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A re-evaluation of the *Aricoris constantius* group with the recognition of three species (Lepidoptera: Riodinidae)

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ABSTRACT. Material currently classified under the name *Aricoris constantius* (Fabricius, 1793) is examined and found to consist of three distinct species inhabiting southeastern and central Brazil, from the Brazilian state of Bahia to Paraguay. They are *A. constantius*, *A. tutana* (Godart, [1824]), reinstated status and *A. monotona* (Stichel, 1910), reinstated status, the latter two removed from synonymy. Besides significant morphological differences in wing pattern and genitalia, their status as separate species is supported by their overlapping ranges where each phenotype is sympatric with at least one other, with no evidence of hybridization. Notes are provided on the habitat in open formations, range and distribution in south eastern Brasil, and biology, including evidence of mymecophily.

KEY WORDS. Brazil; biology; distribution; Paraguay; Planalto Central.

Aricoris Westwood, 1851 has had a long and tortuous history. Described with *Aricoris tisiphone* Westwood, 1851 as the type species, the genus soon became a catchall for many other unrelated riodinid butterflies. Stichel (1911) moved most of the taxa to *Orimba* Herrich-Schäffer, [1853], except for a handful of taxa related to *A. tisiphone*. Hemming (1967) found *Orimba* to be a *nomen nudum* and so the taxa concerned were transferred to the next available genus, *Setabis* Westwood, 1851, where they reside today.

Of the taxa remaining in *Aricoris* – *A. tutana* (Godart, [1824]), *A. tisiphone* Westwood, 1851, and *A. bahiana* C. Felder & R. Felder, 1865 – Stichel (1910) considered *A. tisiphone* and *A. bahiana* as synonyms of "*tutana*", as illustrated in Seitz (1916). In addition, Stichel (1910) described *A. monotona* (Stichel, 1910) (*Melanope*) as a species in the same group, similar to *A. tutana*. *Papilio constantius* Fabricius, 1793, the correct name for the illustration of Seitz, was treated by Stichel (1910) as a *spec. dub.* in *Eurybia* [Illiger], 1807. There the situation remained for nearly 90 years.

The subject was opened again in the first cladistic analysis of *Aricoris* and related genera by Penz & DeVries (1999). A specimen of *A. constantius* (as *A. tutana*) was illustrated. Their conclusion was that *Aricoris* along with *Audre* Hemming, 1934, *Eiseleia* Miller & Miller, 1972 and *Ematurgina* Röber, 1903 formed a monophyletic group. This was followed by a second cladistic analysis of the same genera by Hall & Harvey (2002). They agreed with Penz & DeVries (1999) in the monophyly of *Aricoris*, *Audre* and *Eiseleia*, minus *Ematurgina*, which they moved to *Synargis* Hubner, [1819]. They then synonymized the three remaining genera under *Aricoris* with *A. constantius* = *A. tisiphone* as the type species. They also synonymized *A. monotona* with *A. constantius*, giving no explanation for this action. The remaining taxa of *Aricoris* (sensu Stichel 1910) were left as synonyms. In the Checklist of Neotropical Lepidoptera – Riodinidae (Callaghan & Lamas 2004), the composition of the genus followed Hall & Harvey (2002), as last revisers.

In this paper, I present evidence that the taxon known as *A. constantius* in fact corresponds to three separate species, differentiated by morphology and biogeography, all inhabiting extra-Amazonian Brazil to Paraguay and Argentina.

MATERIAL AND METHODS

A total of 125 specimens were studied, mainly from the Lepidoptera collection of the Departamento de Zoologia, Universidade Federal do Paraná, Curitiba (DZUP), Muséum National d'Histoire Naturelle, Paris (MNHN), the collections of Coleção Entomológica Padre Jesus Santiago Moure (DZUP), of the author (CJC), and the Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ). Additional data was provided by colleagues at the Universidade Federal do Rio Grande do Sul, and from the literature. Sixteen genitalic dissections were made of both males and females.

TAXONOMY

Aricoris constantius (Fabricius, 1793)

Figs 1, 2, 7, 8

Papilio constantius Fabricius, 1793: 152.

