

A NEW SPECIES OF *MORRISONIA* (NOCTUIDAE) FROM
SOUTHEASTERN NORTH AMERICA

J. BOLLING SULLIVAN

200 Craven St., Beaufort, North Carolina 28516; e-mail: sullivan14@earthlink.net

AND

JAMES K. ADAMS

Department of Biology, Dalton State College, Dalton, Georgia 30720; e-mail: jadams@daltonstate.edu

ABSTRACT. We describe *Morrisonia triangula*, (Noctuidae: Hadeninae: Orthosini) from material collected from Virginia to Texas. Illustrations of adults and their genitalia are provided. The generic placement is discussed.

Additional key words: *Achatia*, *Egira*, *Himella*, *Orthosia*

For at least 40 years collectors in the southeastern United States have been aware of an undescribed species of hadenine provisionally placed in the genus *Morrisonia* by Jack Franclemont. Apparently, Franclemont never collected the species but was aware of it from material sent to him for identification by Charles Kimball prior to the latter's publication of the Lepidoptera of Florida in 1965. Kimball (1965) mentions 5 specimens collected in Escambia Co., Florida, 4 in April of 1961 and one in May of 1962. Additional material, much of which is in the U. S. National Museum, was collected in the period from 1960-80 in Virginia, the Carolinas, Louisiana and Texas by several eastern collectors. Kimball (1965) indicated that Franclemont would describe the species but a manuscript was never completed. In this paper we describe the new species and discuss some of the current taxonomic problems posed by the "genus" *Morrisonia*.

MATERIALS AND METHODS

Specimens were examined from the National Museum of Natural History, Washington, DC (USNM) and Furman University, Greenville, SC (FU). Data were provided by Steve Roble on material in the Virginia Department of Natural Resources (VDNR), Richmond, VA; by Steven Hall on specimens in the North Carolina Heritage Program (NCHP), Raleigh, NC; and by Richard Brown on material in the Mississippi State Museum (MSM), Starkville, MS. Data were also provided from the personal collections of James K. Adams; Vernon Brou, Abita Springs, LA; Chuck Ely, Nacogdoches, TX; Irving Finkelstein, Atlanta, GA; Howard Grisham, Maysville, AL; Ed Knudson, Houston, TX; Hugo Kons, Gainesville, FL;

Tom Neal, Gainesville, FL; Brian Scholtens, Charleston, SC; Jeff Slotten, Gainesville, FL; and J. Bolling Sullivan.

Genitalia were prepared by digestion in 10% potassium hydroxide, dissected in water, and photographed with a Nikon Coolpix 995 camera attached to a Nikon SMZS00 microscope. Additional photographs were provided by Donald Lafontaine (see Lafontaine 1998). Recently collected specimens were sent to Paul Hebert at the University of Guelph for barcode COI analyses (Ratnasingham & Hebert, 2007).

Morrisonia triangula sp. nov. Sullivan & Adams
(Figs. 1–2)

Description. *Head:* Antennae fasciculate, setae exceeding shaft diameter at base in male, shorter than shaft diameter in female; scape straw with rusty scales intermixed; antennal dorsum scaled with alternating straw and rusty bands. Palps upturned, slightly longer than eye diameter, tan, dark brown and reddish scaled. Frons straw above tongue, short scaling but dorsal half of frons protruding with ventral part deep maroon, dorsal part straw, tan with reddish scales; a distinct dark line visible across upper part of frons. Area lateral to eye blackish scaled, tan scales below tongue. *Thorax:* Neck with a mixture of reddish and straw scales, largely erect. Collar a mixture of white, straw, tan and deep maroon scales forming a series of horizontal bands; scaled tuft behind collar. Tegulae reddish brown with some white scales; scaling underneath mostly white. Legs with reddish scaling dorsally, brown with cream scales ventrally; single pair of spurs on L2, two pairs on L3. *Abdomen:* two reddish dorsal scale tufts on first two segments, 2nd tuft small. Dorsum of abdomen tan with scattered reddish scales; underneath more reddish but similar.

