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# Occasional Papers

## IN ENTOMOLOGY

A REVIEW OF THE GENUS COCCUS LINNAEUS  
IN AMERICA NORTH OF PANAMA  
(HOMOPTERA: COCCOIDEA: COCCIDAE)

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NO. 24

1977

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*Formerly published under the title Occasional Papers of the Bureau of Entomology of the California Department of Agriculture.*

*This issue mailed November 1, 1977*

**A REVIEW OF THE GENUS *COCCUS* LINNAEUS  
IN AMERICA NORTH OF PANAMA (HOMOPTERA:  
COCCOIDEA: COCCIDAE)**

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**INTRODUCTION**

The scale insect family Coccidae contains a number of economically important species, but unfortunately the taxonomic position of many is doubtful (Williams and Kosztarab 1972). Many type specimens are non-existent or are in such poor condition that they are useless for taxonomic study. Many nomenclatural and taxonomic problems exist within the genus *Coccus* Linnaeus. Moreover, the type-species of *Coccus* also serves as the type for the genus *Lecanium* Burmeister (Morrison and Morrison 1965). This problem of duplicity of types is still unresolved and is further complicated by the fact that the type of *Coccus hesperidum* Linnaeus and therefore the type of the genus *Coccus* itself has never been properly designated. Most authors accept the belief of Fernald (1902a, 1903b, 1906) that *Coccus hesperidum* Linnaeus is the type-species of the genus *Coccus*. The correct status of the genus *Coccus* Linnaeus and *Coccus hesperidum* Linnaeus must be resolved by the International Commission on Zoological Nomenclature.

*Coccus* is the oldest genus in the Coccoidea and numerous species have

been assigned to it since it was proposed by Linnaeus in 1758. We are limiting our study to the species of Coccidae in North America which are assigned to the genus as currently recognized by coccidologists. North America as here used refers to the continental land area north of the Isthmus of Panama and includes the Caribbean Islands.

The genus *Coccus* has been adequately treated systematically for Hawaii (Zimmerman 1948), the Palearctic Region (Borchsenius 1957, Ezzat and Hussein 1969) and the Ethiopian Region (De Lotto 1957c, 1959, 1965a, 1966, 1969a; Hodgson 1967, 1968a). However, a comprehensive systematic study of the genus has not been published for North America. The taxonomic treatises on the genus in North America dealt with few species and were often part of a faunistic study (Cockerell 1893g, Sanders 1909, Campbell 1914, Essig 1915a, Dietz and Morrison 1916a, Lawson 1917, Britton 1923, Hollinger 1923, Steinweden 1930, Ebeling 1959, Williams and Kosztarab 1972). Many articles including the aforementioned ones contain locality records and/or host plant records, and occasionally biological information and field identification characteristics (Fernald 1903b, Herrick 1911, McDaniel 1924, Gowdey 1926, Ballou 1926, Wolcott 1948, Merrill 1953).

Hitherto, various authors listed about 20 species for North America (Fernald 1903b, Campbell 1914, Lawson 1917, Clausen 1923, Merrill 1953, Anon. 1975, Panis et al 1974). Only the eight species currently recognized as valid are treated here. The other species are either synonyms or belong in other genera. The genus *Coccus* is indigenous to Asia and the Ethiopian Region and seven of the treated species have been introduced into the new world. Apparently, only *Coccus pseudoheperidum* (Cockerell) is indigenous to the Neotropical Region. Moreover, this species is not a congener with the type of the genus and it should be transferred along with *Coccus acutissimus* (Green) in future revisional studies of the genus. Reassignment of these two species requires further redefinition of the genus *Coccus* and the possible establishment of new genera which are beyond the scope of this study.

We have no intention of producing a generic revision but rather are presenting the descriptions, other pertinent information and a key to the adult females of the 8 species currently assigned to the genus in North America to enable other workers to identify these species more easily.

## MATERIALS AND METHODS

Type specimens of *Coccus hesperidum* Linnaeus, *C. longulus* (Douglas) and *C. pseudomagnoliarum* (Kuwana), were not available for study. Therefore, we have accepted the species concepts of De Lotto (1959) and Hodgson (1967) for *C. hesperidum*. For *C. pseudomagnoliarum*, we have relied on the type specimens of *C. citricola* Campbell, which is considered to be a synonym. For *C. longulus* we have followed other

contemporary workers in accepting Ferris' concept (in Zimmerman 1948).

