

Phylogenetic Revision of the New Neotropical Riodinid Genus *Minstrellus* (Lepidoptera: Riodinidae)

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ABSTRACT The small Neotropical riodinid genus *Minstrellus* (Lepidoptera: Riodinidae) is described and revised. It seems to be most closely related to *Pseudonymphidia* Callaghan, in the *incertae sedis* section of the Riodininae. A phylogenetic analysis of its four species, using 11 characters of adult morphology, generated a single most parsimonious cladogram with the following structure: *grandis* + (*nivosa* + (*leucotopus* + *emphatica*)). The species *watkinsi* d'Abrera, like all the taxa of *Minstrellus*, was described in *Ematurgina* Röber (a synonym of *Synargis* Hübner) and briefly subsequently treated in *Zelotaea* Bates, but it is here transferred to *Machaya* Hall & Willmott (n. comb.). The taxon *emphatica* Stichel is raised from a subspecies of *leucotopus* Stichel to the rank of species (n. stat.), and the name *candida* Le Cerf is synonymized with *emphatica* (n. syn.).

KEY WORDS *Ematurgina*, *Minstrellus*, Neotropics, phylogeny, *Pseudonymphidia*

Not so long ago, the largely Neotropical Riodinidae (Lepidoptera) was one of the most poorly known families of butterflies, but a surge in published studies on the phylogenetics and taxonomy of riodinids during the last 10 to 20 yr has catapulted the group in among the systematically best known families (Hall 2005a). However, whereas the majority of known undescribed riodinid species have now been named (Hall 2005a), many new genera are still in need of description to ensure that the classification of the family is based as far as possible on natural monophyletic groups. The purpose of this article is to describe and revise a small genus of western Amazonian riodinids in the *incertae sedis* section of the subfamily Riodininae. These distinctive black-and-white species were all erroneously described and subsequently treated in the genus *Ematurgina* Röber, 1903 (Stichel 1910–1911, 1930–1931; Bridges 1994), which was recently shown to be a synonym of *Synargis* Hübner, [1819] (Nymphidiini: Lemonyadina) (Hall and Harvey 2002).

Materials and Methods

Collections. The collection acronyms listed below, which largely follow Heppner and Lamas (1982) and Bridges (1994), are used throughout the text. Unasterisked collections below represent those that I have examined in person and from which I have recorded all specimen locality data. Collections with an asterisk represent those that I have not examined but whose acronym occurs in the text. Several additional collec-

tions were examined (see lists in Hall 1999, 2005a), but found not to contain any *Minstrellus* specimens. In total, 63 *Minstrellus* specimens were examined and identified in the unasterisked collections, consisting of 50 males and 13 females (1:0.27 ratio or \approx 4:1). No single collection was found to harbor all four of the recognized *Minstrellus* species. The collection acronyms are: AMNH, American Museum of Natural History, New York, NY; BMNH, The Natural History Museum, London, United Kingdom; BPH, Collection of Brian P. Harris, Washington, D.C.; CJC, *Collection of Curtis J. Callaghan, Bogotá, Colombia; CMNH, Carnegie Museum of Natural History, Pittsburgh, PA; DA, Collection of David H. Ahrenholz, St. Paul, MN; MNHN, Muséum National d'Histoire Naturelle, Paris, France; MNRJ, *Museu Nacional, Rio de Janeiro, Brazil; PJD, Collection of Philip J. DeVries, University of New Orleans, New Orleans, LA; RCB, Collection of Robert C. Busby, Boston, MA; RPM, Reading Public Museum, Reading, PA; SMF, Senckenberg Museum, Frankfurt, Germany; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; ZMHU, Zoologisches Museum, Humboldt Universität, Berlin, Germany; and ZSM, Zoologische Staatssammlung München, Munich, Germany.

Morphology. Genital dissections were made using standard techniques after placing abdomens in hot 10% KOH solution for \approx 5 to 10 min. The vesica of the male genital aedeagus was everted using methodologies similar to those outlined in Dang (1993) and Sihvonen (2001). Dissected specimens, whose abdomens were stored in glycerin, are indicated with an asterisk under the Specimens Examined section of each species account. The terminology for male and

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Table 1. Character matrix for the phylogenetic analysis

Taxon	5										1
											0
<i>P. clearista</i>	0	0	0	0	0	0	0	0	0	0	0
<i>M. grandis</i>	0	0	0	0	0	0	0	0	0	0	0
<i>M. nivosa</i>	1	1	1	0	0	0	0	1	1	1	0
<i>M. leucotopus</i>	1	1	1	1	1	1	1	1	1	1	1
<i>M. emphatica</i>	1	1	1	1	1	1	1	1	1	1	1

female genital and abdominal structures largely follows Klots (1956) and Eliot (1973), and the nomenclature for wing venation follows Comstock and Needham (1918), with cells named for the vein above. Light microscopy was done using an Olympus SZH (magnification up to 128 \times). Digital images of adults were taken using a Nikon Coolpix 995, and images of morphological structures were taken using a Nikon D1X attached to a Microoptics digital imaging system.

Phylogenetic Analysis. The phylogenetic analysis presented here included all four recognized species of *Minstrellus*, and it was based on morphological characters derived from the adult body, wings, and male genitalia. Phylogenetically uninformative species-level autapomorphies were excluded, although these are given in the relevant species accounts. The analysis, based on maximum parsimony as the optimality criterion, was performed using an exhaustive search in PAUP 4.0b4a (Swofford 2000). All characters were equally weighted and unordered. The type species and most similar member (*clearista* Butler, 1871) of the hypothesized sister genus (*Pseudonymphidia* Callaghan, 1985) to *Minstrellus* was selected to be the outgroup taxon. The strength of branch support was estimated by means of 1,000 bootstrap replicates in PAUP (Felsenstein 1985) and by calculating decay indices (Bremer 1988, 1994), by using the program AUTODECAY 4.0 (Eriksson 1998) in combination with PAUP. Character evolution was studied using MacClade 3.05 (Maddison and Maddison 1995).

Results of Phylogenetic Analysis

The following 11 binary characters were identified from the adult body (1), wing pattern (8), and male genitalia (2) (see Table 1 for character matrix). Given the homogeneity of the genital structures, I was able to code only two characters from the male genitalia, and none from the female genitalia. The phylogenetic hypothesis presented here is therefore based predominantly on wing pattern characters.

Body

1. Orange-brown collar behind head (0) absent; (1) present. CI = 1; RI = 1.

Wing Pattern

2. Ground color of wings in male (0) rufous brown; (1) plain brown. CI = 1; RI = 1.
3. White postdiscal band on dorsal forewing consists

of (0) a single continuous band; (1) two separate elements, one horizontal element at anal margin, and one diagonal element across middle of wing. CI = 1; RI = 1.

4. White postdiscal band on dorsal forewing (0) does extend to anal margin; (1) does not extend to anal margin. CI = 1; RI = 1.
5. Distal margin of basal white area on dorsal hindwing in male (0) extends as tiny streaks along veins; (1) smooth. CI = 1; RI = 1.
6. Basal white area on dorsal hindwing (0) does extend continuously to anal margin; (1) does not extend continuously to anal margin. CI = 1; RI = 1.
7. Basal white area on dorsal hindwing (0) does extend to costal margin; (1) does not extend to costal margin. CI = 1; RI = 1.
8. Narrow brown band at base of dorsal hindwing in both sexes (0) present; (1) absent. CI = 1; RI = 1.
9. White streak through discal cell of ventral forewing (0) absent; (1) present. CI = 1; RI = 1.

Male genitalia

10. Angular valve tips in ventral view (0) absent; (1) present. CI = 1; RI = 1.
11. Length of valve tips in ventral view (0) symmetrical; (1) asymmetrical. CI = 1; RI = 1.

The exhaustive search generated a single most parsimonious cladogram (Fig. 1), with the following structure: *grandis* + (*nivosa* + (*leucotopus* + *emphatica*)). The cladogram has 11 steps, and consistency and retention indices of 1. Thus, this data set was most unusual in containing no homoplasy. Both internal nodes of the *Minstrellus* cladogram are supported by at least five universal synapomorphies, indicating that the phylogenetic hypothesis is robust.

