Fourteen new species of Sonoma Casey (Coleoptera: Staphylinidae: Pselaphinae) with a key to species from western North America

Michael L. Ferro
Clemson University, spongymesophyll@gmail.com

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(Coleoptera: Staphylinidae: Pselaphinae)
with a key to species from western North America

Michael L. Ferro
Clemson University Arthropod Collection
Department of Agricultural and Environmental Sciences
277 Poole Agricultural Center, Clemson University
Clemson, SC 29634-0310 USA

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Michael L. Ferro
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Fourteen new species of *Sonoma* Casey (Coleoptera: Staphylinidae: Pselaphinae) with a key to species from western North America

Michael L. Ferro  
Clemson University Arthropod Collection  
Department of Agricultural and Environmental Sciences  
277 Poole Agricultural Center, Clemson University  
Clemson, SC 29634-0310 USA  
spongymesophyll@gmail.com

Abstract. Fourteen new species of faronine pselaphines in the genus *Sonoma* Casey are described: *S. agitator* (California); *S. cardiac* (Oregon); *S. carltoni* (Oregon); *S. cataloochee* (North Carolina); *S. caterinoi* (California); *S. chandleri* (California); *S. cobra* (California); *S. colberti* (California); *S. maryae* (Oregon); *S. quellazaire* (Oregon); *S. rossellinae* (California); *S. stewarti* (California); *S. twaini* (California); and *S. virgo* (California, Oregon). Thirteen are from western North America and one from the eastern U.S. These species bring the total diversity of the genus to 57 species—40 from western North America and 17 from the eastern U.S. A key to, and updated distributions for, all western species are provided.

Introduction

Members of the genus *Sonoma* Casey (Coleoptera: Staphylinidae: Pselaphinae: Faronitae) are small, predacious, chiefly leaf litter and rotten wood dwelling beetles. An updated taxonomic history was provided in Ferro and Carlton (2010), who also wrote about biology of the group. Recently, Owens et al. (2015) provided a list of Sonoma known from Mount Rainier National Park. After completion of the former manuscript (Ferro and Carlton 2010) the author received requests to provide identifications for specimens of *Sonoma* from western North America, and was invited by Don Chandler to examine several undescribed species of the genus in his collection. As a result of those studies 14 undescribed species were discovered, additional collection localities for described species were obtained (Appendix 1), and genitalia were re-figured for nearly all western species.

Materials and Methods

Specimens of *Sonoma* were examined from the following institutions. Collections and their acronyms are from Evenhuis (2014). Collection managers and curators are indicated.

- **CAS** California Academy of Sciences (San Francisco, CA, USA; Norman Penny).
- **CNC** Canadian National Collection of Insects (Ottawa, ON, Canada; Patrice Bouchard).
- **CSCA** California State Collection of Arthropods (Sacramento, CA, USA; Andrew Cline).
- **DCPC** Don Chandler Personal Collection; Durham, NH, USA.
- **FMNH** Field Museum of Natural History (Chicago, IL, USA; James Boone and Crystal Maier).
- **FSCA** Florida State Collection of Arthropods, Division of Plant Industry (Gainesville, FL, USA; Paul Skelley).
- **LSAM** Louisiana State Arthropod Museum, Louisiana State University (Baton Rouge, LA, USA; Victoria Bayless).
- **MSUC** Michigan State University (East Lansing, MI, USA; Anthony Cognato, Gary Parsons).
- **NCSU** North Carolina State University Insect Collection (Raleigh, NC, USA; Bob Blinn).
- **OSUC** C. A. Triplehorn Insect Collection, Ohio State University (Columbus, OH, USA; Luciana Musetti).
- **RBCM** Royal British Columbia Museum (Victoria, BC, Canada; Claudia Copley).
- **RRPC** Rodney J. Rood Personal Collection; Pullman, WA, USA.
- **SBMN** Santa Barbara Museum of Natural History (Santa Barbara, CA, USA; Michael Caterino and Matthew L. Gimmel).
- **SEMC** Snow Entomological Museum, University of Kansas (Lawrence, KS, USA; Zachary Falin).
Verbatim label data are given for all identifiable 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. “(4♂, FMNH).”

Specimen preparation and dissection followed procedures given in Ferro and Carlton (2010). Head, pronotum, elytra, and antennal measurements were taken from 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 (segment VII). Following Chandler (2001) tergites and ventrites are given Arabic numbers to denote sclerites that are visible (1–5) and Roman numerals to denote the morphological segments to which they belong (IV–VIII).

Systematic Accounts

Classification of Sonoma Casey 1886

Order Coleoptera Linnaeus, 1758
Family Staphylinidae Latreille, 1802
Subfamily Pselaphinae Latreille, 1802
Supertribe Faronitae Reitter, 1882
Genus Sonoma Casey, 1886

For full synonymy and citations for family- and genus-group taxa, see Bouchard et al. (2011) and Newton et al. (2001). For a full description of the genus see Marsh and Schuster (1962).

For convenience, the 57 species of Sonoma are separated into two groups based on general distribution, eastern and western North America, with finer scale distributions, based on literature and specimens examined, noted as state and province codes.

West of the Mississippi River
S. agitator new species – CA
S. cardiac new species – OR
S. carltoni new species – OR
S. cascadia Chandler, 1986 – AK, BC, OR, WA
S. caterinoi new species – CA
S. cavifrons Casey, 1887 – CA, OR
S. chandleri new species – CA
S. cobra new species – CA
S. colberti new species – CA
S. conifera Chandler, 1986 – OR, WA
S. corticina Casey, 1887 – CA, OR
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 – BC, CA, OR, WA
New species of Sonoma

S. humilis Marsh and Schuster, 1962 – CA
S. isabellae (LeConte, 1851) – CA
S. konkoworum Chandler, 2003 – CA
S. margemina Park and Wagner, 1962 – AK, BC, OR, WA
S. maryae new species – OR
S. olycalida Park and Wagner, 1962 – BC, OR, WA
S. parviceps (Mäklin, 1852) – AK, BC, CA, OR, WA
S. petersi Chandler, 1986 – CA, OR
S. priocera Marsh and Schuster, 1962 – OR
S. quellazaire new species – OR
S. quercicola Chandler, 1986 – OR
S. repanda Marsh and Schuster, 1962 – CA
S. rossellinae new species – CA
S. rubida Casey, 1894 – CA
S. russelli Chandler, 1986 – OR
S. spadica Marsh and Schuster, 1962 – CA
S. squamishorum Chandler and Klimaszewski, 2009 – AK, BC
S. stewarti new species – CA
S. tehamae Chandler, 2003 – CA
S. triloba Marsh and Schuster, 1962 – CA
S. twaini new species – CA
S. vanna Marsh and Schuster, 1962 – CA
S. virgo new species – CA, OR
S. wintuorum Chandler, 2003 – CA

East of the Mississippi River
S. baylessae Ferro and Carlton, 2010 – NC, TN
S. brasstownensis Ferro and Carlton, 2010 – GA
S. cataloochee new species – NC
S. chouljenkoi Ferro and Carlton, 2010 – AL, GA, KY, NC, OH, TN
S. cygnus Ferro and Carlton, 2010 – GA, NC
S. gilae Ferro and Carlton, 2010 – GA, TN
S. gimmeli Ferro and Carlton, 2010 – NC, OH, TN
S. holmesi Ferro and Carlton, 2010 – NC, MD, PA, VA, WV
S. mayori Ferro and Carlton, 2010 – TN
S. nhunguyeni Ferro and Carlton, 2010 – AL
S. nicholsae Ferro and Carlton, 2010 – NC
S. parkorum Ferro and Carlton, 2010 – NC, TN
S. sokolovi Ferro and Carlton, 2010 – AL, GA
S. streptophorophallus Ferro and Carlton, 2010 – VA
S. tishechkini Ferro and Carlton, 2010 – GA, NC, SC
S. tolulae (LeConte, 1849) – GA, NC, TN
S. tridens Ferro and Carlton, 2010 – KY

Key to males of Sonoma

The only reliable way to identify most species of Sonoma is direct comparison of the aedeagus. Aedeagus extraction is a straightforward process requiring no special preparation to the specimen (see Ferro and Carlton 2010) 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 reason, the existence of several to many additional undescribed species is expected.
1. Endophallus with lateral digitate process ventrad from right paramere (Fig. 55) (reduced but present in Sonoma tishechkini); east of the Mississippi River; see key in Ferro and Carlton (2010).

