Mosquito collections from a remote unstudied area of southeastern Bolivia[1]

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ABSTRACT. Mosquito collections made during May 1982 from the area of Rincón Del Tigre, Bolivia are summarized. Complete biological data with species associations are provided for 91 separate collections. Fifty-eight species belonging to 14 genera were collected, including 8 new country records and 2 undescribed species. Taxonomic and biological data are separately presented for 26 species.

INTRODUCTION

A multipurpose mosquito study was made in the region of Rincón Del Tigre, Department of Santa Cruz, Bolivia, from 8 May to 27 May 1982, as a follow-up to investigations on concurrent outbreaks of yellow fever and suspected dengue fever in Ayoreo and Chiquitano Indians during early 1981. This study was carried out under the auspices of the Ministerio de Previsión Social y Salud Pública, División Nacional de Epidemiología, La Paz, Bolivia, and the Pan American Health Organization, Washington, D. C.

The Rincón Del Tigre area is located on the southeastern border of Bolivia approximately 80 km west of the Brazilian border in the Department of Santa Cruz, Province of Sandoval (Fig. 1). It lies within an extensive tract of discontinuous marshland along the Río Paraguay, which covers much of eastern Bolivia and extends east, deep into the Brazilian state of Matto Grosso. The settlement of Rincón Del Tigre is the site of the Latvian Baptist Evangelical Mission, which established and developed the area well over 2

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decades ago. A small dirt landing field has been cleared for light aircraft. Air transportation is the only practical means of reaching the area and this is most accessible from the city of Santa Cruz, several hundred km to the west. Dirt trails (roads) exist between several small settlements and the outside, but for most of the year these are impassable due to rains and the nature of the soil. Several hundred hectares of land have been completely or partially cleared around the area for cultivation of crops or grazing of livestock, but considerable scrub is interspersed among plots. The ecology of the area is transitional between the Amazonian tropical (evergreen seasonal) forest to the north and the tropical to semi-arid Gran Chaco of Paraguay and southern Bolivia to the south. Very heavy rains occur in the hot-wet season (October-May), followed by extreme dryness in the cooler dry season (June-September). Although the climate is generally considered to be tropical, the southern winds sometimes bring freezing temperatures during the dry season. Approximately 900 mm of rainfall are received during the wet season and since the land is flat and poorly drained the region becomes a virtual marshland. The maximum/minimum altitude for the mission locale is 232/220 m. Scrub vegetation is dominant over most of the area with taller forest concentrated along margins of streams and rivers (known as gallery forest). The gallery forests vary from single canopy palm forest, with few emergents, to double canopy deciduous forest. The wetter areas seem more thickly populated with palm trees. Cactus plants are sparsely scattered through some areas and many deciduous plants present characteristic adaptations to extreme dryness, e.g., very thick bark, thick, coarse, and curled leaves, light brittle limbs, etc. Plants that are typical of the humid tropics are also abundant in the gallery forest, e.g., aerophytes, palm trees, lianas, orchids and citrus plants.

Objectives of this study were 1) to survey the settlement of Rincón Del Tigre for populations of *Aedes (Stegomyia) aegypti* (Linnaeus), 2) to collect sylvatic mosquitoes from forest sites for virus isolation attempts and 3) to make taxonomic collections of as many different species of Culicidae as possible.

MATERIALS AND METHODS

Concurrent adult and larval collections were made in several different sites by two separate teams. One team collected adult mosquitoes for virus isolation studies and the other made various types of collections for taxonomic studies. All pupae and larvae collected for taxonomic purposes were individually-reared in vials to recover adults with associated skins for study. The cast skins were preserved in alcohol in shell vials and the associated adults were pinned fresh on paper points in the field. All of these specimens are deposited in the Museum of Natural History (USNM). Most adults from resting and biting collections were placed in vials and frozen in liquid nitrogen.

Because of the suspected cases of dengue fever in the Ayoreo and Chiquitano Indians of the settlement and a reported absence (unpublished) of *Aedes aegypti* in the area by health authorities, initial collections were made in the domestic areas. These areas were searched for suitable larval habitats for *Aedes aegypti* and many indoor resting and outdoor human bait collections

were also made.

The taxonomic collections include some voucher specimens from the adult virus collections. These collections were processed and identified first, using all available stages to confirm identifications. A reference adult collection containing all species was then prepared for use in the sorting, identifying and pooling of several thousand frozen adults returned for virus isolation studies (reported elsewhere). This procedure made the final sorting of the frozen material much easier, quicker, and the identifications more reliable.

This paper does not provide a complete listing of literature on Bolivian mosquitoes, however, all references pertinent to the identification of the species collected were consulted and those with direct application to this study are cited. Important references used but not cited elsewhere in the text include: Arnell (1973); Belkin et al. (1968, 1970); Cerqueira (1943); Komp (1942); Rozeboom and Komp (1950); Schick (1970); Senevet and Abonnenc (1939); Sirivanakarn (1979); Zavortink (1968, 1972).

Since all collections were made in the same general region, locality data common to all collections will not be repeated for each number listed in Appendix 1. Common data are: Bolivia, Department of Santa Cruz, Province of Sandoval, Rincón Del Tigre, approximately 18° 8′ S, 58° 2′ W, elevation approximately 232 m, collectors E. L. Peyton and D. R. Roberts. Rincón Del Tigre was not found on maps available at the time of our trip and is not listed in the standard gazetteers. The nearest villages or towns on most available maps or in gazetteers are 30-40 kilometers away from Rincón Del Tigre, however, we have used Rincón Del Tigre and the mission as reference localities for all specific collection sites. As a result, the general directions and distances on each collection form (on file at the Medical Entomology Project) are merely best estimates at the time. Where specific collection sites beyond the settlement had well-known local names, we have placed these in parentheses following the primary locality. In the case of the copper mine location, there is actually no copper mine, but it is well-known to the residents of the mission as an unproductive site of diggings where several Ayoreo Indians presumably contracted the first reported cases of yellow fever during 1981. These locations are not found on maps or in gazetteers, but are useful for follow-up studies by local health authorities or others interested in the epidemiology of the past disease outbreaks or renewed disease transmission in these areas.

Some of the collection numbers listed in Appendix 1 are not necessarily in the order collected, especially for the adult collections. Most adult specimens from either resting or biting collections were intended primarily for virus isolation studies, and assigned a separate set of numbers not reported here. Consequently, each adult collection lists only a few select species for which a voucher sample was retained for study, usually of species not represented or inadequately represented in the taxonomic collections. They do not represent the total number of species collected for a particular locality, time or date. Most adult collections were frozen in liquid nitrogen moments after being collected and a few of the voucher specimens were selected from these and assigned a separate number several weeks after returning to the

United States. Complete data for each taxonomic collection are presented in Appendix 1.

RESULTS

The collections reported here deal only with those made expressly for taxonomic studies and represent only a portion of the total number of collections made. The majority represent collections made of the immature stages from natural habitats and, with few exceptions, each consists of individually-reared adults with associated larval and/or pupal skins. Adult collections made expressly for virus isolation studies will be reported separately along with a more complete discussion of mosquito-borne diseases and potential vectors in the area of Rincón Del Tigre.

Fifty-eight houses occupied by Ayoreo and Chiquitano Indians and the mission school dormitory were surveyed for *Ae. aegypti*, with approximately 2400 adult mosquitoes obtained for virus isolation studies from indoor resting and human bait collections. No *Ae. aegypti* were found in the Rincón Del Tigre area and there is no indication that the species has ever been established in this area. Six separate forest sites, representing a variety of forest types (see description of area in introduction) were sampled and approximately 4000 adult mosquitoes were obtained for virus isolation from resting and human bait collections. Ninety-one collections of taxonomic specimens were made from all areas (Appendix 1). Fifty-eight species (1 undetermined) representing 14 genera were identified (Table 1). Eight of these are new country records and at least 2 are undescribed species. The undescribed larval and/or pupal stages of at least 6 known species were collected. Total specimens retained for taxonomic studies include: 446 males, 817 females, 824 with associated skins (824 pupal and 397 larval) and 512 whole larvae.

