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XXII.—*A Synopsis of the Achilixiidæ of the New World*
(Homoptera: Fulgoroidea). By R. G. FENNAH.

THE Achilixiidæ are to be recognised as Fulgoroidea which in the adult stage have a non-segmented antennal flagellum, a comparatively long second post-tarsal segment, simple venation in the wings, an apical labial segment much longer than wide, a clavus truncate apically with the united claval veins entering the apex, a meenoplid type of male genitalia and an achilid type of female genitalia. Other characters which appear to be constant in the family include a tectiform carriage of the tegmina, the presence of one or two pairs of processes laterally on the abdomen between segments 3 and 5, a vertex rounding into the frons, and a costal margin concave near the base.

If the affinities of the group are unsettled, it is because of uncertainty about the importance to be attached to the evident resemblances to various other families. The specialised shape of the head pro- and mesonotum and

their carination in the New World genera is reminiscent of that in the genus *Derbe* F. (Derbidae). The presence of abdominal processes has been held to link the family with the bennine Cixiidae; the resemblance, however, is of little phylogenetic significance and has almost certainly arisen through parallel evolution; in the genitalia the differences are profound, especially in the female, which in the Bennini is provided with a long curved complete ovipositor and a large wax-bearing area, both covered by a long narrow anal segment; the male in Bennini has a tubular phallus reflexed distally in a flagellum: in Achilixiidae the structure is meenoplid-like, with the "periandrium" or phallobase forming a wide short tube and the phallus reduced or absent. Muir (Phil. J. Sci. (22) v. p. 483, 1923) claimed that the nearest relatives of the Achilixiidae are to be sought in the Meenoplidae on account of the condition of the male genitalia and the tectiform tegmina, although he recognised the form of the clavus and its venation as of the Achilid type. After supplementing previous morphological observations on Achilixiidae with an examination of the female genitalia, the writer is inclined to attach weight to characters shared with the Achilidae. If we picture Meenoplidae devoid of the specialised groups of tegminal pustules, Kinnaridae devoid of abdominal wax glands, Achilidae with tectiform wings instead of the more usual overlapping wings, and Achilixiidae without abdominal processes, the resulting concepts are almost perfectly intergraded: the Achilixiidae agree with the Achilidae in claval structure and in the form of the female genitalia, and differ from the Meenoplidae and Kinnaridae in both, while they agree with the last two families in the structure of the male genitalia. The condition of the achilid aedeagus is specialised owing to the changes accompanying the great withdrawal of the gonopore anteriorly into the abdomen, but its basic plan of a large broadly-tubular phallobase and minute or absent phallus (except for the elongated appendage which springs from each side apically) conforms to the meenoplid pattern. It would thus seem that a pre-meenoplid ancestral type with meenoplid male genitalia, achilid female genitalia, and cixiid tegminal venation split up to produce the Meenoplidae and Kinnaridae (by reduction of the female genitalia and by local aggregation of wax-

bearing organs on the tegmina and abdomen respectively) and an achilixiid-achilid form which developed a truncate clavus. The descendants of this form subsequently diverged, producing by development of abdominal processes the present Achilixiidæ, and by withdrawal of the gonopore and the enlargement of the phallobase the present Achilidæ. The overlapping of the tegmina in Achilidæ must have occurred at a late stage as the tectiform condition is still found in a number of genera (*Sevia*, *Breddiniola*).

Examination of the female genitalia in Achilixiidæ has revealed an interesting specialisation in the form of large spines developed on the sclerotised rings ornamenting the wall of the bursa copulatrix. These spines are evidently produced by elongation of the minute papillæ found on such rings in other families, such as Achilidæ and Dictyopharidæ, and are invariably directed into the lumen of the bursa. Though direct observations are lacking, it is highly probable that the spermatozoa are transferred during mating in a sausage-shaped envelope, or spermatophore, and that these spines, actuated by a muscular network covering the bursa copulatrix, are used to manipulate the spermatophore, especially at the time of its entry.

Two genera are recognised from the New World (*Bebaiotes* Muir and *Muirilixius* Metc.) and one from the old (*Achilixius* Muir). In the first two the vertex is distinctly narrower than long and ecarinate medially, while in the last it is broader than long and provided with a median carina. The differences between the New World genera are slight, but in the absence of intermediate forms it is necessary that both be retained.

The types of the species mentioned below are in the collection of the British Museum (Natural History). The writer is much indebted to the Museum authorities, particularly Mr. W. E. China, for affording facilities for studying the material in the National collection.

Key to the Achilixiidæ of the New World.

