

INSECTA MUNDI

A Journal of World Insect Systematics

0140

Eight new state records of aleyrodine whiteflies found in Clark
County, Nevada and three newly described taxa
(Hemiptera: Aleyrodidae, Aleyrodinae)

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Date of Issue: October 15, 2010

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Insecta Mundi 0140: 1-36

Published in 2010 by

Center for Systematic Entomology, Inc.
P. O. Box 141874
Gainesville, FL 32614-1874 U. S. A.
<http://www.centerforsystematicentomology.org/>

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As of 2007, **Insecta Mundi** is published irregularly throughout the year, not as quarterly issues. As manuscripts are completed they are published and given an individual number. Manuscripts must be peer reviewed prior to submission, after which they are again reviewed by the editorial board to insure quality. One author of each submitted manuscript must be a current member of the Center for Systematic Entomology.

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Printed Copy	ISSN 0749-6737
On-Line	ISSN 1942-1354
CD-ROM	ISSN 1942-1362

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Eight new state records of aleyrodine whiteflies found in Clark County, Nevada and three newly described taxa (Hemiptera: Aleyrodidae, Aleyrodinae)

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Abstract. Eight new state records and the three newly described species are the subject of this publication. Whiteflies (Hemiptera: Sternorrhyncha: Aleyrodidae: Aleyrodinae) were collected from 2003 through 2009 within the Las Vegas area of Clark County, Nevada to determine the occurrence of newly established species and host range and distribution. Prior to 2003 the following ten whiteflies were known to be established in Nevada: *Aleuroglandulus subtilis* Bondar, *Aleuroplatus berbericolus* Quaintance and Baker, *Aleyrodes spiraeoides* Quaintance, *Bemisia tabaci* (Gennadius), *Dialeurodes citri* (Ashmead), *Siphoninus phillyreae* (Haliday), *Tetraleurodes mori* (Quaintance), *Trialeurodes abutiloneus* (Haldeman), *Trialeurodes packardi* (Morrill), and *Trialeurodes vaporariorum* (Westwood). Based on collections made after 2003, eleven additional whitefly species were found in Nevada. Of these the following eight were described species from California and other western U.S. states: *Aleuroparadoxus arctostaphyli* Russell, *Aleuroplatus gelatinosus* (Cockerell), *Aleuropleurocelus ceanothi* (Sampson), *Aleuropleurocelus nigrans* (Bemis), *Tetraleurodes quercicola* Nakahara, *Trialeurodes corollis* (Penny), *Trialeurodes eriodictyonis* Russell, and *Trialeurodes glacialis* (Bemis). Three **new species** are described and illustrated: *Aleuropleurocelus nevadensis* Dooley sp. nov., *Tetraleurodes quercophyllae* Dooley sp. nov., and *Trialeurodes pseudoblongifoliae* Dooley sp. nov.

Key words. Aleyrodidae, faunal survey, Nevada, Taxonomy, whiteflies.

Introduction

The objective of this project is to identify and document the whitefly species that occur in the Las Vegas area and to determine their biogeographical and host range. From 1959 to 1991 whiteflies were collected sporadically in eight counties throughout Nevada by state and university entomologists from California and Nevada (Table 1). A faunal survey of the Aleyrodidae (Sternorrhyncha: Hemiptera) was conducted from 2003 to 2009 (Table 2) in the surrounding Mojave Desert (Clark County, Nevada) at Red Rock Canyon, and at Blue Diamond, “Boy Scout area”, Lee Canyon, and Mahogany Grove of the Mount Charleston area. This research reveals, in addition to the ten whiteflies known to be established in Nevada since 1960, eleven additional whitefly species including three newly described species are established

in Nevada. Provided are protocols for laboratory preparation of specimens, keys to whitefly puparia found in Nevada, information on host plants with associated plant communities, and impact of whiteflies.

Whiteflies (Hemiptera: Aleyrodidae) are phytophagous insects that feed on the phloem tissue of leaves causing both primary and secondary injury including unsightly damage and even plant death. In addition, some species are known to transmit viruses and can infect a wide variety of plants. They comprise a monophyletic group of over 1400 species including one fossil subfamily, Bernaeinae (Grimaldi and Engel 2005). Historically there are three extant subfamilies with only the Aleyrodinae known to occur in Nevada. The Aleurodicinae and the Udamosellinae are not known to occur in Nevada.

The Spring Mountains and Mount Charleston is considered a part of the Humboldt-Toiyabe National Forest. They are located just 30 minutes from downtown Las Vegas and encompass more than 316,000 acres with Mount Charleston. The geology of Red Rock Canyon National Conservation Area provides a window into the adverse climatic and weather conditions of the Mohave Desert affecting the diversity of the plant and animal life.

Plant Communities

More than 1500 species of desert shrubs dominate the biogeography of Clark County (Figure 2). Note that more than 200 endemic plants are found in the Mojave Desert (Center for Biological Diversity 2007). They are not found in the warmer, southern Sonoran Desert or the cooler, northern Great Basin Desert. The Mojave Desert is characterized mostly by low-growing shrubs (including drought deciduous and sclerophyllous plants) as a result of getting all of its rain in the winter (Gurevitch et al. 2006) and with some becoming established as solitary plants.

The plant communities where whiteflies were collected include the deciduous woodlands on Mount Charleston, oak shrub, manzanita with co-dominant oak, and the desert scrub (chaparral) with the latter three occurring within the Red Rock Canyon National Conservation Area (RRCNCA). Whiteflies were collected in two geographical areas: Mount Charleston and primarily at the RRCNCA. Nine plant communities have been described (Bureau of Land Management 2010) with only those from which whiteflies were collected are addressed.

The deciduous woodlands in the Mount Charleston area abounds with pine, aspen, juniper and many low growing plants such as various herbs, barberries, and bearded tongue with which whiteflies were found. The three species of whiteflies found in this area one with pale and two with dark puparia.

The desert shrub community has an annual precipitation from 5 to 8 inches with soils generally shallow to very shallow with the mesic (moist) years producing an exceptional growth of annual plants. The wide varieties of small flowering plants include creosote and yerba santa and are commonly found in this community.

The manzanita community grows from parent rock (cliffs) including the Aztec sandstone (Figure 1), along the trails in the bajadas, and in the scrub as a community associated with juniper, *Ceanothus* sp. (Rhamnaceae), oaks, pinyon pine, and yerba santa.

The oak brush community has oak as the most dominant host for whitefly species distribution and density of whitefly population. Oak is also associated with manzanita and santa yerba.

Whiteflies of Southern Nevada

Prior to 2003, ten whitefly species had been recorded (Table 1) in Nevada by the Nevada Department of Agriculture (NDOA). Based on the collections made after 2003 (Table 2), eleven additional species of whitefly were found in Nevada. Of these, the following eight were described species from California and other western U.S. states: *Aleuoparadoxus arctostaphyli* Russell, *Aleuoplatus gelatinosus* (Cockerell), *Aleuopleurocelus ceanothi* (Sampson), *A. nigrans* (Bemis), *Tetraleurodes quercicola* Nakahara, *Trialeurodes corollis* (Penny), *Trialeurodes eriodictyonis* Russell, and *Trialeurodes glacialis* (Bemis). Three new species are described and illustrated: *Aleuopleurocelus nevadensis* Dooley sp. nov., *Tetraleurodes quercophyllae* Dooley sp. nov., and *Trialeurodes pseudoblongifoliae* Dooley sp. nov. In addition, one unidentified species in the genus *Aleuopleurocelus* and one in the genus *Trialeurodes* were discovered and are mentioned under the appropriate genus.



Figure 1-2. Nevada localities. **1)** Aztec sandstone. **2)** Desert shrubs (Mojave).

Plant species associated with whiteflies include alfalfa, ash, beard tongue, ceanothus, cotton, currants, euphorbia, kumquat, fuchsia, creosote, manzanita, mulberry, oak, pomegranate, and yerba santa (Table 1-2). A large degree of hybridization occurs in both the oak (*Quercus* sp.) and manzanita (*Arctostaphylos* sp.) populations making it difficult to determine the identity species of the oak and manzanita that serve as whitefly hosts.



Figure 3. Sandstone Quarry.

Materials and Methods

Whitefly puparia were collected during the spring, summer and winter months from 2003 to 2009 in the Red Rock Canyon NCA and on Mount Charleston in Clark County, Nevada. Whenever possible, the geographical coordinate locations were recorded using a GPS Magellan Sportrak Pro (Table 3). Host plants were identified by Jeff Knight, Entomologist for the Nevada State Department of Agriculture (NDOA), Susan Lambrecht for San Jose State (SJSU), Tim Torbett (PPQ, San Francisco) and John Dooley (PPQ, San Francisco) (Table 4).

The method used for preparation of slide mounted specimens described under this section is similar to that used by R. Gill (personal communication, 2006), Martin (1987, 1999), and Mound and Halsey (1978), which is modified by Jessie Newhouse by using microcentrifuge tubes and floating the tubes in a bubbling hot water bath for 15 minutes.

The whitefly puparia were prepared for mounting on microscope slides. The preparation method utilized the following chemicals: 5% potassium hydroxide (KOH), water, ammonia and hydrogen peroxide solution (for those specimens requiring bleaching), 70% and 90 % ethanol, clove oil, and balsam or euparal mounting medium. The puparia were placed into tubes containing 5% KOH and heated in a bubbling hot water bath for 15 minutes. The puparia were removed from the water bath. If the puparia were too dark, they were left in cold KOH for 2-3 days. If they are still too dark (not bleached) after soaking in KOH, they were bleached in a solution of ammonia and hydrogen peroxide (8 drops of ammonia in a small crucible filled with peroxide) and slowly heated and monitored for 10 to 15 minutes. The specimens were then washed in water to remove excess ammonia and peroxide. Pale specimens of *Aleuroglandulus* Bondar, *Aleyrodes* Latreille, and some *Trialeurodes* Cockerell, were soaked in Essig's aphid fluid with the addition of two drops of double stain for 10-15 minutes. The dark puparia of the following genera *Aleuoparadoxus* Quaintance and Baker, *Aleuroplatus* Quaintance and Baker, *Aleuropleurocelus* Drews

and Sampson, *Tetraleurodes* Cockerell, and the dark form of two species of *Trialeurodes* were not stained. The stained or dark specimens were placed in 70% ethanol for 15 minutes and then transferred into 90% ethanol each for 10 minutes. Specimens were transferred into clove oil for 15 minutes to dehydrate them in preparation for them to be slide mounted in Canadian balsam or euparal.

Measurements of the pupal cases were taken from a Nikon SMZ 1500 wide field microscope using the 1X objective and the zoom setting at 5. The Nikon Digital Image camera is the DS-Fi1 model.

One adult female of *Bemisia tabaci* (Gennadius) biotype B and two puparia of *Trialeurodes abutiloneus* (Haldeman) were prepared in 100% undenatured ethanol for molecular analysis. The DNA extraction, PCR, sequencing, and molecular identification were done at the US Horticultural Research Laboratory (USDA-ARS) at Fort Pierce, Florida. Voucher specimens were not recovered.

Specimen Depositories. **USNM:** The National Entomological Collection of the National Museum of Natural History, USDA, Agricultural Research Service (ARS), Systematic Entomological Society (SEL), Beltsville, Maryland (USA); **CDFA:** California Department of Food and Agriculture at Sacramento, CA, (USA); **NDOA:** Nevada State Dept of Agriculture reference collection at Reno, NV, (USA); **PPQC:** Plant Inspection Station reference collection, USDA-APHIS-PPQ at San Francisco, CA (USA); **SJSU:** San Jose State University Entomology Collection, Department of Biological Sciences, San Jose, CA (USA).

Whitefly Morphology and Terminology

The family Aleyrodidae (Hemiptera, Sternorrhyncha) consists of two main subfamilies - the Aleurodicinae and Aleyrodinae. A third subfamily, the Udamosellinae (Martin 2007), is described only from adult males from Ecuador but may become synonymized with the Aleurodicinae. Although the Aleyrodinae alone is known to occur in Nevada, it is important to separate the subfamilies should species of the Aleurodicinae or Udamosellinae become established. The two main subfamilies can be separated easily in both the adult and immature stages.

The 4th stage (puparium) is used to identify species because the puparium has many more diagnostic structures than the adult and prepupal immature stages. The puparia can be identified to subfamily easily by the presence or absence of compound pores, the number of setae present at the apex of the lingula, and the presence of a terminal claw versus an adhesive pad at the apex of the tarsi. The following abbreviations are used: A₁-A₈ (abdominal segments 1 through 8); C₁ (cephalon); T₁ (prothorax = thoracic segment 1), T₂ (mesothorax = thoracic segment 2), and T₃ (metathorax = thoracic segment 3). Appendix A presents a glossary of puparium structures, Fig. 4-15 illustrates diagnostic characters for the various species.

The adults can be identified to subfamily easily by the wing venation, the number of antennal segments, and ventral abdominal wax plates in the females and males. Adult males and females of all the Aleurodicinae have the R-1 vein of the fore wing forked (except for the genus *Paraleyrodes*). The genus *Paraleyrodes* (Aleurodicinae) and the Aleyrodinae have the R-1 vein of the fore wing simple (not forked).

Key to the subfamilies of the Aleyrodidae (puparium)

1. Apex of all tarsi terminating in a claw, 2 pairs of setae present at the apex of the lingula; compound pores present in most species. (worldwide including the USA, but not in Nevada) **Aleurodicinae**
- Apex of all tarsi terminating in an adhesive pad, 1 pair of setae present at the apex of the lingula; compound pores absent. (worldwide) **Aleyrodinae**

Key to the genera of the Aleyrodinae of Nevada (based on puparium)

1. Puparium clear to yellowish in color **2**
- Puparium dark brown to black **6**
- 2(1). Puparium with large pair of glands on the dorsum of the metathorax; thoracic and caudal clefts dentate **Aleuroglandulus Bondar**
- Large prothoracic glands absent; tracheal clefts not dentate **3**

- 3(2). Dorsum with elongate siphon tubes *Siphoninus Silvestri*
 — Dorsum without elongate siphon tubes 4
- 4(3). Submarginal row of papillae present (Figure 15), lingula visible and tri-lobed
 *Trialeurodes Cockerell*
 — Submarginal row of papillae absent, if present, does not occur in rows 5
- 5(4). Cranial suture present; caudal and thoracic tracheal clefts and furrows present; vasiform orifice
 semi—hemispherical—shaped; lingula reduced or mostly obscured by operculum
 *Dialeurodes Cockerell*
 — Cranial suture absent; clefts rudimentary or absent; vasiform orifice triangular-shaped; lingula
 lanceolate and exposed *Bemisia Quaintance and Baker*
- 6(1). Dorsum with one row of flat, elongate papillae present in the submargin and median areas (Figure
 4); reniform papillae present *Aleuoparadoxus Russell*
 — Dorsum without elongate and reniform papillae absent; if papillae present, then cone, bullet, or
 rod shaped 7
- 7(6). Papillae present in submarginal rows, with or without dorsal clusters of papillae (Figure 12, 13);
 lingula tri-lobed *Trialeurodes Cockerell*
 — Papillae absent; lingula if visible not lobed 8
- 8(7). Lateral margin deflexed (Figure 7), body boat-shaped or oval; most species with protuberance at
 the posterior apex of puparium *Aleuropleurocelus Drew and Sampson*
 — Lateral margin not deflexed: not boat-shaped 9
- 9(8). Dorsum with a subdorsal fold and submarginal transverse bands (Figure 9, 10, 11)
 *Tetraleurodes Cockerell*
 — Dorsum without subdorsal folds or submarginal transverse bands (Figure 5)
 *Aleuoplatus Quaintance and Baker*

Genus *Aleuroglandulus* Bondar 1923

Aleuroglandulus subtilis Bondar 1923

Diagnosis. Puparium: *Habitus.* Oval puparia scattered to densely populated on the underside of leaf. Pupal case light clear to yellow in color, oval, and with well developed prothoracic glands present and visible with hand lens. The large thoracic and abdominal pairs of glands secrete strands of yellowish to pale bundles of wax that arc above the puparium. *Slide mounted puparium*-Prothorax with a well-defined pair of large glands with smaller pair on A₃ absent or present; with caudal margin truncate; thoracic and caudal tracheal clefts are dentate; base of each leg with a stout spine.