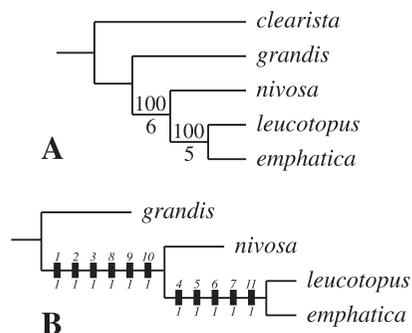
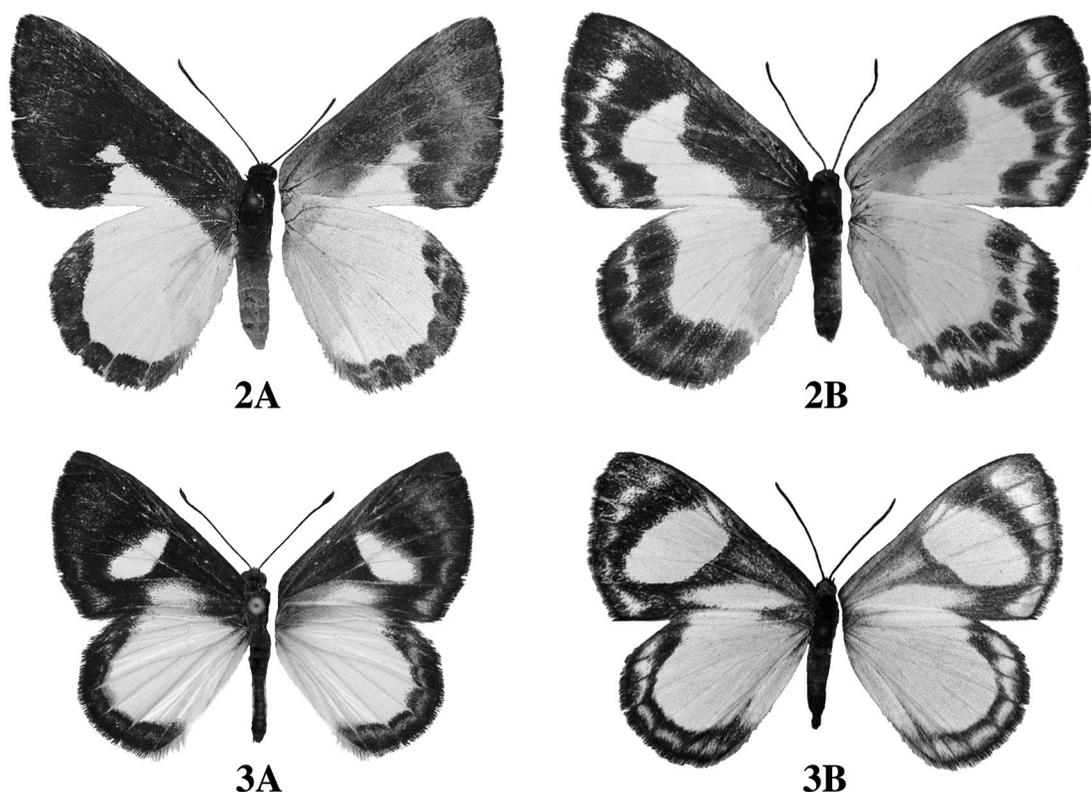


Fig. 1. (A) Single most parsimonious cladogram resulting from the exhaustive analysis of 11 morphological characters for all four species of *Minstrellus* (see Table 1 for data matrix); branch support is given as bootstrap values above branches and decay index values below branches. (B) Cladogram from A, illustrating the distribution of character states, with black bars indicating unique apomorphies.



Figs. 2–3. *Minstrellus* adults (dorsal surface on left, ventral surface on right). (2A) *M. grandis* ♂, Juanjuí, Peru (MNHN). (2B) *M. grandis* ♀, Juanjuí, Peru (MNHN). (3A) *M. nivosa* ♂, Tarapoto, Peru (ZSM). (3B) *M. nivosa* ♀, Tarapoto, Peru (BMNH).

Revision of *Minstrellus*

Minstrellus Hall, n. gen.

(Figs. 2–3; 4–5; 6–7; 8–9; 10–11; 12–13; 14; 15)

Type Species. *Ematurgina leucotopus* Stichel, 1911.

Etymology. The name is based on the medieval European word minstrel, an entertainer often dressed in black and white, the colors sported by the species of this genus.

Description. Male: Forewing length 15–20 mm.

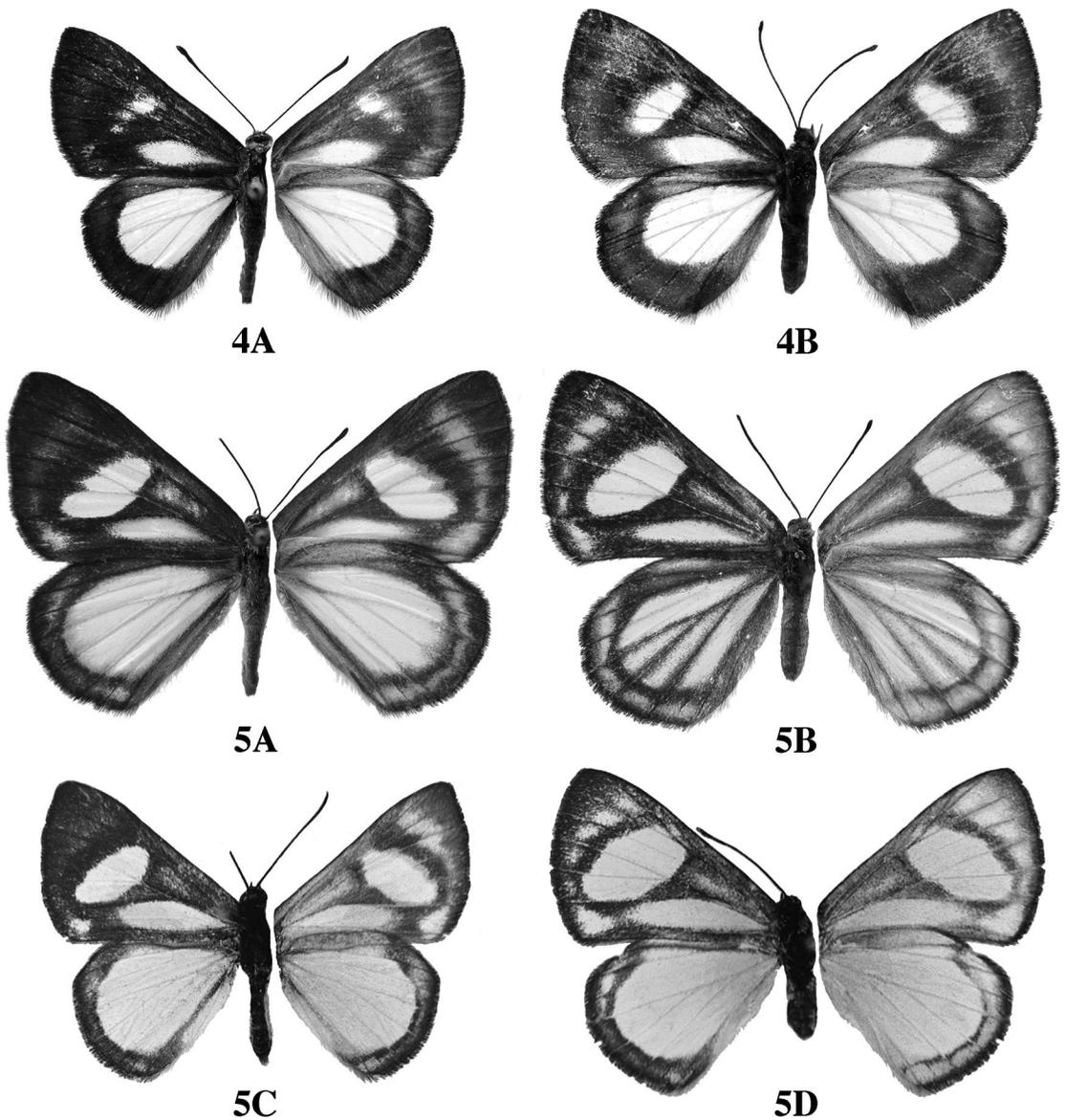
Wing shape. Both wings compact; forewing costa approximately straight, distal margin slightly convex; hindwing rounded. **Venation:** Similar to *Pseudonymphidia* (Callaghan 1982), with four forewing radial veins.