Diagnosis. The characters that separate *A. constantius* from *A. monotona* and *A. tutana* are the nearly uniform marginal row of black spots on both wings, and the discal band of blurred spots of darker scaling, projecting distad along veins M_3 and Cu_1 (Figs 1 and 2). In the male genitalia (Fig. 7), the lobes of

uncus are widely separated with U-shaped space between them, the scaphium is rounded, long with long central sclerotized portion, broadening ventrad, the valvae are long with prominent lateral bulge when viewed ventrad, and turn up sharply anteriorly. The saccus is elongated and uniformly narrow. The female genitalia (Fig. 8) have the tips of interior flange of signa short, rounded, and the invaginated pocket between ostium bursae and papillae anales slightly bifurcated ventrad.

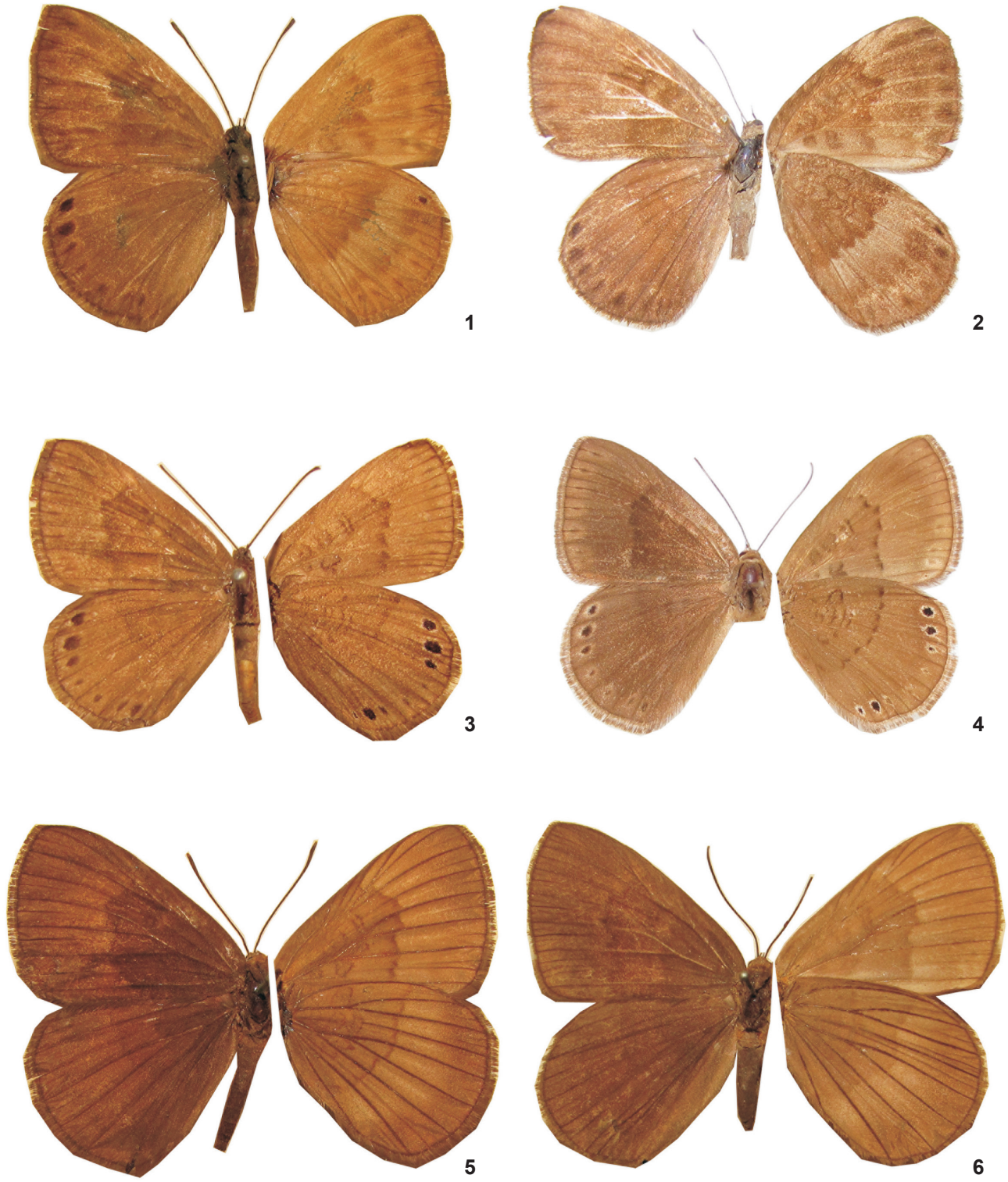
Description. Male (Fig. 1). Average forewing length 23.6 mm, range 22-25 mm (n = 3). Wing shape: forewing costa curved to apex, anal margin straight to tornus, distal margin straight, slightly curved to apex and tornus. Hindwing anal margin slightly curved to tornus, tornus rounded, distal margin and apex curved. Dorsal surface: forewing color uniformly brown with black lines between the veins crossing a faint, blurred row of small uniform marginal black spots, fringe brown with a dark marginal line basally; hindwing uniformly brown with a darker row of uniform marginal black spots and crossed by black lines as on forewing; anal margin a slightly lighter shade, fringe brown. Ventral surface: basal half of forewing dark brown, with three faint irregular spots in the cell and two below; distal half lighter brown containing a faint, irregular area of darker scaling and distally a row of faint marginal spots, the two areas are separated by a jagged discal row of blurred spots of darker scaling, projecting distally along veins M_3 and Cu_1, distal fringe brown, bordered basally with a thin black line; hindwing ground color and markings as on forewing, except that the jagged dark brown postdiscal band separating the two areas is straighter. Head: eyes brown, marginal scaling lighter dirty brown; frons light brown, labial palpi dirty white, proboscis swollen at base, antennal length 55% of forewing length, segments dark brown with some lighter scaling between, nudum along inner ventral margin brown with some white scaling at segments, clubs elongated, black. Body: dorsal surface color of thorax dark brown, collar brown, and abdomen slightly lighter; ventral surface and forelegs, midlegs and hindlegs dirty white. Genitalia (Fig. 7): uncus in lateral view broad, rounded, in ventral view lobes widely separated with U-shaped area between them, nearly reaching the margin of the tegumen; scaphium rounded, long with central sclerotized portion long, broadening ventrad; tegumen short, ventral anterior lobe with sclerotized edge, slightly squared; falces pointed dorsally near uncus; vinculum long, widening slightly in the middle, fused to anterior margin of tegumen. Saccus extending anteroventrally, discontinuous with vinculum, valvae outer portion in lateral view long, narrow, inwardly curved, a lateral bulge turning sharply up anteriorly, valvae anteriorly fused dorsally to opposing valva, valvae in ventral view narrow, elongate, with slightly divergent tips with three socketed spines, dorsal bulge prominent; aedeagus long pointed, uneverted vessica slightly sclerotized at tip, eighth sternite with two separate, slightly sclerotized bands.