**Modification of key in Ferro and Carlton (2010) for Sonoma cataloochee:**
- #6a. apex of endophallus rounded, with two lateral processes on left (Fig. 55) .......................... S. cataloochee new species, 4
- — apex of endophallus flat, with one lateral processes on left .................................................. S. nicholsae Ferro and Carlton
- Endophallus without lateral digitate process ventrad of right paramere (Fig. 15–54; west of the Mississippi River) .................................................. 2

2(1). Parameres paddle-shaped, extremely thin and elongate, >3x longer than phalobase (Fig. 15–18) ................................................................. 3
- Parameres shorter and wide, <2x length of phalobase (Fig. 19–54) ........................................... 6

3(2). Elongate lateral process arising from midpoint of endophallus and extending to or beyond apex (Fig. 16); CA ......................................................... S. wintuorum Chandler
- Lateral process extending halfway to apex of endophallus (Fig. 15), short (Fig. 18), or wanting (Fig. 17) .................................................. 4

4(3). Endophallus with elongate lateral process arising from midpoint and extending halfway to apex; apex of endophallus bulbous with single apical process (Fig. 15); CA ........................................ S. stewarti new species, 12
- Lateral process of endophallus short or wanting; apex of endophallus with elongate process bent at right angle (Fig. 17, 18) ......................................... 5

5(4). Endophallus with two subapical processes; apical ¼ of endophallus bent at a right angle (Fig. 17); CA ......................................................... S. twaini new species, 13
- Endophallus with three apical processes: one short; one elongate and bent like a shepherd's hook; one bent anteriorly (Fig. 18); CA ........................................ S. colberti new species, 8

6(2). Aedeagus more or less bilaterally symmetrical; parameres with large outward facing hook-like apical processes (Fig. 19, 20) ............................................................... 7
- Aedeagus asymmetrical; parameres otherwise (Fig. 21–54) ..................................................... 8

7(6). Paramere with hook-like apical process distinctly curved, with 5–6 setae extending beyond tip of endophallus (Fig. 19); AK, BC .......... S. squamishorum Chandler and Klimaszewski
- Paramere with hook-like apical process nearly straight with angulate tip, with 3–4 setae not extending beyond tip of endophallus (Fig. 20); CA ........................................ S. grandiceps Casey

8(6). Left paramere with two large papillate processes and 3–4 short, thick setae clustered at apex (Fig. 21–25) ................................................................. 9
- Without papillae on parameres (Fig. 26–54) ........................................................................ 13

9(8). Both parameres with distinct papillate apical processes (Fig. 21); AK, BC, OR, WA .......... S. margemina Park and Wagner
- Only left paramere with papillae (Fig. 22–25) ........................................................................ 10

10(9). Endophallus with two elongate, thin processes; right paramere extending beyond apex of endophallus (Fig. 22); AK, BC, OR, WA .............. S. cascadia Chandler
- One process of endophallus distinctly slimmer than the other; right paramere no extending beyond apex of endophallus (Fig. 23–25) ........ 11
11(10). Right paramere rounded at apex; endophallus with: major process with indistinct flange; and
minor process recurved (Fig. 23); CA, OR .................................................. **S. petersi** Chandler
— Right paramere truncate at apex or teardrop shaped; major process of endophallus with distinct
flange (Fig. 24, 25) ............................................................... 12

12(11). Right paramere truncate at apex; major process of endophallus with rounded flange (Fig. 24);
CA, OR .................................................................................. **S. corticina** Casey
— Right paramere teardrop shaped; major process of endophallus with several layers, apico-ventral
most triangular, acute (Fig. 25); OR ........................................**S. quellazaire** new species, 10

13(8). Endophallus spatulata (apex distinctly wider than base), and with a large apical process (Fig.
26–32) ....................................................................................................... 14
— Endophallus wider at base, curved, or subparallel sided (Fig. 33–54) .............................. 20

14(13). Endophallus with two distinct apical processes (Fig. 26, 27) .................................................. 15
— Endophallus with a single distinct apical process (Fig. 28–32) .................................................. 16

15(14). Endophallus with medial apical process narrow at apex and with small projection at base;
lateral apical process spatulata (Fig. 26); CA .................. **S. spadica** Marsh and Schuster
— Endophallus with medial apical process widened at tip, recurved; lateral apical process acuminate
at apex (Fig. 27); CA .......................................................... **S. dolabra** Marsh and Schuster

16 (14). Left paramere with large subapical semi-transparent flange; apical process of endophallus
directed left (Fig. 28, 29) .................................................................................................................. 17
— Left paramere without flange; apical process of endophallus directed left or right (Fig. 30–32)
.................................................................................................................. 18

17(16). Subapical inner flange of left paramere wider than base at approximately midlength, with
thickened cuticle along lateral edge; endophallus without apical process on right corner (Fig.
28); CA .................................................................................. **S. isabellae** (LeConte)
— Subapical inner flange of left paramere widest at base, with thickened cuticle along median
edge; endophallus with blunt apical process on right corner (Fig. 29); CA ..............................
........................................................................................................**S. rossellinae** new species, 11

18(16). Parameres with apices rounded, without any apical processes (Fig. 30); CA ...........................
— Parameres with apices hooked and/or with apical process (Fig. 31, 32) .......................... 19

19(18). Left paramere hooked apically; apical process of right paramere with 4–5 points (Fig. 31); CA
........................................................................................................**S. vanna** Marsh and Schuster
— Left paramere apex rounded; apical process of right paramere simple (Fig. 32); CA ..............
........................................................................................................**S. chandleri** new species, 6

20(13). Endophallus extremely thin, >1/6 width of paramere (Fig. 33, 34) ................................. 21
— Endophallus much wider, <1/4 width of paramere (Fig. 35–54) ........................................... 22

21(20). Both parameres quadrate; apex of endophallus with two small rounded bulbs (Fig. 33); OR ...
........................................................................................................**S. carltoni** new species, 3
— Left paramere elongate-oval; apex of endophallus bent, acuminate (Fig. 34); OR ..............
........................................................................................................**S. russelli** Chandler
22(20). Both parameres with thick apical tufts of 8+ setae as longer or longer than paramere; endophallus simple, subparallel, apex slightly to strongly hooked (Fig. 35–37) ........................................ 23

— Apical setal tufts lacking, subapical, not as long as paramere, or with fewer than 8 setae; endophallus elaborate and or with apical processes (Fig. 38–54) ........................................ 25

23(22). Left paramere with basal lobe pronounced, symmetrical with midline of phalobase; digitate process of left paramere with two distinct projections; endophallus apex with distinct “apical hook”, inner structures distinct (Fig. 36); AK, BC, CA, OR, WA ....... *S. parviceps* Mäklin

— Basal lobe not symmetrical with phalobase; digitate process with 3 or 4 projections; endophallus with three distinct curves, or slight curve at apex (Fig. 35, 37) ........................................ 24

24(23). Digitate process of left paramere with 3 projections; apex of endophallus with slight curve (Fig. 35); CA, OR ................................................................. *S. cavifrons* Casey

— Digitate process of left paramere with 4 projections; endophallus with three distinct curves—at base, below the midline, and subapically (Fig. 37); OR ............... *S. maryae* new species, 9

25(22). Left paramere with apical process with dorsal lobe extending medially but not meeting medial dorsal edge, resulting in a distinct furrow (Fig. 38, 39) ........................................................ 26

— Left paramere without apical process, or process ventral (Fig. 40–54) ........................................ 27

26(25). Apex of endophallus blunt; right paramere without processes (Fig. 38); OR ................................................................. *S. cardiac* new species, 2

— Apex of endophallus acute, with distinct subapical process; right paramere with large ventral process (Fig. 39); CA, OR ................................................................. *S. virgo* new species, 14

27(25). Endophallus or parameres with elaborate, nearly transparent flanges creating an overlapping effect, difficult to see parts distinctly (Fig. 40–42) ........................................................ 28

— Without flanges, endophallus and parameres appear distinct (Fig. 43–54) .................................................. 30

28(27). Right paramere with large dorsal, nearly transparent flange that overlaps endophallus and part of left paramere; left paramere with large ventral nearly transparent flange that extends ventrad of endophallus and medial portion of right paramere’s flange (Fig. 40); OR ................................................................. *S. priocera* Marsh and Schuster

— Flange arising from endophallus (Fig. 41, 42) ................................................................. 29

29(28). Vase-shaped flange of endophallus with dorsal distal edge smooth; right paramere with a short, blunt subapical ventral process (Fig. 41); OR, WA ............................................. *S. conifera* Chandler

— Edge of flange surrounding endophallus jagged ventrally, elongate and acute on right lateral margin; right paramere with multi-digitate ventral process (Fig. 42); BC, CA, OR, WA ...... ................................................................. *S. hespera* Park and Wagner

