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A revision of the new riodinid butterfly genus *Pseudotinea* (Lepidoptera: Riodinidae)

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A revision of the new South American riodinid genus *Pseudotinea* is presented that includes taxonomic and ecological notes, distributional data and illustrations of adults and genital structures for all species. The systematic position of *Pseudotinea* within the Riodinidae, its ecology and biogeography are discussed. Five species are recognized: *volcanicus* Callaghan and Salazar, *hemis* Schaus and *caprina* Hewitson are transferred from *Calydna* (comb. n.) and two new species, *P. eiselei* and *P. gagarini*, are described here. The genus is confined to the Andes and south-east Brazil where all species are very rare and many endangered.

KEYWORDS: biogeography, *Calydna*, conservation, morphology.

Introduction

The Riodinidae, an almost exclusively Neotropical butterfly family of approximately 1300 species, exhibits perhaps the most kaleidoscopic array of wing shapes and patterns of any lepidopteran group (Seitz, 1916–20; d'Abrera, 1994), as well as fascinating adult and early stage biology (Bates, 1859; Callaghan, 1983; DeVries, 1990, 1991, 1997; Hall, 1999b), yet has received relatively little systematic attention. After the earliest attempts at a higher classification of the family by Bates (1868) and Stichel (1910–11, 1930–31), a reasonably stable and widely accepted classification was eventually established by Harvey (1987). However, cladistically derived phylogenies have only very recently been generated for the family (Hall, 1998, 1999a, 2002; Penz and DeVries, 1999; Hall and Harvey, 2001a, 2001b; Harvey and Hall, 2002), and the monophyly of almost all taxonomic categories has never been critically assessed.

This paper presents a revision of a small new riodinid genus whose strikingly moth-like members are extremely rare, only one of them having been described before the 20th century, and occupy an unusual geographic range in peripheral regions of South America, where their habitat is severely threatened.

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Methods

Dissections were made using standard techniques, abdomens being soaked in hot 10% potassium hydroxide (KOH) solution for approximately 5 min, and subsequently stored in glycerol. The terminology for male and female genital and abdominal structures follows Klots (1956) and Eliot (1973), while nomenclature for wing venation follows Comstock and Needham (1918).

Pseudotinea species were collected in Colombia, Ecuador and Brazil by the authors, and all of the collections listed in Hall (1999b) were examined for *Pseudotinea* material, but the following, whose acronyms are used throughout the text, were the only ones found to contain specimens: BMNH, The Natural History Museum, London, England; CJC, Collection of Curtis J. Callaghan, Bogotá, Colombia; DA, Collection of David Ahrenholz, St Paul, MN, USA; JHKW, Collection of Jason P. W. Hall and Keith R. Willmott, Washington, DC, USA; MNRJ, Museu Nacional, Rio de Janeiro, Brazil; MUNB, Museo de la Universidad Nacional, Bogotá, Colombia; SMF, Senckenberg Museum, Frankfurt, Germany; UFP, Departamento de Zoologia da Universidade Federal do Paraná, Curitiba, Brazil; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; ZMHU, Zoologisches Museum für Naturkunde, Humboldt Universität, Berlin, Germany.

Revision of *Pseudotinea*

Pseudotinea Hall and Callaghan, gen. n.
(figures 1–13)

Type species

Calydna volcanicus Callaghan and Salazar, 1997: 57–61.

Etymology

The name is derived from the Greek ‘pseudo’, meaning ‘false’ or ‘similar to’, and the Latin ‘tinea’, meaning ‘moth’, in reference to the moth-like appearance of these riodinids.

Diagnosis

The members of *Pseudotinea* somewhat resemble certain species currently treated in the genera *Adelotypa* Warren and *Petrocerus* Callaghan and even certain moth species, such as those in the Neotropical family Hedylidae (argued by Scoble (1986) to belong in the Papilionoidea) (see Scoble, 1990, 1998). However, the characteristic elongate and scalloped wing shape of the genus *Pseudotinea* is not found elsewhere in the Riodinidae, although such pronounced scalloping alone is found in the unrelated monotypic riodinine genus *Amphiselenis* Staudinger. The combination of long labial palpi, a narrow and elongate abdomen and a mottled moth-like ventral surface is also diagnostic. The male genitalia are interspecifically rather homogeneous, but present a distinctive phenotype for the family. Male genital synapomorphies for the genus include the shape of the valvae and aedeagus, the latter having a very large posterior aperture and narrow, elongate, upwardly curved tip, and the presence of two distinctive aedeagal cornuti, a large and elongate, heavily sclerotized serrate right-hand one, and a rounded left-hand one covered in swirls of variably sized spines (see figures 7–10).

FIG. 1–5. (1) *Pseudotinea volcanicus* (Callaghan and Salazar, 1997), Ecuadorian ♂ [JHKW]: (A) dorsal surface; (B) ventral surface. Colombian ♀ [CJC]: (C) dorsal surface; (D) ventral surface. (2) *P. eiselei* Callaghan and Hall sp. n., holotype ♀ [AME]: (A) dorsal surface; (B) ventral surface. (3) *P. gagarini* Callaghan and Hall sp. n., holotype ♂ [MNRJ]: (A) dorsal surface; (B) ventral surface. (4) *P. hemis* (Schaus, 1927), holotype ♂ [USNM]: (A) dorsal surface; (B) ventral surface. Brazilian ♀ [ZMHU]: (C) dorsal surface; (D) ventral surface. (5) *P. caprina* (Hewitson, 1859), syntype ♂ [BMNH]: (A) dorsal surface; (B) ventral surface.