Forewing: Pattern without obvious cross lines, dominated by a black basal and anal dash and a black triangular wedge at mid costa; whitish scaling in costal area before wedge, distal to wedge are 5 whitish costal spots, the most distal the largest; cream elliptical mark between dashes, marginal line black, scalloped; anal dash with smaller dash on costal side, whitish scaling on vein along anal dash; wing base above and below basal dash

darkened; orbicular and reniform spots lightly outlined, filled with the surrounding light gray ground color of the forewing; orbicular oblong, posterior to triangular black wedge; reniform kidney shaped, just distal to triangular wedge. *Hindwing*: Fuscus with marginal black band and tan marginal scales forming fringe. *Underside*: With distinct discal spots; perceptible PM (post-medial) line. Reddish on marginal half of forewing; black scaling on veins distal to PM line giving a striated appearance; basal half of forewing with blackish scaling. Hindwing with similar scaling, black scales densest on costal edges of both wings.

Male genitalia (Fig. 6): Valvae symmetrical, extending beyond uncus when viewed laterally, flared toward apex; costal region sclerotized, saccular region membranous; digitus arising from costa and curving ventrally well beyond saccular edge; elasper C-shaped, deriving from well developed medial plate; flared apical portion of valva setose with corona; uncus gently tapering and arching ventrally, slender, subbasal setae on dorsal side; gnathos and socii absent; anal tube slightly sclerotized ventrally; tegumen arms broad, forming inverted V; penicillum well developed and located on pointed flap at posterior end of tegumen; vinculum V-shaped, well developed; pleurite slender, curving up to dorsal side of tegumen; justa flaring posteriorly, with deep V in middle, posterior edges rounded; aedeagus rounded at base, sclerotized and tapering to a gentle curving apex; vesica with 3 or more spirals, basal spiral with longitudinal row of short cornuti, largest cornuti in short row above long, longitudinal row, diverticula on first and second spirals, ribbon-like band of embedded cornuti beginning on second spiral, cornuti patch (6–10 long cornuti) ventral to second diverticulum, distal end of vesica membranous.

Female genitalia (Fig. 9): Lightly sclerotized anal papillae, anterior and posterior hypophyses equal in length; ostium a simple flared opening, ductus sclerotized to bursa; accessory bursa arising ventrally, spiralled with sperm duct arising near tip; bursa a well defined sack with 4 evenly spaced longitudinal signa extending 2/3 toward anterior end, walls of bursa striated.

Types: *Holotype*: Male (Fig. 1): U. S. A. North Carolina: Craven Co., Croatan National Forest, Road 169, 2 iv. 2000, J. B. Sullivan. *Paratypes*: (11 males, 8 females) – North Carolina: Collection data same as holotype (2 males); Craven Co., Croatan National Forest, Road 147, 11 iv. 2000 (2 males, 1 female); 23 iv. 2006 (2 males, 1 female); 12 v. 1996 (1 female); 6 vi. 2006 (1 female); Croatan National Forest, Road 3046, 26 vi. 1995 (1 female) J. B. Sullivan. Georgia: Lumpkin Co., Blood Mountain, .25 mi. S of Neel's Gap, 3100', 27 v. 2006 (1 female). Louisiana: St. Tammany Parish, sec 24T6SR12E, 4.2 mi. NE of Abita Springs, 30 iii. 1998 (1 male); 10 iv. 1998 (1 male); 25 iii. 2002 (1 male); 28 iii. 2004 (1 female). Texas: Tyler Co., Big Thicket National Preserve, Turkey Creek Unit, 15–16 iv. 1994 (2 males); 8 iv. 1995 (1 female). The holotype will be deposited into the U. S. National Museum and paratypes into the Canadian National Collection, British Museum, Florida State Collection of Arthropods, Texas A&M University, and the Texas Lepidoptera Survey (with Charles Bordelon and Edward C. Knudson, Houston, TX).

Etymology. The name *triangula* is an adjective describing the distinctive triangular mark along the forewing costa. We suggest Triangle-barred *Morrisonia* as the common name.