Dorsal surface. Ground color of both wings rufous brown in *M. grandis* and plain brown to black in *M. nivosa*, *M. leucotopus* and *M. emphatica*; a faint white streak in forewing discal cell sometimes present, forewing postdiscal band either continuous, triangular and restricted to anal half of wing (*M. grandis*) or divided into an anal (horizontal) and a medial (diagonal) section (*M. nivosa*, *M. leucotopus*, and *M. emphatica*), white submarginal band on both wings variably prominent and undulating, a large white patch occupies most of hindwing, leaving a small brown area at wing base and a variably narrow brown distal border in all

species, and additional narrow black anal and costal borders in *M. leucotopus* and *M. emphatica*; fringe of both wings brown. **Ventral surface:** Differs from dorsal surface in following ways: Ground color of both wings paler brown, white present at anal and costal margins of hindwing in *M. leucotopus* and *M. emphatica*, white submarginal markings more prominent.

Head. Labial palpi whitish, but posterior dorsal tip of second segment and most of third segment brown, second and third segments relatively short (not extending beyond head); eyes brown and bare, dirty white scaling at lateral and ventral margins, brown scaling behind head in *M. grandis*, rufous- to dull orange-brown scaling in *M. nivosa*, *M. leucotopus*, and *M. emphatica*; frons brown with a very thin vertical band of white scales laterally; antennae ≈60% of forewing length, segments entirely brown in *M. nivosa*, *M. leucotopus* and *M. emphatica*, and brown with a small area of white basal scaling in *M. grandis*, nudum along inner ventral margin of shaft variably narrow and discontinuous; clubs black, sometimes with orange-brown tips.

Body. Dorsal surface of thorax and abdomen brown, ventral surface whitish; eighth sternite with two parallel posterior projections one-third to two-thirds length of sternite, tips rounded and outwardly curved; all legs whitish, tarsus of foreleg unimerous, coxa of medium length for family, midleg and hindleg

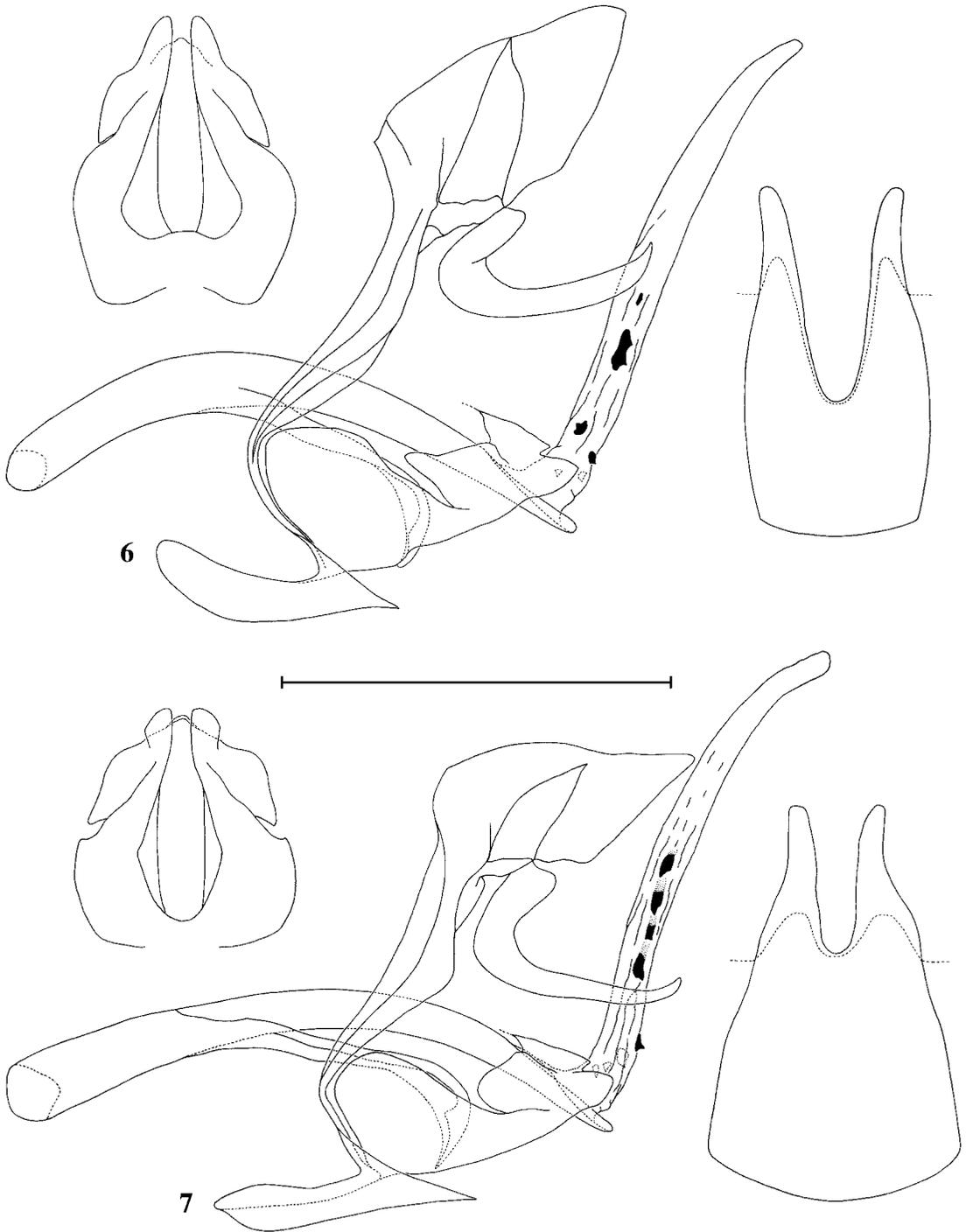


Figs. 4-5. *Minstrellus* adults (dorsal surface on left, ventral surface on right). (4A) *M. leucotopus* ♂, Illapani, Peru (BMNH). (4B) *M. leucotopus* ♀, Qbda. Chaupimayo, Peru (AMNH). (5A) *M. emphatica* ♂, Yurimaguas, Peru (MNHN). (5B) *M. emphatica* ♀, Chazuta, Peru (MNHN). (5C) *M. emphatica* ♂, Buena Vista, Bolivia (BMNH). (5D) *M. emphatica* ♀, Buena Vista, Bolivia (BMNH).

with a tibial spur and a group of spines at inner distal tip of tibia, and spines along inner margin of all tarsal segments.

Genitalia (Figs. 6-9). Uncus triangular in lateral view, with a pointed and more posteriorly elongate dorsal section, and a shallow dorsal indentation medially; falces somewhat larger than average for family, with rounded to angular "elbow"; vinculum broad, variably sinuous, generally broader at middle, and fused along entire anterior edge of tegumen, an additional triangular section of medium sclerotization joins ventral anterior corner of tegumen with vinculum, saccus long and bulbous, with small tri-

angular posterior section; aedeagus of medium length and smoothly concave, with a broad elongate tip in lateral view, anterior tip opens anteriorly, posterior tip opens dorsally and slightly to right; everted vesica perpendicular to aedeagus, with a basal whorl of four to five triangular spine-like cornuti and a further more distal lateral line of two to seven similar cornuti; broad, elongate and strap-like pedicel joins aedeagus in anterior one half to one third; valvae in lateral view with a basal lateral bulge and a posterior section consisting of a rectangular tip and a broad raised transtilla immediately anteriorly, with a small medial posterior projection,



