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A NEW SPECIES OF *OPSIPHANES* DOUBLEDAY, [1849] FROM WESTERN MEXICO (NYMPHALIDAE: MORPHINAE: BRASSOLINI)

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ABSTRACT: A new species of *Opsiphanes* occurring in western Mexico is described, illustrated, and compared with congeners and other members of the tribe Brassolini. It is known from relatively mesic canyons at the interface between the Sonoran Desert and the Sierra Madre Occidental in Sonora and, possibly disjunctly, in Colima. Larval foodplants are identified, the mature larva and pupa are described and illustrated, and biogeographic attributes are discussed.

KEY WORDS: biogeography, butterflies, early stages, foodplants, genitalia

INTRODUCTION

Opsiphanes Doubleday, [1849] (Nymphalidae: Morphinae: Brassolini) are medium-sized butterflies distributed over most of the Neotropics from Mexico to Paraguay and Argentina. Adults of *Opsiphanes* are fast fliers, and their wings are proportionally small compared to their large thorax. Anecdotal information suggests that mating is crepuscular (*e.g.*, Fruhstorfer 1912, DeVries 1987); in some species, groups of males have been observed displaying on the wing and, in others, single males have been seen patrolling edges of forests (CMP, pers. obs.) and among larval foodplants (ADW, pers. obs.). Larvae of *Opsiphanes* feed on various genera of Arecaceae and Musaceae (Penz *et al.* 1999), and some species regularly use coconut palm (*Cocos nucifera* L.) as a larval foodplant (Young and Muyschondt 1975; Young 1977; DeVries 1986, 1987). The 11

known species of *Opsiphanes* (Bristow 1991, Casagrande 2004) are dark brown or tawny on the dorsum usually with a prominent transverse band on the forewing that ranges in color from yellow-orange to white. Several species have similarly-colored submarginal bands on the hindwing. The venter is variously striated, especially on the hindwing, and has prominent eye-spots (ocelli) that are common on brassoline butterflies. Males of *Opsiphanes* have large scent organs laterally on the abdomen, in addition to hairpencils and patches of mealy androconial scales on the wings. During late afternoon, scent released through these organs by displaying males probably plays a key role in mate attraction (e.g., Srygley and Penz 1999). Within the *Opsiphanes*-group (Penz 2007), the quartet *Mielkella* Casagrande, 1982, *Orobrassolis* Casagrande, 1982, *Blepolenis* Röber, 1906, and *Opsiphanes* are structurally similar. Among those genera, the male valva typically displays a cluster of subterminal spines. On *Opsiphanes*, these spines are fused to form a flattened process that is a defining character of the genus (Fig. 16a).

Opsiphanes boisduvallii Doubleday, [1849] (Figs. 1-2, 7-8) had been thought to be unique within the genus in having a completely tawny ground color to both surfaces of the wings and in lacking any trace of a transverse band on the dorsal forewing. Valval morphology, nonetheless, places the unusually colored *O. boisduvallii* within *Opsiphanes*. Perhaps because of the immediately recognizable phenotype of *O. boisduvallii*, detailed examination of tawny individuals of *Opsiphanes* has been delayed, and all reports of tawny *Opsiphanes* have been automatically assumed to represent *O. boisduvallii* (i.e., Bristow 1991, see also below). However, a striking undescribed phenotype, similar to *O. boisduvallii*, occurs at the northwestern limit of the genus' distribution in western Mexico and this study provides a description of this new species. Eight specimens in addition to photographs of living and pinned individuals were examined and compared with other species of *Opsiphanes*, as well as *Mielkella singularis* (Weymer, 1907), *Orobrassolis ornamentalis* (Stichel, 1906), and three species of *Blepolenis*. These comparisons allowed us to verify the generic placement of the new species. A description of the early stages is also provided.

MATERIALS AND METHODS

The new species was compared with several other brassolines to confirm its generic affinity and provide evidence that it represented an undescribed species. Pinned specimens were used to examine general external morphology, and dissections of male and female genitalia were performed using standard procedures. Comparisons of external morphology and patterning were made with all species of *Opsiphanes* except *Opsiphanes camena* Staudinger, [1886]; comparisons were also made with *Mielkella*, *Orobrassolis*, and the three species of *Blepolenis*. Genital morphology was examined for *M. singularis*; *Orobrassolis ornamentalis*; *Blepolenis*; *Opsiphanes boisduvallii*; *Opsiphanes cassina* C. & R. Felder, 1862; *Opsiphanes invirae* (Hübner, [1808]); *Opsiphanes sallei* Doubleday, [1849]; *Opsiphanes quiteria* (Stoll, 1780); *Opsiphanes bogotanus* Distant, 1875; and *Opsiphanes tamarindi* C. & R. Felder, 1861. Specimens so examined and dissected are deposited at the American Museum of Natural History, New York, NY; McGuire Center for Lepidoptera and Biodiversity, Gainesville, FL; Milwaukee Public Museum, Milwaukee, WI; Museo de Zoología "Alfonso L. Herrera", UNAM, Mexico D.F., Mexico; and San Diego Natural History Museum, San Diego, CA. Photographs taken in the field of live individuals were also examined. Field observations of larval biology were made in Sonora, Mexico; larvae and pupae are described from photographs.

***Opsiphanes blythekitzmillerae* Austin & A. Warren, new species**
(Figs. 3-6, 9-12, 14-17, 19-23)

Diagnosis. Among known species of *Opsiphanes*, *O. blythekitzmillerae* is similar only to *O. boisduvallii* in its tawny wing color. Both males and females can be distinguished from *O. boisduvallii* by the following combination of characters: (1) wings slightly translucent revealing the ventral eye-spots; (2) large eye-spots on the ventral hindwing much larger than on *O. boisduvallii*; (3) ventral color of the body and wings predominantly whitish, in contrast to tawny on *O. boisduvallii*.

Description. Male - forewing length 45.2 mm, 45.8 mm (paratypes); venation typical for genus (*e.g.*, Stichel 1904) except distal end of discal cell on forewing less angled from vein M_3 to costa than on any species; forewing with apex produced (extending as far distad as tornus), termen concave between veins M_1 and CuA_2 then convex to anal margin, anal margin straight, hindwing termen convex, slightly undulate, tornus rounded; dorsum deep tawny becoming more tawny-ochreous basad on both wings, appearing mottled due to ventral markings showing through; forewing brownish along costa (broadest towards apex) and outer margin cephalad to vein 2A, hindwing narrowly brownish along outer margin from apex to vein 2A, forewing with suboval blackish subapical macule in M_1 - M_2 , preceded by three small white subapical macules; hindwing with yellow-tan or tawny-brown recumbent hairpencil (6 mm) originating in discal cell just distad of origin of vein CuA_2 , extending caudad over vein cua_1 - cua_2 and overlying pocket of modified black scales in proximo-caudal portion of CuA_1 - CuA_2 ; hindwing with anal area pale yellowish (tan on one paratype) with prominent black cross-striations (showing through from venter); yellow-tan or tawny semi-erect hairpencil (1.8 mm) originating just caudad of the middle of vein 2A with its distal end overlapping vein 2A; narrow shiny area on both sides of vein 2A proximad and distad to hairpencil; remaining portion of anal area heavily overscaled with pale yellow-tan or tan hair-like scales, heaviest distad.

