

NOTES ON NORTH AMERICAN TINGIDÆ  
(HEMIPTERA).<sup>1</sup>

BY H. M. PARSHLEY.

A number of highly interesting forms of the Hemipterous family Tingidæ have recently been submitted to me for study by Mr. Nathan Banks of the Museum of Comparative Zoölogy and others mentioned below. In treating this material it has been necessary to take into account the recent publications of Osborn and Drake,<sup>2</sup> in which there is much requiring comment, as hereafter noted in part. Most of the conclusions were reached by a study of the papers cited in the light of Tingid material in my hands, and they have been verified by an examination of the type specimens concerned, through the courtesy of Professor Osborn.

The eminent European Hemipterist Bergroth has recently remarked on several occasions that the modern system of specific type fixation is likely to promote inadequate describing, and although many will not be able to approve his resultant refusal to designate definite type specimens, the force of his remarks must yet be strongly felt when it becomes necessary to deal with descriptions which are not only inadequate but even seem, in some particulars at least, to have been based upon a study of highly inaccurate figures rather than specimens—work which without some revision puts serious obstacles in the way of later investigators. Of course the designation of type specimens is not entirely to blame for this, but the feeling that species, however inadequately characterized, and genera, even without any description, are firmly established if only types are designated, tends to belittle the importance of the written record. After all, the printed word, capable of indefinite reduplication, accessible to everyone, and permanent, is of prime importance; while type specimens, limited in number, generally inaccessible, and perishable in nature, should be treated as of merely supplementary value. For this reason I am in accord with Van Duzee and others who

---

<sup>1</sup>Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 127.

<sup>2</sup>The Tingitoidea of Ohio, Ohio Biol. Surv., Vol. 2, Bull. 8, 1916, pp. 217–251.  
Some New Species of Nearctic Tingidæ, Ohio Jour. Sci., Vol. 17, 1916, pp. 9–15.

maintain that where description and type disagree in important particulars, the former should take precedence.

#### **Acalypta lillanis** Bueno.

In their first paper Osborn and Drake properly treat the long- and short-winged forms as conspecific, but the drawing on page 221 is very inaccurate as regards the structure of the head, which, of course, is precisely similar in the two forms of the species. The differences in head and antennal structure to be noted in comparing this figure with that on the next page do not exist in nature. This is no doubt due in part to the fact that the artist, being unfamiliar with the subject, drew the two specimens from somewhat different points of view. The authors are then entirely unjustified in announcing, on page 9 of their second paper, that de la Torre Bueno's species is composite, the more so as they have not studied his extensive type series which I can state, after careful examination, to be perfectly homogeneous, as is a good series of the species in Mr. H. G. Barber's collection. Moreover, there is nothing in the original description<sup>1</sup> on which the assumption can be based, and it thus appears that as in some other cases undue attention has been given drawings of doubtful accuracy. Whether or not the type specimen of *A. ovata* O. & D. represents a species distinct from *lillianis* is another question. It is a little broader posteriorly than is usual in the short-winged form of the latter species and the first antennal segment is slightly different in form, but it agrees with the figure little better and presents no characters that I would consider of specific importance.

#### **Fenestrella** O. & D.

In their description of this extraordinary genus the founders omit to mention the following important characters: the bucculæ are contiguous anteriorly, much as in *Melanorhopala*, for instance; the metasternal orifices are obsolete; the surface of the hemielytra is deeply channelled, the main veins being raised on very prominent roof-like elevations, a condition which would be somewhat modified in the as yet unknown long-winged form. The drawing of the type species on page 223 of the first paper is inaccurate in numerous particulars: the general form is in reality much less elongate, the

---

<sup>1</sup> Bull. Brooklyn Ent. Soc., Vol. 11, 1916, p. 39.

costal margin being more abruptly curved posteriorly than the figure would indicate; the base of the third antennal segment is slightly capitate; the eyes project laterally less than one third their width beyond the antenniferous tubercles, etc. *Fenestrella* is extremely isolated, having no close relationship with any Palæ-arctic or American genus known to me. It differs from *Acalypta* in some of the most important characters, and yet it cannot be placed elsewhere with much greater propriety. Further material in the genus will be awaited with great interest.