Nevada distribution. Spring Mountains in Kyle Canyon.

Nevada materials studied (6 puparia). Collected at Kyle Canyon (36°00.707N by 115°25.777W) on *Berberis*.

Nevada hosts. Berberidaceae: *Berberis repens*.

Comments. This species is easily separated from others in Nevada with the presence of differentiated submedian pair of large glands on the prothoracic and abdominal III; vasiform orifice inset from the posterior margin equal to or less than its own length.

Reference. Russell 1944; Martin 2005 (gives key to species and synonymies).

Genus *Aleuoparadoxus* Quaintance and Baker 1914

Aleuoparadoxus arctostaphyli Russell 1947

Diagnosis. Puparium (Figure 4): *Habitus.* Light dark brown to black in color; elliptical to subcircular in shape; with waxy glassy rods extending from submarginal and dorsal papillae. *Slide mounted specimen – Lateral margin.* Thoracic tracheal pore area indicated by 2-4 wide marginal teeth and submarginal ridges; abdominal tracheal pore area less distinct. *Dorsum.* Submarginal papillae 32-56 μ m (usually 40-50 μ m) long and 16-18 μ m wide, not contiguous, the majority separated from each other by a distance of about 1/5 the width of a papilla apart. Tracheal folds present terminating at the dentate margin; submarginal row of noncontiguous flat elongate papillae present with 2 to 3 pairs of cephalic subdorsal modified papillae and 0 to one central subdorsal pair on prothorax; each papillae ranged from 20 to 64 μ m. Four pairs of scattered reniform papillae present on the cephalon. *Vasiform orifice.* Rather broad posteriorly, 68-88 μ m long and 60-80 μ m wide. Operculum 64-80 μ m long and 56-72 μ m wide. *Venter.* Antennae terminate at the T₁ position, abruptly tapered, short finger-like at apex. Each anterior leg with 1-3 poorly to well developed, blunt spines present along the anterior margin of the coxa just mesad of the rugose band; middle and posterior legs each with a seta apparently about 20 μ m long located in the rugose band. *Pores.* Thoracic tracheal pore absent. *Chaetotaxy.* Each cephalic, A₁ and A₈ abdominal setae range from 24 to 32 μ m long; caudal setae from 10 to 30 μ m; ventral abdominal setae from 35 to 40 μ m long.

Nevada distribution. Red Rock Canyon NCA: Sandstone Quarry.

Nevada hosts. Rhamnaceae: *Ceanothus* sp.

Nevada materials studied (2 puparia). Collected at Red Rock Canyon NCA: Sandstone Quarry on 12-ix-2003 deposited in the USNM collection.

Comments. This is a new state record for Nevada and the only species of this genus known to occur in Nevada. It is also a new host for this species collected on *Ceanothus* sp.

Reference. Russell 1947.

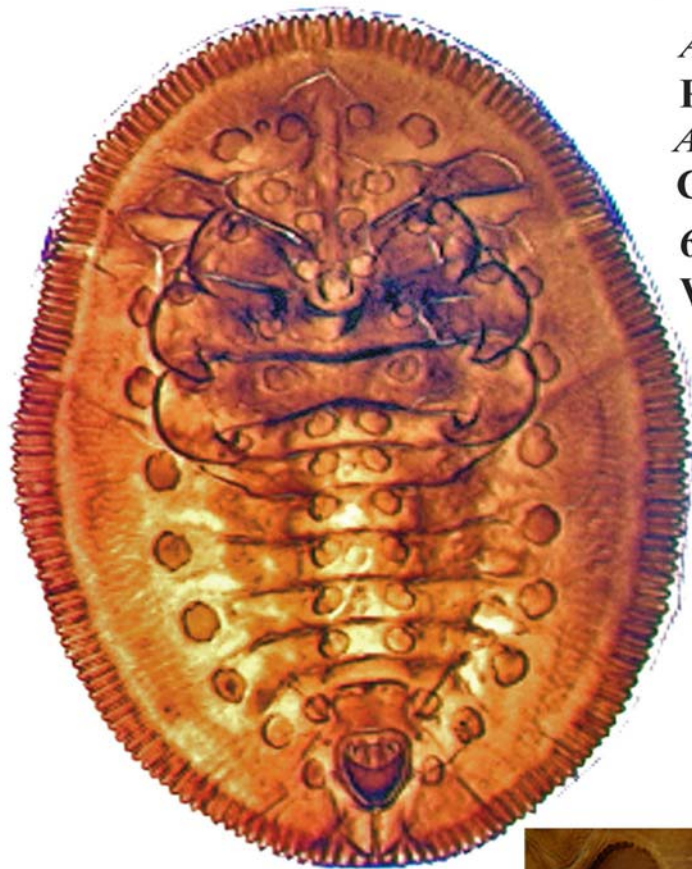
Genus *Aleuoplatus* Quaintance and Baker 1914

Key to the species of *Aleuoplatus* in Nevada (based on puparium)

1. Transverse suture not curving straight upward at submargin; posterior margin of vasiform orifice with a large tooth medially; distance between metathoracic pair of setae much greater than that of mesothoracic setae ***A. berbericolus* Quaintance and Baker**
- Transverse suture curving straight up at submargin; posterior margin of vasiform orifice with a relatively smaller tooth medially, directed inward; distance between mesothoracic pair of setae about equal to that of the metathoracic setae ***A. gelatinosus* (Cockerell)**

Aleuoplatus berbericolus Quaintance and Baker 1917

Diagnosis. Puparium: *Habitus.* Chestnut brown in color; oval to elliptical in shape. *Slide mounted specimen-Lateral margin.* Dentate with truncate teeth; thoracic tracheal comb composed of three or four rather prominent tooth with serrate margins differentiated from the rest of the margin; caudal comb similar to tracheal comb. *Dorsum.* Transverse molting suture not curved-up abruptly at submargin.



Aleuoparadoxus arctostaphyli

Russell

Arctostaphylos sp.

CA

6-ix-1907

Woglum

slide at the Systematic
Entomology Lab, ARS

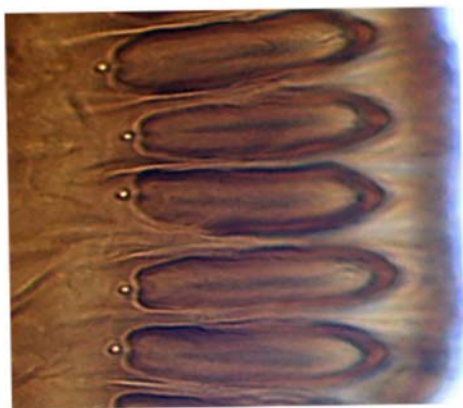


Figure 4. *Aleuoparadoxus arctostaphyli* Russell.

Vasiform orifice. Margin thickened lacking posterior inward projecting tooth; operculum subtriangular in shape, broad and rounded at the apex filling 50% of the orifice. *Venter.* from smooth to variously ornamented. *Pores.* Submarginal pores in multiple rows; subdorsum with irregularly scattered minute pore-like structures. *Chaetotaxy.* Cephalic setae not widened at base; A_3 setae slender and shorter than vasiform orifice.

Nevada distribution. Churchill; Washoe; Douglas; and Clark Counties.



Aleuroplatus gelatinosus Cockerell
 Red Rock Canyon NCA, NV
 Sandstone Quarry
Quercus sp.



Figure 5. *Aleuroplatus gelatinosus* (Cockerell).

Nevada hosts. Aquifoliaceae: *Ilex* sp.; Berberidaceae: *Berberis repens*, *Berberis (Mahonia) aquifolium*.

Comments. Not collected.

Reference. Quaintance and Baker 1917.

***Aleuroplatus gelatinosus* (Cockerell) 1898**

Diagnosis. Puparium (Figure 5): *Habitus*. Black in color, oval to subcircular with heavy to light waxy concentrations dorsally and well beyond margin; individuals solitary or sometimes found in clusters. *Slide mounted specimen-Lateral margin*. Tracheal area differentiated from rest of margin with an obvious fold and a bidentate tracheal cleft. *Dorsum*. Transverse molting suture curving upwards at the submargin. *Vasiform orifice*. Subcircular in outline with the margin thickened and lacks an inward projecting tooth on posterior margin. Operculum covers half the orifice obscuring the lingula. *Venter*. Legs unarmed (without spines) but with setae. *Pores*. Submarginal pores in multiple rows; dorsal pores scattered over the dorsal and submedial regions. *Chaetotaxy*. Cephalothoracic setae present with base of cephalic setae widened; A_1 setae absent; A_8 setae present longer than vasiform orifice.

Nevada distribution. Red Rock Canyon NCA: Pine Creek Canyon; Sandstone Quarry.

Nevada hosts. Boraginaceae: *Eriodictyon* sp.; Fagaceae: *Quercus* sp.

Nevada materials studied (52 puparia) at Rock Canyon NCA. Pine Creek Canyon: 36°07.577N by 115°28.474W (elev. 3935') on *Quercus* sp. 23-xii-2007: 3 puparia; 36°08.879N by 115°29.187W (elev. 4286') on *Quercus* sp., 23-xii-2007: 3 puparia. Sandstone Quarry: 36°09.816N by 115°27.027W on *Eriodictyon* sp. 24-viii-2008: 1 puparium; on *Quercus* sp. 07-iii-2006: 7 puparia; 36°09.787N by 115°27.012W on *Quercus* sp. 24-viii-2008: 20 puparia; 36°09.829N by 115°27.049W on *Quercus* sp. 24-viii-2008: 6 puparia; 36°09.715N by 115°26.998W on *Quercus* sp. 27-iii-2008: 4 puparia; 36°09.781N by 115°26.011W on *Quercus* sp. 27-iii-2008: 6 puparia; on *Quercus* sp. 27-iii-2008: 1 puparium; 36°09.802N by 115°27.013W on *Quercus* sp. 19-vii-2008: 1 puparium.

Comments. This is a new state record for Nevada and a new host record for this species on *Eriodictyon* sp. It is the most common and abundant whitefly found on *Quercus* in Nevada. According to Quaintance and Baker (1917) the wax is unusually prolific causing the black puparia to appear steeped or deeply embedded in the wax.

References. Cockerell 1898; Quaintance and Baker 1917.

Genus *Aleuropleurocelus* Drews and Sampson 1956

Comments. The puparium of all known species of this genus are very dark and need to be bleached before slide mounting. The waxy secretions present on the dorsum are often difficult to remove. Description of this genus can be found in Drews and Sampson (1956) with discussion by Martin (2005). In Nevada this genus appears to be limited to plants of the arid or semi-arid areas of the chaparral community, such as *Eriodictyon* sp. (Yerba Santa) and desert oaks in Nevada. Of the twelve known species in *Aleuropleurocelus*, two described species occur in Nevada. To these are added a new species and we document one unidentified species.

Key to the Species of *Aleuropleurocelus* of Nevada (based on puparium)

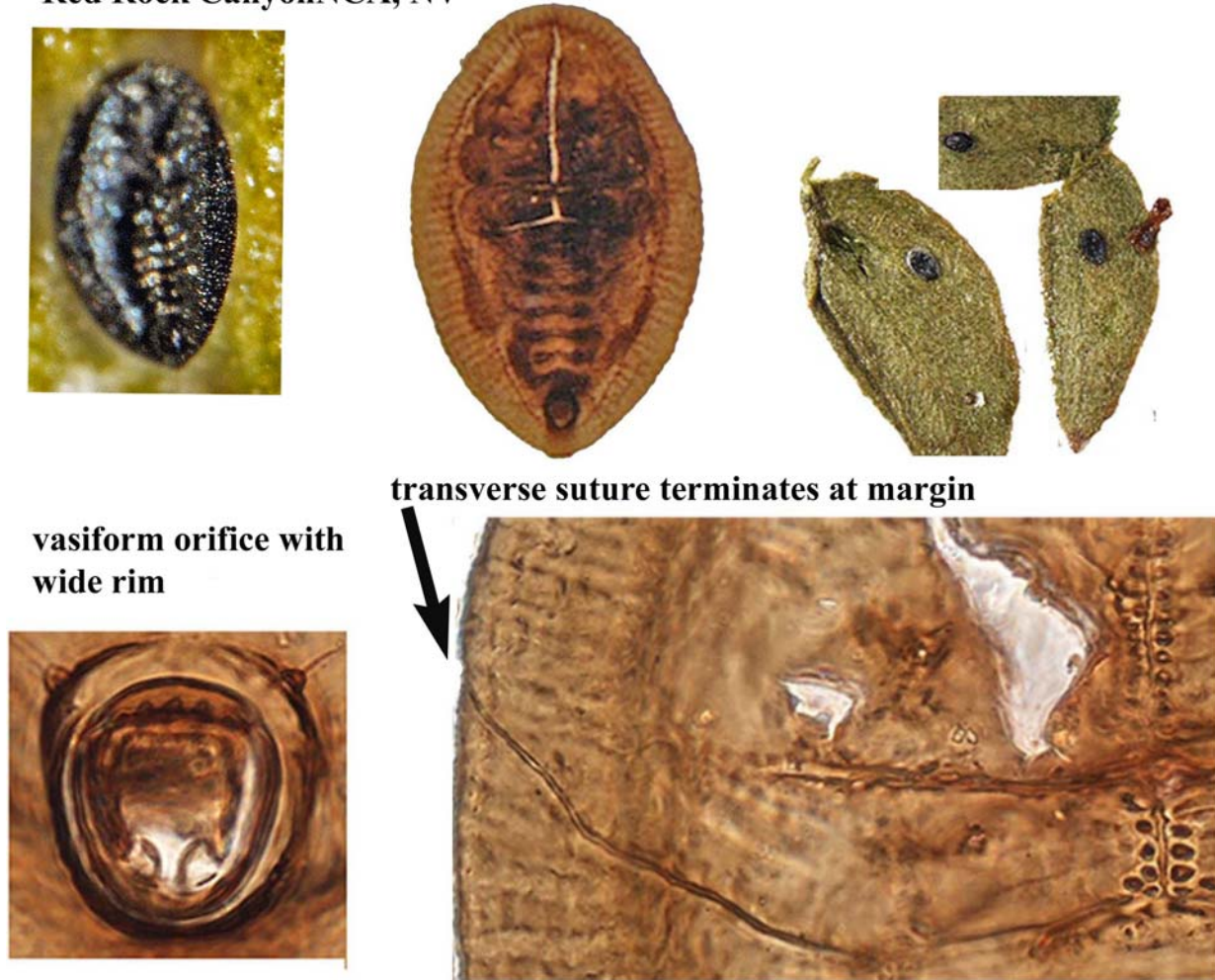
1. Puparium boat shaped with a relatively wide deflexed margin; cauda protuberance developed **3**
- Puparium oval shape with slight or narrow deflexed margin; caudal protuberance absent (Figure 7) **2**
- 2(1). Eyespot narrowed, slit-like (Figure 7) *A. nevadensis* Dooley sp. nov.
- Eyespot oval *Aleuropleurocelus* sp. #2
- 3(1). Transverse suture reaches lateral margin; median abdominal depressions not strongly sclerotized *A. ceanothi* (Sampson)
- Transverse suture not reaching margin; median abdominal depressions strongly sclerotized *A. nigrans* (Bemis)

Aleuropleurocelus ceanothi (Sampson) 1945

Diagnosis. Puparium (Figure 6): *Habitus*. Black in color; boat shaped (elliptical). *Slide mounted specimen-Lateral margin*. Convex with outer lateral margin deflexed with imbricated marginal band; true margin is dentate. *Dorsum*. Transverse molting suture reaches the third thoracic suture; median abdominal depressions weakly or not prominently sclerotized. *Vasiform orifice*. Raised and surrounded by a sclerotized ring; lingula concealed by cordate-shaped operculum; caudal protuberance present. *Pores*. Absent. *Chaetotaxy*; anterior and posterior setae, cephalic, and A₈ setae present.