Description

Male

Fore wing length: 10.5–18 mm.

Wing shape. Both wings somewhat elongate; fore wing costa straight, fore wing distal margin variably scalloped and produced into points at middle of cells Cu1

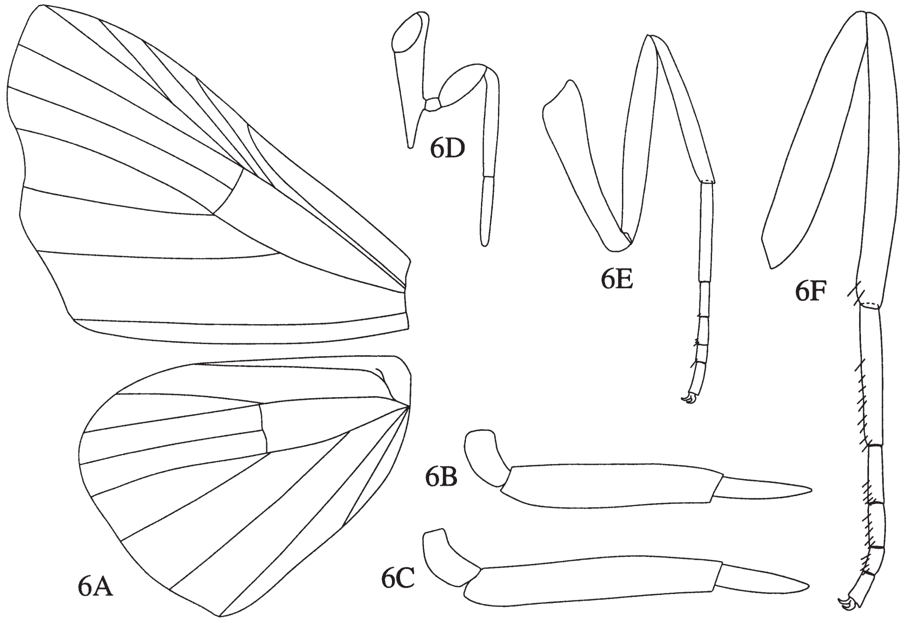

FIG. 6. Morphology. *Pseudotinea volcanicus*: (A) male venation; (B) male palpus; (C) female palpus; (D) male fore leg; (E) female fore leg; (F) male hind leg.

and M2, creating variably falcate apex. Hind wing distal margin variably scalloped and produced into points at middle of cells Cu1 and M2.

Venation (figure 6A). Four fore wing radial veins.

Dorsal surface. Ground colour of both wings shades of brown to black; a variably sized orange or white postdiscal patch typically present on fore wing, extending from vein 2A or Cu2 to vein M2; all species have three evenly spaced darker brown marks in discal cell of fore wing, one marking cell end, and two towards base of cell Cu2, faint column of disjointed postdiscal spots sometimes present; distal fringe brown with pale brown to white scaling in cells Cu2, M1 and M3 to R4+5. Hind wing same as fore wing except orange postdiscal patch in same cell spaces only occasionally present; white scaling at distal fringe not present in apex.

Ventral surface. Fore wing ground colour brown mottled with paler brown and grey scaling; basal dark brown spots and postdiscal patch as on dorsal surface but latter paler if orange; small white flecks variably prominent along costal margin, apex or entire submargin paler brown, grey or dirty white, distal margin dark brown; submarginal black or dark brown spots variably prominent and sometimes only patchily discernible. Hind wing same as fore wing except dark brown square often visible above discal cell, postdiscal dark brown markings typically more extensive, often with pale grey scaling distally at anal margin extending variable distance to costa, dorsal postdiscal patch typically not visible.

Head. Labial palpi typically brown on dorsal surface and grey on ventral surface, second and third segments elongate (figure 6B); eyes brown and bare, cream or pale brown scaling at margins; frons brown typically with grey-brown at margins; antennal length approximately 60% of fore wing length, segments brown with prominent white scaling at base, narrow disjointed nudum line along ventral inner margin of shaft; clubs long and flat, dorsal surface brown, ventral surface brown or grey-brown.

