

NOTES ON BRUCHOMYIA AND NEMOPALPUS

(Diptera, Psychodidae)

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The collection of several species of *Bruchomyia* and *Nemopalpus* by my colleagues and myself during recent work with *Phlebotomus* has stimulated the present note, since the three genera are rather closely related and appear to frequent somewhat similar habitats. During the course of *Phlebotomus* collecting in Mexico, Panama, the West Indies, Peru and Brazil, some eighty or more specimens of these genera, representing seven species, two of *Bruchomyia* and five of *Nemopalpus*, have been gathered together. The purpose of this note is to describe, or redescribe, this material, pointing out in passing certain structures of possible taxonomic significance or phylogenetic interest. The material has mostly been studied after mounting, so that in only a few cases has it been possible to make notes on the color and character of the vestiture. This is unfortunate, as a number of species seem to have been largely based on differences in the vestiture, and it has been impossible in one case to place my material with certainty on the basis of structural characters. At the same time I have taken the opportunity to give a check list of the described species, and to prepare a key to the Neotropical species of *Nemopalpus*.

In describing the genitalia I have used the same terminology applied in a previous paper (Fairchild & Hertig 1947) to the genitalia of *Phlebotomus*. This terminology differs in some respects from that used by Alexander and others in describing these insects. Thus the coxite is often termed the basistyle, while the parameres are usually referred to as gonapophyses. Whether the structures herein called parameres are really homologous with the parameres of *Phlebotomus* is uncertain; their sclerotized blade-like or foliaceous character in *Nemopalpus* is not duplicated in any *Phlebotomus*. It is possible that they are in reality homologous with the basal tuft of the coxite so often developed in *Phlebotomus*. The aedeagus is the median intromittent organ. In *Nemopalpus* and *Bruchomyia* the actual genital orifice appears to be single, while in *Phlebotomus* there is a pair of tubular filaments. In some species of *Phlebotomus*, e.g. *P. perfiliewi* Parr. (Hertig 1949), and probably in all, the genital filaments are inserted deeply into the spermathecal ducts, often, if not always, to the full length of the latter during copulation. This results in a correlation of the length of the spermathecal ducts and genital filaments in the sexes of a given species of *Phlebotomus*. In *Nemopalpus* and *Bruchomyia*, however, the single spermatheca has a very long and slender duct, while the intromittent

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organ of the male is quite short and appears incapable of any great degree of exertion. All three genera appear to possess some sort of pumping device to inject the sperm. In the species studied here of both *Bruchomyia* and *Nemopalpus*, the vasa deferentia are long well sclerotized ducts with annular thickenings in their walls, much like tracheae. They are better developed in *Nemopalpus*, where they terminate in funnel-like expansions bearing numerous fine spines within. In *Bruchomyia* in cleared and stained material, these ducts are more slender, less sclerotized and without the funnel-shaped terminations. The lateral lobes of the ninth tergite, so prominent a feature of the genitalia of *Phlebotomus*, are wholly absent in the Neotropical species of *Nemopalpus* and *Bruchomyia*. It may be well to note here that the description of the genitalia of *Bruchomyia argentina* given by Cole (1927) is based on the female, not the male as he supposed.

The mouth parts of both *Bruchomyia* and *Nemopalpus* are short and unfitted for blood-sucking. Mandibles are absent as functional elements while the maxillae are membranous structures with a ciliate margin, quite unfitted for cutting. The cibarium is rather broad and lightly sclerotized, without a chitinous arch or teeth of any kind in the species examined. The pharynx is much like that of *Phlebotomus*, but wholly unarmed.

Nemopalpus Macquart

1838, in Webb et Berthelot, Hist. Nat. d'Iles Canaries, Ent., 1, Diptera, p. 102 (with *N. flavus* Macq. sole species). Eaton, 1904, Ent. Month. Mag. Ser. 2, 15: 55. Becker, 1908, Mitt. Zool. Mus. Berlin, 4: 71-72 (recharacterizes genus from fresh material). Tonnoir, 1922, Ann. Soc. Ent. Belgique, 62: 125-136, a plate (describes *N. pilipes* from Argentina). Alexander, 1921, Ins. Ins. Mens., 9: 157-160; 1928, Proc. Linn. Soc. N. S. Wales, 53: 291-294; 1929, Proc. U. S. Nat. Mus., 75(7): 1-9, 2 figs.; 1940, Rev. Ent., 11(3): 793-799. Edwards, 1929, Ann. Mag. Nat. Hist., 10(3): 421-423. Tonnoir, 1940, 6th Congr. Internat. Ent. Madrid, 1935, pp. 203-213, 7 figs.

Nygmatalodes Loew 1845, Dipt. Beitr. 1: 9.

Palasosycorax Meunier, 1905, Misc. Ent., 13: 50 (with *P. tertiariae* Meun., Baltic amber). Edwards, 1921, Ann. Mag. Nat. Hist., (9)7: 437-439 (desc. *P. molophilina* from Baltic amber).

The genus now includes 19 species, a check list of which is given below. As can be seen the group is world-wide in distribution within the tropics, only the fossil species being extra-tropical. Although generally considered very rare insects, they will probably be found to be fairly abundant when searched for carefully in suitable habitats. The adults seem to prefer dark and humid places, such as hollow trees, the crevices between the buttressed roots of large trees, rock crevices, etc., as daytime resting places and they are often taken in association with *Phlebotomus*. They are also taken occasionally attracted to lights. Nothing appears to be known of the early stages. The eggs contained within the bodies of captured females are relatively large, as large or larger than those of *Phlebotomus* in proportion to the size of the insect. They appear to be similar to *Phlebotomus* eggs, smooth, long oval and fairly thick shelled.

Nemopalpus is far more diversified structurally than *Bruchomyia* and to a considerable extent structural characters appear to reflect geographical distribution. Thus all the Old World species, including

the fossil ones, have R_2 longer or equal to R_{2+3} , while the New World species, with two exceptions, have R_{2+3} very much longer than R_2 . Most of the Old World species have r-m proximal to the fork of M_1-M_2 , whereas the New World species are divisible into two groups in respect to this character. The Old World species of which the male genitalia have been adequately described, show little of the great complexity and bizarre appendages of many of the New World species; in particular the parameres seem lacking or rudimentary. The ascoids are not usually mentioned in descriptions, only those of *N. zelandiae* being described for Old World species. In this case they are forked or antler-like structures, resembling the ascoids in some species of *Psychoda*. In the New World species of both *Bruchomyia* and *Nemopalpus*, where these structures have been noted, they are circular or oval peltate discoidal sacs, one or rarely a pair per segment in *Nemopalpus*, one or two pairs in *Bruchomyia*.

It seems very probable that this diversity of structure will eventually lead to the recognition of one or more named segregates, but until adequate material of both sexes of the genotype, *N. flavus* Macq., can be studied, it would be premature to do so. Becker's (1908) description of the male genitalia of *flavus*, apparently drawn from a pinned specimen, is not very enlightening but suggests a structure rather different from that of any of the Neotropical species. The genitalia of the other Old World species which have been at all adequately described differ widely among themselves and from the Neotropical species.

CHECK LIST OF SPECIES OF NEMOPALPUS

OLD WORLD SPECIES

- australiensis* Alexander 1928, Proc. Linn. Soc. N. S. Wales, 53: 293-294, fig. 1 (wing) (♀; New South Wales, Australia).
capensis Edwards 1929, Ann. Mag. Nat. Hist., (10) 3: 422, text fig. (♂; Port St. John, Pondoland, South Africa).
flavus Macquart 1838, in Webb et Berthelot, Hist. Nat. d'Iles Canaries, Ent., 1, Diptera, p. 102 (♂; Canary Islands).
orientalis Edwards 1928, Journ. Fed. Malay States Mus., 14: 65 (♀; Cameron's Highlands, Gunong Berumban, Malaya).
unicolor Edwards 1933, Journ. Fed. Malay States Mus., 17: 257 (♀; Lumu Lumu, slopes of Mt. Kinabalu, Br. N. Borneo).
zelandiae Alexander 1921, Ins. Ins. Mens., 9: 158, 1 fig. (no sex, New Zealand); Tonnoir, 1940, 6th Congr. Internat. Ent. Madrid, 1935, pp. 203-213, figs. (♂, ♀; various localities on both islands).

