New species of Eumaeini (Lycaenidae) from Southeastern Brazil II. Review of regional Ministrymon and descriptions of new species (Lepidoptera: Lycaenidae)

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Abstract – *Ministrymon* species of southeastern Brazil Lepidoptera are reviewed based on material in the GAGARIN Collection of southeast Brazilian Lepidoptera (Milwaukee Public Museum) and in the Allyn Museum of Entomology, Florida State Museum of Natural History. Previously described species include *Ministrymon fostera* (SCHAUS) new combination (*M. "phrutus"* group, transferred from *Thecla*) and a species of the *M. "azia"* group described in a simultaneous study of *Ministrymon* from Rondônia, western Brazil. Nine new species are described: *M. gagarini, M. cruor,* and *M. arthuri* of the blue "*phrutus*" species group, *M. androgenus, M. borkini, M. exorbaetus, M. oblongus*, and *M. callicus* of the white "*una*" species group, and *M. cryptus* which appears to be the first known sister species of *M. gamma* H. H. DRUCE (the two comprising a new "gamma" species group). *M. fostera*, a peculiarly marked species, is placed in a new subgroup of the "*phrutus*" group with *M. vena* (H. H. DRUCE) and *M. cruenta* (GOSSE). The many new names stem from two factors: 1) generic type material is from Central and northern South America; its study indicates old names sometimes used in the region do not apply; 2) as shown in other recent studies of the genus, some new species generally resemble previously named taxa, but differ in extraordinary conditions of the external secondary sexual characters as well as genitalia. With 30 figures.

INTRODUCTION

This is the second in a series of papers treating little known and undescribed Eumaeini from southeastern Brazil (BÁLINT *et. al.* 1997) and treats species assignable to the genus *Ministrymon* CLENCH (1961). Recently, the second and third authors of the present study elaborated species of *Ministrymon* from lowland tropical rain forests in the vicinity of Caucalnôdia, Rondônia, Brazil (JOHNSON & AUSTIN, in press).

Fourteen species were identified from this region, ten of which were described as new. Of extreme relevance to these *Ministrymon* species are taxa represented in the GAGARIN collection of Brazilian Lepidoptera housed, in part, at the Milwaukee Public Museum (Milwaukee, United States; hereafter MPM) and samples at the Allyn Museum of Entomology (Florida State Museum of Natural History) (AME). GAGARIN's material was collected in the early 1900's from various southeastern Brazil coastal forests and upland habitats (primarily in Rio de Janeiro and Paraná states) which have since been mostly destroyed. The AME material derives from more recent collecting by Brazilian workers in areas of particular ecological interest.

This paper records nine species from the GAGARIN material, including one recently described from Rondônia, and seven new species; and additional two new species were represented in the AME material. JOHNSON & AUSTIN (1998) designated a number of ne-otypes and lectotypes for *Ministrymon* which also form a basis for the present work.

MATERIALS AND METHODS

We employ the materials and methods mentioned previously in this series (BÁLINT *et al.* 1997) including, for rapid reference to characters of the wing, the abbreviations DFW, DHW and VFW, VHW for dorsal and ventral fore- and hindwings, respectively, and "brands" for the salient, darkly coloured, androconial clusters often present on the DFW of males. For brevity, since all species treated have short hairlike HW tails at vein termini CuA1 and CuA2, we refer to such tails in Descriptions as "typical" of the genus.

We use ELIOT's (1973) term "supralimital characters" to refer to extraordinary features (often of the brands) which readily distinguish certain species from congeners. We format new species descriptions according to the species groups of *Ministrymon* revised by JOHNSON & AUSTIN (1998). Because of numerous *Ministrymon* specimens examined in the present study, we refer to various localities by names provided in Appendix 1, which is a list of localities culled from GAGARIN label data together with clarifying and ecological notes concerning them provided by Dr. K. S. BROWN, JR. (Campinas, Brazil) and Dr. O. H. M. MIELKE (Curitiba, Brazil). To shorten citation format below, we note here that morphological comparisons to figures of *Ministrymon* species other than in the present paper refer to illustration in JOHNSON (1986), JOHNSON & MATUSIK (1989) and JOHNSON & MILLER (1991).

Ministrymon fostera (SCHAUS), comb. n. (Fig. 1)

Thecla fostera SCHAUS 1902: 421.

Diagnosis – Wings. Not readily comparable to other *Ministrymon* species, although placable with two other species also exhibiting vivid orange or red-orange VHW spotbands (see Remarks). *M. fostera* is distinguished by (a) its silver-blue DHW patch being limited to the limbal area and edged distally with bright blotches of red-orange and (b) the VHW showing a bright red-orange postmedial spotband comprised of closely aligned, orbiculate and elliptic red-orange elements over grey or yellow-grey ground. The distinctive VHW band resembles some species of *Strymon* (see Remarks). Morpho-

logy. Typical of genus (see Remarks); to save space, not illustrated (see figures in JOHNSON & KROENLEIN, in press).

Remarks – M. fostera, M. vena (H. H. DRUCE, 1907) and M. cruenta (GOSSE, 1880) belong in a previously unrecognized subgroup of the "phrutus" (blue) group (hereafter, "phrutus" or blue group) of Ministrymon which, consistent with terminology of JOHNSON & AUSTIN (1998), we will here call the "cruenta" subgroup. DRUCE (1902) previously recognized the affinity of M. vena and M. cruenta. Typical of the phrutus group the female genital ductus bursae is robust, posteriorly fluted, anteriorly curvate; male genitalia show triangulate valval base with prominent lateral shoulders. JOHNSON & KROENLEIN (1993) described a noncongener, Strymon rojos, from specimens GAGARIN had identified as males of M. fostera. GAGARIN's confusion attests to the "look-alike" phenomenon often occurring among certain Ministrymon and Strymon; genitalia of the two genera are easily separated (JOHNSON & KROENLEIN 1993). Externally, M. fostera males and females are similar except for the FW brands on the males; S. rojos differs externally by (1) discrete black FW brands (more diffuse and brownish black on M. fostera); (2) redorange in blue DHW patch with outer edge entire (scalloped and/or blotchy in M. fostera); and (3) on venter, a single (medial) band of red orbs (M. fostera with two, postbasal and medial, spotbands comprised of dashlike or elliptic elements). Interestingly, there is a second Strymon "look-alike" of M. fostera in the GAGARIN material that is still undescribed. It was discovered during curation of the MPM material in 1995. It appears likely there is some adaptive significance to the ventral red banding typifying these species and sympatric species of the genera Crimsinota and Nicolaea (JOHNSON 1993).