Venter with complex pattern; forewing with gray-brown outer margin outlined proximad with dark brown, followed by band of pale tawny outlined proximad with scalloped dark brown line defining distal edge of pale (distad) and dark (proximad) brown postmedial band that grades to pale tawny cephalad and contains a large black ocellus (6.5 mm, ocelli measured in mid-cell to outer edge of dark outline) in M_1 - M_2 , this with a crescentic white central mark and outlined with pale tawny (extending into cephalic portion of M_2 - M_3) and then red-brown proximad; fairly prominent (on one paratype, absent on other, present on male specimen seen in photograph, barely discernible on photographed live male, Fig. 15) smaller white-pupiled black ocellus in CuA_1 - CuA_2 outlined with dirty tawny and then black, and two smaller and poorly defined white-pupiled black macules in M_2 - M_3 and M_3 - CuA_1 (absent on one paratype and photographed live male except for white dot in M_2 - M_3 , anterior supernumerary macule with pupil on male specimen seen in photograph); postmedial band defined proximad at its cephalic end by a narrow paler band that is tawny distad and whitish proximad; medial area largely pale tawny striated with dark brown cephalad of vein CuA_2 except distad of end of discal cell where striations are absent; proximal to this from the end of the discal cell to the bases of cells between Sc and M_3 mottled whitish and dirty tan and crossed by irregular black lines, this followed proximad in discal cell by a whitish band, a dark tan band outlined by blackish, whitish, and then tan towards the base; most of wing caudad

of CuA₂ pale tawny with an irregular black submedial mark extending caudad from vein CuA₁; oval whitish patch of mealy, apparently scent, scales just cephalad of vein 2A near base; hindwing largely dull whitish, pale tawny in submargin, pale tan in central portion, heavily striated with blackish (striations mostly 3-4 dark scales in width); large (9.8, 9.1 mm) tan ocellus centered in mid-cell Sc+R₁-Rs but extending into costal cell and especially Rs-M₁, this with crescentic white pupil and heavily outlined by black; another, but somewhat smaller (8.2, 8.0 mm) and black ocellus centered in cell CuA₁-CuA₂ with crescentic white pupil (gray-blue scales within crescent) outlined broadly with tawny (this extending into cell CuA₂-2A and especially into M₃-CuA₁ as an incomplete satellite ocellus with a white pupil and a few blackish scales; black absent on one paratype and on male specimen seen in photograph), the entire marking outlined with blackish proximad and pale brown distad (white in M₃-CuA₁ interrupts dark outline on one paratype); another incomplete ocellus in M₂-M₃ consisting of a white mark with a tawny patch distad and a concentration of blackish scaling proximad (a complete ring around ocellus on one paratype, photographed live male, Fig. 15, and on male specimen seen in photograph); proximad to ocellus in Sc+R₁-Rs is a prominent whitish-tan band, a blackish margined tan band (this extending into cephalic portion of discal cell) followed by another whitish band, a blackish smudge, and another tan band.

Dorsal head and anterior thorax pale warm brown, paler behind eyes; eyes dark (appear tan with dark dots in photograph of living specimen); palpi warm brown on dorsum, otherwise whitish-tan with a brownish band on outer sides; antennae red-brown; remainder of dorsal thorax and entire abdomen tawny-ochreous like bases of wings; ventral thorax and legs gray-tan, forelegs with brownish band on venter (when folded against body); ventral abdomen pale gray-brown; abdominal scent gland suboval, 2.1, 2.2 mm in length.

Male genitalia (Fig. 16) - uncus in lateral view curved downward to sharp point caudad, about same length as tegumen, with a few setae on ventro-lateral surface, nearly triangular in dorsal view narrowing to relatively blunt point caudad; tegumen hood-shaped with two sets of 'hairpencils' (after Penz 2007) on dorsal surface; saccus narrow, very slightly curved upward, about 2/3 length of uncus and tegumen combined; gnathos with expanded and smooth proximal region, distal region abruptly narrower, sharply pointed caudad; valva in lateral view broad cephalad, narrowing caudad to a blunt and slightly upcurved tip, ventral edge with lobe towards cephalic end, dorsal edge with unevenly-shaped flattened process directed dorsad and composed of several fused lobes decreasing in size cephalad, most of ventral surface densely covered with setae; valva in ventral view broad cephalad, abruptly narrowing caudad where curving slightly inward; phallus slightly longer than valvae, nearly straight, with numerous peg-like setae especially near attachment of anellus and on phallobase; juxta heart-shaped.

Female - forewing length 51.2 (ex larva, badly damaged), 54.8 (holotype), 55.7 mm (paratype), apex rounded, not produced, termen nearly straight with slight concavity centrally, anal margin straight, hindwing termen convex with slight angle at M₃, very slightly undulate, tornus rounded; dorsum tawny (paler than male) becoming more tawny-ochreous basad on both wings, appearing mottled due to ventral markings showing through; forewing brownish along costa (broadest towards apex) and outer margin cephalad to vein 2A, hindwing narrowly brownish along outer margin from apex to vein 2A, forewing with suboval blackish subapical macule in M₁-M₂, preceded by 3 small white subapical macules; hindwing with anal area pale tan with prominent black cross-

striations (showing through from venter), heavily overscaled with tan hair-like scales, heaviest distad.

Venter with complex pattern nearly identical with that of male, but with striations finer; forewing with black subapical ocellus (6.6, 6.8, 6.9 mm); paratype (and a badly damaged reared specimen) with white dot in M_2 - M_3 similar to one paratype male (absent on holotype and photographed live female, Fig. 14); hindwing with ocellus centered in mid-cell $Sc+R_1-Rs$ larger than on male (11.0, 11.2, 11.5 mm); ocellus centered in cell CuA_1-CuA_2 also larger (10.7, 11.0, 11.0 mm), this completely enveloping the satellite ocellus in M_3-CuA_1 on holotype, the reared female, and photographed live female and only partially including a white macule on the female paratype; ocelli represented by white macules in M_1-M_2 and M_2-M_3 .

Dorsal head and anterior thorax pale warm brown, paler behind eyes; eyes dark (appear tan with dark dots in photograph of living specimen); palpi warm brown on dorsum, otherwise whitish-tan with a brownish band on outer sides; antennae red-brown; remainder of dorsal thorax and entire abdomen tawny-ochreous like bases of wings; ventral thorax and legs gray-tan, forelegs with brownish band on venter (when folded against body); ventral abdomen pale gray-brown.