Nevada distribution. Mount Charleston area: "Boy Scout Area" and in Lee Canyon; Red Rock Canyon NCA: Pine Creek Canyon; Sandstone Quarry; Willow Springs.

Aleuropleurocelus ceanothi Sampson
Red Rock Canyon NCA, NV



vasiform orifice with
wide rim

transverse suture terminates at margin

Figure 6. *Aleuropleurocelus ceanothi* (Sampson).

Nevada hosts. Boraginaceae: *Eriodictyon* sp.; Ericaceae: *Arctostaphylos* sp.; Fagaceae: *Quercus* sp.; Rhamnaceae: *Ceanothus* sp.

Nevada materials studied (83 puparia). “Boy Scout Area” 35°59.254N by 115°31.637W on *Ceanothus?* sp. 23-viii-06: 3 puparia; Lee Canyon 35°58.528N by 115°22.307W *Eriodictyon* sp., 23-viii-06: 4 puparia. Red Rock Canyon NCA: Pine Creek Canyon at 36°07.514N by 115°28.738W (elev.3971’) on *Eriodictyon* sp., 23-xii-2007: 5 puparia; 36°07.514N by 115°28.738W (elev.3971’) on *Quercus* sp., 23-xii-2007: 2 puparia; Sandstone Quarry on *Arctostaphylos* sp., 28-iii-2008: 2 puparia and 19-viii-2008: 3 puparia; Sandstone Quarry on *Arctostaphylos* sp., 19-viii-2008: 2 puparia; at 36°09.802N by 115°27.9013W and 36°09.709N by 115°26.982W on *Arctostaphylos* sp., 19-viii-2008: 2 puparia; at 36°09.709N by 115°26.782W on *Eriodictyon* sp. 19-viii-2008: 1 puparium; at 36°09.788N by 115°27.010W on *Eriodictyon* sp. 19-viii-2008: 7 puparia; at 36°09.709N by 115°26.782W on *Eriodictyon* sp. 19-viii-2008: 2 puparia; at 36°09.802N by 115°27.013W on *Eriodictyon* sp. 19-viii-2008: 6 puparia; on *Eriodictyon* sp. 03-vii-2006: 13 puparia, 28-iii-2008: 3 puparia, 19-8-2008: 3 puparia; 36°09.816N by 115°27.027W, 24-viii-2006: 3 puparia, 28-iii-2008: 7 puparia; at 36°09.715N by 115°26.998W on *Larrea* sp., 28-iii-2008: 6 puparia and 19-viii-2008: 1 puparium; on *Quercus* sp., 03-vii-2006: 4 puparia. Willow Springs) on *Eriodictyon* sp. 22-vi-2007: 3 puparia.

Comments. This is a new state record of this species in Nevada.

Reference. Drews and Sampson 1956.

***Aleuropleurocelus nevadensis* Dooley sp. nov.**

Diagnosis. Puparium (Figure 7): *Habitus.* Black in color; oval to rotund with pupal case length and width vary from 554-704 μ m long and 409-602 μ m wide; usually solitary on upper or lower surface of the leaf without noticeable wax formation. *Slide mounted-Lateral margin.* Deflexed margin (Figure 7) oriented towards median appearing as two separate dentate margins that are separated by a 28-37 μ m distance. The physical margin is tuberculate with irregularly-shaped structures. True lateral margin is dentate forming a fold-like inner concentric ring with the teeth pointing toward the margin and with a basal row of rectangular-elongated, divided submarginal gland at the base of the teeth (Figure 7). *Dorsum.* Entire dorsum is patterned with multiple rows and clusters of various sized granules from the cephalon to the caudal areas and from the subdorsum (deflexed inner margin) to the submedian area. Median area weakly sculptured. Longitudinal molting suture terminates at margin and is 298 μ m long. The suture has a single row of granules on each side (Figure 7) extending from the transverse suture to 2/3 the distance toward the anterior margin giving a zippered appearance. The transverse suture extends out close to the inner margin and curves upwards terminating at the true inner margin at the level of the T₂ suture. A pair of narrowly transverse eyespots each with a thickened lower margin (Figure 7). *Venter.* Antennae extending posteriorly to the T₁ pair of legs. Thoracic cuticle with a moderate spinulose band present transversing the basal areas of the legs while a broad spinulose area occurs lateral to the mouth parts (Figure 7); abdominal cuticle weakly granulated from the margin to the submargin and smoother toward the median. *Vasiform orifice.* Widely cordate, 55.6 μ m long and 68.4 μ m wide, with a moderate to broad lateral and posterior margin; anterior margin not defined. Operculum 26.3 μ m long and 35.5 μ m wide; completely covers the lingula and most of the vasiform orifice. Caudal protuberance absent or greatly reduced. Caudal setae widely separated (Figure 7). *Pores.* Scarce, on cephalon, thorax and abdomen (submedian to subdorsum). *Chaetotaxy.* Thoracic and A₁ setae absent; A₈ pair of setae present (38.5-48.6 μ m long), each arising from a tubercle base on the anterior-lateral margin of the vasiform orifice. Caudal setae pair is broken off or missing.

Nevada distribution. Red Rock Canyon NCA: Pine Creek Canyon; Sandstone Quarry.

Nevada hosts. Ericaceae: *Arctostaphylos* sp.; Fagaceae: *Quercus* sp. and *Q. turbinella*; Hydrophyllaceae: *Eriodictyon* sp.

Nevada materials studied. Holotype (puparium). Red Rock Canyon NCA, Sandstone Quarry on *Quercus* sp., 3-vii-2006 (36°09.800N by 115°27.006W) deposited at the USNM in Beltsville, MD.

Paratypes (38 puparia) collected at Red Rock Canyon NCA as follows: at Pine Creek Canyon on *Quercus turbinella*, 23-xii-2007 with one puparium (36°07.577N by 115°28.013W elev. 3935') deposited in USNM, and 1 puparium (36°07.462N by 115°28.853 elev. 3976') deposited at PPQC; at Sandstone Quarry on *Arctostaphylos* sp., 28-iii-2008 with 1 puparium (36°09.781N by 115°26.011W) deposited at PPQC; on *Eriodictyon* sp., 28-iii-2008 with 1 puparium each deposited at PPQC and USNM; on *Quercus* sp., 27-iii-2008 (36°09.781N by 115°26.011W) with 7 deposited at PPQC, 1 at NDOA, and 1 at SJSU; and 2 puparia (36°09.715N by 115°26.998W) deposited with CDFa and 2 with PPQC; on *Quercus* sp., 27-vi-2007 with 1 puparium each (36°09.781N by 115°26.011W) deposited at SJSU and NDOA; on *Quercus* sp., 23-viii-2007 with 1 puparium (36°09.790N by 115°26.008W) deposited at PPQC; on *Quercus* sp., 27-iii-2008, with 1 puparium each (36°09.781N by 115°26.011W) deposited at SJSU and NDOA and 7 deposited at PPQC; on *Quercus* sp., 27-iii-2008, with 2 Puparium (36°09.715N by 115°26.998W) deposited at CDFa and 2 at PPQC; and on *Quercus* sp., 19-viii-2008 (36°09.802N by 115°27.013W) deposited at PPQC.

Etymology: The name is the Latin adjective describing Nevada as the origin of the species collected.

Comments. The broadly oval-shaped puparium with a greatly reduced or lacking a caudal protuberance (Figure 7) and widely-separated caudal setae differentiates this species from *A. ceanothi* and *A. nigrans* which have a boat-shaped puparium with a pronounced caudal protuberance and the caudal setae set

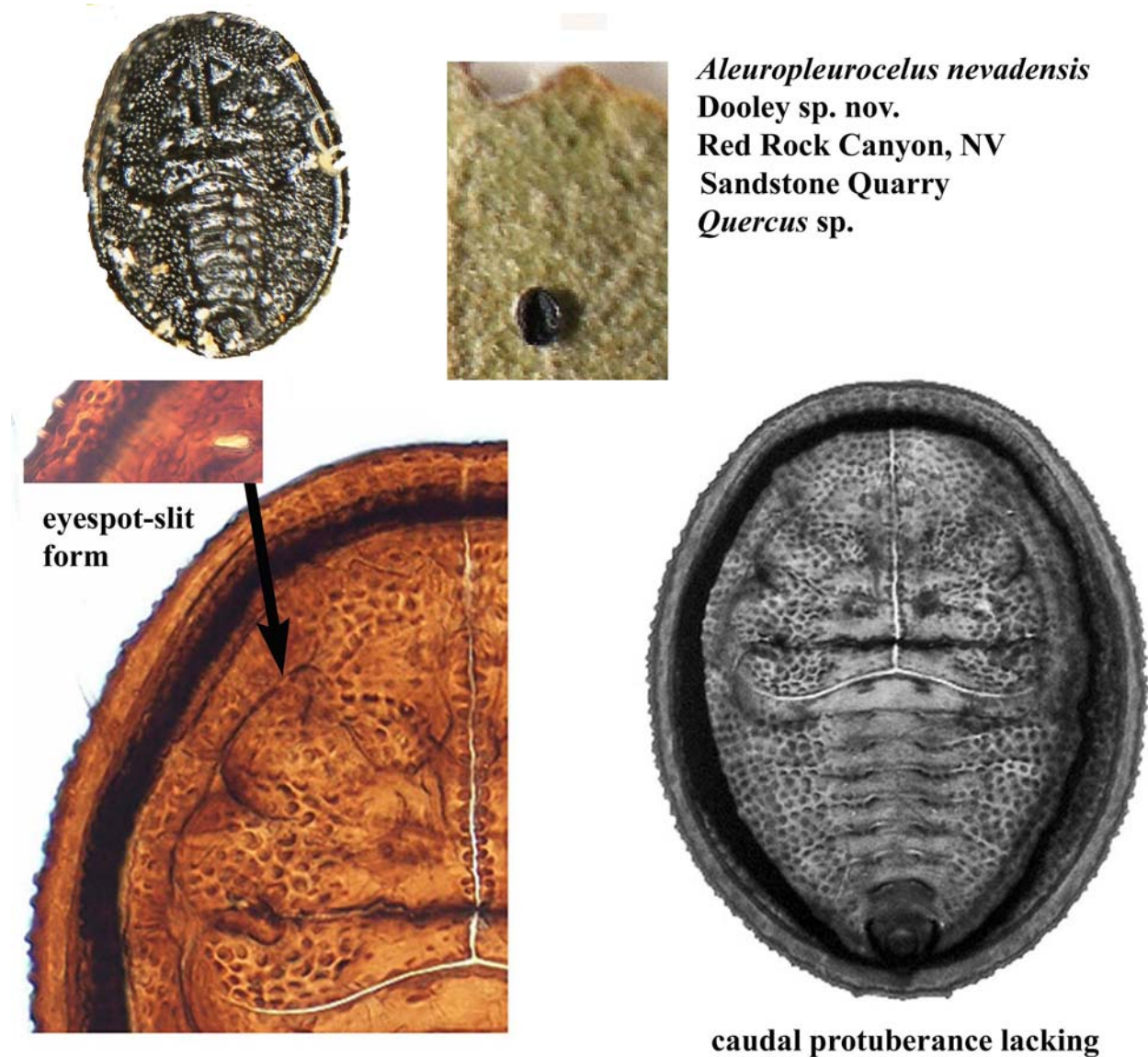
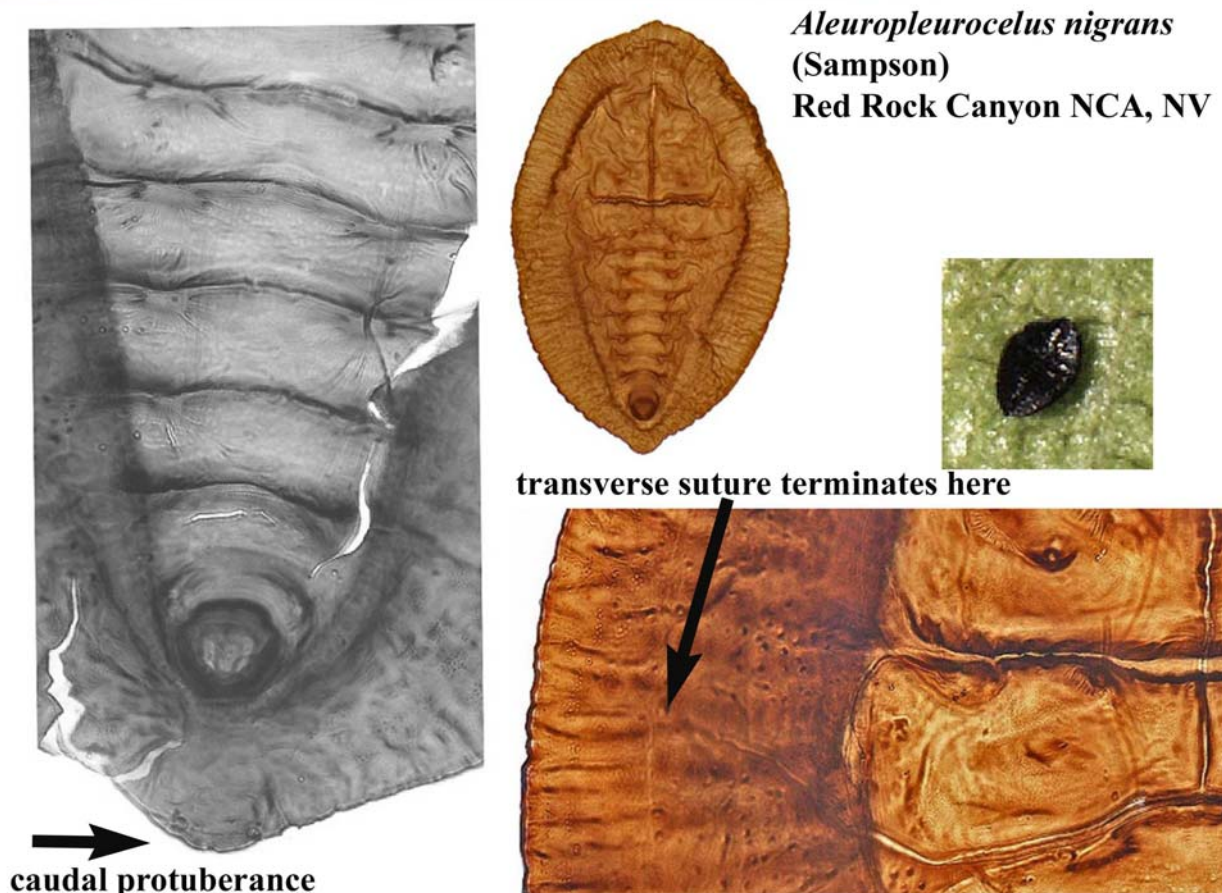


Figure 7. *Aleuropleurocelus nevadensis* Dooley sp. nov.

close together. It is most similar in shape to *Aleuropleurocelus abnormis* Quaintance not known to occur in Nevada but differs from the latter by lacking a wide, curving sclerotized area along the anterior margin. The puparium length and width ranges were taken from 30 puparia measured. The measurements for the individual structures were taken from the Holotype.

