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Two new parapatric species of the genus Eretris Thieme from the Andes in western Ecuador (Lepidoptera, Nymphalidae: Satyrinae)

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Abstract – *Eretris suprarufescens* sp. n. and *E. microrufescens* sp. n. are described from the western Andes in Ecuador. They are closely related to each other and to *E. apuleja* C. et R. Felder, [1867], which occurs allopatrically on the eastern slopes of the Andes. The two species are distributed parapatrically in adjacent elevation zones. With 14 figures.

Key words – Altitudinal distributions, Andes, new species, male and female genitalia, Pronophilini, taxonomy.

INTRODUCTION

The genus *Eretris*, described by Thieme (1905), is one of the most diverse of the tribe Pronophilini (Nymphalidae: Satyrinae) with at least 25 mostly highly polytypic species (Lamas *et al.* 2004). Several new species were described recently (Pyrcz 2004, Pyrcz & Fratello 2005, Pyrcz & Gareca 2009), and several more were identified as new, particularly in Peru and Bolivia. The fauna of *Eretris* of Ecuador has not been monographed so far. However, available data indicate that eight out of nine species reported from the northern Andes occur in Ecuador. Six of them were described by C. & R. Felder [1867], namely *E. calisto*, *E. oculata*, *E. encycla*, *E. ocellifera*, *E. porphyria* and *E. apuleja*. The remaining two are *E. centralis* Krüger, 1924, and *E. depresissima* Pyrcz, 1999 (Adams 1986, Pyrcz 1999, Pyrcz & Wojtusiak 1999, Pyrcz & Rodríguez 2007). Several local populations found in Ecuador deserve subspecific status and are currently

under study (PYRCZ & WILLMOTT, in prep.). The two taxa found on the western slopes represent a particular case of elevational parapatric distribution among closely related species, which merits a separate study. Genus level taxonomy of *Eretris* was discussed in some detail by PYRCZ & GARECA (2009).

MATERIALS AND METHODS

Material studied herein was collected in Ecuador in 1999–2006. Collecting was carried out with entomological nets and Van-Someren Rydon baited traps. Type and comparative material was examined in BMNH, MZUJ and in other major European and Ecuadorian public and private collections. Male genitalia were dissected according to standard procedures by soaking in a warm 10% KOH solution, preserved in glycerol, and examined, alongside other morphological microstructures, under an Olympus SZX9 stereomicroscope. Adults were photographed with an Olympus E-500 digital camera, and colour plates were composed using Adobe PhotoShop7.0.

Abbreviations and collection acronyms – FW = forewing; HW = hindwing; V = ventral surface; D = dorsal surface; BMNH = Natural History Museum, London, UK (formerly British Museum (Natural History)); HNHM = Hungarian Natural History Museum, Budapest, Hungary; MZUJ = Muzeum Zoologiczne Uniwersytetu Jagiellonskiego, Kraków, Poland; PUCE = Museo de Entomología, Pontificia Universidad Católica del Ecuador, Quito, Ecuador; PBF = collection of PIERRE BOYER, Le Puy Sainte Réparade, France; TWP = collection of TOMASZ WILHELM PYRCZ, Warsaw, Poland (to be integrated into MZUJ).