NEW WORLD SPECIES

- antillarum* n. sp. (described in this paper from Hispaniola).
arroyoi de Leon 1950, Univ. San Carlos, Guatemala, pub. no. 150, pp. 14-16, figs. 12-18 (♂, ♀; Mazatenango, Guatemala).
brevinervis Barretto and d'Andretta 1946, Livro homenagem a R. F. d'Almeida, no. 6, pp. 60-62, figs. 1-6 (♂; S. Paulo, Brasil).
dampfianus Alexander 1940, Rev. Ent. 11: 796-798, figs. 2, 4 (♂; Chiapas, Mexico).
dissimilis Barretto and d'Andretta 1946, Livro homenagem a R. F. d'Almeida, no. 6, pp. 62-63, figs. 7-8 (♀; Espirito Santo, Brasil); Barretto 1950, Pap. Avulsos Dept. Zool., Sec. Agric., S. Paulo, 9 (22): 341-343, figs. 1-4 (♂; S. Paulo, Brasil).
immaculatus Freeman 1949, Ent. Month. Mag., 85: 86-87, figs. 1-3 (♂; Sta. Catharina, Brasil).
mopani de Leon 1950, Univ. San Carlos, Guatemala, pub. no. 150, pp. 9-14, figs. 2, 5-11, 21 (♂, ♀; Peten, Guatemala).

- moralessi* de Leon 1950, Univ. San Carlos, Guatemala, pub. no. 150, pp. 17-19, figs. 19-20 (♂, ♀; Mazatenango, Guatemala).
- pallipes* Shannon and Del Ponte 1927, Rev. Inst. Bact. Dept. Nac. Higiene, Buenos Aires, 4 (7): 733-744 (♀; Iguazu Falls, Argentina, as *Bruchomyia*).
- pilipes* Tonnoir 1922, Ann. Soc. Ent. Belgique, 63: 130-134, figs. 1-8 (♂, ♀; San Bernardino, Paraguay).
- maculipennis* Barretto and d'Andretta 1946, Livro homenagem a R. F. d'Almeida, no. 6, pp. 64-66, fig. 9 (♀; S. Paulo, Brasil).
- texanus* Alexander 1940, Rev. Ent. 11: 798, fig. 5 (♂; Rio de Janeiro, Brazil).
- sziladyi* Tonnoir 1940, 6th Congr. Internat. Ent. Madrid, 1935, pp. 203-213, 7 figs. (♂; Suiza de Turrialba, Costa Rica).

FOSSIL SPECIES

- molophilinus* Edwards 1921, Ann. Mag. Nat. Hist., Ser. (9) 7: 437-439, text fig. (♂, ♀; Baltic Amber, East Prussia) described as *Palaeosycorax*.
- tertiariae* Meunier 1905, Miscell. Ent. 13: 50 (♂; Baltic Amber) described as *Palaeosycorax*.

I have been able to recognize from the descriptions all but two of the species of *Nemopalpus* described from the New World, and to place them in the key. *N. pallipes* Shannon and del Ponte was described as a *Bruchomyia* and compared with *B. argentina* Alex. Only females were available to Shannon and del Ponte, and the description is largely one of the color and vestiture. No figure is given nor is the number and disposition of the types mentioned. Alexander later (1929) says the species is very close to *pilipes* Tonn., differing only in color, being darker and with paler legs. He states that the Type is in the United States National Museum. Alexander also identifies a male specimen of *pilipes* Tonn. from Iguazu Falls, the type locality of *pallipes*. It is possible that *pallipes* is another synonym of *pilipes*, a species which Shannon and del Ponte did not know.

Of *Nemopalpus moralesi* de Leon I have seen only the female, which is not separable from females of *N. arroyoi* de L. The original description of the male is not entirely adequate, and the figures accompanying the description are not very clear. The species seems to have a style somewhat like that of *N. arroyoi*, but with four cylindrical finger-like lobes. The parameres appear to be triramous, two branches hooked upwards, the third downwards. The aedeagus would appear to be similar to that of *arroyoi*. The wing is like *arroyoi*, *sziladyi* and *mopani*, with short R_2 . The presence of erectile hairs on the abdomen is not noted, but neither were they noted in the description of *mopani*, although the modifications of the lateral margins of the tergites bearing these tufts were noted and can be seen in one of the photomicrographs. The similarity of the structure of the style of *moralessi* to that of *arroyoi* makes it seem likely that erectile tufts were absent in the former also.

KEY TO MALES

1. Cross vein r-m quite far distal to fork of M_1-M_2 ; R_2 much shorter than stem R_{2+3} ; a small setulose lobe on inner apex of coxite; no erectile abdominal hair tufts. 2
2. Cross vein r-m close to or quite far proximal to fork of M_1-M_2 ; no lobe on coxite; erectile abdominal hair tufts present or absent. 3
2. Style with several setose arms; parameres blade-like or foliaceous. *pilipes*
- Style simple, feebly lobed; parameres probably absent, not mentioned in description. *dampfianus*

- | | | |
|----|--|--------------------|
| 3. | R_2 considerably longer than stem vein R_{2+3} ; r-m cross vein at level of or somewhat distal to fork of M_1-M_2 | 4 |
| | R_2 very much shorter than stem vein R_{2+3} ; r-m cross vein considerably proximal to fork of M_1-M_2 | 5 |
| 4. | Style simple, broadly hooked; parameres virtually absent; tufts of erectile hairs on abdomen on last two segments only, lying transversely in the modified 6th and 7th tergites..... | <i>immaculatus</i> |
| | Style complex, with three curved teeth and numerous setae; parameres blade-like; no abdominal tufts mentioned..... | <i>brevinervis</i> |
| 5. | No tufts of erectile hairs on abdomen; style with two finger-like setose lobes and a flat rounded blade..... | <i>arroyoi</i> |
| | Tufts of erectile hairs present on sides of tergites 3 to 7, folding forward into a median dorsal groove..... | 6 |
| 6. | Style simple, without lobes or blade-like extensions; parameres slender blades bearing apical spinelets..... | <i>dissimilis</i> |
| | Style with two or more long blade-like extensions; parameres otherwise..... | 7 |
| 7. | Style with two simple broad, blade-like extensions; parameres very long, recurved, deeply bifid..... | <i>antillarum</i> |
| | Style with one long, slender, twisted extension and a second forked blade-like extension; parameres otherwise..... | 8 |
| 8. | Forked extension of style long and slender, as long as simple extension, deeply forked; parameres broad, simple, not deeply divided; tip of aedeagus relatively simple..... | <i>mopani</i> |
| | Forked extension of style short and broad, the fork shallow; parameres deeply bifid; Tip of aedeagus flared outwards into lateral wing-like extensions..... | <i>sziladyi</i> |

Nemopalpus mopani de Leon

Figs. 14, 15, 32-35

1950. Univ. San Carlos, Guatemala, pub. no. 150, pp. 9-14, figs. 2, 21, 5-11. (♂, ♀; Mopan and Poptun, Peten, Guatemala, in shallow limestone caves.)

Through the kindness of Dr. de Leon I have been able to study a series of this species and to make the accompanying drawings. The species appears to be closest to *N. sziladyi* Tonn. from Costa Rica, from which it differs in the much longer branches of the double spine on the style and in much lesser development of the spinulose tip of the aedeagus. The parameres also are simpler, Tonnoir's species having these structures deeply bifid.

Male.—Wing length 3.51 to 4.05 mm. Head with vertex rather prominent, the eye very large and separated by a narrow space above the antennae. Proboscis short, not as long as first three palpal segments. Labella large and fleshy, mandibles not discernible, maxillae present but short. Cibarium nearly as broad as long, no chitinous arch and no teeth or spines present. Pharynx long and slender, well sclerotized, unarmed. Third palpal segment with a dense patch of Newstead's scales at about the middle. Ascoids small, platter shaped or perhaps bladder shaped in life, single, inserted on the distal third of each segment, including the terminal one. Antennae of two basal and 14 cylindrical flagellar segments, the terminal segment not abruptly shortened nor markedly different from the preceding ones.