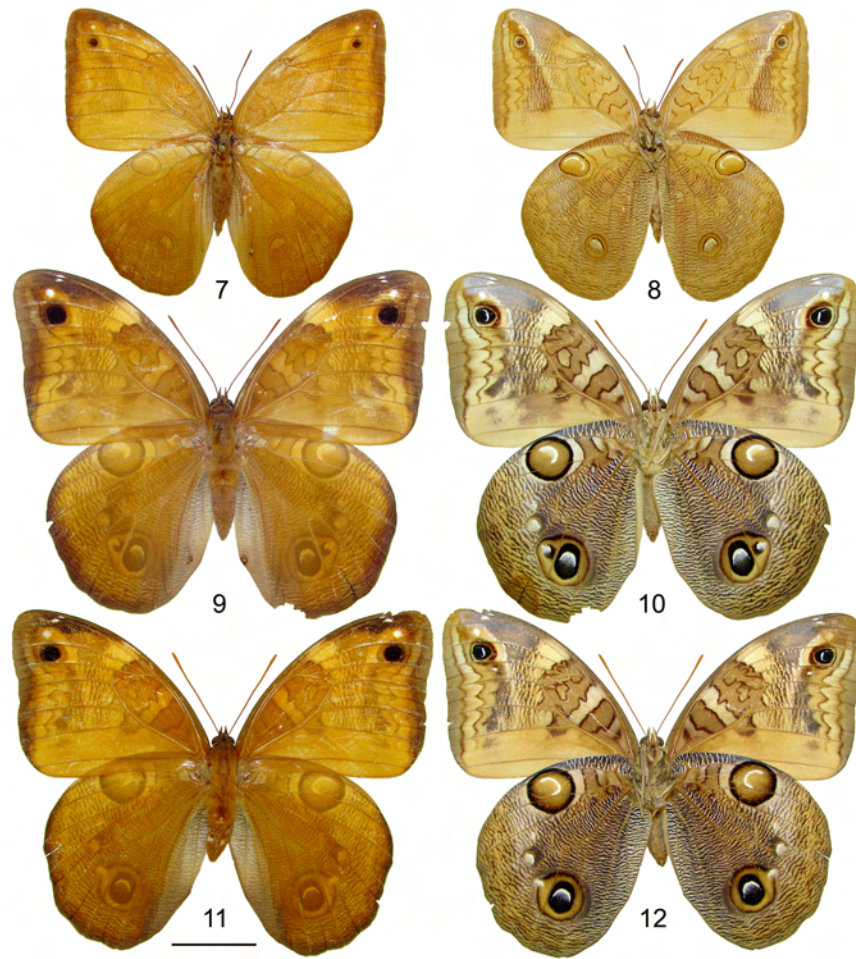
Female genitalia (Fig. 17) - sterigma broader than long, posterior section (Penz 2007) well-developed with prominent central lobe, anterior section with two very thin arms curving inward and nearly meeting centrally; lateral section thin, extended dorsally and fused to edge of tergum 8; ductus bursae long, narrow distally, expanding cephalad to elongate corpus bursae with parallel signa shorter than corpus bursae; papillae anales with more-or-less triangular sclerotized base, but with thin projection from dorsal edge extending caudad, posterior edge of papillae anales curved, this unsclerotized section heavily adorned with setae.

Types. Holotype female - MEXICO: Sonora; Mexican route 16, canyon with palms near km 196, 30 August 1997, to which is attached a red, printed label - / HOLOTYPE / *Opsiphanes blythekitzmilleri* / Austin & A. Warren /. Paratypes: male, MEXICO: Sonora; Cucurpe Road, 18 mi. SE Magdalena, 14 Oct 1979; male, MEXICO: Sonora; Alamos, 27 August 1994; female, MEXICO: Sonora; Mexican route 16, 'fig-tree' canyon near km 196, 16 September 1999 (at banana peel). The holotype is deposited at the Museo de Zoología "Alfonso L. Herrera", Facultad de Ciencias, Universidad Nacional Autónoma de México, México D.F., México.

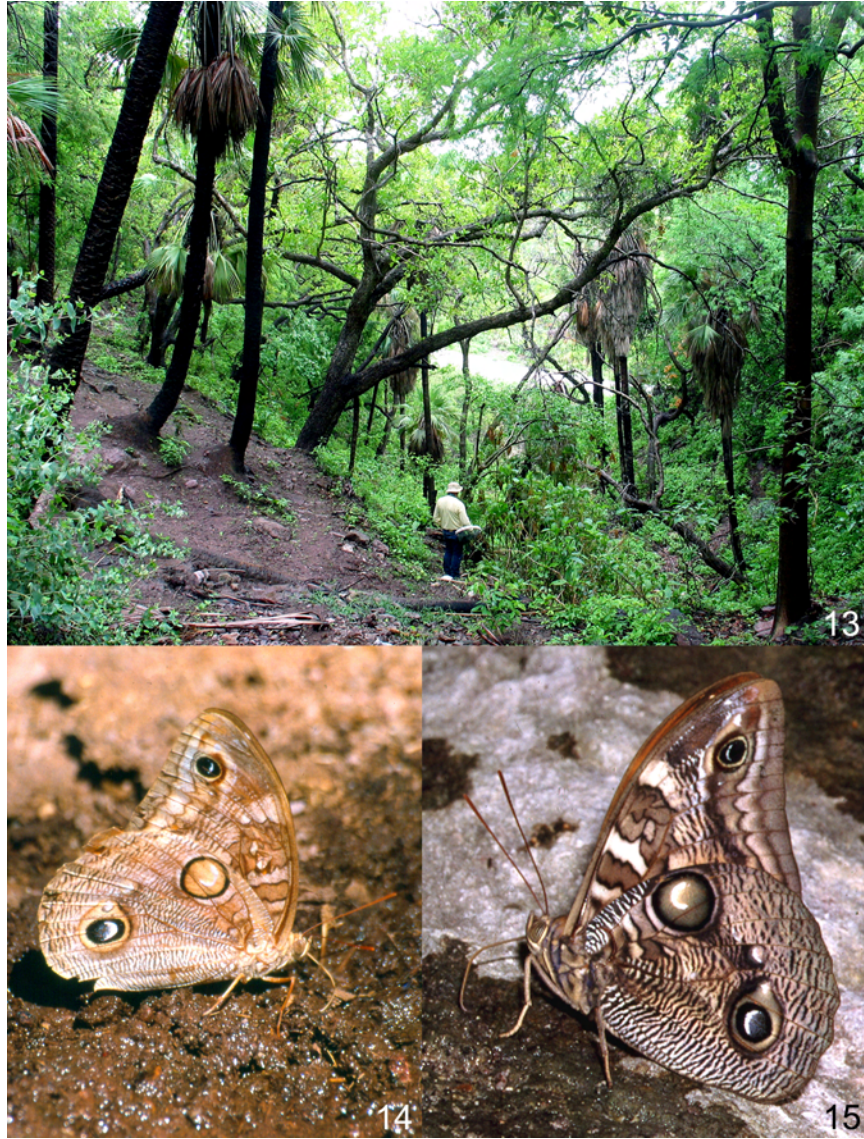
Additional records (specimens not examined by us unless noted otherwise): all from MEXICO: SONORA; Cucurpe Road, 18-19 mi. SE of Magdalena (Sierra Bavispa), 12 September 1981 (1 female), 3-4 April 1982 (1 male); SONORA; Mexican route 20 (E of Hermosillo), 13 mi. E of El Novillo (Río Yaqui), 12 August 1985 (sight), 25-27 April 1987 (sight); SONORA; Mexican Route 16, km 196, E of Río Yaqui, 2 September 2000 (photograph), 11 November 2002 (photograph); SONORA; junction Aros and Bavispa rivers, 9 April 2002 (photograph); SONORA; Sierra Madre Mts., Mexican route 16, 9 April 2005 (1 male); SONORA; Tarahumaris Road, ca. 9 mi. NE of Nuri (Arroyo Honda), 24 September 1988 (2 females); SONORA; near Santa Rosa, 4 mi. E junction Mexican route 16 and Sonora route 11, 23 September 1988 (1 female); SONORA; Río Sahuaripe, 7 miles S of Tacupeto, 27 March 1999 (sight); SONORA; Municipio Ures, Sierra de Mazatán, riparian canyon, 29°08'15"N, 110°13'10"W, 1200 m, 9 October 2004 (larva); SONORA; road to Santa Barbara, 27°05.745'N, 108°45.426'W, 3672', upland oak area, at sap, 2 October 2006 (sight); SONORA; near El Cajón, upper Río Cuchujaqui,