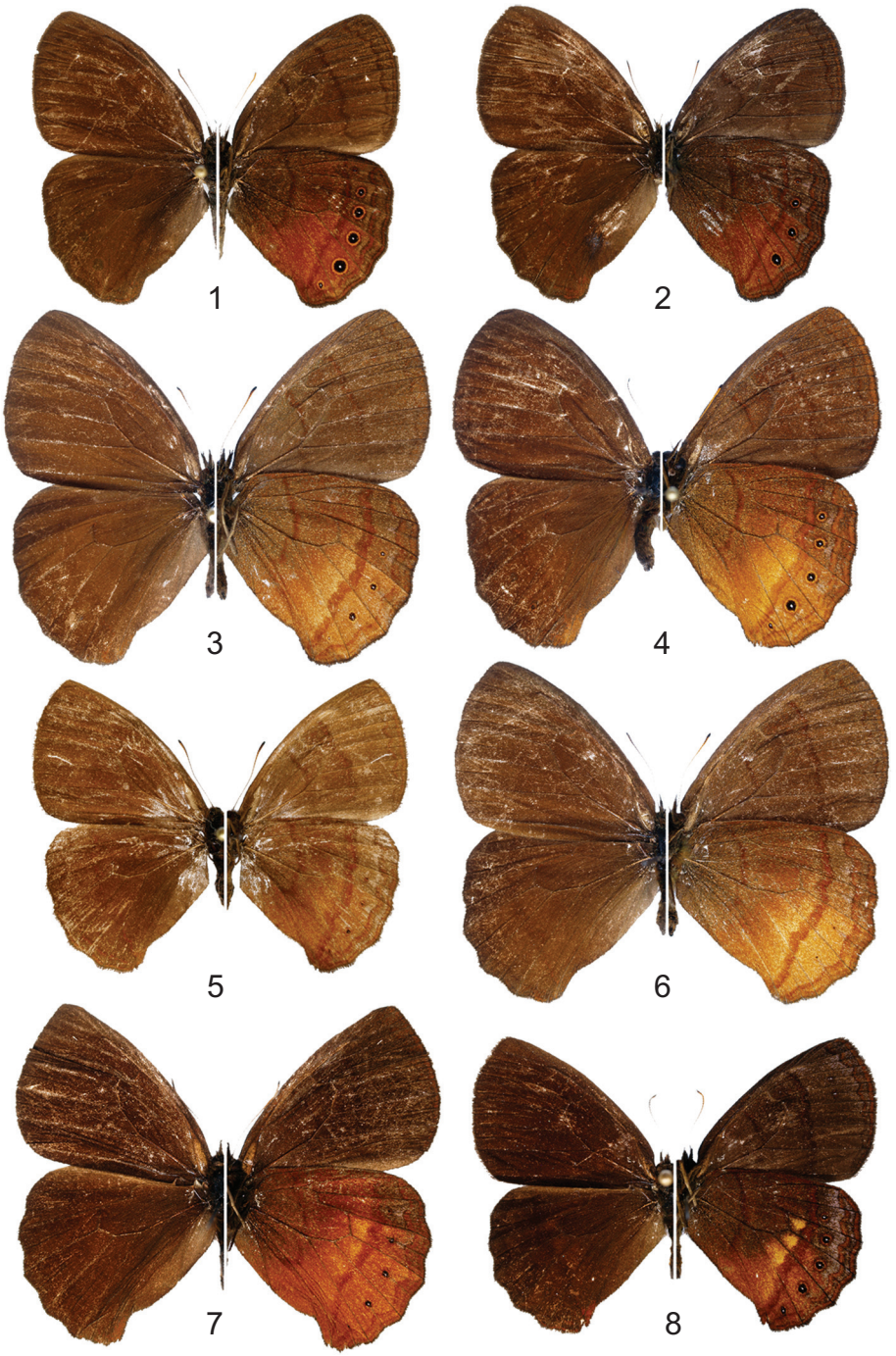
RESULTS

Eretris suprarufescens sp. n.
(Figs 3–4, 6, 10, 13–14)

Type material – ECUADOR: Holotype (male): *Cotopaxi*: Pilaló, nueva Carretera, 3000–3050 m, 3.IX.2004, T. PYRCZ leg., MZUJ. Paratypes (86 males and 8 females): *Carchi*: 1 male: Reserva Forestal Cerro Las Golondrinas, 2550 m, 29.VI.1999, T. PYRCZ & J. WOJTUSIAK leg., MZUJ; 2 males: same data but 2550–2600 m, 20.VI.1999, MZUJ; 2 males: same data but 2600 m, 22.VI.1999, HNHM; 1 male: same data but 2600 m, 24.VI.1999, MZUJ; 1 male: same data but 2500 m, 27.VI.1999, MZUJ; 5 males: same data but 2600 m, 2.VII.1999 (to be deposited in PUCE); 2 males: same data but 2600 m, 29.VI.1999, MZUJ; 1 male: same data but 2500 m, 2.VII.1999, MZUJ; 2 males: same data but 2550 m, 2.VII.1999 (1 prep. genit. 1/22.09.09), MZUJ; 5 males: same data but 2600 m, 2.VII.1999 (1 prep. genit. 3/22.09.09), MZUJ; 2 males: same data but 2500 m, 3.VII.1999,