Dorsum of thorax heavily pigmented, the pleura and coxae much less so. A patch of small setae present on the upper part of the mesanepisternum, a patch of larger setae on the upper part of the mesepimeron and scattered small setae on the upper half of the sternopleuron. Femora clothed with ligulate scales and a few erect setae of which a few

on the mid femora are quite heavy. Tibiae and tarsi with flat scales and scattered heavy spines. Wings with veins clothed with long hairs, longest on the costa and posterior margin. Venation as figured, quite constant in all material seen.

Abdomen clothed with long semi-erect setae. Sides of third to seventh tergites inclusive bearing rounded sclerotized bosses thickly beset with long erect setae. These setae are longer than the other abdominal setae and probably fold forward into the grooves of the first and second tergites. Second sternite hardly differing from the third. First and second, but not third, tergites split or grooved dorsally.

Genitalia as figured. The parameres are heavily sclerotized blade-like structures. The wrinkled sclerotized ducts leading from the genital pump extend forward to about the fourth abdominal segment, where they terminate in large funnel shaped expansions. They are presumably the vasa deferentia. The genital pump appears to be similar to that of *Phlebotomus*, but the aedeagus is single, membranous and spinulose, with a single forked spinulose internal structure which seems to correspond to the genital filaments of *Phlebotomus*, though whether it is tubular cannot be determined. The ninth tergite is well developed, clothed with long heavy setae, but without lobes or protuberances, bearing at its apex the well developed cerci and a median triangular setulose pygidium.

The *female*, of which only one rather poorly preserved specimen is available, does not differ from the male in external characters except that alpha and delta of the wing venation are a trifle longer. The female lacks the lateral tufts on the abdomen. The spermatheca is a single large oval structure indistinguishable from that of *N. arroyoi*. It can be distinguished from the latter species by having a much paler pleura, by the shape of some of the internal sclerotizations of the terminal segments of the abdomen, and by the less developed external lobe on the sides of the ninth tergite.

Material examined: 4♂, 1♀ Canchacan, Peten, Guatemala, 19 July 1946, R. de Leon, coll.; 1♂ Palenque, Chiapas, Mexico, 28 March 1951, at light. Fairchild and Hartmann coll.

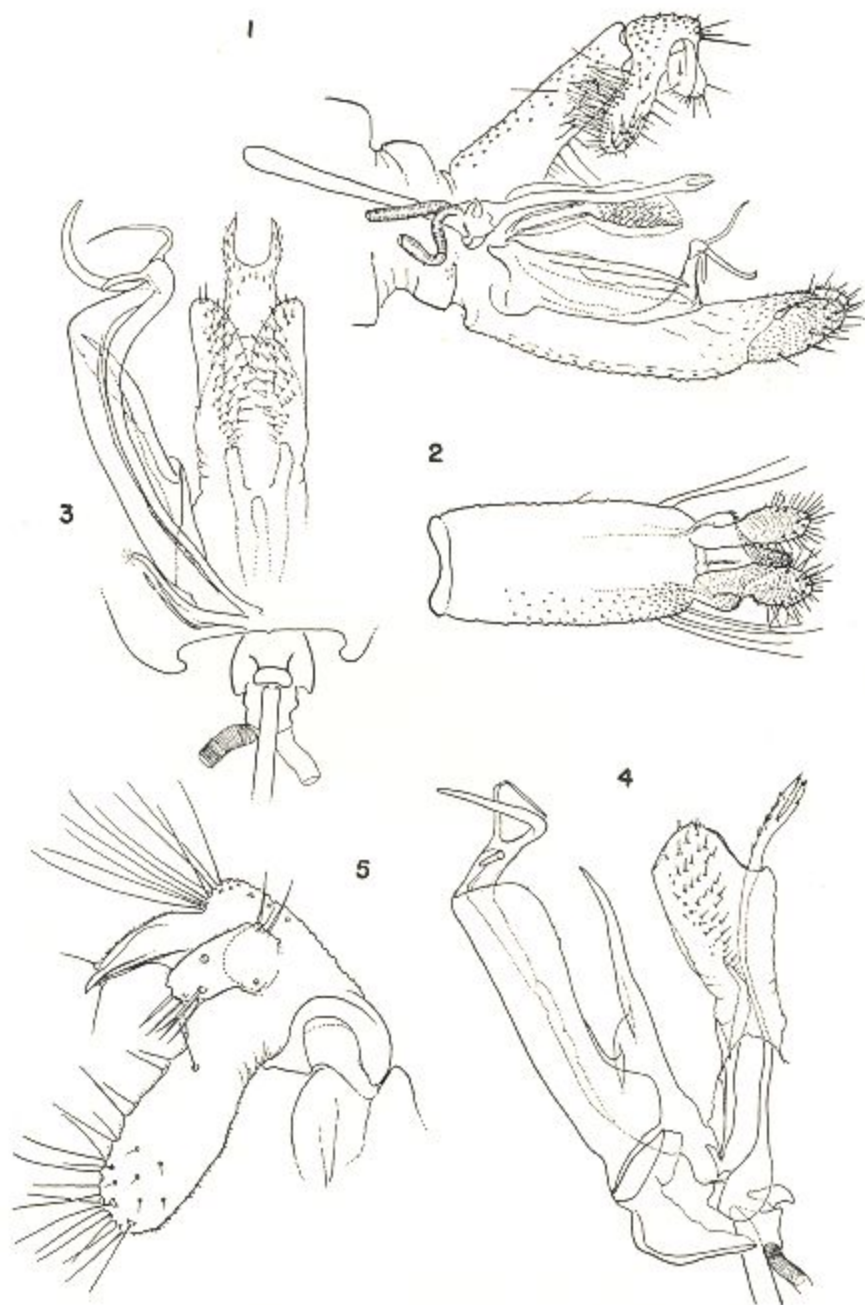
Nemopalpus arroyoi de Leon

Figs. 1-11, 29, 30, 38

1950, Univ. San Carlos, Guatemala, pub. no. 150, pp. 14-16, figs. 12-15, 15 bis 16-18.
(♂, ♀: Mazatenango, Guatemala, in holes in trees.)

In addition to material very kindly sent me by Dr. de Leon, I have a considerable series from several localities at higher elevations in Chiriqui Province, Panama.

Male.—Wing length: 3.87 mm. (Guatemalan specimen); 4.59 to 4.86 (Panama specimens). Venation as figured. Head with vertex prominent, eyes very large and separated by only a narrow space above antennae. Proboscis short, not as long as first three palpal segments, labella large and fleshy, mandibles not discernible, maxillae apparently with membranous tips. Cibarium broad, well sclerotized, without chitinous arch or armature. Pharynx long and slender, pigmented, well sclerotized, unarmed. Third palpal segment with a dense patch of



Nemopalpus arroyoi de Leon. Male terminalia. FIG. 1, lateral aspect, left coxite, style and paramere removed, $\times 67$; FIG. 2, ninth tergite and cerci, ventral aspect, $\times 67$; FIGS. 3 and 4, aedeagus and paramere, ventral and lateral aspects, $\times 135$; FIG. 5, style, ventral aspect, $\times 200$.

Newstead's scales on the middle third. Ascoids as figured, inserted near apex of each flagellar segment including the last, which is not markedly different from preceding segments.

Whole thorax including coxae heavily pigmented. Small setae present on upper part of mesanepisternum and sternopleuron, larger setae on upper part of mesepimeron. Legs less deeply pigmented, clothed with scales and scattered spines as in *N. mopani*. Wings clothed with long hairs on the veins, longer on costa and hind margin, the venation quite constant in all material seen.

Abdomen heavily pigmented, clothed with long semi-erect setae. Sides of tergites without sclerotized bosses or tufts of long setae. Second sternite shorter than third, but little modified.

Genitalia as figured, the aedeagus of similar type to that of *N. mopani*, though the style and parameres are quite different.

