New species, synonymies, and life-histories of the Southeast Asian treehopper genus Pyrgauchenia Breddin (Homoptera: Membracidae: Centrotinae)

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New species, synonymies and life-histories in the South-East Asian treehopper genus *Pyrgauchenia* Breddin (Auchenorrhyncha: Membracidae: Centrotinae)

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Taxonomic information and life-history observations are given for *Pyrgauchenia* treehoppers (Auchenorrhyncha: Membracidae) in South-East Asia. Specimens from field studies in Peninsular Malaysia and Sabah are identified as: *P. biuni* Stegmann & Webb sp. nov., *P. pendleburyi* Stegmann & Webb sp. nov., *P. tristaniopsis* Stegmann & Webb sp. nov., *P. ?brevinota* Funkhouser and *P. colorata* Distant. Two nominal species, *P. angulata* Funkhouser and *P. brunnea* Funkhouser, are placed as junior synonyms of *P. colorata* Distant syn. nov. Descriptions and detailed figures of the new species and *P. colorata* are given, together with type data and some morphological details for *P. breddini*, *P. jugulata* Buckton, *P. kinabaluense* Breddin, *P. wallacei* Breddin, *P. fulmeki* Schmidt, *P. foersteri* Breddin and *P. recurva* Funkhouser. *Pyrgauchenia* nymphs (*P. tristaniopsis*) are described for the first time and an unusual morphological variant in adult females of the same species is described. The first study of the male and female genitalia of South-East Asian Centrotinae has revealed considerable similarity among the *Pyrgauchenia* species studied. Characters found in these structures and in the abdomen of the nymph, which may be useful at a higher level of classification, are discussed. A key and list of all *Pyrgauchenia* species is given, together with their distribution and life-history data (where known). The record of *P. pendleburyi* in Peninsular Malaysia is the first of this genus from mainland South-East Asia. Life-history observations, together with published records, demonstrate maternal egg-guarding, and a potential for polyphagy and for specificity in mutualistic ant partners.

**KEYWORDS:** *Pyrgauchenia*, treehopper, South-East Asia, maternal care.

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**Introduction**

This paper deals with the taxonomy and bionomics of species of *Pyrgauchenia* (Hypsaucheniiini), a genus of treehoppers endemic to South-East Asia. Treehoppers (Auchenorrhyncha: Membracidae) are well known for their interesting life-histories, including their associations with ants. Morphologically, the Membracidae are remarkable for their enlarged pronotum, with processes of many forms and sizes,
anatomically an enormously expanded posterior reduplication of the pronotum (Stegmann, 1998). However, the function of this extraordinary pronotal development remains unknown.

Members of the Hypsaucheniiini (subfamily Centrotinae) have an elongate, dorsally curved pronotal process (figure 2A). Since publication of the original descriptions of taxa currently included in this group, all in the first half of the 20th century, no revisional work and little other taxonomic work has been done. The Metcalf and Wade (1965) membracid catalogue is the most recent synopsis. For Pyrgauchenia, following a brief account of known life-histories, we give revisional notes on the 14 currently recognized species, including three described here as new.

**Life-histories of Pyrgauchenia species**

There are few previous published accounts of *Pyrgauchenia* life-histories (table 1). Melichar (1914) noted that in Java, E. Jacobson found adults and nymphs of *P. foersteri* together on a species of *Melastoma* (Melastomataceae) and on an unspecified number of other plants, all tended by the ant *Myrmicaria arachnoides* Smith. Funkhouser (1935) reported that in Java, M. A. Lieftinck ‘frequently watched small colonies of ... *P. recurva*] on the end-shoots of a small tree of *Talauma candollei* (L.)’ (Magnoliaceae). Observations were made throughout the year and the species was tended by *Myrmicaria brunea subcarinata* Smith.

Field observations by the first author show that host-plant species ranged from one to many per *Pyrgauchenia* species. Host-plants are defined, here, as those plants on which (i) *Pyrgauchenia* eggs together with nymphs or adults were found, or (ii) nymphs and adults were found. Two *Pyrgauchenia* species (*pendleburyi* and *tristianopsis*) were clearly polyphagous, whereas two other species (?*brevinota* and *colorata*) were found only on a single host-plant species (tables 1, 2). To test if the apparent ‘monophagy’ in the latter two species was a sampling artifact (or not) we correlated (i) the number of host-plant species with searching effort and (ii) the number of host-plant species with host-plant individuals across the five *Pyrgauchenia* species studied in the field (table 2). If a significantly positive correlation is shown in either test, apparent monophagy in *P. brevinota* and *P. colorata* might be a result of low search effort and few plant individuals. Indeed, the number of host-plant species correlated positively with both searching effort (Spearman’s rank correlation coefficient \( r = 0.92, P < 0.03, N = 5 \)) and number of host-plant individuals (Spearman’s \( r = 0.92, P < 0.03, N = 5 \)). Moreover, given that other treehopper species tend to have a similar degree of host-plant specialization within a genus (reviewed in Wood, 1993), and that two *Pyrgauchenia* spp. are polyphagous, it may be hypothesized that all species within this genus show some degree of polyphagy.

Ant partners were observed in all *Pyrgauchenia* species studied in the field (see ‘Stegmann field studies’ in tables 1 and 2 and species descriptions for details). The number of ant species as partners did not increase significantly with searching effort (Spearman’s \( r = 0.75, \) n.s., \( N = 5 \)). We cannot decide whether this ant specificity is due to (i) low sample size, (ii) specialized symbiotic interactions or (iii) fewer potential ant partners due to decreasing ant biodiversity at higher elevations, as documented for Mt Kinabalu, Sabah, by Brühl *et al.* (1999).

For the first time we document maternal egg-guarding in *Pyrgauchenia*, a behaviour so far mostly associated with New World Membracidae (Wood, 1993). Egg-guarding was found in all *Pyrgauchenia* species studied in the field (see ‘Stegmann field studies’ in table 1). In addition to the information in table 1 on maternal care
Table 1. Checklist, distribution and life-history data of the genus *Pyrgauchenia* Breddin. Only sources containing information on some of these aspects are cited. '?' is shorthand for ‘no information given’ in the reference cited in the ‘Source’ column.

