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Michael Sabourin

Ronald J. Priest

William E. Miller
University of Minnesota

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NEARCTIC ACLERIS: RESURRECTION OF *A. STADIANA* AND A REVISED IDENTITY FOR *A. SEMIANNULA* (LEPIDOPTERA: TORTRICIDAE)Michael Sabourin¹, Ronald J. Priest², and William E. Miller³

ABSTRACT

Type study showed that *Acleris stadiana* (Barnes & Busck), currently considered a junior synonym of *A. semiannula* (Robinson), is in fact a distinct taxon. Although superficially similar, these taxa differ markedly in genital structure. In males of *A. semiannula*, the aedeagus is short, broad, and virtually straight, whereas in those of *A. stadiana*, it is long, thin, and sharply bent. What was known in literature as *A. semiannula* proved to be *A. stadiana*. We redefine both *A. semiannula* and the resurrected *A. stadiana*.

Several years ago, abundant caterpillars were discovered feeding on the leaves of mature red (*Acer rubrum* L.) and silver maple (*A. saccharinum* L.) growing on a golf course and around residences in Isabella Co., Michigan. Reared adults were identified as *Acleris* sp. These adults superficially resembled what was known at the time as *A. semiannula* (Robinson), but their genitalia differed. Our efforts to identify the species led to the findings reported here.

Acleris stadiana (Barnes & Busck) has been considered a junior synonym of *A. semiannula* since these taxa were synonymized by McDunnough (1934). Their types were not dissected for genitalia study until now, however. We investigated the pertinent types, comparing them with the Michigan specimens reared from maple, and with what was known in literature as *A. semiannula*.

Abbreviations for collections mentioned here are as follows: AMNH, American Museum of Natural History, New York, New York; ANSP, Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania; CMNH, Carnegie Museum of Natural History, Pittsburg, Pennsylvania; DP, Dennis Profant collection, Nelsonville, Ohio; EME, Essig Museum of Entomology, University of California, Berkeley; ERL, Entomological Research Laboratory collection, S. Burlington, Vermont; GJB, George J. Balogh collection, Portage, Michigan; GRN, Gordon R. Nielsen collection, Hinesburg, Vermont; INHS, Illinois Natural History Survey, Champaign; JDG, John D. Glaser collection, Baltimore, Maryland; JRH, J. R. Heitzman collection, Independence, Missouri; MATH, Bryant Mather collection, Clinton, Mississippi; MSUC, Michigan State University, East Lansing; RJP, Ronald J. Priest collection, East Lansing, Michigan; UMSP, University of Minnesota Entomology Museum, St. Paul; USNM, National Museum of Natural History, Washington, D. C.;

¹23476 Johnson Rd., Grantsburg, WI 54840.

²5464 Jo Pass, East Lansing, MI 48823.

³Department of Entomology, University of Minnesota, St. Paul, MN 55108.

UWEM, University of Wisconsin, Madison; WBP, William B. Procter collection, University of Massachusetts, Amherst.

The letter n denotes the number of specimens on which a statement is based; m stands for male; f for female; and glyc. for glycerine. Collection dates are month/day/year format.

Acleris semiannula (Robinson)

(Figs. 1, 3–5)

Teras semiannula Robinson (1869: 282, pl. 7, fig. 70) (Holotype: female, type # 7414, Penn., no date, genit. prep. MS 96115, forewing length 6.8 mm, in ANSP, wings shown here in Fig. 1); Zeller (1875: 212).

Teras ferrugana (not Denis & Schiffermüller 1775); Walsingham (1879: 76), Fernald (1882: 8) (in part).

Acleris ferrugana (not Denis & Schiffermüller 1775); Fernald (1902: 474) (in part), Shaw (1905: 325).

Peronea ferrugana (not Denis & Schiffermüller 1775); Meyrick (1912: 60) (in part), Forbes (1923: 487) (in part), McDunnough (1934: 321) (in part), (1939: 59) (in part), Brower (1983: 49) (in part).

Acleris kearfottana (not McDunnough 1934); Obraztsov (1963: 229).

Acleris tripunctana (not Hübner 1796–99); Obraztsov (1963: 223) (in part), Opheim (1964: 302–303) (in part), ?Powell (1983: 38), Godfrey et al. (1987: 30).