***Aleuropleurocelus nigrans* (Bemis) 1904**

Diagnosis. Puparium (Figure 8): *Habitus*. Black in color and boat shaped (elliptical) with a thin wax layer. *Slide mounted specimen-Lateral margin*. Lateral margin convex; outer margin deflexed with imbricated marginal band; true margin is dentate. *Dorsum*. Transverse molting suture terminates before the third thoracic suture; median abdominal depressions strongly sclerotized. *Vasiform orifice*. Raised and surrounded by a sclerotized ring; lingula concealed by cordate shaped operculum; caudal protuberance present. *Pores*. Each abdominal segment (except A_2) has one or two pairs of porettes near the sclerotized median depressions. *Chaetotaxy*. Anterior and posterior setae present; cephalic and A_8 setae present.



Aleuropleurocelus nigrans
(Sampson)
Red Rock Canyon NCA, NV

Figure 8. *Aleuropleurocelus nigrans* (Bemis).

Nevada distribution. Red Rock Canyon NCA: Lost Creek Canyon; Pine Creek Canyon; Sandstone Quarry.

Nevada hosts. Ericaceae: *Arctostaphylos* sp; Fagaceae: *Quercus* sp.; Rhamnaceae: *Ceanothus* sp.

Nevada materials studied (19 puparia). Red Rock Canyon NCA, Nevada: Lost Creek Canyon on indeterminate host 19-viii-2008: 1 puparium; Pine Creek Canyon at 36°07.514N by 115°28.738W (elev. 3971') on *Quercus* sp. 23-xii-2007: 5 puparia. Sandstone Quarry at 36°09.781N by 115°26.011W on *Arctostaphylos* sp. 27-iii-2008 and 28-iii-2008: 2 puparia; 36°09.781N by 115°26.011W on *Ceanothus* sp. 16-xii-2003, 03-vii-2006, and 05-vii-2006: 7 puparia; 36°09.781N by 115°26.011W on *Ceanothus* sp. 19-viii-2008: 4 puparia.

Comments. This is a new state record for Nevada on *Arctostaphylos* sp.

Reference. Drews and Sampson 1956.

Aleuropleurocelus sp. #2

Diagnosis. This species is similar to *A. nevadensis* and differs by having oval eyespots (narrowed in *A. nevadensis*).

Nevada materials studied (3 slides). One slide with one puparium collected at Sandstone Quarry (Red Rock Canyon NCA) at 36°09.829N by 115°27.049 24-viii-2006 collected on *Quercus* sp. (collected by Dr. Knight and Robert Little); Sandstone Quarry 22-vi-2007: 1 puparium. Sandstone Quarry 36°09.781N by 115°27.011, 27-iii-2008: 1 puparium collected on *Quercus* sp. All specimens collected by John Dooley and some deposited at the USNM.

Nevada hosts Fagaceae: *Quercus* sp.

Comments. Although the species displays unique character traits that differ from other *Aleuropleurocelus* species, more specimens need to be collected and examined to determine if it is indeed a new species.

Genus *Aleyrodes* Latreille 1796

Aleyrodes spiraeoides Quaintance 1900

Diagnosis. Puparium: Habitus. Very large (1115µm in length by 830µm in width), yellow, round to elliptical in shape, dorsum and surrounding surface often dusted with powdery white wax. *Slide mounted specimen-Lateral margin.* Crenulate with an undifferentiated tracheal cleft. *Dorsum.* Papillae and tracheal folds lacking; A_7 medial area as wide as that of A_6 . *Vasiform orifice.* Orifice subcordate to triangular in shape with operculum covering half the vasiform orifice with conical lingula exposed. *Venter.* Smooth with faint caudal furrow. *Pores.* Indistinct or absent. *Chaetotaxy.* Caudal setae minute to fairly long.

Nevada distribution. Panaca (Lincoln County).

Nevada hosts. Solanaceae: *Solanum tuberosum*.

Comments. Not collected since 1961 in Lincoln County, Nevada.

Genus *Bemisia* Quaintance and Baker 1914

Bemisia tabaci (Gennadius) 1889

Diagnosis. Puparium: Habitus. Ovoid and usually pale to yellow with little to no wax visible. *Slide mounted specimen-Lateral margin.* Smooth to crenulate with faint tracheal cleft. *Dorsum.* Longitudinal subdorsal folds or furrows absent. Thoracic tracheal furrows moderately developed from marginal tracheal cleft extending at most half way to spiracle; caudal furrow well developed extending from the vasiform orifice to the caudal marginal cleft. Papillae present or absent. *Vasiform orifice.* Acute-triangular in shape terminating into a pronounced caudal furrow (shorter than orifice); operculum occupying anterior half of orifice exposing the inserted, elongated, lanceolate, and spinulose lingula. *Venter.* Antennae terminate at the T_1 pair of legs; base of legs with minute setae but without large spines. Tracheal furrow well developed and stippled. *Pores.* Pores and porettes distributed on the dorsum. *Chaetotaxy.* Caudal setae long and robust on tubercles. Dorsal setae highly variable, short to long, with acute apices.

Nevada distribution. Las Vegas (Clark County).

Nevada hosts. Euphorbiaceae: *Euphorbia pulcherrima*; Solanaceae: *Datura wrightii*.

Nevada materials studied (1 adult female). Red Rock Canyon NCA, Nevada: Lost Creek Canyon at 36°08.763N by 115°25.844W on *Datura wrightii* 07-vii-2009.

Comments. This was the only adult collected. Confirmed as biotype B by molecular identification at the ARS facility in Fort Pierce, Florida. Characters affected by leaf surface: glabrous to hairy leaf surfaces: papillae presence or absence and the length of the setae extremely variable.

Reference. Gennedius 1889; Martin 2005.

Genus *Dialeurodes* Cockerell 1902

Dialeurodes citri (Ashmead) 1885

Diagnosis. Puparium: *Habitus.* Usually pale and semi-translucent, oval and flat in shape. *Slide mounted specimen-Lateral margin.* Smooth or crenulate with caudal and thoracic tracheal clefts pore-like that is internally smooth. *Dorsum.* Submarginal fold or furrow absent; thoracic and caudal tracheal furrows stippled with micro spines; transverse molting suture terminates well before margin; subdorsal tubercles present; A_1 to A_6 segments subequal in length. *Vasiform orifice.* Broadly elliptical or subcircular; operculum covers almost all of orifice obscuring most of lingula. *Venter.* Antennae terminate at the T_1 pair of legs. *Chaetotaxy.* Cephalic, A_8 (located anterior to the widest diameter of the vasiform orifice) and caudal setae present; A_1 setae absent; 12 pairs of submarginal setae.

Distribution. Las Vegas (Clark County).

Nevada hosts. Rutaceae: *Fortunella* sp.

Comments. Not collected since 1959 in Clark County, Nevada.

Reference. Quaintance and Baker 1916, Jensen 2001.

Siphoninus phillyreae (Haliday) 1835

Diagnosis. Puparium: *Habitus.* Normally oval-shaped, pale with central submedian waxy bundles. *Slide mounted specimen-Lateral margin.* Crenulated with dentate caudal tracheal cleft armed with 12-13 teeth. *Dorsum.* Transverse molting suture terminates well before the margin curving upwards slightly at the apex but not meeting the T_3 segmental suture. Covered with siphon-like tubes of varying lengths. Brown stripe present medially from the cephalothorax past the vasiform orifice. *Venter.* Caudal cleft is differentiated into a series of 14 fleshy, finger-like projects. Legs unarmed. *Pores.* None observed. *Chaetotaxy.* Long cephalic, A_1 , A_8 (anterior to the vasiform orifice) and caudal setal pairs present. Submargin with a series of flagellate setae from the cephalothorax to the cauda.

Nevada distribution. Calico Basin (Clark County); Pahrump (Nye County); Reno, (Washoe County).

Nevada hosts. Oleaceae: *Fraxinus* spp.; Lythraceae: *Punica granatum*; and Rosaceae: *Pyrus* spp.

Comments. The ash whitefly has a high reproductive potential which often results in explosive population increases and subsequent plant damage. Its direct feeding interferes with the flow of nutrients through the phloem of the plants causing defoliation. They secrete copious amounts of honeydew (excrement) discoloring the leaves and nearby surfaces and causes sooty molds to form which negatively affects the marketability and appearance of the plants (Sorenson 1991). Not collected since 1991 in Washoe County, Nevada.

Reference. Silvestri 1915.

Genus *Tetraleurodes* Cockerell 1902

Diagnosis. Puparium: *Habitus.* Dark brown to black in most species, rarely pale; suboval to broadly oval, often heavily sclerotized. *Slide mounted specimen-Lateral margin.* Dentate in most species (Figure 9, 10, 11),

sometimes crenulated, not deflexed. Pale glandular areas, from V-shaped to round or rectangular in shape, present at base of marginal teeth; thoracic and caudal tracheal margins not differentiated from the rest of the marginal teeth. *Dorsum*. Longitudinal molting suture meeting dorsal fold or margin; transverse molting suture terminates before or at the submarginal fold. Submarginal row of tubercles present or absent (Figure 11). Tracheal furrows absent. Submarginal fold present with transverse tuberculate bands (Figure 11) with furrow and ridges between submargin and fold. *Vasiform orifice*. Subcordate, elevated and sometimes overlapping subdorsal fold; operculum subcordate almost filling entire orifice, obscuring the lingua. *Venter* Antennae terminate at the T₁ pair of legs; legs with or without spinulose bands, the latter may be narrow to broad when present. Caudal and thoracic furrows may have a slight pattern (stippled to smooth). *Pores*. In a single row or irregular rows within or outside of the transverse bands; disc pores associated with porettes absent or present. *Chaetotaxy*. Anterior and posterior marginal setae present; caudal setae present. Submedian thoracic setae present or absent; A₁ setae absent; A₈ setae present.

Comments. Two described and one newly-described species are known to occur in Nevada. All Nevada species are black (requiring bleaching) prior to mounting.

References. Cockerell 1902, Quaintance and Baker 1914, Nakahara 1995.

Key to the Species of *Tetraleurodes* in Nevada (based on puparium)

1. Dorsum with three pairs of minute submedian cephalothoracic setae; submarginal to subdorsal cuticle rugose *T. quercophyllae* Dooley sp. nov.
- Dorsum with zero to two pairs of submedian cephalothoracic; cuticle otherwise 2
- 2(1). Dorsum with T₂ and T₃ submedian cephalothoracic setal pairs; A₄ with a subdorsal cluster of 3 to 8 pore(s) *T. mori* (Quaintance)
- Dorsum without cephalothoracic setae; A₄ without subdorsal cluster of 3-8 pores *T. quercicola* Nakahara

Tetraleurodes mori (Quaintance) 1899

Diagnosis. Puparium: *Habitus*. Puparium oval sclerotized, and black; wax scarce or absent. *Slide mounted specimen-Lateral margin*. Margin dentate with tracheal clefts not differentiated from rest of margin. Submargin with V to U-shaped glands associated with marginal teeth. *Dorsum*. Concentric fold separates subdorsum from submargin, roughened area from submargin to submedian area absent; submarginal tubercles absent; tracheal furrows absent; abdomen lacking submedian depressions; operculum without median notch. *Venter*. Cuticle smooth and legs unarmed. *Pores*. 3-8 minute disc pores present on each side of A₄. *Chaetotaxy*. T₂, T₃, and A₈ setae present; cephalic setae absent.

Nevada distribution. Las Vegas and Lee Canyon (Clark County); Virgin Mountains.

Nevada hosts. Berberidaceae: *Berberis repens*; Moraceae: *Morus* sp.; Plantaginaceae: *Penstemon* sp.

Nevada materials studied (18 puparia). Lee Canyon, Nevada (35°58. 524N by 115°22. 308W) on Plantaginaceae: *Penstemon* sp., 23-viii-2006.

Comments. New host record for *Penstemon* sp. This species was easily distinguished from other species in the genus by the presence of a cluster of 3-8 disc pores on A₄. It was found in the Mount Charleston area at Lee Canyon in our study. It had been previously found in the Virgin Mountains which are located in Clark County (36.597478°N by 114.0958°W).

Reference. Quaintance and Baker 1914.

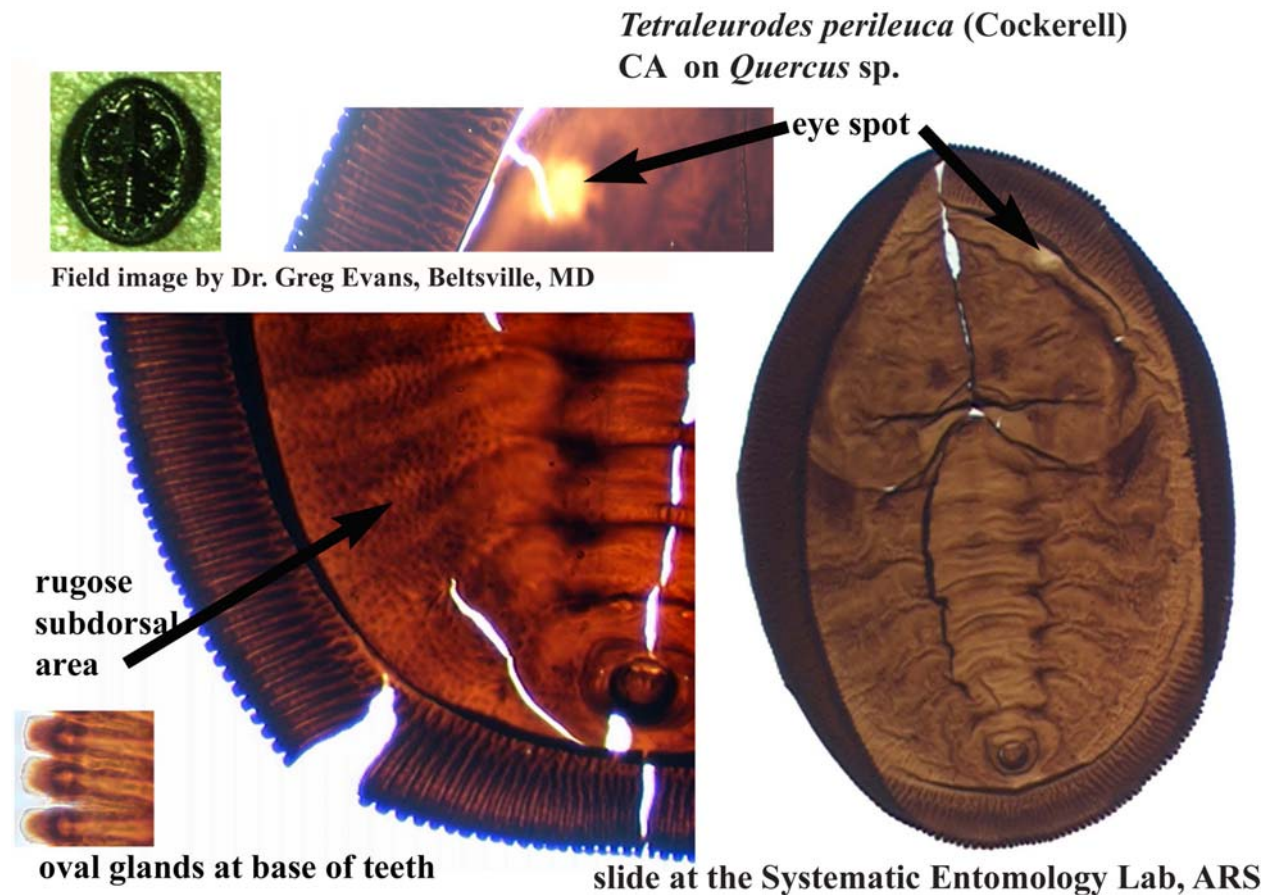


Figure 9. *Tetraleurodes perileuca* (Cockerell).