Material examined – MPM. Umuarama, 8–15 March 1937 (four males, two females). With permission of MPM additional voucher material was deposited as follows: AME, one male, data as above; AMNH, one male, one female, data as above. Male is figured in colour by D'ABRERA (1995: 1200); female is figured herein (Fig. 1).

Ministrymon sp.

Remarks – A second species of *Ministrymon* occurring in the southeast Brazilian GAGARIN material is described in a study of the genus from Rondônia, western Brazil (JOHNSON & AUSTIN 1998). We do not use the name here but the species is readily recognized by being most like *M. azia* (HEWITSON, [1873]) but with dorsum concolorous brown (*M. azia* has blue or grey in limbal area of DHW) and venter with continuous, wide (to 2 mm), dark red-brown medial HW band (*M. azia* band of discontinuous red-orange spots or dashes). This additional *Ministrymon* species has been mistaken in some collections for a small (FW 11–13 mm) "*Thecla*" rubifer (H. H. DRUCE, 1907) (*Crimsinota rubifer* sensu JOHNSON 1993) a much larger (14–15 mm) species having a wide, blood-red, VHW band.

Material examined – The material examined for this species from SE Brazil is included in JOHNSON & AUSTIN (1998).

"phrutus" (blue) group"

There are three members of this group in the GAGARIN material. One has previously been called "*phrutus*" in common usage but recent analysis of type material by JOHNSON & AUSTIN (1998) shows this is incorrect (see Remarks under *M. gagarini*, below). The other two species are readily identified by various supralimital characters and have apparently been overlooked, or ignored, hitherto.



Figs 1–8. Adults of *Ministrymon* species (dorsal left, ventral right; 5 and 6 ventral only). 1 = M. fostera (MPM). 2 = M. gagarini, holotype. 3 = M. gagarini, allotype. 4 = M. cruor, holotype. 5 = M. cruor, paratype. 6 = M. cruor, allotype. 7 = M. arthuri, holotype. 8 = M. androgenus, holotype

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Ministrymon gagarini sp. n. (Figs 2-3, 17, 26)

Diagnosis – Wings. Readily recognized by parallel postbasal and medial VHW bands which are narrow, undulate, and red over a brown-tan ground and, on dorsum, contrasting black and azure grounds (all "*phrutus*"-like characteristics). Sympatric congeners of the "*phrutus*" group show either 1) VHW bands clustered into a red patch in the postbasal area contrasting distal white ground (*M. cruor*) or 2) wider, lavishly edged, red VHW bands (*M. exorbetus*). The latter species also has gigantic DFW brands on males, encompassing nearly all the discal cell (*M. gagarini* a small, 1–2 mm, black brand near the cell-end). Morphology. Females exhibit an elongate ductus bursae curvate in the anterior one-third (latter is typical of species group but, among group taxa, the ductus in *M. gagarini* is far more elongate, e.g. @ x2 compared to *M. phrutus*). Males show the laterally lobate valval bilobes typical of the species group but these are sharply contoured, and with the valve bilobes lateral lobes more posteriorly directed than in *M. phrutus* and the saccus in the latter species is far shorter. See Remarks.

Description - Tailed as typical of genus. Male. Fig. 2. DFW brownish black with small ovate black brand at distal end of discal cell; DHW with silvery blue occurring in prominent, rather ovate, patch covering anal two-thirds of wing, with remaining distal areas brownish black; marginad in the silvery blue patch is a prominent black dot in cell CuA1. VFW with smoky brown ground becoming much paler across the apex, pattern markings including a red-brown dash-like mark at the end of the discal cell and red-brown spots forming various resemblances of a postmedial band, depending on the specimen. VHW with suffusive tan and brown ground crossed by two narrow, undulate but continuous, blood-red bands, the areas between the bands being darker smoky tan; distal area of HW with blood-red postmedial dash near costa, paler red-brown marks in each cell, and a dark reddish black "Thecla-spot". FW length: 9-13 mm. Female (Fig. 3). Similar to male but, on dorsum, lacking FW brand and with DHW with brownish black submarginal borders framing extensive silvery blue patch, the dark border indenting the silvery blue notably in cell M3 and with a prominent black spot marginad in cell CuA1. Venter similar to male, FW length; 9-13 mm. Male genitalia (Fig. 17). Marked by elongate saccus and valvae (each about equal length), former terminating rather elliptic genital capsule, latter terminating bilobes which show laterally produced flaps. Aedeagus elongate, exceeding rest of genitalia by more than caecum length; shaft broadly curvate, caecum short and displaced some 60° out of the plane of the shaft; shaft terminus without dorsal microtrichial bundles. Female genitalia (Fig. 26). Ductus bursae elongate (length to 10× maximal width), posterior with paired elliptic lamellae and slight development of a laterally overlapping superior plate; anterior one-third slightly curvate, cervix bursae flap oblongate, area adjacent ductus seminalis unelaborate.

Types – Holotype male, MPM, Brazil, Gavea, 30 Aug. 1931, FW 10.0 mm; allotype female, Brazil, Teatu, 30 June 1931, FW 9.5 mm, both deposited MPM. Paratypes. HMNH: one male, Brazil, Rio, 19 May 1955; one female, data as on allotype. AMNH: one male, Brazil, Mundo Novo, 200 m., 5 May 1940; one female Rio [de Janeiro], 10 July 1931. MPM: fourteen specimens, all Brazil, with labels conforming to the data of appendix 1 as follows: Independência, Gavea (3), Teatu (2), Morro Dona Marta (2), Guapy, Rio (5 [1 "Rio/ Castorina", 2 "Rio de Janeiro", 2 "Rio"]).



