

## Scale Insects of Citrus in Suriname

by

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Almost every tree in the 2000 ha planted to *Citrus* in Suriname—composed of 1200 ha of orange trees, 600 ha of grapefruits and 200 ha of lemon, mandarin, shaddock and lime — is found infested with one or several species of the following armoured scale insects (fam. Diaspididae): *Lepidosaphes beckii* Newm., *Lepidosaphes gloverii* Pack., *Chrysomphalus ficus* Ashm., *Fiorinia* sp., *Selenaspidus* sp. and the soft scale (fam. Coccidae) *Coccus hesperidum* L.

In general *L. beckii* Newm. is the predominant scale insect in the plantations, followed by *Fiorinia* sp., *Selenaspidus* sp. and *Chr. ficus* Ashm., which are present to a lesser degree. *L. gloverii* Pack. and *Coccus hesperidum* L. are rather scarce.

However, locally, especially on young trees and in young orchards any of these six species may prevail. In these cases the dominance of the species concerned is usually the result of the use of planting material which was already infested with this species. Infested planting material is doubtless the main medium by which scale insects are moved into new areas.

In established plantations in which the trees often originate from several nurseries, a variety of scale insect species can be noticed. Notwithstanding the fact that scale insects are so common on *Citrus* trees, they do not need, for the time being, to be considered as a pest of major importance in established orchards, although the normal growth of the tree may be hampered to some degree. Serious damage such as defoliation, drying up of young twigs, poor blossoming, heavily infested and undersized fruits with low juice content seldom occur in plantations which receive the normal amount of care.

However, seedlings and young *Citrus* trees up to 5 years old often experience a marked injurious influence as a result of a continuous attack by scale insects. Their growth is much retarded, the leaves turn yellow and drop and finally the young twigs may die back causing the death of the tree.

In how far the simultaneous presence of the various species affects their rate of increase has not been studied. Neither has attention been paid to the climatic conditions such as humidity and temperature during the seasons in Suriname, nor to the presence of the many parasites, predators and fungous diseases of the scale insects, which undoubtedly will play a role in the prevention of serious outbreaks.

In order to facilitate the recognition of the six above mentioned scale insects both in the field and in the laboratory, the author here presents a short survey. As different developmental stages of both sexes of the several species are often simultaneously present even on a single leaf, some experience is needed to distinguish between these stages in this complicated medley of scales. A brief literature review, especially concerning micro-recognition characters, is given for each of the insect species treated. Reference is made to:

BALACHOWSKY, A., 1948, Les Cochenilles IV, Classification-Diaspidinae.

BODENHEIMER, F. S., 1951, Citrus Entomology in the Middle East.

FERRIS, G. F., 1937—'38, Atlas of the Scale Insects of North America, S I, S II.

GREEN, E. E., 1896, 1904, The Coccidae of Ceylon, I, III.

NEWSTEAD, R., 1901, 1903, Monograph of the Coccidae of the British Isles I, II.

QUAYLE, H. J. 1938, Insects of Citrus and other subtropical fruit.

Finally, the early publication by VAN HALL<sup>1)</sup>, dealing with the Coccidae on *Citrus* in the West Indies, should be mentioned. This author makes general remarks about the life history of scale insects and the damage they cause, and gives control measures. The following armoured scales are noted for Suriname: *Lepidosaphes beckii* Newm. (*Mytilaspis citricola* Pack.), *Chrysomphalus ficus* Ashm. (*Aspidiotus ficus* Comstock) and *Aonidiella* (*Aspidiotus*, *Chrysomphalus*) *aurantii* Mask. This last mentioned species was observed on young orange trees imported from Trinidad in the Botanical Garden at Paramaribo.

Moreover he lists *Selenaspis* (*Aspidiotus*) *articulatus* Morg., *Lepidosaphes* (*Mytilaspis*) *gloverii* Pack., *Pinnaspis* (*Mytilaspis*) *buxi* Bché., *Coccus* (*Lecanium*) *hesperidum* L., *Saissetia* (*Lecanium*) *hemisphaericum* Targ., *Saissetia* (*Lecanium*) *oleae* Bern. and the mealybug *Planococcus* (*Pseudococcus*) *citri* Riss. (*Dactylopus citri* Boisd.). However, as VAN HALL does not mention from which locality these species were identified, it is not clear from what country or island in the West Indies these species originate. It is almost certain that *Aonidiella aurantii* Mask. is not present in Suriname nowadays.