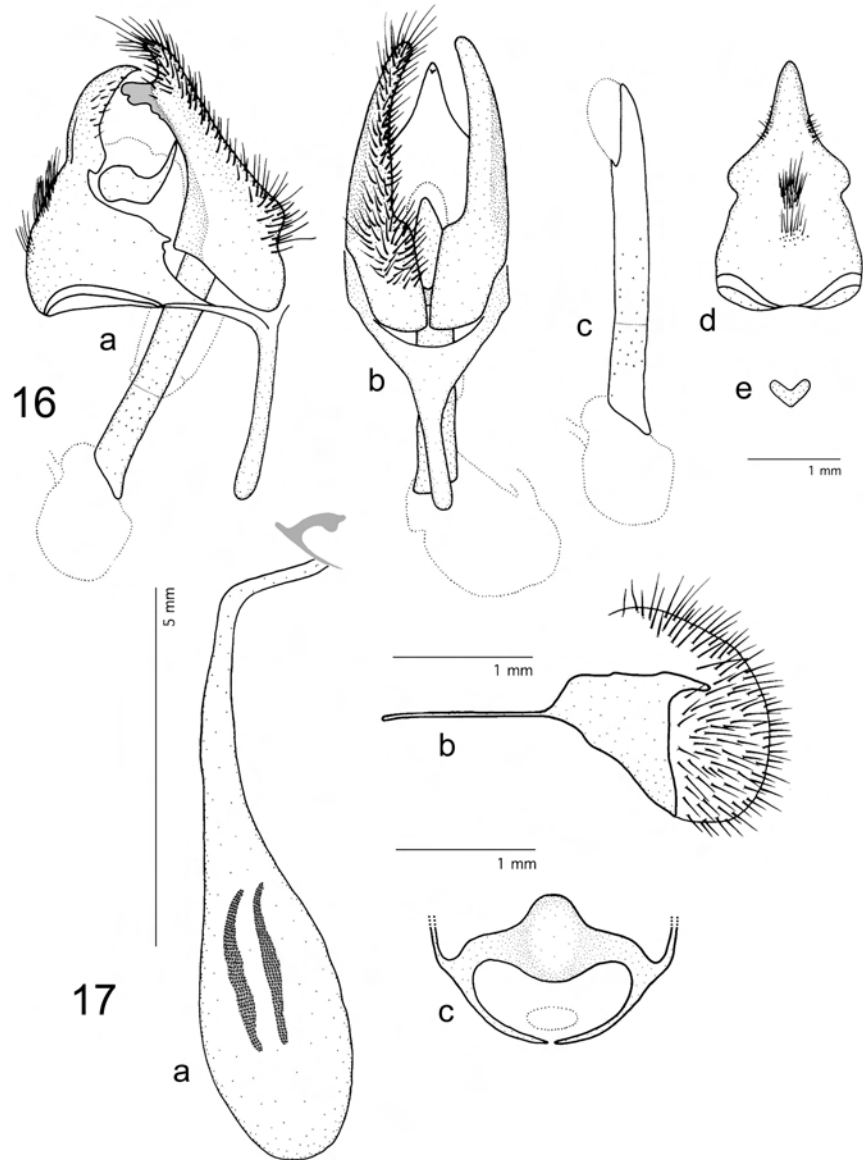
Figures 1-6. Males of *Opsiphanes* (dorsum on left, venter on right; line = 2 cm). **1-2)** *O. boisduvallii*, MEXICO: Oaxaca; Chiltepec, 26.viii.1969; **3-4)** *O. blythekitzmillerae*, paratype, MEXICO: Sonora; Alamos; **5-6)** *O. blythekitzmillerae*, paratype, MEXICO: Sonora; Cucurpe Rd.



Figures 7-12. Females of *Opsiphanes* (dorsum on left, venter on right; line = 2 cm). **7-8)** *O. boisduvallii*, GUATEMALA: Zacapa; La Union, 20.x.1982; **9-10)** *O. blythekitzmillerae*, holotype; **11-12)** *O. blythekitzmillerae*, paratype, MEXICO: Sonora; route 16, 'fig-tree' canyon.



Figures 13-15. *Opsiphanes* habitat and live adults. **13)** Type locality of *O. blythekeitzmilleri* (photograph by Robert Behrstock); **14)** female *O. blythekeitzmilleri*, MEXICO: Sonora; route 16, km 196, 11 November 2002 (photograph by Douglas Danforth); **15)** male *O. blythekeitzmilleri*, MEXICO: Sonora; route 16, palm canyon near km 196, 2 September 2000 (photograph by Priscilla Brodtkin).



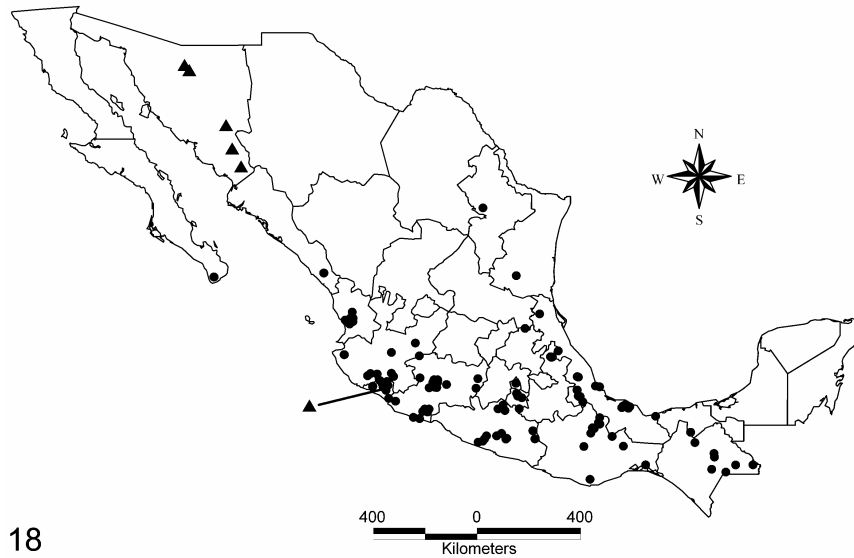
Figures 16-17. Genitalia of *Opsiphanes blytheitzmilleriae*. **16** Male (MEXICO: Sonora, GTA #13762); a. lateral view of genital capsule, b. ventral view of genital capsule, c. lateral view of aedeagus, d. dorsal view of tegumen and uncus, e. juxta; **17** female (MEXICO: Colima, CMP #07-128); a. lateral view of sterigma, ductus bursae, and corpus bursae, b. lateral view of papillae anales, c. ventral view of sterigma.

10 October 2006 (larva); SONORA; Choquincahui, July 2005 (sight); COLIMA; La Salada, 1000', 8 May 1967 (1 female examined); COLIMA; Mpio Villa de Álvarez, Agua Dulce, 250 m, 29 October 1989 (1 male examined), 13 July 1995 (1 female examined).

Type locality. MEXICO: SONORA; Mexico Route 16, canyon with palms near kilometer 196 (Fig. 13).

Distribution and phenology. The northernmost record for *O. blythekeitzmilleræ* is from 18 miles southeast of Magdalena de Kino, on the road to Cucurpe. This site is situated approximately 115 airline kilometers south of the border with Arizona, United States (at Nogales). This and other records suggest that *O. blythekeitzmilleræ* is a resident of palm-inhabited canyons to an elevation of 1200 m along the western base of the northern end of the Sierra Madre Occidental, bordering the Sonoran Desert, at least from northern to southern Sonora (Fig. 18). Given the few known records, the distribution given here is tentative. The occurrence of *O. blythekeitzmilleræ* in Colima (Fig. 18) suggests a broader distribution in western Mexico. Note that all tawny *Opsiphænes* we have examined to date from Sinaloa (from the southern half of the state) and Nayarit are *O. boisduvallii*. Vargas *et al.* (in press) did not record *Opsiphænes* from Sonora.

Available data for *O. blythekeitzmilleræ* suggest it has at least two generations annually in Sonora. Here, the species has been recorded in March and April and from August through November. It has been recorded in Colima in May, July and October, perhaps also representing two generations.