<table>
<thead>
<tr>
<th><em>Pyrgauchenia</em> spp.</th>
<th>Egg guarding</th>
<th>Host-plant species</th>
<th>Ant partners (species)</th>
<th>Elevation/distribution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>biuni</em> sp. nov.</td>
<td>+</td>
<td>2</td>
<td>2</td>
<td>1150 m/Sabah</td>
<td>Stegmann field studies</td>
</tr>
<tr>
<td><em>?brevinota</em> Funkhouser</td>
<td>+</td>
<td>1</td>
<td>2</td>
<td>1000 m/Sabah</td>
<td>Stegmann field studies</td>
</tr>
<tr>
<td><em>colorata</em> Distant</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>1000 m/Sabah</td>
<td>Stegmann field studies</td>
</tr>
<tr>
<td><em>angulata</em> Funk.</td>
<td>+</td>
<td>1</td>
<td>1</td>
<td>914 m/Sabah</td>
<td>Funkhouser, 1932: 114–115</td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>3</td>
<td>1</td>
<td>Mountain on Java</td>
<td>Melichar, 1914: 112</td>
</tr>
<tr>
<td><em>fulmeki</em> (Schmidt)</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?/Sumatra</td>
<td>Schmidt, 1926: 22</td>
</tr>
<tr>
<td><em>jugulata</em> (Buckton)</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?/Sumatra</td>
<td>Buckton, 1905: 332</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>914 m/Sabah</td>
<td>Breddin, 1902: 91</td>
</tr>
<tr>
<td><em>pendleburyi</em> sp. nov.</td>
<td>+</td>
<td>5</td>
<td>2</td>
<td>1200–1450 m/two locations in Peninsular Malaysia</td>
<td>Stegmann field studies</td>
</tr>
<tr>
<td><em>recuva</em> (Funkhouser)</td>
<td>?</td>
<td>1</td>
<td>?</td>
<td>?/Java</td>
<td>Funkhouser, 1929: 112–113</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>800–1450 m/Sumatra and four locations on Java</td>
<td>Funkhouser, 1935: 120</td>
</tr>
<tr>
<td><em>sarasinorum</em> Breddin</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>1524 m and three other mountain ranges/Sulawesi</td>
<td>Breddin, 1901: 30, 27–128</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>?/Sulawesi</td>
<td>Distal, 1915: 325</td>
</tr>
<tr>
<td><em>tristaniopsis</em> sp. nov.</td>
<td>+</td>
<td>11</td>
<td>4</td>
<td>1410–1610 m/Sabah</td>
<td>Stegmann field studies</td>
</tr>
<tr>
<td><em>wallacei</em> (Breddin)</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?/Borneo</td>
<td>Breddin, 1902: 91</td>
</tr>
</tbody>
</table>
Table 2. The number of host-plants, ant partners and the searching effort for those *Pyrgauchenia* species studied in the field.

<table>
<thead>
<tr>
<th>Species</th>
<th><em>biuni</em></th>
<th><em>?brevinota</em></th>
<th><em>colorata</em></th>
<th><em>pendleburyi</em></th>
<th><em>tristaniopsis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Searching effort (h)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>30–50</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Inhabited host-plant individuals</td>
<td>3–6</td>
<td>1</td>
<td>1</td>
<td>20–40</td>
<td>&gt;120</td>
</tr>
<tr>
<td>Host-plant genera/species</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>5/5</td>
<td>11/11</td>
</tr>
<tr>
<td>Host-plant families</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Ant partners (morpho-species)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Ant partners (genera)</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Searching effort is defined as the hours spent searching on various plants at one or more locations where the respective species was found. Ranges of numbers are estimates.

for *P.?brevinota*, it should be mentioned that several aggregations of this species, with nymphs and adults, were found on one *Wendlandia* sp. plant at Sayap (Kinabalu Park, Sabah, 1000 m), with at least five females sitting on egg clutches; aggregations were tended by two ant morpho-species, *Myrmicaria* sp. and *Technomyrmex* sp.

**Distribution of *Pyrgauchenia* species**

The 14 known *Pyrgauchenia* species are distributed across Sumatra, Java, Borneo, Sulawesi and Peninsular Malaysia (Metcalf and Wade, 1965; present work). Two species are restricted to Sumatra, one to Java, six to East Malaysia (Borneo and Sabah), two to Sulawesi and one to Peninsular Malaysia (table 1). The remaining two species both occur on Sumatra; one also occurs on Java and the other in Sabah. Thus, within the genus *Pyrgauchenia*, 11 of the 14 species are endemic to islands of South-East Asia. *P. pendleburyi* from Peninsular Malaysia is the first published record for the genus on the South-East Asian mainland. Considering the available data on altitude (table 1), it appears that *Pyrgauchenia* is restricted to higher altitudes (800–1600 m). Evidence from two species (*P. pendleburyi* and *P. tristaniopsis*) suggests that this pattern may not reflect a collection bias but rather actual altitudinal distribution (see species descriptions below for details).

**Depositories**

The specimens studied in the course of this work are deposited in various institutions, abbreviated in the text as follows: APS, Académie Polonaise des Sciences, Institut de Zoologie, Warszawa, Poland; BMNH, The Natural History Museum, London, UK; DEI, Deutsches Entomologisches Institut, Eberswalde, Germany; MNCN, Museo Nacional de Ciencias Naturales, Madrid, Spain; USNM, United States National Museum of Natural History, Washington DC, USA.

**Terminology**

The following terminology is used to describe the various structures referred to in this paper. The *anterior process* is the dorsal projection of the pronotum, its *length* is the distance between the humeral angle of the pronotum and point A (see marked distance in figure 2A). *Point A* (indicated in figure 2A) denotes the site where the anterior margin of the anterior process (seen in lateral view) bends ventro-posteriorly, sometimes being produced into a small extension (figure 2D, arrowed). Along both
sides of the anterior process run the *lateral carinae* (figure 2D, arrow head). The *distal lobes* are the two bisymmetrical enlargements forming the apex of the anterior process (figure 2C). The pronotal projection over the abdomen, that touches the scutellum and the anal area of the tegmina, is the *posterior process*. Half-way between its base and its apex, the posterior process may be extended dorsally into a foliaceous lobe, the *subapical node* (arrowed in figure 2B).

**Taxonomy**

*Pyrgauchenia* Breddin  
*Pyrgauchenia* Breddin, 1901: 126. Type species: *P. sarasinorum* Breddin.  
*Pyrgolyrium* Breddin, 1902: 92. Type species *P. foersteri* Breddin. Synonymized by Breddin, 1902: 92.  

