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Two new species and two new combinations in *Saphenista* Walsingham, 1914 from western North America (Lepidoptera: Tortricidae)

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Abstract. *Saphenista bartellae* Brown, **new species** (TL: Colorado), and *S. powelli* Brown, **new species** (TL: California) (Lepidoptera: Tortricidae), are described and illustrated. Two other western North American species, *S. latipunctana* (Walsingham, 1879), **new combination**, and *S. dilutana* (Walsingham, 1879), **new combination**, are transferred to *Saphenista* based on morphology of the genitalia.

Key words. Cochylina, genitalia, Neotropics, Rocky Mountains, California.

Introduction

As currently defined, *Saphenista* Walsingham, 1914 includes about 125 described species restricted to the New World, with greatest species richness in Central America and northern South America (Brown 2005; Gilligan et al. 2018). The monophyly of the genus is convincingly supported by features of the male genitalia (e.g., Razowski 1994). Descriptions and illustrations of many Neotropical species can be found in Razowski (1992, 1993, 1994) and Razowski and Becker (1994, 2007). Images of adults of North American species can be found on the Moth Photographers Group website (Nanz 2019). Larval hosts are unknown for most Neotropical species, but De Benedictis et al. (1990) and Powell (in Brown et al. 2010) record Asteraceae (*Ambrosia* L., *Eriophyllum* Lag., *Baccharis* L.), Rhamnaceae (*Ceanothus* L.), and Garryaceae (*Garrya* Douglas ex Lindl.) for species from western North America.

As recently as 1983, North American species of *Saphenista* were included in *Phalonidia* Le Marchand, 1933 (Powell 1983), where they had been placed by Razowski (1964). Brown (2005) included two North American species in *Saphenista* (i.e., *S. nomonana* (Kearfott, 1907) and *S. saxicolana* (Walsingham, 1879)), and Metzler and Brown (2014) transferred a third to the genus (i.e., *S. parvimaculana* (Walsingham, 1879)). While examining North American specimens of *Saphenista* in several collections, I discovered two new species from the western United States and two misplaced species that belong in the genus. The purpose of this contribution is to describe those two new species and propose two new combinations in *Saphenista*.

Materials and Methods

Specimen depositories are abbreviated as follows: CNC, Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada; CSU, Gillette Museum of Entomology, Colorado State University, Fort Collins, Colorado, U.S.A.; DMNS, Denver Museum of Nature and Science, Denver, Colorado, U.S.A.; EME, Essig Museum of Entomology, University of California, Berkeley, California, U.S.A.; LACM, Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A.; NHMUK, The Natural History Museum, London, U.K.; and USNM, National Museum of Natural History, Washington, DC, U.S.A. Methods of dissecting genitalia of adult moths followed those summarized by Brown and Powell (1991). Terms for morphological structures follow Horak (1984), except "phallus" is used rather than "aedeagus." Forewing measurements include the fringe. In descriptions of the forewing, "hind margin" refers to the trailing edge of the wing, which frequently is referred to as the "dorsum" in tortricid literature. Slide mounted genitalia were examined using dissecting and compound microscopes. Images of adults and genitalia were captured using a Canon EOS 40D digital SLR camera (Canon U.S.A., Lake Success, NY) mounted on a Visionary Digital BK Lab System (Visionary Digital, Palmyra, VA), and edited in Photoshop.

Results

Saphenista Walsingham, 1914

Type species. *Conchylis lacteipalpis* Walsingham, 1891, by original designation (Walsingham 1914).

The precise circumscription of *Saphenista* and its putative synonyms (see Brown 2005) has been somewhat elusive owing to the absence of an abdomen of the holotype of the type species of the genus (i.e., *Conchylis lacteipalpis*). As currently defined, the genus is anchored by species that are superficially similar to its type species and assigned to the genus by Walsingham (1914). The most convincing morphological autapomorphy for *Saphenista* is the conspicuous Y- or T-shaped median process of the transtilla, which easily separates males from those of all other Cochylina. Razowski (1994) identified the following as putative autapomorphies for the genus: a tooth-like process of the vinculum (highly variable and not always present); a sclerotized pocket at the base of the valva (usually present); an expanded apex of the median process of the transtilla (mentioned above, always present); and the presence of a subterminal prominence of the phallus (absent in many species). Also, males of some species of *Saphenista* have secondary structures from the venter of the abdomen. For example, *S. multistrigata* Walsingham, 1914 has a small bilobed process on abdominal segment 7 from which a pair of laterally directed hairpencils originate. Similar structures are reported and illustrated by Razowski and Becker (1983: fig. 3, 21) in *S. nauphraga* Razowski and Becker, 1983 and *S. ficta* Razowski and Becker, 1983.

