

ON THE SYSTEMATIC POSITION OF THE FAMILY  
TERMITAPHIDIDÆ (HEMIPTERA, HETEROPTERA),  
WITH A DESCRIPTION OF A NEW GENUS AND  
SPECIES FROM PANAMA.BY J. G. MYERS<sup>1</sup>.

## RELATIONSHIPS OF THE FAMILY, TERMITAPHIDIDÆ (nom. nov.)

In 1902 Wasmann erected the genus, *Termitaphis*, on a peculiar termitophile which he called *Termitaphis circumvallata*, and which he considered an aberrant aphid. Silvestri, describing two additional species in 1911, recognized that the genus was not even homopterous and established for it the new family Termitocoridæ, which he placed in the sub-order, Heteroptera. In 1914 a further species was described in a preliminary manner by Mjöberg, while in 1921 Silvestri recorded from India a fifth species of the genus. These references were all listed in the Zoological Record under the family, Aphididæ, and apparently received no attention from heteropterists. The list of species was brought up to eight by Morrison in 1923. Such in brief is the history of the genus.

The writer is indebted to Dr. W. M. Wheeler for the opportunity to study and describe a ninth species collected at Panama and to offer some suggestions on the relationships of the family to other heteroptera. Mr. Harold Morrison had also received specimens of the same insect from Panama, and was about to describe it but has very generously turned over his material to me.

The Rev. E. Wasmann most kindly sent for comparison the unique specimen of the type of the genus. Thanks are due also to Dr. W. M. Mann for bringing this valuable type from Europe. Previous workers have invariably referred their material to the type-genus, but Wasmann's type shows that it is decidedly not congeneric. A new genus, *Termitaradus*, is therefore erected here for the Panama species and its allies, which

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undoubtedly include all species described subsequently to *T. circumvallata*.

None of the previous workers on these insects has made any suggestion as to the position of the family in the Heteroptera. Nor have the heteropterists themselves given the matter any attention although the very detailed and entirely adequate descriptions and figures of Silvestri and of Morrison were all that could be desired in the absence of actual specimens.

Silvestri's family name must be changed in accordance with the International Rules, which state that the family name must be derived from that of the type-genus. *Termitaphis* Wasm. was the original genus, and was used by Silvestri as the type-genus. The genus, *Termitocoris* apparently does not exist. The family name must therefore be Termitaphididæ. Dr. Wheeler drew my attention to this point.

Superficially the insects of this family are remarkably distinct from all other Heteroptera. This unique appearance is in keeping with a habitat shared, so far as known, by no other members of the sub-order. All the species collected have been found in the nests of termites, and such characters as are entirely peculiar to the family may be tentatively explained as results of adaptation to the termitophilous habit.

Reuter's (1912) Bemerkungen über mein neues Heteropterensystem was taken as the latest authoritative and comprehensive review of heteropterous taxonomy.

In following the key to families and also in comparing the separate diagnoses of Reuter's series and superfamilies, it was found that the *Termitaphididæ* were best placed in or near the series *Phlæobiotica*, a group established to contain the two families of bark-bugs, the Aradidæ and the Dysodiidæ, of which the latter is now by most authorities, e. g. Parshley, 1921, considered a sub-family of the former.

Reuter's diagnosis of this series is as follows (1912, p. 32).—

Unguiculi semper aroliis destituti. *Caput horizontale, inter antennis longe prolongatum*, utrinque tuberculo antennifero plerumque acuto instructum, bucculis sulcum rostralem formantibus. *Ocelli desunt. Rostrum quadri-articulatum*, sed articulo primo minutissimo, aegre distinguendo. *Antennæ capite*

*plerumque longiores, quadriarticulatæ, sæpe crassæ. Hemiellytra e clavo, corio et membrana composita. Clavus apicem versus sensim angustatus, apicem scutelli nunquam superans. Membrana venis nonnullis irregularibus et anastomosantibus vel raro his tota destituta. Meso-et metapleura simplicia. Coxæ posticæ rotatoriæ. Tarsi biarticulati. Corpus superne et inferne deplanatum.*

The characters italicized are those which are clearly exhibited also by the *Termitaphididæ*. The widest divergence lies in the wing characters, both pairs of wings being completely absent in the latter genus. But presence or absence of wings was never even a family character and there are Aradids with both pairs missing. There is therefore a strong presumption that the *Termitaphididæ* are related to the *Aradidæ*. The presumption is rendered almost a certainty by three other considerations now to be examined in some detail.