#### *Chrysomphalus ficus* Ashmead

*Chr. ficus* Ashm. (*Aspidiotus aonidium* L.) has been recorded from tropical and subtropical regions all over the world and is highly polyphagous. On *Citrus* this oviparous scale insect lives on both sides of the leaves and also on the fruits. Egg: yellow shiny, oval, length and width 0.20 mm and 0.10 mm, respectively. Larva I: the newly-hatched yellow larva has a length and width of 0.22 mm and 0.15 mm.

Male: winged, orange-yellow, dark eyed. Length 0.74 mm, the 0.22 mm long stylus inclusive.

Puparium (see fig. 1b): elongate-oval, with more or less parallel sides, and a length and width of 0.8—1.0 mm and 0.6—0.7 mm; colour as in the female scale, with the posterior extension pale brown to grey colorless; circular exuvium I, goldish-yellowish to orange brownish, with a diameter of 0.33 mm.

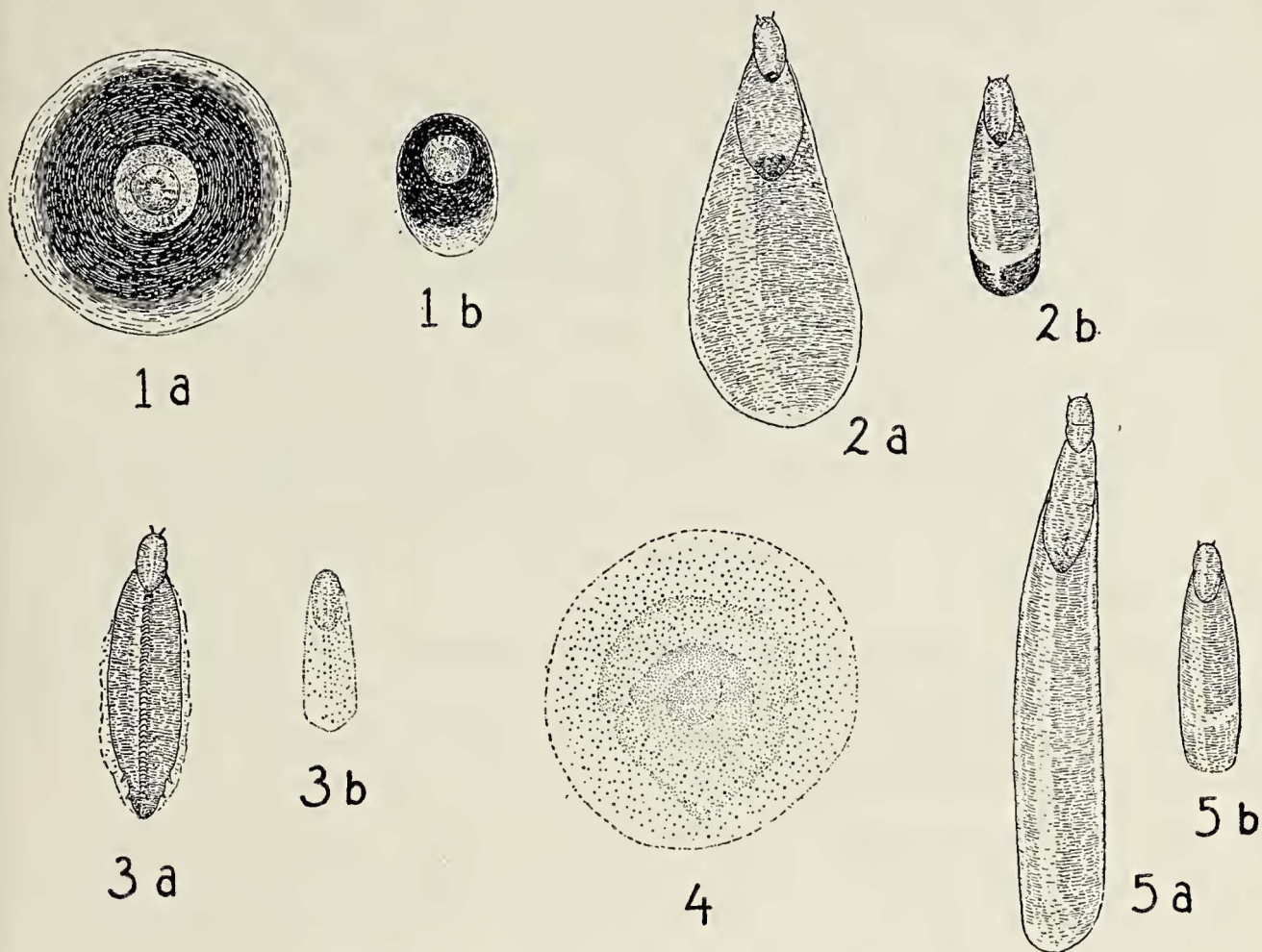
Female: the yellow coloured female, broadly rounded in front and pear shaped behind attains a length and width of 1—1.5 mm and 1—1.3 mm, when mature.

