

The Lepidoptera of White Sands National Monument 6: A New Species of *Chionodes* Hübner, [1825] (Lepidoptera, Gelechiidae, Gelechiinae) Dedicated to Ronald W. Hodges and Elaine R. Snyder Hodges in the Year of Ron's 80th Birthday, 2014

Author: Metzler, Eric H.

Source: The Journal of the Lepidopterists' Society, 68(2) : 80-84

Published By: The Lepidopterists' Society

URL: <https://doi.org/10.18473/lepi.v68i2.a2>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Journal of the Lepidopterists' Society
68(2), 2014, 80–84

THE LEPIDOPTERA OF WHITE SANDS NATIONAL MONUMENT 6: A NEW SPECIES OF
CHIONODES HÜBNER, [1825] (LEPIDOPTERA, GELECHIIDAE, GELECHIINAE)
DEDICATED TO RONALD W. HODGES AND ELAINE R. SNYDER HODGES
IN THE YEAR OF RON'S 80TH BIRTHDAY, 2014.

ERIC H. METZLER

Michigan State University, Adjunct Curator of Lepidoptera, Research Collaborator U.S.N.M. Natural History,
P.O. Box 45, Alamogordo, NM 88311-0045 U.S.A. E-mail: metzlere@msu.edu

ABSTRACT. A new species of *Chionodes* Hübner, [1825] (Lepidoptera, Gelechiidae, Gelechiinae), *C. hodgesorum*, is described from White Sands National Monument, Otero County, New Mexico. Ron and Elaine Hodges were special mentors in my study of Lepidoptera. Thus this description to honor Ron and Elaine is published in the year of Ronald W. Hodges' 80th birthday, 2014. Images of the imago and male and female genitalia are included, and a map of New Mexico showing the type-locality is provided.

Additional key words: biological diversity, endemism

DEDICATION

As a young student studying Noctuidae at Michigan State University I often encountered specimens collected by Ron Hodges. Eventually, on a trip to the U.S. National Museum in Washington, DC, I had the good fortune to meet him. On that first visit, Ron and his wife Elaine took me, an unknown person, to lunch in the Castle of the Smithsonian Institution. Ron spent several hours, on that visit and in many additional visits, tutoring me about the fine arts of studying smaller moths. Thanks to Ron I now work in all families of Lepidoptera, including the ones I pretended not to exist when I was a student. This paper, my fourth paper (Adamski & Metzler 2000; Metzler & Adamski 2002; Metzler & Lightfoot in press) describing species of the Gelechioidea, is testament to Ron's influence on me.

Elaine, an artist with extra ordinary skills, also tutored me by allowing me to watch over her shoulder for hours while she produced the most exquisite illustrations. She never hesitated to teach while she was working. Elaine passed in 2006—my friendship with Ron continues.

Ron and Elaine both served on the Executive Council of The Lepidopterists' Society. Both are the kind of people I hope we all desire to be.

Hodges (1999) revised the species of *Chionodes* Hübner, [1825] in America north of Mexico. As evidence of the poorly known status of the genus, 115 species (62%) of the 187 species treated were new to science. The distributions of many species appear to be highly disjunct. Additional collecting of small moths should fill in some gaps as well as disclosing undescribed species. Hodges (1999) specifically mentioned the need for more collecting in southern New Mexico.

Prior to 2006 when White Sands National Monument invited me to conduct a ten-year study of moths at the Monument, almost nothing was known about the insect fauna of the white gypsum dunes ecosystem in the Tularosa Basin (Schneider-Hector 1993) in southern New Mexico, USA. During the first six years of the study, 2007 through 2013, a new species of *Chionodes* was collected and is described herein.

MATERIALS AND METHODS

Moths and other night flying insects were collected in U.S.D.A. type black-light traps, as described in Smith et al. (1974), in diverse habitats in White Sands National Monument. A detailed description of the study methods is in Metzler et al. (2009).

Specimens of moths were retained for further study. The specimens were sorted and identified. Of them selected specimens were spread and labeled. All non-lepidopteran insects (by-catch) from the traps were placed in 95% EtOH and deposited in the Museum of Southwestern Biology at the University of New Mexico, Albuquerque, New Mexico.

Genitalia of selected moth specimens were examined following procedures outlined in Clarke (1941), Hardwick (1950), Lafontaine (2004), and Pogue (2002). Abdomens were removed from the moths, placed in 95% EtOH for a short time, and soaked in 10% KOH for about 30 minutes at 50°C. Genitalia were dissected in water, stained with Chlorazol Black in water and Safranin O in absolute EtOH, dehydrated in 99.9% propanol under glass chips, and slide mounted in Euparal.

