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A NEW SPECIES OF *EUCOSMA* HÜBNER (TORTRICIDAE) RELATED TO *E. DORSISIGNATANA* (CLEMENS) AND *E. SIMILIANA* (CLEMENS)

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Abstract. *Eucosma oraria*, new species, is described from the mid-Atlantic coast of North America. It is distinguished from its closest congeners, *Eucosma dorsisignatana* (Clemens) and *Eucosma similiana* (Clemens), by size and details of forewing maculation. Reviews are provided of the last two species, including a reevaluation of their relationships with *Eucosma dorsisignatana diffusana* Kearfott, *Eucosma dorsisignatana confluana* Kearfott, and *Eucosma engelana* Kearfott. The new species appears to be associated with marsh habitat.

Additional key words: Olethreutinae, Eucosmini, coastal marsh.

In 1860, Clemens proposed the names *dorsisignatana* and *similiana* for two species of *Eucosma* Hübner, 1823, that have long been a source of confusion for North American taxonomists. Uncertainty with regard to the limits of intraspecific variation, coupled with a lack of diagnostic genitalic characters, resulted in *similiana* being treated as a synonym of *dorsisignatana* for nearly a century, from Fernald (1882) to Miller (1985). In 1905, Kearfott elevated two phenotypes of the then considered *E. dorsisignatana* to subspecies status as *E. d. confluana* and *E. d. diffusana*, and in 1908 he described *E. engelana* based on specimens similar to but allegedly distinct from *E. dorsisignatana*. The history of the nomenclature is complicated by the fact that Fernald (1882) misspelled *similiana* as *similana*, a name that at the time was preoccupied by *Paedisca similana* Hübner, 1793 (now *Epinotia trigonella* Linnaeus, 1758). That error persisted in the literature until Miller (1985) reviewed the situation, treating *E. dorsisignatana* and *E. similiana* as separate species distinguishable by whether the subbasal and median fasciae are disjunct or fused, respectively. His interpretation, with *E. d. confluana* and *E. d. diffusana* as synonyms of *E. similiana*, became the accepted arrangement, though Brown (2005) lists both subspecific names as synonyms of *E. dorsisignatana*. Miller (1985) did not comment on *E. engelana*, which has been treated as a subspecies of *E. dorsisignatana* since Heinrich (1923).

Several years ago I received a *dorsisignatana*-like specimen with unusual forewing markings that had been collected by Steve Johnson in coastal marsh habitat in southern New Jersey. Subsequent investigation revealed that there is no intergradation in maculation between this phenotype and typical *E. dorisignatana*, and I readily assembled a series of similar specimens that had accumulated in the *E. dorsisignatana* material at the United States National Museum of Natural History. The genitalia of these specimens resemble those of *E. dorsisignatana*, but the adults are substantially larger and appear to be restricted to the Atlantic coast (Nova Scotia to North Carolina). I am persuaded that they represent a previously unrecognized species. This paper proposes a name for the new taxon and reviews *E. dorsisignatana* and *E. similiana*, treating *E. engelana* and *E. d. confluana* as synonyms of *E. similiana* and *E. d. diffusana* as a synonym of *E. dorsisignatana*.

MATERIALS AND METHODS

I examined 265 specimens and 29 genitalia preparations from the following collections: American Museum of Natural History, New York (AMNH); University of Connecticut, Storrs (UConn); United States National Museum of Natural History, Washington D.C. (USNM), and Donald J. Wright (DJW). Morphological terminology follows Gilligan et al. (2008), "≈" stands for "approximately equal to," and aspect ratio (AR) refers to the ratio of forewing length (FWL) to medial forewing width. Illustrations were edited in Adobe Photoshop CS.

The type fixation issues associated with *E. dorsisignatana* and *E. similiana* are discussed in Miller (1973). My conclusions regarding *E. d. confluana*, *E. d. diffusana*, and *E. engelana* are based on examination of the lectotypes. In the case of *E. d. confluana*, Klots (1942) reported a lectotype in the AMNH, attributing the designation to Heinrich (1923), but Heinrich's remarks do not single out a unique specimen. For the sake of nomenclatorial stability, a lectotype designation is included below for the specimen interpreted as such by Klots.