This trip was not made during the most favorable time of year for collecting mosquitoes. The dry, cool season had already begun and according to local reports the last significant rainfall had been about one month earlier. A brief but rather heavy rain occurred on the third day of our visit and this did produce a few flood pool *Aedes* and *Psorophora* that would not otherwise have been encountered. However, it was insufficient to flood the treeholes and almost all treeholes and similar habitats were dry. Lower than normal temperatures also affected adult catches. During the last week of our stay in Rincón Del Tigre a southern cold front moved in with intermittent rain and evening temperatures dropped to as low as 10°C. This severely reduced our mosquito collections. The adult biting collections dropped significantly this last week and many of the larvae and pupae that had been isolated for the recovery of adults failed to complete development before our departure.

Table 1. List of species collected from Rincón Del Tigre, Santa Cruz, Bolivia

Genera, subgenera and species	Previous reports		Reported here	
	Bolivia	Santa Cruz	Imm.	Adult
Aedeomyia Theobald				
1. *(Ady.) squamipennis* (Lynch Arribalzaga)	x	x	x	x
Aedes Meigen				
2. *(How.) vanemdeni* Martini	x	-	-	x
3. *(Och.) fulvus* (Wiedemann)	x	x	-	x
4. " *hortator* Dyar and Knab	x	x	-	x
5. " *oligopistus* Dyar	x	x	x	x
6. " *scapularis* (Rondoni)	x	x	x	x
7. " *serratus* (Theobald)	x	x	-	x
8. *(Pro.) terrens* (Walker)	x	x	x	x
Anopheles Meigen				
9. *(Ano.) intermedius* (Peryassu)	x	-	-	x
10. *(Nys.) allopha* Peryassu	x	x	x	x
11. " *argyritarsis* Robineau-Desvoidy	x	x	x	x
12. " *darlingi* Root	x	x	x	x
13. " *evansae* (Brethes)	x	x	x	x
14. " *oswaldoi* (Peryassu)	x	x	x	x
15. " *rangeli* Gabaldon, Cova Garcia and Lopez	x	x	x	x
16. " *rondoni* (Neiva and Pinto)	x	x	-	x
17. " *strodei* Root	x	x	x	x
Coquillettidia Dyar				
18. *(Rhy.) juxtamansonia* (Chagas)	x	x	-	x
Culex Linnaeus				
19. *(And.) conservator* Dyar and Knab	-	-	x	x
20. *(Cux.) chidesteri* Dyar	x	-	x	x
21. " *corniger* Theobald	x	x	x	x
22. " *coronator* Dyar and Knab	x	x	x	x
23. " *mollis* Dyar and Knab	-	-	x	x
24. " *quinquefasciatus* Say	x	x	x	x
25. *(Mel.) aliciae* Duret	-	-	x	x
26. " *educator* Dyar and Knab	x	-	-	x

Genera, subgenera and species	Previous reports		Reported here	
	Bolivia	Santa Cruz	Imm.	Adult
27. *(Mel.) ensiformis* Bonne-Wepster and Bonne	-	-	x	x
28. " *idottus* Dyar	-	-	x	x
29. " sp. near *intrincatus* Brethes	-	-	x	x
30. " *pilosus* (Dyar and Knab)	-	-	x	x
31. *(Mcx.)* sp. undetermined	x	x	-	x
Haemagogus Williston				
32. *(Con.) leucocelaenus* (Dyar and Shannon)	x	x	x	x
33. *(Hag.) janthinomys* Dyar	x	x	-	x
34. " *spegazzini* Brethes	x	x	-	x
Limatus Theobald				
35. *durhamii* Theobald	x	x	x	x
Mansonia Blanchard				
36. *(Man.) humeralis* Dyar and Knab	x	x	-	x
37. " *titillans* (Walker)	x	x	-	x
Orthopodomyia Theobald				
38. *fascipes* (Coquillett)	x	x	x	x
Psorophora Robineau-Desvoidy				
39. *(Gra.) cingulata* (Fabricius)	x	x	x	x
40. *(Jan.) ferox* (von Humboldt)	x	x	-	x
41. " *albigenu* (Peryassu)	x	x	-	x
42. *(Pso.) saeva* Dyar and Knab	x	-	-	x
Sabethes Robineau-Desvoidy				
43. *(Sab.) albiprivus* Theobald	x	x	-	x
44. " *belisarioi* Neiva	x	x	-	x
45. *(Sbo.) chloropterus* (von Humboldt)	x	x	-	x
46. " *glaucodaemon* (Dyar and Shannon)	x	-	-	x
Toxorhynchites Theobald				
47. *(Lyn.) theobaldi* (Dyar and Knab)	x	x	x	x

Genera, subgenera and species	Previous reports		Reported here	
	Bolivia	Santa Cruz	Imm.	Adult
Uranotaenia Lynch Arribalzaga				
48. *(Ura.) calosomata* Dyar and Knab	-	-	-	x
49. " *ditaenionota* Prado	x	-	-	x
50. " *geometrica* Theobald	x	x	x	x
51. " sp. near *geometrica*	-	-	x	x
52. " *leucoptera* (Theobald)	-	-	x	x
53. " *lowii* Theobald	x	x	x	x
54. " *nataliae* Lynch Arribalzaga	x	x	x	x
55. " *pulcherrima* Lynch Arribalzaga	x	x	x	x
Wyeomyia Theobald				
56. *(Den.) kerri* Del Ponte and Cerqueira	x	x	x	x
57. *(Dav.) petrocchiae* (Shannon and Del Ponte)	x	x	-	x
58. *(Dod.) aphobema* Dyar	x	x	x	x

DISCUSSION

Although this trip was brief and the number of taxonomic collections (91) is not large, the number of species, new country records, newly collected life stages and new species collected are considered by the authors to be highly significant. Importantly, our collections were made in conjunction with and in direct support of virus studies. Both taxonomic and adult biting and resting collections for virus isolation were made in the same general sites (domestic and forest).

The latest enumeration of species and their distributions in Bolivia, was Prosen et al. (1964). These authors presented records of their studies from various departments and provinces of the country as well as listing all earlier known records. One hundred fifty-six species from 17 genera were annotated in Prosen et al. (1964). Although many of the 156 species reported from the country were also listed from the department of Santa Cruz (see Table 1), most were from localities in the western half of this largest department We found no records from the province of Sandoval in which Rincón Del Tigre is located.

The taxonomic significance of 25 species and one undetermined species of the 58 collected, is discussed below. Topics discussed under each of the 26 species include: problems of identification and recent synonymy, new country records, undescribed stages collected and possible new species. This is provided primarily for interested workers in Bolivia, many of whom do not have access to the most recent revisions published in the *Contributions of the American Entomological Institute*. We believe that the results of this trip

clearly demonstrate the value and necessity of making taxonomic collections an essential part of investigations of actual or potential disease transmission by mosquitoes or other arthropods. This is particularly true in regions where the fauna is poorly known or the investigators are unfamiliar with the fauna. Working with specimens that will be sacrificed later for disease studies is not a practical means of becoming familiar with identification problems. Specimens for such studies must be captured alive, then freshly killed and frozen to preserve the pathogens; thus there is no time for resolving identification problems.

While reviewing the literature, we found that Berlin and Belkin (1980) provided very useful "Keys to the subgenera of *Culex* in the Americas," for the adults, male genitalia, pupae and larvae. The availability of these keys is not yet generally known since the title of the paper mentions only 3 of the 11 recognized subgenera of *Culex* in the Americas. The key to the adults has a significant error; all *Melanoconion* will not key out under couplet 9. Actually, there are a number of *Melanoconion* species with "Vertex scales on head narrow, even along orbital lines," which, according to the key would not be *Melanoconion*. Otherwise, these keys are very useful.

TAXONOMIC AND BIOLOGICAL NOTES ON CERTAIN SPECIES

1. *Aedes (How.) vanemdeni*

Only 2 females were collected, both biting man in forest during daylight. Unfortunately, the specimens are severely damaged due to freezing, thawing and manipulation before pinning. The specimens were not recognized as unusual when first collected and were frozen along with others collected that date. According to Berlin (1969), this species, described in 1931, is known only from 2 adult specimens of the original type-series deposited in the British Museum (Natural History). The type-locality is Yungas de Coroico (La Paz), Bolivia.

