NOTES ON PHLEBOTOMUS, WITH DESCRIPTIONS OF NEW SPECIES.

Part II.

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In this paper four new species of *Phlebotomus* are described, three from Africa and one from the Malay States, and the differential characters and affinities of seven other known species are described and illustrated. Three specimens, including one of *P. minutus*, Rond., and two of *P. papatasii* (Scop.), have been observed to possess supernumerary spines on the superior claspers: a remarkable and apparently hitherto unrecorded phenomenon in this genus. In several instances fresh data are given as to the geographical distribution of these insects, and an endeavour has been made to clear up some confusion with regard to certain closely allied species.

The major portion of the material has been supplied by the Imperial Bureau of Entomology, through the Director, Mr. Guy A. K. Marshall, to whom I express my grateful thanks. I beg also to acknowledge my indebtedness to Drs. E. Sergent and E. Roubaud, of the Pasteur Institute, Paris; to Captain Marett and Drs. M. H. Babington, A. Ingram, A. T. Stanton and F. D. Walker, and Mr. G. Bedford for the interesting material which they have been pleased to submit to me from time to time.

As our studies of these minute and obscure insects has advanced, the more difficult and serious have the problems concerning the exact elucidation of the specific taxonomic characters become. This is due in a large measure to the apparently great range of variation which exists in the antennal and palpal formulae, and also the wing venation; more especially so is this the case in that group of which *P. minutus* may be taken as a type. Pairs taken in coitu are much needed for microscopical study, as at present the females, at least, are distinguishable only with great difficulty and minute examination.

To the student of this group of insects I would venture to call attention to the inexpediency of relying solely on one set of characters, such as the antennae, the palpi or the wings; and in some instances the male genital armature also. All the factors must be taken into consideration by the systematist. I would appeal also to those who deal with the taxonomy of these small midges to supplement their papers with carefully prepared drawings, as in the absence of these it is often impossible to determine a species with accuracy.

Phlebotomus ingrami, sp. nov. (fig. 1).

♂.—Length, 2·2 mm ; wing, 1·5 mm ; front leg, 2·2 mm ; hind leg, 2·8 mm.

A relatively small species, the distinguishing features of which are the densely packed group of long stiff bristles at the end of the inferior claspers and the two pairs of widely separated spines on the superior claspers.

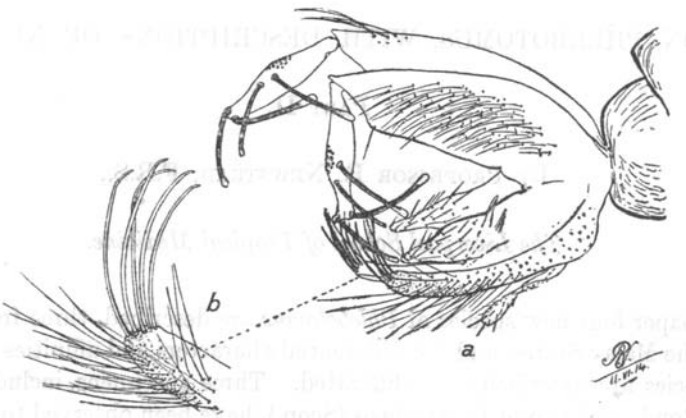

Fig. 1. *Phlebotomus ingrami*, sp.n., ♂ ; *a*, genital armature, × 150 ; *b*, distal portion of inferior clasper, × 225.

Antennae composed of *long slender segments* similar to those of *P. simillimus*, but the third segment is relatively shorter and barely reaches to the tip of the proboscis. Palpi relatively stout, 2nd segment about half the length of the fourth. Wings narrowly lanceolate ; tip of 1st longitudinal vein overlapping the anterior branch of the second vein by a little more than one-third its total length. *Legs* densely clothed with narrowly lanceolate scales ; ungues simple and near them, on the tarsus, three pairs of spines, the ventral pair minute ; the subventral pair about half the length of the lateral ones. External genital armature (fig. 1, *a*) relatively small compared with the width of the abdomen ; terminal segment of the superior claspers with two pairs of widely separated spathuliform spines ; inferior claspers (fig. 1, *b*) with a densely packed group of long stiff bristles ; there are 5 of these on one of the appendages and 7 or 8 on the other, possibly one or more may have been broken away from the former in preparing the specimen for microscopical examination.

I cannot unfortunately give any details regarding the general arrangement of the hairs on the body, as the specimens were mounted in Canada balsam before they were seen to differ in any marked degree from *P. minutus* var. *africanus*, Newst., with which they were associated. I have pleasure in dedicating this very distinct species to its discoverer.

Northern Ashanti : Kintampo, ♂ (type), in latrine, vii. 1913 ; Banda, 1 ♂, in rest house, 24. ix. 13 (*Dr. A. Ingram*).

Phlebotomus simillimus, sp. nov. (fig. 2).

♂.—Length, 2·6–2·7 mm ; wing, 1·5–1·6 mm. ♀.—Length, 2·6–2·8 mm ; wing, 1·8 mm.

