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## Taxonomic Studies of the Genus *Tetraleurodes* (Homoptera: Aleyrodidae)

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**Abstract:** Ten new species of *Tetraleurodes* (*bireflexa*, *caulicola*, *chivela*, *confusa*, *dorsirugosa*, *mexicana*, *perseeae*, *pseudacaciae*, *quercicola*, *tuberculosa*) are described and four previously known species are redescribed. The *acaciae* group consisting of seven species is proposed, and a key to the *acaciae* group and 12 North American species is provided. In addition, *herberti* Penny is synonymized with *acaciae* (Quaintance), *nudus* Sampson and Drews is synonymized with *fici* Quaintance and Baker, and *stanfordi* (Bemis) is synonymized with *perileuca* (Cockerell). *Aleurotrachelus cacaorum* Bondar is reassigned to *Tetraleurodes*, and *T. papilliferus* Sampson and Drews is reassigned to *Aleurotrachelus*.

Key Words: Aleyrodidae, *Tetraleurodes*, new species, synonyms, new combinations, key, whitefly, North America.

*Tetraleurodes* is one of the larger genera in the whitefly family Aleyrodidae. In a catalog of the world species, Mound and Halsey (1978) included 50 species in the genus of which 20 were listed for North America. Eleven species were described from the United States, seven from Mexico, and one each from Jamaica and Panama. Sampson and Drews (1941) treated 10 *Tetraleurodes* species, including four new species, in their review of the Mexican whiteflies. Since then, no new species has been described from North America and only a few, minor taxonomic works have been published. In this initial review of the New World species, the *acaciae* group consisting of six new and one nominal species is proposed. Descriptions of seven other North American species, of which four are new, and notes on three nominal North American species and one South American species are also presented to provide scientific names and taxonomic information for systematic and control studies now in progress. Although several species in this study are assignable to at least two other species groups, the definition of these groups are left to future work when studies of undescribed species are completed. A provisional key treats 19 species including the 14 described species and five North American species which were researched but not redescribed here. Of the 20 North American *Tetraleurodes* species in Mound and Halsey (1978), nine species are included in the key, three species are synonymized, one is reassigned to another genus, five are probably synonymous but require further study, and two species must be studied further.

The immatures of most species are found on the undersurfaces of leaves. *Tetraleurodes caulicola*

and *T. tuberculosa*, new species, are found on the stem, and *T. melanops* (Quaintance) and *T. perileuca* (Cockerell) are found on the upper surfaces of *Quercus* spp. leaves. Species are known only from one plant genus, a few plant families or are polyphagous such as *T. mori* (Quaintance). Most members of the *acaciae* group infest plants of the legume family Fabaceae. According to Hamon (1978), *Tetraleurodes acaciae* (Quaintance) damaged *Calliandra haematocephala* Hassk. in Florida. *Tetraleurodes perseeae*, new species, is a pest in avocado orchards in Uruapan, Mexico (Rose and Woolley 1984).

### Terminology

The terminology for most morphological structures will be found in Russell (1947) and Bink-Moenen (1983).

**Apparent margin** (Fig. 10B): The true margin of species with a reflected margin is beneath the body. The margin observed is the apparent margin, which is part of the submargin.

**Depressions** (Figs. 6B, 15E, 36F, 38E): Normally elongate, oval or subcircular small, scarlike areas located submedially on abdominal tergites I-VIII and in median, submedian and subdorsal areas of the cephalothorax. It is often lighter in color than surrounding derm, and its margins are smooth, irregular or bordered with small teeth.

**Gland tubercle** (Fig. 4B): Circular or oval raised tubercle with rather flat dorsum and with a median pore on the submargin of species in the *acaciae* group.

*Microtubercular band* (Figs. 4E, 12B): Microtubercles on submarginal transverse ridges form a band around body. Referred to as spinules in some publications.

*Pale glandular area* (Figs. 4D, 12C, 18E, 57A): Located proximal of the bases of marginal teeth on transverse ridges. Normally, it is oval, V- or U-shaped, but may have other shapes. In other publications, it is referred to as membranous area or pale spot.

*Transverse ridges and transverse furrows* (Figs. 4E, 12B, 60C, 61F, 61G): Raised transverse ridges between narrow furrows on the submargin extend to bases of marginal teeth or taper distally and do not reach margin. Furrows normally extend to margin between marginal teeth.

Most *dorsal structures* are indicated on figures 1, 2, 3, 6, 15, 25, 38, and 56. Submarginal structures are indicated on figures 4, 12, 18, 57, 60, 62, and 66. Structures of the vasiform orifice and operculum are indicated on figures 2, 37, 41, 62, 63, and 67. Ventral structures are indicated on figures 23, 24, 42, 45, and 46.

#### Methods

Measurements are given in microns ( $\mu\text{m}$ ). The measurements for new species are based on the type series and those for nominal species are based on the types and identified material. The margins of several species are broadly reflected and measurements of the length and width represent the apparent margin. Setae are measured from the extreme base in the setal socket.

In the key to species, the distribution is given if the species is not treated in the text. The host is mentioned if the species is host specific.

Postal abbreviations of states and provinces are used for distribution in the United States and Canada.

The host-plants are arranged by families. Authors for most of the plant species are provided. The plant species without an author were not listed in the following botanical publications used to verify scientific names: (1) A Checklist of Names for 3,000 Vascular Plants of Economic Importance by E.E. Terrell. (2) Checklist of Species for Flora North America by S.G. Sheltzer and L.E. Skog. (3) Common Trees of Puerto Rico and the Virgin Islands by E.L. Little, Jr. and F.H. Wadsworth. (4) In Gardens of Hawaii by M.C. Neal. (5) National List of Scientific Names, Vol. 1 and 2, U.S. Dept. Agriculture, Soil Conservation Service. (6) Plantas Utiles de Colombia by E. Perez Arbelaez. (7) The Native Trees of Florida by E. West and L.E. Arnold. (8) The

Standard Cyclopedia of Horticulture Vol. I-III by L.H. Bailey.

Acronyms for depositories of examined material are: FSCA = Florida State Collection of Arthropods, Gainesville; CDFA = California Dept. of Food and Agriculture, Sacramento; NHM = Natural History Museum, London; UCD = University of California, Davis; USNM = National Museum of Natural History, Smithsonian Institution, Washington D.C.

### *Tetraleurodes* Cockerell

*Aleyrodes* (*Tetraleurodes*) Cockerell 1902:283. Type species: *Aleyrodes perileuca* Cockerell, by original designation. *Tetraleurodes*: Quaintance and Baker 1914:107.

Pupal cases sclerotized, black, suboval to broadly oval. Margin and submargin: margin dentate. Thoracic and abdominal tracheal pore area with teeth undifferentiated from marginal teeth. Anterior and posterior marginal setae present. Submargin vertical, separated from dorsal disc by fold; sculptured with ridges, furrows and band of microtubercles. Pale glandular areas near bases of marginal teeth. Disc pores with associated porettes present. Caudal setae present. Dorsal Disc: Median molting suture reaching submarginal fold or margin, transverse molting suture extending to submarginal fold or terminating before fold. Submedian cephalothoracic setae and eighth abdominal setae normally present, first abdominal setae absent. Disc pores with or without associated porettes and micropores in definite pattern or randomly distributed. Vasiform orifice subcordate, normally elevated, often protruding over submarginal fold. Operculum subcordate, almost filling vasiform orifice. Lingula short, hidden by operculum. Caudal furrow absent. Venter membranous or slightly sclerotized. All spiracles present. Antennae stout, reaching first abdominal spiracle. Legs stout, curved marginally. Thoracic and abdominal tracheal folds well defined or indicated.

#### Key to *acaciae* group and North American species based on pupal cases

1. Submarginal gland tubercles present (Fig. 1C); usually on legume trees and shrubs ..... *acaciae* Group..2
- Submarginal gland tubercles absent; on various host plants ..... 8

- |      |   |        |  |
|------|---|--------|--|
| 2(1) | Cephalothorax with 4 pairs of setae (Fig. 32) .....<br>..... <i>pseudacaciae</i> Nakahara<br>Cephalothorax with 3 pairs of setae ..... 3  |        | posterolateral part of rim of vasiform orifice ..... 9<br>Cephalothorax with 1-3 pairs of submedian setae;<br>eighth abdominal setae anterior or anterolateral<br>of vasiform orifice (cf. Fig. 51B) ..... 11  |
| 3(2) | Abdominal segment VIII not separated from anterior segments (Fig. 15), intersegmental line between VII-VIII not extending to submarginal fold; pupal cases elongate oval (Fig. 15) ..... 4<br>Abdominal segment VIII separated from anterior segments by intersegmental line between VII-VIII extending to submarginal fold (cf. Fig. 33A); pupal cases oval (Fig. 1) ..... 6   | 9(8)   | Vasiform orifice with cell-like structures (Figs. 63A, 67A); small tubercle with pale gland on posterolateral part of rim of vasiform orifice (Figs. 62C, 67B); eighth abdominal seta apparently absent ..... 1<br>Vasiform orifice without cell-like structures; eighth abdominal seta on a small posterolateral lobe of rim of vasiform orifice, occasionally absent, setal base indicated by pale spot; Mexico, Central America, South America. ....<br>..... <i>quadratus</i> Sampson and Drews                                |
| 4(3) | Submarginal microtubercular band narrow, between margin and submarginal gland tubercles (Fig. 38C); 11-58 submarginal gland tubercles, present laterally ..... 5<br>Submarginal microtubercular band wide, extends mesad of gland tubercles to about apparent margin; 0-8 submarginal gland tubercles on head and 0-6 on caudal area of abdomen, absent laterally (Fig. 9) ..... <i>bireflexa</i> Nakahara  | 10(9)  | Vasiform orifice with a row of 3-4 cells on each side (Fig. 67A); caudal setae on distal 1/4 of submargin well developed (Fig. 65B); on various hosts ..... <i>ursorum</i> (Cockerell)<br>Vasiform orifice with 15-16 cells, in 2 lateral rows and 1 posterior row (Fig. 63A); caudal seta indistinct, thin, on median part of submargin (Fig. 62A); on <i>Quercus</i> .....<br>..... <i>quercicola</i> Nakahara   |
| 5(4) | Submargin of thorax with 2 short setae on each side (Fig. 36E); head with eyespot (Fig. 36A); conical teeth on mesothorax and along abdominal intersegmental lines (Figs. 36, 38); disc pores 2.0-3.5 $\mu$ m in diameter .....<br>..... <i>tuberculosa</i> Nakahara<br>Submargin of thorax without setae (Fig. 15); head without eyespot; conical teeth confined to submedian depressions on abdomen (Fig. 15F), absent from mesothorax; disc pores 5-7 $\mu$ m in diameter ..... <i>caulicola</i> Nakahara      | 11(8)  | Cephalic setae present (Fig. 42); submargin with oval, subtriangular or elongate, pale, glandular areas at bases of marginal teeth (Fig. 40) ... 12<br>Cephalic setae absent (Fig. 47); submargin with V- or U-shaped pale, glandular areas at bases of marginal teeth (Fig. 49C) ..... 15   |
| 6(3) | Caudal seta poorly developed, shorter than operculum (Fig. 26A); dorsum of abdomen sculptured, derm irregular (Fig. 25) .....<br>..... <i>dorsirugosa</i> Nakahara<br>Caudal seta well developed, longer than operculum (Fig. 29A); median-submedian dorsal derm of abdomen relatively smooth except for band of small, conical teeth ..... 7   | 12(11) | Spinules absent from mesal bases of thoracic legs; large disc pores, 5-7 $\mu$ m in diameter, aligned in regular row on proximal 1/3 of submargin; abdominal segments with median tubercles; eyespot present or absent; on <i>Quercus</i> ..... 13<br>Band of spinules along mesal bases of thoracic legs (Figs. 39D, 45B); minute disc pores, 2-3 $\mu$ m in diameter, irregularly spaced and aligned on proximal 1/3 of submargin; abdomen without median tubercles; eyespot, small oval (Figs. 39A, 42A); various host ..... 14 |
| 7(6) | Vasiform orifice on slightly elevated segment VIII (Fig. 29); orifice anterior to apparent caudal margin by 3-4 times its length; submedian depressions not indicated on abdomen (Fig. 27) .....<br>..... <i>mexicana</i> Nakahara<br>Vasiform orifice on protruding U-shaped elevation of segment VIII (Fig. 2); orifice anterior to apparent caudal margin by slightly more than its length; submedian depressions well developed on abdominal segments (Figs. 1, 6) .....<br>..... <i>acaciae</i> (Quaintance) | 13(12) | Eyespot with diffused margin; submarginal pale glandular areas oval, about as long as marginal teeth; 2 tubercles anterior of vasiform orifice; vasiform orifice not elevated; Mexico, southern United States. .... <i>perileuca</i> (Cockerell)<br>Eyespot absent; submarginal pale glandular areas elongate, between 1.5 to twice as long as marginal teeth; tubercles absent anterior to vasiform orifice; vasiform orifice greatly elevated; southern California .....<br>..... <i>melanops</i> (Cockerell)                    |
| 8(1) | Cephalothorax without submedian setae (Figs. 59, 65); eighth abdominal seta absent or on  |        |  |



- 14(12)Subventral area of abdomen with spinules (Fig. 42D); ventral submargin with irregular or oval raised areas (Fig. 46B); bottom of vasiform orifice with 1 open area ..... *chivela* Nakahara  
Subventral area of abdomen lacking spinules (Fig. 39); ventral submargin without irregular or oval raised areas; bottom of vasiform orifice with anterior open area and 2 smaller posterior open areas separated by thin sclerite (Fig. 41) ..... *bidentatus* Sampson and Drews
- 15(11)Operculum with small, posterior median notch (Fig. 51A); abdomen with oval submedial depressions (Fig. 47) ..... 16  
Operculum without posterior median notch; abdomen without well defined, oval submedial depressions ..... 17
- 16(15)Submarginal disc pores in 1 or 2 rows between microtubercular band and submarginal fold (Fig. 49A); 7-9 marginal teeth per 100  $\mu\text{m}$  ..... *confusa* Nakahara  
Submarginal disc pores in microtubercular band and in irregular row between band and submarginal fold (Fig. 52); 9-11 marginal teeth per 100  $\mu\text{m}$  ..... *perseae* Nakahara
- 17(15)Median area of abdomen delineated by submedial, longitudinal furrow on each side (Fig. 56B); cluster of subdorsal disc pores absent from abdominal segment IV; broad band of ventral spinules on both sides of legs and extends into abdomen ..... 18  
Median area of abdomen without submedial longitudinal furrows; a cluster of 3-8 subdorsal disc pores on segment IV; narrow band of ventral spinules on mesal base of legs; widespread in North America ..... *mori* (Quaintance)
- 18(17)Transverse molting suture with small notches (cf. Fig. 48); numerous ventral spinules on abdomen; eyespot usually transversely oval; Cuba, Jamaica, Mexico, Central America, Trinidad, Colombia, United States (Florida), Venezuela ..... *fici* Quaintance and Baker  
Transverse molting suture without notches; ventral spinules present only on anterior part of abdomen (Fig. 56); eyespot subcircular or oval (Fig. 56A) ..... *pringlei* Quaintance and Baker

### Acaciae Group

Submarginal gland tubercles present; cephalothorax with 3 or 4 pairs of submedian setae, eighth abdominal setae anterior or anterolaterad of vasiform orifice; margin of vasiform orifice without

cell-like structures; dorsal disc not granulose; submarginal, pale glandular areas of various shapes.

### *Tetraleurodes acaciae* (Quaintance)

(Figs. 1-8)

*Aleurodes acaciae* Quaintance 1900:19.

*Aleyrodes acaciae*: Bemis 1904:530.

*Tetraleurodes acaciae*: Quaintance & Baker 1914:108; Sampson & Drews 1941:172; Mound & Halsey 1978:196; Hamon 1978:1.

*Tetraleurodes herberti* Penny 1922:32; Mound & Halsey 1978:198.

#### New Synonymy.

**Pupal case:** oval, submargin strongly elevated, forming broad rim around case, dorsal disc strongly elevated, higher than submargin, lateral part of subdorsum rising almost vertically to sharply defined ridge on abdomen; or submargin elevated into ridge around case; dorsal disc with elevated, subdorsal longitudinal ridge, then depressed and gradually elevated into longitudinal, median area. Length 782-1146  $\mu\text{m}$ , width 531-798  $\mu\text{m}$ . Shiny black; dorsum with or without wax along subdorsal ridge; fringe of white wax subequal in width throughout, about 1/6 as wide as pupal case.

**Margin and submargin (Figs. 1, 4):** Marginal teeth 6-9 per 100  $\mu\text{m}$  on lateral margin, each tooth usually broader than long with apex broadly rounded or subtruncate (Fig. 4A). Anterior setae on 6-9 teeth from midline, 12-24  $\mu\text{m}$  long; 14-18 teeth between posterior setae, 24-50  $\mu\text{m}$  long. Submargin differentiated from dorsal disc by fold except on anterior part of head (Fig. 1H). Transverse ridges on distal 1/2 of submargin well defined by narrow transverse furrows, extending to marginal teeth. V-shaped, pale glandular area at base of each tooth, distal ends of glandular area extending marginally, terminating at transverse furrows, not joined to adjacent glandular areas (Fig. 4D). Band of microtubercles on ridges mesad of pale glandular area to about midwidth of submargin (Fig. 4E); distal margin of band clearly defined, usually a micropore with sclerotized rim at margin (Fig. 4B); smaller microtubercles on ridges along transverse furrows, larger microtubercles more medially on ridges, or microtubercles about same size; median area of ridges with few microtubercles or relatively bare. Area between microtubercular band and submarginal fold without microtubercles, with 4-59 oval or circular gland tubercles (Fig. 4C), 12-14  $\mu\text{m}$  in diameter, in irregularly spaced row, usually absent from head and area posterior of vasiform

orifice. Micropores, irregularly spaced, between gland tubercles and submarginal fold. Irregular pale area present or absent distad of gland tubercles on each side of cephalic region (Fig. 1K). Caudal setae 54-109  $\mu\text{m}$  long, bases tuberculated, on inner 1/2 of submargin, separated by distance equal to about 2 times width of vasiform orifice (Fig. 1G).

**Dorsal disc** (Figs. 1-3, 5, 6): Median molting suture extending to anterior margin; transverse molting suture terminating in submarginal fold at level of meso-metathoracic suture; margins of molting sutures smooth. Meso-metathoracic suture well defined in median to subdorsal areas, not reaching submarginal fold; small tubercles in submedian furrow on metathorax (Fig. 1J), along suture on both sides of furrow, or occasionally along almost entire length of suture. Eyespots absent. Cephalic setae 12-79  $\mu\text{m}$  long (Fig. 1B), extremely longer than thoracic setae in some populations (Fig. 3A, B); mesothoracic setae 12-62  $\mu\text{m}$  long (Fig. 1C); metathoracic setae 12-54  $\mu\text{m}$  long (Fig. 1D); eighth abdominal setae anterolaterad to vasiform orifice, 19-69  $\mu\text{m}$  long (Fig. 1E). Depressions on head anterior of seta and between seta and molting suture; submedially on prothorax; laterad of seta and between seta and molting suture on mesothorax; metathorax with shallow furrow extending obliquely from meso-metathoracic suture laterad of seta (Fig. 1J); 1 each submedially on abdominal segments I-VIII (Fig. 6B), bordered by microtubercles confined to area around depressions or more numerous and extending medially across segments along segmental lines and into subdorsum. Disc pores about 5  $\mu\text{m}$  in diameter and associated porettes distributed as follows on each side: 2-4 subdorsally on head; prothorax with 0-2 submedially posterior to cephalic seta, and 2-4 close together subdorsally; mesothorax with 1 submedially between seta and molting suture, 1-3 laterad of seta; 2 subdorsally on metathorax along meso-metathoracic suture; abdominal segment I with 1 in submedial-subdorsal area near transverse molting suture; 1 posterior of each submedian depression on II-VII, occasionally 2 on V; 2-3 laterad of vasiform orifice on VIII; 7-9 irregularly spaced along longitudinal ridge on subdorsum (Fig. 5A). Abdomen slightly elevated, intersegmental lines well developed, extending into subdorsum, line between segments VII and VIII extending to longitudinal ridge and submarginal fold, completely separating VIII from anterior segments; median

area of I-VII subequal in length. Subdorsum with longitudinal ridge extending from thorax to intersegmental line of VII-VIII (Fig. 1I), lateral part of ridge darker than mesal part and speckled with paler spots (Fig. 5). Large median tubercle centrally on I (Fig. 6A), also 1 each medially near posterior margin on III-VII, occasionally on II, or completely absent. Vasiform orifice subcordate, 35-52  $\mu\text{m}$  long, 42-52  $\mu\text{m}$  wide, on strongly elevated part of segment VIII, appearing as a wide, U-shaped rim of orifice, not or slightly protruding over submarginal fold (Fig. 2A). Operculum subcordate, 33-52  $\mu\text{m}$  long, 38-52  $\mu\text{m}$  wide, completely filing orifice, apex entire, occasional lateral margin broadly emarginate (Fig. 2B). Lingula hidden by operculum; distal 1/2 spinulose, gradually enlarged, widest just before apex.

**Venter** (Fig. 1): Derm slightly sclerotized, generally finely granulose; submargin without distinct dermal pattern. Antennae almost extending to anterior spiracle. Thoracic and abdominal spiracles well developed. Thoracic and abdominal tracheal folds evident. Cephalothorax with numerous spinules in band mesad of legs and bordering mouthparts, those by mouthparts larger than by legs. Legs with 1 distal microseta and 1 micropore; meso- and metathoracic legs each with basal microseta on lateral margin of spinule band. Adhesive sacks well developed, mesad of microtubercular band. Pair of setae on segment VIII short, anterior and closer to each other than spiracles.

**Third instar larva** (Fig. 7): Similar in shape to pupal case but smaller: Length 504-651  $\mu\text{m}$ , width 390-489  $\mu\text{m}$ ; dorsum sclerotized, dark reddish black. Margin with fringe of white wax subequal in width throughout, 1/5 to 1/4 as broad as width of body.

**Margin and submargin:** Margin with about 18 teeth in 100  $\mu\text{m}$  on lateral margin; anterior setae on 6-7 teeth from midline, 12-17 teeth between posterior setae. Submargin differentiated from dorsal disc by broad fold. Submarginal transverse ridges and furrows in lateral 1/2 of submargin. V-shaped pale glandular area on ridge at base of each tooth. Microtubercular band present, microtubercles on ridges along furrows. Area between microtubercular band and submarginal fold with 0-32 irregularly spaced, oval or circular gland tubercles (Fig. 7E), 9-12  $\mu\text{m}$  in diameter, usually absent from head and posterior of vasiform orifice; 3-6 micropores mesad of gland tubercles on each side. Caudal setae about

2 times longer than vasiform orifice, separated by more than width of vasiform orifice.

**Dorsal disc:** Cephalic, mesothoracic, and metathoracic setae fine, 7-12  $\mu\text{m}$  long (Fig. 7A-C); eighth abdominal setae longer than thoracic setae. Submedial depressions on segments I-VIII with 1-2 teeth on border. Discpores and associated porettes (Fig. 7D) distributed as follows on each side: 1, occasionally 2, subdorsally on head anterior to cephalic seta; 1 posterior of cephalic seta; 2 laterad of mesothoracic seta; 1 mesad and 1 laterad of metathoracic seta; 1 each submedially on abdominal segments I, IV-V; 1 each subdorsally on segments VI-VIII. Intersegmental lines well developed on abdomen, extending into subdorsum; median area of segments I-VII subequal in lengths. Segment I with or without median, oval tubercle, II or II-VI with posteromedial tubercles. Vasiform orifice subcordate, about as long as broad, on strongly elevated part of VIII appearing as thick U-shaped rim of orifice. Operculum subcordate, about as long as broad, apical margin entire, completely filling orifice.

**Second instar larva** (Fig. 8): Similar in shape to third larvae but smaller; length 358-440  $\mu\text{m}$ , width 245-390  $\mu\text{m}$ ; dorsum sclerotized, black.

**Margin and submargin:** Marginal teeth normally reflected beneath submargin, apices subtruncate, rounded, bilobed or irregular. Anterior marginal setae present, posterior marginal setae separated by 10-13 teeth, longer than length of vasiform orifice. Submargin differentiated from dorsal disc by fold; distal part of submargin dissected by transverse ridges and narrow furrows; total of 3-19 gland tubercles between ridges and submarginal fold. Caudal setae separated by distance greater than width of vasiform orifice, longer than length of orifice.

**Dorsal disc:** Minute cephalic, mesothoracic, metathoracic and eighth abdominal setae, bases of setae on cephalothorax smaller than diameter of disc pores. Disc pores and associated porettes distributed on each side as follows: 1 laterad of each cephalic, mesothoracic and metathoracic setae, 1 each subdorsally on abdominal segments IV-V and 1 laterad of vasiform orifice on VIII. Abdominal segments III-V or II-VI each with median tubercles in posteromarginal area. Vasiform orifice subcor-

date, broader than long. Operculum subcordate, broader than long, apical margin entire.

**First instar larva:** Elongate oval, smaller than second larva. Cephalothorax with 7 pairs of setae on margin; abdomen with 2 pairs of setae caudad of vasiform orifice. Antennae and legs not observed.

