

SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

A New Species of *Moneuptychia* Forster (Lepidoptera: Satyrinae: Euptychiina) from Central BrazilANDRÉ V L FREITAS¹, EDUARDO O EMERY², OLAF H H MIELKE³

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ABSTRACT - This paper describes a new species of *Moneuptychia* Forster from the cerrado in the Federal District and Goiás region in central Brazil, and from highland open vegetation (*campos de altitude*) of Minas Gerais and Paraná. We provide details of the adult morphology and discuss the new species placement in the genus *Moneuptychia*.

KEY WORDS: Butterfly, cerrado savannah, Nymphalidae

The Central Brazil Plateau (*Planalto Central do Brasil*) comprises an area of nearly 650,000 square kilometers centered in Brasília, Distrito Federal, with altitudes ranging from 600 to 1300 m (Brown & Mielke 1967a). Most of this region consists of cerrado savanna (see Oliveira & Marquis 2002), and presents marked seasonality, with well defined wet (October-March) and dry (April-September) seasons. The region is very heterogeneous, and a large variety of habitats are represented, which in turn reflect high butterfly diversity (see below).

The butterfly fauna in this region has been studied since the 1960s by K S Brown and O H H Mielke with the intention of filling the immense gap of biological information in this vast area of Brazil (Brown & Mielke 1967a, b). In these studies, the authors provided a list with 604 species of butterflies for the region and discussed the affinities of this rich fauna with those of adjacent biomes such as the Atlantic Forest, Amazonia and Caatinga dry forest. In the last 30 years, some regional lists were published adding more than 200 species to the previous lists (e.g Motta 2002, Emery *et al* 2006, Mielke *et al* 2008). Nevertheless, the fauna of the Planalto Central do Brasil, estimated in more than 900 species (Brown & Mielke 1967b), is still largely unknown, with many species awaiting description.

This scenario of lack of knowledge is especially true for the Satyrinae, the most diverse subfamily of Nymphalidae, with more than 2400 species worldwide (Ackery *et al* 1998). Even in some well known areas in terms of inventories, such as Southeastern Brazil, new species of satyrines have been described even from well collected localities (see Freitas 2004, 2007), with several additional undescribed species recognized from museums and field collections.

This paper describes a new species of *Moneuptychia*

Forster from the Planalto Central do Brasil and from the highland open vegetation formations (“campos de altitude”) from Minas Gerais and Paraná, and discusses morphological characters supporting its taxonomic position.

Material and Methods

This species was first studied in the field in the Cerrado Reserve of the Instituto Brasileiro de Geografia e Estatística (ca. 1100 m, 15°55’S, 47°53’W) in the APA Gama-Cabeça de Veado, South of Brasília, DF and Goiás Velho, Goiás, Central Brazil, and later in Barbacena, Minas Gerais and Ponta Grossa, Paraná. The vegetation in these areas corresponds to the cerrado *sensu stricto* of Goodland (1971) (see also Oliveira-Filho & Ratter, 2002) and to the *campos de altitude*, a typical grassland vegetation from the highlands in south and southeast Brazil. Individuals were observed flying in an area of wet soil with open vegetation (Fig 1) locally known as *campo úmido com murundus* (Oliveira-Filho & Ratter 2002).

Dissections were made using standard techniques (as in Willmott & Freitas 2006), where legs, palpi, and abdomens were soaked in hot 10% KOH solution for 10 min before dissection, and dissected parts were stored in glycerol. Morphological terms for genitalia largely follow Klots (1956).

The acronyms for the Brazilian collections are: DZUP, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná; MZUSP, Museu de Zoologia, Universidade de São Paulo, São Paulo; ZUEC, Museu de Zoologia da Universidade Estadual de Campinas, Unicamp, Campinas, São Paulo.



Fig 1 General view of the habitat of *Moneuptychia giffordi*. a) open field with riparian vegetation; b) close view of a “murundu” (see text).