Very like *P. minutus* var. *africanus*, Newst., but both sexes may be distinguished at once by the great length of the 3rd segment of the antennae, which, in the ♂, is twice the length of the proboscis proper (*i.e.*, exclusive of the clypeus), the distal portion of which projects beyond the tip of the latter. The wings in both sexes are broader than they are in *africanus*, and less pointed, the tip of the first longitudinal vein also extends much further forward, overlapping the anterior branch of the second vein by about half its length; generally both sexes are also much larger and the females decidedly darker.

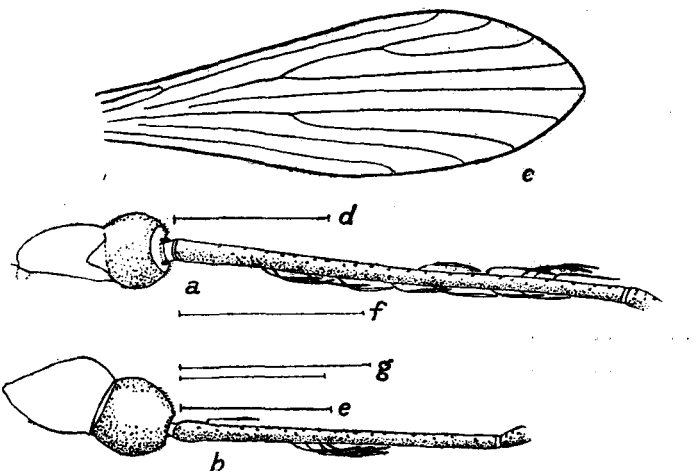

Fig. 2. *Phlebotomus simillimus*, sp.n.; *a*, proximal portion of antenna of ♂; *b*, the same of ♀, × 150; *c*, wing of ♀, × 39. *P. minutus*, Rond.; *d*, line giving relative length of 3rd segment of antenna of ♂; *e*, the same of ♀, × 150. *P. minutus* var. *africanus*, Newst.; *f*, line giving relative length of 3rd segment of antenna of ♂; *g*, the same of two forms of ♀, × 150.

♂.—Similar in colour to *P. papatasii*. Abdominal hairs recumbent. Genital armature not differing structurally from that of *P. minutus*, Rond., but larger; the proximal segment of the superior claspers being about equal in length to *both the segments* of the corresponding appendages in *P. minutus*. The lower or inferior clasper projecting beyond the submedian process to a distance a little less than one-fourth its total length. Antennae (fig. 2, *a*) with the first 3 segments together equal in length to the head, inclusive of the proboscis; the 3rd segment very long, with the distal portion *projecting beyond the proboscis*. Wings (fig. 2, *c*) relatively broad; costa and hind margin very similar in curvature; tip of 1st longitudinal vein extending forwards, so that it overlaps the anterior branch of the 2nd vein by about half its engtth.

♀.—Generally darker in colour than the male. Antennae with the 3rd segment (fig. 2, *b*) very long, but relatively much shorter than that of the ♂; the extremity scarcely reaching to the tip of the proboscis; geniculated spines present on the 4th to 15th segments inclusive. Wing similar to that of the ♂.

NORTHERN ASHANTI: Kintampo, 5 ♂♂, 9 ♀♀ (including type of each sex), all taken in latrines, vii. 1913; Nkoranza, 3 ♀♀, on walls of rest-house in damp corners,

17. viii. 13 and 1 ♀, 17. xi. 13; Sekodumasse, 2 ♀♀, on wall of rest-house, 15. xi. 13 (all *Dr. Ingram*). In addition to the foregoing, there were 9 ♀♀ from Kintampo and 5 ♀♀ from N'Koranza, which have not been prepared for critical microscopical examination; so far as one can judge from the dry material they all belong apparently to this species.

Southern Nigeria: Alumu, 18—24, iv, 14 (*Dr. W. A. Lamborn*). Several additional examples labelled, "Southern Nigeria," were also collected by Dr. Lamborn.

Phlebotomus mascittii, Grassi (figs. 3, 4, 5, 6).

Phlebotomus mascittii, Grassi, Att. Reale Accad. Lincei (v) xvii, p. 68, 1908.

I am extremely grateful to Dr. Ashworth for procuring for me a male example of *P. mascittii* from Professor Grassi. This has enabled me to make a detailed examination of all those characteristics which are of taxonomic importance, and to give figures of the genital armature and other structures which are so much needed for comparison and reference. I now find that this and *P. perniciosus*, Newst., are so closely allied as to be separable only with difficulty. The differential characters in these two insects are set forth in the following table:—

	P. mascittii ♂	*P. perniciosus* ♂
Length	3·5 mm.	1·8—2·6 mm.
Superior claspers	With 5 large and 1 small spine.	With 5 large spines only.
Upper branch of 2nd vein ..	2½ times as long as vein between the forks.	1½ times as long as vein between the forks.
No. of examples examined	1.	16.

