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The Acontiinae and Eustrotiinae (Lepidoptera: Noctuidae) of Great Smoky Mountains National Park

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Abstract

Five species of Acontiinae and nine species of Eustrotiinae are known to occur in Great Smoky Mountains National Park. Each species is documented with an adult image, description/diagnosis, flight period, park distribution, abundance, elevational range, general distribution, and larval hosts. Species accumulation curves using the abundance-based estimators Chao 1 and ACE, and the incidence-based estimators Chao 2 and ICE are presented for each subfamily. The results from these estimators indicate that the number of species observed is equal to or very close to the number of estimated species and, therefore, it is unlikely that additional species will be added to the fauna of GSMNP in these subfamilies.

Key words: systematics, all taxa biodiversity inventory, North Carolina, Tennessee, species richness estimators

Introduction

This is the fourth paper in a series documenting the Noctuidae of Great Smoky Mountains National Park (GSMNP) as part of the All Taxa Biodiversity Inventory (ATBI) project (Pogue 2005, 2006, 2010). Introductory remarks are found in Pogue (2005).

Lafontaine and Schmidt (2010) have recently revised the checklist of the Moths of North America. I followed this classification. The changes in the Acontiinae from the earlier checklist (Franclemont and Todd 1983) include removing the tribe Cydosiini to the subfamily Cydosiinae and raising the rank of the tribe Eustrotiini to subfamily. In addition to these changes there have been several generic reassignments in the Acontiinae (Lafontaine and Poole 2010) and Eustrotiinae (Ueda 1984, 1987; Lafontaine and Schmidt 2010; Ferris and Lafontaine 2009).

The Acontiinae are mostly small moths, many of which are camouflaged as bird droppings. There are 87 species in North America and five in GSMNP. Adults are characterized by the following autapomorphies: 1) tympanum having an enlarged alula that forms a flap partially coving the tympanic opening, 2) tympanum with hood reduced or absent, and 3) male genitalia with scaphium membranous and having one or two areas of hair-like setae. Larvae have two SV setae on the first abdominal segment.

The Eustrotiinae are also mostly small moths, usually included in the Acontiinae (Franclemont and Todd 1983, Covell 1984). There are 51 species in North America and nine in GSMNP. This is a paraphyletic assemblage of species that lacks consistent diagnostic features in adults as well as larvae (Kitching and Rawlins 1998). Larvae have three SV setae on the first abdominal segment (Fibiger and Lafontaine 2005).

Methods and materials

Methods and materials are discussed in Pogue (2005). Adult and larval common names are from Covell (1984, 1999). Each species is sequentially numbered. All collecting localities are listed in Table 1 and shown on Map 1. Scientific and common names of plants were verified from The Plants Database (USDA, NRCS 2008).

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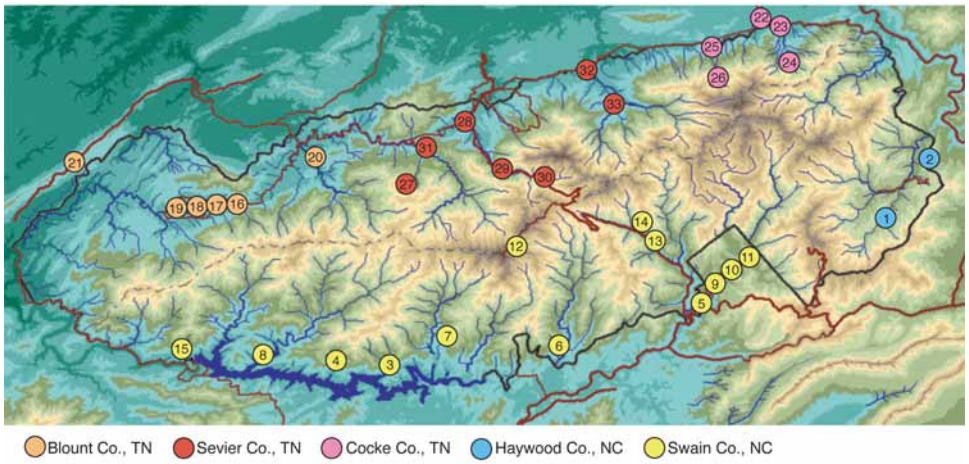
TABLE 1. Collecting localities of GSMNP Acontiinae and Eustrotiinae.

Map No.	State	County	Locality	UTM N	UTM E	Latitude	Longitude	Elev. ft / m
1	NC	Haywood	Purchase Knob at lower creek	3938381	311511	35.5730 N	83.0800 W	4000 / 1219
1	NC	Haywood	Purchase Knob, 1.1 rd. mi from house	3939249	312477	35.5792 N	83.0696 W	4924/ 1501
1	NC	Haywood	Purchase Knob, 0.5 mi N of gate	3939295	312401	35.5814 N	83.0704 W	4640 / 1414
1	NC	Haywood	Purchase Knob, on road in meadow	3939582	312443	35.5840 N	83.0700 W	4520 / 1378
1	NC	Haywood	Purchase Knob at house	3939810	312176	35.5860 N	83.0730 W	4800 / 1463
1	NC	Haywood	Purchase Knob	3939847	312149	35.5863 N	83.0733 W	4924 / 1501
1	NC	Haywood	Purchase Knob NW of house, forest	3939804	312007	35.5859 N	83.0749 W	4911 / 1497
1	NC	Haywood	Purchase Knob, by Ferguson cabin	3939198	312279	35.5805 N	83.0717 W	4600/ 1402
2	NC	Haywood	Cataloochee, pull off at Sal Patch Gap	3945700	313351	35.6393 N	83.0614 W	3440 / 1049
3	NC	Swain	0.5 km from mouth of Chambers Creek, 300 ft. up hillside on NW side	3924950	263269	35.4417 N	83.6080 W	1990 / 607
4	NC	Swain	Welch Ridge, 300 ft. above Lake Fontana	3926205	251764	35.4502 N	83.7350 W	1720 / 524
5	NC	Swain	Oconaluftee Staff Apartments	3932698	291266	35.5159 N	83.3018 W	2024 / 617
6	NC	Swain	Deep Creek Ranger Station	3926502	278706	35.4592 N	83.4385 W	2120 / 646
7	NC	Swain	0.4 km up trail from lake at Forney Creek	3927775	267749	35.4682 N	83.5595 W	2100 / 640
8	NC	Swain	0.2 km W of mouth of Hazel Creek	3928576	253041	35.4718 N	83.7217 W	1900 / 579
9	NC	Swain	Big Cove Road, site c	3931177	291121	35.5040 N	83.3030 W	2080 / 634
10	NC	Swain	Big Cove Road, site p	3932160	291779	35.5130 N	83.2960 W	2040 / 622
10	NC	Swain	Big Cove Road, site w	3931834	291499	35.5100 N	83.2990 W	2030 / 619
11	NC	Swain	Big Cove Road, site b	3932935	291888	35.5200 N	83.2950 W	2120 / 646
12	NC	Swain	Noland Divide Trailhead	3938560	275059	35.5670 N	83.4820 W	5920 / 1804
13	NC	Swain	Collins Creek Picnic area, boglet 0.5 mi NW	3938292	288264	35.5675 N	83.3363 W	2400 / 732
14	NC	Swain	8.3 mi NW of GSMNP entrance on 441, Kephart Prong Trail	3940466	286398	35.5867 N	83.3575 W	2825 / 861
15	NC	Swain	0.7 km S of Payne Cemetery	3927198	244115	35.4572 N	83.8195 W	2000 / 610
16	TN	Blount	Cades Cove Ranger Station	3943213	248428	35.6025 N	83.7770 W	1880 / 573
16	TN	Blount	Cades Cove ATBI house, 2000 m SW	3943081	243315	35.6000 N	83.8333 W	1740 / 530
16	TN	Blount	Near gate to Cades Cove Loop	3943803	248354	35.6060 N	83.7780 W	1820/ 555
17	TN	Blount	Vicinity of Cades Cove	3943572	248311	35.6057 N	83.7784 W	1880 / 573
18	TN	Blount	Cades Cove Primitive Baptist Church	3943252	245073	35.6020 N	83.8140 W	1800 / 549
19	TN	Blount	Cades Cove, Abrams Creek Springs	3942529	242423	35.5930 N	83.8430 W	1706/ 520
19	TN	Blount	Cades Cove Loop, Abrams Creek	3942637	242517	35.5940 N	83.8420 W	1706/ 520
20	TN	Blount	Tremont	3947301	256311	35.64113 N	83.6913 W	1360 / 415
21	TN	Blount	Foothills Parkway West at East end	3956265	245059	35.7170 N	83.8180 W	1001 / 305
22	TN	Cocke	Foothills Parkway south overlook	3955061	298425	35.8090 N	83.2310 W	1860 / 567
22	TN	Cocke	Foothills Parkway at north overlook	3966908	301179	35.8280 N	83.2010 W	2400 / 732
22	TN	Cocke	Foothills Parkway	3966059	299442	35.8200 N	83.2200 W	2020/ 616
22	TN	Cocke	Foothills Parkway East	3964979	298179	35.8082 N	83.2337 W	2400/ 732
22	TN	Cocke	Foothills Parkway, N of 3rd pullout	3965559	299313	35.8137 N	83.2211 W	2198/ 670
22	TN	Cocke	Foothills Parkway, 3rd overlook from Cosby	3966572	300420	35.8248 N	83.2093 W	1880 / 573

continued next page

TABLE 1. (continued)

