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## Fifteen new species of *Sonoma* Casey from the eastern United States and a description of the male of *Sonoma tolulae* (LeConte) (Coleoptera: Staphylinidae: Pselaphinae)

Michael L. Ferro

Louisiana State Arthropod Museum, spongymesophyll@gmail.com

Christopher E. Carlton

Louisiana State University Agricultural Center, ccarlt@lsu.edu

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Fifteen new species of *Sonoma* Casey from the eastern United States  
and a description of the male of *Sonoma tolulæ* (LeConte)  
(Coleoptera: Staphylinidae: Pselaphinae)

Michael L. Ferro

Louisiana State Arthropod Museum,  
Department of Entomology, LSB 400  
Louisiana State University Agricultural Center  
Baton Rouge, LA 70808, U.S.A.

Christopher E. Carlton

Louisiana State Arthropod Museum,  
Department of Entomology, LSB 400  
Louisiana State University Agricultural Center  
Baton Rouge, LA 70808, U.S.A.

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Fifteen new species of *Sonoma* Casey from the eastern United States  
and a description of the male of *Sonoma tolulae* (LeConte)  
(Coleoptera: Staphylinidae: Pselaphinae)

Michael L. Ferro

Louisiana State Arthropod Museum  
Department of Entomology, LSB 400  
Louisiana State University Agricultural Center  
Baton Rouge, LA 70803, U.S.A.  
spongymesophyll@gmail.com

Christopher E. Carlton

Louisiana State Arthropod Museum  
Department of Entomology, LSB 400  
Louisiana State University Agricultural Center  
Baton Rouge, LA 70803, U.S.A.  
ccarlton@lsu.edu

**Abstract.** Fifteen **new species** of faronine pselaphines in the genus *Sonoma* Casey are described: *S. baylessae*; *S. brasstownensis*; *S. chouljenkoi*; *S. cygnus*; *S. gilae*; *S. gimmeli*; *S. holmesi*; *S. mayori*; *S. nicholsae*; *S. parkorum*; *S. nhunguyeni*; *S. sokolovi*; *S. streptophorophallus*; *S. tishechkini*; *S. tridens*. Male specimens of *Sonoma tolulae* (LeConte) were collected from the type locality and this species is redescribed. These species bring the total diversity of the genus to 43 species. The genus is divided into four species groups based on characters of the male genitalia. *Sonoma corticina* Casey was not included in the genus when it was described, thus it cannot be the type species of the genus. We **here designate** *Sonoma tolulae* (LeConte) as the type species of the genus *Sonoma*. A key is provided that will allow discrimination of all eastern species. Life history, habitat, and collection techniques are discussed.

## Introduction

*Sonoma* was described by Casey (1886) to include two species previously placed in *Faronus*, *S. tolulae* (LeConte) and *S. isabellae* (LeConte) (LeConte 1849, 1851). Casey did not designate a type species. Casey (1887) later described two more species (*S. corticina* Casey and *S. cavifrons* Casey) and moved *Euplectus parviceps* Mäklin (1852) into *Sonoma*. Casey refers to “*parviceps* Mäkl” in the diagnoses of the two new species but never mentions the genus *Euplectus* by name. In the first revision of the genus Casey (1893) described four more species (*S. grandiceps* Casey, *S. longicollis* Casey, *S. subsimilis* Casey, and *S. rubida* Casey), and *S. parviceps* (Mäklin) was redescribed. In that same publication Casey (1893) moved *S. tolulae* into a new genus, *Rafonus*, but it was returned when Raffray (1904) synonymized *Rafonus* with *Sonoma*. Lucas (1920) designated *S. corticina* Casey as the type species for the genus; however, this designation is invalid, see below. For nearly three-quarters of a century no new species of *Sonoma* were described until Park and Wagner (1962) added three from the Pacific Northwest, *S. margemina* Park and Wagner, *S. hespera* Park and Wagner, and *S. olycalida* Park and Wagner. The genus was revised again by Marsh and Schuster (1962) who synonymized Casey’s *S. longicollis* and *S. subsimilis* with *S. cavifrons*, and described nine additional species, *S. repanda* Marsh and Schuster, *S. spadica* Marsh and Schuster, *S. dolabra* Marsh and Schuster, *S. vanna* Marsh and Schuster, *S. triloba* Marsh and Schuster, *S. cuneata* Marsh and Schuster, *S. humilis* Marsh and Schuster, *S. dilopha* Marsh and Schuster, and *S. priocera* Marsh and Schuster. This brought the total number of valid species of *Sonoma* to 19, all but one of which were found on the Pacific coast of North America, leaving only one, *S. tolulae*, described from eastern North America. In their revision Marsh and Schuster (1962) redescribed *S. tolulae* and provided an illustration of male genitalia even though the holotype of *S. tolulae* is female (MCZ Type Database 2009). They did not mention how many specimens of *S. tolulae* were studied and only one locality was given as a new distributional record, so presumably only one specimen, or a series of specimens from a single locality were examined (see comments below). Chandler (1983) described an additional species, *S. yahiorum* Chandler, from California, and five more species (Chandler 1986) from Oregon, *S. petersi*



Chandler, *S. cascadia* Chandler, *S. quercicola* Chandler, *S. conifera* Chandler, and *S. russelli* Chandler. A survey of the pselaphid fauna of Tehama and surrounding counties in California resulted in the discovery of three more species, *S. tehamae* Chandler, *S. wintuorum* Chandler, and *S. konkoworum* Chandler (Chandler 2003). *Sonoma yahiorum* was transferred to *Megarafonus* (Chandler 2003). The most recently described species of *Sonoma*, from British Columbia, is *S. squamishorum* Chandler and Klimaszewski (McLean et al. 2009). These later papers brought the total number of species to 28, all from western North America, with the exception of *S. tolulae* (Map 1).

*Sonoma corticina* Casey was not one of the originally included nominal species when Casey (1886) erected *Sonoma*. Therefore, Lucas' (1920) designation of *S. corticina* as type species for the genus is invalid under Article 69 (ICZN 1999). We **herein designate** *Sonoma tolulae* the type species for the genus *Sonoma* Casey 1886.

During 2001 researchers from the Louisiana State Arthropod Museum and collaborators began documenting the beetle diversity of Great Smoky Mountains National Park (GSMNP) (Bayless and Carlton 2005, Carlton and Bayless 2007). This renewed interest in the pselaphine fauna of the area and resulted in the collection of many more specimens. Don Chandler (pers. com.) suspected that there were several cryptic species of *Sonoma* in eastern North America based on genitalic differences and encouraged the author MLF to pursue this line of inquiry further. The type locality of *Sonoma tolulae* was visited and male specimens were collected.

## Materials and Methods

The following institutions and curators loaned material on which this study is based with depositions of primary types as indicated: Field Museum of Natural History (**FMNH**, James Boone and Alfred F. Newton, Jr., Curators); Great Smoky Mountains Natural History Museum (**GSMNP**, Adriean J. Mayor Curator); University of New Hampshire Insect Collection (**DENH**, Donald S. Chandler, Curator); Museum of Comparative Zoology (**MCZC**, Philip D. Perkins, Curator); Louisiana State Arthropod Museum (**LSAM**, Victoria Bayless, Curator); James F. Cornell (**JFCC**, Charlotte, North Carolina). Throughout the text **GSMNP** is used as an abbreviation for the Great Smoky Mountain National Park in label data and discussions.

Verbatim label data are given for all male specimens examined, with specimens separated by an asterisk ("\*"), label breaks indicated by a slash ("/"), and the lending institution and number of specimens are indicated, e.g. "(FMNH) (4M)". Label information for some paratypes has been slightly altered to increase clarity and accuracy. All specimens from Louisiana State Arthropod Museum have a database number as a separate label (i.e. "/LSAM 0000000"). Those specimens are deposited in the LSAM unless otherwise indicated. All holotypes of newly described species are deposited in FMNH.

Collection of additional specimens by ourselves (and others) was done using a sifting/Berlese technique as outlined in Schauff (2001).

Dissections of genitalia were performed after relaxing dried specimens in a warm water bath for 30 minutes. Alcohol preserved specimens were dissected with no additional preparation. Fine forceps were used to anchor the body, an insect pin was inserted between the fourth and fifth visible abdominal segments, the terminal segments of the abdomen were removed, and the aedeagus was extracted. Specimens were allowed to dry and repointed using Elmer's Glue-All®.

The aedeagus was placed directly into glycerin if clean, or cleared briefly in warm 10% KOH solution if contaminated with tissue, then placed into glycerin following an alcohol wash. Sometimes the genitalia of previously dried specimens contained air bubbles within the endophallus or parameres. These were removed by placing the aedeagus in a glass screw cap vial filled with enough alcohol to ensure no air bubbles would form when sealed. The cap was securely screwed down and the vial was left to set for several minutes. The bubble-less genitalia were then carefully recovered. Presumably the increased pressure allowed the air bubbles to dissolve into the alcohol or otherwise drove them from the aedeagus. A temporary glycerin slide mount was prepared and the aedeagi were examined using an Olympus BMax50 compound microscope and illustrated using a camera lucida. Aedeagi and any other detached parts of the specimens were stored in glycerin microwells or glued to cellulose acetate strips with dimethyl hydantoin formaldehyde and attached to the pins below point-mounted specimens.



Map 1. Distribution of *Sonoma* spp.

For each species not represented by a unique specimen, one specimen was cleared in warm 10% KOH overnight, disarticulated, and mounted on a microscope slide in euparal. Head, pronotum, elytra, and antennal measurements were taken from these slide-mounted specimens when they were available, otherwise measurements were taken from the holotype. All measurements are in millimeters. All measurements were taken in the dorsal view and represent the maximum value. The head was measured from the anterior margin of the clypeus to the back of the temples (area of greatest constriction of the occiput), and width was measured at the middle of the eyes. Total length was measured from the holotype and was from the anterior margin of the clypeus to the end of the fourth visible abdominal tergite. Tergite one refers to the first visible tergite.

Point-mounted specimens were examined using a Wild Heerbrugg stereo microscope. Whole specimens were photographed using a Syncroscopy® Automontage system and images were optimized using Adobe Photoshop®.

Maps were created using the mapping utility at <[www.gpsvisualizer.com](http://www.gpsvisualizer.com)> (Schneider 2009). Markers represent collection events, not specimens. Where multiple specimens were taken at a single locality, only one marker is shown. Localities represented by circles are from coordinates taken with a Global Positioning System at the time of collection and may be considered as or more accurate than the map scale allows. Triangles are used to represent localities with verbal descriptions only (label data provided in Material Studied) and the degree of accuracy and precision of these records is unknown. Where multiple samples were taken at the same general location (i.e. Brasstown Bald) care was taken to slightly stagger triangles to illustrate that multiple collections occurred.

## Systematic Accounts

### Classification of *Sonoma* Casey 1886

The 43 known species of *Sonoma* may be arranged into four species groups with distributions noted as state and province codes. For a full description of the genus see Marsh and Schuster (1962).

#### **isabellae group**

- S. cascadia* Chandler 1986 – OR
- S. cavifrons* Casey 1887 – CA, OR
- S. conifera* Chandler 1986 – OR
- S. corticina* Casey 1887 – CA
- S. cuneata* Marsh and Schuster 1962 – CA
- S. dilopha* Marsh and Schuster 1962 – CA
- S. dolabra* Marsh and Schuster 1962 – CA
- S. grandiceps* Casey 1894 – CA
- S. hespera* Park and Wagner 1962 – CA, OR
- S. humilis* Marsh and Schuster 1962 – CA
- S. isabellae* (LeConte 1851) – CA
- S. konkoworum* Chandler 2003 – CA
- S. margemina* Park and Wagner 1962 – BC, OR, WA
- S. olycalida* Park and Wagner 1962 – WA
- S. parviceps* (Mäklin 1852) – BC, OR, WA
- S. petersi* Chandler 1986 – OR
- S. priocera* Marsh and Schuster 1962 – OR
- S. quercicola* Chandler 1986 – OR
- S. repanda* Marsh and Schuster 1962 – CA
- S. rubida* Casey 1894 – CA
- S. russelli* Chandler 1986 – OR
- S. spadica* Marsh and Schuster 1962 – CA
- S. squamishorum* Chandler and Klimaszewski 2009 – BC
- S. tehamae* Chandler 2003 – CA

*S. triloba* Marsh and Schuster 1962 – CA  
*S. vanna* Marsh and Schuster 1962 – CA  
*S. wintuorum* Chandler 2003 – CA

#### cygnus group

*S. baylessae* **new species** – NC, TN  
*S. brasstownensis* **new species** – GA  
*S. cygnus* **new species** – GA, NC  
*S. parkorum* **new species** – NC, TN

#### tolulæ group

*S. chouljenkoi* **new species** – AL, GA, KY, NC, TN  
*S. gilae* **new species** – GA, TN  
*S. gimmeli* **new species** – NC, TN  
*S. nicholsae* **new species** – NC  
*S. sokolovi* **new species** – AL, GA  
*S. tolulæ* (LeConte 1849) – GA, NC, TN

#### tridens group

*S. holmesi* **new species** – NC, MD, PA, VA, WV  
*S. mayori* **new species** – TN  
*S. nhunguyeni* **new species** – AL  
*S. streptophorophallus* **new species** – VA  
*S. tishechkini* **new species** – GA, NC, SC  
*S. tridens* **new species** – KY

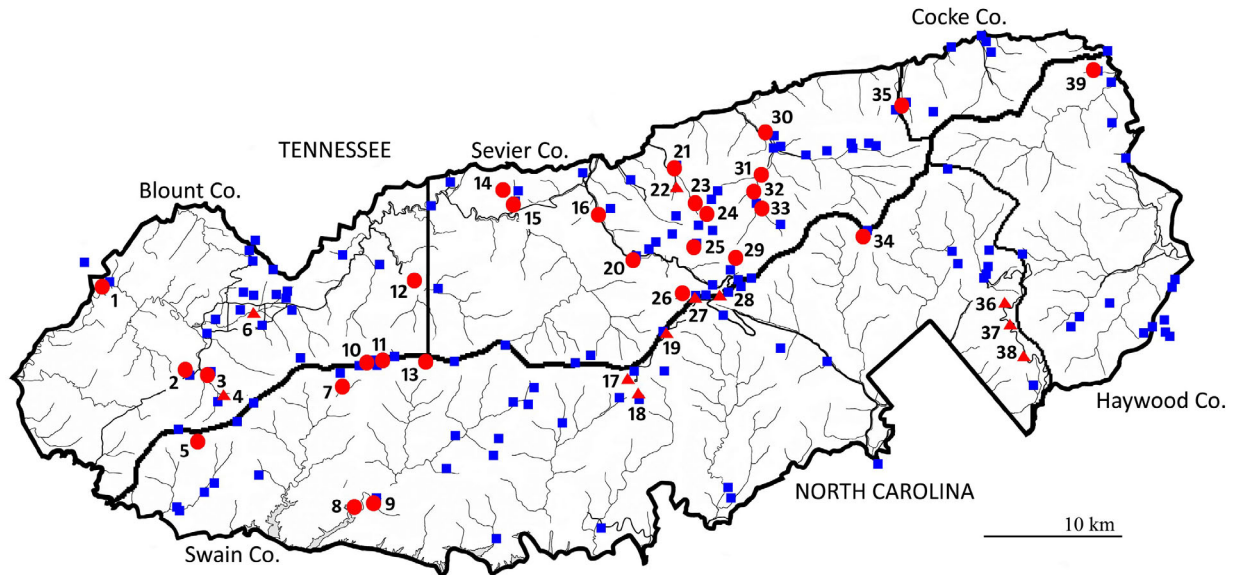
### Key to the males of *Sonoma* east of the Mississippi River

External differences, such as body size, frontal foveae, elytral foveae, size of the eye, and relative width of the first and second antennal segments are not adequate to distinguish species. The only reliable method of identifying male species of *Sonoma* (Fig. 17) is direct comparison of the aedeagus (Fig. 18-33). Aedeagus extraction is a straight forward process requiring no special preparation to the specimen (see Materials and Methods) and provides an unambiguous feature for identification. The known range of any given species is probably a function of sampling rather than its actual distribution in nature, therefore the collection of a species far from previously known localities should not be cause for alarm. For the same reasons, the existence of several to many additional undescribed species in eastern North America is expected. Females may only be identified circumstantially by association with males.

1. Left paramere with apical half internally lobed (scoop shaped), short, only extending posteriorly to basal half of endophallus, never elongate or blade like (Fig. 18-21) (cygnus group) ..... **2**
- Left paramere never internally lobed, usually elongate with a mesal blade or hook, extending posteriorly beyond basal half of endophallus (Fig. 22-33). In *S. mayori* (Fig. 33) and *S. nhunguyeni* (Fig. 29) the left paramere is blunt, but never internally lobed ..... **5**
- 2(1). Apical half of endophallus thick, strongly recurved to left; right paramere with acute apex (Fig. 18); GA, NC ..... **1. *S. cygnus* new species**
- Apical half of endophallus not recurved to left, either with large bulbous apex (Fig. 20), left lateral subapical process (Fig. 19), or wide apically expanded lamina (Fig. 21); right paramere with acute apex or not ..... **3**
- 3(2). Apical half of endophallus with left lateral subapical process; apex of right paramere broad with blunt mesal hook (Fig. 19); NC, TN ..... **2. *S. parkorum* new species**

- Apical half of endophallus without lateral subapical process, either with large bulbous apex (Fig. 20), or wide apically expanded lamina (Fig. 21); apex of right paramere acute ..... 4
- 4(3). Apical half of endophallus with large bulbous apex (Fig. 20); NC, TN ..... **3. *S. baylessae* new species**
- Apical half of endophallus with wide apically expanded lamina (Fig. 21); GA ..... **4. *S. brasstownensis* new species**
- 5(1). Aedeagus compact, ratio of width to length approximately 0.7-0.8; endophallus often with sigmoidally curved apex (Fig. 24-27); right paramere often with apical hook or subapical lobe (Fig. 22, 24, 26, 27) or scythe shaped (Fig. 23) (tolulae group) ..... 6
- Aedeagus elongate, ratio of width to length approximately 0.4-0.7; endophallus apex curved (Fig. 31) or not (Fig. 32), never sigmoidal; right paramere never with apical hook or subapical lobe, may have laterally curved claw (Fig. 28) (tridens group) ..... 11
- 6(5). Left paramere with apical hook (Fig. 22); NC ..... **5. *S. nicholsae* new species**
- Apex of left paramere without apical hook (Fig. 23-27) ..... 7
- 7(6). Endophallus with apex and subapical process connected by a thin membrane; right paramere scythe shaped (Fig. 23); GA, TN ..... **6. *S. gilae* new species**
- Apex of endophallus sinuate (Fig. 25-26), or elongate and strongly curved right; right paramere often with apical hook or subapical lobe (Fig. 24, 26, 27), or acute (Fig. 25) ..... 8
- 8(7). Endophallus with subapical shelf, apex strongly curved right; right paramere as wide as left paramere at midpoint (Fig. 24); NC, TN ..... **7. *S. gimmeli* new species**
- Endophallus without subapical shelf, apex curved left; right paramere about half as wide as left paramere at midpoint (Fig. 25-27) ..... 9
- 9(8). Left paramere with distal third convergent to acute apex; lateral digitate process of endophallus wide at base, approximately 2x width of right paramere; right paramere without apical hook or subapical lobe (Fig. 25); GA, NC, TN ..... **8. *S. tolulae* (LeConte)**
- Left paramere with distal third wide, blade like; lateral digitate process of endophallus narrow; right paramere with apical hook or subapical lobe (Fig. 26-27) ..... 10
- 10(9). Endophallus wide at base, basal left margin bulging, apex with wide, elongate sigmoidal curve to left; right paramere weakly angulate at midpoint, mesally curved to rounded apex (Fig. 26); AL, GA, KY, NC, TN ..... **9. *S. chouljenkoi* new species**
- Endophallus narrow at base, basal left margin straight, apex with shallow sigmoid curve to left; right paramere sides parallel, except lateral angulate process at midpoint and evenly rounded subapical internal lobe, apex acute (Fig. 27); AL, GA ..... **10. *S. sokolovi* new species**
- 11(5). Left paramere with acute apex extending to level of endophallus; endophallus with apex “U” shaped in dorsal profile and curved ventrally; right paramere with laterally curved claw (Fig. 28); VA. .... **11. *S. streptophorophallus* new species**
- Left paramere with acute apex extending to level of endophallus (Fig. 30) or not (Fig. 29, 31-33); apex of endophallus with at most subapical process, not “U” shaped (Fig. 29-31); right paramere without apical hook (Fig. 29-34) ..... 12
- 12(11). Endophallus with subapical process (Fig. 29-31) ..... 13
- Endophallus without subapical process (Fig. 32-33) ..... 15
- 13(12). Left paramere 1/2 length of endophallus, apex truncate; right paramere with apex rounded (Fig. 29); AL ..... **12. *S. nhunguyeni* new species**





**Map 2.** Collection localities of *Sonoma* spp. in GSMNP. *Sonoma baylessae*: 9, 27, 28, 29; *S. chouljenkoi*: 4, 8, 12, 16, 20, 21, 22, 30, 32, 33, 35; *S. gilae*: 1, 2, 3, 4, 5, 6, 14, 30, 32, 35; *S. gimmeli*: 30, 31, 35; *S. mayori*: 17; *S. nicholsae*: 38, 39; *S. parkorum*: 7, 11; *S. tolulae*: 3, 9, 10, 11, 13, 15, 18, 19, 23, 24, 25, 26, 29, 34, 36, 37. Red circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and red triangles represent localities with verbal descriptions only. Blue squares represent localities at which litter samples were taken as part of the Coleoptera component of the All Taxa Biotic Inventory.