Acleris semiannula; Godfrey et al. (1987: 30).

Acleris n. sp.; Grehan et al. (1995: 22).

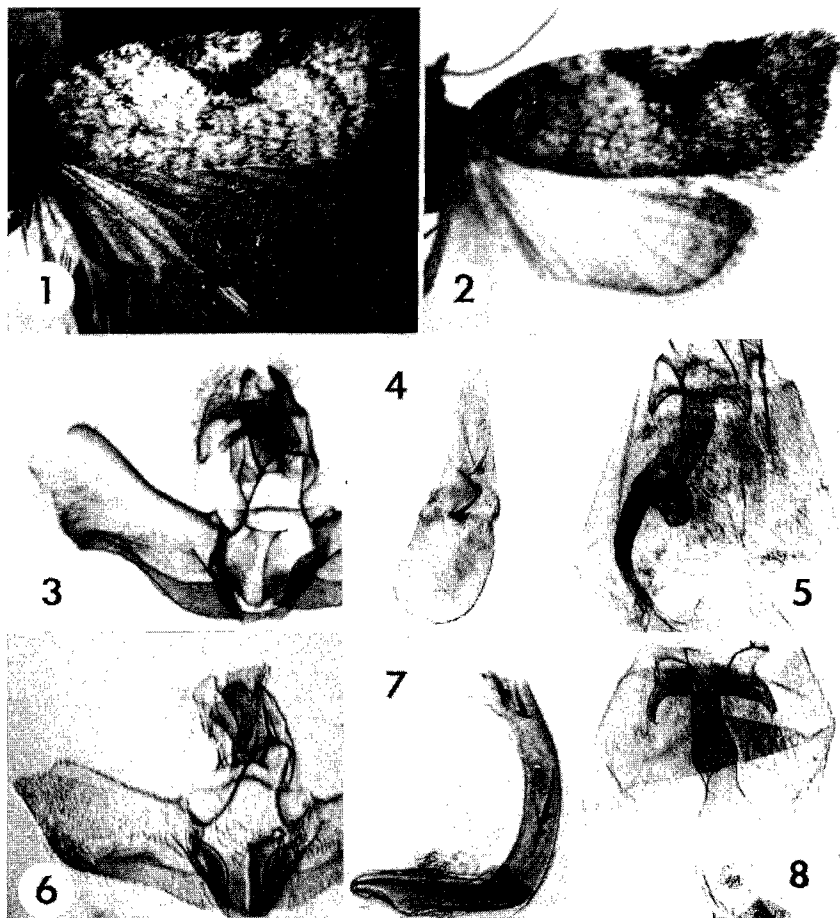
Female and Male. Forewing (Fig. 1) span 12.5–16.5 mm (n=56), costal triangle present. Ground color of forewing, including costal margin within costal triangle, cinnamon drab to fuscous with brownish highlights. Costal triangle consistently dusky brown, always darker than ground, at times barely discernable depending on shade of ground. Basal patch sometimes defined by a fine transverse line. Hindwing color similar to that of forewing.

Male genitalia (Figs. 3, 4) (n=10). Tegumen hood-shaped with large rounded terminal lobes. Tuba analis with a large ventral projection at middle. Sacculus broad throughout its length, concave, interior ventral margin not produced. Brachiola broad. Aedeagus (Fig. 4) short, broadening toward base, virtually straight, with three equal sized cornuti.

Female genitalia (Fig. 5) (n=15). Sterigma broad and flat, lateral tips sharply pointed. Anterior apophyses extending anteriorly beyond tips of sterigma. Ostium bursae circular. Ductus bursae broad caudally with a distinctive bulbous projection at middle, narrow and rugose between the bulbous projection and corpus bursae. Antrum wide, posterior broadly grooved longitudinally.

Biology. Perhaps univoltine, as no summer adult specimens were found in pristine condition. Moths emerge in late August or early September and pass the winter. Adults were captured in Michigan in September and October resting on the upper sides of the leaves of larval foodplants. Brown coloration and sedentary habits make the moths inconspicuous.