Map No.	State	County	Locality	UTM N	UTM E	Latitude	Longitude	Elev. ft / m
22	TN	Cocke	Foothills Parkway N, 4.5 mi from Hwy. 321, 3RD overlook	3966593	300358	35.8250 N	83.2100 W	1920 / 585
22	TN	Cocke	Foothills Parkway East at I-40	3967869	302828	35.8370 N	83.1830 W	1330 / 405
23	TN	Cocke	0.25 mi inside entrance to Cosby	3962756	298273	35.7900 N	83.2321 W	1350 / 411
24	TN	Cocke	Cosby campground area	3958252	301075	35.7500 N	83.2000 W	2600 / 792
24	TN	Cocke	Cosby picnic area off Gabes Mountain trail	3959052	300163	35.7570 N	83.2103 W	2200/ 671
24	TN	Cocke	Cosby ATBI house	3961354	299896	35.7777 N	83.2138 W	1760 / 536
24	TN	Cocke	Cosby Creek, above Cosby Campground	3958230	301075	35.7480 N	83.2000 W	2560/ 780
24	TN	Cocke	Cosby Ranger Station	3961387	299879	35.7780 N	83.2140 W	1750 / 533
25	TN	Cocke	Maddron Bald Trail	3960340	295061	35.7676 N	83.2670 W	1900 / 579
26	TN	Cocke	Albright Grove Trailhead	3956976	293816	35.7370 N	83.2799 W	2000 / 610
27	TN	Sevier	Jake's Creek Trail, above Campsite 27	3945002	264199	35.6225 N	83.6036 W	3600 / 1097
27	TN	Sevier	Jake's Creek Trail, Campsite 27	3945031	264335	35.6228 N	83.6021 W	3550 / 1082
27	TN	Sevier	Jake's Creek Trail	3945069	264155	35.6231 N	83.6041 W	3640 / 1109
27	TN	Sevier	Elkmont, Jake's Creek Trail	3947971	266239	35.6497 N	83.5820 W	2398/ 731
28	TN	Sevier	Park Headquarters	3952000	270417	35.6870 N	83.5370 W	1480 / 451
28	TN	Sevier	Sugarlands Visitor Center	3951889	270414	35.6860 N	83.5370 W	1480 / 451
29	TN	Sevier	above Chimneys Campground	3946720	274457	35.6390 N	83.4910 W	2920/ 890
30	TN	Sevier	7 mi S of Sugarlands Visitor Center	3946354	276778	35.6376 N	83.4652 W	3640 / 1109
31	TN	Sevier	Elkmont	3948640	266434	35.6540 N	83.5800 W	2200 / 671
32	TN	Sevier	Greenbrier Ranger Station	3956495	282355	35.7302 N	83.4064 W	1700 / 518
33	TN	Sevier	Greenbrier picnic shelter	3954537	284335	35.7130 N	83.3840 W	1760 / 536



MAP 1. Collecting localities of Acontiinae and Eustrotiinae. Numbers refer to localities in Table 1.

Species richness estimates (Figs. 1–2) for each subfamily were constructed using the program EstimateS (Colwell 2005). The number of observed species in the study equals Sob. Two species richness estimators were used, Chao 1 and Chao 2. Chao 1 is based on the number of species represented only by one specimen (singleton) and two specimens (doubleton). Chao 2 is based on the number of samples that have only one species and samples that have only two species. For more information concerning these estimates see Colwell and Coddington (1994) and Chao (2004).

Two coverage-based richness estimators were used. The Abundance-based Coverage Estimator (ACE) separates the number of species into two classes, abundant (greater than 10 specimens) and rare (less than 10 specimens). The exact number of rare species is needed to predict the species richness of an area. The Incidence-based Coverage Estimator (ICE) separates the number of samples into two classes, abundant (greater than 10 species) and rare (less than 10 species). For more information concerning these coverage-based richness estimators, see Chazdon *et al.* (1998) and Chao (2004). These can be downloaded off the EstimateS website (http://purl.oclc.org/estimates).

Species accounts

The species of the Acontiinae and Eustrotiinae of Great Smoky Mountains National Park are listed in alphabetical order within each subfamily checklist. The author and year of publication follow the species name. Original spellings of the species epithet are used and are not changed to be in agreement with the gender of the genus name (Poole 1989). Dates that include brackets, [1857] 1856, means that the publication was stated to have been published in 1856, but external information indicates that it was actually published in 1857. The arrangement in the text follows these checklists.

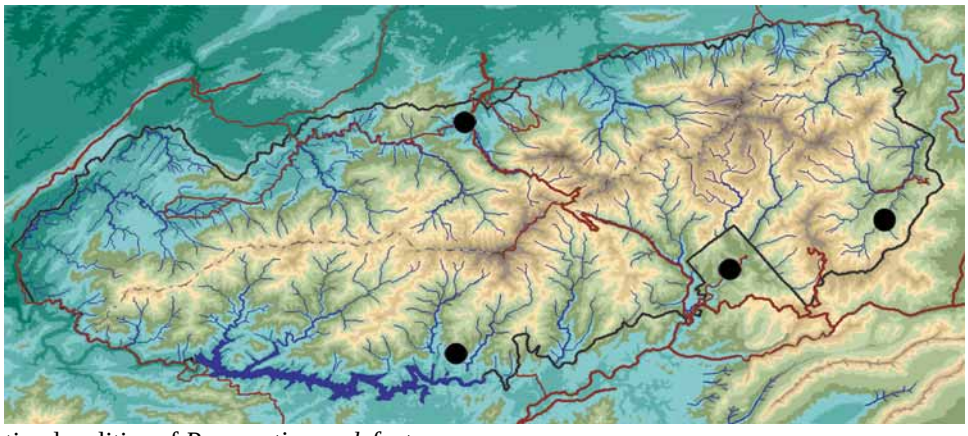
Subfamily Acontiinae

Ponometia candefacta (Hübner, [1831] 1825)
Ponometia erastrioides (Guenée, 1852)
Spragueia apicalis (Herrich-Schäffer, 1868)
Spragueia dama (Guenée, 1852)
Spragueia leo (Guenée, 1852)

1. *Ponometia candefacta* (Hübner), Olive-shaded Bird-dropping Moth

(Figs. 3–4, Map 2)

Identification: Forewing length 9.0–10.5 mm. *Ponometia candefacta* has a white forewing with a brown, fused medial and postmedial lines, and a prominent round, gray reniform spot that is outlined in white. There can be some faint yellow scales proximal to the reniform spot between the brown costal spot and brown band. The orbicular spot is a tiny black dot. The prominent reniform spot distinguishes it from *P. erastrioides* (Guenée). *Ponometia candefacta* and *P. erastrioides* **(**Guenée**)** are considered to be congeneric with *Ponometia* Herrich-Schäffer 1868 (Poole and Lafontaine 2010).



MAP 2. Collecting localities of *Ponometia candefacta.*

Flight period: 9–10 June.

Collected localities: North Carolina: Haywood Co.: Purchase Knob, NW of house; Swain Co.: Big Cove Rd., site w; 0.7 km up creek from mouth of Goldmine Creek. Tennessee: Sevier Co.: Sugarlands Visitor Center. (4 specimens)

Elevation range: 1480–4911 ft. (451–1497 m)

General distribution: Widespread from coast to coast, probably found in every state.

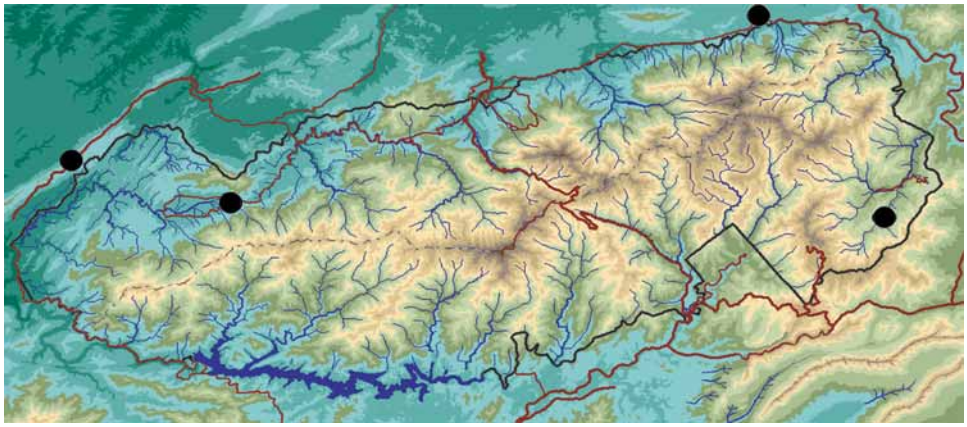
Larval hosts: Various species of ragweed (*Ambrosia* spp., Asteraceae) (Crumb 1956). David L. Wagner collected a larva on *Ambrosia artemisiifolia* L.

2. *Ponometia erastrioides* (Guenée), Small Bird-dropping Moth

(Figs. 5–6, Map 3)

Identification: Forewing length 8.0-9.0 mm. *Ponometia erastrioides* has a cream colored forewing with a large black patch in the distal half that does not extend to apex. The orbicular spot is a tiny black dot. The round, gray reniform spot is present, but obscured by the black distal patch. The black distal patch and slightly smaller size distinguishes it from *P. candefacta*.