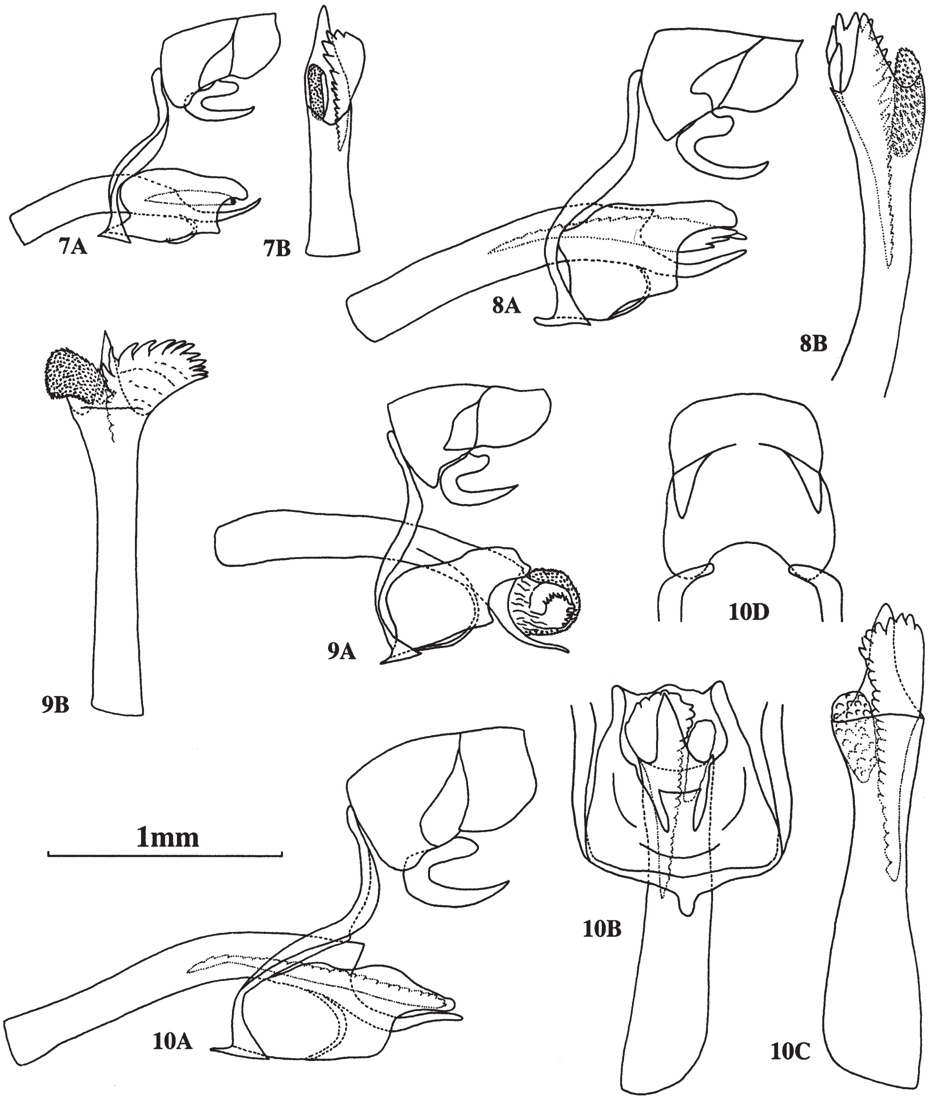

FIG. 7–10. Male genitalia. (7) *Pseudotinea volcanicus*, (A) lateral view; (B) dorsal view of aedeagus. (8) *P. gagarini*, (A) lateral view; (B) ventral view of aedeagus. (9) *P. hemis*, (A) lateral view; (B) dorsal view of aedeagus with vesica partially everted. (10) *P. caprina*, (A) lateral view; (B) ventral view; (C) dorsal view of aedeagus; (D) dorsal view of uncus.

Body. Dorsal surface of thorax and abdomen brown, ventral surface dirty dark grey; legs shades of brown; tarsus of fore leg unimerous, coxa relatively short (figure 6D); mid leg and hind leg with a tibial spur and a group of spines at inner distal tip of tibia and tarsal segments one to four, several further spines along inner distal margin of first tarsal segment (figure 6F).

Genitalia (figures 7–10). Uncus rectangular with rounded ventral posterior margin, separated from triangular tegumen by triangular lightly sclerotized lateral fenestration; vinculum 'S'-shaped and slightly broader at middle, often folded over

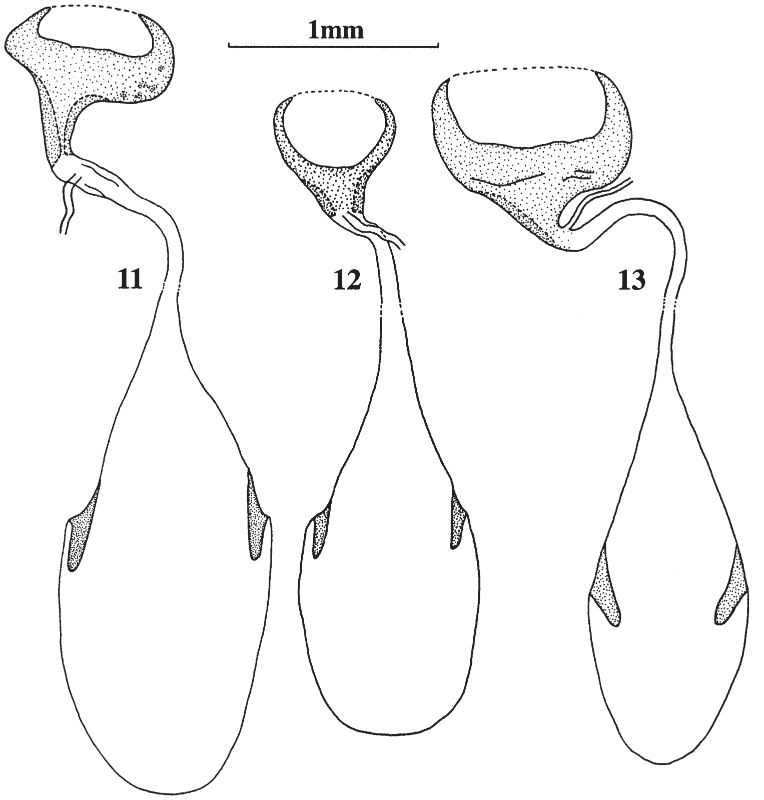

FIG. 11–13. Female genitalia in dorsal view. (11) *Pseudotinea volcanicus*. (12) *P. eiselei*. (13) *P. hemis*.