Known larval foodplants are silver maple, red maple, and white oak (*Quercus alba* L.). The larvae crumple and skeletonize leaves from the underside, tying the lobes with silk. Only the upper leaf epidermis is left intact. Larvae and new pupae are uniform pale green. Pupation occurs in a thin co-



Figs. 1–8. *Acleris* species. 1, Wings of *A. semiannula* holotype female. 2, Wings of *A. stadiana* holotype male. 3, Genitalia of *A. semiannula* male from Isabella Co., Mich. (prep. MS 96009). 4, Aedeagus of *A. semiannula* male from Macomb Co., Mich. (prep. MS 96042). 5, Genitalia of *A. semiannula* female from Gratiot Co., Mich. (prep. MS 96155). 6, Genitalia of *A. stadiana* holotype male. 7, Aedeagus of *A. stadiana* male from Columbia, Mo. (prep. MS 96137). 8, Genitalia of *A. stadiana* female from Hampton, N. H. (prep. MS 96143).

coon among webbing on the crumpled leaf. A leaf may harbor more than one pupa. The pupa extends from the cocoon during emergence.

Material examined (n=56). PENNSYLVANIA: Holotype (Fig. 1). ILLINOIS: Putnam Co., 1m, 09/29/1967, genit. prep. MS 96010, reared from white oak; 1m, 10/14/1968, genit. in glyc., reared from soft maple (INHS).

KENTUCKY: Barren Co., 1f, 08/3-4/1971, genit. prep. JAP 3768 (EME). MAINE: Bar Harbor, 1f, 09/21/1937, reared from *Acer rubrum* (USNM). MARYLAND: Garrett Co., Garret SF, 1f, 07/11/1995, genit. in glyc. (JDG). MICHIGAN: Gratiot Co., 1m, 1f, 09/14/1991; 1f, 09/17/1991; 1f, 09/18/1991, genit. prep. MS 96155 (Fig. 5), all reared from *Acer rubrum*; Isabella Co., 4m, 13f, 09/21/1981, genit. prep. MS 95077; 1m, 09/23/1981; 1m, 09/24/1981; 2m, 2f, 09/28/1981, genit. prep. MS 96009 (Fig. 3); 1m, 10/10/1981, genit. prep. WEM 241951, all reared from *Acer saccharinum*; 1f, 09/22/1981, genit. prep. WEM 2111951; 3m, 1f, 10/09/1991, all on leaves of *Acer saccharinum*; 3m, 1f, 10/09/1991, all on leaves of *Acer saccharinum* (RJP); Grand Traverse Co., 1m, 07/09/1960, genit. prep. MS 96063; Macomb Co., 1m, 01/25/1944, genit. prep. MS 96042 (Fig. 4) (MSUC). MISSISSIPPI: Warren Co., 1f, 12/30/1971, genit. prep. MS 96190 (MATH). NEW HAMPSHIRE: Enfield, 1f, 11/04/1978, genit. in glyc. (YPM); Hampton, 1f, 04/26/1909, genit. prep. Obr. 408 (AMNH). OHIO: Athens Co., Hocking College, 1f, 06/17/1995, genit. in glyc. (DP). VERMONT: Brandon, Otter Creek, 1m, 10/27/1991, genit. prep. MS 96019; Colchester, Sunny Hollow Nature Area, 1f, 10/24/1991, genit. in glyc.; S. Burlington, 1f, 07/09/1992, genit. prep. MS 96020; Guildhall, 1m, 1f, 10/26/1991, genit. preps. MS 96017, MS 96018, 1m, 10/26/1991, genit. in glyc. (UMSP); Chittenden Co., Hinesburg, 1f, 10/10/1991, genit. prep. MS 96205; 2f, 10/18/1991, genit. prep. MS 96152c (GRN). VIRGINIA: Fairfax Co., Alexandria, 1m, 05/29/1976, at light, genit. prep. JAP 4518 (EME).