Flight period: Three distinct dates in the Park, early June, mid July, and mid September, probably representing multiple broods.



MAP 3. Collecting localities of *Ponometia erastrioides.*

Collected localities: North Carolina: Haywood Co.: Purchase Knob. Tennessee: Blount Co.: W Foothills Parkway at E end; Cades Cove Ranger Station; Cocke Co.: Foothills Parkway East; Foothills Parkway East, south overlook. (13 specimens)

Collected localities: 1001–4924 ft. (305–1501 m)

General distribution: Widespread throughout the east from Quebec, Canada and Maine, south to Florida, and west to Minnesota, Michigan, the Great Plains to Kansas, and southern Arizona.

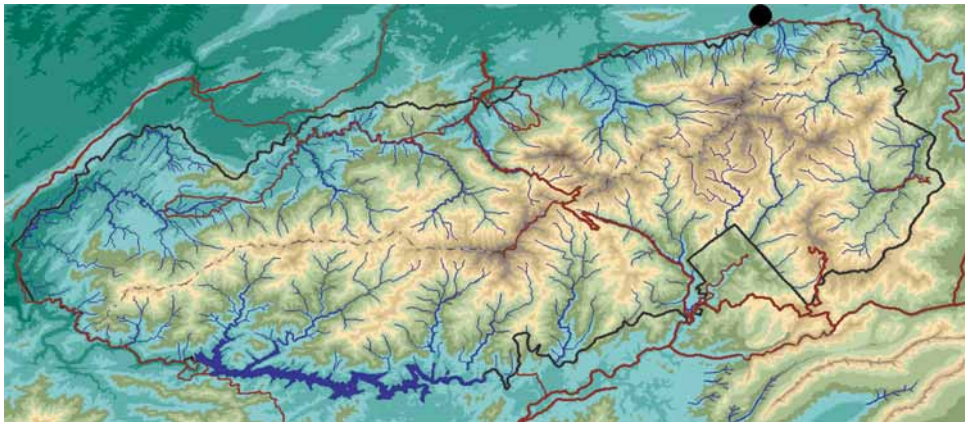
Larval host: Various species of ragweed (*Ambrosia* spp., Asteraceae) (Crumb 1956).

3. *Spragueia apicalis* (Herrich-Schäffer)

(Figs. 7–8, Map 4)

Identification: Forewing length 6.0–8.0 mm. *Spragueia apicalis* is sexually dimorphic with the male forewing ground color yellow (Fig. 9) and the female dark gray (Fig. 10). In the male forewing, the angulate basal band is reddish brown with a small, indistinct patch of gray scales basally along the postmedial margin; the costa and apex ochreous; an indistinct, median longitudinal streak that varies from ochreous to being mixed with reddish-brown scales and ending with an indistinct reddish-brown area at outer margin, which is

adjacent to a black band on fringe. The forewing in the female has numerous thin, white scales scattered on top of the gray scales. The angulate basal band in the female forewing is reddish brown with a distal white spot on costa, which becomes faint toward M vein and does not reach posterior margin. Forewing apex in female is white, with a variable amount of reddish brown scales at tip. Hind wing in both sexes is dark gray with a dark gray fringe.



MAP 4. Collecting localities of *Spragueia apicalis*.

Flight period: Mid July.

Collected localities: Tennessee: Cocke Co.: Foothills Parkway, 4.5 mi from Rt. 321, 3rd overlook. (1 specimen)

Elevation range: 1920 ft. (585 m)

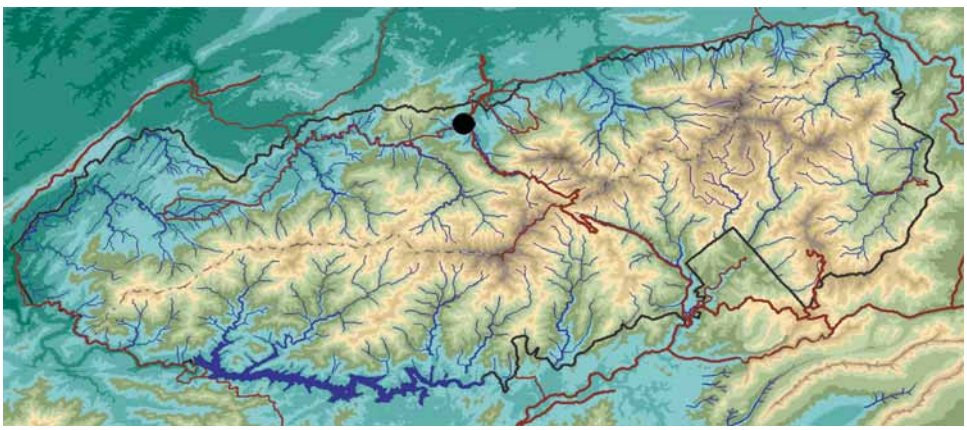
General distribution: Mainly southern in distribution from Pennsylvania south to Florida, west to Louisiana and Texas in the south and Ohio, Missouri, and Illinois in the Midwest. This species also occurs in the Neotropical Region from Mexico to Brazil.

Larval hosts: Broom snakeweed (*Gutierrezia sarothrae* (Pursh) Britton & Rusby, Asteraceae) (Covell 1984).

4. *Spragueia dama* (Guenée)

(Figs. 9–10, Map 5)

Identification: Forewing length 8.0–9.0 mm. This and the next species are small black moths with bright orange and white forewing markings. Forewing with large costal white patch; orange antemedial and postmedial lines; reniform spot black, round, within postmedial line; white costal patch between antemedial and postmedial lines; terminal line and fringe orange with a large median black spot. Hind is wing black. The black ground color between the antemedial and postmedial lines may be orange in some specimens.



MAP 5. Collecting localities of *Spragueia dama*.

Flight period: Mid July.

Collected localities: Tennessee: Sevier Co.: Park Headquarters. (1 specimen)

Elevation range: 1480 ft. (451 m)

General distribution: Mainly southern in distribution from Maryland south to Florida, west to Louisiana and Texas.

Larval hosts: Unknown

5. *Spragueia leo* (Guenée)
(Figs. 11–12, Map 6)

Identification: Forewing length 7.0-8.0 mm. *Spragueia leo* has a white costa with a series of four small black spots, as compared to the large white costal patches and no series of small costal dots in *S. dama*. Forewing has a black horizontal band that may be dissected by orange antemedial and postmedial lines, and narrower black band along posterior margin that can also be dissected by orange. Hind wing is dark gray; lighter than in *S. dama*.

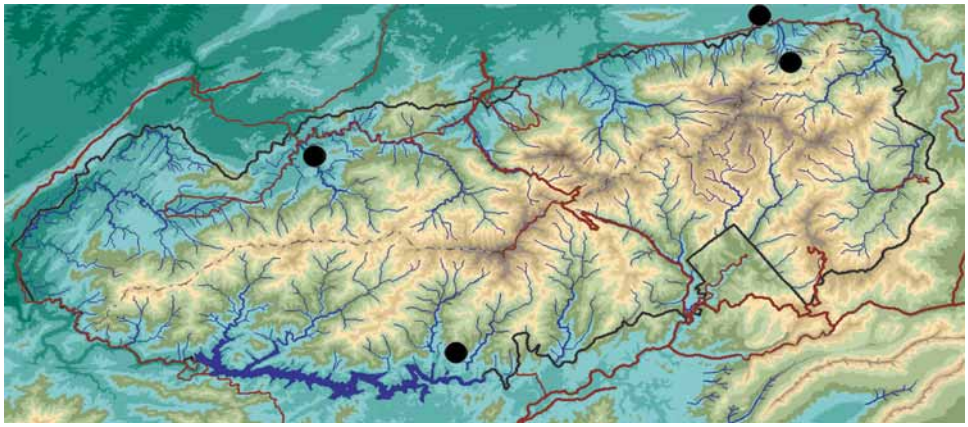
Flight period: Late May, July to early August, and early September.

Collected localities: North Carolina: Swain Co.: 0.7 km up creek from mouth of Goldmine Creek. Tennessee: Blount Co.: Tremont; Cocke Co.: Cosby Ranger Station; Foothills Parkway; Foothills Parkway at north overlook; Foothills Parkway south overlook. (11 specimens)

Elevation range: 1360–2400 ft. (415–732 m)

General distribution: An eastern species ranging from Massachusetts south to Florida, west to Louisiana and Texas, and in the Midwest from Ohio to Kansas.

Larval hosts: Bindweed (*Calystegia* sp., Convolvulaceae) (Covell 1984).



