, 23 Nov 1965, A. Quinonez (PA 828), 1 lpF (828-10); same data (PA 829), 1 pF (829-100); Nuevo Emperador (6km N), Hwy K16 2.7km N of Hwy K16A, 7 Dec 1965, A. Quinonez (PA 869), 1L; Nuevo Emperador (7km N), old Hwy K16 5.3km N of Hwy K16A, 7 Dec 1965, A. Quinonez (PA 874), 1 lpM (874-10) [UCLA]. Paraiso, 1916, 1918, L. H. Dunn, 1M, 1F; 6 Oct 1913, J. Zetek, 1F [USNM]. Paraiso (across Canal from), Hwy K15 between Hwys K2 and K6, 21 Nov 1965, A. Quinonez (PA 804), 1 lpF (804-10) [UCLA]. Paraiso (3km NW), Culebra, 13 Dec 1965, R. X. Schick (PA 899), 1 lpF (899-10); Paraiso (2km NW), Culebra, 13 Dec 1965, R. X. Schick, A. Quinonez (PA 900), 1 lpM (900-10), 1L [UCLA]. Porte Grande, 13, 27 Jan 1923, J. B.

Shropshire, 3M [USNM]. San Pablo, 12 Feb 1908, A. H. Jennings, 1F [USNM]. Santa Rosa, Orange Plantation, 17 Nov 1936, L. E. Rozeboom (PAR 37), 2M [UCLA]. Summit, Oct 1946, N. L.H. Krause, 1F [USNM]; 1 Nov 1939-17 Aug 1941, 4M [USNM]; 12 Jan 1943, W.H.W. Komp (KO 43), 2L [USNM]; 1 Oct-3 Nov 1939, 11M, 10F [UCLA]. Summit (across Canal from), Empire Firing Range, 18 Nov 1965, A. Quinonez, R. X. Schick (PA 796), 1L [UCLA]. Summit, Madden Forest Preserve, Las Cruces Trail, 17 Sept 1964, A. Quinonez (PA 708), 1 lpF (708-10), 1 pM (708-100); Summit, Madden Forest Preserve, Hwy C25 at Las Cruces Trail, 31 Oct 1965, J. N. Belkin, R. X. Schick, M. Moody (PA 735), 1M, 1P, 1L; Summit, Madden Forest Preserve, S of junction of Hwy C25 and Las Cruces Trail, 31 Oct 1965, J. N. Belkin, R. X. Schick, M. Moody (PA 736), 1 lpM (736-20), 1 pM (736-102); Summit, Madden Forest Preserve, Hwy C25 3.7km N of Hwy C2, 15 Nov 1965, R. X. Schick, A. Quinonez (PA 787), 2 lpM (787-10, 20), 2 lpF (787-22, 24), 2 pM (787-103, 105), 2 pF (787-102, 104), 2P, 18L; Summit, Madden Forest Preserve, S of Green Park, 16 Nov 1965, M. Moody, A. Quinonez (PA 794), 2 pM (794-100, 101), 8L [UCLA]. Tabernilla, 28 Apr 1907, A. Busck, 1F (*culicivora* holotype); 4 Feb, 12 Mar 1908, A. H. Jennings, 2M, 1F; A. Busck, 1M [USNM]. Toro Point, 22 July 1922, 12 Jan 1923, J. B. Shropshire, 2M, 2F [USNM], 1F [CU]. Locality unspecified, "Atlantic side," 1F [UCLA]. Locality unspecified, 1920, 1M; A. H. Jennings, 1M; 14 Feb 1924, 1M, 1F; 14 Feb 1924, thru C. S. Ludlow, 1M, 1F [USNM]; 1916, L. P. Dunn, 1F [CU]. **Chiriqui**: David, 19 July 1920, 1F [USNM]. The Falls, 11 Nov 1949, 5F [UCLA]. **Colon**: Colon, Cativa, 22 Nov 1965, R. X. Schick, A. Quinonez (PA 806), 1 lpF (806-10) [UCLA]. Palmas Bellas, Pina, 30 Nov 1963, A. Quinonez (PA 575), 2L; same data (PA 576), 3L [UCLA]. Portobelo, Mar 1941, A. Busck, 1F; 1 Sept 1923, H. G. Dyar, R. C. Shannon, 1F [USNM]; 4 Dec 1963, A. Quinonez (PA 580), 1 lpF (580-113); same data (PA 583), 1 pM (583-101), 1 pF (583-102); same data (PA 584), 1 lp (584-101); same data except 6 Dec 1963 (PA 593), 1 lpM (593-106), 1 pM (593-107), 1 pF (593-105) [UCLA]; same data except 8 Dec 1963 (PA 596), 2 lpF (596-106, 107), 2 pM (596-105, 109), 4 pF (596-101, 103, 104, 108), 2 lp (596-102, 112), 2M, 2F, 5P, 57L [UCLA], 2L [BM]; same data except 9 Dec 1963 (PA 599), 1 pF (599-107) [UCLA]. Portobelo, Isla Caldera, 5 Dec 1963, A. Quinonez (PA 587), 1 lpF (587-102), 1L [UCLA]. Salud, 6 Sept 1945, K. E. Frick, 3L [CAS]. **Darien**: El Real, Boca Yaviza, 9 Jan 1964, A. Quinonez (PA 619), 4 lpM (619-107, 109, 113, 115), 5 lpF (619-119, 122-125), 4 pM (619-112, 117, 118, 121), 4 pF (619-101, 104, 110, 120), 2 lp (619-122, 123), 33L [UCLA], 1 lpM (619-114) [BM]. El Real, Pirre, 14 Jan 1964, A. Quinonez (PA 623), 2 lpM (623-115, 116), 1 pM (623-103), 3 pF (623-106, 110, 113), 1 lp (623-114), 2F, 2P, 13L [UCLA], 1 pF (623-108) [BM]; same data except 15 Jan 1964 (PA 625), 1 pM (625-106), 1 lp (625-107), 1P, 13L; same data except 17 Jan 1964 (PA 628), 1 lpM (628-120), 2 lpF (628-103, 104), 2 pM (628-105, 108), 3 pF (628-109, 117, 119), 33L [UCLA]. La Palma (30km N), 0.8km from Santa Fe, 22 Nov 1966, O.G.W. Berlin (PA 946), 1 lpM (946-10), 2 lpF (946-11, 12), 1L; La Palma (30km N), near Santa Fe, 9 Dec 1966, O.G.W. Berlin (PA 993), 1 lpF (993-10); same data except 10 Dec 1966, O.G.W. Berlin, M. Mena (PA 996), 1 lpF (996-10) [UCLA]. Morte (4km NE), Morti Hydro, 3 Dec 1966, O.G.W. Berlin (PA 976), 1L [UCLA]. Pucro, Camino Tapalisa, 24 Feb 1964, A. Quinonez (PA 629), 2 lpM (629-106, 116), 2 lpF (629-107, 110), 4 pM (629-102-105), 7 pF (629-108, 111-115, 117), 1 lp (629-109), 1 P, 55L [UCLA]. Pucro, La Laguna, 10 July 1963, A. Quinonez (PA 449), 1L; same data (PA 451), 1 pF (451-108), 1L [UCLA]. Pucro, Rio Tacarcuna Valley, 14 June 1963, A. Quinonez (PA 384), 1 lpF (384-110), 3L; same data except 15 June 1963 (PA 392), 1 lpM (392-103); same data except 20 June 1963 (PA 405), 1 lp (405-101); same data except 22 June 1963 (PA 414), 1 pF (414-108); same data except 23 June 1963 (PA 416), 1F; same data except 8 July 1963 (PA 443), 1M [UCLA]. Pucro, Rio Tuira, 6 Mar 1958 (GG 78), 1 pM (78-103) [UCLA]. Pucro, Rio Tuira, mouth of Rio Paya, 27 Mar 1958 (GG 38), 1 lpF (38-105), 1 pM (38-103), 1 pF (38-104) [UCLA]. Pucro, Tacarcuna, 1 Sept 1958 (GG 111), 1 lpM (111-113), 2 lpF (111-103, 107), 1 pF (111-109) [UCLA]. Santa Fe, 13 Apr, 19 May, 17, 19 Aug 1967, 2M, 3F [GML]. Sasardi, 7 Aug 1967, 1M [GML]. Locality unspecified, 7 July 1958 (GG 108), 1 lpM (108-123), 1 lpF (108-122), 2 pM (108-104, 112) [UCLA]. **Panama**: Chame, Nueva Gorgona, Playa Gorgona, 22 Aug 1963, A. Quinonez (PA 532), 1F [UCLA]. Chepo, 16 Oct 1939, 1F [UCLA]. Chiva (14km N), Cerro Campana, 29 Aug 1963, A. Quinonez (PA 539), 1F [UCLA]. Chilibre, Juan Mina, 18 Jan 1963, A. Quinonez (PA 6), 4 lpM (6-101, 104, 105, 108), 4 lpF (6-102, 103, 106, 107), 1L; same data except 20 Jan 1963 (PA 17), 6 lpM (17-106, 117, 119-121, 125), 1 lpF (17-127), 1 pF (17-108), 1L; same data except 24

Jan 1963 (PA 41), 1 lpM (41-101), 1 pM (41-102), 10L [UCLA]. Huile (near, 3km N Nuevo Emperador), 4.8km NW junction Hwys K16 and K19, 23 Nov 1965, A. Quinonez (PA 835), 1 lpF (835-10), 1 pF (835-102), 1P, 1L [UCLA]. La Chorrera, 5 Nov 1944 (ASM 260-2), 1F [UCLA]. Pacora, 15 Dec 1944, 14, 20 Aug 1945, K. E. Frick, 9M, 8F, 2P, 15L [CAS]. Pacora, Station B, 5 Sept, 7 Nov 1950, 7F [UCLA]. Panama City, 13 Sept 1926, D. P. Curry, 1F [USNM]. Pedregal, near Tocumen, 19 Sept 1963, A. Quinonez (PA 556), 1 lpF (556-101) [UCLA]. Pequeni, Rio Pequeni, 9 May 1966, A. Quinonez (PA 941), 1 lp (941-10) [UCLA]. Pequeni (4km NE), Rio Pequeni, Estacion Hidro el Candelaria, 6 May 1966, A. Quinonez (PA 938), 2L [UCLA]. San Juan de Pequeni, D. P. Curry, 9M, 3F [USNM]. Tocumen, Cerro Azul, La Zumbadora, 7 Feb 1963, A. Quinonez (PA 66), 1 lM (66-103); same data except 8 Feb 1963 (PA 72), 1 lpF (72-101), 1L; same data except 8 Feb 1963 (PA 74), 1 lpM (74-101); same data except 10 Feb 1963 (PA 84), 1 pM (84-104), 1 lp (84-108); same data except 10 Feb 1963 (PA 85), 1 lpF (85-101); same data except 14 Feb 1963 (PA 92), 2L; same data except 15 Feb 1963 (PA 94), 1 pM (94-101); same data except 18 Feb 1963 (PA 112), 1L [UCLA]. **San Blas**: Rio Cuadi, 17 June, 6 Nov 1967, 1M, 1F [GML]. **Province Unknown**: Ahorea Lagarta, 31 Aug 1926, D. P. Curry, 1F [USNM]. **Locality Unspecified**: 28 Apr 1907, A. Busck, 1 lp [USNM]; 1 July 1937, L. E. Rozeboom (PAR 118), 1M; Hopkins, 1F; (Arnett 126-1), 1M, 1L [UCLA].