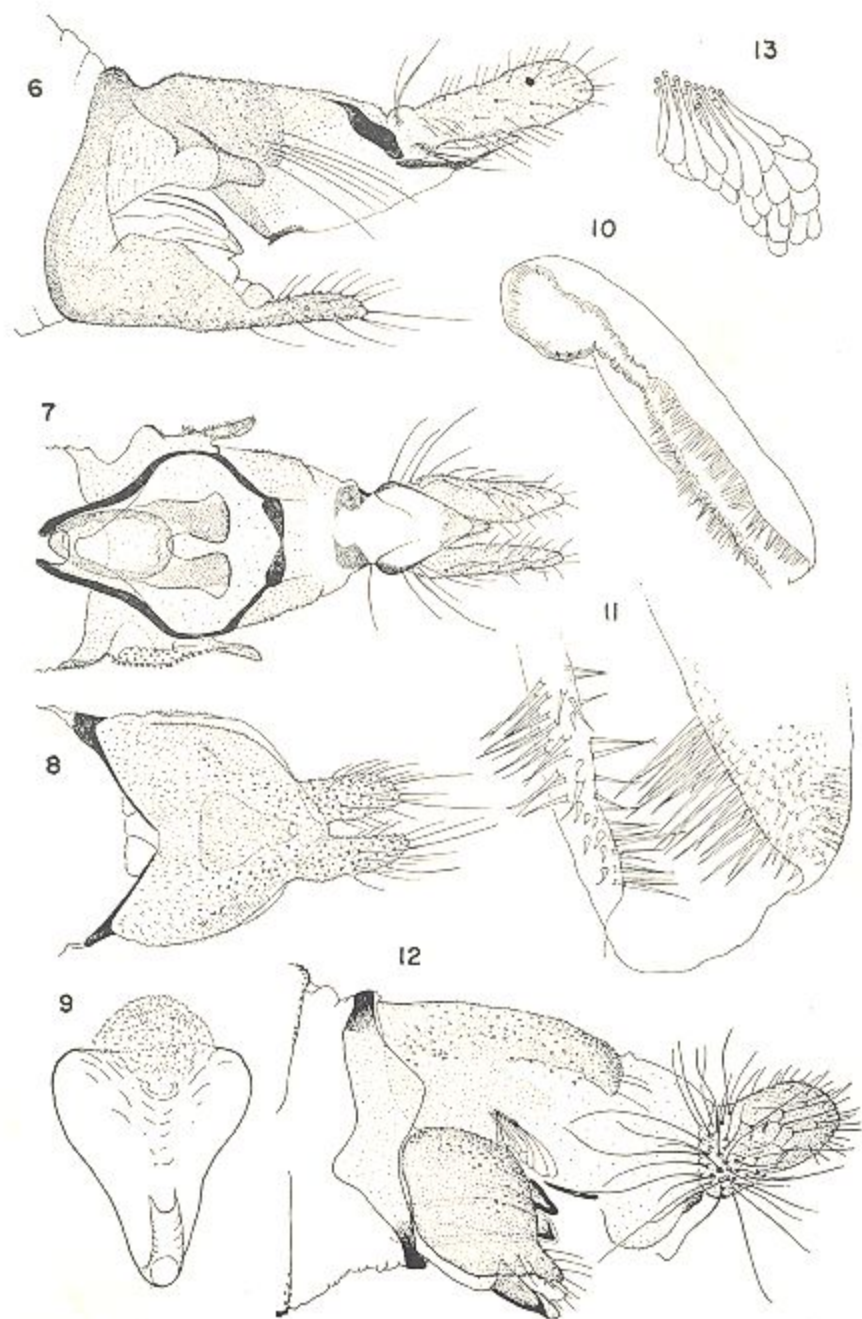
Female.—Wing length: 3.87 to 4.32 mm. (Guatemalan specimens); 4.77 to 5.18 mm. (Panama specimens). Venation as in the male. Ascoids as in male but larger, generally, at least on all but the last few segments, a second smaller though similarly shaped ascoid is discernible. Newstead's scales as in male. Thorax, legs and abdomen as in male. Terminal segments of abdomen as figured, the spermatheca as figured.

The internal structures of the female genitalia are quite complicated. Efforts to portray them in a satisfactory manner have been unsuccessful. The spermathecal duct arises ventrally from the oval sclerotized ring shown as the most dorsal element in fig. 7, the two spinulose arms apparently lying on each side of the vagina. Fig. 9 shows in outline what may be some sort of gland. It is very heavily sclerotized, has what appears to be a duct leading forward and dorsally from its posterior end, while the anterior end is deeply sulcate dorsally and bears some sort of sponge-like median appendage. This "gland" is the most ventral of the genital structures. Between it and the opening of the spermathecal duct lie several folded foliaceous sclerotized sheets, one of which bears a median, rugose, funnel-like aperture, opening between the bases of the spinulose arms. The heavily sclerotized lateral structures, the most ventral elements encircling the others in fig. 7 appear to be homologous with the genital fork of *Phlebotomus*; the latter structure perhaps resulting from a fusion of all three of the elements shown in fig. 7. The various foliaceous ventral structures lying above the ventral "gland" are perhaps modifications of the sclerotized structures called the gonapophyses of the eighth sternite in *Phlebotomus* by Sinton (1925). The heavily sclerotized "gland" seems to have no counterpart in *Phlebotomus*, though some

EXPLANATION OF PLATE II

Nemopalpus arroyoi de Leon. Female terminalia. FIG. 6, lateral aspect, $\times 67$; FIG. 7, ninth tergite and associated structures, ventral aspect, $\times 67$; FIG. 8, eighth sternite, ventral aspect, $\times 67$; FIG. 9, sclerotized "gland" lying in eighth sternite, $\times 200$; FIG. 10, spermatheca, $\times 49$; FIG. 11, posterior end of spermatheca, $\times 200$.

Nemopalpus dampfianus Alexander. Female terminalia. FIG. 12, lateral aspect, $\times 67$; FIG. 13, tuft of modified setae from side of ninth tergite, $\times 200$.



other Psychodids have a somewhat similar structure. The spermatheca is a very thin-walled sac-like structure of large size, equalling at least two abdominal segments in length. It appears to have a long slit in one side and is densely spinose within, the spines longer in the posterior end and along the margins of the slit. The duct is very slender and feebly sclerotized, only occasionally visible in its entirety and apparently arising from the posterior end of the spermatheca. The slit in the spermatheca is probably not open to the body cavity but covered by a thin and tenuous membrane, vestiges of which can be discerned in heavily stained specimens.

Material examined: 1 ♂ 2 ♀, Mazatenango, Guatemala, July, 1945, in hollow Ceiba tree; J. R. de Leon leg.; topotypes. 1 ♂ 2 ♀, Paso Ancho, Chiriqui Prov., Panama, 27 May, 1946, 5000 ft. elev., in hollow tree, P. Galindo coll.; 2 ♂ 1 ♀, El Hato, Chiriqui Prov., Panama, 7 May, 1950, 4500 ft., in buttressed roots, P. Galindo coll.; 2 ♀, same locality, 13 May, 1951, M. Hertig coll.; 9 ♂ 4 ♀, Palo Santo, Chiriqui Prov., Panama, 4600 ft. elev., in buttresses, 18, 24 May, 1950, and 14, 15 June, 1951; 9 ♂ 8 ♀, Bambito, Chiriqui, Panama, 13 June, 1951, in buttresses and rock crevices.

Nemopalpus sziladyi Tonnoir

Figs. 26-28

1940, 6th Congr. Internat. Ent., Madrid, 1935, 1: 203-213, 7 figs. (♂; Suiza de Turrialba, Costa Rica. Types in Mus. Hungarici). Barretto, 1946, *Livro homenagem a R. F. d'Almeida*, no. 6, p. 59 (in key only). Freeman, 1949, *Ent. Month. Mag.*, 85: 85 (in key only).

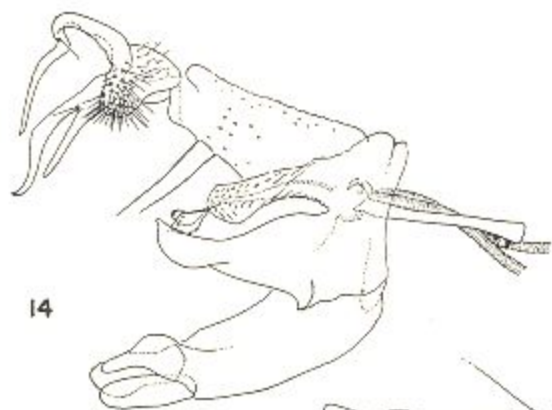
A small series of 2 ♂ and 3 ♀ from Bocas del Toro Province, Panama, less than 100 miles from the type locality, enables me to add a few points to Tonnoir's description and to describe the female.

