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Llorenteana, a New Butterfly Genus from the American Continent (Lepidoptera: Nymphalidae: Satyrinae)

Llorenteana, nuevo género de mariposas del Continente Americano (Lepidoptera: Nymphalidae: Satyrinae)

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ABSTRACT

The genus *Llorenteana*, **gen. nov.**, is diagnosed and described to allocate the enigmatic, relictual, satyrine butterfly, *Euptychia pellonia* Godman, 1901. The taxonomy of this species had been superficial, variable and unstable for more than a century. The new genus is monobasic and endemic to the montane pine-oak forests of the Northern Mexican Altiplano. Its morphology suggests it should be placed within the Ypthimina Miller, 1968, a subtribe notably diverse in other continents, mainly Africa and Asia, but so far unreported in the American continent.

Keywords: *Argestina*, *Callerebia*, *Chillanella*, *Euptychia*, *Euptychiina*, *Hemadara*, *Incertae sedis*, *Loxerebia*, *Mashunoides*, *Megisto*, *Neosatyris*, *Thymipa*, *Ypthimina*, *Ypthimomorpha*.

RESUMEN

Se diagnostica y describe el género *Llorenteana*, **gen. nov.**, al cual se asigna la mariposa satirida *Euptychia pellonia* Godman, 1901, una especie enigmática y relictual. La taxonomía de esta especie había sido superficial, variable e inestable durante más de un siglo. El nuevo género es monobásico y endémico de los bosques de pino-encino del norte del Altiplano Mexicano. Su morfología indica que debería ser ubicado dentro de Ypthimina Miller, 1968, una subtribu notablemente diversa en otros continentes, principalmente África y Asia, pero hasta este momento inadvertida en el continente Americano.

Palabras clave: *Argestina*, *Callerebia*, *Chillanella*, *Euptychia*, *Euptychiina*, *Hemadara*, *Incertae sedis*, *Loxerebia*, *Mashunoides*, *Megisto*, *Neosatyris*, *Thymipa*, *Ypthimina*, *Ypthimomorpha*.

One of the rarest and least known satyrine butterflies from the American continent is the Mexican species *Euptychia pellonia* Godman, 1901. It was described from a representative series of individuals from montane localities of Durango and Jalisco, and after almost 120 years, few additional specimens have reached entomological collections. The strongly clubbed antennae and the presence of a dorsal, conspicuous, double pupilled subapical ocellus, gives *E. pellonia* a singular, very unusual aspect, among the members of the American fauna of Satyrinae (especially Neotropical). Its taxonomic position, although only superficially considered in the past, had been so puzzling that it has historically been placed in five different genera: *Euptychia* Hübner, 1818 (Weymer, 1911; Gaede, 1931; D’Abrera, 1988), *Pindis* R. Felder, 1869 (Lewis, 1973; L. D. Miller, 1978; Shou *et al.*, 2006), *Cissia* Doubleday, 1848 (L. D. Miller & J. Y. Miller, 1988; R. G. De La Maza, 2010), *Megisto* Hübner, [1819] (R. F. De La Maza & J. De La Maza, 1987; Llorente Bousquets *et al.*, 1996; Vargas F. *et al.*, 1996; Warren *et al.*, 1996; Luis Martínez *et al.*, 2000; Díaz-Batres *et al.*, 2001; Michán *et al.*, 2004) and *Zischkaia* Forster, 1964 (Glassberg, 2007). These genera,

each notably distinctive, are all allegedly members of the *Euptychiina* Reuter (1896), a large and widespread, mostly tropical American, subtribe of the Satyrini. Lamas & Viloría (2004) considered *E. pellonia* as *incertae sedis*, but placed it as a member of the *Euptychiina*.

Close examination of peculiar morphological features of *E. pellonia* and comparative studies with other species of Satyrinae have shown that it is not closely related to any other representative of the satyrine fauna of America and strongly suggests that it should be placed in its own genus. It is proposed that this new genus belongs in a subtribe, *Ypthimina* Miller (1968) that has gone so far unnoticed in the American continent.

MATERIALS AND METHODS

Abbreviations and acronyms: **BCA:** Biología Centrali Americana; **FWL:** Forewing length; **HT:** Holotype; **MZFC:** Museo de Zoología “Alfonso Herrera”, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad de México; **NHMUK:** The Natural History Museum, London, UK.