SURINAM. **Para**: Zanderij (5km N), Republiek, 5 Nov 1963, D. C. Geijskes (SUR 34), 1F [UCLA]. **Paramaribo**: Paramaribo, Charlesburg, 16 Feb 1940, D. C. Geijskes, 1F [SSM]. **Locality Unspecified**: J. Bonne-Wepster, 1F [USNM].

TRINIDAD AND TOBAGO. TOBAGO. **St. George**: Mason Hall, Caledonia, 17 Nov 1965, T. Aitken, R. Martinez, A. Guerra (TOB 48), 4F [UCLA]. Mason Hall, Trafalgar Estate, Easterfield, 2 ¾ milepost, 29 Nov 1965, R. Martinez, A. Guerra (TOB 137), 3F; same data except 29, 30 Nov 1965 (TOB 147), 1F [UCLA]. Roxborough, 23 Nov 1965, R. Martinez, A. Guerra (TOB 91), 1 lpM (91-12) [UCLA]. Roxborough, Roxborough-Bloody Bay Road, 10 milepost, 23 Nov 1965, R. Martinez, A. Guerra (TOB 97), 5F [UCLA]. TRINIDAD. **Nariva**: Mayaro, Bush Bush Forest, Nariva Swamp, 3 Nov 1964 (TR 806), 1 lpM (806-114), 1 pF (806-101) [UCLA]. Tabaquite, Charuma Forest, 27 Aug 1964, A. Guerra (TR 635), 1 lpM (635-105), 1 pF (635-102), 1L; same data except 8 Oct 1964 (TR 750), 1 lpM (750-105); same data except 8 Oct 1964 (TR 761), 1F [UCLA]. **St. Andrew**: Arima, Cumaca, 22 Oct 1964, A. Guerra (TR 784), 1F [UCLA]. Arima, Cumaca Road, 14 Jan 1965, A. Guerra (TR 943), 1F [UCLA]. Rio Claro, 20 Aug 1964, A. Guerra (TR 616), 1 lpM (616-104); same data (TR 617), 1 lpM (617-100) [UCLA]. Sangre Grande, Biche, 9 July 1964, F. Powdhar (TR 556), 1 lpM (556-122) [UCLA]. Sangre Grande, Cumaca, 3 Sept 1964, A. Guerra (TR 650), 2 pM (650-110, 113) [UCLA]. Sangre Grande, Cumaca Road, Pamponette Trace Junction, 20 May 1965, A. Guerra (TR 1170), 1F [UCLA]. Sangre Grande, Mt. Harris, 16 July 1964, F. Powdhar (TR 573), 1F [UCLA]. Sangre Grande, Nestor Village, 12 June 1964, A. Guerra (TR 484), 3F [UCLA]. Sangre Grande, Nestor, 6¾ milepost, 24 June 1965, F. Powdhar (TR 1232), 1F [UCLA]. Sangre Grande, Turure Forest, Oct 1966, F. Guerra (TR 1618), 1F; same data except Nov 1966 (TR 1619), 1F [UCLA]. Sangre Grande, Valencia Old Road at 4.5 milepost, 24 Sept 1964, A. Guerra, 1F [UCLA]. Sangre Grande, Valencia Old Road, 1 Oct 1964, A. Guerra (TR 744), 1F [UCLA]. **St. David**: Toco, Matelot, 12 Mar 1964, A. Guerra (TR 182), 1 lpM (182-125) [UCLA]. Toco, Tompire Southbank Road, 27 Feb 1964, A. Guerra (TR 114), 1F [UCLA]. **St. George**: Arima, Andrews Estate, 25 Mar 1965, A. Guerra (TR 1060), 1L [UCLA]. Arima, Arena Forest, 13 Aug 1965, A. Guerra (TR 1326), 1 lpM (1326-20); same data except 20 Aug 1965 (TR 1355), 1M [UCLA]. Arima, Aripo Valley, 19 Mar 1964, A. Guerra, 3F [UCLA]. Arima, Calvary Hill, 30 Aug 1965, A. Guerra (TR 1379), 1F [UCLA]. Arima, Las Hermanas Estate, 18 Aug 1965, A. Guerra (TR 1336), 1 pF (1336-100), 1L [UCLA]. Arima, Mt. Becke, 29 Apr 1965, A. Guerra (TR 1132), 1F [UCLA]. Arima, Verdant Vale, 10 Sept 1964, A. Guerra (TR 686), 1F; same data except 12 Nov 1964 (TR 831), 2F [UCLA]. St. Augustine, 20 Feb 1925, C. L. Withycombe, 1F [BM]. **County Unknown**: Tuencha, 25 May 1926, C. L. Withycombe, 1F [BM]. Forest Reserve, 5 Dec 1965, T.H.G. Aitken (TR 1430), 1L [UCLA].

VENEZUELA. **Aragua**: Choroni (1.0km N), 16 July 1969, T. J. Zavortink (VZ 219), 2 lpF (219-14, 16), 1 pF (219-102), 3L [UCLA]. Guamitas, 12 Aug 1927, M. Nunez Tovar, 1M [USNM]. Maracay, M. Nunez Tovar, 1F [USNM]. Maracay, Guamitas, road to picnic area, 15 July 1969, T. J. Zavortink, J. A. Bergland (VZ 199), 1 lpM (199-11), 1 lpF (199-10) [UCLA]. **Carabobo**: Cara-

bobo, 30 July 1927, M. Nunez Tovar, 1M [USNM]. Puerto Caballo, Borburata, 24 July 1969, J. Pulido, J. Valencia (VZ 263), 1 lpF (263-17), 1 pF (263-101) [UCLA]. **Monagas**: Caripito, 13 Mar, 2 June 1942, 2F [AMNH]. **Sucre**: Guanoco, Green House Bay, 1 Jan 1929, E. de Verteuil, W. Cook, F. W. Urich, 1F [USNM]. **Zulia**: Colon Dist., 18 Dec 1933, P. Anduze, 1F; May 1934, 1F [CU]. La Rivera, July 1934, P. Anduze, 1F [CU]. **Locality Unspecified**: 10 Feb 1973, CDC (VZ 420), 2F [UCLA]; P. Anduze, 1M; No. 2345, 1M [USNM].

NO DATA. D. P. Curry, 2M, 2F; No. 1447, 1M; 2M, 1L [USNM]; No. 168, 1P, 1M [CU].

2. Johnbelkinia longipes (Fabricius)

Figs. 2, 8-10

1805. *Culex longipes* Fabricius 1805:34. *TYPE: *Holotype* male, America meridionali, Smidt [J. C. Schmidt] [ZMC; type locality restricted to Cayenne [Guyane], French Guiana, by Belkin, Schick and Heinemann 1965:41-42]. NEW COMBINATION.

1919. *Lesticocampa trichopus* Dyar 1919: 10-11. *TYPE: *Holotype* female, Teffé [Tefe], Amazonas, Brazil, June 1906, A. Ducke [USNM, 21996]. Considered as doubtfully distinct from *longipes* by Dyar (1928:97); synonymized with *longipes* by Lima (1931:66-67).

1942. *Trichoprosopon (Hyloconops) edwardsianus* Lane and Cerqueira 1942:528. TYPE: *Holotype* female, Belterra, Santarem, Pará, Brazil, Sept 1938 [IOC]. NEW SYNONYMY.

Trichoprosopon (Runchomyia) longipes of Stone, Knight and Starcke (1959:76-77, in part); Fauran (1961:14-15, in part); Forattini (1965:169, 170, 172, 173, 174-175, 176, 217, 291, in part); Belkin, Schick and Heinemann (1965:41-42); Cova Garcia, Sutil and Rausseo (1966a:66, 68, in part; 1966b:67, 131, 384-385, in part); Belkin (1968:36, 46, 58); Knight and Stone (1977: 314, in part).

Trichoprosopon (Rhunchomyia) longipes of Lane (1953:855-857, in part).

Trichoprosopon (Rhynchomyia) longipes of Floch (1956:35, 221, in part).

Trichoprosopon (Hyloconops) longipes of Lane and Cerqueira (1942:525, in part).

Goeldia (Goeldia) longipes of Edwards (1932:72, in part); Senevet and Abonnenc (1939:248-250); Lane (1939:162-163, in part); Floch and Abonnenc (1947:2-3, in part).

Goeldia longipes of Bonne-Wepster and Bonne (1923:124, in part); Bonne and Bonne-Wepster (1925:144-146, in part); Dyar (1928:96-97, in part); Lima (1931:66-67, in part); Komp (1936: 60, in part); Antunes (1937a:72-73, in part); Patino Camargo (1937:242, in part); Boshell-Manrique (1938:415, in part); Floch and Abonnenc (1942b:2-3, in part); Floch (1955:315, in part).

Culex longipes of Wiedemann (1828:7, 546); Macquart (1838:34-35, in part); Zimsen (1964:451).

Culex longipede of Macquart (1834:36).

Sabethes longipes of Robineau-Desvoidy (1827:412); Lynch Arribalzaga (1891:167-168, in part); Hunter (1900:281, in part).

Trichoprosopon (Runchomyia) edwardsianum of Stone, Knight and Starcke (1959:76); Cova Garcia, Sutil and Rausseo (1966a:67, 68; 1966b:131, 384); Belkin, Schick and Heinemann (1971: 9, 36, 47, 53); Knight and Stone (1977:313).

Trichoprosopon (Rhunchomyia) edwardsianum of Cerqueira (1961a:459-464).

Trichoprosopon (Rhunchomyia) edwardsianus of Lane (1953:860); Barreto-Reyes (1955:81); Cerqueira (1961b:154); Xavier and Mattos (1970:452; 1975:255; 1976:402).

Trichoprosopon (Hyloconops) edwardsianus of Lane (1945:133).

Trichoprosopon edwardsianum of Forattini, Rabello and Cotrim (1970:78).

Trichoprosopon edwardsianus of Maia (1963:91).

Goeldia edwardsianus of Horsfall (1955:319).

Trichoprosopon (Runchomyia) trichopus of Belkin, Schick and Heinemann (1971:9, 34, 50, 51).

Goeldia trichopus of Bonne-Wepster and Bonne (1921:18); Dyar (1921:27); Bonne-Wepster and Bonne (1922:38); Dyar (1923a:81); Bonne and Bonne-Wepster (1923:124, in part); Dyar and Shannon (1924:483); Bonne and Bonne-Wepster (1925:141-143, in part); Dyar (1928:97); Martini (1931:201), Evans and Walker (1935:465-466); Lane (1936:7); Antunes (1937b:72); Anduze (1941:9).