***Moneuptychia giffordi* Freitas, Emery & Mielke, new species (Figs 2-5)**

Adult: Diagnosis. Eyes naked, entirely brown. Palpus length 2.0 times head height, beige with long brown hairs. The male palpus is shown in Fig 3D. Antenna of males 6.0-6.5 mm in length, with 33-34 segments extending to mid-costa; shaft light brown, dorsally covered by cream scales, club with 11-12 segments, not conspicuously developed. Hindwing outer margin slightly wavy, especially in males. Male wing venation shown in Fig 3a. Male foreleg covered by long beige hairs and with two tarsomeres, the first as long as tibia, and the second extremely reduced; female foreleg with five tarsomeres (Figs 3b, c). Adults of both sexes are easily distinguished from all other species of the genus by wing pattern.

Description. Male (Figs 2a, 5a-d). Forewing length 14-16 mm; hindwing length 10-12 mm. Body entirely dark brown. Wings with dorsal ground color dark brown with few markings, restricted to marginal and submarginal lines in both wings; hindwing with one ocellus in cell CuA_1-CuA_2 ; this is black, surrounded by orange scales, and with white pupil. Ventral ground color light brown variegated with small dark brown irregular lines; forewing crossed by two dark brown lines, the first irregular, bordered externally by yellowish beige scales, extending from costa to 2a one third from base; the second line wavy, bordered externally by yellowish beige scales and internally by ochre scales, extending from costa to 2a at two thirds from the wing base; a dark brown zigzag submarginal line and a brown regular marginal line extending from costa to 2a; all wing veins covered by yellowish cream scales; three minute ocelli in cells R_5-M_1 (black with white pupil), M_1-M_2

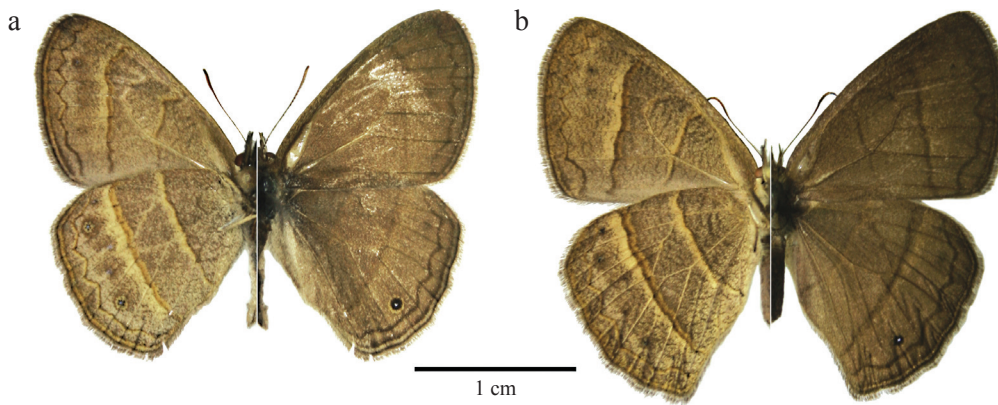


Fig 2 Adults of *Moneuptychia giffordi*, ventral on the left, dorsal on the right. a) holotype male from "Reserva Biológica do IBGE", Distrito Federal: Brazil; b) allotype female, same locality.

and M_2 - M_3 (these two represented by one or two white scales only). Hindwing crossed by two dark brown irregular lines from costa to anal margin, the first bordered externally by yellowish beige scales, one-third from the wing base, and the second bordered externally by yellowish beige scales and internally by ochre scales, two-thirds from it; a dark brown zigzag submarginal line and a brown regular marginal line extending from costa to 2a, both bordered with yellowish

scales; a series of five or six poorly defined ocelli with white pupil can be found in cells $Rs-M_1$ (ocellus 1), M_1 - M_2 (2), M_2 - M_3 (3), M_3 - CuA_1 (4), CuA_1 - CuA_2 (5) and CuA_2 -2A (6); ocelli 1, 3, 4 and six usually small and reduced to few white scales circled by few dark brown scales (ocellus 1 with black center in some individuals; ocelli 2 and 5 larger than the others, and circled by orange scales. No conspicuous androconial scales observed.