- Left paramere at least 2/3 length of endophallus; right paramere with apex acute (Fig. 30-31) ..  
..... 14
- 14(13). Left paramere nearly as long as endophallus, with apical blade elongate; right paramere with lateral setose process approximately 1/6 length of entire paramere (Fig. 30); KY ..... 13. *S. tridens* new species
- Left paramere shorter, approximately 2/3 length of endophallus, apical blade not elongate; right paramere with lateral setose process elongate, 1/3 length of entire paramere (Fig. 31); NC, MD, PA, VA, WV ..... 14. *S. holmesii* new species
- 15(12). Aedeagus long and thin, ratio of width to length 0.38; lateral digitate process on endophallus small; right paramere with low setose process (Fig. 32); GA, NC, SC ..... 15. *S. tishechkini* new species
- Aedeagus wider, ratio of width to length 0.58; lateral digitate process of endophallus large, right paramere with large setose process (Fig. 33); TN ..... 16. *S. mayori* new species

### Description of species groups

The 43 species recognized in the present paper have been arranged into four species groups. The diagnostic characters used to distinguish the groups are based entirely on male aedeagal characters.

#### isabellae group

**Diagnosis.** Aedeagus compact, rarely with parameres as long as endophallus; the parameres are globose basally, with a distinct demarcation between base and any apical processes; often with thin elongate setae from one third to equal to length of paramere; parameres rarely with lateral blades or hooks.

**Distribution.** All species in this group are known from western North America and are not known to be sympatric with those from any other species group.

#### cygnus group

**Diagnosis.** Left paramere uniquely shaped with apical half internally lobed (scoop shaped); endophallus with an enlarged apex or elaborate subapical processes; and right paramere broad, as long as or longer than endophallus, usually with an acute apex or (*S. parkorum*) rounded process, but never a recurved hook.

**Distribution.** Species in this group form a small clump stretching from GSMNP in Tennessee south through the eastern tip of North Carolina to the northeast corner of Georgia. The cygnus group is sympatric with the tolulae and tridens groups.

#### tolulae group

**Diagnosis.** Aedeagus compact, ratio of width to length approximately 0.7-0.8; endophallus often with a sigmoidally curved apex that may be reduced to a hook (*S. nicholsae*) or further reduced and connected by a thin membrane to a subapical process (*S. gilae*); the right paramere has an apical hook or subapical lobe, or is acute apically and lacks a setose process.

**Distribution.** This group has the widest geographic range of the eastern species of *Sonoma*. This is due in large part to *S. chouljenkoi*, which occurs from mid-western North Carolina, through the eastern two thirds of Kentucky, the eastern half of Tennessee, north eastern Alabama, north western Georgia, and into GSMNP in western North Carolina. *Sonoma chouljenkoi* overlaps the known ranges of all other species in this group, although not entirely. The range of *Sonoma sokolovi* extends across to northwestern Alabama; the range of *S. gilae* and *S. tolulae* extends into southwestern North Carolina and northeastern Georgia. The tolulae group is sympatric over the entire range of the cygnus group and most of the tridens group.

#### tridens group

**Diagnosis.** Aedeagus elongate, ratio of width to length approximately 0.4-0.7; left paramere with acute apex or truncate (*S. nhunguyeni* and possibly *S. mayori*), never internally lobed; endophallus straight or shallowly curved, may or may not have a subapical process; right paramere as long as endophallus or nearly so, with an acute or rounded apex, but never with a mesal hook or subapical lobe (*S. streptophorophallus* has a unique laterally curved claw at the apex of the right paramere).

**Distribution.** This group has a very wide geographic range, but none of the species appear to be sympatric, although three species are known from single specimens and further collection may show range overlap. *Sonoma holmesi* has the most northern range of any of the eastern *Sonoma* and is found from southwestern Pennsylvania south to northwestern North Carolina. The rest of the group is geographically dispersed, occurring from western Virginia, westward to eastern Kentucky, south to northeastern Alabama, and east to southeastern North Carolina.

#### Diagnosis of *Sonoma*

Throughout eastern North America members of the genus can be distinguished from those of all other genera of pselaphines by the following combination of characters: head with deep frontal depression between antennal insertions; antennae lacking club, at most weakly clavate; elytra bearing discal foveae in addition to usual basal foveae; tarsomeres 1 and 2 short and subequal, tarsomere 3 relatively much longer (Newton et al. 2001).



## Species Accounts

### 1. *Sonoma cygnus* new species

Fig. 1, 18; Map 5

**Description.** Holotype, male. Measurements: head 0.33 long, 0.40 wide; pronotum 0.43 long, 0.48 wide; elytra 0.75 long, 0.33 wide; antennomeres 1-11 total 0.96; total length 1.92.

*Head.* Eyes prominent, maximum length in dorsal view  $4/5$  length of first antennal segment, with approximately 50 facets. Antennomere 2 approximately  $2/5$  width of 1; 3 smallest.

*Thorax.* Elytra with row of three large sutural foveae in basal third; central row of approximately 10 foveae contained in basal  $1/2$ . Winged.

*Abdomen.* Tergite one with transverse patch of microtrichia narrowly interrupted at midline. Weak basal lateral foveae on ventrites. Basal pubescence present on all visible ventrites.

*Aedeagus.* Asymmetrical. Left paramere: lobed internally (scoop shaped); short, basal half parallel sided; apical half bulbous, with apical margin mesally and mesal face concave; narrow posteriorly curved hooked process at midpoint of external margin, sub-apical setose process with 7 long stout setae, 3 inserted along lateral margin, 4 at apex of subapical process. Endophallus: base of lateral digitate process  $4/5$  width of base, basally broad, distally narrowed to broad truncate apex, ventrad from right paramere; apical one half thick, strongly re-curved to left. Right paramere: elongate, blade like; dorsolateral lobe on basal third with 6 long stout setae inserted distally; lateral constriction at level of digitate process of endophallus; lateral rounded lobe  $1/3$  from base; distal  $2/3$  twisted mesally, apically lamellate and ventral margin curved mesally. Parameres lacking tubercles.

**Type Material.** Holotype, male: \*Rabun Bald, Ga. Rabun Co. 30.V.64 El. 2,500' / Forest floor debris near dead wood / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). Deposited in FMNH.

**Paratypes** (n=3). **UNITED STATES: NORTH CAROLINA: Macon Co.:** \*N.C.: Macon Co. 2 mi NW Highlands 19–III–1976 / berlese rhododendron litter LEWatrous (DENH) (1M). \*N.C. Macon Co. Coweeta Hydrologic Lab rhododendron litter 13 Apr. 1979 R. Turnbow (DENH) (1M); same data (1M) SLIDE.

**Geographical Distribution.** *Sonoma cygnus* has been collected at three localities, Rabun County in the extreme northeastern corner of Georgia, and two localities in neighboring Macon County, North Carolina. The only available elevational record is from 760 m.

**Comments.** *Sonoma cygnus* adults have been collected during March - May. Specimens were collected from “forest floor debris near dead wood,” and “rhododendron litter” using a Berlese funnel.

*Sonoma cygnus* most closely resembles *S. baylessae* in aedeagal characters. The hooked process at the external margin of the left paramere, and the narrow digitate process and strongly recurved apex of the endophallus of *S. cygnus* will serve to separate it from *S. baylessae*. The strongly recurved apex of the endophallus is a unique feature in the genus.

**Etymology.** The specific epithet refers to the curved apical portion of the endophallus, which is reminiscent of curved neck of some species in the genus *Cygnus* (swan).

### 2. *Sonoma parkorum* new species

Fig. 2, 19; Map 2

**Description.** Holotype, male. Measurements: head 0.33 long, 0.41 wide; pronotum 0.41 long, 0.48 wide; elytra 0.76 long, 0.36 wide; antennomeres 1-11 total 1.00; total length 2.04.

*Head.* Eyes prominent, maximum length in dorsal view  $4/5$  length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately  $3/5$  width of 1; 3 smallest.

*Thorax.* Elytra with row of 5 sutural foveae in basal  $1/3$ ; two foveae lateral sutural foveae in basal  $1/4$ ; central row of 5 foveae in basal  $2/5$ . Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: swollen at base, lobed internally (scoop shaped) then narrowed to sharply falcate apex; subapical shelf ventrad, curved right, with 2 thick lateral setae; apex with 4 setae pointed mesally, all setae apically minutely bifid. Endophallus: lateral digitate process elongate, ventrad of right paramere, apex rounded, sharply curved dorsally; base thick, parallel sided, large left lateral subapical process; apex elongate, pointed slightly right, tip blunt. Right paramere: broad throughout; dorsal lateral setose process small, near base, with 5 apical setae; lateral constriction at level of digitate process of endophallus thin, nearly same width distad level of lateral digitate process of endophallus; apex broad with blunt mesal process. Tubercles of left paramere fine, concentrated on ventral face, less numerous dorsally. Right paramere with coarse, sparse tubercles on mesal dorsal face.

**Type Material.** Holotype, male: \*TENNESSEE: Blount Co. *GSMNP*, App. Tr. ~0.6 km W Mt. Thunderhead summit at 35°34.11'N 83° 42.00'W 1585m. Forest litter sifting 13 April 2006. A.K.Tishechkin / LSAM 0107285 (1M). Deposited in FMNH.

**Paratype** (n=2). **UNITED STATES: NORTH CAROLINA: Swain Co.:** \*Smoky Mts., N. C. Bryson City Deep Ck., 2,000 ft. / Aug. 27 1930 Darlington (MCZC) (1M). \*N CAROLINA: Swain Co. *GSMNP*, upper Eagle Creek Tr. at 35°33.03'N 83°43.98'W 1165m. Forest litter. 14 April 2006. A.K.Tishechkin / LSAM 0109115 (1M) SLIDE.

**Geographical Distribution.** *Sonoma parkorum* is known from three specimens, one from Blount County, Tennessee and two from Swain County, North Carolina. All specimens were collected within *GSMNP*. *Sonoma parkorum* was collected between 609 to 1585 m elevation.

**Comments.** Specimens were collected during April and August from leaf litter and extracted with Berlese funnels.

*Sonoma parkorum* has aedeagal characters unlike any other *Sonoma*. The large left lateral subapical process of the endophallus will serve to distinguish this species from all others in the genus.

**Etymology.** This species is named for: Orlando Park (1901-1969), a pselaphine specialist; and Jong-Seok Park, a staphylinid specialist and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at *GSMNP*.

### 3. *Sonoma baylessae* new species

Fig. 3, 20; Map 2

**Description.** Holotype, male. Measurements: head 0.32 long, 0.35 wide; pronotum 0.42 long, 0.45 wide; elytra 0.60 long, 0.32 wide; antennomeres 1-11 total 0.95; total length 1.84.

**Head.** Eyes large, maximum length in dorsal view equal to length of first antennal segment, with approximately 20 facets. Antennomere 2 approximately 2/3 width of 1; 3 smallest.

**Thorax.** Elytra with row of 5 sutural foveae in basal 2/5, first fovea large; single fovea lateral and slightly basal to second sutural fovea; central row of 3 foveae in basal 2/5. Brachypterous.

**Abdomen.** Tergite one without transverse patch of microtrichia. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: swollen at base, lobed internally (scoop shaped); subapical setose process large, flattened, curved dorsomesad; 2 thick setae inserted on lateral margin; 4 thick setae inserted along obliquely truncate apex; large rounded mesal lobe; subapical shelf narrow and spine-like. Endophallus: lateral digitate process base as wide as endophallus base, ventrad of right paramere, sharply curved dorsally; large bulbous apex. Right paramere: dorsolateral setose process near base, long, with 5 apical setae; lateral constriction at level of digitate process of endophallus; apical 4/5 sinuate, apex acute. Tubercles on parameres fine and sparse, concentrated dorsally on left paramere, dorsomesally on right paramere.

**Type Material.** Holotype, male: \*U.S.A., TN, Sevier Co. GSMNP, 0.5 km NE Newfound Gap, elev. 1600m 83°24'46"W, 35°38'9"N / forest litter Berlese 26 June 2001 C. Carlton, V. Moseley A. Tishechkin / LSAM0002288 (GSPN) (1M). Deposited in FMNH.

**Paratypes** (n=4). **UNITED STATES: NORTH CAROLINA: Swain Co.:** \*Gt.Smoky Mts.Nat.Pk. Newfound Gap Swain Co., N. C. 9.VI.60 Alt. 5000' Leaf duff / W. Suter & J. Wagner Collectors / [male symbol] (FMNH) (2M). \*N CAROLIA: Swain Co. *GSMNP*, Appalachian Tr. at Beech Gap. 35°28'27"N 83°42'27"W. 1650m. Forest litter / rotten wood 20 July 2003. A.Tishechkin / LSAM 0091887 (GSPN) (1M). **TENNESSEE: Sevier Co.:** \*USA Tenn. –N.Car. Sevier Co. GSMNP, Newfound Gap to Clingmans Dome / Lot # 76–107 Oct. 11, 1976 Berlesate R.Chenowith & R.T.Allen / LSAM0002046 (1M) SLIDE.

**Geographical Distribution.** *Sonoma baylessae* is known from the proximity of Newfound Gap in GSMNP, which is on the border of Sevier and Swain counties in Tennessee and North Carolina, respectively. One other specimen was collected approximately 30 km west at Beech Gap in GSMNP, Swain County, North Carolina. Specimens were collected between 1520 and 1650 m elevation.

**Comments.** Specimens were collected in June, July, and October from leaf litter and rotten wood and extracted using a Berlese funnel.

*Sonoma baylessae* has aedeagal characters unlike any other *Sonoma*. The large rounded mesal lobe of the left paramere and the large bulbous apex of the endophallus serve to distinguish this species from all others in the genus.

**Etymology.** This species is named for Victoria “Vicky-Loo” Lynn Moseley Bayless, co-collector of the holotype, curator of the Louisiana State Arthropod Museum, and participant and co-PI of the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

#### 4. *Sonoma brasstownensis* new species

Fig. 4, 21; Map 3

**Description.** Holotype, male. Measurements: head 0.31 long, 0.37 wide; pronotum 0.37 long, 0.44 wide; elytra 0.67 long, 0.35 wide; antennomeres 1-11 total 0.85; total length 2.04.

**Head.** Eyes large, maximum length in dorsal view 9/10 length of first antennal segment, with approximately 25 facets. Antennomere 2 approximately 7/10 width of 1; 3 smallest.

**Thorax.** Elytra with row of 4 sutural foveae in basal 1/3, first fovea large, distance from 2<sup>nd</sup> to 3<sup>rd</sup> fovea 3x distance from 3<sup>rd</sup> to 4<sup>th</sup>; single fovea lateral to second sutural fovea; central row of 5 foveae in basal 2/5. Winged.

**Abdomen.** Thick transverse row of microtrichia narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: swollen at base, lobed internally (scoop shaped); apex blunt with long curved lateral spine; single thick distolateral seta adjacent to apical spine, single thick mesal subapical seta; truncate mesal setose process with 5 thick apically finely bifid setae on distal margin. Endophallus: lateral digitate process long and wide, ventrad from right paramere, strongly curved dorsally; strongly curved ventrally in distal 1/3 with apically expanded lamina. Right paramere: dorsolateral setose process near base, long, apex rounded, with 5 thick apical setae; lateral constriction at level of digitate process of endophallus; apex blade-like, acute. Tubercles weak and sparse concentrated on lateral and ventral surface of left paramere, and absent from right paramere.

**Type Material.** Holotype, male: \*USA: Georg., Towns Co., 1 mi. S Brasstown Bald, (4000'), 15-V-1981, FMHD #81-169, ex litter under rhododen. on hillside 20 stream edge, L. Watrous (FMNH) (1M). Deposited in FMNH.

**Paratypes** (n=5). **UNITED STATES: GEORGIA: Towns Co.:** \*USA: Georg., Towns Co., 1 mi. S Brasstown Bald, (4000'), 15-V-1981, FMHD #81-169, ex litter under rhododen. on hillside 20 stream edge, L. Watrous (FMNH) (1M). \*USA: Georg., Towns Co., 1 mi. S. Brasstown Bald, 15-IV-1981, FMHD #81-172, ex damp litter at base of steep incline, L. Watrous (FMNH) (1M). **Union Co.:** \*Brasstown Bald, GA.

Union Co. 8.IX.63 El. 2,750' / Forest floor debris / H.R.Steeves,Jr. J.D.Patrick,Jr. Collectors / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M); same data, (FMNH) (1M) SLIDE. \*Brasstown Bald Union Co., GEORGIA 9.VIII.1965 / Moss on log W.Suter leg. / [male symbol] (FMNH) (1M).

**Geographical Distribution.** *Sonoma brasstownensis* is only known from Brasstown Bald, which is bisected by Towns and Union counties in northeastern Georgia, 830 - 1220 m elevation.

**Comments.** Specimens were collected during April, May, August, and September from litter under rhododendron, damp litter at the bottom of an incline, and from moss on a log.

*Sonoma brasstownensis* has aedeagal characters unlike any other *Sonoma*. The apically expanded lamina of the distal 1/3 of the endophallus will serve to distinguish this species from all others in the genus.

**Etymology.** This species is named for the type and only known locality, Brasstown Bald, Georgia.

### 5. *Sonoma nicholsae* new species

Fig. 5, 22; Map 2

**Description.** Holotype, male. Measurements: head 0.30 long, 0.38 wide; pronotum 0.42 long, 0.42 wide; elytra 0.50 long, 0.32 wide; antennomeres 1-11 total 0.90; total length 2.02.

**Head.** Eyes small, maximum length in dorsal view 2/3 length of first antennal segment, with approximately 25 facets. Antennomere 2 equal to width of 1; 3 smallest.

**Thorax.** Elytra with row of approximately 5 small sutural foveae in basal 1/3; central row of 3 foveae in basal 2/5. Presumed brachypterous.

**Abdomen.** Tergite one without transverse patch of microtrichia. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Compact; apex of endophallus extending beyond parameres. Left paramere: robust; dorso-lateral shelf 1/2 from apex with 6 thick setae; distal 1/3 evenly acuminate, apex hooked. Endophallus: lateral digitate process long, broad, ventrad from right paramere; sides divergent in apical 2/5; apex with large acute hook on left and rounded shelf on right. Right paramere: widened at base, dorsal lateral setose process elongate, with 5 apical setae; lateral constriction at level of digitate process of endophallus wide; apex abruptly curved mesally. Course, irregular tubercles present on mesal aspects of parameres.

**Type Material.** Holotype, male: \*U.S.A., NC, Haywood Co. GSMNP, Chestnut Branch Trail 83°07'24" W, 35°45'34" N elv. 740m, leaf litter Berlese 1 August 2001, A. Tishechkin / LSAM0002378 (1M). Deposited in FMNH.

**Paratype** (n=1). **UNITED STATES: NORTH CAROLINA: Swain Co.:** \*USA NC. Dirt Rd. from Heintooga Overlook to Cherokee / Lot #77-89 June 27, 1977 Berlesate 5100'-4900' R.Chenowith & J.Heiss / LSAM0002044 (1M).

**Geographical Distribution.** Specimens have been collected in GSMNP in Haywood and Swain counties, North Carolina between 740-1550 m elevation.

**Comments.** Specimens have been collected in June and August from leaf litter and extracted with a Berlese funnel.

*Sonoma nicholsae* has aedeagal characters unlike any other *Sonoma*, although it bears a superficial resemblance to *S. gimmeli*. The apical hooks on the parameres and endophallus of *S. nicholsae*, the lack of an apical hook on the left paramere, and the blunt subapical hook of the right paramere of *S. gimmeli* will serve to distinguish these two species.

**Etymology.** This species is named for Rebecca "Becky" Jo Nichols, Entomologist at GSMNP, and a supporter and promoter of the All Taxa Biodiversity Inventory in GSMNP.



**6. *Sonoma gilae* new species**

Fig. 6, 23; Maps 2, 6

**Description.** Holotype, male. Measurements: head 0.30 long, 0.38 wide; pronotum 0.39 long, 0.45 wide; elytra 0.53 long, 0.28 wide; antennomeres 1-11 total 0.92; total length 2.08.

**Head.** Eyes small, maximum length in dorsal view 7/10 length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 4/5 width of 1; 3 smallest.

**Thorax.** Elytra with row of three large sutural foveae in basal half; central row of 3 foveae in basal 1/2. Brachypterous.

**Abdomen.** Tergite one without transverse patch of microtrichia. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: base expanded in lower 1/3; evenly tapering to sharp acute apex; 6 subapical setae. Endophallus: lateral digitate process base 7/10 width of endophallus base, blunt, ventrad from right paramere; subapical process and apex wide, curved right apically, subapical process and apex connected by thin membrane which extends distally. Right paramere: longer than rest of aedeagus; basal third bulbous, bearing 5 thick setae on lateral face; lateral constriction at level of digitate process of endophallus; apical 2/3 scythe shaped, mesally arcuate, narrow and sharply acute. Parameres with scattered tubercles.

**Type Material.** Holotype, male: \*TENNESSEE: Cocke Co. *GSMNP*, Albright Grove @ 35°44.11'N 83°16.78'W 970m. Forest litter. 1 Aug 2004. J.Ciegler, A.Tishechkin / LSAM 0094824 (1M). Deposited in FMNH.