#### Corythucha Stal.

As I am hoping to treat the North American forms of this genus in a later paper, I shall make no other comment here than to point out that while most of the new species recently described by Osborn and Drake are very distinct and well known forms, there are some which cannot be located without reference to the types, because it is impossible to deduce from the descriptions an adequate notion of the important characters derived from exact relative width and height of the hood and from the altitude of the median carina with reference to that of the hood.

#### Galeatus peckhami Ashm.

Of the two examples of this species known to me to have been taken in New England, one was found at Princeton, Me., and the other near the Glen House, Mt. Washington, N. H., both collected by Mr. C. W. Johnson. I have already published the latter record,<sup>1</sup> which may be what Osborn and Drake erroneously refer to on page 237 of their first paper. Uhler in his paper<sup>2</sup> on the Hemiptera of Las Vegas Hot Springs, N. M., makes reference indefinitely to Massachusetts in discussing the distribution of this species, but as is the case with so many of the faunistic generalizations of this author, confirmatory records of actual capture are desirable if one is seeking exact knowledge.

#### Leptobyrsa rhododendri Horv.

Champion has recently shown<sup>3</sup> that *L. explanata* Heid. is synon-

---

<sup>1</sup> Ent. News, Vol. 27, 1916, p. 105. The Connecticut record for *Zelus socius* Uhl. given in this paper pertains to *Z. audax* Banks.

<sup>2</sup> Proc. U. S. N. Mus., Vol. 27, 1904, p. 362.

<sup>3</sup> Ent. Mo. Mag., Vol. 52, 1916, p. 207-208.

ymous with Horváth's previously published name. The species was first described from Holland where it was found infesting rhododendrons, probably as a visitor from the United States, and recently it has similarly occurred in England. As noted by Champion, Heidemann's generic reference is correct, as the lateral pronotal carinae are percurrent in this species and not abbreviated as in *Stephanitis* Stal.

### Leptoypa Stal.

The rather common misspelling, *Leptophya*, is perpetuated by Osborn and Drake on page 241 of their first paper. In their generic diagnosis it is the posterior "tip" of the rostral sulcus which is described as open, though in reality it is nearly or quite closed by the convergent ends of the metasternal ridges. In *L. mutica* Say the head is provided with five spines as in related forms.

The chief characters separating *Leptoypa* from closely allied genera may be stated as follows: Entire surface very finely and evenly reticulate; antennæ short, cylindrical, the third segment not greatly longer than the others together; hood absent; lateral carinæ absent or vestigial; paranota linear, cariniform; costal area linear or narrow and uniseriate; subcostal area with 4-6 rows of areoles.

### *Leptoypa costata* sp. nov.

Long-winged form.—Brown, shining, evenly and finely reticulate; more or less variegated with vague darker markings; pronotum with a black transverse suture interrupted at middle; body beneath chestnut brown, sternal region infuscated.

Head broad; vertex punctate at middle; basal spines short, reaching base of anterior spines, which are short and curved with apices meeting that of median spine; antenniferous tubercles moderate in size, oblique, rounded exteriorly; antennæ short, cylindrical, minutely pubescent, first and second segments nearly equal, slightly longer than broad, thickest, third slightly more slender, cylindrical, a little less than twice as long as the first two together, fourth somewhat longer than the first, fusiform. Pronotum convex at middle, narrowed anteriorly, depressed behind the narrow raised apical collar; median carina slightly raised but appreciably percurrent; lateral carinæ parallel, exceedingly faint, beginning just anterior to summit of pronotal convexity and extending to margins of angu-

late process. Paranota<sup>1</sup> linear, cariniform, exterior margin straight, somewhat broader anteriorly. Hemelytra at middle distinctly broader than pronotum, extending a little beyond apex of abdomen; costal area narrow, distinctly uniseriate, biseriate anteriorly; subcostal area with 5 or 6 rows of areoles at most, obtusely angulate at apex of discoidal, which extends beyond middle of hemelytra; sutural with slightly larger areoles apically. Legs rather robust. Rostrum scarcely reaching middle coxæ. Orifices but slightly elevated, narrow, transverse. Pleuræ largely reticulate. Abdomen shining, the segments roughened posteriorly. Hind wings almost as long as hemelytra. Form obovate, broadest behind middle, costal margin nearly straight in apical half. Length ♀, 2.8 mm.; width 1.3 mm.