Goeldia aff. *trichopus* of Townsend (1934:492).
Lesticocampa trichopus of Stone and Knight (1957:119).
?Trichoprosopon (Runchomyia) longipes of Martinez and Prosen (1953:31); Morales-Ayala (1971: 139).
?Goeldia longipes of Bonne (1923:129).
?Trichoprosopon (R.) edwardsianus of Suarez (1963:239).
?Trichoprosopon (Hyloconops) trichopus of Anduze, Pifano and Vogelsang (1947:12).
?Goeldia (Goeldia) trichopus of Chagas, da Cunha *et al.* (1938:198, 202); Floch and Abonnenc (1947:3).
?Goeldia trichopus of Kumm and Novis (1938:503, 512); Floch and Abonnenc (1942a:3; 1942b:3).
?Trichoprosopon (Runchomyia) leucopus of Fauran (1961:14); Stone (1961:33); Morales-Ayala (1971:139); Kruijf (1972:50).
?Trichoprosopon (Rhunchomyia) leucopus of Xavier and Mattos (1975:256).
?Goeldia (Goeldia) leucopus of Floch and Abonnenc (1947:3).
?Goeldia leucopus of Floch and Abonnenc (1942a:3; 1942b:3).

FEMALE. Wing: 4.60mm. Proboscis: 4.20mm. Femur I: 3.30mm. Abdomen: about 4.4mm. **Thorax**: Scutal scales usually dull brown or weakly iridescent copper, bronze, gold, green, blue or purple. Postnotum usually without scales. Pleural integument usually slightly to moderately darkened on *ssp* and *stp,* sometimes strongly darkened. **Legs**: Leg III with conspicuous outstanding scales on apical part of tibia and on tarsus 1-3 or 4-III, these most conspicuous on tarsus 2-III. Tarsus 2-II with yellowish-cream to white scales in streak in apical 0.1-0.8 of anterior and dorsal surfaces, or in complete band in apical 0.1-0.8, or completely covering segment; 3,4-II completely yellowish-cream to white scaled; 5-II with yellowish-cream to white scales restricted to streak at base of anterior and dorsal surfaces or completely covering segment. Tarsus 3-III dark scaled or white scaled on apical 0.1-0.6; 4,5-III completely white scaled. **Wing**: Upper calypter with short row of setae basally. **Abdomen**: Sternites II-VII usually with dark scales in median line from base to apex or in median apical patch.

MALE (fig. 8). Essentially as in female except for sexual characters. **Head**: Flagellum moderately plumose, middle segments with about 24 bristles. **Legs**: Anterior claw I enlarged, with distinct, long submedian tooth; anterior claw II not enlarged, simple.

MALE GENITALIA (figs. 8, 10). **Segment IX**: Tergite lobe much longer than wide. Setae of lobe 4 or 5 (3-5), strongly to very strongly developed, somewhat flattened apically, with short filamentous apical prolongation. Sternite U-shaped. **Sidepiece**: Slender to stout. Densest region of basal tergal setae proximad of level of apex of basal mesal lobe. Basal sternomesal setae 2-4, moderately long, curved or angularly bent at apex; strongly developed medial sternomesal setae 2-4. **Basal Mesal Lobe**: Body conical, with long narrow dorsal strip; setae directed dorsad, very strongly curled at apex. **Clasper**: Long; constricted basally; slightly to conspicuously swollen apically; with several fine setae apically. Spiniform bent at apex; slender. **Phallosome**: Aedeagus moderately pigmented; distal lateral margin usually not concave in dorsal aspect; distal end of submedian tergal arm angled or curved toward mate; apical tergal arm with patch of 4-11 small, strongly sclerotized, dorsal preapical teeth and serrulate or striate, laterally curved, sclerotized apical process. **Proctiger**: Paraproct with 4-7 (3-7) moderately large, dorsally curved, apical teeth and with crenulate, moderately sclerotized lamella mesad of apical teeth that may project distad beyond more ventral teeth. Cercal sclerite absent or present, elongate.

PUPA (fig. 8). Abdomen: 4.4mm. Trumpet: 0.51mm. Paddle: 0.68mm. **Cephalothorax**: Very weakly pigmented. **Trumpet**: Very weakly to weakly pigmented, sometimes becoming slightly darker distad. **Abdomen**: Predominantly very weakly pigmented; sternites II-IV (II-VII) with median part of anterior margin moderately pigmented, conspicuously darker than remainder of ventral surface. **Terminal Segments**: Male genital lobe large, its width usually greater than 0.50 (0.47-0.60) of segment VIII. **Paddle**: Very weakly pigmented. Index usually 1.26-1.59 (1.21-1.63).

LARVA (fig. 9). Head: 1.18mm. Siphon: 1.21mm. Anal Saddle: 0.23mm. **Head**: Very weakly pigmented, collar darker. Mental plate with 11,12 (10-14) teeth on each side of median tooth. **Antenna**: Without spicules or with very few small spicules medially. **Abdomen**: Seta 6-I usually 11-14b (7-14); seta 6-II usually 10-14 b (8-16); seta 6-III usually 9-12b (8-14). **Segment VIII**: Comb scales usually 33-54 (9-65); most comb scales of patch usually with moderately large apical spine. **Siphon**: Very weakly pigmented, becoming darker distad. Moderately to strongly curved dorsad distally. Seta 1-S inserted 0.51-0.67 distance from base of siphon. Accessory midventral setae (1a-S) usually 30-36 (25-37). **Anal Segment**: Saddle very weakly pigmented, indistinct. Seta 3-X usually 6-9b (5-10). Seta 4-X strongly developed, usually 10-15b (6-17), with alveolar plate.

SYSTEMATICS. The **adult** of *Johnbelkinia longipes* differs from *ulopus* and *leucopus* by: (1) more strongly plumose flagellum of male, (2) distinct tooth on anterior claw I and small anterior claw II of male, (3) usually extensive dark scaled areas on sternites and (4) more extensive distribution of outstanding scales on leg III, these being present on apical part of tibia and all of tarsus 1-III. The adult differs additionally from *leucopus* by: (1) lighter integument on *mep* and meron and (2) entirely white scaled tarsus 4-III. It differs additionally from *ulopus* by: (1) presence of setae on upper calypter of wing and (2) duller brown scales on scutum. The **male genitalia** differ from *ulopus* and *leucopus* by: (1) long tergite IX lobe, (2) shape of clasper, which is constricted basally and swollen apically and (3) presence of small but strongly sclerotized teeth and sclerotized apical process on apical tergal arm of aedeagus. The **pupa** differs from *ulopus* by: (1) darkened integument on median anterior part of sternites II-IV and (2) larger male genital lobe, which is usually broader than 0.50 width of segment VIII. The **larva** differs from *ulopus* by: (1) seta 4-X usually 10-15b (6-17) and with alveolar plate, (2) seta 6-I 11-14b (7-14) and (3) moderately large apical spine of comb scales.

There is variation in tarsus III markings, color of the pleural integument and male genital structure in this species. Specimens from the Guianas and Colombia have tarsus 3-III entirely dark scaled or light scaled in the apical 0.1 only. Most specimens from Para, Brazil, have tarsus 3-III light scaled in the apical 0.2-0.4, but one from Santarem has it dark scaled. Most specimens from Ecuador, Peru and Bolivia have this segment white scaled in the apical 0.3-0.6, but again one specimen from Ecuador has it dark scaled. Two males from the Rio Madeira drainage of Brazil and Bolivia have the integument of *ssp* and *stp* much more strongly darkened than any other specimens I have seen. These same males exhibit some unusual variations in the male genitalia, for the sidepiece is slender, the clasper less curved and less swollen apically, the aedeagus has fewer preapical teeth but a more distinctly serrulate apical process, the cercal sclerite is present and the apical lamella of the paraproct does not extend beyond the ventral paraproct teeth. It is quite possible these two males represent another species, but since this is not absolutely clear at this time, I prefer to include them in *longipes* until more material is available.

Much of the Amazon basin was flooded or very arid at various times in the Pleisto-

cene, and populations of *longipes* that exist there now must have invaded the area from forest refugia in mountains surrounding the basin only relatively recently. In fact, all the variants known in *longipes* probably differentiated in separate refugia in times past when the tropical rain forest was not continuous.

I have studied two slide mounted third instar larvae of *longipes,* and these resemble *ulopus* closely.

BIONOMICS. The larvae of *longipes* have been reported in the literature as occurring in the leaf axils of *Mauritia* sp. (Palmae) by Cerqueira (1961a: 459-464, as *edwardsianum*) and *Musa bihai* [=*Heliconia bihai,* Strelitziaceae] by Senevet and Abonnenc (1939:248-250). Immatures collected for the project "Mosquitoes of Middle America" in the Guianas were found in the leaf axils of *Heliconia* sp. and *Phenakospermum guianense* (Strelitziaceae) and once in the flower bracts of *Heliconia* sp. The immatures were collected from leaf axils of banana (Musaceae) in Brazil by John F. Reinert.

On two separate occasions males of *longipes* were observed flying backwards and forwards about three feet above the ground in a patch of heliconias in Brazil by Evans and Walker (1935:465-466, as *trichopus*). Adults have been collected in resting traps and malaise traps in the forest and females have been collected biting humans.

Numerous papers reporting observations on *longipes* or *trichopus* in South America probably refer at least in part to *ulopus,* and they are summarized under that species.

DISTRIBUTION. *Johnbelkinia longipes* is apparently restricted to the portion of the northern half of South America that drains into the Atlantic Ocean. In the eastern part of the continent, I have seen specimens from the state of Monagas, Venezuela, in the north to the state of Para, Brazil, in the south. In the western part, I have seen specimens from the department of Meta, Colombia, in the north to the department of Beni, Bolivia, in the south. Cerqueira (1961b:154) records this species (as *edwardsianus*) in the south from the state of Mato Grosso, Brazil. Every specimen of *Johnbelkinia* from Trinidad that I have examined is *ulopus.* However, since *longipes* in known from directly across the Gulf of Paria in Venezuela, it may occur also in Trinidad. Material examined: 281 specimens; 25 males, 166 females, 49 larvae, 41 pupae; 38 individual rearings (29 larval, 6 pupal, 3 incomplete).

BOLIVIA. **Beni**: Guajaramerim, Vaca Diez, Mar 1939, 1F [USNM]. **Locality unspecified**: May 1943, H. P. Carr, 1M [USNM].

BRAZIL. **Amazonas**: Humaita, Nov 1937, 1F [BM]. Manaus, W. M. Mann, Baker, 1F [USNM]. Tefé, June 1906, A. Ducke, 1F (*trichopus* holotype) [USNM]. **Para**: Altamira (160km W), 6 Nov 1974, J. F. Reinert (81-A), 1L [MEP]. Belterra, Santarem, Sept 1938, 1F [USNM]. Boa Vista, Tapajos, C.H.T. Townsend, 29 Sept 1932, 1M [USNM]. Cameta, Jan 1936, 1F [USNM]. Curralinho, H. W. Kumm, 1F [BM]. Curralinho, Rio Itauca, 1F [USNM]. Jatobal, Bacuri, 28 Oct 1974, J. F. Reinert (63), 1F [MEP]. Marituba, Sta. Isabel, Feb 1938, 1F [USNM]. **Rondonia**: Guajara Mirim, Rio Madeira, May 1931, R. C. Shannon, 1M [USNM].