30(27). Both parameres: 1) globular to quadrate, not much longer than wide (left paramere elongate in *S. agitator* and *S. cuneata*); 2) with lateral apical setal tufts; AND 3) with thick, usually blunt, ventral processes (Fig. 43–49) ................................................................. 31

— Without above combination of characters, parameres elongate, without ventral processes, etc. (Fig. 50–54) ................................................................. 37

31(30). Ventral process of paramere extended to level of, or beyond, apex of endophallus (Fig. 43–46) .......................................................................................... 32

— Processes of parameres distinctly shorter than endophallus (Fig. 47–49) ................................................................. 35

32(31). Ventral process of right paramere acuminate and recurved creating a hook (Fig. 43, 44) .... 33

— Ventral process of right paramere wide, flattened, not recurved (Fig. 45, 46) ................................................................. 34
33(32). Endophallus with large lateral basal process on left; width of endophallus at midpoint greater than 1/3 width of paramere (Fig. 43); CA ..................................S. agitator new species, 1

— Endophallus without large lateral basal process; width of endophallus less than ¼ width of paramere (Fig. 44); CA ..................................................S. rubida Casey

34(32). Apex of endophallus acute; ventral process of right paramere not widening toward apex (Fig. 45); CA, Coast Ranges ................................S. humilis Marsh and Schuster

— Apex of endophallus obtuse; ventral process of right paramere widening toward apex (Fig. 46); CA, Sierra Nevada and southern Cascade Mountains ...........S. konkoworum Chandler

35(31). Endophallus narrow, <½ width of paramere (Fig. 47); CA ...S. triloba Marsh and Schuster

— Endophallus wide, >½ width of paramere (Fig. 48, 49) ..........................................................36

36(35). Apical half of endophallus equal width (Fig. 48); CA ..............S. cuneata Marsh and Schuster

— Endophallus widest just above midline, narrowing to apex (Fig. 49); BC, OR, WA ....................S. olycalida Park and Wagner

37(30). Endophallus distinctly longer than parameres, with apical hook (Fig. 50, 51) ....................38

— Endophallus as long as or shorter than parameres, with or without hook (Fig. 52–54) ...........39

38(37). Left paramere without apical or ventral process; right paramere with thin, elongate apical process (Fig. 50); CA ....................................................S. repanda Marsh and Schuster

— Left paramere with ventral process forming lateral facing hook; right paramere with short wide ventral process (Fig. 51); OR ...........................................S. quercicola Chandler

39(37). Right paramere with large subapical process extending mesad perpendicular to midline; apex of endophallus also bent perpendicular to midline (Fig. 52); CA ....S. cobra new species, 7

— Right paramere with large subapical process not bent; apex of endophallus bilobed, or straight (Fig. 53, 54) ..........................................................40

40(39). Apex of endophallus bilobed (Fig. 53); CA .....................S. dilopha Marsh and Schuster

— Apex of endophallus globular with two processes directed rearward (Fig. 54); CA ..................S. caterinoi new species, 5

Species Accounts

1. Sonoma agitator new species

Fig. 1, 43; Map 2.

Description. Holotype, male. Measurements: head 0.24 long, 0.30 wide; pronotum 0.29 long, 0.35 wide; elytra 0.60 long, 0.30 wide; antennomeres 1–11 total 0.73; total length 2.01. Body uniformly pale brown. Body covered in elongate setae (greater than half the length of the eye).

Head. Eyes prominent, maximum length in dorsal view 1.06x length of first antennal segment, with approximately 50 facets. Antennomere 2 approximately 0.73x width of 1; 3 smallest.

Thorax. Elytra with indistinct sutural foveae; 2–3 foveae lateral to sutural fovea; central row of 5–6 foveae in basal 1/3. Winged. Metatrochanter rounded; metatibia with process on inner margin approximately halfway from base.

Abdomen. Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites V–VI only, reduced. Basal pubescence present on ventrites IV–VII.

Aedeagus. Asymmetrical. Left paramere: apical process with three elongate setae; inner subapical process thin, hooked dorsally, with three basal setae. Endophallus: with large, blunt, lateral basal process on left; width at midpoint greater than 1/3 width of left paramere; blunt apical and subapical
processes. Right paramere: globose; with three apical and three subapical setae; ventral digitate process approximately 1/4 width of paramere; with acute mesad subapical process and reflexed apical process.

**Type Material.** Holotype, male: *CA: Monterey Co. 36.0812°N, 121.5947°W UC Big Creek Reserve Big/Brunette Ck. confl. iii.28-iv.2.2004, FIT M. Caterino / CA BEETLE PROJ CBP0018666 (1♂). Deposited in SBMNH.


**Geographical Distribution.** Sonoma agitator is only known from two locations, one each in Monterey and San Luis Obispo counties, California.

**Comments.** Specimens were collected during March through June using flight intercept traps.

Aedeagal characters of Sonoma agitator are similar to those of S. rubida. The two can be separated based on the following characters, S. rubida in brackets [ ]: endophallus with large lateral basal process on left [basal process wanting], width at midpoint greater than 1/3 width of left paramere [width less than 1/4 width of left paramere], apex blunt [apex narrowly pointed], with blunt subapical process [without subapical process]; right paramere ventral digitate process approximately 1/4 width of paramere [process approximately 1/6 width of paramere].

**Etymology.** The specific epithet celebrates the three separate times the author became deeply concerned that the species was S. rubida (on the grounds that the sketch in Marsh and Schuster 1962 was flawed), and the three separate times he discovered his own illustration of the aedeagus of S. rubida that not only vindicated Marsh and Schuster, but clearly showed S. agitator to be undescribed.

2. **Sonoma cardiac** new species

Fig. 2, 38; Map 3.

**Description.** Holotype, male. Measurements: head 0.31 long, 0.38 wide; pronotum 0.37 long, 0.45 wide; elytra 0.57 long, 0.35 wide; antennomeres 1–11 total 0.80; total length 2.30. Body brown, maxillary palps paler. Body with moderate length (approximately 1/2 or less width of eye) setae.

**Head.** Eyes prominent, maximum length in dorsal view 0.93x length of first antennal segment, with approximately 26 facets. Antennomere 2 approximately 0.80x width of 1; 3 smallest.

**Thorax.** Pronotum with lateral discal foveae. Elytra with indistinct sutural foveae; 2–3 foveae lateral to sutural fovea; central row of 5–6 foveae in basal 1/3. Apparently brachypterous. Metabasitibia unmodified.

**Abdomen.** Tergite IV without transverse patch of microtrichia. Basal lateral foveae obscure, weak if present. Basal pubescence present on ventrites IV–VI, lacking on VII.

**Aedeagus.** Compact. Left paramere: wide at base, abruptly narrowing in apical 1/3; apical process with dorsal lobe extending medially but not meeting medial dorsal edge, resulting in a distinct furrow; 5 setae along inner margin of apical process extended medially; one seta on outer margin of apical process extending posteriorly. Endophallus: large blunt lateral projection at basal 1/3, projected to the left; thick lateral process at midpoint projected to the right; apex blunt, subequal in width to apical 1/2 of endophallus. Right paramere: oval, lacking processes and setae [possibly damaged].
**Type Material.** Holotype, male: *USA: OR: Joseph Co, 5 mi S Obrien 1700’, XII-18-71 EM Benedict, doug-fir & cedar litter (1♂). Deposited in FMNH.

**Geographical Distribution.** *Sonoma cardiac* is known from a single specimen collected from Josephine Co., Oregon.

**Comments.** The specimen was collected during December from Douglas fir and cedar litter.

Aedeagal characters of *Sonoma cardiac* are similar to those of *S. virgo*. The left parameres of each are indistinguishable, but unique among known species of *Sonoma*. The two can be separated based on the following characters, *S. virgo* in brackets [ ]: endophallus with large blunt lateral projection (1/4 length of endophallus) in basal 1/3 [small process approximately 1/10 length]; apex of endophallus blunt, no projections [apex of endophallus with two projections, one narrow and one wide]; right paramere without apical projections or setae [right paramere with ventral process with two apical projections, tuft of lateral apical setae present].

**Etymology.** The specific epithet is based on the resemblance of the aedeagus to a heart.

### 3. *Sonoma carltoni* new species

Fig. 3, 33; Map 4.

**Description.** Holotype, male. Measurements: head 0.22 long, 0.28 wide; pronotum 0.28 long, 0.32 wide; elytra 0.54 long, 0.26 wide; antennomeres 1–11 total 0.55; total length 1.86. Body brown, antennae, maxillary palpi, and legs paler. Body covered in short setae (less than 1/4 length of the eye).