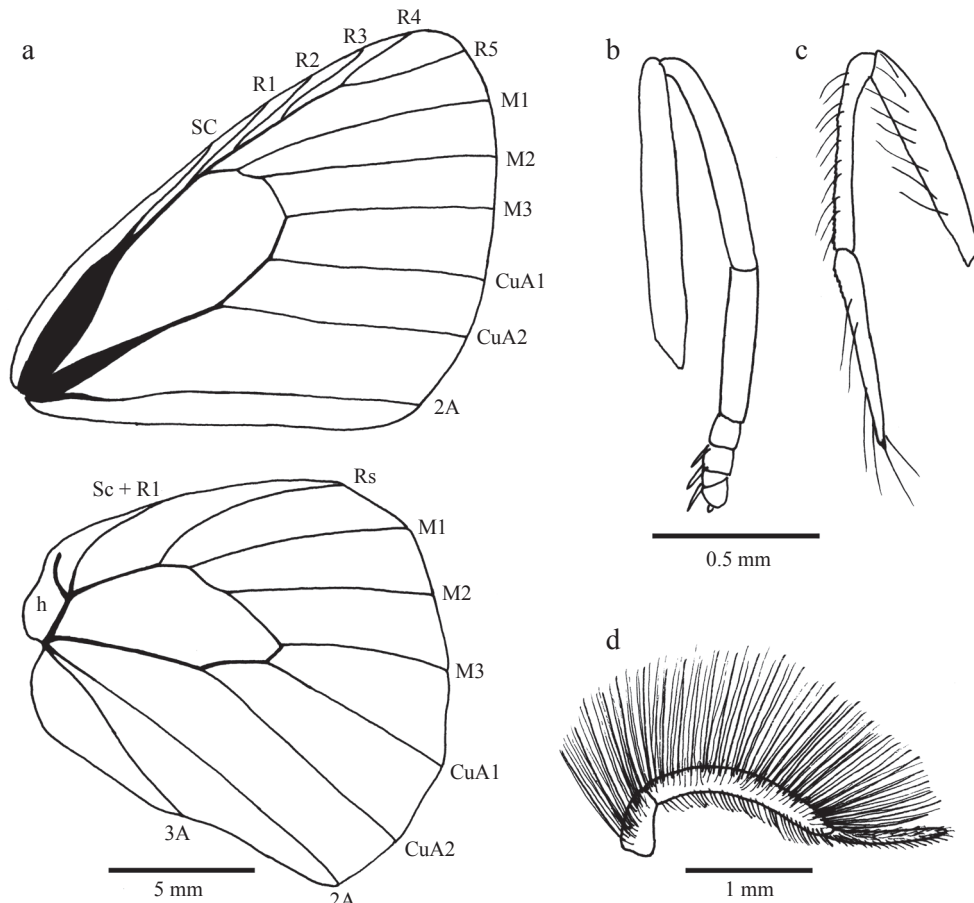


Fig 3 Morphological characters of *Moneuptychia giffordi*. a) male wing venation - forewing above and hindwing below; b) female foreleg; c) male foreleg; d) male palpus.