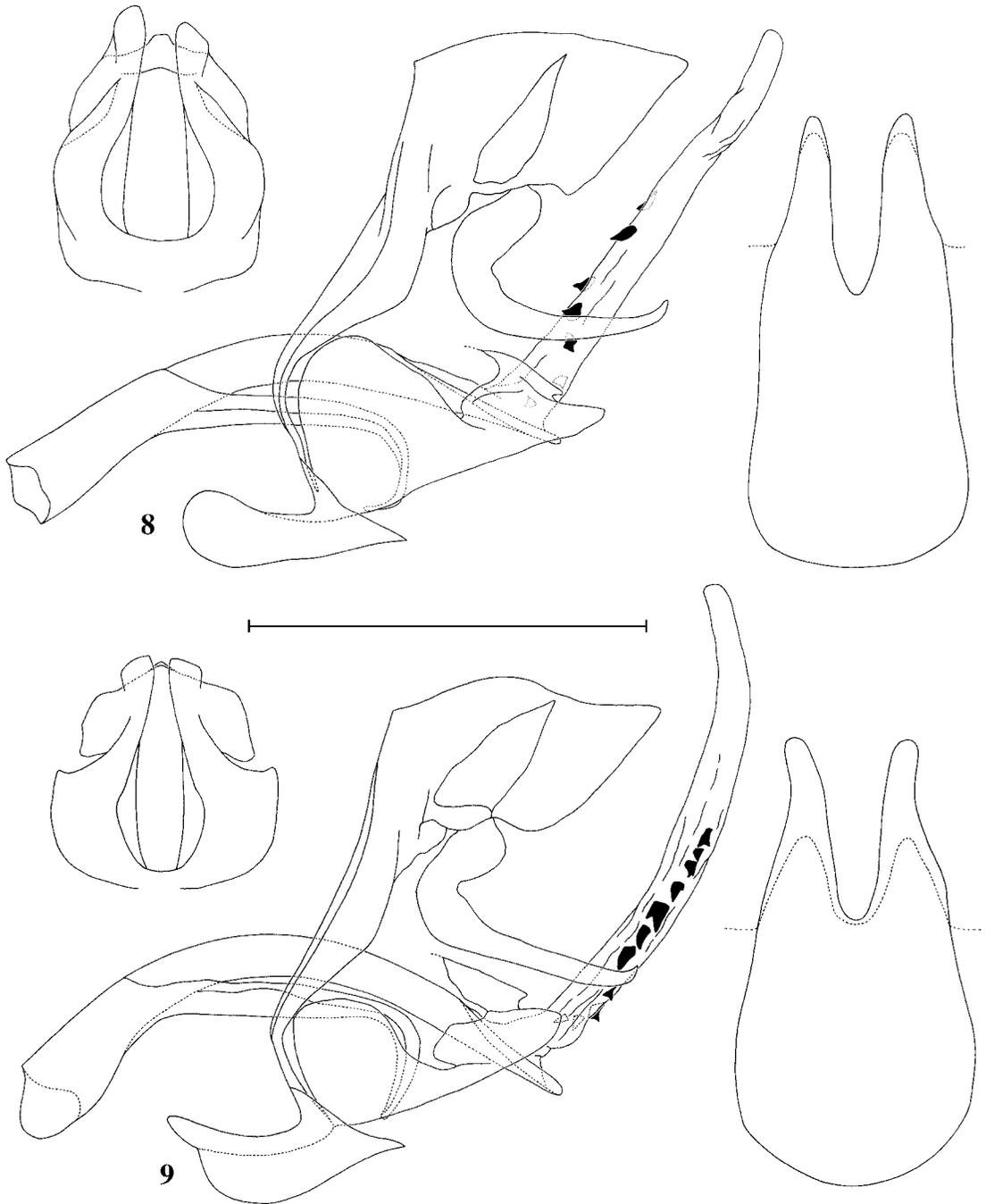
Figs. 6-7. *Minstrellus* male genitalia in lateral view, with ventral view of valvae at upper left and ventral view of last abdominal sternite at right. (6) *M. grandis*, Juanjuí, Peru (MNHN). (7) *M. nivosa*, Tarapoto, Peru (ZSM). Scale bar = 1 mm.

valve tips in ventral view rounded in *M. grandis* and angular in *M. nivosa*, *M. leucotopus*, and *M. emphatica*, and asymmetrical in length in *M. leucotopus* and *M. emphatica*.

Female: Differs externally from male in following ways: Forewing length 16–21 mm. Both wings more

rounded; ground color of both wing surfaces paler plain brown; diagonal portion of forewing postdiscal band broader, hindwing white area narrower in *M. grandis*, white submarginal markings on both wings more prominent.

Head. Third palpal segment slightly more elongate.

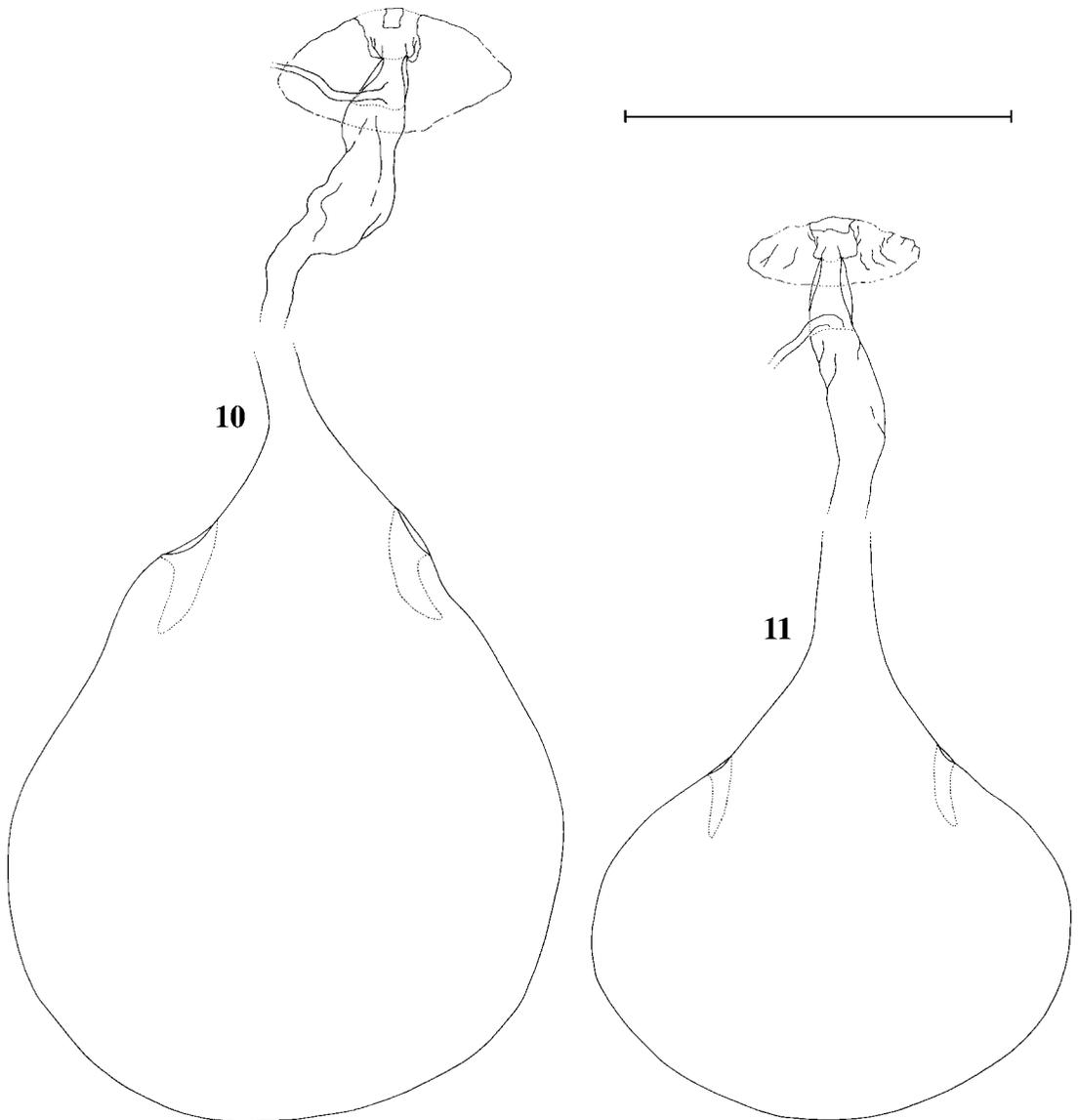


Figs. 8-9. *Minstrellus* male genitalia in lateral view, with ventral view of valvae at upper left and ventral view of last abdominal sternite at right. (8) *M. leucotopus*, Illapani, Peru (BMNH). (9) *M. emphatica*, Buena Vista, Bolivia (BMNH). Scale bar = 1 mm.