Male.—Wing length 3.60 mm. Mesonotum dark grey, obscurely striped. Pleura and abdomen beneath clothed with pale silvery grey setae. Long erectile setae of abdomen silvery grey, about the same color as the other abdominal hairs, lying forward as in *antillarum*, but not as long as in that species. Wings uniformly colored, clothed with dark grey shining setae, those on basal costal area not erect or especially long. Legs clothed with dark grey, shining appressed scales and scattered dark erect setae, not more numerous on the fore legs. The hind tarsi are white scaled, the other tarsi somewhat paler than their respective tibiae. The general impression is of a very large and dark *Phlebotomus* with conspicuously white hind tarsi. The genitalia have been well if somewhat diagrammatically figured by Tonnoir.

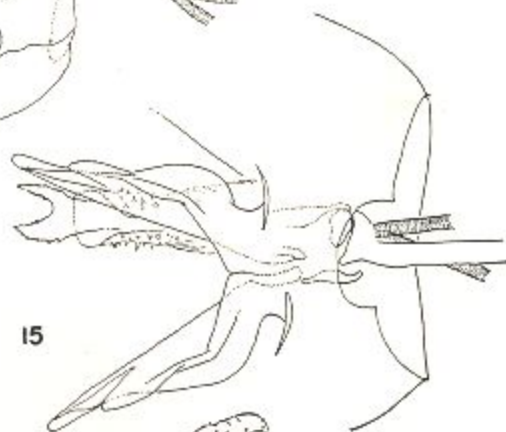
EXPLANATION OF PLATE III

Nemopalpus mopani de Leon. Male terminalia. FIG. 14, lateral aspect, right coxite and style removed, $\times 67$; FIG. 15, aedeagus and parameres, ventral view, $\times 139$.

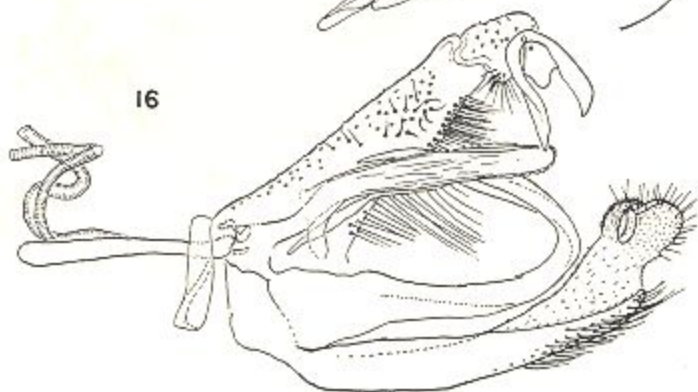
Nemopalpus antillarum n. sp. Male terminalia. FIG. 16, lateral aspect, left coxite, style and paramere removed, $\times 67$, Holotype; FIG. 17, right paramere, lateral aspect, $\times 67$; FIG. 18, style, outer aspect, $\times 200$.



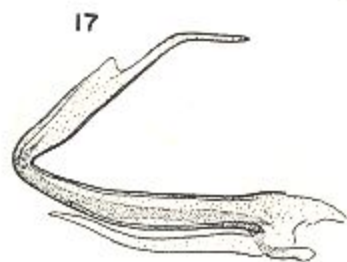
14



15



16



17



18

Female.—Wing length, 3.51 to 3.78 mm. Similar to the male in color characters, but lacking the erectile tufts of hairs on the abdomen. Terminal abdominal segments similar to those of *N. arroyoi*, differing in the shape of some of the internal sclerotizations, in the lesser development of the sclerotized ventral "gland" and in the shorter lateral lobes of the ninth tergite. From *N. mopani* the females cannot be differentiated on the basis of available material. In mounted material both *mopani* and *sziladyi* in both sexes show the pleura considerably less infuscated than the notum, while in *arroyoi* the pleura are very deeply infuscated.

Nemopalpus antillarum sp. nov.

Figs. 16–20, 31, 37

Male.—Wing length 3.78 mm. General color dark grey. Mesonotum obscurely striped, clothed with dense and long pale grey hairs. Legs pale grey, thinly clothed with flat appressed scales, the fore tibiae and to a less extent the fore tarsi with numerous long erect hairs on the outer surfaces. Wings very hairy, the hairs pale grey. Posterior fringe of very long hairs in the anal area, becoming progressively shorter towards the apex. Abdomen with dense tufts of very long pale yellowish erectile hairs on lateral tubercles of segments three to seven inclusive. Tergites one to three inclusive are divided dorsally by a median longitudinal unsclerotized area forming a groove. In repose the long lateral erectile hairs are folded down into this groove, so that they fold forward more or less parallel to the main axis of the body. In life, the hair tufts may be erected into great fans at will, much as are the hair tufts (androconia) of certain male butterflies. It may be surmised, as Tonnoir (1940) has done, that these hairs serve to disseminate an odoriferous substance, perhaps a sexual attractant, though histological investigation of the tubercles bearing the hairs and the groove in which they lie would be needed to prove the point. Abdomen otherwise clothed with grey hairs, the genitalia with light yellowish hairs. Integument of thorax, including coxae, and of abdomen quite heavily pigmented. Legs and genitalia much less infuscated, yellowish.

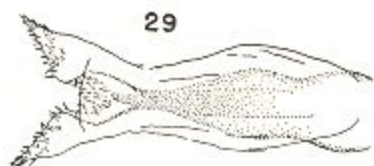
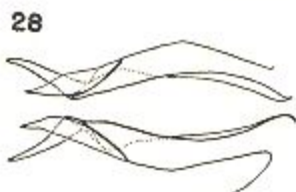
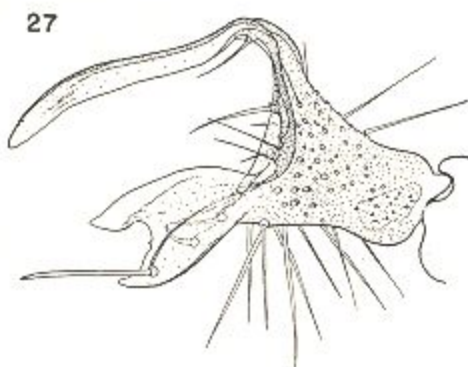
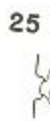
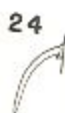
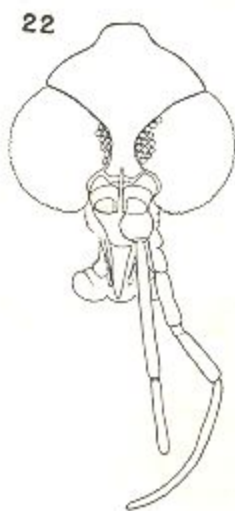
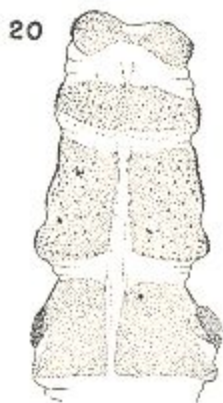
Wing venation as figured. Setae present on the upper part of the mesanepisternum, upper part of mesepimeron and upper half of sternopleuron. Head and mouth parts similar to *N. arroyoi* and *N. mopani*. Palpi and basal antennal segments as figured, ascoids and Newstead's scales essentially as in *arroyoi*. Genitalia as figured, the

EXPLANATION OF PLATE IV

Nemopalpus antillarum n. sp. Male. FIG. 19, abdomen, dorsal aspect, $\times 12.2$; FIG. 20, same, first three tergites only, $\times 32.5$; FIG. 21, seta bearing tubercle of abdominal tergite, dorsal view, $\times 269$.

Nemopalpus dampfianus Alexander. Female. FIG. 22, head, $\times 39$; FIG. 23, eighth antennal segment, $\times 135$; FIG. 24, spinose ascoid, $\times 270$; FIGS. 25 and 26, lateral and dorsal aspects of discoidal ascoids, $\times 270$.

