



A new species of armored scale (Hemiptera: Coccoidea: Diaspididae) found on avocado fruit from Mexico and a key to the species of armored scales found on avocado worldwide

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Abstract

A new species of armored scale, *Abgrallaspis aguacatae* Evans, Watson, and Miller spec. nov. is described and illustrated from specimens collected on avocado fruit from Mexico. This species has caused considerable concern as a quarantine issue in the United States. A key to the armored scale species known to feed on avocado worldwide is provided.

Key words: Pest, *Persea americana*, quarantine, taxonomy, regulatory, invasive species

Introduction

Avocado (*Persea americana* Mill., Lauraceae), known as *aguacate* or *palta* in Spanish, is a tree native to Mexico and Central America. Evidence suggests that it may have been cultivated in Mexico for as long as 10,000 years (Barry, 2001). It has been cultivated in South America since at least 900 A.D, because an avocado-shaped water jar was found in the pre-Incan city of Chan Chan in Peru (Barry, 2001). The fruit has become very popular around the world; according to the United Nations Food and Agriculture Organisation (FAOSTAT, 2008), nearly 3.45 million metric tons of avocados were produced worldwide in 2004. Mexico is the largest producer; it accounted for 33.2% (an estimated 1.14 million tons) of global production and 27.6% of the export market in 2004 (Evans & Nalampang, 2006).

Beginning in 1914, U.S. authorities prohibited the importation of fresh avocados from Mexico because of the presence of avocado seed weevils in Mexico. In 1994, the Mexican government requested that the United States Department of Agriculture (USDA)/Animal Plant Health Inspection Service (APHIS) allow importation into the U.S. of fresh 'Hass' avocado fruit from the State of Michoacán, Mexico. A pest risk assessment was prepared and restrictions were lifted in 1997, allowing avocados to be imported into 13 U.S. States from Michoacán (USDA/APHIS, 2004). A new policy took effect in January 2005 that allowed 'Hass' avocados from approved orchards in municipalities in Michoacán to be sold year-round in 47 U.S. states, with a two-year delay on importation into the commercial avocado-producing states of California, Florida and Hawaii (USDA/APHIS, 2007). The last U.S.-imposed trade restrictions were lifted on February 1, 2007, and the first avocados were shipped to these remaining states on that day (Associated Press, 2007). On the same day, agricultural inspectors in California intercepted armored scales from Mexico on 'Hass' variety of avocado fruits. Specimens were sent to Dr. Gillian Watson of the California Department of Agriculture, and later to the other two authors of this paper, who together concluded that the material contained an undescribed species with similarities to San Jose scale (*Diaspidiotus perniciosus* (Comstock)), *Hemiberlesia diffinis* (Newstead)

and *H. neodiffinis* Miller & Davidson, which are also found on avocado. The new species is described and illustrated below, and is compared with these three species and other similar *Abgrallaspis* species. Avocado growers in California expressed their concern about the possibility of this species becoming established in the United States but a panel of experts concluded that the likelihood of the species entering and establishing in the U.S. via commercial shipments of fresh avocado fruit from Mexico was low.

Gerson and Zor (1973) provided a key to seven species of armored scales (in six genera) on avocados in Israel and discussed their biology, population trends and spatial distribution on the plant. Herein, we provide a key to the 53 species of armored scales in 29 genera recorded in the literature on avocado worldwide. In addition, we record *Aulacaspis tubercularis* Newstead for the first time on avocado, although it was recorded by Miller and Davidson (2005) on *Persea* and this record probably pertains to avocado. It was intercepted on “avocado” from Mexico, June 10, 1941; on “*Persea* sp.” from Brazil, January 16, 1959; on “*Persea* sp. fruit” from South Africa on April 15, 1980; on *Persea americana* fruit from the Dominican Republic, on December 22, 2003; and was identified on avocado fruit entering California from Mexico on February 23, 2007; the species has often been found on Mexican mango fruit entering other parts of the United States also. This is the first published record of the presence of *A. tubercularis* in Mexico.