**Identification of genus**

For the generic placement of the new species described here we rely on the most recent description of the genus *Pyrgauchenia* and generic key by Funkhouser (1951: 215). This description contains the following diagnostic characters: presence of a subapical node (figure 2B, arrowed); apex of head unilobed ‘truncate’ (or ‘spatulate’; Goding, 1931) (figure 1A, arrowed); anterior process recurved; tegmen with apex obliquely truncate and venation ‘normal’, i.e. with five apical and two discoidal cells (figure 1B). These characters are found in other genera but their combination is unique to *Pyrgauchenia*. It should be noted that the number of tegminal cells varies intraspecifically, sometimes differing among the two tegmina within one individual, i.e. there may be one to three discoidal cells and five or six apical cells. As in other Hypsauchenini, the pronotum is extended into an anterior process, a posterior process touches the tegmina, and suprahumerals are lacking (Funkhouser, 1951). Funkhouser (1951) revised and provided a key to all valid Hypsauchenini genera, except for *Hybanda* Distant (1908) which lacks the subapical node occurring in the new species described here.

**Identification of species**

Some difficulty was experienced in identifying the field-collected specimens for this study. This was due to the similarity between species in the shape of the male genitalia (the source of critical characters in other Auchenorrhyncha families), the lack of workable keys (e.g. Goding, 1950), and intraspecific variation in the shape of the anterior process (sometimes missing). In addition to the above, we found that individuals of a species varied considerably, in both external characters and in the male genitalia, especially in the lengths of the anterior parts of the aedeagus and the style. Sufficient ‘gap’ exists between these extremes, however, to recognize the species when all characters are taken together. To show these variabilities we have figured both extremes of the variation for each species. Despite strong intraspecific variation in the degree of sclerotization of the male genitalia, due to specimens being mostly taken from aggregations of teneral as well as mature adults, this variation is independent of other morphological variation. Our specimens were compared with the types of all nominal species that could not definitely be excluded by the original descriptions alone (see below).
We found several characters common to the species studied which, to our knowledge, have not been described for other Centrotinae so far. They are mentioned here for their potential use in future generic or higher-order-taxa revisions:

1. The male pygofer has a separate dorso-posterior process (figure 1C, arrowed) that articulates via a membrane with the pygofer.

2. The female pygofer has a dorsal and a ventral process (figure 1F, arrowed) without membranous articulation.

3. The second valvulae are moderately broad in lateral aspect. Proximally, the ventral margin curves above the ramus in lateral view (broken line in figure 1E).

4. Long tergal projections in the final instar nymphs of *P. biuni*, *P. pendleburyi* and *P. tristaniopsis* extend laterally on both sides of the 6th to 8th abdominal segments (figure 7I); *P. colorata* lacks the projections on the 6th and 7th abdominal segments, but those on the 8th segment are much longer and directed posteriorly (figure 1K).

5. The 9th abdominal segment in the final instar nymph bears a singular process dorsal to the anal tube and a bifurcated process ventral to the anal tube (figure 7I, J); these processes are much smaller in *P. colorata* (figure 1K).

6. The pronotum of the final instar nymph has a more or less tapering dorsal extension and a distinct posterior process (figures 1G–J, 1L, M, 7J, K). Both sides of the pronotum bear a spatulate margin, presumably marking the position of the internal distal lobe-primordia (e.g. figure 1G, arrowed). In species with small or lacking distal lobes in adult females (*P. tristaniopsis* and *P. colorata*, respectively), this margin is reduced (figure 7K, arrowed) or lacking (figure 1I) in nymphal females.

**Key to species in Pyrgauchenia**

A few species (denoted by *), whose identity remains uncertain, are not keyed out in full (but see Goding’s 1950 key). The identity of *suberecta* is based on the male type (with its apical process largely missing) and a series of similar specimens (all in BMNH). Males are unknown for *P. breddini*, *P. foersteri*, *P. jugulata* and *P. recurva* and the sex of the type of *P. sarasinorum* (not examined) is unclear from its description. The two female morphs of *tristaniopsis* are keyed out separately.

1 Apex of anterior process of pronotum broadened and flattened into a small plate, varying from rounded with an emarginate hind margin to heart-shaped. *brevinota* Funkhouser, *cornuta* Goding, *fulmeki* (Schmidt), *kinabalense* (Breddin), *wallacei* (Breddin)
   - Apex of anterior process of pronotum either bilobed (figure 2C) or simple (without plate or distal lobes) (figure 3J)
   2 Anterior process, in lateral view, slightly curved (figure 2A), apex with two distal lobes (figure 2C, E)
   3 Anterior process, in lateral view, strongly curved, without distal lobes (figures 6F, H)
   13 Tegmina with a transverse band of white spots; length 9.5 mm; known only from Sulawesi
   - Tegmina without a transverse band of white spots; length less than 9.5 mm
   4 *sarasinorum* (see figure 16 in Haupt (1953) and Distant (1915) for description in English)
   - Tegmina with a transverse band of white spots; length 9.5 mm
New species, synonymies and life-histories of *Pyrgauchenia*  

Species descriptions

**Pyrgauchenia biuni** Stegmann & Webb sp. nov.  
(figures 1G, H, 2)

**Diagnosis**

Anterior process broad with distal lobes in both sexes. In external characters similar to *P. tristaniopsis* sp. nov., but clearly differing in male genitalia. Genitalia are similar to *P. pendleburyi* sp. nov., but the gonopore is smaller in apical view.