2. *Aedes (Och.) oligopistus*

A moderate number of adult females were encountered biting man in forest. One adult was reared from a larva collected in a freshly flooded ground pool in association with *scapularis* and others (see collection no. 31). This species is a member of the Serratus Group which includes at least 10 described species (Arnell 1976). In the Rincón Del Tigre area *oligopistus* and *serratus* were encountered biting in the same collecting sites, but the latter was much more common. Adults of these 2 species are not always easy to separate, especially when the scutal scale pattern has been damaged or rubbed after being in frozen pooled samples. The differentiating character for adult females of the 2 species is the color of the median line of scales on the vertex and on the scutum, i.e., white or silvery on *oligopistus* and golden or yellowish on *serratus*. Considerable variation in this character was noted in the *serratus* specimens (see below).

3. *Aedes (Och.) scapularis*

This species is widely distributed and apparently common during the wetter months of the year. However, females were scarce in our human biting collections. A few larval collections were made from ground pools produced by a relatively heavy rain occurring on the third day after our arrival. This was the first rainfall in approximately 4 weeks. Other temporary flood pool species appearing at the same time were: *oligopistus* and *Ps. cingulata*. The pools did not contain many *Aedes* or *Psorophora* larvae, suggesting that the rain did not innundate all of the eggs present, or that the lower seasonal temperatures prevented the hatching of all of the eggs. It is likely that both factors were involved. No broods of *Aedes* or *Psorophora* were noted in pools during the remainder of our stay.

4. *Aedes (Och.) serratus*

This was one of the most common *Aedes* taken in daytime human biting collections at all sites inside the forest. However, no immatures were encountered. As stated above under *oligopistus*, there is considerable variation in adult ornamentation and occasional specimens are easily confused with that species. There are 2 distinct forms encountered in about equal numbers in the region; one with, and one without a narrow or broad, median, longitudinal stripe of golden or pale yellowish scales on the scutum from anterior margin to scutellum. Specimens of both forms are apparently common throughout much of the range of the species. Lane (1953) describes the female as having "mesonotum with bronzy scales (in some specimens there is a longitudinal narrow or broad golden stripe which, from the anterior margin reaches the scutellum)." The male was described as having a "stripe of creamy scales from anterior margin to scutellum." Prosen et al. (1964) apparently found the same variation in both sexes as indicated in their statement "De Bolivia, tenemos adultos de ambos sexos con la ornamentación del mesonoto atípica." We have some reservations in naming all of these specimens *serratus* even though they fit current descriptions. This species is reported from Mexico south to Argentina, but it has never received a detailed taxonomic review. Such a review might reveal several distinct species instead of a single polymorphic species. Individually-reared associated specimens or progeny rearings will be required to resolve this question.

5. *Anopheles (Ano.) intermedius*

The four females collected (collections 88 and 91) appear to be this species. Knight and Stone (1977) and Knight (1978) do not include Bolivia in the reported distribution of *intermedius*, and Prosen et al. (1964) did not record this species from the country. However, Forattini (1962) reported *intermedius* from Bolivia and included it in a map and a table of geographic distribution of the anophelines of the neotropical region. Gorham et al. (1973) also list the species from Bolivia in a table of geographic distribution of the anophelines of western South America. The occurrence of *intermedius* in Rincón Del Tigre or other areas of eastern Bolivia is not unusual since it has long been known from the state of Matto Grosso, Brazil (Deane et al. 1946, Floch and Abonnenc 1951). Except for the key to the adults in Deane et al. (1946) our specimens fit the available descriptions and

keys for *intermedius* quite well. In the adult key of Deane et al. (1946), the mesepimeron of *intermedius* and *punctimacula* Dyar and Knab is said to be without scales. Our specimens have a small but distinct patch of white scales on upper mesepimeron, which, according to this key, would be more like *neomaculipalpis* Curry or *mediopunctatus* (Theobald). Our specimens cannot be either of these 2 species because of other very significant differences. We find no other mention of the presence or absence of scales on the mesepimeron in the following additional references to *intermedius*: Bonne and Bonne-Wepster (1925), Lane (1953), Stojanovich et al. (1966) and van der Kuyp (1950). The original description of *intermedius* in Peryassu (1908) refers to scales on the pleuron as follows: "*Pleuras* [*sic*] escuras, com pequenas escamas esbranquicadas e otras pretas, e com pontos negros e estrias esbranquicadas formadas por pigmentos." The scales mentioned might refer to those on the mesepimeron, but this needs to be confirmed by examination of the type or topotypic specimens which were not available.

6. *Anopheles (Nys.) allopha*

All prior records of *albitarsis* Lynch Arribalzaga from Bolivia probably represent this species. Prosen et al. (1964) recorded *albitarsis* from all departments in Bolivia, except Oruro and Potosi, which are in the southwest corner of the country, and commonly referred to as the "Altiplano," with an average elevation of 3500 m. Faran and Linthicum (1981), on the basis of specimens examined, removed *allopha* from synonymy under *albitarsis* and restricted the distribution of *albitarsis* to south of Bolivia, namely Argentina, Uruguay, regions of Paraguay and southern Brazil. We collected this species in both daytime-forest and evening-domestic human biting collections, but only once as immatures.

7. *Anopheles (Nys.) evansae*

Prosen et al. (1964) record this species from the departments of Santa Cruz and Tarija. However, in 1964, *strodei* Root was considered a synonym of *evansae*. Faran (1980) removed *strodei* from synonymy and elevated it to species status, but relegated *evansi* [*sic*] to *nomen dubium* status. Faran (1981) revalidated *evansae* [as *evansi*] and assigned *noroestensis* Galvao and Lane as a synonym. Faran (1980) lists both *strodei* and *noroestensis* (= *evansae*) from Bolivia, including 3 sites for *noroestensis* and 2 sites for *strodei* in Santa Cruz. Consequently, the record in Prosen et al. (1964) could have referred to either species. We encountered both species in our human biting and immature collections. We are emending the spelling of the name *evansi* (see Faran 1981) to *evansae* once again (see Knight and Stone 1977), even though *evansi* is as originally spelled in Brèthes (1926). It is clear that Brèthes named the species in honor of Miss Alwen M. Evans who was quite active in mosquito taxonomy from the early 1920s to 1937 (Kitzmiller 1982).

8. *Anopheles (Nys.) rangeli*

This was one of the most common species of *Anopheles* encountered in the region in both human biting and immature collections. Larvae of this species were collected in almost every ground pool. Without the many individually-reared, associated specimens we would not have been able to correctly identify

this or other members of the Oswaldoi Group using the currently available keys and descriptions. There is excessive variation in some of the key characters currently used for the adult, pupal and larval stages. In the adult, the dark basal band on hindtarsomere 2 is particularly variable and a fair number of adults would key to *oswaldoi* on this character. This band ranged from 0.20-0.40 the length of the tarsomere. The humeral pale spot on vein C also showed considerable variation and was not very useful as a key character. However, the long subcostal pale spot on the costa was consistently 0.5 or more the length of the subcostal dark spot and is useful for separating this species from some of the others. The lengths and ratios of pupal seta 9 on segments IV to VII were also quite variable in specimens from this region. Workers from this region should be aware that specimens of the Oswaldoi Group will be extremely difficult to identify with the currently available keys, especially those constructed to key all species from throughout the entire range of the group. Wherever possible, species from this area should be initially identified by the use of reared, associated specimens to help determine the range of variations in local populations. These may not always assure accurate identifications, but they will make identifications easier.