Methods: This is a study of comparative morphology

of adult butterflies of the subfamily Satyrinae. Type specimens were examined and compared with original descriptions and illustrations for taxonomic identification. We have identified structures, interpreted, compared and described the morphology of wing pattern, wing veins and male genitalia of dry adult butterfly specimens preserved in two major natural history museums. To diagnose and describe the genus herein erected we have also examined the morphology of representatives of almost all genera of Satyrinae recognized in America and a number of externally similar taxa from other continents (mentioned in discussion) and established homological comparisons. Some nomenclatural, taxonomic and biogeographic information has been gathered from published sources (cited in the synonymy, the discussion and the conclusions).

Nomenclatural acts of this work follow the provisions of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999)

Technical procedures: Due to the limited number of specimens examined for this study we have selected the minimum necessary quantity of individuals for dissecting their morphological structures. Wing diaphanization and genitalia dissections were performed by standard basic procedures. These were accomplished by simple chemical treatments like bleaching and, watering of wings and digesting soft abdominal tissues with strong alkaline solutions to remove sclerotized male genitalia structures. Cleaning was performed manually with microdissecting tools under stereoscopic magnification. Illustrations have been produced while examining the insects and their structures with several types and brands of microscopes and stereomicroscopes (Leica, Nikon, Olympus, Wild) coupled with artificial light systems and camera lucida (for drawings) or 35 mm photographic camera (for macro and microphotographs). Figures were generated with the aid of imaging software Zerene Stacker™ and Adobe Photoshop™ (several versions).

RESULTS

Llorenteana Viloria and Luis-Martínez, **gen. nov.**

<http://zoobank.org/E6815CA0-F0C0-4E03-B8F6-40A735DCAE12>

Type species: *Euptychia pellowia* Godman, 1901: 655, pl. 107, figs. 5, 6; herein designated.

Diagnosis: Members of the new genus *Llorenteana*, **gen. nov.**, can be diagnosed by their forewing venation, in which the five radials (R1 to R5) conspicuously branch out from a single root or sector; R1 emerging after the first basal sixth of the length of Rs, well beyond the costal corner of the discal cell. This character has only been detected in two other genera of Satyrinae in the American continent: *Neosatyrus* Wallengren, 1858 and *Chillanella* Herrera, 1966 (herein considered valid), both restricted to southern latitudes (Chile and Argentina). In all other known American genera forewing R1 always departs independently from the

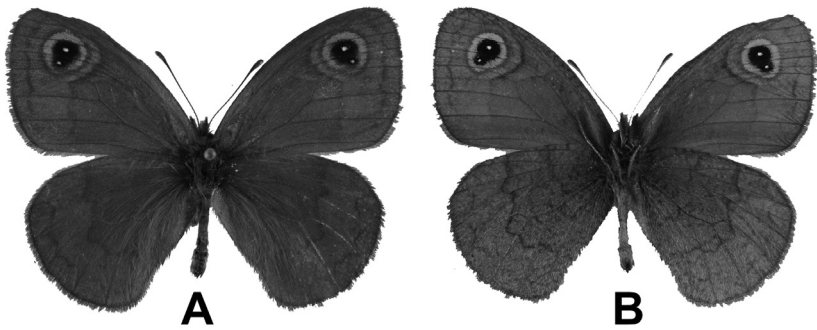
root of R2-R5, at the distal extremity of the discal cell.

Description: Butterflies of small size (males FWL: 17.9-18.7, \bar{x} =18.5, n=6; females FWL: 18.5-20.3, \bar{x} =20.3, n=5), antennae conspicuously clubbed; forewing subtriangular, with rounded angles; hindwing suboval, outer margins not scalloped. Hindwing lacking ocelli.

Venation (Fig. 2, female): Forewing: Sc independent, inflated at basal third, with small constriction at base, running from base through three fifths of costa; all radials (R1-R5) emerging from same single root, which forms the costal margin of discal cell; R1 branches out towards costa at first sixth of radial sector, beyond distal extremity of discal cell; R2 shorter than other radials, emerging slightly beyond second sixth of radial sector; R3 emerging about half length of radial sector; R4 and R5 diverging at its second third, their distal extremities limiting both sides of wing apex (R4 costal, R5 marginal); M1 independently emerging from anterior extremity of discal cell, running smoothly parallel to radial sector; M2 independent, emerging from distal end of discal cell, more or less half way between emergence of radial sector and that of M3; M3 independent, emerging from the vertex of a right angle formed by the junction of m_2-m_3 and m_3-cu_1 ; Cu1 independent, running free from posterior corner of distal end of discal cell to outer margin, parallel to anal margin; Vogel's chordotonal organ present at base of cubital sector, which is only slightly swollen along its basal third; conspicuous constriction distally limiting Vogel's structure; A2 independently running from wing base to tornus, slightly sinuous and parallel to anal margin; r_5-m_1 straight, one seventh length of m_2-m_3 ; m_1-m_2 curved towards cell, approximately two thirds length of m_2-m_3 ; m_2-m_3 straight. Hindwing: Humeral present, thick at base, thin basal branch towards wing base, thick branch, twice as long as previous one emerging towards costa in opposite direction; Sc + R1 ending over middle point of coastal margin; R5 independent, emerging from middle length of anterior border of discal cell, M1, M2 and M3 independent, the latter emerging from distal vertex of discal cell, ending in middle point of outer margin; Cu1 and Cu2 independent and more or less straight; A2 and A3 both independent but emerging from wing base very close to each other, quickly diverging as they run separately; A2 ends at tornus; A3 ends at first, basal third of anal margin; $rs-m_1$ straight; m_1-m_2 double length of $rs-m_1$, slightly angled towards cell; m_2-m_3 straight, twice length of m_1-m_2 .