**Description**

Body length (vertex to distal end of tegmina): ♂, 5.8–6.6 mm (six specimens) (mean 5.9 mm); ♀, 6.0–6.4 mm (seven specimens) (mean 6.3 mm). Length of anterior process
Fig. 1. External features and genitalia in Pyrgauchenia species, left lateral view, except where indicated (for arrows see text). (A–F) tristaniopsis: (A) head, frontal view; (B) left tegmina; (C) male genital capsule; (D) subgenital plates, ventral view; (E) 2nd valvulae; (F) female genital capsule. (G–H) biuni: left side of pronotum of last instar nymph, (G) female; (H) male. (I–K) colorata, last instar nymph: (I) pronotum of female; (J) pronotum of male; (K) abdominal apex in dorsal view. (L, M) pendleburyi, pronotum of last instar nymph: (L) female; (M) male.
New species, synonymies and life-histories of *Pyrgauchenia*

Fig. 2. *Pyrgauchenia biani* (paratypes unless stated otherwise) (for arrows and arrowhead see text). (A) Habitus male, right lateral and frontal view (marked distance indicates length of anterior process). (B) Habitus female, right lateral and frontal view. (C) Distal lobes of male anterior process, anterodorsal view (dotted line: median carina). (D) Distal lobes of male anterior process, left lateral view. (E) Distal lobes of female anterior process, anterodorsal view. (F–H) Aedeagus, posterior (right: holotype), left lateral and apical view respectively (broken line in (G) indicates gonoduct on posterior side and median groove on anterior side). (I) Left style, left lateral view (upper: holotype) (broken line indicates membrane connecting the styles; marked distance with arrowhead indicates perspective of (J)). (J) Left style in posterior view, as indicated by arrowhead in (I) (left: holotype) (line indicates median plane).
from humeral angle to point A: ♂, 4.1–4.8 mm (mean, 4.4 mm); ♀, 3.6–5.5 mm (mean 4.2 mm).

**Colour.** Male: uniformly dark brown, base of posterior process and tibiae, yellow to ochraceous, hyaline spot near tip of clavus (figure 2A). Female: same as in male but lighter brown with or without ochraceous spots (figure 2B).

**Pronotum.** Male: anterior process moderately bent posteriorly and broad in lateral view (figure 2A); point A sometimes extended (figure 2D); lateral carina (arrowed in figure 2D) slightly nearer to anterior margin and not running towards the anterior margin of anterior process at point A; distal end of anterior process at about 45° (relative to longitudinal body axis) and extended into two lobes (figure 2A, C); subapical node distinct, broader than high (figure 2A). Female: same as in male except for smaller distal lobes with mesally less produced margins (figure 2E) and a slightly higher subapical node (figure 2B).

**Genitalia.** Male: shaft of aedeagus slender in posterior view (figure 2F) with its posterior margin straight or weakly convex below gonopore and incurved bordering gonopore, in lateral view (figure 2G); gonopore always distinct in apical view (figure 2H); style apical process robust (figure 2I), broadly rounded apically in lateral view (figure 2I) and tip truncated and directed laterally in posterior view (figure 2J).

**Distribution**

Mt Kinabalu (Sabah, Malaysia).

**Material examined**

**Holotype, ♂,** Malaysia: Sabah, Bundu Tuhan (5°58′N, 116°32′E), 1150 m, leg. U. E. Stegmann, 22 February 1998 (BMNH). **Paratypes, 2♂, 4♀ (BMNH), 3♂, 3♀ (DEI),** same data as holotype.

**Remarks**

This species is known only from the village Bundu Tuhan where all stages of the life cycle were found on *Melastoma malabathricum* Linn. (Melastomataceae) and *Wendlandia* sp. (Rubiaceae) growing along roadsides and on cleared land. Aggregations of nymphs and/or adults lived on young twigs and petioles and they were visited by two ant morpho-species: *Myrmicaria* sp. (on *M. malabathricum* Linn.) and *Camponotus* sp. (on *Wendlandia* sp.). Eggs were deposited as clutches into slits of plant tissue and the parts jutting out were sparsely covered with a whitish substance. Several females were found sitting on their egg clutch.

This species is named after Mr Alim Biun, Assistant with the Research and Education division of Sabah Parks. Our work profited greatly from his exceptional knowledge of the fauna and flora of Mt Kinabalu and the history of the National Park; more specifically, he remembered having seen *Pyrgauchenia*-like treehoppers at his home town Bundu Tuhan and then helped us to search and find this new species there.

**Pyrgauchenia colorata** Distant

(figures 11–K, 3, 4)

New species, synonymies and life-histories of *Pyrgauchenia*

Fig. 3. External features in *Pyrgauchenia colorata*. (A–C) Habitus, right lateral and frontal view: (A) *brunnei* paratype male; (B) male leg. U. Stegmann; (C) *colorata* paralectotype female. (D, E) Distal lobes of anterior process of pronotum, anterodorsal and left lateral view respectively, male leg. U. Stegmann (dotted and solid line, respectively: median carina). (F–H) Habitus female, right lateral and frontal view: (F) *colorata* lectotype; (G) *angulata* paratype; (H) leg. U. Stegmann. (I) Female pronotum, left lateral view, leg. U. Stegmann. (J) Apex of anterior process of female, posterior view, leg. U. Stegmann.
**Fig. 4.** *Pyrgauchenia colorata.* (A–C) Aedeagus, posterior, apical and left lateral view, respectively (broken line in (C) indicates gonoduct on posterior side and median groove on anterior side). (D) Left style in lateral view (broken line indicates membrane connecting styles). (E) Left style, posterior view, i.e. as indicated by arrowhead in figure 2I, line indicates median plane.

*Pyrgauchenia angulata* Funkhouser, 1932: 114. Holotype ♀. Sabah (BMNH), examined, syn. nov.

*Pyrgauchenia brunnea* Funkhouser, 1932: 113. Holotype ♂. Sabah (BMNH), examined, syn. nov.

**Diagnosis**

Anterior process very slender in both sexes, in males bent backwards with distal lobes angulate, in females without distal lobes; male styles similar to *P. tristaniopsis*, but differing in the aedeagus. Females of this species resemble those of *P. fulmeki*, *P. foersteri* and *P. recurva* in their strongly recurved anterior process but clearly differ in several other characters (see under ‘Additional species examined’).

**Description**

Length: ♂ 5.8–6.0 mm (five specimens) (mean 5.9 mm), ♀ 6.0–6.9 mm (12 specimens) (mean 6.3 mm). Length of anterior process from humeral angle to point A: ♂ 4.1–5.0 mm (mean 4.5 mm).

*Colour.* Male: uniformly light to dark brown, base of posterior process and tibiae yellow to ocraceous, hyaline spot near tip of clavus. Female: same as male but a hyaline band runs across the tegmina.