Body. Foreleg with spines at inner distal tip of tibia and tarsal segments 1 to 4.

Genitalia (Figs. 10-14). Corpus bursae "pear"-shaped, signa medium-sized, downwardly recurved, "horn"-like invaginations; ductus bursae membranous, with a small, laterally curled, concave, sclerotized sec-

tion immediately before ostium bursae; membranous ductus seminalis exits ductus bursae dorsally, immediately before sclerotized section; ostium bursae a large, ill-defined, weakly and spottily sclerotized, oval to triangular ring, posterior membranous section at opening approximately square, invariably with a small



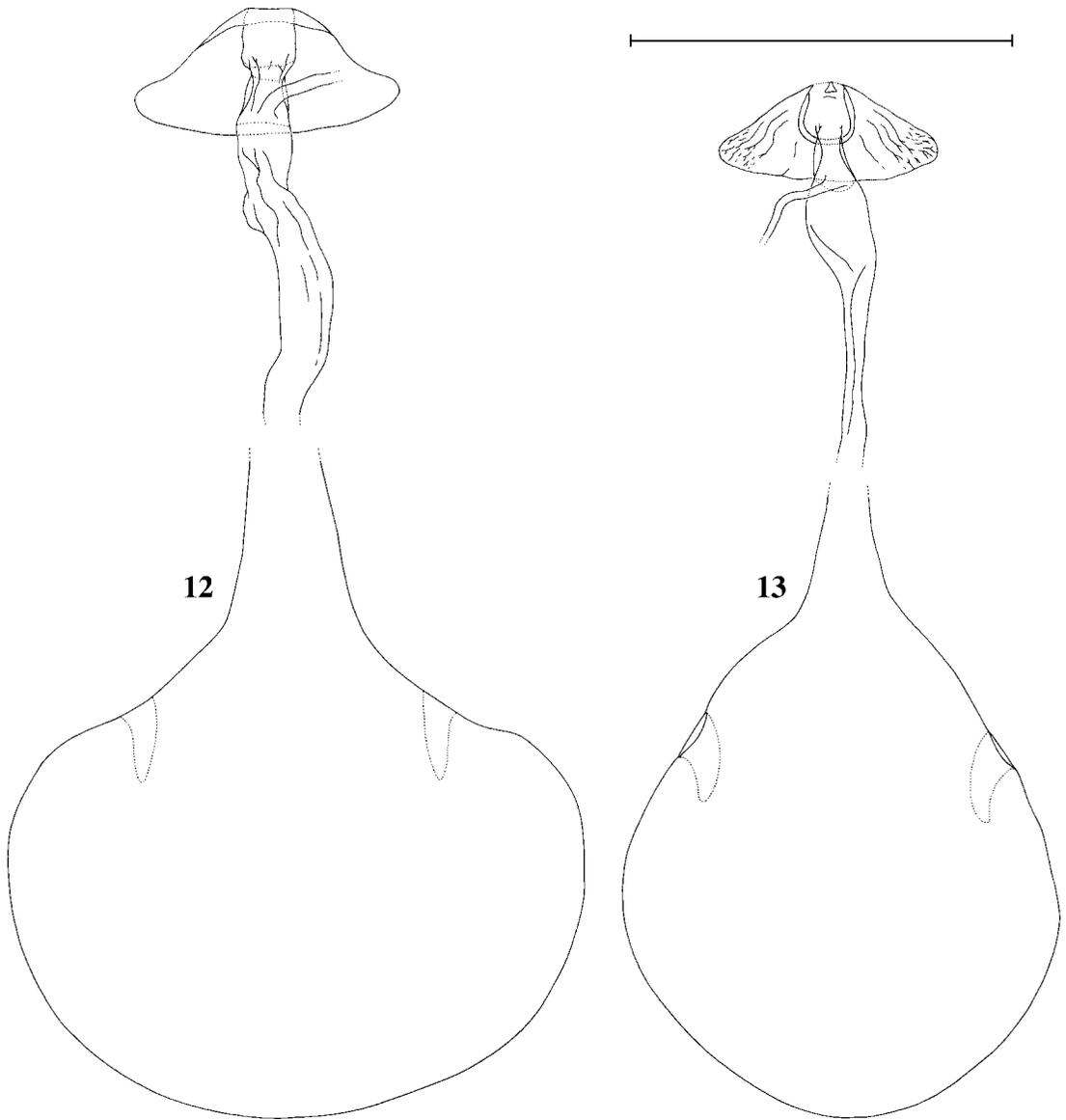
Figs. 10–11. *Minstrellus* female genitalia in dorsal view. (10) *M. grandis*, Juanjuí, Peru (MNH). (11) *M. nivosus*, Tarapoto, Peru (BMNH). Scale bar = 1 mm.

piece of sclerotization at dorsal margin; rounded papillae anales divided into a well sclerotized anterior section with long and sparsely distributed setae, and a membranous posterior section with a very dense covering of shorter setae.

History of Classification. For reasons that remain unclear, all four of the species treated here in the new genus *Minstrellus*, and their synonyms, were described in *Ematurgina*, a genus in the Nymphidiini (subtribe Lemoniadina) (although see the “Systematic Position and Diagnosis” section). Because of their rarity and western Amazonian distributions, beyond the reach of the early Amazonian collectors, no *Minstrellus* species were described until the 20th century. Recent phylogenetic work by Hall and

Harvey (2002) showed that the two black and yellow *Ematurgina* species, including the type species *E. axenus* Hewitson, 1876, were actually basal members of *Synargis*. *Ematurgina* was therefore synonymized with *Synargis*, and the names *albovata*, *candida*, *emphatica*, *grandis*, *leucotopus*, *nivosa*, and *watkinsi*, all referring to similarly patterned black-and-white species, were temporarily transferred to *Zelotaea* Bates, 1868 (Hall and Harvey 2002), a nymphidiine genus of superficially similar species, until a new genus could be described for them.

The first six of these names are here transferred from *Zelotaea* to *Minstrellus*, but further morphological study has indicated that the last, *watkinsi*, does not belong to the genus *Minstrellus*, despite a close exter-



Figs. 12–13. *Minstrellus* female genitalia in dorsal view. (12) *M. leucotopus*, Qbda. Chaupimayo, Peru (AMNH). (13) *M. emphatica*, Buena Vista, Bolivia (BMNH). Scale bar = 1 mm.

nal similarity to its members. The species *watkinsi*, known to me from only two females in the BMNH (not males as stated in the original description by d'Abrera 1994), differs externally from the females of all *Minstrellus* species by having shorter palpi (1), a more elongate wing shape (2), a slightly angular instead of rounded hindwing (3), white fringe elements at the hindwing apex (4), a forewing subapical patch (white) (5), and a basal forewing patch that extends to the wing base, is horizontally divided by a black bar through the middle of cell Cu_2 , and has yellow scaling along its costal margin (6). The female genitalia differ from those of all *Minstrellus* species by having straight instead of downwardly recurved signa (7), a short sclerotized posterior section to the ductus bursae (8),

a well-sclerotized ostium bursae (9), and no well demarcated area of densely distributed short setae at the posterior margin of the papillae anales (10). The species *watkinsi* also exclusively inhabits montane forest up to 1,800 m (in southern Peru and Bolivia), whereas all *Minstrellus* species but one are confined to lowland habitats (11). After a comprehensive comparison of the above-mentioned character states with those of all other riodinid genera, especially those without known females, and a process of elimination, I have come to the tentative conclusion that *watkinsi* should be placed for now in *Machaya* Hall & Willmott, 1995 (n. comb.) (*incertae sedis* section). It would represent the first (clearly sexually dimorphic) known female in that genus. The known females of *watkinsi* share characters

