

Two new species of *Euptychia* Hübner 1818 (Lepidoptera: Nymphalidae: Satyrinae) from Mexico and Guatemala

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Abstract. Two new species of *Euptychia* are described and illustrated from southern Mexico and Guatemala. *Euptychia neblina* A. Warren & Nakahara **n. sp.**, is described from eleven specimens from cloud forest habitats in the Mexican states of Oaxaca and Chiapas, as well as Baja Verapaz, Guatemala. *Euptychia lacandona* A. Warren & Nakahara **n. sp.**, is currently known from a single female specimen from Chiapas, Mexico. We discuss possible relationships between these two new species and other species of *Euptychia*.

Key words: Biogeography, butterfly, cloud forest, endemic, satyr.

Resumen. Se describe e ilustra a dos especies nuevas de *Euptychia* del sur de México y Guatemala. *Euptychia neblina* A. Warren & Nakahara **n. sp.** se describe en base a once ejemplares de bosque mesófilo de los estados de Oaxaca y Chiapas en México, junto con Baja Verapaz, Guatemala. *Euptychia lacandona* A. Warren & Nakahara **n. sp.** actualmente se conoce de una hembra de Chiapas, México. Se discuten las posibles relaciones entre estas dos especies nuevas y otras especies de *Euptychia*.

Palabras clave: Biogeografía, mariposa, bosque mesófilo, endémico, satirino.

INTRODUCTION

The New World fauna of Satyrinae butterflies remains incompletely documented, and a large number of undescribed species await formal description and classification (Lamas, 2004). This is especially true in the tropics, but several new species of Satyrinae have been described in recent years from the United States and Nearctic regions in Mexico (*e.g.*,

L. Miller & J. Miller, 1988; Warren *et al.*, 2008; Cong & Grishin, 2014). While searching for specimens of the recently described *Hermeuptychia intricata* Grishin, 2014 in the collections of the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida (see Warren *et al.*, 2014), specimens representing two undescribed Mesoamerican species of *Euptychia* were encountered from Mexico. Subsequent searches in other institutional collections revealed additional specimens of one of these undescribed species. Herein, we describe and illustrate these two new species of *Euptychia*.

MATERIALS AND METHODS

Male and female genitalia were studied using standard techniques, with adult abdomens being soaked in hot 10% KOH for 5-10 minutes, dissected and subsequently stored in glycerol. Female genitalia were stained in diluted chlorazol black before being stored in glycerol. Dissected specimens are indicated below (in Types sections). The terminology for

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genital and abdominal structures follows Klots (1956) except for the term 'aedeagus' where we follow Peña & Lamas (2005). Forewing length was measured from the base to the tip of the right forewing using a Vernier caliper. Nomenclature for wing venation follows the Comstock-Needham system as described by Miller (1970: 44), and nomenclature for the areas and elements of the wing pattern follows Peña & Lamas (2005) and Neild (2008). The following collection acronyms are used throughout this paper:

AMNH — American Museum of Natural History, New York, USA

IBUNAM — Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, Mexico

MGCL — McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, USA

USNM — National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

RESULTS

Euptychia neblina A. Warren & Nakahara, sp. nov.
(Figs. 1a-d, 2a-g)

"*E. fetna*?" in d'Abrera, 1988: 761

ZooBank LSID: urn:lsid:zoobank.org:act:5521C014-0707-48B1-90FB-9A767511740D

MALE: Forewing length 19.1 mm (mean: $n = 2$)

Wing venation: Most of forewing subcostal vein swollen; base of cubital vein barely so; forewing recurrent vein present in discal cell; hindwing humeral vein not developed. **Wing shape:** Forewing subtriangular, costal margin convex, outer margin slightly convex, inner margin straight, but rounded towards anterior thorax near base; hindwing slightly elongate, rounded, outer margin not undulating, inner margin very slightly concave near tornal angle, anal lobe convex, slightly round.

Dorsal forewing: Ground colour light brown, distally darker, slightly translucent, thus subtly revealing ventral dark bands and ocelli; trace of ocellus present in dorsal forewing cell M_1 . **Dorsal hindwing:** Ground color as above; trace of ocellus present in ventral hindwing cell M_1 ; ocellus in cell Cu_1 , black with one white pupil in center, surrounded by one yellow ring extending across veins M_3 and Cu_2 ; dark brown setal patch along cubitus of posterior cell to tornus and to anal margin.