- **Head.** Eyes large, maximum length in dorsal view subequal to length of first antennal segment, with approximately 40 facets. Antennomere 2 approximately 0.75x width of 1; 3 smallest. Elongate setae at temples (greater than 1/2 length of eye).

- **Thorax.** Elytra with 3 sutural foveae; 2 foveae lateral to sutural fovea; central row of 3–4 foveae in basal 1/3. Winged. Metatibia unmodified.

- **Abdomen.** Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites V–VI. Basal pubescence present on ventrites IV–VII.

- **Aedeagus.** Blunt. Left paramere: subequal in size to phallobase; mesal margin straight; four large setae on posterio-lateral corner, greater than 1/2 length of paramere; central ventral shelf bearing setal tuft; lateral ventral shelf with setal tuft. Endophalus: elongate; thick hook-like basal process on right; cup-like setae-bearing flange on left at mid-point; apical half elongate, parallel sided; tip consisting of apical and subapical knobs. Right paramere: subequal in size to phallobase; with single ventral digitate process extending beyond apex of paramere; 4–5 elongate setae on posterio-lateral corner and row of 5 smaller setae arranged medially.

**Type Material.** Holotype, male: *USA: OR: Benton Co., Siuslaw N.F., Marys Peak, Meadowedge Tr. (top part), 1189-1197 m, 44°30.417’N, 123°33.12’W, 17.ix.2012, old-growth *Abies procera* forest, FMHD#2012-030, berl., log & litter, A. Newton & M. Thayer; ANMT site 1245 (1♂). Deposited in FMNH.


**Geographical Distribution.** *Sonoma carltoni* is only known from Mary’s Peak, Benton Co., Oregon.

**Comments.** Specimens have been collected during May, July, and September from Berlesed log and leaf litter material taken in an old-growth *Abies procera* forest, and at elevations ranging from 1189–1219 m.

Aedeagal characters of *Sonoma carltoni* are similar to those of *S. russelli*. The two can be separated based on the following characters, *S. russelli* in brackets [ ]: postero-lateral setae of left paramere greater...
than 1/2 length of paramere [setae approximately 1/4 length of paramere]; central ventral shelf of left paramere not extending beyond apex of paramere [ventral process extending beyond paramere]; apical half of endophallus elongate, parallel sided, tip consisting of apical and subapical knobs [apical 2/3 of endophallus elongate, spine hooked near apex]; postero-lateral setae of right paramere approximately 1/2 length of paramere [setae approximately 1/4 length of paramere].

**Etymology.** _Sonoma carltoni_ is named for Christopher Eugene Carlton, an entomological polymath who has contributed greatly to our understanding of the Pselaphinae.

**4. Sonoma cataloochee** new species

Fig. 4, 55; Map 6.

**Description.** Holotype, male. Measurements: head 0.26 long, 0.34 wide; pronotum 0.36 long, 0.42 wide; elytra 0.36 long, 0.28 wide; antennomeres 1–11 total 0.84; total length 1.82. Body brown, maxillary palps and legs paler. Body covered in elongate setae (greater than half the length of the eye).

_Head._ Eyes prominent, maximum length in dorsal view 0.83x length of first antennal segment, with approximately 20 facets. Antennomere 2 approximately 0.86x width of 1; 3 smallest.

_Thorax._ Elytra sutural foveae obscured, sutural stria distinct; central row of approximately 3 foveae in basal 1/2. Brachypterous. Metatibia unmodified.

_Abdomen._ Tergite one without transverse patch of microtrichia. Abdominal foveae and basal pubescence obscured.

_Aedeagus._ Compact; apex of endophallus extending beyond parameres. Left paramere: robust; cluster of 5 thick setae 2/3 from base; distal 1/3 evenly acuminate, apex blunt. Endophallus: lateral digitate process long, base greater than 2x as wide as narrowest point, ventrad from right paramere; sides divergent in apical 2/5; apex rounded, with dorsal recurved process on left overlapping blunt anteriorly directed process. Right paramere: widened at base, dorsal lateral setose process short, with 4 apical setae; lateral constriction at level of digitate process of endophallus narrow, less than medial width of left paramere; apex blunt, directed posteriorly.

**Type Material.** Holotype, male: *Cataloochee Divide, N.C. / June 10 1940 Quirsfeld (1♂). Deposited in CNC.

**Geographical Distribution.** _Sonoma cataloochee_ is known from a single specimen collected at Cataloochee Divide in North Carolina, presumably in Haywood County. Cataloochee Divide is a ridge that creates the southeastern border of the Cataloochee valley. The northwestern slope of Cataloochee Divide is within the borders of Great Smoky Mountains National Park and _Sonoma cataloochee_ is likely to be found within the park.

**Comments.** _Sonoma cataloochee_ was collected in June.

Aedeagal characters of _Sonoma cataloochee_ are similar to those of _S. nicholsae_. The two can be separated based on the following characters, _S. nicholsae_ in brackets [ ]: left paramere with lateral margin straight from basal 1/3 until level of lateral setae [paramere with lateral margin narrowing then widening below lateral setae]; endophallus with apex rounded, with two left lateral processes [endophallus flat with lateral lobe on right and recurved process on right]; right paramere with dorsal lateral setose process short (approximately 1/2 length of apical setae), midpoint narrower than midpoint of left paramere [dorsolateral process short (more than 1/2 length of setae), midpoint wider than midpoint of left paramere].

**Etymology.** _Sonoma cataloochee_ is named for the Cherokee term “Gadalutsi”, which means “fringe standing erect” used to described the tall trees on the ridges surrounding the valleys that define the region.
5. *Sonoma caterinoi* new species
Fig. 5, 54; Map 7.

**Description.** Holotype, male. Measurements: head 0.21 long, 0.33 wide; pronotum 0.34 long, 0.39 wide; elytra 0.43 long, 0.26 wide; antennomeres 1–11 total 0.65; total length 1.90. Body brown, maxillary papli and legs paler. Body covered in elongate setae (greater than half the length of the eye).

*Head.* Eyes reduced, maximum length in dorsal view 0.79x length of first antennal segment, with approximately 12 facets. Antennomere 2 approximately 0.95x width of 1; 3 smallest.

*Thorax.* Elytra with indistinct sutural foveae; 1 fovea lateral to sutural fovea; central row of 3 foveae in basal 1/3. Apparently brachypterous. Metatibia unmodified.

*Abdomen.* Tergite IV without transverse patch of microtrichia. Basal lateral foveae obscured, weak if present. Basal pubescence present on all ventrites.

*Aedeagus.* Left paramere: oval; 2/3 length of endophallus; with tuft of lateral subapical setae approximately 1.5x longer than paramere; central ventral shelf with tuft of short setae. Endophallus: deflexed left in basal 1/4; approximately same width throughout; tip widened with apical and subapical processes directed anteriorly. Right paramere: widest at middle; ventral tuft of setae originating below midline, setae subequal in length to paramere; ventral shelf above midline against mesal border with tuft of short setae; three part digitate process at apex.


**Geographical Distribution.** *Sonoma caterinoi* is known from a single specimen collected in Riverside Co., California.

**Comments.** The single specimen was collected in an unbaited pitfall trap during May. The reduced eyes, apparent brachyptery, and collection method indicate that the species may be associated with more subterranean habitats than its congeners.

Aedeagal characters of *Sonoma caterinoi* are similar to those of *S. dolabra*. The two can be separated based on the following characters, *S. dolabra* in brackets [*]: left paramere with subapical setae longer than paramere [subapical lateral setae equal to or less than length of paramere]; endophallus with apical processes projecting anteriorly [apical processes projecting posteriorly]; right paramere with ventral tuft of setae originating below midline, setae subequal in length to paramere [without ventral tuft of setae, all setae shorter than paramere].

**Etymology.** *Sonoma caterinoi* is named for Michael Stephen Caterino, collector of the type specimen and creator and first director of the California Beetle Project.

6. *Sonoma chandleri* new species
Fig. 6, 32; Map 9.

**Description.** Holotype, male. Measurements: head 0.19 long, 0.27 wide; pronotum 0.27 long, 0.31 wide; elytra 0.40 long, 0.22 wide; antennomeres 1–11 total 0.53; total length 1.98. Body brown; antennae, maxillary palpi, legs, and elytra paler. Body with short setae (1/2 or less width of eye).

*Head.* Eyes small, maximum length in dorsal view 0.86x length of first antennal segment, with approximately 18 facets. Antennomere 2 approximately 0.73x width of 1; 3 smallest.

*Thorax.* Elytra with indistinct sutural foveae; single fovea lateral to sutural fovea; central row of 3 foveae in basal 1/3. Wings present but reduced. Metatibia unmodified.