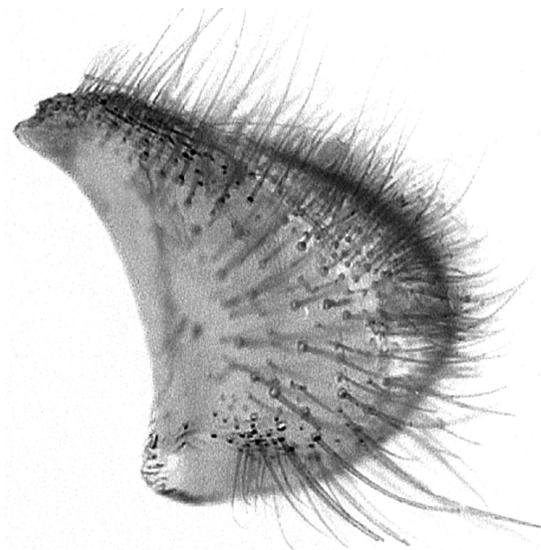


Fig. 14. Right female genital papilla of *M. emphatica*, illustrating the very dense covering of short setae in the posterior half of the papillae anales in *Minstrellus*.

1, 2, 3, 5 (in part), 6 (in part) and 11 (in part) in common with the known males of *Machaya* (Hall and Willmott 1995a), and characters 7, 8, and 9 are typical of females in closely related genera, such as *Pachythone* Bates, 1868 (J.P.W.H., unpublished data). The species *watkinsi* is certainly more similar in wing shape and pattern to the species of *Machaya* than to those of *Pachythone*, and no *Pachythone* species are known to exclusively inhabit montane forest. However, a comprehensive phylogenetic analysis of the *Pachythone* cluster of genera (J.P.W.H., in preparation) is needed to determine whether *Pachythone* and *Machaya* are both monophyletic genera, or whether *Machaya* merely represents a derived clade within *Pachythone*.

Below, I provide a synonymic checklist for *Minstrellus*, recognizing four species (synonyms are preceded by a double dash "--").

Minstrellus Hall, n. gen.

emphatica (Stichel 1911) n. comb., n. stat.

-- *albovata* (Stichel 1929)

-- *candida* (Le Cerf 1958) n. syn.

grandis (Callaghan 1999) n. comb.

leucotopus (Stichel 1911) n. comb.

nivosa (Stichel 1929) n. comb.

Systematic Position and Diagnosis. By possessing a costal vein on the hindwing and a strap-like pedicel joining the aedeagus to the valvae, *Minstrellus* can be placed in the Riordininae (Harvey 1987, Hall 2003). However, *Minstrellus* has none of the synapomorphies defining the eight currently recognized tribes within this subfamily (Harvey 1987; Hall 1998, 1999, 2002a, 2003) and can thus only be placed for now in the paraphyletic *incertae sedis* section established by Harvey (1987). Preliminary investigation suggests that

this *incertae sedis* section can be broadly divided into four generic groupings: the *Argyrogrammana* Strand, 1932, cluster of genera; the *Emesis* F., 1807, cluster; the *Calydna* Doubleday, 1847, cluster; and the *Pachythone* cluster (J.P.W.H., unpublished data). For the following reasons, I suggest that *Minstrellus* should be placed next to *Pseudonymphidia* in the *Pachythone* cluster of genera. Within the context of the *incertae sedis* section, the derived loss of black wing spotting in *Minstrellus* species is common only in the *Pachythone* cluster; the short antennae and palpi, and wing greasiness of *Minstrellus* species are shared only with genera in the *Pachythone* cluster; the bifurcation of the eighth male abdominal sternite of *Minstrellus* species is approached only in *Pseudonymphidia clearista* in the *Pachythone* cluster (although this species has no posterior projections, a bifurcate pattern of sclerotization is discernible on the rectangular sternite membrane); and the least derived member of *Minstrellus* is very similar externally only to *P. clearista* in the *Pachythone* cluster. The morphology of *Minstrellus* is not particularly similar to that of any other riordinid genus, but is inconsistent with morphological characters documented for genera in the *Argyrogrammana* (Hall and Willmott 1995b, 1996), *Emesis* (Harvey 1987; J.P.W.H., unpublished data) and *Calydna* (Hall 2002b) clusters. Confirmation of the systematic placement of *Minstrellus* must await a phylogenetic analysis of the *Pachythone* cluster of genera (J.P.W.H., in preparation). It is worth noting that the wing greasiness of species in the *Pachythone* cluster of genera suggests that the caterpillars, none of which have yet been discovered, might be aphytophagous (Hall and Harvey 2002), and therefore myrmecophilous (Cottrell 1984). I regard the rearing of a *Pachythone* cluster species to be the highest priority task in the field of riordinid immature stage biology, because the process could tell us whether this group forms a third clade of myrmecophilous riordinids (with the Eurybiini and Nymphidiini), whether it is the sister group to the Nymphidiini, or whether it should be subsumed within the Nymphidiini.

Only a few riordinid genera exclusively or largely contain species that are entirely brown or black and white (e.g., *Pseudonymphidia* and *Zelotaea*). The wing patterns of *Minstrellus* species, with their combination of a rounded and solid white hindwing patch, a narrow white forewing postdiscal band that is medially divided in the derived majority of species into diagonal and anal sections, and a complete lack of black basal, postdiscal and submarginal spotting, are unique. Their relatively short antennae and palpi are also a rare combination, although these are not as short as they are in *Pachythone* species. In the male genitalia of *Minstrellus* species, the configuration of the valvae, and the shape and arrangement of aedeagal cornuti are both unique in the Riordininae. The prominent pair of posterior projections from the eighth male abdominal sternite in all *Minstrellus* species is unique within the *incertae sedis* section, and common only in the subtribes Aricorina and Lemoniadina (Nymphidiini), a fact that perhaps explains in part why all *Minstrellus* taxa were described in the lemoniadine genus *Ematur-*

gina. In the female genitalia of *Minstrellus* species, the downwardly recurved shape of the signa is rare within the Riordininae, and the presence of a posterior area of densely distributed short setae on the papillae anales (Fig. 14) is, to my knowledge, a unique synapomorphy within the family.

Key to the Species of *Minstrellus*

1. White forewing postdiscal markings consist of separated anal (horizontal) and medial (diagonal) sections 2
 - White forewing postdiscal markings consist of a continuous vertical band *grandis*
- 2(1). Anal portion of white forewing postdiscal band does not extend to anal margin below vein 2A, hindwing white patch does not extend to costal margin 3
 - Anal portion of white forewing postdiscal band does extend to anal margin below vein 2A, hindwing white patch does extend to costal margin *nivosa*
- 3(2). Diagonal white forewing postdiscal band relatively narrow, white streak in discal cell of dorsal forewing absent, anal margin of dorsal hindwing always brown, hindwing white patch does not approach distal wing margin, dorsal submarginal white absent *leucotopus*
 - Diagonal white forewing postdiscal band relatively broad, white streak in discal cell of dorsal forewing present, anal margin of dorsal hindwing white in southern specimens and brown in northern specimens, hindwing white patch does approach distal wing margin, dorsal submarginal white present *emphatica*

Biology. Most *Minstrellus* species inhabit wet lowland forest from 200 to 1,000 m near the base of the eastern Andes, but *M. leucotopus* seems to inhabit lower montane forest from 1,000 to 1,500 m. There is no published information on adult behavior, or the food plants and immature stages, but unpublished information, including label data, suggests that both sexes are most commonly found in association with slightly disturbed streamside habitats.

Biogeography. *Minstrellus* is confined to the western Amazon, between Colombia and Bolivia and into extreme western Brazil (Fig. 15). Given the small amount of material available, it is difficult to accurately predict the ranges of individual *Minstrellus* species. Two species, *M. nivosa* and *M. leucotopus*, are still only known from relatively small areas. However, Peru seems likely to remain the only country from which all four species will be known, with Ecuador and Bolivia perhaps each harboring three species (Table 2). Given the lack of records from the far eastern lowlands of Peru, Brazil seems unlikely to have more than one species.