**Paratypes** (n=23). **UNITED STATES: GEORGIA: Union Co.:** \*Brasstown Bald, GA. Union Co. 27.IX.64 El. 2812' / Forest floor debris nr. rotten wood / H.R.Steeves, Jr. J.D.Patrick, Jr Collectors / H.R.Steeves, Jr. Collection (FMNH) (1M). \*Brasstown Bald, GA. Union Co. 24.X.65 El. 2415' / Forest floor debris nr. rotten wood / H.R.Steeves, Jr. J.D.Patrick, Jr Collectors / H.R.Steeves, Jr. Collection (FMNH) (2M). **TENNESSEE: Blount Co.:** \*Cade's Cove. Blount Co. Smoky Mts N.P. Tenn 13:IX:53, 5A KO / Field Mus. Nat. Hist. Orland Park Pselaphidae Colln. (FMNH) (1M). \*USA: TN: Blount Co. *GSMNP*, Cades Cove Parsons Branch Rd .5 mi from jct Force Creek Rd / 35°33.75'N 83°51.62'W Hemlock log litter 28 Jul 2004 SA Gil, J Hiltner / LSAM 0146840 (GSPN) (1M). \*USA: TN: Blount Co. *GSMNP*, lower Gregory Ridge Tr 1 mi from trail-head / Berlese leaf litter 28 Jul 2004 A Tishechkin Beetle Blitz / LSAM 0146909 (1M). \*TENNESSEE: Blount Co. *GSMNP*, lower Gregory Ridge Tr. @ 35°33.5'N 83°50.5'W. 630m. For. Litter 28 Jul 2004. A.K.Tishechkin / LSAM 0095574 (1M); same data LSAM 0095578 (1M). \*TENNESSEE: Blount Co. *GSMNP*, lower Cooper Rd. Tr.@35°37.02'N 83°55.61'W 375m. Forest litter. 31 July 2004. J.Ciegler & S.Gil / LSAM 0094923 (GSPN) (1M); same data, LSAM 0094925 (1M). \*TENNESSEE: Blount Co. *GSMNP*, Parsons Branch Rd. 0.5mi from jct. with Forge Creek Rd. 605m. 35°33.75'N 83°51.62'W. Forest litter 31 Jul. 2004. J.Hiltner & S.Gil / LSAM 0094934 (1M) SLIDE. \*TENNESSEE: Blount Co., *GSMNP*, upper Long Hungry Ridge Tr. at 35°30.89'N 83°51.00'W. 1390m. For. litter 12 April 2006. A.K.Tishechkin / LSAM 0109118 (GSPN) (1M). **Cocke Co.:** \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 24 VI – 15 VII 2006 SP35C – CWD Rear 1 – M Ferro / LSAM 0167670 (1M). \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 15 VII–17 VIII 2006 SP35A – CWD Rear 1 – M Ferro / LSAM 0167677 (1M). \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 5 October 2006 SP3 CWD5 2 of 3 – M Ferro / LSAM 0152199 (1M). \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 31 March 2007 SP3 CWD5 1 of 3 – M Ferro / LSAM 0152202 (1M). \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 31 March 2007 SP3 CWD5 3 of 3 – M Ferro / LSAM 0152203 (1M); same data, LSAM 0152204 (1M). \*USA: TN: Cocke Co. *GSMNP* Albright Grove N35°44.173' W83°16.647' 4X06 – IV 2007 SP35A – CWD Rear 1 – M Ferro / LSAM 167678 (1M). **Sevier Co.:** \*Tenn.: Sevier Co. Smoky Mtn. Natl. Pk., VI–17–1978 TPCopeland (DENH) (1M). \*USA: TN: Sevier Co. *GSMNP* Greenbrier N35°43.147' W83°23.349' 18 V – 24 VI 2006 SN15C – CWD Rear 1 – M Ferro / LSAM 0167680 (1M). \*USA: TN: Sevier Co. *GSMNP* Laurel Falls N35°40.808' W83°36.067' 2 April 2007 SP1 CWD5 1 of 3 – M Ferro / LSAM 0152195 (1M). \*USA: TN: Sevier Co. *GSMNP* Porters Creek trail N35°41.42' W83°23.56' 6 October 2008 Sifting CWD5 M. Ferro / LSAM 0170163 (1M).

**Geographical Distribution.** Specimens have been collected from Cocke and Blount counties in eastern Tennessee within GSMNP and Brasstown Bald in north central Georgia between 375-1390 m elevation.

**Comments.** Specimens have been collected in March, April, and June-October from “forest litter,” “leaf litter,” “hemlock log litter,” coarse woody debris decay class III-IV and V, and “forest floor debris near rotten wood”. Berlese funnels and dead wood emergence traps were used as a collection technique.

*Sonoma gilae* has aedeagal characters unlike any other *Sonoma*. The curved subapical and apical processes of the endophallus connected by a thin membrane and the smoothly curved scythe shaped right paramere will serve to separate this species from all others in the genus.

Individuals may have either fully formed flight wings, reduced flight wings, or be entirely brachypterous. Individuals with fully formed flight wings have a transverse patch of microtrichia narrowly interrupted at the midpoint on tergite one.

**Etymology.** This species is named for Stephanie Anne Gil, one of the co-collectors of the paratypes of this species and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

### 7. *Sonoma gimmeli* new species

Fig. 7, 24; Maps 2, 7

**Description.** Holotype, male. Measurements: head 0.33 long, 0.40 wide; pronotum 0.42 long, 0.48 wide; elytra 0.55 long, 0.35 wide; antennomeres 1-11 total 0.94; total length 1.96.

**Head.** Eyes prominent, maximum length in dorsal view 1.2 x length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 7/12 width of 1; 3 smallest.

**Thorax.** Elytra with row of three sutural crenulations in basal third; row of 4 foveae in center 2/5, distance from first to second twice distance from second to third. Brachypterous.

**Abdomen.** Tergite one without transverse patch of microtrichia. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Compact; apex of endophallus extending beyond parameres. Left paramere: base wide; parallel sided in basal half; apical half with wide, thin mesal blade; cluster of 6 thick elongate setae 1/3 from apex. Endophallus: basal 2/3 extremely asymmetrical; lateral digitate process at base 2/3 width of endophallus base, ventrad from right paramere; subapical shelf-like process directed ventrad; tip bowed, strongly curved right with expanded apex. Right paramere: base enlarged, rounded laterally; dorsolateral setose process short, rounded, with 4 setae along apex; lateral constriction at level of digitate process of endophallus; distal 1/3 as wide as left paramere, with straight outer margin; apex obtuse with blunt subapical hook mesad. Tubercles sparse, fine, scattered along mesal basal half of dorsal faces of both parameres.

**Type Material.** Holotype, male: \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 31 March 2007 SN1 Litter 2 of 3 –M Gimmel / LSAM 0152215 (1M). Deposited in FMNH.

**Paratypes** (n=14). **UNITED STATES: NORTH CAROLINA: Jackson Co.:** \*NC: Jackson Co. Waterrock Knob, pitfall trap Spruce–fir forest, Ridge #8 648102N 763704E 06–20 June 2002, J. Robertson (GSMNP) (1M). **TENNESSEE: Cocke Co.:** \*USA Tenn Cocke Co. GSMNP Cosly Crekk Trail / Lot #76–110 Oct. 15, 1976 Berlesate R.Chenowith & R.T.Allen / LSAM0002052 (GSMNP) (1M). \*TN: Cocke Co. GSMNP ATBI Plot: Albright Grove Pitfall 85 83 16 50 35 43 60 Parker, Stocks, Petersen 16 FEB–2 MAR 2001 (GSMNP) (1M). \*USA: TN: Cocke Co. GSMNP Albright Grove N35°44.173' W83°16.647' 24 VI–15 VII 2006 SP35A–CWD Rear 1 –M Ferro / LSAM 0167674 (1M). **Sevier Co.:** \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 14 IV–18 V 2006 SN15B–CWD Rear 1 –M Ferro / LSAM 0170157 (1M); same data LSAM 0170158 (1M); same data LSAM 0170159 (1M) SLIDE. \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 14 IV–18 V 2006 SN12B–CWD Rear 1 –M Ferro / LSAM 0170160 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 14 IV–18 V 2006 SN15C–CWD Rear 1 –M Ferro / LSAM 0170161 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 5 October 2006 SN1 CWD5 3 of 3 –M Ferro / LSAM 0152194 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 4V06 – 1 IV 2007 SN15C–CWD Rear 1 –M

Ferro / LSAM 0167669 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 31 March 2007 SN1 Litter 1 of 3 –M Gimmel / LSAM 0152219 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 31 March 2007 SN1 Litter 2 of 3 –M Gimmel / LSAM 0152216 (1M). \*USA: TN: Sevier C. GSMNP Porters Creek trail N35°41.42' W83°23.56' 6 October 2008 Sifting CWD5 M. Ferro / LSAM 0170162 (1M).

**Geographical Distribution.** Specimens have been collected from four locations in Sevier and Cocke counties in the Tennessee side of GSMNP and from one location south of the park in Jackson County, North Carolina.

**Comments.** Specimens have been collected during March-July, and October from litter and coarse woody debris decay class 3-4 and 5. Berlese funnels and emergence traps were used as a collection technique. Two specimens were collected with pitfall traps; one set from February through early March, and the other set from early to late June.

Aedeagal characters of *Sonoma gimmeli* are similar to those of *S. chouljenkoi*. The wide lateral digitate process and subapical shelf of the endophallus, and width of the right paramere of *S. gimmeli* will serve to separate it from *S. chouljenkoi*.

**Etymology.** This species is named for Matthew Lincoln Gimmel, collector of the holotype specimen, phalacrid systematist, and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

#### 8. *Sonoma tolulæ* (LeConte, 1849)

Fig. 8, 25; Maps 2, 13

*Faronus tolulæ* LeConte 1849: 108-109. Holotype, female. Label: \*[orange disc = Southern States; Gulf States; VA, NC, SC, eastern TN?, GA, AL, MS, FL, AR?, LA] / Type, [typed] 6184 [hand written] / *Faronus tolulæ* [hand written] / HOLOTYPE [typed] *Faronus tolulæ* LeConte [hand written]. Type locality: Tolulæ cataractam Georgiæ. Type deposition: MCZC. LeConte 1851: 215. Brendel and Wickham 1890: 75-77.

*Rafonus tolulæ*: Casey 1893: 441-442. Casey 1908: 257.

*Sonoma tolulæ*: Raffray 1904: 499-500. Bowman 1934: 6.

**Description.** Male. Measurements: head 0.30 long, 0.40 wide; pronotum 0.40 long, 0.45 wide; elytra 0.58 long, 0.29 wide; antennomeres 1-11 total 1.04; total length 2.04.

**Head.** Eyes large, maximum length in dorsal view equal to length of first antennal segment, with approximately 40 coarse facets. Antennomere 2 approximately 3/4 width of 1; 3 smallest.

**Thorax.** Elytra with a row of five sutural foveae extending distad to midpoint; a second row of 4 foveae parallel and mesad to the sutural foveae, distance of the first and second foveae greater than 2x the distance from the second to third foveae; a third row of three smaller foveae laterad to the central row and contained within the middle one third of the elytra. Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Compact; parameres and endophallus approximately same length. Left paramere: bulbous, distal 1/3 symmetrically convergent to acute apex, ventral longitudinal flange with 7 thick curved setae at distal 1/3. Endophallus: base half as wide as left paramere, wide lateral digitate process ventrad from right paramere, apex with sigmoid curve to left terminated posteriorly. Right paramere: lateral lobe short, rounded, with 5 thick curved setae along apex; lateral constriction at level of digitate process of endophallus; right lateral margin abruptly curved to produce acute apex with straight outer margin. Tubercles scattered along basal 3/4 of dorsal surface of left paramere, and basal half of dorsal face of right paramere.



**Material Studied** (n=63). **UNITED STATES: GEORGIA: Rabun Co.:** \*USA:GA:Rabun Co., Satolah, V-29-1983 DSChandler, [?] Rhododendron & mixed leaf litter (DENH) (1M). \*USA: Georgia: Rabun Co. Tallulah Falls N 34°44.360' W 83°23.917' 7 Oct 2008 M. Ferro Leaf Litter 475m / LSAM 0170147 (1M); same data, LSAM 0170165 (1M). **Towns Co.:** \*USA: Georg., Towns Co., 1 mi. S Brasstown Bald, (4000'), 15-V-1981, FMHD #81-169, ex litter under rhododen. on hillside 20 stream edge, L. Watrous (FMNH) (4M). \*USA: Georg., Towns Co. 1 mi. S. Brasstown Bald, 15-V-1981, FMHD #81-170, ex litter under rhododen. along stream, L. Watrous (FMNH) (1M). \*USA: Georg., Towns Co., 1 mi. S. Brasstown Bald, 15-IV-1981, FMHD #81-172, ex damp litter at base of steep incline, L. Watrous (FMNH) (9M). **Union Co.:** \*Brasstown Bald, GA. Union Co. II-VIII-63 El. 2750 B / H.R.Steeves Jr. J.D.Patrick Jr. Collectors/ Rhododendron and softwood debris/ H. R. Steeves Jr. Collection / [male symbol]. (FMNH) (2M). \*GA.: Union Co. Blairsville (7 mi. E.?); below Brasstown Bald; VI:14:1973; 1400'. leg. W. Suter WS#73-60a; FM(HD)#73-243 Ber.: sawdust & pine litter on periphery of small pile. (FMNH) (1M). **NORTH CAROLINA: Macon Co.:** \*USA: N. Carol., Macon Co., 3 mi NW Highlands, 15-V-1981, FMHD #81-174, ex litter under rhododen. and hemlock, L. Watrous. (FMNH) (1M). **Swain Co.:** \*USA N.C. Swain Co. Dirt Rd. from Heintooga Overlook to Cherokee / Lot # 76-103 Oct. 14, 1976 Berlesate 5300'-5000' R.Chenowith & J.Heiss / LSAM0002042 (1M). \*USA N.C. Swain Co. Dirt Rd. from Heintooga Overlook to Cherokee / Lot #77-89 June 27, 1977 Berlesate 5100'-4900' R.Chenowith & J.Heiss / LSAM0002061 (1M). \*N CAROLINA: Swain Co. *GSMNP*, Andrews Bald 1755m. 1m<sup>2</sup> litter. 27 June 1996. Coyle, Edwards, Stiles & Wright / LSAM 0096222 (1M). \*N CAROLINA: Swain Co. *GSMNP*, Andrews Bald 1755m. 1m<sup>2</sup> litter. 6 Sept 1997. Aiken, Coyle, Davis & Edwards / LSAM 0096221 (1M); same data, LSAM 0096224 (GSMNP) (1M). \*N CAROLINA: Swain Co. *GSMNP*, Appalachian Tr. at Beech Gap. 35°28'27"N 83°42'27"W. 1650m. Forest litter / rotten wood 20 July 2003. A.Tishechkin. / LSAM 0091889 (1M); same data, LSAM 0091890 (1M). \*N CAROLINA: Swain Co. *GSMNP*, Thunderhead Mt. nr. summit @ 35°33.95'N 83°42.6'W 1615m. Forest litter. 30 July 2004 A.K.Tishechkin / LSAM 0095568 (1M); same data, LSAM 0095569 (1M) SLIDE; same data, LSAM 0095570 (1M); same data, LSAM 0095571 (1M); same data, LSAM 0095572 (1M). \*USA: NC: Swain Co. *GSMNP* Near Pecks Corner Shelter Leaf litter, Berlese Funnel Mixed forest on ridge, 5396' 35°39.064N, 83°18.566W 5 Oct 2004, WD Merritt / LSAM 0170146 (1M). **TENNESSEE: Blount Co.:** \*Smoky Mts. N. C.-Tenn Newfound Gap 5,000-5,200 ft. / Aug. 30 1930 Darlington (MCZC) (1M). \*USA NCSWAINCOGSMNP Indian Gap 17 VII 03 J&S Cornell Hemlock Litter w/ fungi JFC003-VII-17-2C (JFCC) (1M). \*TENNESSEE / N. CAROL. Border. *GSMNP* Newfound Gap. 35.611°N 83.425°W. 5075'. Sift litter 19 July 2003. S.O'Keefe / LSAM 0091840 (1M) SLIDE. \*TENNESSEE: Blount Co. *GSMNP*, lower Gregory Ridge Tr. @ 35°33.5'N 83°50.5'W. 630m. For. Litter 28 Jul 2004. A.K.Tishechkin / LSAM 0095579 (GSMNP) (1M); same data, LSAM 0095580 (1M). \*TENNESSEE: Blount Co., *GSMNP*, App. Tr. ~0.6km W Mt. Thunderhead summit at 35°34.11'N 83°42.00'W 1585m. Forest litter sifting 13 April 2006. A.K.Tishechkin / LSAM 0107286 (1M). \*TENNESSEE: Blount Co., *GSMNP*, Mt. Thunderhead nr. summit at 35°34.02'N 83°42.60'W. 1625m. Forest litter.30.vii.2004. A.Tishechkin / LSAM 0107295 (1M). \*TENNESSEE: Blount Co. *GSMNP*, Mt. Thunderhead nr. Summit @ 35°34.1'N 83°42.5'W. 1650m. Litter 30 Jul 2004. A.K.Tishechkin / LSAM 0091947 (GSMNP) (1M); same data, LSAM 0091948 (1M); same data, LSAM 0091950 (1M). **Sevier Co.:** \*U.S.A., TN: Sevier Co. *GSMNP*, 0.5 kn NE Newfound Gap, elev. 1600m 83°24'46"W, 35° 38'9" N / forest litter Berlese 26 June 2001 C. Carlton, V. Moseley A. Tishechkin / LSAM0002286 (1M); same data, LSAM0002287 (1M); same data, LSAM0002289 (1M); same data, LSAM0002290 (1M); same data, LSAM0002291 (1M). \*U.S.A., TN, Sevier Co. Appalachian Trail at Beech Gap on Clingmans Dome Rd. 83°26'50" W, 35°36'36" N / elev. 1750 m, forest litter berlese 28 June 2001, C. Carlton, A. Tishechkin, V. Moseley / LSAM0002629 (1M). \*USA, TN, Sevier Co. Great Smoky Mt. Nat. Pk. Beech gap on Clingmans Dome Rd. where Appal. / Trail crosses rd. 28 June 2001, C. Carlton, A. Tishechkin, V. Moseley / LSAM 0096334 (1M). \*U.S.A., TN, Sevier Co. *GSMNP*, Laurel Falls Trail 83°35'36"W, 35°40'19"N / elev. 747m, Epifagus berlese 1 July 2001, C. Carlton, V. Moseley A. Tishechkin / LSAM0002546 (1M). \*USA: TN: Sevier Co. *GSMNP*, Trillium Gap Tr. on Mt. Leconte 35°39.9'N 83°26.2'W / Berlese litter 29 Jul 2001 A Tishechkin / LSAM 0146470 (1M); same data, LSAM 0146471 (1M). \*TENNESSEE: Sevier Co. *GSMNP*, Indian Head Tr. 35.60944°N 83.44659°W Sift litter. 5290' 20 July 2003. S.O'Keefe / LSAM 0080774 (1M). \*TENNESSEE: Sevier Co. *GSMNP*, Road Prong Tr. at 35°36'36"N 83°27'3"W 1580m. Leaf / moss mat litter. 20 July 2003 A. Tishechkin / LSAM 0091848 (1M); same data, LSAM 0091854 (1M); same data, LSAM 0091868 (1M). \*Tennessee: Sevier Co. *GSMNP*, Trillium Gap Tr. @ 35°39.9'N 83°26.2'W 1400m. Forest litter. 29 July 2004. A.Tishechkin/ LSAM 0091968/ (1M). \*Tennes-

see: Sevier Co. GSMNP, Trillium Gap Tr. @ 35°40.3'N 83°26.7'W 1420m. Forest litter. 29 July 2004. A.Tishechkin/ LSAM 0091968/ (1M). \*Tennessee: Sevier Co. GSMNP, Alum Cave Bluff ~¼mi behind Alum Cave 35°38.6'N 83°26.8'W 1480m. Forest litter. 30 Jul 2004. J.Brown & B.Pynn / LSAM 0094908 (GSPN) (1M); same data, LSAM 0094915 (1M). \*TENNESSEE: Sevier Co. GSMNP, App. Tr. ~2km W Derrick Knob Shelter 35°34.07'N 83°39.81'W 1450m. Forest litter. 7 June 2005. A.K.Tishechkin / LSAM 0094927 (1M).

**Geographical Distribution.** *Sonoma tolulæ* is known from the central portion of the eastern border of Tennessee, across the western tip of North Carolina and into extreme northeastern Georgia. Specimens have been collected from elevations ranging from 425-1755 m.

**Comments.** Specimens have been collected every month from April through October from “leaf litter,” “forest litter,” “Leaf/moss mat litter,” “*Epifagus berlese*,” “Forest litter / rotten wood,” “litter under rhododendron and hemlock,” “sawdust & pine litter on periphery of small pile,” and “damp litter”. Author MLF collected one female and two male specimens from rotted wood (decay class V).

The holotype described by LeConte is female (MCZ Type Database 2009) and was collected from “*Tolulæ cataractam Georgiæ*” (LeConte 1849). Author MLF visited Tallulah Falls in Rabun County, Georgia in the fall of 2007 and the fall of 2008 and collected two male and one female specimens. The aedeagal characters of the two male specimens were identical. Based on the presumed type locality and absence of other species, we concluded that these specimens are conspecific with *S. tolulæ*.

Aedeagal characters of *Sonoma tolulæ* are similar to those of *S. sokolovi*. However, the acute apex of the left paramere and shape of the right paramere (right lateral margin abruptly curved to produce an acute apex with straight outer margin) and the lack of a subapical internal lobe on the apex of the right paramere in *S. tolulæ* will distinguish these two species.

Individuals may have either fully formed flight wings, reduced flight wings, or be entirely brachypterous. Individuals with reduced or absent flight wings have no microtrichia on tergite one.

A disarticulated specimen of *Sonoma chouljenkoi* from Black Mountain, Buncombe County, North Carolina was in Orlando Park’s collection labeled *Sonoma tolulæ*. It appeared to be specifically prepared to be used as a model for external morphology illustrations. Park provided several illustrations of “*Sonoma tolulæ*” in *A Study in Neotropical Pselaphidae* (1942) and we suspect that *S. chouljenkoi* was used as the model. However, the stylized form of the drawings and lack of noticeable differences in the external structures between *S. chouljenkoi* and *S. tolulæ* resulted in drawings that were not species specific.

The only previous illustration of an aedeagus attributed to *S. tolulæ* is in Marsh and Schuster (1962). The illustration is clearly of *S. chouljenkoi* and the only additional locality given by them is “Black Mountain, Buncombe County, North Carolina.” They do not say how or from whom they obtained the specimen or illustration, but probably the specimen or illustration came from Orlando Park and is based on a specimen from the same series from which his disarticulated model came. We found no examples of dissected genitalia labeled *Sonoma tolulæ* in Orlando Park’s material.