Female (Fig. 2). Average forewing length 23.3 mm, range 23-25 mm (n = 3). Wing shape: like male, but with distal margin slightly more rounded. Dorsal surface: forewing color uniformly brown, a lighter shade than male, marginal row of uniform black spots more pronounced. Ventral surface: ground color light brown, with basal half of wing darker, but with same pattern as male. Head: like male, only proboscis not swollen at base. Body: like male, with articulated forelegs. Genitalia (Fig. 8): two elongated invaginated signa pointing to entrance of ductus bursae with tips of interior flange of signa short, rounded, one slightly longer; ductus bursae unsclerotized portion narrow, sclerotized portion cup-shaped, exit of ductus seminalis at base, invaginated pocket between ostium bursae and papillae anales slightly bifurcated caudad.

Material examined. Brazil, *Bahia*: 1 male Bahia, 1928 (MNHN); *Rio de Janeiro*: Itatiaia (Campo Belo, 700 m), 2 females, February (DZUP); Guapimirim, 2 males (DZUP); Angra-Japuiba, 1 male March (DZUP); Teresópolis, 1 male (DZUP); Angra dos Reis (Jussaral), 1 male , March (DZUP); Silva Jardim (BR 101, km 225), 2 males (CJC); *Paraná*: Curitiba, (900 m), 1 female, March (DZUP); Paranaguá, 2 males (DZUP); *Santa Catarina*: Florianópolis (Lagoa do Peri), 2 males March (DZUP); Joinville, 3 males, 1 female (DZUP); 3 males, (CJC); 1 male (MNRJ); Barra do Sul, 2 males March (DZUP).

Distribution and habits. The distribution of *A. constantius* (Fig. 13) is coastal Brazil in the Atlantic Forest east of the Serra do Mar from Santa Catarina state north to Bahia, from sea level to 700 m. It is sympatric with *A. monotona* in Bahia, with no evidence of intergrades, suggesting these two phenotypes are indeed separate species. The habitat is clearings and other open areas, where the original forest cover has been removed. The butterflies fly in the early morning with a satyrid-like flight, resting on leaf and grass ventral surface with wings closed.