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SPECIES ACCOUNTS

Eucosma dorsisignatana (Clemens)
(Figs. 1–7, 17–19, 23–25)

Poecilochroma dorsisignatana Clemens 1860:353.
Paedisca dorsisignatana: Fernald 1882:42.
Eucosma dorsisignatana: Fernald [1903]:459; Barnes and McDunnough 1917:171; Heinrich 1923:120; McDunnough 1939:47; Powell 1983:34; Miller 1985:244; Miller 1987:53; Brown 2005:319; Gilligan et al. 2008:111.
Paedisca clavana Zeller 1876:303.
Carpocapsa distigmana Walker 1863:394.
Eucosma dorsisignatana diffusana Kearfott 1905:355; Barnes and McDunnough 1917:171; Heinrich 1923:121; McDunnough 1939:47; Powell 1983:34; Miller 1985:246; Brown 205:319.

Discussion. *Paedisca clavana* and *Carpocapsa distigmana* were first recognized as synonyms of *E. dorsisignatana* by Fernald (1882), a decision that is supported by the forewing maculation of the type specimens (Figs. 5, 6).

Kearfott (1905) described *E. d. diffusana* from 11 syntypes. I examined 5 of those specimens and found that they present two different forewing patterns. It seems from the original description that Kearfott intended the name to apply to the phenotype illustrated in Figs. 10 & 11, and apparently Miller (1985) was operating under that assumption when he placed *diffusana* in the synonymy under *E.* similiana. However, the lectotype (Fig. 7) for *E. d. diffusana*, designated by Heinrich (1923), has the *dorsisignatana* forewing maculation, and therefore *diffusana* belongs in the synonymy under *E. dorsisignatana*. [Heinrich's comments "Type – In American Museum" and "Type Locality – Vernon Parish, Louisiana" constitute a valid designation since the AMNH has only one syntype of *E. d. diffusana* from that location.] As in Miller (1985), individuals with the forewing appearance depicted in Figures 10 and 11 are treated here as *E. similiana*.

The *E. dorsisignatana* forewing pattern (Figs. 1–7) consists of three transverse marks: a fragment of a subbasal fascia, extending from dorsum to cell but not reaching the radius; a median fascia that is almost always incomplete near the dorsum, where usually it is represented by a small disjunct spot; and a postmedian band that terminates at the tornus and frequently is interrupted near the costa. The markings are reddish brown to blackish brown and thinly edged with white, contrasting with pale gray to reddish-brown interfascial areas that are extensively overlaid with brown to reddish-brown reticulations. The separation of the subbasal and median fasciae by a broad interfascial band is the basis for distinguishing *E. dorsisignatana* from *E. similiana* (Miller 1985). Forewing statistics: ♂ FWL 6.6–11.5 mm (mean = 9.3, n = 44), AR = 2.89; ♀ FWL 8.8–11.4 (mean = 9.9, n = 9), AR = 2.70.

The literature contains several illustrations of the male genitalia: Heinrich (1923, fig. 180), Miller (1985, fig. 21), Miller (1987:53), Gilligan et al. (2008:218). Figures 17–19 give some indication of the variation in valval shape. The female genitalia was illustrated by Miller (1985, figs. 22, 23); the sterigma by Miller (1987:53) and by Gilligan et al. (2008:271). Figures 23 and 24 show what seems to be the extent of the variation in the lamella postvaginalis.

Types. *Poecilochroma dorsisignatana*. Lectotype designated by Darlington (1947): ♂, no. 7217, Academy of Natural Sciences, Philadelphia. Miller (1973) casts some doubt on whether this specimen is a Clemens syntype. The type locality was reported by Miller (1973) as unknown, by Heinrich (1923) as Pennsylvania ?, and by Brown (2005) as USA (Pennsylvania). *Paedisca clavana*. Lectotype designated by Miller (1985) (Fig. 5): ♂), Cambridge, Boll, genitalia slide 11565, BMNH. *Carpocapsa distigmana*. Holotype (Fig. 6): ♀, North America, genitalia slide 11543, BMNH. Walker (1863) based this name on a single specimen, which he incorrectly reported as a male. *Eucosma dorsisignatana diffusana*. Lectotype designated by Heinrich (1923) (Fig. 7): ♂ Louisiana, Vernon Parish, G. Coverdale, August, genitalia slide DJW 2570, AMNH.