Grassi (*l.c.*) states that there are 5 spines present on the distal articulation of the superior claspers (*gonapofisi*), two of which at the distal extremity are nearly as long as the segment of the clasper to which they are attached. In the mounted example from Professor Grassi's collection, which I take to be typical of the species and from which the accompanying drawing (fig. 3) was made, there was clearly an additional

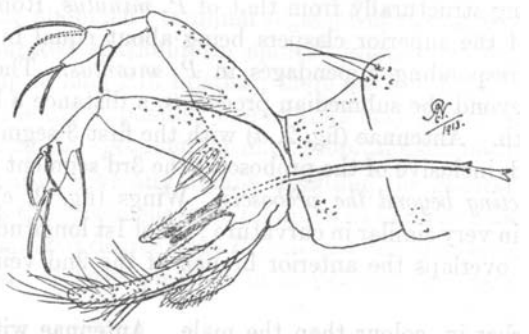

Fig. 3. *Phlebotomus mascittii*, Grassi; genital armature of ♂, × 75.

spine (making 6 in all), which he does not mention in his diagnosis. The spine in question arises on the ventral surface a little posterior to the inner lateral pair of spines; but it is much smaller and finer than the rest. In the enlarged drawing (fig. 6, *a*) this spine is shown in dotted line, as, owing to an unfortunate accident,

the whole preparation had to be remounted, and in doing this the small spines broke away, though the points of attachment are still very clearly defined on both the claspers. The wing venation (fig. 5, *a*) is, if constant in a series, strikingly different from that of *P. perniciosus* (fig. 5, *b*), and may in itself serve to distinguish it from the latter. As to the antennae (fig. 4, *a*, *b*) there is a marked difference in the relative length of the 3rd segment in the two species, but when compared with the length of the segments of the palpi or with that of the proboscis both species give the same relative index.

Phlebotomus perniciosus, Newst. (figs. 4, 5, 6).

Phlebotomus perniciosus, Newst., Bull. Ent. Res., ii, p. 70, 1911.

Phlebotomus legeri, Mansion, Bull. Soc. Path., vi, p. 639, fig., 1913.

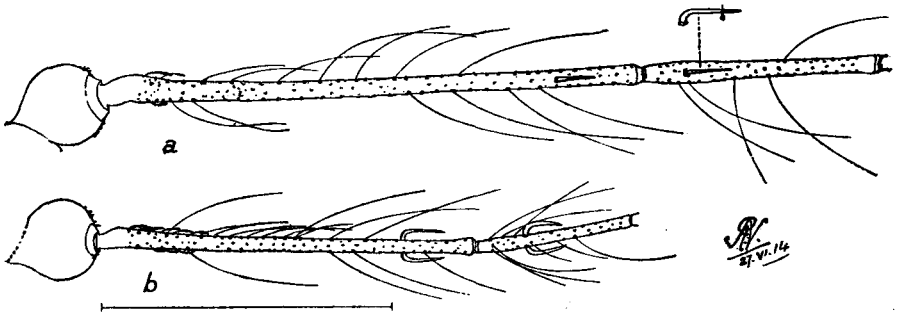

Fig. 4. *Phlebotomus mascittii,* Grassi; *a,* proximal portion of antenna of ♂, × 150. *P. perniciosus,* Newst.; *b,* the same; the line below indicates the length of the 3rd segment in an exceptionally small example from Malta.

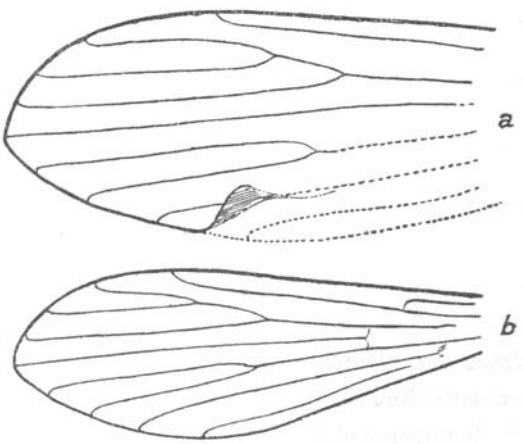

Fig. 5. *Phlebotomus mascittii,* Grassi; *a,* wing of ♂, × 39. *Phlebotomus perniciosus,* Newst.; *b,* wing of ♂, × 39.

In the male genital armature the arrangement of the spines on the superior claspers (fig. 6, *b*, *c*, *d*) is often very difficult of interpretation; more especially is this the case when the segments to which they are attached are superimposed, the picture presented

in such cases being a confused bundle of spines arising from various planes. With careful manipulation, however, the superior claspers may be so displayed that the exact arrangement of the spines can be followed with little difficulty. Three distinct phases may be presented : a dorso-ventral view (fig. 6, *b*) with the pronounced lateral spine-bearing processes ; an outer-lateral view (fig. 6, *c*), and an inner-lateral view

Fig. 6. *Phlebotomus mascittii*, ♂ ; *a*, ventral view of distal segment of superior clasper, × 150. *P. perniciosus*, ♂ ; *b*, distal segment of superior clasper, ventral view ; *c*, the same, outer lateral view ; *d*, inner lateral view ; all × 150.

(fig. 6, *d*). Compare also fig. 17 in the volume of this Bulletin quoted above. Reference has already been made to the length of the 3rd segment of the antennae, and a drawing to the same scale as that of *P. mascittii* is given (fig. 4, *b*) ; this segment exhibits a slight variation in length, the range in 16 examples amounting approximately to ·075 mm.