MZUJ; 2 males: same data but 2550 m, 3.VII.1999, MZUJ; 3 males: same data but 2600 m, 3.VII.1999, to be deposited in PUCE; 1 male: Las Golondrinas, 1800 m (unreliable), 18.VI.1999, T. PYRCZ leg., MZUJ; 3 males: Volcán Chiles, vía a Maldonado, 2650–2700 m, 27.VIII.2004, T. PYRCZ leg., MZUJ; 4 males: Tulcán – Maldonado, 2500–2700 m, 23.V. 1997, A. JASIŃSKI leg., MZUJ; 2 males: Tulcán – Maldonado km 40 à 50, 2800–3200 m, 7.V.1999, P. BOYER leg., PBF; *Imbabura*: 2 males: Parque Nacional Cotacachi-Cayapas, Cuicocha-Chacras, 3150–3200 m, 30.VIII.2004, T. PYRCZ leg., MZUJ; 1 female: same data but 3.II.2005; 1 male: Route de Buenos Aires, La Carolina km 25, 2600 m, 5.V.2000, P. BOYER leg., MZUJ; 2 males and 1 female: route de Buenos Aires km 25 (La Carolina) 2600 m, 5.V.2000, P. BOYER leg., PBF; *Pichincha*: 2 males: Reserva Geobotanica Pululahua, 2500–2600 m, 11.II.2003, T. PYRCZ leg., MZUJ; 1 male: same data but 7.VI.1999; 1 male: same data but 21.II.2002; 1 male: same data but 1.II.2002, MZUJ; 1 male: Pichincha, Aloag vía Tandapi, 2.II.2002, 2800 m, I. ALDAS leg., MZUJ; 1 male: Volcan Pululahua, 3000 m, 31.I.2004, P. BOYER leg., PBF; *Cotopaxi*: 3 males and 1 female: Pilaló, nueva Carretera, 3000–3050 m, 3.IX.2004, T. PYRCZ leg., MZUJ; 6 males and 1 female: Latacunga – Quevedo km 87, 2900 m, 11.III.1998, P. BOYER leg., MZUJ (female prep. genit. J. WOJTUSIAK 1/14.10.2009); 2 males: Latacunga – Quevedo km 87, 2900 m, 11.III.1998, P. BOYER leg.; 1 male: Piloloa, 3000 m, 1.XII.1996, P. BOYER leg., PBF; *Bolívar*: 2 males and 2 females: Balzapamba, above Santa Lucía, vieja carretera a Guaranda, 2600 m, 5.II.2002, T. PYRCZ leg., MZUJ; 7 males: same data but 2600–2650 m, 3.IX.2002, 5 MZUJ, 2 HNHM; 4 males: same data but 2400–2450 m, 5.IX.2002, MZUJ; 5 males and 1 female: same data but 2200–2250 m, 5.IX.2002, to be deposited in PUCE; 1 male and 1 female: same data but 2600–2650 m, 3.IX.2003, MZUJ; 1 male: same locality, VIII.1997, I. ALDAS leg., MZUJ; 2 males: Guaranda, VIII.1997, I. ALDAS leg., MZUJ; 1 male: Balzapamba, Río Alcacer, 2700 m, 4.XI.1996, S. ATTAL leg., MZUJ; 1 male: no data, MZUJ.