## 9. *Sonoma chouljenkoi* new species

Fig. 9, 26; Maps 2, 4

*Sonoma tolulæ*: Marsh and Schuster 1962 (not LeConte 1849)

**Description.** Holotype, male. Measurements: head 0.33 long, 0.40 wide; pronotum 0.44 long, 0.50 wide; elytra 0.70 long, 0.35 wide; antennomeres 1-11 total 0.89; total length 2.00.

**Head.** Eyes prominent, maximum length in dorsal view 6/10 length of first antennal segment, with approximately 50 facets. Antennomere 2 approximately 7/10 width of 1; 3 smallest.

**Thorax.** Elytra with row of 2 sutural foveae in basal 1/3; single fovea laterad of basal sutural fovea; row of five central foveae extending distad to midpoint. Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

*Aedeagus*. Compact; apex of endophallus extending beyond parameres. Left paramere: curved, base parallel sided, blade-like in apical one third, row of 6 thick setae attached in lateral 1/3, apex acute. Endophallus: base bulbous; lateral digitate process equal to width of and ventrad from right paramere, sharply curved dorsally to rounded apex; sigmoidal and narrowing in apical third, apex with elongate sclerotized sigmoid curve to left followed by lightly sclerotized sigmoid curve terminated posteriorly. Right paramere: bulbous at base, width 3/5 length; dorsolateral setose process short, rounded, with 1 basal and 3 apical setae; lateral constriction at level of digitate process of endophallus; apical 1/2 narrow, weakly angulate at midpoint, mesally curved to rounded apex. Tubercles sparse, fine, scattered along basal half of dorsal faces of both parameres.

**Type Material.** Holotype, male: \*TENNESSEE: Sevier Co. *GSMNP*, Porters Creek Tr. @ 35°40.1'N 83°23.6'W 850m. Forest litter. 31 July 2004. C.E. Carlton & N. Lowe / LSAM 0094971 (1M). Deposited in FMNH.

**Paratypes** (n=88). **UNITED STATES: ALABAMA: Cherokee Co.:** \*ALA., Jackson Co. Indian Rocks Cave 5.5 mi. s Skyline 16.IX.67 x / Forest floor debris at rotten wood / T.G. Marsh W.M. Andrews Collectors / H.R. Steeves Collection / [male symbol] (FMNH) (1M). \*Alabama: Cherokee Co. Desoto SP 34° 29.880'N 85° 37.152'W forest liter 20 Aug 2009 I.M. Sokolov / LSAM 0170154 (1M). **GEORGIA: Dade Co.:** \*GA: Dade Co., 5mi SE of Cloudland Can. SP. [?]ogd's Lake April 20, 1983 [?]ing forest floor / 4.20.83 F CLC / (FMNH) (1M). **Walker Co.:** \*GA: Walker Co. Pigeon Mtn. Nr. Rocky Lane at 34°39.972' N 85°22.467' W 495m / Litter Berlese I.M. Sokolov 24 March 2008 / LSAM 0170155 (1M); same data, LSAM 0170156 (1M). **KENTUCKY:** \*Ky. / H. C. FALL COLLECTION (MCZC) (1M). **Bath Co.:** \*USA :KY :Bath Co., Daniel Boone N. F. 4 mi from Clear / Ck. Rec. Area [??] [??] 918. XIII-5-1988 RMReeves sift rotten stump (DENH) (1M). **Edmonson Co.:** \*KY. Edmonson Co. Mammoth Cave Nat. Park 8-APR-1950. L.J. Stannard Acc. 49602 / LSAM0002060 (1M). \*KY.:Edmonton [Edmonson] Co.; Mammoth Cave Natl. Pk. Bruce Hollow VIII:24-27:1967 / leg.S. Peck, A. Fiske FM(HD)#67-145 Berlese log, stump litter / Field Mus. Nat. Hist. Orland Park Pselaphidae Colln. (FMNH) (11M). \*KY.:Edmonson Co.; Mammoth Cave Natl. Pk. Cabin Woods h 24.III.1973 / Litter at log leg. W. Suter / [male symbol] (FMNH) (5M). \*KY.:Edmonson Co.; Mammoth Cave Natl. Pk. Cabin Woods 24 March 1973 / Litter at log lowland leg. W. Suter / [male symbol] (FMNH) (1M). \*USA: Ky., Edmonson Co., Mammoth Cave Natl. Pk., Cabin Woods, 20-IV-1983, FMHD #83-26, ex log, W. Suter (FMNH) (1M). \*USA: Ky., Edmonson Co., Mammoth Cave Natl. Pk., Cabin Woods, 20-IV-1983, FMHD #83-119, litter pocket along stream, W. Suter (FMNH) (2M). **Meade Co.:** \*Rockhaven KY [Meade Co.] 7/22/94 / LSAM0002053 (1M). **NORTH CAROLINA: Buncombe Co.:** \*BlackMts. NC VII-15 1912 Beutenmuller (MCZC) (1M). \*BlackMts. NC VII-30 1912 Beutenmuller (MCZC) (1M). \*BlackMts. NC VIII-27 1912 Beutenmuller (MCZC) (1M). \*BlackMts. NC VIII-31 1912 Beutenmuller (MCZC) (2M). \*BlackMts. NC X-11 1912 Beutenmuller (MCZC) (1M). \*Mt. Mitchell St. Pk. Commissary Ridge Trail Buncombe Co., N. C. 2.VII.60 Alt. c6,600' Rhododendron & spruce duff / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). \*Bl. Mount [??]\_N.C. / Field Mus. Nat. Hist. Orland Park Pselaphidae Colln. (FMNH) (1M). \*Field Mus. Nat. Hist. Orland Park Pselaphidae Colln. / Faronus tolulae [male symbol] Black Mt., N.C. Sept. ABDOMEN (FMNH) (1M). \*Bl. Mount N.C. / Sonoma tolulae LeC. (MCZC) (1M). **Haywood Co.:** \*USA: NC: Haywood GSMNP BRPW nr. Cove Field Ridge Overlook; litter / 35°25.84'N 83°21.15'W 1420m 21 Sep. 2005 ATishechkin / LSAM 0092324 (1M). **Swain Co.:** \*N Carolina: Swain Co. *GSMNP*, Lakeshore Tr. at 35°28'20"N 83°43'14"W 630m. Forest litter 18 July 2003. A.Tishechkin / LSAM 0091822 (1M) SLIDE. **Yancy Co.:** \*Mt. Mitchell N.C. 4-6000' / June 1939 Quirsfeld / Sonoma tolulae LeC. / C. A. Frost Collection 1962 (MCZC) (1M). \*N.CAR.:Yancy Co. Mt. Mitchell 31.V.1973 g / fern rhizome W. Suter leg. / [male symbol] (FMNH) (3M). \*N.CAR.:Yancy Co. Mt. Mitchell 31.V.1973 g / fern rhizome fir, summit W. Suter leg. / [male symbol] (FMNH) (5M). \*N.CAR.:Yancy Co. Mt. Mitchell 31.V.1973 [?] / fern rhizome fir, summit W. Suter leg. / [male symbol] (FMNH) (1M). \*N.CAR.:Yancy Co. Mt. Mitchell 31.V.1973 [?] / Litter at log leg. W. Sute / [male symbol] (FMNH) (2M). **TENNESSEE: Bledsoe Co.:** \*Fall Creek Falls St. Park, Bledsoe Co., TENNESSEE 1 September 1961 J. Wagner & W. Suter legs. / Floor Litter nr. Rhododendron W. Suter leg. / [male symbol] (FMNH) (4M). **Blount Co.:** \*USA: TN: Blount Co. *GSMNP*, lower Gregory Ridge Tr 1 mi from trail-head / Berlese leaf litter 28 Jul 2004 A Tishechkin Beetle Blitz / LSAM 0146908 (GSPN) (1M). \*TENNESSEE: Blount Co., *GSMNP*, Grapeyard Ridge Tr. at. 35°41.68'N 83°27.77'W Litter sifting. 1 August 2004 V. Bayless & S. Gil / LSAM 0107302 (GSPN) (1M). \*USA: TN:



Blount Co. GSMNP Tremont N35°37.308' W83°40.447' 4 October 2006 SN2 CWD5 2 of 3 –M Ferro / LSAM 0152196 (1M); same data, LSAM 0152197 (1M). \*USA: TN: Blount Co. GSMNP Tremont N35°37.308' W83°40.447' 3 April 2007 SN2 CWD5 2 of 3 –M Ferro / LSAM 0152211 (1M). **Cocke Co.:** \*USA: TN: Cocke Co. GSMNP Albright Grove N35°44.173' W83°16.647' 15 VII–17 VIII 2006 SP33B –CWD Rear 1–M Ferro / LSAM 0170153 (1M). **Fentress Co.:** \*Jordan Motel TENN. Jamestown, Pickett Co. [Fentress Co.] 16.VI.62 A Forest Floor Debris / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (3M). \*Jordan Motel TENN. Jamestown, Fentress Co. B 13–IV–63 / Forest floor debris nr. dead wood / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). **Pickett Co.:** \*USA: Tenn., Pickett Co., Pickett St. Pk., 7–XII–1980, FMHD #80-120, conc. litter nr. stream (pine rhodod.), H. Dybas (FMNH) (1M). **Sevier Co.:** \*Tenn.: Sevier Co., Smoky Mtn. Natl. Pk., VI–17–1978 TPCopland (DENH) (1M) SLIDE. \*TN: Sevier Co., GSMNP Roaring Fork Motor Nature Trl. Dry leaf litter, 13 April 1995 / (GSPN) (1M). \*TENNESSEE: Sevier Co. GSMNP, Twin Creek ATBI Plot. FIT#1. 26 June – 1 July 2001. V. Bayless, C.E. Carlton & A.K. Tishechkin / LSAM 0113013 (1M). \*TENNESSEE: Sevier Co. GSMNP, Twin Creek ATBI Plot. Malaise trap MT-0120010706. 21 June – 6 Jul 2001. I.C. Stocks / LSAM 0096225 (GSPN) (1M). \*U.S.A, TN, Sevier Co. GSMNP, Chimneys Picnic Area Nature Trail, 83°29'45" W, 35°38'6" N, elev. 891 m / forest litter berlese 28 June 2001, C. Carlton, A. Tishechkin, V. Moseley / LSAM0002767 (GSPN) (1M). \*TENNESSEE: Sevier Co. GSMNP, Porters Creek Tr. @ 35°40.1'N 83°23.6'W 850m. Forest litter. 31 July 2004. C.E. Carlton & N. Lowe / LSAM 0094963 (1M) SLIDE; same data, LSAM 0094964 (1M); same data, LSAM 0094970 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek N35°40.790' W83°23.855' 12 IV -18 V 2006 SP25C –CWD Rear 1 –M Ferro / LSAM 0167675 (1M). \*USA: TN: Sevier Co. GSMNP Greenbrier N35°43.147' W83°23.349' 24 VI -15 VII 2006 SN12A –CWD Rear 1 –M Ferro / LSAM 0167676 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek N35°40.790' W83°23.855' 24 VI -15 VII 2006 SP25C –CWD Rear 1 –M Ferro / LSAM 0170150 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek N35°40.790' W83°23.855' 15 VII-17VIII 2006 SP24C –CWD Rear 1 –M Ferro / LSAM 0167673 (1M). \*USA: TN: Sevier Co. GSMNP Sugarlands QW N35°39.826' W83°31.509' 6 October 2006 SN3 CWD5 2 of 3 –M Ferro / LSAM 0152214 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek trail 6 October 2008 N35°40.79' W83°23.85' Sifting CWD5 M.Ferro / LSAM 0170149 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek N35°40.790' W83°23.855' 4X'06 – 1 IV 2007 SP25A –CWD Rear 1 –M Ferro / LSAM 0167672 (1M). \*USA: TN: Sevier Co. GSMNP Porters Creek 5 April 2007 N35°40.790' W83°23.855' SP2 Litter 1 of 3 –M. Gimmel / LSAM 0152198 (1M). \*USA: TN: Sevier Co. GSMNP Sugarlands QW N35°39.826' W83°31.509' 8 October 2008 Sifting Litter/CWD5 M.Ferro / LSAM 0170151 (1M); same data, LSAM 0170152 (1M). **Sullivan Co.:** \*Tenn.: Sullivan Co. Bristol [?]-5–1978 TPCopland (DENH) (1M). **Locality Unknown:** \*[?] / ex: Collection of Rev. Jerome Schmitt (1890–1904)? St. Vincent Archabby / Raf. tolulae L (FMNH) (1M).

**Geographical Distribution.** *Sonoma chouljenkoi* has the widest known distribution of any eastern species of *Sonoma*. It ranges from north central Kentucky south to northern Alabama and eastward to western North Carolina. Specimens have been collected from elevations ranging from 495–2011 m.

**Comments.** *Sonoma chouljenkoi* has been collected every month from March through October from “forest litter,” coarse woody debris decay class V (“CWD5”), “dry leaf litter,” “pine and rhododendron litter,” “fern rhizome,” “rhododendron & spruce duff,” and “log, stump litter”. A Berlese funnel was reported as a collection technique. This is the only eastern species of *Sonoma* to have been collected in Malaise and flight intercept traps indicating an active flight period. Both specimens were collected during a late June to early July trapping period.

Aedeagal characters of *Sonoma chouljenkoi* are similar to those of *S. sokolovi*. The wide base, wide digitate process, and shape of the apical 1/3 of the endophallus along with the shape of the right paramere (angulate at midpoint of apical 1/2) and the mesally curved to rounded apex will serve to separate it from *S. sokolovi*. The elongate sclerotized sigmoid curve at the apex of the endophallus is a unique feature in the genus.

Individuals may have either fully formed flight wings, reduced flight wings, or be entirely brachypterous. Individuals with reduced or lacking flight wings have no microtrichia on tergite one.

**Etymology.** This species is named for Dmitry “Mad Dog” Vladimirovich Chouljenko, one of the co-collectors of the paratypes of this species and a participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

# 10. *Sonoma sokolovi* new species

Fig. 10, 27; Map 10

**Description.** Holotype, male. Measurements: head 0.32 long, 0.39 wide; pronotum 0.39 long, 0.45 wide; elytra 0.69 long, 0.43 wide; antennomeres 1-11 total 1.00; total length 2.16.

**Head.** Eyes prominent, maximum length in dorsal view 9/10 length of first antennal segment, with approximately 35 facets. Antennomere 2 approximately 7/10 width of 1; 3 smallest.

**Thorax.** Elytra with basal row of approximately 8 sutural crenulations extending to distad 1/3; one distinct fovea laterad to base of crenulations; center with 7 foveae extending to distad 4/10. Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Compact; apex of endophallus extending beyond parameres. Left paramere: curved, same width until apical 1/5, simple and blade-like in apical one third, ventral setose process with 6 thick elongate setae, apex acute. Endophallus: slightly thicker at base than left paramere, lateral digitate process 2/3 width of and ventrad from right paramere, apical 1/3 curved abruptly ventrally, then slightly anteriorly to bluntly rounded apex of main process, long slender secondary process originating subapically and with 5 spirally arranged curves, extends posteriorly. Right paramere: base bulbous, width 2/5 length; dorsolateral setose process short, rounded, with 6 setae along apex; apical 2/3 narrow, sides parallel, except lateral angulate process at midpoint and evenly rounded subapical internal lobe, apex acute. Tubercles sparse, fine, scattered along basal half of dorsal faces of both parameres.

**Type Material.** Holotype, male (slide mounted): \*USA: GEORGIA, Dade Co., Cloudland Canyon State Pk. 34°48.88'N 85°29.10'W 510m. 17 Sept 2006. Forest litter sifting. I.M.Sokolov / LSAM 0108981 (1M) SLIDE. Deposited in FMNH.

**Paratypes** (n=27). **UNITED STATES: ALABAMA: Cherokee Co.:** \*Rock Bridge Canyon Franklin Co. nr. Hodges, ALA. 21.V.61 Forest floor debris / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). \*USA: Alabama: Cherokee Co. Desoto SP 34°29.880'N 85°37.152'W 20 August 2009 Forest Litter Col. I.M.Sokolov / LSAM 0170148 (1M). **Franklin Co.:** \*The Dismals, Ala. Franklin Co. (B) 19.VII.59 Leaf mold / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (5M). \*The Dismals, Ala. Franklin Co. (B) 19.VII.59 Wet leaf mold / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M); same data, *Sonoma tolulae* (Lec.) [male symbol] 59 Det. H.R. Steeves Jr. / *Sonoma* (*Sonoma*) horrenda Park (FMNH) (1M). **Lawrence Co.:** \*Bee Branch Scenic Area Bankhead Nat'l Forest Lawrence Co., Ala. 30.IV.61 Oak tree hole / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). **Winston Co.:** \*AL: Winston Co. Sipsey R. Rec Area Bankhead Nat For 22 June 1985 RD Cave colr / taken in rotten log and leaf litter (DENH) (1M). **GEORGIA: Dade Co.:** \*Cloudland Canyon S.Pk. Dade Co., GA. 3-IX-61 Debris nr. log / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (1M). \*Cloudland Canyon St. Park, Trenton, Dade Co. GEORGIA 3 September 1961 W. Suter & J. Wagner legs. / stream debris / [male symbol] (FMNH) (2M). \*Cloudland Canyon St. Park, Trenton, Dade Co. GEORGIA 3 September 1961 W. Suter & J. Wagner legs. / Floor Litter at Log on Slope W.Suter leg. / [male symbol] (FMNH) (1M). \*Cloudland Canyon S.Pk. Dade Co., GA. 7-VII-62 B Forest floor debris / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (3M). \*Cloudland Canyon S.Pk. Dade Co., GA. 7-VII-62 C Forest floor debris / H. R. Steeves Jr. Collector / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (3M). \*Cloudland Canyon S.Pk. Dade Co., GA. 14-IV-63 / Forest floor debris nr. dead wood / H.R.Steeves,Jr. J.D.Patrick,Jr. Collectors / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (4M). \*GA.,Dade Co. Cloudland Canyon St.Park,16.V.72 S&JPeck,Ber.236 Rhododendron litter / [male symbol] / CNCI Ottawa, Canada (FMNH) (2M).

**Geographical Distribution.** *Sonoma sokolovi* is known from several localities across northern Alabama including numerous specimens from “The Dismals,” Franklin County, and from Cloudland Canyon State Park, Dade County, in the extreme northwestern corner of Georgia. The only available elevational record is 510 m.

**Comments.** *Sonoma sokolovi* has been collected every month from April through September from “forest floor debris near dead wood,” “rhododendron litter,” “stream debris,” “wet leaf mold,” “rotten log and leaf litter,” and an “oak tree hole”. This is the only mention of a specimen of an eastern *Sonoma* species collected from a tree hole.

Aedeagal characters of *Sonoma sokolovi* are similar to those of *S. chouljenkoi*. The depth of spiral of the apical secondary process of the endophallus varies in *S. sokolovi* but is never as great as in *S. chouljenkoi*. The narrow base, narrow digitate process, shape of the apical 1/3 of the endophallus and the lateral angulate process at midpoint and evenly rounded subapical internal lobe of the right paramere of *S. sokolovi* will serve to separate it from *S. chouljenkoi*.

**Etymology.** This species is named for Igor Michailovitch Sokolov, collector of the holotype specimen, carabid systematist, and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

### 11. *Sonoma streptophorophallus* new species

Fig. 11, 28; Map 11

**Description:** Holotype, male. Measurements: head 0.32 long, 0.39 wide; pronotum 0.42 long, 0.44 wide; elytra 0.64 long, 0.36 wide; antennomeres 1-11 total 0.94; total length 2.10.

**Head.** Eyes large, maximum length in dorsal view 1.1x length of first antennal segment, with approximately 45 facets. Antennomere 2 approximately 3/5 width of 1; 3 smallest.

**Thorax.** Elytra with row of five sutural foveae in basal one half; central row of two large foveae in basal 1/4. Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: base parallel sided; main body short; apical 1/3 dagger shaped, attached subapically to base, blade expended apex of endophallus, extremely acute; setose process bearing 8 thick setae. Endophallus: wide to apex; lateral digitate process wide, broadly emarginate along posterior margin, not curved; apex “U” shaped in dorsal profile and curved ventrally. Right paramere: base bulbous; setose process shallow with 8 apical setae, dorsolateral seta bifid at tip; apical 2/3 narrow, sinuate, lateral constriction at level of digitate process of endophallus deep; apex with laterally curved claw. Scattered moderately coarse tubercles on dorsal and lateral surface of left paramere and dorsal surface of right paramere and sparse fine tubercles on lateral process of endophallus.

**Type Material.** Holotype, male: \*17 mi NW Amherst Amherst Co., Va. VIII-12-1975 DSChandler / shifting oak litter DSChandler (DENH) (1M). Deposited in FMNH.

**Geographical Distribution.** *Sonoma streptophorophallus* is represented by a single specimen collected in central Virginia (Amherst Co.).

**Comments.** *Sonoma streptophorophallus* was collected in August from “oak litter”.

*Sonoma streptophorophallus* has aedeagal characters unlike any other *Sonoma*. The left paramere is very similar to *S. tridens* but the “U” shaped apex of the endophallus in *S. streptophorophallus* will separate the two species. Both the apex of the endophallus and the laterally curved claw at the apex of the right paramere are unique to *S. streptophorophallus* and serve to distinguish it from all other species in the genus.

**Etymology.** The specific epithet is derived from *streptophoros* (Greek, “collared”), and *phallus* (Greek, “penis”), referring to the unique form of the endophallus apex.

### 12. *Sonoma nhunguyeni* new species

Fig. 12, 29; Map 9

**Description.** Holotype, male. Measurements: head 0.32 long, 0.40 wide; pronotum 0.40 long, 0.46 wide; elytra 0.70 long, 0.38 wide; antennomeres 1-11 total 0.90; total length 1.92.

*Head.* Eyes prominent, maximum length in dorsal view 9/10 length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 7/10 width of 1; 3 smallest.