**Material examined:** Lectotype pupal case of *acaciae* on slide (cover glass cracked) with following paralectotypes; 32 whole or damaged (parts missing) pupal cases, 4 third instar larvae and 1 first instar larva: Chilhua, Mexico, Dr. Vasey Coll., Jan. 27, 1886, USNM Type No. 3863. Lectotype designated here is indicated by arrow between two closely associated specimens. Other paralectotypes on two slides with same data as lectotype; 28 whole or damaged pupal cases plus parts of damaged cases, 7 third instar larvae and 5 second instar larvae (USNM). *Tetraleurodes herberti* Penny, 5 pupal cases mounted from type material, Pleasanton, Alameda Co., California, *Robinia pseudo-acacia* L., Oct. 1918, F.W. Herbert (USNM). Other material examined: Many specimens from countries listed in distribution (FSCA, USNM).

**Distribution.** Belize, Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Jamaica, Mexico (Baja California Norte, Baja California Sur, Coahuila, Colima, D.F., Durango, Jalisco, Morelos, Nuevo Leon, Puebla, Sinaloa, Sonora, Tamaulipas), Nicaragua, Panama, Puerto Rico, Trinidad, United States (AZ, CA, FL, TX), Venezuela.

**Hosts.** Anacardiaceae: *Spondias* sp. Arecaceae: *Chamaedorea* sp. Bombacaceae: *Pachira* sp., *Pseudobombax ellipticum* (HBK) Dug. Burseraceae: *Bursera microphylla* A. Gray. Caprifoliaceae: *Symphoricarpos* sp. Euphorbiaceae: *Jatropha gossypifolia* L. Geraniaceae: *Pelargonium* sp. Fabaceae: *Acacia baileyana* F. Muell., *A. collinsii*, *A. koa* Gray, *A. linearis* Sims, *A. melanoxylon* R. Br., *A. pravissima* F. v. M., *A. scopioides*, *Acacia* sp., *Albizia* sp., *Amorpha californica* Nutt., *Bauhinia mexicana*, *B. petersiana*, *B. purpurea* L., *B. variegata* L., *Bauhinia* sp., *Bolusanthus speciosus* (Bolus) Harms, *Caesalpinia gilliesii* (Hook.) Wallich ex Benth., *Caesalpinia* sp., *Calliandra haematocephala* Hassk., *C. surinamensis* Benth., *Calliandra* sp., *Cassia alata* L., *C. fasciculata* Michx., *C. fistula* L., *Cassia* sp., *Centrosema*

*virginianum* (L.) Benth., *Centrosema* sp., *Ceratonia siliqua* L., *Cercis canadensis* L., *C. siliquastrum* Adanson, *Cercis* sp., *Chamaecrista* sp., *Cladrastis lutea* Koch, *Coursetia microphylla* Gray, *Cytisus scoparius* (L.) Link, *C. sessilifolius* L., *Dalbergia sisso* Roxb., *Desmodium* sp., *Diphysa robinoides* Benth. ex Benth. & Oerst., *Erythrina abyssinica* Lam., *E. acanthocarpa*, *E. americana* Mill., *E. corallodendrum* L., *E. coralloides*, *E. cristo-gallii* L., *E. falcata* Benth., *E. fusca* Lour., *E. humeana* Spreng., *E. tahitensis*, *E. variegata* Stickm., *E. vespertilio* Benth., *Erythrina* sp., *Gliricidia sepium* (Jacq.) Walp., *Gymnocladus dioicus* (L.) K. Koch, *Hardenbergia comptoniana* Benth., *Indigofera gerardiana* Grah. ex J. G. Baker, *Inga vera* Willd., *Inga* sp., *Kennedyia rubicunda* Vent., *Maackia amurensis* Rupr., *Milletia dura*, *Mimosa* sp., *Olneya tesota* Gray, *Pachyrhizus tuberosus* (Lam.) Spreng., *Parkia* sp., *Phaseolus vulgaris* L., *Piscidia piscipula* (L.) Sarg., *Pithecellobium flexicaule* (Benth.) Coult., *P. unguis-cati* (L.) Benth., *Prosopis glandulosa* Torr., *P. pubescens* Benth., *Robinia hispida* L., *R. kelseyi* H. P. Kelsey, *R. pseudoacacia* L., *Robinia* sp., *Sophora japonica* L., *S. secundiflora* (Oretega) DC., *S. viciifolia* Hance (= *dauidii* Komarov), *Sophora* sp., *Templetonia retusa* R. Br., *Tephrosia cinerea* (L.) Pers., *T. heydeana*, *Wistaria* sp. Moraceae: *Morus* sp. Myrtaceae: *Melaleuca* sp., *Myrica* sp. Nyctaginaceae: *Bougainvillea* sp. Rhamnaceae: *Rhamnus californica* Eschsch. Rosaceae: *Cotoneaster ambiguus*, *Rosa* sp. Salicaceae: *Populus* sp. Solanaceae: *Capsicum* sp. Urticaceae: *Parietaria* sp. Based on examined material and Hamon (1978).

**Discussion.** This is a morphologically variable species. The median tubercles on abdominal segments I-VII range from 0-7. The lengths of the submedial setae on the cephalothorax, eighth abdominal setae and caudal setae are extremely variable as shown on the following table in  $\mu\text{m}$ :

Setae	Types				
	CA	<i>Centrosema</i>	PR	Jam	Others
Cephalic	33-42	12-28	26-33	52-76	12-66
Mesothoracic	24-59	12-19	24-50	12(2)	12-17
Metathoracic	24-40	12-17	26-52	14(1)	
Eighth	29-59	19-47	35-66	47-59	24-35
Caudal	64-99	19-47	57-87	80-91	38-104

(1) based on 1 specimen, (2) based on 2 specimens.  
CA = California, Jam = Jamaica, PR = Puerto Rico.

The specimens from Puerto Rico and Jamaica normally have longer and thicker cephalic setae with larger setal bases than the mesothoracic and metathoracic setae. Material from California generally have short and fine cephalothoracic setae.

Another variable character is the total number of submarginal tubercles. Specimens on *Centrosema* always have fewer submarginal gland tubercles in the pupal cases (4-17) and either lack or have only 1 or 2 in the third instar larvae in contrast to specimens on other host plants that vary from 10-59 in the pupal cases and 19-30 in the third instar larvae. The reduced number of gland tubercles may indicate that the populations on *Centrosema* represent another species. However, no other differentiating characters were found and the difference in the number of gland tubercles is probably a host induced variation.

*Tetraleuroides acaciae* closely resembles *T. pseudacaciae*. It is readily differentiated by having three pairs of submedial setae on the cephalothorax instead of four pairs on *T. pseudacaciae*.

Hamon (1978) reported *T. acaciae* damaging *Calliandra haematocephala* in Florida.

### *Tetraleuroides bireflexa* Nakahara

new species (Figs. 9-14)

**Pupal case:** elongate oval, widest at anterior abdominal segments, anterior margin with slight median projection with subtruncate apex. Dorsum elevated, dorsal disc margined with slight ridge, median longitudinal area slightly elevated; subdorsum reflected, with reflected part upright and slanted outward or depressed and overlying submargin; distal part of submargin and margin reflected, with reflected part upright and slanted outward. Measurements of apparent margin: Length 1032-1062  $\mu\text{m}$ , width 586-651  $\mu\text{m}$ . Black; wax amorphous, white, on median area of abdomen to segment VIII, in a band along margin of dorsal disc, in a band on reflected distal part of submargin, and along margin on surface of leaf.

**Margin and submargin** (Figs. 9, 10, 12): True margin (Fig. 10A) and distal part of submargin reflected, each reflected part 1/6-1/5 as wide as distance between apparent margin; true marginal teeth 13-15 per 100  $\mu\text{m}$  at lateral margin, each broader than long, apically subtruncate, bilobed or irregular, often poorly developed (Fig. 12A). Apparent margin appears dentate (Figs. 9, 10B); nar-

row lines extending from apparent margin into microtubercular band. Anterior setae about 9  $\mu\text{m}$  long, on sixth tooth from midline, posterior setae about 19  $\mu\text{m}$  long, about 15 teeth between setae. Submargin differentiated from dorsal disc by submarginal fold except fold absent on head and caudad of vasiform orifice. Submargin with transverse ridges defined by narrow transverse furrows; each ridge terminating distally in a marginal tooth. Small, pale, oval or semihemispherical glandular areas of varying sizes at base of each tooth (Fig. 12C). Small pores mesad of pale, glandular areas, 1 usually on or near distal margin of close-set, narrow band of minute microtubercles. Larger microtubercles on ridges forming wider band around body (Fig. 12B), irregularly distributed or in short longitudinal lines, extending almost to apparent margin. Gland tubercles oval or rotund, 9-14  $\mu\text{m}$  in diameter, total of 0-8 on head, 0-6 on caudal part of abdomen, absent laterally, in microtubercular band about midway between true margin and apparent margin (Fig. 9A). Reflected part of submargin about equal to or wider than non-reflected part. Caudal setae not seen.

**Dorsal disc** (Figs. 9, 14): Subdorsum reflected laterally, partially or completely overlapping submargin (Figs. 9, 10). Median molting suture extending to anterior margin; transverse suture extending beneath reflected subdorsum to submarginal fold anterior to position of meso-metathoracic suture; margins of molting sutures smooth. Meso-metathoracic suture well developed, extending into subdorsum, not reaching submarginal fold. Eyespots represented by a short, longitudinal slit on subdorsum anterolaterad or laterad of cephalic seta (Fig. 11). Cephalic, meso- and metathoracic setae present submedially, bases tuberculate; cephalic seta about 19  $\mu\text{m}$  long; mesothoracic seta curved, about 14-20  $\mu\text{m}$  long; metathoracic setae about 17  $\mu\text{m}$  long, setal base midway between anterior and posterior margin of segment; eighth abdominal setae 24-28  $\mu\text{m}$  long, anterior to vasiform orifice, either closer to orifice or about equidistant between orifice and anterior margin of segment VIII, slightly farther apart than width of orifice. Depressions on head between seta and molting suture; submedially on prothorax and mesothorax; laterad of seta in oblique furrow on metathorax; abdomen with 1 submedially on each side of segments I-VI or -VII. Disc pores 2-3  $\mu\text{m}$  in diameter and associated porettes distributed on each side as follows: 3-6 subdorsally on head, 2-4 aligned posterior of cepha-

lic setae; prothorax with 1-4 subdorsally; mesothorax with 2-4 submedially, 1-2 subdorsally; metathorax with 2 submedially, 1-3 subdorsally; abdomen normally with 1 each submedially on segments I-VI, 0-1 on VII, occasionally 2 on VI and VII, subdorsally 3-5 on segment III, 2-3 on segment IV, 2-4 on V, 2-5 on VI, 2-4 on VII; on segment VIII, 1 near eighth abdominal seta, 1-2 near lateral rim of vasiform orifice. Dorsum almost completely tuberculated (Fig. 13); small conical tubercles submedially on cephalothorax and along anterior and posterior margins of medio-submedial areas of abdominal segments I-VII. Abdomen: slightly elevated, intersegmental lines well defined, extending into subdorsum, absent from reflected part of subdorsum; segment VIII not separated from anterior segments, intersegmental line between VII and VIII not extending to submarginal furrow. Median tubercle on abdominal segment I, 1 median tubercle each posteriorly on segments IV-VI or II-VI, absent on VII. Vasiform orifice subcordate, 47-52  $\mu\text{m}$  long, 50-52  $\mu\text{m}$  wide, with apparent wide subrotund rim 1/4-1/3 as wide as orifice, anterior to apparent caudal margin by less than its length (Fig. 14). Operculum subcordate, 40  $\mu\text{m}$  long, 40(42)  $\mu\text{m}$  wide, completely filling orifice. Lingula included in orifice, hidden by operculum, apically knobbed, spinulose.

**Venter** (Fig. 9): Without distinct dermal pattern. Antennae short, reaching anterior spiracle. Thoracic tracheal folds with spinules, abdominal tracheal fold indistinct. Legs developed; meso- and metathoracic legs each with 1 basal microseta in spinule band, 1 distal microseta and micropore; prolegs with 1 distal micropore. Minute spinules mesad of legs, and laterad of mouthparts. Adhesive sac oval, mesad of prolegs. Eighth abdominal setae anterior to position of vasiform orifice.

**Third, second and first instar larvae:** Not available.

**Type material.** Holotype pupal case second from left on slide with 4 paratype pupal cases. El Centro, Imperial Co., California, 19-VIII-74, ex mesquite, Flock and Pineda (No. 7413-75 CDA) (USNM). Other paratypes: Holtsville, Imperial Co., California, 2 pupal cases on 1 slide, 5 unmounted pupal cases on leaves, *Prosopis* sp., summer of 1991, E. Natwick and L. Osborn (CDFA).

**Distribution.** United States (CA).

**Host.** Fabaceae: *Prosopis* sp. (mesquite).

**Etymology.** Specific epithet is a combination of Latin "bi" (twice) and "reflexus" (turned back). This species has reflected submargin and subdorsum.

**Comments.** Most of the cephalothoracic setae are missing and because of the strongly reflected submargin and subdorsum, part of the dermal features could not be observed.

This species resembles *T. caulicola* new species, which also occurs in the same habitat in California. *Tetraleurodes bireflexa* has a wide band of microtubercles of varying sizes on the submargin extending mesad of gland tubercles to about the apparent margin, total of 0-8 gland tubercles in the microtubercular band on the head and 0-6 on caudal part of the abdomen, small disc pores 2-3  $\mu\text{m}$  in diameter, and the eighth abdominal setae separated by slightly more than the width of vasiform orifice. Conversely, *T. caulicola* has only a narrow band of minute microtubercles on lateral one-third of the submargin distal of the gland tubercles; 11-58 gland tubercles in an irregular row in the lateral 1/3 of the submargin, disc pores 5-7  $\mu\text{m}$  in diameter, and the eighth abdominal setae separated by almost 2 times the width of the vasiform orifice.

Because of the strongly reflected submargin, *T. bireflexa* was previously identified as a species of *Tetralicia*. However, *T. bireflexa* has a submarginal fold and gland tubercles which are absent from *Tetralicia* species.

#### *Tetraleurodes caulicola* Nakahara

new species (Figs. 15-22)

**Pupal case:** elongate oval, anterior margin rounded, posterior margin more broadly rounded or slightly subtruncate; submargin slightly to strongly elevated; dorsal disc relatively flat, slightly higher than submargin, or strongly elevated, higher than submargin with outer subdorsum slightly overlapping submargin. Measurements of apparent margin: Length 912-1317  $\mu\text{m}$ , width 537-798  $\mu\text{m}$ . Black; wax absent. On twigs and leaves of desert legume shrubs.

**Margin and submargin** (Figs. 15, 16, 18, 19): True margin and short distal part of submargin usually reflected, reflected part rather short in contrast to distance between apparent margin; marginal teeth short, usually small, conical or lobular, or undivided and rather broad, sizes and

shapes variable, 12-16 teeth per 100  $\mu\text{m}$  (Figs. 18A, 19). Anterior seta slender, 14-20  $\mu\text{m}$  long; posterior setae 35-47  $\mu\text{m}$  long. Submargin differentiated from dorsal disc by submarginal fold, except fold absent from anterior part of head. Transverse ridges and narrow furrows dissecting submargin (Fig. 19A); short furrows extending mesally to about gland tubercles, long furrows extending mesad of gland tubercles; ridges between gland tubercles and margin, terminating in 1-3 marginal teeth, each ridge with a pale, V- or U-shaped glandular area (Fig. 18E) near margin; small, short ridge near margin between normal ridges, terminating marginally in 1 or 2 conical or lobelike teeth. Microtubercles on ridges in a short band between pale glandular area and gland tubercles (Fig. 18C). Micropores in irregularly spaced row near pale glandular areas (Fig. 18B). Irregularly spaced row of 11-58 oval or rotund gland tubercles (Fig. 18D), 8-12  $\mu\text{m}$  in diameter, in about distal 1/3 of submargin, usually absent between positions of caudal setae. About 2/3 of submargin normally covered by overlapping subdorsum. Caudal setae 31-45  $\mu\text{m}$  long, anterior to microtubercular band, separated by distance equal to 3-5 times width of vasiform orifice (Fig. 17).

**Dorsal disc** (Figs. 15, 17): Subdorsum normally reflected (Fig. 16C), overlapping as much as 2/3 of submargin. Median molting suture extending to anterior margin; transverse molting suture extending to submarginal fold, terminating at level of or anterior to level of meso-metathoracic suture; margins of molting sutures smooth. Meso-metathoracic suture extending to subdorsum, not reaching submarginal fold. Eyespot absent. Cephalic setae 24-33  $\mu\text{m}$  long, mesothoracic setae 12-24  $\mu\text{m}$  long, and metathoracic setae 14-35  $\mu\text{m}$  long; eighth abdominal setae hairlike, 26-45  $\mu\text{m}$  long, usually shorter than length of operculum, anterolaterad of vasiform orifice, nearer to anterior margin of segment VIII than to orifice. Depressions on head anterior to seta and between seta and molting suture, and submedially on prothorax and mesothorax; metathorax with shallow furrow arising from meso-metathoracic suture anterior to seta and extending obliquely posteriorly; abdominal segments I-VIII each with U-shaped depression submedially on each side of anterior marginal area; area between depressions often delineated posteriorly by shallow groove. Disc pores 5-7  $\mu\text{m}$  in diameter distributed on each side as follows: 4-12 subdorsally and submedially on head anterior or

laterad of cephalic seta; prothorax with 2-4 submedially and subdorsally, 2-6 along submarginal fold; mesothorax with 1-2 submedially, 3-5 aligned subdorsally laterad of seta in anterior 1/2 of segment, 1 occasionally subdorsally in posterior 1/2 of segment, 2-7 along submarginal fold; metathorax with 0-4 submedially, 3-6 aligned subdorsally laterad of seta; abdominal segments I-VII each with 1 submedially posterior of or slightly posterolaterad of depression; subdorsally 3-4 on III, 2-5 on IV, 0-4 on V, 1-3 on VI, 1-3 on VII, 3-5 laterad of vasiform orifice on VIII, 12-21 along submarginal fold. Small conical teeth in and bordering depression on metathorax, bordering submedial depressions on abdominal segments. Medial-submedial derm relatively smooth, subdorsal and part of submedial derm of abdomen and often cephalothorax tuberculated (Fig. 20). Abdomen elevated in submedial-medial areas, without median tubercle; intersegmental lines well defined, extending into subdorsum, not reaching submarginal fold, segments I-VII not separated from VIII; median area of VII slightly shorter than median area of anterior segments. Vasiform orifice subcordate or suboval, 45-57  $\mu\text{m}$  long, 42-57  $\mu\text{m}$  wide, anterior rim thick, on slightly elevated oval or U-shaped area of segment VIII, not protruding caudally over submarginal fold (Fig. 17); orifice anterior to apparent margin by about 2 times its length. Operculum subcordate, 40-52  $\mu\text{m}$  long, 40-57  $\mu\text{m}$  wide, completely filling orifice. Lingula hidden by operculum, apical half enlarged into oval knob, spinulose.

**Venter** (Fig. 15): Without distinct dermal pattern. Antennae extending to anterior spiracle. Thoracic and abdominal tracheal folds distinct, thoracic folds with minute spinules. Legs developed; mesothoracic and metathoracic legs each with 1 basal microseta; all legs each with 1 distal microseta and 1 micropore. Minute spinules on mesal bases of legs. Adhesive sac well developed. **Eighth** abdominal setae hairlike, anterior to position of vasiform orifice.

**Third instar larva** (Fig. 21): Similar in shape to pupal case except smaller; length 635-781  $\mu\text{m}$ , width 358-489  $\mu\text{m}$ . Submargin elevated into ridgelike rim around body, dorsal disc elevated in median area. Black or dark reddish brown. Wax absent.

**Margin and submargin:** Marginal teeth short, usually conical or lobelike, variable in size, 14-17

per 100  $\mu\text{m}$ . Anterior setae slender, shorter than posterior setae; posterior setae about as long as or longer than operculum. Submargin differentiated from dorsal disc by fold. Ridges and furrows in distal 1/3 of submargin; each ridge terminating marginally in 1-3 conical or lobelike teeth, with a pale, V- or U-shaped glandular area near margin; usually with short conical lobe between marginal teeth; microtubercles absent. Total of 5-19 oval or circular gland tubercles, about 7  $\mu\text{m}$  in diameter, mesad of pale glandular areas, absent from head and caudal area between caudal setae. Caudal setae shorter than operculum, base tuberculated, separated by about 3 times width of vasiform orifice.

**Dorsal disc:** Cephalic, mesothoracic, and metathoracic setae missing, represented by setal bases; eighth abdominal setae anterolaterad to vasiform orifice, shorter than operculum. Cephalothorax and abdomen with depressions, submedial depressions on abdominal segments I-VII, with 1-2 short, conical teeth on margin. Disc pores about 5  $\mu\text{m}$  in diameter distributed as follows on each side: 2-4 submedially and subdorsally on head anterior to cephalic seta; prothorax with 1-2 submedially, 1 subdorsally; mesothorax with 1 submedially just laterad of seta, 1-2 subdorsally; metathorax with 1 submedially just laterad of seta, 1-2 subdorsally; abdominal segments I and IV-V each with 1 submedially, occasionally with 2 or absent from one side of IV or V, 1 subdorsally on VI-VII, usually 2 laterad of vasiform orifice on VIII, 2-7 subdorsally along submarginal fold. Abdomen slightly elevated in medial area, rachis well developed, extending into subdorsum; segment VIII not separated from anterior segments, anteromedial margin broadly lobed; median areas of VI and VII subequal in lengths. Vasiform orifice subcordate, about as broad as long, on oval or U-shaped and slightly elevated area of segment VIII, anterior to apparent caudal margin by about its length; operculum subcordate, about as broad as long, completely filling orifice.

**Second instar larva** (Fig. 22): Similar in shape to third larva except smaller; length at apparent margin about 451  $\mu\text{m}$ , width 264  $\mu\text{m}$ . Dorsum relatively flat; sclerotized, dark reddish brown. Wax absent.

**Margin and submargin:** Margin irregularly lobed, usually reflected ventrally. Anterior and



posterior setae not seen. Submargin differentiated from dorsal disc by fold; 1-2 oval or circular gland tubercles about 8  $\mu$ m in diameter on each side of abdomen. Setal base of caudal setae separated by 2.5-3 times width of vasiform orifice.

**Dorsal disc:** Setal bases of cephalic, mesothoracic, metathoracic and eighth abdominal setae present on examined specimens. Disc pores, about 5  $\mu$ m in diameter and associated porettes distributed on each side as follows: 1 on head laterad of cephalic seta; mesothorax with 1 subdorsally; metathorax with 1 subdorsally; abdominal segments IV and V each with 1 subdorsally, occasionally 1 subdorsally on III; 1 laterad of vasiform orifice on VIII. Vasiform orifice subcordate, about as broad as long, on slightly elevated, oval or U-shaped part of segment VIII, anterior to apparent caudal margin by about its length. Operculum subcordate, about as broad as long, completely filling orifice, posterior margin entire.

**First instar larva:** Not available.

**Type material.** Holotype pupal case second from right, on slide with 3 paratype pupal cases; on stem of *Psorothamnus spinosus* (Gray) Barneby, Rancho Mirage, Riverside Co., Calif., 4-V-60, Cordill fr. Keifer (60E 6-11, 60-12002) (USNM). Other paratypes: ARIZONA: Ehrenberg, Yuma Co., 4 pupal cases (2 slides), *Dalea*, 13-II-83, Gilbert and Clark (CDA 458810). CALIFORNIA: Barstow, San Bernardino Co., 4 pupal cases (1 slide), 28-III-72, *Cassia* sp. near *armata*, D. Cordas & E. Paddock (CDA 72124-33). Mojave, Kern Co., 6 pupal cases (1 slide), stem bark of *Cassia armata* S. Wats., 31-I-68, T.R. Haig (68-4297). 5 mi. W. Mojave on Hwy 14, Kern Co., 3 pupal cases (3 slides), *Cassia armata*, 31-I-68, T.R. Haig (CDA 68B5-73); same location and host, 3 pupal cases, 3 third instar larvae (6 slides), 11-VI-68, T.R. Haig (CDA 68F17-77). Mojave Desert, 4 pupal cases (1 slide), *Psorothamnus spinosus*, 15-XI-54, C. May (55-2860). Palm Canyon, Riverside Co., 5 whole and 2 partial pupal cases (2 slides), 7 third instar larvae (1 slide), 3 whole and 3 partial second instar larvae (1 slide), *Dalea* sp. stems, 31-III-63, L.D. Anderson. Palm Springs, Riverside Co., 4 pupal cases (1 slide), *Dalea* sp. stems, 7-V-69, Johnson, Gill & Okumura (69F9-91, 69-10435). MEXICO: Baja California, 4 pupal cases (1 slide), *Psorothamnus spinosus*, 7-VIII-48, E.D. Algart (San Ysidro 1224, 48-14310).

Rocky Pt., Sonora, 1 pupal case, twig of *Psorothamnus spinosus*, 11-III-56, Alexander & Kaiser (Noglaes 75123, 56-14415). Paratypes deposited in CDFA, FSCA and USNM.

**Distribution.** Mexico (Baja California, Sonora), United States (AZ, CA).

**Hosts.** Fabaceae: *Cassia armata* S. Wats., *Cassia* sp. near *armata*, *Dalea* sp., *Psorothamnus emoryi* (Gray) Rydb. (= *Dalea emoryi*), *Psorothamnus spinosus* (Gray) Barneby (= *D. spinosa*).

**Etymology.** Specific epithet is a combination of latin "caulis" (stem) and "cola" (inhabitant). This species is found usually on stems.