Remarks. For many years, this was a lost butterfly. Fabricius' description of *Papilio constantius* was very terse and no illustrations were provided. The type is lost. For nearly 200 years this taxon was thought to belong to *Eurybia* by most authors and finally appeared as such in Stichel (1930) as a *spec. dub.* of that genus. Both Stichel and Seitz (1916) applied the name *tutana* to material from coastal Brazil, a practice that has subsequently been maintained to the present (Penz & DeVries 1999), undoubtedly based on the illustration of *tutana* in Seitz (1916). The breakthrough came with the availability of Jones' Icones, a compilation of illustrations of many of Fabricius' types, particularly those described in his Ent. Syst. (1793) and the Syst. Ent. (1795). The plates were photographed and distributed to specialists and major museums. Among these was the illustration of *Papilio constantius* (Vol. 5(6), pl. L). Although the illustration is not of photographic accuracy, the uniform rows of marginal spots on dorsal surface of both wings and the shape of the dark scaling on the basal half of the wing place it closer to coastal Brazilian material and to the plate of Seitz. *A. constantius* was illustrated in D'Abrera (1994) as the *A. tutana* male. The correct name for this taxon was first applied by Hall & Harvey (2002).



Figures 1-6. *Aricoris constantius* group, adults. (1-2) *A. constantius*: (1) male; (2) female; (3-4) *A. tutana*: (3) male; (4) female; (5-6) *A. monotona*: (5) male; (6) female.

Aricoris tutana (Godart, [1824]), reinstated status

Figs 3, 4, 9, 10, 13

Aricoris tisiphone Westwood, 1851: 450.
Aricoris bahiana C. Felder & R. Felder, 1865: 295.
Erycina tutana (Godart, [1824]): 577.

Diagnosis. *Aricoris tutana* is differentiated from *A. constantius* and *A. monotona* by a row of tiny, sharp marginal spots on forewing, a discal band consisting of an irregular row of dark brown spots, but no significant projection distad, and the hindwing dorsal and ventral surfaces with three prominent submarginal ocelli at apex and one at tornus, ringed with yellow, sometimes a complete row in hindwing of the female (Figs 3 and 4). The lobes of the uncus of the male genitalia (Fig. 9) are widely separated, but with a V-shaped space between them, like *A. monotona*, but unlike *A. constantius*; the scaphium is short, rounded with the central sclerotized portion short. The valvae are long and the lateral bulge not prominent, and the saccus is short and pointed. In the female genitalia (Fig. 10), the tips of interior flange of signa are long and pointed. The base of the sclerotized portion of the ductus bursae is slightly bifurcated, and the invaginated pocket between ostium bursae and papillae anales flat, similar to *A. monotona*, not bifurcated as in *A. constantius*.