Terminology for elements of wing pattern, morphology, and genital structures follows Hodges (1999) and Scoble (1995). Terminology for color comes from wing markings and regions of the wing follows Mikkola et al. (2009). Forewing lengths were measured to the nearest 0.1mm, from the base to the apex excluding fringe, using an ocular micrometer in the



FIGS. 1–4. *Chionodes hodgesorum* adults; 1. male holotype (Genitalia on slide USNM 144565); 2. female paratype; 3. male paratype; 4. female paratype.

eyepiece of a Wild™ model M5 stereo-microscope at magnification of 6x.

Photographs of adults were taken with a Nikon® model D200 camera with bellows and Micro-NIKKOR™ 105mm 1:2.8 macro lense. Illumination was provided by an Aristo DA-10 lightbox manufactured by Aristogrid™. Photographs of the mounted male and female genitalia were taken with a Nikon™ model D200 camera mounted on the photo tube of a Zeiss™ Lumipan Universal Research Microscope using a Leitz™ 1x plan objective and bright field transmitted light. Photographs were processed with Microsoft Windows™ versions of Zerene Stacker™ and Adobe Photoshop CS6™ software.

The coordinates for latitude and longitude on the labels of the specimens from the studies are in degrees and decimal minutes. Specimens of Lepidoptera cited in this paper are deposited in the following collections:

EHM Eric H. Metzler, Alamogordo, NM, for subsequent transfer to MSUC.

MSUC Albert J. Cook Arthropod Research Collection, Department of Entomology, Michigan State University, East Lansing, MI

UNM Museum of Southwestern Biology, University of New Mexico, Albuquerque, NM

USNM U. S. National Museum of Natural History (Smithsonian Institution), Washington, DC

RESULTS

Chionodes hodgesorum Metzler, new species (Figs 1–10)

Diagnosis. *Chionodes hodgesorum* is a black and yellow moth with pale-gray reflective hindwings. Of similar species of *Chionodes* in the *sistrella*-complex, *C. hodgesorum* and *C. oecus* Hodges, 1999 occur sympatrically at White Sands National Monument. *Chionodes hodgesorum* is noticeably larger (forewing length = 1.5 x the forewing length of *C. oecus*). The

similar *Chionodes xanthophilella* (Barnes & Busck, 1920), not recorded from White Sands National Monument, is the same size as *C. oecus*. In addition to *C. hodgesorum*'s larger size, structures of the male genitalia can readily separate *C. hodgesorum* from its congeners. The basal portions of the valvae of *C. hodgesorum* are straight with the apices bent mesally; the basal portions of the valvae of *C. oecus* are strongly C shaped, and the valvae of *C. xanthophilella* are broadly curved laterally with the apices directed mesally.

Description. Adult male (Figs. 1, 3). *Head*: Front, clypeus, and vertex pale yellow, scales appressed to surface. Labial palpi directed slightly laterally from base, upcurved to center of front; first segment brown, second segment basal one-third brown, distal two-thirds pale yellow, ventral surface shaggy, dorsal and lateral surfaces with scales appressed, third segment apically pointed, pale yellow, scattered brown scales near apex. Haustellum scaled, pale yellow. Antenna scaled, dorsal surface dark brown black, ventral surface of each segment alternating dark black brown and paler brown. *Thorax*: Dorsum pale yellow, tegulae and patagia dark brown black, scales appressed; underside pale yellow, scales appressed. Foreleg with dorsal surface pale yellow, ventral surface dark brown scales appressed, apex of tibia and each tarsomere pale yellow. Midleg dorsally pale yellow, ventrally dark brown, scales appressed laterally and ventrally, shaggy fringe dorsally; tarsomeres pale yellow, ringed with dark brown basally, scattered setae on ventral surface. Hindleg pale yellow mesally and ventrally, scales appressed, dirty yellow dorsally, shaggy, alternating brown and pale yellow laterally, scales appressed, tarsomeres dorsally, ventrally, and mesally pale yellow, laterally alternating pale yellow and dark brown, scattered setae on ventral surface. Forewing: Length 8.1–8.7 mm (mean 8.5 mm, n = 5). Costal half black to 2/3 length, a more or less complete pale-yellow fascia at 2/3 length, costal scales from fascia to apex fuscous, subcostal scales from fascia to apex black with scattered yellow scales. Black costal region with 2 or 3 subcostal vague pale-yellow spots. Posterior half yellow, with 1 or 2 shallow semicircular yellow markings intersecting the black region at or near antemedial line (not always present), postmedial line, and the fascia at 2/3 wing length. Basal streak black, narrow, inconspicuous, extending apically to yellow fascia, interrupted by yellow semicircular markings. Terminal line comprised of scattered black scales, apex mostly black intermixed with pale-yellow scales; fringe pale fuscous. Underside fuscous gray, costa at base edged with black, fading to dark fuscous apically, sub apical 1/5 pale yellow, posterior margin narrowly lined with pale yellow, outer margin at tornus lined with pale yellow; fringe gray fuscous. Hindwing reflective gray-fuscous, veins overlaid with fuscous scales, costa pale-