*Abdomen.* Tergite IV without microtrichia. Basal lateral foveae on ventrites IV–VI. Basal pubescence present on all visible ventrites.

*Aedeagus.* Left paramere: subtriangular; apex with 10+ elongate setae 2/3 length of paramere; ventral medial ridge with row of approximately 8 elongate setae 2/3 length of paramere. Endophallus: distinctly spatulata; longer than parameres; apical process directed to the right, perpendicular to ae-
deagus. Right paramere: with thin elongate apical process; distal 1/4 of inner and outer margin bearing elongate setae.

**Type Material.** Holotype, male: *USA: Calif., Glenn Co., 6mi NE Alder Springs, 20-XI-1979. / FMHD #79-3021, sift pine & oak litter, D. S. Chandler (1♂). Deposited in FMNH.

**Paratypes** (n=2). **UNITED STATES: CALIFORNIA: Glenn Co.: *Calif.:Glenn Co., 5 mi NE Alder Springs, XI-20-79 DSChandler / sift black & live oak litter (DCPC) (2♂) 1 SLIDE.

**Geographical Distribution.** *Sonoma chandleri* is known from specimens collected at two locations in Glenn Co., California.

**Comments.** *Sonoma chandleri* was collected in November by sifting black and live oak and pine litter. Aedeagal characters of *Sonoma chandleri* are similar to those of *S. vanna*. The two can be separated based on the following characters, *S. vanna* in brackets [ ]: left paramere subtriangular [left paramere with large apical hook directed mesad]; endophallus symmetrical until apical process [endophallus asymmetrical beyond midpoint]; right paramere with apical process simple [apical process with 5–6 projections].

**Etymology.** *Sonoma chandleri* is named for Donald Stewart Chandler, collector of the type series and an important contributor to the study of world-wide Pselaphinae.

7. *Sonoma cobra* new species
Fig. 7, 52; Map 10.

**Description.** Holotype, male. Measurements: head 0.27 long, 0.36 wide; pronotum 0.41 long, 0.43 wide; elytra 0.40 long, 0.28 wide; antennomeres 1–11 total 0.67; total length 1.80. Body brown, distal portion of antennae, maxillary palpi, and legs paler. Body covered in short setae (less than 1/2 length of the eye).

**Head.** Eyes reduced, maximum length in dorsal view 0.75x length of first antennal segment, with approximately 9–10 facets. Antennomere 2 approximately 0.78x width of 1; 3 smallest.

**Thorax.** Elytra with indistinct sutural foveae; 2–3 foveae lateral to sutural fovea; single elongate central fovea in basal 1/3. Apparently brachypteryous. Metatibia unmodified.

**Abdomen.** Tergite IV without microtrichia. Basal lateral foveae obscured, weak if present. Basal pubescence present on all visible ventrites.

**Aedeagus.** Left paramere: longer than endophallus; blade-like apical projection with 4 setae arranged palmately directed posteriorly to mesad. Endophallus: wide as base, narrowing to apex; s-shaped; apical 1/5 perpendicular to aedeagus; subapical wart with two stout setae. Right paramere: elongate apical hook-like process approximately 2/3 length of paramere, directed mesad with 4–5 setae at base.

**Type Material.** Holotype, male: *CALIF: Shasta Co. Buckhorn Summit IV.15.1981 T.R.Haig, Coll. / Berlesed from Oak duff (1♂). Deposited in CSAC.

**Geographical Distribution.** *Sonoma cobra* is known from a single specimen collected in Shasta Co., California.

**Comments.** The specimen was collected during April from Berlesed oak duff. The reduced eyes, apparent brachyptery, and collection method indicate that the species may be associated with more subterranean habitats than its congeners.

Aedeagal characters of *Sonoma cobra* are unique. Lack of elongate latero-apical setae on the parameres separate it from *S. spadica, S. repanda*, and *S. dolabra*. The s-shaped endophallus and hook-like apical process on the right paramere will separate *S. cobra* from all other known species.
Etymology. *Sonoma cobra* is named for its unique serpentine endophallus complete with “fang-like” setae. “Cobra” is derived from *cobra de capelo*, a Portuguese term, and today is commonly used to refer to snakes in the family Elapidae.

8. *Sonoma colberti* new species
Fig. 8, 18; Map 11.

Description. Holotype, male. Measurements: head 0.23 long, 0.27 wide; pronotum 0.27 long, 0.28 wide; elytra 0.51 long, 0.26 wide; antennomeres 1–11 total 0.62; total length 1.90. Body uniformly brown. Body setae covered in elongate (greater than half the length of the eye).

*Head.* Eyes prominent, maximum length in dorsal view 0.83x length of first antennal segment, with approximately 40 facets. Antennomere 2 approximately equal width of 1; 3 smallest.

*Thorax.* Elytra with 3 indistinct sutural foveae; 2 foveae lateral to sutural fovea; central row of 2–4 foveae in basal 1/3. Winged. Metatrochanter elongate; metatibia unmodified.

*Abdomen.* Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites IV–VI. Basal pubescence present on ventrites III–VI.

*Aedeagus.* Elongate. Left paramere: subequal in length to endophallus; subequal in width in basal 4/5; apical 1/5 widened, paddle shaped with 7–10 stout setae directed mesad. Endophallus: widest at basal 1/3; stout subapical projection 3/5 from base on right lateral margin; left apical process with wide posteriorly directed triangular projection, tip bent anteriorly; median apical process thin, elongate, shaped like a shepherd’s hook; right apical process a stout pointed projection; Right paramere: 2/3 length left paramere; subequal in width in basal 3/4; apical 1/4 widened, paddle shaped, with 7–10 stout setae directed mesad.


Geographical Distribution. *Sonoma colberti* is only known from one location in Shasta County, California.

Comments. *Sonoma colberti* was collected during January and March.

Aedeagal characters of *S. colberti* are superficially similar to *S. wintuorum*, *S. twaini*, and *S. stewarti* all of which share a similar gestalt comprised of narrow, elongate parameres and an elongate endophallus with elaborate apical hooks or processes. The following combination of characters will separate *S. colberti* from the others: endophallus with three projections [S. *twaini* and *S. stewarti* with one, *S. wintuorum* with two]; subapical lateral projection of endophallus directed posteriorly and short, approximately 1/10 length of endophallus [S. *stewarti* with projection 1/5 length of endophallus, *S. wintuorum* with projection greater than 1/3 length of endophallus, *S. twaini* with two projections perpendicular to endophallus].

Etymology. *Sonoma colberti* is named for Stephen Colbert (silent “t”) a character created by Stephen Tyrone Colbert (sounded “t”), an author, philosopher, humanitarian, champion of science, and humorist.

9. *Sonoma maryae* new species
Fig. 9, 37; Map 23.

Description. Holotype, male. Measurements: head 0.28 long, 0.39 wide; pronotum 0.37 long, 0.43 wide; elytra 0.72 long, 0.39 wide; antennomeres 1–11 total 0.87; total length 1.96. Body brown; antennae, maxillary palpi, and legs paler. Body with short setae (1/4 or less width of eye).
Head. Eyes large, maximum length in dorsal view 1.66x length of first antennal segment, with approximately 70 facets. Antennomere 2 approximately 0.78x width of 1; 3 smallest.


Abdomen. Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites obscured, weak if present. Basal pubescence present on all visible ventrites.

Aedeagus. Left paramere: elongate oval; ventral shelf running along 9/10 mesal margin; subapical digitate process with 5 projections directed mesad; apical tuft of 7–10 setae subequal in length to paramere; 5 additional setae along inner margin in apical 1/3, directed mesad. Endophallus: more or less same width throughout; curved; base projecting behind right paramere, abruptly curving to the left until achieving midline of aedeagus, straightening and projecting posteriorly until apical 1/5 curves right. Right paramere: oval with ventral shelf running from apex to inner margin near base; single subapical digitate ventral process with multiple convoluted projections; apical tuft of 12–15 setae subequal in length to paramere.


Geographical Distribution. Sonoma maryae is known from a single specimen collected from Marys Peak, Benton Co., California.