Ventral forewing: Ground color paler than dorsal with gray overtones; reddish-brown narrow band extends basally along swollen subcostal vein from radius to wing base; reddish-brown, straight discal band extends from radial vein to vein 2A, across discal cell in a slightly inward diagonal direction; reddish-brown postdiscal band almost parallel to discal band, relatively broad, extends from radial vein (near origin of R_3) towards inner margin until reaching vein 2A; forked narrow band along discocellular vein m_1 - m_2 and m_2 - m_3 ; narrow, dark reddish submarginal band sinuate; marginal band undulating, same color as submarginal band, slightly thinner than submarginal band; ocellus in cell M_1 , extending across veins M_1 and M_2 , black with one white pupil in

center, surrounded by two concentric creamy-yellow rings, yellow rings are outlined in dark reddish brown, outer ring paler, forming small satellite ocellus in cell M_2 ; cell M_3 with small ocellus; orange suffusion patch in cell Cu_1 extending to cell M_3 ; fringe dark brown at apex shading to fuscous at M_3 with dark brown at tornus and along inner (anal) margin, below fuscous mixed with pale gray. **Ventral hindwing:** Ground color base of wing pale whitish gray with a few black scales; reddish dark-brown narrow band about one-third distance from wing base; discal band almost same width as forewing band, nearly straight, posterior one-third very slightly bent inwards; postdiscal band parallel to discal band, concolorous, slightly wider; narrow submarginal band dentate, especially in cells M_1 , M_2 and M_3 , rather straight towards tornus, same color as forewing submarginal band; marginal band slightly darker than submarginal band, undulating, much thinner than submarginal band; reddish hint at tornus; cells Rs , M_1 and Cu_1 each with ringed, submarginal ocellus identical to forewing ocellus in cell M_1 , ocellus in Rs relatively small; cells M_2 and M_3 each with small ocellus, identical to forewing ocellus in M_3 ; fringe whitish.

Head: Eyes sparsely hairy; labial palpi second segment about two times head height, covered with white scales laterally, second and third segment dorsally covered with dark brown scales, ventrally covered with long brown and white hairy scales, third segment one-fourth of second segment in length; antennae approximately 40% of forewing length, color of club uniformly orange.

Thorax and Abdomen: Dorsally dark brown with head and thorax similar in coloration; abdomen below pale gray brown.

Legs: Foreleg figured in Fig. 2c; meso- and metatibial spurs present.

Genitalia (Figs. 2a-b): Tegumen appears subtriangular in lateral view, dorsally flattened, approximately half the length of uncus, with conspicuous posterior projection above uncus; uncus narrow, long, without setae, very slightly hooked, slightly tapered posteriorly, appears subtriangular in dorsal view, cluster of bristle-like structures present on anterior dorsal surface of tegumen; ventral surface of anal tube weakly sclerotized; gnathos absent; combination of ventral arms from tegumen and dorsal arms from saccus straight; appendices angulares absent; saccus approximately two-thirds length of uncus; juxta present; valva sparsely setose, at approximately 30° angle to horizontal; basal half of valva appears somewhat elliptical in lateral view, ventral margin convex, dorsal margin concave, distal half evenly narrow with angular apex, slightly hooked in dorsal view; aedeagus straight, tubular, elongate, approximately 1.5x as long as uncus, posterior third of aedeagus relatively narrow, broadening anteriorly and open anterodorsally, cornuti absent.

FEMALE: Forewing length 18.8 mm (mean: $n = 3$; holotype 18.1 mm)

Similar to male, except as follows: both forewing and hindwing slightly wider and rounder; dorsally paler, dorsal translucence present on both forewing and hindwing, distally darker; dorsal ground color paler; discal band, postdiscal band present on both forewing and hindwing of dorsal surface; submarginal band and marginal band, darker than postdiscal band present on both forewing and hindwing of dorsal surface; orange patch in cells M_3 and Cu_1 of dorsal forewing. **Legs:** Foretarsus divided into 5 segments, second, third and fourth segments with 2 pairs of spines, outer spine 1.5 times longer than inner spine (Fig. 2d); meso- and metatibial spurs present. **Abdomen:** Weakly sclerotized region between eighth and seventh sternite present in intersegmental membrane. **Genitalia (Figs. 2e-g):** Lamella antevaginalis very well developed, forming a sclerotized region at very base of eighth abdominal segment; ductus bursae membranous; ductus seminalis located close to ostium bursae (posterior end of ductus bursae); corpus bursae roughly oval in dorsal view, without signum, extends to juncture of third and fourth abdominal segment.