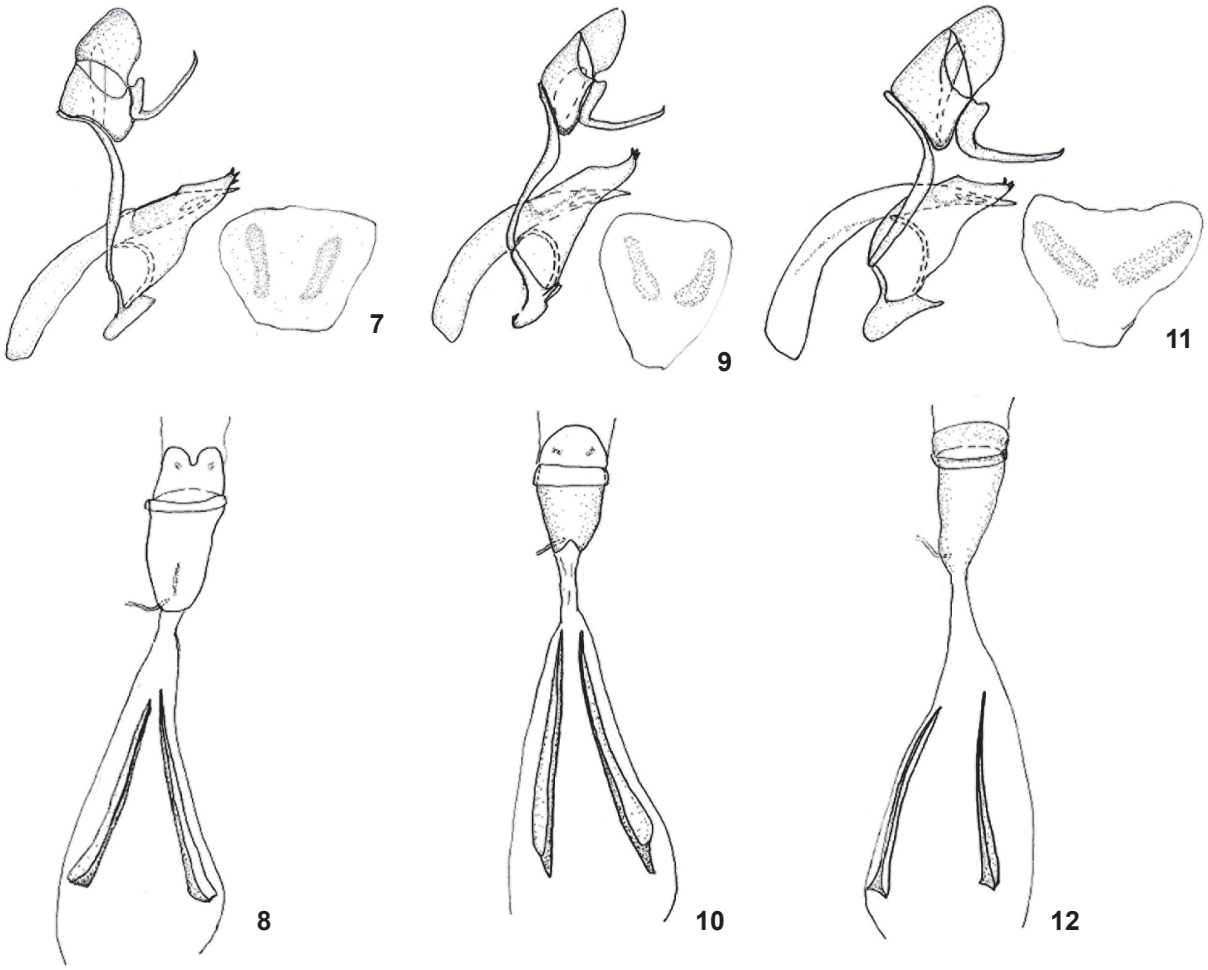
Description. Male (Fig. 3). Forewing length 21 mm (n = 2). Wing shape as in *A. constantius*. Dorsal surface: forewing basal half dark brown, distal half lighter, separated by a dark line, slightly rounded; distally a streak of slightly darker scales between the veins, on some specimens passing through a faint row of tiny, sharp marginal spots. Hindwing basal half only slightly darker than distal half, distal margin with a row of black spots, the first three in cells R_S-M_1, M_1-M_2 and M_2-M_3, and at tornus, larger and darker; fringe brown on both wings, bordered with a fine black line. Ventral surface: forewing ground color light brown, with basal half only slightly darker than distal half, discal cell with three irregular spots and two below; discal band an irregular row of dark brown spots separating lighter and darker areas; between veins a short, thin black streak to the distal margin. Hindwing ground color light brown, basal half of wing with two figures in the cell and two below; discal band separating light and dark disjunct areas, less prominent than on forewing; three prominent ocelli at apex and one at tornus, ringed with cream scales, connected to margin with a black streak; black scales along veins. Head: eyes light brown, marginal scaling black; proboscis black and swollen at base, frons light brown, labial palpi light brown, antennal length 55% of forewing length, segments black, nudum along inner ventral margin with light brown scaling between segments, clubs black, elongated. Body: dorsal surface color of thorax and abdomen dark brown, collar brown; on ventral surface, forelegs, midlegs and hindlegs light brown, abdomen dirty white. Genitalia (Fig. 9): uncus in lateral view short, slightly pointed; in ventral view lobes widely separated, space between them V-shaped; scaphium short, rounded, tegumen short, ventral lobe rounded, sclerotized anteriorly, falces at uncus pointed dorsad; vinculum fused to anterior margin of tegument, saccus narrow, pointed; valvae outer portion in lateral view with tips slightly elongated, valvae anteriorly fused dorsally to opposing valva, valvae in ventral view with posterior dorsal bulge behind tips minimal, as is lateral bulge on valvae; tips with socketed spines; aedeagus long, pointed, uneverted vesica with slightly sclerotized posterior portion, eighth sternite with two slightly sclerotized elongated patches.