Female scale (see fig. 1a): circular, moderately convex, with the largest diameter of 2—2.3 mm. Dark-brown, pale brown-colorless towards the margin and with centrally or slightly subcentrally placed dark orange to reddish brown circular exuvia (diameter of exuvium I 0.33 mm; that of exuvium II for the part that is visible from the dorsal 0.63 mm).

Micro-recognition characters and other data, see: BALACHOW-

<sup>1)</sup> VAN HALL, C. J. J., 1905, Schildluizen op oranjeboomen en hun bestrijding; Inspectie van den Landbouw in West-Indië, Bulletin No. 3, 1—19.

SKY, IV, 107—111; BODENHEIMER, 274—301; FERRIS, S II—201; GREEN, I, 43—44; NEWSTEAD, I, 104—107; QUAYLE, 133—136.



Armoured scales on *Citrus*: *Chrysomphalus ficus* Ashm., 1a scale of adult female, 1b puparium; *Lepidosaphes beckii* Newm., 2a scale of adult female, 2b puparium; *Fiorinia* sp., 3a exuviae I and II of female, 3b puparium; *Selenaspidus* sp., 4 semitransparent scale, vaguely showing adult female; *Lepidosaphes gloverii* Pack., 5a scale of adult female, 5b puparium.

All figures about  $14 \times$  natural size.

### *Lepidosaphes beckii* Newman

*L. beckii* Newm. (*Aspidiotus citricola* Pack.) has its original home in tropical America, but has been recorded from *Citrus* and several other foodplants all over the world. The scale insect lives on the *Citrus* leaves, preferably on the lower side and on the fruits. Branches and stem are as a rule attacked to a far lesser degree.

**Egg:** elongate-oval, pearly-white,  $0.27 \times 0.12$  mm; the eggs are deposited rather irregularly beneath the female scale; however, scales containing eggs that are more regularly arranged in several longitudinal running rows, can also be found.

**Larva I:** the newly hatched pearly-white larva has a length and width of  $0.28 \times 0.13$  mm.

**Pupae:** purplish in colour and dark eyed; the body of the pupa has a length of about 0.8 mm, the stylus sheath included.

**Male:** winged, faintly violet coloured, dark eyed; body length 0.7—0.8 mm, including the 0.22 mm long stylus.

**Puparium** (see fig. 2b): generally straight with a length and width of 1.4 mm and 0.4 mm, exuvium I ( $0.42 \times 0.22$  mm) at the tip inclusive; colour light brown, hind part of the scale purplish coloured.

**Female:** The elongate fusiform body has a length of 1.2—1.3 mm; the body is creamy white-colorless, the yellowish brown pygidium excepted.

**Female scale** (see fig. 2a): the length is up to about 2.5 mm, including exuvium I ( $0.43 \times 0.22$  mm) and exuvium II ( $0.8 \times 0.4$  mm), which are situated at the tip, the largest width 0.8—1.0 mm. The colour is light to darker brown, the shape elongate more or less straight or curved and resembles an oyster-shell.

**Micro-recognition characters and other data**, see: BODENHEIMER, 301—321; FERRIS, SI—71; GREEN I, 78—79; NEWSTEAD I, 204—206; QUAYLE, 163—173.

*Lepidosaphes gloverii* Packard

*L. gloverii* (*Mytilaspis gloverii* Pack.), a fairly polyphagous scale, with a world-wide distribution has been noticed in Suriname on *Citrus*. Here the insect lives on the leaves — often along the margin — the fruits, the twigs and the young stem.