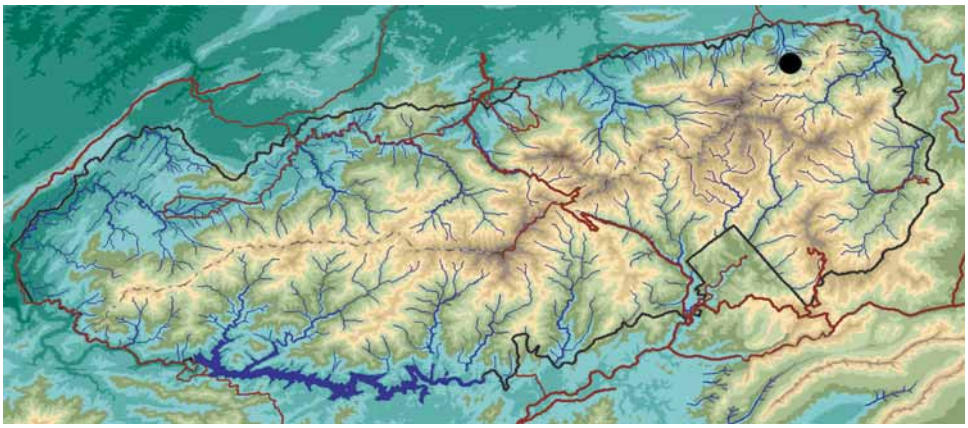
MAP 6. Collecting localities of *Spragueia leo.*

Subfamily Eustrotiinae

Amyna axis (Guenée, 1852)
Argillophora furcilla Grote, 1873
"Lithacodia" musta (Grote & Robinson, 1868)
Maliattha concinnimacula (Guenée, 1852)
Maliattha synochitis (Grote & Robinson, 1868)
Marimatha nigrofimbria (Guenée, 1852)
Ozarba aeria (Grote, 1881)
Protodeltote muscosula (Guenée, 1852)
Tripudia rectangula Pogue, 2010

1. *Amyna axis* (Guenée), Eight-spot
(Figs. 13–15, Map 7)

Identification: Forewing length 10.0-12.0 mm. *Amyna axis* has a brown to reddish-brown forewing. The male has a round, white reniform spot. In the female the reniform spot is either absent or is cream colored to cream colored mixed with reddish-brown scales and is never bright white as in the male. There are five white dashes along the costa from the reniform spot to apex. Most of the forewing markings are obscure. The faint postmedial line is crenulate, dark brown with some white scales distally, and may be absent in worn specimens. Hind wing is dark gray. *Amyna axis* is a synonym of *Amyna octo* (Guenée). See Edwards (1996) for an explanation of the synonymy.

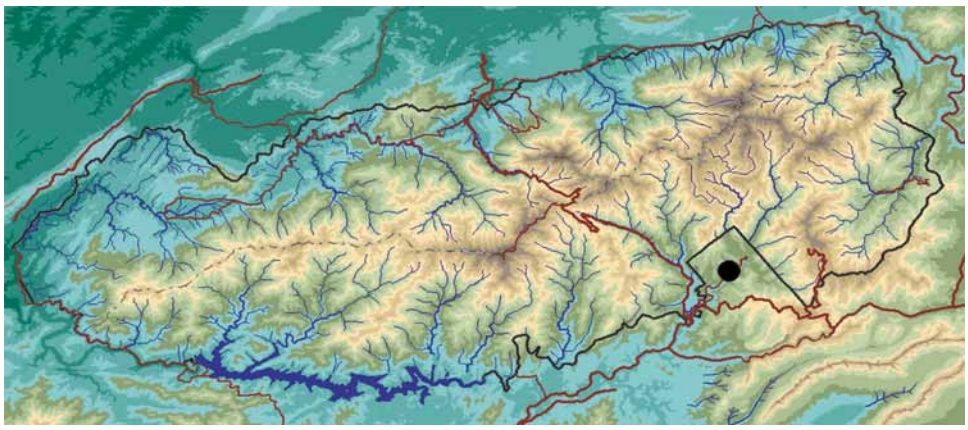


MAP 7. Collecting localities of *Amyna axis.*

Flight period: Mid October.
Collected Localities: Tennessee: Cocke Co.: Cosby, ATBI house. (1 specimen)
Elevation range: 1760 ft. (536 m)
General distribution: This is a tropical species distributed from the Caribbean and Mexico, south throughout Central America and South America to Brazil. It migrates northward each year, becoming common in the southern U.S., but more rare in the north. Recorded from Maine, south to Florida and west to Michigan, Illinois, Missouri, and eastern Texas.
Larval hosts: Known from *Chenopodium* spp. (Chenopodiaceae) (Covell 1984).

2. *Argillophora furcilla* Grote
(Fig. 16, Map 8)

Identification: Forewing length 10.0-11.0 mm. *Argillophora furcilla* is a distinctive species with cream forewings speckled with black scales and an angular white band in the middle of the wing that is bordered by darker linear patches, with small black dots along outer margin. Hind wing is white to pale gray that becomes darker at wing margin.
Flight period: Late May to June.
Collected Localities: North Carolina: Swain Co.: Big Cove Rd. site p, site w. (4 specimens)
Elevation range: 2030–2040 ft. (619–622 m)
General distribution: This is an uncommon southern species found from North Carolina, south to Florida and west to Mississippi, Arkansas, Louisiana, and eastern Texas.
Larval hosts: Unknown.



MAP 8. Collecting localities of *Argillophora furcilla*..

3. *"Lithacodia" musta* (Grote & Robinson), Small Mossy Lithacodia

(Fig. 17, Map 9)

Identification: Forewing length 8.0-9.0 mm. This species is similar to *P. muscosula*, but is generally smaller and with less white in the forewing. It differs from *P. muscosula* by having distinct orbicular and claviform spots, and the reniform spot is more round and filled with rufous scales, the terminal area is a brighter green in *L. musta* than the olive green in *P. muscosula*. Hind wing is gray.This species does not belong to any current genus in the Eustrotiinae, so it is retained in *Lithacodia* of authors (*"Lithacodia"*) until a genus name is proposed.

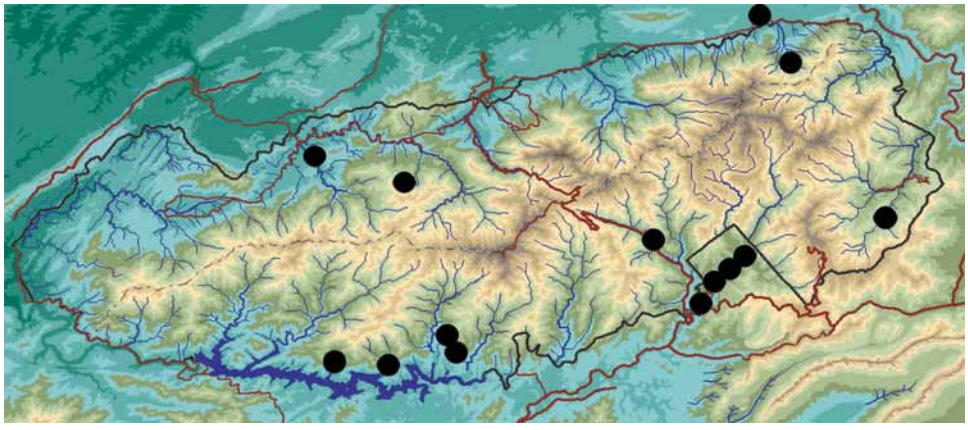
Flight period: May to September.

Collected localities: North Carolina: Haywood Co.: Purchase Knob; Purchase Knob at house; 0.5 mi N of gate to Purchase Knob; 1.1 rd. mi from house at Purchase Knob; Purchase Knob NW of house; Swain Co.: Big Cove Rd., site b, site c, site p; Boglet 0.5 mi NW of Collins Creek Picnic area; 0.5 km from mouth of Chambers Creek, 300 feet up hillside on NW side; 300 feet above lake on Welch Ridge; 0.7 km up creek from mouth of Goldmine Creek; 0.4 km up trail from lake on Forney Creek; Oconaluftee Staff Apartments. Tennessee: Blount Co.: Tremont; Cocke Co.: Cosby Ranger Station, Foothills Parkway; Sevier Co.: Jakes's Creek Trail above Campsite #27. (30 specimens)

Elevation range: 1390–4924 ft. (424–1501 m)

General distribution: New Hampshire to northern Florida, west to Texas, Missouri, and Wisconsin.

Larval hosts: Unknown.



MAP 9. Collecting localities of *"Lithacodia" musta.*

4. *Maliattha concinnimacula* (Guenée), Red-spotted Maliattha
(Fig. 18, Map 10)

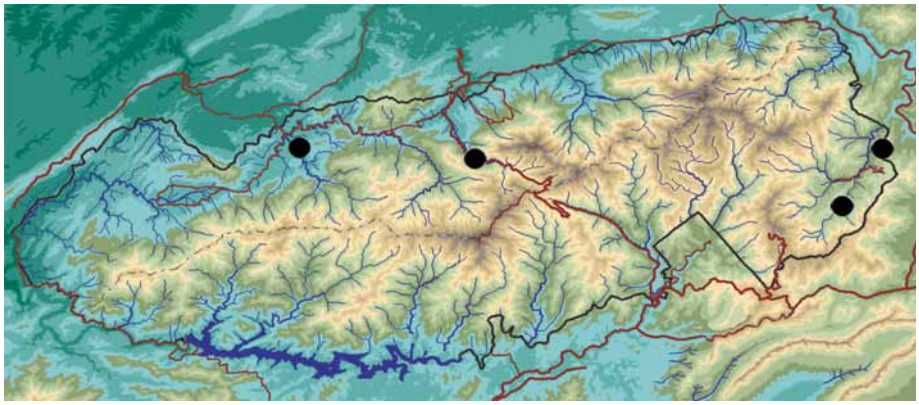
Identification: Forewing length 8.0-11.5 mm. *Maliattha concinnimacula* is a distinct species with pale grayish-green ground color and large reddish-orange claviform and reniform spots. The forewing also has a black orbicular spot; white zigzag antemedial, medial, postmedial, and subterminal lines; and an apex with a black, irregular, subapical patch and a black spot that is separated by a white line. Hind wing is pale gray.
Flight period: May.