9. *Anopheles (Nys.) strodei*

It appears that Forattini (1962) was the first to list this species from specific areas (Beni and Santa Cruz) in Bolivia. There is some possible confusion over earlier records of this species and *evansae* (see above), primarily because of earlier synonymy with *evansae*. Forattini (1962) clearly treats *strodei* as a valid species and makes no reference to *evansae*. He does, however, treat *noroestensis* Galvao and Lane (= *evansae sensu* Faran 1981) and includes illustrations of the male terminalia, larval head and other parts of *strodei* and *noroestensis* on the same page (Fig. 136) for comparison. He also lists *noroestensis* from 4 departments in Bolivia. However, *strodei* continued to be treated as a synonym of *evansae* in Knight and Stone (1977), with Pinto (1939) cited as the authority for the synonymy. This is the same citation, with minor modification, which appeared in the first edition of the catalog of Stone et al. (1959). Interestingly, Bolivia is not listed under the reported distribution of *evansae* or *strodei* in either Stone et al. (1959) or Knight and Stone (1977), even though Forattini (1962) reported *strodei* and Prosen et al. (1964) reported *evansae* from various localities in Bolivia. Faran (1980) formally resurrected *strodei* from synonymy with *evansae* and reported 6 females examined from 2 localities in Santa Cruz, Bolivia. Faran (1980) lists *strodei* and *noroestensis* of Forattini (1962) as valid references to the species.

10. *Culex (And.) conservator*

This is a new record for Bolivia. One collection of this species was made from a large tree hole (see collection 71). Although many larvae were collected, only 3 completed development to the adult stage (1 female and 2 males) before our departure. Twenty-six whole larvae were preserved and later permanently mounted on slides and deposited in the USNM. The terminalia of both males also are mounted on slides.

11. *Culex (Cux.) mollis*

This species has not been reported previously from Bolivia. The *Culex (Cux.) virgultus* Theobald, of Lane (1953) and Prosen et al. (1964) from Bolivia may refer to this species, in whole or in part. Stone [1956 (1957)] proposed that *virgultus* was an unrecognized species and suggested the name *declarator* Dyar and Knab for *virgultus* of Lane (1953). *Culex virgultus* is presently treated as a *nomen dubium* in Knight and Stone (1977), and the *virgultus* of Lane (1953) and others from Bolivia is listed under *declarator*. Bram (1967) and Belkin (1968) also treat *virgultus* as an unrecognized species. All stages of our specimens, including male terminalia, fit the description of *mollis* very well and are also very similar to the *virgultus* of Lane (1953). This species appears to be relatively common in the region, with the immatures being collected in a variety of habitats. The pupal stage has not been described.

12. *Culex (Cux.) quinquefasciatus*

The *Culex (Cux.) pipiens* Linnaeus in Prosen et al. (1964) may include this species, in whole or in part. An examination of male terminalia confirmed that the specimens from Rincón Del Tigre are very typical *quinquefasciatus*. This species is the dominant domestic pest in the mission area. It was encountered in very high numbers resting inside various dwellings during the daytime, and frequently was the only species in these collections. Both sexes were collected resting inside and most of the females were either fully engorged or gravid.

13. *Culex (Mel.) aliciae*

This is a new record for Bolivia. Only 2 males (one with associated pupal skin) were collected. Identification was based on male terminalia. The larval and pupal stages of this species have not been described.

14. *Culex (Mel.) ensiformis*

This is a new record for Bolivia. A sample of 20 reared adults with associated immature skins was obtained from 3 separate collections. The female and pupa have not been described for this species.

15. *Culex (Mel.) idottus*

This is a new record for Bolivia. Only 3 males (one with associated pupal skin) were collected. Identification was based on male terminalia. The female, pupa and larva of this species have not been described.

16. *Culex (Mel.)* sp. near *intrincatus* Brethes

We believe that this is very likely an undescribed species. *Culex (Mel.) intrincatus* is known for certain only in the male, although a larval skin presumed to be *intrincatus* was described by Foote (1954). The male terminalia of our specimens are quite similar to *intrincatus*, but differ in 2 significant characters. Interestingly, these are the same 2 differences noted by Duret

(1954) for 3 male specimens from northern Argentina. These 3 specimens differed from typical *intrincatus*, which he had compared with the type and fully illustrated in Figs. 29, 45 and 60. Duret described the differences in detail on page 115, but provisionally identified the 3 specimens from "*Presidente Perón (ex Chaco)*: Zapiran, Ciervo Petizo and *Corrientes*: Ramada Paso, as *intrincatus* ?," until the corresponding larva and pupa had been studied. We have examined all later papers on *Culex (Melanoconion)* by Duret, but found no further mention of these specimens or others resembling this form. The specimens from northern Argentina were from along the Paraguay River drainage as were our collections. We believe our specimens are the same species as the 3 atypical males of *intrincatus* from Argentina treated by Duret (1954). However, we reserve judgement on the significance of the male terminalia differences until we have had the opportunity to make detailed comparisons with specimens of *intrincatus* from other localities. Our collection of this species consists of a relatively large number of individually-reared males and females with associated larval and pupal skins, plus several whole fourth stage larvae.

17. *Culex (Mel.) pilosus*

We found no record of this species from Bolivia. This is somewhat unusual since this is one of the most common and widely distributed of all the *Melanoconion*. It is reported from southeastern United States to Argentina.

18. *Culex (Mcx.)* sp. undetermined

We encountered a small number of adult females in our forest biting collections which were identified as *Microculex* sp. All appeared to be the same species. Only one species has been recorded from Bolivia, but this is probably due to the lack of collections. There are a considerable number of described species in this subgenus and a majority are known from areas immediately surrounding Bolivia, particularly Brazil. In view of this and the difficulty of identifying adult females, no attempt was made to determine the species involved in our studies.

19. *Psorophora (Jan.) albigenu*

A moderate number of adult females were collected biting during the daytime at all collection sites, usually inside the forest. This species is listed from several localities in Bolivia in Lane (1953) and Prosen et al. (1964) as *varipes* (Coquillett), and as *albigenu* in Guedes et al. (1965). Guedes and Souza (1964) removed *albigenu* from the synonymy of *varipes* and concluded that *varipes* does not occur in the Neotropical region. Belkin et al. (1971) confirmed that *albigenu* was distinct from *varipes*. Knight and Stone (1977) listed *albigenu* from 6 South American countries, including Bolivia, and suggested that most of the South American records of *varipes* are *albigenu*, while the distribution and identification of *varipes* was uncertain. These conclusions are quite likely correct, but it is presently impossible to define the distributions of these species since all early records from the southern United States to Argentina were as *varipes*. All Bolivian records, however, should be considered as *albigenu*.

20. *Psorophora (Pso.) saeva*

A very small number of females were collected biting in the forest in the daytime. Each of these females had rubbed scales, frayed wings, or, in several instances, broken legs, suggesting considerable longevity, corresponding with the long prior dry spell discussed elsewhere. Most previous records of *lineata* (von Humboldt) from Bolivia are probably this species. Stone (1967a) suggested that Bolivia be deleted from the distribution of *lineata*, and Bolivia was listed under *saeva* with a question mark. Stone (1967b) resurrected *saeva* from synonymy with *lineata* and presented characters for separating the adults of the 2 species. He further stated that "the known distribution of the 2 species shows *saeva* to be a species of northern and eastern South America from Venezuela to Argentina, and *lineata* to be a species of Central America and northern and western South America from Mexico to Bolivia and Surinam. The 2 species overlap in Venezuela, Trinidad and Surinam." Stone (1967b) was in press at the time the 1967a paper appeared. Knight and Stone (1977) list the same distribution as that in Stone (1967a). The situation with the distribution of these 2 species is quite similar to that cited above for *albigenu*. The question cannot be resolved without further study and reports from others in the region.

21. *Uranotaenia (Ura.) calosomata*

This is a new record for Bolivia. Only adults were collected.

22. *Uranotaenia (Ura.) ditaenionota*

Reported from Tarija, Gran Chaco by Prosen et al. (1964). This record was overlooked by Knight and Stone (1977) and Knight (1978).

23. *Uranotaenia (Ura.) leucoptera*

This is a new record for Bolivia. A small number of males and females with associated pupal skins were obtained. This is a significant extention of the range of this species. Previously, it was reported only from a few countries of northern South America and Central America to Mexico.