gray overlaid with fuscous scales, apex with small patch of pale-yellow scales, fringe gray-fuscous. **Abdomen:** Dorsum segments 1 through 3 moderate to grayish-yellow, then pale-yellow to distal end; underside pale-yellowish gray, intermixed with fuscous scales. Genitalia (Figs. 5, 6): uncus broadly rounded, spoon-shaped, setae on the ventrolateral margin; culcitula absent; gnathos base sclerotized, lobed laterally asymmetrical, lobes may be bifurcate; gnathos sharply curved at .2x length, shallowly curved to subapical region, sharply curved apically, 2 or 3 minute scobinations on inside of subapical surface, apex bluntly pointed; tegumen elongate, broadly A shaped, slightly narrowed apically, each arm gradually narrowing to junction with vinculum; vinculum = 1.1x length of tegumen, abruptly narrowed anteriorly from junction with tegumen extended anteriorly, and elongated (vinculum + saccus) with a blunt apex; posterolateral lobe of vinculum membranous, sclerotized basally, sparse setae; saccus not differentiated from vinculum; valvae slightly asymmetrical, both nearly parallel to tegumen, slightly sinuous, shallowly curved outwardly along basal 1/3, shallowly curved mesally along apical 1/6, with shallow sculpting along a sharply pointed apex. Aedeagus with distal part sculpting complex, several narrow longitudinal fin-like structures; caecum = slightly more than 2x length of distal part.

Adult female (Figs. 2, 4). Appearance similar to male. Forewing length 7.8–8.9 mm, (mean 8.5 mm, $n = 9$). Frenulum acanthae multiple. Genitalia (Fig. 7): Ovipositor telescopic; papillae anales membranous, sparsely setose, with most setae clustered apically; apophyses posteriors extending anteriorly to between 8th and 9th segments; 9th abdominal ventrolateral margins extended to form anterior apophyses; anterior apophyses extending anteriorly to base of antrum; antrum sclerotized laterally with narrow longitudinal folds; ductus bursae membranous, short, slightly bulbous; corpus bursae ovoid; signum an inward excavation with broad marginal dentitions.

Holotype. Adult male, pinned with labels as follows: "USA: NM: Otero Co. White Sands Nat[ional] Mon[ument], edge of dunes habitat, 106°11.32'W, 32°45.72'N 4,000', 14 Sept. 2009 wsnm9, Eric H. Metzler uv tr[a]p, Access # WHSA 00131" "HOLOTYPE USNM *Chionodes hodgesorum* Metzler" [red handwritten label] "U.S.N.M ♂ 144,565 E.H. Metzler Holotype [green handwritten label]. (USNM).

Paratypes. 4 ♂, 12 ♀: all are "USA: NM: Otero Co. White Sands Nat Mon, Access # WHSA 00131" details as follows: edge of dunes habitat, 32°45.724'N, 106°11.315'W, 4,000', 10 June 2013, WHSA9, Eric H. Metzler uv trp, 1 ♂, 5 ♀; edge of dunes habitat, 106°11.32'W, 32°45.72'N, 4,000', 14 Sept. 2009, wsnm9, Eric H. Metzler uv trp, [slide E.H.M. 515] 1 ♂; interdune vegetation, 106°11.59'W, 32°45.57'N 4,006', 21 Aug 2007, WSNM2, Eric H. Metzler uv trp, slides USNM 144566 & E.H.M. 517] 2 ♀; interdune vegetation, 106°11.38'W, 32°46.69'N 4,000', 17 May 2010, WSNM8, Eric H. Metzler uv trp, 1 ♀; edge of dunes, 11–12 June 2007, 32°45.704'N 106°11.240'W, 4,001 ft. Coll. E.H. Metzler & D. Adamski, Blacklight, 2 ♂, 1 ♀; edge of dunes habitat, 106°11.32'W, 32°45.72'N, 4,000', 5 Sept. 2013, WSNM9, Eric H. Metzler uv trp, 2 ♀; interdune vegetation, 106°10.84'W 32°46.64'N 4,000', 5 Sept. 2013, WSNMF, Eric H. Metzler uv trp, 1 ♀ (EHM, MSUC, UNM, USNM).

