

A NEW SPECIES OF *COLORADIA* FROM SONORA AND CHIHUAHUA, MEXICO (SATURNIIDAE: HEMILEUCINAE)

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ABSTRACT. *Coloradia prchali*, new species, is described from the mountains of eastern Sonora and western Chihuahua, Mexico. This charcoal black species is sympatric with *Coloradia luski* and has been collected only from the region around Yecora, Sonora, Mexico, at an elevation of 1050 m to 1900 m, primarily in the pine/oak forest habitat (Petran [Madrean] Conifer Forest). It also has been collected sparingly in the oak woodland habitat (Madrean Evergreen Woodland) just below the pine/oak forest community. Females of this species are attracted to Mercury Vapor and Ultra-violet light, but only five males have been collected at light. Males are primarily day fliers and have been observed flying (and attracted to virgin females) between 0900 and 1500 h. Genitalic characters indicate that *C. prchali* is most closely related to *C. luski* but characters of the foretibia are more similar to *Coloradia pandora*.

Additional key words: Systematics, variation, distribution, habitat, Sonoran Lepidoptera Survey.

The Lepidoptera fauna of Sonora, Mexico, was poorly known until the past decade. Recent collecting efforts have increased significantly our understanding of this fauna (Holland & Forbes 1981, Friedlander 1985, Smith 1985, Opler 1986, Miller & Miller 1988, Donahue 1989, Rindge 1990). In 1982, Steve Prchal of Tucson, Arizona, began his ecological and entomological studies in the mountains and plains of Sonora. The successes of his early trips sparked the interests of several other Arizonan collectors and resulted in annual collecting trips into various parts of Sonora. A result of these expeditions has been a dramatic increase in the number of Lepidoptera recorded from northwestern Mexico, including saturniid moths (Saturniidae). Hoffmann (1942) recorded only six species of saturniids from Sonora. There are now 37 species of Saturniidae documented and another 5 to 10 species are considered possible from this Mexican state (M. Smith, unpubl. data). Many of these species have proven to be significant range extensions for Mexican Saturniidae, including *Rothschildia orizaba orizaba* (Westwood), *Antheraea montezuma* (Sallé), *Copaxa muellerana* (Dyar), *Automeris boudinotiana* Lemaire, *Automeris metzli* (Sallé), *Anisota assimilis* Druce, *Syssphinx colloida* (Dyar), *Citheronia beledonon* Dyar,

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and *Dysdaemonia boreas* (Cramer). Certainly one of the most interesting discoveries was an undescribed charcoal-black, white-fringed *Coloradia* (Hemileucinae). Collecting efforts in 1988 through 1991 provided a number of specimens for study.

***Coloradia prchali* Lemaire & M. J. Smith, new species**

(Figs. 1A & B, 2; Plate 1A & B)

Male. Head: Black, scattered with whitish scales; labial palpi two-segmented, about the same color as the frontal area. Antennae quadripectinate to the apex, flagellum rusty yellow, rami black; apical rami shorter than basal rami, those of outer side less than half as long as those of inner side of flagellum. **Thorax:** Dorsally covered with black hairs, speckled with white hairs, the latter most prevalent on the metathorax. Legs dark brown with intermixed black and white hairs; foretibia (Fig. 1C, D) lacking the epiphysis in the dissected specimens ($n = 4$) but bearing a long spine arising from the inner apical angle. **Abdomen:** Black, the white scales not abundant dorsally and ventrally but laterally forming well defined streaks. **Forewing:** Length 28.1–31.0 mm ($\bar{x} = 29.4$ mm, $n = 12$). Above charcoal black, slightly and irregularly suffused with white scales; the overscaling most prevalent on the anterior half of the costa, the medial area and the outer side of the almost obsolescent postmedian line. The latter and the black rounded discal spot are all that remain of the ornamentation, except for small but contrasting white dots of the fringes at the apex of veins A to R5. Forewing below as dorsally with the whitish overscaling much reduced and restricted to the postmedian area. **Hindwing:** Above and below entirely black, with a slightly darker rounded discal spot; the pure white fringes contrasting well on both sides of the wing.