Based on morphological features, primarily the dorso-posteriorly directed socii, Razowski (1985, 1994) concluded that *Saphenista* is closely related to *Phalonidia*, and a recent phylogenetic analysis of the subtribe (Brown et al. 2019) provides some support for this conclusion, although in the latter study *Saphenista* (+ *Amallectis* Meyrick, 1917) was recognized as one of six major lineages in the subtribe Cochylina, sister to the *Phalonidia* Group + the *Cochylis* Group (sensu Brown et al. 2019).

Adults of *Saphenista* are highly variable in maculation and size (i.e., forewing length). Males lack a forewing costal fold, and most (but not all) species have a hindwing costal roll (hair pencil), the last feature shared with most "advanced" Cochylina (Brown et al. 2019). In contrast, females of many *Saphenista* species retain the plesiomorphic condition of three spines in the frenulum.

Saphenista bartellae Brown, new species

Fig. 1, 2, 7, 11

Diagnosis. *Saphenista bartellae* is easily distinguished from all congeners by facies alone (Fig. 1, 2), which are more similar to those of *Aethes* Billberg, 1820 than to other species of *Saphenista*. The forewing has a uniform white to cream ground color with a gray-brown, nearly complete median fascia of nearly uniform width, the costal portion of which is represented by a small, disjunct, semicircular patch near the mid-costa. Other North American congeners have a more mottled ground color and a variably developed, brownish median fascia from the hind margin that usually attenuates or terminates at or before the discal cell.

In the male genitalia of *S. bartellae* (Fig. 7) the spur from the vinculum is much longer and narrower than in other North American congeners. In the female genitalia of *S. bartellae* (Fig. 11) the posterior margin of the sterigma is distinctly V-shaped with a strongly sclerotized edge, and this feature is shared with no other *Saphenista*.

Description. *Head*. Vertex and frons white; labial palpus white, with scattered brown scales on second segment laterally and ventrally, scaling only slightly expanded distally on segment II, segment III exposed; antenna with white scales, sensory setae 2.0–2.5 times flagellomere diameter in male, extremely short, sparse in female. *Thorax*. Nota white to cream; scales of tegula rather short, white; no mid-posterior crest; forewing length 6.0–7.0 mm (mean = 6.5 mm, n = 10); forewing ground color white, sometimes with faint cream-ocherous overscaling, with a well-defined gray-brown median fascia extending from near mid-costal to middle of hind margin, interrupted subcostally, leaving a small gray-brown semicircular patch at costa; often with a rhomboidal gray-brown patch subapically, with a few extremely short, gray-brown strigulae scattered along costa from base to apex of forewing. Fringe concolorous with forewing. Hindwing white to pale cream with faint pale gray-brown overscaling; male

with distinct costa roll (hair pencil) ca. 0.5 length of costa; frenulum with one spine in male, three in female (rarely two). Fringe whitish to pale cream. *Abdomen*. Lacking specialized processes. Mostly pale gray-cream. Male genitalia (Fig. 7) with tegumen flattened at top; uncus absent; socii slender, erect, densely hairy, arising from lateral edge of top of tegumen; valva slender, gently upcurved throughout, widest at base, weakly attenuate throughout to narrow apex; sacculus short, confined to basal 0.1 of venter of valva, followed distally by a small lobe; transtilla well developed with median process bearing a wide, T-shaped expansion distally, lateral margins of process mostly parallel-sided throughout, only slightly expanded distally; vinculum arms joined distally, each bearing a long, slender flange, pointed distally; phallus large, almost as long as valva, slightly curved at ca. 0.6 distance from base, apically with slender ventral projection with blunt apex, vesica with a single slender cornutus. Female genitalia (Fig. 11) with papillae anales slipper-shaped; apophyses unmodified, slender, length of apophyses anteriores about equal to that of apophyses posteriores; sterigma with posterior margin deeply V-shaped immediately posteriad of ostium, with strongly sclerotized margins; ductus bursae moderately wide, abruptly expanded ca. 0.3 distance from ostium to corpus bursae, with longitudinal wrinkles and membranous expansion on left side; corpus bursae short, ovoid, with sparsely distributed, minute spicules on entire inner surface, frail ductus of accessory bursae arising near middle of corpus.