Nemopalpus sziladyi Tonnoir. Male terminalia. FIG. 27, right style, external aspect, $\times 135$; FIG. 28, parameres, dorsal aspect, $\times 135$; FIG. 29, aedeagus, dorsal aspect, $\times 135$.



aedeagus longer, less spinulose, more tubular than in *arroyoi* and *mopani*, but apparently of basically similar structure. In neither of the two available specimens is it well enough oriented for detailed drawing.

Holotype male, slide 1453, Sabana de la Mar, Dominican Republic, 12 June, 1949; taken in buttresses of large tree in cacao plantation 100 ft. elev., 4 km. south of town; Fairchild and Trapido colls.

Paratype male, slide 3678b, genitalia, and slide 3678a, wing, the rest of the specimen preserved dry in a vial; taken between Hato Mayor and Sabana de la Mar, Dominican Republic, 34 km. south of the latter town, under loose bark of a large tree in a coffee plantation at 650 ft. elev., 12 June, 1949; Fairchild and Trapido colls.

This species seems most closely related to *N. mopani* de Leon, from which it differs in the structure of the genitalia, especially the greatly developed parameres, in the greater length of the erectile hairs of the abdomen and in having the third tergite split. In the latter respect it is like *N. sziladyi* Tonn. from Costa Rica, but differs very much from that species in the structure of the style and parameres.

Nemopalpus dampfianus Alexander

Figs. 12, 13, 21-25, 36

1940. Rev. Ent., 11: 796-798, figs. 2, 4 (1 ♂; Finca Vergel, Chiapas, Mexico, May).
Barretto and d'Andretta, 1946, Livro homenagem a R. F. d'Almeida, no. 6, p. 59 (in key).

Female.—Wing length 3.87 mm. Venation as figured. Head with vertex rather prominent. Eyes large, narrowly separated above antennal bases. Proboscis shorter than first three palpal segments. Labella large and fleshy, mandibles not discernible, maxillae membranous at tips. Cibarium without chitinous arch, unarmed. Pharynx slender, well sclerotized, unarmed. Newstead's scales pigmented, interspersed among thickly set short stout spines over about the basal two-thirds of third palpal segment. Antennal segments shorter than in *N. mopani* and *arroyoi*, the ascoids relatively larger, bladder like, two pairs on the first flagellar segment, one pair on at least the next ten flagellar segments, the remainder of the antennal segments missing.

Dorsum of thorax heavily pigmented, pleura moderately so. No pleural setae. Wings with dark hair tufts at least on the main cross

EXPLANATION OF PLATE V

Nemopalpus arroyoi de Leon. Basal antennal segments and palpi. FIG. 30, male; FIG. 31, female, both $\times 67$.

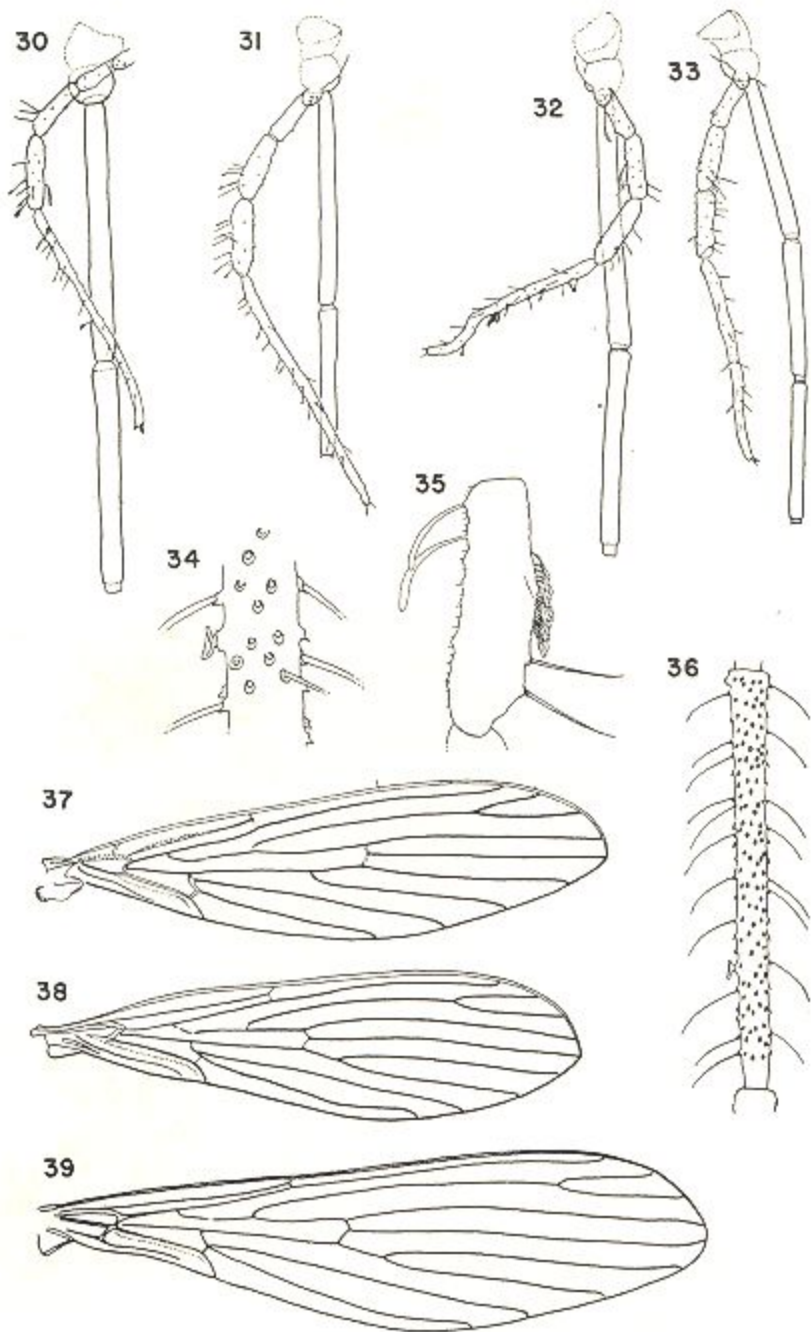
N. antillarum n. sp. FIG. 32, basal antennal segments and palpi of male. $\times 67$.

N. mopani de Leon. FIG. 33, basal antennal segments and palpi of female. $\times 67$; FIG. 34, part of fifth antennal segment showing ascoid, $\times 270$; FIG. 35, third palpal segment showing Newstead's scales, $\times 232$; FIG. 36, fifth antennal segment. $\times 135$.

N. dampfianus Alexander. FIG. 37, wing, $\times 18.6$.

N. antillarum n. sp. FIG. 38, wing, $\times 18.6$.

N. arroyoi de Leon. FIG. 39, wing, $\times 18.6$.



veins. Legs as in *N. mopani*. Abdomen quite heavily pigmented, clothed with semi-erect setae, the second sternite much broader than long. Spermatheca absent, at least no structure comparable to that found in *N. mopani* and *N. arroyoi* is present, though it may well have been lost during mounting. Terminalia as figured, quite distinct from those of the other species considered here, and lacking the ventral heavily sclerotized "gland" of *arroyoi*.

Material examined: 1 female, slide 2972, Palenque, Chiapas, Mexico, 28 March, 1951; taken between the buttressed roots of a large tree in swampy forest on the outskirts of the village of Palenque; Fairchild and Hartman coll.

This specimen is believed to be the female of *N. dampfianus* mainly on the basis of the wing venation and the presence of dark hair tufts on the wings, noted before mounting. The Type locality of *dampfianus* is near Huixtla, in the southeastern part of Chiapas, while Palenque is in the northern part, but both are at relatively low elevations and have rather similar climate, judging by the vegetation.

Aside from the venation and terminal abdominal structure, the absence of pleural setae sets this species quite apart from the other Central American forms. No mention of pleural setae appears in the descriptions of other species.