Holotype and paratype, two ♀ ♀, Marshall Hall, Md., 1 August, 1891 (N. Banks), in M. C. Z. Collection.

This species is easily distinguished from *mutica* by its shorter and broader form, slightly shorter antennæ with more slender third segment and distinctly shorter fourth, somewhat more prominent paranota, and especially by its distinct and completely reticulated costal area which in Say's species is cariniform and perceptibly reticulate only toward apex. The lateral pronotal carinæ are very inconspicuous in *costata* and obsolete or nearly so in *mutica*.

#### Physatocheila Fieb.

In connection with my treatment of the North American species in a recent paper,<sup>2</sup> it should be made clear that the arrangement of areoles in the costal area is somewhat variable and not always symmetrical, although a majority of specimens exhibit the conditions described. In cases of doubt the other characters mentioned are amply sufficient to insure recognition of the forms.

#### Melanorhopala Stal.

Our conception of this genus must be slightly modified to accommodate *M. durji* O. & D. and the new form described below, which, though in my opinion congeneric with *clavata*, exhibits certain marked differences. According to this view the chief characters

---

<sup>1</sup> See Jour. New York Ent. Soc., Vol. 24, 1916, p. 8. Crampton in a morphological paper has proposed this convenient name for the lateral expansions of the pronotum.

<sup>2</sup> Psyche, Vol. 23, 1916, pp. 163-168. The holotype of *D. tricornis americana* is in the collection of the Boston Society National History, not in mine, as erroneously stated on p. 164.

of *Melanorhopala* may be stated as follows: Form elongate, depressed, the hemelytra flat or showing only the slightest convexity. Antennæ usually rather long and slender, the third segment cylindrical, usually somewhat curved and enlarged toward the apex in varying degrees. Pronotum tricarinate; hood small and not produced anteriorly; paranota narrow, uniseriate, reflexed vertically or against the pronotal surface. Hemelytra in the long-winged form widely overlapping and broadly rounded at apex, in the short-winged form very slightly overlapping, acute and distinctly divaricate at apex; main veins distinctly costate; costal area usually uniseriate, sometimes irregularly biseriate; subcostal area biseriate.

The following table will assist in separating the species:

1. Third antennal segment slender, not thicker than the fourth except sometimes at extreme apex; size larger. . . . . 2  
 Third antennal segment rather thick, cylindrical, slightly clavate toward apex which is one third thicker than the fourth segment; form very broad; length, 3.5 mm  
*duryi* O. & D.
2. Costal area (costal membrane of Stal) uniseriate, evenly reticulated; color pale and uniform in general. . . . . 3  
 Costal area bi- or triseriate in part, irregularly reticulated; color variegated. . . . . *infuscata* sp. nov.
3. Third antennal segment very slender, much thinner than the fourth, abruptly and strongly clavate at apex; fourth segment conical. . . . . *clavata* Stal.  
 Third antennal segment less slender, but little thinner than the fourth, less enlarged at apex; fourth fusiform. . . . . 4
4. Length less than 5 mm.; form narrow; paranota vertically reflexed; antennæ distinctly though not strongly clavate  
*obscura* Parsh.  
 Length more than 5 mm.; paranota reflexed almost or quite against pronotal surface; antennæ scarcely clavate. . . . . 5
5. Antennæ very long, extending beyond apex of abdomen; second segment distinctly narrowed at base; form narrow  
*lurida* Stal.  
 Antennæ much shorter; second segment less narrowed at base; form broad. . . . . *uniformis* Stal.