Methods

The morphological terminology used follows that in Miller and Davidson (2005) which also includes illustrations for most of the genera and species treated herein. All measurements are given in micrometers (μm). The following abbreviations are used for the pygidial lobes: medial lobe (L1), 2nd lobe (L2), 3rd lobe (L3), 4th lobe (L4). Abbreviations used for the paraphyses are: arising from the median lobes, PL1; originating at L2 anteromesad base, PL2; situated between L2 and L3, PL3; and originating at anteromesad base of L3, PL4. The paraphysis formula gives the number of paraphyses between the lobes, e.g. 2 paraphyses between L1 and L2, 2 between L2 and L3, and 3 between L3 and L4 would be expressed as formula 2-2-3.

Abgrallaspis aguacatae Evans, Watson, and Miller spec. nov.

(Fig. 1)

Description of Adult Female

Appearance in life: scale cover fairly flat, more or less broadly oval with central or subcentral exuviae. Secreted scale material thin, flexible, mid-brown, blending into color of ripe fruit skin. Exuviae more yellow to reddish brown than secreted material. First instar exuviae surrounded by a raised circle of dark grey secretion, but this sometimes gets rubbed off the scale cover. Adult female beneath scale cover pale creamy yellow; pygidium yellowish brown, darker towards apex.

Slide-mounted adult female (Fig. 1) broadly oval, length of holotype 1378, range (n=10): 846–1378, mean 1140.5; maximum width of holotype: 1045; range (n=10) 649–1078, mean 886.6.

Pygidium: Lobes — posterior margin with 3 pairs of well-sclerotized lobes; median lobes (L1) large, convergent, each hoof-shaped, with inner border short and straight, outer border long and curved with small indentation at base, sometimes with several small teeth along posterior margin. Second lobe (L2) shorter than L1, often wider than long, usually with 3 or 4 small teeth along outer margin. Third lobe (L3) sometimes slightly longer than wide, usually with 2 or 3 teeth along outer margin. **Paraphyses** — 4 pairs of paraphyses present (formula 2-2-0): (1) L1 with a medium-sized paraphysis (PL1) with a clubbed inner end originating at anterolateral base; (2) L2 with a slightly smaller paraphysis (PL2), similar in shape to PL1, originating at L2 anteromesad base; (3) a smaller paraphysis (PL3) present between L2 and L3; and (4) a small paraphysis (PL4) originating at anteromesad base of L3. Ventral area anterior to L1 with large, triangular basal sclerotization arising from mesad half of lobe, longer than wide, longest on mesad margin, laterad margin often rather irregular. **Plates** — two slender plates present between L1, each about as long as L1 (these appear