Description – Male (Figs 3–4). Head: eyes chocolate-brown, hairy; antennae slender, orange, club darker; labial palpi light brown, covered with orange-brown hair; FWD (FW length: 19–24, mean: 22.2 mm, n=62) chestnut, lustrous; a faint, darker brown submarginal line, parallel to outer margin. HWD chestnut, same as on the FW; a faint undulated, darker brown submarginal line. FWV dull chestnut; a faint, dark brown postbasal line across discal-cell; a dark brown postmedian line, nearly straight from costa to vein Cu1, from vein Cu1 to anal margin slightly undulated; a slightly undulated dark brown submarginal line; a thin orange marginal band. HWV chestnut in basal, postbasal area and along costa, the rest of the wing suffused with orange gradually more intense towards outer margin and tornus; a red orange postbasal arched line; a postmedian red orange band, roughly parallel to outer margin, in most individuals with a shallow basal curve in Cu1-Cu2, merging near tornus with a thin, undulated orange submarginal band; small or very small black submarginal ocelli with white pupils and orange rings, varying in number, between one, in Cu1-Cu2 in the least patterned individuals, and six; a thin orange marginal band. Male genitalia (Fig. 10): Closely similar to *E. microrufescens* other than: uncus slightly shorter and aligned to tegumen shoulder, usually bent downwards in *E. microrufescens*, which appear to be the natural position of uncus, not an artefact of the dissection, since it is consistent in several examined specimens; valvae slightly less curved upwards in basal part.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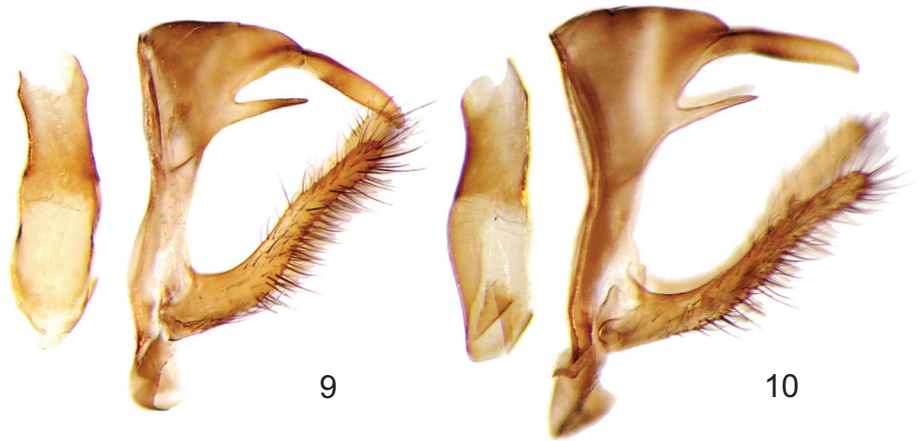
Female (Fig. 6). FWD (FW length: 21–24 mm, mean: 22.5 mm, n=4) light chestnut, dull; a faint, darker brown submarginal line, parallel to outer margin. HWD light chestnut, same as on the FW; a faint undulated, darker brown submarginal line. FWV dull chestnut; a faint, dark brown postbasal line across discal-cell; a dark brown postmedian line, nearly straight from costa to vein Cu1, from vein Cu1 to anal margin slightly undulated; a slightly undulated dark brown submarginal line; a thin orange marginal band. HWV light brown suffused with yellow orange towards tornus; a red orange postbasal arched line; postmedian red orange band, roughly parallel to outer margin, merging near tornus with a thin, undulated yellow orange submarginal band; a minute submarginal dot in Cu1-Cu2; a thin yellow orange marginal band. Female genitalia (Figs 13–14): Lamella antevaginalis in *E. suprarufescens* about half the length of *E. microrufescens.* In *E. microrufescens* the long axis of bursa and ductus bursae form an obtuse angle to the 8-th abdominal segment, whereas in *E. suprarufescens* the angle is acute. Ductus bursae with delicate spiral marks in *E. microrufescens* and with parallel ones in *E. suprarufescens.* Anal tube in *E. microrufescens* is longer and wider than in *E. suprarufescens.*

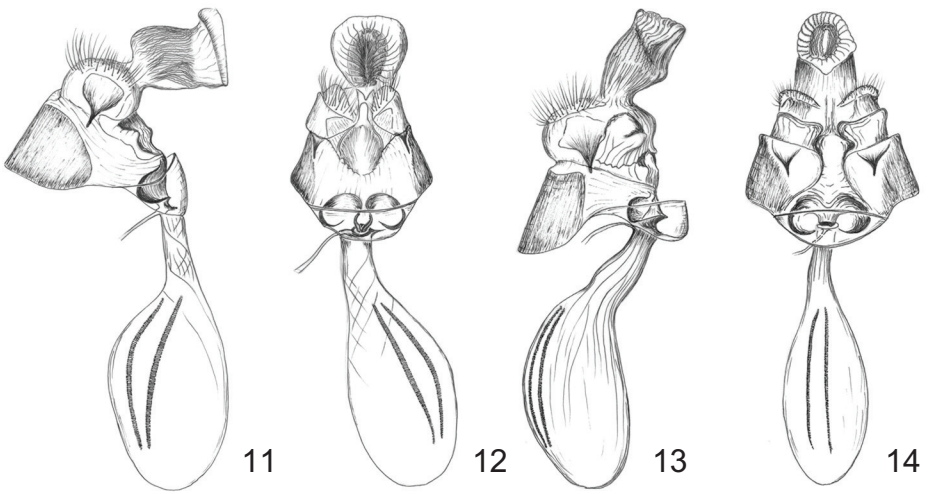
Etymology – The epithet of this species is a composite of *supra*, which is an allusion to the fact that it occurs above its closest relative, and *rufescens*, which indicates its affinity with *E. apuleja subrufescens* (GROSE-SMITH et KIRBY, 1895).