Female. Head: Same as male except antennae yellow, strongly bidentate to the apex. **Thorax and abdomen:** Same as male, except usually a more conspicuous speckling of white hairs on the dorsum of the abdomen. **Forewing and hindwing:** Same ground color and markings as in male, except usually with less white speckling on the upper forewings. Forewing length: 35.7–41.9 mm ($\bar{x} = 39.0$ mm, $n = 22$), about one-third larger than the male.

Variation. Wing pattern elements and other structures appear to be consistent. Variation is restricted to the degree of whitish overscaling on the upper surface of the forewings of both sexes. Sexual dimorphism is negligible and is restricted to smaller overall size of males.

Male genitalia (Fig. 2A, B). Uncus down-curved, simple but apically bidentate, dorsally crowned by a broad subsclerotic protuberance, rising from the posterior edge of the tegumen, characteristic of the genus. Valves bilobed, transtilla with a narrow but strongly sclerotic medial plate laterally connected both to the anterior portion of the costal lobe of the valves and the posterior area of the tegumen. Juxta very narrow, laterally connected by a membrane to the base of the sacculus lobe of the valves. Saccus broad, anteriorly rounded. Aedeagus small, slightly sinuous.

Female genitalia (Fig. 2C). Sclerotization of the eighth sternum circumvaginal with a broad membranous subtriangular medial area and laterally separated from the eighth tergum by a narrow membranous gap. Eighth tergum bilobed, subsclerotic. Postapophyses about one-fourth longer than the anapophyses. Ductus bursae membranous; bursa short, not bulky; ductus seminalis rising from the right hand side of base of bursa. Oviporus well developed, covered with relatively strong setae.

Types. Holotype: male, Mexico, Sonora, 11.2 km NW of Yecora, off old Santa Rosa to Yecora road, 1550 m, 2/4 July 1989 (*leg.* M. Lindberg). **Allotype:** female, same data as holotype. **Paratypes:** 15 males, 41 females, data as follows: 1 male, 11 females, same data as holotype; 1 male, 2 females, same locality as holotype, 3 July 1989 (*leg.* K. Koppos); 1 female, same locality as holotype, 3 July 1988 (*leg.* M. Lindberg); 2 females, same locality as holotype, 3 July 1989 (*leg.* R. Nagle); 3 females, same locality as holotype, 1/3 July 1989 (*leg.* M. Wilson); 9 females, same locality as holotype, 28/29 June 1990 (*leg.*