**Comments.** Whiteflies usually infest leaves of plants and are rarely found on the stems. *Tetraleurodes caulicola* is known from the green wood of *Psorothamnus spinosus* inhabiting the Colorado and Mojave Deserts of southern California, Arizona and Sonora, and *Cassia armata*, which inhabits the Colorado and Mojave Deserts of Arizona, southern California and Nevada. Both legumes are leafless during most of the year which is apparently the reason for the adaptation of *T. caulicola* to living on the stems. This species is similar in shape to *T. tuberculosa*, which also infests stems, and *T. bireflexa*. The irregularly lobed margin (12-16 teeth per 100  $\mu$ m), large disc pores 5-7  $\mu$ m in diameter, small, conical teeth confined to area around submedian depressions on the abdomen and absent from mesothorax, caudal setae separated by 4-5 times the width of the vasiform orifice, and the absence of submarginal thoracic setae differentiates the pupal cases of *T. caulicola* from *T. tuberculosa*. The latter species has 8-9 marginal teeth per 100  $\mu$ m, disc pores 3.5  $\mu$ m or less in diameter, numerous small, conical teeth completely across abdominal segments and on the mesothorax, caudal setae separated by about 2 times the width of the vasiform orifice, and 2 submarginal setae on each side of the thorax. The differences between *T. caulicola* and *bireflexa* are discussed under *T. bireflexa*.



*Tetraleurodes dorsirugosa* Nakahara

new species (Figs. 23-26)

**Pupal case:** oval, anterior and posterior margins with similar shapes. Outer submargin almost vertically elevated, forming ridge around body, ridge occasionally overhangs and extends outside margin; inner submargin sharply depressed into submarginal fold; lateral part of subdorsum almost vertical; dorsal disc higher than submargin, somewhat level, except low ridges formed along molting sutures and on abdominal segments. Length 809-840  $\mu\text{m}$ , width 517-576  $\mu\text{m}$ . Black, dorsum with thin white wax cover; fringe of white, crystalline wax rods of subequal lengths, about 1/5 to 1/4 width of case.

**Margin and submargin** (Figs. 23, 25, 26): Marginal teeth subtruncate, broadly rounded or bilobed apically, 8-10 teeth per 100  $\mu\text{m}$  on lateral margin. Anterior setae 24-28  $\mu\text{m}$  long, on 8-12th tooth from midline; posterior setae 26-31  $\mu\text{m}$  long, longer than caudal setae, 21-23 teeth between setae. Submargin differentiated from dorsal disc by submarginal fold. Transverse ridges and narrow furrows dissecting distal 1/2 of submargin; ridges of varying lengths terminating marginally into a single tooth or bilobed tooth. Pale glandular area at base of each marginal tooth. Band of microtubercles on ridges mesad of pale glandular areas, extending to about mid-width of submargin; microtubercles along transverse furrows smaller than ones more dorsally on ridge, absent from medial parts of longer ridges. Micropores with pale halo in irregularly spaced row mesad of V- or U-shaped pale glandular areas on distal margin of microtubercular band. Total of 23-30 oval or circular gland tubercles, 7-12  $\mu\text{m}$  in diameter, in irregularly spaced row in medial area of submargin, about twice their diameter from microtubercular band. Irregular, pale area on each side of head between gland tubercles and microtubercular band (Fig. 23A). Caudal setae small, 9-12  $\mu\text{m}$  long, shorter than operculum, in submarginal microtubercular band, separated by about 2 times width of vasiform orifice (Fig. 26A).

**Dorsal disc** (Figs. 23, 25, 26): Median molting suture extending to anterior margin; transverse molting suture not reaching submarginal fold, terminating laterally posterior to level of meso-metathoracic suture; margins of molting sutures

smooth. Meso-metathoracic suture extending to subdorsum, not reaching submarginal fold. Eyespot absent or indicated by pale, elongate oval subdorsal spot laterad of cephalic seta. Cephalic, mesothoracic and metathoracic setae poorly developed, about 9  $\mu\text{m}$  long; eighth abdominal setae 9-12  $\mu\text{m}$  long, anterolaterad to vasiform orifice and closer to anterior margin of segment VIII than orifice. Depressions submedially on head, prothorax, mesothorax, in submedial furrow on metathorax; submedial depressions on abdominal segments poorly defined or represented by oval areas on anterior marginal areas of I-VII. Disc pores about 2.5  $\mu\text{m}$  in diameter and associated porettes distributed on each side as follows: 2-3 subdorsally on head along submarginal fold; prothorax, mesothorax and metathoracic each with 2 submedially; abdominal segments I-VII each with 1 submedially, VIII with 2 laterad of vasiform orifice; subdorsally 2-3 on combined I-III (Fig. 25B), 2 on IV, 1-2 on V, 1-2 on VI and 0-1 on VII. Numerous, small, conical teeth submedially on abdominal segments I-VIII, extending mesad and laterad into subdorsum along anterior and posterior marginal areas of most segments; in submedial furrow on metathorax and along meso-metathoracic suture. Dorsum with sculpture lines, derm irregular, rugose (Fig. 25). Abdominal segments slightly elevated medially, intersegmental lines well developed, extending to subdorsum, not reaching submarginal fold on I-VI; intersegmental line between VII-VIII extending to fold, separating VIII from anterior segments; medial part of segment VI subequal to longer than that of VII. Vasiform orifice subcordate, 35  $\mu\text{m}$  long, 38-45  $\mu\text{m}$  wide, on slightly elevated oval area of VIII, anterior to caudal margin by 2-3 times its length (Fig. 26). Operculum subcordate, 28-33  $\mu\text{m}$  long, 35-42  $\mu\text{m}$  wide, sculpture lines dorsally, apically entire, almost completely filling orifice. Lingula hidden by operculum, spatulate, apical 1/2 enlarged into knob, spinulose.

**Venter** (Figs. 23, 24): Without distinct dermal pattern. Thoracic and abdominal tracheal fold distinct, thoracic tracheal fold with spinules (Fig. 24F). Antennae reaching anterior spiracles (Fig. 24E). Legs with microseta at base of mesothoracic and metathoracic legs in lateral margin of spinule band (Fig. 24D), each leg with 1 distal microseta and usually 1 distal microseta base (Fig. 24H). Adhesive sac well developed (Fig. 24B). Band of spinules (Fig. 24C) mesad of legs and laterad of mouthparts (Fig. 24A). Eighth abdominal setae anterior to position of vasiform orifice (Fig. 23C).

**First, second and third instar larvae:** Not available.

**Type material.** Holotype pupal case on same slide with 4 paratype pupal cases; Caldas, Antioquia, Colombia, on Ceasalpinaceae, II-74, R. Velaz-Angel (74-7816); 3 other paratype pupal cases on 2 slides and 1 unmounted specimen with same data (USNM).

**Distribution.** Colombia (Antioquia).

**Host.** Fabaceae: Ceasalpinaceae.

**Etymology.** Specific epithet is a combination of Latin "dorso" (dorsum) with "rugosum" (rugose) to indicate that the dorsum is irregularly sculptured.

**Comments.** This species resembles *T. acaciae* but differs by the irregularly sculptured dorsum; short, poorly developed caudal setae; submarginal micropore in with pale halo; submarginal ridges variable in lengths; and marginal teeth usually smaller. Whereas, *T. acaciae* has relatively smooth dorsum; caudal setae long with enlarged bases; submarginal micropore with dark sclerotized rim and without pale halo; the submarginal ridges are regularly aligned and about equal in length; and the marginal teeth are larger.

***Tetraleurodes mexicana* Nakahara**  
new species (Figs. 27-31)

**Pupal case:** broadly oval, anterior and posterior margins broadly rounded; submargin elevated forming rounded ridge encircling case, higher than somewhat flat dorsal disc; dorsal disc with raised area or ridges along cephalothoracic sutures, and abdominal segments. Measurements of apparent margin: Length 809-918  $\mu\text{m}$ , width 622-685  $\mu\text{m}$ . Black, fringe of white wax about 1/3 width of case, dorsal wax absent.

**Margin and submargin** (Figs. 27, 28): True margin dentate, usually reflected beneath submargin (Fig. 27), 5-7 teeth per 100  $\mu\text{m}$  on lateral margin (Fig. 28A); teeth broader than long, rounded apically. Anterior seta short, on 3-6th, tooth from midline; posterior setae subapical on tooth, 11-14 teeth between setae. Submargin differentiated from dorsal disc by submarginal fold, except head with broader fold. Submargin with transverse

ridges and narrow furrows, furrows extending to margin; ridges extending from marginal teeth mesally, coalescing with adjoining ridges before row of large, gland tubercles. Pale glandular area V-shaped (Fig. 28B), defined by strongly sclerotized margins, at base of each tooth, distal ends extending marginally, terminating at furrows. Microtubercles on ridges forming narrow band mesad of V-shaped glandular areas, band slightly wider than diameter of gland tubercles (Fig. 28C). Micropore present or absent mesad of V-shaped area (Fig. 28D). 37-62 oval or circular gland tubercles, 12-19  $\mu\text{m}$  in diameter, irregularly spaced around body. Micropores, 7-14 irregularly spaced on each side of submargin between gland tubercles and fold (Fig. 28D). Caudal setae well developed (partially missing, completely missing or curved too much to measure), longer than length of operculum, partial setae about 59-83  $\mu\text{m}$  long, between margin and position of gland tubercles, bases enlarged, separated by distance equal to about 3 times width of vasiform orifice (Fig. 29A).

**Dorsal disc** (Figs. 27, 29): Median molting suture extending to anterior margin; transverse molting suture extending to submarginal fold; margins of sutures smooth. Meso-metathoracic suture well defined, extending to subdorsum, not reaching fold; small conical teeth clustered on metathorax along suture. Eyespot absent. Cephalic, mesothoracic and metathoracic setae present (all setae partially or completely missing); eighth abdominal setae shorter than operculum, anterolaterad of vasiform orifice. Depressions on head, prothorax and mesothorax, none on metathorax. Disc pores often on small, low tubercles; disc pores about 2  $\mu\text{m}$  in diameter and associated porettes distributed on each side as follows: 1 on head posterior of cephalic seta, 0-1 cephalad of seta and 1-2 between seta and molting suture on mesothorax, 1 submedially on abdominal segments II-VII (Fig. 27B) or replaced by micropores on IV-VII, occasionally 1 on VIII. Smaller disc pores distributed on each side as follows: 1 subdorsally occasionally on head anterior of cephalic seta; prothorax and mesothorax each with 0-4 subdorsally near submarginal fold; 0-2 cephalad of seta and 1-2 between setae and molting suture on mesothorax; 1 subdorsally on metathorax; 1 or 2 infrequently submedially on abdominal segment I, occasionally 1 or 2 submedially on IV-VII, scattered subdorsally on abdomen as follows (Fig. 27A): III 4-7, IV 6-7, V 5-6, VI 2-6, VII 2-4, VIII 1-2. Abdomen slightly elevated medially,

intersegmental lines strongly developed, extending into subdorsum and almost reaching submarginal fold, segmental line between VII-VIII reaching fold, separating VIII from other segments, occasionally segmental line of VI-VII complete, separating VII from other segments. Small, conical teeth on anterior submedial part of I, along segmental lines on submedial and subdorsal parts of II-VII, often along medial parts of posterior segments. Median tubercle centrally on I or absent, absent from other segments. Vasiform orifice subcordate (Fig. 29), 26-33  $\mu\text{m}$  long, 35-40  $\mu\text{m}$  wide, on slightly elevated VIII that appear relatively flat; orifice 3-4 times its length anterior of apparent caudal margin. Operculum subcordate with apex broadly rounded or subtruncate, or subtriangle, almost completely filling orifice, 21-26  $\mu\text{m}$  long, 31-33  $\mu\text{m}$  wide, apex entire. Lingula completely hidden by operculum; apical one-half enlarged into oval knob, spinulose.

**Venter** (Fig. 27): Antennae reaching anterior spiracles. Thoracic and abdominal tracheal folds distinct; thoracic ones relatively parallel sided before widening at margin, with minute spinules on proximal part; abdominal fold without spinules. Legs with basal microseta on meso- and metathorax at lateral margin of spinule band; 1 distal microseta and 1 microseta base on all legs. Spinules in band mesad of each leg, few larger ones laterad of mouthparts. Adhesive sack well developed; often oval, saclike enlargement mesad of meso- and metathoracic legs. Minute submedial setae on abdominal segment II. Eighth abdominal setae anterior to position of vasiform orifice.

**Third instar larva** (Fig. 30): Similar in shape or more circular than pupal cases. Measurements based on apparent margins: length 498-568  $\mu\text{m}$ , width 436-482  $\mu\text{m}$ . Submargin elevated, forming ridgelike rim around dorsal disc. Dorsum sclerotized, dark reddish black. Fringe of white wax broader than width of body.

**Margin and submargin:** Marginal teeth about 5 per 100  $\mu\text{m}$  on lateral margin, each tooth broader than long, rounded apically; margin usually reflected ventrally, apparent margin broadly lobed. Anterior setae subapically on tooth; posterior setae subapically on tooth, 9-11 marginal teeth between setae. Each submarginal ridge terminating into 1-3 marginal teeth. Large, poorly defined V- or U-shaped pale glandular areas between bases of mar-

ginal teeth and sclerotized band encircling body. Microtubercles absent. Mesad of sclerotized band, irregularly spaced row of 25-29 oval or circular gland tubercles, 9-12  $\mu\text{m}$  in diameter, around body. Micropores, 4-14 mesad of gland tubercles on each side. Caudal setae between position of gland tubercles and caudal margin, longer than vasiform orifice, separated by distance equal to about 1.5 times width of vasiform orifice

**Dorsal disc:** Cephalic, mesothoracic and metathoracic setae present, bases of latter 2 larger than that of cephalic seta; eighth abdominal setae anterolaterad of vasiform orifice. Dorsal disc pores and associated porettes and microspores distributed on each side as follows: Head with micropores, 1 posterior of cephalic seta, 1 laterad of cephalic seta, occasionally 1 subdorsally anterior of cephalic seta; mesothorax with 1 disc pore and porette just anterior or anterolaterad of seta (Fig. 30B), 1 micropore just laterad of seta and another on subdorsum; metathorax with 1 disc pore and porette just anterolaterad or laterad of seta, 1 micropore laterad of seta and usually another on subdorsum; abdominal segments IV and V each with 1 submedial disc pore; micropores 1 each subdorsally on abdominal segments III-VIII (Fig. 30A), or absent from III-V, occasionally 1 each submedially on IV and V instead of disc pores. Small, conical teeth submedially on metathorax along meso-metathoracic suture, distributed along segmental lines on each side of abdomen as follows: 1-2 submedially on I-III (Fig. 30C), 1-4 on IV, 4-5 on VI, 2-4 on VII, extending medially and into subdorsum on posterior segments. Abdomen with well developed rachis, median areas of segments II-VII subequal in lengths. Median tubercle absent. Vasiform orifice broader than long, subtriangular, on slightly elevated segment VIII, about 3.5 times its length from apparent margin. Operculum completely filling orifice, subcordate, broader than long, apex entire. Lingula hidden by operculum, apical 1/2 enlarged into oval knob, spinulose. Submedial depressions absent from abdomen.

**Second instar larva** (Fig. 31): Similar in color and wax fringe as third larva but smaller; oval, length 334-363  $\mu\text{m}$ , width 175-281  $\mu\text{m}$ .

**Margin and submargin:** Margin dentate. Submargin sectioned into rather broad, flat, ridges in distal part, each ridge terminating marginally into a single tooth or divided into 2 or 3 teeth. Large

V- or U-shaped pale glandular areas mesad of teeth. Microtubercles absent. Proximal 1/2 of submargin with oval or circular gland tubercles, 9-12  $\mu\text{m}$  in diameter; 3-5 on each side of abdomen and 1 on each side of head. Caudal setae farther apart than width off orifice.

**Dorsal disc:** Cephalic, mesothoracic and metathoracic setae present, eighth abdominal setae anterolaterad of vasiform orifice, setal bases smaller than disc pores. Pores distributed on each side as follows: 1 disc pore and porette occasionally laterad of cephalic seta, 1 disc pore and porette laterad of each mesothoracic and metathoracic setae, 1 disc pore or 1 micropore subdorsally on abdominal segments IV-V, 1 disc pore and porette laterad of vasiform orifice on VIII. Submedial, small conical tooth, 1 each on abdominal segments I-VII on each side or absent from II-VII. Vasiform orifice subtriangular, broader than long, about 2 times its length from caudal margin, not elevated; operculum subcordate, filling orifice, apex entire.

**Type material.** Holotype pupal case circled on slide with 5 paratypes (2 pupal cases, 3 third instar larvae) and 2 third instar larvae of *T. acaciae*; Hermosillo, Sonora, Mexico, *Inga* sp., 19-V-51, Gunderson (Nogales 91340, 51-3310) (USNM). Other paratypes: MEXICO: 7 pupal cases, 3 third instar larvae, 1 second instar larva (3 slides) with same data as holotype; 1 third instar larva, unknown host, 30-I-1956, Alexander (56-4913); 2 pupal cases, 1 third instar larva, 2 second instar larvae (1 slide), *Ruta* sp., 11-VIII-84, M. Segall (Houston 010093, 84-09682); 1 pupal case, unknown host, 25-II-88, T. Giles (88-04728). Cuernavaca, Morelos, 4 pupal cases, 3 third instar larvae (1 slide), unknown host, 10-IV-45, N.L.H. Krauss (45-10483); 7 pupal cases (2 slides), *Pithecellobium dulce* (Roxb.) Benth., VII, 1955, N.L.H. Krauss (5320, 55-9146). Uruapan, Michoacan, 5 pupal cases, 1 third instar larva, 2 second instar larvae (3 slides), *Citrus* leaf, 4-VI-57, Kodama (Brownsville 78623, 57-9305). Alamos, Sonora, 1 pupal case, 1 third instar larva (with 1 *T. acaciae* pupal case) (1 slide), unknown host, 19-XI-53, Alexander (Nogales 73217, 54-76). Sinaloa, 1 pupal case, 1 third instar larva (1 slide), *Tamarindus indica* L., 7-X-75, A.D. Wood (Nogales 4074, 75-12936) (USNM).

**Distribution.** Mexico (Michoacan, Morelos, Sinaloa, Sonora).

**Hosts.** Fabaceae: *Inga* sp., *Pithecellobium dulce* (Roxb.) Benth., *Tamarindus indica* L. Rutaceae: *Citrus* sp., *Ruta* sp.

**Etymology.** This species is named after the country of Mexico.

**Comments.** Although this species has large, submarginal gland tubercles, it differs from the other members of the *acaciae* group by lacking the elevated, U-shaped process with broad apparent rim around the vasiform orifice on abdominal segment VIII; minute pores on the subdorsum of the abdomen instead of large disc pores and associated porettes; and abdominal segment I without pores or with minute pores instead of disc pores and associated porettes.

The margins are mostly reflected ventrally and the true margin is difficult to study; the length and width are based on the apparent margin. The length or relative lengths of most setae are not given because the setae were partially or completely missing.

#### *Tetraleurodes pseudacaciae* Nakahara

new species (Figs. 32-35)

**Pupal case:** oval, widest at metathorax; submargin elevated, narrowed and subtruncate posterior of vasiform orifice; dorsal disc elevated, higher than submargin. Length 615-918  $\mu\text{m}$ , width 451-622  $\mu\text{m}$ . Slide mounted specimens black.

**Margin and submargin** (Figs. 32-35): Margin often reflected ventrally beneath submargin; apparent margin narrowed posteriorly, subtruncate posterior of vasiform orifice, with pair of caudal setae usually on apparent margin (Fig. 33). True margin with 6-8 teeth per 100  $\mu\text{m}$  on lateral margin (Fig. 34); teeth usually broader than long, tapering slightly to subtruncate apices. Anterior setae on 6-11th tooth from midline, 7-12  $\mu\text{m}$  long (apparently partially missing); posterior setae 14-24  $\mu\text{m}$  long (42  $\mu\text{m}$  long on 1 specimen), 14-19 teeth between setae. Submargin differentiated from dorsal disc by submarginal fold, except on head. Transverse ridges narrow, well defined, extending mesad from marginal tooth, separated by narrow, sharply defined furrows, coalesced with adjoining ridges before row of large, gland tubercles. Pale glandular area near base of each tooth (Fig. 34) (shape uncer-

tain because of reflected margin and submargin). Band of microtubercles mesad of pale glandular areas on ridges extending to about mid-width of submargin, median area of ridges with few microtubercles or relatively bare, distal margin of band clearly defined, usually with micropores with sclerotized rim. Between microtubercular band and submarginal fold with total of 17-47 oval or circular gland tubercles, 9-12  $\mu\text{m}$  in diameter, irregularly spaced in row, usually absent from head on both sides of midline and from between positions of caudal setae. Micropores sparse, about 8 between row of gland tubercles and submarginal fold. Irregular pale area present or absent distal of gland tubercles on each side of head region. Caudal setae usually on apparent margin, curved, 45-87 long, bases tuberculated, separated by 1.75-2.50 times width of vasiform orifice.

**Dorsal disc** (Figs. 32, 33): Median molting suture extending to anterior margin; transverse molting suture terminating in submarginal fold at level posterior of meso-metathoracic suture; margins of molting sutures smooth. Meso-metathoracic suture extending to subdorsum, not reaching fold; teeth occasionally present along almost entire length of suture, also in submedian furrow on metathorax arising from suture. Eyespot usually represented by small, oval, pale or dark spot or tubercle on subdorsum just anterior to cephalic line (Fig. 32A), or absent. Cephalic, prothoracic, mesothoracic and metathoracic setae with well defined bases, missing or partially missing (Figs. 32B, C,D,E); mesothoracic seta (1 seta) hairlike, length about 35  $\mu\text{m}$  long; eighth abdominal setae anterolaterad of vasiform orifice, 17-35  $\mu\text{m}$  long. Depressions, oval, submedially on head and thoracic segments; 1 on each side of abdominal segments I-VIII bordered by teeth confined to area of depressions (Fig. 32F) or teeth extending across segment to subdorsum along segmental lines. Disc pores about 2.5  $\mu\text{m}$  in diameter and associated porettes distributed as follows on each side: 2-3 subdorsally on head near submarginal fold, 2 or 3 posterior of cephalic seta; prothorax with 0-2 submedially, 2 subdorsally near submarginal fold; mesothorax with 1 or 2 submedially, 2 subdorsally laterad of seta; metathorax with 2 subdorsally along meso-metathoracic suture; abdominal segments I-VII each with 1 submedially, occasionally 2, 5-6 subdorsally, and VIII with 2 laterad of elevated area. Dorsal disc of abdomen elevated; intersegmental lines well developed, extending into subdorsum, intersegmental line of

VII-VIII extending to submarginal fold, separating VIII from anterior segments (Fig. 33A); median area of II-VII subequal in lengths. Median tubercle centrally on I, posteriorly on III-IV or V, or absent. Vasiform orifice subcordate, 38-50  $\mu\text{m}$  long, 40-50  $\mu\text{m}$  wide, on strongly elevated, U-shaped section of segment VIII posterior of eighth abdominal setae that protrudes slightly over fold (Fig. 33); orifice about its length from caudal margin; bottom of orifice open in anterior 2/3. Operculum subcordate, anterior margin truncate, apex entire, 33-42  $\mu\text{m}$  long, 35-45  $\mu\text{m}$  wide, completely or almost completely filling orifice. Lingula hidden by operculum, distal 1/2 spinulose, enlarged.

**Venter** (Fig. 32): Without distinct dermal pattern. Thoracic and abdominal tracheal folds distinct, widened mesally on subventer, narrowed on submargin, thoracic ones with spinules. Antennae almost extending to anterior spiracles. Legs with microseta on mesal base of mesothoracic and metathoracic legs in lateral margin of spinule band; 1 distal microseta and 1 micropore on all legs. Band of spinules mesad of legs and laterad of mouthparts. Adhesive sac well developed. Abdominal spiracle laterad and aligned with anterior part of vasiform orifice. Eighth abdominal setae anterior to position of vasiform orifice.

**Third instar larva** (Fig. 35): Similar in shape to pupal case but smaller: Length 451-603  $\mu\text{m}$ , width 315-428  $\mu\text{m}$ ; dorsum sclerotized, black.

**Margin and submargin:** Marginal teeth 9-11 per 100  $\mu\text{m}$  on lateral margin, usually broader than long, slightly tapering to subtruncate apices. Anterior setae slender, slightly longer than teeth; posterior setae slightly shorter than length of operculum, 12-17 teeth between setae. Submarginal transverse ridges and furrows in distal 1/2 of submargin; microtubercles on ridges in narrow band; pale glandular areas at bases of marginal teeth; submargin usually without gland tubercles, occasionally with 1 and rarely with 2. Micropore in each furrow between pale glandular areas; 1 micropore each on several ridges in microtubercular band. Caudal setae usually well developed, slightly longer to 2 times longer than length of operculum, separated by distance greater than width of vasiform orifice.

**Dorsal disc:** Cephalic, prothoracic, mesothoracic and metathoracic setae short, occasionally bases of 1 or 2 setae not sclerotized; eighth abdominal setae

anterolaterad of vasiform orifice. Disc pores 2.0-3.5  $\mu\text{m}$  in diameter and associated porettes distributed on each side as follows: 1, rarely 2, subdorsally, 1 posterior of cephalic seta on head; mesothorax with 1 cephalad or laterad of seta, 0-1 subdorsally; metathorax with 1 laterad of seta, 1 subdorsally; abdominal segments I and IV-V each with 1 submedially, rarely on III, VI-VIII each with 1 subdorsally. Abdominal rachis well developed, median areas of II-VII subequal in lengths. Median tubercles on III-IV or absent. Vasiform orifice subcordate, slightly wider than long, on U-shaped posterior elevation of VIII, apparent rim of orifice wide, rather broad; orifice anterior to caudal margin by less than its length. Operculum completely filling orifice, subcordate, slightly wider than long. Lingula hidden by operculum; distal half spinulose, forming oval knob.