Diagnosis – Most similar to *E. microrufescens* sp. n., described below, from which it differs by the larger size, lighter, orange instead of brick red colour of distal 2/3 of HWV, and very small HWV submarginal ocelli usually as black dots, in some specimens barely noticeable. Compared to the populations of *E. apuleja* found in the Colombian Central Cordillera (Fig. 7), or in southern Ecuador (Fig. 8) FW apex is less acute, HWV suffusion is lighter, yellow orange. There are no triangular postmedian yellow patches in M3-Cu1 and Cu1-Cu2, present in most individuals of *E. apuleja.*

Figs 1–8. Adults. 1 = *Eretris microrufescens* sp. n., male, holotype (Balzapamba, Bolívar), 2 = *E. microrufescens* sp. n., male, paratype (Las Golondrinas, Carchi), 3 = *E. suprarufescens* sp. n., male, holotype (Pilaló, Cotopaxi), 4 = *E. suprarufescens* sp. n., male, paratype (Las Golondrinas, Carchi), 5 = *E. microrufescens* sp. n., female, paratype (Las Golondrinas, Carchi), 6 = *E. suprarufescens* sp. n., female, paratype (Pilaló, Cotopaxi), 7 = *E. apuleja* C. et R. FELDER, [1867] ssp. male (Nevado de Ruíz, Tolima, Colombia), 8 = 8. *E. apuleja* C. et R. FELDER, [1867] ssp., male (Loja-Zamora road, Zamora-Chinchipe, Ecuador)



Figs 9–10. Male genitalia. 9 = *Eretris microrufescens* sp. n., paratype (Las Golondrinas, Carchi) in lateral view, 10 = *E. suprarufescens* sp. n., paratype (Las Golondrinas, Carchi) in lateral view



Figs 11–14. Female genitalia. 11 = *Eretris microrufescens* sp. n., paratype (Tandapi, Pichincha) in lateral view, 12 = *E. microrufescens* sp. n., paratype (Tandapi, Pichincha) in ventral view, 13 = *E. suprarufescens* sp. n., paratype (Pilaló, Cotopaxi) in lateral view, 14 = *E. suprarufescens* sp. n., paratype (Pilaló, Cotopaxi) in ventral view

Eretris microrufescens sp. n.
(Figs 1–2, 5, 9, 11–12)