As to the synonymy, Mansion's *P. legeri* is clearly the same as *P. perniciosus*, Newst. His excellent figure and clear description leaves one in no doubt as to this, so that the former name must sink.

The following record regarding the geographical distribution of this species is of interest :—

ALBANIA : Scutari (British Detachment), 1 ♂, 21. viii. 13 (*Dr. M. H. Babington*).

Dr. Babington, in a communication which accompanied the specimen, states that " these insects occur in small numbers " and further that " we have had a fair amount of fever, which in Malta we attribute to the bites of sand-flies."

Phlebotomus perniciosus var. **nigerrimus,** Newst.

Phlebotomus nigerrimus, Newst., Bull. Ent. Res., ii, p. 68, 1911.

Since publishing the description of *P. nigerrimus* I have, thanks to Captain Marett, been able to examine several males, all captured by him in Malta. As the taxonomic characters of these agree with those of *P. perniciosus*, Newst., I have come to the conclusion that the former can only rank as a good melanic variety. There is apparently some slight difference in the venation of the wing of the ♀ var. *nigerrimus* (compare fig. 5, *loc. cit.*), which may also serve to distinguish it from typical *P. perniciosus*.

Phlebotomus minutus, Rondani.

Male with abnormal genital armature (fig. 7). Left superior clasper normal,

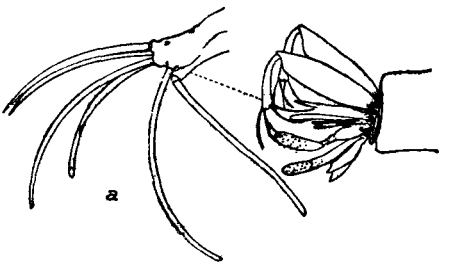

Fig. 7. *Phlebotomus minutus*, Rond., ♂ genital armature; *a*, superior clasper, with supernumary spines, × 225.

right superior clasper (fig. 7, *a*) with three pairs of strong spines; two pairs apical, one sub-apical; the additional spines occupy a superior position and are much more pointed than the others. This is the most singular case of excessive development of the small parts of the genital armature that I have yet seen, and had the additional spines occurred on both claspers I should have unhesitatingly described the insect under a new name.

TUNIS: Metlavui, 1913 (*Dr. E. Roubaud*), together with typical examples of both sexes.

Phlebotomus minutus, var. **africanus,** Newst.

NORTHERN ASHANTI: Kintampo, 9 ♂♂, 2 ♀♀, in latrine, vii. 1913; Bjere, Volta River, 1 ♂, 1 ♀, in rest-house, 12. ix. 13; Banda, 4 ♂♂, 2 ♀♀, 24. ix. 13; Atabubu, 5 ♂♂, in rest-house, 15. x. 13; N'Koranza, 4 ♀♀, on walls of rest-house, 6 ♂♂, "on unwhitewashed corner of room," 17. xi. 13; Sekodumasse, 3 ♂♂, on walls of rest-house, 15. xi. 13 (all *Dr. A. Ingram*).

The following additional records are based upon an examination of the dry material, so that the exact specific identity of these must be regarded with a measure of doubt:— Kintampo, 8 ♂♂, 1 ♀; Banda, 1 ♀; Atabubu, 3 ♀♀; N'Koranza, 24 examples representing both sexes, many of them imperfect. In addition to the foregoing there are four examples from Kintampo (1 ♂, 3 ♀♀) and one ♀ from Atabubu which are, so far as one can judge at present, referable to this species, but all of them possess such remarkably short 3rd antennal segments as compared with typical *P. minutus* var. *africanus* that I think it desirable to call attention to the fact, though it should be noted that in this respect they do not differ from typical *P. minutus*, Rond., from Malta.

SOUTHERN NIGERIA: Ibadan, 1 ♀, 20–21. viii. 13, 1 ♂, 2. x. 13, 8 ♀♀, 5. iv. 14; Olumu, 1 ♂, 20. iv. 14 (*Dr. W. A. Lamborn*). Iseyin, 60 m. N.W. of Ibadan, 4 ♀♀, 7. xi. 12 (*Dr. W. S. Clark*); these Dr. Clark informs me were "taken in a rest-house which was rather badly infested with these insects. Many were seen to be resting on the surface of the mud walls, in dark corners, and also under a table."

IVORY COAST: Bingerville, on a lizard, *Agama colonorum*, 1 ♂, 6. xii. 12 (*Dr. E. Roubaud*).

NYASALAND: Mwanza River, Lower Shire, 4 ♀♀, 5. vii. 13 (*S. A. Neave*); only one example has a perfect antenna, but judging from the pointed wings and small size

all belong, I believe, to this species. The dark colour of the specimens is an artifact produced by an accumulation of fine pulverulent dirt. S.W. of Lake Chilwa, Lower Shire, 3 ♀♀, 12. i. 14 (*S. A. Neave*).