Distribution and biology. Fernald (1882) reported that the larvae feed in the roots of *Solidago canadensis* Linnaeus (Canada goldenrod) (Asteraceae), crediting that information to Kellicott. I examined specimens that document a geographical range extending across southern Canada (Nova Scotia to British Columbia), south to the Gulf of Mexico and southwest to a line running roughly from eastern Oregon to eastern Texas. I am not aware of any records from Nevada, Utah, Arizona, or New Mexico. Powell & Hsu (1998) reported a population of a species "near *dorsisignatana*" from Plumas County, California in the northern Sierra Nevada mountains, but I have not examined those specimens. Adult flight occurs from mid-July to the end of October.

Eucosma similiana (Clemens)
(Figs. 8–12, 20–22, 26, 27)

Poecilochroma similiana Clemens 1860:353.
Paedisca similana: Fernald 1882:42 [misspelling].
Eucosma similana: Fernald [1903]:459; Barnes and McDunnough 1917:171. [misspelling].

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FIGS. 1–16. **1–7**, *E. dorsisignatana*. **1**, ♂, Adams Co., Ohio. **2**, ♀, Ithaca, New York. **3**, ♂, Larimer Co., Colorado. **4**, ♂, Halifax, Nova Scotia. **5**, *P. clavana* lectotype. **6**, *C. distigmana* holotype. **7**, *E. d. diffusana* lectotype. **8–9**, *E. similiana*, form *confluana*. **8**, ♀, Hamilton Co., Ohio. **9**, ♂, Susquehanna Co., Pennsylvania. **10–11**, *E. similiana*, form *diffusana*, ♂, ♂, Hamilton Co., Ohio. **12**, *E. engelana*, lectotype. **13–16**, *E. oraria*. **13**, Holotype. **14**, ♀, Accomack Co., Virginia. **15**, ♀, Northampton Co., Virginia. **16**, ♂, Worcester Co., Maryland.

Eucosma dorsisignatana similana: Heinrich 1923:121; McDunnough 1939:47; Powell 1983:34 [misspelling].

Eucosma similiana: Miller 1985:246; Miller 1987:53; Brown 2005:327; Gilligan et al. 2008:111.

Eucosma dorsisignatana confluana Kearfott 1905:355; Barnes and McDunnough 1917:171; Heinrich 1923:121; McDunnough 1939:47; Powell 1983:34; Miller 1985:246; Brown 205:319.

Eucosma engelana Kearfott 1908:169; Barnes and McDunnough 1917:170, **new synonymy**.

Eucosma dorsisignatana engelana Heinrich 1923:122; McDunnough 1939:47; Powell 1983:34; Brown 2005:319, **revised synonymy**.

Discussion. In proposing the name *confluana*, Kearfott (1905) intended to recognize the taxon described as *E. similiana* (Clemens) as a subspecies of *E. dorsisignatana*. Because of the prevailing misspelling of *similiana* as *similana*, the Clemens name seemed to be unavailable for this purpose, being preoccupied by *E. similana* Hübner. Miller (1985) interpreted *confluana* as a substitute name for *similiana*, implying that the type for *confluana* is the type for *similiana*. However, by publishing a description, based on 12 syntypes, Kearfott established *confluana* a valid taxon. Klots (1942) reported a lectotype, designated by Heinrich (1923), in the AMNH, but as pointed out above, Heinrich's