Figs 9–16. Adults of *Ministrymon* species (dorsal left, ventral right). 9 = M. and rogenus, allotype. 10 = M. borkini, holotype. 11 = M. borkini, allotype. 12 = M. exorbaetus, holotype. 13 = M. oblongus, holotype. 14 = M. oblongus, allotype. 15 = M. callicus, holotype. 16 = M. cryptus, holotype

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Remarks – HEWITSON (1868) described Thecla fidentia from syntypes labelled "New Granada" [Colombia], "Venezuela", and "Rio" [Brazil], JOHNSON & AUSTIN (1998) designated the lectotype of T. fidentia (HEWITSON, 1868) from Colombia and showed (1) it and the Venezuelan syntypes were conspecific with Ministrymon phrutus (GEYER, [1832]) and (2) the syntypes from Brazil were a different species (e.g. M. gagarini described here). M. gagarini, consistent with the affinities of numerous southeast Brazilian Eumaeini, is the sister species of M. sparsa (HAYWARD, 1949) (Argentine Andes and adjacent lowlands northward into Paraguay, see below). Workers more unfamiliar with Ministrymon should be careful not to confuse the phrutus complex and M. gagarini with two widespread South American Ministrymon species more vaguely similar M. adria (HEWITSON, [1873]) and M. zilda (HEWITSON, [1873]). D'ABRERA (1995: 1232) figures M. zilda in colour, JOHNSON and AUSTIN (1998) distinguish all these taxa in detail. Based on general external characters of the phrutus group, workers might also confuse M. gagarini with M. phrutus or M. sparsa. In males, these species share general genitalic characters unifying the phrutus group. However, specific differences in female genitalia are outstanding. For instance, because of geographic proximity, the name M. sparsa might be misapplied to M. gagarini. Male genitalia of M. sparsa lack the elongate saccus and highly contoured valvae venter typical of M. gagarini; female genitalia of M. sparsa have an elongate, but not curved, ductus bursae. Further testimony to the distinction of M. phrutus, M. sparsa and M. gagarini comes in (1) the existence of other, divergent, sister species (like the two species described immediately below) and the fact that, due to homoplasy, it is possible to find among the "white" Ministrymon, species which also show genitalic characters that might otherwise be considered typical of the "phrutus" group.

Etymology - Patronym for PAULO GAGARIN.

Ministrymon cruor sp. n. (Figs 4–5, 6, 18, 27)

Diagnosis – Wings. Readily recognized by the VHW pattern in which a blood-red postbasal patch contrasts with the whitish distal ground. The blood-red postbasal patch is formed from closely aligned, concentric, postmedial and submedial bands combined with intervening dark ground; distal areas of the wing are white except for small reddish blotches at the discal cell-end and postmediad near the costa. On the DHW there is expansive violet-blue extending to a thin fuscous marginal border. Morphology. Male genitalia with extremely sculptured valvae, bilobes with lateral lobes greatly protruding (although not terminally inclined is in *M. gagarini* and other group members); caudal extension tapered in two successive steps; aedeagus with caecum angled over 60 from shaft. Female genitalia robust but elongate and uncured at the anterior; ductus bursae forming fluted antrumal configuration in the terminal three-fifths, terminal opening very large with slight evidence of a triangulate superior plate along the dorsum.



Figs 17–25. Male genitalia of new species of *Ministrymon* (line drawings from camera lucida). Ventral view (ce = valve caudal extension, bl = valve bilobes) with aedeagus removed and placed at right in lateral view. 17 = M. gagarini, holotype. 18 = M. cruor, holotype. 19 = M. arthuri, holotype. 20 = M. androgenus, holotype. 21 = M. borkini, holotype. 22 = M. exorbaetus, holotype. 23 = M. oblongus, holotype. 24 = M. callicus, holotype. 25 = M. cryptus, holotype

Description - Tailed as typical of the genus. Male (Figs 4 and 5). DFW brownish black with small ovate black brand at distal end of discal cell; HW with violet-blue occurring in widely ovate patch covering anal two-thirds of wing; remaining distal areas brownish black and, marginad in the violet blue patch, one or two prominent black dots in cells CuA1 and CuA2. VFW ground smokey throughout with minute red spots forming a postmedial band from costa to cell M3. VHW with basal and distal grounds greatly contrasted, basal area with suffusive blood-red patch, distal areas nearly all white. Basal suffusive blood-red patch formed by closely aligned concentric blood-red bands, one across postbasal area, the other intervening from costal region of submedial area, areas between the bands also suffusive rust-coloured; distal areas whitish with only slight smoky suffusions, and with narrow, wavy, red marks at the end of discal cell and submarginad along the costa; limbal areas also whitish, marked only with slight smoky suffusion, a red-black "Thecla-spot" and red-black at the anal angle. FW length: 11-13.5 mm. Female (Fig. 6). Similar to male but, on dorsum, lacking FW brand and with DHW showing wider field of intense violet-blue bordered by blackish brown submargins somewhat indenting the blue patch in cell M3 and with a black marginal spot in cell CuA1. Venter similar to male, FW length: 11-13.5 mm, Male genitalia (Fig. 18). Valvae extremely sculptured with bilobes greatly protruding in lateral view; caudal extension tapered in two successive steps; aedeagus with caecum angled over 60 from shaft. Female genitalia (Fig. 27). Ductus bursae robust compared to other members of species group but also elongate (length to 7× maximal width). Terminal three-fifths fluted to antrumal configuration, terminal opening very large with dorsum showing a triangulate superior plate terminolaterally with a slight overlap of the contour of the ductus bursae; anterior plate at cervix bursae robust and somewhat crescent shaped.

Types – Holotype male, Brazil, Rio, Mundo Nova, 5 May 1940; allotype female, Rio, 2 August 1956; both deposited MPM. Paratypes. HMNH: one male, Brazil, Rio; AMNH: one male, Brazil, Independência; MPM: one male, Brazil, Petrópolis, 900 m, 5 May 1938; one female, same data as allotype.

Remarks – The very distinctive genitalia in this species testify to the diagnostic importance of the blood-red, costally concentrated, postbasal patch on the VHW which distinguishes this species. In a simplistic omnibus concept of *Ministrymon*, this species and the one of the entry just above would be mistaken as "*phrutus*" (TL Mexico) (see Remarks under *M. gagarini*).