24. *Uranotaenia (Ura.)* sp. near *geometrica*

This is most likely a new species, but it is represented only by a single reared male with associated pupal skin. No further comments can be made until additional material becomes available.

25. *Wyeomyia (Den.) kerri*

This species was reported earlier from Bolivia, but the immature stages and their habitat were unknown. We made one larval collection from a palm stump near ground level which contained several hundred larvae. This palm tree is common in some of the low-wet areas and is locally named "Motacù." These stump habitats are created by the local inhabitants harvesting the heart of the palm. The stumps are quite common in some areas though all do not hold water. We did not encounter adults in our biting collections in the area

where this larval collection was made, nor did we encounter adults in most of the other forested areas collected. However, at one site several kilometers west of the larval collection site, in a forest of predominantly mature "Motacù" palm, or "Motacusal" (Palm forest), this species was collected in fair numbers biting man and was the most common sabethine encountered during 3 daytime collections. This strongly suggests a close association of this species and the palm forest environment in this region, and possibly also in the nearby Brazilian Matto Grosso, the type-locality of the species.

26. *Wyeomyia (Dod.) aphobema*

This is the type-species for the subgenus *Dodecamyia* Dyar. The catalog of Knight and Stone (1977) lists *Dodecamyia* as a synonym of the subgenus *Wyeomyia* Theobald. However, Heinemann and Belkin (1978) lists *aphobema* under the subgenus *Dodecamyia* without comment. We cannot find an earlier reference specifically removing *Dodecamyia* from the synonymy of *Wyeomyia*, but accept the listing in the above article as recognition of the validity of the subgenus by the authors. It was the only species encountered among several bromeliad collections.

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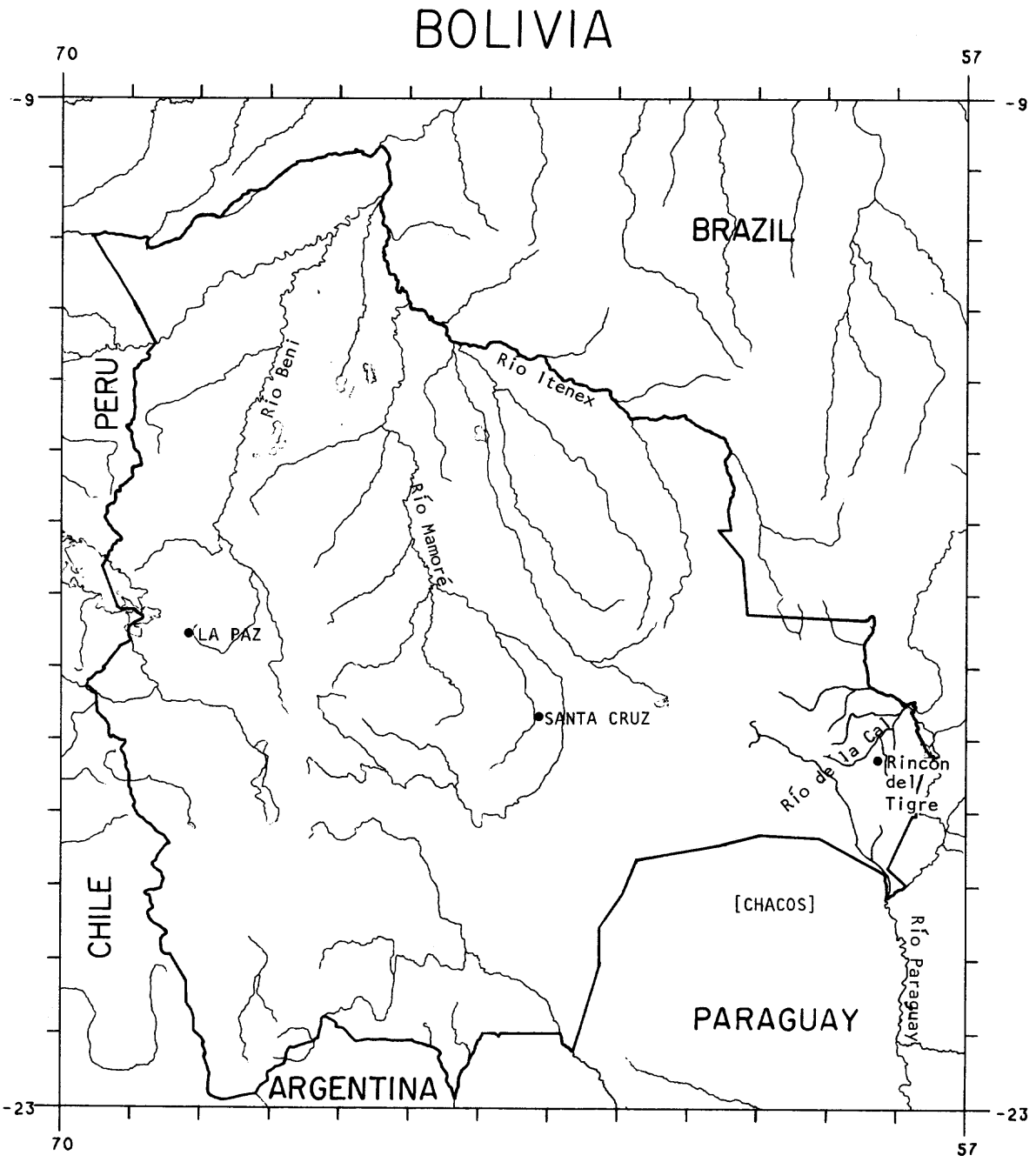

Fig. 1. Computer-generated map of Bolivia showing location of Rincón del Tigre. This map was produced by the computer program World Data Bank II, plotted on a CALCOMP plotter, and hand-labelled and outlined, with the cooperation of Charlotte Burnett of the Mosquito Information Management Project (MIMP), Smithsonian Institution.

Appendix 1. Collection Records from Rincón Del Tigre, Santa Cruz, Bolivia.

1. Cultivated area, 3 km E of Mission (Chaco), 10 May 1982. Medium-sized, partially dried up swamp-marshy depression, edge of forest, surrounded by very tall grass, water semipermanent, clear, fresh, mud bottom, some organic matter (animal), abundant floating vegetation, green algae, partial shade. *An. (Nys.) rangeli, Cx. (Cux.) mollis, Cx. (Mel.) ensiformis, Cx. (Mel.) idottus, Ur. (Ura.)* sp. nr. *geometrica, Ur. (Ura.) lowii.*

2. Cultivated area, 2.5 km E of Mission (Chaco), 10 May 1982. Small swamp-marshy depression, in open cultivated area, water semipermanent, clear, fresh, mud bottom, abundant submerged and floating vegetation, full sun. *An. (Nys.) rangeli.*

3. Mission Clinic, on porch, 10 May 1982, 1930-2130 h. Adults attracted to light and human, aspirated from porch walls. *An. (Nys.) allopha, An. (Nys.) rangeli, Cx. (Cux.) coronator, Cx. (Mel.) idottus.*

4. Mission Clinic, inside, 10 May 1982, 1930-2130 h. Adults resting on walls or biting human. *An. (Nys.) allopha, An. (Nys.) rangeli, Cx. (Cux.) quinquefasciatus, Ur. (Ura.) lowii.*

5. Domestic area, 8 m from house, 10 May 1982. Artificial container (208 liter drum), water temporary, clear, no vegetation, bottom with a few leaves, partial shade. *Cx. (Cux.) quinquefasciatus.*

6. Domestic area, 4 m from house, 10 May 1982. Artificial container (wooden trough) on ground, water temporary, clear, no vegetation, bottom with leaves, partial shade. *Cx. (Cux.) coronator, Cx. (Cux.) quinquefasciatus.*

7. Domestic area, 10 m from house, 11 May 1982. Artificial container (small plastic jar) on ground, water temporary, clear, few leaves on bottom, partial shade. *Li. durhamii.*