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Figure 18. Distribution of *Opsiphænes blythekeitzmilleræ* (triangles) and *O. boisduvallii* (dots) in Mexico.

Habitat. Areas inhabited by *O. blythekeitzmilleriae* in Sonora host a mosaic of short tropical deciduous forest and desert scrub, with at least four species of palms in the genus *Brahea* Mart. (Arecaceae), including *Brahea brandegeei* (Purpus) H. E. Moore, *Brahea aculeata* (Brandegee) H. E. Moore, *Brahea dulcis* (Kunth) Mart., and *Brahea nitida* Andre, as well as additional palms, *Washingtonia robusta* H. Wendl. (cultivated) and *Sabal uresana* Trel. (Búrquez *et al.* 1999, Búrquez, pers. comm.). Such habitats have been described and illustrated by various authors (*e.g.*, Búrquez *et al.* 1999, Martínez-Yrizar *et al.* 2000, also Fig. 13 herein), and frequently occur as isolated montane habitat patches separated by extensive areas of desert scrub (*e.g.*, Sierra del Aguaje and Sierra Libre) within the Sonoran Desert, the northern limit of tropical deciduous forests in western Mexico. These essentially tropical habitats host numerous ‘micro-endemic’ taxa of neotropical affinities, some of which are at the northern limits of their ranges, occasionally as highly disjunct populations (Búrquez 1997, pers. comm.; Búrquez *et al.* 1999; Búrquez & Martínez-Yrizar 2006, in press).

Biogeography. The primary known distribution of *O. blythekeitzmilleriae*, from northern to southern Sonora, corresponds with the Sonoran area of endemism (which includes northern Sinaloa) revealed by many groups of plants and animals (Goldman and Moore 1945, Cabrera and Willinik 1973, Marshall and Liebherr 2000, Morrone 2001, Morrone *et al.* 2002, Espinosa *et al.* 2006). This region includes the lower elevations of the western slope of the Sierra Madre Occidental, below the pine-oak zone, and most of the Sonoran Desert west to the Pacific Coast. Other endemic species of butterflies sharing this primary distribution include *Polites norae* MacNeill, 1993 (Hesperiidae), *Euchloe guaymasensis* Opler, 1987 (Pieridae), and *Voltinia danforthi* (A. Warren & Opler, 1999) (Riodinidae). The presence of *O. blythekeitzmilleriae* in Colima, however, shows that it is not strictly restricted to the Sonoran region, but that it also occurs, apparently disjunctly, in the Armería-Coahuayana area of endemism as defined by Espinosa *et al.* (2006).

Larval foodplants and early stages. In Sonora, larvae were found on *Brahea aculeata* (Fig. 22) near Municipio Ures and El Cajón (one finished feeding on cultivated *Brahea armata* S. Watson). Furthermore, *O. blythekeitzmilleriae* co-occurs with *Brahea nitida* at the site southeast of Magdalena, the northern known limit of that palm’s distribution (*vide* R. Felger 2007; see Felger and Joyel 1999, Fleger *et al.* 2001). Adjacent to kilometer 196, along Route 16, *O. blythekeitzmilleriae* is associated with a congener, *Brahea brandegeei* (Fig. 13). Both of these palms potentially serve as larval foodplants. Although known larval foodplants of other *Opsiphanes* are largely species of Arecaceae and Musaceae, *Brahea* has not previously been reported as a larval foodplant for any member of the Brassolini (Penz *et al.* 1999).

Mature larvae long and slender, head more-or-less rectangular in dorsal view bearing two pairs of pointed and granulated scoli caudad; a shorter pair laterad, a longer pair dorsolaterad. Two known color forms; one (Figs. 19, 21-22) largely reddish brown with yellow-tan (becoming greenish cephalad) beneath whitish spiracles; entire body covered with very short white setae emitting from minute white dots (probably chalazae); lateral surface with two vague whitish lines, one just above spiracles, the other more dorsad. More prominent and broader dorsolateral white line followed by another vague whitish line on mid-dorsum. Ground color slightly deeper red-brown along spiracular area and flanking pale lines. ‘Anal fork’ (=caudae) tan, intersegmental lines whitish. Head deeper red-brown (nearly maroon), with broad yellow-green lateral stripe, the yellow-green continuing onto the lateral scolus. Dorsolateral scolus red with narrowly yellowish tip.

Dorsal head with yellow-green central stripe flanked by narrower lines of a paler and more yellowish color. Head covered with heavy vestiture of white setae of moderate length, setae also occurring as pair of blackish tufts ('moustache') laterally from near ventral portion of anterior head. Second form (Fig. 20) similar, but red-brown replaced by blue-green with darker green flanking pale lines, mid-dorsal line yellow; and 'anal fork' concolorous with the body. Green of head more bluish than on body, lateral stripe yellow-green, narrow grayish stripe between lateral and mid-dorsal stripes, mid-dorsal stripe also yellow-green becoming greener caudad where flanked by whitish. Dorsolateral pair of scoli brighter red than on red form with black tips preceded by yellowish.

Pupae (Fig. 23) stout and somewhat hourglass shaped in dorsal view with slightly bifurcate head. Dorsum with prominent keel and, in lateral view, convex and somewhat bulbous cephalad. Ventral edge slightly concave. Pale greenish caudad, but pinkish over wing pads and head. Abdomen with thin and darker green-brown lateral line below spiracles, spiracles outlined with pale brown. Less prominent line dorsolaterally, two thinner lines ventrolaterally. Entire pupa with reticulate pattern of very fine lines, brown on abdomen and thorax, deeper pink than ground color cephalad. Ochreous line along edge of wing pad with prominent white macule outlined with brown just caudad of its middle.

Mature larvae of *O. blythekitzmillerae* are typical of the genus in their general aspect. Larvae of *Opsiphanes* tend to be greenish and often prominently striped with contrasting colors (Harrison 1963, Young and Muyschondt 1975, Young 1977, Cubero 1985, DeVries 1987), perhaps more so than larvae of *O. blythekitzmillerae*; we, however, found no report of larval dimorphism within the genus. All species studied have prominent markings on the head with the number of scoli varying from two to four pairs; this may vary intraspecifically (Young and Muyschondt 1975, Young 1977, Cubero 1985). Pupae of *O. blythekitzmillerae* are also typical; those of the genus are amazingly similar in form and pattern (Harrison 1963, Young and Muyschondt 1975, Young 1977, Cubero 1985, DeVries 1987). A pupal case of *O. boisduvallii* examined from Colima appears indistinguishable from those of *O. blythekitzmillerae*.

Larvae of *O. blythekitzmillerae* fed nocturnally, as apparently usual for Brassolini (e.g., DeVries 1986, 1987) including *Opsiphanes* (Harrison 1963, Young 1977), and spend the day in silken crèches (Figs. 19-21) as do others of the genus (Harrison 1963, Young 1977, Cubero 1985). Both solitary larvae wandered away from the foodplant at night to pupate, one on a vertical surface and the other on a horizontal surface. Pupation occurred two days after leaving the foodplant as noted for the prepupal stage of other species in the genus (Harrison 1963, Young and Muyschondt 1975, Cubero 1985). Pupal duration was 15 and 16 days, within the range previously reported for *Opsiphanes* (Harrison 1963, Young and Muyschondt 1975, Cubero 1985).

Etymology. This species is named in honor of Margery Minerva Blythe Kitzmiller. She was born November 17, 1883 in Malvern, Ohio and died March 10, 1972. She married Frank Kitzmiller on September 7, 1904 in Cleveland, Ohio and they lived in Pittsburgh, Pennsylvania. They had three sons, all of whom fought in World War II. Minerva, or "Bango" to her grandchildren, was a very creative person who wrote poetry, played piano and sang. This owl butterfly is being named in her honor on behalf of her five grandchildren, who loved her very much.