in upper two-thirds, produced into small saccus ventrally with triangular posterior section, incomplete dorsally (i.e. not present around anterior margin of tegumen); valvae with angular lower posterior corner, variably bulbous ventral margin and variably short projection from upper posterior corner, joined dorsally by soft tissue; aedeagus of approximately even width with ventral bulge towards tip, large dorsal opening posteriorly, ventral tip narrow and elongate, containing one elongate heavily sclerotized triangular structure at right with pointed or rounded teeth at tip and along left side (becomes dorsoventrally expanded and directed to right when vesica is everted), and one rounded lightly sclerotized structure at left covered with variably sized spines (becomes inflated with spines forming a left and anteriorly directed swirl when vesica is everted); pedicel broad and strap-like.

Female

Differs from male in following ways: fore wing length 12–14.5 mm (females not known for largest species).

Wing shape. Both wings more rounded and not as elongate; distal fore wing margin pronouncedly more scalloped in species where male does not have markedly scalloped distal margin.

Dorsal surface. Ground colour of both wings paler brown; orange postdiscal wing patches present in all known females even when absent in males, typically more extensive both distally and proximally, in one species (*eiselei*) extending to wing bases.

Ventral surface. Ground colour of both wings slightly paler.

Head. Second palpal segment more elongate (figure 6C).

Body. Fore leg with one or two small spines at inner distal tip of tarsal segments two and three, two long spines on segment four (figure 6E).

Genitalia (figures 11–13). Corpus bursae ovoid, signa small peg-like sclerotized invaginations with small aperture, ductus bursae and ductus seminalis, which joins former at entrance to ostium bursae, unsclerotized, ostium bursae broad and 'U'-shaped with no sclerotization dorsally.

Systematic position

The taxa *caprina*, *hemis* and *volcanicus* were all described in the genus *Calydna* Doubleday (Hewitson, 1859; Schaus, 1927; Bridges, 1994; Callaghan and Salazar, 1997), and the first two of these were treated in the 'Hiriiformes' species-group (cohors) of *Calydna* by Stichel (1930). However, *Calydna* and its relatives are being revised by the first author, and the wing shape and pattern, and male genital characters outlined in the Diagnosis clearly distinguish the aforementioned group of species from the type species of *Calydna* (*thersander* Stoll) and its relatives, and all other genera, necessitating the description of a new genus, *Pseudotinea*, for them and two further species described below.

The wing pattern elements of *Pseudotinea* species are so heavily modified compared to the typical riodinid ground plan that such characters are useless in helping to identify close relatives. By virtue of possessing a pedicel connecting the aedeagus to the base of the valvae, *Pseudotinea* can be placed in the subfamily Riodininae (Harvey, 1987). However, the genus does not possess any of the synapomorphies defining the nine currently recognized riodinine tribes (*sensu* Harvey, 1987, and Hall, 1998, 1999b) and thus we tentatively place it for now in the paraphyletic *incertae sedis* section (four fore wing radial veins) of Harvey (1987). The male (and in many cases female) genitalia of all genera and species groups in the aforementioned *incertae sedis* section have been examined. However, only those of *Calydna punctata* C. and R. Felder and *C. chaseba* Hewitson approximate those of *Pseudotinea* species, and then only to a limited degree in the arrangement of aedeagal cornuti. Morphologically, the members of *Pseudotinea* differ from those of all other genera in the *incertae sedis* section by possessing an incomplete vinculum dorsally at the anterior margin of the tegumen and long labial palpi, characters prevalent in many members of the Nymphidiini (e.g. see Stichel, 1910–11; Hall, 1999a, 1999b). While we conservatively place *Pseudotinea* in the *incertae sedis* section (4 FRV) of Harvey (1987), we suspect that it may eventually be found to belong in the Nymphidiini.

Biology

Pseudotinea species are known to occur across a wide range of elevations (600–2100 m) and habitats, from the ecotone of lowland rainforest and lower premontane forest to open montane scrub. Available information suggests that *Pseudotinea* species are typically encountered in open areas such as clear hilltops and hillsides, and even in areas that have been disturbed by man, such as plantations. At present, two species are known from the Andes and three from the mountains of south-east Brazil. The often very restricted ranges of *Pseudotinea* species suggest that there are probably further undescribed species, and raise concerns about their conservation status. Given the great rarity of all species, which are collectively only represented by approximately 35 specimens in collections (mostly *P. volcanicus*), their restricted ranges, and the devastatingly rapid rate of deforestation in their mid-elevation Andean and south-east Brazilian habitats (Myers, 1988; Brown, 1991; Brown and Brown, 1992; Dinerstein *et al.*, 1995; Myers *et al.*, 2000), most species should be considered 'Vulnerable' or even 'Endangered' under the Red Data Book categories of the International Union for the Conservation of Nature and Natural Resources (IUCN) (e.g. see Collins and Morris, 1995). Two of the south-east Brazilian species have not been seen in the last 50 years.