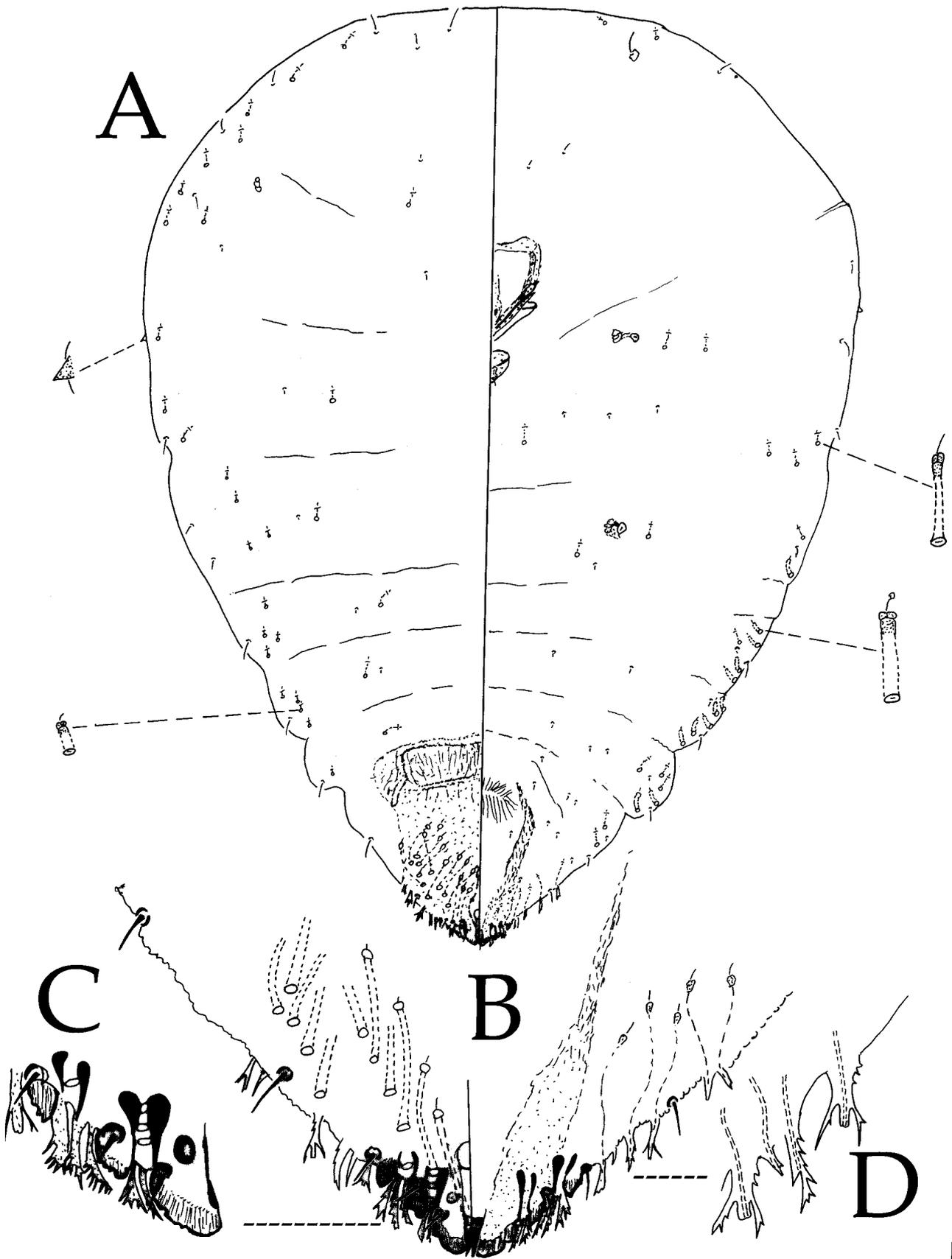


FIGURE 1. *Abgrallaspis aguacatae* Evans, Watson, and Miller, spec. nov. adult female. A) habitus, B) pygidium, C) detail of pygidial lobes, D) detail of pygidial plates.

to have pointed apices, often obscured by convergent L1); 2 plates with fringed apices present between L1 and L2 on each side, each slightly longer than L1, much longer than L2; 3 plates with fringed apices present between L2 and L3 on each side, each plate about 2 to 3x as long as L3; plates anterior to L3 each with a median internal microduct and base wider than an interlobular plate, with a lateral tine on either side of microduct, each tine slightly fringed along the margins. **Ducts** — 11 or 12 pairs of macroducts present on dorsum in submarginal and marginal areas of segments 5 and 6. **Anal opening** — small, slightly longer than wide (12.2 µm long x 10.6 µm wide in holotype), located about 1.7x its diameter from anterolateral base of L1. **Perivulvar pores** — absent, but sclerotized frame surrounding vulva present, longer than wide.

Prepygidium: dorsum with ducts of 2 sizes; macroducts along dorsolateral margin each about 2x as long as microducts sometimes present on submargin; abdominal segments 1–3 each with 1–5 macroducts on each lateral margin. **Cephalothorax:** each posterior spiracle with 2 microducts situated on medial and lateral sides, and 2 or 3 microducts on ventral lateral margin laterad of the spiracle. Each anterior spiracle with one or two microducts laterad of the spiracle, and about 8 microducts on dorsolateral margin between anterior spiracle and apex of head; pores absent from near spiracles. Setae along margin long and slender with pointed apices. Eyes very small, round and inconspicuous; antennae each bearing 1 conspicuous seta.

Specimens examined

Type material is deposited at the following institutions: Museo Nacional de Historia Natural, Mexico City, Mexico (MCM); National Museum of Natural History, Washington, D.C., U.S.A. (USNM); California State Collection of Arthropods, Sacramento, California, U.S.A. (CSCA); Florida State Collection of Arthropods, Gainesville, Florida, U.S.A. (FSCA); University of California at Riverside, California, U.S.A. (UCR); and The Natural History Museum, London, U.K. (BMNH). Voucher specimens from the DNA study by Morse *et al.* (in preparation) have a DNA extraction number given in [square parentheses]. Paratype specimens are mounted individually on slides unless specified otherwise.