Types. Holotype female with the following labels: white, printed and handwritten: T. Escalante / Santa Rosa / Comitán /

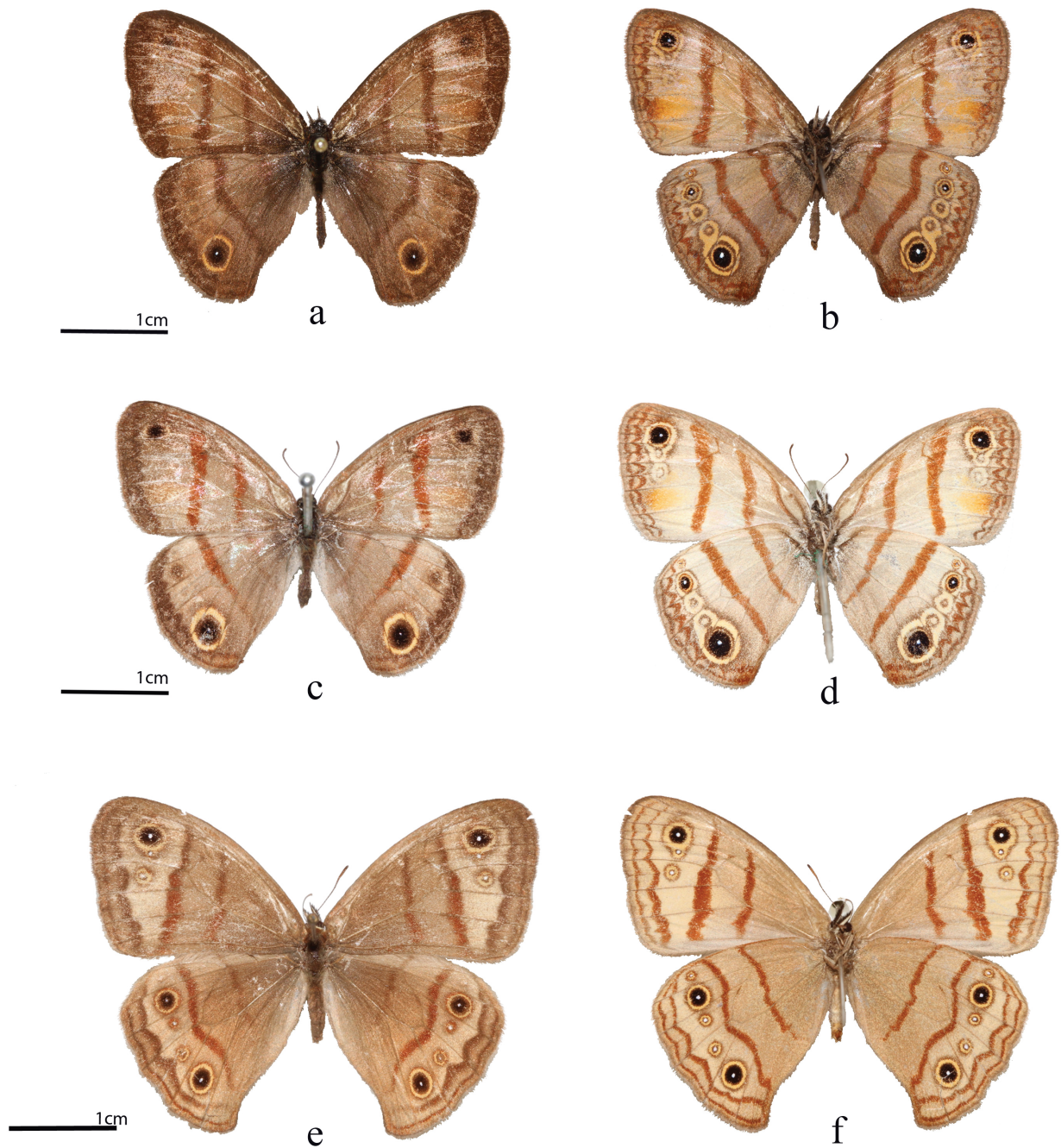


Figure 1. Adult specimens of *E. neblina* and *E. lacandona*: **a** dorsal surface of male *E. neblina* (paratype from La Esperanza, Oaxaca, Mexico); **b** ventral surface of *E. neblina* (paratype from La Esperanza, Oaxaca, Mexico); **c** dorsal surface of female *E. neblina* (holotype from Santa Rosa Comitan, Chiapas, Mexico); **d** ventral surface of female *E. neblina* (holotype from Santa Rosa Comitan, Chiapas, Mexico); **e** dorsal surface of female *E. lacandona* (holotype from Bonampak, Chiapas, Mexico); **f** ventral surface of female *E. lacandona* (holotype from Bonampak, Chiapas, Mexico).