Males have been encountered as solitary individuals or in small groups perching in the afternoon from 12.00 to 3.20 p.m. on top of the leaves of low bushes with their wings outspread. Their flight is slow with a rapid wing beat when not disturbed, but can become rapid when males are involved in aerial whirling. The more rarely encountered females have been found near these male perching areas, and visiting flowers. The slow flight and aposematic dorsal coloration of some species suggests that they may be involved in mimicry with day-flying moths, and, in the case of *Pseudotinea eiselei*, certain lycaenids (Benyamini, 1995). The north Andean species probably flies throughout most of the year, but the southern Andean and south-east Brazilian species have only been encountered during the southern summer months, from September to May.

Distribution

Pseudotinea species occur in the Andean regions of Colombia, Ecuador and Argentina, and the mountains of south-east Brazil (see figure 14), although the genus is very likely to range along the length of the east Andean slope, also occurring in Peru and Bolivia. The centre of diversity lies in south-east Brazil. While a few riodinid genera are endemic to either the Andes or south-east Brazil, no others are solely restricted to both these biogeographic regions. However, a few nymphalid genera (e.g. *Cybdelis* Boisduval) do exhibit such a distribution, and Ebert (1960) was the first entomologist to discuss the biogeographical connection between the south-east Brazilian and Andean butterfly faunas, one that has also been shown to exist in several other groups of organisms, including birds (Sick, 1985) and plants (Smith, 1962). Smith (1962) hypothesized that the Andes of modern-day northern Argentina and the mountains of south-east Brazil (around 27°S) were floristically connected during Pleistocene glaciations, allowing a temporary flow of the fauna and flora from one region to the other. The evidence from plants and birds (Smith, 1962; Sick, 1985) suggests that this flow was mainly from the Andes to south-east Brazil.

Since only a few specimens of each *Pseudotinea* species are known, our understanding of their geographic ranges is poor. No two species have thus far been collected sympatrically, but *P. caprina* and *P. gagarini* (described below) do have overlapping distributions.

Pseudotinea volcanicus (Callaghan and Salazar, 1997) comb. n.
(figures 1A–D, 6A–F, 7A, B, 11)

Calydna volcanicus Callaghan and Salazar, 1997: 57–61. Type locality: Cerro Aguacatal, Caldas, Colombia. Holotype ♂ MUNB [examined].

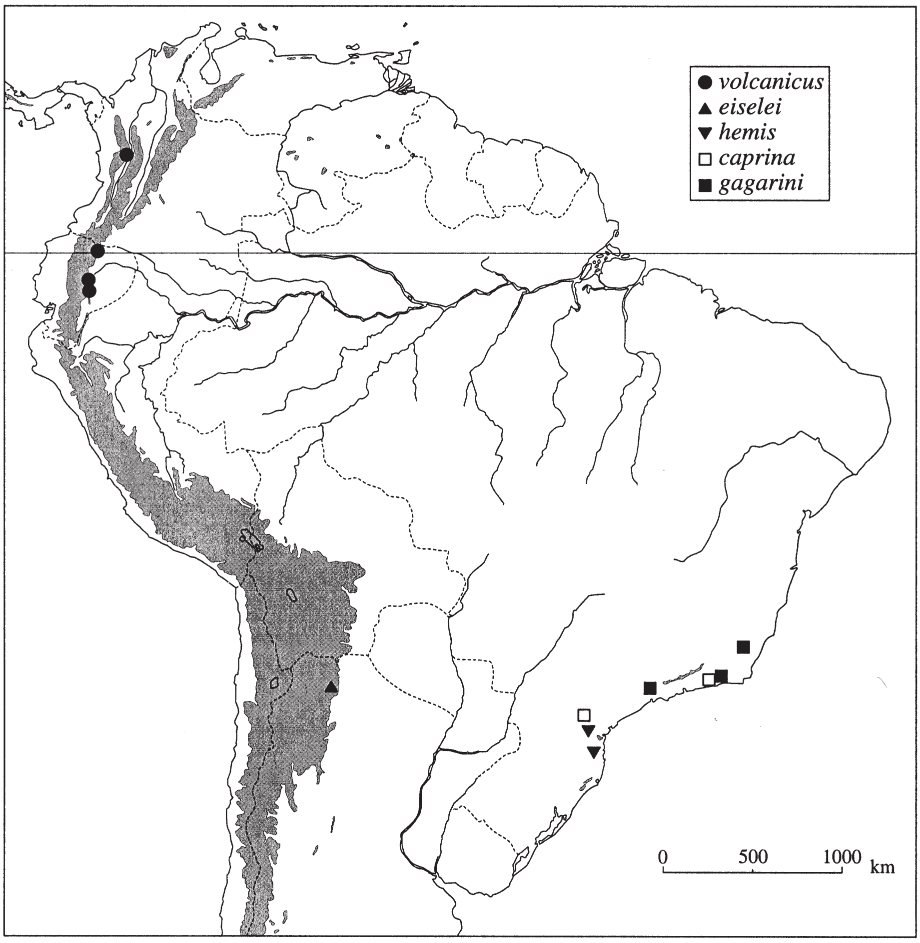

FIG. 14. A map of South America illustrating the distribution of *Pseudotinea* species.