### M. duryi O. & D.

The shape of the antennæ in this species is not correctly represented in the figure given by the authors on page 15 of their second paper. In the type specimen the first and second segments are nearly equal in size, the third almost perfectly cylindrical with some slight enlargement toward the apex, decidedly longer in proportion to its thickness than indicated, and slightly curved as in all the other species of the genus except *infuscata*, and the fourth is thinner than the figure shows and fusiform, not conical. The anterior spines of the head are short and decidedly curved, the main veins of the hemielytra though strongly costate are unusually irregular, tending to follow the outlines of the areoles, and the general form is very broad, even for a short-winged form.

### M. lurida Stal and M. uniformis Stal.

I believe that these species have been correctly located by Osborn and Drake, as from Stal's descriptions it is impossible to suppose that these species differ from *clavata* in any characters of importance beyond those drawn from the form of the antennæ. I have seen *infuscata* sp. nov. in several collections determined as *uniformis*, but the former differs so strikingly from *clavata*, to which the latter is compared by Stal, that such a view cannot be entertained unless examination of Stal's type should unexpectedly demonstrate its truth.

### Melanorhopala infuscata sp. nov.

Long-winged form.—Dark yellowish brown with conspicuous darker markings. Head uniform brown, the spines paler; antennæ dark brown, the fourth segment and apex of third slightly darker. Pronotum broadly and variably infuscated, lateral margins and hood excepted; apex of angulate process yellowish white. Hemielytra variegated with very irregular and variable infuscation of veinlets here and there in all the areas, the infuscation sometimes extending to large portions of the surface; sutural area with a large paler region at apex. Body beneath brown, abdomen broadly pale along median line, narrowly at the lateral margins; genital segment darker. Legs brown; tarsi black. Hind wings fuscous.

Head much as in *clavata*, the median spine arising more posteriorly, between the eyes. Antennæ minutely pubescent, very slender, longer than head and pronotum together; first segment oblong, about as thick as the eye is wide as seen from above, second segment smaller, evenly enlarged toward apex, third very long and slender, thinner than the second, cylindrical, with an almost imperceptible enlargement at extreme apex, almost or quite straight, apex oblique; fourth as long as the first and second

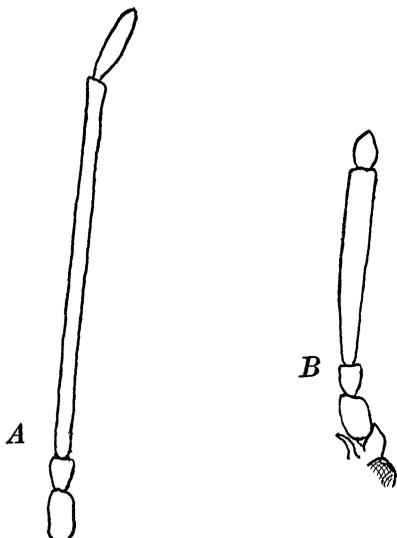


Fig. 1. Antennæ; A, *Melanorhopala infuscata* sp. nov.; B, *Alveotingis grossocerata* O. & D.

together, very slightly thicker than the third, fusiform but not quite regular in shape. Pronotal hood roof-like, a little more elevated than in *clavata*; convexity of pronotum bounded posteriorly by a continuous transverse impression; carinæ very low, uniseriate; paranota reflexed closely against pronotal surface. Costal margin of hemielytra slightly curved in male, more strongly so in female; costal area broader behind middle, irregularly reticulate, uniseriate anteriorly, biseriate at middle, triseriate behind middle, uniseriate at extreme apex; subcostal area almost perfectly and regularly biseriate; discoidal area a little more sinuate exteriorly than in *clavata*, extending much beyond middle of hemielytra; sutural area with larger areoles at apex and along inner margin. Legs and structures of ventral aspect much as in *clavata*, except that the bucculæ are more rounded ventrally, rostrum extends beyond hind coxæ, and the female genitalia encroach farther upon the disc of the abdomen. Wings extending beyond apex of abdomen. Form broader than in *clavata*, male narrower than the female. Length ♂ 5.4 mm., ♀ 5.5 mm.; width ♂ 1.5 mm., ♀ 1.7 mm.