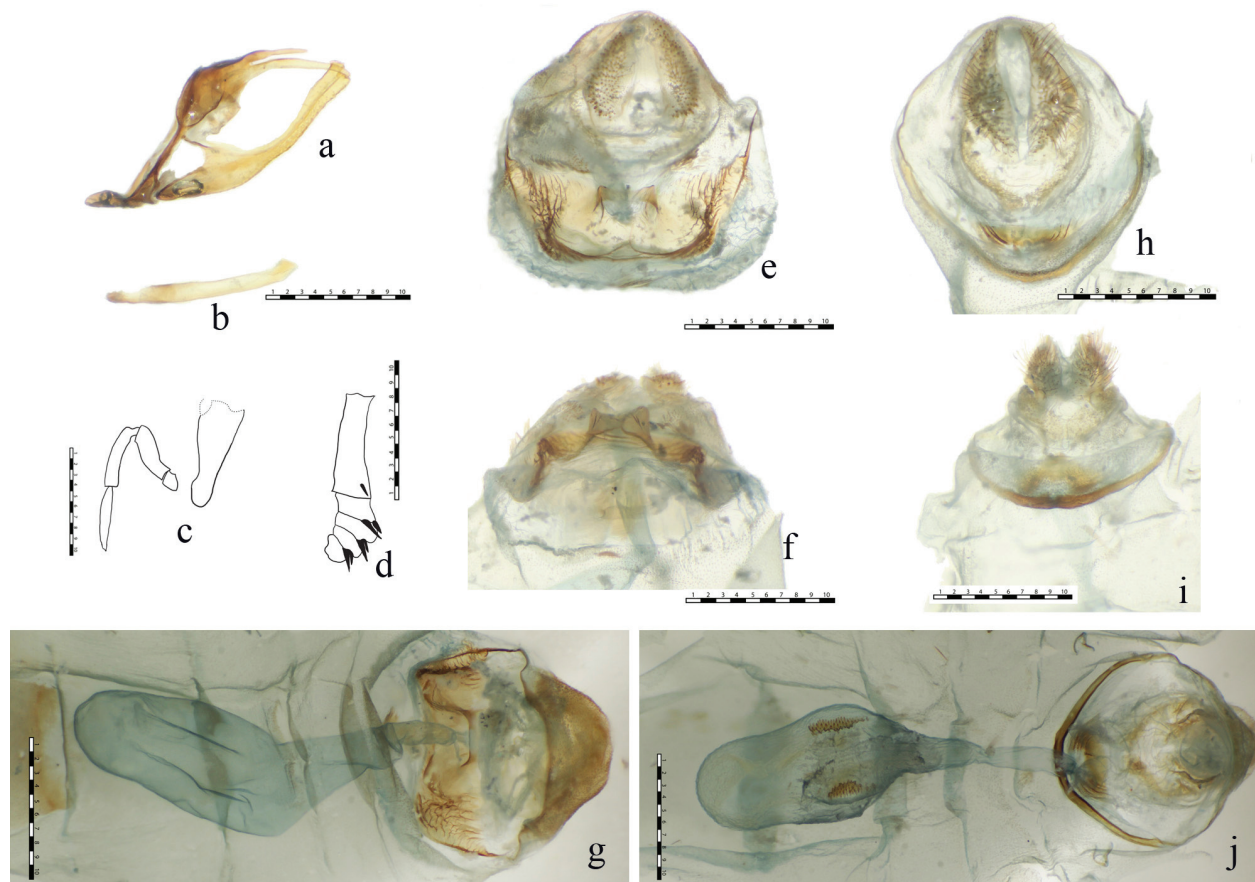


Figure 2. Morphological characters of *E. neblina* and *E. lacandona*: **a** male genitalia of *E. neblina* in lateral view (SN-14-155); **b** aedeagus of *E. neblina*; **c** male foreleg of *E. neblina* (SN-14-155); **d** female foretarsus of *E. neblina*; **e** female genitalia of *E. neblina* in front view (SN-15-43); **f** female genitalia (lamella antevaginalis) of *E. neblina* in ventral view (SN-15-43); **g** female genitalia of *E. neblina* in dorsal view (SN-15-43); **h** female genitalia of *E. lacandona* in front view (SN-14-160); **i** female genitalia (lamella antevaginalis) of *E. lacandona* in ventral view (SN-14-160); **j** female genitalia of *E. lacandona* in dorsal view (SN-14-160). Scale bars indicate 1mm.

Chis. [Chiapas] 3-[19]58 /; white, printed and handwritten: Allyn Museum photo / No. 090475-4 /; white, printed: A. C. Allyn / Acc. 1973-48 /; red, printed: HOLOTYPE / *Euptychia neblina* / A. Warren & Nakahara /. The holotype is deposited in the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida (MGCL).

Paratypes (3♂, 7♀): 1♀, same data as holotype (genitalia dissection SN-14-156) (MGCL); 1♀, México: Chiapas: Rancho Santa Ana, 27 kms. SE Santa Rosa, 1200m, June 1969, Peter Hubbell (AMNH); 1♂, 1♀, México: Oaxaca: Vista Hermosa, July 1964 A. Díaz Francés (MGCL); 1♂, same locality, 25 March 1978 (IBUNAM); 1♂, México: Oaxaca: La Esperanza, 1750m 21 March 1987, J. de la Maza (genitalia dissection SN-14-155) (MGCL); 4♀♀, Guatemala: Purulhá, July, Schaus and Barnes coll. (genitalia dissection prepared for one specimen: SN-15-43) (USNM).