PORTUGUESE E. AFRICA : East of Mount Mlanje, 2500 ft., 4 ♀♀, 1 ♂, 5. x. 13 ; 4 ♀♀, 2 ♂♂, 23–25. xi. 13 (*S. A. Neave*).

TRANSVAAL : Onderstepoort, near Pretoria, 1 ♂, 6 ♀♀, on walls of bathroom, laboratory and latrine, during the months of April to September, 1912-13 (*G. Bedford*).

ANGLO-EGYPTIAN SUDAN : Tokar, Red Sea Province, 9 ♂♂, 8 ♀♀, 1913 (*H. H. King*).

ALGERIA : Biskra, 1 ♂, 4 ♀♀, 1913 (*Dr. E. Sergent*).

Phlebotomus antennatus, Newst.

♀.—Body hairs dull amber-coloured, those on the head and thorax erect, on the abdomen recumbent. Hairs on the wing area bright pale buff to golden buff ; costal hairs similar, with black ones intermixed.

NORTHERN ASHANTI : Kintampo, 8 ♀♀, in latrines, viii. 1913 (*Dr. A. Ingram*).

Phlebotomus papatasii (Scop.).

Males with abnormal genitalia. I have examined two examples : one from Rawul Pindi (ex coll. *Dr. J. H. Ashworth*), the other from Malta (*Capt. P. J. Marett*). In both of these examples a supernumerary spine was present on one of the inferior claspers. In typical individuals of this species only two flattened, spathuliform spines arise from the distal extremity of the inferior claspers ; so that examples with such supernumerary appendages as those herein recorded can only be regarded as abnormalities.

TUNIS : Metlavui, 1 ♂, 2 ♀♀, x, 13 (*Dr. E. Roubaud*).

ALGERIA : Biskra, 2 ♀♀, 1913 (*Dr. E. Sergent*).

ANGLO-EGYPTIAN SUDAN : Tokar, Red Sea Province, 9 ♂♂, 7 ♀♀, 1913 (*H. H. King*).

Phlebotomus roubaudi, Newst. (fig. 8).

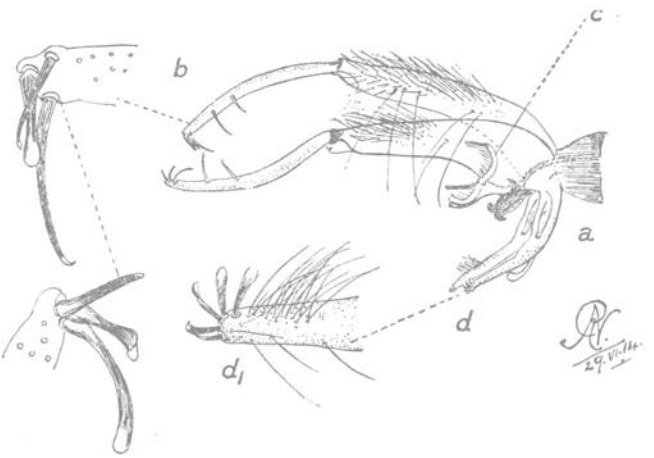

Fig. 8. *Phlebotomus roubaudi*, Newst., ♂ ;
a, genital armature, × 52 ; *b*, distal segment of superior clasper ; *c*, median fringed process ; *d*, d_1, arrangement of spines on the inferior clasper, × 300.

Phlebotomus roubaudi, Newst., Bull. Soc. Path. Exot., vi, pp. 124-126, 1913.

I have recently secured another male of this species, unfortunately without data, but as it agrees in all the structural details with the type, now in the Pasteur Institute, Paris, I have added a few more details and a figure of the armature, so that its differential characters may be more easily followed. On comparing the illustration of the armature of this species (fig. 8) with that of *P. papatasii*,* the marked morphological differences which exist between these two species will be readily seen. The male genital armature is relatively large and in general outline similar to that of *P. papatasii* (Scop.); distal segment of superior claspers (fig. 8, *b*) with 5 spines, 3 at the distal extremity and 2 widely separated from them and also from each other; the former are markedly unequal in length and two of them are broadly dilated and flattened distally, more especially the central one. Inferior claspers (fig. 8, d_1) a little more than half the length of the proximal segment of the superior claspers, apex with 4-5 short stout spines (5 is apparently the normal number); these when viewed dorso-ventrally are seen to be spathuliform, but in profile they appear pointed and simple. Median fringed process (fig. 8, *c*) very small and about *one-third the total length of the inferior claspers*. Thus the armature presents four well-marked characters by means of which it may be distinguished at once from *P. papatasii*; these are set forth in the following table :—

	P. roubaudi, ♂.	*P. papatasii*, ♂.
Distal spines on superior claspers	Three; one about twice the length of the others ..	Three; all of nearly equal length.
Inferior claspers	Slightly over one-half the length of the proximal segment of the superior claspers, approximately	Three-fourths the length of the proximal segment of the superior claspers, approximately.
Number of spines on inferior claspers	Four to five	Two.
Submedian fringed process (fig. 8, *c*)	Scarcely longer than the median paired process.	More than twice the length of the median paired process.

Roubaud's example (type ♂) came from Akjoucht, in Mauretania, French West Africa.