**Second instar larva** (based on poor specimen): Similar in shape as third larva but smaller. Dorsum sclerotized, black.

**Margin and submargin:** Marginal teeth associated with submarginal ridges. Anterior setae not seen; posterior setae separated by 12 teeth. Distal part of submargin dissected by transverse ridges and narrow furrows. Gland tubercles absent. Caudal setae on submargin, with tuberculated bases, wider apart than width of vasiform orifice.

**Dorsal disc:** Cephalic, prothoracic, mesothoracic, metathoracic and eighth abdominal setae short; bases of setae on cephalothorax less distinct than disc pores. Disc pores and associated porettes distributed as follows on each side: 1 laterad of each cephalic, mesothoracic and metathoracic setae, 1 each subdorsally on abdominal segments IV-V and 1 laterad of vasiform orifice. Vasiform orifice subcordate, on U-shaped elevation of VIII. Operculum subcordate, wider than long, apex entire, completely filling orifice.

**First instar larva:** Not seen.

**Type material.** Holotype pupal case with 22 paratypes (7 pupal cases, 13 third instar larvae, 1 second instar larva) on slide labeled; Port-Au-Prince, Haiti, on leaves of *Cassia mexicana*, 20-X-27, G.N. Wolcott (USNM). Other paratypes: 8 pupal cases and 6 third instar larvae (2 slides) with same data as holotype (USNM). DOMINICAN REPUBLIC: 10 pupal cases (1 slide), *Guaiacum officinale* L., 8-

XII-76, A.I. Mercado (77-723) (USNM). JAMAICA: Kingston, 5 pupal cases (1 slide), *Brya* leaves, 27-VII-50, Mills (50-11124) (USNM); 3 pupal cases (3 slides), *Brya ebenus* (L.) DC., 18-V-70, K. Heinze (Heinze 209) (NHM); 3 pupal cases (3 slides), *Brya ebenus*, 20-V-70. K. Heinze (Heinze 206) (NHM).

**Distribution.** Dominican Republic, Jamaica, Puerto Rico.

**Hosts.** Fabaceae: *Brya ebenus* (L.) DC., *Brya* sp., *Cassia mexicana*. Zygophyllaceae: *Guaiacum officinale* L.

**Etymology.** Specific epithet is a combination of Greek prefix "Pseudo" (false) and specific name *acaciae*. This new species is almost identical to *T. acaciae* and is often mistaken for it.

**Comments.** Of the seven species in the *acaciae* group, this is closest to *T. acaciae*. It differs principally by having a pair of submedial setae on the prothorax which is lacking in *T. acaciae* and other members of the group.

### *Tetraleurodes tuberculosa* Nakahara

new species (Figs. 36-38)

**Pupal case:** elongate oval, anterior and posterior margins broadly rounded; dorsum elevated, subdorsum partially overlapping submargin. Measurements of apparent margin: Length about 809  $\mu\text{m}$ , width about 521  $\mu\text{m}$ . Slide mounted specimen black.

**Margin and submargin** (Figs. 37, 38): True margin usually reflected beneath submargin; marginal teeth 8-9 per 100  $\mu\text{m}$  at lateral margin, broader than long, apically subtruncate or rounded, margins denticulate (Fig. 38A); minute tooth or narrow membranous area between teeth; apparent margin lobed or dentate. Anterior and posterior setae missing. Submargin differentiated from dorsal disc by fold, except absent from anterior part of head. Submargin with transverse ridges and narrow furrows; each ridge usually associated with a marginal tooth, coalescing with adjoining ridges mesadly (Fig. 38C). V- or U-shaped, pale glandular area at base of each tooth, distal ends towards margin, not terminating in furrows (Fig. 38B). Micropores present or absent near bases of pale glandular areas. Band of microtubercles on transverse ridges,

about 1/4 width of submargin, mesad of pale glandular areas, not extending to row of gland tubercles (Fig. 38C). Total of 51-56 oval or circular gland tubercles, 9-12  $\mu\text{m}$  in diameter, in irregularly spaced row around body. 2 small setae on each side of thorax between gland tubercles and microtubercular band (Fig. 36E). Caudal setae on proximal 1/2 of submargin, hairlike, length 14-17  $\mu\text{m}$  long, shorter than operculum, separated by about 2.4 times width of vasiform orifice (Fig. 37). Proximal 1/2 of submargin partially covered by reflected subdorsum.

**Dorsal disc** (Figs. 36, 38): Subdorsum reflected laterally and folded over proximal 1/2 of submargin. Median molting suture extending to anterior margin; transverse suture extending to submarginal fold; margins of molting sutures smooth. Meso-metathoracic suture extending into subdorsum, not reaching submarginal fold. Eyespot on subdorsum, small, elongate oval longitudinally (Fig. 36A). Cephalic, mesothoracic and metathoracic submedial setae missing, represented by their non-tuberculated bases (Fig. 36B-D); eighth abdominal seta anterolaterad of vasiform orifice. Depressions on head, prothorax (Fig. 36F) and mesothorax; submedial depressions on abdomen poorly indicated (Figs. 36F, 38E). Disc pores 2.3-3.5  $\mu\text{m}$  in diameter or smaller and associated porettes distributed on each side as follows: 4-6 submedially and subdorsally on head; prothorax with 1 submedially or subdorsally; mesothorax with 2 subdorsally, 1 submedially; metathorax with 2 subdorsally; abdominal segments I-VII each with 1 submedially, 2-3 subdorsally on III-VII (Fig. 36G), 2 laterad of vasiform orifice on VIII. Numerous small, conical teeth distributed as follows: On mesothorax in area of submedial depressions and setal base and extending to subdorsum; on margins of submedial depressions and from midline to subdorsally on metathorax; in medial-subdorsal bands along anterior 1/3 and along posterior 1/4 of abdominal segments I-VII (Fig. 38F). Subdorsal areas of cephalothorax and abdomen tuberculated (Fig. 38D). Abdomen slightly elevated, intersegmental lines well defined, extending into subdorsum, not reaching submarginal fold; segment VIII not separated from anterior segments by complete intersegmental lines; median area of VII slightly shorter than VI. Median tubercle absent. Vasiform orifice subcordate, 35-38  $\mu\text{m}$  long, 35  $\mu\text{m}$  wide, on oval, elevated area on VIII, with apparent wide rim about 1/3 as wide as orifice, anterior of caudal margin by about its length (Fig. 37B). Operculum subcordate, 31-33

$\mu\text{m}$  long, 33  $\mu\text{m}$  wide, almost completely filling orifice (Fig. 37A). Lingula hidden by operculum, spatulate; apical 1/2 enlarged into oval knob, spinulose.

**Venter** (Fig. 36): Without distinct dermal pattern. Antennae reaching anterior spiracle. Thoracic and abdominal tracheal folds indistinct. Meso- and metathoracic legs each with 1 basal microseta; each leg with distal microseta and micropore. Minute spinules mesad of legs. Adhesive sac well developed. Eighth abdominal setae short, hairlike, anterior to position of vasiform orifice.

**Third, second and first instar larvae:** Not available.

**Type Material.** Holotype pupal case on slide with 1 paratype pupal case; stem of unident. plant, El Paso Co., Texas, 27-VI-56, J.W. Green (El Paso 55091, 56-7602) (USNM).

**Distribution and host:** Same as type material.

**Etymology.** Specific epithet derived from Latin "tuberculum" (lumpy) for the tuberculated appearance of the dorsum.

**Comments.** This species and *caulicola* new species, which inhabit the arid areas of southwestern United States and adjoining areas of Mexico, infest the stems. The morphological characters to differentiate these two species are discussed under *T. caulicola*.

## Descriptions of Miscellaneous Species

### *Tetraleurodes bidentatus* Sampson and Drews (Figs. 39-41)

*Tetraleurodes bidentatus* Sampson and Drews 1941:172; Mound and Halsey 1978:196.

**Pupal case:** oval, broadly rounded on head, widest at metathorax and narrowed caudally. Length 807  $\mu\text{m}$ , width 617  $\mu\text{m}$ . Slide mounted specimen brown (natural color unknown).

**Margin and submargin** (Figs. 39, 40): Marginal teeth 9 per 100  $\mu\text{m}$  on lateral margin, broader than long, apices usually bidentate and slightly concave

between denticles, subtruncate or blunt without denticulation, sides converging distally (Fig. 40A). Anterior marginal setae short, about 7 teeth from midline; posterior marginal setae not seen. Submargin differentiated from dorsal disc by fold. Distal 1/4-1/3 of submargin with transverse ridges extending from base of marginal teeth (Fig. 40C), and narrow transverse furrows separating ridges extending to margin between marginal teeth. Small, oval, pale glandular areas outlined by darker rims at base of each marginal teeth (Fig. 40B). Micropores sparse, a pore occasional in transverse furrow between pale glandular areas. Rather coarse microtubercles in about distal 1/2 of submargin (Fig. 40C), forming a band around body. Disc pores and associated porettes in a row between microtubercular band and submarginal fold, porettes usually proximal of disc pores (Fig. 40D). Submarginal or caudal setae not seen.

**Dorsal disc** (Fig. 39): Subdorsal ridge, irregular in outline, extending from head to near vasiform orifice. Median molting suture terminus uncertain; transverse molting suture terminating in subdorsal ridge, slightly anterior of meso-metathoracic suture; margins of sutures smooth. Meso-metathoracic suture well defined, not extending to subdorsal ridge, without teeth or tubercles. Eyespot small, oval, about 9  $\mu\text{m}$  wide, longer transversely, on edge of subdorsal ridge (Fig. 39A). Cephalic setae about 14  $\mu\text{m}$  long, closer to each other than distance between the other pairs of setae; mesothoracic setae about 14  $\mu\text{m}$  long; metathoracic setae missing (Fig. 39B), bases further apart than those of other two pairs; eighth abdominal setal bases anterolaterad of vasiform orifice (Fig. 39C), seta missing. Depressions on cephalothorax apparently obliterated by macerating treatment; submedian depressions indicated on anterior area of abdominal segments II-VII, associated with 1-2 teeth. Disc pores minute, about 2  $\mu\text{m}$  or less in diameter, and associated porettes distributed on each side as follows: 2 submedially, 1 subdorsally on head; mesothorax with 1 submedially, 2 anterolaterad of setae; metathorax with 2 anterolaterad of setae; 1 each submedially on abdominal segments I-V, those on II-V posterior of submedian depressions; 1 laterad of eighth abdominal setae; subdorsally 2 on abdominal segment III, 1 each on IV-V. Abdominal intersegmental lines poorly indicated, extending to subdorsal ridge. Vasiform orifice subcordate, about 47  $\mu\text{m}$  long, 42  $\mu\text{m}$  wide, not protruding over submarginal fold,

about 1.5 times its length from posterior margin; rim completely around orifice; bottom open in anterior part, divided from caudal part by transverse sclerotized bar, caudal part with 2 pale areas divided by longitudinal sclerotized line (Fig. 41A and B)). Operculum subrectangle, 35  $\mu\text{m}$  long, 42  $\mu\text{m}$  wide, apical margin membranous, filling 2/3 of orifice. Lingula hidden by operculum.

**Venter** (Fig. 39): Thoracic and abdominal tracheal folds present. Submargin without defined marks. Antenna short, not extending to anterior spiracle. Bases of mesothoracic and metathoracic legs with two rows of conical spinules, largest about 5  $\mu\text{m}$  long, and short band of minute spinules mesad of conical ones (Fig. 39D), prothoracic legs with few conical spinules. Adhesive sac oval, between pro- and mesothoracic legs. Minute submedian seta on each side of abdominal segment II; eighth abdominal setae about 19 long, anterolaterad of vasiform orifice.

**Material examined.** Holotype pupal case; Chivela, Oaxaca, Mexico, undetermined tree, April, 1926, G.F. Ferris (UCD 833) (UCD).

**Distribution and hosts:** Same as material examined.

**Comments.** This species is known only from the holotype. Two other specimens collected on the same day and locality as the holotype and previously labeled as paratypes are described here as *T. chivela*, new species. The difference between these two species are discussed in the comments for *T. chivela*.

The subdorsal ridge, especially on the abdomen and the intersegmental line between the abdominal tergites I and II as shown in the illustration, probably are artifacts caused by the overtreatment of the specimen.

***Tetraleurodes chivela* Nakahara**  
new species (Figs. 42-46)

**Pupal case:** broadly oval. Measurements of apparent margin: Length 710  $\mu\text{m}$ , width 553  $\mu\text{m}$ . Slide mounted specimen dark brown (natural color unknown).

**Margin and submargin** (Figs. 42-44): Margin and part of submargin reflected (Fig. 42). Marginal



teeth 10-11 per 100  $\mu\text{m}$  on lateral margin, as wide as long or slightly wider than long, apices truncate, slightly concave or denticulate, sides parallel, slightly convex or medially concave (Fig. 43A). Anterior marginal seta on 9-10th tooth from midline (broken or missing); posterior marginal setae on 14-15 teeth from midline (broken or missing). Submargin completely differentiated from dorsal disc by submarginal fold. Transverse ridges separated by narrow furrows, each ridge extending mesad from base of marginal tooth (Fig. 43D), may be subdivided into two ridges with microtubercles. Small, oval, pale glandular area on transverse ridge near base of each marginal tooth (Fig. 43B), often a median, low, broad microtubercle between glandular area and base of marginal tooth. Band of microtubercles on transverse ridges, distal margin of band well defined with numerous microtubercles, fewer proximally. Micropore in each transverse furrow aligned with distal margin of microtubercular band (Fig. 43C). Proximal area of submargin without microtubercles, with single row of disc pores, about 2  $\mu\text{m}$  in diameter, and associated porettes around body along fold (Fig. 43E). Caudal setae (partially missing or completely missing) closer to each other than width of vasiform orifice (Fig. 44A), on proximal part.

**Dorsal disc** (Figs. 42, 44): Derm relatively smooth. Median molting suture extending to anterior margin; transverse molting suture extending to submarginal fold near level of meso-metathoracic suture; margins of molting sutures smooth. Meso-metathorax suture extending to subdorsal areas, not reaching submarginal fold, without teeth; submedian furrow on metathorax absent. Eyespot small, oval, about 7  $\mu\text{m}$  wide, longer longitudinally, on transverse fold between positions of submarginal fold and cephalic seta (Fig. 42A). Cephalic, mesothoracic and metathoracic setae on small tuberculated bases; cephalic setae about 19  $\mu\text{m}$  long, closer to each other than distance between other two setae; meso- and metathoracic setae partially or completely missing; eighth abdominal setae about 19  $\mu\text{m}$  long, anterolaterad and close to vasiform orifice, on small tuberculated base. Depressions on head and mesothorax (Fig. 42B); absent or poorly defined submedially on abdominal segments I-VII, indicated by 3-5 teeth of various sizes on anterior part of segment (Fig. 42C). Disc pores in pairs, 1.5  $\mu\text{m}$  or less in size, distributed on each side as follows: 3 submedially or subdorsally on head, 1 posterior of eyespot; mesothorax with 1 submedially;

metathorax with 2 subdorsally along meso-metathoracic suture; abdominal segments I-VII each with 1 submedially or absent from IV and VI, 1 laterad of eighth abdominal seta, 1 each subdorsally on III-V. Abdomen slightly elevated medially, with well defined segmental lines not extending to submarginal fold; median area of segments II-VII subequal in length. Vasiform orifice subcordate, about 33  $\mu\text{m}$  long, 28  $\mu\text{m}$  wide, on slightly elevated caudal part of segment VIII, not protruding over submarginal fold, about 4 times its length from apparent caudal margin; rim not complete anteriorly (Fig. 44); bottom almost completely open. Operculum subcordate, apex entire, about 33  $\mu\text{m}$  long, 28  $\mu\text{m}$  wide, completely filling orifice. Lingula hidden by operculum.

**Venter** (Figs. 42, 45, 46): Thoracic and abdominal tracheal folds well defined (Figs. 42E, 45A). Submargin completely sculptured with irregular or oval raised areas (Fig. 46B). Numerous spinules completely around body in subventral-submedial band, bordering mouthparts, ones mesad of legs fewer and larger than those laterad of legs (Figs. 42D, 45B). Adhesive sac oval, mesad of prothoracic legs. Mesothoracic and metathoracic legs each with basal microseta along border of mediad spinules, and 1 subdistal and 1 distal microseta. Antenna extending to anterior spiracle. Eighth abdominal setae about 24  $\mu\text{m}$  long, anterolaterad of vasiform orifice.

**First to third instar larvae:** not available.

**Type material.** Holotype pupal case and 1 paratype pupal case; Chivela, Oaxaca, Mexico, April, 1926, G.F. Ferris (USNM). Paratypes: MEXICO: 2 paratype pupal cases (1 slide), *Chamaedorea* sp., 16-XI-76, D. Johnston (San Antonio 9749; 77-6938) (USNM).

**Distribution.** Mexico (Oaxaca).

**Hosts.** Arecaceae: *Chamaedorea* sp.; unknown host.

**Etymology.** Species is named after Chivela, Mexico, the type locality.

**Comments.** The types from Chivela were originally labeled paratypes of *T. bidentatus* Sampson and Drews, a species also collected at Chivela on the same date. Both species have cephalic, mesotho-

racic and metathoracic setae. *Tetraleurodes chivela* has a subventral band of spinules completely around the body and irregular or oval raised areas on the venter of the submargin; whereas, *T. bidentatus* has only a narrow band of spinules on the mesal base of the legs and the irregular or oval raised areas are absent from the venter of the submargin.

***Tetraleurodes confusa* Nakahara**

new species (Figs. 47-50, 54)

**Pupal case:** oval, broadly rounded anteriorly and posteriorly, widest at transverse molting suture; submargin almost vertical, dorsal disc elevated. Length 946-1103  $\mu\text{m}$ , width 678-848  $\mu\text{m}$ . Black, broad fringe of white, flocculent, filamentous wax, narrower to wider than width of case; dorsum with dusting and patches of white, flocculent wax (Fig. 54).

**Margin and submargin** (Figs. 47, 49): Marginal teeth 8-9 in each 100  $\mu\text{m}$ ; teeth about as broad as long, sides converging to arched apex; with close-set series of short ridges and alternating paler marginal areas, giving striped or dentate appearance. Anterior marginal setae 17-26  $\mu\text{m}$  long, usually 24-26  $\mu\text{m}$  long, on 6-12th tooth from midline; posterior marginal setae 38-50  $\mu\text{m}$  long, separated usually by 20-29 teeth. Submargin differentiated entirely from dorsal disc by fold. Submarginal transverse ridges separated usually by indistinct furrows (Fig. 49B); each ridge extending mesad from base of a marginal tooth; furrows 1/2 as wide to about as wide as ridges, narrowed distally between membranous pale areas and to margin between teeth. A narrow, V-shaped glandular pale area on each ridge at base of each marginal tooth, distal arms of glandular pale area terminating before transverse furrow (Fig. 49C). Micropore in transverse furrow between or near distal ends of membranous pale areas. Numerous microtubercles in a wide band completely around body mesad of V-shaped membranous pale area (Fig. 49B); microtubercles in transverse furrows subequal in size to those on ridges. Area between microtubercular band and submarginal fold without microtubercles, narrower than microtubercular band; with disc pores subequal to microtubercles, in 1 or 2, occasionally 3 rows, occasional disc pores near or in microtubercular band (Fig. 49A). Caudal setae in microtubercular band, 90-118  $\mu\text{m}$  long.

**Dorsal disc** (Fig. 47): Median molting suture extending from transverse molting suture to anterior margin. Transverse molting suture extending obliquely from midpoint caudally, and broadly recurved anterolaterally to slightly developed subdorsal longitudinal ridge at about level of metathoracic setae. Minute notches along longitudinal molting suture on head to metathorax (Fig. 48) and on transverse suture. Meso- metathorax suture not extending to submarginal fold; margins of suture strongly sclerotized, without small tubercles. Eyespots oval, near or touching submarginal fold. Cephalic setae absent; meso- and metathoracic setae 35-59  $\mu\text{m}$  long, on enlarged, tuberculate bases; eighth abdominal setae 94-136  $\mu\text{m}$  long, on lateral part of oval tubercles anterolaterad of vasiform orifice (cf. Fig. 51B). Depressions submedially on head and mesothorax; 1 submedian depression on each side of abdominal segments I-VIII with irregular margins outlined by small teeth, 1 on anterior margin of abdominal segment I often less defined than those on posterior segments. Disc pores and associated porettes distributed as follows on each side of body: 2-3 subdorsally on head; prothorax with 5-8 extending from near median molting suture to near eyespot; mesothorax with 1-2 submedially, 2-4 subdorsally laterad of setae; metathorax with 1 laterad of metathoracic seta, 2-4 along meso-metathoracic suture, often 1 near distal end of transverse molting suture on or near subdorsal, longitudinal ridge; abdominal segments I-VIII each with 1 posterior of each submedian depression, occasionally segment with 2 on one side; submedian-subdorsal area of segments II-V each with 1 or 2, VI-VIII each with 1 subdorsally. Median area of abdomen between submedian depressions on segments I-VII and median area of segment VIII elevated. Segmental lines well defined in median and submedian areas, weaker laterally on subdorsum; segments subequal in length medially; elevated part of segment VIII with 2 tubercles anterior to vasiform orifice (cf. Fig. 51B). Vasiform orifice subcordate, on posterior part of segment VIII, elevated, often protruding over submarginal fold, anterior to caudal margin by 2 to 3 times its length; orifice 31-35  $\mu\text{m}$  long, 33-45  $\mu\text{m}$  wide, encircled by rim, anterior part of rim 5-7  $\mu\text{m}$  wide; inner walls vertical, smooth or with few short lines lining posterior 1/2 to 1/3 of orifice. Lingula hidden by operculum; distal 1/2 slightly wider than basal part, spinulose, spinules longer in apical part. Operculum subcordate, completely filling orifice; 26-31  $\mu\text{m}$  long, 31-33  $\mu\text{m}$  wide; usually patterned

with short, longitudinal and diagonal marks; with one apical, median notch 2.5-3.5  $\mu\text{m}$  deep (cf. Fig. 51A), and 1 to 2 minute indentations in form of short lines on each side of notch.

**Venter** (Fig. 47): Antenna short, reaching or almost reaching anterior thoracic spiracles; apically narrowed with minute spinules; setae and spines absent. Each leg with 3 minute setae at base; 2 close-set median setae by anterior margin of mouthparts; eighth abdominal setae, 33-47  $\mu\text{m}$  long. Thoracic and abdominal spiracles well developed. Thoracic and abdominal tracheal folds indicated. Adhesive sacs indistinct.

**Third instar larva:** Similar to pupa, except smaller.

**Margin and submargin** (Fig. 50): Margin dentate, teeth rounded apically, about as long as wide, 13-14 teeth in 100  $\mu\text{m}$ . Submargin with transverse ridges and furrows. V-shaped pale glandular areas on ridges at bases of marginal teeth. Submarginal microtubercular band on transverse ridges and furrows, completely around body. A row of 7-11 irregularly spaced disc pores between submarginal microtubercular band and submarginal fold. Caudal setae between submarginal fold and margin.

**Dorsal disc:** Eyespot oval, mesad of submarginal fold by about its longest diameter to less than its diameter. Cephalic and first abdominal setae absent; meso- and metathoracic setae on enlarged, tuberculated bases; eighth abdominal setae on tubercles. Submedial depressions on abdomen poorly developed. Disc pores and associated porettes distributed on each side as follows: 1 submedially occasionally on head; 1 in submedian area of prothorax; 1 anterolaterad of mesothoracic setae; 1 laterad of metathoracic setae; 1 laterad of submedian depression on abdominal segment III; 1 caudad of submedian depression on IV and VII; 1 occasionally laterad to pores on IV. Abdominal segment VII shorter than VI in median part. Operculum subcor-date, sclerotized except for spinulose apical part.