Etymology. *Neblina* is Spanish for fog or mist, and was chosen for *E. neblina* since all known habitats are in cloud forest habitats, which are frequently dominated by fog and mist.

Diagnosis. Diagnostic characters of *E. neblina* which are not shared with other *Euptychia* species are: cluster of bristle-like structures present on anterior dorsal surface of tegumen; absence

of signum in corpus bursae. This species resembles *E. hilara* (C. Felder & R. Felder, 1867), but can be distinguished by the following characters: 1) ventral hindwing submarginal band being reddish in *E. neblina*, whereas whitish in *E. hilara*; 2) ventral forewing and hindwing ocelli surrounded by two concentric creamy-yellow rings in *E. neblina*, whereas surrounded by only one ring in *E. hilara*; 3) dorsal margin of tegumen of male genitalia relatively short in *E. neblina*, whereas long in *E. hilara*; 4) projection of the tegumen above uncus present in *E. neblina*, whereas absent in *E. hilara*; 5) lateral sclerotization of the female eighth abdominal segment present in *E. hilara*, whereas absent in *E. neblina*. 6) abdomen of male is relatively longer in *E. hilara* when compared to hindwing inner margin; 7) female foretarsus of *E. neblina* is divided into 5 distinct segments, whereas first and second segment of foretarsus is partially fused in *E. hilara*. In addition, wing pattern of *E. neblina* somewhat resembles that of *E. jeta* Butler, 1870, although adult size of *E. neblina* is relatively larger and specimens of this new species possesses two concentric creamy-yellow rings surrounding ventral forewing and hindwing ocelli.

Distribution (Fig. 3). Although rare in collections, *E. neblina* is fairly widely distributed in low- (800-1600m) and