Comments. Sonoma maryae was collected in February by sifting cedar litter. Aedeagal characters of Sonoma maryae are similar to those of S. cavifrons and S. parviceps. The three can be separated based on the following characters, S. cavifrons in brackets [], S. parviceps in braces {}. Left paramere with small basal lobe on inner margin that does not project across midline of phalobase [basal lobe larger, projecting slightly beyond midline of phalobase]; basal lobe pronounced, symmetrical with midline of phalobase; left paramere with digitate process with 5 projections directed mesad [digitate process with three projections], left paramere with digitate process with 5 projections directed mesad [digitate process with two distinct projections]; endophallus with three distinct curves—at base, below the midline, and subapically [with major curve at base, otherwise projected posteriorly, slight curve at apex], with major curve at base, apex with distinct “apical hook”, inner structures distinct); right paramere with single subapical digitate ventral process with multiple convoluted projections [subapical digitate ventral projection with single tip], ventral projection in two parts, distal part consisting of three short processes, basal part elongate projection shaped like a crooked finger).

Etymology. Sonoma maryae is named for Mary Elizabeth (Mary E.) Ferro Chapa, the author’s sister and a longtime supporter of his research endeavors, who shares the name of the locality.

10. Sonoma quellazaire new species
Fig. 10, 25; Map 28.

Description. Holotype, male. Measurements: head 0.20 long, 0.28 wide; pronotum 0.28 long, 0.32 wide; elytra 0.50 long, 0.25 wide; antennomeres 1–11 total 0.58; total length 1.90. Body brown, maxillary palpi, antennae, and legs paler. Body with moderate length setae (approximately 1/2 or less width of eye).

Head. Eyes prominent, maximum length in dorsal view 0.87x length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 0.73x width of 1; 3 smallest.

Thorax. Pronotum with weak lateral discal foveae. Elytra with indistinct sutural foveae; 2 foveae lateral to sutural fovea; central row of 4 foveae in basal 1/3. Winged. Metatrochanter rounded; metatibia with small tubercle on inner margin near middle.

Abdomen. Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites VI–V, weak on VII. Basal pubescence present on all visible ventrites.

Aedeagus. Left paramere: oval; subequal in width from base to apex; two large papillate processes and 4 short, thick setae clustered at apex. Endophallus: deflexed to right; apical 1/2 with 4 overlapping
layers, third layer with thin, elongate double pronged posteriorly-directed process; ventral-most layer with thin triangular flange. Right paramere: teardrop-shaped; 3 short, thick setae at apex.

**Type Material.** Holotype, male: *USA: OR: Lane Co., Siuslaw N.F., Cummins Ck. Tr., 90-210m, 44°16.12’N, 124°05.89’W, 8.xi.2011, old-growth Picea sitchensis forest; FMHD#2011-002, berl., leaf & log litter, M. Thayer & A. Newton; ANMT site 1235 (1♂). Deposited in FMNH.

Paratype (n=1). **UNITED STATES: OREGON: Benton Co.:** *USA: OR: Benton Co., Siuslaw N.F., Marys Peak, Meadowedge Tr. (W part), 1050-1070 m, 44°30.52’N, 123°33.56’W, 17.ix.2012, old growth Abies procera forest; FMHD#2012-033, berl., log & litter, A. Newton; ANMT site 1204 (FMNH) (1♂) SLIDE.

**Geographical Distribution.** Sonoma quellazaire is known from Benton and Lane counties, Oregon, but both locations are within the Siuslaw National Forest.

**Comments.** Specimens have been collected during September and November from Berlesed log and leaf litter material taken in old-growth Abies procera and Picea sitchensis forests at elevations ranging from 90–1070 m.

Aedeagal characters of *S. quellazaire* are similar to those of *S. petersi*. The left parameres of each are indistinguishable, but unique among known species of Sonoma. The two can be separated based on the following characters, *S. petersi* in brackets [ ]: endophallus with four distinct horizons, right lateral apical corner acute, elongate posteriorly-directed process double pronged [endophallus with two horizons, right lateral apical corner rounded, posteriorly directed process with single tip]; right paramere teardrop shaped [right paramere round].

**Etymology.** The apical process of the endophallus is reminiscent of a cigarette holder with its cigarette, an image typified by Audrey Hepburn in the movie *Breakfast at Tiffany’s*. “Quellazaire” is a neologism for “cigarette holder”.

**11. Sonoma rossellinae new species**

Fig. 11, 29; Map 31.

**Description.** Holotype, male. Measurements: head 0.21 long, 0.23 wide; pronotum 0.23 long, 0.27 wide; elytra 0.47 long, 0.23 wide; antennomeres 1–11 total 0.49; total length 1.68. Body dark brown, antennae, maxillary palpi, legs, and elytra paler. Body covered in elongate setae (greater than half the length of the eye).

**Head.** Eyes prominent, maximum length in dorsal view 1.11x length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 0.84x width of 1; 3 smallest.

**Thorax.** Elytra with row of 3 sutural foveae in basal 1/4, evenly spaced; single fovea lateral to sutural fovea; central row of 3 fovea in basal 1/4. Winged. Metatrochanter quadrate; metatibia with process on inner margin approximately halfway from base.

**Abdomen.** Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Distinct basal lateral foveae on ventrites IV–VII. Basal pubescence present on ventrites IV–VI, lacking on VII.

**Aedeagus.** Left paramere: apical digitate process <2x longer than wide, process with three apical setae directed posteriorly and three subapical setae curved toward midline; subapical inner flange widest at base, cuticle becoming thinner laterally. Endophallus: widening to apex; blunt apical process on right corner; elongate apical process extending perpendicular to endophallus directed toward left paramere. Right paramere: elongate apical process and triangular subapical process with six setae, three posteriorly directed and three curved toward midline.

**Type Material.** Holotype, male: *CA: Los Angeles Co. 34.0871°N, 118.8541°W Santa Monica Mts NRA Zuma Canyon, iv.29.2009 K.J. Hopp, Quercus litter / CA BEETLE PROJ CBP0091880 (1♂). Deposited in SBMNH.
Paratypes (n=5). UNITED STATES: UNITED STATES: CALIFORNIA: Los Angeles Co.: *CA: Los Angeles Co. 34.0871°N, 118.8541°W Santa Monica Mts NRA Zuma Canyon, iv.29.2009 K.J. Hopp, Quercus litter / CA BEETLE PROJ CBP0091877 (SBMNH) (1♂). *Same data / CA BEETLE PROJ CBP0091878 (SBMNH) (1♂). *Same data / CA BEETLE PROJ CBP0091881 (SBMNH) (1♂) SLIDE. *Same data / CA BEETLE PROJ CBP0091882 (SBMNH) (1♂). *CA: Los Angeles Co. 34.0809°N, 118.7958°W Santa Monica Mts NRA Castro Crest, iv.29.2009 K.J. Hopp, Umbellularia litter / CA BEETLE PROJ CBP0091917 (SBMNH) (1♂).

Geographical Distribution. Sonoma rossellinae is only known from Los Angeles County, California, where it was collected at two locations within the Santa Monica Mountains National Recreation Area.

Comments. Specimens were collected during April from Quercus and Umbellularia litter.

Aedeagal characters of Sonoma rossellinae are similar to those of S. isabellae. The two can be separated based on the following characters, S. isabellae in brackets [ ]: left paramere with elongate apical process greater than 2x longer than wide [left paramere with apical process shorter, ca. as wide as long]; subapical inner flange of left paramere widest at base, cuticle becoming thinner laterally [subapical inner flange of left paramere wider than base at approximately midlength, with thickened cuticle along lateral edge]; endophallus with blunt apical process on right corner [endophallus without apical process on right corner]; right paramere with triangular lateral subapical process directed laterally [right paramere with small subapical process at base of apical process directed medially]. Sonoma rossellinae possess metatibia with a process on inner margin, S. isabellae lack a metatibial process.

Etymology. Sonoma rossellinae is named after Isabella Fiorella Elettra Giovanna Rossellini, an Italian actress and film maker who wrote and starred in Green Porno, a series of short films on animal sexual behavior.

12. Sonoma stewarti  new species
Fig. 12, 15; Map 36.

Description. Holotype, male. Measurements: head 0.29 long, 0.46 wide; pronotum 0.41 long, 0.47 wide; elytra 0.82 long, 0.42 wide; antennomeres 1–11 total 0.88; total length 2.30. Body brown, maxillary palps paler. Body covered in elongate setae (greater than half the length of the eye).

Head. Eyes large, maximum length in dorsal view 0.74x length of first antennal segment, with approximately 70 facets. Antennomere 2 approximately 0.82x width of 1; 3 smallest.


Abdomen. Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites obscure, weak if present. Basal pubescence present on all visible ventrites.

Aedeagus. Elongate. Left paramere: equal in length to endophallus; subequal in width from base to apex; with 3–4 stout apical setae and 3 ventral subapical setae. Endophallus: widest at basal 1/5; thin elongate processes arising 2/3 from base on right projecting posteriorly; apex bulbous with s-shaped apical process. Right paramere: 2/3 length left paramere; subequal in width from base to apex; with 2–3 stout apical setae and 3 ventral subapical setae.