Etymology - From the Latin meaning "blood" and referring to the blood-red postbasal markings.

Ministrymon arthuri sp. n.

(Figs 7, 19)

Diagnosis – Wings. Larger than the preceding species (FW 12.5 – 14.0 mm) and with DFW showing an extremely large brand, dull fuscous in colour and extending across the entire discal cell with adjacent areas of the wing suffusive black against the brownish black ground colour of the FW. VHW lavishly marked with wide red postbasal and medial band (each edged with white and black) connected by two red spots across the discal cell; distal areas of the VHW white with some suffusive smoky black and showing a large red "*Theclat*-spot" surrounded by red suffusion in the adjacent cells.

Morphology. Male genitalia showing genital capsule of quite rectangular shape with elongate, triangulate and blunt saccus; valvae very squat, caudal extension short and relatively robust, bilobes with extremely prominent ventral keels.

Description - Tailed as typical of the genus. Male (Fig. 7). DFW brownish black with discal cell completely covered by fuscous brand and with areas immediately distad suffusive black. DHW with large extensive, but irregularly defined, field of silvery blue (covering medial areas of the discal cell and cells M2-M3, thereafter extending to the margin in cells CuA1 and CuA2 with promient black spots marginad in the latter two cells and black line around the area of the anal lobe. VFW smoky dark tan from base to well defined red-brown postmedial spots band costa to cell M3); distad of band, at apex, ground white crossed by three to four red-brown submarginal blotches, toward tornus again suffused smoky; VHW with wide red postbasal and medial bands of red, edged distally with black and basally with white, separated by an area of suffusive ground, tan toward costa, white towards anal margin, and broken by two red spots across the discal cell connecting the bands. Anal area of medial band bent in a jagged "W" shape and prominently edged with distal white and black. Distad of bands wing ground variegated, whiter toward costa, smoky toward anal angle with last marked by black spot with basal white slash, "Thecla-spot" prominent and red, surrounded by red suffusion in the adjacent cells, FW length: 12.5-14.0 mm. Female, Unknown, Male genitalia (Fig. 19). Genital capsule of quite rectangular shape, with elongate, triangulate and blunt saccus; valvae very squat, caudal extensions short and relatively robust, bilobes with extremely prominent ventral keels. Aedeagus narrow, length exceeding rest of genitalia by about caecum length, latter displaced some 45 from plane of shaft, shaft terminus with somewhat sculptured dorsal cap marked by four bundles of microtrichia.

Types – Holotype male, MPM, Brazil, Rio [Castorina], 2 August 1956, FW 13.0 mm. Paratypes. MPM: five males, Brazil, Icatu, 5 May 1951 (four), 8 June 1967 (one); one male, Brazil, Colegia Batista, 13 June 1937; one male, Brazil, Gavea, 30 May 1930 (see Remarks).

Remarks – The presence of this species in the MPM GAGARIN material, marked by obviously supralimital FW brands, draws attention to overlooked diversity in *Ministrymon*. Dr. K. S. BROWN notes additional GAGARIN material is at the Instituto Oswaldo Cruz (Curitiba, Brazil) ("IOC"); it is likely that more specimens of this species may be found there. Because of limited original loan of this taxon, paratypes could not be marked for additional distribution beyond MPM.

Etymology – Patronym for ARTHUR BORKIN.

"una" (white) group

JOHNSON and AUSTIN (1998) demonstrated unelaborated diversity in the dorsally white *Ministrymon* (hereafter, "*una*" or white group), showing that, along with radical genitalic differences, many new species of the group were readily recognized by extraordinary ("supralimital" sensu ELIOT 1973) configurations of the DFW brands in males. This is true of nearly all the species described below, the condition of the male FW in one species being so like the female of another that the gender of such males has been previously misdiagnosed.

Ministrymon androgenus sp. n. (Figs 8–9, 20, 28)

Diagnosis - Wings. This species is similar only to M. borkini (described below); males might superficially be identified as females of this latter species. The DFW of fresh males of *M. androgenus* shows a large (3-4 mm) ovate blackish-brown suffusive patch not readily idenitified as a scent brand; with wear a small ovate (1.5 mm) ellipsoid brand is evident. Fresh males of M. borkini show a distinctively black, ellipsoid (1×1.5) mm) ellipsoid brand over brown ground colour and females a suffusive patch similar to the males of M. androgenus. The DHW of M. androgenus is white with a 1-2 mm greybrown border extending in general even contour about the wing; on M. borkini the VFW white is more restricted, occurring basad of the costa vein of the discal cell and with a narrower (1 mm) submarginal border. On the VHW, the block-like marks on M. androgenus are diminutive, on M. borkini pronounced; on the distal VFW all spots on M. androgenus are disjunctive, on M. borkini the postmedial ones form a band. Females of M. androgenus differ from M. borkini by the ventral specific characters and lack of the wide, crisp dark brown, margin occurring along the DHW costa in M. borkini. Morphology. Male genitalia with distinctive oblongate and asymmetrical saccus, as well as distinctive quadraspherical ventral shape to the valval bilobed. Female genitalia extremely robust and squat compared to congeners; ductus bursae a short tube, fluting gradually to prominent, spade-shaped, lamellae; cervix bursae at ductus seminalis particularly produced.