Wing pattern (Fig. 1, male): prominent black postdiscal ocellus on forewing (recto and verso), in middle of cell M1, central pupil white; smaller element from neighboring cell M2 expressed as fused satellite of main M2, with a second, eccentric, white pupil.

Male genitalia (Fig. 3): genital capsule compact and stout, thickly sclerotized (3A, B, C). Tegumen subglobular, not much higher than the origin of uncus; the latter more or less distinct from tegumen, beak-like, 1.3 times as long as tegumen, slightly curved, pointing downwards; subunci stylized and well defined, thin but stout, half length of uncus,



Figs. 1. Habitus of *Llorenteana pellationia* (Godman, 1901), **comb. nov.**, male (MZFC 66965). **A.** Dorsal; **B.** Ventral.

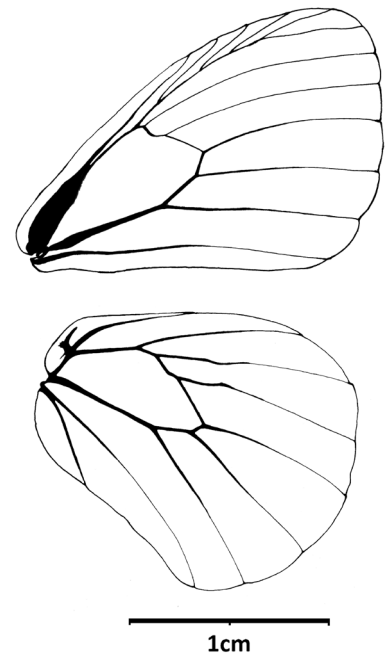


Fig. 2. Wing venation of *Llorenteana pellationia* (Godman, 1901), **comb. nov.**, female (MZFC 56108).

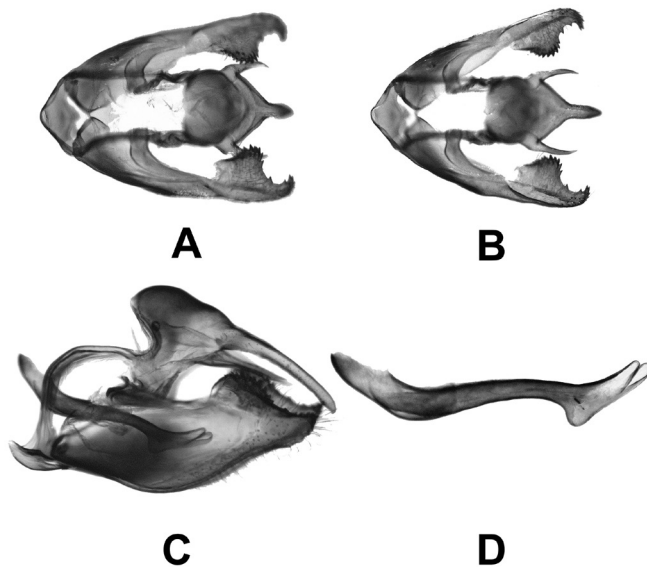


Fig. 3. Male (MZFC 66965) genitalia of *Llorenteana pellationia* (Godman, 1901), **comb. nov.**, **A.** Dorsal view of the genital capsule, aedeagus removed; **B.** ventral view of the genital capsule, aedeagus removed; **C.** Lateral view of the genital capsule, with aedeagus in natural position; **D.** Lateral view of detached aedeagus.

emerging laterally outwards, just below base of uncus; vinculum thin, stout, strongly sigmoidal in lateral view, forming a ring laterally compressed; saccus as wide as tegumen and very short, dorsally depressed; valvae moderately setose at distal quarter, large, deep in lateral view, broader at base, as much as lateral extension of tegumen, slightly less towards tip, ampullar process conspicuous with many short, denticular spines pointing to inner side, distal spiny process; a diastema or space without spines between ampulla and distal tip; aedeagus (Fig. 3D) very strong and rather sclerotized, moderately thick, sinuous in lateral view, a broad, bifid distal extremity, reminiscent of a human foot in lateral view.