Specimens examined during the course of this study were from the collections of the United States National Museum (USNM); the California Department of Food and Agriculture (CDFA), Sacramento; the University of California at Davis (UCD), and Riverside (UCR); Auburn University (AU); and the British Museum (Natural History) (BM). The depositories of only the type material are indicated.

All measurements given are either in millimeters (mm) or microns ( $\mu$ ). Measurements are not given unless the authors considered them essential for the identification of the species. The leg measurements include all segments plus the claw.

An asterisk after a synonym indicates that the type-material has been examined.

## BIOLOGY

Under natural conditions, the species in the genus *Coccus* are restricted to the warmer climatic areas of the world. *Coccus hesperidum* however, will occur out of doors in North America as far north as Victoria, British Columbia on the West Coast (Andison 1940), and coastal Virginia on the East Coast (Williams and Kosztarab 1972).

In cases where the number of generations per year are known, all species were multivoltine except *C. pseudomagnoliarum* which is univoltine. Females of *C. hesperidum* and *C. pseudomagnoliarum* have two immature instars (Ebeling 1959) and males of *C. hesperidum* have five developmental stages (Saakyan-Baranova 1964). Studies of closely related species and species in other genera of Coccidae indicate three immature stages for the females.

Males are known to occur in *C. hesperidum* but are seldom encountered, and apparently the females are normally parthenogenetic (Saakyan-Baranova 1964). Adult males of *C. pseudomagnoliarum* have been collected by Campbell (1914) and one subsequent worker.

For additional biological information, see the discussion for each species.

## ECONOMIC IMPORTANCE

The eight *Coccus* species in North America attack various ornamental and agricultural plants. Some species also attack native and uncultivated plants in their natural habitats.

Injury to the host is typical of that caused by many species of scale insects. Sap is removed from the plant during the feeding process, result-

ing in a general decline in host vigor. Heavy infestations of some species may cause defoliation and die-back of twigs and branches. Consequently, the production and quality of infested agricultural crops may be adversely affected.

Secondary injury occurs when honeydew secreted by these scale insects adheres to plant parts and forms a substrate for sooty mold. This mold is unsightly and undesirable on nursery stock and in ornamental plantings. Growth of the black mold is believed to block light normally available to host leaves, thereby reducing normal photosynthesis (Williams and Kosztarab 1972) and further reducing host vigor.

Fortunately, scale insects in this genus in North America are controlled for the most part by natural enemies. Occasional outbreaks of one or more species still occur however, and heavy infestations are encountered in nurseries, greenhouses, ornamental plantings, and perennial crops such as citrus. Outbreaks often result in losses directly to the crop host and indirectly by requiring chemical treatments by the grower. Such infestations are caused by adverse effects on the pest-natural enemy balance due to chemical pesticides, changes in the environment or other factors (Van den Bosch and Telford, 1965).

Ants attend and protect some species of soft scales. Although *Coccus hesperidum* is normally associated with ants in California, the parasites were able to reduce the population of this scale. However, the scale colonies were reduced more quickly when the ants were controlled (Ebeling 1959).

The economic status of the eight species covered is discussed under individual species treatments. One economic aspect not readily apparent in the discussion of each species, or in the general literature, is the plant quarantine regulations which prevent or restrict the movement of infested plant material. *Coccus moestus* De Lotto does not occur in the United States, and plant material infested with living specimens is either refused entry or is required to be treated. *C. viridis* (Green), *C. capparidis* (Green), and *C. acutissimus* (Green) do not occur in the states of Arizona and California and any plant material entering these states is required to be free of the living stages of these species.

## TERMINOLOGY

General morphological characters used here are illustrated in Figure 1. Details of the anal opercula, legs and some variations present in the setae and opercula are illustrated in Figure 2. The terminology and descriptions for most structures will be found in the publication by Williams and Kosztarab (1972), De Lotto (1965a) and Ben-Dov et al (1975).