intermediate-elevation (1600-2200m) cloud forest habitats from the southern Sierra Madre Oriental (Sierra de Juárez) of Oaxaca (Vista Hermosa, ca. 1335m; La Esperanza, 1750m, both Mpio. Santiago Comaltepec), through central Chiapas (Santa Rosa, Mpio. Comitán, 1060m; Rancho Santa Ana, 1200m (we were unable to locate this locality, thus it is not shown in Fig. 3), to central Guatemala (Purulhá, Baja Verapaz, ca. 1370m). The habitats in the Sierra de Juárez in Oaxaca include the rainiest sites in montane Mexico (ca. 6000 mm of rain annually). Given this distribution, *E. neblina* should be found at other cloud forest sites between 1060 and 1750m in Oaxaca, Chiapas, and Guatemala, and potentially in Veracruz. Considering the vicariant distributions of other cloud forest species in Mexico, search for *E. neblina* should be conducted in the Sierra de Los Tuxtlas in Veracruz. This region frequently hosts disjunct populations or subspecies of widespread cloud forest taxa, e.g., the pierid *Dismorphia eunoe* (E. Doubleday, 1844), with *D. e. eunoe* in the Sierra Madre Oriental, *D. e. popoluca* Llorente & Luis, 1988 from Los Tuxtlas in Veracruz, and *D. e. chamula* Llorente & Luis, 1988 from Chiapas (Llorente & Luis, 1988). Other examples of disjunctly distributed cloud forest taxa include the nymphalid *Prepona deiphile* (Godart, [1824]) and the riodinids *Mesosemia gaudiolum* H. Bates, 1865 and *M. gemina* J. de la Maza & R. G. de la Maza, 1980, which occur in Chiapas and Los Tuxtlas, Veracruz, respectively. The vicariant biogeographic pattern exhibited by these taxa was discussed by Toledo (1982) and Llorente & Escalante (1992).

***Euptychia lacandona* A. Warren & Nakahara, sp. nov.**
(Figs. 1e-f, 2h-j)

ZooBank LSID: urn:lsid:zoobank.org:act:34FB8BDE-4E67-4D2C-A418-BF84AB562D6C

MALE: Unknown

FEMALE: Forewing length 22.3 mm (n = 1)

Wing venation: Most of forewing subcostal vein swollen; base of cubitus barely so; forewing recurrent vein present in discal cell; hindwing humeral vein not developed. **Wing shape:** Forewing rounded, subtriangular, costal margin convex, outer margin slightly convex, inner margin slightly concave; hindwing slightly elongate, rounded, outer margin slightly undulating, inner margin slightly concave near tornal angle, anal lobe convex, slightly round.

Dorsal forewing: Ground colour light brown and slightly greyish, postmedian paler compared to remainder of wing, translucent thus revealing ventral reddish bands that are darker on the dorsal surface, and ocelli; wing pattern of dorsal surface similar to ventral surface (see below), except for submarginal and marginal band being darker, somewhat broader or thicker than on the ventral surface. **Dorsal hindwing:** ground colour same as forewing; wing pattern of dorsal surface similar to ventral surface (see below), except for submarginal and marginal band being darker.

Ventral forewing: Ground colour creamy white, basal two-thirds darker with subtle ochre overtones; both wings with several reddish transverse bands; reddish-brown, discal band extends from radial vein (near origin of R_1) to vein 2A, across discal cell, slightly outward diagonal direction below cubital vein; reddish-brown postdiscal band almost parallel to discal band, extends from radial vein (near origin R_4-R_5) towards inner margin until reaching vein 2A, almost same width as discal band above vein M_3 , broadens below this vein; narrow submarginal band sinuate, same colour as discal and post discal band, broadens towards tornus; marginal band very weakly undulating, same color as submarginal band, almost same width as submarginal band above vein M_2 , thinner than submarginal band below this vein; ocellus in cell M_1 ,

extending across veins M_1 and M_2 , black with one white pupil in center, surrounded by creamy-yellow ring, forming small satellite ocellus in cell M_2 ; cell M_3 with small ocellus; fringe brownish.

Ventral hindwing: Reddish discal band slightly narrower than forewing discal band, extends from costal margin to anal margin, fading between veins 2A and 3A, very slightly bent outwards in discal cell; postdiscal band parallel to discal band, concolorous, almost same width as discal band, curved outward between veins M_2 and Cu_2 ; submarginal band undulating, less wavy towards tornus, same color as forewing submarginal band, somewhat fused to post discal band both anteriorly and posteriorly; marginal band concolorous with and slightly thinner than submarginal band, weakly undulating; cells M_1 and Cu_1 each with submarginal ocellus with creamy-yellow ring, identical to forewing ocellus in cell M_1 ; cells Rs , M_2 and M_3 each with small ocellus identical to forewing ocellus in cell M_3 ; fringe fuscous, darker at tornus.