Collected localities: North Carolina: Haywood Co.: Cataloochee, pull off at Sal Patch Gap; Purchase Knob, on road in meadow. Tennessee: Blount Co.: Tremont; Sevier Co.: above Chimneys Campground. (8 specimens)

Elevation range: 1360–4520 ft. (415–1378 m)

General distribution: This is a mainly northeastern species distributed from Nova Scotia and southeastern Canada, south to Maryland, and west to Tennessee, Missouri, Mississippi, and eastern Texas.

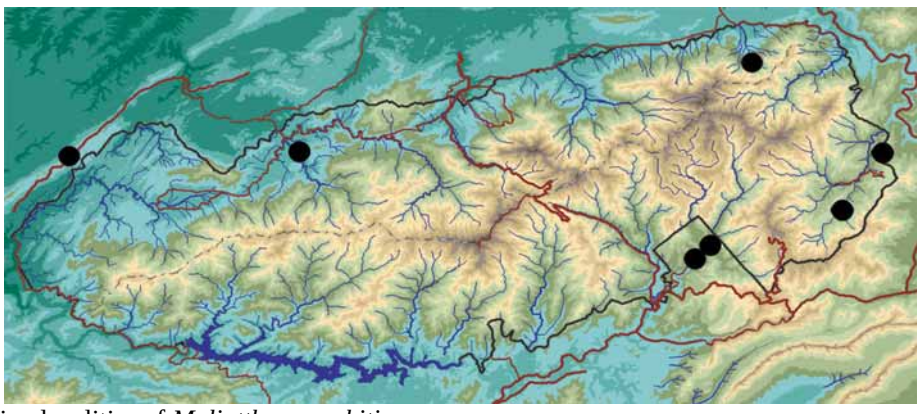
Larval hosts: Unknown.



MAP 10. Collecting localities of *Maliattha concinnimacula.*

5. *Maliattha synochitis* (Grote & Robinson), Black-dotted Maliattha
(Figs. 19–20, Map 11)

Identification: Forewing length 8.5–10.0 mm. This species can be distinguished by its large, olive-green, quadrate patch from the posterior margin of the forewing to the M vein and the black orbicular spot. Forewing with a white basal patch below M vein, distinct black orbicular spot, an olive bar distal to orbicular spot from M vein to costa, reniform spot gray encircled with white and indistinct, a large olive patch in terminal area irrorated with gray scales, apex with a variably distinct spot of black and gray scales, and faint elongate, olive spots along outer margin. Hind wing is pale gray.



MAP 11. Collecting localities of *Maliattha synochitis.*

Flight period: May to June.

Collected localities: North Carolina: Haywood Co.: Purchase Knob; Purchase Knob at house; Purchase Knob on road in meadow; Purchase Knob NW of house; Purchase Knob by Ferguson cabin; Purchase Knob, 1.1 rd. mi from house; Cataloochee, pull off at Sal Patch Gap. Swain Co.: Big Cove Rd., site b, site p. Tennessee: Blount Co.: Tremont; West Foothills Parkway at E end; Cocke Co.: Cosby Ranger Station. (22 specimens)

Elevation range: 1360–4924 ft.

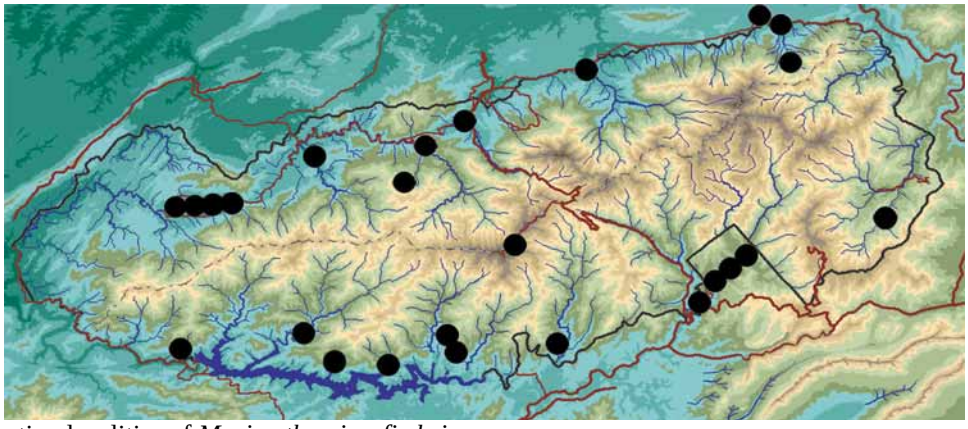
General distribution: This is mainly an eastern species ranging from Nova Scotia and southeastern Canada, south to North Carolina and Tennessee, west to Michigan, Illinois, North Dakota, Nebraska, Kansas, and eastern Texas. A single specimen was recorded from southwestern New Mexico.

Larval hosts: Sedges (*Carex* spp., Cyperaceae) and smartweed (*Polygonum* spp., Polygonaceae).

6. *Marimatha nigrofimbria* (Guenée), Black-bordered Lemon Moth

(Figs. 21–22, Map 12)

Identification: Forewing length 8.0-10.0 mm. *Marimatha nigrofimbria* cannot be confused with any other species in the Eustrotiinae. Forewing is yellow with a black border; claviform and reniform spots are small black dots. Hind wing is pale gray.The genus *Marimatha* Walker [1866] is congeneric with *Thioptera* Franclemont, 1950. The North American species of *Marimanta* was recently revised (Ferris and Lafontaine 2010).



MAP 12. Collecting localities of *Marimatha nigrofimbria.*

Flight period: May to September.

Collected localities: North Carolina: Haywood Co.: Purchase Knob, 0.5 mi N of gate; Purchase Knob, at house; Purchase Knob, NW of house; Swain Co.: Big Cove Rd., site b, site c, site p, site w; Deep Creek Ranger Station; Noland Divide trailhead; 0.5 km from mouth of Chambers Creek, 300 feet up hillside on NW side; 300 feet above lake on Welch Ridge; 0.7 km up creek from mouth of Goldmine Creek; 0.7 km S of Payne Cemetery; 0.4 km up trail from lake on Forney Creek; 0.2 km W mouth of Hazel Creek; Oconaluftee Staff Apartments. Tennessee: Blount Co.: Cades Cove; vic. Cades Cove; Cades Cove ATBI house, 2000 mi SW; Cades Cove Ranger Station; Cades Cove Primitive Baptist Church; Cades Cove Abrams Creek Springs; Cades Cove Loop, Abrams Creek; Tremont; Cocke Co.: Cosby, 1/4 mi inside entrance; Cosby campground; Cosby Ranger Station; Cosby picnic area off Gabes Mountain trail; Foothills Parkway; Foothills Parkway at I-40; Foothills Parkway, 4.5 mi from Rt. 321; Foothills Parkway, 3rd overlook from Cosby; Sevier Co.: Greenbrier Ranger Station; Elkmont; Jake's Creek Trail; Jake's Creek Trail, Campsite #27; Jake's Creek Trail, above Campsite #27; Park Headquarters. (91 specimens)

Elevation range: 1330–5930 ft. (405–1807 m)

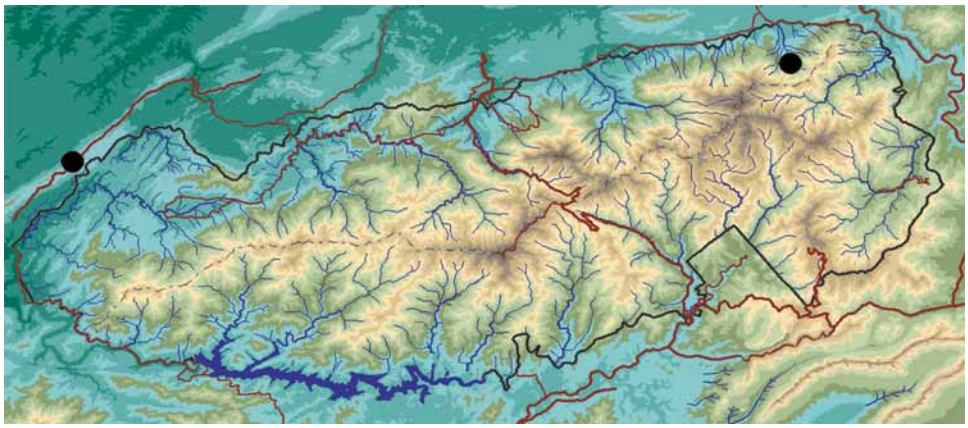
General distribution: Massachusetts to Florida, west to Texas and Arizona, and from the Midwest in Ohio, Missouri, Kansas, and Oklahoma.

Larval hosts: Smooth crabgrass (*Digitaria ischaemum* (Schreb.) Schreb. Ex Muhl., Poaceae) and saltmarsh morning-glory (*Ipomoea sagittata* Poir., Convolvulaceae).