Type material – ECUADOR: Holotype (male): *Bolívar*: Balzapamba, arriba de Santa Lucía, 1700–1750 m, 3.IX.2003, T. PYRCZ leg., MZUJ. Paratypes (59 males and 5 females): 14 males: same data as the holotype, 4 HNHM, 10 to be deposited in PUCE; 1 female: same data as the holotype, MZUJ; 6 males: same data but 1600–1650 m, 5.IX.2004, MZUJ; 1 male: same data but 2000–2050 m, MZUJ; 1 male: same data but VIII.1997, MZUJ; 1 male: same data but 1700 m, 5.II.2002, MZUJ; 1 male: same data but 2200–2250 m, 5.IX.2005, T. PYRCZ leg., MZUJ; 1 female: same data but 2600 m, 5.II.2002, MZUJ; *Cotopaxi*: 1 male: Pilaló, nueva Carretera, 3000–3050 m, 3.IX.2004, T. PYRCZ leg., MZUJ; 1 male: Piloloa, route Latacunga-Quevedo, 3000 m, 1.XII.1996, P. BOYER leg., PBF; *Pichincha*: 1 male: Tandapi – Aloag, 2200 m, 11.X.1995, A. NEILD leg., TWP; 4 males and 2 females: same data but 28.IX.1995 (female prep. genit. J. WOJTUSIAK 2/14.10.2009), MZUJ; 1 male: same locality?, no date, MZUJ; 1 male: same locality but no date and no elevation, MZUJ; 1 male: vía Calacalí, Nanegalito km 23, 2000–2200 m, 19.II.1997, TWP; 2 males: Otonga, 1900 m, 3.II.2002, T. PYRCZ leg., MZUJ; 2 males: same data but 1.II.2002, MZUJ; 2 males: same data but 1700 m, 5.II.2004, T. PYRCZ leg., MZUJ; 1 female: same data but 1750 m, T. PYRCZ leg., MZUJ; 1 male: same data but 1850–1900 m, II.2004, MZUJ; 1 male: Yunguilla vers Pululahua 2000/2300 m, 31.I.2004, P. BOYER leg., PBF; *Carchi*: 1 male: Reserva Cerro Las Golondrinas, 2200 m, 1.VII.1999, J. WOJTUSIAK & T. PYRCZ leg., MZUJ; 1 male: same data but 2000 m, 24.VI.1999; 2 males: same data but 2150 m, 22.VI.1999, MZUJ; 1 male: same data but 2200 m, MZUJ; 1 male: same data but 2500 m, 27.VI.1999, MZUJ; 1 male: same data but 2100 m, 24.VI.1999, MZUJ; 1 male: same data but 2000 m, 23.VI.1999, MZUJ; 1 male: same data but 2000 m, 4.VII.1999, MZUJ; 1 male: same data but 2300 m, 29.VI.1999, MZUJ; 1 male: same data but 1800 m, 18.VI.1999, MZUJ; 1 male: same data but 2600 m, 3.VII.1999, MZUJ; 1 male: same data but 2150 m, 27.VI.1999, MZUJ; 1 male: same locality?, no date, MZUJ; 1 male: same data but 2200–2400 m, 19.VI.1999, MZUJ; 1 male: same data but 2200 m, MZUJ; 1 male: same data but 2100 m, 27.VI.1999, prep-genit 4/22.09.2009, J. LORENC, MZUJ; 1 male: same data but 2000–2050 m, 29.I.2005, prep-genit. 2/22.09.2009, J. LORENC, MZUJ.

Description – Male (Figs 1–2). Head: eyes chocolate-brown, hairy; antennae slender, orange, club darker; labial palpi light brown, covered with orange-brown hair; FWD (length: 18–20 mm; 19.3 mm, n=42) chestnut, lustrous; a faint, darker brown submarginal line, parallel to outer margin. HWD chestnut, same as on the FW; a faint undulated, darker brown submarginal line. FWV dull chestnut; a faint, dark brown postbasal line across discal-cell; a dark brown postmedian line, nearly straight from costa to vein Cu1, from vein Cu1 to anal margin slightly undulated; a slightly undulated dark brown submarginal line; a thin orange marginal band. HWV chestnut in basal, postbasal area and along costa, the rest of the wing suffused with red orange gradually more intense towards outer margin and tornus; a red orange postbasal arched line; a postmedian red orange band, roughly parallel to outer margin, in most individuals with a shallow basal curve in Cu1-Cu2, merging near tornus with a thin, undulated orange submarginal band; a series of

three to five small or medium sized black submarginal ocelli with white pupils and orange rings, the two in M3-Cu1 and Cu1-Cu2 invariably being the biggest of all; a thin orange marginal band. Male genitalia (Fig. 9): For diagnosis see under *E. suprarufescens.*

Female (Fig. 5). FWD (length: 18–20 mm; mean: 19.2 mm, n=4) light chestnut, dull; a faint, darker brown submarginal line, parallel to outer margin. HWD light chestnut, same as on the FW; a faint undulated, darker brown submarginal line. FWV dull chestnut; a faint, dark brown postbasal line across discal cell; a dark brown postmedian line, nearly straight from costa to vein Cu1, from vein Cu1 to anal margin slightly undulated; a slightly undulated dark brown submarginal line; a thin orange marginal band. HWV light brown suffused with yellow orange towards tornus; a red orange postbasal arched line; a postmedian red brown band, roughly parallel to outer margin, merging near tornus with a thin, undulated yellow orange submarginal band; a series of three to six submarginal small or medium sized ocelli, with white pupils and orange rings; a thin yellow orange marginal band. Female genitalia (Figs 11–12): For diagnosis, see under *E. suprarufescens*.