Material examined: **MEXICO, Jalisco:** 1 male (Type HT), Bolaños, Jalisco, Mex.[ico], Richardson, Godman-Salvin Coll.1904-1., B. C. A. Lep. Rhop. *Euptychia pellationia*, Godm., Agrees with Figure of Type. N.[orman] D. R.[iley], B. M. TYPE No. Rh. 3295, *Euptychia pellationia*, [male] Godm., SYNTYPE *Euptychia pellationia* Godman & Salvin, det. P.Ackery 1974 [NHMUK]; **Durango:**

1 male (MZFC 56097), 1 female (MZFC 56096), 25 mi W Durango, 24° 01'18", -105° 03'11", 20.vii.1964, J. A. Powell; 1 female (MZFC 56126, Genit. prep. ALV-528-14, 11.xii.2014), 29 mi W Durango, 28° 08'25", -104° 58'23", 20.vii.1964, J. A. Powell; 1 male (MZFC 56125), 30 mi W Durango, 24° 01'18", -105° 05'17", 31.vii.1964, J. A. Powell; 1 male (MZFC 56098), 1 female (MZFC 56099), 29 mi W Durango, 24° 08'25", -104° 58'23", 18.vii.1969, J. A. Powell; 1 male (MZFC 56107), 1 female (MZFC 56108, Wing prep. ALV009-14, Genit. prep. ALV527-14, 11.xii.2014), same data, 7.viii.1972; 2 males (MZFC 66723, 66965 [Fig. 1 A (dorsal), B (ventral)]), 1 female (MZFC 66964), La Michilia, Mesa del Burro, Municipio Sùchil, [Durango], 23° 35'17", -104° 04'33", 3.viii.1984, M. E. Díaz B. [MZFC]

Etymology: *Llorenteana* means "belonging or relative to Llorente". It is a feminine Spanish derivation of the first surname of our long-time friend and colleague, Jorge Enrique Llorente Bousquets, prominent Mexican scientist, philosopher, evolutionary biologist, biogeographer

and especially, lepidopterist. He is an Emeritus Professor of the Universidad Nacional Autónoma de México (UNAM). Professor Llorente Bousquets owns a rich academic record among Latin American lepidopterists. He was one of the founders of the Museo de Zoología “Alfonso L. Herrera” in the Faculty of Sciences at UNAM, where he pioneered and continues developing modern studies of systematics, faunistics and biogeography of Mexican and other Neotropical butterflies. Our knowledge of the butterfly fauna of Mexico has been greatly improved by the initiative and persisting efforts of Jorge Llorente and the members of his research team, as to become one of the most complete of any country in Latin America. We feel honored to name this new, peculiar genus of satyrine butterfly endemic to Mexico after Jorge Llorente, tutor, companion and mentor.

Llorenteana, **gen. nov.**, is herein recognized as a monobasic genus of satyrine butterflies, endemic to the mountains of the northern Mexican Altiplano.

Llorenteana pellowia (Godman, 1901), **comb. nov.**

Figs. 1 male, A (dorsal), B (ventral);

2 female (wing venation); 3 male (A-D genitalia)

Euptychia pellowia Godman, 1901: ii, xxxii, 655, pl. 107, figs. 5, 6.

Euptychia pellowia Godman; Weymer, 1911: 202; Gaede, 1931: 459; D’Abrera, 1988: 876 [index].

Pindis pellowia (Godman); Lewis, 1973: 235, pl. 63, fig. 16; L. D. Miller, 1978: 1; Shou *et al.*, 2006: 86.

“*Euptychia*” *pellowia* Godman & Salvin [*sic*]; L. D. Miller, 1978: 1.

“?” *pellowia* Cramer [*sic*]; D’Abrera, 1988: 788, 789 [rows 4, 5] figs. male recto, verso.

Cissia pellowia (Godman & Salvin) [*sic*]; L. D. Miller & J. Y. Miller, 1988: 276; R. G. De La Maza, 2010: 184.