*Pronotum.* Male: anterior process strongly bent posteriorly and narrow in lateral aspect; point A not or weakly produced (figures 3A, B, E); lateral carina in the middle or near to anterior margin (figure 3E); distal end of anterior process at less than 45°, i.e. mostly horizontal (figure 3A, B, E); mesal margins of distal lobes sometimes overlapping (figure 3D); subapical node low (figure 3A, B). Female:
anterior process strongly and variably bent ventro-posteriorly and narrow in lateral aspect (figure 3C, F–I); point A not or weakly pointed (figure 3I); lateral carina near posterior margin or in the middle (figure 3I); distal end of anterior process angulate and more or less vertical relative to longitudinal body axis (figure 3G–I); its tip always simple (figure 3J); subapical node about 1.4 mm, i.e. much higher than broad (figure 3F–I).

Genitalia. Male: shaft of aedeagus robust, its margins slightly incurved above and below gonopore in posterior view (figure 4A); posterior margin above and below gonopore, strongly convex in lateral view (figure 4C); anterior surface of the aedeagus densely covered with cuticular hooks (figure 4C); gonopore in apical view distinct but sometimes small (figure 4B); style apical process elongate (figure 4D), its apex bent ventrally, sometimes medio-ventrally (figure 4D, E), and tapering to a subacute tip (figure 4D, E).

Distribution

Mt Kinabalu (Sabah, Malaysia).

Type material examined


Other material. 3♂♀ (BMNH), 2♂♀ (DEI), length: 5.8–6.0 mm (mean 5.9 mm), length of anterior process: 4.1–4.8 mm (mean 4.4 mm). 2♂♀ (BMNH), 2♂♀ (DEI), length: 6.0–6.4 mm (mean 6.3 mm). All, Borneo (Sabah), Sayap Ranger Station of Kinabalu Park (6°10’N, 116°35’E), 1000 m, leg. U. E. Stegmann, 9 December 1998.
Remarks

We synonymize *P. angulata* Funkhouser with *P. colorata* Distant because we can find no difference between the type specimens of these two species apart from a lighter coloration of some *P. angulata* specimens. More specifically, body size and height of the subapical node is the same; the (proximal part of the) anterior pronotal process of the one *P. colorata* specimen in which it is still intact is bent backwards just as in *P. angulata*; the second valvulae and other parts of the genitalia cannot be distinguished consistently; all specimens have a hyaline band on the tegmina; and all specimens are from the same locality (Kiau village). *P. colorata* was described from three females with their ‘anterior pronotal process elevated and recurved (its apex mutilated in the three specimens now before me)’ (Distant, 1915: 162). Males of *P. colorata* remained unknown as did the shape of the intact anterior process. Also, *P. angulata* was originally described only from females. We do not know why Funkhouser (1932) described some females as the new species *P. angulata* despite the similarities to *P. colorata*; he gave no comparisons with *P. colorata* or other *Pyrgauchenia* species. Also, in the following note of caution, Funkhouser (1932) suggested that *P. colorata* (his *P. angulata*) and *P. brunnea* might be opposite sexes of one biological species: ‘Another fact which at once attracts attention is that of two of the species here described [*P. brunnea* and *P. angulata*], one is represented by a series of twenty-seven males only and the other by a series of ten females only, all thirty-seven specimens collected at the same locality on the same dates, as evidenced by the specimen labels. This of course at once suggests that the two series represent the two sexes of the same species, yet in general appearance and contour they are so entirely dissimilar that such a conclusion seems hardly tenable. None of the insects were taken in cop and we have no data on their life-histories… Since we have no breeding work or field observations to guide us in the matter, we are here describing the two forms as distinct and await further information or more material to justify or disprove our conclusions.’

Our collection data indicate, indeed, that *P. colorata* Distant are the females and *P. brunnea* Funkhouser are the males of one biological species. At Sayap, the first author found aggregations of adult treehoppers, whose females could not be distinguished from *P. colorata*, and whose males could not be distinguished from *P. brunnea* except for their darker coloration. The soft pronota of some adults and the predominantly final instar nymphs indicated that the aggregations were eclosing offspring cohorts of one species. The fact that the final instar nymphs were as sexually dimorphic in their pronotum as the adults supports this conclusion: (1) nymphal females had a node on the posterior process of the pronotum (figure 1I), while it was lacking in nymphal males (figure 1J; only adult females had a high subapical node); (2) the spatulate margin was present only in nymphal males (figure 1J), but not in nymphal females (figure 1I; only adult males had distal lobes). For the above reasons, we consider that *P. angulata* Funkhouser, *P. brunnea* Funkhouser and *P. colorata* Distant are all synonyms with *P. colorata* as the senior name.

The specimen labels show that at both of the locations on Mt Kinabalu where this species was found (Sayap, Kiau) it occurred at similar altitudes (900 m, 1000 m). At Sayap, we found aggregations on several twigs of one *Tristaniopsis clementis* (Merr.) Wilson & Waterhouse (Myrtaceae) specimen growing at the roadside; they were visited by a *Camponotus* sp. Eggs were deposited as in *P. biuni* and at least five females were seen sitting on egg clutches.
**Pyrgauchenia pendleburyi** Stegmann & Webb sp. nov.  
(figures 1L, M, 5)

**Diagnosis**
Anterior process slender with comparatively small distal lobes in both sexes; male genitalia are similar to *P. biuni* with a larger gonopore in apical view.

**Description**
Length: ♂, 6.5–7.0 mm (six specimens) (mean 6.8 mm); ♀, 6.7–7.4 mm (nine specimens) (mean 7.0 mm). Length of anterior process: ♂ 3.8–4.5 mm (mean 4.2 mm); ♀, 3.2–4.5 mm (mean 3.9 mm).

**Colour.** Male and female same as *P. biuni*, but no spotted forms and more conspicuous yellow-ochraceous carinae on anterior process (figure 5A, B).

**Pronotum.** Male: anterior process strongly tapered from base to apex, moderately bent posteriorly, sometimes straight (figure 5A); point A not or weakly pointed (figure 5C); lateral carinae in the middle or near to anterior margin (figure 5C); distal end of anterior process at about 45° (figure 5A, C); distal lobes small, mesal margins either overlapping (figure 5D) or not produced and far apart; subapical node distinct, slightly broader than high (figure 5A). Female: same as male except for a higher subapical node (figure 5B) and smaller lobes (figure 5E).