COLOMBIA. **Meta**: ?Chipadera, Nov 1936 (COR 107), 2F; 12 Nov 1936 (COR 109), 1F [UCLA]. ?Maragal, 14 Nov 1936 (COR 113), 1F [UCLA]. Restrepo, 1935 (KO 30-7), 1F; 3 Sept 1935 (KO 4-16), 1F; 10 July 1935 (KO 30-36), 1F [UCLA]. Restrepo, Vega Grande, 27 Dec 1936 (COR 74, 75), 3F [UCLA]. Villavicencio, Bosque Ocoa, 6 June 1944 (COK 42), 1F; 14 June 1944 (COK 44), 11F; 20 June 1944 (COK 47), 5F [UCLA]. Villavicencio, Palmichal, 1936 (COR 91), 1F; 9 Nov 1936 (COR 98), 1F [UCLA]. Locality unspecified, 12 Nov 1936 (COR 108), 1F; 19 Nov 1936 (COR 115), 2F; Nov 1936 (COR 123, 125), 8 F; 20 Oct 1936 (COR 128), 1F; 21 Oct 1936 (COR 130), 10F; 23 Oct 1936 (COR 132, 133), 2F; 8 Nov 1936 (COR 136), 6F; 9 Nov 1936 (COR 138), 1F; 10 Nov 1936 (COR 140), 1F; 27 Nov 1936 (COR 161), 6F; 22 Dec 1936 (COR 175, 176), 4F [UCLA].

ECUADOR. **Napo:** Coca and Napo Rivers, 23 Apr-12 May 1965, L. E. Pena (ECU 8), 1M, 4F [UCLA]. Napo, Pompeya Island, Napo River, 19-26 May 1965, L. E. Pena (ECU 19), 1F [UCLA].

FRENCH GUIANA. **Guyane:** Cayenne, Smidt, 1M (*longipes* holotype) [ZMC]. Cayenne, Apr 1943, 2F [UCLA]. Cayenne, foret de Cabassou, 14 Nov 1967, J. Clastrier (FGC 3278), 1F; 12 July 1968, J. Clastrier (FGC 3911), 1F; 8 Sept 1968, J. Clastrier (FGC 3636), 1 lpF (3636-40); same data (FGC 3639), 3L; same data (FGC 3640), 1L [UCLA]. Cayenne, foret de la Chaumiere, 7 Aug 1968, J. Clastrier (FGC 3580), 1L; same data (FGC 3581), 1 lpF (3581-31); same data (FGC 3592), 1 lpM (3592-32) [UCLA]. Cayenne (near), Ile de Cayenne (FGA 154), 1F [UCLA]. Cayenne (24km SW), Le Gallion, 1 Feb 1965, T.H.G. Aitken, R. Martinez, A. Guerra (FG 20), 2 lpF (20-20, 21); same data except 2 Feb 1965 (FG 30), 1 lpM (30-10), 1 lpF (30-13), 1 lp (30-11) [UCLA]. Cayenne, Roura, 13 Sept 1968, J. Clastrier (FGC 3648), 1L; same data (FGC 3652), 1 lpM (3652-44); same data (FGC 3653), 1 pM (3653-40); same data (FGC 3656), 1 lpF (3656-31) [UCLA]. Couachi, Mana (10km E), 15 Mar 1969, J. Clastrier (FGC 4021), 1L; same data (FGC 4023), 1L [UCLA]. Le Gallion (3km W), Pont des Cascades, 16 Mar 1967, R. X. Schick, J. Frederick (FG 151), 1 lpM (151-10), 1 lpF (151-30); same data (FG 152), 1 lpM (152-10), 1L [UCLA]. Matoury, 2F [UCLA]. Matoury, Camp Rochambeau (E edge), 19 July 1968, J. Clastrier (FGC 3538), 1 pF (3538-30); same data (FGC 3540), 1 pM (3540-12); same data (FGC 3543), 1 lpF (3543-34); same data (FGC 3544), 1 lpF (3544-30); same data (FGC 3545), 1L; same data (FGC 3553), 1 lpM (3553-30) [UCLA]. Matoury, foret de Cogneau, 28 May 1968, J. Clastrier (FGC 3459), 1 pF (3459-10); 25 Sept 1968, J. Clastrier (FGC 3663), 1 pF (3663-41); same data (FGC 3665), 1M; same data (FGC 3666), 1L [UCLA]. Matoury, Matoury A, 10 July 1968, J. Clastrier (FGC 3503), 1L [UCLA]. Matoury, Matoury C, 20 Nov 1968, J. Clastrier (FGC 3802), 1 lpF (3802-54); same data (FGC 3803), 1 lpF (3803-26) [UCLA]. Montjoly, Cabassou, Ile de Cayenne, 2 July 1952 (FGA 191), 1F [UCLA]. Montjoly, Raban, Ile de Cayenne, base of Montagne Tigre (FGA 43), 1 pF (43-10), 1L [UCLA]. Montsinery, Tonegrande, 6 Sept 1968, J. Clastrier (FGC 3628), 1 lpM (3628-43) [UCLA]. Remire (SW), Chemin Vidal, 14 Mar 1967, R. X. Schick (FG 129), 2 lpM (129-10, 11); same data (FG 131), 1 lpF (131-10) [UCLA]. Rochambeau, 1F [UCLA].

GUYANA. **Demerara:** Madewiri Creek, Mar 1941, 1F [UCLA].

PERU. **Huanuco:** Tingo Maria, 21 Oct 1946, J. C. Pallister, 1F [AMNH]; date unspecified, E. J. Hambleton, 3M, 1F [USNM]. **Loreto:** Chimbote, Amazon, Mar 1931, R. C. Shannon, 1F [USNM]. Iquitos, Mar-Apr 1931, R. C. Shannon, 45F, 1 lp, 1p, 2L [USNM]. Pachitea Mund, 6 Nov 1903, 1F [BM].

SURINAM. **Para:** Onverwacht (5km S), Wegnaar Overtoon, 7 Apr 1967, R. X. Schick, H.A.M. de Kruijf (SUR 228), 1L; same data (SUR 229), 1 lp (229-10) [UCLA]. Zanderij (2km N), 13 Apr 1967, R. X. Schick, H.A.M. de Kruijf (SUR 242), 2 lpM (242-10, 11); same data (SUR 242A), 1P; same data (SUR 243), 1P; same data (SUR 245), 1 lpM (245-11), 1 lpF (245-10); same data (SUR 246), 2 lpM (246-10, 12), 1 lpF (246-11); same data (SUR 247), 1 lpF (247-10) [UCLA]. **Locality unspecified:** 25 Sept 1946, D. C. Geijskes, 1F [SSM].

VENEZUELA. **Monagas:** Caripito, 10 Mar 1942, 1F [AMNH].

3. Johnbelkinia leucopus (Dyar & Knab)

Figs. 2, 10

1906. *Lesticocampa leucopus* Dyar and Knab 1906:137. *TYPE: *Lectotype* female, Bluefields [Zelaya], Nicaragua, W. F. Thornton [USNM, 10003; designation by Stone and Knight 1957:118]. NEW COMBINATION.

Trichoprosopon (Runchomyia) leucopus of Stone, Knight and Starcke (1959:76, in part); Belkin, Schick and Heinemann (1965:42); Cova Garcia, Sutil and Rausseo (1966a:67, 68, in part); Knight and Stone (1977:314, in part).

Trichoprosopon (Rhunchomyia) leucopus of Lane (1953:857-858, in part).

Trichoprosopon (Hyloconops) leucopus of Lane and Cerqueira (1942:526).

Trichoprosopon leucopus of Arnett (1949:245).

Goeldia (Goeldia) leucopus of Dyar (1923a:86, in part; 1923b:174); Edwards (1932:72); Lane (1939:161).

Goeldia leucopus of Bonne-Wepster and Bonne (1921:17; 1922:38); Dyar and Shannon (1924: 483); Bonne and Bonne-Wepster (1925:152, in part); Dyar (1925:129, in part; 1928:97-98, in part); Lane (1936:7); Antunes (1937b:72); Kumm, Komp and Ruiz (1940:397); Horsfall (1955: 319).

Lesticocampa leucopus of Busck (1908:76); Theobald (1910:622); Howard, Dyar and Knab (1915: 170-172, in part); Stone and Knight (1957:118).

?Trichoprosopon (Rhunchomyia) leucopus of Trapido and Galindo (1957:122, 124, 125, 128, 131, 134, 135, 138).

?Trichoprosopon leucopus of Galindo and Trapido (1957:146).

FEMALE. Wing: 4.60mm. Proboscis: 4.04mm. Femur I: 3.47mm. Abdomen: about 3.7mm. **Thorax**: Scutal scales usually dull brown or weakly iridescent copper, bronze, gold, green, blue or purple. Postnotum often with dark iridescent scales. Pleural integument strongly darkened on *ssp, psp, stp, mep* and meron. **Legs**: Leg III without outstanding scales. Tarsus II with streak of light scales on anterior surface of apical segments, streak varying from inconspicuous, with creamy-tanish scales from apical part of 3-II to base of 5-II, to conspicuous, with white scales from apex of 2-II to apex of 5-II. Tarsus III with white scales on apical 0.1-0.4 of 4-III and all of 5-III. **Wing**: Upper calypter with short row of setae basally. **Abdomen**: Sternites II-VII entirely light scaled.

MALE (fig. 10). Essentially as in female except for sexual characters. **Head**: Flagellum sparsely plumose, the middle segments with about 16 bristles. **Legs**: Anterior claw I enlarged, with submedian crestlike swelling; anterior claw II enlarged, simple.

MALE GENITALIA (fig. 10). **Segment IX**: Tergite lobe about as long as wide. Setae of lobe 6 or 7, moderately to strongly developed, flattened apically, with long filamentous apical prolongation. Sternite V-shaped. **Sidepiece**: Stout. Densest region of basal tergal setae proximad of level of apex of basal mesal lobe. Basal sternomesal setae 4, moderately long, angularly bent at apex; strongly deveolped medial sternomesal setae absent. **Basal Mesal Lobe**: Body conical, with long narrow dorsal strip; setae directed dorsad, very strongly curled at apex. **Clasper**: Moderately long; without basal constriction; uniformly slender beyond base; without setae. Spiniform straight, slender. **Phallosome**: Aedeagus weakly pigmented; distal lateral margin not concave in dorsal aspect; distal end of submedian tergal arm nearly parallel with mate; apical tergal arm without dorsal preapical teeth or sclerotized apical process. **Proctiger**: Paraproct with 4 moderately large, dorsally curved apical teeth and with moderately sclerotized crenulate apical lamella mesad of apical teeth that does not project beyond teeth. Cercal sclerite present, elongate.

PUPA, LARVA. Unknown.

SYSTEMATICS. *Johnbelkinia leucopus* combines characteristics of *ulopus* and *longipes*. From the apparently more closely related but allopatric *longipes* it differs by the following characters: in the **adult** most conspicuously by: (1) presence of dark scales in basal 0.6-0.9 of tarsus 4-III, (2) absence of outstanding scales on leg III, (3) strongly darkened integument on *mep* and meron, (4) crestlike submedian swelling on anterior claw I and enlarged anterior claw II of male and (5) light scaled sternites; and in the **male genitalia** by: (1) shorter tergite IX lobe, (2) shape of clasper, which is without a basal constriction and is uniformly slender beyond base, (3) absence of dorsal preapical teeth or sclerotized apical process on apical tergal arm of aedeagus and (4) absence of strongly developed medial sternomesal setae. From *ulopus*, with which it is sympartic, *leucopus* is distinguished as follows: in the **adult** by: (1) pres-

ence of setae on upper calypter of wing and (2) duller brown scutal scales; and in the **male genitalia** by: (1) shape of basal mesal lobe, which has a conical body and a long narrow dorsal strip, (2) dorsally directed, strongly curled setae of basal mesal lobe, (3) location of dense patch of basal tergal setae proximad of level of apex of basal mesal lobe and (4) stouter sidepiece.