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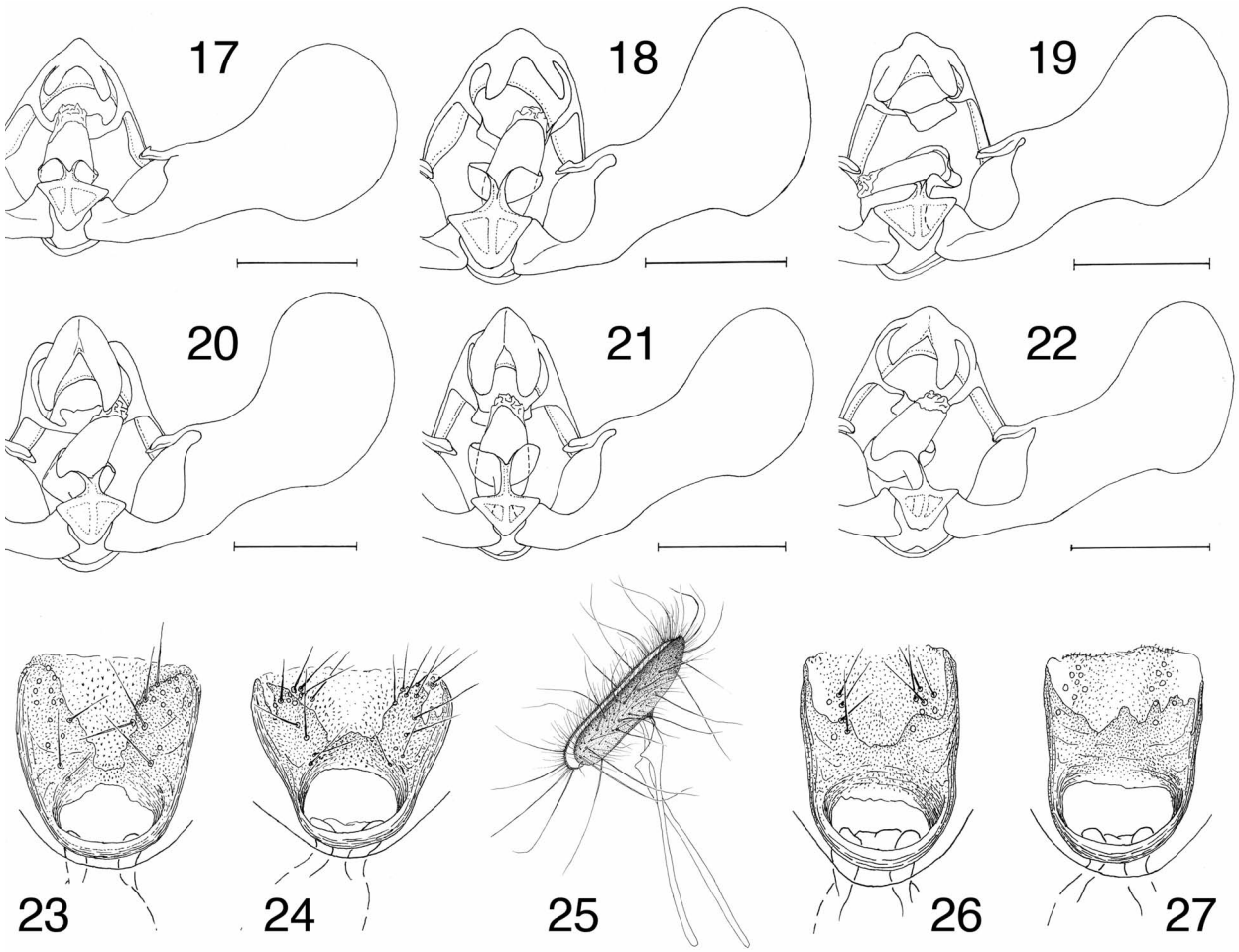

FIGS. 17–27. Genitalia. **17–19**, *E. dorsisignatana* ♂; slides DJW 1307, Adams Co., Ohio; DJW 865, Albany Co., Wyoming; DJW 2449, Baker Co., Oregon. **20–21**, *E. similiana* ♂; slides DJW 1304, Adams Co., Ohio; USNM 70425, Washington, DC. **22**, *E. engelana*, lectotype. **23–24**, *E. dorsisignatana* sterigmata; slides DJW 2446, Adams Co., Ohio; DJW 2447, Grand Co., Colorado. **25**, *E. dorsisignatana* papillae anales, slide DJW 2446, Adams Co., Ohio. **26–27**, *E. similiana* sterigmata; slides DJW 2450, 1305; Adams Co., Ohio. Scale bar = 0.5 mm.

comments do not constitute a valid designation. The lectotype designated below is the specimen mentioned by Klots. It bears a green label, presumably attached by Klots, with the inscription "LECTOTYPE."

With regard to *E. engelana*, Heinrich (1923) noted that the lectotype (Fig. 12) is "so rubbed that no markings are left" but treated the taxon as a subspecies of *E. dorsisignatana*, presumably based on the genitalia (Heinrich 1923, Fig. 170). The reinstatement of *E. similiana* to species status by Miller (1985) raises the question as to which of *E. dorsisignatana* and *E. similiana* is the appropriate senior synonym, particularly since the two taxa are not known to be distinguishable based on male genitalia. My investigations indicate that the uncus and socii are more strongly developed in *E. similiana* than in *E. dorsisignatana* (see below), and in this respect the *E. engelana* lectotype (Fig. 22) more closely resembles *E. similiana*. This is the basis for the new synonymy.