***Tetraleurodes quercicola* Nakahara 1995**

Diagnosis. Puparium (Figure 10): *Habitus*. Oval sclerotized and black; wax not observed. *Slide mounted specimen-Lateral margin*. Lateral margin dentate, teeth wider than long and apically truncate to subtruncate; small, oval glandular areas at base of marginal teeth; submargin with transverse ridges and furrows terminating at, or close to, base of marginal teeth; band of microtubercles present extending from the pale glandular areas on the ridges. *Dorsum*. Submargin differentiated from dorsal disk by submarginal fold. Eyespots diffuse. Longitudinal molting suture terminates at the anterior margin; transverse molting suture diagonally extends to subdorsal ridge curving anterior to the level of the meso-metathoracic suture. *Venter*. Smooth without distinct sculpture or pattern. *Vasiform orifice*. Subcordate located on a raised area of A_8 ; small tubercle with pale gland on posterolateral part of rim; orifice margin with two rows of cell-like structures (inner row with 4 cells laterally and outer row with 15-16 cells laterally and caudally). Operculum is subcordate and subequal to orifice size completely covering the lingula. *Pores*. Disk pores, 4-5 μ m in diameter, with associated porettes in median row around submargin; 3 in diameter, with associated porettes present on cephalothorax and abdomen subdorsally and submedially. *Chaetotaxy*. Cephalothoracic and A_8 submedian setae absent; caudal setae short, thin about 5 μ m long.

Nevada distribution. Red Rock Canyon NCA: Pine Creek Canyon.

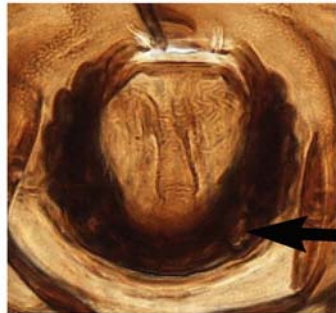
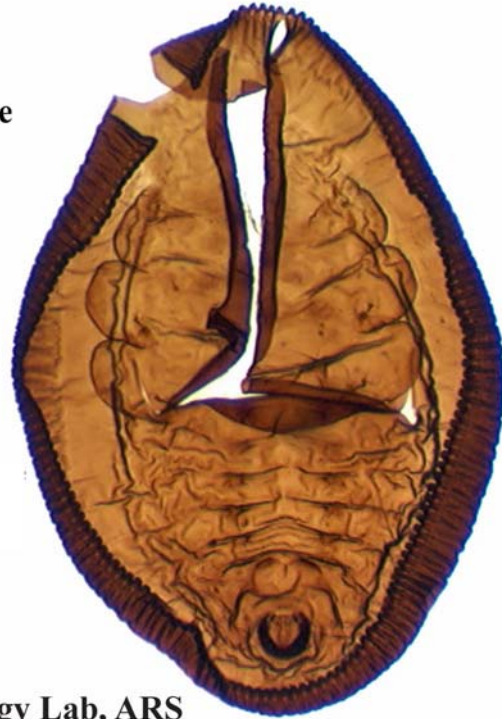
Nevada hosts. Fagaceae: *Quercus* sp.

Tetraleurodes quercicola Nakahara

indet shrub

UT

1-iv-1966

oval glands at base
of marginal teethpale gland with
tubercle

slide at the Systematic Entomology Lab, ARS

Figure 10. *Tetraleurodes quercicola* Nakahara.

Nevada materials studied (one puparium). Red Rock Canyon NCA, Nevada. Pine Creek Canyon at 36°07.577N by 115°28.474W (elev.3935') on *Quercus* sp., collected on 23-xii-2007 by John Dooley.

Comments. New Nevada state record.

Reference. Nakahara 1995.

Tetraleurodes quercophyllae Dooley sp. nov.

Diagnosis. Puparium (Figure 11): *Habitus*. Oval sclerotized and black with pupal case length and width vary from 699-1222 μ m long and 574-963 μ m wide; wax forms a marginal ring; usually solitary on upper or lower part of leaf. *Slide mounted specimen-Lateral margin*. Ovoid length and width vary from 730-1270 μ m long and 560-960 μ m wide. Dentate, not differentiated at thoracic or caudal tracheal openings, with 6 to 8 teeth per 100 μ m; submarginal, pale glandular areas vary from thimble-shaped to distorted, not U or V-shaped (Figure 11). *Dorsum*. Longitudinal suture terminates close to the margin. Transverse suture terminates on or before the subdorsal fold. Cuticle rugose from submargin to subdorsum being smooth in the median region. Eyespot absent. Submedian abdominal depressions well defined from A₁ to A₇. Median tubercles well defined from A₂ to A₇. *Vasiform orifice*. Orifice and operculum subcordate; operculum with dorsum rugose completely obscuring the lingula. Posterior notch absent on both the vasiform orifice and operculum. *Pores*. Tubercle-like small pores present in a single irregular row in the transverse band between the dorsal fold and microtuberculate band (Figure 11) averaging from 60-80 pores combined for both sides. Each pore about 57 μ m in diameter. Numerous pores each associated with a porette present on dorsum on the subdorsum to the submedian areas: cephalic from 0-1 submedian and 0 to 2 subdorsum pores; T₂ with 0-2 submedian and 0 to 3 subdorsal pores; T₃ with 1-3 subdorsum pores only; A₁ pores absent or with 1 submedian or 1 subdorsal pore present; A₂ with 0-1 submedian pore present; A₃ with 0-1 submedian pores present; A₄ with 0-1 subdorsal and 1-2 submedian pores present; A₅ with 1-2 submedian and 0-2 subdorsal pores present; A₆ with 0-1 submedian and from 1-2 subdorsal pores present;

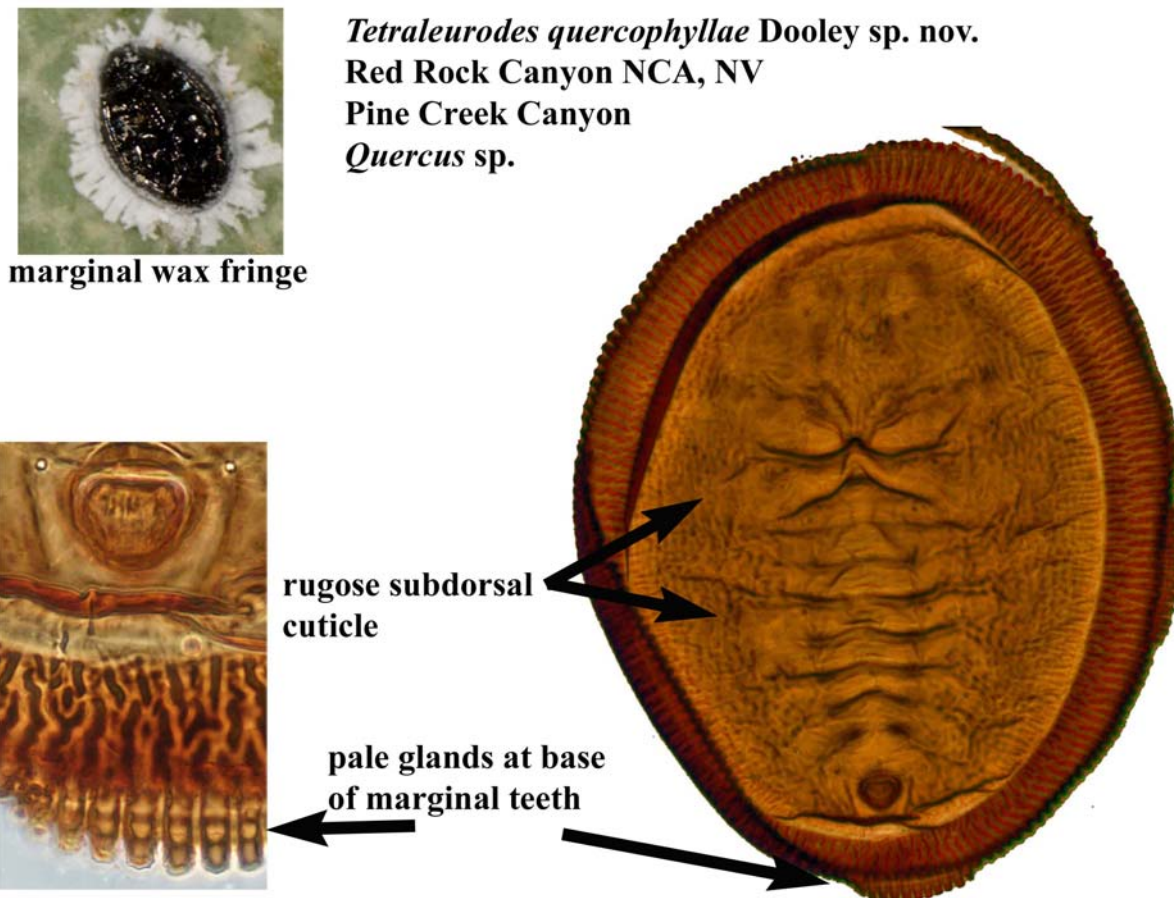


Figure 11. *Tetraleurodes quercophyllae* Dooley sp. nov.

A_6 with 0-1 submedial and 1-2 subdorsal pores present; A_7 from 0-1 submedial and 0-2 subdorsal pores present; and A_8 1-3 submedial present and no subdorsum pores. *Chaetotaxy*. Submarginal, thoracic and abdominal setae present; cephalic setae 15 μ m long, T_2 setae 10-30 μ m long; T_3 setae 15 to 25 μ m long; A_1 setae absent; and A_8 setae 5 to 16 μ m long. Submarginal setae at irregular pattern with 6-8 setae on transverse ridge between tubercle-like pores and microtuberculate band.

Nevada distribution. Red Rock Canyon NCA: Pine Creek; Sandstone Quarry.

Nevada hosts. Fagaceae: *Quercus* sp., *Quercus turbinella*.

Nevada material studied. Holotype (one puparium, slide-mounted) Red Rock Canyon NCA: at Sandstone Quarry, on *Quercus* sp., 03-vii-2006, deposited at the USNM in Beltsville, MD.

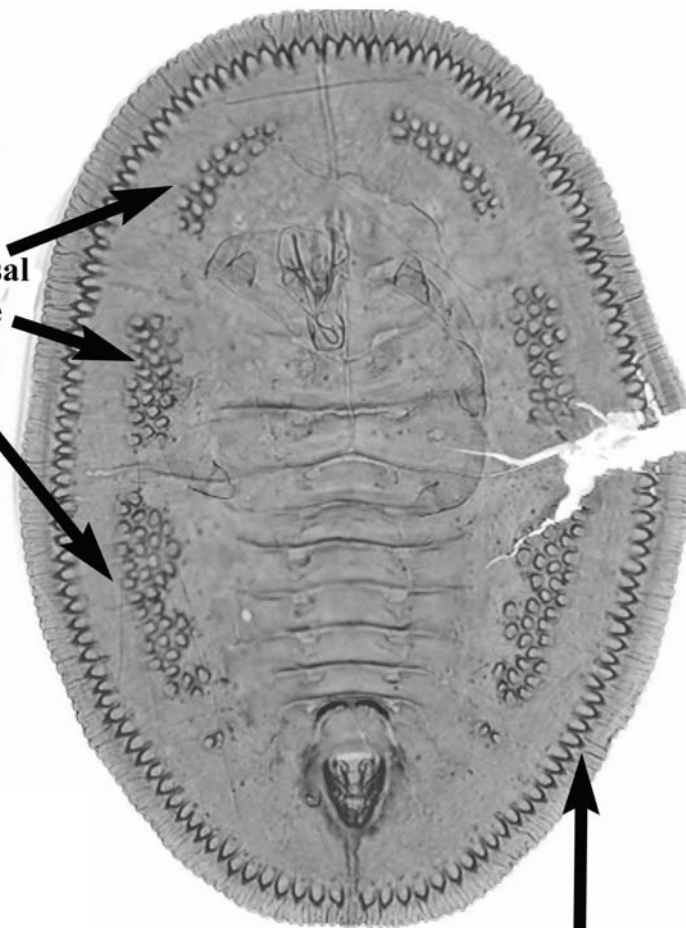
Paratypes (7 puparia) collected at Red Rock Canyon NCA as follows: at Pine Creek Canyon on *Quercus turbinella*, 23-xii-2007 with 1 puparium (36°07.577N by 115°28.424W, 3535' elevation) deposited at USNM; at Sandstone Quarry on *Quercus* sp., ix-2004, with 1 puparium (GPS location unknown) deposited at USNM; on *Quercus?* sp., 08-ix-2005, with 1 puparium (GPS location unknown) deposited at PPQC, on *Quercus?* sp., 24-viii-2006, with 1 puparium (36°09.829N by 115°27.049W) deposited at PPQC, on *Quercus* sp., 05-vii-2006, John Dooley, 3 (1 puparium each (GPS location unknown) deposited at CDFA, NDOA, and SJSU.

Etymology. The species name is derived from the Latin and Greek meaning oak leaves.

Field image below of
Trialeurodes corollis (Penny)
Red Rock Canyon NCA, NV
Arctostaphylos sp.



subdorsal
papillae
clusters



submarginal papillae row

Slide image (right)
California
Arctostaphylos sp.
27 March 1976
slide at the Systematic
Entomology Lab, ARS

Figure 12. *Trialeurodes corollis* (Penny).

Comments. This species is usually found solitary or in few numbers on the upper side of the oak leaf. The submedian setae were broke off during the mounting process. The cephalothoracic setae are very small.

This species fits well within the genus *Tetraleurodes* and is closest to the species *T. perileuca* (Cockerell) which is not known to occur in Nevada (Figure 9). A comparison was made to the four specimens of *T. perileuca* deposited at Beltsville, Maryland. *Tetraleurodes quercophyllae* differs from *T. perileuca* by the absence of an eyespot; a lesser number of tubercle-like pores in a single row on the inner margin between the microtuberculate band and the dorsal fold (from 30-50 pores verses 49 to 58 in *T. perileuca*); the distribution and pattern of the pores (each associated with a porette) on the cephalothorax and abdomen: more numerous, especially on A_8 and T_2 , and distributed differently from *T. perileuca*.

Tetraleurodes quercophyllae differs from *T. mori* by the presence of numerous pores and associated porettes distributed on the submedian and subdorsum from the thoracic segments to the lateral area of the vasiform orifice (absent in *T. mori*); the rugose cuticle (smooth in *T. mori*); absence of v-shaped submarginal glands and the single, submarginal row of tubercle-like pores; the absence of a cluster of 3-8 disc pores on A_4 ; and a row of spinules at the base of the legs absent. In addition, *T. mori* is not known to occur on oaks.

Field Image below:

Trialeurodes eriodictyonis Russell

Red Rock Canyon NCA, NV

Lost Creek, Willow springs

Datura wrightii

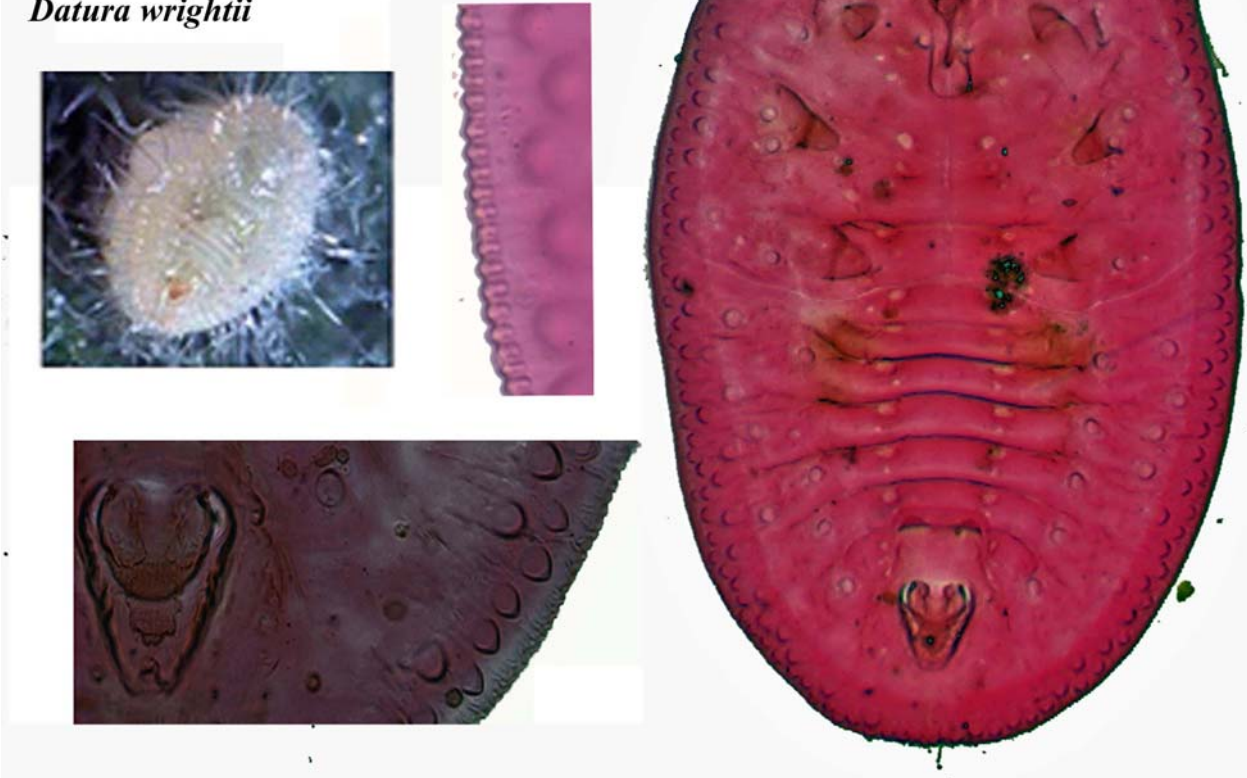


Figure 13. *Trialeurodes eriodictyonis* Russell.