extreme apex; subcostal area almost perfectly and regularly biseriate; discoidal area a little more sinuate exteriorly than in *clavata*, extending much beyond middle of hemielytra; sutural area with larger areoles at apex and along inner margin. Legs and structures of ventral aspect much as in *clavata*, except that the bucculæ are more rounded ventrally, rostrum extends beyond hind coxæ, and the female genitalia encroach farther upon the disc of the abdomen. Wings extending beyond apex of abdomen. Form broader than in *clavata*, male narrower than the female. Length ♂ 5.4 mm., ♀ 5.5 mm.; width ♂ 1.5 mm., ♀ 1.7 mm.

Holotype ♂, allotype, and two paratypes, ♂ and ♀, Falls Church, Va., 27, 30 July, 2 August (N. Banks) in M. C. Z., Barber's, and my collection. From bark of tulip tree (*Liriodendron*).

This species is easily distinguished by its slender inclavate antennæ (fig. 1, A), irregularly reticulate costal area, dark and variegated coloration, and broad form. These characters are not of subgeneric value according to the standards established in the treatment of Palearctic genera.

### **Hesperotingis gen. nov.**

Form ovate, broadly so in the short-winged forms; surface of hemielytra distinctly but not strongly convex in both forms. Head with two basal spines and three anterior as in allied genera; vertex with a narrow punctate area behind the median spine; antennæ incrassate, the third segment very distinctly clavate, subcylindrical at base and apex. Hood very feebly developed, prothorax otherwise as in *Melanorhopala*. Hemielytra somewhat convex, the areas distinctly limited by moderately costate veins; costal area uniseriate, subcostal almost perfectly biseriate in known species; discoidal narrow, four or five areoles wide at most, slightly sinuate exteriorly, extending beyond middle of hemielytra, similar in long- and short-winged forms; sutural as in *Melanorhopala*; apices of hemielytra not divaricate in the short-winged form. Bucculæ almost or quite contiguous anteriorly, not fused. Metasternal orifices distinct.

This genus is most closely related to *Melanorhopala* Stal and *Alveotingis* O. & D., but I have found it impossible to unite it with either even as a distinct subgenus. From the former it is distinguished by the incrassate, almost evenly clavate antennæ, convex oval form, and nondivaricate hemielytral apices in the short-winged condition, while in habitus it is totally unlike the latter, though similar in antennal structure, the form being much less convex, the hemielytral areas more distinctly defined, and the reticulation less uniform.

Type of the genus *Hesperotingis antennata* sp. nov.

### **Hesperotingis antennata** sp. nov. (Fig. 2).

Long-winged form.—Brown; head, pronotum, and antennæ beyond the middle, infuscated; membranous portions between the

veinlets opaque white. Anterior margin of pronotum, hood, anterior portion of paranota, and margins and apical region of angulate process, yellow. Veinlets of hemielytra light brown, a few irregularly darker; veins defining discoidal area, sometimes one running obliquely across it, one extending from its apex, and one near and parallel with sutural margin, dark brown. Abdomen