Phlebotomus zeylanicus, Annandale (fig. 9).

♀.—Abdominal hairs, with the exception of those on the proximal segment, recumbent. Abdominal hairs ochraceous grey; those on the head and thorax slightly paler and many with infuscated tips. Wings hyaline; fringe of costa either pale grey (2 ♀♀) and scarcely darker than the hairs on the veins, or infuscated (1 ♀) and much darker than the rest; fringe behind margin pale silvery grey to dusky grey; anterior branch of the 2nd vein, in 2 ♀♀, about two and one-third times the length of the space between the forks. Palpi (fig. 9, *a*) of 5 segments; the 2nd slightly shorter than either the 3rd or 4th; 5th longer than the two preceding together. Antennae (fig. 9, *b*) with the 3rd segment equal in length to the first three segments of the palpi; segments 3-15, inclusive, each with a pair of geniculated spines, and there are also indications of similar spines on the terminal segment.

* Bull. Ent. Res., ii, p. 74, fig. 18.

CEYLON: Peradeniya, 3 ♀♀, 30. iv. 14 (*A. Rutherford*).

If the foregoing description of the wing is compared with that given by Annandale* it will be seen that there are marked differences regarding the relative length of the anterior branch of the second long vein. Annandale describes this as being "nearly five times as long as the distance between the two forks," though in his illustration (fig. 5) the vein in question is shown as being only slightly more than *three* times the length of the distance between the two forks. In a later communication (§), however, he makes the following statement: "It should ..... be noted that the figure of *P. zeylanicus* printed in my former paper (p. 60, fig. 4) gives, because of the angle at which the wing was drawn, a somewhat incorrect idea of the venation in that species; fig. 5 on the same page is more exact in this respect." This is somewhat difficult of interpretation, as it leaves one still in doubt as to whether we are to consider his diagnosis as correct or his illustration (fig. 5); for the present both must be accepted as indicating exceptional variation in the wing venation. I have ventured to call attention to this because I find, as already stated, that in the examples collected

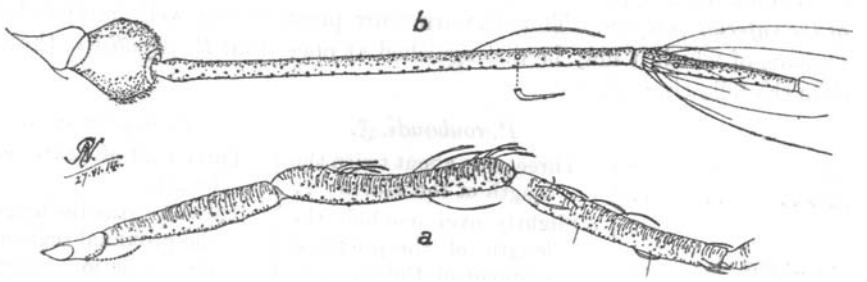

Fig. 9. *Phlebotomus zeylanicus*, Ann., ♀; *b*, proximal portion of antenna, × 300; *a*, 1st to 4th segments of palpus, × 300.

by Mr. Rutherford the anterior branch of the second vein is only two and one-third times the length of the space between the forks. In other respects the venation agrees, especially in regard to the position of the tip of the first longitudinal vein, which is, as Annandale states, far in advance of the anterior branch of the second. *P. malabaricus*, Annandale, presents a similar wing venation to that of *P. zeylanicus*, but on the whole my examples agree best with the latter. There the matter must stand until more material is available. Pairs in coitu are much needed, and I sincerely trust that Mr. Rutherford will be successful in securing these.

Phlebotomus longipalpis, Lutz & Neiva (fig. 10).

BOLIVIA-BRAZIL BOUNDARY: Abuna River, ♂♂ and ♀♀, 1913 (*Dr. F. D. Walker*).

So far as I can possibly ascertain at the moment there is a measure of doubt as to whether the specimens recorded above are specifically identical with *Phlebotomus longipalpis* described by Lutz & Neiva.† Finding it impossible to determine Dr. Walker's material from the author's description alone, I submitted an example of the male to Dr. Lutz (carefully prepared for microscopical examination). In his reply

* Spolia Zeylanica, vii, p. 60, 1910.
§ *Ibid.*, xxviii, p. 203, 1911.
† Mem. Inst. Oswal. Cruz, iv, p. 90, 1912.

he states : " I received and examined your *Phlebotomus*. It is certainly of the type of *longipalpis*, though I seemed to notice some little differences by comparing another male in microscopical preparation. Those, however, might be due to accidents in