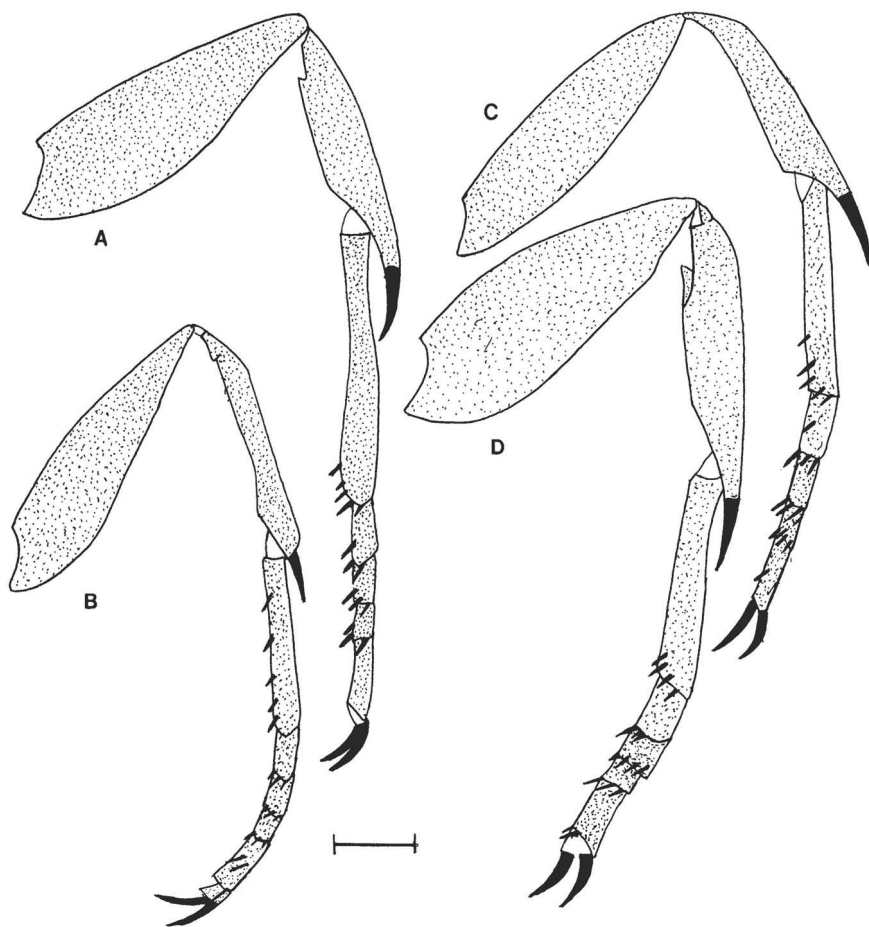


FIG. 1. Forelegs of *Coloradia*: A) *C. pandora davisi* male; B) *C. luski* male; C) *C. prchali* male; D) *C. prchali* female. Scale line = 1 mm.

M. Smith); 2 females, same locality as holotype, 28/29 June 1990 (leg. D. Mullins); 2 females, same locality as holotype, 28/29 June 1990 (leg. K. Hansen); 1 male, same locality as holotype, 28/29 June 1990 (leg. M. Lindberg); 1 male, same locality as holotype, 1/3 July 1989 (leg. J. Palting); 1 female, 4.0 km east of Santa Rosa, old Santa Rosa-Yecora road, 1040 m, 11/12 August 1983 (leg. S. Prchal); 1 female, 3.2 km south of La Trinidad mine, off old Santa Rosa-Yecora road, 1200 m, 28 July 1987 (leg. P. Jump); 11 males, 7 females, 9.6 km WSW of Yecora, Hwy 16, 1600 m, 7 July 1991 (leg. J. Brock & S. Prchal).

Disposition of types. The holotype male and allotype female have been deposited in the Natural History Museum of Los Angeles County, Los Angeles, California. One paratype pair has been deposited in the Muséum national d'Histoire naturelle, Paris, France; two paratype pairs have been deposited in the Sonoran Arthropod Studies, Inc. (SASI) collection, Tucson, Arizona. Two paratype pairs have been deposited in the UNAM collections: Instituto de Biología, Mexico, D.F., Mexico and Museo de Zoología, Mexico, D.F., Mexico. Paratype pairs have been deposited in the collections of the following institutions: Natural History Museum of Los Angeles County, Los Angeles, California;