Megisto pellowia (Godman); R. F. De La Maza & J. De La Maza, 1987: 94, 200 lám. 24, fig. 10; Llorente Bousquets *et al.*, 1996: 45; Vargas F. *et al.*, 1996: 128; Warren *et al.*, 1996: 15; Luis Martínez *et al.*, 2000: 285; Díaz Batres *et al.*, 2001: 41.

“*Megisto*” *pellowia* (Godman); Michán *et al.*, 2004: 40; 2005: 130.

[*Incertae sedis*] *pellowia* Godman; Lamas & Viloría, 2004: 223.

Zischkaia pellowia (Godman); Glassberg, 2007: 139 figs.

DISCUSSION

Diagnostic or prominent characters of *Llorenteana*, **gen. nov.**, could only be compared with those of a limited number of satyrine taxa. In the American continent, forewing radial veins all emerging from a single root is a character so far detected in two austral genera of the Andean region: *Neosatyris* Wallengren (1858) and *Chillanella* Herrera (1966) (Wallengren, 1858: 79; Hayward, 1958: 258-259; Herrera, 1966: 71; Herrera & Howarth, 1966: 121, fig. 77, 122, fig. 83). It is found in some African genera such as *Thymipa* Moore (1893), *Ypthimomorpha* Van Son (1955: 152, fig. 175c) and *Mashunoides* Mendes & Bivar de Sousa (2009: 8, fig. 1), along with some Asian species currently classified in the genus *Ypthima* Hübner, 1818, which are certainly not close to the type species of the genus, *Y.*

huebneri Kirby, 1871: ‘*Ypthima philomela* (Linnaeus, 1763), ‘*Ypthima coorgensis* Sharma, 2013 and ‘*Ypthima tripuraensis* Sharma, 2013. Members of the *Y. huebneri* group have a different arrangement in the forewing radial veins and have been set apart, as supported by molecular phylogenies (see Sharma, 2013: 8 fig.1, 9 fig. 11; Jisming-See *et al.*, 2016; Osozawa *et al.*, 2017).

Among American satyrs, the double-pupilled postdiscal-subapical ocellus on the forewing upperside is only found in some species placed in the southern South American genera *Pampasatyris* Hayward (1953) and *Stegosatyris* Zacca, Mielke & Pyrcz (2013), the North American genus *Megisto* and the enigmatic species ‘*Euptychia rubricata* W. H. Edwards, 1871, recently classified in *Cissia* by Zacca *et al.* (2018). However, it is a generalized trait within the Asian and African ypthimine satyrids.

The markedly capsular male genitalia of *Llorenteana*, **gen. nov.**, is only comparable to similarly featured structures in a few genera of American Satyrinae, including the Mexican-North American *Paramacera* Butler, 1868 and *Gyrocheilus* Butler, 1867, the Central American and West Colombian *Inbio* Nakahara & Espeland, 2015, and the West Indian *Calisto* Hübner, 1823. Subtribal allocation of all these genera is currently uncertain.

Certain Asian genera of Satyrinae contain species that can be superficially similar to *Llorenteana pellowia*, **comb. nov.**, but they do not share the diagnostic character of R1 emerging distad to the discal cell in the forewing. Such is the case of *Argestina* Riley (1923: 469). The morphology of the genitalia in males of the genera *Callerebia* Butler (1867), *Hemadara* Moore (1893) and *Loxerebia* Watkins (1925), may be reminiscent of that of *Llorenteana* **gen. nov.**, particularly in the general shape of the valvae or the reduced saccus. However, they lack the characteristic sigmoidal vinculum of the new Mexican genus (see Della Bruna *et al.*, 2002; Huang & Wu, 2003; Singh, 2015).

CONCLUSIONS

Judging from the aforementioned morphological homologies, especially wing venation, but also wing pattern affinities, *Llorenteana pellowia* (Godman), **comb. nov.**, should be considered a member of the subtribe Ypthimina Miller (1968). It represents the first and so far only confirmed example of this clade known in the American continent; a possible relictual element confined to particular montane forest habitats of the northern Mexican Altiplano, chiefly “bosque de pino – encino”, but also “matorral” and “bosque de pino – encino – madroño” (Díaz Batres *et al.*, 2001). Comparative genetic studies (DNA sequencing and molecular phylogenies) are needed to test this hypothesis. Paralleling the case of close relationship between the North American *Megisto* Hübner and the Asian *Palaeonympha* Butler (Peña *et al.*, 2010), which cannot be taken as an isolated biogeographic anomaly, we would expect the nearest relative of *Llorenteana*, **gen. nov.**, to be found among the rich ypthimine fauna of central or eastern Asia.

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