**Genitalia.** Male: similar to *biuni* but with larger gonopore in apical view (figure 5H).

**Distribution**
Peninsular Malaysia.

**Material examined**

**Holotype,** ♂, Malaysia, Pahang, Genting Highlands (3°22'N, 101°44'E), leg. U. E. Stegmann, 5 May 1996 (BMNH). **Paratypes,** 2♂♂, 3♀♀, same data as holotype; 1♂, 1♀♀, same data as holotype except, 15 January 1997 and 11 May 1996, respectively; 2♂♂, 3♀♀, Malaysia, Cameron Highlands (4°30'N, 101°23'E), leg. U. E. Stegmann, 22 May 1996 (all BMNH, DEI); 1♂ Malaysia, Pahang, BMNH (labels: ‘Malay Penins./Pahang, F.M.S./Fraser’s Hill 4200 ft./18.6.1931 [reverse side:] H. M. Pendlebury/F.M.S./Museums.’, ‘Pyrgauchenia/recurva/Funkh./Det/W D Funkhouser.’, ‘Ex F.M.S./Museum./B.M.1955-354’); 1♂ Malaysia, Pahang, BMNH (labels: ‘Malaya/Fraser’s Hill/July 1933./N.C.E. Miller’); 2♀♀ Malaysia, Pahang, BMNH (labels: ‘Malay Penins./Cameron Highlands/28.IX.1944 [reverse side:] Dr. R. Pakahashi’, ‘Ex F.M.S./Museum./B.M.1955-354’). Fraser’s Hill: 3°43’N, 101°45’E.

**Remarks**
All stages of the life cycle were found on the following host-plants growing along roadsides: *Acalypha wilkesiana* Muell. Arg. (Euphorbiaceae), *Uncaria* sp., *Piper aduncum* Linn. (Piperaceae), *Ficus* sp. (Moraceae), *Saurauia* sp. (Actinidiaceae). This species was always found at higher altitudes of lowland rainforests and in lower montane rainforests of Peninsular Malaysia. We collected it in the Genting Highlands from 1200 to 1420 m and in the Cameron Highlands at about 1450 m (both Pahang); Pendlebury and Miller found specimens at Fraser’s Hill (Pahang) which is at about 1300 m. In the Genting Highlands we also searched at higher (1730 m: no known host-plants) and lower elevations (620 m and below: *A. wilkesiana, Saurauia* sp.,
Fig. 5. *Pyrgauchenia pendleburyi*. (A, B) Habitus right lateral and frontal view: (A) holotype male; (B) female. (C–E) Distal lobes of anterior process of pronotum: (C) left lateral view; (D, E) anterodorsal view of male and female, respectively (dotted line indicates median carina). (F–H) Aedeagus, posterior, left lateral and apical view, respectively (holotype: (F) left, (G) right, (H) lower) (broken line in (G) indicates gonoduct). (I) Left style, lateral view (upper: holotype); broken line indicates membrane connecting styles. (J) Left style in posterior view, i.e. as indicated by arrowhead in figure 2I (left: holotype) (line indicates median plane).
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*P. aduncum*, but never found *P. pendleburyi*, indicating an altitudinal distribution that is, at least at its lower end, independent of known host-plant availability. Nymphs and adults were regularly found together with two ant morpho-species: *Myrmicaria* spp. (Myrminicinae). Eggs are like *P. biuni* and located at the underside of internodia and petioles. At least 16 females were seen sitting on egg clutches. Only once was a female, similar in shape to the curvata-morph of *P. tristaniopsis*, found.

This species is named after Henry Maurice Pendlebury (1893–1945), Director of the Federated Malay States Museums, whose efforts resulted in an outstanding collection of South-East Asian insects and who collected specimens of this species for the first time during one of his expeditions in 1931.

**Pyrgauchenia tristaniopsis** Stegmann & Webb sp. nov.
(figures 1A–F, 6, 7)

**Diagnosis**

Anterior process of pronotum moderately broad and bent backwards with comparatively large distal lobes in males but small distal lobes in females, the latter represented by two morphs. The male genitalia are similar to *P. colorata*, but can be distinguished by the aedeagus having (i) an invisible or minute gonopore (figure 6K), (ii) more elongate and slightly bent apical region of the shaft above the gonopore in lateral view (figure 6J), and (iii) a more slender outline of the aedeagus in posterior view (figure 6I).

**Description**

Length: ♂, 5.6–6.5 mm (seven specimens) (mean 6.0 mm); ♀, 5.7–6.3 mm (eight specimens) (mean 6.0 mm). Length of anterior process: ♂, 4.3–5.4 mm (mean 4.7 mm); ♀, 3.5–3.9 mm (mean 3.7 mm).

**Colour.** Male: uniformly dark brown except for base of posterior process and tibiae, yellow-ocularous, and a hyaline spot near the tip of clavus (figure 6A). Female: same as male (figure 6B) or with pronotum and spots on the tegmen ochraceous (figure 6H).

**Pronotum.** Male: anterior process moderately bent posteriorly and moderately broad in lateral view (figure 6A); point A not pointed (figure 6C); lateral carina near to anterior margin, especially so towards point A (figure 6C); distal end of anterior process at about 45° (figure 6A, C); subapical node low and indistinct (figure 6A). Female: there are two morphs differing from the male by the following characters: anterior process either about 1 mm shorter than in the male with its distal lobes much smaller and more slender (figure 6B, D) or anterior process strongly curved posteriorly-ventrally in a spiral with its distal end angulate, orientated vertical to anterior-dorsal relative to long-body axis (figure 6F–H) and its tip broadened or heart-shaped (figure 6G); in both female morphs the subapical node is distinct and higher than in the males (figure 6B, H).

**Genitalia.** Male: shaft of aedeagus moderately broad in posterior view (figure 6I), its tip slightly bent anteriorly and its posterior margin, below gonopore, strongly convex, in lateral view (figure 6J); gonopore, when visible, minute (figure 6K); apical part of posterior part of style long (figure 6L), its apex bent medio-ventrally and tapering to a subacute tip (figure 6L, M).
Nymphs. The five nymphaal stages are distinguished thus (for changes in width of prothorax see table 3):

1st Instar: Length approximately 1.2 mm with increasing abdominal expansion of older individuals. No projection on the pronotum (figure 7A); no tergal extensions of the 6th to 8th abdominal segments (figure 7B); 9th segment with a short projection dorsal and two projections ventral to the anal tube (figure 7A, B).

2nd Instar: Length approximately 2.2 mm. Slight, but distinct projection on the pronotum (figure 7C); slight extensions of the 6th to 8th abdominal segments (figure 7D); projections of the 9th segment become progressively longer in this and the following stages (figure 7D).