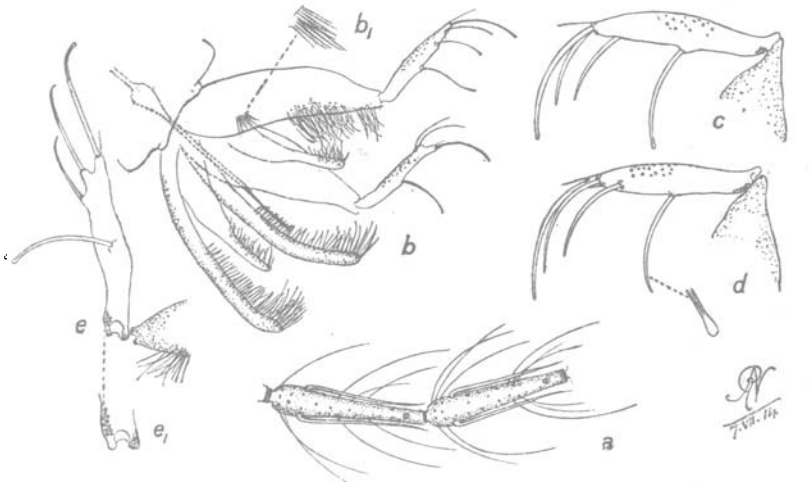

Fig. 10. *Phlebotomus longipalpis*, Lutz & Neiva ;
a, 13th and 14th segments of antenna of ♀, × 225; *b*, genital armature of ♂, × 75; b_1, ventral groups of spinose hairs; *c*, outer lateral; *d*, inner lateral; *e*, ventral aspect of inferior claspers, × 150; e_1, proximal portion of *e*, showing group of hair attachments.

position and preparation. The place where it was found speaks also for it, as *longipalpis* has a very wide range. It certainly is not the species of Sophia Summers, nor a larger undescribed one I brought from Southern Brazil, which has the antennae of the same type as *longipalpis*. The new species from Trinidad and Peru . . . . . described by Knab and Townsend have the same type of antennae, but seem to be different, though I do not feel sure about it . . . . . The feet seem rather heavily scaled in your specimens." This leaves one still in doubt as to the specific identity of Dr. Walker's material, the outstanding features of which are so strikingly characteristic that I fail to understand how it was that Dr. Lutz was unable to determine definitely the specimen submitted to him. In view, therefore, of the slight discrepancies which Lutz has observed, and also that there exist in my specimens certain taxonomic characters which have, apparently, been overlooked, it may be desirable to call attention to these, so that in future the insect may be determined the more readily.

♀.—Antennae of 16 segments, the 3rd relatively very short ; 5th reaching to the tip of the proboscis ; 3rd and 4th together a little longer than the 5th segment of the palpi ; geniculated spines present on the 3rd to the 15th, inclusive ; those on the 11th-15th (fig. 10, *a*) of great length, the tips reaching to the articulation of the succeeding segment and in some instances slightly beyond ; the length of the spines on the other segments not determinable in my preparations, but all of them appear to be unusually long, differing markedly in this respect from those observed in the African and European species. Legs densely scaled, the individual scales long and narrowly lanceolate.

♂.—3rd segment of the antennae slightly longer than the corresponding segment in the ♀; 4th segment reaching just beyond the tip of the proboscis; distal extremities of the geniculated spines on the 3rd-15th segments, inclusive, reaching to or just beyond the articulation of the succeeding segment. Genital armature (fig. 10, *b*): inferior claspers or appendages longer than the basal segment of the superior claspers; the latter (fig. 10, *c*, *d*, *e*) with 4 unequal spathuliform or oar-shaped spines, the three distal ones distinctly separated (*e*) and the terminal one the longest; the 4th, about equal in length to the distal one, arises a little proximal to the centre of the segment; a single fine short bristle is placed slightly dorsal to the distal spine; this rarely breaks away, as do the hairs which clothe the segment; figure 10 (*c*, *d*, *e*) shows three different views of the anterior segment of the superior claspers, the outer lateral, the inner lateral and the ventral, respectively. There is a well-marked group of cicatrices at the base of the segment (fig. 10, e_1), but the spines or hairs are invariably broken away in my material. Basal segment of the superior claspers with a densely packed, linear group of fine hairs or bristles (fig. 10 b_1).

Thus it will be seen there are several well marked characters. The short 3rd antennal segment in both sexes; the long and strikingly characteristic geniculated spines (*a*); the well-marked group of fine spinose hairs (b_1) on the basal segment of the superior claspers; the arrangement of the large spines on the distal segments of the superior claspers and the presence of the fine terminal bristle; and the well-marked group of cicatrices (e_1).

The palpal formula is as Lutz & Neiva describe it in their *P. longipalpis*. If the specimens herein described should eventually prove to be new I would suggest the name *walkeri* in honour of the discoverer.

Phlebotomus stantoni, sp. nov. (fig. 11).

♀.—Length, 2·1 mm. Wing, 1·9 mm.

♂.—Unknown.

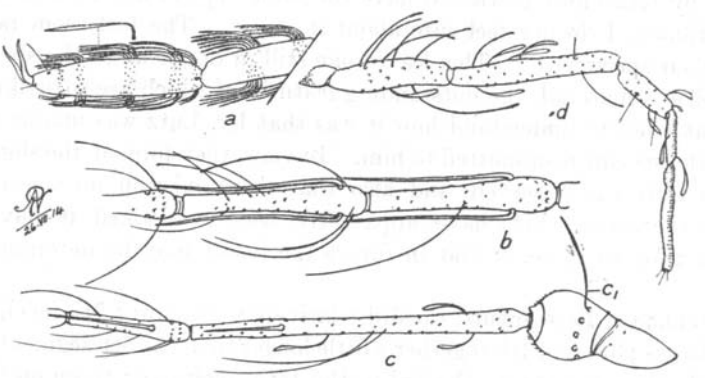

Fig. 11. *Phlebotomus stantoni*, sp.n., ♀;

a, distal portion of tarsus, × 225; *b*, two segments of the antenna, × 225; *c*, proximal portion of antenna; c_1, verticel of hair-like scales, × 150; *d*, palpus, × 150.