Diagnosis. *Morrisonia triangula* is abundantly distinct in maculation and genitalia from other species of *Morrisonia* and from other hadenine species encountered in the Eastern United States. In pattern it

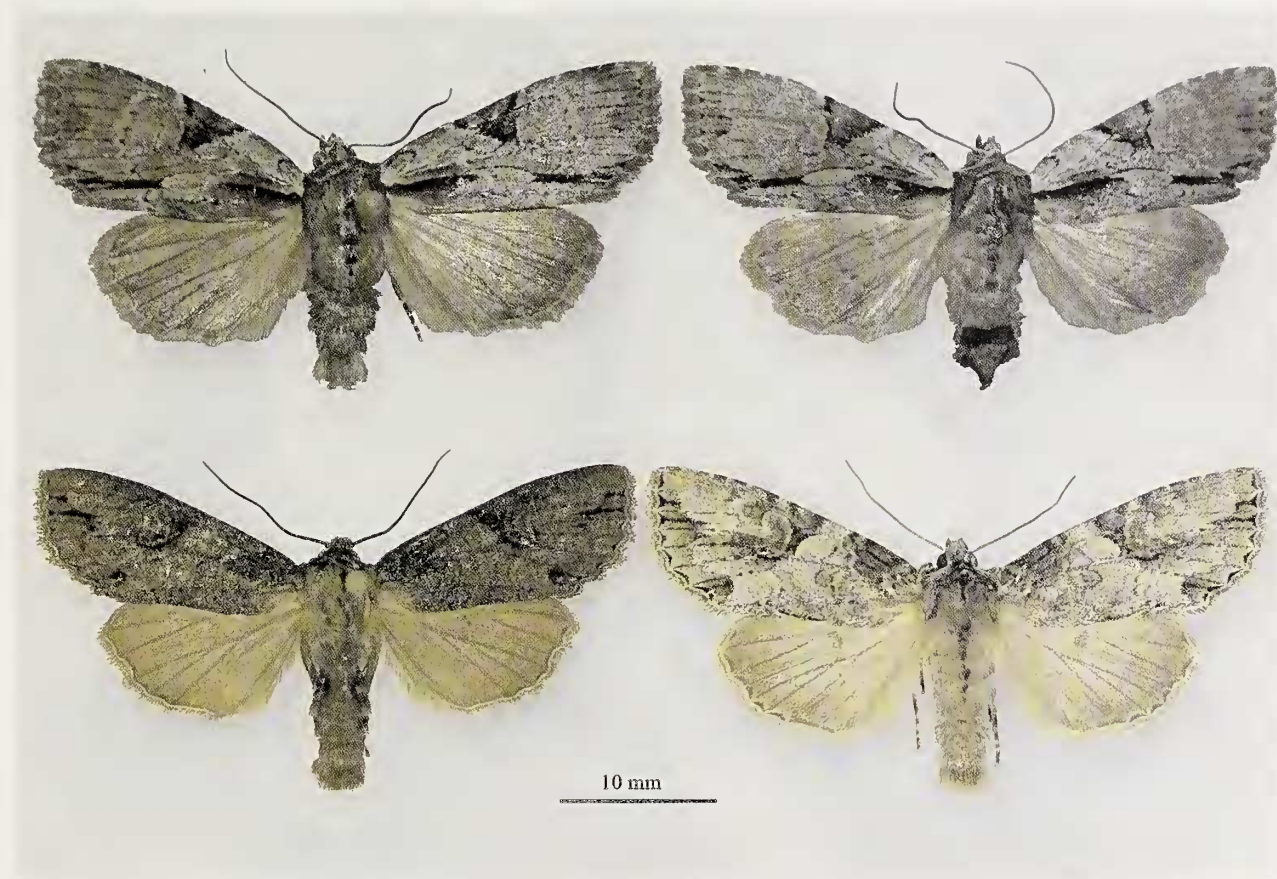
resembles less heavily marked forms of *M. evicta* (Grt.) but is larger, has the distinct costal triangle and except perhaps for a few mountain localities, is allopatric. If the two species do fly together, one would expect *M. evicta* to be on the wing earlier in the spring, *M. triangula* more closely resembles *M. latex* (Gn.) (Figs 3, 4) in size and ground color, and, to some extent, in the major dark markings of the forewing. The two species certainly occur in similar habitats in the mountains and possibly on the coastal plain.

When the wing pattern is obscured, the genitalia of either sex can be used to distinguish the species. Males of *M. triangula* lack hair pencils at the base of the abdomen as do *M. confusa* (Hbn.) and *M. latex*. The digitus is almost basal in *M. confusa* but crosses the membranous sacculus more distally in *M. latex* and *triangula*. In *M. latex* the membranous area is swollen distally, in *triangula* it tapers evenly. The everted vesica of *triangula* is unique in the genus because it has no large cornutus nor comb-like concentrations of smaller cornuti. Instead, it has a ribbon-like band of small cornuti.