Identification and taxonomy

Average FW length: male 12 mm, female 13 mm. The male of *P. volcanicus* is readily identified by its more weakly scalloped distal wing margins, pale brown-cream instead of bright white distal fringe elements, typically uniform brown dorsal surface and pale mottled brown ventral surface that lacks any prominent pale or dark transverse bands on the hind wing. Some specimens have faint postdiscal orange scaling on the fore wing, but in specimens from a locality in north-east Ecuador this is more prominent. The male genitalia have a slightly shorter, downwardly rounded upper projection to the valvae, and a slightly shorter right-hand aedeagal cornutus. Typical females are similar to those of *P. hemis*, but do not have orange extending to the costa on the fore wing nor a prominent whitish postdiscal band on the ventral hind wing. Females from a population in north-east Ecuador have more extensive fore wing orange than the figured individual and no hind wing orange. The female genitalia of the three species examined, *volcanicus*, *eiselei* and *hemis*, differ slightly in the shape of the signa and ostium bursae, but with so few specimens to examine it is not possible to conclude whether these differences represent intra-or interspecific variation.

Biology

Pseudotinea volcanicus has been encountered between 600 and 950 m in Ecuador, at the ecotone of lowland rainforest and lower premontane forest, and at 1300 m in Colombia, in premontane habitat. In Colombia, males were found perching on the upper leaf surface of low bushes with their wings outspread, in a deep canyon and along the trails of a shaded coffee plantation from 12.00 to 2.00 p.m.; females were encountered in the same areas visiting flowers (Callaghan and Salazar, 1997). In central Ecuador, solitary males were encountered in a large forest lightgap beside a stream that was under partial cultivation with various small fruit and coffee trees, between 1.40 and 3.20 p.m., flying 5–6 m above the ground with a slow flight but very rapid wing beat. In north Ecuador, males were encountered perching in small groups along the shaded forest edge of a prominent hilltop from 12.45 to 2.45 p.m., where they would incessantly 'patrol' up and down a short stretch of several metres. Their flight was typically slow and fluttering, but became rapid when they engaged with conspecific males in spiralling aerial chases. Solitary females were found flying slowly in the understorey and along the forest edge between 8.30 a.m. and 12.00 p.m.. Although the species was relatively abundant at the north Ecuadorian locality in the wet month of August, during an extended return visit in the drier month of March, no individuals were seen, suggesting the species may be seasonal.

Distribution

This species was recently simultaneously discovered on the eastern slope of the western cordillera in Colombia and at the base of the eastern Andes in Ecuador (see figure 14). It probably also occurs in the Andes of Peru.

Specimens examined

Colombia: Caldas, Cerro Aguacatal and Cerro Clavijo, nr Ríosucio (April, July) 7♂, 2♀ MUNB (+distributed among CJC and collections of J. LeCrom, E. Schmidt-Mumm and the Museo de Historia Natural, Universidad de Caldas, Colombia). **Ecuador**: Sucumbíos, Cerro Lumbaquí Norte, above Lumbaquí (August) 6♂, 2♀ JHKW; 1♂ MECN (Museo de Ciencias Naturales, Quito, Ecuador); Napo, Pimpilala, nr Tena (August, September) 2♂ JHKW; Pastaza, km 42 Puyo-Arajuno rd (September) 1♀ DA.

Pseudotinea eiselei Callaghan and Hall, sp. n.
(figures 2A, B, 12)

Description

Female

Fore wing length: 12 mm.

Wing shape and pattern. See figure 2A, B.

Head. Labial palpi brown, second and third segments elongate; eyes brown and bare, cream scaling at margins; frons brown with pale brown at margins; antennal length approximately 60% of fore wing length, segments brown with prominent white scaling at base, clubs brown, long and flat.

Body. Dorsal surface of thorax and abdomen brown, ventral surface dirty grey; legs brown with some white scaling.

Genitalia (figure 12). Papillae anales blade-like, rounded and setose with a small point dorsally between lobes; ostium bursae not sclerotized dorsally, ductus seminalis joins ductus bursae near ostium bursae; corpus bursae round with two small, peg-like signa.

Male

Unknown.

Types

Holotype: ♀, **Argentina**: Jujuy, Río Lozano, Morro de Alizar, 2100 m, 31 January 1970 (R. Eisele) (to be deposited in the Allyn Museum of Entomology, Sarasota, FL, USA).

Etymology

This species is named for its discoverer, Rev. Robert Eisele.

Diagnosis

The female of *Pseudotinea eiselei* sp. n. is similar to those of *P. volcanicus* and *P. hemis*, and will also undoubtedly be similar to the female of *P. gagarini*, but dorsal orange extends from the wing base to the submargin on both wings instead of being confined to the postdiscal area, and there are no submarginal orange crescents on the dorsal hind wing. On the ventral surface, *P. eiselei* differs by having larger dark brown spots on the fore wing, no submarginal spots on both wings, a more uniform brown ventral ground colour without prominent paler flecking, and an entirely brown distal fore wing fringe. The female genitalia of *P. eiselei* do not differ significantly from those of the other known females, *P. volcanicus* and *P. hemis*.