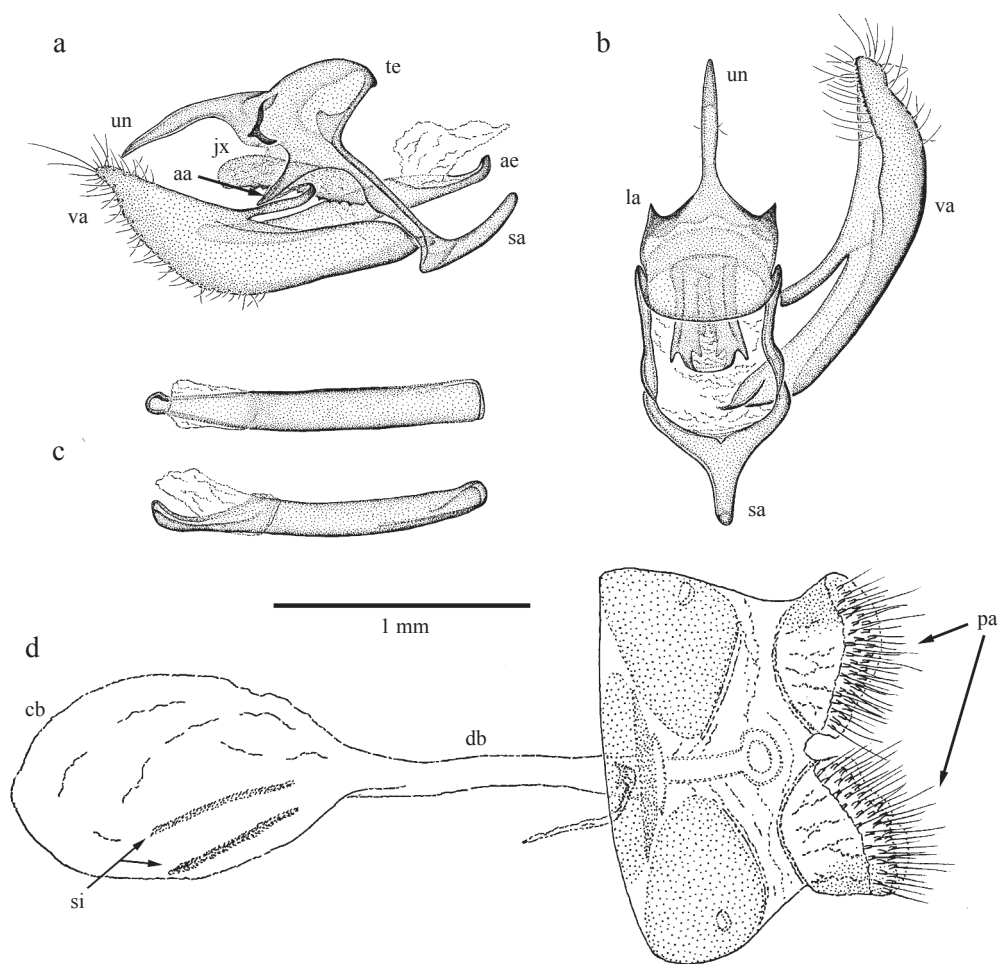


Fig 4 Male and female genitalia of *Moneuptychia giffordi*. a) lateral view; b) dorsal view; c) aedeagus (dorsal above, lateral below); d) female genitalia; sa = saccus, va = valva, ae = aedeagus, un = uncus, te = tegumen, la = latero-posterior apophyses of tegumen, jx = juxta, aa = appendices angulares, cb = corpus bursa, db = ductus bursa; pa = papilla analis; si = signa.

Male genitalia (Figs 4a-c). Anterior projection of saccus short and narrow in ventral view; tegumen rounded with small pointed latero-posterior apophyses; appendices angulares extremely conspicuous projecting posteriorly as a long process; uncus elongated and pointed; valvae elongated, ending in a single point, internal margin with a series of small teeth; aedeagus slightly curved upwards; cornuti absent; juxta broad and heavily sclerotized.

Female (Figs 1b, 5e, f). Forewing length 16-17 mm; hindwing length 13-14 mm. Body entirely dark brown. General color and pattern very similar to that of males, with wings more rounded.

Female genitalia (Fig 4d). Corpus bursae rounded; paired signa long, formed by two rows of tiny teeth. Ductus bursae not sclerotized, same length as corpus bursae; sterigma weakly sclerotized; papillae anales semicircular with numerous long hairs.

Remarks on color variation. Two contrasting forms are known in this species (with differences observed only in the underside): one form is typical of cold dry months (July

to September - winter phenotype, Figs 1a, b, Figs 5a, b, e) and the other of hot wet months (February to June, and October to December - summer phenotype, Figs 5c, d), with some intermediates (e.g. Fig 5f). The winter form is the most common, and represent the majority of the collected individuals, justifying the description based on this phenotype. The summer form is rare, and only 11 individuals are known from the examined collections. Summer forms have all lines and markings in the same position, but strongly differ from winter forms by two conspicuous characters: 1) the absence of the yellowish cream scales that in winter forms cover the wing veins and border the crossing lines, and 2) by the ocelli 2 and 5, that are much enlarged, black with white pupil and circled by a broad ring of yellowish cream scales.

Behavior and natural history. The species occurs in areas of open vegetation, flying low within the grass. In the *cerrado* region it is more commonly observed in wet regions (*campo úmido com murundus*) or in the low vegetation near the gallery forests (Fig 1a). They were never observed far from water, being absent in dry areas. Host plant and immature stages are unknown.