Description - Tailed as typical of genus. Male (Fig. 8). DFW brown except for iridescent blue strewn along the inner margin, large ovate area (3-4 mm) of FW discal area covered by darker brown suffusion, this area showing a small (1.5 mm) whitish scent brand when rubbed. DHW dirty white surrounded by a 1-2 mm grey-brown border extending in general even contour about the wing; margin with black spots in cells CuA1 and CuA2. Ventral ground whitish with beige (to more brownish on worn specimens) blotched and dash-like elements, on FW as disjunctive marks in discal cell, at cell-end and spaced irregularly along the postmedial area to the costa; base of FW suffused grey. HW with beige blotch prominent only in the medial area at the costa, other beige elements in the cells across medial and postbasal areas small and obsolescent. Margin with slight beige crescents in each cell and prominent black spots at cells CuA1 and CuA2. Length of FW: 11-13 mm. Female (Fig. 9). Similar to male except on DFW (where the black suffusion characterizing the male brand is lacking and, instead, the brown subapical border arches around the discal cell). Male genitalia (Fig. 20). Genital capsule rather square, terminating in a pronounced, oblongate and asymmetrical saccus. Valvae bilobes forming a notably quadraspherical base, the bilobe of each valve with a sharp shoulder; caudal extensions elongate and narrowly tapered. Aedeagus robust with prominent caecum displaced some 45 from the shaft, shaft straight with fluted terminus, latter showing an arch of minute microtrichia across its hoodlike venter. Female genitalia (Fig. 28). Ductus bursae extremely robust and squat compared to congeners, a short, rather flat, tube fluting gradually to prominent, spade-shaped, lamellae; cervix bursae flap prominent, oblongate and of uneven contour, dorsal juncture with ductus seminalis heavily sclerotized and produced, with lateral areas connected to prominent flaps of heavily sclerotized tissue.

Types – Holotype male, Brazil, Gavea, 2 Dec. 1928, FW 12.0 mm; allotype female, Brazil, Rio, 26 July 1934, FW 12.0 mm; both deposited MPM. Paratypes. HMNH: one male, Brazil, Rio

[Alagas]. AMNH: one male, Brazil, Colegio Batista, 13 May 1927. MPM: all males, one specimen: Brazil, Guapy, 3 December 1956; two specimens: Brazil, Colegio Batista 15 Aug. 1937, 13 June 1937; seven specimens: Brazil, Rio, 15 Aug. 1937, 5 Aug. 1934, 2 December 1928, 5 August 1934 (two specimens), 1 June 1932 (two specimens); four specimens: Brazil, Guapy 3 June 1936, 25 June 1939 (two specimens), 3 June 1956; two specimens: Brazil, Gavea, 2 Dec. 1928.

Remarks – GAGARIN placed males of this species as females of the species described immediately below. When sexed by genitalia the male specimens become evident and detailed examination of the DFW reveals scent brand covered by an ovate patch of suffusive brown scales. More females associable with this species are unknown but may be in the IOC.

Etymology – From the Greek meaning "without gender", referring to males of this species having been historically considered females.



Figs 26–30. Female genitalia of new species of *Ministrymon* (line drawings from camera lucida, ventral view from posterior lamellae, oriented at top, to cervix bursae flap, oriented at bottom).
26 = M. gagarini, allotype. 27 = M. cruor, allotype. 28 = M. androgenus, allotype. 29 = M. borkini, allotype. 30 = M. oblongus, allotype

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Ministrymon borkini n. sp. (Figs 10–11, 21, 29)

Diagnosis – Wings. DFW grey-brown with discrete, ellipsoid (1×1.5 mm) brand (brownish-black but fading to white when worn). *M. androgenus* has a large (3–4 mm) suffusive black ovate patch covering the discal area, obscuring a small (1.5 mm) brand beneath. *M. borkini* with VFW white restricted, occurring basad of the costal vein of the discal cell and with a narrower (1 mm) submarginal border; VHW with all beige elements of generally equal size and, on FW, the postmedial elements fused into a beige postmedial band. Female dorsum showing white on both wings, FW with wide (postmedial and distad) brown border and wingbase strewn with iridescent blue; HW with white occurring basad of the costa vein of the discal cell and distad to a narrow (1 mm) submarginal border. Morphology. Male genital valvae, in ventral view, with rather rhomboidshaped bilobes but, being rather transparent, curving dorsally about so as to form rather "ductlike" appearance; otherwise with caudal extension elongate and narrow, saccus robust and spikelike, length a little more than one-half that of valvae; dorsum of aedeagus at terminus with arc of minute microtrichial bundles. Female genitalia robust with ductus bursae fluted gradually to an arrowhead shaped terminus.

Description - Tailed as typical of genus. Male (Fig. 11). DFW brown except for white along the inner margin, discal area with small, discrete, ellipsoid (1×1.5 mm) brand (brownish-black fading to white when worn). DHW white to dirty white surrounded by a narrow (1 mm) grey-brown border extending in general even contour about the wing and, along costa, a wide, dark and crisply brown, margin extending from the costal vein of discal cell; outer margin with black spots in nearly ever cell, those of cells CuA1 and CuA2 most prominent. Ventral ground whitish with beige (to more brownish on worn specimens) blotched and dash-like elements, on FW postmedial marks fused into a beige postmedial spotband paralleled in the submarginal by suffusive beige marks in each cell; HW with all beige blotches prominent and of about equal size, forming prominent medial spot band across entire wing and paralleled in the submargin by dark suffusive beige marks in each cell; limbal area with a prominent blackish spots in cell CuA1 and at the anal margin. Length of FW: 10-12 mm. Female (Fig. 12). Similar to male except on DFW (where male brand is lacking), DHW with prominent brown costal border as typical of the species. Length of FW: 10-12 mm. Male genitalia (Fig. 21). Valvae in ventral view with rather rhomboid-shaped bilobes but, being rather transparent, curving dorsally about so as to form rather "ductlike" appearance; otherwise with caudal extension elongate and narrow, saccus robust and spikelike, length a little more than one-half that of valvae; aedeagus elongate, exceeding rest of genitalia by slightly more than caecum length, caecum displaced some 45° from plane of shaft, dorsum of aedeagus terminus with arc of minute microtrichial bundles. Female genitalia (Fig. 29). Ductus bursae robust, fluted gradually to arrowhead shaped terminus, latter formed by prominent superior plate; cervix bursae flap prominent and oblongate but of uneven contour, dorsum of cervix bursae leading to ductus seminalis not prominent.