Types. Holotype ♂, USA, Colorado, Gilpin Co., 2538 Golden Gate Canyon Road (State Highway 46), 2674 m, 28 July 2016, B. K. Bartell (USNM).

Paratypes (41♂, 28♀): CANADA: British Columbia: Vancouver, Stanley Park Aquarium, 15 m, 24 Jul 2007 (2♀), A. Li (CNC). USA: California: Kern Co.: Mt. Pinos, 6800′, 2 Jul 1965 (2♂, 1♀), J. Powell (EME). Marin Co.: Inverness, Kehoe road, 75 m, 10–16 Oct 2001 (1♂), 17–23 Oct 2001 (1♂), 24–31 Oct 2001 (5♂), 1–6 Nov 2001 (2♂), J. Powell (EME). Inverness Park 15–22 Oct 1998 (1♀), 15–21 Oct 1999 (1♂, 1♀), 20–26 Nov 2003 (2♂), J. Powell (EME). Inverness, top of Highland Road, 125 m, 9–16 Oct 2000 (1♂), 17–24 Oct 2000 (1♂), 25 Oct–2 Nov 2000 (1♂, 2♀), 11–17 Nov 2004 (1♂, 1♀), J. Powell (EME). W of Inverness, Kehoe Way, 75 m, 10–16 Oct 2001 (1♂), J. Powell (EME). Placer Co.: Ward Creek, 2 mi S Tahoe City, 6250', 14 Jul 1984 (1♂), 16 Jul 1988 (1♀), 20 Jul 1988 (1♀), 27 Jul 1991 (2♂), 7 Aug 1983 (1♀), N. Westerland (LACM). Tuolomne Co.: Twain Harte, 21 Jul 1985 (1♂), M. Lundgren (EME). Colorado: Gilpin Co.: 2538 Golden Gate Canyon Road (State Highway 46), 2674 m, 12 Jul 2010 (1♂), 3 Aug 2010 (1♂), 12 Aug 2010 (1♀), 13 Jul 2012 (1♂), 17 Jul 2012 (1♂), 22 Jul 2014 (1♀), 23 Jul 2014 (1♂), 24 Jul 2014 (2♀), 17 Aug 2014 (1♂), 24 Aug 2015 (1♂), 26 Aug 2015 (1♂), 14 Jul 2016 (1♂), 16 Jul 2016 (1♀), 17 Jul 2016 (1♀), 18 Jul 2016 (1♂), 31 Jul 2016 (1♂), 2 Aug 2016 (1♀), 3 Aug 2016 (1♂, 1♀), 8 Aug 2016 (1♂, 1♀), 10 Aug 2016 (1♀), 11 Aug 2016 (1♂), B. K. Bartell (CSU). 2538 Golden Gate Canyon Road (State Highway 46), 2674 m, 11 Jul 2010 (1♀), 8 Aug 2010 (2♀), 10 Aug 2010 (1♂), 22 Jul 2011 (1♀), 27 Jul 2010 (1♂), 13 Aug 2011 (1♀), 14 Aug 2010 (1♂), 18 Aug 2011 (1♀), B. K. Bartell (DMNS). La Plata Co.: San Juan National Forest, 0.5 mi N Chris campground, 8 mi N Hermosa, 30 Aug 1991 (1♀), P. Opler (CSU). Montana: Mineral Co.: Superior, 4 Jul 1958 (1♂), M. May (USNM).

Distribution and biology. *Saphenista bartellae* is recorded from coastal California (Marin Co.) (EME), north to Vancouver, British Columbia (CNC), at elevations of 15–75 m, east to the Rocky Mountains in Colorado and Montana at elevations of 2600–2700 m. In British Columbia, the Sierra Nevada (California), and the Rocky Mountains (Colorado), adults have been collected from early July through mid-August. In coastal California, captures are from October and November.