Some of the terms of this paper are not generally used by other workers. Anal plates are commonly used for the sclerotized plates over the anal opening at the anterior end of the anal cleft. However, we have

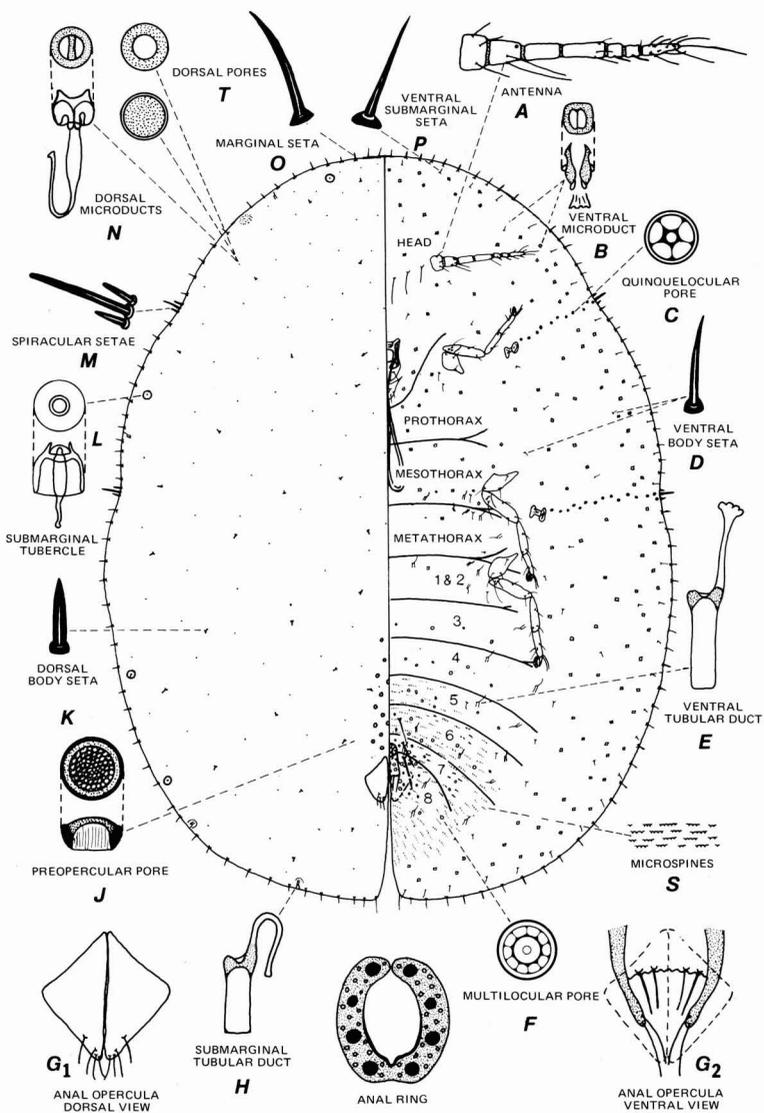
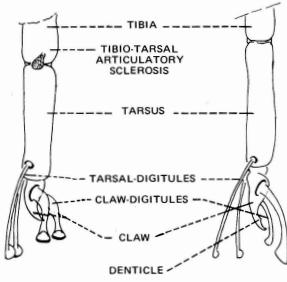
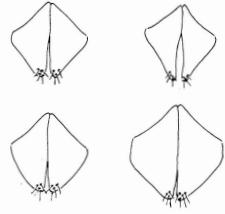


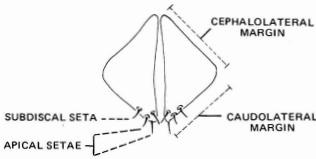
Figure 1. General morphology of adult female.