Systematics. This new species is placed in the genus *Chionodes* Hübner based on the presence of the caecum on the aedeagus (Hodges 1999).

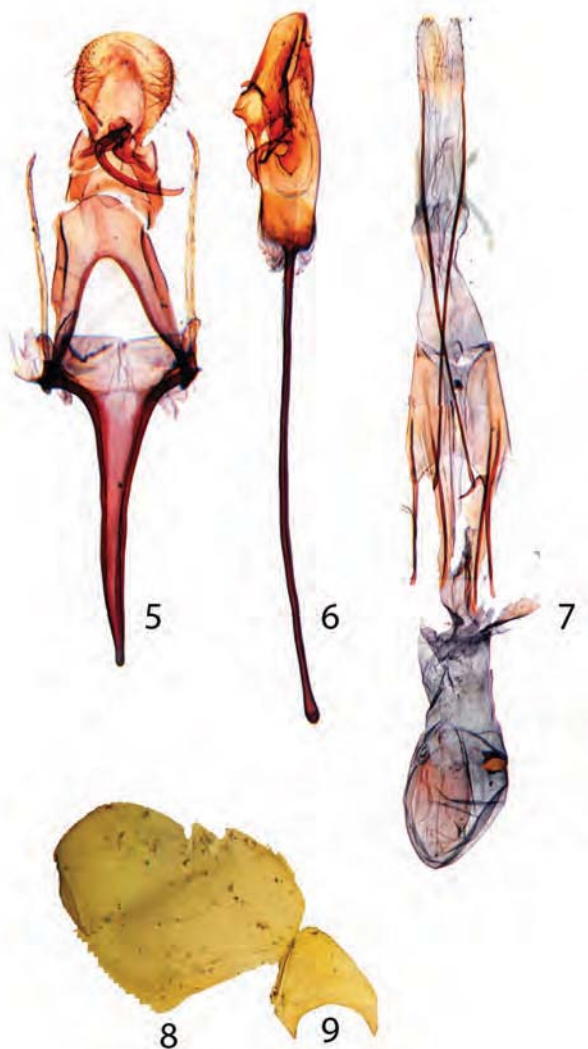
Etymology. The specific name of this species, *hodgesorum*, honors Ronald W. Hodges and his late wife, Elaine R. Snyder Hodges, both of whom are my mentors and personal friends. Both contributed significantly to my study of Lepidoptera.

Distribution. *Chionodes hodgesorum* occurs in the gypsum dunes at White Sands National Monument.

Phenology. Emergences of fresh specimens in the early summer and autumn suggest two broods. Other details of its life history are unknown.

DISCUSSION

Hodges (1999) cautioned that "All species in the *sistrella*-complex" which includes *C. hodgesorum* "are variable to highly variable in coloration, maculation, and genital characters," and in personal conversations, when Hodges was preparing the revision of *Chionodes*, he told me this group of moths can be extremely difficult. Fortunately, for users of Hodges' (1999) revision, he qualified the variability and provided detailed diagnoses,



FIGS. 5–9. *Chionodes hodgesorum* genitalia and male seventh abdominal segment (on slide USNM 144565); 5. male genitalia Holotype (on slide USNM 144565); 6. male aedeagus Holotype (on slide USNM 144565); 7. female genitalia paratype (on slide USNM 144566). 8. male seventh abdominal segment tergum Holotype (on slide USNM 144565); 9. Male seventh abdominal segment sternum Holotype (on slide USNM 144565).



FIG. 10. *Chionodes hedgesorum* distribution map. *Chionodes hedgesorum* is known only from White Sands National Monument, Otero Co., New Mexico.

key characters, and descriptions which allowed me to focus on the features of each species which either included it or excluded it from consideration as I distinguished *C. hedgesorum*. When I sent photographs of the adult and genital preparations to Ron Hodges, he agreed with my diagnosis. One male specimen of *C. hedgesorum* has a hint of orange in the yellow area of the forewing.