Figures 19-23. Larvae and pupae of *Opsiphanes blythekitzmilleri* (MEXICO: Sonora; Sierra de Mazatán). **19, 21)** Red form of larva on *Brahea aculeata*, **20)** green form of larva on *B. aculeata*, **22)** red form of larva showing distinctive feeding damage on *B. aculeata*, **23)** pupa (artificially attached to *B. aculeata* for photography). Images by Michael Wilson.

Discussion. Among butterflies, Nymphalidae is considered one of the best known families taxonomically and it is thought that few species remain to be discovered (Brown 1996, 1997). This is especially true for large and showy taxa, particularly those that have obviously distinctive phenotypes. Within *Opsiphanes*, more than 100 years has elapsed since the description of a new species (Stichel 1902), making the discovery of *Opsiphanes blythekeitzmillerae* so close to the border of the United States and the northernmost known record of a Brassolini (Bristow 1991) all the more remarkable.

It has been four decades since the first known specimen of *Opsiphanes blythekeitzmillerae* was obtained. A specimen from Sonora, originally identified as *O. boisduvallii*, was noted (but not examined) in the revision of the genus by Bristow (1991), and was assumed to represent the northernmost occurrence of that species, as a late-season stray. Indeed, *O. blythekeitzmillerae* had been “hiding” in plain sight for some time as a photograph on the internet (Warren *et al.* 2006). Warren first noticed the unusual appearance of this taxon in December 2005 while examining photos taken by Doug Danforth. None of the specimens in Warren’s series of *O. boisduvallii* from Sinaloa, Nayarit, Jalisco, Colima or Michoacán matched Danforth’s image from Sonora, but the image was tentatively determined as *O. boisduvallii*, and posted online, since no other *Opsiphanes* had been reported from that far north or had a tawny dorsum. While sorting collections at the McGuire Center in February, 2007, Austin called Warren’s attention to the unique phenotype of a specimen from Sonora. This led to a detailed study of the few available images and specimens of *Opsiphanes* from northwestern Mexico, leaving no doubt that an undescribed species was involved.

Similarity in size and wing shape between the new species and the Mexican *Mielkella singularis* led us to ask whether *O. blythekeitzmillerae* belonged to that genus. Accordingly, we compared wing and genital morphology of both taxa. On *Mielkella*, wings are predominantly brown dorsally, and the forewing displays an orange postmedial band that branches into the discal cell. In contrast, in species of *Opsiphanes*, this band is yellow or white, and usually does not cross the discal cell (but see below). The region between veins CuA₁ and CuA₂ on the ventral hindwing of both *Mielkella* and *Opsiphanes* has enlarged scales with 3-5 long sharp points. Those scales are intermixed with a dense cover of long and very fine filiform scales on *Mielkella*, while *Opsiphanes* have a variable mix of the pointed scales and more robust filiform scales (see below). The scent organ originating in the discal cell on the dorsal hindwing of *O. blythekeitzmillerae* corresponds with that on other species of *Opsiphanes*, but is lacking on *Mielkella*. It should be noted, however, that the same organ is present on two species of *Blepolenis* and even on *Ooptera* Aurivillius, 1882, and can thus be considered plesiomorphic for *Opsiphanes*. The abdominal scent organ occurs throughout the *Opsiphanes* clade (Penz 2007). Male genitalia of *O. blythekeitzmillerae* closely resemble those of other *Opsiphanes*. On *Mielkella* (and also *Orobrassolis* and *Blepolenis*), the male valva has a cluster of spines on the distal edge, while on *Opsiphanes* these are fused to form an unevenly-shaped flattened process that is characteristic of the genus. Also on *Mielkella*, the cluster of spines is located more distally than on *Blepolenis*, *Orobrassolis*, or *Opsiphanes* (as a flattened process). In short, wing and genitalic morphology indicated that the new taxon should be included within *Opsiphanes*. Furthermore, populations of *Mielkella* always occur in evergreen forests in Mexico, while populations of *Opsiphanes* occur in a wide variety of evergreen and deciduous forests, as well as riparian and disturbed habitats (JLI, pers. obs.).

Among congeners, *Opsiphanes blythekeitzmilleriae* is similar in color to *O. boisduvallii*, those two being the only species of *Opsiphanes* exhibiting a predominantly tawny dorsum. The two species, however, differ in several important aspects (Table 1). *Opsiphanes blythekeitzmilleriae* is, on average, notably larger than *O. boisduvallii*, with a proportionally longer forewing having a produced apex and a broader and less truncated hindwing. The overall shapes of the wings of male *O. blythekeitzmilleriae*, while incorporating characters seen on other species of the genus, overall do not resemble those of any individual species. The dorsum of *O. blythekeitzmilleriae* has broader dark margins on both wings than on *O. boisduvallii* and most males of the latter have no dark margin on the hindwing. The hairpencils of *O. blythekeitzmilleriae* are pale and concolorous, while these are at least dark distad on *O. boisduvallii*; that originating in the discal cell is longer on *O. blythekeitzmilleriae* than on *O. boisduvallii*. The abdominal scent glands of *O. blythekeitzmilleriae* appear similar to those of *O. boisduvallii*, although those of the latter average 2.5 mm in length (2.1-3.1 mm, n=11). The venter on *O. blythekeitzmilleriae* is whitish compared with tawny on *O. boisduvallii*, and more heavily marked with coarser striations (striations on *O. boisduvallii* are mostly 2-3 dark scales in width). The large sizes of the ocelli on *O. blythekeitzmilleriae* differ from the small ocelli on *O. boisduvallii*, but resemble those seen on the majority of other species of *Opsiphanes*. The extension of the outline of the ocellus in CuA_1-CuA_2 cephalad to envelop a satellite ocellus in M_3-CuA_1 , however, is rarely seen on other *Opsiphanes* (see below). On *O. blythekeitzmilleriae*, the ocelli on the ventral hindwing are visible dorsally through a subtle translucency that is considerably more pronounced than the intense and more opaque colors typical of *O. boisduvallii*. As noted above, *Opsiphanes* have a mix of enlarged multipointed and filiform scales on the ventral hindwing in cell CuA_1-CuA_2 . These range from a thick vestiture of hair-like scales [*Opsiphanes cassiae* (Linnaeus, 1758), *Opsiphanes zelotes* Hewitson, 1873, *O. bogotanus*, *O. tamarindi*], a more even mix of pointed scales and yet thicker and much shorter rod-like scales (*O. invirae*, *O. cassina*), to those with very few of those undivided scales (*O. sallei*, *O. quiteria*, *Opsiphanes mutatus* Stichel, 1902). Both *O. boisduvallii* and *O. blythekeitzmilleriae* are similar to the latter, but the divided scales have very long points.

Among specimens examined, none were encountered that were intermediate between *O. boisduvallii* and *O. blythekeitzmilleriae*; those examined from Sinaloa (Magistral, east of Mazatlán) are typical of *O. boisduvallii* occurring further south. The specimens of *O. blythekeitzmilleriae* from Colima are smaller in size (male forewing length = 40.0 mm, female = 44.5, 47.2 mm) than are individuals from Sonora. Aside from this, we do not see differences between material from Sonora and Colima, nor do we detect any patterns of geographic variation in *O. boisduvallii*. Where *O. blythekeitzmilleriae* and *O. boisduvallii* occur in sympatry in Colima, they may be readily separated by wing characters. We also note one female of *Opsiphanes* from Baja California Sur, Mexico, listed by Brown and Faulkner (1982) and illustrated by Brown *et al.* (1992). This individual is not *O. blythekeitzmilleriae* and no different from females seen from populations of *O. boisduvallii* in other parts of Mexico. Until additional specimens from Baja California become available, the range of variation of *Opsiphanes* there will remain unknown. The single extant specimen suggests, however, that the population in Baja California is *O. boisduvallii* and not *O. blythekeitzmilleriae*. It is possible that *Opsiphanes* may have been introduced into Baja California on ornamental palms; the two records of *O. boisduvallii* from Mexico City, at 2250m elevation, most likely represent this type of human-assisted introduction (González-Cota, pers. comm.).