Reuter (1912) laid considerable emphasis on the presence or absence of arolia as a taxonomic character. The *Aradidæ* are said to possess no arolia and it was largely on this account that Reuter was unable to agree with Kirkaldy and with Bergroth that the *Aradidæ* exhibit marked affinity with the *Pentatomoids*. The *Termitaphididæ* on the other hand are furnished with very well-developed arolia shown clearly in Silvestri's excellent figures (1911, 1921). Whether this deficiency should be taken to indicate lack of affinity between the *Termitaphids* and the *Aradids* is questionable, since it is doubtful whether these organs afford such good taxonomic characters as has been supposed. In fact Reuter, who used their presence or absence so largely, has himself shown (1912) that they are probably of directly adaptive origin, varying apparently with the habitat even in genera of the same family. In the present case however no decision as to the importance of the arolia is essential to the argument since the *Aradid* genus, *Ctenoneurus* Bergroth, (*Dysodiinæ*, *Mezirinæ*) possesses arolia as well-developed as those of *Termitaphis*, or as those of any of Reuter's aroliate families—*Miridæ*, *Pentatomidæ* etc. The arolia of *Ctenoneurus hochstetteri* (Mayr) are shown in figure 9. This constitutes the first supplementary proof of the relationship of *Termitaphis* to the *Aradidæ*. Similar structures

occur in certain species of the genera *Aradus*, *Dysodius* and *Isodermus*.

Incidentally the term "arolium" is used in general insect morphology and in hemipteran taxonomy with several different meanings which urgently need elucidation. Crampton (1923) applies the name primarily to the undivided pad-like structure between the claws of Orthoptera, e. g. *Periplaneta*. Further he mentions that the arolium in certain Hymenoptera and Homoptera may be partially divided or faintly marked off into two lateral portions. There is no reference in Crampton's paper to the fact that in Heteroptera the arolium is always divided and in fact is referred to by taxonomists only in the plural. As illustrative of the most exact use of the term in Hemipterology, figure 11 shows the arolia of a Mirid after Knight (1923). The same drawing shows also the *pseudarolia* which in many Mirids are greatly developed and perhaps take the place of the true arolia which are reduced to mere bristles. Knight's arolia arise as shown in the figure truly between the claws and are probably homologous with the undivided arolium described by Crampton. But in Pentatomids, Coreids, some Aradids and in *Termitaphididae*, the present writer finds that the arolia do not arise between the claws, but each from the base of the corresponding claw as shown in figures 7, 9 and 12. In these families it would seem that the so-called arolia are really homologous with the pseudarolia of the Miridae, while the true Mirid arolia are represented by bristles between the claws as shown in the Pentatomid, *Euschistus* (fig. 12) and in a *Termitaphid* in Silvestri's drawings. Organs evidently exactly homologous with the so-called arolia of *Euschistus*, *Ctenoneurus* and *Termitaphis* are described and figured in the Coreid, *Anasa*, by Tower (1913) as *pulvilli*.

Whether the appendages figured in *Termitataradus* and in *Ctenoneurus* constitute true or pseudarolia or pulvilli does not affect the question of relationship since they are obviously homologous structures in the two genera.

In 1920 Spooner for the first time recorded a peculiar condition in the Aradid head in which the rostral setæ, instead of proceeding more or less directly cephalad and then caudad to

enter the labial trough or rostrum, are coiled several times, like a watch-spring, in a semi-circular sheath formed by the tylus. The setæ are thus extremely long. That such an extraordinary condition should previously have escaped the notice of hemipterists is probably the result of the heavy chitination and black coloration of the head, which renders this structure entirely invisible in the untreated insect. The present writer noticed the setal coil independently in 1920 in the newly hatched nymph of *Ctenoneurus*, in which the coil shows as a dark mass against the soft white nymphal tissues. This arrangement of the trophi is present in an almost identical condition in the *Termitaphididae* and constitutes the second supplementary proof of the relationship of these interesting termitophiles with the Aradids. To these two families alone of the Heteroptera are the coiled setæ apparently confined.

Here we meet the difficulty that the feeding-habits of Aradidae and even more so of the *Termitaphididae* are very little known. It seems likely that the insects of both families suck the sap of trees or the moisture of dead wood and of fungi. Obviously only liquid nutriment could be taken up by such mouth-parts.

The first important character in which the *Termitaphididae* appear to differ from the Aradidae lies in the extraordinary development of laminae on the margin of the body, round every portion of the periphery. These laminae are furnished with stout outwardly directed bristles and with peculiar *flabella*, so named by Morrison. In some Aradids there is a lobulate expansion of the flattened lateral margin of the body. Such lobes are conspicuous in the imago of *Dysodius lunatus* (Fabr.) of which Dr. Nathan Banks has shown me specimens from Panama. In addition, Dr. Wheeler collected at Barro Colorado Island, Canal Zone, Panama, a single *Dysodius* nymph, probably referable to *D. lunatus*. This nymph, which is apparently in the third stadium, shows the marginal lobes very well-developed and offering striking points of resemblance to those of *Termitaphis*. There are twelve rounded lobes on each side of the body, not including projections of the head. The first is pro-, the second meso- and the third and fourth together metathoracic, while the rest pertain to the