**Second, and first instar larvae:** Similar to those of *T. perseae*.

**Adult** not seen.

**Type material.** Holotype pupal case with 2 paratype pupal cases on one slide: Palm City, FL,

*Persea* sp., 9-V-79, E.W. Campbell (FSCA). Paratypes: FLORIDA: 1 pupal case, 2 third instar larvae on 3 slides with same collection data as holotype; 2 pupal cases (1 slide), oak, 4-I-18, Magnette and Sanford (Q 12221). Brandon, 3 pupal cases (3 slides), *Persea* sp., 19-II-81, J. Felty. Cocoa, 3 pupal cases (3 slides), *Persea borbonia* (L.) Spren., 1-VIII-80, R.E. Burns and W.P. Henderson; 1 pupal case (1 slide), *Persea borbonia*, 13-V-82, F.A. Smith. Fellsmere, 1 pupal case, 1 third instar larva (2 slides), *Persea palustris* (Raf.) Sarg., 24-I-83, E.W. Campbell and K. Hibbard. Ft. Pierce, 2 pupal cases (2 slides), *Persea* sp., 14-IV-80, E.W. Campbell. Gainesville, 1 pupal case, *Persea borbonia*, 27-IV-78, C. Lieberman. Lake Hamilton, 2 pupal cases (1 slide), hammock bay, 8-XI-18, Nanny and Baoson. Longwood, 5 pupal cases (1 slide), *Cinnamomum* sp., 16-VI-60, C. Youtsey. Miami, 2 third instar larvae (1 slide), *Persea palustris*, 26-II-61, D. Palmer; 1 pupal case, *Persea* sp., 8-XI-82, L. Kornfeind. Orchid Island, 1 pupal case, *Persea borbonia*, 6-VI-80, S.P. Beidler. Ormond Beach, 3 pupal cases (1 slide), *Magnolia virginiana* (L.), 7-VIII-59, Smith and Roberts; 2 pupal cases, 1 third instar larva (2 slides), *Gordonia lasianthus* (L.) Ellis, 11-III-80, J. N. Pott; 6 pupal cases, 1 third instar larva (7 slides), *Gordonia lasianthus*, 4-VIII-80, J.N. Pott. Ochopee, 6 pupal cases, 1 third, 7 second and 8 first instar larvae (3 slides), unknown host, 17-XII-49, L.M. Russell. Port St. Lucie, 3 pupal cases (3 slides), *Persea* sp., 6-III-79, E.W. Campbell; 4 third instar larvae (4 slides), *Persea* sp., 7-III-79, E.W. Campbell; 3 pupal cases (3 slides), *Persea borbonia*, 20-II-80, E.W. Campbell. St. Cloud, 1 pupal case, *Persea* sp., 22-XI-82, V.G. Brown. Steinhatchee, 3 pupal cases (3 slides), *Magnolia* sp., 19-III-79, Q. Anglin. Stuart, 1 pupal case, 1 third instar larva (2 slides), *Persea* sp., 25-IV-61, E. Campbell; 5 pupal cases (5 slides), *Persea borbonia*, 30-I-78, E.W. Campbell; 2 pupal cases (2 slides), *Persea borbonia*, 4-XII-78; 3 pupal cases (3 slides), *Persea borbonia*, 14-V-83, G. Wheeler. Vero Beach, 1 pupal case, *Persea* sp., 24-IV-80, R. Kendrick. White City, 2 pupal cases, *Persea borbonia*, 30-V-80, E.W. Campbell. MISSISSIPPI: Bay St. Louis, 8 pupal cases (2 slides), *Persea palustris*, 27-I-44, Mayer (44-5186). PUERTO RICO: Sabana Grande-San German Rd., 2 pupal cases (1 slide), *Nectandra coriacea* (Sw.) Griseb., 14-III-52, Martorell & Russell. Paratypes in CDFA, FSCA, NHM, USNM. Other specimens examined on various hosts in FSCA.

**Distribution.** Puerto Rico, United States (FL, MS).

**Hosts.** Fagaceae: *Quercus* sp. Lauraceae: *Cinnamomum* sp., *Nectandra coriacea* (Sw.) Griseb., *Persea borbonia* (L.) Spreng., *P. palustris* (Raf.) Sarg., *Persea* sp. Magnoliaceae: *Magnolia virginiana* L. Theaceae: *Gordonia lasianthus* (L.) Ellis.

**Etymology.** Specific epithet derived from Latin "confusus" to indicate that the species can be easily confused with *T. perseae*.

**Comments.** The pupal case of this species is difficult to differentiate from that of its allopatric congener, *T. perseae*. It differs by having 7-9 marginal teeth in each 100  $\mu$ m, distal ends of V-shaped pale glandular areas are separated from adjoining pale area, and submarginal area between microtubercular band and submarginal fold narrower than the band and with 1 or 2 rows of disc pores as large as the microtubercles. Conversely, *T. perseae* has 9-11 marginal teeth in each 100  $\mu$ m, distal ends of V-shaped pale glandular areas almost touching adjoining pale areas; submarginal disc pores minute, smaller than microtubercles, in an irregular row about proximal 1/3 of the microtubercular band, and in another irregular row between the microtubercular band and submarginal fold. *Tetraleurodes mori* also has V-shaped, pale glandular areas at the bases of marginal teeth, submarginal microtubercular band, and well developed meso- and metathoracic setae with tuberculated base; however, the operculum does not have an apical, median notch, which is present in the other 2 species, and a cluster of submedial disc pores is present on each side of abdominal segment IV, which is lacking from the other two.

The third instar larva of *T. confusa* does not have cephalic setae, but has 1 submedial disc pore and porette caudad of submedial depression on each side of abdominal segment IV, and submarginal disc pores between the submarginal microtubercular band and submarginal fold; whereas, *T. perseae* has cephalic setae, 1 submedial pore and porette posterior of the submedial depression on each side of segments III and V, occasionally absent from III or V, and submarginal disc pores and porettes are in the proximal part of the microtubercular band.

### *Tetraleurodes perseae* Nakahara

new species (Figs. 51-53, 55)

**Pupal case:** oval, broadly rounded anteriorly and posteriorly, widest at transverse molting suture; submargin almost vertical, dorsal disc elevated; exuviae of larval stages often found adhering to dorsum (Fig. 55). Length 803-1158  $\mu$ m, width 597-930  $\mu$ m. Black, band of white, close-set, parallel strands of crystalline wax that curls over submargin to subdorsum from base of marginal teeth; dorsal disc bare except for patches of white wax on thorax.

**Margin and submargin** (Fig. 52): Marginal teeth 9-11 in each 100  $\mu$ m; teeth about as broad as long or longer than broad, sides converging to arched apex; with closely set series of short ridges and alternating paler marginal areas. Anterior marginal setae usually on 10-11th (9-14th) tooth from midline; posterior marginal setae 31-42  $\mu$ m long, separated by 21-30 teeth. Submargin differentiated entirely from dorsal disc by fold. Submarginal transverse ridges separated by transverse furrows (Fig. 52A), extending mesad from marginal teeth; furrows usually 1/4, occasionally 1/2, as wide as ridges, narrowed between V-shaped glandular pale areas to margin between teeth. V-shaped, pale glandular areas on ridges at bases of marginal teeth, their distal ends terminating at transverse furrow, almost meeting distal ends of adjoining glandular area. Micropore usually in transverse furrow between distal ends of glandular pale areas. Numerous microtubercles in wide band mesad of V-shaped glandular pale areas (Fig. 52A), those in furrows sparse, usually smaller than those on ridges. Area between microtubercular band and submarginal fold without microtubercles, as wide or wider than band. Irregular row of disc pores in proximal part of microtubercular band (Fig. 52B), another irregular row of disc pores and associated porettes between microtubercular band and submarginal fold. Caudal setae in microtubercular band, 83-130  $\mu$ m long.

**Dorsal disc** (cf. Fig. 47): Median molting suture extending from transverse molting suture to anterior margin. Transverse molting suture extending obliquely from midpoint caudally, broadly recurved anterolaterally to subdorsal longitudinal ridge at about level of metathoracic setae. Minute notches along suture partially on head to metathorax, and on transverse suture (cf. Fig. 48)). Meso-metatho-

racic suture not reaching subdorsal longitudinal ridge, with small tubercles on both margins of suture. Eyespots oval, near submarginal fold. Cephalic setae absent; meso- and metathoracic setae well developed, usually apically expanded and frayed, 52-86  $\mu\text{m}$  long, about 5  $\mu\text{m}$  thick, on enlarged tuberculate bases; eighth abdominal setae 69-111  $\mu\text{m}$  long, on lateral part of oval tubercles (Fig. 51B), anterolaterad of vasiform orifice. Depressions distributed as follows on each half of body: 2 submedian paired depressions on head, another paired depression anteromedial of mesothoracic seta; submedian depressions on abdomen with irregular margins outlined by small tubercles, 1 on anterior margin of abdominal segment I often less defined than on posterior segments, 1 each between segmental lines on II-VIII. Disc pores and porettes distributed on each side as follows: 1-3 subdorsally on head; prothorax with 5-7 extending diagonally from near median molting suture to near eyespot; mesothorax with 1-2 mesad of setae, 3-4 anterolaterad of setae; metathorax with 3-4 laterad of setae, 1-2 near distal end of transverse molting suture on subdorsal longitudinal ridge; abdominal segments I-II and VI-VIII each with 1 posterior of submedian depression, III-V each with 1-3 posterior of depression. Median area of abdomen between submedian depressions on segments I-VII and median area on segment VIII elevated. Segmental lines well defined in median and submedian areas, weaker laterally on subdorsum; segments subequal in length medially; median area of segment VIII with 2 tubercles anterior to vasiform orifice (Fig. 51B). Vasiform orifice subcordate, 31-35  $\mu\text{m}$  long, 33-40  $\mu\text{m}$  wide, on posterior part of eighth abdominal segment, elevated, often protruding over submarginal fold, anterior to caudal margin by 2-3 times its length; encircled by rim, anterior part of rim 5-7  $\mu\text{m}$  wide; inner walls vertical, smooth or with few short lines on posterior 1/2 to 2/3 of orifice. Operculum subcordate (Fig. 51), completely filling orifice; 26-33  $\mu\text{m}$  long, 31-38 wide; usually with pattern of longitudinal and diagonal marks; with median, apical notch (Fig. 51A), 2.5-3.5  $\mu\text{m}$  deep, and 1-2 minute indentations in form of short lines on each side of notch. Lingula hidden by operculum; distal half slightly wider than basal part, spinulose, spinules on apical part longer.

**Venter** (cf. Fig. 47): Antenna short, apically narrowed with minute spinules, setae and spines absent, reaching anterior thoracic spiracles. Each leg

with 3 minute setae on base; 2 close-set median setae by anterior margin of rostrum; eighth abdominal setae 24-38  $\mu\text{m}$  long. Thoracic and abdominal spiracles well developed. Thoracic and abdominal tracheal folds indicated. Adhesive sac indistinct.

**Third instar larva:** Black; fringed with white wax. Similar to pupa, except smaller.

**Margin and submargin** (Fig. 53): Margin dentate, teeth curved apically, about as long as wide, 10-15 teeth in 100  $\mu\text{m}$ . Anterior marginal setae on 9-12th tooth from midline; posterior marginal setae separated by 22-24 marginal teeth. Submargin with transverse ridges and furrows. V-shaped pale glandular areas, shorter than teeth, on transverse ridges at bases of teeth. Submarginal microtubercular band on transverse ridges and in furrows, completely around body. A row of 11-12 disc pores and associated porettes, occasionally 13, irregularly spaced in proximal 1/3 of microtubercular band. Caudal setae between submarginal fold and margin.

**Dorsal disc:** Eyespot oval, mesad of submarginal fold by more than its longest diameter. Cephalic setae long; meso- and metathoracic setae apparently well developed (all setae broken); eighth abdominal setae on tubercles, anterolaterad to vasiform orifice. Abdominal segments II-VI subequal in length, VII shorter than VI. Submarginal depressions on each side as follows; 1 on mesothorax, 1 each on anterior margin of abdominal segments I-VIII. Disc pores and associated porettes distributed on each side as follows: 1 posterior and 1 posterolaterad to cephalic setae; 1 laterad of each meso- and metathoracic setae; 1 posterior to each submedian depression on abdominal segments III-V and VII, occasionally absent from III or V, 1 present or absent subdorsally on II, III and VI. Abdominal segment VII shorter than VI in median part. Operculum subcordate, sclerotized except for spinulose apical part.

**Second instar larva:** Light yellow. Similar to third instar except smaller.

**Margin and submargin:** Margin dentate, apices of teeth curved. Glandular pale areas at bases of teeth small, oval. Submargin without microtubercles or disc pores. Caudal setae, thinner than eighth abdominal setae.

**Dorsal disc:** Cephalic setae not observed; meso- and metathoracic setae extremely long, apices expanded and frayed; eighth abdominal setae laterad and in line with anterior margin of vasiform orifice. Disc pores and associated porettes distributed as follows on each side: 1 subdorsally on head and prothorax; meso- and metathorax each with 1 subdorsal and 1 submedian just laterad of setae; 1 each submedially on abdominal segments II, IV-VI, and 1 laterad of eighth abdominal seta. Vasiform orifice subcordate, less than its length from body margin. Operculum subcordate, completely filling orifice.

**First instar larva:** Light yellow. Smaller than second instar, oval.

**Margin and submargin:** Margin finely dentate; marginal and submarginal setae well developed, 6 pairs on cephalothorax, 1 pair on anterior abdominal segment and 2 pairs on caudal part of abdomen; anterior 2 pairs longest.

**Dorsal disc:** Cephalic, meso- and metathoracic setae extremely long, tapering apically; metathoracic setae reaching or surpassing posterior margin of body. Eighth abdominal setae anterolaterad of vasiform orifice, arising from tubercles. Vasiform orifice subtriangular, on triangular platelike elevation of eighth segment, protruding over submargin and reaching or almost reaching body margin. Operculum subquadrate or subcordate, filling 3/4 of vasiform orifice; with or without short, posteromedian suture about 1/3 length of operculum.

**Venter:** Antenna segmented, almost as long as mouthparts. Legs developed, segmented. Ventral setae: pair of close-set, short, median setae at anterior margin of mouthparts; 2 short setae at bases of meso- and metathoracic legs; eighth abdominal seta short, anterior to position of vasiform orifice.

**Type material.** Holotype pupal case and 3 paratype pupal cases on one slide; San Diego, San Diego Co., California, VIII-5-82, avocado, Ginsky & Blocker (no. 82J8-24 CDFA) (USNM). Paratypes: EL SALVADOR: 2 pupal cases (1 slide), 3 third instar larvae (2 slides), *Persea americana* Miller, III-31-71, J.R. Davidson (Los Angeles 007232). MEXICO: 3 pupal cases, 5 third instar larvae (1 slide), *Persea*

*americana*, VI-26-76, D. Walters (JFKIA 023284, 76-10872); 1 pupa, 3 third instar larvae (1 slide), *Persea americana*, VI-24-78, P. Gomes (San Diego 5169); 2 pupal cases, *Persea* sp., 21-VIII-80, G. Kluzik (Nogales 587); 1 pupal case, 1 third instar larva (1 slide), *Laurus nobilis* L., VI-1-82, D. Yeutter (Los Angeles 31183); 5 pupal cases, 2 third instar larvae (1 slide), *Persea americana*, IX-10-83, D. DeWeese (Miami 043612); 1 pupal case, 1 third instar larva (1 slide), *Persea americana*, 13-IX-83, J. Mintz (Miami 43662); 1 pupal case, 4 third instar larvae, *Persea americana*, 27-VIII-86, K. Bryan (Chicago 11520, 86-10351); 5 pupal cases (1 slide), *Persea* sp., 17-V-88, W. Carlo (Miami 76979, 88-09189); 6 pupal cases (1 slide), *Persea* sp., 26-III-92, H. Grieb (El Paso 041204, 92-04171). Mexico City, 5 pupal cases (1 slide), *Persea* sp., II-17-75, S. Kendall (Laredo 008753). Durango, 1 pupal case, *Persea* sp., 17-I-80, Y. Medrano (El Paso 10820). Puebla, 3 pupal cases (1 slide), 3 third instar larvae (1 slide), *Persea* sp., II-6-69, C.R. Kodama (Laredo 69703, 69-2947). San Luis Potosi, 4 pupal cases, 1 third instar larva (1 slide), *Persea americana*, 23-I-67, Main (Eagle Pass 13843, 67-4506). Uruapan, Michoacan, 7 pupal cases (2 slides), avocado, VIII-13-82, M. Rose. Vera Cruz, 4 pupal cases, 1 third instar larva (1 slide), *Litsea* sp., VI-12-72, D.W. Gutierrez (Laredo 004539, 72-17765). UNITED STATES: CALIFORNIA: 17 pupal cases on 8 slides, 6 third instar larvae on 2 of the 8 slides, with same collection data as holotype; Bonita, San Diego Co., 2 third, 7 second, and 4 first instar larvae (2 slides), avocado, XII-8-82, Hinton. Paratypes deposited in CDFA, FSCA, NHM, USNM.

**Distribution.** El Salvador, Mexico (D.F., Durango, Michoacan, Puebla, San Luis Potosi, Vera Cruz), United States (CA).

**Hosts.** Lauraceae: *Laurus nobilis* L., *Litsea* sp., *Persea* sp., *P. americana* Miller, *Umbellularia californica* (Hook. and Arn.) Nutt.

**Etymology.** Specific epithet derived from generic name of its common host, *Persea americana*.

**Comments.** The differences between its allopatric congener, *T. confusa*, is discussed under *T. confusa*. This species and *T. confusa* thus far are the only species in *Tetraleurodes* with a posterior median notch on the operculum.

Since the species was first found in the United States in September, 1982, in an avocado orchard in

San Diego Co., California, it has dispersed northward to Santa Barbara and Ventura Counties in California and is infesting commercial avocado orchards. According to Rose and Woolley (1984), *Cales noacki* Howard, a hymenopterous parasitoid previously introduced into California to control *Aleurothrixus floccosus* (Maskell), the woolly whitefly, effectively controlled *T. perseeae*. When a pesticide used to control another pest in avocado orchards eliminated its natural enemies in Uruapan, Mexico, it became a pest (Rose and Woolley, 1984).

***Tetraleurodes pringlei* Quaintance and Baker (Figs. 56-58)**

*Tetraleurodes pringlei* Quaintance and Baker 1937:617; Sampson and Drews 1941:176; Mound and Halsey 1978:202.

**Pupal case:** elliptical in shape, rounded apically and caudally; submargin almost vertically elevated from margin into submarginal ridge around case; dorsal disc elevated along molting sutures and a rounded, median longitudinal ridge on abdomen. Length 912 (1156)  $\mu\text{m}$ , width 645 (884)  $\mu\text{m}$ . Dorsum black; "...appears as a shiny black object surrounded by a lateral fringe of white wax. The fringe consists of white waxy filaments as long as the width of the case and overlaid with flocculent white wax" (Quaintance and Baker 1937).

**Margin and submargin** (Figs. 56, 57): True margin slightly reflected; marginal teeth 12 (11-12) per 100  $\mu\text{m}$  on lateral margin, slightly wider than long to slightly longer than wide, apically subtruncate or convex, close set. Anterior setae 14 (19)  $\mu\text{m}$  long on 9th (8-10) tooth from midline; posterior setae about 42  $\mu\text{m}$  long, about 32 teeth between setae. Submargin differentiated completely from disc by fold. Transverse ridges extending mesad from base of marginal teeth, separated by narrow transverse furrows, terminating in proximal 1/5 of submargin into close-set transverse striae. V or U-shaped pale glandular area with similarly shaped darker margins on each ridge mesad of marginal tooth, distal arms of pale area separated from neighboring pale areas by transverse furrow (Fig. 57A). Microtubercles on ridges forming wide band extending from base of pale areas to near submarginal fold; microtubercles just mesad of each pale area minute, closely set (Fig. 57B), remainder of band with larger microtubercles (Fig. 57C). A pore occasionally in transverse furrow

aligned between distal arms of pale glandular areas; other pores sparse, irregularly spaced, on transverse ridges located on or near border between minute and larger microtubercles; an irregular row of pores in proximal 1/3 of submargin (Fig. 57D). Caudal setae 52 (40-47)  $\mu\text{m}$  long, on proximal part of microtubercular band, separated by about the width of vasiform orifice (Fig. 58).

**Dorsal disc** (Figs. 56, 58): Median molting suture extending to anterior margin, margins of suture with series of short lines on head to mesothoracic-metathoracic segmental line; transverse suture terminating subdorsally at about level of meso-metathoracic segmental line, margins of suture smooth. Meso-metathorax suture terminating laterally at slightly developed subdorsal ridges. Eyespot on head subcircular or longitudinally oval (Fig. 56A), 1-3 times its diameter from submarginal fold. Cephalic setae absent, meso- and metathoracic setae on tuberculated bases (setae completely or partially missing); eighth abdominal setae about 90  $\mu\text{m}$  long, on two oval tubercles anterior to vasiform orifice, setae laterad of anterior rim of orifice, separated by about twice width of vasiform orifice. Depressions submedially on head; submedial depressions on abdomen part of submedian, longitudinal furrow running from anterior part of segment I into segment VII, depressions indicated by few small, conical teeth. Disc pores about 2  $\mu\text{m}$  in diameter and associated porettes few, distributed on each side as follows: 2-3 subdorsally on head; prothorax with 2 submedially and 1 further laterad; mesothorax 2-3 submedially, 1 further laterad; metathorax with 2 laterad of seta; abdominal segments I, III, V and VII each with 1 submedially, 0-1 on IV, absent from II and VI; 1 each subdorsally on segments III-VIII; 7-10 minute pores laterad of vasiform orifice usually in two rows. Dorsal derm smooth, not tuberculated or granulated. Abdomen: median part elevated into longitudinal ridge, strongly delineated by submedian, longitudinal furrows (Fig. 56B); intersegmental lines dissecting longitudinal furrows, extending into subdorsum; segment VIII with median, elevated subtriangular plate-like area containing eighth abdominal setae and vasiform orifice; median part of segment VII slightly shorter than that of VI. Median tubercles absent. Vasiform orifice subtriangular, 35  $\mu\text{m}$  long, 42 (45)  $\mu\text{m}$  wide, on posterior part of subtriangular elevated plate of segment VIII, about 2.5 times its length from posterior margin (Fig. 58). Operculum subcordate, completely filling orifice, 33  $\mu\text{m}$  long 38



(40)  $\mu\text{m}$  wide. Lingula hidden by operculum, distal part spinulose, enlarged.

**Venter** (Fig. 56): Without distinct dermal pattern; fine spinules submedially and on subventer of cephalothorax, extending from mouthparts to submedial parts of anterior abdominal segments. Antenna extending to anterior spiracles. Thoracic and abdominal tracheal folds evident. Prolegs with 1 distal micropore; mesothoracic and metathoracic legs each with 1 microseta and 1 micropore distally; 1 minute seta each at mesal bases of meso- and metathoracic legs in spinule band; 1 pair of minute setae submedially on abdominal segment II; pair of setae about 24  $\mu\text{m}$  long anterior to position of vasiform orifice on abdominal segment VIII.

**Third, second and first instar larvae.** Not available.

**Material examined.** Holotype pupal case, on *Caulanthus hispites*, (collection date not given), Oaxaca, Mexico, G.C.G. Pringle (Q-8884) (USNM). Other material: Mexico, Oaxaca, 2 pupal cases (1 slide), unknown host, 3-II-64, Kaiser (Nogales 89115; 64-5458) (USNM).

**Distribution.** Mexico (Oaxaca).

**Hosts.** Cruciferae: *Caulanthus hispites*.

**Comments.** Only one slide mounted type specimen was found in the Aleyrodidae collection of the USNM. A holotype was not designated by Quaintance and Baker nor is there any indication in the original description of the number of type specimens. For these reasons, I have designated here the single slide mounted type specimen as the holotype.

The holotype has been overtreated and many morphological structures cannot be seen clearly; thus most of the redescription is based on the two identified specimens.

This species is similar to *T. fici* which also has a wide submarginal band of microtubercles, submarginal ridges extending from bases of marginal teeth to almost the submarginal fold, meso- and metathoracic submedian setae present, dorsal disc rather smooth, abdomen with median part elevated and delineated by longitudinal submedian furrows, subcordate vasiform orifice and operculum, and and tracheal folds present. It differs by lacking minute notches on the molting sutures, marginal

teeth about as long or slightly longer than wide, and ventral spinules only submedially on anterior to intermediate abdominal segments; whereas, *fici* has minute notches on the molting sutures, marginal teeth are about twice as long as wide, and spinules are present on the subventral and submedial parts of the abdomen.

### *Tetraleurodes quercicola* Nakahara

new species (Figs. 59-63)

**Pupal case:** oval. Length from apparent margin 745(625-722) $\mu\text{m}$ , true margin 838(691-803) $\mu\text{m}$ ; width from apparent margin 528(431-532) $\mu\text{m}$ , true margin 617(516-644) $\mu\text{m}$ . Slide mounted specimens black. Field characters unknown.

**Margin and submargin** (Figs. 60, 61): Margin normally reflected ventrally; marginal teeth 8-11 per 100  $\mu\text{m}$ , wider than long, variable in shape, often truncate or subtruncate at apex, laterally constricted and with or without denticles, separated from enjoining teeth by space less than width of tooth (Fig. 60A). Anteromarginal setae on 7-10 teeth from midline (setae absent or broken), posteromarginal setae thin, about 12 long, on 10-12 teeth from midline. Submarginal fold differentiating submargin from dorsal disc, except fold indistinct on head. Transverse ridges and furrows on distal 1/2 of submargin; ridges irregular in length, ridges extending to bases of marginal teeth (Fig. 61F) or tapering distally to a point and not reaching margin (Figs. 61G). Small, oval, pale glandular areas on ridges at bases of marginal teeth (Fig. 60B). Band of microtubercles on ridges, extending from oval, pale glandular areas to about midwidth of submargin, microtubercles often in longitudinal rows (Fig. 60C). Row of micropores in distal 1/4, often with additional (Fig. 60D), irregularly spaced pores just mesad of row. Disc pores 4-5  $\mu\text{m}$  in diameter and associated porettes (duplex pores) in median row around submargin (Fig. 60E), other disc pores about same size or smaller, closely associated with duplex pores or scattered between row of duplex pores and row of micropores (Fig. 60D). Often with 1-5 disc pores along submarginal fold caudad of eyespot usually in a cluster, or occasionally absent. Thoracic microsetae 2, thin, indistinct, 9-12  $\mu\text{m}$  long, aligned with row of duplex disc pores (Fig. 59A). Caudal setae indistinct, thin, about 5  $\mu\text{m}$  long, in microtubercular band on submargin,



slightly distal to row of duplex pores, separated by about width of vasiform orifice (Fig. 62A).