Table 1. Comparative measurements of wing length, hairpencil length, and ocelli width for *O. blythekeitzmilleriae* and *O. boisduvallii*. All specimens of *O. boisduvallii* are from Veracruz, Mexico.

	<i>O. blythekeitzmilleriae</i>	<i>O. boisduvallii</i>
male forewing length (mm) average / range / n	43.7 / 40.0-45.8 / n=3	32.7 / 35.6-38.7 / n=10
female forewing length (mm) average / range / n	50.7 / 44.5-55.7 / n=5	46.0 / 42.0-50.6 / n=9
hairpencil in HW discal cell (mm) average / range / n	6.0, 6.0 / n=2	4.4 / 4.0-4.8 / n=10
male ocellus on forewing (mm) average / range / n	6.5 / n=1	2.9 / 2.4-3.2 / n=10
male anterior ocellus on hindwing (mm) average / range / n	9.1, 9.8 / n=2	4.9 / 4.0-5.4 / n=10
male posterior ocellus on hindwing (mm) average / range / n	8.0, 8.2 / n=2	3.8 / 3.2-4.2 / n=10
female ocellus on forewing (mm) average / range / n	6.8 / 6.6-6.9 / n=3	3.5 / 2.9-4.0 / n=9
female anterior ocellus on hindwing (mm) average / range / n	11.2 / 11.0-11.5 / n=3	6.1 / 4.8-7.2 / n=9
female posterior ocellus on hindwing (mm) average / range / n	10.9 / 10.7-11.0 / n=3	4.8 / 4.0-5.6 / n=9

The genitalia of *O. blythekeitzmilleriae* (Figs. 16-17), although establishing its placement within *Opsiphanes*, appear uninformative at the species-level. The genitalia of the small sample of *O. blythekeitzmilleriae* examined (2 males, 1 female from Sonora; 1 male, 1 female from Colima) are consistent with the descriptions given above. We have noted during our investigations of the genus that there may be considerable intraspecific variation in the genitalia of both males and females. This variation among males of *O. boisduvallii* (n=12) includes the height and breadth of the tegumen, the length and robustness of the uncus, the length of the saccus, and the breadth and angularity of the harpe. While these structures tend to be less robust in *O. boisduvallii*, as might be expected due to their smaller average size than *O. blythekeitzmilleriae*, there are males of *O. boisduvallii* with genitalia that appear virtually identical to those of *O. blythekeitzmilleriae*. Similarly, the sterigma of females of *O. boisduvallii* (n=10) exhibit a range of variation from having the anterior portion continuous (as illustrated by Penz 2007) to having a wide gap; the two females of *O. blythekeitzmilleriae* examined have a narrow gap. No character of the genitalia has yet been found that would unequivocally distinguish the two species. Insufficient samples of most species of *Opsiphanes* have been examined to determine if the genital variability seen in *O. boisduvallii* is widespread within the genus or if there are species-specific characters. For example, the shaft of the phallus of *O. blythekeitzmilleriae* has many peg-like setae, particularly close to the attachment point of the anellus, and also on the phallobase. Those peg-like setae are also present on several other *Opsiphanes*, including *O. boisduvallii*, *O. sallei*, *O. invirae*, *O. quiteria*, and *O. cassina*. They are absent on *O. bogotanus* and *O. tamarindi* (genitalia of the remaining species of the genus were not examined, see Materials and Methods).

Some elements of the wing pattern are shared among most species of *Opsiphanes*. Transverse bands occur on the forewings in variable degrees of development involving elements of the medial, submedial, and submarginal regions of the wing. The occurrence

of those bands is associated with a nearly uniform dark (generally brownish) region posteriorly on the forewing with only *O. mutatus* and *O. sallei* exhibiting immediately obvious medial patterns caudad of the discal cell. The discal cell on the ventral forewing of *Opsiphanes* and the region just distad of it has alternating pale and dark bands. On many species, the dark (and in some instances, the pale) bands are divided into macules outlined with black. On *O. blythekeitzmilleriae* along with *O. boisduvallii*, *O. camena* (from photograph in Bristow 1991), *O. zelotes*, and some *O. invirae*, and *O. cassina*, the dark bands are undivided, presenting a more orderly aspect to this region of the wing. Detailed examination of the pattern elements is likely to provide useful characters for understanding the relationships within *Opsiphanes*. While *O. blythekeitzmilleriae* might have evolved through parapatric speciation from the geographically nearest taxon, *O. boisduvallii*, it is not yet clear which *Opsiphanes* species is the closest living relative of *O. blythekeitzmilleriae*, due to the distribution and intraspecific variation of morphological characters among the species of *Opsiphanes* discussed above.

Supernumerary macules occur widely within *Opsiphanes*. Individuals of most, if not all, species have one or more such macules showing varying degrees of development on the ventral hindwing. Those macules, however, rarely occur on the ventral forewing. Examination of several hundred specimens of the genus indicated less than one percent have supernumerary macules on the forewing; these were seen only on *O. boisduvallii*, *O. cassiae*, *O. invirae*, and *O. cassina*. It is thus interesting that all five males and two of six females of *O. blythekeitzmilleriae* examined from specimens or photographs have supernumerary macules on the ventral forewing. It is also worthy of note that on *O. blythekeitzmilleriae* the outline of the ocellus in CuA_1-CuA_2 on the ventral hindwing encloses or is split by the white of the macule in M_3-CuA_1 . A similar enclosure occurs very rarely on *O. tamarindi* (e.g., Bristow 1991, Figs. 8E, 10B); the white macule more often splits the dark outline on that species (e.g., Bristow 1991, Figs. 8F, 10C) as it occasionally also does on *O. cassiae* (e.g., Bristow 1991, Figs. 6C, 6F), *O. bogotanus* (e.g., Bristow 1991, Figs. 12D, 13A, 13D), and *O. quiteria* (e.g., Bristow 1991, Fig. 15B).

In summary, the new brassoline from northwestern Mexico is the northwestern-most ranging species of the tribe Brassolini. Although it is undoubtedly an *Opsiphanes* and variably shares a number of characters with other species of the genus, the unique combination of these features characterizes the distinct phenotype of *O. blythekeitzmilleriae*. The tawny color of *O. boisduvallii* had stood it uniquely apart from the general dark-colored and pale-banded aspect otherwise universal within *Opsiphanes*, and contributed to the delay in discovery of the new species. *Opsiphanes blythekeitzmilleriae* adds a second tawny and unbanded phenotype to the genus, an apparent enigma that has yet to be elaborated within the current knowledge of the phylogeny, ecology, and biology of the genus.