A medium-sized species distinguishable by the silvery grey, recumbent hairs on the venter of the abdomen; in the palpi, by the unusually short 4th segment, and

the relatively short terminal segment; by the verticel of long hair-like scales on the 2nd segment of the antennae; and also by the scales on the tarsi being arranged in broad, distinct bands.

Abdominal hairs more or less erect *dorsally*, and arranged in indefinite tufts; *those on the venter recumbent* and silvery grey, standing out in marked contrast to those on the dorsum, which are faintly infuscated. Legs: tarsi clothed with dull silvery scales arranged in complete and well defined bands or zones; when mounted in balsam and examined in optical section the arrangement of the scales (fig. 11, *a*)* is seen to be strikingly characteristic, but it is curious to note that the integument in the inter-zonal spaces is covered with cicatrices, though there is no trace of either scales or hairs arising from any of them. Antennae with geniculated spines on all the segments of the flagellum, with the exception of the terminal one, *i.e.*, 3rd-15th inclusive; these for the most part at least are of great length (fig. 11, *b*), the tips reaching nearly to the bases of the spines on the succeeding segment; 2nd segment (scape) with a single verticel of long stout hair-like scales (fig. 11, c_1); 3rd segment (fig. 11, *c*) long, the tip reaching almost to the tip of the proboscis; hairs relatively long and stout, and the smaller segments of the flagella rather densely clothed with them; sensoria on terminal segments with a few rather conspicuous hairs. Palpi (fig. 11, *d*) rather short and slender; 3rd and 5th segments the longest and about equal in length; 4th unusually short, being a little more than half the length of the 2nd; formula, 1, 4, 2 (3, 5). Wings with the 1st longitudinal vein terminating well in advance of the anterior branch of the 2nd; anterior branch of the 2nd longitudinal vein one and a half times as long as the distance between the two forks; no further particulars can be given, as the margins of both wings are crumpled.

Federated Malay States: Kuala Lumpur, 1 ♀ (*type*), 15. vi. 14 (*Dr. A. T. Stanton*).

Phlebotomus bedfordi, sp. nov. (fig. 12).

♀.—Length, 3 mm.; wing, 1·9 mm.

♂.—Unknown.

A fairly large and somewhat robust species, very closely resembling a large example of *P. minutus* var. *africanus*, Newst., but separable from the latter and also from all the other known African species by the short terminal segment of the palpi (fig. 12, *aa*).

Colour as in *P. minutus* var. *africanus*. Abdominal hairs, with the exception of those on the proximal segment, recumbent both dorsally and ventrally. Antennae: 3rd segment relatively very short and about one and two-thirds the length of the 4th, the tip of the latter reaching to the end of the proboscis; the paired geniculated spines present on the 3rd to the 15th segments inclusive, those on the 14th and 15th extending to or just beyond the articulation of the succeeding segments; those on the lower segments, so far as they are traceable, do not reach the articulations by a relatively considerable distance, so that their form and arrangement are very similar to those found on the other members of the genus elsewhere in Africa; all the segments

* Marginal scales only shown.

with numerous, fine, short outstanding hairs. Palpi (fig. 12, *a a*) with the 4th and 5th segments about equal in length, they are also much the longest, but the 5th is comparatively speaking unusually short; the 3rd slightly incrassate proximally; formula 1, 2, 3 (4, 5). Wings (fig. 12, *b*) lanceolate and relatively narrow; 1st longitudinal

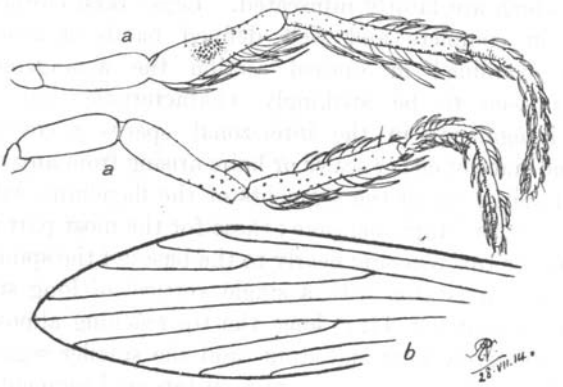

Fig. 12. *Phlebotomus bedfordi*, sp.n., ♀; *a a*, palpi, × 150; *b*, wing, × 39.

vein terminating considerably in advance of the anterior branch of the 2nd; upper branch of the 2nd longitudinal vein shorter than the distance between the two forks, the latter being about one and one-third times the length of the former.

TRANSVAAL: Onderstepoort, near Pretoria, 1 ♀ (*type*), in latrine, 2. vi. 12 (*G. Bedford*).