Minstrellus grandis (Callaghan 1999) n. comb. (Figs. 2A, B; 6, 10, 15)

Ematurgina grandis Callaghan, 1999. Revta. Bras. Zool. 16: 1055–1056, figs. 29–32. Type locality: Lagoa Ceará, Piasabal, upper Rio Juruá, W. Brazil. Holotype male MNRJ; type illustrations [examined].

Identification and Taxonomy. Typical forewing length: male 19 mm, female 20 mm. *M. grandis* is the most distinctive species in the genus, and in many ways it is more similar to the Central American *Pseudonymphidia clearista* (Butler, 1871). It differs externally from *P. clearista* by having a more compact wing shape, a brown distal hindwing margin that always extends broadly around the entire wing margin, a narrower white forewing postdiscal band, white submarginal bands (prominent in the female only), an entirely brown wing fringe, and no black spotting. *M. grandis* differs externally from its more derived congeners by having a brown collar behind the head, a rufous instead of plain brown dorsal ground color in males, a continuous vertical white postdiscal band on the forewing, an entirely brown forewing discal cell, a narrow brown band at the base of the dorsal hindwing, and prominent undulating submarginal markings on both ventral wings in females. It is worth noting that the name of this recently described species is not especially descriptive, because many northern specimens of *M. emphatica* are larger than *M. grandis*. In the male genitalia of *M. grandis*, the posterior projections of the eighth abdominal sternite are considerably longer, constituting more than one half its length, the valve tips are slightly more elongate and rounded in ventral view, and the everted aedeagal vesica contains six cornuti instead of seven to 11, with a larger gap between the basal and distal clusters. The female genitalia of all four *Minstrellus* species exhibit only very slight differences, and few, if any, of these seem likely to be diagnostic.

Biology. No biological information was given for this very rare species in the original description (Callaghan 1999).

Distribution. *M. grandis* is currently known only from the area between northern Peru, central Bolivia, and western Brazil (Fig. 15), but it may eventually also be found in Amazonian Ecuador and Colombia. The following additional locality was listed by Callaghan (1999) (as *Ematurgina grandis*) for PERU: Ucayali, Pucallpa (one male in coll. CJC).

Specimens Examined. 11♂, 3♀.

PERU: San Martín, Juanjuí 6♂*, 3♀* MNHN; 2♂ SMF; 1♂ RPM; Ucayali, middle Río Ucayali 1♂ AMNH. BOLIVIA: Santa Cruz, Cuatro Ojos 1♂ CMNH.

Minstrellus nivosa (Stichel 1929) n. comb. (Figs. 3A, B; 7; 11; 15)

Ematurgia [sic] *nivosa* Stichel, 1929. Mitt. Zool. Mus. Berl. 5: 22. Type locality: Tarapoto, N. Peru. Holotype male ZMHU [examined].

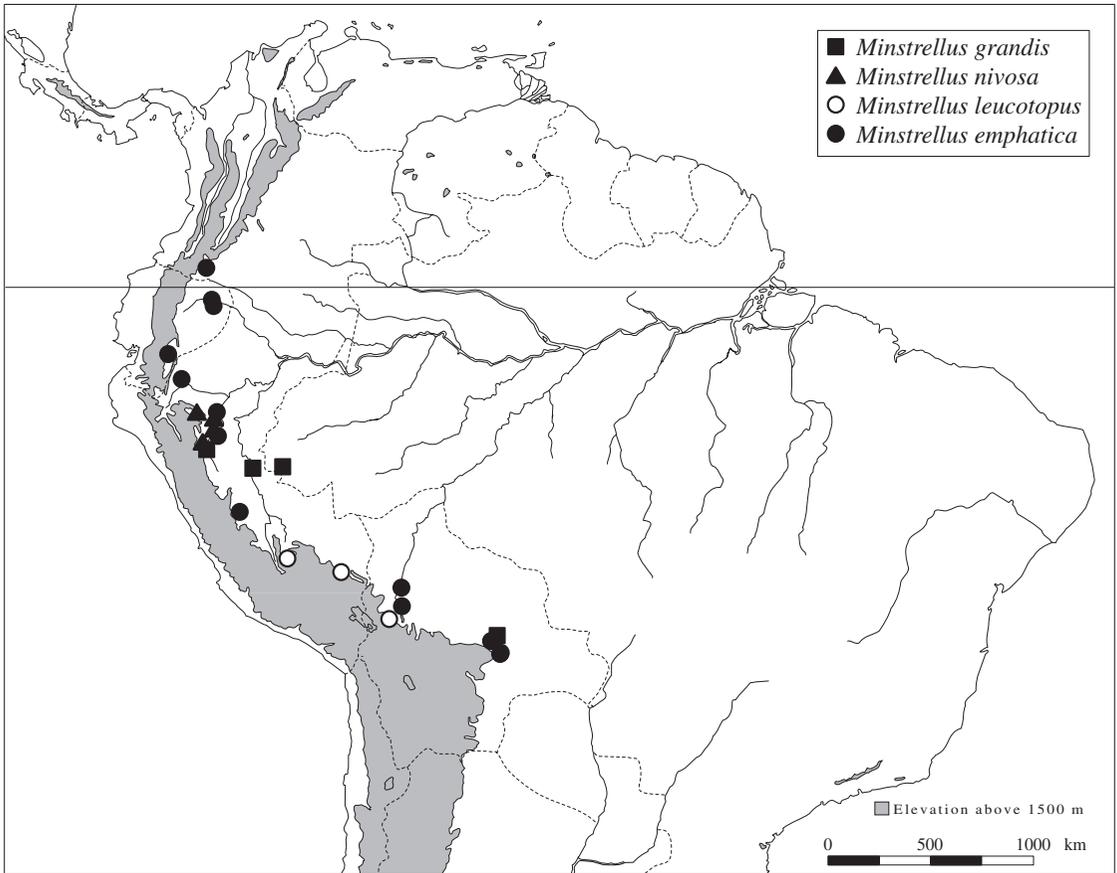


Fig. 15. Map of South America illustrating distributions of *Minstrellus* species.

Identification and Taxonomy. Typical forewing length: male 15 mm, female 16 mm. *M. nivosa* can be placed in a clade with *M. leucotopus* and *M. emphatica* as all three species share an orange-brown collar behind the head, a plain brown dorsal ground color in males, a white postdiscal band on the forewing that is medially divided into horizontal and diagonal elements, no well-defined narrow brown band at the base of the dorsal hindwing, a white streak through the discal cell of the ventral forewing, and angular valve tips in ventral view. It differs externally from these similar congeners by having a consistently shorter forewing length, an anal portion to the white forewing postdiscal band that extends to the wing margin below vein 2A in both sexes and is narrower in males, and a hindwing white patch that has tiny streaks extending along the veins in males and extends to the anal and costal margins in both sexes instead of being isolated in the middle of the wing. The male genitalia of these three derived *Minstrellus* species are very similar, but, at least in the material examined, those of *M. nivosa* have symmetrical valve tips in ventral view and a slightly different arrangement of aedeagal cornuti. *M. nivosa* has a whorl of four basal spines and four distal spines on its everted vesica, *M. leucotopus* has a whorl of five basal spines

and two distal spines, and *M. emphatica* has a whorl of four basal spines and seven distal spines. It is worth noting that the holotype male of *M. nivosa* in the ZMHU bears the label "conspersa," presumably an earlier manuscript name.

Biology. Nothing is known about the biology of this very rare species, which is known from moist to wet lowland forest at the base of the eastern Andes between 500 and 800 m.

Distribution. *M. nivosa* is rather curiously known to date only from the northern Peruvian province of San Martín, in proximity to the Andes (Fig. 15). However, it probably ranges further south in Peru, and possibly into southern Ecuador.

Specimens Examined. 13♂, 2♀.

PERU: San Martín, Moyobamba 2♂ RPM; San Antonio de Cumbasa 1♂ SMF; Tarapoto 4♂, 1♀* BMNH; 1♂ ZMHU; 2♂* ZSM; Yumbatos 1♂ BMNH; Juanjuí 1♂, 1♀ MNHN; 1♂ SMF.