8. Domestic area, 4-10 m from house, 11 May 1982, 1900-0600 h. CDC light traps, catch from 4 traps pooled under this number, clear, no wind. *Ae. (Och.) scapularis, An. (Nys.) argyritarsis, An. (Nys.) evansae, An. (Nys.) rangeli, An. (Nys.) strodei, Ur. (Ura.) calosomata, Ur. (Ura.) ditaenionota, Ur. (Ura.) geometrica, Ur. (Ura.) lowii, Ur. (Ura.) nataliae.*

9. Domestic area, 1 m from house, 11 May 1982. Artificial container (208 liter drum), water clear, fresh, few leaves on bottom, partial shade. *Cx. (Cux.) coronator.*

10. Domestic area, 0.5 m from house, 11 May 1982. Artificial container (glass jar) on ground, water clear, fresh, mud on bottom, deep shade. *Cx. (Cux.) corniger, Li. durhamii.*

11. Domestic area, 5 m from house, 12 May 1982. Artificial container (208 liter drum), water clear, few leaves on bottom, partial shade. *Cx. (Cux.) corniger, Cx. (Cux.) mollis, Cx. (Mel.) aliciae.*

12. Domestic area, 1 m from house, 12 May 1982. Artificial container (small tin can) on ground, water colored, mud on bottom, deep shade. *Cx. (Cux.) corniger, Li. durhamii.*

13. Domestic area, 0.3 m from house, 12 May 1982. Artificial container (small tin can) on ground, water clear, mud on bottom, deep shade. *Li. durhamii.*

14. Domestic area, 50 m from nearest house, 12 May 1982. Artificial container (1 of 2 large concrete tanning tanks, also see collection 15) sunken into ground, unused, inside enclosed thatched shed, very dense floating leaves and sticks fallen from aging thatched roof, several trapped and dead decaying toads, water colored, deep shade, almost totally dark. *Cx. (Cux.) coronator, Cx. (Cux.) mollis, Cx. (Cux.) quinquefasciatus.*

15. Domestic area, 50 m from nearest house, 12 May 1982. Artificial container (1 of 2 large concrete tanning tanks, see also collection 14) sunken into ground, unused, inside enclosed thatched shed, very heavy floating leaves and sticks fallen from aging thatched roof, several trapped and dead toads, water colored, deep shade, almost totally dark. *An. (Nys.) rangeli, Cx. (Cux.) chidesteri, Cx. (Cux.) corniger, Cx. (Cux.) coronator, Cx. (Cux.) mollis, Cx. (Cux.) quinquefasciatus.*

16. Cultivated area, 200 m from nearest house, 12 May 1982. Animal tracks (cattle) at edge of small pond-lake, water temporary, stagnant, clear, fresh, mud bottom, no vegetation, full sun. *An. (Nys.) rangeli, Cx. (Cux.) coronator.*

17. Cultivated area, 100 m from nearest house, 12 May 1982. Small ground pool near edge of pond-lake, water temporary, stagnant, clear, fresh, mud bottom, no vegetation, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator, Ur. (Ura.) lowii.*

18. Cultivated area, 100 m from nearest house, 12 May 1982. Small ground pool, water temporary, clear, fresh, mud bottom, some green algae, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

19. Plantation area, 200 m from nearest house, 12 May 1982. Large ground pool, water semipermanent, clear, fresh, mud bottom, some emergent grassy vegetation, partial shade. *An. (Nys.) rangeli.*

20. Plantation area, 100 m from nearest house, 12 May 1982. Large, shallow, natural, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent vegetation, full sun. *An. (Nys.) darlingi, An. (Nys.) rangeli, An. (Nys.) strodei, Cx. (Cux.) educator.*

21. Grazing area, 150 m from nearest house, 12 May 1982. At edge of large, shallow, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent grassy vegetation, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, An. (Nys.) strodei.*

22. Ayoreo village, inside house, 12 May 1982, 1800-2000 h. Adults collected resting or biting human. *An. (Nys.) allopha, An. (Nys.) darlingi, Cx. (Cux.) quinquefasciatus, Cx. (Mel.) educator, Ps. (Jan.) albigenu.*

23. Mission area, on porch of house, 11 May 1982, 1800-2000 h. Adults collected biting or landing on human. *An. (Nys.) allopha, An. (Nys.) evansae, An. (Nys.) rangeli, Ma. (Man.) humeralis.*

24. Clearing, plantation area, 200 m S of Mission near stream, 12 May 1982. Malaise trap, 1800-0600 h. *An. (Nys.) allopha, An. (Nys.) argyritarsis, An. (Nys.) rangeli, Ur. (Ura.) geometrica, Ur. (Ura.) lowii.*

25. Clearing, cultivation area, 200 m S of Mission, near stream, 13 May 1982. Malaise trap, 1800-0600 h. *Ad. (Ady.) squamipennis, An. (Nys.) evansae, An. (Nys.) oswaldoi, An. (Nys.) rangeli, Ur. (Ura.) calosomata, Ur. (Ura.) ditaenionota, Ur. (Ura.) geometrica, Ur. (Ura.) lowii, Ur. (Ura.) nataliae.*

26. Clearing, plantation area, 200 m SW of Mission, 13 May 1982. Medium-sized, shallow, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent grassy vegetation, full sun. *Ae. (Och.) scapularis, An. (Nys.) rangeli.*

27. Clearing, plantation area, 200 m from nearest house, 13 May 1982. Medium-sized, shallow, swamp-marsh pool, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent grassy vegetation around edges only, full sun. *Cx. (Cux.) coronator, Cx. (Cux.) mollis, Cx. (Mel.) pilosus.*

28. Clearing, plantation area, 200 m from nearest house, 13 May 1982. Large, shallow, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent vegetation, some green algae, partial shade. *An. (Nys.) rangeli, Cx. (Cux.) coronator, Cx. (Cux.) mollis, Ur. (Ura.) geometrica.*

29. Domestic area, 6 m from house, 13 May 1982. Epiphytic bromeliad (*Billbergia* ?), in yard, on cut tree limb, 1 m above ground, water colored, partial shade. *Wy. (Dod.) aphobema.*

30. Partially cleared area, some secondary growth, 250 m W of Mission near stream, 13 May 1982. Medium-sized, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, abundant submerged and emergent grassy vegetation, deep shade. *Ae. (Och.) scapularis, An. (Nys.) rangeli, Cx. (Cux.) chidesteri, Ur. (Ura.) geometrica.*

31. Partially cleared area, some secondary growth, 250 m W of Mission, along stream, 13 May 1982. Small, freshly-flooded ground pool, water temporary, stagnant, clear, fresh, mud bottom, with leaves and sticks, green algae, deep shade, pool almost totally hidden by low bushes. *Ae. (Och.) oligopistus, Ae. (Och.) scapularis, An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator, Cx. (Mel.)* sp. near *intrincatus, Ps. (Gra.) cingulata.*

32. Partially cleared area, some secondary growth, 300 m NW of Mission, near stream, 13 May 1982. Small, flooded pool in animal (cattle) trail, water temporary, stagnant, turbid, fresh, mud bottom, no vegetation, full sun. *Cx. (Cux.) coronator, Ps. (Gra.) cingulata.*

33. Mission area, inside house, 13 May 1982. Adults collected resting in daytime. *An. (Nys.) allopha, Cx. (Cux.) quinquefasciatus.*

34. Forested area, 6 km SW of Mission (copper mine), 14 May 1982. Epiphytic bromeliad, (*Billbergia* ?) 2 plants, 2 m above ground, water clear, partial shade. *Wy. (Dod.) aphobema.*

35. Forested area, 6 km SW of Mission (copper mine), 14 May 1982. Epiphytic bromeliad (*Billbergia* ?), 2 plants, 8 m above ground, water clear, partial shade. *Wy. (Dod.) aphobema.*

36. Forested area, 6 km SW of Mission (copper mine), 14 May 1982. Epiphytic bromeliad (*Billbergia* ?), 3 plants, 5 m above ground, water clear, partial shade. *Wy. (Dod.) aphobema.*

37. Forested area, 6 km SW of Mission (copper mine area), 14 May 1982. Animal (cattle) hoof prints in low muddy area, middle of trail, water clear, temporary, fresh, no vegetation. *Cx. (Cux.) coronator, Cx. (Cux.) mollis, Ps. (Gra.) cingulata.*