Osterhout collected two females and one male of *Johnbelkinia* in Bocas del Toro, Panama, in 1903. All three specimens were determined as *leucopus* by Dyar and Knab, and the genitalia of the male were illustrated repeatedly (Howard, Dyar and Knab 1913:fig. 47; Dyar 1928:fig. 66; Lane 1953:fig. 849; Cova Garcia, Sutil and Rausseo 1966a:fig. 124). However, only one of the females is actually *leucopus*; the other one and the male are *ulopus*.

I have not noted any significant variations in the few specimens available for study.

BIONOMICS. Very little is known about this species. Kumm, Komp and Ruiz (1940:397) reported taking adults in daytime captures in the forest in Costa Rica. The single male collected for the "Mosquitoes of Middle America" project was taken resting in the forest between 0700 and 1230 hours on 17 April 1963; the two females collected for the project were attracted to man in a forest between 1100 and 1400 hours on 21 April 1963 at a height of 12m above the ground.

The reports of captures of *leucopus* at human bait in the Caribbean versant of Nicaragua and western Panama by Galindo and Trapido (1957:146) and Trapido and Galindo (1957:122, 124, 125, 128, 131, 134, 135, 138) refer in part or whole to *ulopus* and are summarized under that species.

DISTRIBUTION. *Johnbelkinia leucopus* is apparently a rare, relictual species restricted to the Caribbean Coast of Central America from central Nicaragua to western Panama and the Pacific Coast of Central America in southern Costa Rica. Most reports of this species in Central America actually pertain to *ulopus*; I do not know upon what species most reports from South America are based. Material examined: 16 specimens; 1 male, 15 females.

COSTA RICA. **Limon**: Liverpool, H. W. Kumm, 2F [BM]; 1F [USNM]. **Puntarenas**: San Vito (6km S), 19-30 Apr 1967, D. F. Veirs, 4F [UCLA].

NICARAGUA. **Zelaya**: Bluefields, W. F. Thornton, 4F (including holotype) [USNM]. Rio Curinguas (60mi up), 27 Nov 1941, 1F [UCLA].

PANAMA. **Bocas del Toro**: Chiriqui Grande, Mata de Cacao, 17 Apr 1963, A. Quinonez (PA 220), 1M [UCLA]. Punta de Pena, Chiriquicito, 21 Apr 1963, A. Quinonez (PA 247), 2F [UCLA]. Locality unspecified, 25 Sept 1903, P. Osterhout, 1F [USNM].

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FIGURES

1. Distribution of *Johnbelkinia ulopus*
2. Distribution of *Johnbelkinia leucopus* and *J. longipes*
3. *Johnbelkinia ulopus*; male and female heads and claws; male tarsus 5-I; female thorax, wing, legs, genitalia
4. *Johnbelkinia ulopus*; male genitalia, pupa
5. *Johnbelkinia ulopus*; fourth instar larva
6. *Johnbelkinia ulopus*; third instar larva
7. *Johnbelkinia ulopus*; male genitalia; second instar larval head, siphon
8. *Johnbelkinia longipes*; male genitalia, male claws, pupa
9. *Johnbelkinia longipes*; fourth instar larva
10. *Johnbelkinia longipes*; male genitalia
    Johnbelkinia leucopus; male genitalia, male claws

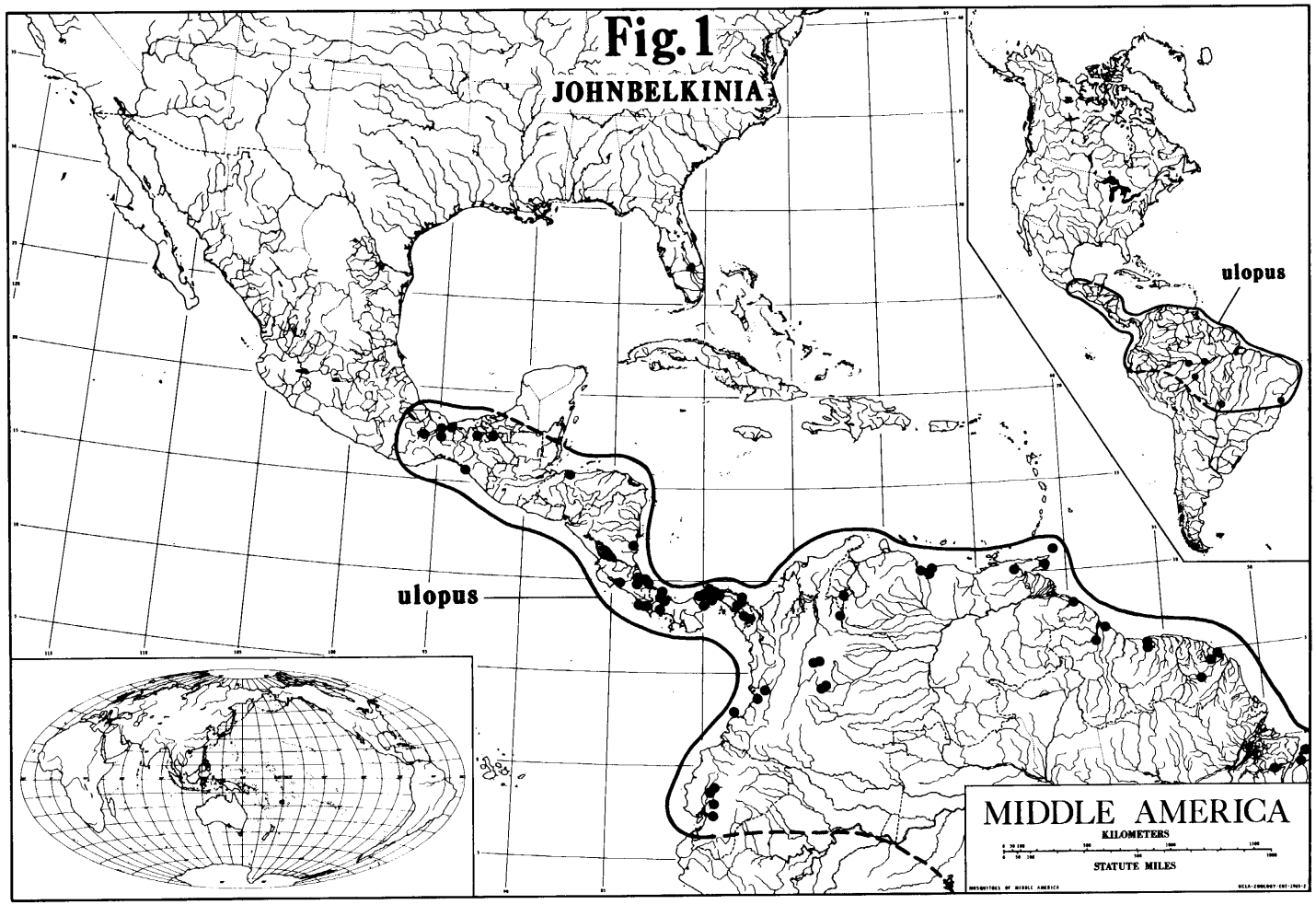


Fig. 1
JOHNBELKINIA
ulopus
ulopus
MIDDLE AMERICA
KILOMETERS
STATUTE MILES

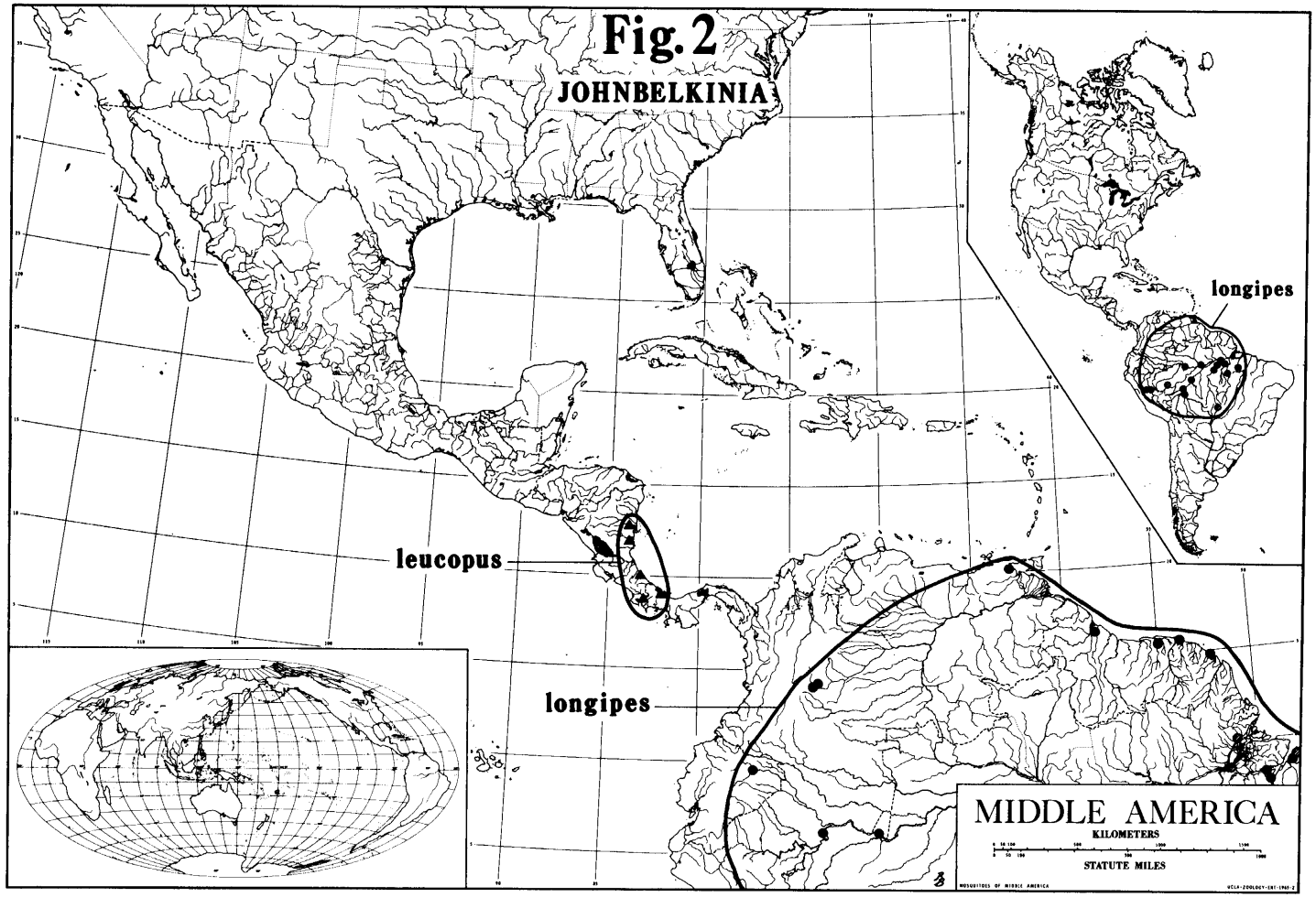


Fig. 2
JOHNBELKINIA
longipes
leucopus
longipes
MIDDLE AMERICA
KILOMETERS
STATUTE MILES