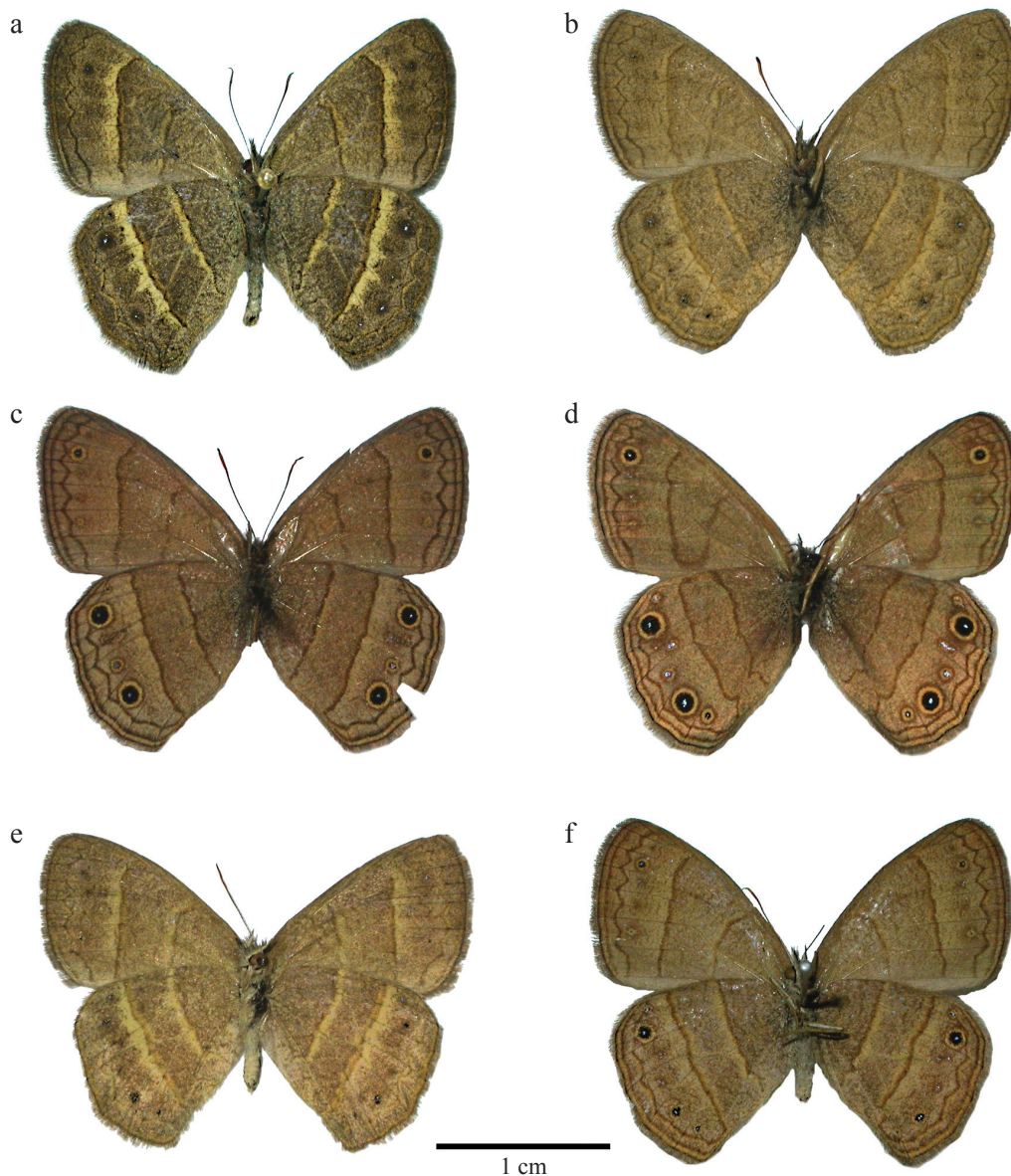


Fig 5 Adults males (a-d) and female (e, f) of *Moneuptychia giffordi* showing variation in underside wing pattern (all paratypes). a) Vila Velha, Ponta Grossa, PR, 3-VII-2002 (DZ 15.773); b) Barbacena, MG, 19-VIII-1951 (DZ 8.709); c) Vila Velha, Ponta Grossa, PR, 21-III-2002 (DZ 16.155); d) Barbacena, MG, 16-XI-1952 (DZ 16.197); e) Reserva Biológica do IBGE, DF, 23-VIII-2005 (DNA voucher NW 149-6); f) Fazenda Água Limpa, Brasília, DF, 19-III-1977 (DZ 15.703). a, b, e = winter forms, c, d = summer forms, f = intermediate form.