7. *Ozarba aeria* (Grote), Aerial Brown

(Figs. 23–26, Map 13)

Identification: Forewing length 7.9-10.0 mm. The basal third of the forewing varies from light gray to brown to pale reddish brown. Antemedial and medial lines (both can be absent) are faint, zigzag, and darker than ground color. Center of reniform spot is dark gray with scales barely tipped with white; a short, slender white line and a similar-sized black line are contiguous with reniform spot proximally. Postmedial line is white with a dark ground color to black proximal border; angulate from costa to reniform spot with two peaks adjacent to reniform spot then almost straight to posterior margin. Adjacent to the peaks of the postmedial line are several streaks of black scales that vary in number and size. Subterminal line is a faint, white, sinuate line from subapical spot on costa to tornus. Terminal line consists of a series of short, black dashes between veins that can be absent on some specimens. Hind wing is gray with a white fringe that is streaked with light gray.



MAP 13. Collecting localities of *Ozarba aeria*.

Flight period: Mid May.

Collected localities: Tennessee: Blount Co.: West Foothills Parkway at E end; Cocke Co.: Cosby Creek above Cosby Campground. (2 specimens)

Elevation range: 1001–2560 ft. (305–780)

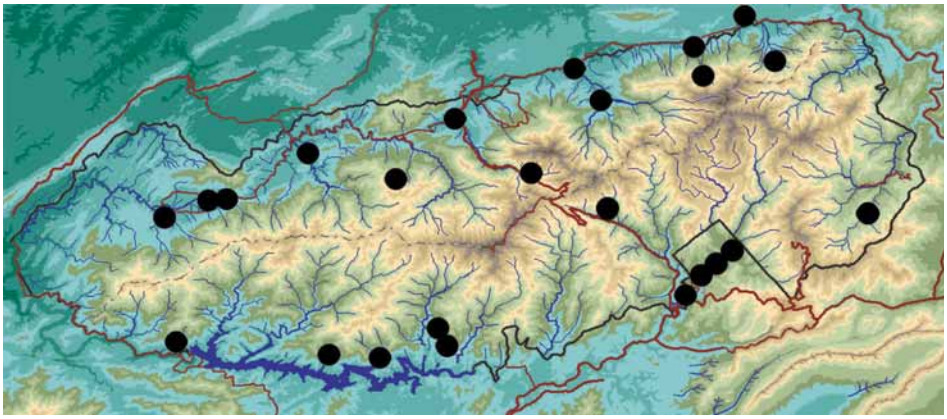
General distribution: This species has a disjunct distribution from Maryland, Virginia, southern Ohio, Tennessee, Texas, and Louisiana.

Larval hosts: Unknown.

8. *Protodeltote muscosula* (Guenée), Large Mossy Lithacodia

(Figs. 27–28, Map 14)

Identification: Forewing length 9.0-12.0 mm. This is a dark species heavily mottled with white, gray, black, and olive scales. Forewing with a black and olive quadrate patch on costa proximal to reniform spot; reniform spot gray, centered and outlined in white; olive patch with central black line below reniform; postmedial and subterminal lines olive; elongate black spots along outer margin. Hind wing is pale gray to gray. Ueda (1984, 1987) revised the group of genera related to *Deltote* R. L. from Japan and Taiwan and described the genus *Protodeltote* Ueda 1984. The North American species *P. muscosula* and *P. albidula* (Guenée) were determined to be congeneric with *Protodeltote* (Lafontaine and Schmidt 2010).



MAP 14. Collecting localities of *Protodeltote muscosula.*

Flight period: May to September.

Collected localities: North Carolina: Haywood Co.: Purchase Knob; Purchase Knob, on road in meadow; Purchase Knob, by Ferguson cabin; Purchase Knob, at house; Purchase Knob, at lower creek; Purchase Knob, NW of house; Purchase Knob, in woods at base of knob; Swain Co.: Big Cove Rd., site b, site c, site p; Kephart Prong Trail; 0.5 km from mouth of Chambers Creek, 300 feet up hillside on NW side; 300 feet above lake on Welch Ridge; 0.7 km up creek from mouth of Goldmine Creek; 0.7 km W of Payne Cemetery; 0.4 km up trail from lake on Forney Creek; Oconaluftee Staff Apartments. Tennessee: Blount Co.: vic. Cades Cove; Cades Cove Ranger Station; Cades Cove ATBI house, 2000 m SW; near gate to Cades Cove Loop; Cades Cove, Forge Creek Rd.; Tremont; Cocke Co.: Albright Grove Trailhead; Cosby campground area; Cosby Ranger Station; Foothills Parkway; Foothills Parkway, N of 3rd pullout; Maddron Bald Trail; Sevier Co.: Greenbrier Ranger Station; Greenbrier picnic shelter; Jake's Creek Trail, Campsite #27; Jake's Creek Trail; Jake's Creek Trail above Campsite #27; Elkmont, Jakes' Creek; Park Headquarters; ca. 7 mi S Sugarlands Visitor Center. (98 specimens)

Elevation range: 1360–4924 ft. (415–1501 m)

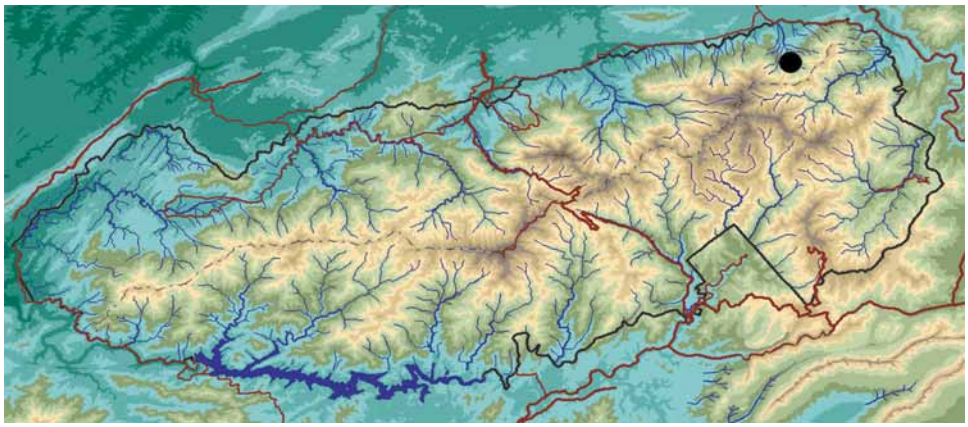
General distribution: Nova Scotia to northern Florida, west to Texas, Missouri, and North Dakota.

Larval hosts: Grasses (Covell 1984).

9. *Tripudia rectangula* Pogue

(Fig. 29, Map 15)

Identification: Forewing length 6.0-7.0 mm. This is a small moth with a dark gray forewing and a large black quadrate patch on the posterior margin that extends into the middle of the forewing. A small bar of brown dissects the quadrate patch near the apex. Hind wing is gray to dark gray.



MAP 15. Collecting localities of *Tripudia rectangula.*

Elevation range: 1750 ft. (533 m)

General distribution: An eastern species from Massachusetts to Florida and west to Louisiana, Tennessee, Illinois, Kansas, and Oklahoma.

Larval hosts: The only recorded host is wild petunia (*Ruellia* sp., Acanthaceae), where larvae bore into the seed (Pogue 2008).

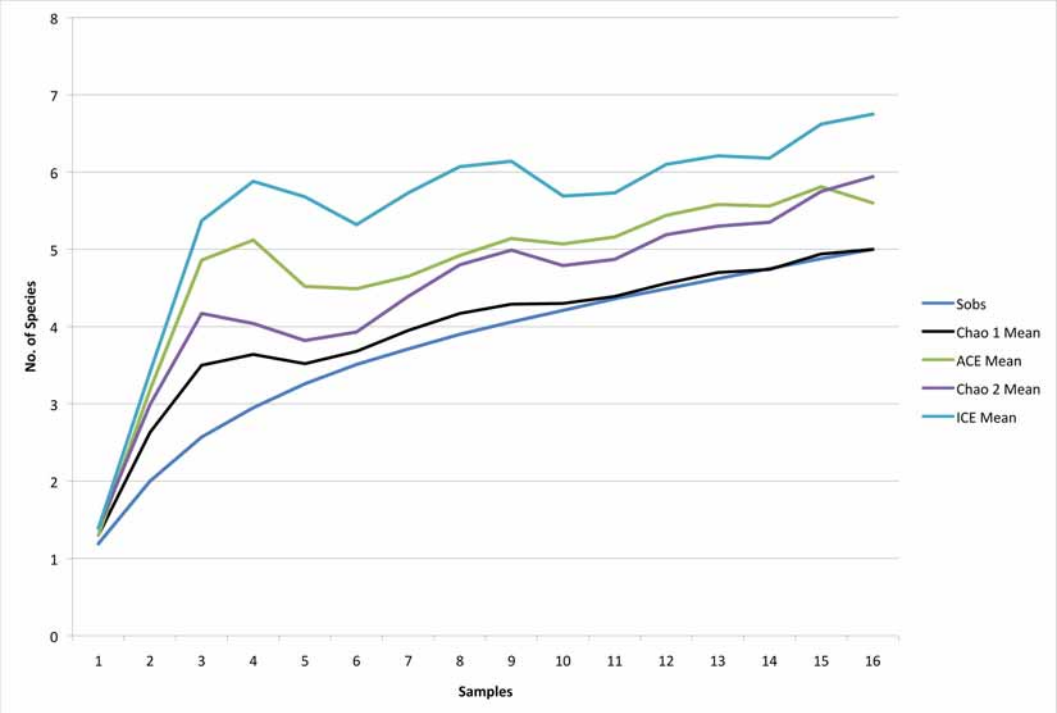


FIGURE 1. Acontiinae species accumulation curve. Sobs = 5; Chao 1 Mean = 5; ACE Mean = 5.6; Chao 2 = 5.94; ICE Mean = 6.75. Samples = 16.