Type Material. Holotype, male: *CALIF: Butte Co., 4.4 mi SW Rackerby II-6-80 to II-4-81 A.R.Hardy coll. Antifreeze Pit Trap / CDAE (1♂). Deposited in CSCA.

Geographical Distribution. Sonoma stewarti is known from a single specimen collected from Butte Co., California.

Comments. Sonoma stewarti was collected in a pitfall trap that was active for an entire year, so no meaningful collection date is available.
Aedeagal characters of *S. stewarti* are superficially similar to *S. wintuorum*, *S. twaini*, and *S. colberti* all of which share a similar gestalt comprised of narrow, elongate parameres and an elongate endophallus with elaborate apical hooks or processes. The flowing combination of characters will separate *S. stewarti* from the others: endophallus with single apical projection [*S. wintuorum* with two, *S. colberti* with three]; endophallus with elongate thin posteriorly directed process arising 2/3 from base not projecting beyond tip of endophallus [with process projecting beyond tip of endophallus in *S. wintuorum*; without process in *S. twaini*, and *S. colberti*].

**Etymology.** *Sonoma stewarti* is named for Jon Stewart (born Jonathan Stuart Leibowitz), a humanitarian, champion of science, and humorist best known for reintroducing skepticism and intelligence to news reporting through a television program called *The Daily Show.*

13. *Sonoma twaini* new species
Fig. 13, 17; Map 39.

**Description.** Holotype, male. Measurements: head 0.25 long, 0.31 wide; pronotum 0.30 long, 0.34 wide; elytra 0.59 long, 0.28 wide; antennomeres 1–11 total 0.57; total length 1.92. Body brown, maxillary palpi and legs paler. Body with moderate length setae (approximately 1/2 or less width of eye).

*Head.* Eyes prominent, maximum length in dorsal view 0.47x length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 0.90x width of 1; 3 smallest.


*Abdomen.* Tergite IV with transverse patch of microtrichia narrowly interrupted at midline. Basal lateral foveae on ventrites V–VII. Basal pubescence present on all visible ventrites.

*Aedeagus.* Elongate. Left paramere: equal in length to endophallus; subequal in width from base to apex; with 4–5 stout apical setae and 3 ventral subapical setae. Endophallus: widest at basal 1/5; with two ventral processes arising 2/3 from base projecting perpendicular to aedeagus; apex bent 90° to the left. Right paramere: 2/3 length left paramere; subequal in width from base to apex; with 4–5 stout apical setae and 3 ventral subapical setae.

**Type Material.** Holotype, male: *T.R.Haig Whiskeytown Shasta Co.Cal. III.9.1973 (1♂). Deposited in CSCA.


**Geographical Distribution.** *Sonoma twaini* is only known from two locations, one each in Shasta and Trinity counties, California.

**Comments.** *Sonoma twaini* was collected in January and March, collection method is unknown.

Aedeagal characters of *S. twaini* are superficially similar to *S. wintuorum*, *S. stewarti*, and *S. colberti* all of which share a similar gestalt comprised of narrow, elongate parameres and an elongate endophallus with elaborate apical hooks or processes. The flowing combination of characters will separate *S. twaini* from the others: endophallus with two ventral processes arising 2/3 from base projecting perpendicular to aedeagus [absent in *S. wintuorum*, *S. stewarti*, and *S. colberti*]; without elongate thin posteriorly directed process arising 2/3 from base of endophallus [present in *S. wintuorum* and *S. stewarti*]; endophallus with single apical process [two in *S. wintuorum, three in S. colberti*].

**Etymology.** *Sonoma twaini* is named for the character Mark Twain, developed by Samuel Langhorne Clemens, an author, lecturer, philosopher, humanitarian, champion of science, and humorist. Clemens lived in California for awhile, but traveled nowhere near where this species occurs—the author forgives the oversight.
**14. Sonoma virgo new species**

Fig. 14, 39; Map 41.

**Description.** Holotype, male. Measurements: head 0.25 long, 0.29 wide; pronotum 0.30 long, 0.34 wide; elytra 0.49 long, 0.25 wide; antennomeres 1–11 total 0.65; total length 2.12. Body brown; maxillary palpi, antennae, and legs paler. Body with moderate length setae (approximately 1/2 or less width of eye). Elongate setae at temples (greater than 1/2 length of eye).

*Head.* Eyes prominent, maximum length in dorsal view subequal to length of first antennal segment, with approximately 30 facets. Antennomere 2 approximately 0.75x width of 1; 3 smallest.


*Abdomen.* Tergite IV without transverse patch of microtrichia. Basal lateral foveae on ventrites IV-V, weak on VII. Basal pubescence present on all visible ventrites.

*Aedeagus.* Compact. Left paramere: wide at base, abruptly narrowing in apical 1/3; apical process with dorsal lobe extending medially but not meeting medial dorsal edge, resulting in a distinct furrow; 5 setae along inner margin of apical process extended medially; one seta on outer margin of apical process extending posteriorly. Endophallus: deflexed to the right; small blunt lateral projection (1/10 length of endophallus) in basal 1/3; nearly transparent lateral process at midpoint extending to the right with multiple short projections on tip; two apical processes subequal in length, one on left wide, one on right narrow. Right paramere: oval; 1/2 length of left paramere; with large ventral process extending beyond endophallus with 2–3 apical processes; apical tuft of 5–7 setae directed posteriorly.

**Type Material.** Holotype, male: *USA: OR: Lane Co., Siuslaw N.F., Cummins Ck. Tr., 90-210m, 44°16.12'N, 124°05.89'W, 8.xi.2011, old-growth *Picea sitchensis* forest; FMHD#2011-002, berl., leaf & log litter, M. Thayer & A. Newton; ANMT site 1235 FIELD MUSEUM NAT. HIST. / [second label with same information folded beneath] (1♂). Deposited in FMNH.

**Paratype** (n=2). UNITED STATES: CALIFORNIA: Humboldt Co.: *Fieldbrook 28.5.03 [1903] Cal / HSBarber Collector (USNM) (1♂). OREGON: Lane Co.: *USA: OR: Lane Co., Siuslaw N.F., Cummins Ck. Tr., 90-210m, 44°16.12’N, 124°05.89’W, 8.xi.2011, old-growth *Picea sitchensis* forest; FMHD#2011-002, berl., leaf & log litter, M. Thayer & A. Newton; ANMT site 1235 FIELD MUSEUM NAT. HIST. (FMNH) (1♂) SLIDE.

**Geographical Distribution.** *Sonoma virgo* is known from two locations—Lane Co., Oregon and Humboldt Co., California—separated by approximately 400 km.

**Comments.** Two specimens were collected during November from Berlesed leaf and log litter taken from an old-growth *Picea sitchensis* forest in Oregon, and one specimen was collected during May in California. The California location, Fieldbrook, was the site of lumber companies around the time the specimen was collected in 1903, and is located near remaining redwood forests that include *Picea sitchensis*. Therefore, *S. virgo* may be associated with old-growth forests.

Aedeagal characters of *S. virgo* are similar to those of *S. cardiac*. The left parameres of each are indistinguishable, but unique among known species of *Sonoma*. The two can be separated based on the following characters, *S. cardiac* in brackets [ ]; basal third of endophallus with small process approximately 1/10 length of endophallus [large blunt lateral projection approximately 1/4 length of endophallus]; apex of endophallus with two projections, one narrow and one wide [apex of endophallus blunt, no projections]; right paramere with ventral process with two apical projections, tuft of lateral apical setae present [right paramere without apical projections or setae].

**Etymology.** The specific epithet refers to old-growth or “virgin” forests from which specimens have been collected.
Discussion

Despite more than a century and a half of work—beginning with LeConte (1849)—the genus Sonoma is still poorly known. Of the 14 species newly described, nearly half (6) are known from only a single specimen. Sonoma, like most other invertebrate taxa, offers a standard but exciting heap of mysteries for the future student of the group.

**Females.** While a few female descriptions exist and some females can be accurately distinguished based on unambiguous morphology (Chandler 2003), most females are virtually unidentifiable within the genus.

**Phylogeny.** The key, prior to couplet 39, represents a rough-sort of “natural” groups based on aedeagal morphology. For example, the lateral digitate process of the endophallus that is ventrad from the right paramere represents an autapomorphy possessed by all eastern, but no western, species. A future, thorough phylogenetic analysis should include genetic characters, but those are currently unavailable for the majority of species.