abdomen. Every lobe (fig. 10) is furnished with an irregular series of long conical processes, evidently hollow and provided with a rather thick but elongate distal flagellum usually more or less curved. The flagella are very liable to be broken off, particularly from processes near the apices of the lobes; and many are missing in the nymph under study. In the pinned imago of *Dysodius lunatus* no trace of the flagella is discernible, but in alcohol specimens examined later they are as well-marked as in the nymph. In the nymph there is thus a striking similarity to *Termitaphis* in the essential features of the marginal lobes. The number and distribution of the lobes themselves, their division into lobules or processes, the presence on every lobule of an easily detachable solid appendage arising apparently at the base of the lobule and running through or beneath its axis to protrude beyond its apex—in all these particulars there is practical agreement between the two genera. These constitute a third group of facts which may reasonably be considered to support the hypothesis of relationship between the *Termitaphididae* and the *Aradidae*. The most striking superficial difference lies in the fact that the lobes in *Dysodius* are widely separated and thus fail to form such a continuous peripheral margin as in the *Termitaphididae*. In the *Dysodius* nymph the conical processes with flagella are present also on the margin and projections of the head, and on the segments of the antennæ. The metanotum is provided with two lateral lobes instead of one as in *Termitaphis* and allies.

It seems probable that marginal laminæ in *Termitaradus* constitute a defensive apparatus enabling the insect to withdraw all its appendages under cover. For such withdrawal the form and articulation of the peculiar antennæ are especially adapted. Were the laminæ closely appressed to the substratum there would remain no unprotected part of the whole periphery. A similar development of lateral laminæ is frequent in myrmecophiles and termitophiles, notably in the larva of *Microdon* and in certain beetles and Myriapoda. In the termitophilous millipedes of the genera *Leuritus* Chamberlin and *Gasatomus* Chamberlin the general form of the body segments with their lateral lobes is strikingly reminiscent of the condition in *Termitaradus*

Wasmann (e. g. 1911, pp. 228-230) recognises this type of lateral lamination of body segments coupled with flattening of the ventral surface, as a direct adaptation to termitophily or myrmecophily—as a protection against the owners of the nests in which these arthropods live. It is a modified form of the adaptive type which he designates “der Trutztypus.” All the specimens of *Termitaphididae* so far known have been collected in company with termites or in their nests.

The total absence of eyes and ocelli in *Termitaphids* is probably correlated with life in the gloomy recesses of the termite nest. The Aradids, themselves living in a cryptozoic habitat, have advanced a stage in this direction in that ocelli are lacking. The absence of wings in *Termitaphids* is similarly explicable. The peculiar structure of the antennæ, by which a superficially cryptocerate condition has been achieved, has been explained as a provision for tucking these organs under the cephalic laminæ. The antennæ are inserted very near the lateral margin and are folded in towards the rostrum.

The chief remaining morphological distinction between the *Termitaphids* and the Aradids lies in the structure of the rostrum and related parts. The head itself differs considerably. In the former it is more flattened and exhibits on side margins and fore-border a remarkable lamination with division into two main lobes on each side. This condition could perhaps be derived from that of a typical Aradid by an antero-lateral extension and lamination on each side of the tylus, so that the latter instead of forming the anterior projection of the head as in most Aradids, came to lie at the posterior end of a deep incision extending caudad from the anterior margin of the head.

So far as the rostrum is concerned the Aradids show a condition which has been described as apparently three-segmented but really four-segmented. As a matter of fact, in *Ctenoneurus* at least, (fig. 8) the second segment is peculiarly constricted where it lies between the bucculæ, but four distinct segments are easily discernible. In *Termitaphids* the bucculæ form no appreciable sulcus for the rostrum. Wasmann described and figured the rostrum of *Termitaphis* as three-segmented and such it decidedly appears to be to all but the most searching

examination. Silvestri, however, in all his work characterizes it as four-segmented and shows four very distinct segments in his figures. Such distinctness is certainly in error. The second segment, reckoning on this basis, is very indistinctly articulated and the present writer is by no means sure that it constitutes a true segment. (Figs. 2, 3).

The dorsal pores described and figured by Morrison are unlike anything known in other Heteroptera. Possibly, however, this worker's technique would reveal similar structures in other families.

To sum up it would appear that the Termitaphididae may be regarded as Aradoids specialized, in some respects degeneratively (absence of wings, eyes, ocelli and rostral sulcus), in others additionally (lateral lamination and armature and folded antennæ in *Termitaradus*; physogastry in *Termitaphis*), for a life of termitophily.