3rd Instar: Length approximately 2.8 mm. Pronotal projection conspicuous (figure 7E); extensions of the 6th to 8th abdominal segments distinct (figure 7F).

4th Instar: Length approximately 3.4 mm. Pronotum triangular and tapering in lateral view (figure 7G); extensions of the 6th to 8th segments long (figure 7H).

5th Instar: Length approximately 4.9 mm. Pronotum with a distinct posterior process with its dorsal margin curved convexly in females (figure 7K) and nearly straight in males (figure 7J); anterior margin of pronotum convexly bent in both sexes; males with a spatulate margin on the pronotum (figure 7J), indistinct in females (arrowed in figure 7K); long, spine-like abdominal extensions (figure 7I). Head with two dorsal projections (figure 7L).

Distribution
Mt Kinabalu (Sabah, Malaysia).

Material examined
Holotype, ♂, Malaysia, Sabah, Kinabalu National Park Headquarters (6°01′N, 116°33′E), 1500 m, leg. U. E. Stegmann, 15 December 1998 (BMNH). Paratypes, 3♂, 8♀♀, same data as holotype except 17 and 26 April 1996, and 3 February, 26 April and 16 November 1997 (all BMNH, DEI).

Remarks
This species is known from only one population at 1410–1610 m at the headquarters area on Mt Kinabalu, although its host-plants were also found at higher (up to 2000 m) and lower elevations (1150 m). This indicates a specific altitudinal range. There are two female morphs, with or without a strongly curved pronotal process (see description of pronotum above); polymorphisms of this type are rare within the Membracidae (Wood, 1976; Carroll and Loye, 1986). Although in the type

Fig. 6. *Pyrgauchenia tristaniopsis*. (A, B) Habitus, right lateral and frontal view: (A) male; (B) female. (C–E) Distal lobes of anterior process of pronotum: (C) left lateral view of male (lower: holotype); (D, E) anterodorsal views, female and male, respectively (dotted line indicates median carina). (F) Anterior part of pronotum of female morph, left lateral view. (G) Apex of anterior process of female morph (posterior view). (H) Habitus, female morph, right lateral and frontal view. (I–K) Aedeagus, posterior, left lateral and apical view, respectively (holotype: I left, (K) lower) (broken line in (J) indicates gonoduct on posterior side and median groove on anterior side). (L) Left style in lateral view (lower: holotype) (broken line indicates membrane connecting styles; marked distance with arrowhead indicates perspective of (M)). (M) Left style in posterior view, i.e. as indicated by arrowhead in (L) (left: holotype) (line indicates median plane).
series, females with or without a strongly curved pronotal process are ochraceous or brown in colour, respectively, the reverse situation was also noted in the field population.

This species was found on many host-plant species and families (table 4). Eggs were deposited and guarded as in *P. biuni*. Most aggregations of nymphs and adults were visited by a *Myrmicaria* sp. but some others by *Camponotus* sp., and *Prenolepis*
Fig. 7. Nymphs of *Pyrgauchenia tristaniopsis*. (A, B) First instar: (A) habitus left lateral view, rostrum and legs not drawn; (B) apex of abdomen, dorsal view. (C, D) second instar, ditto. (E, F) Third instar, ditto. (G, H) Fourth instar, ditto. (I, J) Fifth instar: (I) apex of abdomen; (J) habitus, left lateral view, rostrum and legs not drawn. (K) Pronotum left lateral view (fifth instar female, for arrow see text). (L) Head and thorax, dorsal view (fifth instar). 1st, 2nd, 3rd Instars and 4th–5th Instars drawn to scale, respectively.
Table 3. Nymphal growth in *P. tristaniopsis*: greatest prothoracic width (mean SD; *N*) when viewed from dorsal (figure 7L).

<table>
<thead>
<tr>
<th></th>
<th>1st instars</th>
<th>2nd instars</th>
<th>3rd instars</th>
<th>4th instars</th>
<th>5th instars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.49 ± 0.03; 13</td>
<td>0.7 ± 0.03; 11</td>
<td>0.9 ± 0.04; 14</td>
<td>1.14 ± 0.07; 11</td>
<td>1.49 ± 0.09; 10</td>
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</tbody>
</table>

Table 4. Host-plants of *Pyrgauchenia tristaniopsis*.

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flacouriaceae</td>
<td><em>Flacourtia</em></td>
<td><em>kinabaluensis</em> Sleum.</td>
</tr>
<tr>
<td>Lauraceae</td>
<td><em>Lindera</em></td>
<td><em>pipericarpa</em> Boerl.</td>
</tr>
<tr>
<td>Melastomataceae</td>
<td><em>Melastoma</em></td>
<td><em>malabathricum</em> Linn.</td>
</tr>
<tr>
<td>Myrtaceae</td>
<td><em>Tristaniopsis</em></td>
<td><em>clementis</em> (Merr.) Wilson &amp; Waterhouse</td>
</tr>
<tr>
<td>Rosaceae</td>
<td><em>Rubus</em></td>
<td><em>moluccanus</em> Linn.</td>
</tr>
<tr>
<td>Rubiaceae</td>
<td><em>Nauclea</em></td>
<td><em>?bernardoi</em> Merr.</td>
</tr>
<tr>
<td>Theaceae</td>
<td></td>
<td><em>Wendlandia</em> sp.</td>
</tr>
<tr>
<td>Urticaceae</td>
<td><em>Adinandra</em></td>
<td><em>excelsa</em> Korth.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Debregaesia</em> longifolia Wedd.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Pouzolzia sanguinea</em> (Blume) Merrill</td>
</tr>
</tbody>
</table>

sp. The name of this species is derived from of the host-plant *Tristaniopsis clementis* (Merr.) Wilson & Waterhouse on which it was found for the first time.

Additional species studied

During the course of this work it was necessary to examine the types of some nominal *Pyrgauchenia* species as the new species could not be distinguished from their descriptions alone. Some details of these types and other material are given below.

*Pyrgauchenia jugulata* (Buckton, 1905: 332, pl. 21, figure 12, *Hypsauenchenia*)

*Description.* Length 8 mm; anterior process of pronotum slightly bent backwards, distal lobes with mesal and lateral margins strongly produced, area between lateral and posterior margin of each lobe nearly vertical (horizontal in some other species); proximal area connecting the distal lobes almost entirely reduced; subapical node very low and indistinct (like in males of *P. tristaniopsis*).