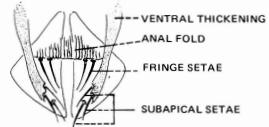
Q-Leg structures



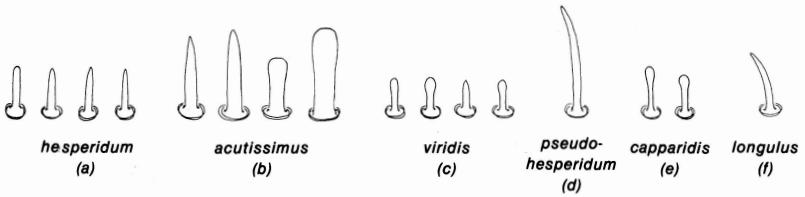
Anal Operculum Variations in *Coccus hesperidum*



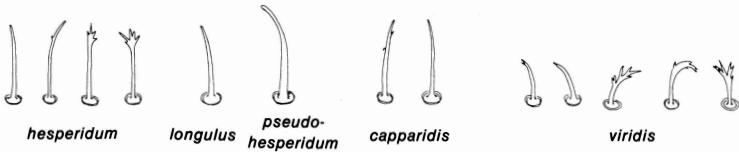
G<sub>1</sub>-Anal Operculum Structures  
Dorsal



G<sub>2</sub>-Anal Operculum Structures  
Ventral



K-Variations in dorsal body setae in *Coccus*



O-Variations in marginal setae in *Coccus*

Figure 2. Morphological details of *Coccus*.

followed De Lotto (1965a) in using the term anal opercula for these plates. "Preopercular pores" is a collective term for various types of dorsal pores anterior to the anal opercula. These pores are usually larger than the other dorsal pores and are either scattered, in loose groups, or as in *Coccus pseudohesperidum*, in a longitudinal median band. "Stigmatic setae", "stigmatic furrows" and "stigmatic clefts" are terms commonly used by many workers, but the adjective "spiracular" will be used here in conjunction with these structures as in two recent publications (Williams and Kosztarab 1972; Ben-Dov et al 1975).

## ACKNOWLEDGMENTS

The authors are indebted to Linda Huddleston, Department of Entomology, British Museum (Natural History), London, for the loan of type specimens. Special appreciation is extended to Charles S. Papp, Special Services, California Department of Food and Agriculture, Sacramento, and Charles H. Ray, Department of Entomology, Auburn University, Auburn, Alabama, for their assistance with the illustrations. We extend our sincerest thanks to Louise M. Russell, Systematic Entomology Laboratory, ARS, USDA, Beltsville, Maryland; Michael Kosztarab, Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg; and John A. Davidson, Department of Entomology, University of Maryland, College Park, for their reviews of the manuscript and useful suggestions.

## NAMES USED IN THE GENUS *COCCUS*

The following specific names have been either referred to the genus *Coccus* in North America or are synonyms of the eight species treated here:

A

acuminatum Signoret, Lecanium \*  
 Syn. of Kilifia acuminata  
 acuminatus (Signoret), Coccus  
 Syn. of Kilifia acuminata  
 acutissimum Green, Lecanium  
 Syn. of Coccus acutissimus  
 acutissimus (Green), Coccus  
 Retained in Coccus  
 alienum Douglas, Lecanium  
 Syn. of Coccus hesperidum  
 angustatum Signoret, Lecanium  
 Syn. of Coccus hesperidum  
 angustatus (Signoret), Coccus  
 Syn. of Coccus hesperidum  
 assimile var. amaryllis Cockerell,

Lecanium

Syn. of Coccus hesperidum  
 aurantii Alfonso, Chermes  
 Syn. of Coccus hesperidum

### C

capparidis (Green), Coccus \*  
 Retained in Coccus  
 capparidis Green, Lecanium  
 Syn. of Coccus capparidis  
 celtium Kuwana, Lecanium (Coccus)  
 Syn. of Coccus longulus  
 ceratoniae Gennadius, Lecanium  
 Syn. of Coccus hesperidum  
 chirimoliae Maskell, Lecanium  
 Syn. of Coccus longulus

\* Type material examined.