Acleris stadiana (Barnes & Busck), New Status

(Figs. 2, 6-8)

- Peronea stadiana* Barnes & Busck (1920: 217) (Holotype: male, Ottawa, Ontario, 18.9.05, C. H. Young, genit. prep. MS 96122, forewing length 7.0 mm, in USNM, wings shown here in Fig. 2); Forbes (1923: 485).
Peronea ferrugana (not Denis & Schiffermüller 1775); Forbes (1923: 487) (in part), McDunnough (1934: 321) (in part), Procter (1946: 308), Brower (1983: 49) (in part).
Peronea semiannula (not Robinson 1869); McDunnough (1934: 322, figs. 328(8), 332(9), (1935: 138), (1939: 59), Prentice (1965: 735), Brower (1983: 49).
Acleris tripunctana (not Hübner, 1796-99); Obratsov (1963: 223) (in part), Opheim (1964: 302, pl. 1, fig. 7) (in part).
Acleris semiannula (not Robinson 1869); Mackay (1962: 18, fig. 12), Obratsov (1963: 230), Razowski (1966: 459, pl. 35, Figs. 3, 4), Grehan et al. (1995: 22), Ferge (1995: 29), Grehan & Sabourin (1995: 24-25, pl. 3, Figs. 26, ?27).

Female and Male. Wingspan 11.2-17.0 mm (n=89). Forewing with costal triangle. Ground color of forewing light buff to amber. Color of costal margin within costal triangle same as rest of forewing or darker. Costal triangle varying from tawny to dusky brown, darker than ground, at times barely discernible depending on shade of ground. Costal triangle coloration occasionally continues from its apex to dorsal wing margin. Hindwing paler than forewing.

Male genitalia (Figs. 6, 7) (n=27). Ventral margin of sacculus slightly concave, a slight interior rise at middle. Aedeagus (Fig. 7) long, thin, sharply bent, with two pairs of cornuti separated by a chitinous plate.

Female genitalia (Fig. 8) (n=19). Sterigma broad and flat, lateral tips

rounded and blunt. Anterior apophyses projecting anteriorly no farther than lateral tips of sterigma. Ostium bursae circular. Ductus bursae with a sclerotized ring around neck, broad through most of its length, narrowed at junction with corpus bursae. Antrum small, sclerotized along rim.

Biology. Bivoltine. Prentice (1966) stated that *A. stadiana* (as *A. semiannula*) is a solitary leaf roller on birch (*Betula*), with pupae appearing in late June and again in late August. Mackay (1962) described the larva (as *A. semiannula*). Fall generation adults overwinter.