The diagnosis of the series Phlæobiotica (=superfamily Aradoidea) as set out by Reuter in 1912 and quoted above, may be modified as follows to include the Termitaphididæ.—

Arolia present or absent; head horizontal, much prolonged between the antennæ or else furnished with an acute antenniferous tubercle; a rostral sulcus formed by the bucculæ present or absent; ocelli absent; rostrum 4-segmented, often thickened. Hemelytra when present formed of clavus, corium and membrane; clavus narrowed towards the apex and never reaching beyond apex of scutellum. Membrane with some irregular and anastomosing veins or rarely completely destitute of venation. Meso- and meta-pleura always simple. Posterior coxæ rotatory. Tarsi 2-segmented. Body except in *Termitaphis* flattened above and below.

This series and superfamily comprises two families distinguished as follows.—

Tylus forming anterior projection of head; bucculæ forming a rostral sulcus; margin of body more or less simple or furnished with well separated irregular lobes. . . . . *Aradidæ* (Spin.)

Tylus at end of a deep incision extending caudally from anterior margin of head; bucculæ forming no appreciable rostral sulcus; margin of body furnished with lobes, separate or fused,

which form a practically continuous lamina encircling the whole.

*Termitaphididae* (n. n.)

As regards the position of the series Phlœobiotica, the discovery of arolia or similar structures in the Aradid, *Ctenoneurus*, is a further indication that Bergroth is correct in considering it nearest related to the Pentatomoids. Reuter was impressed by the fact that the eggs of Pentatomoids and of Coreoids are operculate, the embryo being furnished with a peculiar egg-burster for forcing up this lid; while the ova of Aradids, according to Heidemann, lack lids entirely and resemble more those of Lygæids. The operculum and correlated egg-burster are, however, by no means universal in the Pentatomoids, since they are totally lacking in the New Zealand Acanthosomatine genera, *Oncacontias* Breddin and *Rhopalimorpha* Mayr. The writer's notes on these insects are now in the press. In addition, observations now being carried out on certain North American Coreoids indicate a lack of these structures in this superfamily also. Since the above was written I have seen Barber's (Psyche, 1923) description of the egg of *aradus 4-lineatus*, which has a distinct cap and chorial processes.

BIOLOGY OF TERMITAPHIDIDAE.

Very little is known under this heading. All the recorded specimens have been collected in association with termites, of which the following species have been identified. The hosts of Dr. Wheeler's Panama examples were kindly determined by Mr. Banks, those of the other Panama material by Dr. Snyder.—

|   |                 |
|---|-----------------|
| <i>Termitaphis circumvallata</i> Wasm.,                             |                 |
| <i>Amitermes foreli</i> Wasm.,                                      | Colombia.       |
| <i>Termitaradus mexicana</i> (Silvestri),                           |                 |
| <i>Leucotermes tenuis</i> (Hag.),                                   | Mexico.         |
| <i>T. subafra</i> Silv., . . . <i>Rhinotermes putorius</i> Sjöst.   | Africa.         |
| <i>T. australiensis</i> (Mjöb.),                                    |                 |
| <i>Coptotermes</i> sp.,   | Australia.      |
| <i>T. annandalei</i> (Silv.), . . . <i>Coptotermes heimi</i> Wasm., | India.          |
| <i>T. guianæ</i> (Morr.),   |                 |
| <i>Leucotermes crinitus</i> (Emerson),                              | British Guiana. |
| <i>T. trinidadensis</i> (Morr.), . . . <i>L. tenuis</i> (Hag.),     | Trinidad.       |

|                              |       |                                 |           |
|------------------------------|-------|---------------------------------|-----------|
| <i>T. insularis</i> (Morr.), | ....  | <i>L. tenuis</i> (Hag.),        | Trinidad. |
| <i>T. panamensis</i> n. sp., | ..... | <i>L. tenuis</i> (Hag.),        | } Panama. |
|                              |       | <i>L. convexinotatus</i> Snyder |           |

In view of the additional species which have been brought to light within recent years coincident probably with intensified study of termites and of termitophiles, it would be premature to say much about distribution of the family. At present Central America seems to be the centre of greatest abundance but this may be due to greater collecting in the region. The distribution is certainly however practically circumtropical. In many respects it resembles that of *Peripatus* (sens. lat.) and may, as in the case of that genus indicate considerable antiquity as Mjöberg has suggested.

Habitat notes of the previously described species are scanty in the extreme. Of *T. mexicana*, Silvestri (1911) writes "in cuniculis nidi *Leucotermes tenuis* (Hag.)." When describing *T. annandalei* the same writer states "in nido *Coptotermes Heimi* Wasm., in trunco arboris (*Ficus bengalensis*) emortui et super solui sistentis exempla nonnulla Dr. N. Annandale legit." Mjöberg found a number of examples of his Queensland species "under bark of dead eucalyptus trunks in the colonies of a white ant (*Coptotermes* sp.) in the open forest country."