Etymology – The epithet of this species is a composite of *micro*, which is an allusion to its small size, especially in comparison to its closest relative *E. suprarufescens* and of *rufescens*, which indicates its affinity with *E. apuleja subrufescens.*

Diagnosis – Most similar to *E. suprarufescens* sp. n. from which it differs by the smaller size, reddish instead of orange colour of distal 2/3 of HWV, and larger, fully developed HWV submarginal ocelli, particularly in M3-Cu1 and Cu1-Cu2.

DISCUSSION

E. microrufescens and *E. suprarufescens* occur parapatrically throughout western Ecuador within adjacent zones of altitude. Their elevation ranges in Las Golondrinas show a strong negative correlation (PYRCZ *et al*., in press). The two species differ consistently in size and colour patterns. The differences detected in the genitalia are slight. However, male genital structures in *Eretris* are simple and show very little morphological variation between the species; whereas female genitalia have not been studied enough to conclude the taxonomic importance of the observed differences (PYRCZ 2004, PYRCZ & GARECA 2009). *E. suprarufescens* and *E. microrufescens* do not seem to hybridize, or at least no adults showing intermediate phenotypes were detected. It implies efficient isolation mechanisms. Available data strongly support the conclusion that they are specifically distinct, not ecotypes. Pairs of morphologically closely related, possibly sister species replacing each other parapatrically in elevation are frequent in the genus *Eretris*.

This is the pattern for *E. oculata* and *E. calisto* on the eastern slopes of the Andes in Colombia and Ecuador (ADAMS 1986), *E. encycla* and *E.* n. sp. (VILORIA *et al*., in press) in the Venezuelan Cordillera de La Costa, or *E. depresissima* and *E. encycla* in western Colombia (PYRCZ & WOJTUSIAK 1999).

E. suprarufescens and *E. microrufescens* are similar to *E. apuleja*, which occurs allopatrically on the eastern slopes of the Andes in Ecuador (and locally on the western slopes in the south-west) and throughout Colombia (PYRCZ & RODRÍGUEZ 2007). While morphologically (colour patterns) and ecologically (altitudinal band) *E. microrufescens* is more closely related to an undescribed subspecies of *E. apuleja* found at intermediate elevations (2000–2600 m) in SW Ecuador (Fig. 8), *E. suprarufescens* is related to another undescribed subspecies occurring at high elevations (2800–3200 m) in the Colombian Central Cordillera (Fig. 7). However, it is impossible to determine, based on available morphological data of adults, which one of the two is closer in phyletic terms to *E. apuleja*. Accordingly, both taxa are treated here as species on their right. Such a geographic distribution and morphological data suggest that the two species might have originated from independent colonization events of western slopes of the Andes by the populations of *E. apuleja* stock, one from the NE across the main ridge, and the other from the South. This process resulted in the overlapping the geographic ranges and the stabilization of parapatric altitudinal distributions of *E. microrufescens* and *E. suprarufescens*. It is a scenario which agrees in general terms with the biogeographical hypothesis explaining the patterns of distribution and in particular the occurrence of closely related pairs of species replacing each other along elevation gradients in the tribe Pronophilini (ADAMS 1985). It also agrees with the results of a study on allopatric and sympatric speciation patterns in the genus *Lymanopoda* WESTWOOD, 1851 (CASNER & PYRCZ, in press). ATTAL & CROSSON-DU-CORMIER (1996) discussed a somewhat similar example, the existence of a potential hybrid zone between two subspecies of *Perisama bomplandii* (GUÉRIN-MÉNEVILLE, 1844) in western Ecuador. They hypothesized it to be an outcome of a colonization of this area by *P. bomplandii equatorialis* (GUENÉE, 1872) from South and *P. bomplandii parabomplandii* DOGNIN, 1899 from NE. It therefore exemplifies a similar biogeographical pattern as for *Eretris*, with the difference that it has resulted in the creation of a hybrid

zone not in the partition of niches and full speciation. The genetics of *Eretris apuleja* and allied species from western Ecuador need to be studied in detail in order to confirm or reject the above hypothesis. Also, further research is likely to uncover other examples of this biogeographical phenomenon in western Ecuador.

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