Holotype. Adult female mounted in Canada balsam, MEXICO, Michoacán, Nuevo Parangaricutiro, Huerto (=Orchard) Mesa de Gallegos, on fruit of *Persea americana* var. Hass, E. Campoverde, 31 March 2007, deposited in the MCM.

Allotype. One adult male (allotype specimen), 1 male pupa, 1 male nymph and 1 adult female paratype, all together on one slide, ex Mexico, intercepted at California, Blythe Border Station, Hafen, on avocado fruit, 18 March 2007, deposited in the CSCA.

Paratypes:

Specimens deposited in the MCM. Collected in MEXICO: 1 adult female, Michoacán, Uruapan, Cherangueran, on tronco [=trunk] of *Persea americana* var. Hass, Ma. R. Perez, 15 MAY 2007; 1 adult female, Michoacán, Taretan, Huerto El Uro, on rama [=branch] of *Persea americana* var. Hass, L. Adame E, 30 March 2007; 3 adult females, Michoacán, Nuevo Parangaricutiro, Traspatio, on branch of *Persea americana* var. Hass, P. Cortes, 30 March 2007. Intercepted from MEXICO: 1 adult female, intercepted at California, Blythe Inspection Station, ex *Persea americana* fruit, Villa, 10 February 2007 (PDR#11376459 [DNA AS013]; 1 adult female, intercepted in California, on *Persea americana*, W. Burkey, 8 May 2007 (SD 043623 CA).

Specimens deposited in the USNM. Collected in MEXICO: 1 adult female, Michoacán, Salvador Escalante, Huerto Los Trojes, on fruit of *Persea americana* var. Hass, R. Gudiño M, 30 March 2007; 2 adult females, Michoacán, Salvador Escalante, Huerto Puente Alto, on fruit of *Persea americana* var. Hass, Control Calidad, GWP, 30 March 2007; 4 adult females (2 females on fruit, 1 female on leaf, 1 female on trunk), Michoacán, Uruapan, Cherangueren, on branch of *Persea americana* var. Hass, R. Perez, 15 May 2007; 1 adult female, Michoacán, Nuevo Parangaricutiro, Huerto La Loma, on fruit of *Persea americana* var. Hass, H. Toral U, 30 March 2007; 1 adult female, Michoacán, Nuevo Parangaricutiro, Huerto El Centenario, on fruit of *Persea americana* var. Hass, H. Toral U, 30 March 2007. Intercepted from MEXICO: 1 adult female, intercepted at California, Blythe Inspection station, on *Persea americana*, J. Morse, 18 May 2007 [DNA study AS281].

Specimens deposited in the CSCA. Collected in MEXICO: 1 adult female, Michoacán, Los Jacales, Tacambaro, Huerto Las Tijeras, on fruit of *Persea americana* var. Hass, L. Adam E., 5 March 2007; 2 adult females, Uruapan, Jicalam, on branch of *Persea americana* var. Hass, R. Perez, 6 June 1985 [sic? 2007]. Intercepted from MEXICO: 2 adult females, quar. California, Blythe Inspection Station, ex avocado, Villa, 10 February 2005 (PDR#1293144); 1 adult female, via Arizona, at California, Blythe Inspection Station, ex *Persea americana* fruit Villa, 9 March 2007 (PDR#1376456) [DNA AS015]; 1 adult female, at California, Blythe Inspection Station, ex *Persea americana* fruit, Villa, 10 March 2007 (PDR#1376459) [DNA AS014]; 2 adult females, intercepted in California, on *Persea americana*, R. Concepción, 8 May 2007 (SD 043622); 1 adult female, intercepted in California, on *Persea americana*, W. Burkey, 8 May 2007 (SD 043623); 2 adult females, intercepted in California, on *Persea americana*, A. Shifefaw, 7 May 2007 (SD 043624); 1 adult female, at California, Blythe Inspection station, on *Persea americana* fruit, Gonzales/Herrera, 6 March 2007 [DNA AS024] (PDR#1353338); 8 adult females (4 on each of 2 slides), intercepted at California, Vidal Inspection Station, ex *Persea americana* on fruit skin, R. Duarte, 7 March 2007 (PDR# 1386212); 3 adult females and 1 immature together on 1 slide, intercepted at California, Needles Inspection Station, on avocado fruit, Y. Rodriguez, 28 July 2007 (PDR#1467028). Specimens from GUATEMALA: 1 adult female, quarantine at California, U.C. Riverside, ex budwood of *Persea* sp. 'B', coll. J. Chandler and D. Elsweci, 13 December 1988 (CDFA #827343); 6 adult females (4 on one slide, 2 on second slide), Antigua, quarantine at California, U.C. Riverside, ex avocado budwood, J. Chandler, 16 September 1985 (CDFA#85523-27).