38. Forested area, 6 km SW of Mission (copper mine area), 14 May 1982. Small treehole, 2 m above ground, water clear, very small amount, only 2 larvae, partial shade. *Cx. (Cux.) coronator.*

39. Forested area, 6 km SW of Mission (copper mine area), 14 May 1982. Large treehole (hole cut in standing hollow tree trunk at ground level to rob beehive), water level below ground level, dark red color, partial shade. *Tx. (Lyn.) theobaldi.*

40. Forested area, 4 km NE of Mission (Chaco), 15 May 1982. Small swamp-marshy depression in deep forest, water semipermanent, stagnant, clear, fresh, mud bottom, abundant fallen leaves and sticks, some floating (duckweed) vegetation, green algae, deep shade. *Ae. (Och.) scapularis, An. (Nys.) evansae, Cx. (Cux.) chidesteri, Cx. (Cux.) coronator, Cx. (Mel.)* sp. near *intrincatus, Ps. (Gra.) cingulata.*

41. Forested area, 5 km NE of Mission (Chaco), 15 May 1982. Medium-sized, swamp-marshy depression, water temporary, stagnant, clear, fresh, mud bottom, with leaves and sticks, scarce floating vegetation, deep shade. *An. (Nys.) evansae, Cx. (Cux.) chidesteri, Cx. (Cux.) coronator, Cx. (Cux.) mollis.*

42. Forested area, 5 km NE of Mission (Chaco), 15 May 1982. Medium-sized, shallow, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, leaves and sticks, no vegetation, deep shade. *Ae. (Och.) scapularis, An. (Nys.) evansae, An. (Nys.) rangeli, Cx. (Cux.) chidesteri, Cx. (Cux.) coronator, Cx. (Cux.) mollis, Ps. (Gra.) cingulata.*

43. Forested area, 5 km NE of Mission (Chaco), 15 May 1982. Animal (cattle) hoofprints at edge of swamp, water temporary, stagnant, clear, mud bottom, deep shade. *An. (Nys.) evansae, Cx. (Cux.) coronator, Cx. (Mel.)* sp. near *intrincatus, Ps. (Gra.) cingulata.*

44. Forested area, 5 km NE of Mission (Chaco), 15 May 1982. Large, swamp-marshy depression, water semipermanent, stagnant, clear, fresh, mud bottom, some root mats suspended from bushes above water, some leaves (larvae were under root mats), deep shade. *Cx. (Mel.) ensiformis, Cx. (Mel.)* sp. near *intrincatus.*

45. Forested area, 5 km NE of Mission (Chaco), 15 May 1982. Medium-sized, swamp-marshy depression, water semipermanent, stagnant, clear, mud bottom, leaves, many roots suspended from bushes above water, some floating vegetation (duckweed), deep shade. *An. (Nys.) evansae, Cx. (Cux.) chidesteri, Cx. (Cux.) coronator, Cx. (Mel.) ensiformis, Cx. (Mel.)* sp. near *intrincatus, Ur. (Ura.) leucoptera, Ur. (Ura.) lowii, Ur. (Ura.) nataliae.*

46. Mission area, 1 m from house, 16 May 1982, 1830-1930 h. Adults collected biting or landing on human. *An. (Nys.) allopha, An. (Nys.) argyritarsis, An. (Nys.) rangeli, Ma. (Man.) humeralis.*

47. Forested area, 4 km SW of Mission (road to copper mine), 17 May 1982. Epiphytic bromeliad (*Billbergia* ?), on log at ground level, 5 separate plants grouped together, water clear, partial shade. *Wy. (Dod.) aphobema.*

48. Forested area, 4 km SW of Mission (road to copper mine), 17 May 1982. Epiphytic bromeliad (*Billbergia* ?), 6 m above ground, 5 separate plants grouped together, water clear, partial shade. *Wy. (Dod.) aphobema.*

49. Mission area, 5 m from house, 17 May 1982. Artificial container (18.9 liter can), water clear, partial shade. *Cx. (Cux.) quinquefasciatus.*

50. Forested area, 4 km SW of Mission (road to copper mine), 17 May 1982. Large, swamp-marshy depression, water semipermanent, stagnant, clear, mud bottom, leaves along edges, no vegetation, partial shade, larvae mostly in leaves along edges. *An. (Nys.) evansae, An. (Nys.) oswaldoi, An. (Nys.) rangeli, Cx. (Cux.) coronator, Cx. (Mel.) idottus, Cx. (Mel.)* sp. near *intrincatus.*

51. Forested area, 5 km SW of Mission (road to copper mine), 17 May 1982. Epiphytic bromeliad (*Billbergia* ?), 2.5 m above ground, water clear, partial shade. *Wy. (Dod.) aphobema.*

52. Mission area, in yard, 17 May 1982. Epiphytic bromeliad (*Billbergia* ?), 1 m above ground, water clear, partial shade. *Wy. (Dod.) aphobema.*

53. Partially cleared area, edge of forest, 3 km SE of Mission, 18 May 1982. Palm (Motacú) stump, about 11-13 cm above ground level, water slightly colored and fermented with sour smell, larvae between the many palm fibers and very crowded (500 +), partial shade. *Wy. (Den.) kerri.*

54. Cleared, grazing area, 3 km SE of Mission, 18 May 1982. Animal (cattle) hoofprints, edge of watering hole, water turbid, mud bottom, full sun. *An. (Nys.) rangeli.*

55. Cleared, grazing area, 3 km SE of Mission, 18 May 1982. Animal (cattle) hoofprints in low-wet swampy area, water semipermanent, turbid, mud bottom, some cattle waste, scarce emergent grass, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, An. (Nys.) strodei, Cx. (Cux.) coronator.*

56. Forested area, 4 km SE of Mission, 18 May 1982. Epiphytic bromeliad (*Billbergia* ?), 2.5 m above ground, water clear, some organic matter, partial shade. *Wy. (Dod.) aphobema.*

57. Cleared, grazing area, 4 km SE of Mission, 18 May 1982. Large wheel ruts in road, water temporary, stagnant, turbid, mud bottom, no vegetation, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

58. Partially cleared area, some low secondary growth, 4 km SE of Mission, 18 May 1982. Shallow seepage-spring, water semipermanent, very slow movement, clear, mud bottom, some leaves, no vegetation, deep shade. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

59. Partially cleared area, some low secondary growth, 4 km SE of Mission, 18 May 1982. Very small seepage pools, water semipermanent, clear, mud bottom, no vegetation, partial shade. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

60. Partially cleared area, some low secondary growth, 4 km SE of Mission, 18 May 1982. Small seepage-spring, water semipermanent, clear, mud bottom, some fallen leaves and sticks, no vegetation, deep shade. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

61. Cleared, grazing area, 3 km SE of Mission, 18 May 1982. Large marsh, water semipermanent, slow movement, clear, fresh, mud bottom, abundant submerged, floating and emergent, grassy vegetation, some green algae, full sun. *An. (Nys.) rangeli, Cx. (Cux.) coronator.*

62. Forested area, 4 km SE of Mission, 18 May 1982, 1200-1600 h. Mixed collection of adults from resting, biting or landing on human, on ground or 3 m above ground level. *Ae. (Och.) scapularis, Ae. (Och.) serratus, An. (Nys.) allopha, An. (Nys.) evansae, Hg. (Con.) leucocelaenus, Hg. (Hag.) janthinomys, Ps. (Jan.) albigenu, Ps. (Jan.) ferox, Sa. (Sab.) belisarioi, Tx. (Lyn.) theobaldi, Ur. (Ura.) calosomata.*

63. Partially cleared area, some low scrub, 300 m W of Mission, near stream, 19 May 1982, 1600-1830 h. Adults collected landing on or biting human. *Ae. (Och.) scapularis, Ae. (Och.) serratus, An. (Nys.) allopha, An. (Nys.) argyritarsis, An. (Nys.) darlingi, An. (Nys.) evansae, An. (Nys.) rangeli, An. (Nys.) rondoni, Ma. (Man.) humeralis, Ur. (Ura.) ditaenionota, Ur. (Ura.) nataliae.*