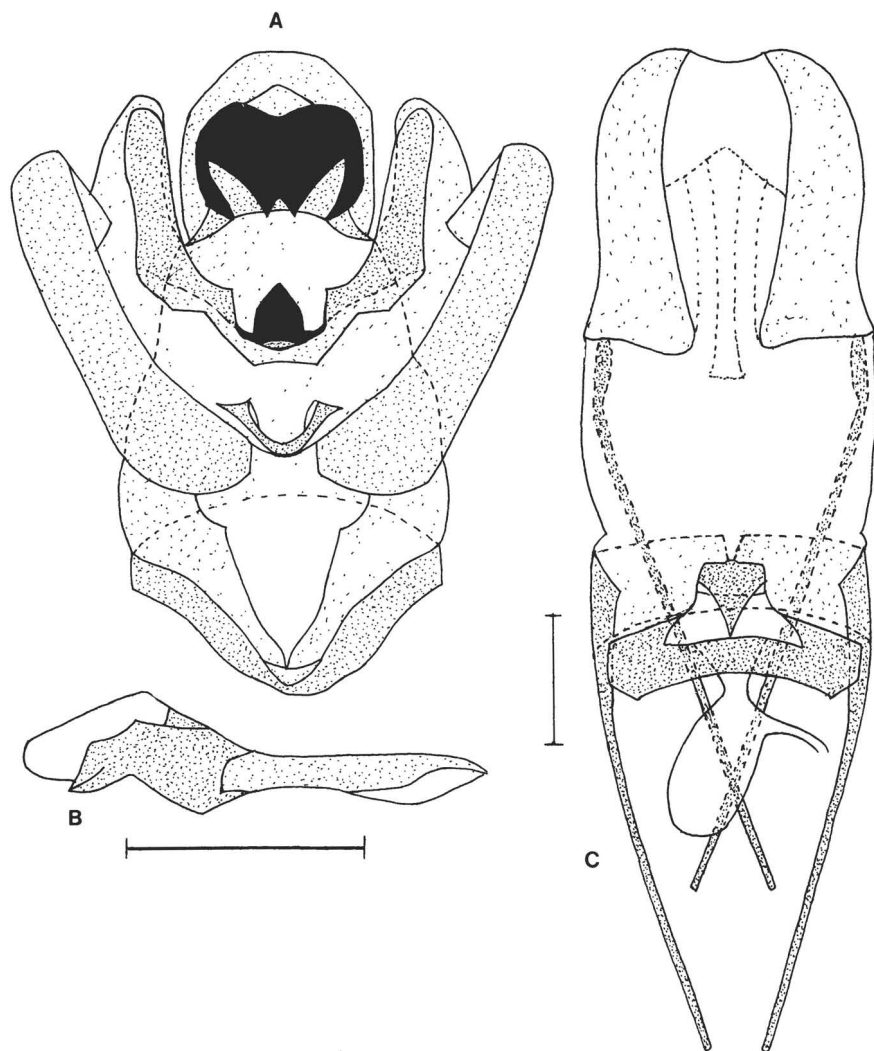


FIG. 2. Male genitalia of *Coloradia prchali* new species: A) Ventral view, aedeagus removed; B) Lateral view of aedeagus. C) Female genitalia of *Coloradia prchali* new species. Scale line = 1 mm.

California Academy of Sciences, San Francisco, California; United States National Museum (Smithsonian Institution), Washington, D.C.; and American Museum of Natural History, New York, New York. Other paratypes will remain in the collections of the original collectors and of the junior author.

Diagnosis. *Coloradia prchali* differs from previously described *Coloradia* species by its darker coloration, extreme reduction of ornamentation, and complete absence of red scales from the body as well

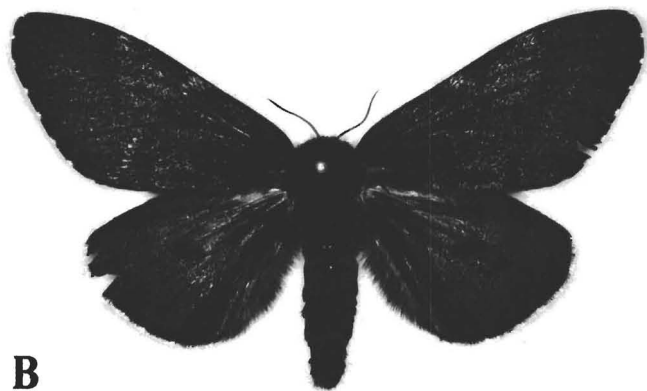
**A****B**

PLATE 1. *Coloradia prchali*, new species. A) Male holotype, Mexico, Sonora, 11.2 km NW of Yecora, off of Santa Rosa road, 1550 m, 2/4 July 1989 (leg. M. Lindberg). B) Female allotype, same data as holotype. Scale line = 10 mm.