Distribution. Besides the localities mentioned in the methods section, the species is known from few areas of *cerrado*, including Barbacena, Barroso, São João del Rei (Minas Gerais), Goiás Velho (Goiás) and several localities in Brasília region (Distrito Federal). There are also individuals collected from open grasslands habitats (known locally as *campos de altitude*, see also Freitas, 2007) in Ponta Grossa (Paraná), suggesting that the species could occur in other types of open habitats. The map in Fig 6 shows the distribution of the species based on all known museum specimens and field work.

Etymology. The specific epithet refers to the late Dr. David R Gifford, who collected this species in several sites in Central

Brazil, including the type locality.

Holotype. Holotype: Adult male (Fig 2a) from Reserva Biológica do IBGE (15°55'S, 47°53'W), 1000m a.s.l, APA Gama - Cabeça do Veado, Distrito Federal, Brazil, collected by E O Emery on August 23, 2005. Deposited in the Museu de Zoologia da Universidade Estadual de Campinas (ZUEC), Unicamp, São Paulo, Brazil. Labels on the holotype (four labels, separated by transverse bars): /HOLÓTIPO/ Res. [erva] Ecológica do IBGE, APA Gama-Cabeça de Veado, Brasil, DF [Distrito Federal]: 23-VIII-2005 15°55'S 47°53'W – Alt. 1000 m E O Emery (col.)/ Brasil DF [Distrito Federal] Reserva IBGE 23.VIII.2005 E O Emery leg./ HOLÓTIPO



Fig 6 Known distribution of *Moneuptychia giffordi* in Brazil. Grey areas represent the distribution of the Brazilian cerrado (based on Miranda *et al* 2000).

Moneuptychia giffordi Freitas, Emery & Mielke/.

Allotype. Adult female (Fig 2b), same locality as holotype, also deposited in the ZUEC. Labels on the allotype (four labels, separated by transverse bars): /ALÓTIPO/ Res.[erva] Ecológica do IBGE, APA Gama-Cabeça de Veado, Brasil, DF [Distrito Federal]: 23-VIII-2005 15°55'S 47°53'W – Alt. 1000 m E O Emery (col.)/ Brasil DF [Distrito Federal] Reserva IBGE 23.viii.2005 E O Emery leg./ ALÓTIPO *Moneuptychia giffordi* Freitas, Emery & Mielke/.

Paratypes (six illustrated in Figs 5a-f). **ZUEC** – *Distrito Federal*: four males 23-VIII-2005, Reserva Biológica do IBGE, E O Emery leg.; two males 11-IX-2003, Reserva Biológica do IBGE, E O Emery leg. **MZUSP** – *Distrito Federal*: one male (without left antenna) 9-IX-2006, Reserva Biológica do IBGE, and one female (with both antennae broken) 23-VIII-2005, Reserva Biológica do IBGE, E O Emery leg. **DZUP** – *Minas Gerais*: one male 15-XI-1952, one female 31-X-1952, one female 17-VII-1951, one male 25-VII-1951, three males (one without abdomen) 28-VII-1951, four males (one without abdomen) and three females (two without