*citricola* Campbell, Coccus  
Syn. of *Coccus pseudomagnoliarum*  
*citricola* (Campbell), Lecanium \*  
Syn. of *Coccus pseudomagnoliarum*

#### D

*depressum* var. *simulans* Douglas,  
Lecanium  
(Manuscript name cited in  
synonymy with *C. hesperidum*)

#### E

*elongatum* Signoret, Lecanium  
Syn. of *Parthenolecanium persicae*  
*elongatus* (Signoret), Coccus  
Syn. of *Parthenolecanium persicae*

#### F

*ficus* (Maskell), Coccus  
Syn. of *Coccus longulus*  
*ficus* Maskell, Lecanium \*  
Syn. of *Coccus longulus*  
*flaveolum* Cockerell, Lecanium \*  
Syn. of *Coccus hesperidum*  
*flaveolus* (Cockerell), Coccus  
Syn. of *Coccus hesperidum*  
*frontale* Green, Lecanium  
Syn. of *Coccus longulus*

#### H

*hesperidum* Linnaeus, Coccus  
Type-species of Coccus  
*hesperidum* (Linnaeus), Calymnatus  
Syn. of *Coccus hesperidum*  
*hesperidum* (Linnaeus), Calypticus  
Syn. of *Coccus hesperidum*  
*hesperidum* (Linnaeus), Chermes  
Syn. of *Coccus hesperidum*  
*hesperidum* (Linnaeus), Lecanium  
Syn. of *Coccus hesperidum*  
*hesperidum africanum* Newstead,  
Lecanium (*Trechocoris*)  
Syn. of *Coccus viridis*  
*hesperidum alienum* (Douglas),  
Coccus  
Syn. of *Coccus hesperidum*  
*hesperidum lauri* (Boisduval),  
Coccus  
Syn. of *Coccus hesperidum*  
*hesperidum* var. *minimum* Newstead,  
Lecanium (*Calymnatus*)  
Syn. of *Coccus hesperidum*  
*hesperidum pacificum* (Kuwana),  
Lecanium (*Calymnatus*)  
Syn. of *Coccus hesperidum*  
*hesperidum pacificus* (Kuwana),

\* Type material examined.

Coccus  
Syn. of *Coccus hesperidum*

#### K

*kraunhiarum* Lindinger, Lecanium  
Syn. of *Coccus longulus*

#### L

*laevis* Costa, Calypticus  
Syn. of *Coccus hesperidum*  
*lauri* Boisduval, Chermes  
Syn. of *Coccus hesperidum*  
*longulum* Douglas, Lecanium  
Syn. of *Coccus longulus*  
*longulus* (Douglas), Coccus  
Retained in Coccus

#### M

*maculatum* Signoret, Lecanium  
Syn. of *Coccus hesperidum*  
*maculatus* (Signoret), Coccus  
Syn. of *Coccus hesperidum*  
*mangiferae* Green, Lecanium  
Syn. of *Protopulvinaria*  
*mangiferae*  
*mangiferae* (Green), Coccus  
Syn. of *Protopulvinaria*  
*mangiferae*  
*mauritiense* Mamet, Lecanium  
Syn. of *Coccus hesperidum*  
*minimum* Newstead, Lecanium  
Syn. of *Coccus hesperidum*  
*minimum* var. *pinicola* Maskell,  
Lecanium  
Syn. of *Coccus hesperidum*  
*minimum* (Newstead), Coccus  
Syn. of *Coccus hesperidum*  
*minimus pinicola* (Maskell), Coccus  
Syn. of *Coccus hesperidum*  
*moestus* De Lotto, Coccus \*  
Retained in Coccus

#### N

*nanum* Cockerell, Lecanium  
Syn. of *Coccus hesperidum*  
*nanus* (Cockerell), Coccus  
Syn. of *Coccus hesperidum*

#### P

*patelliformis* Curtis, Coccus  
Syn. of *Coccus hesperidum*  
*pseudohesperidum* (Cockerell), Coccus  
Retained in Coccus  
*pseudohesperidum* Cockerell, Lecanium \*  
Syn. of *Coccus pseudohesperidum*  
*pseudomagnoliarum* (Kuwana), Coccus  
Retained in Coccus

pseudomagnoliarum Kuwana, *Lecanium*  
Syn. of *Coccus pseudomagnoliarum*  
punctuliferum Green, *Lecanium* \*  
Syn. of *Coccus hesperidum*  
punctuliferus (Green), *Coccus*  
Syn. of *Coccus hesperidum*

## R

rubellum Cockerell, *Lecanium*  
A nomina dubium  
rubellus (Cockerell), *Coccus*  
A nomina dubium