Etymology. The species name is a patronym for Barbara Bartell, collector of the holotype.

Remarks. Based on the considerable differences in habitat, it is possible that low elevation, coastal populations of *S. bartellae* (i.e., California) represent a different species than the high elevation, montane populations (i.e., Sierra Nevada and Rocky Mountains). However, because I can find no difference in facies, male secondary features, or genitalia, I am treating them all as conspecific.

Saphenista powelli Brown, new species

Fig. 3, 8, 12

Diagnosis. *Saphenista powelli* appears to be closely related to *S. latipunctana* and *S. dilutana*. In all three the forewing has similar maculation, although variable; the male lacks a hindwing costal roll

(present in all other congeners); and the female genitalia have thickened apophyses and somewhat distally pointed papillae anales. However, the absence of a flangelike process from the vinculum (present in *S. latipunctana* and *S. dilutana*) in the male genitalia (Fig. 8) and the long, thickened apophyses posteriores (much shorter in *S. latipunctana* and *S. dilutana*) (Fig. 12) easily distinguish *S. powelli* from those related congeners.

Description. *Head*. Vertex and frons white; labial palpus with length ca. 3 times diameter of compound eye, white, second segment laterally with distinct brown-tipped cream scales, segment III exposed, white; antenna with white scales, sensory setae extremely long, 4–5 times flagellomere diameter in male, extremely short, sparse in female. *Thorax*. Nota white to cream; scales of tegula rather short, sometimes brown at base, otherwise white; no mid-posterior crest; forewing length 5.0–6.0 mm (mean = 5.5 mm, n = 10); forewing ground color white with variable, usually sparse, gray speckling, infrequently (ca. 10% of specimens examined) with faint, oblique, brown dash from near middle of hind margin representing median fascia (somewhat similar to that of *S. latipunctana*). Fringe concolorous with forewing. Hindwing white to pale cream with faint pale gray-brown overscaling; male lacking costa roll (hair pencil); frenulum with one spine in male, three in female. Fringe whitish to pale cream. *Abdomen*. Lacking specialized processes. Mostly pale gray-cream. Male genitalia (Fig. 8) with tegumen slightly curved at top; uncus absent; socii slender, densely hairy, erect, from lateral edge of top of tegumen; valva slender, gently upcurved throughout, nearly parallel-sided throughout, rounded apically; sacculus very short, ill-defined; transtilla well developed with median process bearing a wide, T-shaped expansion distally, lateral margins of process only slightly expanded distally; vinculum arms joined distally, lacking flange or other process; phallus large, almost as long as valva, slightly curved near middle, apically with slender ventral projection with attenuate, rounded apex, vesica with a single slender cornutus. Female genitalia (Fig. 12) with papillae anales narrow, weakly pointed distally; postero-lateral margin of segment VIII densely covered with tiny spines; apophyses thickened, especially apophyses anteriores, length of apophyses anteriores about 0.75 that of apophyses posteriores; sterigma mostly membranous; ductus bursae moderately wide, intersection with corpus bursae poorly defined; corpus bursae short, ovoid, with sparsely distributed, minute spicules on entire inner surface, frail ductus of accessory bursae arising near middle of corpus.

Types. Holotype ♂, USA, California, Los Angeles Co., San Clemente Island, Eel Cove, 12 May 2002, r.f. *Eriophyllum confertiflorum*, em: 17 Jun 2002, J. Powell & D. Rubinoff (EME)

Paratypes (4♂, 17♀): USA, California: same data as holotype, em: 17 Jun–2 Aug 2002 (EME).

Distribution and biology. This species is known only from a series of adults reared from larvae discovered on *Eriophyllum confertiflorum* DC. A. Gray (Asteraceae) on San Clemente Island, California. Larvae collected on 12 May produced adults in June and July, with a single August emergence.

Saphenista latipunctana (Walsingham), new combination

Fig. 4, 5, 9, 13

Phalonia latipunctana Walsingham 1879: 29, pl. 67, fig. 2; McDunnough 1939: 60.
Phalonidia latipunctana: Razowski 1964: 367; Powell 1983: 42; Brown 2005: 489; Metzler and Brown 2014: 277.