Biology

Since *P. eiselei* is known only from the unique female holotype, no additional specimens having been discovered during searches of the Tucumán and other Argentine museums, little is known about its biology, except that the holotype was captured in open ‘campo’ habitat at 2100 m (R. Eisele, personal communication). This is the highest recorded altitude for any species in the genus. Interestingly, the aposematic orange dorsal pattern and cryptic mottled brown ventral surface of *P. eiselei* are very similar to those of many Andean Argentine and Chilean lycaenids, especially females, in the thecline genus *Strymon* Hübner and the polyommatine genus *Pseudolucia* Nabokov (e.g. see d’Abrera, 1995; Benyamini and Johnson, 1995; Peña and Ugarte, 1996). Benyamini (1995) hypothesizes that the common lycaenid *Pseudolucia chilensis* (Blanchard), which flies in Chile at altitudes up to 3000 m, might be unpalatable, since its larvae feed on *Cuscuta* parasites (Convolvulaceae) of *Colliguaja odorifera* (Euphorbiaceae) which contain toxic alkaloids (Horvat *et al.*, 1973; Wink and Witte, 1993; Benyamini, 1995), and therefore act as a mimetic model for other sympatric lycaenids, and certain Satyrinae and geometrid moths (Larentiinae and Ennominae). It seems likely that *P. eiselei* is also part of the aforementioned mimicry ring, although the toxic model in northern Argentina is certainly different, and it is perhaps the great similarity in flight of *P. eiselei* to common sympatric lycaenids that has led to its being overlooked in the past.

Distribution

This species is currently known only from the type locality in northern Argentina, but it may also occur in southern Bolivia (see figure 14).

Pseudotinea gagarini Callaghan and Hall, sp. n.
(figures 3A, B, 8A, B)

Description

Male

Fore wing length 15 mm.

Wing shape and pattern. See figure 3A, B.

Head. Labial palpi brown on dorsal surface and ventral surface of segment three, ventral surface of segment two grey, second and third segments elongate; eyes brown and bare, cream scaling at margins; frons brown with grey-brown at margins; antennal length approximately 60% of fore wing length, segments brown with prominent white scaling at base; clubs long and flat, dorsal surface brown, ventral surface grey-brown.

Body. Dorsal surface of thorax and abdomen brown, ventral surface dirty dark grey; legs pale brown.

Genitalia (figure 8A, B). Uncus rectangular; vinculum narrow, 'S'-shaped and slightly wider medially, produced into tiny saccus ventrally with triangular posterior section; valvae with rounded right-angled lower posterior corner, bulbous ventral margin and relatively long angular projection from upper posterior corner; posteriorly aedeagus has large dorsal opening, ventral tip narrow and elongate, aedeagus contains one elongate sclerotized triangular structure at right with pointed teeth at tip and along left side, and one rounded lightly sclerotized structure at left with spiny surface; pedicel narrow and strap-like.

Female

Unknown.

Types

HOLOTYPE: ♂, **Brazil**, Rio de Janeiro, Independencia, Petrópolis, 900 m, 16 February 1936 (Gagarin) (MNRJ).

PARATYPES: 1♂, same data as HT. 1♂, same locality data as HT, 9 December 1936 (Gagarin) (MNRJ). 1♂, same locality data as HT, 17 November 1936 (Gagarin) (MNRJ). 1♂, same data as HT, November (Gagarin) (CJC). 1♂, Espírito Santo, Fazenda Jerusalem, 14 September 1912 (MNRJ).

Etymology

This species is named in memory of Paulo Gagarin, who formed an important collection of Brazilian butterflies during the early part of the 20th century, including most of the type series.

Diagnosis

The male of *Pseudotinea gagarini* sp. n. is similar only to that of *P. hemis*, but it has considerably broader orange patches on the dorsal and ventral fore wing and dorsal hind wing, less prominent submarginal spots on both ventral wings, a prominent diagonal black postdiscal band on the hind wing, with whitish scaling distally that is restricted to the anal half of the wing, and lacks a dark brown patch in the apex of the ventral hind wing. The upper portion of the valvae of the male genitalia is elongate, as in *P. caprina*, although the uncus is produced into a small blunt point dorsally.

Pseudotinea gagarini apparently exhibits some geographic variation in wing pattern. The specimen figured by Brown (1992) from São Paulo state has a more yellowish brown ventral ground colour than the illustrated holotype with more strongly contrasted black pattern elements, especially on the fore wing; the fore wing postdiscal black band is separated into anal and costal elements and there is a prominent black square at the distal margin of cell Cu1, and the basal hind wing band is more clearly divided into basal and costal spots.

Biology

This very rare species has been encountered only in coastal mountainous regions between 900 and 1100 m, predominantly on hilltops. The vegetation in these sites is subtropical, ranging from semi-deciduous mesophytic forest in Serra do Japi (Leitão-Filho, 1992) to wetter forest at the type locality, where there are abundant tree ferns and *Chusquea* bamboo. Since *P. gagarini* partially inhabits seasonal forest, like other riodinids in this region it is probably most abundant during the southern summer months and perhaps absent during the coldest and driest months; it has been recorded from September to February. The type locality has now been encroached upon by a shanty town and is practically devoid of natural vegetation, and no specimens of *P. gagarini* were found there on numerous visits by the second author. Although *P. gagarini* is present in the heavily forested Serra do Japi, this area is not officially protected (Joly, 1992), and thus this species, like all those in this genus from south-east Brazil, must be regarded as highly vulnerable to extinction.