Minstrellus leucotopus (Stichel 1911) n. comb.
(Figs. 4A, B; 8; 12; 15)

Ematurgina leucotopus Stichel, 1911. Gen. Insectorum 112B: 283. Type locality: Illapani Viejo, S. Peru. Lectotype male ZMHU [designated].

Table 2. Distribution of *Minstrellus* species by country

Taxon	Mexico	Belize	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama	Venezuela	Colombia	Ecuador	Peru	Bolivia	Argentina	Brazil	Paraguay	Uruguay	Guyana	Surinam	French Guiana	Trinidad	
<i>grandis</i>										○	○	●	●		●							
<i>nivosa</i>											○	●	●									
<i>leucotopus</i>												●	●									
<i>emphatica</i>										●	●	●	●									
Total recorded	0	0	0	0	0	0	0	0	0	1	1	4	3	0	1	0	0	0	0	0	0	0
Total expected	0	0	0	0	0	0	0	0	0	2	3	4	3	0	1	0	0	0	0	0	0	0

The ● circles represent known records, and ○ circles represent expected records.

Identification and Taxonomy. Typical forewing length: male 16 mm, female 18 mm. By having a white postdiscal band on the forewing and a white basal patch on the hindwing that do not extend to the wing margins, a smooth distal margin to the basal white hindwing patch, and asymmetrical valve tips in ventral view, *M. leucotopus* can be placed as the sister species to *M. emphatica*, which is raised here to the rank of species from a subspecies of *M. leucotopus* (see the next species account). *M. leucotopus* differs externally from this very similar congener by having a narrower, and in males variably disjointed, diagonal element to the white forewing postdiscal band, a slightly shorter anal element (in cell Cu_2) to the white forewing postdiscal band, no white streak in the discal cell of the dorsal forewing in males, a slightly smaller white hindwing patch, a consistently black anal margin on the dorsal hindwing, and no prominent white submarginal markings on the dorsal wings. The male genitalia of *M. leucotopus* seem to differ by having much more prominently asymmetrical valve tips in ventral view, and only seven spines along the aedeagal vesica instead of the 11 spines I counted in specimens of *M. emphatica* from both the northern and southern portions of its range.

The name *leucotopus* was proposed from one male from Illapani Viejo, Peru, and one male from La Paz province, Bolivia. To confine the type locality to a single location, I designate a male in the ZMHU with the following label data as a lectotype: "Type," "Hil-lap./Peru," "Coll./Staudinger," and "Ematurgina/leucotopus/Stich." Note that the spelling *leucotopa*, with the ending changed to create gender agreement with the generic name *Ematurgina*, has been used in the literature (e.g., Stichel 1930–1931).

Biology. This very rare species seems to inhabit lower montane forest from 1,000 to 1,500 m, perhaps altitudinally replacing its lowland sister species *M. emphatica*. The label data for the only known female indicate that the specimen was collected in an area of coffee trees and secondary vegetation along a stream.

Distribution. *M. leucotopus* seems to be endemic to the eastern Andes of southern Peru and Bolivia (Fig. 15).

Specimens Examined. 4♂, 1♀.

PERU: Cuzco, Illapani Viejo 1♂* BMNH; 1♂ ZMHU; Quebrada Chaupimayo 1♀* AMNH. BOLIV-

IA: La Paz, Farinas 1♂ BMNH; no specific locality 1♂ ZMHU.

Minstrellus emphatica (Stichel 1911) n. comb., n. stat.

(Figs. 5A–D; 9; 13; 14; 15)

Ematurgina leucotopus emphatica Stichel, 1911. Gen. Insectorum 112B: 283, pl. 27, fig. 73. Type locality: Yurimaguas, N. Peru. Holotype male ZMHU [examined].

= *Ematurgina albobata* Stichel, 1929. Mitt. Zool. Mus. Berl. 5: 22. Type locality: Río Suapi, N.W. Bolivia. Holotype female ZMHU [examined].

= *Ematurgina albobata* f. *candida* Le Cerf, 1958. Mém. Mus. Nat. Hist. Nat. A 15: 195–196, pl. 2, fig. 19. Type locality: Puerto Umbría, S. Colombia. Holotype male MNHN [examined]. n. syn.

Identification and Taxonomy. Typical forewing length: male 18 mm, female 19 mm. Stichel (1910–1911) described *emphatica* as a subspecies of *leucotopus*, but because the two taxa exhibit several consistent wing pattern and male genitalia differences (see the previous species account), and *M. leucotopus* seems to occupy elevations above those of *M. emphatica* within only a portion of the geographic range of that species, I here tentatively raise *M. emphatica* to the rank of species (n. stat.).

Unlike the other members of the genus, *M. emphatica* is geographically variable. Bolivian specimens of both sexes (Fig. 5C, D) are usually smaller than those from more northern areas (Fig. 5A, B) (typical forewing length 16–17 mm instead of 19–20 mm) and tend to have a slightly broader anal element (in cell Cu_2) to the white forewing postdiscal band, more prominent white submarginal markings on both dorsal wings, a variably prominent white streak along the anal margin of the dorsal hindwing, and an entirely white hindwing patch without any prominent internal black veins. The female holotype of *albobata*, a name that Stichel (1929) proposed as a full species, represents the above described Bolivian phenotype. Given the significant intrapopulation variation found in *M. emphatica*, for example in the size of all white markings, and the slight clinal variation observable, Cal-

laghan and Lamas (2004) were justified in synonymizing *albovata* with *emphatica*. Male specimens from Colombia and Ecuador are very similar to nominal specimens from northern Peru, but they generally have variably prominent dull purplish scaling overlying the white dorsal markings at the base of the forewing and submargin of the hindwing. The holotype of *candida* represents such a Colombian male, not a female as stated in the original description (Rebillard 1958). The name *candida* was probably only proposed, as a form of *albovata*, because the author (Le Cerf) was unwittingly comparing a Colombian male to a Bolivian female, which as outlined above are indeed very different looking entities. I therefore conclude that Callaghan and Lamas (2004) were not justified in their recent catalog in listing *candida* as an unavailable name representing a new undescribed species. The name *candida* is readily argued to be nomenclaturally available (under Article 45.6.4 of the code of the ICZN 1999), for the same reasons that were outlined recently in the cases of *Metacharis umbrata* Stichel (Riodinini) (Hall 2005b) and *Sarota lasciva* Stichel (Helicopini) (Hall 1998), and I here synonymize it with *M. emphatica* (n. syn.).

Biology. This is the only *Minstrellus* species that is relatively well represented in collections. However, it is uncommon to rare in nature, in wet lowland forest between 200 and 1,000 m along the base of the eastern Andes. Both sexes have been encountered in Ecuador in association with streamside vegetation.

Distribution. *M. emphatica* ranges from southern Colombia to central Bolivia, along the base of the eastern Andes (Fig. 15).

Specimens Examined. 22♂, 7♀.

COLOMBIA: Putumayo, Puerto Umbría 1♂ MNHN. ECUADOR: Sucumbíos, La Selva Lodge, Garzacochoa, Río Napo 1♂ PJD; Orellana, Estación Científica Yasuní, middle Río Tiputini 1♂ DA; Morona-Santiago, 25 km south of Santiago de Méndez 1♂ RCB; 1♀ DA. PERU: Loreto, Yurimaguas 1♂ MNHN; 1♂ ZMHU; 1♂*, 1♀ SMF; Amazonas, Río Santiago 1♂ AMNH; San Martín, Tarapoto 1♂ MNHN; Chazuta 5♂, 1♀ MNHN; Pasco, Río Pachitea 1♂ ZSM. BOLIVIA: La Paz, Río Suapi 1♀ ZMHU; Beni, 5 km north of Rurrenabaque 1♂ BPH; Santa Cruz, Buena Vista 2♂*, 2♀* BMNH; 1♂ MNHN; Santa Cruz 1♂* AMNH; 17° 46' 55" S 63° 05' 34" W 1♂* USNM; No locality data 1♂ ZSM. Mislabelled: Rio de Janeiro, S.E. Brazil 1♀* USNM.

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