Genus *Trialeurodes* Cockerell 1902

Diagnosis. Puparium: *Habitus.* Normally oval-shaped, mostly pale with a few species dark brown, or having a pale and dark brown form; about 100 species are described. More abundant on the underside of the leaf and less dense on the upper surface. *Slide mounted specimen-Lateral margin.* Crenulate (crenulations from small to large, uniform or of varying widths), somewhat weak, and sometimes modified at the thoracic tracheal openings and showing some stippling in the thoracic furrow. *Dorsum.* A submarginal row of variously shaped papillae (cylindrical, bullet, conical apically rounded or acute) well or poorly developed; if well developed, then separated or closely appressed; such papillae may also occur on the dorsal disc. Seven or 8 abdominal segments apparent in median region of abdomen: A_7 in most species reduced with the median length no more than one-third the length of A_6 . *Vasiform orifice.* Cordate-shaped, defined, enclosing a posteriorly lobed lingula that is contained within the vasiform orifice. The lingula has 3 paired lobes and one apical lobe that is usually partially, but may be totally covered by the operculum. The operculum, cordate to subcordate, covers at least half the vasiform orifice. *Venter.* Antennae usually terminate at the T_1 position. Legs armed with spines on inner portion of leg or such spines absent. Thoracic tracheal folds usually present and unmarked. *Pores.* Submarginal disc pores and porettes present while distribution and location varies and may be associated with papillae. *Chaetotaxy.* Cephalic, A_8 (not anterior to anterior margin of vasiform orifice), and caudal pairs of submedian setae present; A_1 setae present or absent.

Comments. Physical characteristics of the host plant leaves sometimes cause a high degree of variation in the shape and pattern of the papillae, and cuticle sculpturing of species in this genus. Of the 67 described species in *Trialeurodes*, five species are known to occur in Nevada along with one newly described species and one unidentified species. Two species are dark, three are pale to yellow in color and one has both the light and dark form.

Key to the species of *Trialeurodes* found of Nevada (based on puparium)

1. Marginal crenulations narrow, 20 or more per 100µm; puparium light in color 2
 — Marginal crenulations wide, less than 20 per 100µm; puparium light to dark in color 4
- 2(1). Peg-like tooth at the posterior border of the vasiform orifice absent; each leg with a robust spine, the spine on T₂ leg slightly large *T. packardi* (Morrill)
 — Peg-like tooth present or slight; T₂ spine absent 3
- 3(2). Puparium shape ovoid with posterior end narrowed; papillae conical and tips acute; posterior part of the vasiform orifice with a slight peg-like, median tooth or such tooth absent; A8 and caudal setae long with base strongly tuberculate *T. eriodictyonis* Russell
 — Puparium shape elliptical and posterior end broad; papillae broadly conical and tips blunt; posterior part of the vasiform orifice with a strong peg-like, median tooth; A8 and caudal setae long or short but without tuberculate base *T. abutiloneus* (Haldeman)
- 4(1). Puparium dark brown to black in color 5
 — Puparium light in color 7
- 5(4). Submarginal papillae aligned closely together or in 2 to 3 irregular rows 6
 — Submarginal papillae in a single row and spaced well apart, not touching
 *T. sp. #2 near notata* Russell
- 6(5). Submarginal papillae aligned closely together; 3 pairs of median reniform papillae clusters (Figure 12) *T. corollis* (Penny)
 — Submarginal papillae in 2-3 irregular rows (Figure 14), clusters absent . *T. glacialis* (Bemis)
- 7(4). Submarginal row of well-separated papillae less than 100; submedian papillae few in numbers or absent; median abdominal row of papillae absent *T. vaporariorum* (Westwood)
 — Submarginal single row of papillae adjacent or in 2-3 irregular rows; submedian papillae numerous; median abdominal row of papillae absent or present 8
- 8(7). Submarginal single row of papillae adjacent, oriented toward the margin with more than 100 papillae; submedian papillae present and numerous; median abdominal row of tubercles present *T. pseudoblongifoliae* Dooley sp. nov.
 — Submarginal papillae in 2-3 irregular rows, clusters absent; submedian papillae of irregular shape present and numerous in groups; median abdominal row of papillae absent
 *T. glacialis* (Bemis)

***Trialeurodes abutiloneus* (Haldeman) 1850**

Diagnosis. Puparium: *Habitus.* Colorless to pale yellow and sometimes with a median brown strip. Mounted specimens from 600-900µm long and 450-600µm wide. *Slide mounted specimen-Lateral margin.* With narrow crenulations, 20 or more per 100µm. Submarginal row of papillae in a single irregular row or a regular close-set row numbering 44-112. *Vasiform orifice.* Orifice elongate-cordate with a tooth arising from the posterior margin. Operculum covers up to 75 percent with the lobed tip of the lingual

Trialeurodes glacialis Bemis
 Red Rock Canyon NCA, NV
 Sandstone Quarry
Quercus sp.

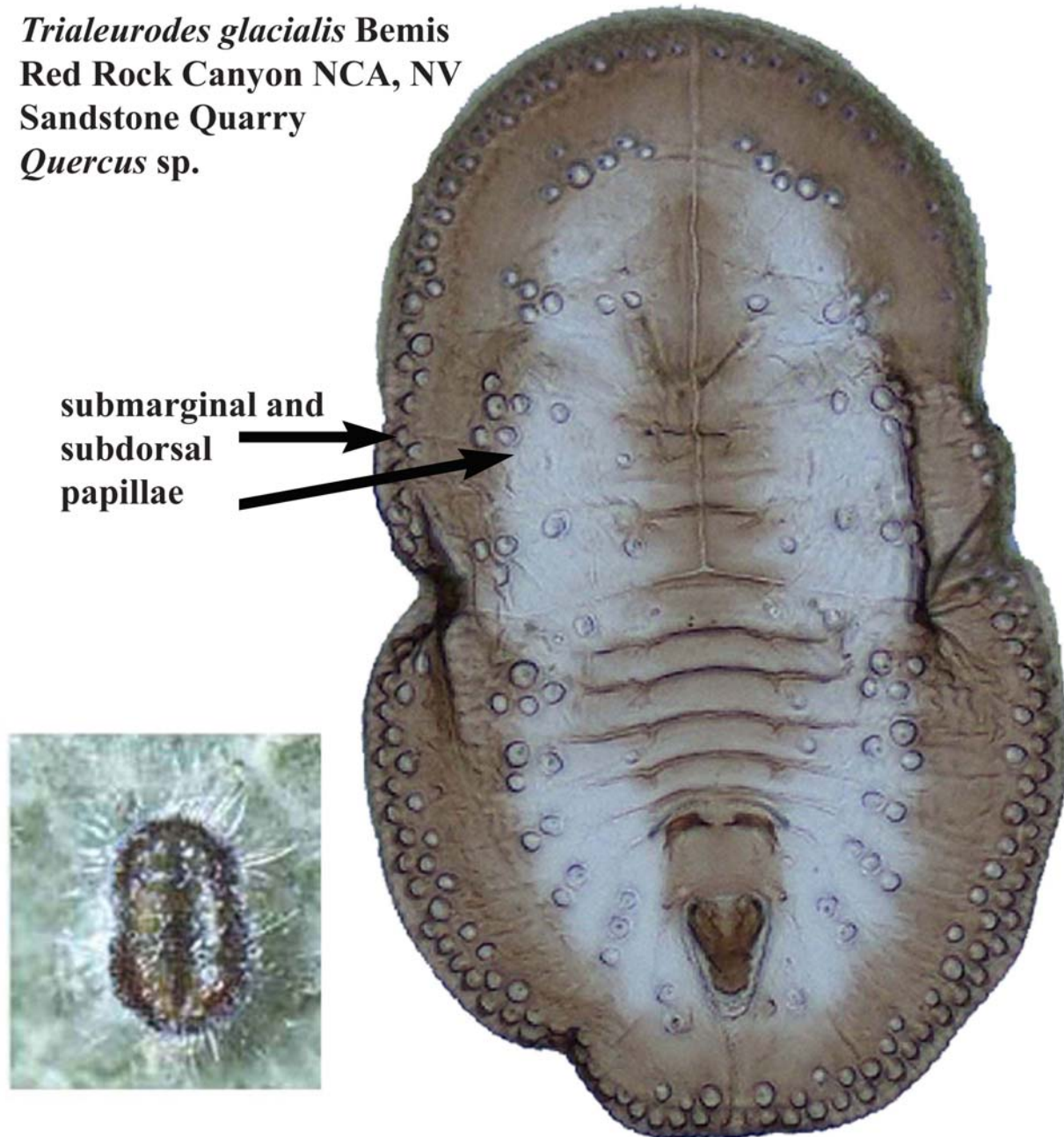


Figure 14. *Trialeurodes glacialis* (Bemis).

exposed. *Venter*. Microsetae present on each leg but lack spines. See Russell (1948: 71-75) for complete species description.

Nevada distribution. Overton and Red Rock Canyon NCA (Clark County); Pahrump (Nye County).

Nevada hosts. Fabaceae: *Medicago sativa*; Malvaceae: *Gossypium hirsutum*; Fagaceae: *Quercus* sp.

Nevada materials studied (2 puparia). Red Rock Canyon NCA, Nevada: Lost Creek Canyon at 36°09.397N by 115°29.739W on *Quercus* sp. 05-vii-2009.

Comments. Confirmed by molecular identification at the ARS facility in Fort Pierce, FL.

Reference. Russell 1948.

***Trialeurodes corollis* (Penny) 1922**

Diagnosis. Puparium (Figure 12): *Habitus*. Dark brown, oval in shape. *Slide mounted specimen – Lateral margin*. Smooth or crenulate, not dentate; marginal crenulations large with less than 20 crenulations per 100 μ m; tracheal combs slightly differentiated from rest of margin. *Dorsum*. Transverse molting suture reaches submarginal papillae; with irregular submarginal row and 3 pairs of submedian papillae clusters. See Russell (1948: 36-38) for complete description.

Nevada distribution. Red Rock Canyon NCA: Sandstone Quarry.

Nevada hosts. Ericaceae: *Arctostaphylos* sp.

Nevada materials studied (2 puparia) Red Rock Canyon NCA, Nevada. Sandstone Quarry at 36°9.781N by 115°26.011W (elev.4294') on *Arctostaphylos* sp., collected on 28-iii-2008 by John Dooley.

Comments. New Nevada record. It can be separated from other *Trialeurodes* puparia by the three pairs of papillae clusters on the submedian area.

References. Penny 1922, Russell 1948.

***Trialeurodes eriodictyonis* Russell 1948**

Diagnosis. Puparium (Figure 13): *Habitus*. Puparium minute, bright yellow from ovoid to elongate posteriorly; from 770-750 μ m in length and 500-550 μ m in width. *Slide mounted specimen – Lateral margin*. With narrow crenulations, 20 or more per 100 μ m. *Dorsum*. Transverse molting suture extends to the margin and slightly anterior to the position of its midpoint with the longitudinal suture. Submarginal papillae numbering 64-74 and arranged in an irregular single line; papillae apically pointed and oriented towards the margin; papillae separated normally by a distance apart the width of a papillae. *Venter*. Legs unarmed (lacking spine). *Vasiform orifice*. Elongate cordate with a slight inverted tooth at posterior end; operculum covering all but the lateral lobes of the lingula. *Pores*. Marginal discoidal pore associated with each papilla for the most part. Submedian disc pores usually with 1 pair per segment except for A₂ and A₈ segments each having from 2 to 6 pores. *Chaetotaxy*. Cephalic, A₁ and A₈ setal pairs present; C¹ and A₁ setal pairs unusually large in one specimen and short in second specimen. See Russell (1948: 76-77) for complete description.

Nevada distribution. Red Rock Canyon NCA: Along scenic route roadside between Calico Hills Trailhead and Sandstone Quarry; Willow Springs.

Nevada hosts. Hydrophyllaceae: *Eriodictyon crassifolium*; Solanaceae: *Datura* sp. (in Clark County, Nevada 2009).

Nevada materials studied (2 of 3 puparia deposited in the USNM at Beltsville, MD): Red Rock Canyon NCA, Nevada along scenic route roadside between Calico Hills Trailhead and Sandstone Quarry: 36°08.763N and 115°25.844W; and at Willow Springs: 36°07.735N and 115°28.413W.

Comments. This is a new distribution record of this species occurring in Nevada and a new host record for its occurrence on *Datura*. The length of C₁ and A₁ setal pairs are variable in this species. The puparia are easily overlooked usually found on the underside of the leaf.

References. Penny 1922, Russell 1948.

***Trialeurodes glacialis* (Bemis) 1904**

Diagnosis. Puparium (Figure 14): *Habitus*. From 800-850µm in length and 500-550µm in width. *Slide mounted specimen-Lateral margin*. Thoracic pore and furrow usually undifferentiated; thoracic tracheal margin somewhat differentiated by a slight indentation of 2-3 crenulations. *Dorsum*. Submargin with total number of 115-175 cone-shaped papillae arranged in an irregular single to triple row; papillae apically pointed and oriented towards the margin. *Venter*. Legs unarmed (lacking spine). *Pores*. Marginal discoidal pores proximal to the outer papillae for the most part while lateral to the inner submarginal papillae. See Russell (1948: 51-52) for complete description.

Nevada distribution. Red Rock Canyon NCA: Sandstone Quarry.

Nevada hosts. Ericaceae: *Arctostaphylos* sp.; Fagaceae: *Quercus* sp.

Nevada materials studied (1 puparium). Red Rock Canyon NCA, Nevada (Sandstone Quarry at 36°09.781N by 115°26.011W) on *Arctostaphylos* sp., 28-iii-2008.

Comments. This is a new distribution record of this species occurring in Nevada and a new host record for its occurrence on *Arctostaphylos*.

References. Bemis 1904, Quaintance and Baker 1914, Russell 1948.

***Trialeurodes packardi* (Morrill) 1903**

Diagnosis. Puparium: *Habitus*. Colorless or pale yellow, oval-shaped. *Slide mounted specimen -Lateral margin* Smooth or crenulate, not dentate; narrow crenulations (20 to 22 or more per 100µm); tracheal combs slightly differentiated from the rest of lateral margin. *Dorsum*. Transverse molting suture reaching the margin; submarginal papillae as long as broad, submedian and median row absent; median area of A₈ suture does not extend past the A₇ suture giving the appearance of 8 abdominal segments. *Venter*. Each leg with spine; leg 2 with spine larger than other legs. *Pores*. Submarginal row of dorsal disc pores present. *Chaetotaxy*. C₁, A₁ and A₈ setal pairs present. See Russell (1948: 59-63) for complete description.