The forewing appearance of *E. similiana* (Figs. 8–12) is like that of *E. dorsisignatana* except that the subbasal and median fasciae merge in the median area forming a single mark, hence Kearfott's subspecific name *confluana*. That mark always contrasts with the interfascial areas along the dorsal margin but often fades into the interfascial color near the costa, the latter condition presumably being the basis for the subspecific name *diffusana*. Forewing statistics: ♂ FWL 8.1–11.0 mm (mean = 9.2, n = 32), AR = 2.88; ♀ FWL 8.2–10.3 (mean = 9.1, n = 21), AR = 2.75.

Illustrations of the male genitalia can be found in Heinrich (1923, figs. 170, 171, 172), Miller (1985, fig.

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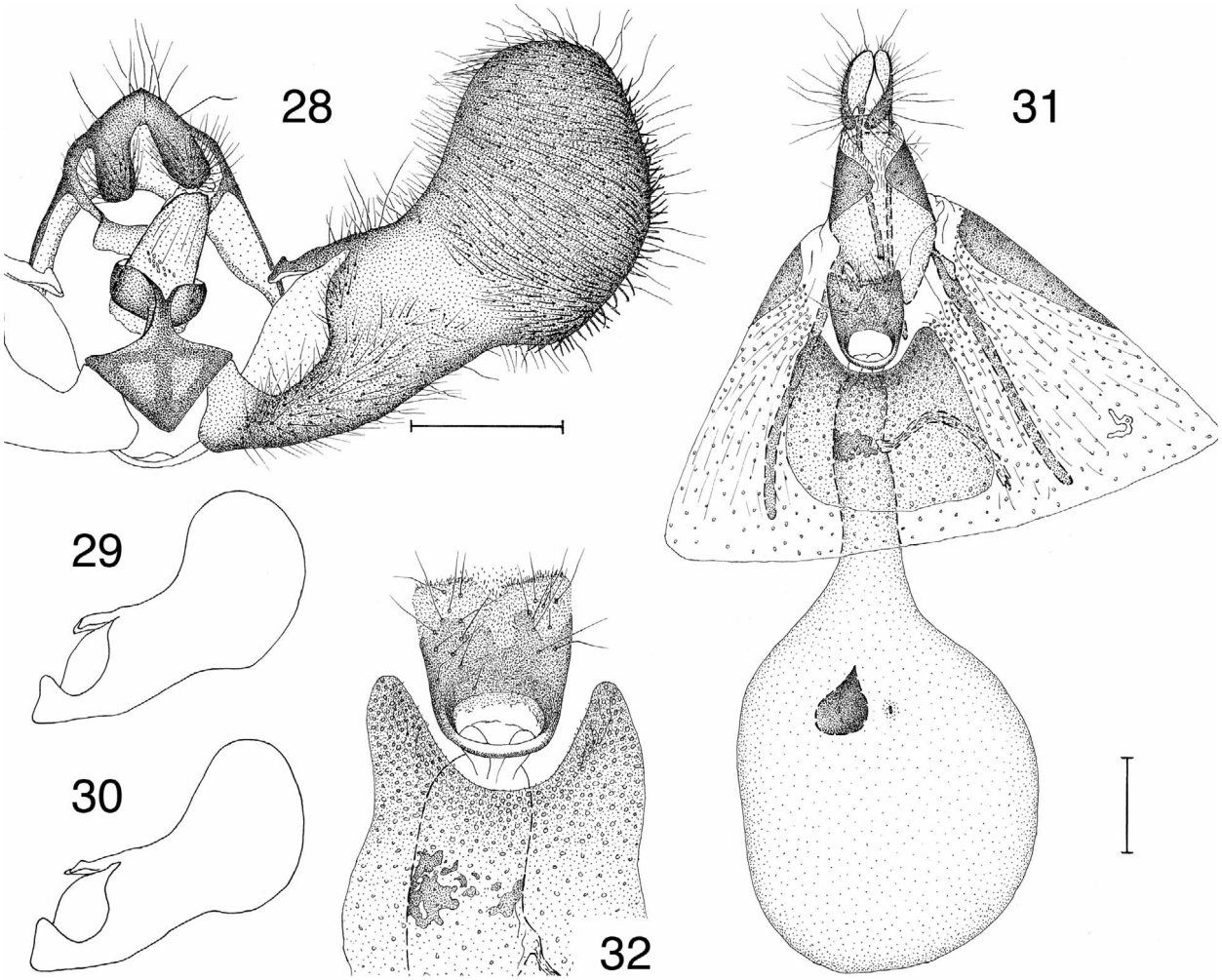

FIGS. 28–32. *Eucosma oraria* genitalia. **28**, ♂, holotype. **29–30**, male valvae; slides DJW 901, Cumberland Co., New Jersey; DJW 2445, Dukes Co., Massachusetts. **31**, ♀, slide DJW 2443, Accomack Co., Virginia. **32**, sterigma, slide DJW 2454, Dukes Co., Massachusetts. Scale bar = 0.5 mm.