Specimens deposited in the UCR. Intercepted from MEXICO: 2 females, intercepted at California, Blythe Inspection station, on *Persea americana*, J. Morse, 18 May 2007 [DNA AS277, AS292].

Specimens deposited in the FSCA. Collected in MEXICO: 1 adult female, Michoacán, Nuevo Parangaricutiro, Huerto La Hierbabuena, on fruit of *Persea americana* var. Hass, E. Campoverde, 30 March 2007; 1 adult female, Michoacán, Nuevo Parangaricutiro, Huerto La Hierbabuena, on fruit of *Persea americana* var. Hass, L. Adams E., 3 March 2007.

Specimens deposited in BMNH. Collected in MEXICO: 1 adult female, Michoacán, Uruapan, Yácatas, on rama [=branch] of *Persea americana* var. Hass, Ma. R. Perez, 7 June 2007; 1 adult female, Michoacán, Tancitaro, Huerto Panzinda, on fruit of *Persea americana* var. Hass, B. Gonzalez, 30 March 2007.

NON-TYPE SPECIMENS. All non-type specimens listed below are deposited in the USNM. Intercepted from MEXICO: 5 adult females, intercepted in Texas, on *Persea americana*, D. McCoy, 6 April 2007; 6 adult females, intercepted at California, Blythe Inspection Station, on *Persea americana*, J. Morse, 18 May 2007 [DNA AS278, AS282, AS283, AS286, AS288, AS290].

Etymology

The species name means "of avocado". It is based upon "aguacate", the common name for *Persea americana* in the Spanish language.

Discussion

The distinctions between the genera *Abgrallaspis* Balachowsky, *Hemiberlesia* Cockerell and *Diaspidiotus* Berlese are sometimes unclear. Takagi (1969) suggested that these genera (along with *Quadraspidotus* MacGillivray, a junior synonym of *Diaspidiotus*), all belong to a single genus. The separation of these genera has been based primarily on differences in the number and shape of the pygidial lobes and the size and relative position of the anal opening (see Table 1). However, the usefulness of these characters to distinguish between *Abgrallaspis* and *Hemiberlesia* species may be compromised as more information becomes known regarding the degree of intraspecific variation. Stannard (1965) showed that the number and shape of the pygidial lobes of *Diaspidiotus ancylus* varied depending on which part of the host plant the species was feeding. He found that *Abgrallaspis howardi* (Cockerell) and *Abgrallaspis comstocki* (Johnson) were names given to leaf-feeding forms of the same species as *D. ancylus*, which was described from the bark-feeding form. The L2 of

the leaf-feeding form are well developed and sclerotized, whereas those of the bark-feeding form are poorly developed. However, no morphological differences were observed between specimens of *A. aguacatae* collected on bark and those collected on leaves or fruit. The relative size and position of the anal opening is useful to separate most species of *Hemiberlesia* from *Abgrallaspis* and *Diaspidiotus* species, but in some cases it appears to be intermediate in size and more separated from the posterior margin than in other species. All three genera are in need of revision. We have placed this new species in the genus *Abgrallaspis* based upon the presence of 3 pairs of well-developed pygidial lobes and a relatively small anal opening that is well separated from the posterior margin of the pygidium.

TABLE 1. Diagnostic characters used to distinguish the genera *Abgrallaspis*, *Diaspidiotus* and *Hemiberlesia*.