Dr. Wheeler found the Panama specimens within a termite nest (*Leucotermes convexinotatus* Snyder) the Termitaphids themselves being close to the cambium of the tree trunk from which they might probably have extracted nourishment. They were running about fairly actively.

What little is known of its habitat therefore seems to suggest that *Termitaphids* may have the same feeding habits as the *Aradidæ*.

What advantage they derive from living in the termite nest is uncertain. *Termitaradus* is probably protected from the termites themselves by its lateral laminæ and their armature. *Termitaphis* exhibits a certain degree of physogastry, a well-known feature of termitophiles and one which might indicate this genus as the more specialized of the two, though in the

structure of the body margin it is intermediate between the Aradids and *Termitaradus*.

Dr. Wheeler suggests they may extract nourishment from either the nest material or the contained debris. Wasmann (1902) considers *Termitaphis* and *Termitococcus* Silvestri as affording the only known cases of trophobiosis among termites. Of *Termitococcus* nothing has been reported since the original description. As regards *Termitaradus* the peculiar dorsal pores discovered by Morrison may possibly secrete some material attractive to the termites, but only field observations can decide this point.

Most of the species of the family have been described from females alone. Males are now known of *Termitaradus annandalei*, *T. guianæ* (?), and *T. panamensis* sp. n. Silvestri has given good figures of the male genitalia. Nymphs have been found of *T. annandalei* and of *T. panamensis* only. Silvestri has figured the outline of the body of the ultimate and second (?) instars in *T. annandalei*. Both these instars have one lateral lobe on each side of the body more than in the imago (female) the numbers being 14 and 13 respectively. The same difference is observable in *T. panamensis*, between all female nymphs examined and the common 13-lobe type of female adult. Silvestri considers the additional lobe in the nymph to belong to the metathorax but to the present writer it seems to correspond exactly to the extra lobe present in the adult females of some of the species and shown by Morrison to pertain to the mesothorax. The reduction of lobes has gone furthest in *T. insularis* (Morr.) in which the female possesses only twelve, the number present in the males of those species in which both sexes are known.

#### TAXONOMY.

An examination of the unique and beautifully preserved type of *Termitaphis circumvallata* Wasm. shows it to be a female, of a different genus from all later described species. Wasmann's figures (1902) express these divergences quite clearly. It is a very different-looking insect with a swollen egg-shaped body surrounded by an incurved and upcurved dorso-lateral, segmentally-divided lamina almost meeting on the anterior half of

of the body and showing the structure described in the key below. Some of the Panama material showed an upward curling of the laminae in alcohol, but the condition thus artificially produced was not even superficially similar to that in *Termitaphis*. The Panama species is strongly flattened above and below, both in alcohol specimens and in life (Professor Wheeler), whereas *Termitaphis* would be rotund even were the laminae removed entirely. A new genus is therefore erected for the Panama species and for all other species described since *T. circumvallata*. The Panama material was used as the genotype as it is the best known to me.

Silvestri's family diagnosis (1911, p. 232) may be modified by deletion of the phrase "corpus valde depressum," and by changing his statement regarding stigmata to read as follows: stigmata 9, of which two are thoracic and seven abdominal.

The two genera may be separated as follows: *Termitaphis*, Wasm. (1902, p. 105); Body egg-shaped, surrounded by a strongly incurved and upcurved, dorso-lateral segmentally divided lamina, the edges of which are further divided into distinct, often quite distantly separated lobules each with a long fine almost smooth flagellum.

Type, *T. circumvallata* Wasm. *Termitaradus*, gen. nov., Entire body strongly flattened above and below and surrounded by a flat lateral segmentally divided lamina the margin of which is crenulate forming short non-separated lobules, each provided with a short, circular, clavate or lanceolate flabellum with serrate edges.

Type, *T. panamensis*, sp. nov.

In addition, the tylus, covering the setal coil, is in *Termitaphis* strongly protuberant, while in the other genus it shares the general flattening of the body. In the structure of the rostrum, antennae, legs and last ventral segments of the female the two genera are similar.

To Wasmann's original description of *T. circumvallata* may be added the following: marginal lamina on each side divided into 13 lobes (Wasmann did not count the minute 8th abdominal), bearing lobules as follows: 6, 3 (head), 9 (prothorax), 7 (mesothorax), 7-8 (metathorax), 8-10, 8-9, 9-10, 8-9, 7, 6, 5, 3 (the 8

abdominal segments). There are thus fewer head lobules than in any other species of the family and more than the average of abdominal lobules. The flagella seem to me in most cases longer than figured by Wasmann. Both in the distinct separation of the marginal lobules and in the length and flagellate appearance of their appendages *Termitaphis* is clearly intermediate between the Aradid nymph described above and *Termitaradus*. The swollen form of the body is however very un-Aradoid, and may be best explained as an instance of termitophilic physogastry.