27), and Gilligan et al. (2008:219), of the female genitalia in Miller (1985, figs. 28, 29), and of the sterigma in Miller (1987:53) and Gilligan et al. (2008:271). Figures 20–22 show the variation in valval shape. A comparison of the male genitalia of *E. similiana* (n = 6) and *E. dorsisignatana* (n = 9) revealed that the uncus in *E. similiana* is more strongly developed, with a distinct medial line of division on the ventral surface, and the socii are somewhat larger and more strongly integrated with the uncus (Figs. 20–22 vs. 17–19). Otherwise, I found no consistent differences in male genitalia between the two species. Females exhibit little variation in the shape of the sterigma (Figs. 26, 27).

Types. *Poecilochroma similiana*. Lectotype designated by Darlington (1947): ♀, no. 7316, Academy of Natural Sciences, Philadelphia. An image of the lectotype appears in Miller (1973, fig. 42). The type locality was reported by Miller (1973) as unknown, by Heinrich (1923) as Pennsylvania ?, and by Brown (2005) as USA (Pennsylvania). *Eucosma dorsisignatana confluana*. Lectotype here designated: ♂, New Jersey, [Essex Co.], Montclair, W. D. Kearfott, 24 August 1899, AMNH. *Eucosma engelana*. Lectotype designated by Heinrich (1923) (Figs. 12, 22): ♂, Pennsylvania, [Allegheny Co.], Pittsburgh, Henry Engel, 20 August 1906, genitalia slide CH 16 Dec 1919, AMNH. Genitalia illustrated by Heinrich (1923, fig. 170).

Distribution and biology. *Eucosma similiana* is restricted to eastern North America, the range extending from Nova Scotia to Manitoba and south to Georgia and Mississippi. Adult flight occurs from mid-July to the end of October. The larvae bore in root-stalks of *Solidago* (goldenrod) (Asteraceae). Čapek, (1971)

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studied this species as a possible biological control for introduced *Solidago* in Central and Western Europe.

Eucosma oraria, new species
(Figs. 13–16, 28–32)

Diagnosis. *Eucosma oraria* is distinguished from *E. dorsisignatana* and *E. similiana* by size (mean FWL ≈ 10.8 mm vs. 9.4 mm and 9.2 mm, respectively) and by forewing maculation (large semitriangular mark in the median area disjunct from subbasal fascia, separating *E. oraria* from *E. similiana*, but connecting to apex, separating *E. oraria* from *E. dorsisignatana*).

Description. *Head*: Lower frons creamy white; scales of vertex brown with tan apices; labial palpus with lateral surface brown, medial surface whitish, shading to brown along margins; antenna concolorous with head. *Thorax*: Dorsal surface brown; ventral surface whitish; legs with anterior surfaces brown, posterior surfaces whitish; tarsi with inconspicuous tan annular markings at distal extremities of tarsomeres. *Forewing* (Figs. 13–16): ♂ FWL 7.3–12.2 mm (mean = 10.6, n = 30), AR = 2.78; ♀ FWL 10.5–13.2 mm (mean = 11.6, n = 8), AR = 2.78; costa weakly arched, apex nearly 90°, termen weakly concave; dorsal surface with dark brown subbasal and medial markings and pale brown interfascial areas, the latter extensively overlaid with brown reticulations; subbasal fascia represented by sharply defined mark arising on dorsum and narrowing to a rounded apex on cubitus; median fascia fading into ground color near costa but expanding posterior to radius into a large triangular mark with anterior edge running longitudinally through distal portion of cell and extending to apex and with posterior vertex approaching dorsum; subbasal and median fasciae disjunct and thinly edged with white; postmedian band sometimes obsolete (Figs. 15, 16) but usually expressed as a short bar at termen near tornus (Figs. 13, 14), occasionally connecting to medial mark (Fig. 14); ocellus not expressed; costa lacking pale strigulae; fringe scales blackish gray to gray brown, with whitish apices, the darker coloration producing a thin terminal line. *Hindwing*: Gray brown. *Male genitalia* (Figs. 28–30) (n = 3): Uncus semitriangular, with weakly developed central ridge on ventral surface; dorsolateral shoulders of tegumen weakly differentiated; socii finger-like and moderately setose; vesica with 13–15 deciduous cornuti; valva with costal margin concave at neck, apex broadly and sometimes bluntly rounded, distal margin convex, anal angle weakly developed, ventral emargination of neck shallow; cucullus with medial surface densely covered with fine setae. *Female genitalia* (Fig. 31, 32) (n = 3): Papillae anales laterally facing and moderately setose (as in Fig. 25); membrane from papillae anales to tergum 8 microspinulate and folded in collar-like arrangement; lamella antevaginalis ring-like and largely membranous; lamella postvaginalis semirectangular, broadening somewhat posteriorly, length ≈ average width, microspinulate throughout, with medial section weakly depressed at ostium, and with ca. a dozen setae on lateral sections; sclerotization of lamella postvaginalis variable and somewhat blotchy; sternum 7 with posterior margin roundly emarginated to approximately one-half length of sterigma and usually with microspinulae interspersed with scale sockets near posterior margin; ductus bursae with irregularly sclerotized patch at juncture with ductus seminalis; corpus bursae with large signum on dorsal surface and vestigial signum on ventral surface, the latter usually reduced to a tiny speck of sclerotized membrane surrounded by a patch of microspinules.