- (1) (2). Second segment of antennæ 1·5 times length of first, first segment 1·5 times as long as broad; frons with lateral carinæ almost contiguous; posterior part of pronotum not pustulate *Muirilixius* Metc.

- (2) (1). Second segment of antennæ twice as long as first, first scarcely longer than broad; frons with lateral carinæ separated (close in *pulla*); hind part of pronotum usually pustulate *Bebaiotes* Muir.

MUIRILIXIUS Metcalf.

Metcalf, 1938, Bull. Mus. Comp. Zool. lxxxii. p. 333.
Orthotype, *M. banksi* Metc. *ibid.*

Key to the Species.

- (1) (2). Tegmina with T-shaped fuscous band, abdomen black, excluding process *nigrigaster* Muir.
 (2) (1). Not as above (3).
 (3) (4). Tegmina with two dark bands parallel to apical margin, not interrupted, no vitta between *Sc* and *Cu* one-third from base; clavus dark *guianesus*, sp. n.
 (4) (3). Tegmina with apical suffusion H-shaped, a vitta one-third from base between costal cell and *Cu*; clavus pale *banksi* Metc.

Muirilixius guianesus, sp. n. (Figs. 1, 2.)

Female.—Length 4·8 mm., tegmen 6·0 mm.

Vertex as in the genotype. *Sc+R+M* forking three-thirteenths from base, *Sc+R* forking four-thirteenths from base, *M* forking two-fifths from base, *Cu* 1 forking slightly basad of *M* fork.

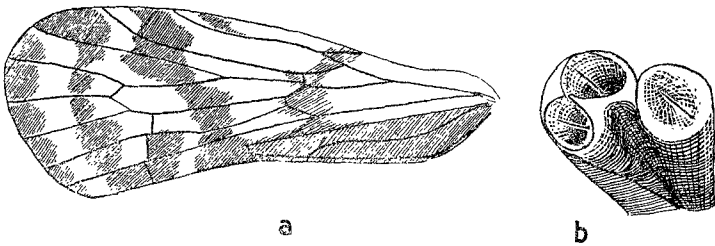
Reddish-brown to fuscous; lateral carinæ of pronotal disc and hind margin of pronotum narrowly pallid, tegulæ pallid around margins; mesonotal carinæ brown to testaceous; abdominal sclerites fuscous. Tegmina pallid fawn; a vitta across primary forks of main veins, another from stigma to apex of clavus, a third in basal half of apical areoles, but not reaching transverse veins, a narrow marginal band apically, and clavus fuscous. Wings smoky in basal half, pallid on distal half, with a broad, well-defined oblique dark band passing to apex between *Sc* and *R*.

Anal segment of female short, rounded, apical margin slightly sinuate.

Ovipositor with first valvulæ in profile subrectangular with apical margin oblique, bearing at apex two long smooth spines directed posteriorly upturned at tip, and with a short smooth spine at their base; below these on a non-pigmented flange four shorter spines parallel to them, each spine toothed; ventral lobe ovate, setose;

second valvulæ tapering distally with the pointed apex of each directed obliquely outward; third valvulæ sub-rectangular, apical margin oblique, convex, dorsal lobe

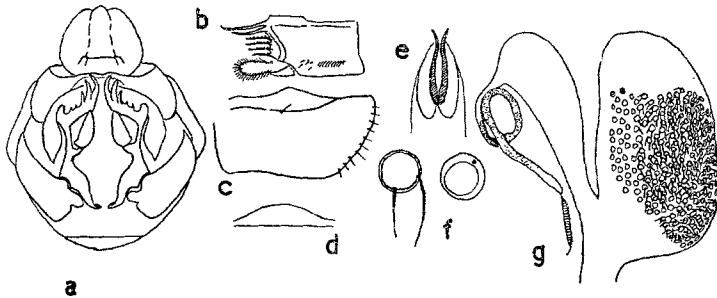
Fig. 1.



Muirilixius guianesus, sp. n.
(a) Tegmen, (b) abdominal process.

with a slight eminence at middle. Subvaginal plate broad, lenticular, weakly sclerotised. Bursa copulatrix spheroidal, middle two-thirds beset with sclerotised rings, those on outer edge of this area eccentrically thick-walled

Fig. 2.



Muirilixius guianesus, sp. n.
(a) Female genitalia, (b) first valvula of ovipositor, (c) third valvula, (d) subvaginal plate, (e) second valvula, (f) trichophorous and simple rings on bursa copulatrix, (g) bursa copulatrix and spermatheca.

bearing one tubercle, those within area extremely thin-walled, each bearing two or three long slender spines directed into lumen of bursa.