**Egg:** the newly deposited egg is colorless creamy; afterwards the egg becomes purplish. The ovally shaped eggs (length 0.21—0.25 mm, width 0.11 mm) are deposited rather regularly in two parallel rows beneath the scale.

**Larva I:** pale violet, length 0.29 mm, width 0.12 mm.

**Male:** winged, pale purplish, dark-eyed.

**Puparium** (see fig. 5 b): colour lightbrown-brown, its posterior region pale brown and not purplish as in *L. beckii*. Length 1.1—1.4 mm, including yellowish exuvium I ( $0.37 \times 0.20$  mm); width 0.3—0.4 mm.

**Female:** elongate, with more or less parallel, lateral margins; pale purplish coloured when full-grown. Length and width 1—1.3 mm and 0.25—0.4 mm respectively.

**Female scale** (see fig. 5a): long and narrow, mostly straight. Colour lightbrown. Scale at its anterior region sometimes covered with a transparent whitish film. Exuvia more pale-yellowish. Total length is 2.0—3.5 mm including exuvium I (length 0.37—0.39; width 0.15—0.20 mm) and exuvium II (length 0.6—0.84 mm; width 0.25—0.37 mm); the width is 0.25—0.58 mm. In specimens living along the leaf margin, the scale is very narrow (0.25 mm), when seen from the dorsal side and strongly arched in cross-section.

**Micro-recognition characters and other data**, see: BODENHEIMER, 320—321; FERRIS, SI—74; GREEN I, 83—84; QUAYLE, 173—175.

*Fiorinia* sp. has been observed living on the leaves, preferably on the lower side, and to a lesser degree on the fruits and branches. Male larvae often congregate on the lower side of the leaf. This region (diameter 0.5—2 cm) of the leaf becomes slightly covered with a waxy film, while fine silky threads, produced during the crawler stage, may form a woolly mass. This scale-insect is pupillarial, the adult female being retained within the exuvium of the second stage, which splits near the pygidial margin to permit the escape of the larvae.

**Egg:** yellow, ovally shaped,  $0.21 \times 0.10$  mm. The eggs, up to a number of about 25 are deposited inside the exuvium of the second stage; they are often arranged in two parallel longitudinal rows.

**Larva I:** the newly hatched yellow larva has a length and width of  $0.26 \times 0.13$  mm.

**Pupae:** yellow, dark-eyed; the body of the pupa has a length of 0.7 mm, the stylus sheath inclusive.

**Male:** winged, orange coloured, dark eyed; body length 0.65—0.75 mm, including the 0.17 mm long stylus.

**Puparium** (see fig. 3b), fragile snowy-white, uncarinated. The length, including the pale yellowish exuvium I ( $0.43 \times 0.23$  mm) is 0.9—1.1 mm; the largest width 0.4 mm.

**Female:** elongate, yellow and delicate. Dorsally, on the anterior margin and between the antennae, the head is provided with a fleshy trunk-like process. Ventrally, the small tubercle-like antennae are situated rather closely together; the antenna bears a stout seta. Pygidium without large marginal ducts, in contrast with the larva of the second instar.

**Exuvium of the second instar** (see fig. 3a): elongate, total length including exuvium I ( $0.45 \times 0.22$  mm) varies from 1.6—1.9 mm; the largest width is 0.55 mm. The rather heavily sclerotized exuvium shows a more or less distinct median keel and is covered with a transparent film of wax. (The young and not full-grown yellow coloured larva II is very flat and has a delicate derm).

Exuvium II shows 2 stout mastoid processes along the lateral margin in front of the pygidium; a third and lowest placed small process can also be recognized. All three processes are provided at their tip with a hollow spine into which a small marginal duct opens.

Morphological and other data of the genus, see: GREEN I, 93; NEWSTEAD I, 133.

### *Selenaspidus*

This ovoviviparous species lives on both sides of the leaves, preferably at the upper side, and also on the fruits. Hatching occurs almost immediately after depositing and only a few newly hatched larvae can be noticed at a time under the transparent scale.

**Egg:** yellow, oval, length and width 0.19—0.22 mm and 0.12 mm, respectively.

**Larva I:** the newly hatched yellowish and flat ovally shaped larva has a length and width of 0.20—0.22 mm and 0.15 mm. The slender final antennal joint is provided with one long seta on the tip only. (The antenna of the crawler of the closely related *Selenaspidus articulatus* Morg. has another form. See FERRIS S II—265, fig. A).