Distribution

This species is only known from a small area in the south-east Brazilian states of Espírito Santo, Rio de Janeiro and São Paulo (see figure 14). In addition to the type series, Brown (1992, 1993) illustrates recently collected specimens from Serra do Japi, near Jundiaí, in São Paulo state. The species may also occur in the Serra da Mantiqueira in southern Minas Gerais state.

Pseudotinea hemis (Schaus, 1927) comb. n.

(figures 4A–D, 9A, B, 13)

Calydna hemis Schaus, 1927: 73. Type locality: Santa Catarina, Brazil. Holotype ♂ USNM [examined].

Identification and taxonomy

Average FW length, both sexes: 14.5 mm. Male *Pseudotinea hemis* closely resembles only *P. gagarini*, but its postdiscal orange patches on both dorsal wing surfaces are considerably narrower, that on the fore wing being divided in cell Cu2, it has a prominent postdiscal whitish band on the ventral hind wing that extends from the costal to anal margin without a continuous black band proximally, and it has more prominent submarginal spots on both ventral wing surfaces. As the female of *P. gagarini* is unknown, female *P. hemis* most closely resembles that of *P. volcanicus*. It differs on the dorsal surface by having fore wing postdiscal orange that extends to the costa, and on the ventral surface by having the same prominent postdiscal whitish band on the hind wing as the male.

The female *P. hemis* specimen in the ZMHU bears Stichel's manuscript label 'bombax', but the specimen was not collected until 1930, shortly before his death, and he clearly never had time to publish the name.

Biology

Nothing is known about the biology of this very rare species. Given its rarity and restricted range, and the human threat to its habitat, *P. hemis* must be considered vulnerable in conservation terms.

Distribution

This species is only known from the coastal Serra do Mar range in Paraná and Santa Catarina states in south-east Brazil (see figure 14). However, it should be looked for in the Serra do Mar of Rio Grande do Sul state to the south, and in the inland Serra Geral range of Santa Catarina and Paraná states.

Specimens examined

Brazil: Paraná, Lapa, 1♂ SMF; Santa Catarina, Blumenau, Rio Lacisz (December), 1♀ ZMHU; No specific locality, 1♂ USNM.

Pseudotinea caprina (Hewitson, 1859) comb. n.

(figures 5A, B, 10A–D)

Calydna caprina Hewitson, 1859: 93. Type locality: Brazil. Syntype ♂ BMNH [examined].

Identification and taxonomy

Average FW length: male 17.5 mm. *Pseudotinea caprina* is a highly distinctive species known only from males. Its ventral surface is most similar to those of the two other south-east Brazilian species, *P. hemis* and *P. gagarini*, but there are no prominently continuous pale or dark transverse bands on the hind wing, and the fore wing ground colour is predominantly a darker brown. *Pseudotinea caprina* is instantly recognizable on the dorsal surface by the single white postdiscal patch on the fore wing. The male genitalia are perhaps most similar to *P. gagarini*, but the right-hand aedeagal cornutus is flat instead of rolled, with shorter more closely spaced serrations, and the left-hand one has fewer, larger and more rounded spines.

Pseudotinea caprina superficially resembles *Pachythone robusta* Lathy (*incertae sedis* section [four fore wing radial veins]), from Mato Grosso, Brazil, but this species has even distal margins on both wings, with a pointed hind wing, a falcate fore wing apex, and a concave fore wing costa; the white patch on the dorsal fore wing is positioned more distally and slightly closer to the costal margin, and the ventral surface is more uniformly patterned without such large white blotches. The sympatric *Lepricornis atricolor* Butler (Riodinini), has an identical dorsal wing pattern to *P. caprina* except for variably prominent interneural white rays at the wing bases, but its ventral pattern is the same as that of the dorsal surface and the distal wing margins are not scalloped.

Biology

Nothing is known about the biology of this very rare species, but the occurrence of several sympatric species with very similar black and white dorsal wing patterns, including species in the genera *Riodina* Westwood, *Melanis* Hübner and *Lepricornis* C. and R. Felder (all Riodinini) (see d'Abrera, 1994), suggests that it may be involved in a mimetic relationship with these species. *Pseudotinea caprina* is another south-east Brazil endemic that should be considered vulnerable in conservation terms.

Distribution

This species is currently only known from the Serra do Paranapiacaba region of eastern Paraná state and from central Rio de Janeiro state in south-east Brazil (see figure 14). This distribution suggests that it should also be found in mountainous areas such as the Serra do Mar in intervening São Paulo state and perhaps also southern Minas Gerais state. Within Paraná state it should also be looked for in the Serra Geral further inland, which also extends into northern Santa Catarina state to the south.

Specimens examined

Brazil: Rio de Janeiro, Paineiras (May), 1♂ UFP; Paraná, Castro, 2♂ BMNH; no locality data, 1♂ BMNH.

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