abdomen) 11-VIII-1951, one male (without abdomen) 14-VIII-1951, one female 17-VIII-1951, one male 19-VIII-1951, one male 28-VIII-1951, one female 1-IX-1951, one male and one female 3-IX-1951, one female 18-VIII-1952, one female 21-VIII-1952, one male 16-XI-1952, one female (without abdomen) 2-VII-1953, one male 20-VIII-1956, Barbacena, Serra da Mantiqueira, 1100 m, H Ebert leg., ex col. H Ebert, DZ 16.162, DZ 16.024, DZ 5.640, DZ 8.693, DZ 8.725, DZ 8.741, DZ 15.451, DZ 15.402, DZ 15.409, DZ 8.644, DZ 8.677, DZ 8.660, DZ 8.732, DZ 8.701, DZ 15.479, DZ 15.465, DZ 8.709, DZ 8.708, DZ 15.472, DZ 8.653, DZ 15.458, DZ 8.724, DZ 8.685, DZ 16.197, DZ 15.430, DZ 8.700; one male 2-XII-1952, Barroso, Rio das Mortes, Minas Gerais, 950 m, H Ebert leg., ex col. H Ebert, DZ 16.169; one male 31-VII-1951, São João Del Rei, Rio das Mortes, 800-1000 m, H Ebert leg., ex col. H Ebert, DZ 8.733; one female (without abdomen) 29-VIII-1952, São João Del Rei, Rio das Mortes, 950 m, H Ebert leg., ex col. H Ebert, DZ 8.716; *Distrito Federal*: two females 8-IX-1964, one male 8-IV-1965, four males and three females 8-IX-1965, one female 4-VIII-1968, one male 2-II-1968, one female, 23-II-1968, Brasília, H Ebert leg., ex col. H Ebert, DZ 15.437, DZ 15.514, DZ 15.423, DZ 15.444, DZ 15.416, DZ

15.542, DZ 15.486, DZ 15.493, DZ 15.500, DZ 15.570, DZ 15.535, DZ 16.017, DZ 16.134; two males 7-IX-1976, one female 10-IX-1976, one female 18-IX-1976, one female 19-III-1977, one female 4-X-1978, one female 13-III-1977, one female 4-VI-1977, Fazenda Água Limpa, Brasília, D Gifford leg., ex col. Gifford, DZ 15.521, DZ 15.731, DZ 15.752, DZ 15.724, DZ 15.703, DZ 15.696, DZ 16.038, DZ 16.031; one male 27-VIII-1978, Cabeça do Veado, Brasília, D Gifford leg., ex col. Gifford, DZ 15.745; two females 9-IX-1978, Jardim Zoológico, Brasília, Raw leg., DZ 15.682, DZ 15.689. *Goiás*: one male (without abdomen) 5-VII-1981, Goiás Velho, Raw leg., DZ 15.710. *Paraná*: one male 3-VII-2002, one male 21-III-2002, Vila Velha, Ponta Grossa, 900 m, Mielke leg., DZ 15.773, DZ 16.155. One male (without abdomen), 5-VII-1955, illegible locality, [H Ebert leg.], ex col. H Ebert, DZ 15.528.

Molecular data. DNA sequence COI sequenced (DNA voucher NW 149-6), GenBank accession number FJ851400. From a female paratype, same locality data as holotype, collected on August 23, 2005 (Fig 5e). All details, including the picture of the voucher specimen can be found at <http://nymphalidae.utu.fi/story.php?code=NW149-6>

Discussion

The genus *Moneuptychia* Forster as presently defined includes three described species, namely *M. soter* (Butler), *M. melchiades* (Butler) and *M. itapeva* Freitas (Freitas 2007), and is supported at least by one conspicuous synapomorphy: the well developed appendices angulares that project posteriorly in male genitalia (see Freitas 2007). This character has not been observed in any other known Euptychiina (Forster 1964, Ebert & Dias 1997, Freitas 2003, 2004, Freitas & Peña 2006, Peña & Lamas 2005), and might be considered an apomorphic trait for this genus. Based on this character, we place the new described taxon in *Moneuptychia*.

With the description of this new species, the geographical distribution of the genus *Moneuptychia* is extended as far as the *cerrado* of the Central Brazil, as it was previously known to be restricted to Southeastern South America. However, the limits and definitions of this genus probably need to be revised in the future with additional morphological and molecular work. In Peña *et al* (2006), the genus *Moneuptychia* (*sensu* Freitas 2007) is part of a clade that includes *Euptychoides* Forster and *Pharneuptychia* Forster, but only one species of each genus has been sampled so far, and the monophyly of all three genera could not be assessed with the available data.

Thus, a broader study including additional species of the three genera cited above should be conducted using both molecular and morphological data to help us understand the diversification of this clade.

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