64. Forested area, mixed, primarily Motacú palm, 3 km W of Mission

(Palmeta), 20 May 1982. Swampy seepage area about 4 m inside tree line from open field, water temporary, slow moving, clear, mud bottom, some fallen leaves, scarce emergent grass, partial shade. *An. (Nys.) strodei.*

65. Forested area, mixed, primarily Motacú palm, 3 km W of Mission (Palmeta), 20 May 1982. Animal (cattle) hoofprints at edge of stream, water temporary, clear, mud bottom, partial shade. *Cx. (Cux.) coronator.*

66. Cleared area, 3 km W of Mission (Palmeta), 20 May 1982. Stream margin, water semipermanent, slow moving, clear, mud bottom, abundant submerged and emergent grass, some green algae, partial shade. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Ur. (Ura.) geometrica.*

67. Partially cleared area, 3 km W of Mission (Palmeta), approximately 500 m from nearest home, 20 May 1982. Animal (cattle) hoofprints in seepage area, water temporary, stagnant, clear, sand bottom, no vegetation, full sun. *An. (Nys.) argyritarsis, An. (Nys.) strodei.*

68. Forested area, mixed, primarily Motacú palm, 3 km W of Mission (Palmeta), 20 May 1982, 0900-1600 h. Adults collected landing on or biting human. *Ae. (Och.) oligopistus, Ae. (Och.) serratus, An. (Nys.) argyritarsis, An. (Nys.) darlingi, An. (Nys.) rangeli, Ps. (Jan.) albigenu, Ps. (Jan.) ferox, Sa. (Sab.) albiprivus, Sa. (Sab.) belisarioi, Sa. (Sbo.) chloropterus, Sa. (Sbo.) glaucodaemon, Wy. (Den.) kerri.*

69. Cleared area, 3 km W of Mission (Palmeta), 20 May 1982, 1630-1730 h. Adults collected biting human inside abandoned thatched hut. *An. (Nys.) allopha, An. (Nys.) argyritarsis, An. (Nys.) darlingi.*

70. Partially cleared area, some secondary growth, 8 km NW of Mission (Curiche Bravo), 21 May 1982. Large terrestrial bromeliad, water clear, full sun. *Wy. (Dod.) aphobema.*

71. Forested area, 8 km NW of Mission (Curiche Bravo), 21 May 1982. Large treehole, in large fallen hollow tree trunk, about 0.3 m above ground, water colored dark wine red, considerable quantity (14-15 liters), deep shade. *Ae. (Pro.) terrens, Cx. (And.) conservator, Or. fascipes, Tx. (Lyn.) theobaldi.*

72. Partially cleared area, some secondary growth, 8 km NW of Mission (Curiche Bravo), 21 May 1982. Animal (cattle) hoofprints on bank above small stream, water turbid, mud bottom, full sun. *An. (Nys.) argyritarsis, Cx. (Cux.) coronator.*

73. Forested area, 6 km SW of Mission (copper mine), 14 May 1982. Dry treehole, mud in bottom with slight moisture, hole flooded with fresh water at midday, water extracted about 4 hours later, hole about 1 m above ground, many 1st stage larvae visible on following day. *Hg. (Con.) leucocelaenus.*

74. Domestic-plantation area, edge of forest, 8 km NW of Mission (Curiche Bravo), 21 May 1982, 1400-1600 h. Adults collected biting human inside thatched hut. *An. (Nys.) allopha, An. (Nys.) darlingi, Sa. (Sab.)*

belisarioi.

75. Partially cleared area, some low secondary growth, 200 m E of Mission, along stream, 22 May 1982. Very deep, medium-sized ground pool, water semipermanent, clear, some emergent grasses around edge, full sun. *An. (Nys.) evansae, An. (Nys.) rangeli, Ur. (Ura.) lowii.*

76. Partially cleared area, some secondary growth, 250 m from nearest house, 22 May 1982. Animal (cattle) hoofprints, edge of swampy area, water clear, mud bottom, full sun. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, Cx. (Cux.) coronator.*

77. Partially cleared area, some secondary growth, 500 m SE of Mission, 22 May 1982. Animal (cattle) hoofprints at margin of stream, water clear, mud bottom, scarce grassy vegetation, full sun. *An. (Nys.) argyritarsis, Cx. (Cux.) coronator.*

78. Partially cleared area, some low secondary growth, 500 m W of Mission, 22 May 1982. Medium-sized, swamp-marshy depression, water semipermanent, stagnant, clear, mud bottom, with leaves and sticks, dense green algae, partial shade. *An. (Nys.) argyritarsis, An. (Nys.) rangeli, An. (Nys.) strodei, Ur. (Ura.) geometrica.*

79. Domestic area, 2 m outside house, 22 May 1982, 1830-1930 h. Adults collected biting human. *An. (Nys.) darlingi, Ma. (Man.) titillans.*

80. Domestic-plantation area, 8 km NW of Mission (Curiche Bravo), 21 May 1982, 1600-1700 h. Adults collected biting human. *An. (Nys.) darlingi.*

81. Forested area, mixed, primarily Motacú Palm, 3 km W of Mission (Palmeta), 22 May 1982, 1200-1600 h. Adults collected biting human at ground level. *Ae. (Och.) hortator, Wy. (Den.) kerri.*

82. Cleared area, 8 km NW of Mission (Curiche Bravo), 21 May 1982, 1000 h. Adults collected resting under bank of stream. *Ur. (Ura.) calosomata, Ur. (Ura.) geometrica.*

83. Partially cleared area, 400 m W of Mission, 25 May 1982. Medium-sized, swamp-marshy depression, water semipermanent, stagnant, clear, mud bottom, abundant submerged and emergent grassy vegetation and green algae, full sun. *An. (Nys.) argyritarsis, An. (Nys.) darlingi, An. (Nys.) rangeli, An. (Nys.) strodei, Ur. (Ura.) geometrica, Ur. (Ura.) lowii.*

84. Forested area, mixed, primarily Motacú Palm, 3 km W of Mission (Palmeta), 26 May 1982, 1500-1600 h. Adults collected resting on tree trunk or landing on human, 5 m above ground. *Sa. (Sab.) belisarioi, Tx. (Lyn.) theobaldi.*

85. Domestic area, 4 m outside house, 26 May 1982, 1800-2000 h. Adults collected biting human. *An. (Nys.) darlingi, An. (Nys.) rangeli, Cx. (Cux.) quinquefasciatus.*

86. Domestic area, inside student dormitory, 27 May 1982, 0830-1030 h. Adults collected resting. Gravid females held in vials for oviposition,

colony established from egg rafts at Walter Reed Army Institute of Research, Washington, D. C. *Cx. (Cux.) quinquefasciatus.*

87. Forested area, mixed, primarily Motacú Palm, 3 km W of Mission (Palmeta), 25 May 1982, 1045-1145 h. Adults collected biting or landing on human at ground level. *Ae. (Och.) hortator.*

88. Forested area, 3-4 km SE of Mission, 18 May 1982, 0830-1600 h. Adults, mixed collection, biting or landing on human at ground level. *Ae. (How.) vanemdeni, An. (Ano.) intermedius, Or. fascipes, Sa. (Sbo.) glaucodaemon, Wy. (Dav.) petrocchiae.*

89. Forested area, 4 km SW of Mission (road to copper mine), 17 May 1982, 1230-1830 h. Adults, mixed collection, biting or landing on human at ground level. *An. (Nys.) rondoni, Co. (Rhy.) juxtamansonia, Or. fascipes, Sa. (Sab.) albiprivus.*

90. Forested area, 6 km SW of Mission (copper mine), 14 May 1982, 1230-1630 h. Adults collected biting human. *Ae. (How.) vanemdeni, Hg. (Hag.) spegazzini, Ps. (Pso.) saeva.*

91. Forested area, 5 km NE of Mission (Chaco), 15 May 1982, 1715-1915 h. Adults collected biting human. *Ae. (Och.) fulvus, An. (Ano.) intermedius.*