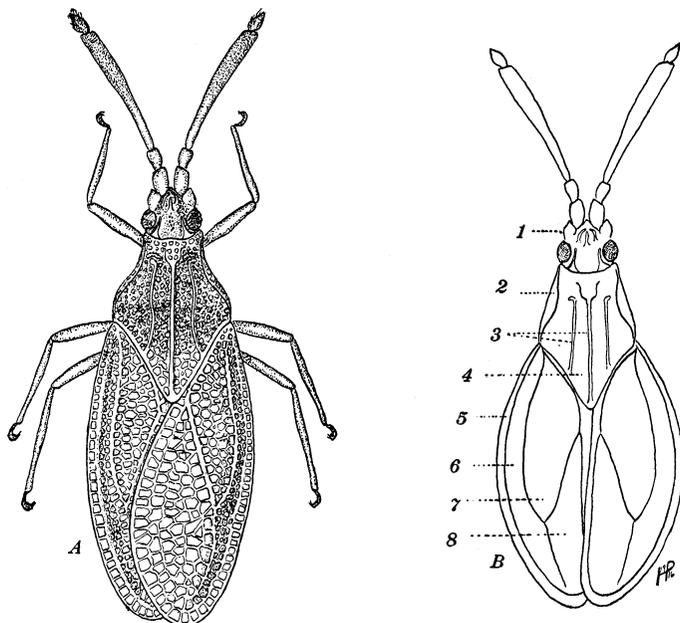


Fig. 2. *Hesperotingis antennata* gen. et sp. nov. A, long-winged ♀; B, short-winged ♀; 1, antenniferous tubercle; 2, paranotum; 3, pronotal carinae; 4, angulate process of pronotum; 5, costal area (costal membrane of Stal); 6, subcostal area (costal of Stal); 7, discoidal area; 8, sutural area (apical of Puton in long-winged form).

beneath chestnut brown, shining, sutures darker; bucculae, sternal ridges, and pleural margins pale.

Spines of head somewhat variable in length and shape, the two anterior short, strongly curved, and almost or quite meeting over apex of median; eyes strongly granulated, as seen from above longer than wide; antenniferous tubercles as seen from above prominent, convex exteriorly, acute at apex, obliquely truncate. Antennae almost as long as head and pronotum together; first

segment oblong, almost glabrous; second shorter and a little narrower than the first, wider toward apex, with minute decumbent pubescence; third very large, clavate, in basal third more slender than the second, in apical third about as wide as the first is long, with fine pubescence becoming denser toward apex; fourth segment small, conical, more slender than the third at apex, with long dense pubescence. Pronotum transversely convex; narrowed, subcylindrical, and depressed anteriorly, margins and apical half of angulate process depressed, flat; anterior margin arcuate, with a slightly elevated collar of one or two rows of areoles; hood represented by a small backward extension of the collar; paranota reflexed closely against pronotal surface; carinæ low, slightly divergent posteriorly, the extreme apices of the lateral outcurved, terminating at the level of the posterior margin of hood, the median percurrent. Hemelytra extending much beyond apex of abdomen, the marginal vein depressed, the costal area reflexed; sutural area with somewhat enlarged areoles. Bucculæ large, curved ventrally, angulate posteriorly; rostral sulcus deeper and wider posteriorly. Rostrum reaching hind coxæ. Hind wings extending beyond apex of abdomen. Segments of abdomen faintly and irregularly striate on apical half. Genitalia much as in allied species. Form elongate oval. Length ♀ 4.5 mm.; width 1.5 mm.

Short-winged form (fig. 2, B).—Similar in every way to the preceding, except that the general form is broadly oval; pronotum is flat and less broadened posteriorly; the carinæ parallel; hemelytra but slightly longer than abdomen, the costal margin strongly curved, apices narrowly rounded, and sutural area much reduced. Length ♀ 3.7 mm.; width 1.5 mm.

Holotype: long-winged ♀, Lakehurst, N. J., 27 June (H. G. B.) in Barber's collection; paratypes: long-winged ♀, Smiths Point, Fire Island Beach, N. Y., 19 July, 1913 (J. R. T. B.) in de la Torre Bueno's collection; short-winged ♀♀, Delaware Water Gap, 4 September (Mrs. A. T. Slosson) in Barber's collection; New Haven, Conn., 4 September, 1911 (C. E. Olsen) in de la Torre Bueno's collection.

A specimen from Hampton, N. H., 15 August, 1909 (S. A. Shaw) differs from the others in having very slightly shorter and uniformly dark antennæ and the subcostal area somewhat irregularly and asymmetrically reticulated with three rows of areoles in places

behind the middle. It does not appear to me to be specifically distinct and in the absence of further material may, for the sake of exact reference, be called var. *borealis* nov. Holotype in M. C. Z collection.