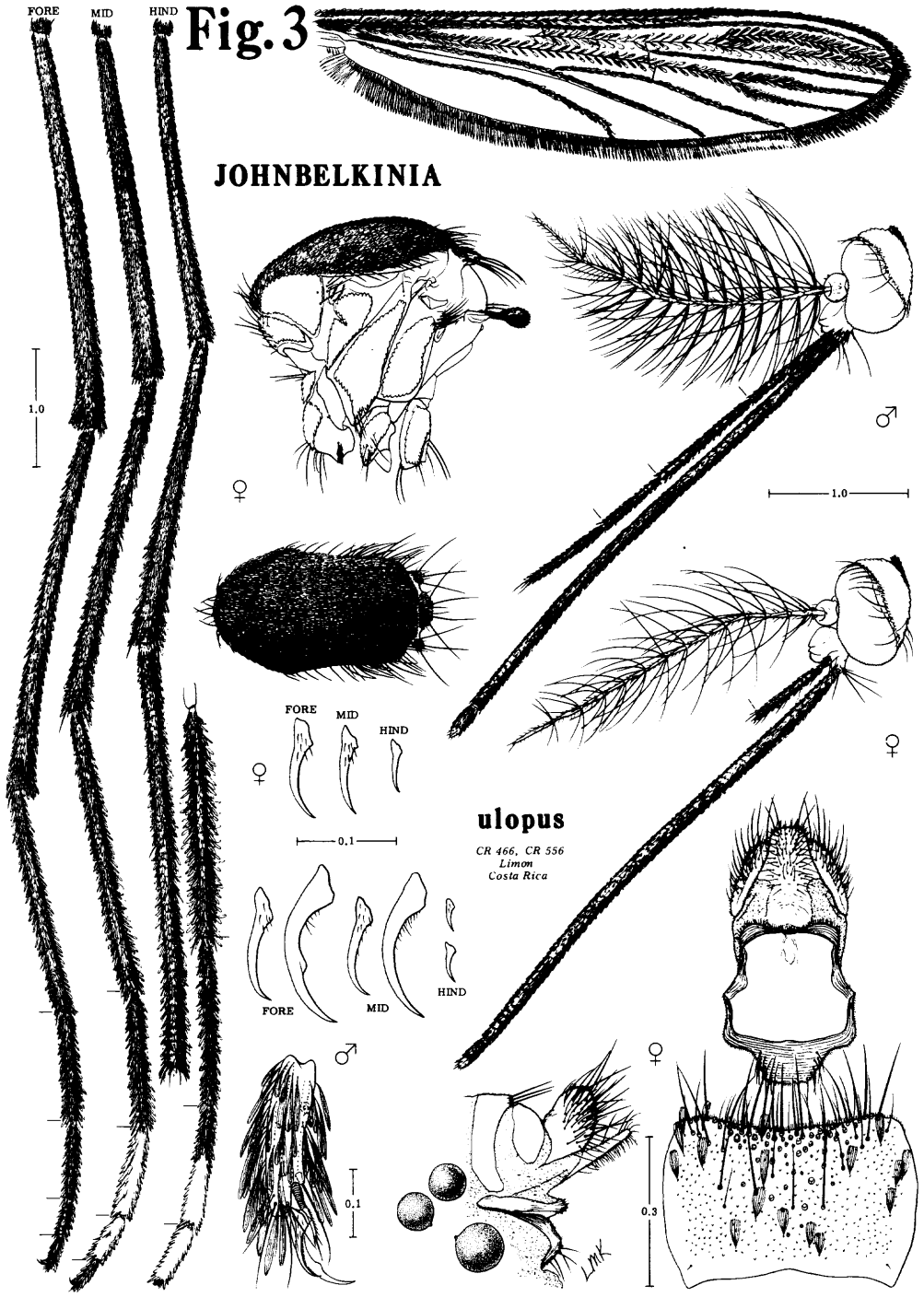

FORE
MID
HIND
Fig. 3
JOHNBELKINIA
1.0
♀
♂
1.0
FORE
MID
HIND
♀
0.1
ulopus
CR 466, CR 556
Limon
Costa Rica
FORE
MID
HIND
♂
0.1
♀
0.3
LMK

Fig. 4

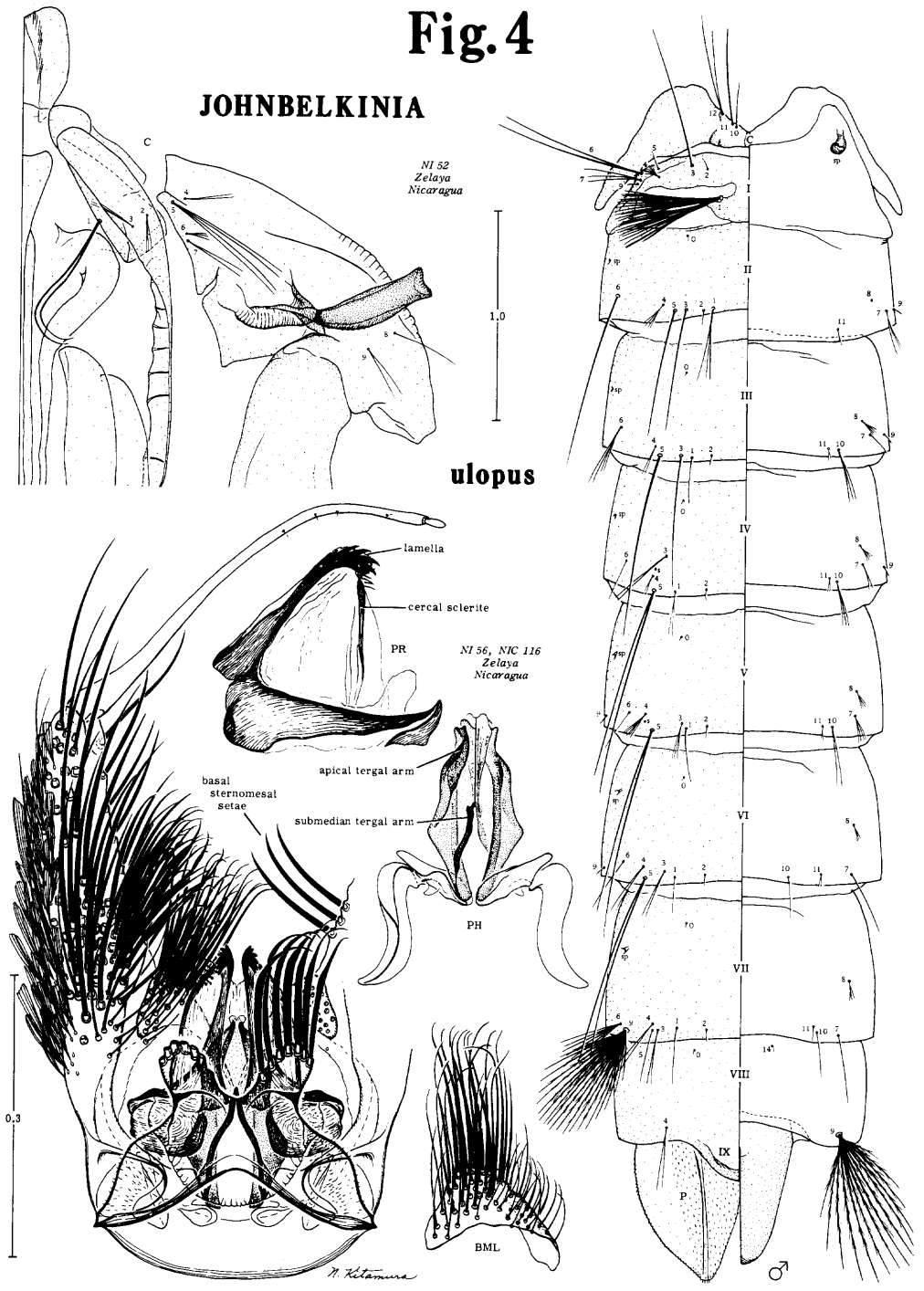

JOHNBELKINIA
ulopus
NI 52
Zelaya
Nicaragua
1.0
lamella
cercal sclerite
PR
NI 56, NIC 116
Zelaya
Nicaragua
apical tergal arm
basal
sternomesal
setae
submedian tergal arm
PH
BML
0.3
I
II
III
IV
V
VI
VII
VIII
IX
P
♂
N. Kitamura

Fig. 5

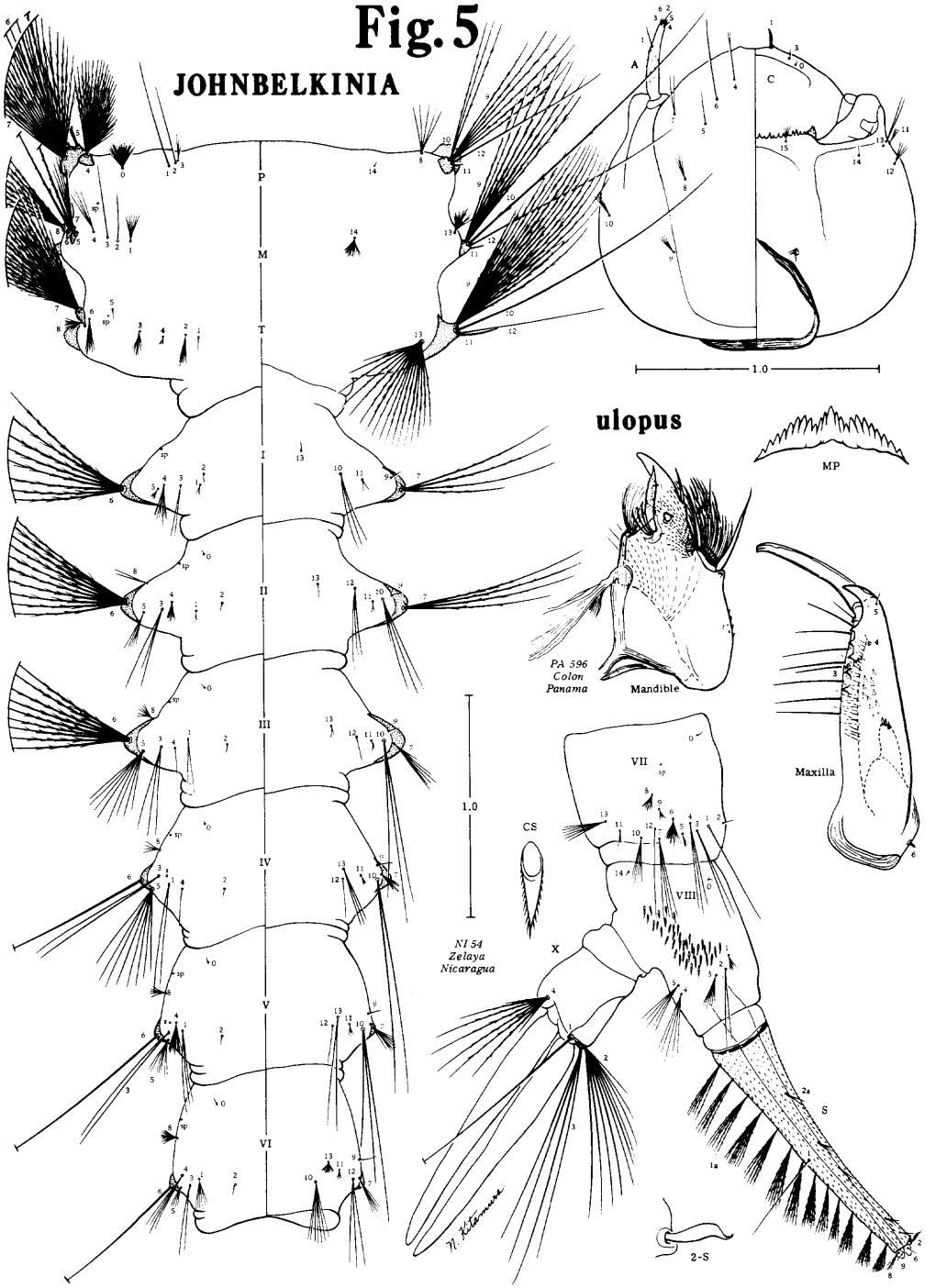

JOHNBELKINIA
ulopus
P
M
T
I
II
III
IV
V
VI
A
C
1.0
MP
PA 596
Colon
Panama
Mandible
Maxilla
VII
VIII
CS
X
NI 54
Zelaya
Nicaragua
1.0
S
2-S