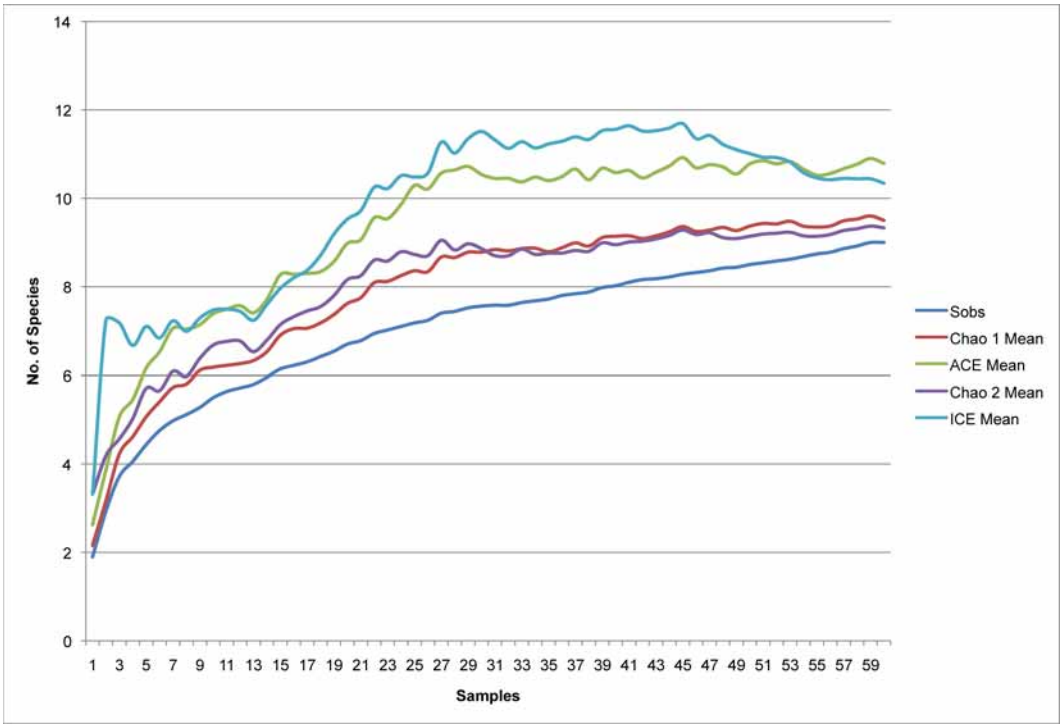


FIGURE 2. Eustrotiinae species accumulation curve. Sobs = 9; Chao 1 Mean = 9.5; ACE Mean = 10.79; Chao 2 = 9.33; ICE Mean = 10.34. Samples = 60.

Discussion

The Acontiinae are represented in North America by 87 species. This subfamily is most diverse in western North America with 52 species, in the east there are 26 species, and there are nine widespread species that are present in both the East and West. This group is not well represented in GSMNP, with only five species and 30 specimens from 15 localities. The most abundant species is *P. erastrioides* with 13 specimens collected at six different localities that range in elevation from 1001–4924 feet (305–1501 m) and are distributed at both ends of the Park (Map 3).

There are 51 species of Eustrotiinae recorded from North America. There are 21 eastern species, 26 western, and four widespread species. There are nine species in GSNMP from 60 localities. The four most diverse localities in the Park were the Cosby Ranger Station, Cocke Co., Tennessee; 0.5 km from mouth of Chambers Creek, 300 feet up hillside on NW side, Swain Co., North Carolina; 300 feet above Lake Fontana on Welch Ridge, Swain Co., North Carolina; and NW of house on Purchase Knob, Haywood Co., North Carolina, each with six species. The most abundant species are *P. muscosula* (98 specimens) and *M. nigrofimbria* (91 specimens).

For the acontiines, the abundance-based estimator Chao 1 exactly predicts the number of observed species (Fig. 1). The other abundance-based estimator, ACE, and the incidence estimators, Chao 2 and ICE, predict 5.6, 5.94, and 6.75 species, respectively (Fig. 1). Based on these estimators, only 1 or 2 more species are likely to be added to the Park list.

Both the Chao 1 and Chao 2 estimators predicted the number of Eustrotiinae species in the Park at 9.5 and 9.33 respectively. The ACE and ICE estimators predicted only slightly higher at 10.79 and 10.34, respectively (Fig. 2). The two singletons and one doubleton species is what the Chao 1 estimator is using to predict the 9.5 species estimate. If more specimens of any of these species were collected, the estimator would predict the number of observed species. Based on these estimators the species accumulation curve for Eustrotiinae has essentially reached its asymptote and only 1 or 2 more species are likely to be added to the park.

There are so few faunistic studies of places like GSMNP that it is difficult to compare the biodiversity among different areas. The Acontiinae may be compared between GSNMP and the states of Kentucky (Covell 1999, Covell and Gibson 2008), Ohio (Rings, *et al.* 1992), and Maryland (unpublished list). The five species present in GSMNP seems a reasonable number as compared with the 10 species from Kentucky and eight from Ohio and Maryland.

Great Smoky Mountains National Park has nine species of Eustrotiinae, which is the same as Kentucky, Ohio, and Maryland. The much smaller area of GSMNP is highly diverse for this subfamily.

Acknowledgments

Discover Life in America (DLIA) provided partial funding for this project in 2003, 2004, and 2007. Jeanie Hilten of DLIA was helpful in providing logistic support during my stays in GSNMP and Keith Langdon of the National Park Service was instrumental in providing collecting permits. David L. Wagner (University of Connecticut, Storrs, CT) and Brian Scholtens (College of Charleston, Charleston, SC) helped organize and invited me to participate in the Lepidoptera BioBlitzes held during 2000, 2002, and 2004. Brian Scholtens provided his main database of the Noctuidae, which was helpful in obtaining records that were new to me. David Wagner provided specimens included in this study. David Adamski (Systematic Entomology Laboratory, U.S.D.A., Washington, DC) prepared the maps and figures. Eric H. Metzler (Alamogordo, New Mexico) and Thomas J. Henry and David A. Nickle (Systematic Entomology Laboratory, U.S.D.A., Washington, DC) critically reviewed a draft of this paper.