Female (Fig. 4). Forewing length 21 mm (n = 2). Wing shape: similar to male with distal margins slightly rounded. Dorsal surface: forewing color and maculation as in male, but lighter, and submarginal row of small spots between the veins more prominent, rarely with marginal ocelli. Hindwing nearly uniformly light brown, distal margin with a complete row of ocelli, the first three in cells R_S-M_1, M_1-M_2 and M_2-M_3 larger, fringe brown with dark marginal line. Ventral surface: with same maculation as in male, but lighter with ocelli and medial area maculations more prominent. Head: similar to male, but with proboscis less swollen at base. Genitalia (Fig. 10): corpus bursae with two long invaginated signa, one slightly longer than the other, internal flange of signa long, pointed. Unsclerotized portion of ductus bursae narrow; sclerotized portion of ductus bursae slightly funnel-shaped, slightly bifurcated at base, invaginated pocket between ostium bursae and papillae anales slightly rounded, not bifurcated.

Material examined. Brazil, *Bahia*: (Rio de Contas, Pico das Almas, 1400-1600 m), 19 males, 2 females (DZUP); (Pico do Barbado, 1300 m), 1 male (DZUP); *Minas Gerais*: Santana do Riacho (Serra do Cipó), 5 males, (DZUP); Corinto (Cabeceira do Córrego Leitão), 1 male, 1 female (DZUP); Diamantina (lighter females), 1 male, 4 females (DZUP); Conceição da Aparecida, 2 males (DZUP); *Distrito Federal*: Brasília, 10 males, 8 females (DZUP); Planaltina, 1 males, 1 female (CJC); (Jardim Zoológico), 1 female (CJC); (Brasília Country Club), 1 female (CJC); *Goiás*: Goiás Velho, 1 female (DZUP); Serra Dourada, 1 female (CJC); *Mato Grosso*: (Rio de Contas, 1600 m), 1 male (DZUP); Palmas (Morro Pai Inácio), 1 female (DZUP); *Paraná*: Ponta Grossa (Vila Velha, 1000 m), 10 males, 3 females (DZUP); Jaguariaíva, 2 males, 2 females (DZUP); *Santa Catarina*: Curitibanos 1 male (DZUP). Paraguay: Villarica, 1 male, 1 female (MNHN).

Distribution and habits. *Aricoris tutana* has the greatest distribution of the three species (Fig. 13), occupying the central part of extra-Amazonian Brazil from northern Bahia south to Paraná, and west to Paraguay, possibly also reaching Catamarca in northern Argentina (Ezequiel Bustos, pers. comm.). *Aricoris tutana* is sympatric with *A. monotona* in Paraná (Vila Velha), with no indication of intergrades.

The habitat of this species is *cerrado* and open grassland, especially grassy areas around seeps and springs. Their flight is bouncy like that of satyrids, and they rest on grass leaves hanging downward with wings closed.



Figures 7-12. Genitalia. Above are lateral views of the male genitalia, with the 8th sternite showing areas of sclerotization. Female genitalia are below. (7-8) *A. constantius*: (7) male; (8) female; (9-10) *A. tutana*: (9) male; (10) female; (11-12) *A. monotona*: (11) male; (12) female.

Biology. Specimens are often greasy, suggesting that they live off ant larvae in ant nests (DeVries 1997). This possibility is supported by observations of fresh adults emerging from ant's nests near Brasilia (Vitor O. Becker, pers. comm.).

Remarks. *Aricoris tutana* was described by Godart from a female from "Brésil." The type is lost, and the species was not illustrated in the original description. However, Godart mentions "points noires ocellés" (ocellated black spots) on the border of the ventral hindwing, which is a characteristic of the females of both *A. tisiphone* and *A. bahiana*. As *tutana* is the older name, both *tisiphone* and *bahiana* are junior synonyms of this taxon, as established by Stichel (1910). This taxon is illustrated in D'Abrera (1994) as the *A. tutana* female. The types of both *A. tisiphone* and *A. bahiana* are in the Natural History Museum of London.

Aricoris monotona (Stichel, 1910), reinstated status

Figs 5, 6, 11-13

Melanope (Aricoris) monotona Stichel, 1910: 13.