**Dorsal disc** (Figs. 59, 62): Subdorsal ridge extends from prothorax to anterior abdominal segments. Median molting suture extends to anterior margin, transverse molting suture extends diagonally towards subdorsal ridge, then recurved anterolaterally, terminating at about level of meso-metathoracic suture; margins of sutures smooth. Meso-metathoracic suture extends almost to subdorsal ridge, margins of suture without teeth or tubercles; a submedian furrow extends caudally from suture to median area of metathorax. Submedian setae absent from cephalothorax; eighth abdominal setae absent, apparently represented by tubercle with pale gland on posterior part of rim of vasiform orifice (Figs. 62C, 63B). Eyespot diffuse, at cephalic end of submarginal fold (Fig. 59B). Depressions submedially on head and prothorax; submedially and subdorsally on mesothorax; 1 laterad of submedian furrow on metathorax; 1 submedially on abdominal segments II-VII, margins of depressions normally with 1-3 teeth. Disc pores 4-5  $\mu\text{m}$  in diameter with associated porettes, and simple disc pores about 3  $\mu\text{m}$  in diameter distributed on each side as follows: 2-4 subdorsally on head; prothorax with 1-2 submedially and 2-4 subdorsally; mesothorax with 1-2 submedially and 2-5 subdorsally; metathorax with 1-2 submedially and 1-4 subdorsally; abdominal segments I, III-V, VII-VIII each with 1 submedially, occasionally 1 on VI or absent from one side of other segments; one or two types of disc pores subdorsally on abdomen: III with 3-6, IV with 2-3, V with 1-6, VI with 0-1, VII with 1 and VIII with 1-2. Derm with fine but distinct granules. Abdomen elevated medially into a longitudinal keel extending from segment I to lobed elevated part of segment VIII; intersegmental lines extending to subdorsum; median part of abdominal segment VII almost displaced by anterior lobed areas of segment VIII, 1/4 as long or shorter than median part of segment VI. Vasiform orifice subcordate, 38(33-42) $\mu\text{m}$  long, 38(31-40) $\mu\text{m}$  wide (Fig. 63); on subcircular or subquadrate raised area of abdominal segment VIII, 1.5 to 2.5 times its length from caudal margin; small tubercle with pale gland on posterolateral part of rim apparently representing base of eighth abdominal seta; margin of orifice with two rows of cell-like structures, outer row with 15-16 cells laterally and caudally, inner row with 4 cells laterally (Fig. 63A); 3/4 of bottom of orifice open. Operculum subcordate, about same

size as orifice, sculptured with vermiform striae (Fig. 62B). Lingula enlarged apically, clublike, spinulose, completely hidden by operculum.

**Venter** (Fig. 59): Thoracic and abdominal tracheal folds evident; minute spinules in small cluster laterad of anterior thoracic spiracle. Venter without distinct sculpture or spinules. Antenna narrowed into spinelike tip, extending to anterior spiracle. Legs each with 1 microseta and 1 micropore distally, and 1 microseta on base. Adhesive sac oval. Eighth abdominal setae laterad of anterior part of vasiform orifice.

**First, second and third instar larvae and adults.** Not seen.

**Type material.** Holotype pupal case and 1 paratype pupal case on same slide; Zion National Park, Utah, N.E. from tunnels, Mt. Carmel Highway, evergreen oak, 16-IV-63, G.F. Knowlton (63-8124) (USNM). Paratype pupal cases: MEXICO: 4 (1 slide), native oak, 26-IV-51, Ehringer, at Nogales (51-3991); 1, *Quercus*, 3-VI-66, W.E. Jackson, at Nogales (66-17953). Magdalena, Sonora, 4 (1 slide), oak leaves, 25-IX-49, Allen, at Nogales (49-16839). UNITED STATES: ARIZONA: near Pena Blanca, 1, *Quercus emoryi* J.TCRR., 23-XI-66, G. Ehni (66-30787). Nogales, 2 (1 slide), native oak, 17-IV-48, Ehringer (48-5948). Oak Creek Canyon, 2 (1 slide), *Quercus gambelli* E.L. Green, 11-X-72, T.F. Halstead (72-16831). Sycamore Canyon, Ruby, 6 (1 slide), oak leaves, 13-VII-49, (49-12659), 1, *Quercus*, 6-IV-66, Kaiser (66-10952). CALIFORNIA: San Bernardino Co., New York Mts., 2 (1 slide), *Quercus turbinella* Nutt., 25-IX-48, J.M. Tucker (52-13377). Mt. Wilson, 3 (2 slides), on oak, VIII-08, Woglum. UTAH: Washington Co., Dixie State Park, 2 (2 slides), evergreen oak, 11-VII-63, Knowlton and Pease (63-16134); 5 (2 slides), evergreen oak, 9-VI-64, G.F. Knowlton (64-14221); 13 (5 slides), evergreen oak, 1-IV-66, G.F. Knowlton; 3 (1 slide), evergreen oak, 24-IV-68, G.F. Knowlton and D.W. Davis. Leeds, 1, evergreen oak, 31-III-66, G.F. Knowlton. Pintura, 1, evergreen oak, 15-IV-63, Knowlton (63-12497). Snow Canyon, 2 (1 slide), *Quercus*, 1-IV-66, G.F. Knowlton; 1, 24-IV-68, G.F. Knowlton and D.W. Davis. Zion National Park, 2, evergreen oak, 1-IV-66, G.F. Knowlton. Paratypes deposited in CDFA, FSCA, NHM, USNM.

**Distribution.** Mexico (Sonora), United States (AZ, CA, NM, UT).

**Hosts.** Fagaceae: *Quercus* sp., *Q. emoryi* J.TCRR., *Q. gambelli* Nutt., *Q. turbinella* E.L. Green, evergreen oak.

**Etymology.** Specific epithet is a combination of generic name of oak, *Quercus*, and Latin "cola" (inhabitant). This species is known only from *Quercus* spp.

**Comments.** This species differs from *T. ursorum* by the 2 rows of cell-like structures in the vasiform orifice, the outer row with 15-16 cells, inner row with 4 cells, dorsal derm with fine but distinct granules, margins of median molting suture smooth, and caudal setae indistinct, about 5 long, on about median part of submargin. In contrast, *T. ursorum* has only 4 cell-like structures laterally in the vasiform orifice, dorsal derm with fine but faintly indicated granules, margins of median molting suture with series of short lines, and caudal setae well developed, 14-54 long, in the distal 1/4 of the submargin.

#### *Tetraleurodes ursorum* (Cockerell)

(Figs. 64-71)

*Aleyrodes ursorum* Cockerell 1910:171.

*Tetraleurodes ursorum*: Quaintance & Baker 1914:108; Baker 1937:616; Sampson & Drews 1941:178; Mound & Halsey 1978:204.

**Pupal case:** oval, usually narrower at caudal end than head to almost rotund; submargin strongly elevated, almost vertical, forming ridge-like rim around body; dorsal disc with subdorsal, longitudinal ridge elevated on thorax and anterior abdominal segments; transverse ridge following transverse molting suture, extending to subdorsal ridge; longitudinal median ridge on abdomen extending posteriorly from transverse ridge; rachis slightly elevated. Length of slide mounted specimens (flattened) from *Arctostaphylos* 741-920  $\mu\text{m}$  long, 586-741  $\mu\text{m}$  wide, slide specimens from other hosts variously mounted, 609-876  $\mu\text{m}$  long, 400-700  $\mu\text{m}$  wide. Shiny black or shiny dark reddish brown; marginal fringe of white wax, less than width of submargin; dorsal wax absent.

**Margin and submargin** (Figs. 65, 66): Marginal teeth 9-12 per 100  $\mu\text{m}$  on lateral margin, longer than wide, apices subtruncate to truncate, distal 3/5 of sides straight, widest in basal 2/5 with usually

1-2 denticles; distance between teeth 1/3-1/2 width of teeth (Fig. 66A). Anterior marginal setae slender, 12-21  $\mu\text{m}$  long, on 10-12th tooth from midline; posterior marginal setae 17-28  $\mu\text{m}$  long, 21-33 teeth between setae. Transverse ridges and narrow furrows on submargin; ridges irregular in lengths and width, each ridge extending from marginal tooth or extending from 2 marginal teeth and joined into one ridge, or tapering distally to a point and not reaching margin (Fig. 66C, D). Small, oval pale glandular areas at bases of teeth on transverse ridges (Fig. 66B). Microtubercles fine, considerably smaller than disc pores, in a band on 1/2 to 3/5 of submargin; in 7-10 longitudinal rows on ridges, and few scattered on ridges (Fig. 66E). Row of micropores in distal 1/10-1/5 of submargin, aligned with 3rd or 4th distal rows of microtubercles. Disc pores, about 3  $\mu\text{m}$  in diameter, and closely associated porettes in a median row around submargin (Fig. 66G), other disc pores usually without porettes distal of row on head, thorax and anterior abdominal segments (Fig. 66F); occasional pores between row and submarginal fold; 1 or cluster of 2-4 disc pores in submarginal fold on prothorax or mesothorax. Submarginal seta 1 on each side of thorax, variable in length, 5-31  $\mu\text{m}$  long (Fig. 65A). Caudal setae in distal 1/4 of submargin, variable in lengths and positions depending on hosts, 14-54  $\mu\text{m}$  long, separated by about width to 2 times width of vasiform orifice (Fig. 65B).

**Dorsal disc** (Fig. 65): Median molting suture extending to anterior margin, margins of suture with series of short lines on head to mesothorax; transverse molting suture extending laterad of subdorsal ridge but not reaching submarginal fold or level of meso-metathoracic suture, margins of suture smooth. Subdorsal ridge extending from head to anterior abdominal segments. Meso-metathoracic suture not extending to subdorsal ridges, without teeth, a submedian furrow extending caudally on metathorax from suture. Submedian setae absent from cephalothorax; eighth abdominal setae apparently represented only by setal base in pale, oval protrusion on posterior 1/4 of vasiform orifice rim. Eyespot absent. Depressions submedially on head and prothorax; 3 on mesothorax; 1 near submedian furrow on metathorax; 1 submedian depression each on abdominal segments I-VII, usually with conical teeth on margin. Disc pores and associated porettes distributed on each side as follows: 1 submedially and 2-3 subdorsally on head; 1-2 submedially and 1-2 subdorsally on prothorax;

mesothorax with 1 submedially and 2 subdorsally; metathorax with 1-2 submedially and 3 subdorsally; 1-2 submedially on abdominal segment I, 0-1 submedially on II; 1 submedially and 5-7 subdorsally on III; 1 submedially and 1-4 subdorsally on IV; 1 submedially and 3 subdorsally on V; 0-1 submedially and 1-4 subdorsally on VI; 1-2 submedially and 1-2 subdorsally on VII; 1 submedially and 1-2 subdorsally on VIII. Derm smooth or with fine, faint granules. Abdomen: medially elevated longitudinally, rachis present; median part of segment VII 1/4 to about 1/2 as long as VI; anteromedian part of VIII with 2 low tubercles, vasiform orifice on U-shaped elevation of VIII. Vasiform orifice subcordate, 37-47  $\mu\text{m}$  long, 33-42  $\mu\text{m}$  wide, about 2 times its length from caudal margin, with 3-4 cell-like structures on each side (Fig. 67A); rim undeveloped anteriorly, small conical tubercle with pale gland on posterior 1/4 of rim apparently representing base of eighth abdominal seta, seta absent (Fig. 67B); bottom of orifice almost completely open. Operculum subcordate, 35-42  $\mu\text{m}$  long, 33-40  $\mu\text{m}$  wide, completely filling orifice. Lingula included in orifice, spinulose, apical 1/3 knobbed.

**Venter** (Fig. 65): Thoracic tracheal fold indicated, abdominal tracheal fold obscure. Submargin without distinct marks or spinules. Subventer with fine, faint spinules on head, in thoracic tracheal fold just laterad of anterior spiracle, and from metathoracic spiracle to caudal area. Antenna narrowed into spine-like tip, extending to anterior spiracle. Adhesive sac oval, distinct. Legs well developed; prothoracic leg distally with 1 microseta and 1 micropore, and 3 basal microsetae; mesothoracic and metathoracic legs each with 1 distal microseta and 2 micropores, basally with 5 microsetae. Eighth abdominal setae 14-24  $\mu\text{m}$  long. Posterior spiracle laterad of orifice.

**Third instar larva** (Fig. 68): Narrow fringe of white wax, dorsum bare. Similar in shape as pupa but smaller; submargin elevated, forming ridge around body, dorsal disc broadly elevated; length 417-582  $\mu\text{m}$ , width 303-504  $\mu\text{m}$ .

**Margin and submargin** (Fig. 68): Marginal teeth similar to pupa, 15-17 teeth per 100  $\mu\text{m}$ . Anteromarginal setae 12-14  $\mu\text{m}$  long, on 12-16 teeth from midline; posteromarginal setae 12-21  $\mu\text{m}$  long, 28-33 teeth between setae. Submargin with transverse ridges and narrow furrows. Small, oval pale glandular areas on transverse ridges at

bases of marginal teeth. Microtubercles fine, in band on ridges along furrows and in 4-5 longitudinal rows on ridges. Row of 13-18 disc pores about 3  $\mu\text{m}$  in diameter and associated porettes on each 1/2. A microseta 5-7 long on each side of prothorax (Fig. 68A). Caudal setae with tuberculate bases near caudal margin, 42-85  $\mu\text{m}$  long, usually farther apart than width of vasiform orifice.

**Dorsal disc** (Fig. 68): Submedial cephalothoracic setae absent; eighth abdominal setae represented by apparent setal base in pale, oval protrusion on rim of vasiform orifice. Disc pores and associated porettes distributed on each side as follows: 1 submedially and 1-2 subdorsally on head; 0-2 subdorsally on prothorax; 1 submedially and 0-1 subdorsally on mesothorax; 1 submedially and 1-2 subdorsally on metathorax; 1 submedially on abdominal segments I and IV, occasionally 1 submedially on III and V; subdorsally 2 on III, 1-2 on IV, 0-2 on V, 0-1 on VI, 1 on VII and 1-2 on VIII. Vasiform orifice on U-shaped elevation of segment VIII, subcordate, about its length anterior of caudal margin, without cell-like structures (Fig. 69); rim undeveloped anteriorly, small, conical tubercle with pale gland on posterior 1/4.

**Second instar larva** (Fig. 70): Similar in field characters but smaller than third larva; length 330-372  $\mu\text{m}$ , width 208-256  $\mu\text{m}$ .

**Margin and submargin** (Figs. 70, 71): Teeth (Fig. 69) 20-27 per 100  $\mu\text{m}$  on margin. Anteromarginal setae 7-12  $\mu\text{m}$  long, 14-22 teeth between setae; posteromarginal setae 9-14  $\mu\text{m}$  long, 19-25 teeth between setae. Submargin with short transverse ridges, each ridge extending mesad from a marginal tooth (Fig. 71). Small, oval pale glandular areas on ridges at bases of marginal teeth. Few microtubercles on ridges and along furrows, at least 1 indistinct longitudinal row on ridges. Disc pores absent. A microseta present on thorax on each side (Fig. 70A). Caudal setae near caudal margin, 37-64  $\mu\text{m}$  long.

**Dorsal disc** (Fig. 70): Cephalothoracic setae absent; eighth abdominal setae apparently represented by small, pale spot on midlength of rim of vasiform orifice. Disc pores distributed on each side as follows: 4 subdorsally on cephalothorax, 1 each subdorsally on abdominal segments III-VI and VIII. Vasiform orifice on U-shaped elevation of abdomi-

nal segment VIII, subcordate, slightly less than its length from caudal margin.

**First instar larva** (Fig. 64): Smaller than second instar; elongate oval, length 229-260  $\mu\text{m}$ , width 125-168  $\mu\text{m}$ .

**Margin and submargin:** Margin finely dentate. 10 pairs of setae on margin; 7 pairs on cephalothorax, lengths of setae from anterior-most about 14  $\mu\text{m}$ , 19-24  $\mu\text{m}$ , 24-26  $\mu\text{m}$ , about 19  $\mu\text{m}$ , about 24  $\mu\text{m}$ , 12-17  $\mu\text{m}$ , 12-14  $\mu\text{m}$  and 5-9  $\mu\text{m}$ ; 1 pair on anterior abdominal segments 5-9  $\mu\text{m}$  long; caudal area with longer setae 31-35  $\mu\text{m}$  long, caudal-most setae 28-38  $\mu\text{m}$  long.

**Dorsal disc:** Eyespot circular, laterad of mouthparts. Cephalothoracic setae absent. Eighth abdominal setae anterolaterad of vasiform orifice, fine, indistinct, about 5  $\mu\text{m}$  long. Vasiform orifice subtriangular, slightly anterior of caudal margin. Sclerotized part of operculum subrectangular, posterior part membranous, spinulose. Antenna segmented, longer than mouthparts, extending beyond margin of thorax. Legs developed, segmented. Ventral setae: eighth abdominal setae about 14  $\mu\text{m}$  long, anterior to position of vasiform orifice.

**Material examined.** Lectotype 3rd instar larva and 1 paralectotype third instar larva on two slides: Boulder, Colorado (Flagstaff Mts.), *Arctostaphylos uva-ursi* L. Spreng., 20-III-10, Cockerell (Q No. 8707. USNM No. 1483). Lectotype here designated by S. Nakahara (USNM). Other material examined. Pupal cases on *Arctostaphylos uva-ursi* L. Spreng.: COLORADO: 2, 30-V-1891, Crandall & Cowen No. 315 (USNH No. 256704). CONNECTICUT: Fairfield, 3, 17-V & 22-VIII-1895, E.H. Eamica (USNH No. 183485). MONTANA: Lost Horse Canyon, Bitter Root Forest Preserve, 2, 21-VIII-1897, J.B. Leiber (USNH No. 306700). WASHINGTON: Spokane Co., 1, 1902, F.O. Kreager (USNH No. 620216). WISCONSIN: Camp Douglas, 1, 12-VIII-1891, E.A. Mearns (USNH No. 670826) (USNM). Many pupal cases, 25 third instar larvae, 15 second instar larvae, and 6 first instar larvae from various other hosts and localities (USNM).

**Distribution based on examined material.** Canada (NS), Jamaica, Mexico (Chihuahua, Coahuila, Colima, DF, Durango, Jalisco, Michoacan, Nuevo Leon, Tamaulipas), Puerto Rico, United

States (AL, CO, CT, FL, GA, LA, MA, MS, MT, NJ, SC, TX, VA, WA, WI).

#### Hosts based on examined material.

Anacardiaceae: *Schinus molle* L., *Spondias mombin* L. Annonaceae: *Annona* sp., *A. glabra* L. Arecaeae: *Chamaedorea* sp. Berberidaceae: *Berberis* sp. Ericaceae: *Arbutus* sp., *Arctostaphylos uva-ursi* L. Spreng., *Azalea* sp., *Epigaea repens* L., *Gaultheria shallon* Pursh., *Rhododendron californicum*, *Vaccinium arboreum* Ait., *V. corymbosum* L., *V. macrocarpon* Ait. Iridaceae: *Iris* sp. Lauraceae: *Persea borbonia* (L.) Spreng. Magnoliaceae: *Magnolia* sp. Malvaceae: *Hibiscus* sp. Myricaceae: *Myrica cerifera* L., *M. pennsylvanica* Lois., *M. rubra* Sieb. and Zucc. Myrtaceae: *Myrtus* sp. Rhizophoraceae: *Rhizophora mangle* L. Rosaceae: *Pyracantha* sp., *Rosa* sp., *Rubus* sp. Rutaceae: *Amyris parviflora*, *Citrus* sp., *C. aurantiifolia* (Christm.) Swingle, *C. aurantium* L., *C. sinensis* (L.) Osbeck, *C. paradisi* Macfad., *C. reticulata* Blanco, *Zanthoxylum clava-herculis* L. Zygophyllaceae: *Guaiacum officinale* L.

**Comments.** There are only 2 slide mounted third instar larvae from Cockerell's type material in the USNM collection. According to Cockerell (1910), the type material included pupae and adults. The measurements of the pupae in Cockerell's description indicate that he did examine pupae and not the third instar larvae.

This species is commonly found on plants in the Ericaceae, Rosaceae and Rutaceae. It closely resembles *T. quercicola*. The differences are discussed under *T. quercicola*.

#### Notes on Miscellaneous Species

*Aleurotrachelus cacaorum* Bondar 1923:154 = *Tetraleurodes cacaorum* (Bondar), **New Combination.** This species is known from several countries in South America.

*Aleyrodes stanfordi* Bemis 1904:508; *Tetraleurodes stanfordi*: Quaintance and Baker 1914:108 = *Tetraleurodes perileuca* (Cockerell), **New Synonymy.** This species occurs on *Quercus* in southern United States and Mexico.

*Tetraleurodes nudus* Sampson and Drews 1941:174 = *Tetraleurodes fici* Quaintance and Baker, **New Synonymy.** This species occurs in Mexico,

Central America, several Caribbean Islands and Florida.

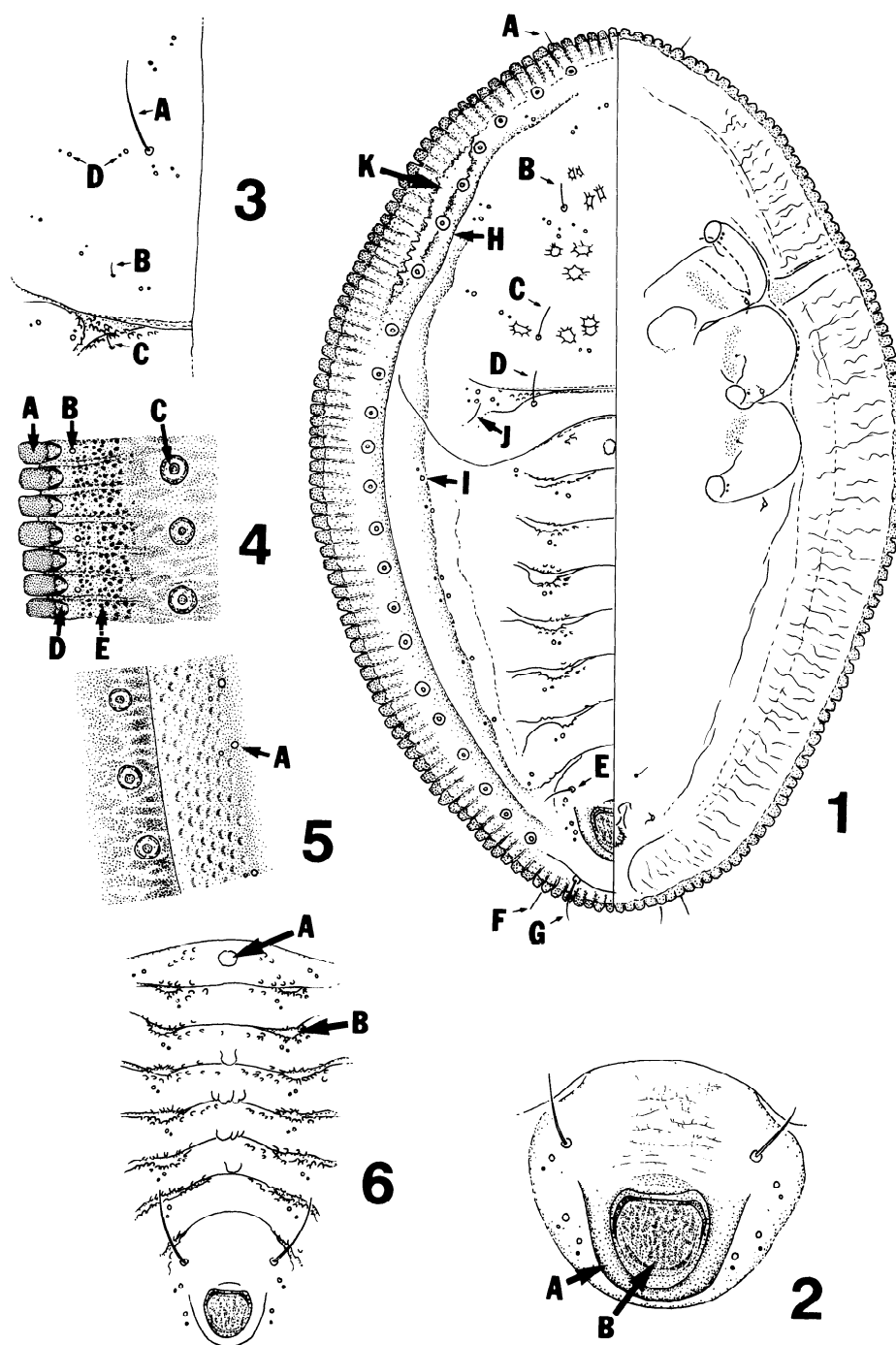
*Tetraleurodes papilliferus* Sampson and Drews 1941:176 = *Aleurotrachelus papilliferus* (Sampson and Drews), **New Combination**. This species is known only from Panama.