Nevada distribution. No data.

Nevada hosts. No Data.

Comments. This record was provided by the Jeff Knight, the Nevada State Entomologist.

Reference. Russell 1948.

***Trialeurodes pseudoblongifoliae* Dooley sp. nov.**

Diagnosis. Puparium (Figure 15): *Habitus*. Oval to elongate with pupal case length and width vary from 838-1116µm in length and 584-741µm in width; bright yellow with a dorsal a Y-shape pattern. Dense dorsal transparent wax secretions are present causing significant problems when removing the wax during the mounting process. Found solitary usually on the upper leaf surface near margin. *Slide mounted specimen -Lateral margin* crenulate with 10 irregular crenulations per 100µm. *Dorsum*. Longitudinal and transverse sutures terminate at the submarginal papillae. Dorsal disk with abdominal segments slightly differentiated only from the median to the subdorsum and less defined in the cephalothorax. A₆ segment more than twice the width of A₇ medially. Submedian abdominal depressions faint. Submargin with total number of 102-105 cone-shaped papillae (Figure 15) in a continuous row, each being 19-26µm in length, oriented toward but not reaching the margin. A₁ through A₆ with poorly defined median abdominal

Trialeurodes pseudoblongifoliae Dooley sp. nov.
Red Rock Canyon NCA, NV
Quercus sp.

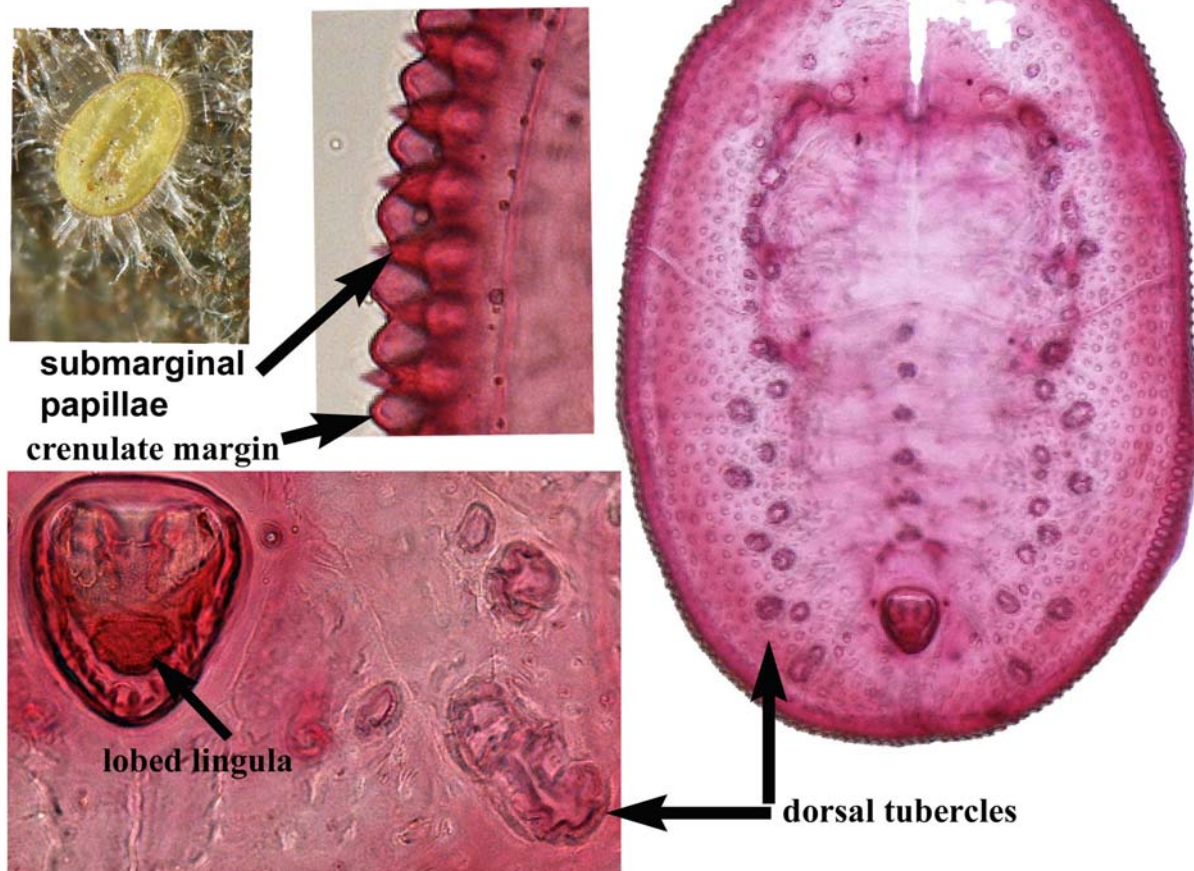


Figure 15. *Trialeurodes pseudoblongifoliae* Dooley sp. nov.

tubercles subequal in size ranging from 24-39 μ m in diameter. Subdorsum with irregular row of tubercles of various sizes: on the cephalothorax consisting of one row and from A_1 to A_8 in two irregular rows. *Vasiform orifice*. Orifice is cordate in shape 166.23 μ m in length and 150.5 μ m in width; operculum shield-like covering almost the entire lingula exposing only the tip. *Venter*. Legs unarmed with microsetae but lacking spines. Antennae terminate at the T_1 pair of legs. *Pores*. Each marginal papilla with a central, basal disc pore, some with two; also present at base between submarginal papillae. *Chaetotaxy*. Submedian setal pair present are on the cephalon each 23-26 μ m in length (Figure 15), A_1 setae each 17.7 μ m in length, A_8 setae 15-19 μ m in length, and caudal setae each 10-13.4 μ m in length.

Nevada distribution. Red Rock Canyon: Sandstone Quarry.

Nevada hosts. Fagaceae: *Quercus* sp.

Nevada material studied. Holotype (one puparium, slide-mounted) Red Rock Canyon NCA: at Sandstone Quarry, on *Quercus* sp., 03-vii-2006, deposited in the USNM in Beltsville, MD.

Paratypes (19 puparia) collected at Red Rock Canyon NCA in Sandstone Quarry on *Quercus* sp. as follows: ix-2004, with 1 puparium (GPS location unknown) deposited at USNM; 24-vii-2006, with 2 puparia deposited at CDFA, 2 at NDOA, and 2 at USNM; 24-viii-2006, 2 puparia deposited at PPQC, 2 at SJSU and 2 at USNM (36°09.829N by 115°27.049W); 23-viii-2007, with 1 puparium (36°09.790N by

115°27.008W) deposited at PPQC and 24-viii-2007 with 1 puparium (36°09.829N by 115°27.049W) deposited at PPQC; 27-iii-2008 with 2 puparia (36°09.715N by 115°27.998W) deposited at PPQC; and 06-vii-2009 2 puparia each (36°09.403N by 115°29.593W) deposited at PPQC with specimens to ARS, Ft. Pierce Florida for DNA analysis.

Etymology. From the Greek *pseudo* meaning false and morphologically closest to *T. oblongifolia* Russell.

Comments. This species is most similar to *Trialeurodes oblongifolia* Russell, not known to occur in Nevada, but differs by the presence of a median row of dorsal papillae from A₁ thru A₆ and the total number of marginal papillae from 204 to 212. In *T. oblongifolia*, the median tubercles are absent and the marginal papillae number from 282-368 (Russell 1947).

Trialeurodes vaporariorum (Westwood) 1856

Diagnosis. Puparium: Habitus. Normally oval shaped, pale to yellow in color. Fresh specimens relatively thick with waxy patches dorsally and marginally. *Slide mounted specimen-Lateral margin.* Crenulations large (from 9-12 per 100µm) and subequal in width. Submargin with variously shaped papillae (bullet, cylindrical, conical apically rounded or acute), numbering 64 to 140, well to poorly developed and from small to large usually oriented to the margin; if well developed, then well-separated to closely appressed; marginal clefts slightly modified at the openings or not at all. *Dorsum.* Papillae present or absent on the subdorsal and submedian areas. Longitudinal suture present from the margin to the transverse suture that terminates before or at the submargin. Eight abdominal segments apparent in median region of abdomen with the median length of A₇ reduced to no more than one-third the length of A₆. *Vasiform orifice.* The cordate-shaped vasiform orifice contains the lingula, usually with three paired lobes and one apical lobe; operculum cordate-shaped covering half the vasiform orifice. *Venter.* Antennae terminate at the T₁ pair of legs; legs with setae present but lacking spines on inner portion. Thoracic tracheal clefts and folds absent. *Pores.* Submarginal disc pores and porettes present, distribution and location variable; pores may be associated with papillae. *Chaetotaxy.* Cephalic and abdominal segments with or without a pair of setae; A₈ and caudal pair of setae present. See Russell (1948: 43-49) for complete description.

Nevada hosts. Asteraceae: *Calendula officinalis*; Onagraceae: *Fuchsia hybrida*; Solanaceae: *Solanum melongena*.

Comments. The records of this species in Nevada are based on specimens collected prior to our study. Morphological characters of this species are highly variable especially differing in specimens collected on plants with hairy versus glabrous leaves. Not collected since 1976 in Elko County, Nevada.

Reference. Russell 1948.

Trialeurodes sp. #2 near *notata* Russell

Diagnosis. Field characteristics unknown, except puparia very dark and closely resembles *T. notata* Russell. This species differs from *T. notata* by notably by a dark brown puparium. The specimen is in poor condition with submedian to median diagnostic characters missing in the abdominal and cephalothoracic region.

Nevada material studied. Two puparia collected (one slide poor) on *Ribes* sp. at Mahogany Grove in the temperate biogeographical area of Mount Charleston at 36°18.722N by 115°37.098W.

Host. Grossulariaceae: *Ribes* sp.

Comments. More specimens need to be collected and examined before determining if this is a new species.

Discussion

Only one female adult of *Bemisia tabaci* biotype B and two puparia of *Trialeurodes abutiloneus* were successfully identified by molecular sequencing. Neither was available for morphological identification. All other identifications were done using traditional taxonomy of the puparia. Of all the pupae that were analyzed with molecular techniques, *Aleuroplatus gelatinosus* and *Trialeurodes quercophyllae* were the most difficult because of heavily concentrated wax deposits. In their cases specific primers were not available and the analysis did not work.

Of all the whiteflies collected only *Aleuroglandulus subtilis* and *Tetraleurodes mori* were found exclusively in temperate regions at higher elevations of Mount Charleston and not within the desert ecosystem. No whiteflies were found within the riparian plant communities within Red Canyon NCA. Several of the whitefly species reported to occur in Nevada was not collected in our study. Because a small geographical area was surveyed, a larger survey should be completed to determine if other species are also established with their geographic and host range. Moreover, the genus *Aleuropleurocelus* needs to be revised utilizing morphological and molecular techniques.

What impact will the whiteflies have on the plant communities and desert ecosystems of Nevada? Onions, potatoes, wheat, greenhouse and nursery products are important local agricultural resources that may be impacted by whiteflies. Whiteflies affect plants and trees that serve as nutrients for the desert animals. They also interact with their host plants that may also be allelopathic, such as manzanita, which inhibit the growth of other plants species. Manzanita is a fire-resistant shrub often used as erosion control and its foliage and berries are used as a food source for some desert wildlife such as wild turkeys and other birds. The oaks also provide food for deer and other desert animals.

Another concern is that two of the species known to vector various Gemini virus diseases, *Bemisia tabaci* and *Trialeurodes vaporariorum*, are known to occur in Nevada. According to the Global Invasive Species Database maintained by the Invasive Species Specialist Group (<http://www.issg.org/>), *Bemisia tabaci* has a host record exceeding 900 plants and reportedly transmits more than 111 plant virus (Brown 2000) species. These may cause considerable economic damage should these two pests become infected especially *Bemisia tabaci* biotype Q known to be highly resistant to pesticides (Hodges 2006) and vector the diseases to their local hosts in Nevada.

Acknowledgments

We are grateful to Greg Evans, United States Department of Agriculture-Animal and Plant Health Inspection Service-Plant Protection and Quarantine (USDA-APHIS-PPQ, Beltsville, MD) for validating new host state records; to Jeff Knight, Nevada State Entomologist for the Nevada Department of Agriculture (NDOA, Reno, Nevada) for collecting samples and identifying host plants; to Cindy McKenzie United States Department of Agriculture-Agricultural Research Service (USDA-ARS, Fort Pierce, Florida) for conducting the molecular analysis; to Arthur Berlowitz (USDA-APHIS-PPQ) for supporting the author to complete this research; to Jessica Newhouse (USDA-APHIS-PPQ) for experimenting with mounting techniques producing excellent mounted reference specimens; to Tim Torbett (USDA-APHIS-PPQ, CITES specialist) for his assistance in identifying plants found in the Mojave desert; to Katherine Kleinick, United States Department of the Interior-Bureau of Land Management (USDOI-BLM, Las Vegas, Nevada) for approving the collecting permit and providing access; and, to Dan Gerling (Tel Aviv University) and Ray Gill (retired), California Department of Food and Agriculture (CDFA) for allowing the use of the pupal illustration.

We are also grateful to Ray Gill (retired, CDF), Greg Evans (USDA-APHIS-PPQ), and Greg Hodges, Division of Plant Industry, Florida Department of Agriculture and Customer Services, Gainesville, Florida (DPI-FDACS), for reviewing this publication.

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Received May 4, 2010; Accepted September 2, 2010.

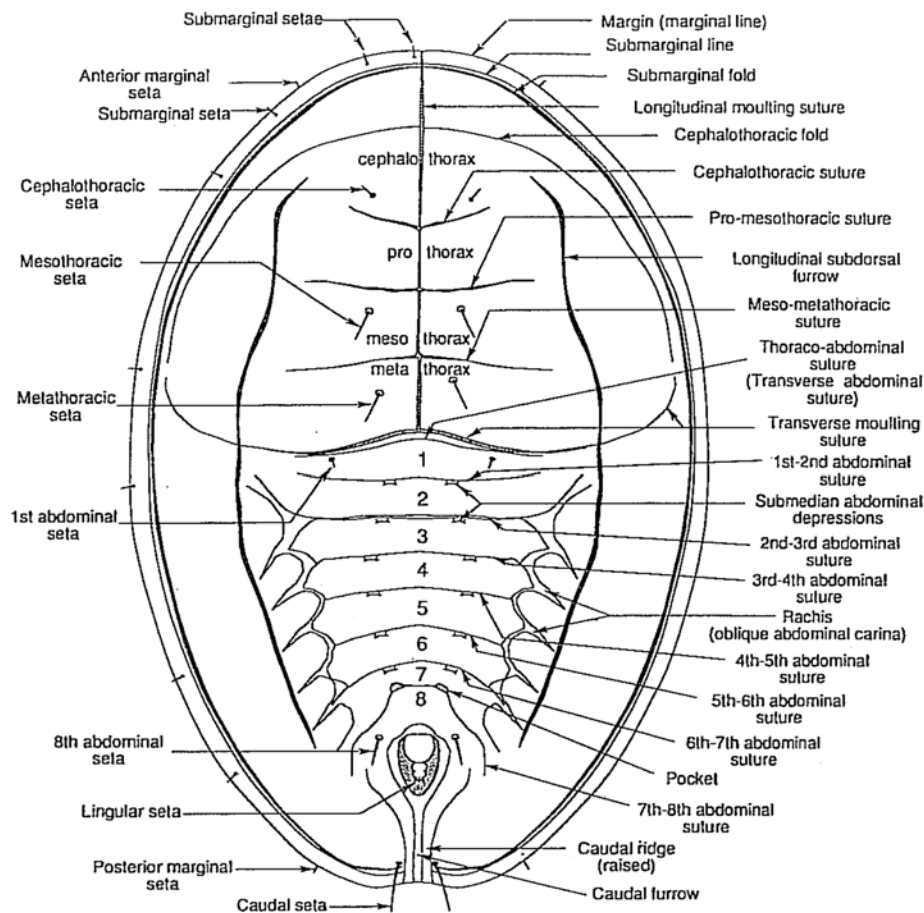


Figure 16. Structures of the puparium

Appendix A. Glossary of puparium structures.