In 2006, the U.S. National Park Service invited me to initiate a ten-year study of the moths at White Sands National Monument, Otero County, NM. A primary purpose of the study was to compile an inventory of moths in various habitats within the Monument, and to describe new species discovered during the study. Descriptions of species from the Monument are important because the names facilitate cataloging, protecting, and communicating information about their significance.

More than 600 species of moths (unpublished data), including ca. 30 species new to science (unpublished data), were recorded in the first six years of the study from black-light traps along a 2.4 km transect in the southeastern corner of the dunes of the Monument. Most of the new species from the Monument are apparently endemic to the white dunes, and several are

white species (Kain 2000). The number of endemic species of moths to White Sands National Monument compared to all of North America is the highest for a single location. These numbers seem more impressive in consideration of the small study area and the short time of the study to date.

The diagnosis of the genus *Chionodes* and identification of its many species rely heavily on genital characters. The species described here is an excellent example of a species, which requires dissection for positive identification. I dissected 2 males and 2 females. They were remarkably consistent in structure.

The dearth of collections of smaller moths in southern New Mexico (Hodges 1999) means it is not possible to conclude that *C. hedgesorum* is endemic to White Sands National Monument. Nonetheless, the high rate of endemism, ca. 5%, of the number of recorded species of moths at White Sands National Monument, and the failure to detect this species until now, suggests that this species may be endemic to the white gypsum dunes.

This is the 8th in a series of papers to document the Lepidoptera at White Sands National Monument (Metzler et al. 2009, 2010a, 2010b, in press; Metzler & Forbes 2011a, 2011b, 2011c, 2012; Metzler & Lightfoot in press), and the 7th species of Lepidoptera described as new to science from the study.

ACKNOWLEDGMENTS

The Western National Parks Association, Tucson, Arizona contributed travel funding during the first 3 years of this study of Lepidoptera at White Sands National Monument. The El Paso Zoo Conservation Fund provided a small grant, which covered the cost of publication of this paper. I am grateful to both for their financial support.

David Bustos from White Sands National Monument provided special assistance and support of my research. All of the personnel at the Monument were mindful and helpful with my study. I thank my friends Gregory S. Forbes and David Adamski for their companionship during the collection of several of the specimens in the type series. Representatives from research collections provided insect pins, alcohol, identification services, research consultation, and storage space for specimens collected. I thank the following persons for offering support from their respective institutions: C. Scott Bundy and David B. Richman (New Mexico State University, Las Cruces, NM); Kelly B. Miller, Sandra L. Brantley, and David C. Lightfoot (UNM); Frederick W. Stehr, Anthony I. Cognato, and Gary L. Parsons (MSUC); Charles V. Covell, Jr. (McGuire Center for Lepidoptera and Biodiversity, University of Florida, Gainesville, FL); Larry Berger (Ohio Department of Agriculture, Reynoldsburg, OH); J. Donald Lafontaine, B. Christian Schmidt, and Jean-François Landry (Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, ON); and John W. Brown, David G. Furth, Jon A. Lewis, Michael G. Pogue, and Michele A. Touchet (USNM). Patricia A. Metzler was my faithful companion on collecting trips to the Monument, and she accompanied me on several long driving trips to Washington, DC and other locations for the purpose of identifying specimens. She contributed financially to the study. I thank two reviewers for reading the paper and offering valuable suggestions.