*Thorax.* Elytra with row of 4 sutural hemi-foveae in basal 2/5; 2 foveae laterad of second hemi-fovea; single fovea laterad of distal fovea; central row of 6 foveae in basal 2/5. Winged.

*Abdomen.* Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

*Aedeagus.* Asymmetrical. Left paramere: short, blunt, parallel sided; sclerotized lateral apical spine directed posteriorly; apex with 6 thick setae. Endophallus: lateral digitate process, broad basally, narrowed apically, ventrad from right paramere, curved dorsally; apical 2/5 wide, parallel sided, bearing a dorsal lamina from right lateral margin curved obliquely across dorsal surface and terminating on left lateral margin, apex blunt. Right paramere: wide; dorsolateral setose process small, bearing 2 setae; lateral constriction at level of digitate process of endophallus shallow; apical half parallel sided, curved mesad; apex obliquely truncate. Parameres with few widely scattered tubercles.

**Type Material.** Holotype, male: \*ALA., Jackson Co. 5mi.N.Garth 19.V.1972 S.Peck.Ber.239 / CNCI Ottawa, Canada / [male symbol] (FMNH) (1M). Deposited in FMNH.

**Paratypes** (n=5): **UNITED STATES: ALABAMA: Jackson Co.:** \*Horseshoe Cave Sink Jackson Co., Ala. 29.IV.61 Forest floor debris / H.R.Steeves,Jr. J.D.Patrick,Jr. Collectors / H. R. Steeves Jr. Collection / [male symbol] (FMNH) (2M). \*ALA., Jackson Co. 5mi.N.Garth 19.V.1972 S.Peck.Ber.239 / CNCI Ottawa, Canada / [male symbol] (FMNH) (1M) SLIDE. \*USA: Ala., Jackson Co., 6 mi N Princeton, Horseshoe Cave, 30–VI–1976, FMHD #67–110, residue, outside cave, S. Peck & A. Fiske (FMNH) (2M).

**Geographical Distribution.** *Sonoma nhunguyeni* is represented by specimens collected in Jackson County in extreme northeastern Alabama.

**Comments.** *Sonoma nhunguyeni* has been collected in April through June from “residue, outside cave” and forest floor debris.

Aedeagal characters of *Sonoma nhunguyeni* are similar to those of *S. mayori*. The dorsal lamina on the apical 2/5 of the endophallus, small dorsolateral setose process of the right paramere, and the obliquely truncate apex of the right paramere of *S. nhunguyeni* will serve to distinguish it from *S. mayori*.

**Etymology.** This species is named for Nhu Huynh Nguyen, a mycoentomologist and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP. The specific epithet is pronounced “new-win-eye.”

### 13. *Sonoma tridens* new species

Fig. 13, 30; Map 14

**Description.** Holotype, male. Measurements: head 0.34 long, 0.42 wide; pronotum 0.46 long, 0.48 wide; elytra 0.76 long, 0.40 wide; antennomeres 1-11 total 1.12; total length 2.38.

*Head.* Eyes large, maximum length in dorsal view 4/5 length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 3/4 width of 1; 3 smallest.

*Thorax.* Elytra with row of approximately 5 fine sutural foveae in basal 2/5; central row of approximately 3 large foveae in basal 1/4. Winged.



**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Lanceolate. Left paramere: base broadly oval; apical 1/3 dagger shaped, attached subapically to base, blade not extending to apex of endophallus, extremely acute; setose process bearing 4 thick mesal setae, and 3 lateral thick setae. Endophallus: lateral digitate process very wide, ventrad from right paramere, sharply curved dorsally; apical 1/2 sinuate to right; with small subapical dorsal shelf 1/5 from apex; apex blunt. Right paramere: setose process very large, 4 thick apical setae, dorsolateral seta bifid at tip; lateral constriction at level of digitate process of endophallus very deep; apex acute. Sparse fine tubercles scattered on dorsal surfaces of left and right parameres.

**Type Material.** Holotype, male: \*USA: Ky., Powell Co., Natural Bridge St. Pk., 12–VII–1968, FMHD #68–41, log stump litter, S. Peck (FMNH) (1M). Deposited in FMNH.

**Geographical Distribution.** *Sonoma tridens* is known from a single specimen collected in Powell County, Kentucky from within Natural Bridge State Park.

**Comments.** *Sonoma tridens* was collected in July from log and stump litter.

*Sonoma tridens* is the only species of *Sonoma* in which both parameres and the endophallus have acute apices pointed posteriorly. However if the left paramere of *S. mayori* is damaged and possesses an elongate blade-like apex the two species may be distinguished by the presence of the subapical dorsal shelf in the apical 1/5 of the endophallus and the very deep lateral constriction of the right paramere at the level of the digitate process of the endophallus in *S. tridens*.

**Etymology.** The specific epithet of this species refers to the unique trident-like, elongate, posteriorly pointed parameres and endophallus of the aedeagus.

#### 14. *Sonoma holmesii* new species

Fig. 14, 31; Map 8

**Description.** Holotype, male. Measurements: head 0.32 long, 0.41 wide; pronotum 0.45 long, 0.52 wide; elytra 0.77 long, 0.37 wide; antennomeres 1–11 total 0.97; total length 2.16.

**Head.** Eyes large, maximum length in dorsal view 9/10 length of first antennal segment, with approximately 35 facets. Antennomere 2 approximately 3/4 width of 1; 3 smallest.

**Thorax.** Elytra with row of two sutural foveae in basal 1/4; single foveae lateral of midpoint between sutural foveae; central row of 5 foveae in basal 2/5. Winged.

**Abdomen.** Transverse row of microtrichia on first visible tergite narrowly interrupted at midline. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Lanceolate. Left paramere: wide, gently curving mesad; apical blade broadly triangular with acute apex; outer lateral setose process with 5 thick setae inserted dorsally and 1 thick seta inserted apically. Endophallus: lateral digitate process ventrad of right paramere, broad at base and elongate, strongly curved dorsally at apex, infiltrated with complex canaliculi; distal 1/3 of endophallus forming a broad dorsally curved shelf terminating to reinforced knob; terminating a short distance beyond reinforced portion as a thin lightly sclerotized tube. Right paramere: sinuate above base, nearly bifurcate; lateral setose process elongate, 1/3 length of entire paramere, 6 thick setae along lateral margin; lateral constriction at level of digitate process of endophallus; apical 3/5 thin with a left sigmoidal curve, apex blunt. Tubercles sparse, fine, scattered along dorsal faces of both parameres.

**Type Material.** Holotype, male: \*N CAROLINA: Wilkes Co., Blue Ridge Parkway, Sheets Gap. 1020m. 36°21.84'N 81°18.29'W. Litter sifting 30 Apr 2006. A.K.Tishechkin / LSAM 0170166 (1M). Deposited in FMNH.

**Paratypes** (n=20). **UNITED STATES: MARYLAND: Garrett Co.:** \*MARYLAND; Garrett Co. 2.1mi.E.KeysersRidge 18.vi.1968, 2500'el S.Peck, Ber#129 log–stump litter 220 lbs, 231 liters / FM([?]D)68–46 (FMNH) (1M). **PENNSYLVANIA: Westmoreland Co.:** \*St. Vinc. Penn. / 10/13-[18]97 / Liebeck

Coll. / H. C. FALL COLLECTION (MCZC) (1M). \*St. Vinc. Penn. / 10/13-[18]97 / 10 [yellow circular label] / Liebeck Collection (MCZC) (1M). \*St. Vinc. Penn. / 1/2-[18]99 / H. C. FALL COLLECTION / Sonoma tolulae LeC. (MCZC) (1M). \*Chestnut Ridge, E. of Youngstown, Westmoreland Co., PENNSYLVANIA 27.VI.1961 / Duff nr. Rhodod J. Wagner & W. Suter leg. / [male symbol] (FMNH) (2M). \*Chestnut Ridge, E. of Youngstown, Westmoreland Co., PENNSYLVANIA 11.VII.1961 / Flood duff W. Suter, J. Wagner & D. Reichle legs. (FMNH) (2M). \*Chestnut Ridge, E. of Youngstown, Westmoreland Co., PENNSYLVANIA 16.IX.1961 J. Wagner / Log Mold & Floor Berlese (FMNH) (1M). \*Chestnut Ridge, E. of Youngstown, Westmoreland Co., PENNSYLVANIA 16.IX.1961 J. Wagner / Log Mold & Floor Berlese (FMNH) (1M); same data, / [male symbol] (FMNH) (1M). \*Chestnut Ridge, E. of Youngstown, Westmoreland Co., PENNSYLVANIA 22.VI.1962 / Floor Litter J. Berry & W. Suter leg. (FMNH) (1M). \*Chestnut Ridge, PENNA. Westmoreland Co. 16.IX.1964 / Litter at Log W. Suter leg. / [male symbol] (FMNH) (1M). **VIRGINIA: Tazewell/Bland Co.:** \*USA: Va., Tazewell–Bland Cos., 4.4 mi S Burks Garden, 30–VI–1968, FMHD #68–34, log litter, S. Peck (FMNH) (1M). **WEST VIRGINIA: Pocahontas Co.:** \*USA: WV: Pocah. [Pocahontas] Co. 16 mi East Richwood near For. Serv. Rd. 437; off Hwy 150 VIII–23–1990 / Sift hardwood litter near dead logs. S. O’Keefe (DENH) (2M); same data (DENH) (1M) SLIDE. \*USA: WV. Pocahontas Co. 5 mi N jct 150 & 39 on 150 V–17–1991 sift maple & conif. S. O’Keefe Collr. (DENH) (2M). **Wyoming Co.:** \*Pineville WV a / Leng. / 536 / 1953 (MCZC) (1M).

**Geographical Distribution.** Specimens have been collected from southwestern Pennsylvania south through western Maryland, south central West Virginia, and western Virginia to northwestern North Carolina. Specimens have been collected from elevations ranging from 760–1020 m.

**Comments.** Specimens have been collected every month from April through September from “litter,” “hardwood litter near dead logs,” sifted maple and conifer, “flood duff,” “log–stump litter,” and duff near rhododendron. A Berlese funnel has been used as a collection technique.

Aedeagal characters of *Sonoma holmesi* are similar to those of *S. tridens*. The short broadly triangular blade of the left paramere, the broadly curved knob on the distal portion of the endophallus, and the elongate lateral setose process of the right paramere in *S. holmesi* will distinguish these two species. The right paramere will serve to distinguish it from all other species in the genus.

**Etymology.** The specific epithet is in recognition of Orlando Park’s enthusiasm for Sherlock Holmes, that culminated in *Sherlock Holmes, Esq., and John H. Watson, M.D.: an encyclopaedia of their affairs* (Park 1962). The specific epithet also celebrates the 160 year-old mystery surrounding the cryptic species of the genus *Sonoma* in eastern North America.

### 15. *Sonoma tishechkini* new species

Fig. 15, 32; Map 12

**Description.** Holotype, male. Measurements: head 0.32 long, 0.40 wide; pronotum 0.39 long, 0.45 wide; elytra 0.61 long, 0.29 wide; antennomeres 1–11 total 0.87; total length 2.08.

**Head.** Eyes large, maximum length in dorsal view 9/10 length of first antennal segment, with approximately 50 facets. Antennomere 2 approximately 1/2 width of 1; 3 smallest.

**Thorax.** Elytra with row of five large sutural foveae in basal 2/5; single large fovea lateral of second sutural fovea; central row of 5 foveae in basal 2/5. Winged.

**Abdomen.** Tergite one with transverse patch of microtrichia narrowly interrupted at midpoint. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Elongate. Left paramere: broadly triangular in basal 1/2, distal 1/2 elongate, narrowly acuminate to extremely acute apex; 6 long stout setae on lateral low flange at midpoint. Endophallus: elongate, thin, weakly sinuate, 1.4 x length of left paramere; lateral digitate process short and sharply curved dorsally, ventrad of right paramere; apex blunt. Right paramere: elongate, slightly longer than endophallus; lateral setose process low with 5 thick setae; lateral constriction at level of digitate process of endophallus; apical 4/7 parallel sided, distal 1/3 weakly curved measily; apex blunt. With sparse tubercles on basal half of dorsal face of both parameres.

**Type Material.** Holotype, male: \*N CAROLINA: Rutherford Co. Chimney Rock State Park at 35°26.07'N 82°15.27'W. 620m Deep litter/dead logs, Berlese 20 Sept 2005. A.K.Tishechkin / LSAM 0170164 (1M). Deposited in FMNH.

**Paratypes** (n=11). **UNITED STATES: GEORGIA: Rabun Co.:** \*GA: Rabun Co., Satolah (3 mi S.) 15 April 1973 / Litter under Rhododendron leg. W.R.Suter / [male symbol] (FMNH) (1M). \*USA:GA:Rabun Co., Satolah, V-29-1983 DSChandler, sift Rhododendron and mixed leaf litter (DENH) (1M); same data, no genitalia (DENH) (1M). **NORTH CAROLINA: Brunswick Co.:** \*N. Carolina: Brun. [Brunswick] Co., nr. Mako [Maco?] X-15-1979 / JPCornell hardwood litter (DENH) (1M) SLIDE. **Jackson Co.:** \*N.Car.:Jackson Co. Cashiers 7 mi SE 11.VI.1973 b / Pseudofork Elm-Maple Whitewater Falls W.Suter leg. / [male symbol] (FMNH) (1M). **Transylvania Co.:** \*USA NC TRANSYLVANIA CONr Brevard PisgahNF PinkBeds Picnic Area N35°21'11" W82°43.557' E1 2500' 4/5 Aug 09J.F.& TADCornell ExLitter/ FloodDebr UnderRhododendrononBeaver Pond Trail Sift/Berlese (JFCC) (1M). **SOUTH CAROLINA: Greenville Co.:** \*SC: Greenville Co. Paris Mtn. St. Park 373263 3867371 [zone 17] 6-VII-09 UV light (JFCC) (2M). **Oconee Co.:** \*USA:SC:Oconee Co. 7 mi S NC state line on Hwy. 107 / V-29-1983 DSChandler, sift forest litter (DENH) (3M).

**Geographical Distribution.** Specimens have been collected from Rutherford and Jackson counties in southwestern North Carolina, Oconee County in northwestern South Carolina, and Rabun County in northeastern Georgia. A single specimen was reportedly collected from Brunswick County in extreme southeastern North Carolina near the Atlantic Coast. This is an unexpected location as all other eastern *Sonoma* appear to be restricted to highland locations. Specimens have been collected from elevations ranging from 620-762 m.

**Comments.** Specimens have been collected in April-October from "deep litter/dead logs," "pseudofork elm-maple," "rhododendron and mixed leaf litter" using a Berlese funnel. Two specimens were collected at an ultraviolet light trap, this is the only record of *Sonoma* specimens being taken with this collection technique.

*Sonoma tishechkini* has aedeagal characters unlike any other *Sonoma*. A combination of the elongate, pointed left paramere, weak lateral digitate process of the endophallus, thin elongate endophallus lacking subapical modifications, low lateral setose process on right paramere and right paramere slightly longer than endophallus of *S. tishechkini* will serve to separate this species from all others in the genus.

**Etymology.** This species is named for Alexey Konstantinovich Tishechkin, collector of the holotype, histerid systematist, and participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

## 16. *Sonoma mayori* new species

Fig. 16, 33; Map 2

**Description.** Holotype, male. Measurements: head 0.34 long, 0.44 wide; pronotum 0.44 long, 0.48 wide; elytra 0.56 long, 0.36 wide; antennomeres 1-11 total 1.00; total length 2.14.

**Head.** Eyes large, maximum length in dorsal view equals length of first antennal segment, with approximately 40 facets. Antennomere 2 approximately 3/4 width of 1; 3 smallest.

**Thorax.** Elytra with row of approximately 5 fine sutural foveae in basal 2/5; central row of three large foveae in basal 1/4. Presumed brachypterous.

**Abdomen.** Tergite one without transverse patch of microtrichia. No abdominal foveae. Basal pubescence present on all visible ventrites.

**Aedeagus.** Asymmetrical. Left paramere: short; apical half bulbous, inner apical blade wide at base (apex possibly damaged in holotype); sub-apical lateral setose process with 5 stout setae, and 4 thick ventral setae. Endophallus: base of lateral digitate process wide, ventrad from right paramere, sharply curved dorsally; apical half sinuate, slightly recurved to left, apex blunt. Right paramere: elongate, blade like; dorsolateral setose process long with 5 thick setae along apex; lateral constriction at level of digitate

process of endophallus shallow; distal 2/3 curved left, narrowed to acute apex. Scattered, sparse, fine tubercles on setose processes.

**Type Material.** Holotype, male: \*USA: Tenn., Sevier Co., Gt. Smky. Natl. Pk., Clingman's Dome nr. tower, 29–V–1982, FMHD #82–48, at stump, u. fern, W. S. Suter (FMNH) (1M). Deposited in FMNH.

**Geographical Distribution.** *Sonoma mayori* is known from a single specimen collected near the tower at Clingman's Dome in Sevier County, Tennessee within GSMNP at 2020 m elevation.

**Comments.** *Sonoma mayori* was collected in June “at stump, u. [under?] fern”.

Aedeagal characters of *Sonoma mayori* are similar to those of *S. tridens* and *S. nhunguyeni*. The left paramere of the holotype may be damaged apically, and if it possesses an elongate blade-like apex it could be similar to the left paramere of *S. tridens*. However, the lack of a subapical dorsal shelf on the endophallus, the shallow constriction at the level of the digitate process of the endophallus on the right paramere, and the acute apex of the right paramere which extends distad of the endophallus in *S. mayori*, will serve to distinguish it from *S. tridens*. The lack of a dorsal lamina on the endophallus, and the acute apex of the right paramere extending distad of the endophallus of *S. mayori* will serve to distinguish it from *S. nhunguyeni*.

**Etymology.** This species was named for Adriean Johann Mayor, Museum Curator of the GSMNP Collection, melyrid specialist, and a participant in the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP.

### Biology of Pselaphines with an emphasis on *Sonoma* spp.

Very little is known about the bionomics of *Sonoma*. Park (1942) outlined two major lifestyles of pselaphines, “Myrmecocoles” and “Mold species.” *Sonoma* belongs to the latter and is found in logs in the Class V (advanced stage) of decay (Pyle and Brown 1999) and in the leaf litter (“mold”) of the forest floor (Marsh and Schuster 1962; Chandler 1983, 1986, 2003). Pselaphines are largely predators of earth-worms, insect larvae, small flies, Collembola, and mites (Denny 1825; Park 1932; Jacot 1935; Park 1942, 1947a,b; Park et al. 1950; Engelmann 1956; Schomann et al. 2008). Park (1932, 1947a) observed the feeding behavior of *Batrisodes lineaticollis* Aubé (as *B. globosus* LeConte) that were associated with ants. They appeared to be scavengers of dead or injured ant larvae. When a potential food item was found the adult would wave its antennae and twirl its palpi around the item before feeding. Feeding mostly occurred every other day.

Schomann et al. (2008) and Engelmann (1956) observed the feeding behavior of pselaphines in the “Mold Species” group. While there were differences, all the species were active predators and readily ate Collembola, the main prey item offered in the studies. In general a foraging pselaphine would slowly advance, waving its head and antennae side to side. Recognition of a prey item was made through fine tactile and/or chemical clues collected with the multitude of sensilla located on the antennae. After a prey item was “sighted” the hunter would immediately raise the front of its body, fling itself forward, attack (sometimes while guiding the prey item to its jaws with its antennae or raptorial forelimbs), and capture the prey with the mandibles and apparently sticky maxillary palps. Schomann et al. (2008) also observed 1 to 3 prey capture events over two hours of observation, indicating that their study species eat frequently. While no direct observations have been made, it is likely that *Sonoma* exhibit similar feeding behavior. As we become more appreciative of the complex interactions that take place on small scales (Jacot 1935; Park 1947b; Schomann et al. 2008) it may be more accurate to refer to the pselaphines as “litter lions” rather than the inarticulate nomen “short-winged mold beetles.”

Pselaphines have been collected using a multitude of techniques including hand collection, Berlese funnels, pitfall traps, flight intercept traps, Malaise traps, emergence chambers, Lindgren funnel traps, and ultraviolet light (Park 1942, 1947b; Wolda and Chandler 1996; Carlton et al. 2004; Chatzimanolis et al. 2004; Carlton and Leschen 2008; McLean et al. 2009). While more systematic sampling and observations are needed, *Sonoma* populations mostly occur in leaf litter or within or near well rotted hardwood



logs, adults rarely fly or venture through the leaf litter, and are rarely attracted to ultraviolet light. In a study comparing the rotted log and leaf litter habitats in GSMNP, rotted logs yielded almost 4 times more *Sonoma* specimens than leaf litter (data not shown). Seven specimens of *S. gimmeli*, six of *S. chouljenkoi*, and four of *S. gilae* were collected from decay class V coarse woody debris during a systematic study in GSMNP using emergence traps. A single specimen of *S. sokolovi* was reportedly collected from a tree hole, although whether the tree hole was in contact with the ground or elevated is unknown. *Sonoma* adults have been collected in flight. Two specimens of *S. squamishorum* were collected using Lindgren funnel traps (McLean et al. 2009). One specimen of *S. chouljenkoi* was collected in a ground-level flight intercept trap and another was collected in a Malaise trap (where the collecting container is located above ground). Two specimens of *S. gimmeli* were collected in pitfall traps. Two *Sonoma tishechkini* specimens have been collected at an ultraviolet light trap, but no *Sonoma* spp. have been collected from the numerous light trap samples taken as part of the Coleoptera portion of the All Taxa Biodiversity Inventory at GSMNP (Carlton and Bayless 2007).

Nothing is known about the egg, larval, or pupal stages of *Sonoma*. The immatures of pselaphines in general are poorly known (Carlton and Leschen 2008). The life history of *Pselaphophus atriventris* (Westwood) was studied by Martin (1983) and immatures were described by Carlton and Leschen (2008). Collection records indicated that the species passed through one generation per year, and, while adults were collected throughout the year, larvae only occurred for a short period during in the spring (Carlton and Leschen 2008). If *Sonoma* has a similar life history then frequent sampling throughout the year may be the best strategy when searching for immatures.