## S

schini (Cockerell), *Coccus*  
Not a *Coccus*. Generic placement  
uncertain.  
schini Cockerell, *Lecanium* \*  
Not a *Coccus*. Generic placement  
uncertain.  
signiferum Green, *Lecanium* \*  
Syn. of *Coccus hesperidum*  
signiferus (Green), *Coccus*  
Syn. of *Coccus hesperidum*

## T

terminaliae (Cockerell), *Coccus*  
Syn. of *Coccus hesperidum*  
terminaliae Cockerell, *Lecanium* \*  
Syn. of *Coccus hesperidum*

## V

ventrale Ehrhorn, *Lecanium* \*  
Syn. of *Coccus hesperidum*  
ventralis (Ehrhorn), *Coccus*  
Syn. of *Coccus hesperidum*  
viride Green, *Lecanium* \*  
Syn. of *Coccus viridis*  
viridis (Green), *Coccus*  
Retained in *Coccus*

## W

wistariae Brain, *Lecanium*  
Syn. of *Coccus longulus*  
wistaricola Borchsenius,  
Parthenolecanium  
Syn. of *Coccus longulus*

*Coccus rubellus* (Cockerell) (1893aa: 378) originally described as *Lecanium rubellum*, was assigned to *Coccus* by Fernald (1903b: 173) but was reverted to *Lecanium* by MacGillivray (1921: 179). We have not been able to locate type material and because we are not able to associate Cockerell's description with any biological entity we consider this species to be a nomina dubium.

Another species described by Cockerell is *Lecanium schini* (18931: 304) from Mexico. Fernald (1903b: 173) assigned the species to *Coccus* but MacGillivray (1921: 179) reverted the species to *Lecanium*. We have examined the type material, which is deposited in the USNM, and have concluded that it is not a congener, although, the correct generic placement is uncertain. Apparently the species has been collected only a few times since the original collection and is seldom mentioned in the literature.

## DEFINITION OF THE GENUS *COCCUS*

The genus *Coccus* includes a rather heterogeneous mixture of species. Two of the 8 species in this paper should be removed from the genus but additional information is needed about other similar species before they can be properly reassigned. The purging of species by De Lotto (1965a) and Ben-Dov et al (1975) has helped to define the genus but many problems remain to be resolved before homogeneity can be attained. The recent studies on the Ethiopian species by De Lotto (1957c, 1959, 1965a, 1966, 1969a) and Hodgson (1967, 1968a) were significant contributions toward a better understanding of the genus.

\* Type material examined.

## **COCCUS LINNAEUS**

Type-species: *Coccus hesperidum* Linnaeus 1758, by general acceptance.

Diagnosis: Body of adult female usually oval but varying to elongate or pyriform; normally flat to moderately convex in advanced stages of maturity; live female with thin film or plates of transparent wax. DORSUM—Derm membranous, often becoming slightly to heavily sclerotized with age. Setae sparse, spine-like, cylindrical, capitate or clavate. Submarginal tubercles and submarginal tubular ducts present or absent. Preopercular pores variable in number and types. Anal opercula more or less quadrate with lateral angulations; with variable numbers of apical, subapical and fringe setae. MARGIN—With a fringe of simple, hair-like, or fimbriated setae of fairly uniform size. Spiracular setae number 3 in each spiracular cleft. VENTER—Antennae 3 to 8-segmented; reduced or well developed. Spiracular pore band composed of one or more rows of quinquelocular pores. Legs number 3 pairs, well developed or reduced; tibio-tarsal articulatory sclerosis present or absent. Multilocular pores with varying numbers of loculi and normally restricted to abdomen. Ventral tubular ducts present or absent.

### **KEY TO THE SPECIES OF *COCCUS* AND THREE SIMILAR SPECIES IN NORTH AMERICA**

The following key is based on slide mounted adult females. Immature stages are readily recognized because of a general lack of ventral multilocular pores.

Included in the key are three other species not included in the genus *Coccus*. Two of these species were recently removed from the genus *Coccus* (De Lotto 1965a, Ben-Dov et al 1975) and one species appears to be a member of this genus when the derm of the adult female is membranous. The three species are very similar to the genus *Coccus* both in the field and in their morphological characteristics. The authors have included them in the key because they are so similar to *Coccus* and because there are no published keys which would enable the student to separate them on the generic level.