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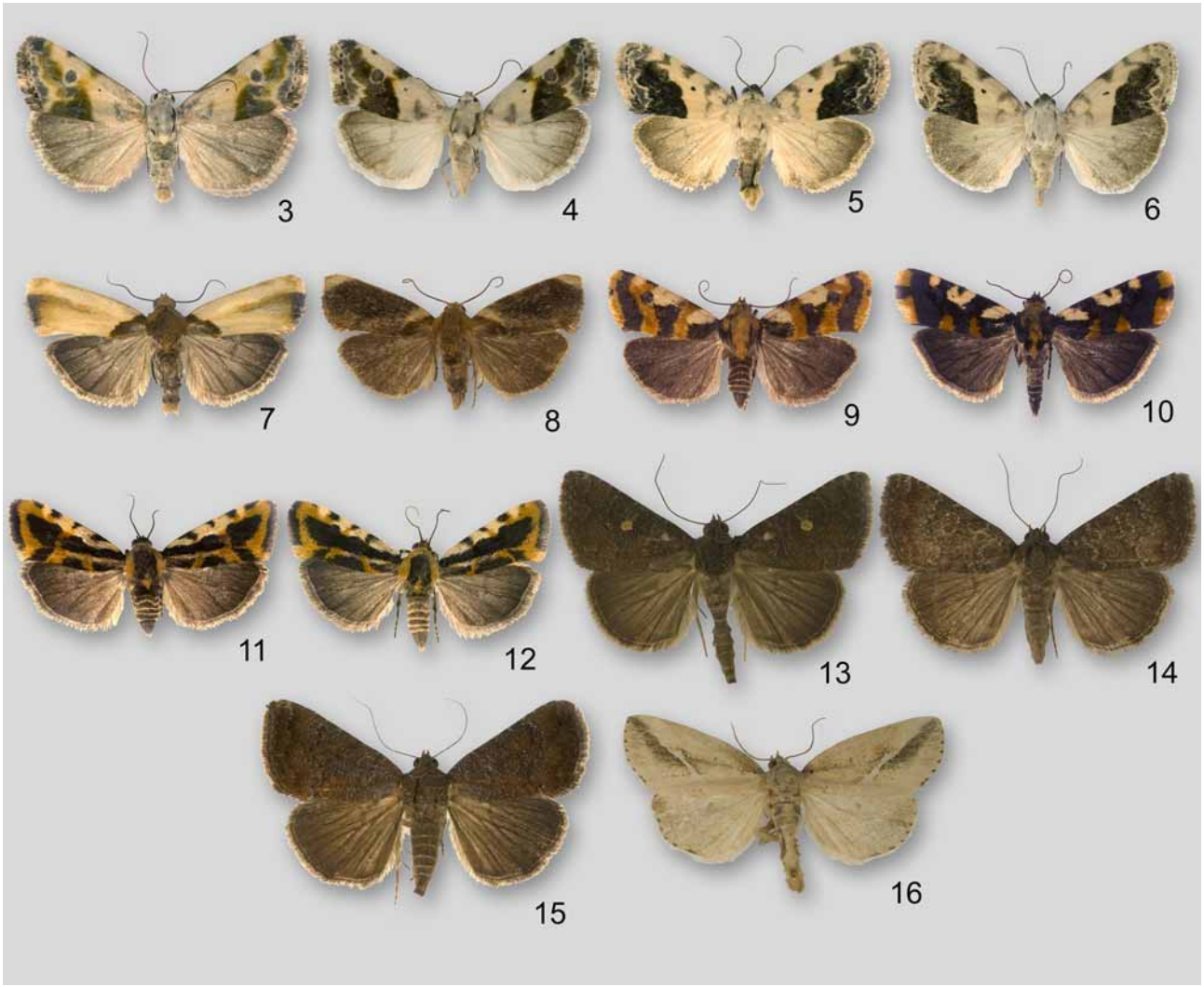
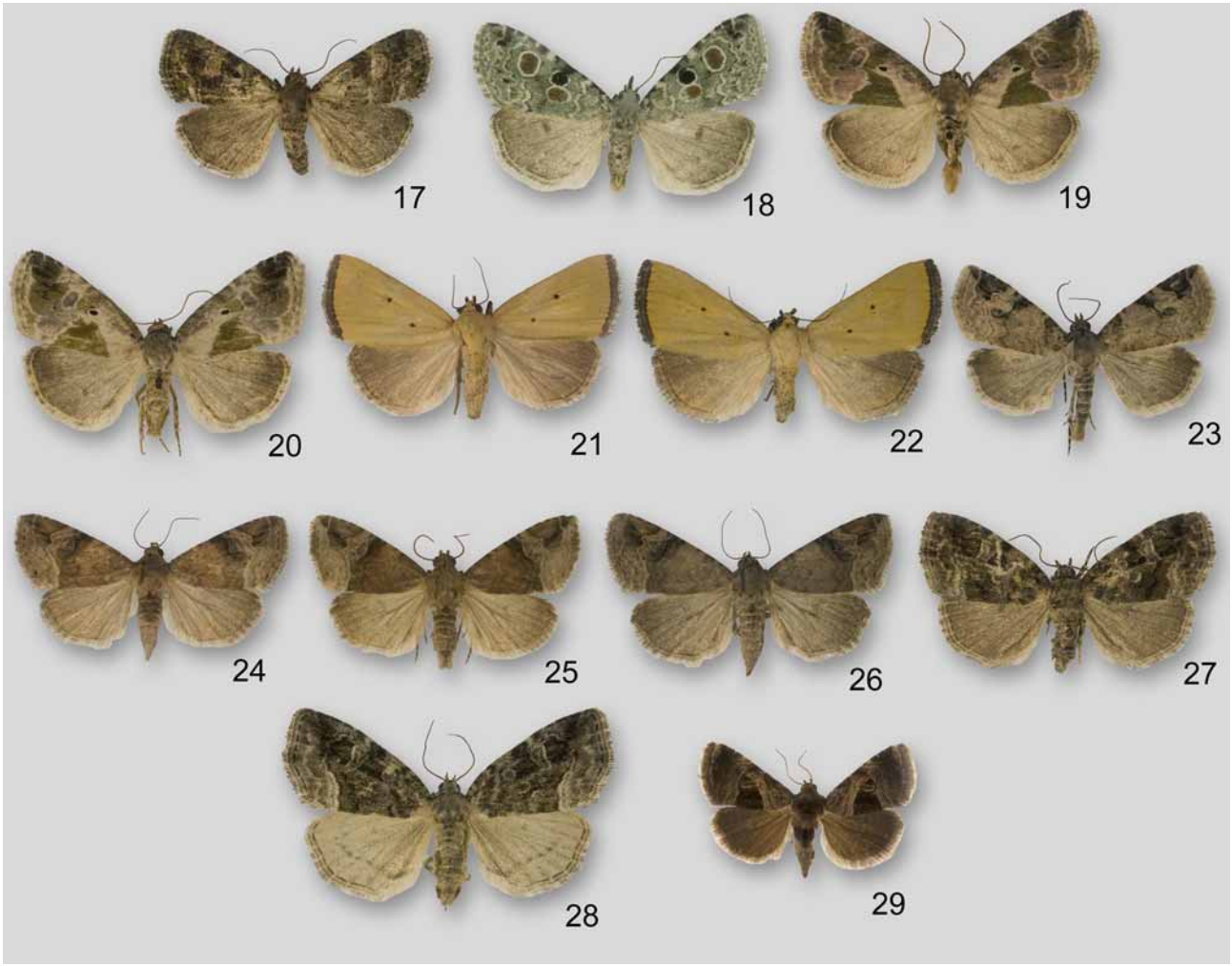


FIGURES 3–16. Adults. 3, *Ponometia candefacta*, m, Oklahoma, Cimarron Co., Black Mesa State Park, east end of primitive area, nr. Lake Elling, 4281 ft., 36o 50.783' N, 102o 52.583' W, 24 Aug. 2004, M.G. Pogue; 4, *Ponometia candefacta*, f, Arkansas, Washington Co.: Devil's Den State Park, 12 July 1966, R.W. Hodges; 5, *Ponometia erastrioides*, m, Maryland, Montgomery Co.: Colesville, 29 Aug. 1978, D.C. Ferguson; 6, *Ponometia erastrioides*, f, Arkansas, Washington Co.: Devil's Den State Park, 25 June 1966, R.W. Hodges; 7, *Spragueia apicalis*, m, Texas, Montgomery Co., Camp Strake 9 Sep. 1975, A. & M.E. Blanchard; 8, *Spragueia apicalis*, f, Texas, Tyler Co., Town Bluff (Dam B) 15 Sep. 1975, A. & M.E. Blanchard; 9, *Spragueia dama*, f, Maryland, Dorchester Co., Fishing Bay Wildlife Management Area, 7 Aug. 1999, J. Glaser; 10, *Spragueia dama*, f, Maryland, Prince Georges Co., Spice Creek Marsh, 17 Aug. 2003, J. Glaser; 11, *Spragueia leo*, f, Maryland, Prince Georges Co.: Oxon Hill, 11 July 1972, G.F. Hevel; 12, *Spragueia leo*, f, Arkansas, Washington Co.: Devil's Den State Park, 3 June 1966, R.W. Hodges; 13, *Amyna axis*, m, Texas, Tarrant Co., Fort Worth, 14 Sep. 1962, E. Jackh Jr.; 14, *Amyna axis*, f, Texas, Cameron Co.: Brownsville, 27 Oct. 1970, A. & M.E. Blanchard; 15, *Amyna axis*, f, Texas, La Salle Co.: Artesia Wells, 11 Nov. 1971, A. & M.E. Blanchard; 16, *Argillophora furcilla*, m, Florida, Alachua Co.: Gainesville, hardwood hammock, 25 May 1972, E.C. Knudson.



FIGURES 17–29. Adults. 17, *"Lithacodia" musta,* f, Tennessee, Sevier Co., Jake's Creek trail above campsite #27, GSMNP, 3600 ft., 23 July 2004, M.G. Pogue, USNMENT 00221900; 18, *Maliattha concinnimacula,* m, North Carolina, Haywood Co., Cataloochee, pull off at Sal Patch Gap, GSMNP, 3440 ft., 18 May 2005, M.G. Pogue, USNMENT 00254469; 19, *Maliattha synochitis,* m, Nebraska, Cherry Co., Valentine National Wildlife Refuge, Hackberry Lake, 8 June 1983, D.C. Ferguson; 20, *Maliattha synochitis,* f, Maryland, Allegany Co., Warrior Mountain Wildlife Management Area, 25 June 2001, J. Glaser; 21, *Marimatha nigrofimbria,* f, Tennessee, Sevier Co., GSMNP, Jake's Creek Tr., above Campsite #27, 3600 ft., 23 July 2004, M.G. Pogue, USNMENT 00221897; 22, *Marimatha nigrofimbria,* f, Tennessee, Cocke Co., Cosby Picnic area off Gabes Mountain trail, GSMNP, 2200 ft., 29 July 2007, M. Pogue, D. Adamski, M. Metz, GSMNP 1063; 23, *Ozarba aeria,* m, Maryland, Prince Georges Co., Ft. Washington Park, 6 June 2003, J. Glaser; 24, *Ozarba aeria,* f, Texas, Uvalde Co., Garner State Park, 21 Sep. 1965, A. & M.E. Blanchard; 25, *Ozarba aeria,* m, Texas, Kimble Co., Junction, 26 Oct. 1973, A. & M.E. Blanchard; 26, *Ozarba aeria,* f, Texas, Culberson Co., Sierra Diablo Wildlife Management Area, 6000 ft., 15 July 1971, A. & M.E. Blanchard; 27, *Protodeltote muscosula,* f, Tennessee, Sevier Co., Jake's Creek trail above campsite #27, GSMNP, 3600 ft., 23 July 2004, M.G. Pogue, USNMENT 00221898; 28, *Protodeltote muscosula,* f, Canada, Nova Scotia, Halifax Co., Arndale, 12 July 1972, D.C. Ferguson; 29, *Tripudia rectangula,* f, Arkansas, Washington Co., Devil's Den State Park, 5 July 1966, R.W. Hodges.

Index to animal names

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