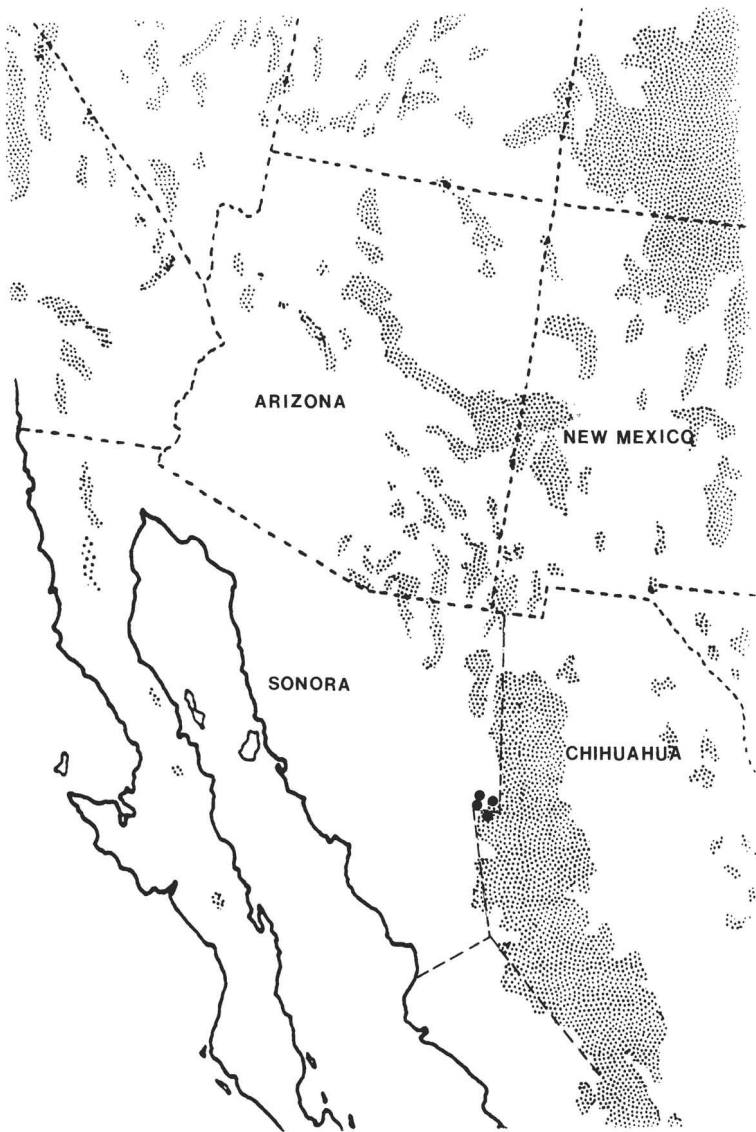


FIG. 3. Distribution of *Coloradia prchali* (●) in northwestern Mexico.

as from the hind wing. *Coloradia prchali* appears more closely related to *Coloradia luski* Barnes and Benjamin than to any other form of *Coloradia*. The wing pattern elements in both sexes are most similar to that of dark females of *C. luski* (see Ferguson 1971: pl. 6, fig. 13). However, *C. luski* never has the charcoal black color as on *C. prchali*. *Coloradia prchali* also differs from *C. luski* by its absence of sexual

dimorphism in color and pattern and the lack of individual variation; whereas *C. luski* is probably the most variable species in *Coloradia* (Ferguson 1971; Lemaire, pers. obs.). *Coloradia prchali* is larger than *C. luski* in both sexes: *Coloradia prchali* males, \bar{x} = 29.4 mm, n = 12; *C. luski* males, \bar{x} = 26.5 mm, n = 12; *Coloradia prchali* females, \bar{x} = 39.0 mm, n = 22; *C. luski* females, \bar{x} = 30.6 mm, n = 2). The two species also are differentiated by the coloration of the rami in the male antennae, black in *C. prchali* and yellow in *C. luski*. Male specimens of *C. prchali* fly during the daytime (J. Brock & S. Prchal, pers. comm.), a unique habit within the genus. The foretibial spine (Fig. 1) is noticeably longer in relation to the tibia in *C. prchali* than in *C. luski* (24 percent vs. 16.7 percent). It is about the same percentage in *C. prchali* and *C. pandora davisi* Barnes & Benjamin (see Ferguson 1971). The small differences between the genitalia of *C. prchali* and *C. luski*, such as the absence of the notch at the apex of the dorsal protuberance of the uncus and the larger medial plate of the transtilla, require larger series of dissections to be analyzed for significance.

Etymology. This species is named in honor of Steve Prchal, who captured the first specimen of this saturniid and whose enthusiastic interests in Sonora sparked the collecting efforts of many others over the past decade.