Abdominal segments. 7-8 visible segments below the third pair of legs and the transverse molting suture.

Caudal cleft. Differentiated marginal areas at the posterior apex of the pupal case below the vasiform orifice that may be smooth, dentate, comb or plate-like.

Caudal furrow. A crease or fold (smooth to patterned), that usually extends from or in continuation of vasiform orifice and may terminate at the caudal margin of the pupal case.

Caudal ridge. Ridge-like structure that borders laterally the caudal furrow and may extend from the vasiform orifice to the caudal cleft.

Cephalon and cranial suture. Cephalon refers to the area from the anterior margin of the body to the first pair of legs. Cranial suture refers to a crease or fold (may be faint) extending from the longitudinal suture above the antennae and the first pair of legs.

Cephalothorax. Composed of the cephalon and the thorax represented by the prothorax, mesothorax, and metathorax marked dorsally by molting sutures and ventrally by legs.

Lateral margin. Outermost puparial region that is toothed (dentate), crenulate (plate-like) or smooth. In species that have the lateral margin reflexed or deflexed, the true margin is folded, dorsally or ventrally, appearing to be in the submedian area of the body, and the submargin appears to be the false lateral margin.

Legs. Normally 2-segmented structures, rarely 1-segmented in some African species; oriented down or toward the median axis; tarsus terminating into a pad-like structure (Aleyrodinae) or a claw (Aleurodicinae).

Lingula. Various-shaped dorsal organ in the vasiform orifice, used to remove fecal material, inserted (within the vasiform orifice) or exerted (extending beyond the vasiform orifice), and partially or completely covered by the operculum.

Median and submedian areas. Median refers to the area along the center axis for the puparium; submedian refers to the area adjacent to the median areas.

Molting sutures. Dorsal median suture extends from the anterior apex of the margin to the transverse molting suture. Transverse molting suture is a dorsal, transverse, curved line separating the thorax from the abdomen terminating at or well before the margin.

Operculum. Plate-like structure that partially or completely covers the vasiform orifice.

Papillae. Bullet, rod or reniform shaped structures often found in the submarginal rows dorsally from the cephalon to the cauda.

Subdorsal and submarginal areas. Subdorsal area falls between the submedian and the submarginal area; the submarginal area falls between the subdorsal area and the margin.

Terminal leg appendage. See legs. An appendage at the apex of the tarsus either pad-like (Aleyrodinae) or a claw (Aleurodicinae); absent in a few genera.

Tracheal clefts. Differentiated marginal areas opposite the spiracles that may be smooth, dentate, comb or plate-like.

Tracheal furrow. A crease or fold, smooth to patterned, usually between the tracheal cleft at the margin extending as far as and opposite the spiracle.

Tubercles. Raised, rounded, or amorphous structures found in submarginal rows or scattered over the dorsum.

Vasiform orifice. Various shaped structure (cordate, subcordate, rectangular, quadrate or triangular) located medially on A_8 containing the lingula and partially or entirely covered by an operculum

Table 1. Intercepted whitefly species in Nevada from 1959 to 1991.

Whitefly	Host	Locality	Date
<i>Aleuroglandulus subtilis</i>	<i>Berberis repens</i>	Kyle Canyon	5/6/1977
<i>Aleuroglandulus subtilis</i>	<i>Berberis repens</i>	Spring Mountains	5/6/1977
<i>Aleuroplatus berbericolus</i>	<i>Mahonia aquifolium</i>	Fallon	10/21/1960
<i>Aleuroplatus berbericolus</i>	<i>Mahonia aquifolium</i>	Reno	10/21/1960
<i>Aleuroplatus berbericolus</i>	<i>Berberis aquifolium</i>	Minden	10/28/1975
<i>Aleuroplatus berbericolus</i>	<i>Berberis repens</i>	Kyle Canyon	5/6/1977
<i>Aleuroplatus berbericolus</i>	<i>Berberis repens</i>	Spring Mountains	5/6/1977
<i>Aleyrodes spiraeoides</i>	<i>Solanum tuberosum</i>	Panaca	8/30/1961
<i>Bemisia tabaci</i>	<i>Euphorbia</i> sp.	Las Vegas	2/14/1991
<i>Dialeurodes citri</i>	<i>Fortunella</i> sp.	Las Vegas	3/16/1959
<i>Siphoninus phillyreae</i>	<i>Punica granatum</i>	Las Vegas	9/18/1990
<i>Siphoninus phillyreae</i>	<i>Fraxinus velutina</i>	Las Vegas	9/27/1990
<i>Siphoninus phillyreae</i>	<i>Fraxinus velutina</i>	Calico Basin	10/21/1990
<i>Siphoninus phillyreae</i>	<i>Fraxinus anomala</i>	Calico Basin	10/21/1990
<i>Siphoninus phillyreae</i>	<i>Pyrus communis</i>	Pahrump	11/15/1990
<i>Siphoninus phillyreae</i>	<i>Fraxinus</i> sp.	Reno	8/21/1991
<i>Tetraleurodes mori</i>	<i>Morus</i> sp.	Las Vegas	9/21/1964
<i>Tetraleurodes mori</i>	<i>Berberis repens</i>	Virgin Mountains	5/3/1977
<i>Trialeurodes abutiloneus</i>	<i>Gossypium hirsutum</i>	Pahrump	7/19/1960
<i>Trialeurodes abutiloneus</i>	<i>Medicago sativum</i>	Overton	8/4/1961
<i>Trialeurodes packardi</i>	no data	no data	no data
<i>Trialeurodes vaporariorum</i>	<i>Calendula officinalis</i>	Reno	9/30/1974
<i>Trialeurodes vaporariorum</i>	<i>Fuchsia hybrida</i>	Reno	2/23/1973
<i>Trialeurodes vaporariorum</i>	<i>Solanum melongena</i>	Reno	10/02/1974
<i>Trialeurodes vaporariorum</i>	no data	Elko	11/03/1976

Table 2. Data of species collected in southern Nevada from 2003 to 2009 (* denotes new state record).

Whitefly	Host	Location
<i>Aleuroglandulus subtilis</i> Bondar	<i>Berberis repens</i>	Spring Mountain
<i>Aleuroparadoxus arctostaphyli</i> Russell*	<i>Ceanothus</i> sp.	Sandstone Quarry
<i>Aleuroplatus gelatinosus</i> (Cockerell)*	<i>Eriodictyon</i> sp.	Sandstone Quarry
<i>Aleuroplatus gelatinosus</i> (Cockerell)*	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Aleuroplatus gelatinosus</i> (Cockerell)*	<i>Quercus</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Arctostaphylos</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Ceanothus?</i>	Boy Scout Area
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Eriodictyon</i> sp.	Lee Canyon
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Eriodictyon</i> sp.	Pine Creek Canyon
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Eriodictyon</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Larrea</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Aleuropleurocelus ceanothi</i> (Sampson)*	<i>Eriodictyon</i> sp.	Willow Springs
<i>Aleuropleurocelus nigrans</i> (Bemis)*	<i>Arctostaphylos</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus nigrans</i> (Bemis)*	<i>Ceanothus</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus nigrans</i> (Bemis)*	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	<i>Arctostaphylos</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	<i>Eriodictyon</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	<i>Larrea</i> sp.	Blue Diamond
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	<i>Quercus</i> sp.	Sandstone Quarry
<i>Aleuropleurocelus</i> sp. #2 near <i>A. nevadensis</i> Dooley	<i>Quercus</i> sp.	Sandstone Quarry
<i>Bemisia tabaci</i> (Gennadius) biotype B	<i>Datura wrightii</i>	Lost Creek Canyon
<i>Tetraleurodes mori</i> (Quaintance)	<i>Penstemon</i> sp.	Lee Canyon
<i>Tetraleurodes quercicola</i> Nakahara*	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Tetraleurodes quercophyllae</i> Dooley sp. nov.	<i>Quercus</i> sp.	Pine Creek Canyon
<i>Tetraleurodes quercophyllae</i> Dooley sp. nov.	<i>Quercus</i> sp.	Sandstone Quarry
<i>Trialeurodes abutiloneus</i> (Haldeman)	<i>Quercus</i> sp.	Lost Creek Canyon
<i>Trialeurodes corollis</i> (Penny)*	<i>Arctostaphylos</i> sp.	Sandstone Quarry
<i>Trialeurodes eriodictyonis</i> Russell*	<i>Datura wrightii</i>	Willow Springs
<i>Trialeurodes eriodictyonis</i> Russell*	<i>Datura wrightii</i>	Scenic Loop-roadside
<i>Trialeurodes glacialis</i> (Bemis)*	<i>Quercus</i> sp.	Sandstone Quarry
<i>Trialeurodes pseudoblongifoliae</i> Dooley sp. nov.	<i>Quercus</i> sp.	Sandstone Quarry
<i>Trialeurodes</i> sp. #2 near <i>T. notata</i> Russell	<i>Ribes</i> sp.	Mahogany Grove

Table 3. GPS data of species collected in southern Nevada.

Whitefly	GPS north	GPS west
<i>Aleuroglandulus subtilis</i> Bondar	36°00.707N	115°25.777W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°09.816N	115°27.027W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°07.577N	115°28.474W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°08.802N	115°27.013W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°08.879N	115°29.187W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°09.787N	115°27.012W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°09.829N	115°27.049W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°09.715N	115°26.998W
<i>Aleuroplatus gelatinosus</i> (Cockerell)	36°09.781N	115°26.011W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	35°59.245N	115°31.637W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	35°58.528N	115°22.307W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°07.514N	115°28.738W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.400N	115°27.748W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.438N	115°27.649W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.748N	115°27.010W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.816N	115°27.027W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.781N	115°26.011W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°09.715N	115°26.998W
<i>Aleuropleurocelus ceanothi</i> (Sampson)	36°07.514N	115°28.738W
<i>Aleuropleurocelus nigrans</i> (Bemis)	36°09.718N	115°26.011W
<i>Aleuropleurocelus nigrans</i> (Bemis)	36°09.781N	115°26.011W
<i>Aleuropleurocelus nigrans</i> (Bemis)	36°07.514N	115°28.738W
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	36°07.462N	115°28.853W
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	36°09.781N	115°26.011W
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	36°09.715N	115°26.998W
<i>Aleuropleurocelus nevadensis</i> Dooley sp. nov.	36°09.790N	115°27.049W
<i>Aleuropleurocelus</i> sp. #2 near <i>A. nevadensis</i> Dooley	36°09.829N	115°27.049W
<i>Aleuropleurocelus</i> sp. #2 near <i>A. nevadensis</i> Dooley	36°09.781N	115°27.011W
<i>Bemisia tabaci</i> (Gennadius) biotype B	36°08.763N	115°25.844W
<i>Tetraleurodes mori</i> (Quaintance)	35°58.524N	115°22.308W
<i>Tetraleurodes quercicola</i> Nakahara	36°07.577N	115°28.474W
<i>Tetraleurodes quercophyllae</i> Dooley sp. nov.	36°09.829N	115°27.049W
<i>Trialeurodes abutiloneus</i> (Haldeman)	36°09.397N	115°29.739W
<i>Trialeurodes corollis</i> (Penny)	36°09.781N	115°26.011W
<i>Trialeurodes eriodictyonis</i> Russell	36°08.763N	115°25.844W
<i>Trialeurodes eriodictyonis</i> Russell	36°07.735N	115°28.413W
<i>Trialeurodes glacialis</i> (Bemis)	36°09.781N	115°26.011W
<i>Trialeurodes pseudoblongifoliae</i> Dooley sp. nov.	36°09.790N	115°27.008W
<i>Trialeurodes pseudoblongifoliae</i> Dooley sp. nov.	36°09.403N	115°29.593W
<i>Trialeurodes pseudoblongifoliae</i> Dooley sp. nov.	36°09.715N	115°26.998W
<i>Trialeurodes pseudoblongifoliae</i> Dooley sp. nov.	36°09.829N	115°29.049W
<i>Trialeurodes</i> sp. #2 near <i>T. notata</i> Russell	36°18.722N	115°37.098W

Table 4. Common and scientific names of plants including hosts of Nevada whiteflies.

Common Names	Genus and species	Plant family
ash	<i>Fraxinus</i> spp.	Oleaceae
bearded tongue	<i>Penstemon</i> sp.	Plantaginaceae
big galleta grass	<i>Pleuraphis rigida</i> Thurber	Poaceae
black brush	<i>Acacia rigidula</i> Bentham	Fabaceae
black cottonwood	<i>Populus balsamifera</i> Linnaeus	Salicaceae
bursage	<i>Ambrosia</i> spp.	Asteraceae
catclaw	<i>Acacia greggi</i> A. Grey	Fabaceae
ceanothus	<i>Ceanothus</i> spp.	Rhamnaceae
cheesebush	<i>Ambrosia salsola</i> (Torrey and A. Gray)	Asteraceae
cholla cactus	<i>Opuntia</i> spp.	Cactaceae
cotton	<i>Gossypium hirsutum</i> Linnaeus	Malvaceae
creeping barberry	<i>Berberis repens</i> Lindley	Berberidaceae
creosote bush	<i>Larrea tridentata</i> (DeCandolle) Coville	Zygophyllaceae
currants	<i>Ribes</i> spp.	Grossulariaceae
datura	<i>Datura wrightii</i> Regel	Solanaceae
desert almond	<i>Prunus fasciculata</i> (Torrey and A. Gray)	Rosaceae
desert willow	<i>Chilopsis linearis</i> (Cavanilles) Sweet	Bignoniaceae
euphorbia	<i>Euphorbia</i> sp.	Euphorbiaceae
fuchsia	<i>Fuchsia hybrida</i> hort. ex Siebold and Voss	Onagraceae
holly	<i>Ilex</i> sp.	Aquifoliaceae
holly barberry	<i>Berberis aquifolium</i> Pursh	Berberidaceae
joshua tree	<i>Yucca brevifolia</i> Engelman	Asparagaceae
juniper	<i>Juniperus</i> sp.	Cupressaceae
kumquat	<i>Fortunella</i> sp.	Rutaceae
manzanita	<i>Arctostaphylos</i> sp.	Ericaceae
Mohave yucca	<i>Yucca schidigera</i> Roezl ex Ortgies	Asparagaceae
mormon tea	<i>Ephedra</i> spp.	Ephedraceae
mulberry	<i>Morus</i> sp.	Moraceae
oak	<i>Quercus</i> spp.	Fagaceae
Oregon-grape	<i>Berberis aquifolium</i> Pursh	Berberidaceae
pinyon pine	<i>Pinus monophylla</i> Torrey and Fremont	Pinaceae
pomegranate	<i>Punica granatum</i>	Lythraceae
ponderosa pine	<i>Pinus ponderosa</i> P. and C. Lawson	Pinaceae
prickly pear	<i>Opuntia</i> spp.	Cactaceae
sagebrush	<i>Artemisia tridentata</i> Nuttall	Asteraceae
serviceberry	<i>Amelanchier</i> sp.	Rosaceae
snowberry	<i>Symphoricarpos albus</i> (Linnaeus) S. F. Blake	Caprifoliaceae
Spanish bayonet	<i>Yucca</i> spp.	Asparagaceae
willow	<i>Salix</i> spp.	Salicaceae
yerba santa	<i>Eriodictyon</i> spp.	Boraginaceae