#### THE SPECIES OF TERMITARADUS.

Eight species, including the new one described below may be referred to this genus. Of these, one, namely *T. australiensis* (Mjög.) is quite inadequately described and its relationships at present obscure.

The important characters in the genus appear to be the form and average number of the flabella. It is therefore unfortunate that these peculiar structures are so easily detached. In their absence however, their number can be ascertained by counting the lobules in which they arise. The number of the lobes, at least in those species which show 13 or 14 on each side seems less reliable. One would of course have been inclined to regard the presence or absence of an additional lobe as a character at least of specific importance, but the following considerations have led the writer to reject it as such.—

It is a single meristic character, and such are known to vary intraspecifically.

Nymphs in species in which the adult female is 13-lobed (*T. annandalei* and the normal 13-lobed Panama form) show the extra lobe clearly developed.

Specimens taken together in the case of three separate lots include a mixture of 13-lobe and 14-lobe examples.

The specimens in these lots agree exactly in all other characters.

The males taken with these lots are all identical and all show 12 lobes, as does also the male of the typically 13-lobed *T. annandalei*.

The 14-lobed specimens have the lobes distributed as follows in the manner indicated by Morrison.—2 to the head, one to the prothorax, 2 to the mesothorax, one to the metathorax and

eight to the abdomen. Silvestri differs from this interpretation in considering the extra lobe (which by the way may be easily distinguished by its smaller size) to belong to the metathorax in *annandalei* nymphs, and to the prothorax in the 14-lobed adults, while Morrison assigns it to the mesothorax. The writer agreed with Silvestri but a rigorous combined examination by Mr. Morrison and himself of material treated in different ways has led to the conviction that Morrison's interpretation is correct.

The males differ from the females in that none of the abdominal segments after the seventh are furnished with lobes or form part of the marginal lamina. In number of flabella on head, thorax and segments 1 to 7 of the abdomen they agree with the corresponding female except that there is a tendency towards an average of one more flabellum in the abdominal segments.

The following table shows the number of lobules and their flabella on one half of the body in the seven adequately known species, in the females only. The thirteen-lobed form of the Panama species has been taken as typical and the description founded on it alone. Should future work show that the fourteen-lobed form is specifically distinct there need then be no confusion.—

|               | <i>mexicana</i> | <i>subrafa</i> | <i>annandalei</i> | <i>guianæ</i> | <i>trinidadensis</i> | <i>insularis</i> | <i>panamensis</i> |
|---------------|-----------------|----------------|-------------------|---------------|----------------------|------------------|-------------------|
| Head          | 7<br>4          | 7<br>3         | 8<br>3            | 7<br>3        | 7<br>3               | 7<br>3           | 7-8<br>3          |
| Prothorax     | 9               | 12             | 10                | 9-10          | 8                    | 10-11            | 10                |
| Mesothorax    | { 4<br>5        | { 4<br>5       | 6-7               | { 4<br>4      | { 4<br>4             | } 11             | 5                 |
| Metathorax    | 5               | 5              | 6-7               | 4-5           | 3-4                  |                  | 5                 |
| 1st abdominal | 7               | 7              | 7-8               | 5-6           | 4                    | 6                | 6                 |
| 2nd "         | 7               | 7              | 8-10              | 6             | 4                    | 7-8              | 6-7               |
| 3rd "         | 7               | 7              | 8-10              | 6-7           | 4                    | 6-7              | 6-7               |
| 4th "         | 7               | 7              | 8-10              | 6-7           | 4                    | 7                | 6-7               |
| 5th "         | 7               | 7              | 8-10              | 6             | 4                    | 7                | 6-7               |
| 6th "         | 7               | 7              | 8-10              | 6             | 4                    | 6                | 6                 |
| 7th "         | 4               | 4              | 5                 | 4             | 4                    | 4                | 4                 |
| 8th "         | 2               | 2              | 2                 | 3             | 3                    | 3                | 3                 |

*Key to the females of the seven adequately described species.*

- a Only 12 lobes to body margin on each side. . . . .  
*T. insularis* Morr.
- aa 13-14 lobes to body margin on each side.
- b Lobules of 2nd to 6th abdominal lobes not more than four. . .  
*T. trinidadensis* Morr.
- bb Lobules of 2nd to 6th abdominal lobes six or more.
- c Flabella short and rounded, at most hardly more than  
twice as long as broad.
- d 8th abdominal lobe with two lobules; anterior abdom.  
segments with normally 7 or more lobules on each margin.
- e Lobules of 2nd to 6th abdom. lobes not more than 7;  
flabella rounded. . . . . *T. mexicana* Silvestri.
- ee Lobules of 2nd to 6th abdom. lobes 8 or more; flabella  
short clavate. . . . . *T. annandalei* Silvestri.
- dd 8th abdominal lobe with 3 lobules; anterior abdom. seg-  
ments with normally 6 or fewer lobules on each margin.  
*T. guianæ* Morr.
- cc Flabella elongate, much more than twice as long as broad
- f Flabella lanceolate, very acute at apex; 8th abdominal  
lobe with 3 lobules . . . . . *T. panamensis* sp. n.
- ff Flabella subcylindrical, rounded at apex or at most very  
obtusely pointed; 8th abdom. lobe with 2 lobules.  
*T. subafra* Silvestri.