Fig. 6

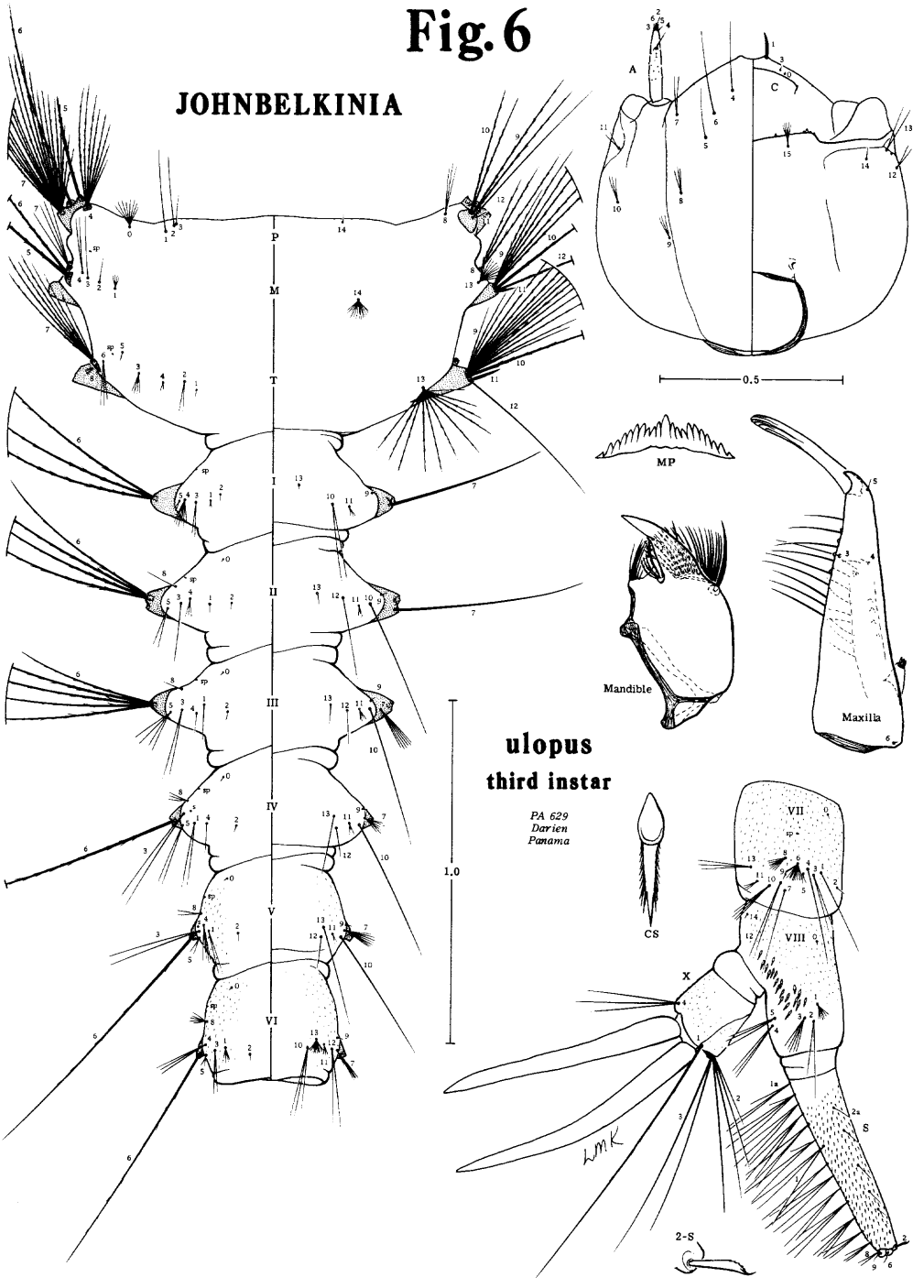

JOHNBELKINIA
A
C
0.5
MP
Mandible
Maxilla
ulopus
third instar
PA 629
Darien
Panama
1.0
CS
VII
VIII
X
S
2-S
P
M
T
I
II
III
IV
V
VI

Fig. 7

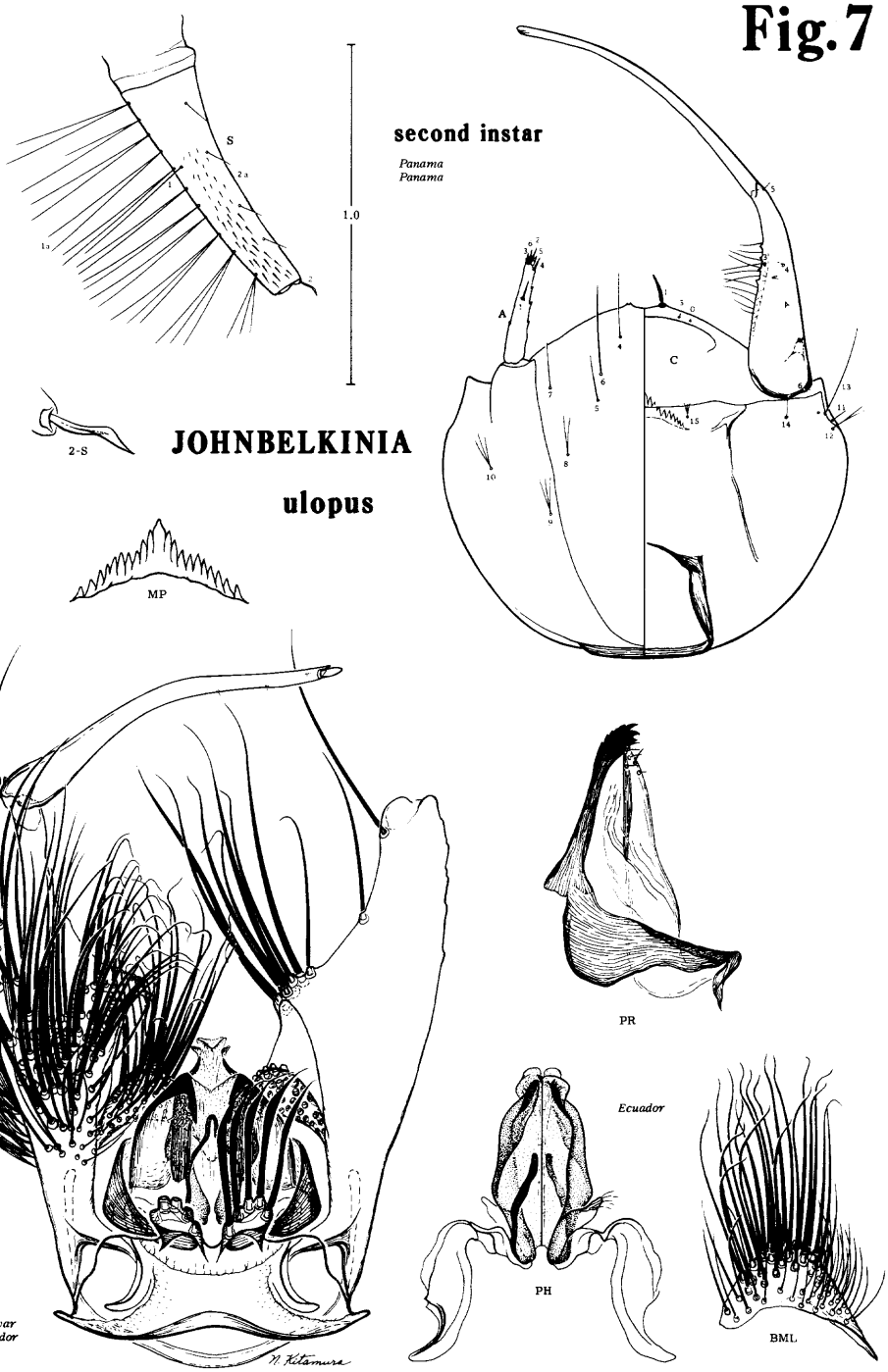

second instar
Panama
Panama
S
1.0
2-S
JOHNBELKINIA
ulopus
MP
A
C
PR
Ecuador
PH
BML
0.3
Bolivar
Ecuador
N. Kitamura