*Sonoma* adults have been collected during the spring, summer, and fall. The lack of specimens from the winter months is likely more a reflection of lack of collecting effort rather than adult absence. Adults may be very long lived. Engelmann's (1956) wild caught adults representing the genera *Cedius* LeConte, *Euplectus* Leach, and *Biblopectus* Reitter (Coleoptera: Staphylinidae: Pselaphinae) had remained alive for more than 100 days at the time of his publication. *Sonoma* caught while moving across the landscape (pitfall, flight intercept traps, ultraviolet light traps) were collected only in the spring and summer months (February-July), suggesting higher activity during spring.

## Discussion

The discovery of numerous undescribed *Sonoma* species, many represented by specimens collected 20 or more years ago, illustrates a larger problem in taxonomy and systematics called "Overlooked Syndrome" (OS) (Park et al. 2010). This syndrome presents when undescribed species, found across an otherwise familiar landscape, persist because researchers are ignorant of their existence or are otherwise impotent to rectify the issue. Taxa suffering from OS are generally small, have slight or non-existent external morphological differences, obscure habits, little economic value, and are not considered charismatic by the public. Overlooked Syndrome is especially aggravated when taxonomic expertise is lacking. The results are artificially anemic estimates of total diversity in the region and lack of credibility of ecological research involving OS taxa at any functional or analytical levels. Bossart and Carlton (2002) showed that taxa with OS characteristics were much less likely to be considered for conservation or monitoring than other taxa, and Staphylinidae especially receive little conservation attention.

Extensive collecting in GSMNP yielded eight species of *Sonoma* (Map 2), the highest concentration of species of this genus anywhere in North America. *Sonoma chouljenkoi*, *S. gilae*, and *S. tolulae* were each collected from ten or more localities and have been collected from more localities outside of the park. In contrast *Sonoma baylessae*, *S. gimmeli*, *S. mayori*, *S. nicholsae*, and *S. parkorum* were collected from fewer than five localities, and all, except *S. gimmeli*, are only known from GSMNP. Four of the eastern species of *Sonoma* are only known from one or two male specimens, and five species have only been collected at one locality. Local abundance and habitat specificity of some species may account for their true or perceived rarity.

This publication represents a portion of a larger body of research, specifically the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP (Carlton and Bayless 2007). This effort has resulted in a unique body of publications related by collectors, localities and even specific samples (e.g. species described in this publication and in Park et al. (2010) were originally collected as part of separate

research (unpublished) by the authors). The overall research of the Coleoptera component of the All Taxa Biodiversity Inventory at GSMNP has resulted in publications on the following taxa: Carabidae: *Anillinus* Casey (Sokolov et al. 2004, 2007; Sokolov and Carlton 2008, 2010), Cerylonidae: *Philothermus* Aubé (Gimmel and Slipinski 2007), Chrysomelidae: *Psylliodes* Latreille (Konstantinov and Tishechkin 2004), Leiodidae: *Ptomaphagus* (*Appadelopsis*) Illiger (Tishechkin 2007), Mycetophagidae: *Pseudotriphyllus* Reitter (Carlton and Leschen 2009), Staphylinidae: Aleocharinae: *Leptusa* Kraatz (Park et al. 2010), Pselaphinae: *Arianops* Brendel (Carlton 2008), *Reichenbachia* Leach (Carlton 2010).

As more attention is given to diminutive fauna we should expect to discover more undescribed species even in taxonomically well-known eastern North America. Taxonomic expertise is essential if we wish to complete goals of inventorying, understanding, and conservation of the few complex ecosystems that are left on Earth.

## Acknowledgments

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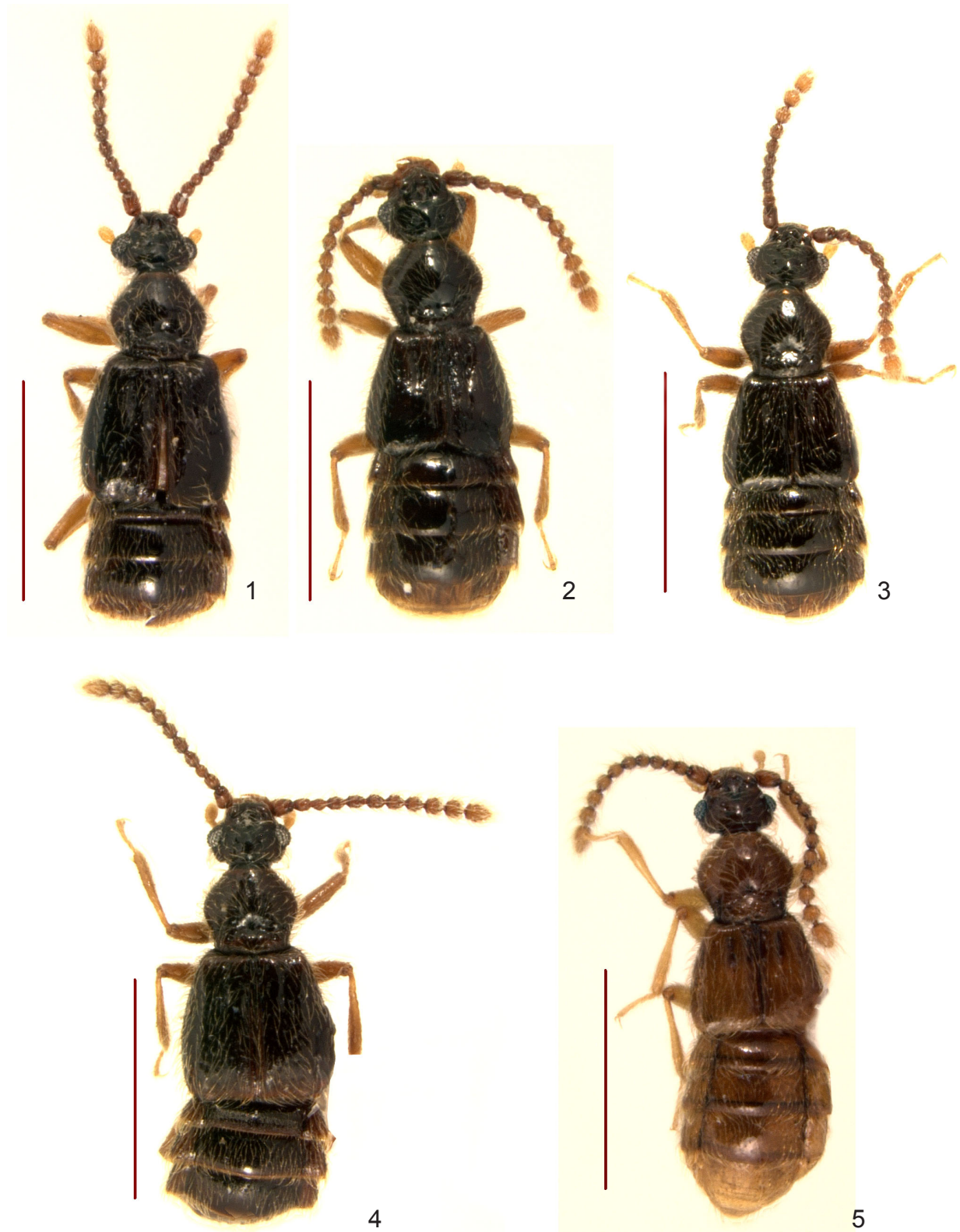
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**Figure 1-5.** Habitus images. 1) *Sonoma cygnus*, holotype. 2) *Sonoma parkorum*, holotype. 3) *Sonoma baylessae*, holotype. 4) *Sonoma brasstownensis*, holotype. 5) *Sonoma nicholsae*, holotype. Scale lines equal 1.0 mm.



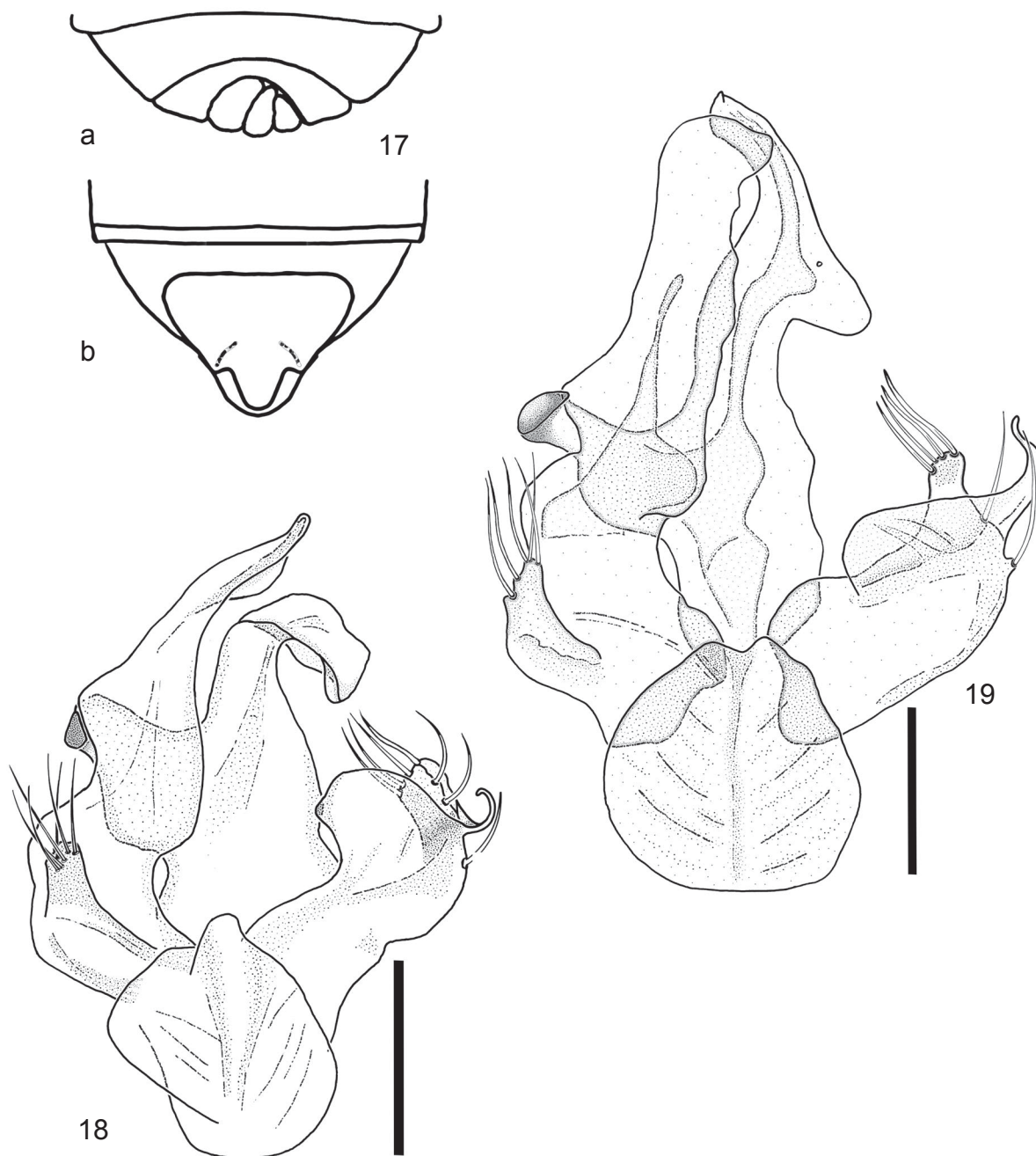
**Figure 6-10.** Habitus images. **6)** *Sonoma gilae*, holotype. **7)** *Sonoma gimmeli*, holotype. **8)** *Sonoma tolulae* (M). **9)** *Sonoma chouljenkoi*, holotype. **10)** *Sonoma sokolovi*, paratype (M). Scale lines equal 1.0 mm.



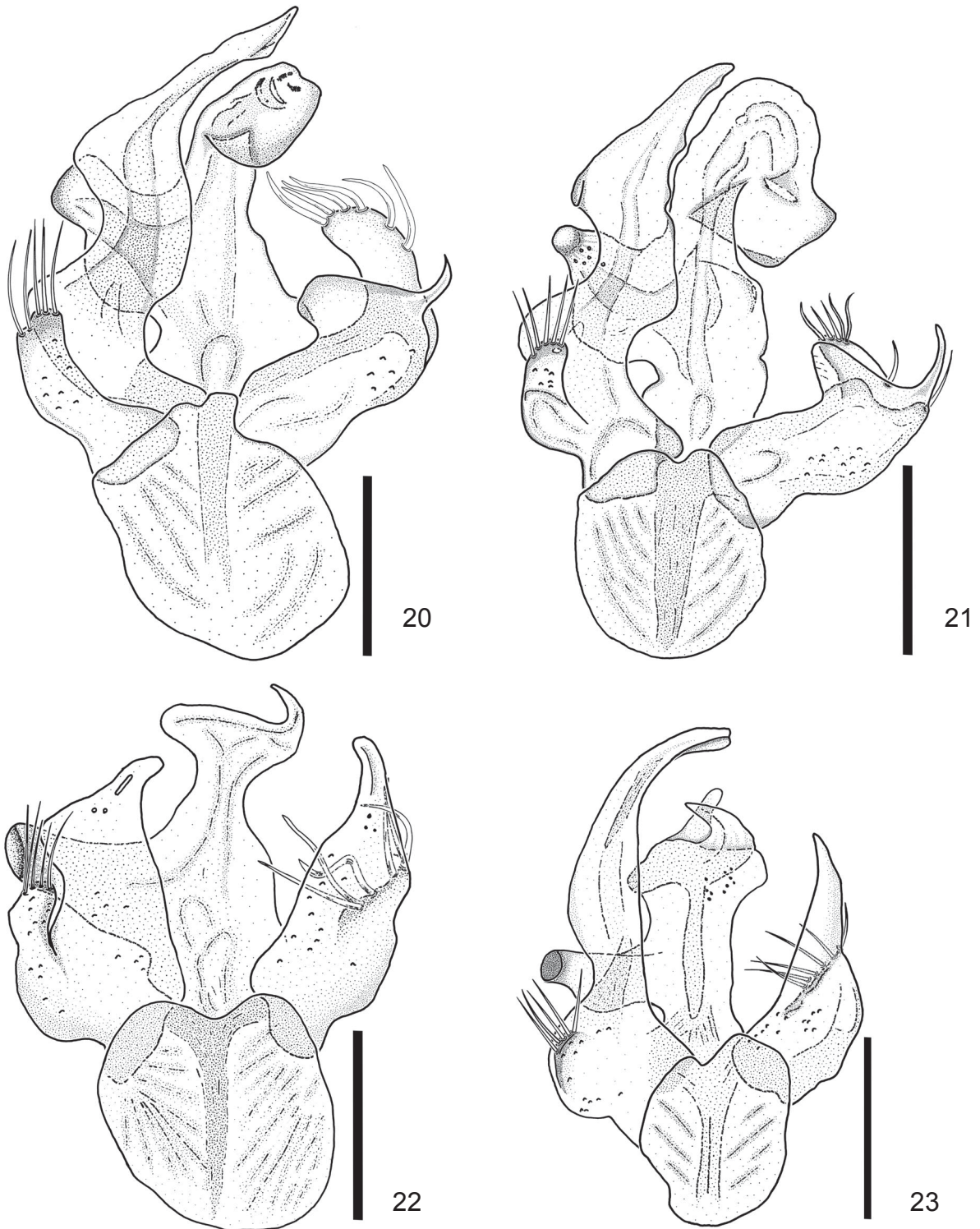


**Figure 11-16.** Habitus images. **11)** *Sonoma streptophorophallus*, holotype. **12)** *Sonoma nhunguyeni*, holotype. **13)** *Sonoma tridens*, holotype. **14)** *Sonoma holmesi*, holotype. **15)** *Sonoma tishechkini*, holotype. **16)** *Sonoma mayori*, holotype. Scale lines equal 1.0 mm.

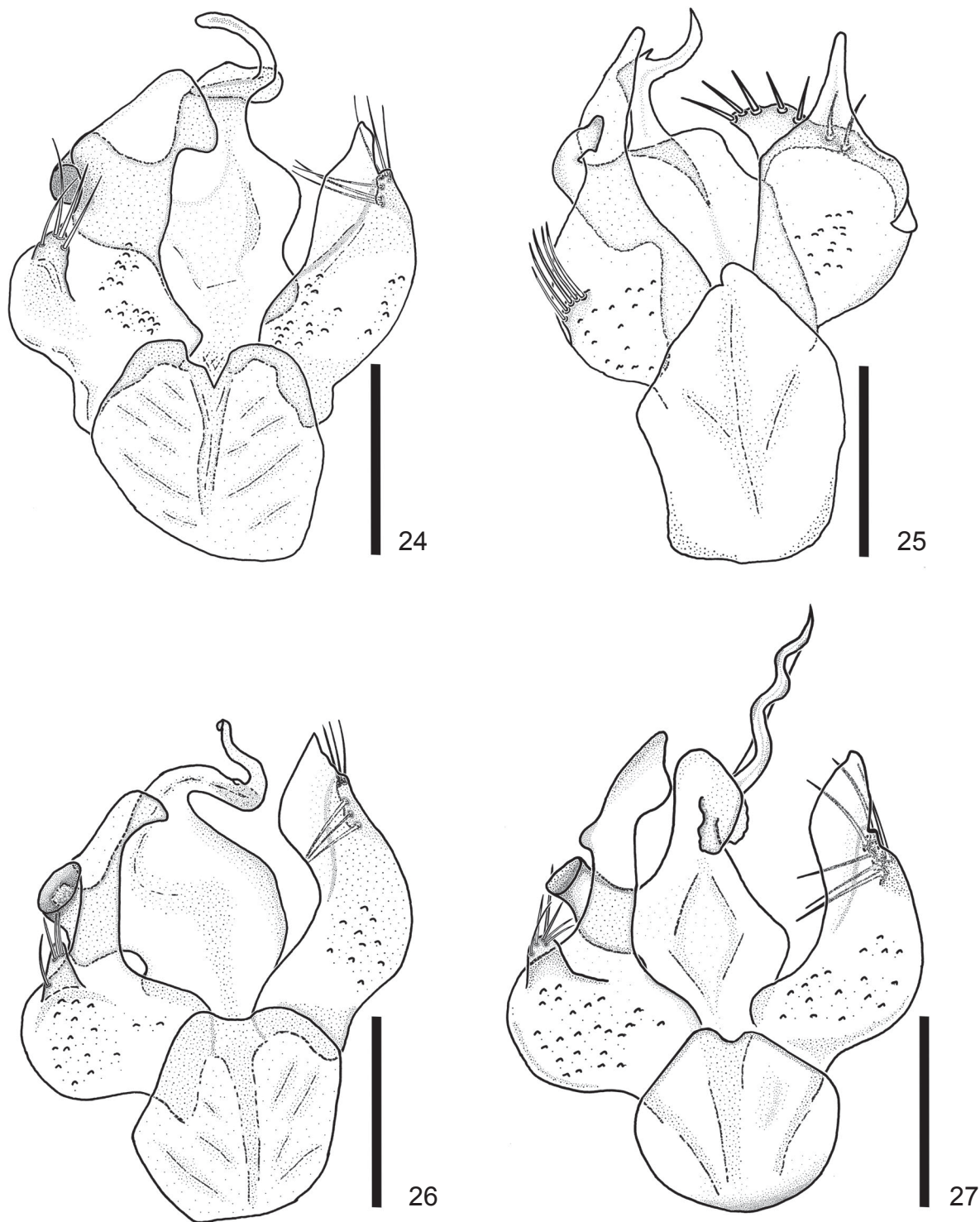




**Figure 17-19.** Sexual dimorphism and aedeagus images. **17a)** Ventral aspect of abdomen, male (redrawn from Park 1942). **17b)** Ventral aspect of abdomen, female. **18)** *Sonoma cygnus*, aedeagus (dorsal view). **19)** *Sonoma parkorum*, aedeagus (dorsal view). Scale lines equal 0.1 mm. Right side of Fig. 17-19 is anatomical left.