Head: Eyes sparsely hairy; labial palpi second segment about two times head height, covered with white scales laterally, second and third segment dorsally covered with brown scales, ventrally covered with long brown hairy scales; antennae approximately 55% of forewing length, dorsally darker than ventral side, divided into 35 segments, whitish scales scattered on each segment, anterior 3 segments of club significantly darker.

Thorax and Abdomen: Thorax dorsally dark brown; abdomen dark brown on first abdominal segment and second abdominal segment shading to pale brown with darker end segments; ventral abdomen creamy white with ochre first to fourth abdominal segments shading to creamy white with reddish brown on eighth abdominal segment.

Legs: Meso- and metatibial spurs present.

Genitalia (Figs. 2h-j): Lamella antevaginalis sclerotized; sclerotized 'ring' between seventh and eighth abdominal segment, apparently independent from lamella antevaginalis; ductus bursae membranous; origin of ductus seminalis close to ostium bursae (posterior end of ductus bursae); corpus bursae somewhat like 'pear-shaped' in dorsal view, extends to third abdominal segment, with two short signa, spines of signa developed.

Types. Holotype female with the following labels: white, printed and handwritten: T. Escalante / Bonampak / Chis [Chiapas] / VII-[19]64 /; printed and handwritten: Allyn Museum photo / No. 090475-9 /; white, printed: A. C. Allyn / Acc. 1973-48 /; white, printed: Genitalia vial / SN-14-160 / S. Nakahara /; red, printed: HOLOTYPE / *Euptychia lacandona* / A. Warren & Nakahara /. The holotype is deposited in the McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida (MGCL).

Etymology. This species is named for the Lacandon Forest (Selva Lacandona), situated primarily in Chiapas, Mexico, and adjacent parts of Guatemala.

Diagnosis. The primary diagnostic character of *E. lacandona* is the developed spines of signa, which are apparently more prominent than in any other *Euptychia* species. Externally it can be distinguished from other *Euptychia* species by its relatively large adult size and narrow reddish bands on ventral forewing and hindwing. However, the latter character is, to some extent, similar to those of *E. fetna* and *E. rubrofasciata* L. Miller & J. Miller, 1988. *Euptychia lacandona* can be distinguished from *E. fetna* by its absence of orange patch in ventral forewing cells Cu_1 and Cu_2 . *Euptychia lacandona* can be distinguished from *E. rubrofasciata* by its zigzagging ventral hindwing submarginal band.

Distribution (Fig.3). To date, *E. lacandona* is known only from the type locality, Bonampak, Mpio. Ocosingo, Chiapas, Mexico, at an elevation of about 462m. This site is comprised of lowland tropical rain forest. However, this species is most likely distributed in other extremely humid regions of the Lacandon Forest in Chiapas and Guatemala.