Described from one female collected in British Guiana by C. A. Hudson labelled "New River, 750-1000 ft., 15-25. v. 1938." This species is distinguished by the coloration of the tegmina from *M. banksi*.

Muirilixius nigrigaster Muir, comb. nov.

After examining the type and the paratype series of 14 specimens the writer is satisfied that this species belongs in *Muirilixius*. It is well distinguished by the coloration.

BEBAIOTES Muir.

Muir, 1924, Canadian Ent. lvi. p. 33.
Orthotype, *B. bucayensis* Muir, *ibid*.

Key to the Species.

- | | |
|---|------------------------------|
| (1) (2). Tegmina with <i>M</i> four-branched | (3). |
| (2) (1). Tegmina with <i>M</i> five to seven-branched .. | (5). |
| (3) (4). Tegmina with <i>M</i> 3+4 fused with Cula for a short distance, pronotal pustules prominent | <i>pallidinervis</i> Muir. |
| (4) (3). Tegmina with <i>M</i> not touching Cula, pronotal pustules absent or obsolete. | <i>nivosa</i> , sp. n. |
| (5) (6). Tegmina with <i>M</i> five-branched | (7). |
| (6) (5). Tegmina with <i>M</i> six- or seven-branched, frons and pronotum not pustulate, second antennal segment only 1.7 times length of first, median carina of pronotum and all carinae of mesonotum obsolete, a pale stripe dorsally from frons to apex of clavus | <i>dorsivittata</i> , sp. n. |
| (7) (8). Frons not pustulate, pronotal pustules weak, species dark brown, veins and carinae pale. | <i>pulla</i> Muir. |
| (8) (7). Frons with five pustules on each side, pronotal pustules strongly present, species stramineous, corium infusate at <i>R-M</i> cross-vein, veins pale | <i>bucayensis</i> Muir. |

Bebaiotes dorsivittata, sp. n. (Figs. 3, 4.)

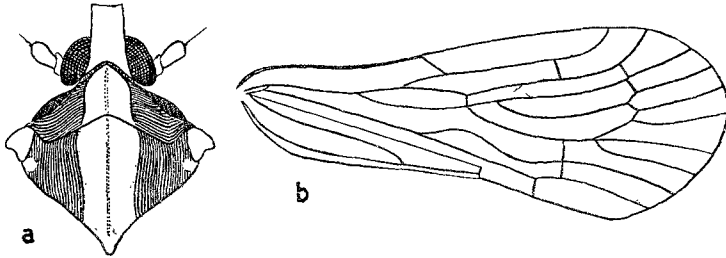
Male.—Length, 5.0 mm.; tegmen 6.1 mm.

Vertex at apex half as wide as long in middle line. Tegmina with *Sc+R+M* forking one-quarter from base, *Sc+R* forking one-third from base, *M* forking just basad of apex of clavus, *Cu* 1 fork slightly distad of junction of calval veins. Wings with *R* simple to apex, *M* two-branched, *Cu* 1 with three branches at apex.

Testaceous; vertex, disc of pronotum and mesonotum pallid, lateral areas of pronotum and mesonotum fuscous; abdomen fuscous tinged with crimson red. Tegmina

smoky fuscous; all transverse veins, a narrow band across middle of apical areoles, and commissural margin to apex of clavus pallid. Veins red. Wings slightly smoky.

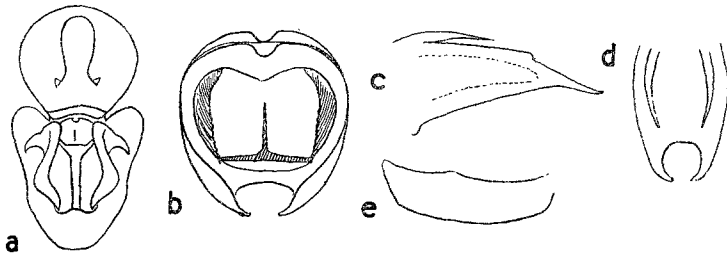
Fig. 3.

*Bebaiotes dorsivittata*, sp. n.

(a) Head and thorax, (b) tegmen.

Anal segment of male relatively large, broadly rounded, margin not exceeded by telson. Pygofer ring-like, lateral margins slightly convex, medioventral process merely a small convex eminence.

Fig. 4.

*Bebaiotes dorsivittata*, sp. n.