Types – Holotype male, Brazil, Gavea, 2 December 1928; allotype female, Independência, Petrópolis, 8 May 1938; both deposited MPM. Paratypes. HMHN: one female, Brazil, Independência, 10 August 1936. AMNH: one female, Brazil, Rio [de Janeiro], 14 June 1936. MPM: five specimens: Brazil, Independência, 900 m., 5 May 1938 (two males, one female), 26 March 1937 (male, female), 10 Aug. 1936 (male); seven specimens: Brazil, Rio, 2 July 1934 (male), 12 March 1933

(male), 2 March 1945 (female), 4 June 1938 (female), 4 June 1936 (female), 2 December 1958 (male), 12 June 1936 (male); one male, Brazil, Guapy 2 June 1936; three specimens: Brazil, Colegio Batista 13 June 1937 (2 males), 14 May 1936 (male); four specimens: Brazil, Jacarepaguá, 4 June 1928 (female), 8 March 1948 (female), 26 July 1934 (female), 2 March 1948 (female); two specimens: Brazil, Gavea, 3 March 1927 (female), 2 March 1946 (female).

Remarks – Females of this species are apparent based on similarity of dorsal HW and ventral FW/HW pattern and duplicate label data among specimens from several localities (see Types).

Etymology - Patronym for Ms SUSAN BORKIN, collections manager at the MPM.

Ministrymon exorbaetus sp. n.

(Figs 12, 22)

Diagnosis – Wings. Males large (FW 13.5 mm.), recognized by 1) large blackish DFW brands (covering the distal two thirds of the discal cell and surrounded by additional black suffusion in the radial area) and 2) crisply defined dorsal white (on FW in cells CuA1, CuA2 and around the FW tornus), on HW posterioriad of vein M1 extending completely to the outer margin, there broken only by a prominent black spot in cell CuA1. Venter with blocklike markings all large but lacking central colour; rather, expressed only as the prominent grey-brown basal and distal edges of these blocks. Another "*una*" group species has been described from Rondônia, Brazil (JOHNSON & AUSTIN 1998) with extremely large DFW brands but its brand encompasses the entire discal cell, DFW is completely dark, HW has a wide dark costal and submarginal borders and, on the venter, the blocklike marks are prominent and golden. Morphology. Male genitalia with robust, thickly tapered, saccus and robust valval venter showing wide protruding, basally oriented, triangulate bilobes; aedeagus comparatively elongate and narrow with four discrete bundles of terminal microtrichia, not a row or rows as in other group members.

Description - Tailed as typical of genus. Male (Fig. 12). DFW with crisply defined white patches across cells CuA1, CuA2, and around the tornus, rest of FW wing dark brown and with distal two-thirds of FW discal cell showing an elongate fuscous brand surrounded costally with black suffusion extending into the radial areas. DHW showing crisply defined white caudad of vein M1 and, cephalad, with white extending completely to outer margin, there with a prominent black spot in cell CuA1. Ventral ground bright white with blocklike markings typical of group but without prominent colour within; rather, expressed as the grey-brown distal and basal endings FW as disjunctive marks in discal cell, along postmedial area, at distal end of discal cell and at center of discal cell. HW blocklike markings prominent in postbasal area, those in medial area expressed only by the more orange distal edges (thus appearing obsolescent). Limbal area concolorous white with vaguely noticeable marginal mark in cell CuA1. Length of FW: 13.5 mm. Female. Unknown. Male genitalia (Fig. 22). Genital capsule elliptic but robust, with saccus particularly robust, tapering thickly toward anterior in two steps; valvae extremely robust in the bilobes, each showing widely protruding, basally oriented, shoulders covered by thick, keel-like, sclerotin. Aedeagus elongate and narrow, shaft quite straight, caecum rather straight and displaced only about 30 from the shaft; hooded ventral terminus of shaft with four discrete bundles of microtrichia.

Type – Holotype male, MPM, Brazil, Icatu, 12 May 1951.

Remarks – This species is the second discovered in the *una* group with an unusually large DFW brand (the other from Rondônia). This further emphasizes the previously une-laborated diversity of the white *Ministrymon*.

Etymology – From the Latin for "exorbitant", referring to the outstanding FW brand and contrasting black and white colours that mark the dorsum of this species.

Ministrymon oblongus sp. n.

(Figs 13-14, 23, 30)

Diagnosis – Wings. Recognized by the mostly warm brown dorsum on which, on the HW, an oblongate central white field is framed by wide brown costal and submarginal borders. One the venter reduced expression of the blocklike markings, especially on the HW, with only the blocks' distal dark grey-brown edges being prominent over the white ground. There is little sexual dimorphism except for the male's rather squareshaped brownish black DFW brand. Morphology. Male genitalia marked by reduced saccus, being short (less than one-half valve length), narrow and blunt; valvae bilobes with triangulate and strongly opaque shoulders, caudal extensions narrow and elongate, slightly inwardly "hooked" in terminal one third. Female genitalia robust, fluted tube, opening terminally with quite elliptical lamellae lacking any evidence of a dorsal superior plate; cervix bursae quite produced dorsally and ventrally.

Description - Tailed as typical of genus, Male (Fig. 13). DFW warm brown except for an oblongate white patch on the HW between the anal angle and cell M3, the latter framed by a wide brown costal border and a wide submarginal border, the latter which is somewhat darker basally, but with a bright white marginal line from the anal angle to vein M3. DFW with a large [3×3 mm] somewhat square-shaped fuscous brand. Ventral ground whitish with clocklike markings reduced to mostly their distal grey-brown edges, on FW as disjunctive marks in discal cell, at the cell-end, and space regularly along the postmedial area to the costa. HW with postbasal marks appearing as three spots, in the medial area as single, dashed, lines but, near the costa with both the basal and distal edges expressed (somewhat like a "quotation mark"). Limbal area with only slight, suffusive, crescent-like marks and light golden "Thecla-spot". Length of FW: 12.0 mm. Female (Fig. 14). Appearing almost exactly like the male except for the lack of FW brand and showing very slight suffusion of white in cell CuA2 of the DFW, and slightly more distinction to the cellular elements of the DHW submarginal band. Length of FW: 12.0 mm. Male genitalia (Fig. 23). Genital capsule marked by reduced saccus, being short (less than one-half valve length), narrow and blunt; valvae bilobes with triangulate and strongly opaque shoulders, caudal extensions narrow and elongate, slightly inwardly "hooked" in terminal one third; aedeagus robust, exceeding length of rest of genitalia by about caecum length, caecum and shaft both bowed, latter comprising about two-fifths aedeagus length; aedeagus terminus fluted, dorsum with rows of minute microtrichial bundles. Female genitalia (Fig. 30). Ductus bursae robust, fluted tube, opening terminally with quite elliptical lamellae lacking any evidence of a dorsal superior plate; cervix bursae flap prominent and oblongate, dorsal area adjacent ductus seminalis is heavily sclerotized.