Diagnosis. *Aricoris monotona* has no marginal spots, except for a small black dot at apex of the hindwing in some specimens. The distal half of wing much lighter, crossed with dark scaling along the veins on both wings, discal band a nearly continuous line with no projection distad along vein M_3 (Figs 5 and 6); area between lobes of uncus U-shaped like in *A. constantius*, unlike *A. tutana*; scaphium long, rounded ventrad with a sclerotized line extending anteriorly. Appendages, ventral side of abdomen and ventral base of wings have variable orange scaling instead of dirty white or brown. The valvae of the male genitalia (Fig. 11) are truncated, and the saccus broad

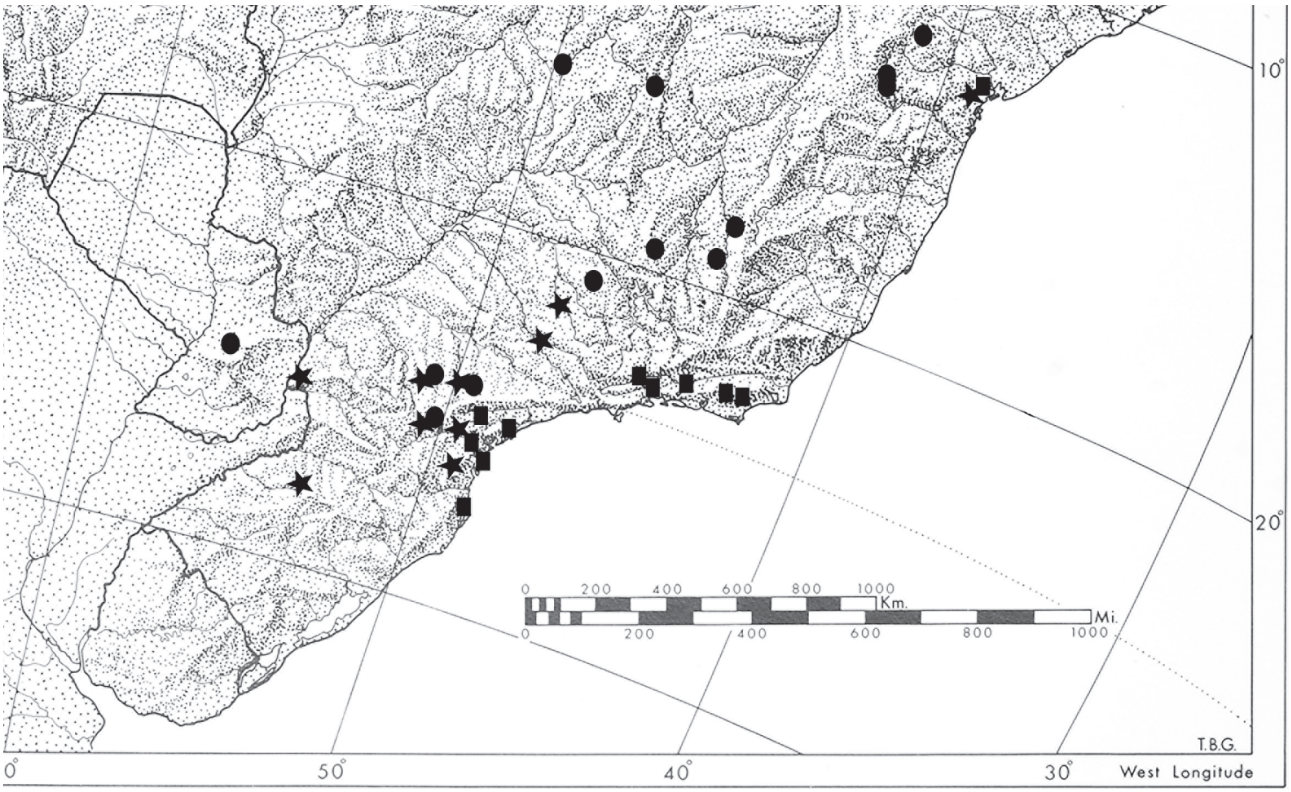


Figure 13. Distribution: *A. constantius*, squares; *A. tutana*, circles; *A. monotona*, stars.

and rounded. In the female genitalia (Fig. 12), the tip of inner flange of the signa is short, similar to *A. constantius*, but slightly pointed, and the invaginated pocket between ostium bursae and papillae anales flat, not bifurcated as in *A. constantius*.