Character	<i>Abgrallaspis</i>	<i>Diaspidiotus</i>	<i>Hemiberlesia</i>
No. pairs of lobes	3	2	1 to 2 (rarely 3)
Tips of plates	Fringed	Pointed	Pointed or fringed
Anal opening size	Relatively small	Relatively small	Relatively large
Distance of anal opening from posterior margin	Often more than 2x	More than 2x	Less than 2x
Plates anterior to L3	Usually fringed	Slender and pointed	Usually slender and pointed

Of the species of armored scale found on avocado, *A. aguacatae* is most similar to *H. diffinis* (Newstead) and *H. neodiffinis* Miller & Davidson. All these species lack perivulvar pores, and have 3 pairs of pygidial lobes with L1 short, wide and hoof-shaped; the plates between L1 and L2, and those between L2 and L3, are long with fringed apices, and the plates anterior to L3 are wide-based, tined, and each contains a median internal microduct. *A. aguacatae* differs from these species of *Hemiberlesia* primarily by the shape and number of teeth along the outer margins of L2 and L3 and the size and position of the anal opening (see Table 2). *A. aguacatae* may also be confused with the San Jose scale, *Diaspidiotus perniciosus* (Comstock), but can be distinguished from the latter species by the number of distinct pairs of pygidial lobes, the form of the plates between L1 and L2 and between L2 and L3, and by possessing a longer pygidium on which the sclerotized frame surrounding the vulva is longer than wide (see Table 2).

TABLE 2. Diagnostic characters used to distinguish *Abgrallaspis aguacatae*, *Diaspidiotus perniciosus*, *Hemiberlesia diffinis* and *Hemiberlesia neodiffinis*.

Character	<i>Abgrallaspis aguacatae</i>	<i>Diaspidiotus perniciosus</i>	<i>Hemiberlesia diffinis</i> and <i>H. neodiffinis</i>
No. pairs of lobes	3	2	3
L2 basal width	Wider than long	Wider than long	Longer than wide
L2 no. of lateral teeth	3 or 4	1	1 or 2
L3 basal width	Longer than wide	(Absent)	Longer than wide
L3 no. of lateral teeth	Usually 2 or 3	1 or 2	Teeth absent
Anal opening size	Small	Fairly small	Large
Distance of anal opening from posterior margin	Ca. 1.7x its diameter	Ca. 1.6–2.6x its diameter	1–1.2x its diameter
Tips of plates between L1 and L2	Fringed	Pointed	Fringed
Shape of sclerotised frame around vulva	Longer than wide	About as long as wide	Wider than long

When compared to other *Abgrallaspis* and *Hemiberlesia* species not found on avocado, *A. aguacatae* resembles *A. liriodendri* Miller and Howard and *H. massoniana* Tang. All three species lack perivulvar pores and have 3 pairs of pygidial lobes, the anal opening is relatively small and may be separated from the posterior margin by more than 2x its diameter, and fringed plates are present along the margin anterior to L3. However, *Abgrallaspis aguacatae* can be distinguished by its convergent L1 lobes; the size and shape of each L1 lobe, which is short, wide asymmetric (hoof-shaped); and by its wide L2 with 3 or 4 lateral teeth: whereas in each of these other species, L1 is longer, more slender, symmetrical and parallel, and L2 is elongate and lacks teeth on the lateral margin.

Currently, *A. aguacatae* is only known to feed on avocado. Its biology has not been studied; however, observations on infested fruit intercepted at border inspection stations in California suggest that the species reproduces sexually, as immature and adult winged males have been collected. Adult females have only been observed in association with crawlers, not eggs. This suggests that the females are probably ovoviviparous or viviparous. The absence of perivulvar pores supports this deduction, as these pores are usually present in oviparous armored scale species.

Based on the scientific literature (Ben-Dov *et al.*, 2008; Watson, 2002) and the collection in the United States National Museum, Beltsville, Maryland, U.S.A., 53 species of armored scale in 29 genera have been recorded feeding on avocado worldwide. An identification key is provided below to separate the adult females of these species. Miller and Davidson (2005), which provided illustrations for most of the genera and species treated in the key. Additional *Diaspis* spp. have been intercepted on avocado fruit from Mexico, some possibly undescribed, but these have not been authoritatively identified and are not included in the key below.