Bruchomyia Alexander

1920, Ann. Ent. Soc. Amer., 13: 402-405; genotype *B. argentina* Alex. Edwards, 1921, Ann. Mag. Nat. Hist., (9)7: 437-439. Alexander, 1929, Proc. U. S. Nat. Mus., 75(7): 1-9, 2 figs. Tonnoir, 1939, Brit. Mus. Ruwenzori Exped., 1934-5, 1(4): 37-38; 1940, 6th Congr. Intern. Ent., Madrid, 1935, p. 211. Barretto and d'Andretta, 1946, Livro homenagem a R. F. D'Almeida, no. 6, pp. 66-68.

This genus appears to be limited to the southern part of South America, extending north to about the latitude of Lima, Peru, on the west and the State of Ceara, Brasil, on the east. It is as yet unrecorded from Chile.

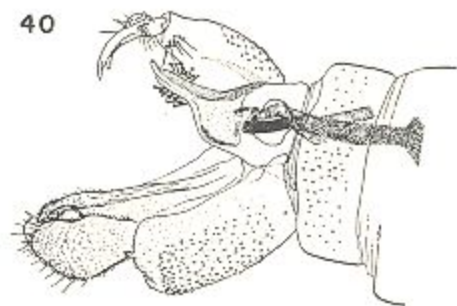
Bruchomyia may be distinguished from any of the Neotropical species currently placed in *Nemopalpus* by the long Cu_1 , which generally bears a short spur to the margin before its end, by having more than 16 antennal segments, and by the simpler genitalia. The species are all very similar and have been distinguished on relatively small differences in wing venation, number of antennal segments, genitalic details and color characters. It is quite possible that with the accumulation of more material some of the characters now depended upon for specific separation will prove unsatisfactory. The eight species so far described

EXPLANATION OF PLATE VI

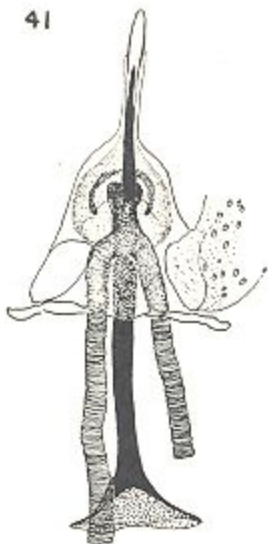
Bruchomyia fusca Barretto. Male terminalia. FIG. 40, lateral aspect, right coxite and style removed, $\times 67$; FIG. 41, aedeagus, dorsal aspect, $\times 135$; FIG. 42, coxite and style, inner aspect, $\times 200$.

Bruchomyia shannoni Alexander. Male terminalia. FIG. 43, lateral aspect, right coxite and style removed, $\times 67$; FIG. 44, dorsal aspect, semi-diagrammatic, $\times 67$; FIG. 45, apex of coxite and style, inner aspect, $\times 200$.

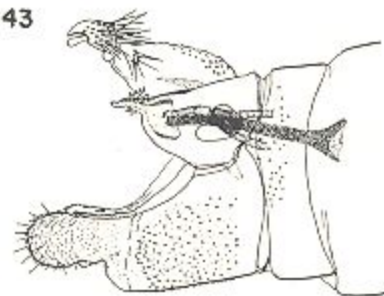
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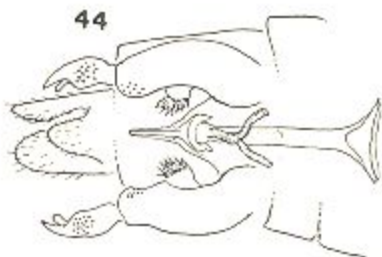
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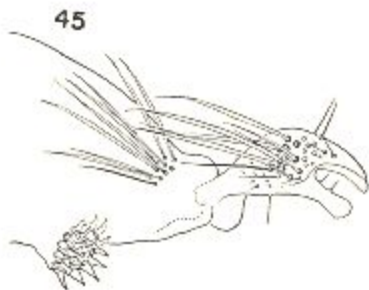
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are listed below but it has been found impossible to construct a satisfactory key based on structural character to these species from the available descriptions.

CHECK LIST OF SPECIES OF BRUCHOMYIA

- almeidai** Barretto and d'Andretta 1946, Livro homenagem a R. F. d'Almeida, no. 6, pp. 68-71, figs. 10-13 (♀; S. Paulo, Brasil). Barretto 1950, Pap. Avulsos Dept. Zool. Secret. Agric. S. Paulo, 9 (22): 343-346, figs. 9-13 (♂; S. Paulo).
- argentina** Alexander 1920, Ann. Ent. Soc. Amer., 13: 405, figs. 1-9 (♂; Prov. Cordoba, Argentina).
- brasiliensis** Alexander 1940, Rev. Ent., 11 (3): 795-796, figs. 1, 3 (♂; Ceara, Brasil).
- fusca** Barretto 1950, Papeis Avulsos Depto. Zool. Secr. Agric. S. Paulo, 9(22): 348-349, figs. 6-9 (♂; S. Paulo, Brasil).
- peruviana** Alexander 1929, Proc. U. S. Nat. Mus., 75 (7): 6 (♀; Colonia Perene, Chanchamayo, Peru).
- plaumanni** Alexander 1944, Rev. Ent., 15 (3): 313-315, figs. 1-2 (♂; Santa Catarina, Brasil).
- shannoni** Alexander 1929, Proc. U. S. Nat. Mus. 75 (7): 4 (♂, ♀; Verrugas Canyon, Lima, Peru).
- unicolor** Barretto 1950, Pap. Avulsos, Dept. Zool. Secr. Agric. S. Paulo, 9 (22): 347-348, figs. 14-16 (♂; Sao Paulo, Brasil).

Bruchomyia fusca Barretto

Figs. 39-41, 45-51

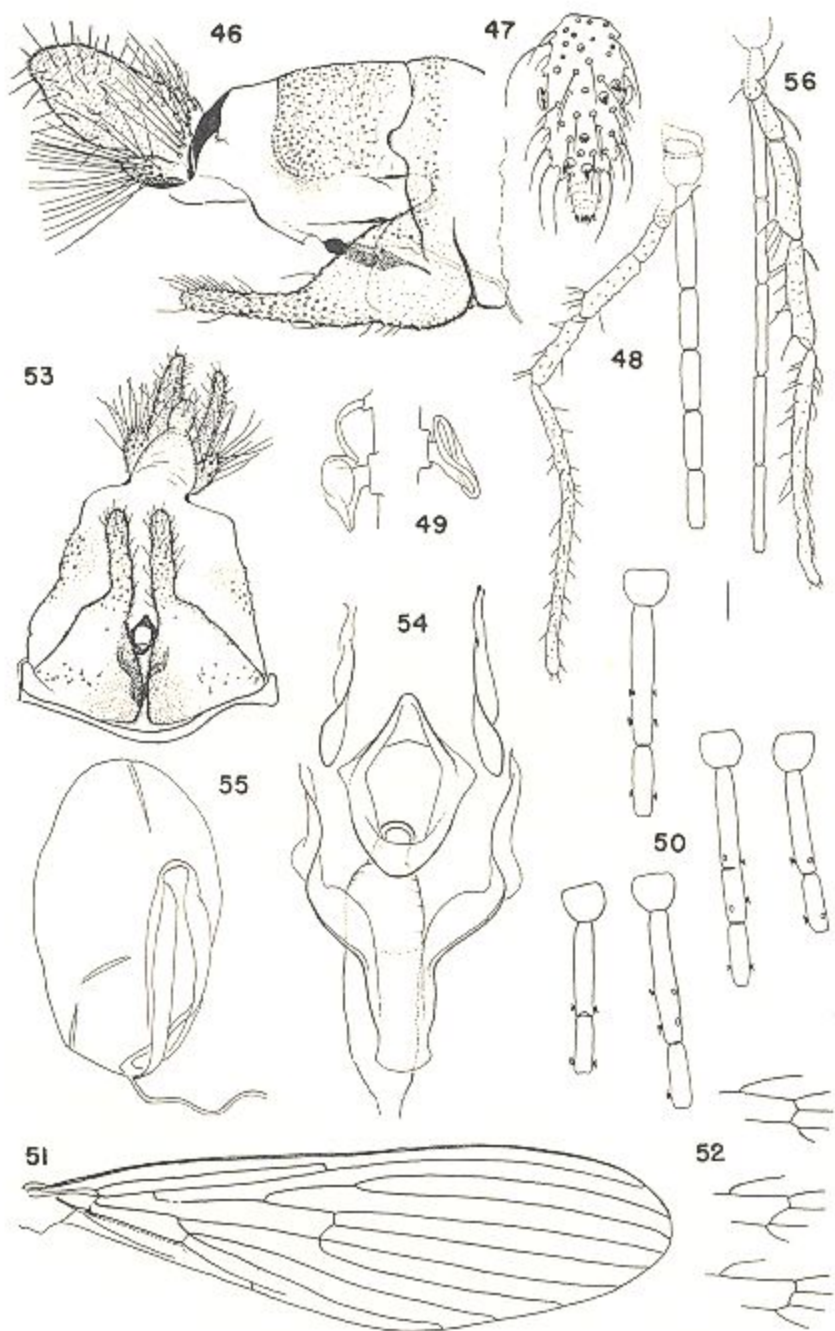
1950, Papeis Avulsos Depto. Zool. Secr. Agric. S. Paulo, 9 (22): 348-350, figs. 6-9 (♂; Serra da Cantareira, S. Paulo, Brasil).