Distribution and Habitat. This species occurs from the southeastern corner of Virginia along the coastal plain to all of Florida and west to east Texas. There are very few piedmont records (which may reflect a lack of collecting in this area). In the mountains it occurs from Avery Co. in North Carolina to the foothills in NE Alabama. County records are as follows: **VIRGINIA**: City of Suffolk, City of Virginia Beach, Isle of Wright; **NORTH CAROLINA**: Bladen, Brunswick, Carteret, Craven, Cumberland, Hoke, Macon, Martin, Moore, Onslow, Pender, Union; **SOUTH CAROLINA**: Charleston, Greenville, Oconee; **TENNESSEE**: Cocke; **GEORGIA**: Fulton, Long, Lumpkin, Rabun, Towns, Union; **FLORIDA**: Alachua, Escambia, Liberty, Monroe, Okaloosa; **ALABAMA**: Bibb, Conecuh, Sumpter; **MISSISSIPPI**: Forrest, Franklin, George, Hancock, Harrison, Jackson, Pearl River, Pike; **ARKANSAS**: Ashley, Union; **LOUISIANA** (Parishes): Iberville, St. Tammany, West Feliciana, Winn; **TEXAS**: Hardin, Jasper, Polk, Sabine, Tyler.

Collections of this moth are not limited to a specific habitat. It occurs in swamps, savannahs, pinelands and mesic hardwood sites throughout the Coastal Plain. Mountain sites are equally undistinguished.

Flight Season. In the Coastal Plain of North Carolina the extended flight period runs from late March into June and perhaps early July. Most males fly in mid April and most females are in flight in May–June. Mountain records (above 4000') are May through mid July. For other states with numerous records, the recorded flight periods are as follows: **Mississippi**:

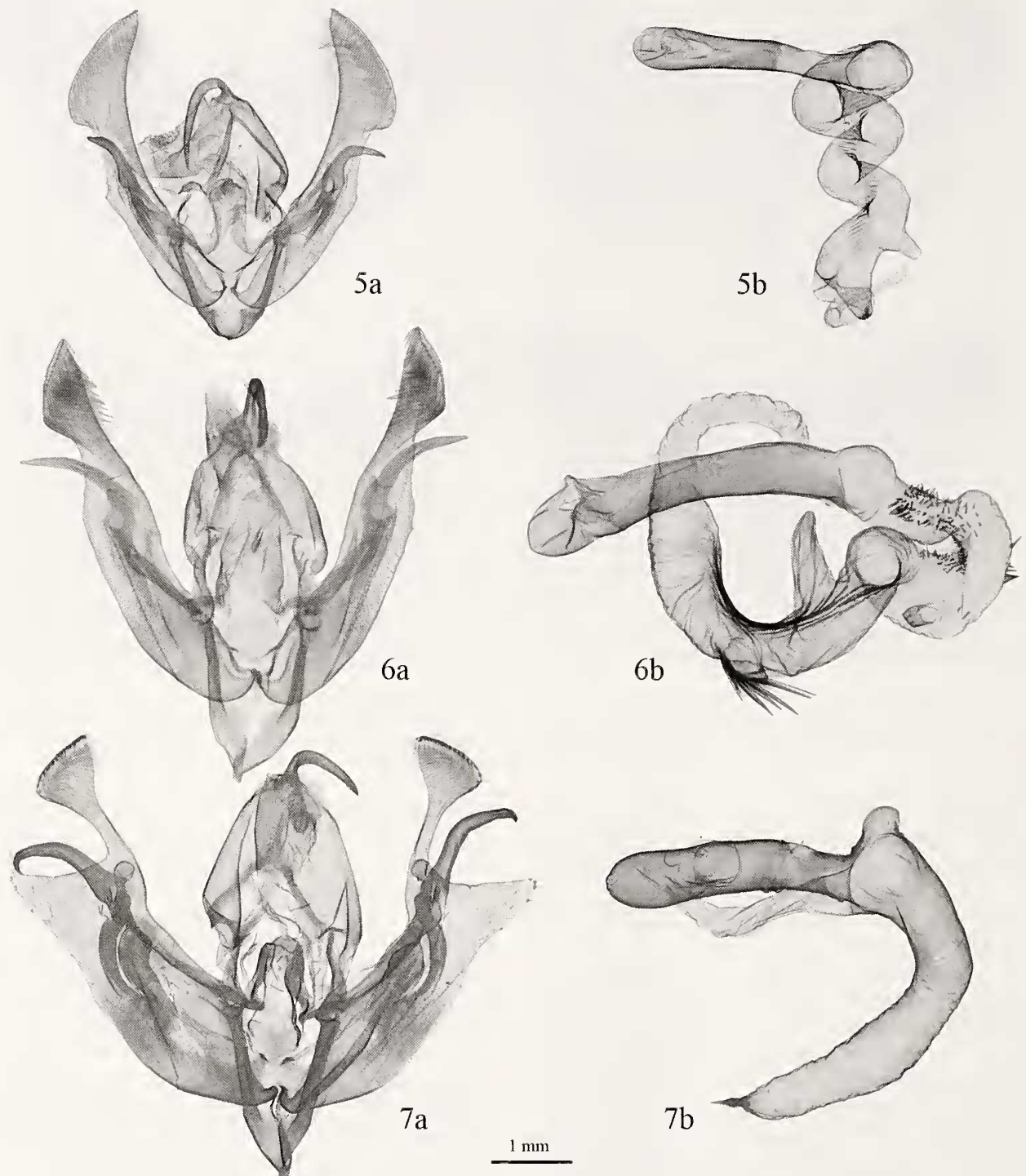


FIGS. 1–4. Adult *Morrisonia triangula* Sullivan and Adams. Male. Little Deep Creek Rd., Croatan National Forest, Craven Co., N. C. April 2, 2000, J. Bolling Sullivan. 2. *Morrisonia triangula* Sullivan and Adams. Female. Croatan National Forest Rd. 147, Craven Co., N. C. April 11, 2000, J. Bolling Sullivan. 3. *Morrisonia latex* (Guenée). Male. East side of Carp Ridge, 45°24.63'N, 76°03.45'W, Ontario, 14 June 2003, J. Troubridge. 4. *Morrisonia latex* (Guenée). Female. Temiscouata Co., Québec, 16 June 1993, Henry Hensel.

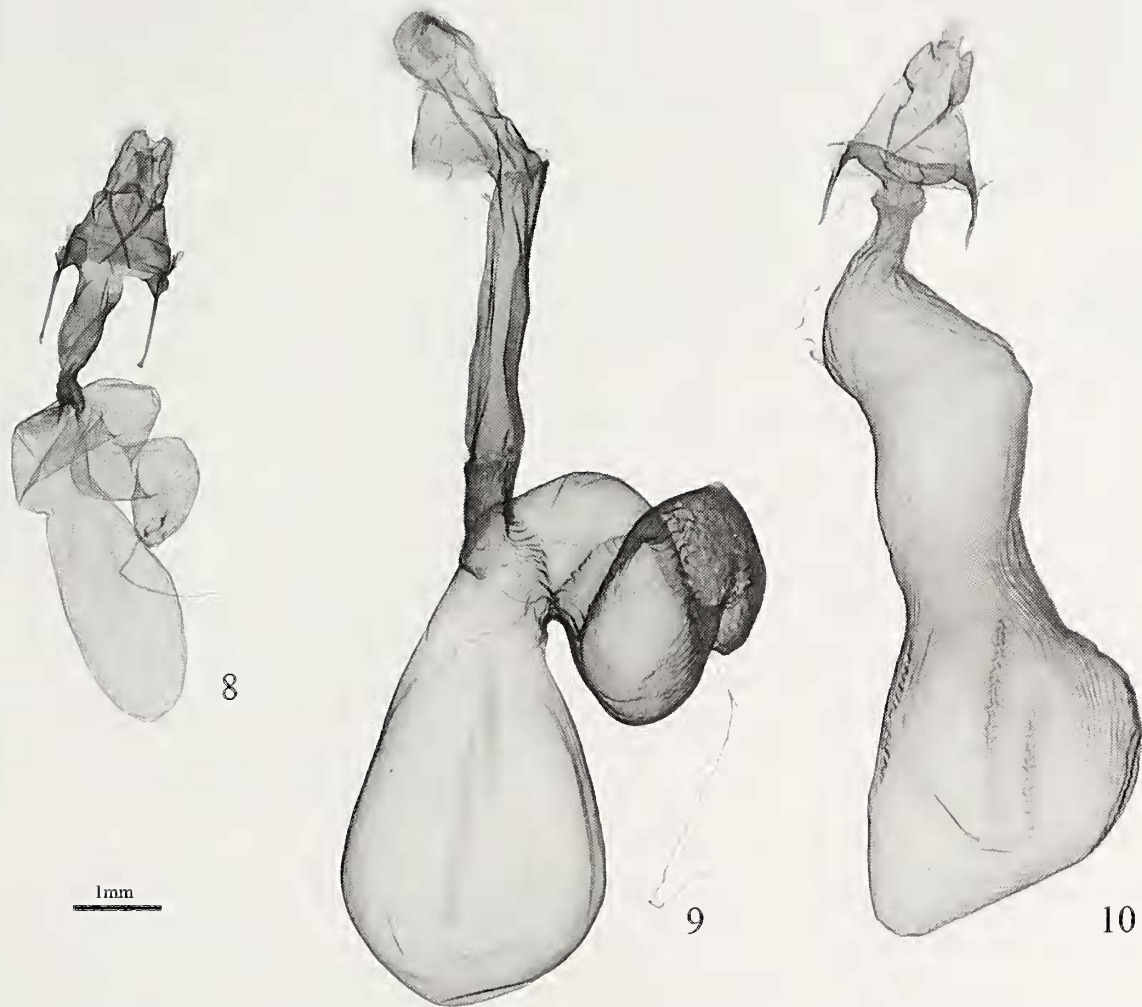
March 27–June 2; Louisiana: March 12–June 15; Texas: April 8–May 22; South Carolina: May 21–July 25 (the latest recorded specimen, from the mountains [Oconee Co.]); Georgia: April 23–May 27; Florida: March 17–May 23; Alabama: June 3–June 12. There is no evidence for a second brood.