Fig. 8

JOHNBELKINIA

longipes

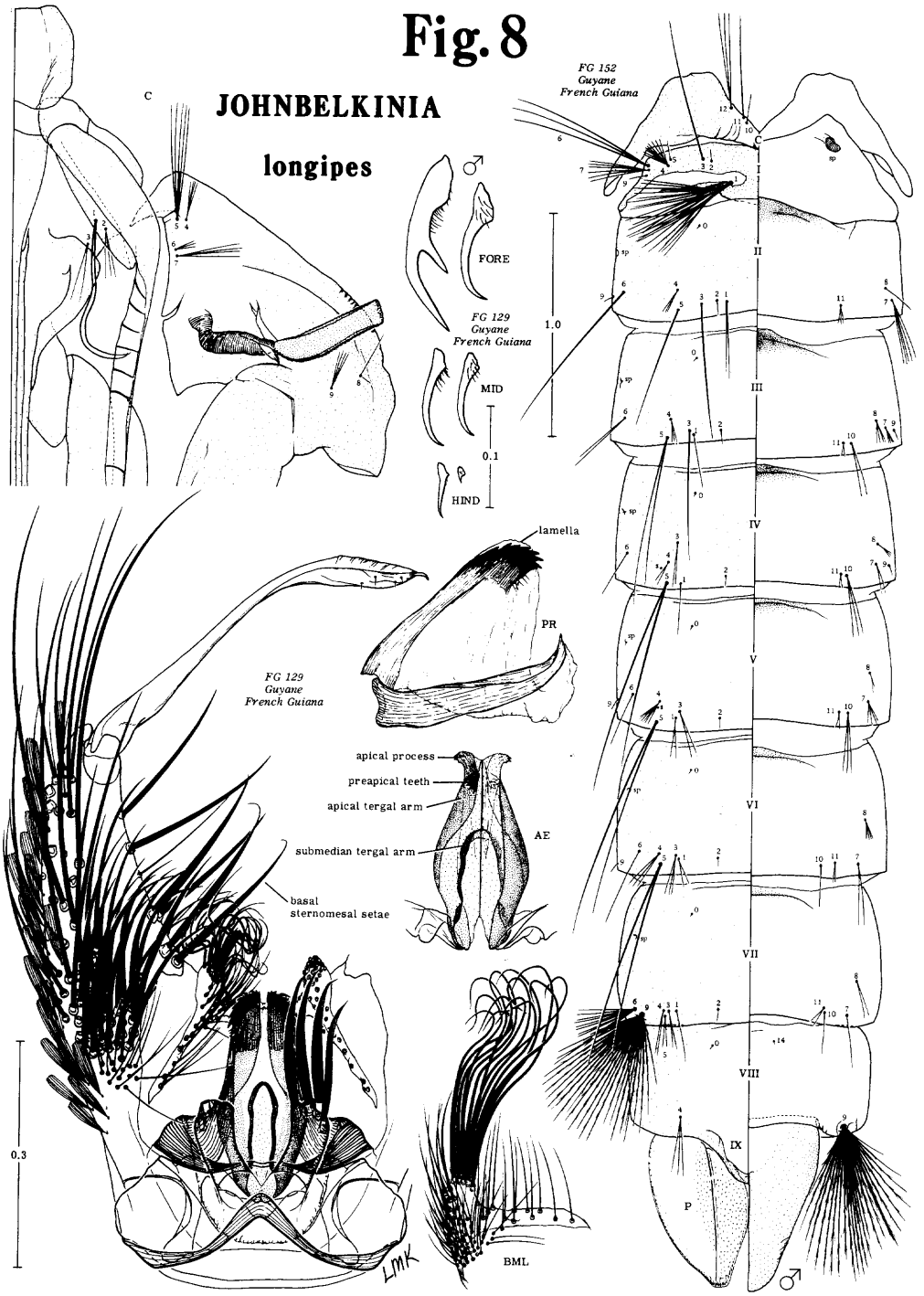


Fig. 9

JOHNBELKINIA longipes

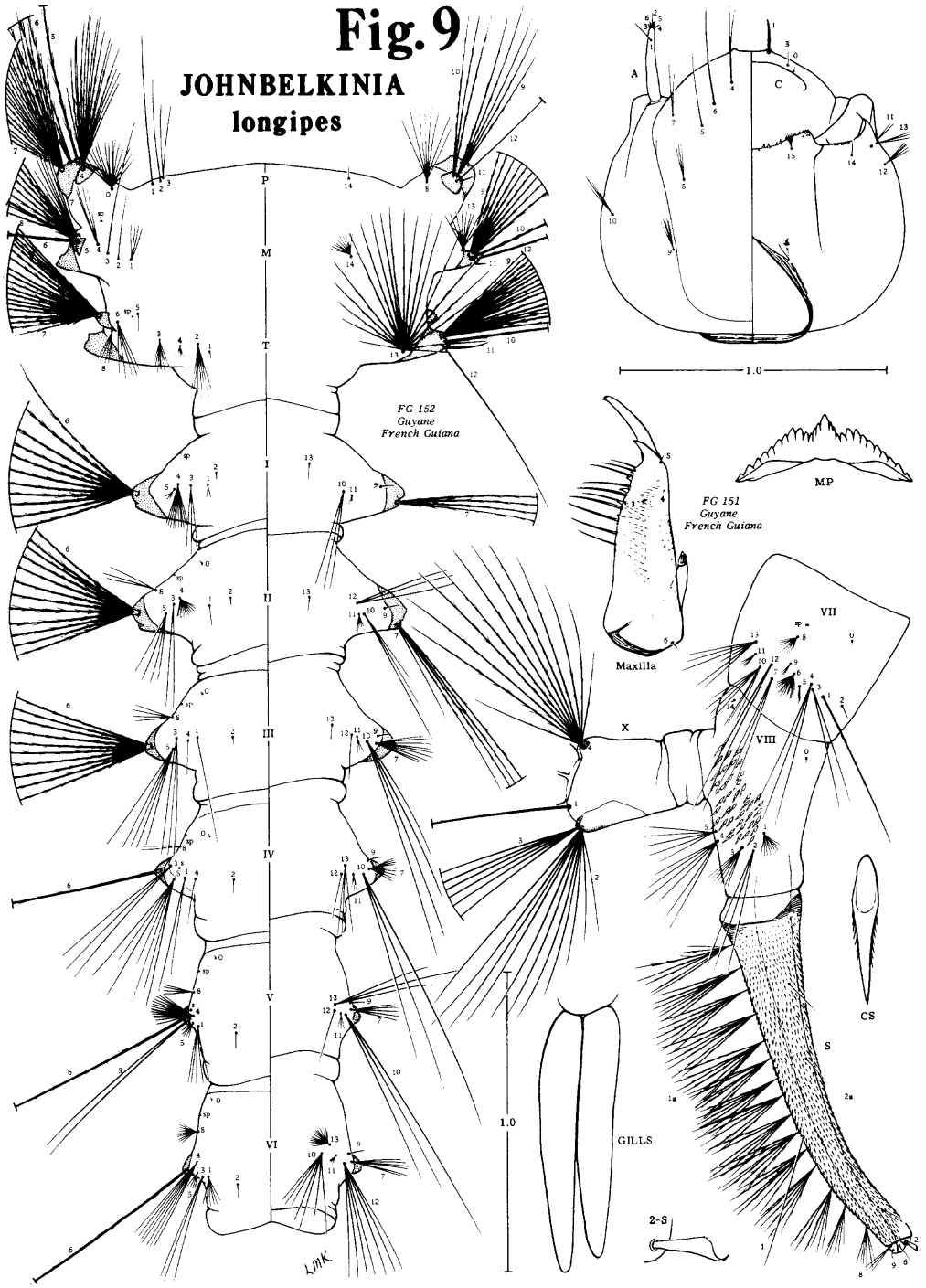
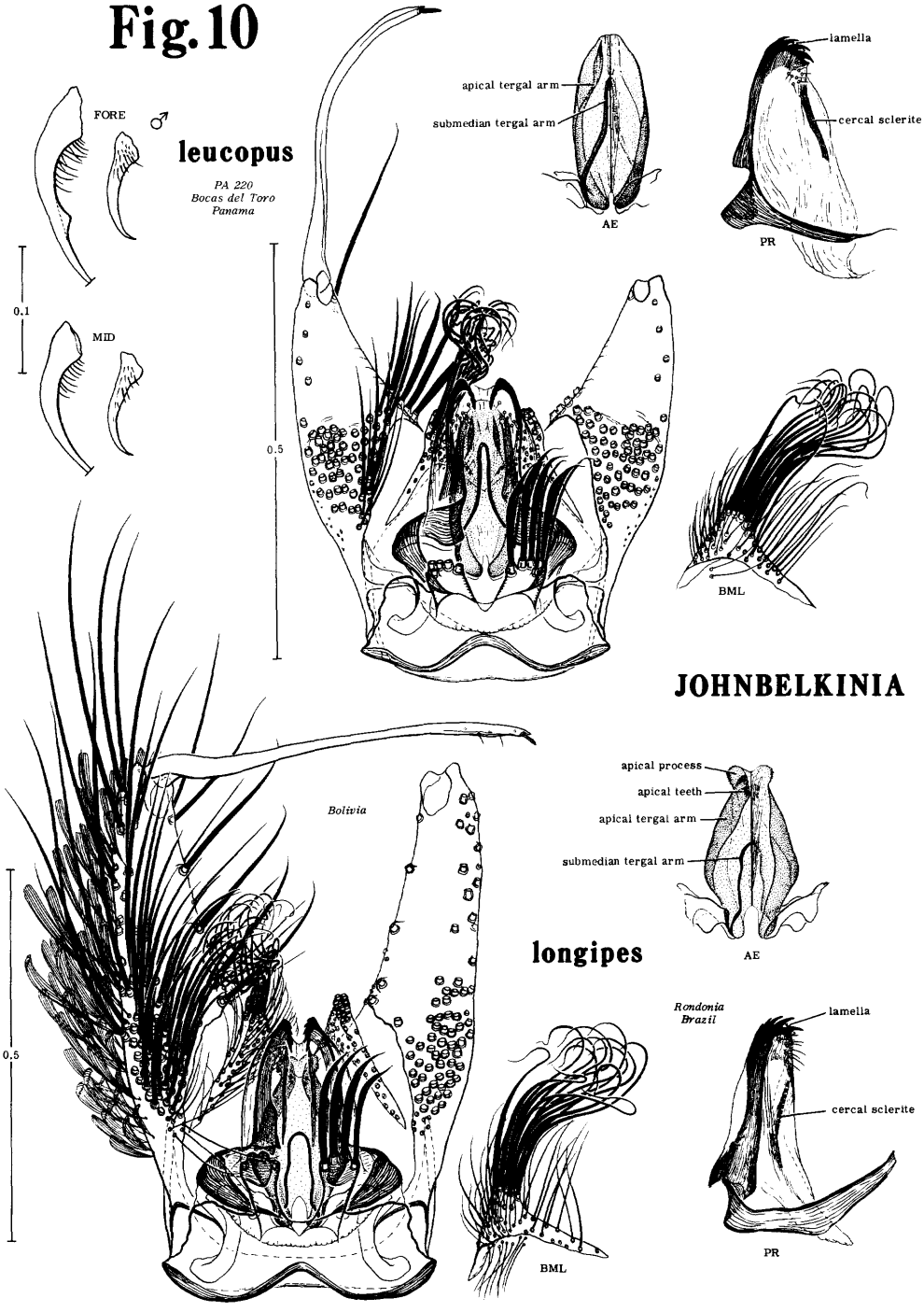


Fig. 10


FORE ♂
leucopus
PA 220
Bocas del Toro
Panama
0.1
MID
0.5
apical tergal arm
submedian tergal arm
AE
lamella
cercal sclerite
PR
BML
JOHNBELKINIA
Bolivia
0.5
apical process
apical teeth
apical tergal arm
submedian tergal arm
AE
longipes
Rondonia
Brazil
lamella
cercal sclerite
PR
BML

CONSPECTUS OF PRELIMINARY RECLASSIFICATION OF COMPOSITE GENUS *TRICHOPROSOPON*

Genus *Johnbelkinia*

culicivora
edwardsiana
leucopus
longipes
trichopus
ulopus

Genus *Trichoprosopon*

andinum
brevipes
castroi
compressum
digitatum
evansae
lampropus
lanei
mogilasium
nivipes
obscurum
pallidiventer
simile
soaresi
splendens
subsplendens
townsendi
trichorryes
vonplesseni
wilsoni

Genus *Shannoniana*

fluviatilis
longipalpis
moralesi
schedocyclia

Genus *Runchomyia*

Subgenus *Runchomyia*

cerqueirai
frontosa
humboldti
rapax
reversa
theobaldi

Subgenus *Ctenogoeldia*

dicellaphora
homotina
magna
walcotti

Subgenus *Isostomyia*

espini
lunata
paranensis
perturbans
shropshirei

Genus *Wyeomyia*

luederwaldti

Nomina Dubia

cotopaxensis
hyperleuca

INDEX TO SCIENTIFIC NAMES

Invalid taxa are in *italics*; valid taxa treated in detail by present paper are in **boldface**. Major page references are in **boldface**; page reference to key is shown by suffix "k"; figure numbers are in *italics*.