### Acknowledgments

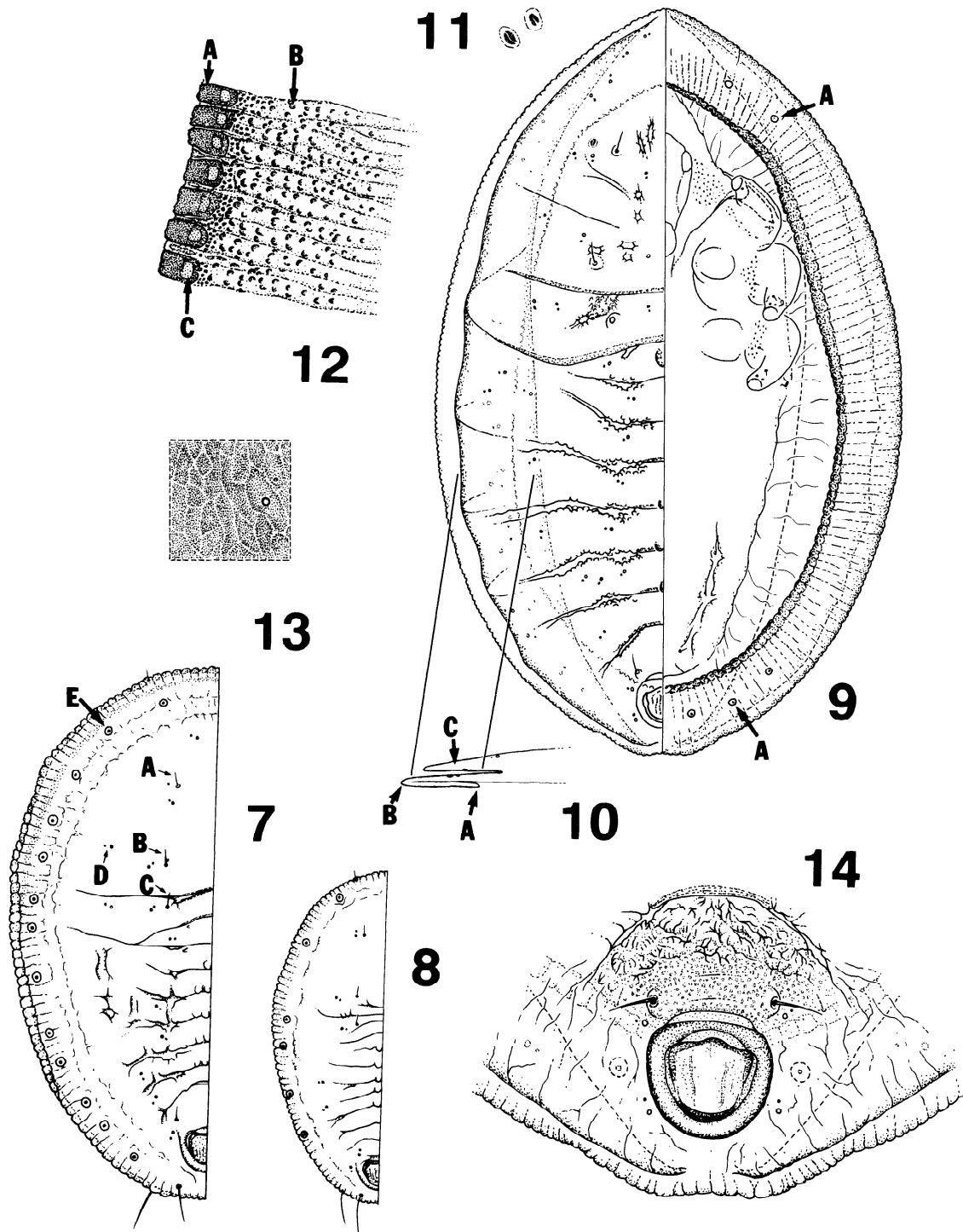
I thank R. J. Gill, California Dept. of Food and Agriculture, Sacramento, and A. B. Hamon, Florida Dept. of Agriculture and Consumer Services, Gainesville, for loan of specimens, the insitu photographs, and for their reviews of the manuscript and constructive suggestions. Appreciation is also extended to D. R. Smith, Systematic Entomology Laboratory, Washington D.C. and R. L. Smiley, same laboratory, Beltsville, Maryland for reviews of the manuscript and useful suggestions. The illustrations were prepared by L. H. Lawrence, staff artist, Systematic Entomology Laboratory.

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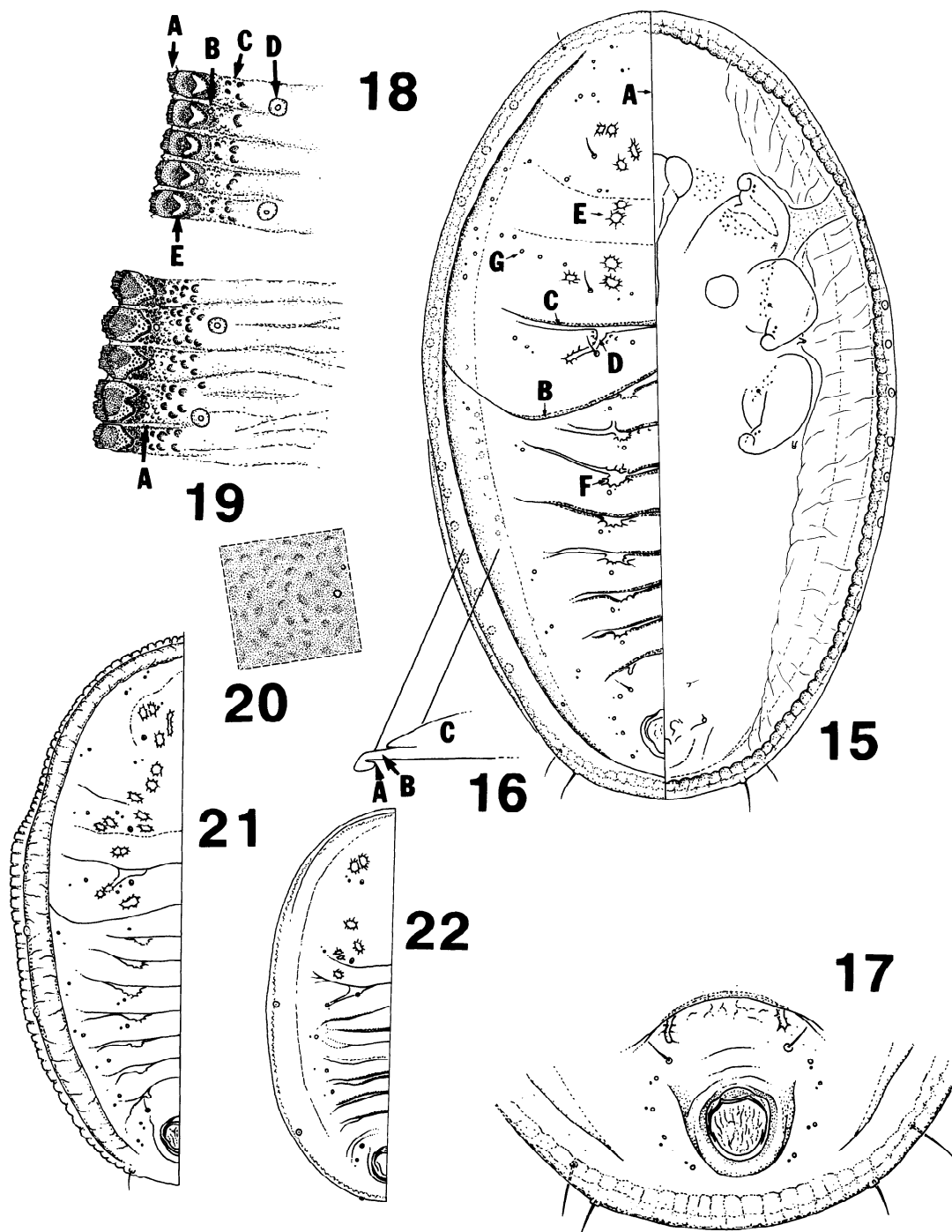


**Figs. 1-6:** *Tetraleurodes acaciae*. 1. Habitus of pupal case; A. anterior marginal seta, B. cephalic seta, C. mesothoracic seta, D. metathoracic seta, E. eighth abdominal setae, F. posterior marginal seta, G. caudal seta, H. submarginal fold, I. longitudinal ridge, J. submedian furrow, K. pale area. 2. Elevated part of abdominal segment VIII; A. U-shaped rimlike part, B. vasiform orifice and operculum. 3. Part of head and thorax; A. cephalic seta, B. mesothoracic seta, C. metathoracic seta, D. disc pores and porettes. 4. Margin and submargin; A. marginal tooth, B. disc pore, C. gland tubercle, D. pale glandular area, E. microtubercular band. 5. Part of submargin and subdorsum; A. disc pores and porette. 6. Abdominal segments; A. median tubercle, B. submedian depression.



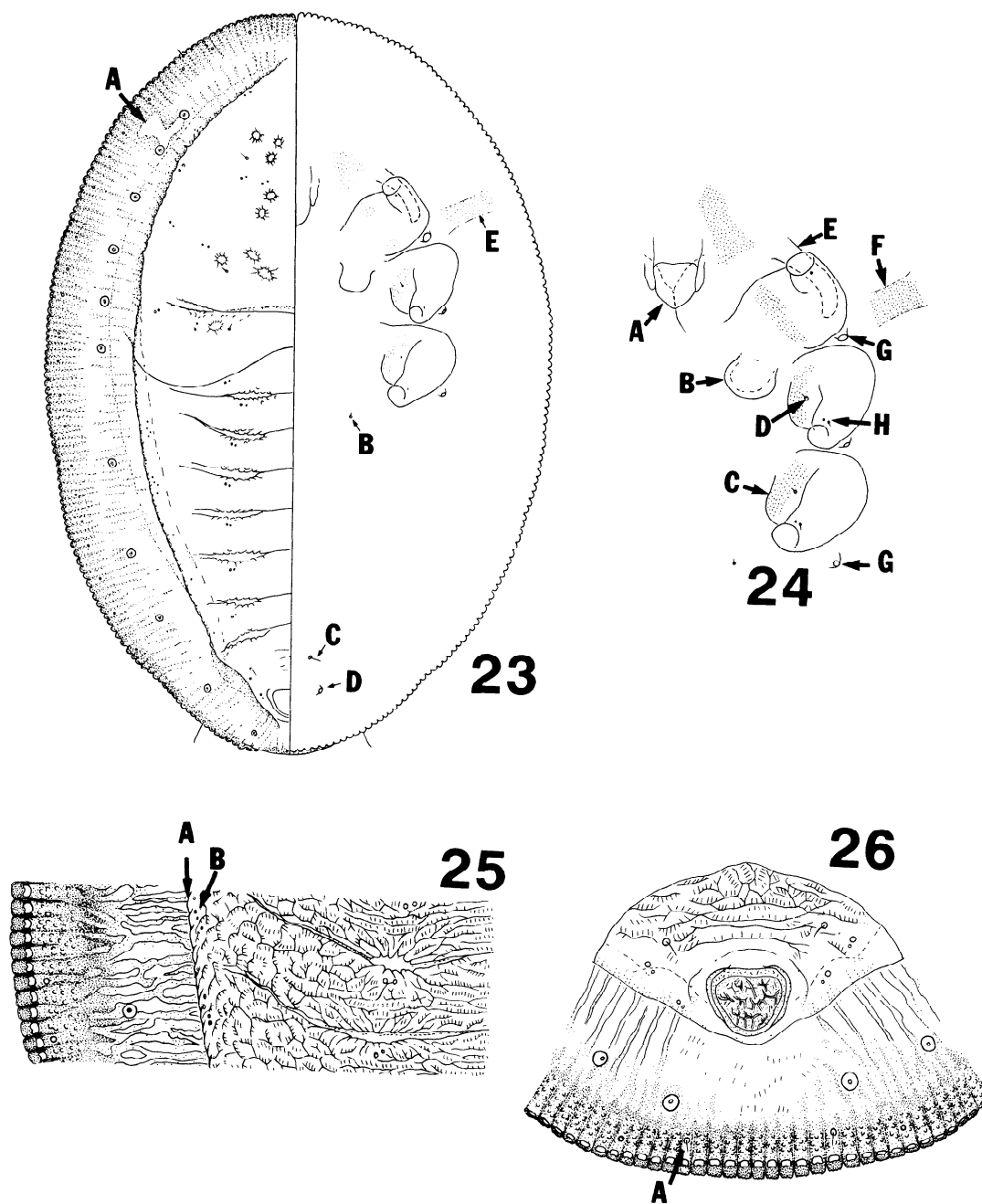
**Figs. 7-8:** *Tetraleuroides acaciae*. 7. Third instar larva; A. cephalic seta, B. mesothoracic seta, C. metathoracic seta, D. disc pore and porette, E. gland tubercle. 8. Second instar larva.

**Figs. 9-14:** *Tetraleuroides bireflexa*. 9. Habitus of pupal case; A. gland tubercle. 10. Reflected margin and submargin, and subdorsum; A. true margin, B. apparent margin, C. subdorsum. 11. Eyespot on head (variations). 12. Margin and submargin; A. marginal tooth, B. microtubercles, C. pale glandular area. 13. Derm of subdorsum with disc pore and porette. 14. Abdominal segment VIII and caudal part.

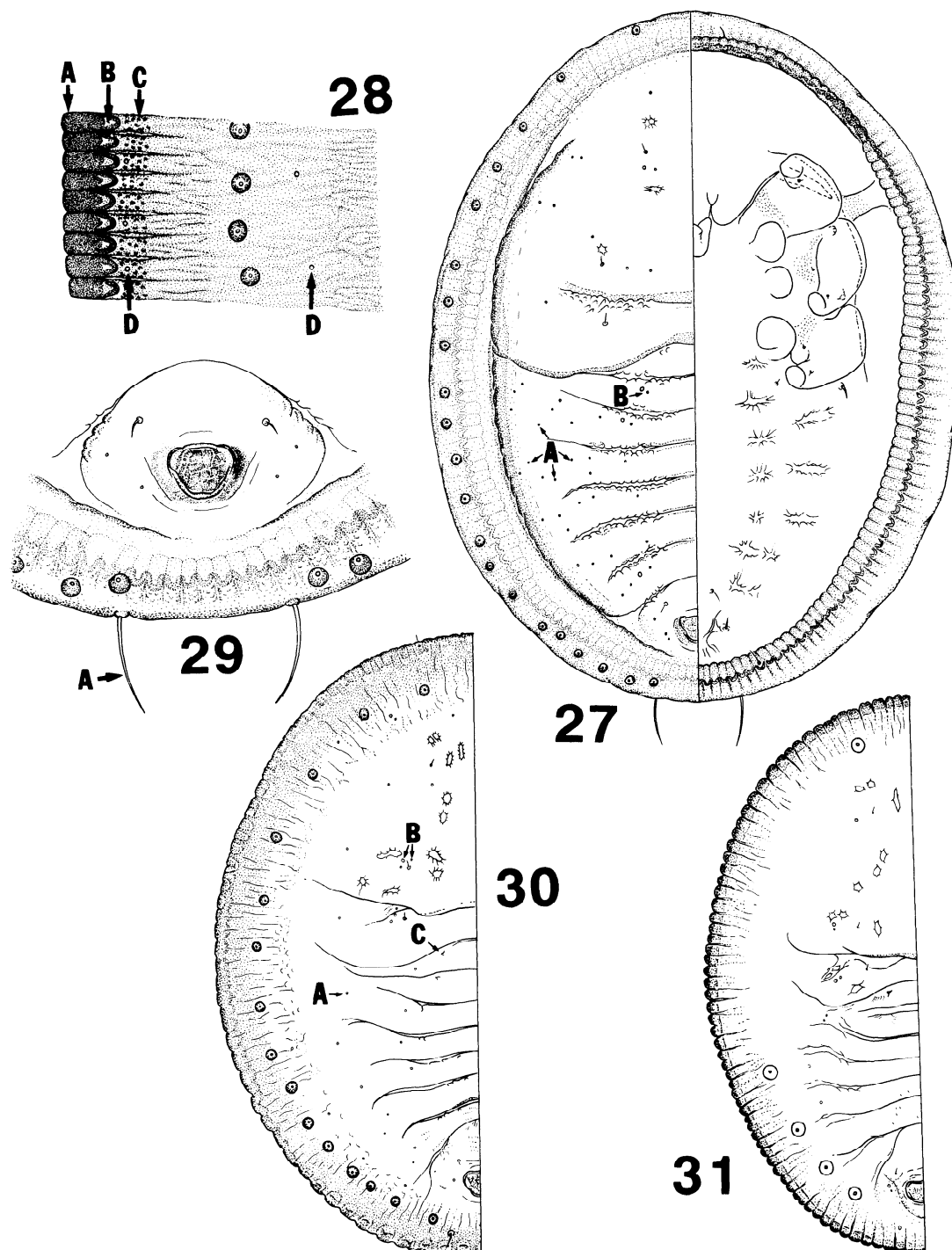


**Figs. 15-22:** *Tetraleurodes caulicola*. 15. Habitus of pupal case; A. longitudinal molting suture, B. transverse molting suture, C. meso-metathoracic suture, D. submedial furrow, E. depressions; F. submedial depression, G. disc pores. 16. Reflected part of submargin and subdorsum; A. true margin, B. submargin, C. subdorsum. 17. Abdominal segment VIII and caudal part, with vasiform orifice and operculum on U-shaped rimlike part. 18. Margin and submargin; A. marginal tooth, B. disc pore, C. short microtubercular band, D. gland tubercle, E. pale glandular area. 19. Margin and submargin; variations of structures; A. transverse furrow. 20. Derm of subdorsum with disc pore and porette. 21. Third instar larva; cephalic and thoracic setae represented by setal bases. 22. Second instar larva.

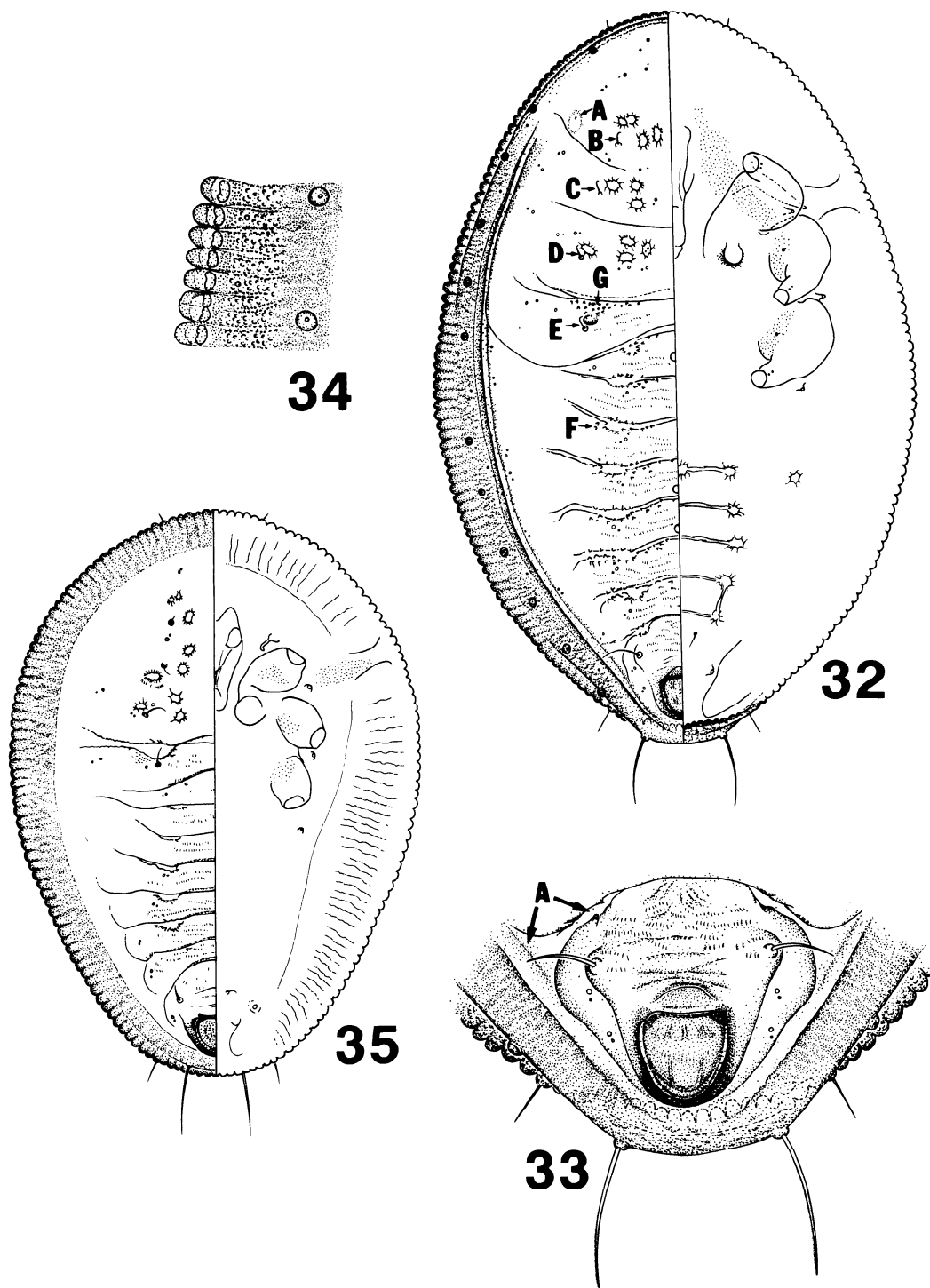




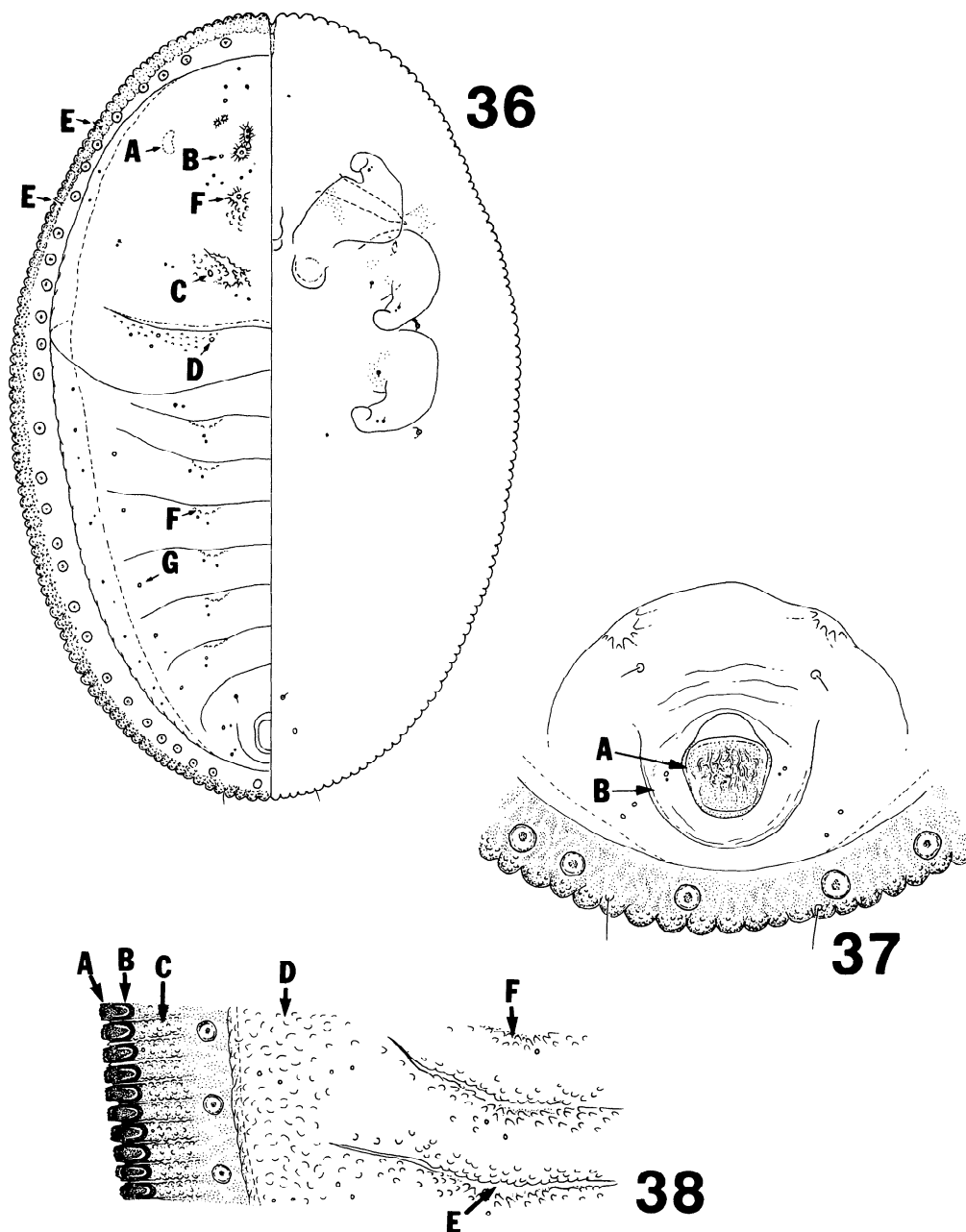
**Figs. 23-26:** *Tetraleurodes dorsirugosa*. Fig. 23. Habitus of pupal case; A. pale area, B. second abdominal seta, C. eighth abdominal ventral seta, D. abdominal spiracle, E. thoracic tracheal fold. 24. Venter of thorax and head; A. mouthparts, B. adhesive sac, C. spinules on mesal base of leg, D. microseta, E. antenna, F. thoracic tracheal fold, G. spiracle, H. microseta and base of microseta. 25. Section of abdomen from margin to midline; rugose sculpturing of subdorsum and submedian areas; A. apparent margin of subdorsum, B. disc pores. 26. Abdominal segment VIII and caudal part; A. caudal seta.