Type – Holotype male, allotype female, Brazil, Espiritu Santo, Conceica da Carra, June 1972, leg. P. C. ELIAS, ex. ARTHUR ALLYN Collection, AME.

Remarks - The lack of sexual dimorphism in this species is particularly of interest.

Etymology – An arbitrary euphonious combination referring to the shape of the white DHW patch in both sexes.

Ministrymon callicus sp. n.

(Figs 15, 24)

Diagnosis – Wings. Recognized by the profusely spotted, nearly irregularly banded, venter in which the markings are in dark shades of grey over light grey ground, not beige or golden over white. On the dorsum the entire FW and costa and margins of the HW are blackish, the black brand being nearly obscured at the distal end of the FW discal cell. Morphology. Male genitalia extremely robust and sculptured in all features; valval bilobes with prominent baso-lateral shoulders, caudal extensions narrow, and tapered terminad in a two-step fashion.

Description - Tailed as typical of the genus. Male (Fig. 15). DFW entirely blackish, obscuring black brand at distal end of discal cell, DHW with wide, crisp, blackish brown borders, across costa to vein M1 and around entire submargin, the latter showing a crisp marginal white line from cell M2 to the anal margin, with submarginal band elements in cells CuA1 and CuA2 blacker and more spotlike. DFW basad of dark borders dirty white. Ventral ground colour grizzled light grey throughout, showing lighter, whitish, intercellular colour only along submargins of FW and postmedial and submarginal areas of HW. Blocklike elements typical of species group prominent and enlarged and forming more bandlike patterns on both wings. Blocklike elements each centrally dark grey, distally and basally edged blackish; on FW forming postmedial FW band paralleled by blocks at center of discal cell and at cell-end, on HW showing dark blotches across the postbasal area, a nearly continuous medial band breaking into widened orbs at the cell-end, and distally with varigated white and gray intercellular patterns across the submargins. Limbal area with suffusive black near the anal angle and with a black "Thecla-spot". Length of FW: 12.0 mm. Female. Unknown. Male genitalia (Fig. 24). Robust and extremely sculptured, saccus and falces both robust and of uneven contour, former prominent, length about two-thirds that of valvae; valvae with narrow caudal extensions, terminating in a two-step taper, bilobed areas extremely robust with prominent basally oriented triangulate shoulders. Aedeagus robust and exceeding length of rest of genitalia by about caecum length, latter displaced some 45 out of the plane of the shaft, shaft terminus broadly fluted, dorsum of terminus with row of robust microtrichial bundles.

Type – Holotype male, Brazil, Espiritu Santo, Conceição da Barra, June 1972, leg. P. C. ELIAS, ex. ARTHUR ALLYN Collection, AME.

Remarks – It is notable that the male genitalia of this species generally resemble those of taxa in the blue "*phrutus*" group. JOHNSON & AUSTIN (1998) noted the same for certain white species of Rondônian *Ministrymon*. They suggested that despite the drastic external colour differences, one subgroup of "white" *Ministrymon* may be more closely

related to its blue congeners and mimicry of white models (see JOHNSON 1986) should be investigated.

Etymology – An arbitrary euphonious combination referring to the "Calico"-like grey patterns of the venter.

"gamma" new species group

Hitherto, *Ministrymon gamma* (H. H. DRUCE, 1909), new combination, a central Argentine species, has been an "isolated taxon" (sensu DRAUDT 1919) of uncertain intrageneric affinity. Its venter shows a white, grey, and tan "smear" pattern reminscent of bird droppings. SALAZAR & JOHNSON (1997) have recently documented ventral protective colouration patterns resembling bird droppings on certain Eumaeini which, along with pronophiline Satyrini (Nymphalidae), perch of bird excrement. The new species described below resembles *M. gamma* both in the character of its DFW brand and the VHW white, tan and brown ruptive pattern (the shades of which are, among *Ministrymon*, reminiscent only of *M. gamma*). In the genitalia the two species are also similar, males showing a greatly distended valval base with widely sclerotized lateral rims.

Ministrymon cryptus n. sp.

(Figs 16, 25)

Diagnosis – Wings. Dorsum completely brown, FW outer angle sharp. VHW with readily recognized cryptic pattern of brown, white and black patches in which a large medial brown patch (framed by dark brown and black remnants of the postbasal and medial bands typical of *Ministrymon*) vividly contrasts a white basal patch and distal white and tan suffusions. Morphology. Male genitalia with extremely prominent, asymmetrical saccus, length just slightly less than valvae; valvae with elongate, narrowly tapering caudal extensions terminating bilobes distended greatly along the base with prominent lateral rims; aedeagus extremely elongate and undulate.

Description – Male (Fig. 16). Tails missing on known specimen but likely tailed as typical of genus. Dorsum completely brown, discal area covered with extensive suffusive blue-hued black, FW brand apparent beneath this patch when rubbed, FW with outer angle very sharp with outer margin very straight. VFW ground smoky tan from base to well-marked blackish brown postmedial band extending from costa to cell CuA2, distad of this band ground lighter whitish tan toward costa, darker smoky tan beneath. VHW with prominent suffusive brown patch extending across entire wing between postbasal and medial area framed by variously obsolescent postbasal and medial bands; postbasal band blackish, narrow and undulate, outstanding only because of a bright whitish tan ground colour patch immediately basad, medial band comprised of blackish brown centrad, white distad and black basad and angled in a slight "W" near anal angle. Base of wing with prominent whitish tan patch, rather triangulate in shape; distad of banded central brown patch ground colour light tan to whitish tan closer to costa, darker suffusive tan toward toward anal angle, latter with

prominent black spot with white slash at base; "*Thecla*-spot" unapparent. Length of FW: 12.0 mm. Female. Unknown. Male genitalia (Fig. 25). Genital capsule with anterior showing extremely prominent, asymmetrical saccus, length just slightly less than valvae; valvae with elongate, narrow-ly tapering caudal extensions terminating bilobes with prominent distal flaps (similar to but much wider and more basally oriented than in *M. gagarini* described herein). Aedeagus extremely elong-ate, length exceeding rest of genitalia by more than caecum length; shaft undulate and terminating with sharp dorsal hood marked by four bundles of microtrichia; caecum narrow and displaced some 60° from plane of the shaft.