Generic Placement. The genus *Morrisonia* is attributed to Grote (1874), with *evicta* as the type species, but no characters are given in his work to help delineate the genus. Hampson (1898–1913) included taxa from North America and New Zealand but species from New Zealand have since been removed (Dugdale 1988). Forbes (1954) characterized the genus as follows: “vestiture always mixed, the division of the tuft on upper part of face obvious; collar usually with suggestion of a central ridge, and concave on either side; double dorsal tufts of thorax distinct; several distinct tufts on abdomen.” Since Forbes’ treatment of the genus, *M. distincta* Hbn. has been moved to the genus *Achatia* (Hodges et al. 1983) and *Mamestra latex* (Gn.) has been moved into *Morrisonia* (Poole 1989). Other North

American genera placed in the tribe Orthosiini by Lafontaine (2007) are *Acerra*, *Stretchia*, *Perigonica*, *Orthosia*, *Himella*, *Egira* and *Achatia*. Members of the tribe are united by characters of the larval hypopharynx and spinneret (Fibiger & Lafontaine 2005), characters which we have not evaluated. Genitalic variation in this tribe and within several of the genera is extreme (Ronkay et al. 2001). The genus *Morrisonia* is no exception. What characters then seem to place this new species in *Morrisonia*? Two external characters other than wing pattern support placement of the new species in *Morrisonia*. First, the vestiture is coarse, a mixture of scales and hairs, and in most of the other genera only hair scales are present. Second, there is a well-differentiated line across the frons that occurs in the other *Morrisonia* species but is extremely faint when present (rarely) in other genera. Comparison of related species and genera (*Egira alternans* (Wlk.), *variabilis* (Sm.), *dolosa* (Grt.), *crucialis* (Harv.), *rubrica* (Harv.), *cognata* (Sm.); *Stretchia inferior* (Sm.); *Perigonica angulata* (Sm.); *Himella fidelis* Grt.; *Orthosia praeses*



FIGS. 5-7. Male genitalia of *Morrisonia*. **5a,b.** *Morrisonia evicta* (Grote). **a.** Valves, Dunrobin, Ontario (CNC 13538). **b.** Aedeagus. Same data as male valves. **6a, b.** *Morrisonia triangula* Sullivan and Adams. **a.** Valves, Wedge Plantation, 7miN McClellanville, South Carolina (CNC 13964). **b.** Aedeagus. same data as male valves. **7a,b.** *Morrisonia latex* (Guenée). **a.** Valves, North Gower, Ontario (CNC 13539). **b.** Aedeagus. same data as male valves.