(a) Male genitalia, (b) aedeagus, posterior view, (c) aedeagus, lateral view, (d) aedeagus, dorsal view, (e) right genital style, lateral view.

Ædeagus comprising a very slender, short, aciculate phallus directed obliquely upward. Phallobase broadly tubular, ventral margin nearly twice as long as dorsal, a deep narrow cleft latero-dorsally; each lateral apical angle of ventral margin produced into a short incurved

lobe; a pair of flattened plates arising at base and lying within each side of phallobase, but not touching it, each of these plates in profile elongate, tapering, sharply rounded distally. Phallobase resting basally on a transverse sclerotised bar.

Genital styles in profile subequal in width throughout, ventral margin convex, dorsal margin slightly concave with a point directed outward before apex; in ventral view narrow, diverging from base, converging distally, a prominent lobe tapering to a point on external margin of each at apex.

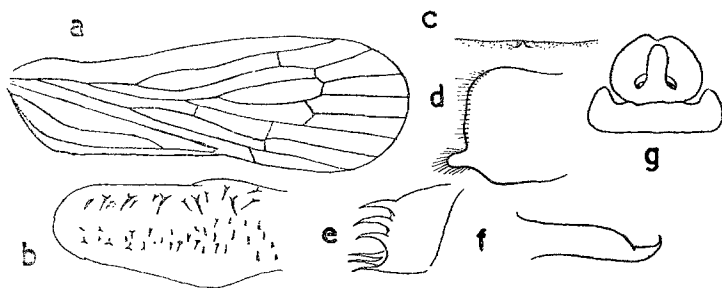
Described from a single male collected by F. X. Williams at Feltons, 12 kilometres from Napo near Tena, Ecuador, April 8, 1923. This species stands quite apart from all others of the genus in the colour of the head, thorax and tegmina, as well as in the details of the genitalia.

Bebaiotes nivosa, sp. n. (Fig. 5.)

Female.—Length 3.5 mm.; tegmen 5.1 mm.

Vertex broader than eye viewed from above (1.5 : 1); second segment of antennæ twice as long as first, first broader than long; frons and pronotum devoid of pustules,

Fig. 5.



Bebaiotes nivosa, sp. n.

- (a) Tegmen, (b) bursa copulatrix, (c) seventh sternite, hind margin, (d) third valvula of ovipositor, (e) first valvula, (f) second valvula, (g) anal segment.

lateral carinae of pronotum distinct, median carina obsolete, tegmina with *M* four-branched. Wings with *R* simple, *M* two-branched, forked deeply, *Cu* 1 three-branched.

Stramineous; apex of rostrum and of post-tibiæ piceous, pro- and mesotibiæ slightly dusky. Tegmina white with a faint dusky suffusion at apex of clavus.

Anal segment broadly rounded, apical margin shallowly concave. Ovipositor with first valvulæ broad, beset with six simple spines on distal margin, three laterally and three sub-ventrally; second valvulæ narrow in ventral view, abruptly narrowed near apex and tapered to a point directed laterad; third valvulæ in profile subquadrate, produced in a blunt lobe near ventral apical angle. Hind margin of seventh sternite transverse with a small triangular eminence submarginally. Bursa copulatrix elongate; a series of fourteen alternating spines along one side, those of one row being the largest and fully 1.5 times as long as the remainder; a series of about 37 smaller spines, slightly curved, on other side arranged in two tracts which converge to meet distally, each tract beginning with three rows of spines and narrowing distally to one.

Described from three females taken at Kutari Sources, British Guiana, by G. A. Hudson (Jan.-Feb. 1936), labelled B.M. 1935-360. This species is readily distinguished by the characters given in the key.

With the concurrence of Mr. China, the writer takes this opportunity to correct an error in our paper on the genera *Tetigonia* Geoff., *Tetigonia* F., *Tetigoniella* Jac. and *Iassus* F. (Ann. & Mag. Nat. Hist. (11) xii. pp. 707-712, 1946) in which Latreille's fixation of *Cicada plebeia* Scopoli (a species not originally included) as the type of *Cicada* L. was inadvertently accepted as valid.

The citation by Van Duzee of *Cicada orni* L. as the type of *Cicada* is correct. In consequence of our fixation of *C. plebeia* Scop. (= *orni* F., not L.) as the type of *Tetigonia* F., this genus and *Lyristes* Horvath are syntypical. If at any future date *Tetigonia* Geoff. is suppressed as invalid by the International Commission of Zoological Nomenclature, and *Tetigonia* L. (Orthoptera) is not validated, *Lyristes* Horv. will fall in synonymy with *Tetigonia* F.