- 1 Dorsal setae curved, apices pointed or blunt (Fig. 2d,f) ..... 2  
 Dorsal setae spine-like, cylindrical, clavate or  
 capitate (Fig. 2a,b,c) ..... 4
- 2(1) Legs well developed with tibio-tarsal articulatory sclerosis  
 (Fig. 2Q); preopercular pores on abdomen only ..... 3  
 Legs greatly reduced, tibio-tarsal articulatory sclerosis  
 absent; preopercular pores in longitudinal band or groups  
 on mid-region of abdomen and thorax (Fig. 8J); on  
 Orchidaceae ..... *Coccus pseudohesperidum* (Cockerell)
- 3(2) Anal operculum with subdiscal seta (Fig. 2G<sub>1</sub>), apical setae  
 not set along lateral margin, fringe setae 7-8 (Fig. 6G<sub>2</sub>);  
 marginal setae mostly simple, a few bifid or slightly  
 fimbriate ..... *Coccus longulus* (Douglas)  
 Anal operculum without subdiscal seta, two apical setae  
 set along lateral margin, fringe setae 4; marginal setae  
 mostly bifid or slightly fimbriate, few simple; dorsal derm  
 becoming tessellated with advancing  
 maturity ..... *Eucalymnatus tessellatus* (Signoret)
- 4(1) Anal operculum with cephalo-lateral margin more than 1.5  
 times longer than caudo-lateral margin ..... 5  
 Anal operculum with cephalo-lateral margin less than 1.5  
 times the length of caudo-lateral margin ..... 6
- 5(4) Meso- and metathoracic coxae enlarged and of unusual shape,  
 differing in shape from prothoracic coxae; ventral tubular  
 ducts absent ..... *Kilifia acuminata* (Signoret)  
 Meso- and metathoracic coxae normal, similar in shape to  
 prothoracic coxae; ventral tubular ducts  
 present ..... *Protospulvinaria mangiferae* (Green)
- 6(4) Legs greatly reduced; body slender, extremities pointed;  
 dorsum strongly sclerotized ..... *Coccus acutissimus* (Green)  
 Legs well developed; body oval, elongate-oval or pyriform;  
 dorsum membranous or slightly sclerotized ..... 7
- 7(6) Dorsal setae spine-like, apically pointed ..... 8  
 Dorsal setae cylindrical, clavate or capitate ..... 9
- 8(7) Submarginal tubercles present (Fig. 1L); antenna 7-segmented;  
 ventral tubular ducts present near attachments of  
 mesothoracic legs ..... *Coccus hesperidum* Linnaeus  
 Submarginal tubercles absent; antenna 8-segmented; ventral,  
 thoracic tubular ducts  
 absent ..... *Coccus pseudomagnoliarum* (Kuwana)
- 9(7) Ventral, thoracic tubular ducts absent; tibio-tarsal articulatory  
 scleroses absent ..... *Coccus capparidis* (Green)  
 Ventral, thoracic tubular ducts present; tibio-tarsal  
 articulatory scleroses present (Fig. 10Q) ..... 10

- 10(9) Dorsal, submarginal tubular ducts present (Fig. 7H); antenna 8-segmented; marginal setae slender, moderately long, simple or slightly fimbriate ..... *Coccus moestus* De Lotto  
 Dorsal, submarginal tubular ducts absent; antenna 7 segmented; marginal setae short, fimbriate.....*Coccus viridis* (Green)