The example from the Delaware Water Gap, recently submitted to me by Barber, bears the MS. name *Melanorhopala slossoni* Heid.

#### **Hesperotingis fuscata** sp. nov.

Short-winged form.—Uniform dark fuscous, pronotum somewhat paler, membrane of areoles opaque gray, main veins of hemielytra black.

Anterior spines of head short, separated, but slightly curved. Antennæ shorter and thicker than in the preceding, the third segment more evenly clavate, being subcylindrical only toward apex, not at base. Hood still more reduced, scarcely noticeable as distinct from the raised pronotal margin; paranota vertical, not applied to pronotal surface; carinæ more strongly elevated, as are the chief veins of the hemielytra; subcostal area biseriate but having a few extra areoles along the middle. Other characters as in the preceding. Form broadly ovate. Length ♀ 3.4 mm.; width 1.4 mm.

Holotype: short-winged ♀, Golden, Colo. (W. J. Gerhard) in Barber's collection.

Easily distinguished from *antennata* by its uniform dark color, antennal shape, and vertical paranota.

#### **Alveotingis** O. & D.

This genus is notable for a very peculiar habitus arising from the extremely convex form and shining surface. In most of its characters it closely approaches *Melanorhopala* and *Hesperotingis*, while bearing a certain superficial resemblance to the Serenthiini although it of course lacks the pronotal and femoral structure characteristic of this tribe. It approaches the European *Oncochila* in having the hemielytral areas poorly defined, but differs widely in paranotal structure and in facies. The more important characters of *Alveotingis* may be stated as follows: form elongate oval, hemielytra very convex, their surface smooth and shining, without costate main veins, although the outlines of the areas are traceable. Head as in related genera, the antennal tubercles of

the usual structure, as in *Melanorhopala* for instance; antennæ (fig. 1, B) shaped much as in *Hesperotingis*, the third segment clavate, smallest at base and cylindrical toward apex. Thorax as in *Melanorhopala*. Costal area of hemielytra uniseriate in the only known species; subcostal biseriate; discoidal extending beyond middle of hemielytra. In the short-winged form the hemielytra are rounded at apex, not divaricate, in the long-winged they are broadly rounded at apex and widely overlapping. Bucculæ closed anteriorly. Metasternal orifices distinct.

#### A. *grossocerata* O. & D.

Probably this specific name must stand for the present, although Oshanin in his catalogue of Palaearctic Hemiptera rejects such on grammatical grounds. The type specimen of this species is a short-winged male. The figure on page 246 of Osborn and Drake's first paper is incorrect in certain important details. The antenniferous tubercles are in reality constructed just as in related genera, and have no very striking similarity to an antennal segment. The third antennal segment is almost evenly clavate (fig. 1, B) and not fusiform as in Osborn and Drake's drawing. The hemielytral areas are traceable, though stated in the description to be undifferentiated, but the main veins are scarcely elevated. The general form is more elongate and narrowed posteriorly than the drawing would indicate. In this species the rostrum reaches the middle coxæ.

Long-winged form.—Pronotum enlarged and convex as in related genera. Hemielytra ample, extending considerably beyond apex of abdomen; costal margin slightly curved; sutural area with areoles grading larger inwardly and toward apex. Hemielytra distinctly more convex than in related genera, and habitus just as in the short-winged form except for structures affected by dimorphism. Length ♀ 3.4 mm.

Described from a female specimen lacking the third and fourth antennal segments and otherwise somewhat mutilated, taken on Mt. Washington, N. H. (W. F. Fiske), and sent to me for examination by Drake. The basal antennal segments are somewhat smaller than in the short-winged type specimen of the species, but this is no doubt due to individual variation as indicated by a short-winged male example intermediate in this regard but otherwise identical, submitted to me by de la Torre Bueno.



**Hindawi**

Submit your manuscripts at  
<http://www.hindawi.com>