Material examined (n=89). ONTARIO: Holotype (Fig. 2, 6). CONNECTICUT: New Haven Co., North Haven, 1f, 11/06/1959; Tolland Co., Mansfield, 1m, 11/15/1958 (YPM); New Haven Co., Hamden, 1f, 10/18/1968, reared from *Betula populifolia*, genit. in glyc. (USNM). ILLINOIS: Algonquin, 1f, 03/25/1985, genit. prep. MS 96145 (INHS). MAINE: Bar Harbor, 07/17/??, Mount Desert Is., 10/05/??, (WBP); Lincoln, 1f, 05/21/??, genit. in glyc. (USNM). MARYLAND: Adelphi, 1f, 05/29/1969, genit. in glyc. (USNM). MASSACHUSETTS: Lancaster, pine barrens, 1m, 11/05/1993, genit. prep. MS 96111 (UMSP). MICHIGAN: Cheyabogan Co., Ocqueoc Lk., 3f, 07/25-26/1996, at blacklight, genit. preps. MS 95068, MS 96146; 1f, 07/27/1994 (USNM); Chippewa Co., Tahquamenon SP, 1m, 09/27-29/1995, at UV light, genit. prep. MS 96207; Clinton Co., Dansville SGA, 1f, 03/24/1994, genit. in glyc. (RDK). MINNESOTA (?): 1m (no locality), C, 04/10/1892, genit. prep. MS 96007 (UMSP). MISSOURI: Columbia, 1m, 06/10/1969, genit. prep. MS 96137 (Fig. 7) (JRH). NEW HAMPSHIRE: Enfield, 1m, 10/26/1978, genit. in glyc. (YPM); Hampton, 1m, 04/27/1911, genit. prep. MS 97102; 1f, 11/10/1911, genit. prep. MS 96143 (Fig. 8); 1f, 11/20/1904, genit. prep. MS 96159 (CMNH). NEW JERSEY: Montclair, 1f, 11/02/1903; 1f, 11/01/1923, genit. prep. MS 97103 (CMNH); Montclair, 1f, 11/02/1903 (EME). NOVA SCOTIA: Armdale, 1f, 04/13/1948, genit. in glyc.; Kings Co., Aylesford, 1f, 10/03/1950 (YPM). PENNSYLVANIA: Finleyville, 1f, 11/20/?? (CMNH). RHODE ISLAND: Elmwood, 1m, 1f, 10/16/1920, genit. preps. MS 97104, MS 96144 (CMNH). VERMONT: Addison Co., Bristol, 1m, 07/28/1991, genit. prep. MS 96030; Chittenden Co., Burlington, 1m, 04/06/1993, genit. in glyc., 1m, 03/27/1993, genit. prep. MS 96149; Colchester, 1f, 04/14/1991, genit. in glyc.; 1m, 10/25/1991, genit. prep. MS 96148; 1m, 04/20/1992, genit. prep. MS 96154e; 1f, 09/28/1992; 1m, 10/16/1993, genit. prep. MS 96107; 1m, 11/10/1993, genit. prep. MS 95070; Essex Town, Sleepy Hollow Rd., 1m, 04/04/1991, genit. in glyc.; Jericho Research Forest, 1m, 05/08/1993, genit. prep. MS 95042; S. Burlington, 1f, 07/17/1991, genit. prep. MS 96153d; 1f, 07/25/1992; 1f, 04/15/1993, genit. in glyc.; Guildhall, 1m, 10/26/1991, genit. in glyc.; Rutland Co., Chittenden, 1m, 10/27/1991, genit. prep. MS 96113 (UMSP); Chittenden Co., Hinesburg, 1m, 11/02/1968, genit. prep. MS 96150a; 1f, 10/31/1991, genit. prep. MS 96151b (GRN); Underhill St. Pk., el. 715m, 1f, 08/20/1995, genit. prep. MS 96132 (ERL). WISCONSIN: Bayfield Co., 1f, GMP #748050B, 08/20-09/06/1974, reared from *Betula papyrifera*; 1f, (no locality), GMP #764356B, 09/17/1976, reared from *Betula papyrifera*; 1f (no locality), 09/13/1976, reared (foodplant unrecorded), genit. prep. MS 96135; Polk Co., Gibson Lk., 1f, 06/29/-07/07/1960, reared (foodplant unrecorded) (UWEM); Oneida Co., Lk. Katherine, 1m, 04/13/1961, genit. prep. JAP 980; 2m, 04/18/1961, genit. prep. JAP 2769; 10m, 2f, 04/21/1961, genit. preps. JAP 1418, JAP 2765, genit. in glyc.; 3m, 05/07/1961; 1m 05/22/1961; 1f, 06/01/1961; 2m, 07/10/1961, genit. prep. JAP 1421; 1m, 07/16/1961, genit. prep. JAP 1410; 1m, 07/20/1961; 1m, 07/22/1961, genit. prep. JAP 2770; 1m, 10/08/1961; 2m, 10/09/1961, genit. prep. JAP 2771; 2m, 3f, 10/16/1961; 1m, 10/19/1961; 2m, 04/22/1962; 1m, 07/04/1962 (EME); Vilas Co., W side of Carlin Lk., 1f, 07/02/1987 (GJB).

DISCUSSION

Polymorphism and geographic variation in exterior traits of *Acleris* are often so pronounced that genitalia provide the only reliable diagnostic characters. Even then, occasionally one sex only may be distinguished by genitalia. *Acleris semiannula* and *A. stadiana* differ from each other most notably in genital structure.

The lateral tips of the sterigma are flat and sharply pointed in *A. semiannula*, whereas they are round and blunt in *A. stadiana*. The anterior apophyses extend beyond the lateral tips of the sterigma in *A. semiannula*, but not in *A. stadiana*. The ductus bursae in *A. semiannula* has a bulbous projection at its middle, then narrows rugosely to the corpus bursae, whereas that in *A. stadiana* is broad to just before the corpus bursae (Figs. 5, 8). The aedeagus of *A. stadiana* is long, narrow and sharply bent, whereas that of *A. semiannula* is short, broadening toward base and virtually straight (Figs. 4, 7). Superficially, the contrast between fore- and hindwings is greater in *A. stadiana* than in *A. semiannula* (Figs. 1, 2), *A. semiannula* varies more in the intensity of wing color, and *A. stadiana* varies more in wing pattern and body size.