Key to Armored Scales on Avocado (adult females)

1. Pygidium with 1-barred macroducts; second lobes (L2) unilobate (not divided); anterior spiracles usually not associated with disc pores; antennae each rarely with more than 1 obvious seta; body usually short and broad (oval, turbinate or circular); fringed plates present between pygidial lobesAspidiotinae ... 2
- 1b. Pygidium with 2-barred macroducts; L2 usually bilobate (divided); anterior spiracles usually associated with disc pores; antennae each commonly with 2 or more obvious setae; body of most species long and relatively narrow, gland spines often present between pygidial lobes Diaspidinae ... 37

Aspidiotinae

- 2(1) Dorsum of pygidium extensively reticulate; with 4 pairs of well-developed lobes; cosmopolitan..... *Pseudaonidia trilobitiformis* (Green)
- 2b. Dorsum of pygidium smooth or weakly striate (not extensively reticulate); number of lobes variable 3
- 3(2b) Pygidial paraphyses present 4
- 3b. Pygidial paraphyses absent 31
- 4(3) At maturity, prosoma expanded and sclerotized at least at margin, often kidney-shaped; paraphyses shorter than lobes *Aonidiella* ... 5
- 4b. Prosoma not kidney-shaped, usually membranous or only partly sclerotized; paraphysis length variable 7
- 5(4) Perivulvar pores present; plates lateral to L3 clavate, not fringed; three prepygidial segments each with cluster of macroducts on each side; prosoma expanded but not obviously kidney shaped at maturity; cosmopolitan *Aonidiella orientalis* (Newstead)
- 5b. Perivulvar pores absent; plates lateral to L3 fringed; prepygidial segments without lateral clusters of macroducts; body obviously kidney shaped at maturity 6
- 6(5b) Venter of pygidium with 1 pair of prevulvar apophyses, each shaped like an inverted, sclerotized V; additional prevulvar scleroses absent; cosmopolitan *Aonidiella citrina* (Coquillett)
- 6b. Venter of pygidium with 2 pairs of linear prevulvar scleroses in addition to 1 pair of apophyses; cosmopolitan .
..... *Aonidiella aurantii* (Maskell)
- 7(4b) All paraphyses shorter than L1; all arising from lobe bases, absent from spaces between lobes (except in *Abgrallaspis aguacatae* which has one paraphysis between L2 and L3) 8
- 7b. At least some paraphyses obviously longer than L1, arising from lobe bases and from within at least one interlobular space 19
- 8(7) Perivulvar pores present 9