**Pupae:** yellow, dark eyed.

**Male:** winged, the yellow coloured body has a length of 0.5 mm, the 0.2 mm long stylus exclusive.

**Puparium:** transparent, ovally shaped with a largest diameter of about 1.2 mm; exuvium I pyriformous, excentrically placed, length 0.3—0.43 mm.

**Female:** yellowish, when young; the derm becomes sclerotized, brownish yellow throughout at maturity. The rather flat body, which attains a length of 1.2—1.4 mm and a width of 1.0—1.25 mm, shows a deep constriction between meso- and metathorax.

**Female scale** (fig. 4): flat, semi transparent, circular to slightly ovally

shaped with a diameter of 2—2.5 mm; the pyriformous yellowish coloured exuviae I and II are centrally to slightly excentrically placed, their largest diameters measuring 0.3—0.4 mm and 0.6—1.0 mm respectively.

Morphological and other data of the genus, see: FERRIS S II—265; NEWSTEAD I, 127—129.

*Coccus hesperidum* Linnaeus

*Coccus (Lecanium) hesperidum* L. is polyphagous and widely distributed throughout the world. In Suriname this ovoviviparous insect can be noticed on the leaves and young branches of *Citrus*, as a rule in negligibly small numbers. Larvae: oval, flat, pale yellowish-green and more or less transparent.

Female: The rather flat to slightly convex adult female has an oblong-oval but slightly asymmetric form and is usually broader behind; length 2.4—3.5 mm, width 1.4—2.5 mm. The colour varies from greenish-yellow to yellowish-brown, often irregularly mottled in dark reddish brown. The minute specks may agglomerate into patches or bands. Eyes small, dark, marginal. Antennae seven-jointed; third, fourth and seventh segments the longest. The anal plates are rather narrow, the cephalo-lateral margin being slightly shorter than the caudo-lateral margin; the lateral angles are rounded, the caudal angles more sharply rounded. Each plate bears two fringe setae, two sub-apical setae and four small apical setae. The anal ring, situated far in front of the plates, is provided with eight long stout hairs. Stigmatic cleft with three spines, the middle one longer than the other two, projecting well beyond the body margin. Several of the slender, pointed marginal setae are forked or fringe-like at the tip and may also be slightly serrated.

Micro-recognition characters and other data, see: BODENHEIMER, 354—364; GREEN, III, 188—189; NEWSTEAD, II, 78—85; QUAYLE, 96—101.

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Deurs, W. van, *Sommerfugle. VIII. Viklere*. G. E. C. Gads Forlag, København, pp. 1—292, 36 tekstfiguren, 31 platen, 1956.

Dit boekje vormt deel 61 uit de serie „Danmarks Fauna”, een reeks van geïllustreerde handboekjes, fauna's in zakformaat. Een boekje om iedere faunist te doen watertanden, en een zoals ieder van ons eens dolgraag zou willen schrijven. De stevige linnen band, het handige formaat, keurig papier, duidelijk lettertype verlenen aan dit boekje een welverzorgd uiterlijk. De beschikbare ruimte is net voldoende om de Bladrollers onder de Macrolepidoptera (Viklere, superfamilie Tortricoidea) naar behoren te behandelen. Van iedere soort wordt een korte beschrijving, met aantekeningen over levenswijze, vliegtijden, verspreiding etc. gegeven. Er zijn zeer bruikbare schetsjes van de mannelijke genitaliën van enkele lastig op naam te brengen soorten gegeven. Tenslotte wordt het boekje afgesloten met 31 platen naar uitstekende foto's van de 318 Deense soorten van bladrollers. Vooral de platen maken dit werk bijzonder bruikbaar en aantrekkelijk. Zowel de tekst als de tabellen van genera en soorten zijn kort en duidelijk gehouden. Een handboekje, overzichtelijk voor de veldentomoloog, handig voor de verzamelaar.

Het is wel jammer dat de vrouwelijke genitalia niet worden afgebeeld of beschreven, wat des te bedenkelijker is, aangezien — althans bij vele genera van de subfamilie Olethreutinae (= familie Eucosmidae) — men daarmee haast eerder de soorten determineert dan met de mannelijke genitaalkenmerken.