Type - Holotype male, Brazil, Icatu, 7 Jan. 1961, deposited MPM.

Remarks – It is particularly of interest that external similarities between this species and *M. gamma* are borne out in the genitalia. This strongly supports JOHNSON & AUS-TIN's (1998) view that species of *Ministrymon* can be reliably characterized by consiliences of wing, secondary sexual, and morphological characters. Previously, *M. gamma* has been of uncertain affinity in the genus. The species is not readily recognized as a *Ministrymon* species by its dorsum, mostly because of the concolorous brown wings and the angulate FW. Close examination of the ventral pattern shows it cryptic, patched appearance to be formed by remnants of the postbasal and medial bands typical of the genus; dissection readily confirms the association.

Etymology - The name refers to the cryptic pattern of the venter.

DISCUSSION

With regard to the diversity of new species described herein, it is important to note that type specimens of nearly all previously described species of *Ministrymon* relevant to this paper are from Mexico or Central America. Study of type material, and additional specimens (particularly with regard to genitalia, secondary sexual marks, and sexual dimorphism), reveals that the old northern names are seldom applicable to specimens from south of the Amazon basin in South America. JOHNSON and AUSTIN designated the lectotypes and neotypes necessary for this distinction. Previous wide use of old Mexican and Central American names for Southeastern Brazilian material mostly reflected (i) availability and (ii) very general similarities in wing pattern. Like numerous species described in the recent study of Rondônian Ministrymon, males of several new species from the present paper show extraordinary conditions of the FW scent brands. Occurrence of these in both the "white" and "blue" species groups of Ministrymon confirms that significant undescribed diversity has pervaded the genus hitherto. The existence of such "supralimital taxa" (sensu ELIOT 1973) also supports our view of specific characters in such complexes as the "phrutus" group in southeastern Brazil. In order to consider all "phrutus" group taxa in southeastern Brazil synonymous, one has to not only dismiss the pattern and genitalic distinctions of M. gagarini and M. cruor but also the huge FW brands of M. arthuri. The "white" group of Ministrymon in southeastern Brazil shows similar diversity, with some species also distinguished by supralimital characters. In this context, discovery in southeastern Brazil of a sister species of the oddly marked *M. gamma* of Argentina does not seem so surprising.

APPENDIX

List of localities from GAGARIN specimen labels. Words in brackets, listed in alphabetical order, are the ones used in the text. Following after are details concerning the locality provided by Dr. K. S. BROWN, JR. (Campinas, Brazil) and Dr. OLAF H. H. MIELKE (Curitiba, Brazil).

"Colégio Batista". Refers to the Baptist high school located at the base of "Mundo Nova" (22°56'S, 43°13'W).

"Friburgo". Refers to Nova Friburgo (22°17'S, 42°33'W) in the state of Rio, located atop mountains northeast of Rio city and east of Petrópolis and Teresópolis; typified by cloud forests to 2000 m but with temperate forest and drier habitats around 1000–2000 m.

"Gavea". Refers to a deep canyon just west of the Jardim Botânico which cuts through the coastal mountains northwest of Lagoa, 22°58'S, 43°15'W. The area once had lush vegetation but now is "favela".

"Goyas". Refers Goyas Campinas, now a suburb of Goinia, Goiás, 16°39'S, 49°19'W, a locale with high water table, woods on fairly level ground (deciduous in winter dry season, lush in summer), surrounded by field and cerrado vegetation, on very good soil.

"Guapy". Refers to labels also stating "Estado do Rio – Guapimirim"; 22°32'S, 42°59'W, located at base of road up to Teresópolis. It was originally lush, heavy, rainforest with small rivers coming off nearby steep mountain flanks; now there is frequent mild disturbance and small plantations.

"Icatu". On GAGARIN labels looks confusingly like "Teatu"; Icatu refers to a street in the city of Rio de Janeiro, 22°58'S, 43°14'W, starting across from GAGARIN's house and ascending the steep flank of the Morro Doña Marta (22°56'S, 43°13'W). Once heavy, but not too tropical forest; now a "favela".

"Independência". Refers to labels reading "Independência, Petrópolis" and is a hilltop and surrounding cloud forest at front of Serra do Mar, 22°34'S, 43°13'W, SW of the city of Petrópolis; elevation about 1500 m with a plateau to the north and steep mountain face to the south. Once a high diversity area for Lycaenidae, now "favela".

"Jacarepaguá". Now a western suburb of the city of Rio, some distance from the waterfront; characterized by restinga vegetation and mountain base forest (22°56'S, 43°51'W).

"Jardim Botânico". In Rio de Janeiro just west of GAGARIN's house, 22°57'S, 43°14'W, mostly on flat land north of Lagoa Rodrigo de Freitas, plantation, some virgin vegetation along small creeks, many flowers.

"Mundo Novo". Refers to Morro "Monte", i.e. Morro Mundo Novo (22°56'S, 43°13'W) west of Botafogo and Flamengo in the city of Rio de Janeiro; it is located east of Morro Doña Marta and is lower in elevation (300 m); typified by mixed vegetation and a lower humidity due to sea winds.

"Petrópolis". Refers to the city, 22°32'S, 43°11'W.

"Rio". Herein can refer to a number of localities in or near the city of Rio de Janeiro (sometimes undecipherable as written). In GAGARIN's time the city was not in the same location as the state of the same name but noted either as in the Distrito Federal or State of Guanabara. **"Umuarama".** A hotel to the S of Campos de Jordão in the high Serra de Mantiqueira at 1600–2200 m, 22°45'S, 45°35'W; temperate forest and open fields with heavy frosts all winter; GAGARIN spent summers here and found a Patagonian-related fauna.

* * *

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