8b.	Perivulvar pores absent	15
9(8)	Anal opening large (wider and longer than L1) and separated from bases of anal lobes by not more than 2x its longitudinal diameter	10
9b.	Anal opening small (narrower and shorter than L1) and separated from bases of anal lobes by more than 2x its longitudinal diameter	12
10(9)	L1 appearing slightly convergent, with lateral margin notched and slightly longer than mesal margin; L1 each lacking basal sclerosis; cosmopolitan	<i>Hemiberlesia lataniae</i> (Signoret)
10b.	L1 parallel, each lobe symmetrical with a notch on either side; L1 each with well-developed basal sclerosis; cosmopolitan	11
11(10b)	Pygidial plates obviously longer than L1 and elaborately fringed; plates anterior to L3 usually fringed on outer margin as well as at tip; L2 long and slender, usually pointed; cosmopolitan....	<i>Hemiberlesia palmae</i> (Cockerell)
11b.	Pygidial plates no more than slightly longer than L1 and only moderately fringed; plates anterior to L3 lacking lateral fringes; L2 long and narrow, apex usually rounded; cosmopolitan	<i>Abgrallaspis cyanophylli</i> (Signoret), in part
12(9b)	L1 each with well-developed basal sclerosis; L1 parallel, each lobe symmetrical and notched on either side ..	13
12b.	L1 each without basal sclerosis; L1 usually appearing slightly convergent, with lateral margin notched and slightly longer than mesad margin, but L1 occasionally parallel and symmetrical	14
13(12)	Pygidial macroducts in single rows, numbering fewer than 20 on 1 side of pygidium; pygidial macroducts relatively short and wide, each about 15x as long as wide; plates anterior to L3 about same length as L1, fimbriate; cosmopolitan	<i>Abgrallaspis cyanophylli</i> (Signoret), in part
13b.	Pygidial macroducts in double to triple rows, numbering more than 35 on 1 side of pygidium; pygidial macroducts long and slender, each more than 20x as long as wide; plates anterior to L3 each with a fleshy filament longer than L1; Argentina, Chile	<i>Abgrallaspis latastei</i> (Cockerell)
14(12b)	L2 always present, about as wide as long; L3 short, broad, sclerotized point, as long as wide; macroducts each about 10x as long as wide, numbering fewer than 25 on 1 side of pygidium; USA (Georgia, Texas)	<i>Abgrallaspis perseae</i> Davidson
14b.	L2, if present, longer than wide; L3, if present, a slender sclerotized point; macroducts each more than 10x as long as wide, often numbering more than 26 (15–58) on 1 side of pygidium; N. and S. America, S. Africa, Australia, parts of W. Europe (bark form with numerous macroducts, L2 often reduced to points and L3 reduced to minute points or absent; leaf form with fewer macroducts, and L2 and L3 both developed)	<i>Diaspidiotus ancyclus</i> (Putnam)
15(8b)	Anal opening large (wider and longer than L1) and separated from bases of L1 by not more than 2x its longitudinal diameter.....	16
15b.	Anal opening small (narrower and shorter than L1) and separated from bases L1 by more than 2x its longitudinal diameter.....	18
16(15)	L2 and L3 each a simple sclerotized point, never toothed; anal opening large, located less than 1x its diameter from base of L1; plates anterior to L3 each simple or slightly fringed, not containing a duct; cosmopolitan	<i>Hemiberlesia rapax</i> (Comstock)
16b.	L2 a well-developed, sclerotized point, with lateral margin at least slightly toothed; L3 a simple point or with several lateral teeth; anal opening small- to medium-sized, located 1–2x its diameter from base of L1; plates anterior to L3 unusually large, each branched and containing 1 or more microducts	17
17(16b)	L1 with macroduct opening between lobes; branched plates anterior to L3 each containing 2 or 3 microducts; Nearctic, Neotropical	<i>Hemiberlesia diffinis</i> (Newstead)
17b.	L1 without macroduct opening between lobes; large, branched plates anterior to L3 each containing only 1 microduct; USA, Mexico	<i>Hemiberlesia neodiffinis</i> Miller & Davidson
18(15b)	L3 sclerotized, pointed; L2 and L3 each with several lateral teeth; pygidium fairly long with straight margins, forming an apical angle usually less than 100°; plates between lobes long with fringed apices; sclerotized frame around vulva longer than wide; Mexico	<i>Abgrallaspis aguacatae</i> Evans, Watson, and Miller spec. nov.
18b.	L3 unsclerotized, plate-like, without lateral teeth; L2 with only one lateral tooth at most; pygidium short and wide with rather rounded margins, forming an apical angle more than 115°; plates between lobes simple or with only a few tines; sclerotized frame around vulva wider than long; cosmopolitan.....	<i>Diaspidiotus perniciosus</i> (Comstock)
19(7b)	At maturity, body elongate and parallel-sided	<i>Pseudischnaspis</i> ... 20
19b.	Body broadly pyriform / oval / circular, not elongate or parallel-sided	21
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20b.	Anterior margin of head curved; pygidium longer (about 0.22x body length in mature specimens); sclerotized margin anterior to L3 longer than distance from L1 to L3; Nearctic, Neotropical.....	

 <i>Pseudischnaspis bowreyi</i> (Cockerell)	
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22b.	Pygidium shorter, margins usually convex, apex more or less rounded; apical angle usually more than 90°	26
23(22)	Each lateral margin produced into a point about opposite posterior spiracle; Nearctic, Neotropical, Western Palearctic	<i>Acutaspis perseae</i> (Comstock)
23b.	Each lateral margin of thoracic region curved, not produced into a point about opposite posterior spiracle	24
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24b.	On L2, a paraphysis arising from outer angle shorter, only 1.0–1.6x as long as paraphysis arising from inner angle	25
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27b.	Pygidial plates anterior to L3 clavate; submarginal clusters of prepygidial macroducts, if present, containing no more than 5 ducts each; perivulvar pores absent from midline anterior to vulva; scale cover yellow- or chocolate-brown with yellow exuviae	28
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