**Life History.** Other than collection date, method, and gross habitat descriptions, nothing is known about the life history of the genus: immature, life span, prey, behavior (hunting, feeding, mating, nesting, etc.), etc. Variations in eye size and possession or loss of wings indicate some variability of life histories among species. Predatory feeding habits are inferred based on the morphology of the mouthparts and documented feeding habits of other pselaphines, see the review in Ferro and Carlton (2010).

**Ecology.** Despite similar morphology, habitat use, and presumably prey, numerous species of Sonoma are apparently able to coexist at a single location. Currently nine species are known from Great Smoky Mountains National Park (Tennessee and North Carolina, USA). The park’s fractured landscape of rivers, mountains, and valleys offers the opportunity to test geographic barriers as the reason for coexistence. However, 11 species have been collected from Mary’s Peak, Benton Co., Oregon (S. carltoni, S. cascadia, S. conifera, S. hespera, S. margemina, S. maryae, S. olycalida, S. parviceps, S. priocera, S. quellazaire, S. russelli) where geographic barriers are seemingly less important. Researchers interested in species competition and niche differentiation may find an interesting opportunity in the Sonoma of Mary’s Peak. After all, MacArthur (1958) based his ground-breaking niche partitioning work on only five species.

**Field Trips.** With the completion of this research the majority (but not quite all) of specimens of Sonoma within museums have been reviewed. Go collect some more!

Acknowledgments

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Literature Cited


**Ferro, M. L., and C. E. Carlton. 2010.** Fifteen new species of *Sonoma* Casey from the eastern United States and a description of the male of *Sonoma tolulae* (LeConte) (Coleoptera: Staphylinidae: Pselaphinae). Insecta Mundi 0137: 1–44.


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Figures 1–6. Sonoma spp. holotype habitus. 1) S. agitator. 2) S. cardiac. 3) S. carltoni. 4) S. cataloochee. 5) S. caterinoi. 6) S. chandleri.
Figures 40–42. Aedeagi of *Sonoma* spp. 40) *S. priocera* Marsh and Schuster. 41) *S. conifera* Chandler. 42) *S. hespera* Park and Wagner. Right side of figures is anatomical left.
Figures 53–55. Aedeagi of Sonoma spp. 53) S. dilopha Marsh and Schuster. 54) S. caterinoi new species. 55) S. cataloochee new species. Right side of figures is anatomical left.
Map 1. County-level distribution of Sonoma spp. west of the Mississippi River.
Maps 2–5. County-level distribution of Sonoma spp. 2) S. agitator. 3) S. cardiac. 4) S. carltoni. 5) S. cascadia.
Maps 6–8. County-level distribution of Sonoma spp. 6) S. cataloochee. 7) S. caterinoi. 8) S. cavifrons.
NEW SPECIES OF Sonoma

Maps 29–32. County-level distribution of Sonoma spp. 29) S. quercicola. 30) S. repanda. 31) S. rossellinae. 32) S. rubida.
Appendix 1

Verbatim label data are given for all identifiable specimens examined of previously described species, with specimens separated by an asterisk (“*”), label breaks indicated by a slash (“/”), and the lending institution and number of specimens are indicated, e.g. “(4♂, FMNH)”. Specimens from the University of Alaska Museum have a unique identifier that begins with the prefix “UAM”.

Sonoma baylessae Ferro and Carlton, 2010 – NC, TN

Sonoma cascadia Chandler, 1986 – AK, BC, OR, WA

Sonoma cavifrons Casey, 1887 – CA, OR
USA: CALIFORNIA: Humboldt Co.: *USA:CA: Humboldt Co. Prairie Creek State Park 41 22.02'N 124 0.95'W (WGS84/NAD83) / Prometheus, upper mat Litter bag # 68 9 December 2000 Clint Jones [♀ LSAM]. Marin Co.: *MuirWoods Marin Co VIII-30-08 [1908] / Van Dyke Collection / ♀ / Sonoma cavifrons
**New species of Sonoma**

**Sonoma chouljenkoi** Ferro and Carlton, 2010 – AL, GA, KY, NC, OH, TN

**Sonoma conifera** Chandler, 1986 – OR, WA

**Sonoma cuneata** Marsh and Schuster, 1962 – CA

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**Sonoma chouljenkoi** Ferro and Carlton, 2010 – AL, GA, KY, NC, OH, TN

**Sonoma conifera** Chandler, 1986 – OR, WA

**Sonoma corticina** Casey, 1887 – CA, OR

**Sonoma cuneata** Marsh and Schuster, 1962 – CA

Sonoma cygnus Ferro and Carlton, 2010 – GA, NC
USA: NORTH CAROLINA: Swain Co.: *USA NC SwainCo GSMNP ForkRidgeTrailHead nr Clinman’s Dome–6000’ 11Aug06J&SCornellBerl ExSiftLitU MossyHemlock Logs JFC006-VIII-11-1C ♂, LSAM].

Sonoma dilopha Marsh and Schuster, 1962 – CA

Sonoma dolabra Marsh and Schuster, 1962 – CA

Sonoma gimmeli Ferro and Carlton, 2010 – NC, OH, TN

Sonoma hespera Park and Wagner, 1962 – BC, CA, OR, WA
Sonoma holmesi Ferro and Carlton, 2010 – NC, MD, PA, VA, WV

Sonoma humilis Marsh and Schuster, 1962 – CA
Sonoma konkoworum Chandler, 2003 – CA

Sonoma margemina Park and Wagner, 1962 – AK, BC, OR, WA
Sonoma mayori Ferro and Carlton, 2010 – TN


Sonoma olycalida Park and Wagner, 1962 – BC, OR, WA

Sonoma parviceps (Mäklin, 1852) – AK, BC, CA, OR, WA


*AK: PoW Is. Staney Ck; 55.79723, -133.13467; 25-Jul-08; Berlese; J.S., S. M., I. M.; ♀ [♀, CNC]. *AK: PoW Is. Staney Ck; 55.79901, -133.11782; 10-May-06; Berlese; J. Slowik, A. Hutton; ♀ [♀, CNC].


*AK: PoW Is. Hatchery Ck.4; 55.88602, -132.8607; 2-Aug-08; Berlese; J. Slowik, A. Hutton; ♀ [♀, CNC]. *AK: PoW Is. Hatchery Ck.4; 55.88602, -132.8607; 2-Aug-08; Berlese; J. Slowik, A. Hutton; ♀ [♀, CNC].
New species of Sonoma

Insecta Mundi 0472, March 2016 • 55

Abies procera

Sonoma petersi Chandler, 1986 – CA, OR


Sonoma priocera Marsh and Schuster, 1962 – OR

USA: OREGON: Benton Co.: *ORE., Mary’s Peak 8mi.W.Philomath 4000’,V.9.1968 Campbell&Smtea [♀, CNC]. *USA: OR: Benton Co., Siuslaw N.F., Mary’s Peak, Meadowedge Tr. (W part), 1050-1070 m, 44°30.52’N, 123°33.56’W, 17.ix.2012, old growth Abies procera forest; FMHD#2012-033, belr., log & litter, A. Newton; ANMT site 1204 [♀, FMNH]. *USA: OR: Benton Co., Siuslaw N.F., Mary’s Peak, Meadowedge Tr. (W part), 1050-1070 m, 44°30.52’N, 123°33.56’W, 21.vi.2006, old growth Abies procera; / FMHD#2006-030, belr., log & litter, A. Newton & M. Thayer ANMT site 1245 FIELD MUSE. NAT. HIST. / **EXEMPLAR** additional specimens in 95+ % ethanol for DNA extraction 2 [♀, FMNH]. *USA: OR: Benton Co., Siuslaw N.F., Mary’s Peak, Meadowedge Tr. (top part), 1180-1197 m, 44°30.417’N, 123°33.12’W, 17.ix.2012, old growth Abies procera forest; FMHD#2012-030, belr., log & litter A. Newton & M. Thayer ANMT site 1245 FIELD MUSE. NAT. HIST. / ***VOUCHER*** Associated with larva(e) 1? / **EXEMPLAR** additional specimens in 95+ % ethanol for DNA extraction 2 [♀, FMNH].

Sonoma repanda Marsh and Schuster, 1962 – CA


Sonoma rubida Casey, 1894 – CA

NEW SPECIES OF SONOMA

INSECTA MUNDI 0472, March 2016 • 57

Sonoma russelli Chandler, 1986 – OR


Sonoma spadica Marsh and Schuster, 1962 – CA


Sonoma squamishorum Chandler and Klimaszewski, 2009 – AK, BC


Sonoma tishechkini Ferro and Carlton, 2010 – GA, NC, SC


Sonoma toluae (LeConte, 1849) – GA, NC, TN


Sonoma vanna Marsh and Schuster, 1962 – CA