### ***Termitaradus panamensis* sp. nov.**

Male, female: Colour of alcohol specimens pale yellowish. Very similar save in details, to the Indian *T. annandalei* Silv., from which it differs in the smaller number of lobules on the marginal lobes, and in the shape of the flabella, which are elongate and lanceolate, the broadest part being nearer base than apex, the apex itself being very sharply pointed. The dorsal surface of the body is minutely papillated, marked into innumerable polygonal areas (chiefly irregular hexagons) by lines of slightly larger papillæ, and supplied with numerous pores. The tibial comb is similar to that described and figured by

Morrison in *T. guianæ*. The male genital segments differ from those of *T. annandalei*, especially in the caudal margin of the seventh abdominal segment, (mesad of the marginal lamina, see Silvestri, 1921, fig. III, 4) which is far less sinuate in the present species.

Length: male, 2.35; female, 2.40 mm.

*Holotype* (a slide mount) Type Cat. No. 27855 U. S. National Museum.

*Allotype* (slide mount, 13-lobed form). U. S. National Museum.

*Paratypes* in U. S. Nat. Mus. and in colls. Dr. W. M. Wheeler and Museum of Comparative Zoology.

Described from eight lots, with data as follows.—

5 males and 3 females, Barro Colorado Id., C. Z., Panama, 20th June, 1924, W. M. Wheeler. No. 510 (in nest of *Leucotermes convexinotatus* Snyder);

2 females, same locality, 21st Feb., 1924, T. E. Snyder. (in nest of *Leucotermes tenuis* Hag.)

3 females, same locality, 6th June, 1923, Zetek-Malino coll. (with *Leucotermes tenuis* on soft dry wood on ground) Z.2081

10 females, 2 males and 4 nymphs, near Fort San Lorenzo, C. Z., Panama, 14th June, 1923, J. Zetek, Z.2128A. (on soft wood of tree-stump);

3 females and two nymphs, same locality and date, J. Zetek, Z.2132A. (with *Leucotermes tenuis*);

1 female (Z.2171): In moist very soft rotting log on ground, Rio Aejeta, C. Z., Panama, Aug. 19th, 1923. With *L. tenuis* and *Cornitermes acignathus* Silv. J. Zetek coll.

1 female (Z.2263 S): In branch on ground, hard wet wood, Sweetwater, Fort Sherman, C. Z., Sept. 7th, 1923. With *L. tenuis*. Zetek-Malino coll.

3 females and one nymph (Z.2264 A) in pieces of branches on ground, hard wood. Other data as Z.2263 S.

### **Termitaradus guianae** (Morr.)

Among the material kindly lent by the U. S. Bureau of Entomology through the courtesy of Mr. Morrison, were six females and one male from Rio Frio, Colombia, collected by Dr. W. M. Mann in February, 1924. These have been referred

provisionally to *T. guianæ*. The male has twelve marginal lobes on each side, while five of the females have thirteen and the sixth shows fourteen. These seem all conspecific in spite of the divergence in the number of lobes. In this connection reasons have been adduced above for rejecting this character as specific among thirteen—and fourteen-lobed forms. Unfortunately the flabella are almost entirely lacking in the seven specimens, but the few that remain (fig. 13.) are identical in shape with those figures by Morrison in *T. guianæ*. Moreover the number of lobules in the respective lobes corresponds very closely with that in *T. guianæ*, the chief differences being as follows:

| Number of lobules      | <i>T. guianæ</i> | Colombian material |
|------------------------|------------------|--------------------|
| 2nd lobe of mesothorax | 4                | 5-6                |
| 2nd abdominal lobe     | 6                | 7                  |
| 5th abdominal lobe     | 6                | 7                  |