FIGS. 8–10. Female genitalia of *Morrisonia* spp. 8. *Morrisonia evicta* (Grote). Female. Aweme, Manitoba (CNC 13560). 9. *Morrisonia triangula* Sullivan and Adams. Female. Key Largo, Florida (CNC 13542). 10. *Morrisonia latex* (Guenée). Female. Lac Mondor, Ste Flore, Québec (CNC 13540).

(Grt.), *rubescens* (Wlk.), *hibisci* (Gn.), *alurlina* (Sm.), *pacifica* (Harv.), *revicta* (Morr.), *pulchella* (Harv.), *mys* (Dyar), *erythrolita* (Grt.), *garmani* (Grt.) and *segregata* (Sm.) and all 5 *Morrisonia* species using COI barcoding techniques (Hebert et al. 2006) reveals that, whereas most species sort with their supposed congeneric members, there are often inclusions of one or two additional non congeneric species in each generic cluster. In the case of *Morrisonia* both *evicta* and *triangula* sort together but may be separated from the other *Morrisonia* species by *Orthosia hibisci* or *rubescens*. Examination of the male and female genitalia (Figs. 5, 6, 8, 9) shows that *M. evicta* and *triangula* are quite similar in all characters and the pair is most similar to *M. mucens* (Hbn.). *M. confusa* and *M. latex* have genitalia which are quite divergent from the *mucens*, *evicta*, *triangula* complex. Significant

divergence is seen in the COI data from *M. latex* but not *M. confusa*.

Diverse assemblages of species are characteristic of *Orthosia*, *Egira*, and perhaps other orthosiine genera with multiple species (Ronkay et al. 2001). Finding good generic characters is difficult at best. For *M. mucens*, *evicta* (Fig. 5) and *triangula* (Fig. 6) we could list the spiral vesica with groups of cornuti but no major spine, a short diverticulum near the apex of the vesica, and the valva, diaphanous along its ventral edge, indented from the ventral side past the midpoint and expanded distally. The valve process derives from the costal plate; the medial plate often produces a small process. In females (Figs. 8, 9) the appendix bursa is coiled, the ductus bursa well sclerotized, and the ostium simple. These same characters are either missing or highly modified in *M. confusa* and *latex* (Fig. 10).

Morrisonia confusa and *latex* are polyphagous (Covell 2005; Rings *et al.* 1992). Most records for *Morrisonia evicta* are from *Prunus*, although *Kalmia* and *Corvus* are listed also, perhaps erroneously (Wagner *et al.* 2008). Jaek Franelemont reared *Morrisonia mucens* from Water Oak (*Quercus nigra* L.) as reported in Godfrey (1972). While most orthosiines require tender new foliage, both *M. confusa* and *M. latex* develop comparatively slowly on older, hardened summer foliage. *M. confusa* is exceptional among noctuids in taking as long as 6–7 months to mature (Wagner 2005). The habits of *M. confusa* and *M. latex* are strikingly different from each other and completely different from the other spring feeding orthosines. *M. confusa* begins the year feeding externally on new growth as do the other species, but in the last instar it fashions a shelter on old summer foliage, densely lines it with silk, and continues to feed for upwards of 5–6 months. *Morrisonia latex* also feeds throughout the summer but rests on bark by day (at least in the last instar), a habit completely unique to other orthosines (Wood & Butler 1989; Wagner *et al.* 2008). Based on the sum of differences in larval morphology, behavior, and life history, *M. evicta*, *confusa* and *latex* could easily be placed in three separate genera.

Thus, everything points to inclusion of *triangula* in the genus *Morrisonia*, considering that it seems to be the closest relative to *evicta*, the type species. In fact it is a better fit than some of the other species currently placed there. When the larval biology of *triangula* is known, hopefully, it will confirm this placement rather than add more heterogeneity to yet another genus in the Orthosini.