Holotype (Figs. 13, 28). ♂, Nova Scotia, Kings County, Grand Pré, D. C. Ferguson, 28 August 1952, genitalia slide DJW 2444, USNM.

Paratypes. CONNECTICUT: New Haven Co., Guilford, Leetes Island, D. L Wagner, 18 September 1992 (2 ♂); New Haven Co., Milford Point Audubon Center, M. Volovski, 25 September 2004 (1 ♂). MARYLAND: Worcester Co., Vaughn WMA, J. Glaser, 15 September 1998 (2 ♂); Nassawango Preserve, J. Glaser, 19 September 1995 (2 ♂); Assateaque Island, J. Glaser, 7 October 1993 (1 ♂); Dorchester Co., Taylor's Island WMA, J. Glaser, 5 October 2001 (1 ♂); Somerset Co., Deal Island WMA, J. Glaser, 30 September 1991 (1 ♂). MASSACHUSETTS: [Dukes Co.], Martha's Vineyard, F. M. Jones (3 ♂, genitalia slide DJW 2445; 1 ♀, genitalia slide DJW 2454). NEW JERSEY: Cumberland Co., 2.5 mi. W. Port Norris, S. Johnson, 28 September 2002 (1 ♂, genitalia slide DJW 901). NEW YORK: [Suffolk Co.], Riverhead, Long Island, Roy Latham, 30 May 1953 (1 ♂). NORTH CAROLINA: Carteret Co., Beaufort, J. B. Sullivan, 13 October 1998 (1 ♂), 15 October 1991 (1 ♂); Carteret Co., Fort Macon State Park, maritime shrub, J. B. Sullivan, 6 October 1997 (1 ♀), 14 October 1996 (2 ♂). VIRGINIA: Northampton Co., Kiptopeke, W. E. Steiner, 4–6 October 1986 (2 ♀, genitalia slide DJW 2442); [Accomack Co.], Chincoteaque, D. C. Ferguson, 23 September 1984 (1 ♀, genitalia slide DJW 2443). Depositories: DJW, UConn, USNM.

Etymology. The specific epithet comes from the Latin adjective orarius, meaning coastal, and refers to this insect's apparent preference for coastal habitat.

Distribution and biology. Amongst the 38 examined specimens (30 ♂, 8 ♀) were three males in the USNM labeled "Fernald Collection." Two have no associated data, but one has what I believe to be a Jacob Boll pin label with the inscription "Dallas, Texas." Between 1869 and 1871, while in the employ of Louis Agassiz at the Museum of Comparative Zoology, Boll collected extensively both in New England and in the vicinity of Dallas, Texas (Geiser 1948). There was, therefore, the opportunity for this last specimen to be mislabeled, and I suspect that is what happened. There is no other evidence to indicate the presence of this moth anywhere except along the Atlantic seaboard. Nearly all the types were collected from late August to early October, but one record from Long Island, New York dated 30 May suggests the possibility of a double brooded life cycle.

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