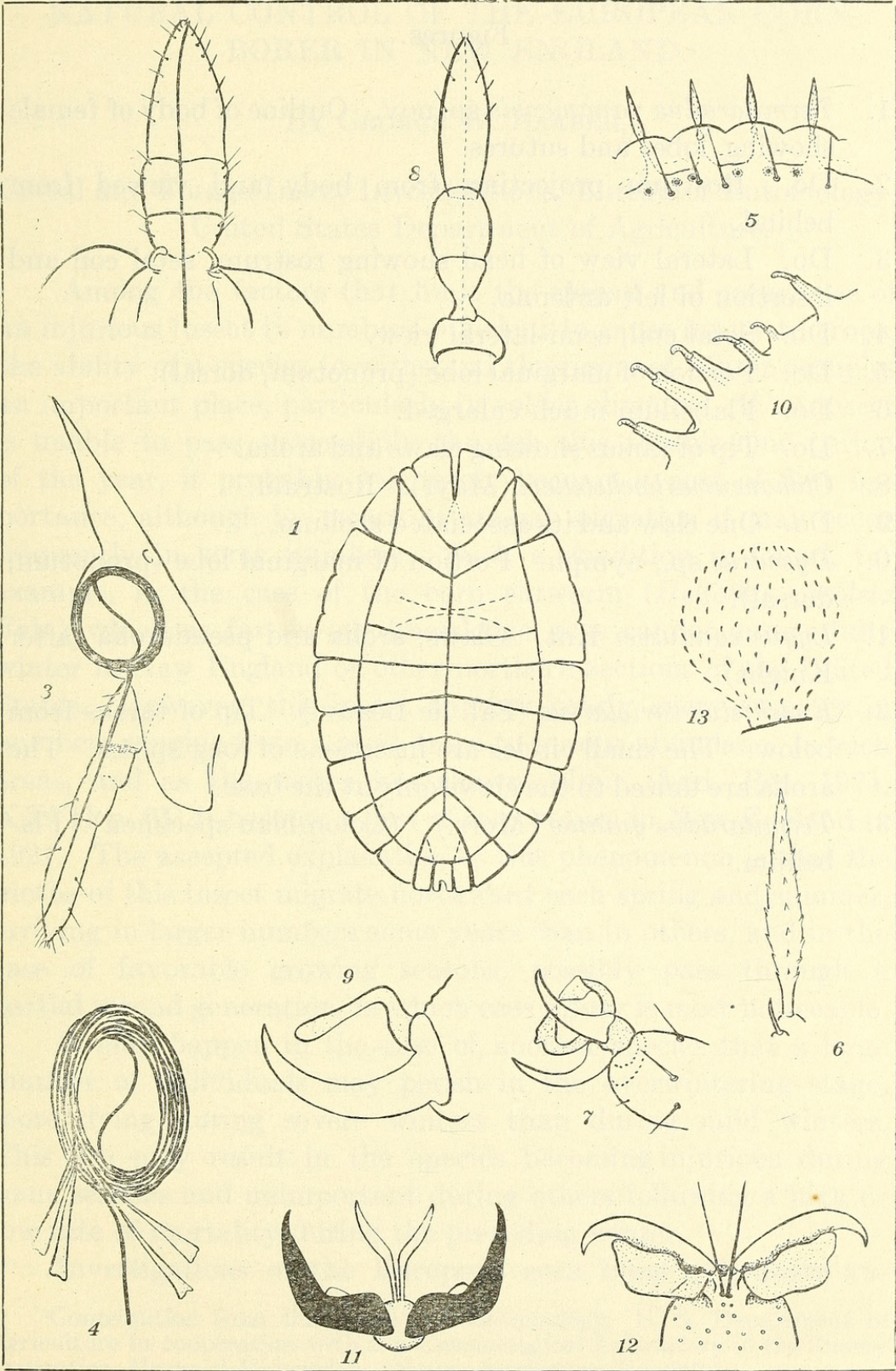
The variation in the considerable series of *T. panamensis* examined supports the suggestion that these differences come well within the range of intraspecific variability. In any case they seem an insufficient basis for specific rank.

In conclusion the writer would express his deep indebtedness to Professor W. M. Wheeler, Professor C. T. Brues and Mr. Nathan Banks for references to and loan of literature and for much helpful advice; and to Mr. Harold Morrison not only for turning over the task of describing his new species but also for much time, and patient work in demonstrating the interpretation of the segmentation.

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## Figures.

1. *Termitaradus panamensis* sp. nov. Outline of body of female showing lobes and sutures.
2. Do. Rostrum projecting from body and viewed from behind.
3. Do. Lateral view of head showing rostrum, setal coil and insertion of left antenna.
4. Do. Setal coil, semi-lateral view.
5. Do. Portion of marginal lobe (pronotum, dorsal).
6. Do. Flabellum much enlarged.
7. Do. Tip of tarsus showing claws and arolia.
8. *Ctenoneurus hochstetteri* (Mayr). Rostrum.
9. Do. One claw and its associated arolium.
10. *Dysodius* sp., nymph. Portion of marginal lobe (pronotum, dorsal).
11. *Lygus vanduzeei* Knt. Claws, arolia and pseudarolia (after Knight).
12. *Euschistus variolarius* (Pal. de Beauv.). Tip of tarsus from below. The small circles are insertions of long spines. The arolia are united to the claws only at the base.
13. *Termitaradus guianæ* (Morr.) (Colombian specimen). Flabellum.



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