We found the *A. semiannula* and *A. stadiana* type specimens and their labels to be in excellent condition for usability. The sexes of *A. semiannula* were associated through numerous specimens reared by us from the same foodplant at the same locality; those of *A. stadiana*, by museum specimens reared from the same foodplant and locality, reared from the same foodplant at different localities, and from adults collected at the same localities.

Several other *Acleris* species can be similar to *A. semiannula* and *A. stadiana* superficially. The occasional continuation of costal-triangle coloration from the triangle apex to the dorsal wing margin in some *A. stadiana* is like that in *A. braunana* (McDunnough). Paler specimens of *A. stadiana* match some specimens of *A. comandrana* (Fernald) and *A. subnivana* (Walker). Darker specimens of *A. semiannula* match some specimens of *A. implexana* (Walker), *A. oxycoccana* (Packard), and *A. kearfottana* (McDunnough).

We refer to *A. semiannula*, *A. stadiana*, and their look-alikes as the *A. semiannula* species complex. Members of the complex include *A. schalleriana viburnana* (Clemens), *A. oxycoccana*, *A. subnivana*, *A. cervinana* (Fernald), *A. braunana*, *A. comandrana*, *A. implexana*, *A. cornana* (McDunnough), *A. simpliciana* (Walsingham), *A. negundana* (Busck), *A. ferrugana* (Denis & Schiffermüller), *A. kearfottana*, *A. caryosphena* (Meyrick), and *A. notana* (Donovan). These taxa have wingspans less than 20 mm, whitish to dark brown forewing coloration, and possess a costal triangle. Some specimens can have finely reticulated wings, or costal-triangle coloration continuing from the triangle apex to the dorsal wing margin. Some species may have a useful superficial character such as the emarginate forewing costal margin in *A. subnivana*, but it bears emphasis that reliable identification must be based on genitalia.

In Eurasia, *A. notana* and *A. ferrugana* frequently have been confused with each other (Obraztsov 1957, Bradley et al. 1973). In North America, nearctic members of the complex have not only been mistaken for each other, but for palaeartic counterparts. Several nearctic species of the complex are close enough to the palaeartic *A. notana* and *A. ferrugana* to have been mistaken for them. Obraztsov's (1963) report of *A. notana* (as *A. tripunctana*) from New Hampshire is actually *A. obtusana fuscana* (Busck), a taxon also confused with *A. notana* in Eurasia (Kyrki 1982). The report by Godfrey et al. (1987) of *A. notana* (as *A. tripunctana*) in Illinois is based on a misidentified specimen of *A. semiannula*. Although we were unable to locate the two

Canadian specimens McDunnough (1934) identified as *A. ferrugana*, we have not otherwise encountered *A. ferrugana* or *A. notana* in the Nearctic. Sources useful for identifying taxa of the complex are Bentinck and Diakonoff (1968), McDunnough (1934), Razowski (1966), and Wolff (1964).

Based on male genital characters, the following key separates *A. semianula* and *A. stadiana* from other species of the complex.

1. Ventral margin of sacculus deeply emarginate just before cucullus
 *oxycoccana*, *s. viburnana*.
- 1.' Ventral margin of sacculus not deeply emarginate 2
2. Ventral margin of sacculus bulging at middle.
 *caryosphena*, *notana*, *implexana*, *braunana*, *cervinana*.
- 2.' Ventral margin of sacculus not bulging at middle 3
3. Ventral margin of sacculus straight or slightly concave. 4
- 3.' Ventral margin of sacculus markedly concave 6
4. Aedeagus possessing fewer than four cornuti. *simpliciana*, *subnivana*.
- 4.' Aedeagus possessing four or more cornuti. 5
5. Aedeagus possessing four cornuti and a separate sclerite *stadiana*.
- 5.' Aedeagus possessing four or more cornuti and no separate sclerite
 *cornana*.
- 5." Aedeagus possessing five cornuti and a separate sclerite *comandrana*.
6. Aedeagus possessing three cornuti *semiannula*.
- 6.' Aedeagus possessing other than three cornuti
 *ferrugana*, *negundana*, *kearfottana*.

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