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LITERATURE CITED

- Bristow, C. R. 1991. A revision of the brassoline genus *Opsiphanes* (Lepidoptera: Rhopalocera). *Zool. J. Linn. Soc.* 101:203-293.
- Brown, J. W. and D. K. Faulkner. 1982. New Rhopalocera records for Baja California with the description of a new species of *Habrodais* Scudder (Lepidoptera: Theclinar [sic]). *Bull. Allyn Mus.* 67:1-6.
- Brown, J. W., H. G. Real and D. K. Faulkner. 1992. *Butterflies of Baja California. Faunal Survey, Natural History, Conservation Biology.* Beverly Hills, CA: The Lepidoptera Research Foundation, Inc. iv + 129pp., 8pls.
- Brown, K. S., Jr. 1996. The use of insects in the study, inventory, conservation and monitoring of biological diversity in neotropical habitats in relation to traditional land use systems. Pp. 128-149 in S. A. Ae, T. Hirowatari, M. Ishii, and L. P. Brower (eds.), *Decline and Conservation of Butterflies in Japan.* Osaka: Lepid. Soc. Japan (Yadoriga, special issue).
- Brown, K. S., Jr. 1997. Diversity, disturbance, and sustainable use of neotropical forests: insects as indicators for conservation monitoring. *J. Insect Conserv.* 1:25-42.
- Búrquez, A. 1997. Distributional limits of euglossine and meliponine bees (Hymenoptera: Apidae) in northwestern Mexico. *Pan-Pacific Ent.* 73:137-140.
- Búrquez, A. and A. Martínez-Yrizar. 2006. Conservation and landscape transformation in northwestern Mexico. Pp. 465-477 in R. S. Felger and B. Broyles (eds.) *Dry Borders: Great Natural Reserves of the Sonoran Desert.* Salt Lake City: The University of Utah Press.
- Búrquez, A. and A. Martínez-Yrizar. (in press). Límites geográficos entre las selvas bajas caducifolias y los matorrales espinosos y xerófilos: ¿qué conservar? In G. Ceballos and J. E. Bezaury (eds.) *Identificación de Amenazas y Prioridades para Conservación en las Selvas Secas del Pacífico Mexicano.* México, D.F.: WWF-CONABIO.
- Búrquez, A., A. Martínez-Yrizar, R. S. Felger and D. Yetman. 1999. Vegetation and habitat diversity at the southern edge of the Sonoran Desert. Pp. 37-67 in R. H. Robichaux (ed.), *Ecology of Sonoran Desert Plants and Plant Communities.* Tucson: The University of Arizona Press.

- Cabrera, A. L. and A. Willinik. 1973. *Biogeografía de América Latina. Monografía de la OEA, Serie de Biología, no. 13.* Washington, DC: Organización de Estudios Americanos. 122pp.
- Casagrande, M. M. 2004. Tribe Brassolini. Pp. 201-205 in G. Lamas (ed.), *Atlas of Neotropical Lepidoptera. Checklist: Part 4A, Hesperioidea-Papilionoidea.* Gainesville, FL: Scientific Publishers. 439pp.
- Cubero, R. 1985. Notes on the life cycle and natural history of *Opsiphanes quiteria quirinus* Godman and *Eryphanis aesacus buboculus* Butler (Brassolidae). *J. Lepid. Soc.* 39:33-42.
- DeVries, P. J. 1986. Hostplant records and natural history notes on Costa Rican butterflies (Papilionidae, Pieridae & Nymphalidae). *J. Res. Lepid.* 24:290-333.
- DeVries, P. J. 1987. *Butterflies of Costa Rica and Their Natural History. I. Papilionidae, Pieridae and Nymphalidae.* Princeton, NJ: Princeton Univ. Press. 327pp.
- Espinosa, D., J. Llorente and J. J. Morrone. 2006. Historical biogeographical patterns of the species of *Bursera* (Burseraceae) and their taxonomic implications. *J. Biogeogr.* 33:1945-1958.
- Felger, R. S., M. B. Johnson and M. F. Wilson. 2001. *Trees of Sonora, Mexico.* New York: Oxford Univ. Press. 391pp.
- Felger, R. S. and E. Joyal. 1999. The palms (Arecaceae) of Sonora, Mexico. *Aliso* 18:1-18.
- Fruhstorfer, H. 1912. 5 Familie: Brassolidae. Pp. 285-332 in A. Seitz (ed.), *Die Gross-Schmetterlinge der Erde, vol. 5.* Stuttgart: Alfred Kernen.
- Goldman, E. A. and R. T. Moore. 1945. The biotic provinces of Mexico. *J. Mammal.* 26:347-360.
- Harrison, J. O. 1963. On the biology of three banana pests in Costa Rica (Lepidoptera: Limacodidae, Nymphalidae). *Ann. Ent. Soc. Amer.* 56:87-94.
- Marshall, C. J. and J. K. Leibherr. 2000. Cladistic biogeography of the Mexican Transition Zone. *J. Biogeogr.* 27:203-216.
- Martínez-Yrizar, A., A. Búrquez and M. Maass. 2000. Structure and functioning of tropical deciduous forest in western Mexico. Pp. 19-35 in R. H. Robichaux and D. R. Yetman (eds.), *The Tropical Deciduous Forest of Alamos: Biodiversity of a Threatened Ecosystem in Mexico.* Tucson: The University of Arizona Press.
- Morrone, J. J. 2001. *Biogeografía de América Latina y el Caribe. M & T Manuales y Tesis, Vol. 3.* Zaragoza, Spain: Soc. Entomol. Aragonesa.
- Morrone, J. J., D. Espinosa and J. Llorente. 2002. Mexican biogeographic provinces: preliminary scheme, general characterizations, and synonymies. *Acta Zool. Mex.* 85:83-108.
- Penz, C. M. 2007. Evaluating the monophyly and phylogenetic relationships of Brassolini genera (Lepidoptera, Nymphalidae). *Syst. Ent.* 32:668-689.
- Penz, C. M., A. Aiello and R. B. Srygley. 1999. Early stages of *Caligo illioneus* and *C. idomeneus* (Nymphalidae, Brassolini) from Panama, with remarks on larval food plants for the subfamily. *J. Lepid. Soc.* 53:142-152.
- Srygley, R. B. and C. M. Penz. 1999. Lekking in neotropical owl butterflies, *Caligo illioneus* and *C. oileus* (Lepidoptera: Brassolini). *J. Ins. Behav.* 12:81-103.
- Stichel, H. 1902. Aufteilung der Gattung *Opsiphanes* Westw., Beschreibung neuer Brassoliden und synonymische Notizen. *Berl. Ent. Zeit.* 46:487-524.

- Stichel, H. 1904. Lepidoptera, Rhopalocera, Fam. Nymphalidae, Subfam. Brassolinae. *Genera Insectorum* 20:1-48.
- Vargas-Fernández, I., J. Llorente-Bousquets, A. Luis-Martínez and C. Pozo. (in press). *Nymphalidae de México II (Libytheinae, Ithomiinae, Morphinae, Charaxinae): Distribución Geográfica e Ilustración*. México, D.F.: Facultad de Ciencias, UNAM. 208pp.
- Warren, A. D., J. E. Llorente-Bousquets, A. Luis-Martínez and I. Vargas-Fernández. 2006. *Interactive Listing of Mexican Butterflies*. <http://www.mariposasmexicanas.com/> (acc. 16 Feb. 2007)
- Young, A. M. 1977. Notes on the defoliation of coconut palm (*Cocos nucifera*) by the butterfly *Opsiphanes quiteria quirinus* in northeastern Costa Rica (Lepidoptera: Brassolidae). *Dtsch. Ent. Z.* 24:353-365.
- Young, A. M. and A. Muysshondt. 1975. Studies on the natural history of Central American butterflies in the family cluster Satyridae-Brassolidae-Morphidae (Lepidoptera: Nymphaloidea). III. *Opsiphanes tamarindi* and *Opsiphanes cassina* in Costa Rica and El Salvador. *Studies Neotrop. Fauna* 10:19-56.