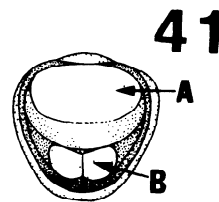
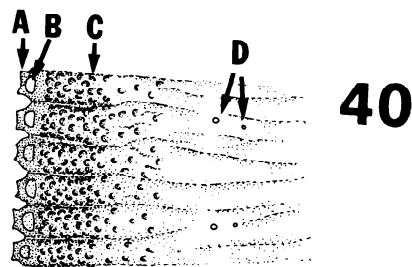
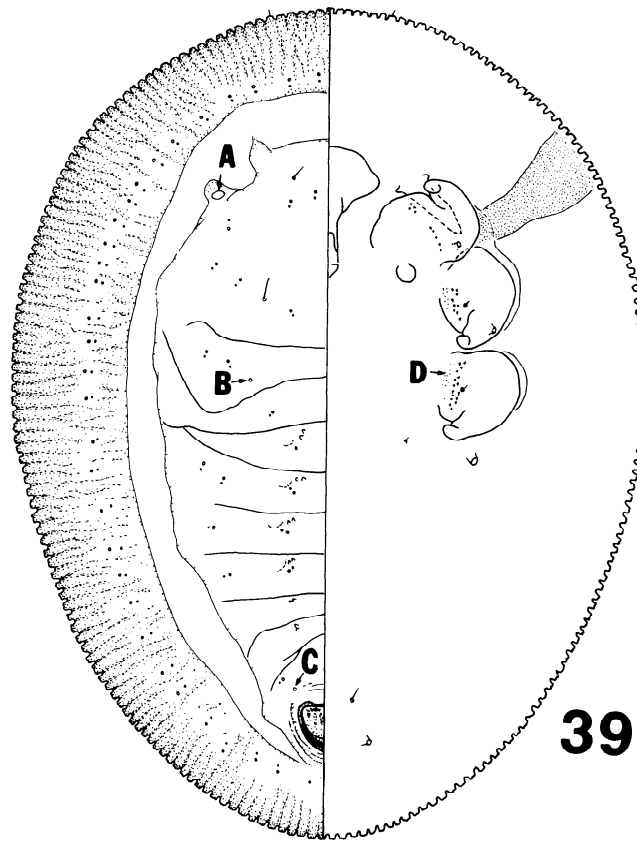
**Figs. 27-31:** *Tetraleurodes mexicana*. 27. Habitus of pupal case; A. disc pore, B. disc pore and porette. 28. Margin and submargin; A. marginal tooth, B. pale glandular area with well defined margin, C. microtubercular band, D. disc pore. 29. Abdominal segment VIII and caudal part; A. caudal seta. 30. Third instar larva; A. disc pore, B. disc pore and porette, C. small conical tooth. 31. Second instar larva.



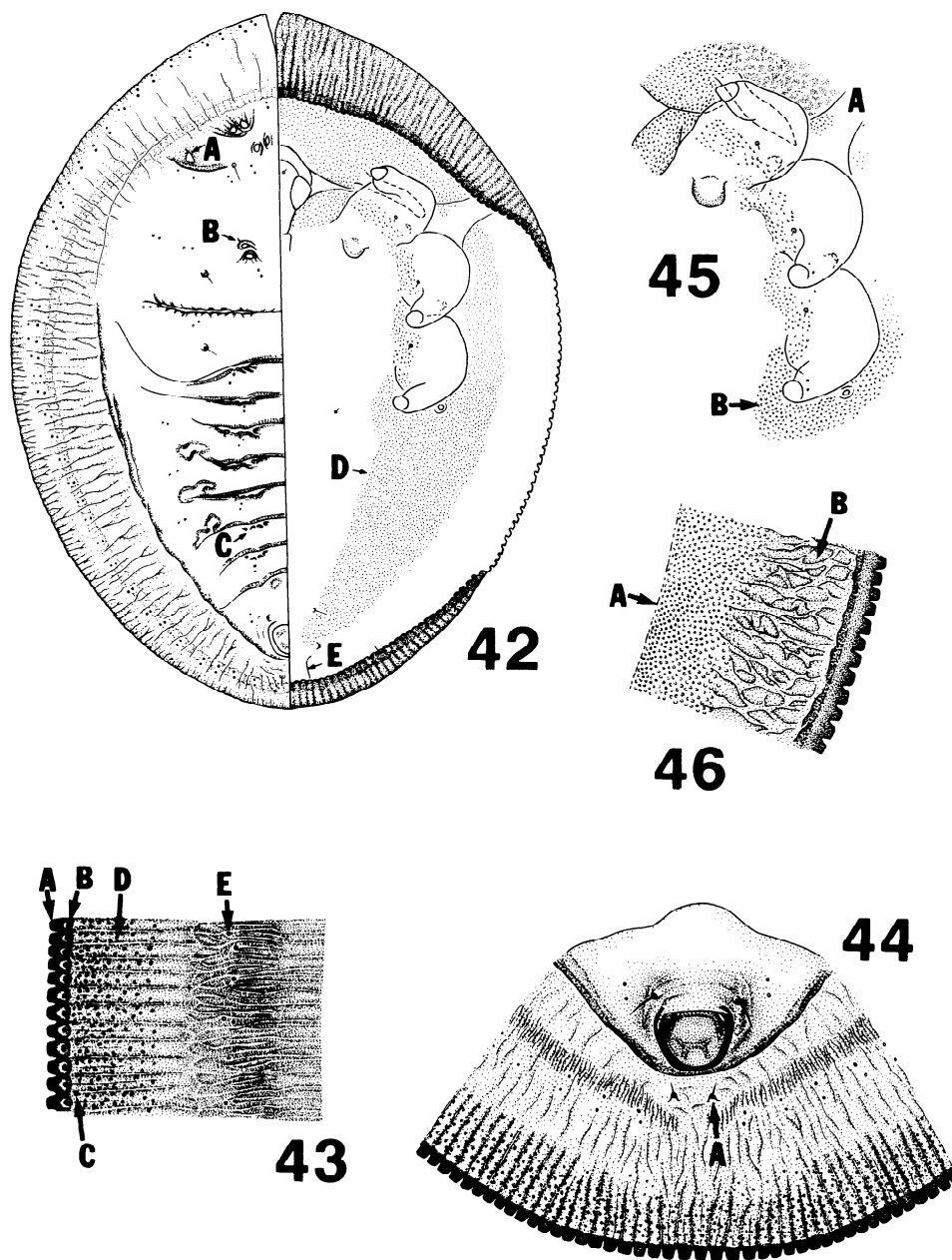
**Figs. 32-35:** *Tetraleurodes pseudacaciae*. 32. Habitus of pupal case; A. eyespot, B. cephalic seta, C. prothoracic seta, D. mesothoracic seta, E. metathoracic seta, F. submedium depression with small conical teeth, G. small conical teeth. 33. Abdominal segment VIII and caudal part; with vasiform orifice and operculum on U-shaped rimlike elevated part of VIII; A. intersegmental division of segments VII-VIII extending to submarginal fold, separating VIII from anterior segments. 34. Margin and submargin. 35. Third instar larva.



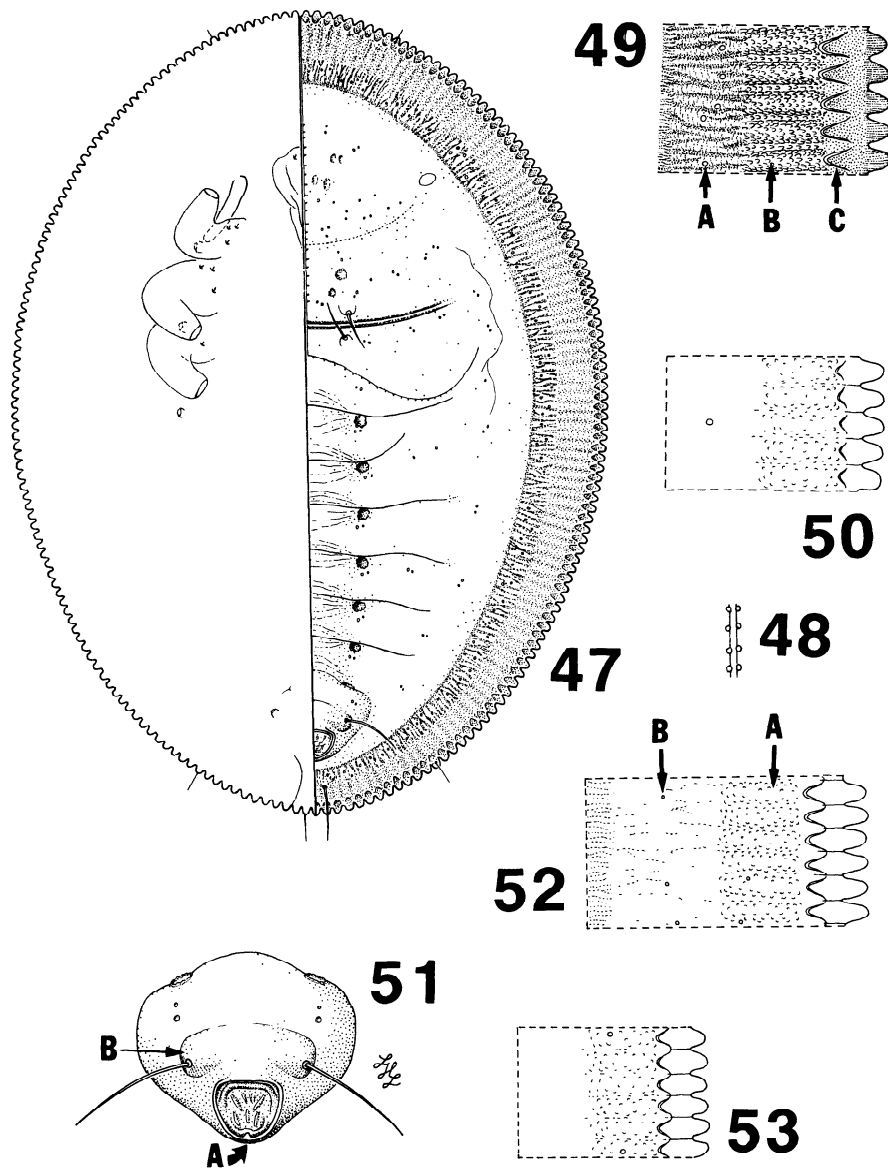
**Figs. 36-38:** *Tetraleurodes tuberculosa*. 36. Habitus of pupal case; A. eyespot, B. base of cephalic seta, C. base of mesothoracic seta, D. base of metathoracic seta, E. microseta, F. depression with associated conical teeth, G. disc pore. 37. Abdominal segment VIII and caudal part; A. vasiform orifice and operculum, B. wide apparent rim. 38. Dorsum of abdomen from margin to midline; A. marginal teeth, B. pale glandular area, C. transverse ridge with microtubercular band, D. tuberculated subdorsal derm, E. submedian depression, F. conical teeth.



**Figs. 39-41:** *Tetraleurodes bidentatus*. 39. Habitus of pupal case; A. eyespot, B. base of metathoracic seta, C. base of eighth abdominal seta, D. spinules in two rows of different sizes. 40. Margin and submargin; A. marginal teeth, B. pale glandular area, C. microtubercles on transverse ridge, D. disc pore and porette. 41. Bottom of vasiform orifice; A. anterior area, B. posterior area divided by longitudinal line.



**Figs. 42-46:** *Tetraleurodes chivela*. 42. Habitus of pupal case; A. eyespot, B. depression, C. submedian depression with conical teeth, D. spinulose derm E. abdominal tracheal fold. 43. Submargin; A. marginal tooth, B. pale glandular area, C. micropore, D. transverse ridge with microtubercles, E. disc pore and porette. 44. Abdominal segment VIII and caudal part; A. caudal seta. 45. Legs and ventral part of thorax; A. thoracic tracheal fold, B. spinules. 46. Margin, submargin and subventer of abdomen; A. spinulose subventer, B. irregular raised areas.

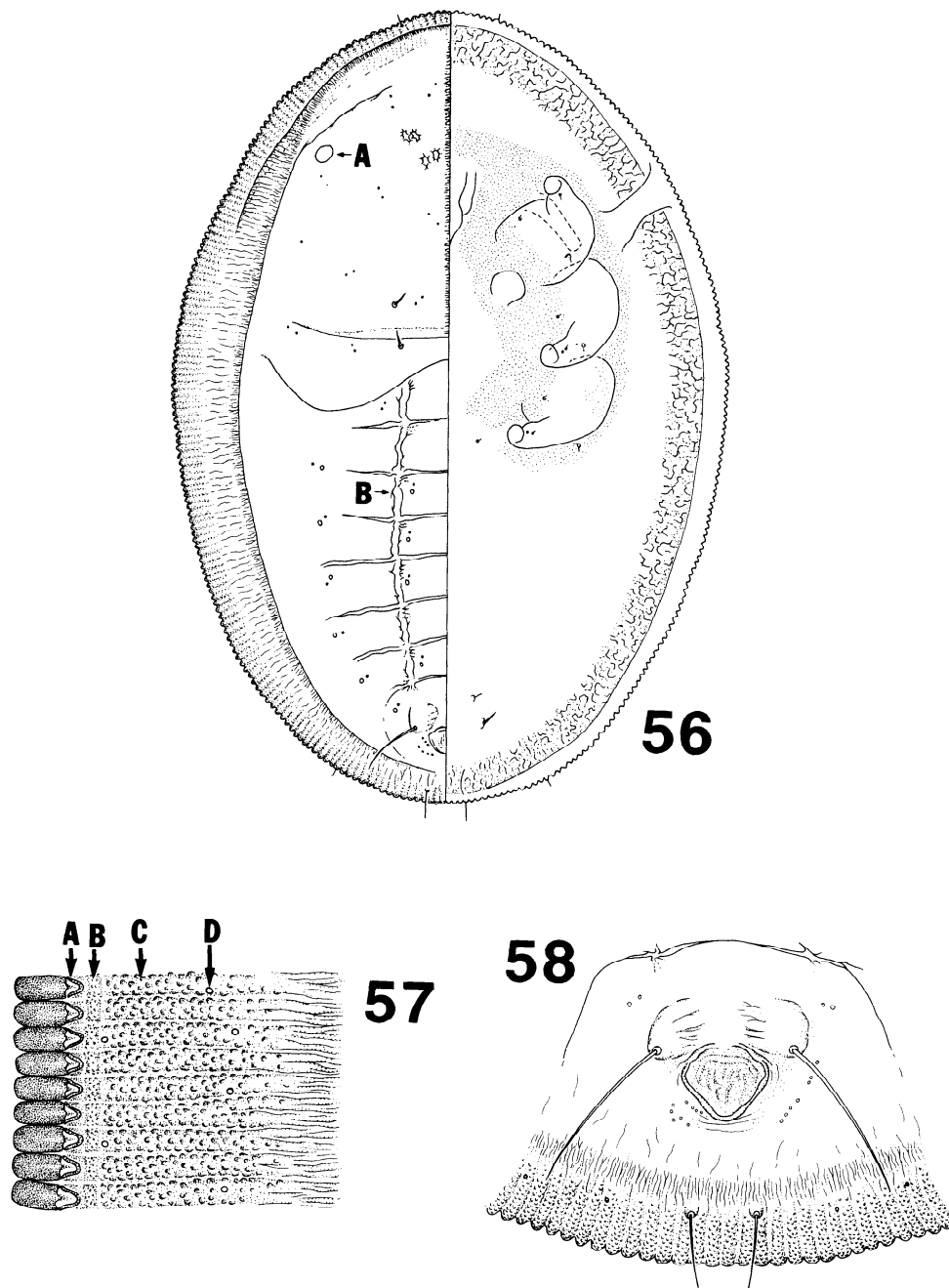


**Figs. 47-50:** *Tetraleurodes confusa*. 47. Habitus of pupal case. 48. Notches on transverse molting suture. 49. Margin and submargin; A. disc pore, B. transverse ridge and microtubercular band, C. V-shaped, pale glandular area. 50. Margin and submargin of third instar larva. **Figs. 51-53:** *Tetraleurodes perseae*. 51. Abdominal segment VIII; A. median notch on operculum, B. eighth abdominal seta on tubercle. 52. Margin and submargin; A. transverse ridge and microtubercular band, B. disc pore. 53. Margin and submargin of third instar larva.

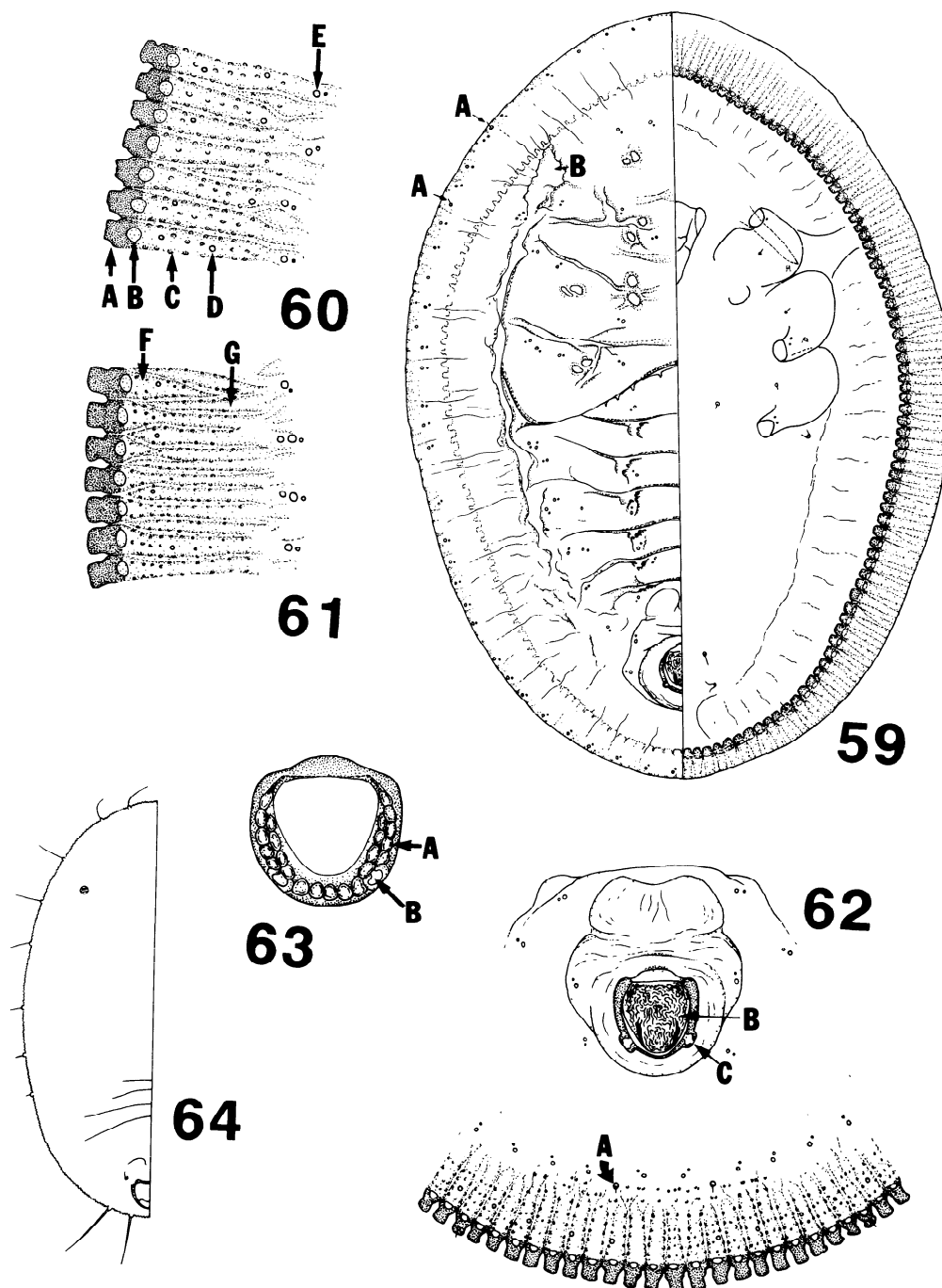
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**Fig. 54:** *Tetraleurodes confusa*. Insitu photographs of pupal instar with wax formation. **Fig. 55.** *Tetraleurodes perseae*. Insitu photograph of pupal instar with wax formation.

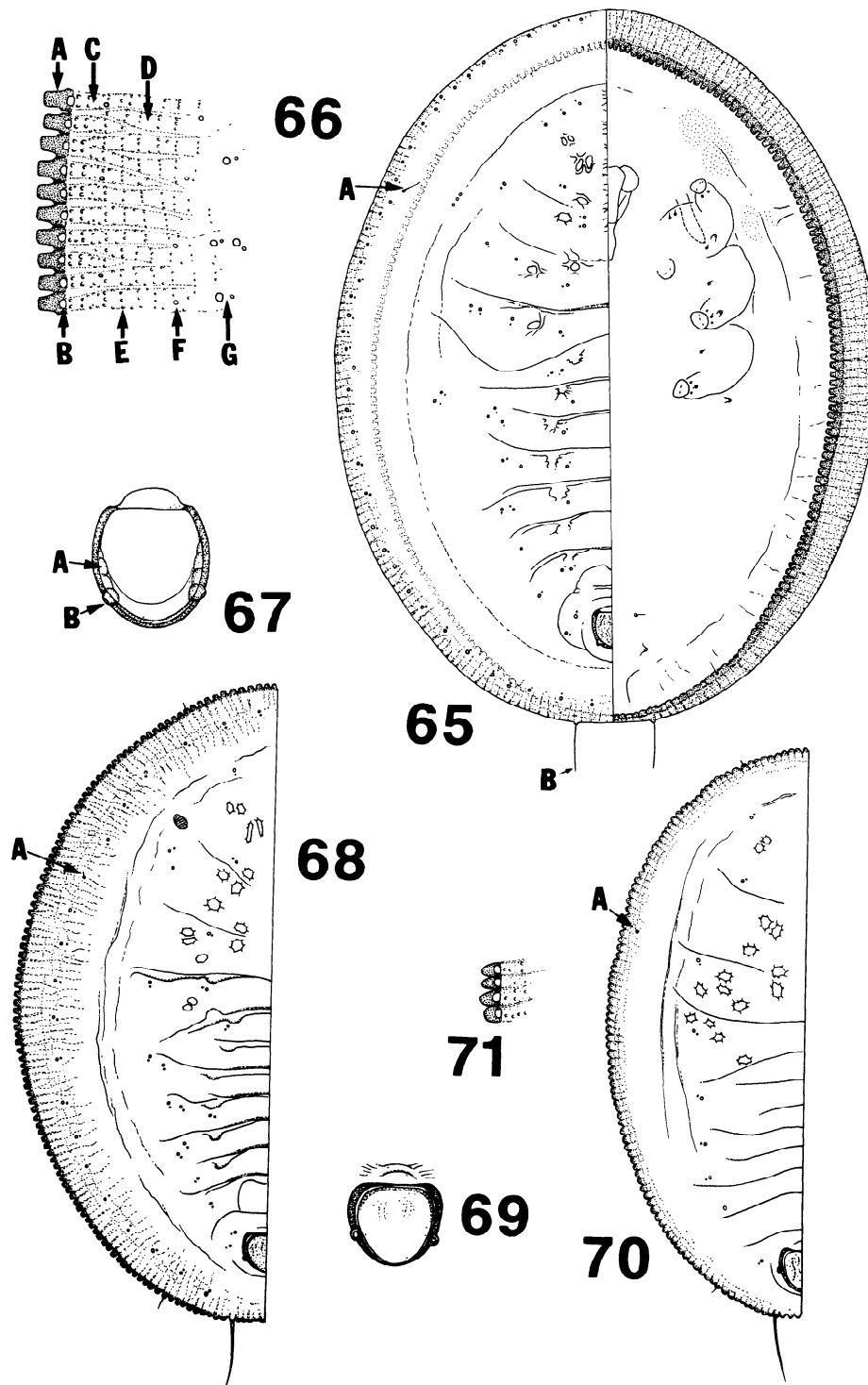




**Figs. 56-58:** *Tetraleurodes pringlei*. 56. Habitus of pupal case; A. eyespot, B. submedian longitudinal furrow. 57. Margin and submargin; A. pale glandular area, B. band of small microtubercles, C. band of larger microtubercles, D. disc pore. 58. Abdominal segment VIII and caudal area.



**Figs. 59-63:** *Tetraleuroides quercicola*. 59. Habitus of pupal case; A. microseta, B. diffused eyespot. 60 and 61. Margin and submargin showing variations of structures; A. marginal tooth, B. pale glandular area, C. microtubercles in longitudinal row on transverse ridge extending to marginal teeth, D. disc pore, E. disc pore and porette, F. transverse ridge extending to marginal tooth, G. transverse ridge tapering distally, not reaching margin. 62. Abdominal segment VIII and caudal part; A. caudal seta, B. operculum, C. small tubercle on rim with pale gland. 63. Vasi-form orifice; A. two rows of cell-like structures, B. small, tubercle on rim with pale gland. Fig. 64. *Tetraleuroides ursorum*; first instar larva.



**Figs. 65-71:** *Tetracleurodes ursorum*. 65. Habitus of pupal case; A. submarginal seta, B. caudal seta. 66. Margin and submargin; A. marginal tooth, B. pale glandular area, C. transverse ridge extending to marginal tooth, D. transverse ridge tapering distally, not reaching margin, E. microtubercles in row, F. disc pore, G. disc pore and porette. 67. Vasiform orifice; A. cell-like structures, B. small, conical tubercle with small gland on rim. 68. Third instar larva; A. microseta. 69. Vasiform orifice, operculum and small, conical tubercle with small gland on rim of third instar larva. 70. Second instar larva; A. microseta. 71. Margin and submargin of second instar larva.