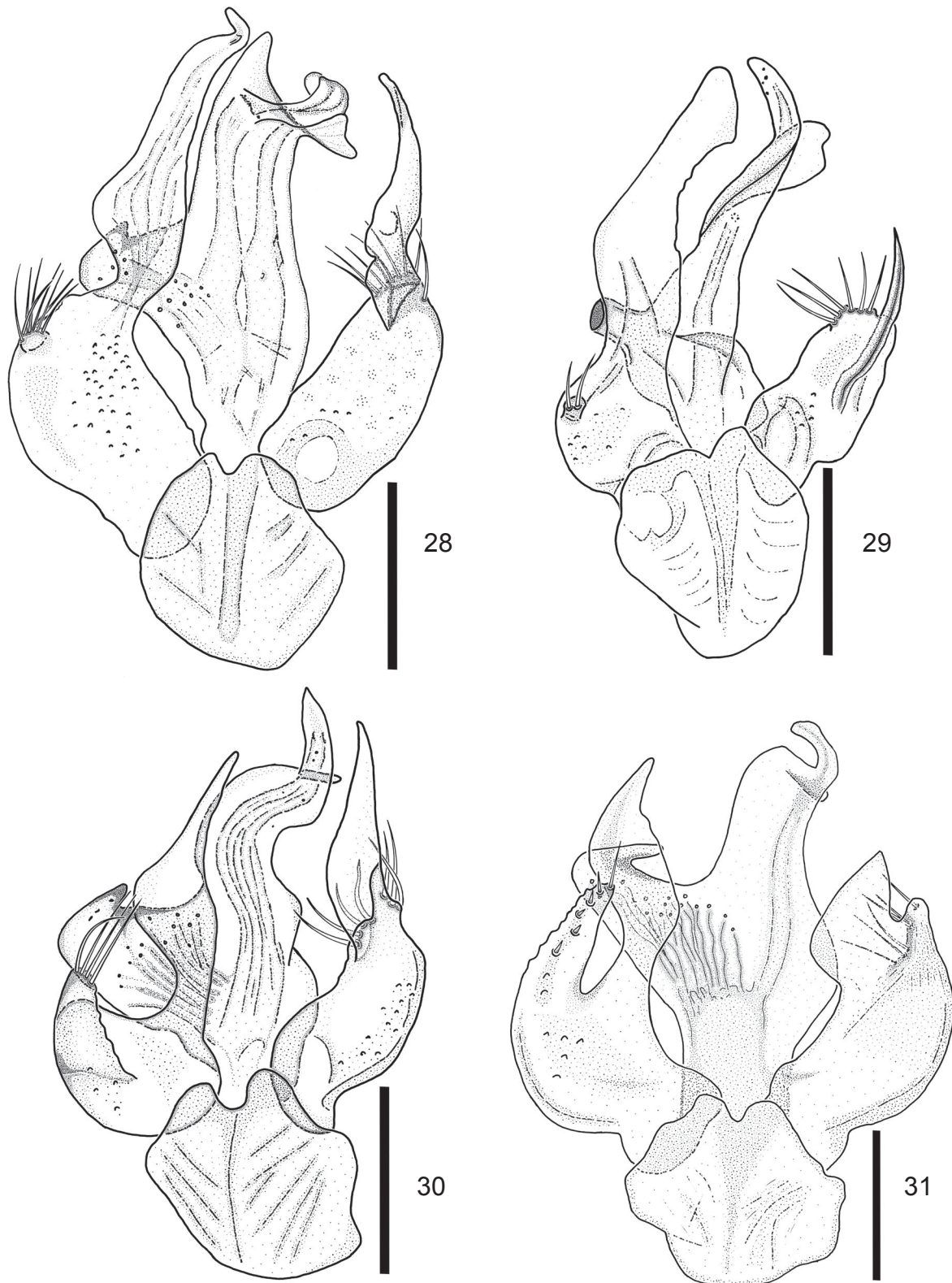


**Figure 20-23.** Aedeagus images. **20)** *Sonoma baylessae*, aedeagus (dorsal view). **21)** *Sonoma brasstownensis*, aedeagus (dorsal view). **22)** *Sonoma nicholsae*, aedeagus (dorsal view). **23)** *Sonoma gilae*, aedeagus (dorsal view). Scale lines equal 0.1 mm. Right side of figure is anatomical left.



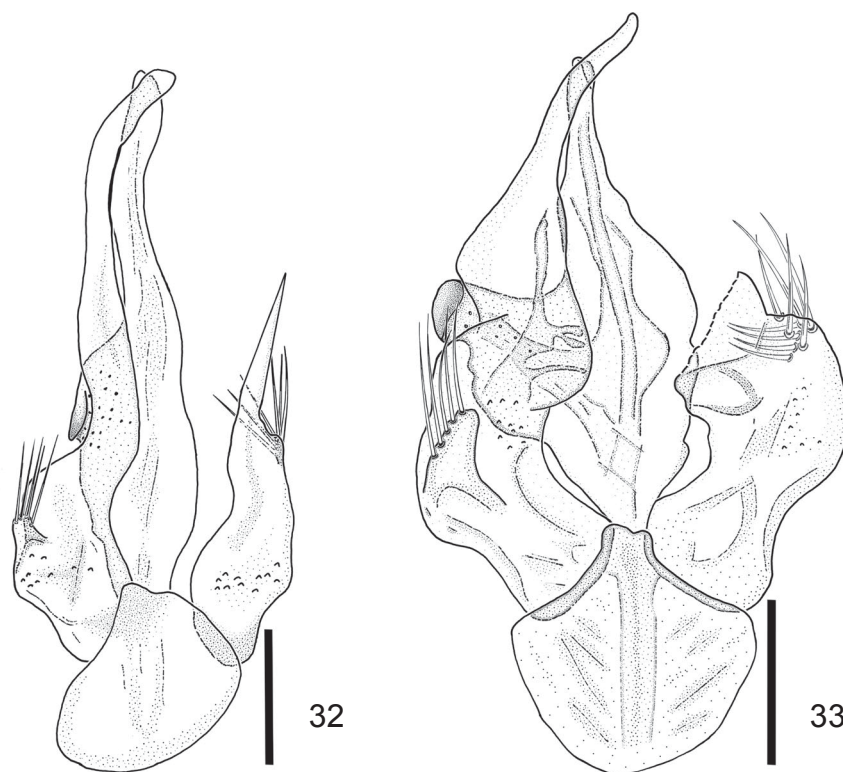
**Figure 24-27.** Aedeagus images. **24)** *Sonoma gimmeli*, aedeagus (dorsal view). **25)** *Sonoma tolulae*, aedeagus (dorsal view). **26)** *Sonoma chouljenkoi*, aedeagus (dorsal view). **27)** *Sonoma sokolovi*, aedeagus (dorsal view). Scale lines equal 0.1 mm. Right side of figure is anatomical left.



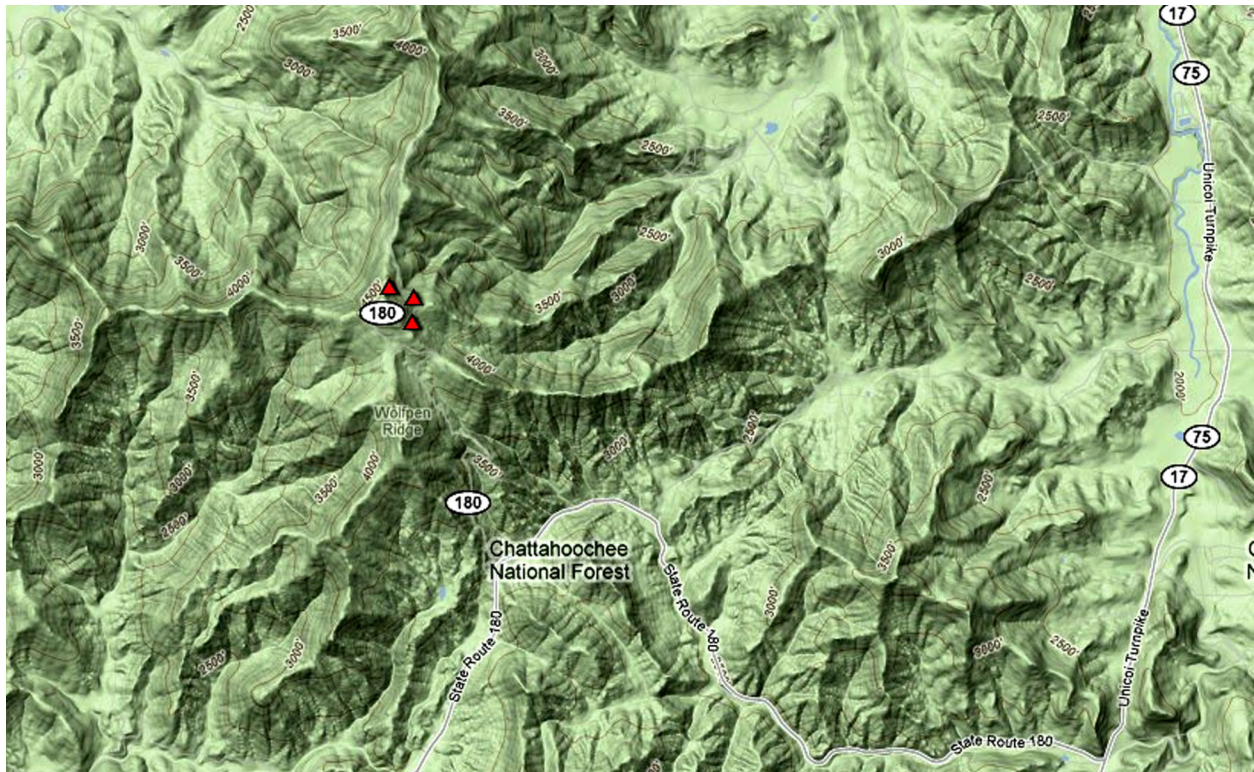


**Figure 28-31.** Aedeagus images. **28)** *Sonoma streptophorophallus*, aedeagus (dorsal view). **29)** *Sonoma nhunguyeni*, aedeagus (dorsal view). **30)** *Sonoma tridens*, aedeagus (dorsal view). **31)** *Sonoma holmesii*, aedeagus (dorsal view). Scale lines equal 0.1 mm. Right side of figure is anatomical left.

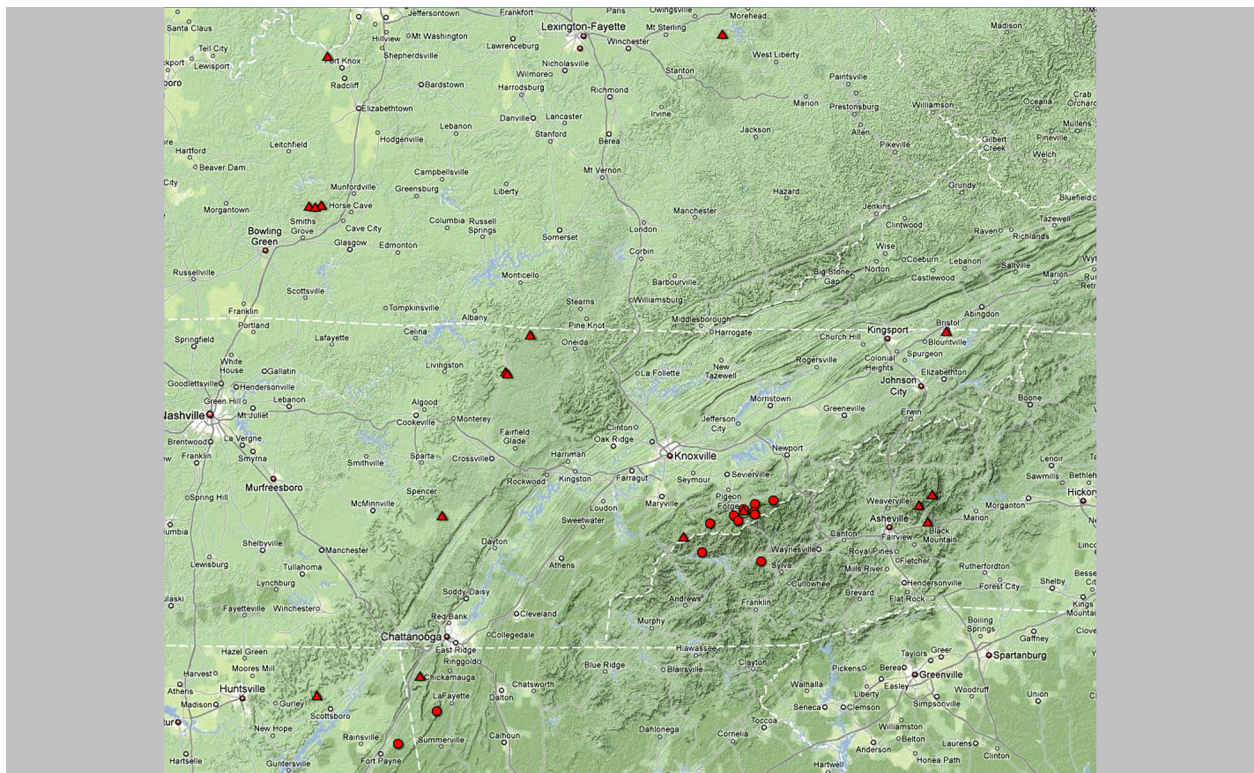




**Figure 32-33.** Aedeagus images. **32)** *Sonoma tishechkini*, aedeagus (dorsal view). **33)** *Sonoma mayori*, aedeagus (dorsal view). Scale lines equal 0.1 mm. Right side of figure is anatomical left.

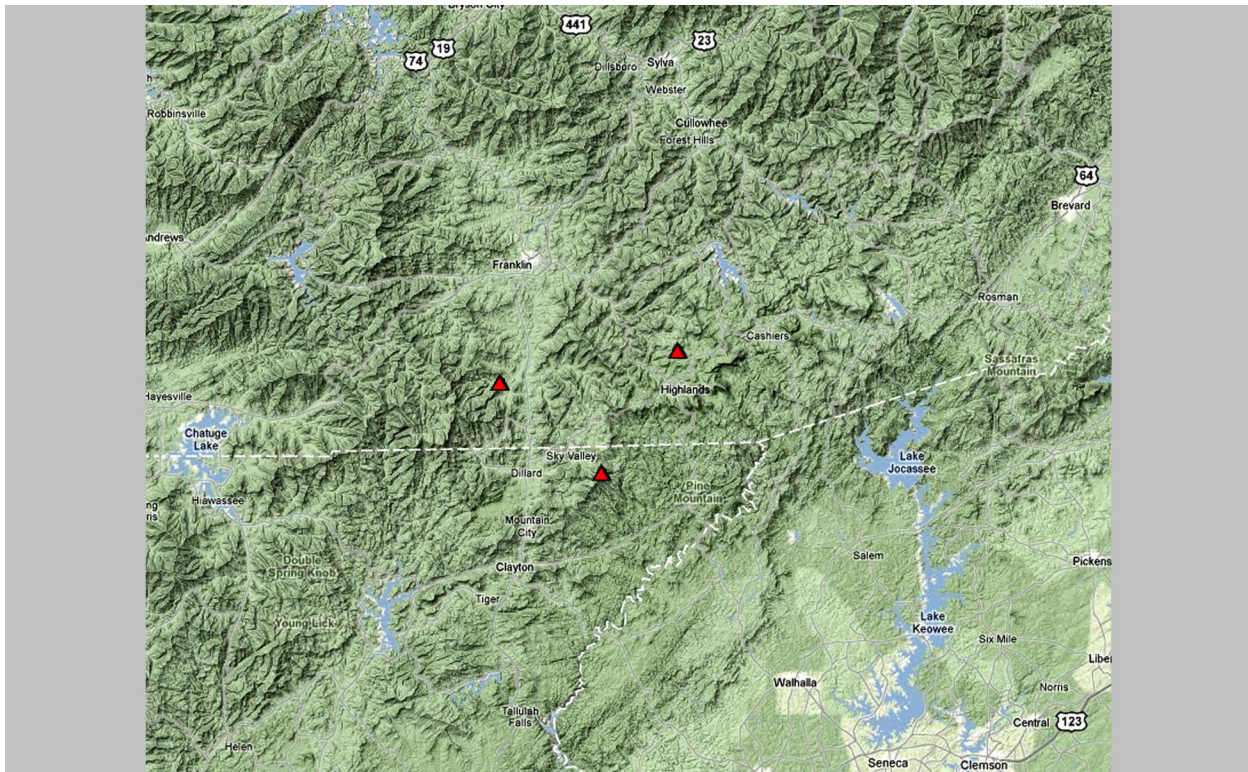


**Map 3.** Collection localities of *Sonoma brasstownensis*: Towns/Union County, Georgia. Triangles represent localities with verbal descriptions only.

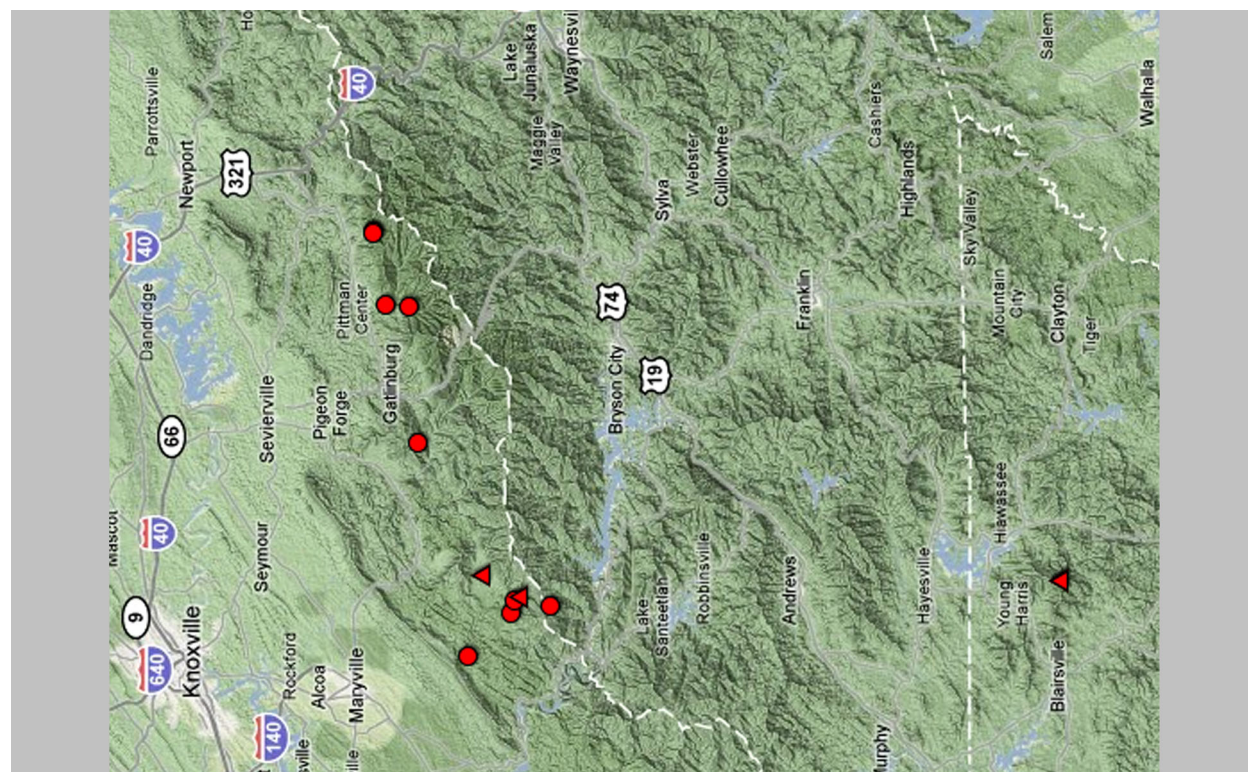


**Map 4.** Collection localities of *Sonoma chouljenkoi*: Alabama, Georgia, Kentucky, North Carolina, Tennessee. Circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.



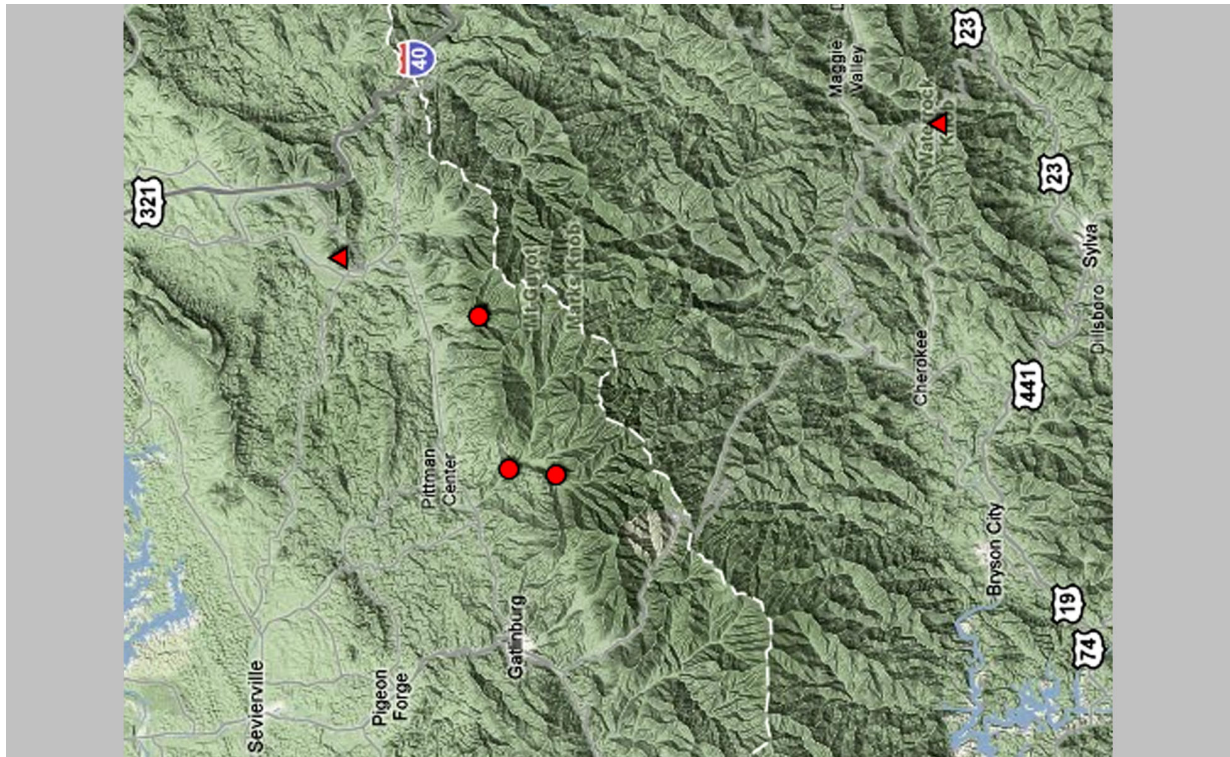


**Map 5.** Collection localities of *Sonoma cygnus*: Georgia, North Carolina. Triangles represent localities with verbal descriptions only.