Described in *Phalonia* and treated as such by McDunnough (1939), *P. latipunctana* was transferred to *Phalonidia* by Razowski (1964: 367), where the species has resided ever since (e.g., Powell 1983; Brown 2005; Metzler and Brown 2014). The male genitalia of the lectotype, illustrated by Razowski (1964: fig. 26, 27), possess several features diagnostic for *Saphenista*, including the expanded distal end of the median process of the transtilla, the erect socii, and the lateral, pointed flange from the vinculum. On the basis of these features, *P. latipunctana* is transferred to *Saphenista*.

Diagnosis. *Saphenista latipunctana* is most similar to *S. dilutana* and *S. powelli* among described species. All lack a costal roll in the male hindwing, and all have thickened apophyses in the female genitalia. Although the forewing pattern is somewhat variable in *S. latipunctana* (Fig. 4, 5), there usually is a well-defined, somewhat oblique dash from near the middle of the hind margin representing the median fascia. *Saphenista latipunctana* can be distinguished from *S. dilutana* by the shape of the median

process of the transtilla. In *S. latipunctana* its termination is broader and more T-shaped, compared to the slightly narrower, more U-shaped process of *S. dilutana* (Fig. 9, 10).

Types. Lectotype ♂, USA, California, Mendocino Co., mouth of Albion River, 30–31 May 1871, Walsingham, BMNH slide 7755 (NHMUK). Paralectotype ♂, same data as lectotype (USNM).

Distribution and biology. Specimens that appear to be conspecific with the lectotype have been collected in central coastal California (Marin, Mendocino, and Contra Costa counties). The species is double-brooded with flights in May–June and again in October. Jerry Powell (Brown et al. 2010) has reared the species from *Ceanothus thrysiflorus* Eschsch. (Rhamnaceae) and *Eriophyllum stachaedifolium* Lag. (Asteraceae).

Saphenista dilutana (Walsingham), new combination

Fig. 6, 10

Cochylis dilutana Walsingham 1879: 29, pl. 67, fig. 3.
Phalonia dilutana McDunnough 1939: 60.
Phalonidia dilutana Powell 1983: 42.
Incertae sedis ["Cochylini Unplaced"] *dilutana*: Razowski 1964: 383; Brown 2005: 208; Metzler and Brown 2014: 278.

Described in *Cochylis* and transferred to *Phalonia* by McDunnough (1939), *C. dilutana* was treated as "incertae sedis" by Razowski (1964: 359), who designated a lectotype (NHMUK) and illustrated its female genitalia. Powell (1983) transferred it to *Phalonidia*, and Brown (2005) and Metzler and Brown (2014) followed Razowski (1964), treating it as "unplaced Cochylini."

After dissecting numerous females of *Saphenista* from the western U.S., it became clear that the thickened apophyses of the lectotype of *P. dilutana* (see Razowski 1964: fig. 82) are very similar to those of *S. latipunctana* (Fig. 13). Also, the male genitalia of the paralectotype (USNM) from the type locality have an expanded distal end of the median process of the transtilla characteristic of *Saphenista*. On the basis of these two features, *P. dilutana* is transferred to *Saphenista*.

Diagnosis. *Saphenista dilutana* is extremely similar to *S. latipunctana*. Its forewing pattern falls within the range of variation of the latter, and its female genitalia are identical to those of the latter. Based on these features it is possible that *S. dilutana* is a synonym of *S. latipunctana*. However, subtle differences in the male genitalia may separate the two. In *S. latipunctana* the distal end of the median process of the transtilla is broad and T-shaped, whereas in *S. dilutana* (known from a single male paralectotype from the type locality) it is slightly narrower and more U-shaped owing to the shorter "arms" of the process; and the cornutus is slightly longer in *S. dilutana*.

Types. Lectotype ♀, USA, Oregon, Jackson Co., Rogue River, 4–6 May 1872, Walsingham, BMNH slide 7756 (NHMUK). Paralectotype ♂, same data as lectotype (USNM).