Distribution (Fig. 3). All known specimens of *C. prchali* have been collected in the mountainous region around Yecora, in eastern Sonora, Mexico. This distribution includes western Chihuahua and is in the Sierra Madre Occidental mountains of northwestern Mexico. The type locality, located in the Petran (Madrean) Conifer Forest habitat of Brown (1982), is a plateau region northwest of Yecora at about 1550 m. Most of the known specimens of *C. prchali* have been collected in this habitat, which is community of pine/oak trees, some shrubs, and grasslands, including various conifer species as *Pinus ponderosa* Lawson, *P. engelmannii* Carr. [= *P. latifolia* Sarg.], and *P. leiophylla* var. *chihuahuana* Engelm. (all Pinaceae); *Juniperus deppeana* Steud. (Cupressaceae); and various evergreen oaks, including *Q. pennivenia* Trel., *Q. arizonica* Sarg., *Q. grisea* Liebm., *Q. viminea* Trel., and *Q. fulva* Liebm. (Fagaceae). Within this habitat, *C. prchali* also has been recorded from 6.4 km east-northeast of Yecora and from 9.6 km south of Yecora by P. Jump and S. McCleve. This latter locality is in Chihuahua, Mexico, and thus documents *C. prchali* for this Mexican state. *Coloradia prchali* also was recorded from 13.6 km west-southwest of Yecora at 1900 m by D. Mullins and B. Kelly. The latter locality is a more mixed chaparral habitat within the Petran (Madrean) Conifer Forest community.

Outside of this habitat community, one female paratype was collected

in the Madrean Evergreen Woodland habitat south of La Trinidad mine, a region of steep canyons (barrancas) and ridges that is primarily oak woodland with associated pine and juniper species, and several shrubs such as *Ceanothus* (Rhamnaceae) and *Arbutus* (Ericaceae). Another paratype female (actually the first known specimen of this species) was collected in Sinaloan Thornscrub habitat between Santa Rosa and La Trinidad mine. However, this locality is a canyon bottom immediately below the Madrean Evergreen Woodland habitat occurring on the hills just above. The female probably strayed down from the latter habitat.

Coloradia prchali should be found in similar habitats in eastern Sonora and western Chihuahua in the Sierra Madre Occidental. *Coloradia luski* has been collected sympatrically with *C. prchali*, although the flight period of *C. luski* begins approximately two weeks later (M. Smith, unpubl. data). The surrounding Sierra Madre Occidental, east and south of the Yecora region, also supports populations of *C. pandora davisii*.

Collection dates for *C. prchali* range from 28 June to 15 August, indicating a midsummer flight. The peak flight seems to be early July, coinciding with the beginning of the annual monsoon rains. Since 1983, a total of five males and over 50 females (including non-paratype females) have been collected at UV and MV light. Field studies in 1991 resulted in males being attracted to virgin female *C. prchali*, indicating that males of this species are diurnal, flying between 0900 and 1500 h (J. Brock & S. Prchal, pers. comm.). This diurnal flight habit is unusual for the genus. *Coloradia pandora lindseyi* Barnes & Benjamin was reported as a day flier by Patterson (1929); Schmid and Bennett (1988) and Brown (1984) reported *C. pandora davisii* flying in the daytime during years of unusual abundance.

The larval stages of *C. prchali* have not been observed in nature; however, larvae of this species have been reared in captivity on various *Pinus* species (Pinaceae) by several workers. The life history of *C. prchali* will be the subject of a later paper by K. Wolfe of Escondido, California.