Description. Male (Fig. 5). Forewing length 25 mm (n = 3). Wing shape: as in *A. constantius*. Dorsal surface: color of both wings nearly uniformly brown, with some golden brown scaling at the base of the wings, some lighter scaling on distal half. Ventral surface: basal half of both wings dark brown with six black lines in cell, three below, with orange-brown scaling at base, and bordered distally with a continuous thin black band; distal half of wing much lighter, crossed with dark scaling along the veins and a black streak between them, and a prominent dark brown line along margin at base of fringe; hindwing of some individuals with two small dark spots in cells S_c-M_1 and M_1-M_2, and at tornus. Head: eyes brown, marginal scaling black, frons golden brown, labial palpi golden brown, antennal length 55% of forewing length, segments black, nudum along inner ventral margin and clubs black. Body: dorsal surface color of thorax and abdomen dark brown, collar golden brown; ventral surface, forelegs, midlegs and hindlegs with golden brown scaling. Genitalia (Fig. 11): uncus in lateral view elongated, in ventral view lobes of uncus widely separated, space between them U-shaped, scaphium long, rounded ventrad with a sclerotized line extending anteriorly, tegumen short, ventral lobe rounded with sclerotized margin, top of falces more rounded; vinculum fused to anterior margin of tegumen, curved, narrow, widening slightly in middle, saccus anteroventral, separated from vinculum, rounded, broad. Outer portion of valva in lateral view shorter, truncated, anterior half fused dorsally to opposing valva, tips shorter, three socketed spines on end, valvae in ventral view broad, elongate, and slightly divergent at tips, with a prominent lateral bulge behind tips dorsally, and another in middle; aedeagus long, pointed. uneverted vesica with a slightly sclerotized plate; eighth sternite with two separate slightly sclerotized patches.

Female (Fig. 6). Forewing length 21 mm (n = 2). Wing shape: same as in male, except that distal margin slightly more convex. Dorsal surface: forewing color lighter brown than male, with basal half of wing slightly darker than distal half, maculation same, edged basad with a dark brown line. Hindwing nearly uniformly light brown, fringe brown with dark marginal line. Ventral surface: lighter than dorsal surface, but with same maculation, basad with orange scaling; distal half crossed with dark scaling along the veins and a black streak between them, and a prominent dark brown line along margin at base of fringe,

postdiscal band a thin continuous line, distal fringe bordered with a prominent black line. Head: eyes light brown, marginal scaling black; proboscis black and less swollen than male at base, frons golden brown, labial palpi golden brown, antennal length 55% of forewing length, segments black, nudum along inner ventral margin with white scaling between segments, clubs black, elongated. Body: dorsal surface color of thorax and abdomen brown, ventral surface with forelegs, midlegs, hindlegs and abdomen golden brown. Genitalia (Fig. 12): corpus bursae with two elongated, invaginated signa, tip of inner flange short, similar to *A. constantius*, but slightly pointed; sclerotized portion of ductus bursae with ductus seminalis connected to a slightly bifurcated base, unsclerotized portion of ductus bursae long, narrow. Invaginated pocket between ostium bursae and papillae anales flat, not bifurcated, similar to *A. tutana*.

Material examined. Brazil, *Bahia*: Bahia (ex. O. Staudinger), 1 male, 1 female (MNHN); *São Paulo*: Campinas (Mata do Ribeirão Cachoeira), 2 males (CJC); *Paraná*: Ponta Grossa (Vila Velha, 1000 m), 8 males, 5 females (DZUP); Foz do Iguaçu, 1 male (DZUP); Jaguariaiva, 1 male, 1 female September (DZUP); Mandirituba, (850 m) 1 male (DZUP); Palmeiras (Colônia Witmarsum), 1 male (DZUP); *Santa Catarina*: Curitibanos, 3 males (DZUP); S. Bento do Sul (Rio Vermelho, 850 m), 1 male (DZUP).

Distribution and habits. *Aricoris monotona* inhabits the area of the "Zona da Mata" (Fig. 13), west of the Serra do Mar, from Bahia south to northern Rio Grande do Sul. The species is sympatric with *A. tutana* in western Paraná and with *A. constantius* in Bahia without evidence of hybridization. The habitat is grassy clearings in areas of disturbed forest, as well as natural grass pampas, such as found at Vila Velha (Paraná). The flight habits are similar to the other two species.

Remarks. *Aricoris monotona* was described by Stichel (1910) from two males and a female from Casa Branca, São Paulo, Brazil. One male was figured in Gen. Ins. (1911), and the type is in the Humboldt Universität, Berlin. Wing shape, size and dorsal surface match other specimens from southeast Brazil. The type lacks the lighter postdiscal coloration on the ventral surface. However, examination of the type specimen shows the same orange-brown scaling at the base of the wings on the ventral surface, and the medial band is the same shape. Therefore, Stichel's name is conservatively applied to specimens with the orange-brown ventral scaling. As mentioned, *A. monotona* was synonymized with *A. constantius* (Hall & Harvey 2002), however its morphology and distribution justify its reinstatement as a species. This taxon was illustrated in D'Abrera (1994) as the *A. monotona* male.

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