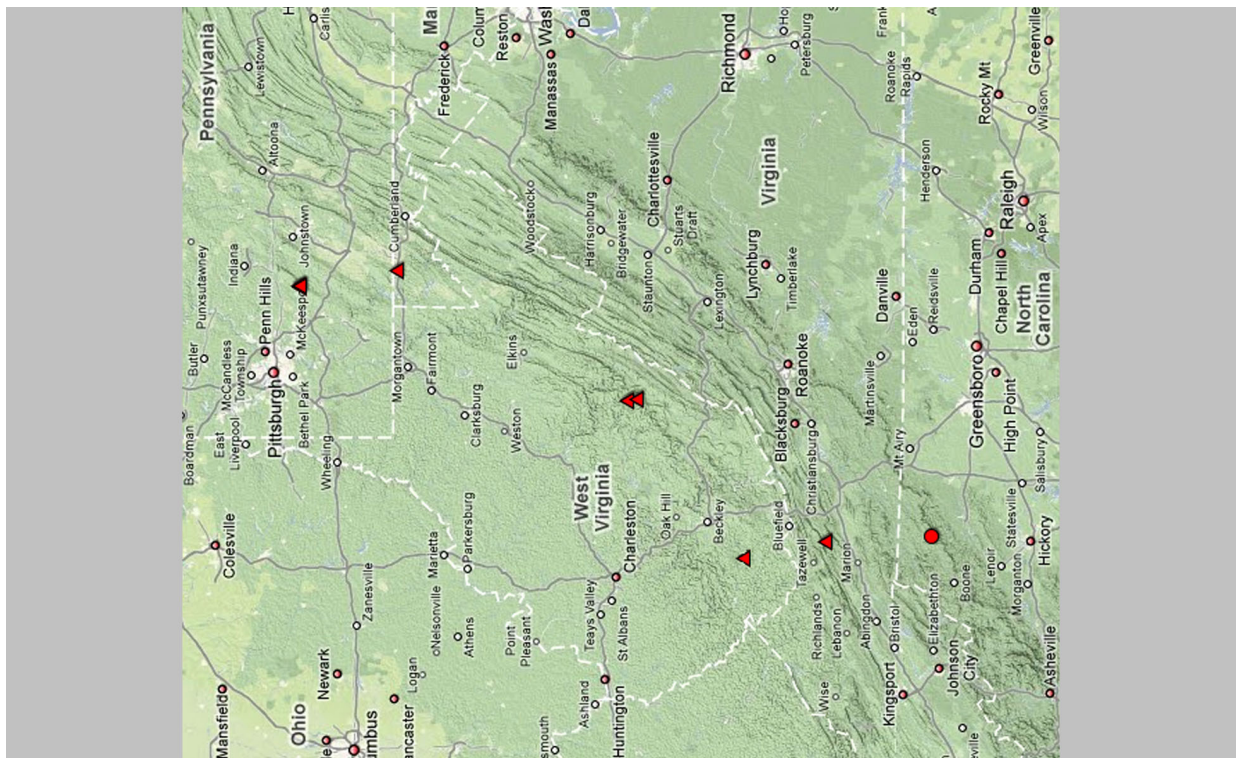


**Map 6.** Collection localities of *Sonoma gilae*: Georgia, Tennessee. Circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.



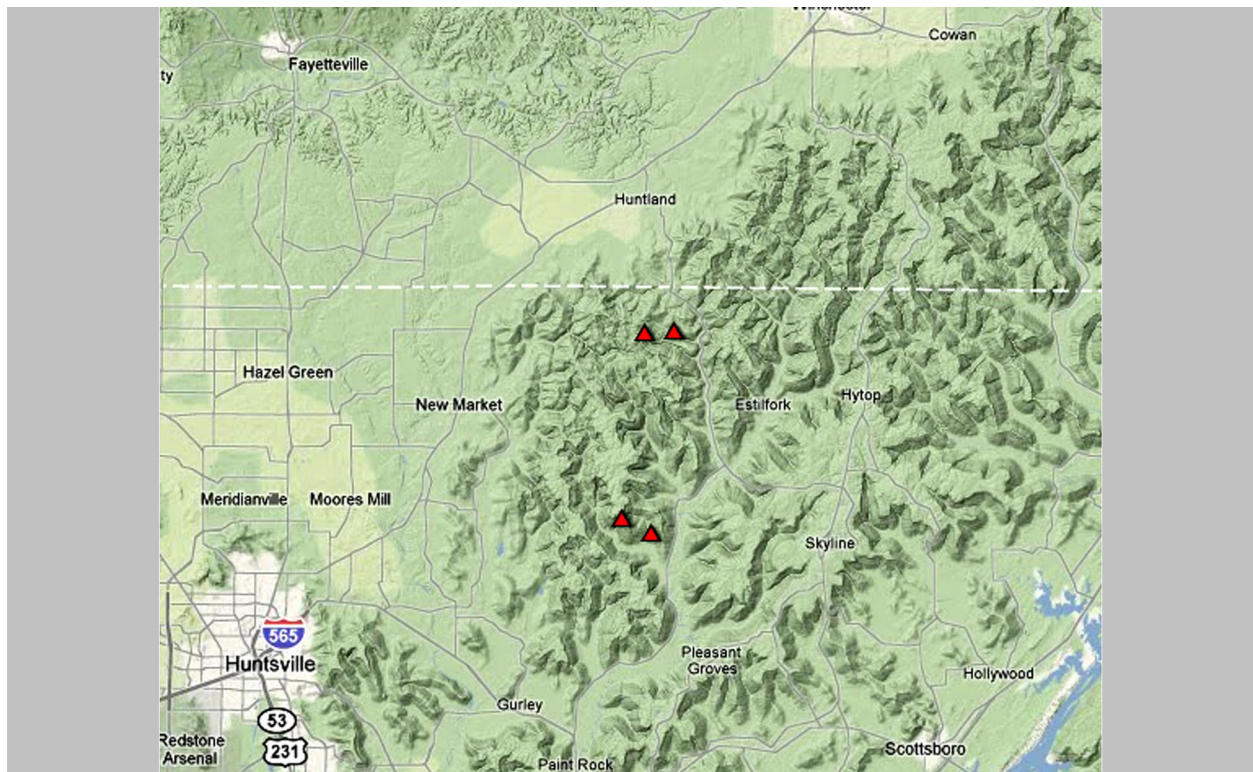


**Map 7.** Collection localities of *Sonoma gimmeli*: North Carolina, Tennessee. Circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.

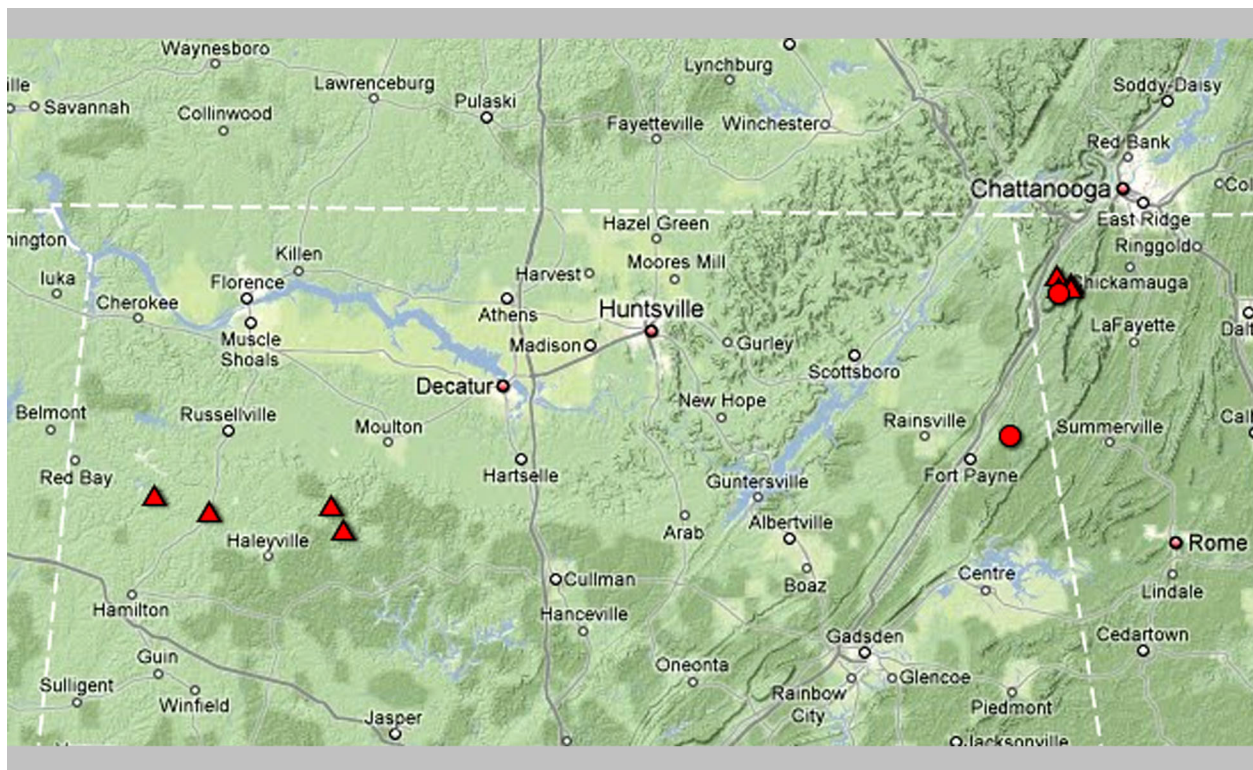


**Map 8.** Collection localities of *Sonoma holmesii*: North Carolina, Maryland, Pennsylvania, Virginia, West Virginia. The circle represents a locality from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.



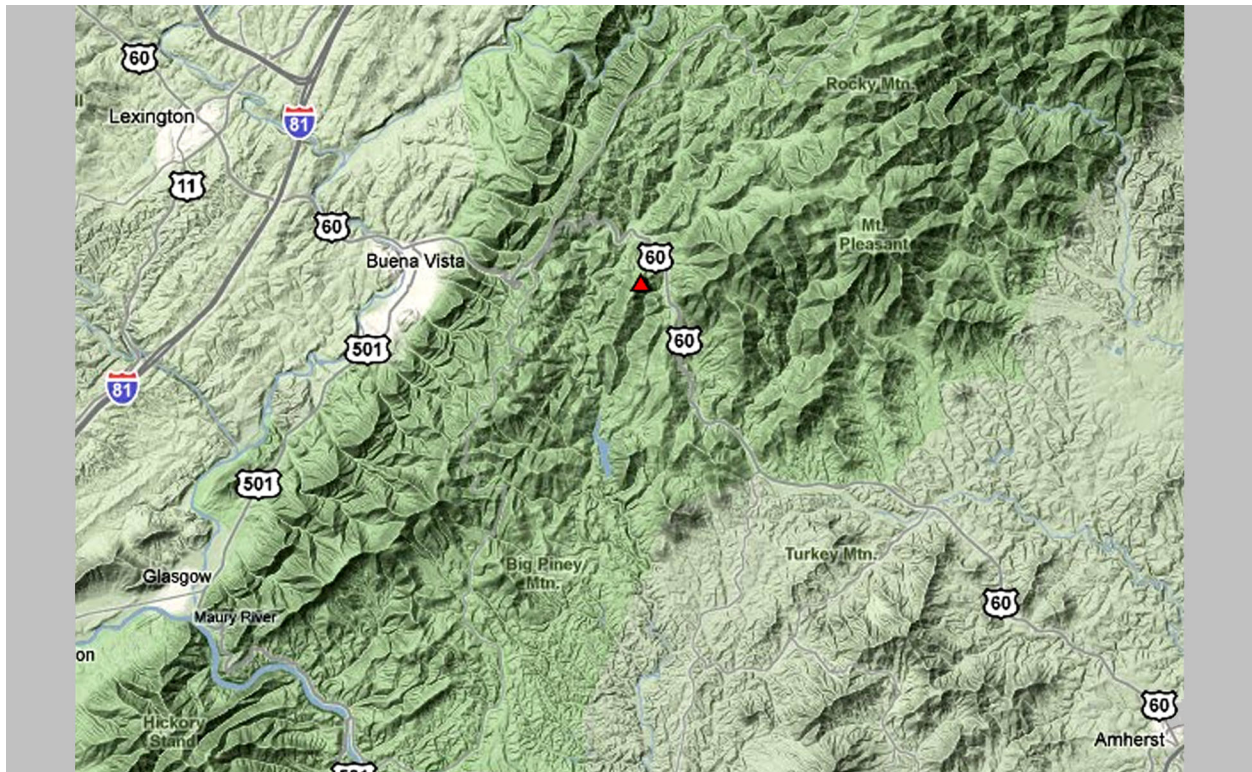


**Map 9.** Collection localities of *Sonoma nhunguyeni*: Jackson County, Alabama. Triangles represent localities with verbal descriptions only.

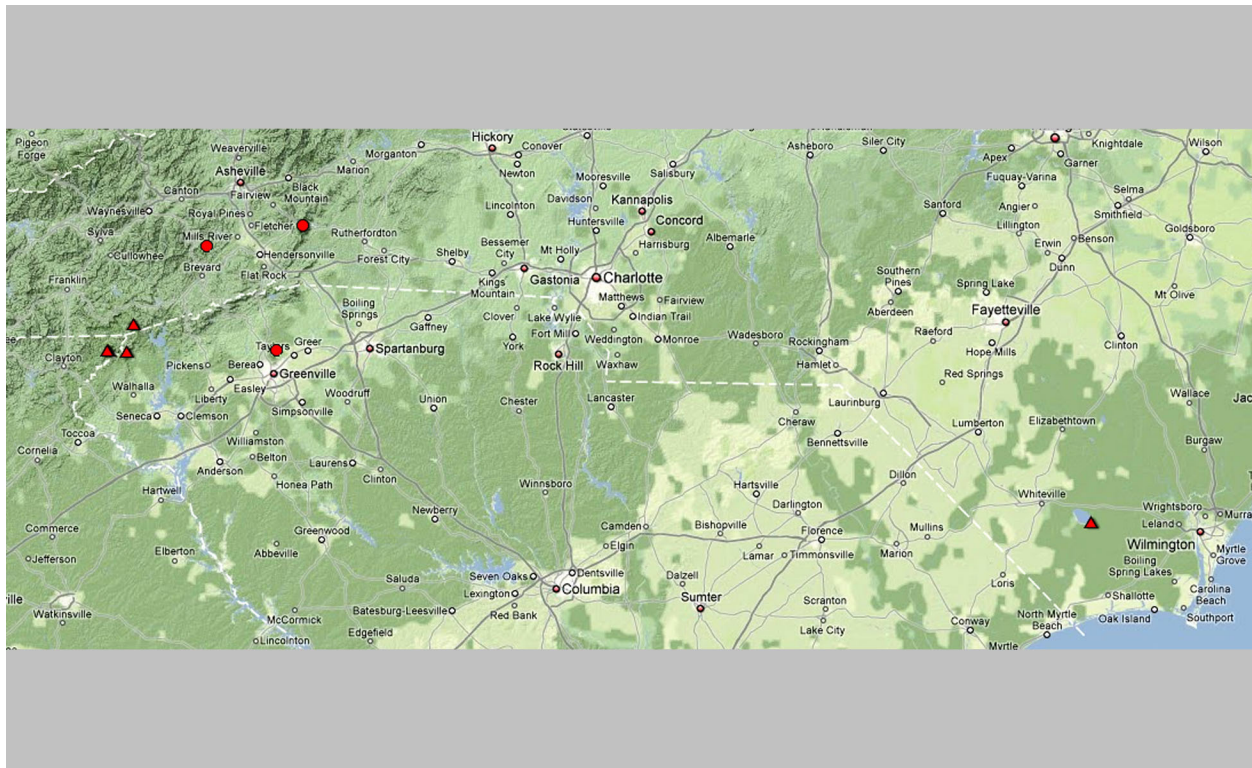


**Map 10.** Collection localities of *Sonoma sokolovi*: Alabama, Georgia. Circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.



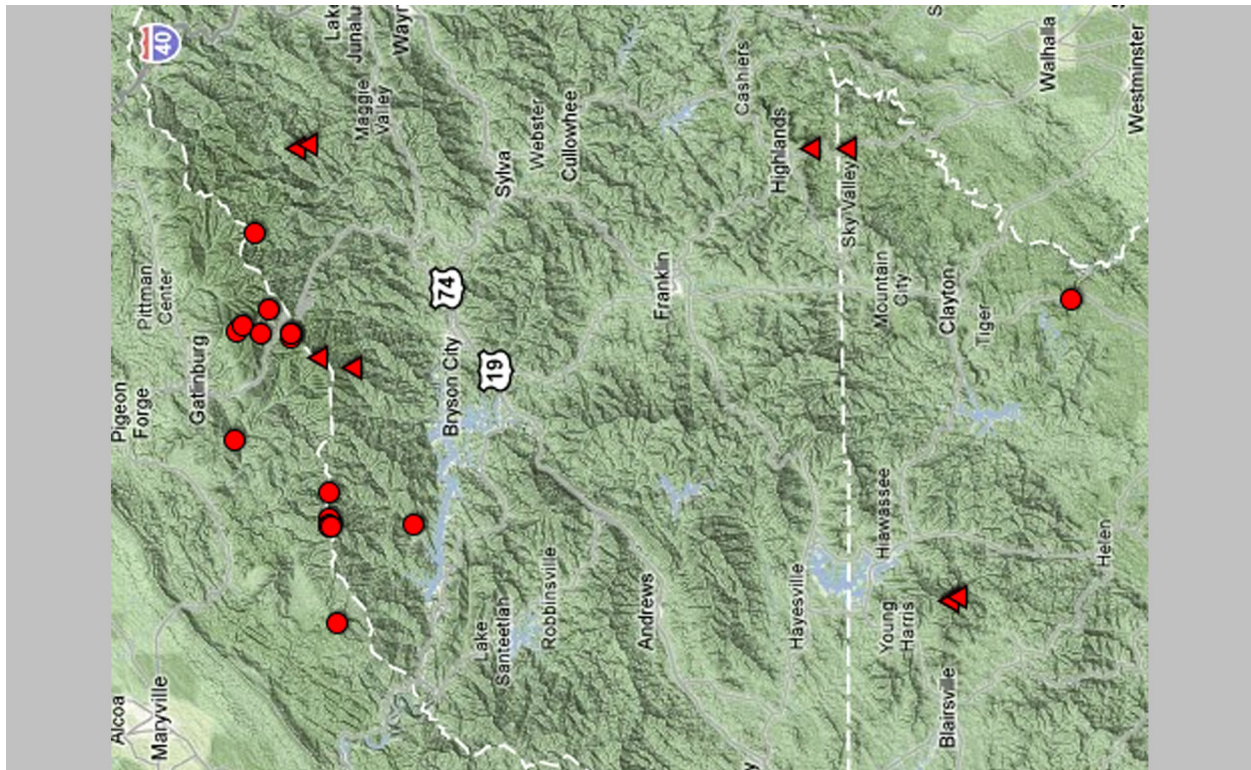


**Map 11.** Collection locality of *Sonoma streptophorophallus*: Amherst County, Virginia. The triangle represents a locality with a verbal description only.

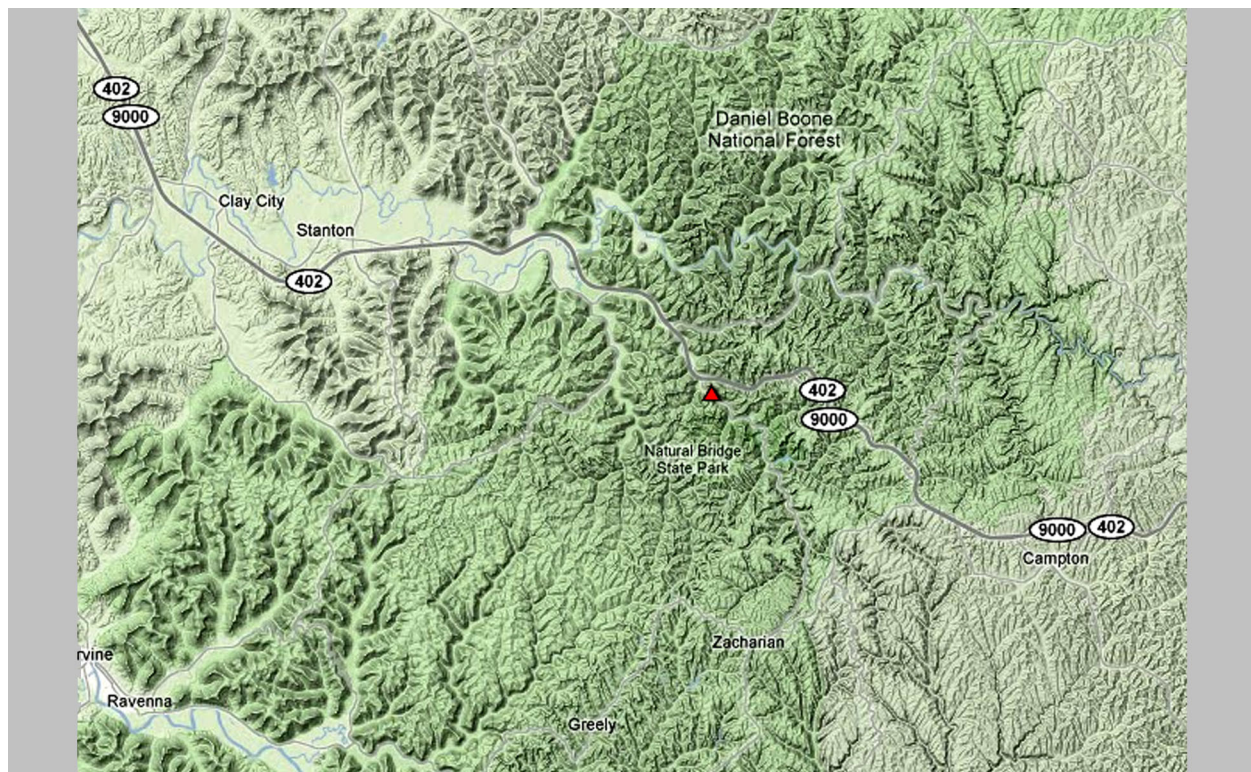


**Map 12.** Collection localities of *Sonoma tishechhini*: Georgia, North Carolina, South Carolina. The circles represent a locality from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.





**Map 13.** Collection localities of *Sonoma tolulae*: Georgia, North Carolina, Tennessee. Circles represent localities from coordinates taken with a Global Positioning System at the time of collection, and triangles represent localities with verbal descriptions only.



**Map 14.** Collection locality of *Sonoma tridens*: Powell County, Kentucky. The triangle represents a locality with a verbal description only.