ACKNOWLEDGEMENTS

We would like to acknowledge the following persons who contributed data, insight or both: Vernon Brou, Richard Brown, Chuck Ely, Irving Finkelstein, Howard Grisham, Steven Hall, Paul Hebert, Ed Knudson, Hugo Kons, Don Lafontaine, Tim McCabe, Tom Neal, Steve Roble, Dale Schweitzer, Brian Scholtens, Darryl Searcy, Jeff Sloten, John Snyder and Dave Wagner. Figures were prepared by Jocelyn Gill.

LITERATURE CITED

COVELL, C. V., Jr. 2005. A field guide to the moths of eastern North America. 2nd Ed. Houghton Mifflin Col, Boston, Mass.

- DUGDALE, J. S. 1988. Lepidoptera-annotated catalogue, and keys to family group taxa. Fauna of New Zealand 14: 1–262.
- FIBIGER, M. & J. D. LAFONTAINE. 2005. A review of the higher classification of the Noctuoidea (Lepidoptera) with special reference to the Holarctic fauna. Esperiana (Buchreihe zur Entomologie), Band 11, pp. 7–92.
- FORBES, W. T. M. 1954. Lepidoptera of New York and neighboring states. Noctuidae, Part III. Cornell University Agricultural Experimental Station. 433 pp.
- GODFREY, G. L. 1972. A review and reclassification of larvae of the subfamily Hadeninae (Lepidoptera, Noctuidae) of America north of Mexico. Tech. Bull. No. 1450. U. S. Dept. Agriculture, Washington, D. C. 265 pp.
- GROTE, A. R. 1874. List of the Noctuidae of North America. Bull. of the Buffalo Society of Nat. Hist. 2: 1–77.
- HAMPSON, G. F. 1898–1913. Catalogue of the Lepidoptera Phalaenae in the British Museum. Volumes 1–13.
- HEBERT, P. D. N., E. H. PENTON, J. M. BURNS, D. H. JANZEN & W. HALIWACHS. 2006. Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptes fulgerator*. Proc. Natl. Acad. Sci. 101: 14812–14817.
- HODGES, R. W., T. DOMINICK, D. R. DAVIS, D. C. FERGUSON, J. G. FRANCELMONT, E. G. MUNROE, J. A. POWELL (eds). 1983. Check list of the Lepidoptera of America north of Mexico (including Greenland). E. W. Classey Ltd. and The Wedge Entomological Research Foundation, London. 284 pp.
- KIMBALL, C. P. 1965. The Lepidoptera of Florida: an annotated checklist. In Arthropods of Florida and neighboring land areas. Vol. 1. Fla. Dept. Agric., Gainesville. 363 pp.
- LAFONTAINE, J. D. 1998. Noctuoidea: Noctuidae (part), Noctuinae (part-Noctuini). Fascicle 27.3. In R. B. Dominick *et al.* (eds), The moths of America north of Mexico. The Wedge Entomological Research Foundation, Washington, D. C. 348 pp.
- _____. 2007. Updated electronic checklist of the moths of America.
- POOLE, R. W. 1989. Lepidoptorum catalogus. Fascicle 118, Noctuidae, 3 volumes.
- RATNASINGHAM, S. & P. D. HERBERT. 2007. Bold: The barcode of life data system. Molecular Ecology Notes 7(3): 355–364.
- RINGS, R. W., E. H. METZLER, F. J. ARNOLD, & D. H. HARRIS. 1992. The owl moths of Ohio (Order Lepidoptera: Family Noctuidae). Ohio Biol. Survey Bull., New Series, Vol. 9, College of Biological Sciences, Ohio State University, Columbus, Ohio. 219 pp.
- RONKAY, L., J. L. YELA & M. HREBLAY. 2001. Noctuidae Europaeae, Hadeninae II. Soro: Entomological Press. 452 pp.
- WAGNER, D. L. 2005. Caterpillars of eastern North America: A guide to identification and natural history, Princeton University Press. 496 pp.
- _____, D. F. SCHWEITZER, J. B. SULLIVAN, & R. C. REARDON. 2008. Owllet caterpillars of Eastern North America (Lepidoptera: Noctuidae). Princeton University Press (in preparation).
- WOOD, P. S., & L. BUTLER. 1989. Biology and immature states of *Polybia latex* (Guenee) (Noctuidae). J. Lepid. Soc. 43: 299–304.

Received for publication 31 January 2008; revised and accepted 20 October 2008