Discussion. The genus *Coloradia* Blake, 1863, with type-species *Coloradia pandora* Blake, 1863, by original designation (Fletcher & Nye 1982), occupies the western half of the United States, ranging as far north as Wyoming and South Dakota (Ferguson 1971), and south to at least Oaxaca and Chiapas in southern Mexico (K. Wolfe, pers. comm.). Four species occur in the United States: *C. pandora*, *C. doris* Barnes, *C. luski*, and *C. velda* Johnson & Walter (Ferguson 1983, Johnson & Walter 1979). Beutelspacher (1978) cited only three species from Mexico, all endemics: *C. euphrosyne* Dyar, *C. vazquezae* Beutelspacher, and *C. hoffmanni* Beutelspacher, although Hoffmann (1942) also listed

C. pandora from Sinaloa. Since the 1978 revision by Beutelspacher, *C. luski* and *C. p. davisi* have been found in northern Mexico (specimens at Univ. California Davis, in the collection of T. Sears from southwestern Chihuahua) and *C. pandora* (probably subspecies *lindseyi*) has been confirmed from Baja California Norte (Johnson & Walter 1979). This description of *Coloradia prchali* brings the number of *Coloradia* species known from Mexico to six.

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LITERATURE CITED

- BEUTELSPACHER B., C. R. 1978. Revisión del género *Coloradia* Blake (Lepidoptera: Saturniidae) para México con descripción de dos especies nuevas. An. Inst. Biol. Univ. Nat. Autón. México 49, Ser. Zoología (1):231-240.
- BROWN, D. E. (ed.). 1982. Biotic communities of the American Southwest—United States and Mexico. Desert Plants 4:1-342.
- BROWN, L. N. 1984. Population outbreaks of Pandora Moths (*Coloradia pandora* Blake) on the Kaibab Plateau, Arizona (Saturniidae). J. Lepid. Soc. 38:65.
- DONAHUE, J. P. 1989. Discovery of the carpenter moth *Morphets clenchi* (Cossidae) in Mexico. J. Lepid. Soc. 43:327-328.
- FERGUSON, D. C. 1971. Bombycoidea, Saturniidae (part.). In Dominick, R. B., et al. (eds.), The moths of America north of Mexico. Fasc. 20. 2A. E. W. Classey Ltd. & R. D. B. Publications, Inc., London. 153 pp., 11 pls.
- . 1983. Saturniidae, pp. 108-109. In Hodges, R. W. et al. (eds.), Check list of the Lepidoptera of America north of Mexico. E. W. Classey Ltd. and The Wedge Entomol. Res. Foundation, London. 284 pp.
- FLETCHER, D. S. & I. W. B. NYE (eds.). 1982. The generic names of moths of the world. Vol. 4, Bombycoidea. Trustees of the British Museum (Natural History), London. XIV + 192 pp.
- FRIEDLANDER, T. P. 1985. The biology and morphology of the immature stages of *Asterocampa idyia argus* (Bates) (Lepidoptera: Nymphalidae). J. Res. Lepid. 24:209-225.
- HOFFMANN, C. C. 1942. Catálogo sistemático y zoogeográfico de los Lepidópteros mexicanos. Tercera Parte. Sphingoidea y Saturnioidea. An. Inst. Biol. México 13:213-256.
- HOLLAND, R. & G. S. FORBES. 1981. Rediscovery of *Apodemia phycioides* (Riodinidae). J. Lepid. Soc. 35:226-232.
- JOHNSON, J. W. & E. WALTER. 1979(80). A new species of *Coloradia* in California (Saturniidae, Hemileucinae). J. Res. Lepid. 18:60-66.
- MILLER, L. D. & J. Y. MILLER. 1988. A new *Euptychia* species from northwestern Mexico (Satyridae). J. Lepid. Soc. 42:276-280.

- OPLER, P. A. 1986. A new *Euchloe* (Pieridae) from northwestern Mexico. J. Lepid. Soc. 40:188–190.
- PATTERSON, J. E. 1929. The pandora moth, a periodic pest of western pine forests. U.S. Dept. Agric. Tech. Bull. 137. 19 pp.
- RINDGE, F. H. 1990. A revision of the Melanolophiini (Lepidoptera, Geometridae). Bull. Amer. Mus. Nat. Hist. 199:1–148.
- SCHMID, J. M. & D. D. BENNETT. 1988. The North Kaibab pandora moth outbreak, 1978–1984. USDA For. Serv. Gen. Tech. Report RM-153, 18 pp.
- SMITH, M. J. 1985. Ecological observations on *Apodemia phycioides* Barnes & Benjamin (Riodinidae). J. Lepid. Soc. 39:337–338.

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