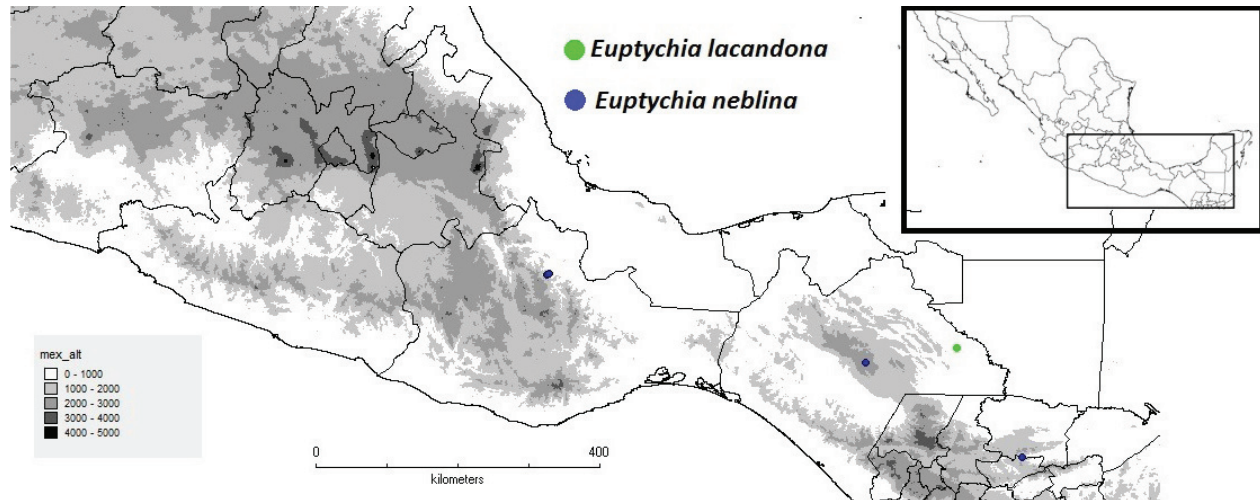


Figure 3. Map showing collecting localities for *E. neblina* (blue dots) and *E. lacandona* (green dot).

DISCUSSION

Euptychia neblina is described in the genus *Euptychia* because of the following characters: 1) presence of projection of the tegumen above the uncus in the male genitalia; 2) presence of the forewing recurrent vein in the discal cell; 3) absence of the basal swelling of forewing cubital vein; 4) presence of the sclerotized region of the eighth abdominal segment, located at the very basal side of the eighth abdominal segment; 5) absence of the lateral sclerotization of the eighth abdominal segment of female; 6) origin of ductus seminalis at the posterior end of ductus bursae; 7) reduced humeral vein. All of these characters (1) – (7) are shared by *Euptychia* species and are absent or rarely seen in other euptychiine butterflies. Although state (1) is considered to be a diagnostic character for the genus (Freitas *et al.*, 2012, 2013; Neild *et al.*, 2014; Nakahara *et al.*, 2014), it appears that this structure is absent in some *Euptychia* species (S. Nakahara, unpubl. data). The male of *E. lacandona* remains unknown, thus we were unable to verify state (1), however, the presence of characters (2), (3), (4), (5), (6) and (7) seems sufficient to place this taxon in *Euptychia*.

As mentioned in the diagnosis, the wing pattern of *E. neblina* is similar to that of *E. hilara*, although evidence from morphology, host plant records and molecular data suggests that *E. hilara* should be excluded from the genus *Euptychia*, and a new genus will be described for *E. hilara* (Nakahara *et al.*, in press). Thus, *E. hilara* is probably not a close relative of *E. neblina* and the wing pattern similarities are

likely a result of convergent evolution. Based only on wing pattern, *E. neblina* is also similar to *E. fetna*, which is a widely distributed species in Central America. However, the male and female genitalia of *E. neblina* and *E. fetna* are dissimilar in many ways (e.g., projection of the tegumen being very short in *E. fetna*) implying that they are not closely related to each other. In fact, the male genitalia of *E. neblina* is apparently most similar to *E. meta* Weymer, 1911, in terms of its valva shape, relatively long and narrow uncus and the presence of the weakly sclerotized anal tube. Interestingly, these two species both possess two concentric creamy-yellow rings surrounding ventral forewing and hindwing ocelli. Despite its morphological similarity to some *Euptychia* species, *E. neblina* possesses three interesting characters which are not or rarely seen in other members of the genus: cluster of bristle-like structures present on anterior dorsal surface of tegumen, absence of signa in the corpus bursae, and presence of the meso- and metatibial spurs. The bristle-like character on tegumen is apparently homologous to that reported in *Forsterinaria emo* Zubek, Pycz & Boyer, 2013 (Zubek *et al.*, 2013) and needs further investigation when materials become available. The absence of the tibial spur was first reported in *E. mollina* Hübner, 1818, the type species of the genus, in Miller (1968). This spur is apparently absent in many *Euptychia* species except for the two new species described herein, as well as *E. rubrofasciata* and *E. hilara*.

Euptychia lacandona is superficially similar and perhaps closely related to *E. rubrofasciata*, judging from its wing pattern and the female genitalia

description in the original description (L. Miller & J. Miller, 1988). We were unable to examine the female genitalia of *E. rubrofasciata* in good condition, but based on the original description of this taxon, the shape of the lamella antevaginalis and its separation from the sclerotized ring correlates well with those of *E. lacandona*. However, due to the fact that *E. rubrofasciata* is a unique member of the genus *Euptychia* based on morphology and biogeography, further study on *E. lacandona* including discovery of the male is necessary in order to reveal its systematic placement. Given that *Euptychia* species are not usually abundant, special collecting efforts should be made to detect the presence of both newly described species at additional sites.

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