A series of 7 ♂ 1 ♀ taken in a rock grotto at Boa Vista, Rio de Janeiro, Brasil, 6 Feb. 1950 by my colleague, Dr. Marshall Hertig, which I believe to be this species, enables me to make some additions to Barretto's description, and to give figures of some structures of possible taxonomic significance. This material was collected in alcohol, so I am unable to describe the vestiture, but it does not appear as though the wings bore contrasting markings. The series is quite variable in regard to the length of the third antennal segment and the position of the r-m cross vein in relation to the bifurcation of M_1 - M_2 , characters hitherto considered sufficiently stable to be used for specific differentiation. In the case of the antennae, the third segment usually is about twice as long as the fourth, but the ratio third-fourth varies from 1.6 to 2.5. Four specimens have the third segment relatively

EXPLANATION OF PLATE VII

Bruchomyia fusca Barretto. FIG. 46, female terminalia, lateral aspect, $\times 67$; FIG. 47, terminal antennal segment of male, $\times 270$; FIG. 48, basal antennal segments and palpus, male, $\times 67$; FIG. 49, ascoids, lateral aspect, showing spinose and discoidal types, $\times 604$; FIG. 50, basal antennal segments of three male specimens, the single one showing the normal proportions, the other two pairs showing the variations mentioned in the text, all $\times 67$; FIG. 51, wing of male, $\times 18.6$; FIG. 52, variations in position of r-m in relation to fork of M_1 - M_2 in different specimens, $\times 18.6$.

Bruchomyia shannoni Alexander. FIG. 53, female terminalia, ventral aspect, $\times 67$; FIG. 54, sclerotized structures surrounding genital opening, ventral aspect, $\times 270$; FIG. 55, spermatheca, $\times 400$; FIG. 56, basal antennal segments and palpus of female, $\times 67$.



long, the ratio being greater than 2, two have it short, the ratio less than 2, while three have the third segments markedly unequal on the two sides. In one of these the suture between the third and fourth segments is incomplete on one side. In those specimens having the third segment relatively long, there are two pairs of ascoids on this segment, while in those having the third segment short, there is but a single pair of ascoids, as on the remaining segments. In the specimens with unequal segments, two have a single pair of ascoids on the short side, two pair on the long side. The third specimen has one side short, with a single pair of ascoids, the other side with the suture between the third and fourth segments incomplete, this suture falling between the two pairs of ascoids. This unstable condition may indicate the method by which *Eutonnoiria edwardsi* (Tonn.) achieved its very numerous antennal segments. Unfortunately, in only one specimen of this series, a male, is there a complete antenna, of 31 segments, so it is not possible to say whether this species shows the variability in number of antennal segments demonstrated for *B. shannoni*, though it is a likely possibility.

In the case of the position of the r-m cross vein relative to the bifurcation of M_1-M_2 , several specimens have the cross vein joining M_1 precisely at the bifurcation, as in *shannoni*, while in others the junction may be either proximal or distal to the bifurcation.

Coxite rounded externally, apparently deeply grooved on the internal aspect, where there is a long tapering strip of sclerotization extending from the base of the coxite to beyond the internal tuft of setae. This strip bears an internal flat strip of sclerotization joined at right angles to the internal surface of the coxite and acts as an apodeme for the attachment of muscles. This structure is not well shown in the figure of coxite and style, and has been omitted to avoid confusion in the figures of the aedeagus.

Aedeagus a hollow sclerotized cone, probably the modified 8th sternite, lying between the bases of the coxites. The coxites appear to be inserted dorsolaterally near the base of this cone, in cleared preparations their places of attachment form windows in the cone. Within the cone there lies a smaller sclerotized hollow hemisphere, its apex drawn out to form the tubular intromittent organ. Into its open base is inserted the distal end of the sperm pump plunger, to which is attached near the apex the paired vasa deferentia, so that the whole structure no doubt corresponds to the sperm pump and genital filaments of *Phlebotomus*.

The 9th tergite arises slightly anterior to the base of the aedeagus, its anterior angles apparently attaching to a pair of horns arising from the lateral margins of the cone. The inner, upper surface of the 9th tergites is largely membranous, but bears a median sclerotized strip which is joined to the thickened lower margin of the aedeagal cone. This strip extends posteriorly to form the pygidium lying between the cerci. There are no lateral lobes, unless a pair of very small finger-like processes arising laterally from the membrane between the more sclerotized part of the 9th tergite and the base of the cerci can be considered incipient lateral lobes. Homologues of these protuberances are also found in

the female, but the large setiferous knobs lying laterally at the base of the cerci in the female, seem totally wanting in the male.

The spermatheca of *fuscata* is indistinguishable from that of *shannoni*, consisting of a large thin-walled roughly spherical sac one side of which bears a long slit like an elongated button hole, bordered by two broad sclerotized strips. The duct is very slender and long, tenuous and thin walled.

Bruchomyia shannoni Alexander

Figs. 42-44

1929, Proc. U. S. Nat. Mus., 75 (7): 4-6, figs. 1-2 (5 ♂, 1 ♀; Verrugas Canyon, Dept. of Lima, Peru, April). Alexander, 1940, Rev. Ent., 11 (3): 795 (in key). Barretto and d'Andretta, 1946, Livro homenagem a R. F. d'Almeida, no. 6, p. 67 (in key).

A series of 6 ♂ and 7 ♀ from Surco and Tornamesa in the Rimac Valley above Lima, Peru, enables me to make some additions to Alexander's description of this species. The two teeth of the style appear to be shorter and blunter than in any of the other described species, while the setae in the tuft on the inner aspect of the coxite are very short, almost conical, and do not have the frayed or multiple branched tips of some of the other species. The position of the r-m cross vein in relation to the forking of M_1-M_2 is very constant in my material, the cross vein arising at or exceedingly close to the fork in all cases. The number of antennal segments varies somewhat, the three males in the series with complete antennae showing 27, 29 and 29 segments, the last three rather abruptly shortened. The five females with complete antennae show two with 26 segments and three with 27. The length of the third segment relative to the fourth also is rather variable, the ratio third-fourth varying from 1.5 to 2.0 in the females and 1.33 to 1.38 in the males. The ascoids appear to be of two sorts, discoidal or sac-like organs, and short curved hollow seta-like structures. Of the first, the females appear to have a pair on each flagellar segment, perhaps more on the first flagellar (segment 3), while in the males only one per segment can be made out. These discoidal ascoids are quite near the distal end of each segment. The seta-like ascoids are more numerous and scattered about on the segments. Newstead's scales are present in a diffuse patch on the middle third of the third palpal segment.

This species is not uncommon in the Verruga zone of the Rimac valley in Peru, being quite often taken resting in dark corners of houses and in shallow caves in company with *Phlebotomus*. Dr. Aristides Herrer of the Instituto de Hygiene in Lima has discovered that the immature stages are apparently passed in leaf mold, as a number of specimens emerged from litter collected from beneath pepper trees in the Verruga zone. It is hoped that he will be able to secure larvae in the near future.

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