*Type material examined.* SYNTYPE, ♀, MNCN (labels: ‘Sumatra’, ‘L[?]b. ent. Escalera’, ‘Tipo/Pyrgauchenia/jugulata/(Buckton)’, ‘MNCN/Cat Tipos N®/10701’).


*Remarks.* Described from an unspecified number of specimens from Sumatra. Distant (1915: 325) noted that Buckton’s original description and figure indicated a ‘mutilated’ anterior process of the pronotum. In fact the process of the type is broken off and glued to a card. Distant (1915: 326) also gave the following description of the apical process of a complete specimen with data matching the first nontype specimen mentioned above (process now missing): ‘its apex is strongly and longly bilobed, these lobes being subtriangular in shape, with their inner angles rounded and their outer angles acute, between their bases the process is widened and centrally a little anteriorly produced’. See also remarks under *P. breddini*. 
Pyrgauchenia breddini Schmidt, 1906: 370

Description. Length of type approximately 8.4 mm; head, abdomen and parts of thorax, missing; base of anterior process slightly bent backwards (apex missing), subapical node very low, indistinct.


Remarks. Described from one female from ‘Bekantiang (Dr. H. Dohrn)’. The identity of this species is problematical due to the poor condition of the unique type. We follow Distant (1915) in tentatively regarding P. breddini as junior synonym of P. jugulata Buckton. Distant (1915: 325) placed a question mark before P. breddini and wrote that ‘Schmidt’s P. breddini appears to refer to Buckton’s species, but I have not seen his type’. Funkhouser (1927: 345) notes P. breddini as a synonym to P. jugulata without a question mark but did not comment on whether he had seen the type. In the original description of P. breddini there is no mention of the shape of the apex of the anterior process explicitly but that the anterior process as a whole is built as in P. foersteri (‘Der Pronotumaufsatz ist wie bei Foersteri geformt …’). On this basis one could argue that, because the bilobed apex in P. foersteri is quite different from that in P. jugulata, P. breddini and P. jugulata are two different species. However, even though the anterior process in the P. breddini type is broken off a little bit proximal to point A, there is still enough anterior process to see that it is less bent backwards than the same part of the anterior process in the P. foersteri types and, therefore, the more distal parts of the process must also have been less bent backwards in P. breddini than in P. foersteri.

Pyrgauchenia foersteri Breddin, 1902: 91

Description. Length 6.6–7.3 mm (mean 6.9 mm); anterior process of pronotum strongly bent backwards with distal lobes similar to P. pendleburyi and P. biuni; apex directed horizontally or obliquely ventral, but never vertically; subapical node nearly as high as broad.


Remarks. Described from six or more specimens from ‘Java, but probably Borneo’, collected by Prof. Dr. Förster. In describing P. foersteri var. fulva from Java, Schmidt (1906) disagreed with Breddin’s (1902) statement that P. foersteri probably occurred in Borneo and not Java. In the absence of any evidence to the contrary, and that the types are labelled from Java, it appears that Breddin’s statement was unjustified.

Pyrgauchenia fulmeki (Schmidt, 1926: 22, Pyrgolyrium)

Description. Lengths of types 6.3 (female), 6.6 and 6.4 mm; anterior process of pronotum not sexually dimorphic; bent up then downwards (n-shaped); apex slightly broadened or heart-shaped (as in P. brevinota, figure 3, Funkhouser, 1932: 115) and ending anteriorly to subapical node; subapical node in males and females broader than high.

Remarks. Described from an unspecified number of specimens (♂ and ♀) from ‘Sumatra, Brestagi VII. 1922 (Dr. Fulmek)’.

*Pyrgauchenia kinabalense* (Breddin, 1902: 91, *Pyrgophyllium (?)*)

**Description.** Length: ♂ 6 mm, ♀ 5.8–5.9 mm; pronotum not sexually dimorphic; anterior process nearly straight, 3.1 mm (male), 2.8 mm (female), with apex forming a broadened or heart-shaped plate (as in *P. brevinota*, figure 3, Funkhouser, 1932: 115); subapical node distinct, broader than high.


Other material. 1♂, 1♀ (from long series, see below) BMNH (labels: ‘Mt. Kinabalu./3000 ft./Sep 1913’, ‘Sarawak/Museum./1914-253’).

Remarks. Described from an unspecified number of specimens from ‘Borneo (Kina Balu, Coll. Breddin)’. Distant (1915) re-described this species, as vars a–c, from topotypical specimens (Mt Kinabalu) collected by Moulton and specimens from Sumatra. An altitude of 3100 feet may apply to the latter specimens as this altitude is given for *jugulata* from the same location in Sumatra (Distant, 1915: 325). A long series of topotypical specimens (BMNH) are believed to represent the Moulton specimens. Although these specimens lack Moulton’s name, otherwise similar data labels, with Moulton’s name, are present on the types of *colorata*. Two of these *kinabalense* specimens have been examined in detail as noted above. An example of the unreliability of colour in museum specimens as means for identification in the species discussed here is Breddin’s now uniformly light brown/ochraceous type, originally described as blackish with only the apical parts of the tegmina lighter (‘Schwärzlich, die Spitzen der Flügeldecken lichter’).

*Pyrgauchenia recurva* (Funkhouser, 1929: 112, pl. 1, figure 2, *Hypsauchenia*)

**Description.** Length: ♀ 6.8 mm; anterior process strongly bent backwards, its apex (missing in type) bifurcate with dorsoventrally flattened lobes (according to original description); subapical node distinct, broader than high.


Remarks. Described from two females from ‘Roban, Java’. According to Dr. S. McKamey (personal communication) only the above-mentioned paratype is present in the USNM collection.

*Pyrgauchenia wallacei* (Breddin, 1902: 91, *Pyrgophyllium*)

**Description.** Length: 5.6 mm; anterior process nearly straight, 2.6 mm long, apex missing in type series, according to the original description, apex of anterior process with small, heart-shaped plate, subapical node distinct, broader than high (nearly as high as in females of *P. biuni*).

Type material examined. **Lectotype**, ♂, designated by Gaedike (1971), DEI

**Remarks.** Described from two or more specimens from ‘Borneo (Coll. Breddin)’.

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