LITERATURE CITED

- ADAMSKI, D. & E. H. METZLER. 2000. A new species of *Glyphidocera* Walsingham from southwestern Ohio (Lepidoptera: Gelechioidea: Glyphidoceridae). *Proc. Ent. Soc. Washington* 102(2): 301–307.
- CLARKE, J. F. G. 1941. The preparation of slides of the genitalia of Lepidoptera. *Bull. Brooklyn Entomol. Society* 36: 149–161.
- HARDWICK, D. F. 1950. Preparation of slide mounts of lepidopterous genitalia. *Canad. Entomol.* 82: 231–235.
- HODGES, R. W. 1999. The Moths of America North of Mexico. Fascicle 7.6. Gelechioidea Gelechiidae (Part. Gelechiinae (Part—*Chionodes*). The Wedge Entomological Research Foundation. Washington, DC. 339 pp.
- HÜBNER, J. [1825]. 3. Berein, Coitus 3. Chionoden, Chionodae. p. 420. In *Verzeichniss bekannter Schmettlinge* [sic]. Augsburg, Germany. 501 pp.
- LAFONTAINE, J. D. 2004. The Moths of North America Including Greenland, Fascicle 27.1, Noctuoidea Noctuidae (part. Noctuidae (part Agrotini)). The Wedge Entomological Research Foundation, Washington, DC. 385 pp.
- METZLER, E. H. & D. ADAMSKI. 2002. A new species of *Gnorimoschema* Busck, 1900 (Lepidoptera: Gelechiidae, Gelechiinae) from Ohio and Illinois. *Faberies*. 27(1): 59–68.
- METZLER, E. H., D. BUSTOS, & G. S. FORBES. 2009. The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 1. Two new species of Noctuidae (Lepidoptera, Noctuidae, Agrotini). In Schmidt, B. C. & Lafontaine, J. D. (Eds.). Contributions to the systematics of New World macro-moths. *ZooKeys* 9: 47–62.
- METZLER, E. H., G. S. FORBES, & D. BUSTOS. 2010a. Moth Studies at White Sands National Monument. In: Greenwald, D. H. (Ed.). A Walk Through Time—The Tularosa Basin's Past. 2009 Tularosa Basin Conference Proceedings. pp. 1–6. CD-ROM.
- METZLER, E. H., G. S. FORBES, D. BUSTOS, & R. WEST. 2010b. First records, representing major range extensions, of three species of Lepidoptera (Erebidae, Noctuidae, and Lasiocampidae) from New Mexico. *Southwestern Entomologist* 35: 309–311.
- METZLER, E. H. & G. S. FORBES. 2011a. The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 2. Rediscovery and description of *Sparkia immacula* (Grote, 1883. (Noctuidae, Noctuidae, Hadenini). In Schmidt, B. C. & Lafontaine, J. D. (Eds.). Contributions to the systematics of New World macro-moths III. *ZooKeys* 149: 117–123.
- METZLER, E. H. & G. S. FORBES. 2011b. The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 3. A new species of *Aleptina* Dyar, 1902 (Lepidoptera, Noctuidae, Amphipyryinae, Psaphidini). In Schmidt, B. C. & Lafontaine, J. D. (Eds.). Contributions to the systematics of New World macro-moths III. *ZooKeys* 149: 125–133.
- METZLER, E. H. & G. S. FORBES. 2011c. The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 4. A new species of *Schinia* Hübner, 1818 (Lepidoptera: Noctuidae: Heliothinae). In Schmidt, B. C. & Lafontaine, J. D. (Eds.). Contributions to the systematics of New World macro-moths IV. *ZooKeys* 149: 135–144.
- METZLER, E. H. & G. S. FORBES. 2012. The Lepidoptera of White Sands National Monument 5: two new species Cochylini (Lepidoptera, Tortricidae, Tortricinae). *Zootaxa* 3444: 51–60.
- METZLER, E. H., G. S. FORBES, D. BUSTOS, & R. WEST. in press. Moth studies in the northern Chihuahuan Desert with illustrations of new species. In LoBello, R. L. (Ed.). A Desert Without Borders. Proceedings of the Chihuahuan Desert Conference. The Chihuahuan Desert Education Coalition, El Paso, TX.
- METZLER, E. H. & D. C. LIGHTFOOT. In press. The Lepidoptera of White Sands National Monument, Otero County, New Mexico, USA 7. A new species of the genus *Areniscythris* (Scythrididae), a recently discovered iconic species from the Monument. *J. Lepid. Soc.* In press.
- MIKKOLA, K. E., J. D. LAFONTAINE, & J. GILL. 2009. The Moths of North America Fascicle 26.9 Noctuoidea Noctuidae (Part) Xylinae (Part) Apameini (Part—*Apamea* group of genera). The Wedge Entomological Research Foundation. Washington, DC. 192 pp.
- POGUE, M. G. 2002. A World revision of the genus *Spodoptera* Guenée (Lepidoptera: Noctuidae). *Mem. Am. Entomol. Society* 43: 1–202.
- SCHNEIDER-HECTOR, D. 1993. White Sands, The History of a National Monument The University of New Mexico Press. Albuquerque, NM. 270 pp.
- SCOBLE, M. J. 1995. The Lepidoptera. Natural History Museum Publications, Oxford University Press. Oxford, UK. 404 pp.
- SMITH, J. S., JR., J. M. STANLEY, J. G. HARTSOCK, & L. W. CAMPBELL. 1974. S-1 Black-light Insect-survey Trap Plans and Specifications. ARS-S-31. New Orleans, LA. 4 pp.

Submitted 21 November 2013. Revised and accepted 16 January 2014.