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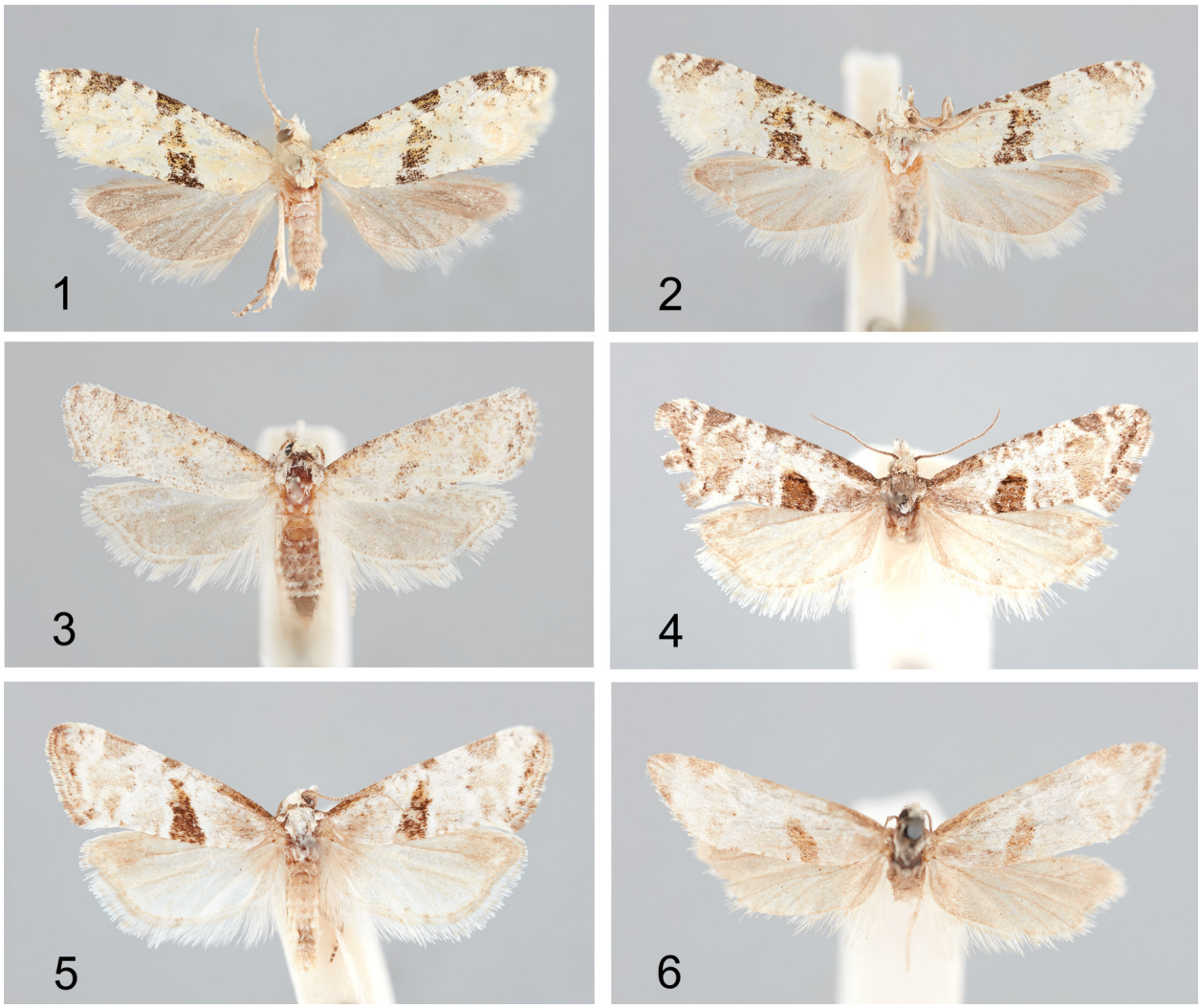
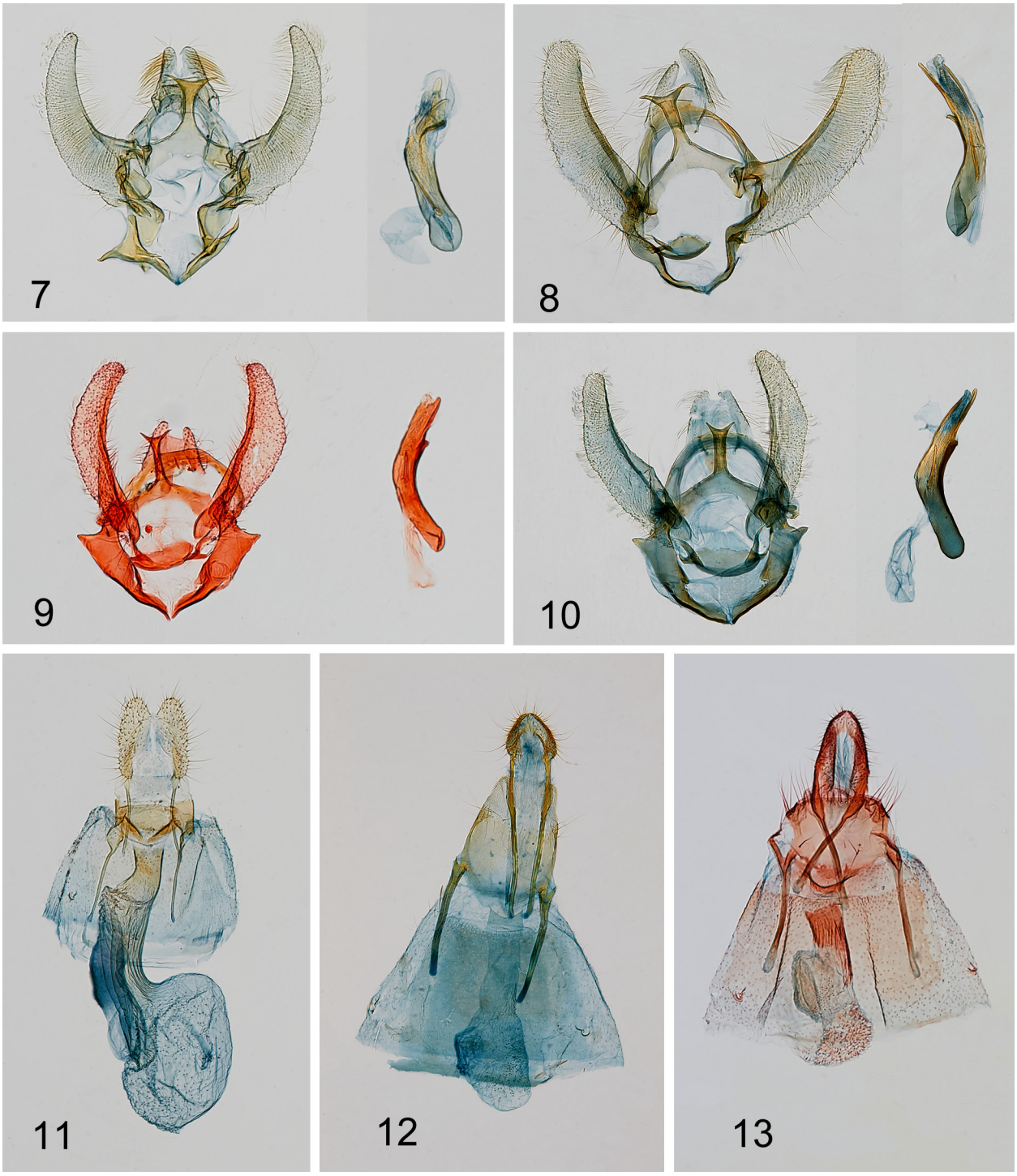


Figures 1–6. Adults of *Saphenista*. **1)** *S. bartellae*, paratype, Gilpin Co., Colorado. **2)** *S. bartellae*, paratype, Marin Co, California. **3)** *S. powelli*, paratype, Los Angeles Co., California. **4)** *S. latipunctana*, Marin Co., California. **5)** *S. latipunctana*, Contra Costa Co., California. **6)** *S. dilutana*, paralectotype, Josephine Co., Oregon.



Figures 7–13. Genitalia of *Saphenista*. **7)** Male of *S. bartellae*, USNM slide 150,181. **8)** Male of *S. powelli*, USNM slide 153,767. **9)** Male of *S. latipunctana*, MGP slide 349. **10)** Male of *S. dilutana*, USNM slide 150,185. **11)** Female of *S. bartellae*, USNM slide 150,182. **12)** Female of *S. powelli*, USNM slide 153,565. **13)** Female of *S. latipunctana*, EME slide 2762.