***COCCUS ACUTISSIMUS* (GREEN)**

Figure 3

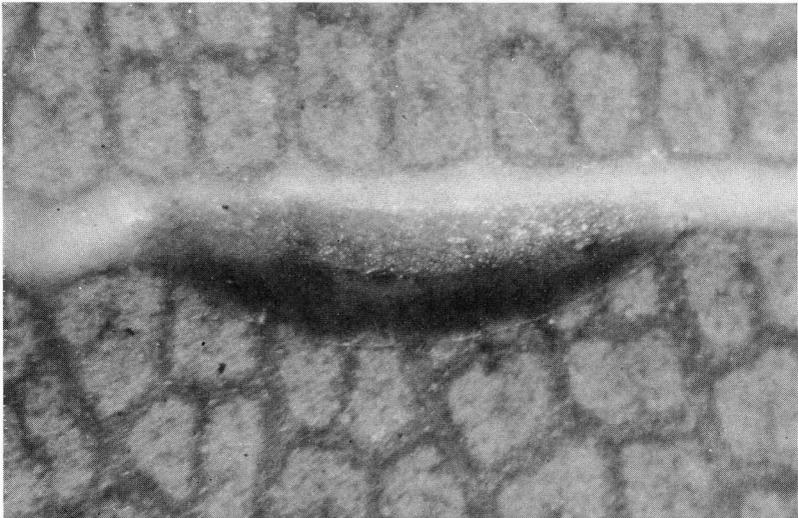
*Lecanium acutissimum* Green 1896:10.

*Coccus acutissimus* (Green): Fernald 1903b:168; Steinweden 1929:223; Takahashi 1942b:17; Ferris *in* Zimmerman 1948:295; Takahashi 1952:15.

**Suggested Common Name:** slender soft scale

**Diagnosis:** Females elongate, slender, pointed at extremities, slightly convex, symmetrical or asymmetrical. Newly molted adult females creamy-white, older specimens brown to blackish-brown with paler margins.

**Description:** Mounted adult females 2.5–5.5 mm in length, 1–2 mm



*Coccus acutissimus* (Green)

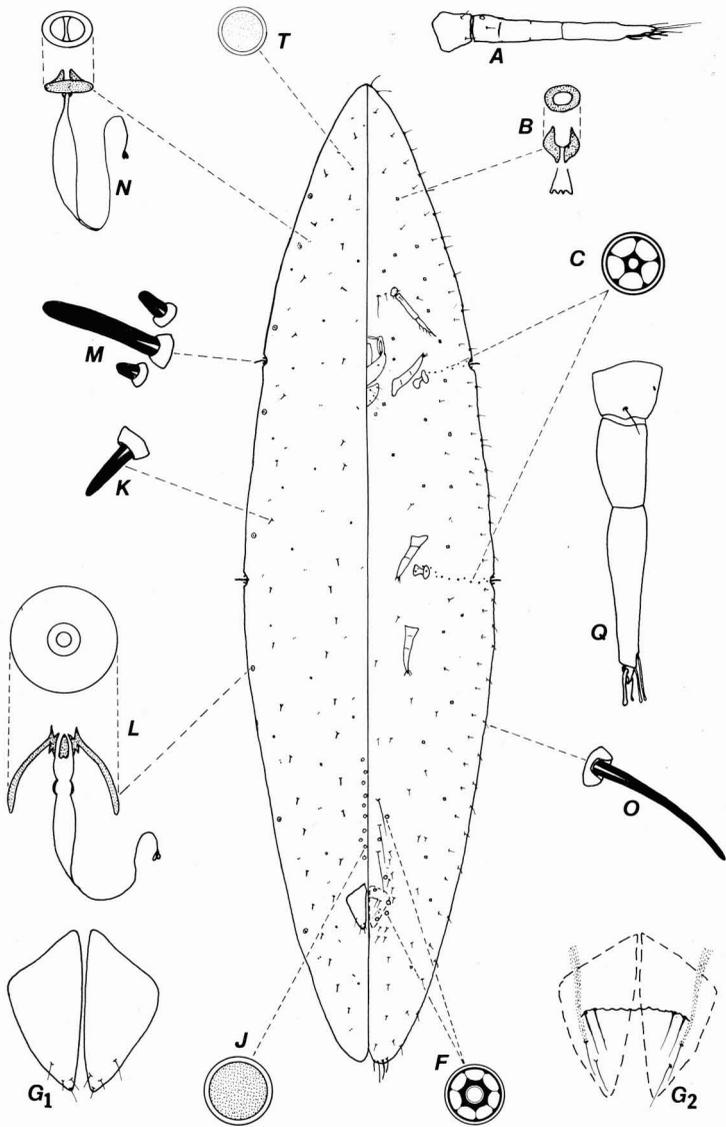
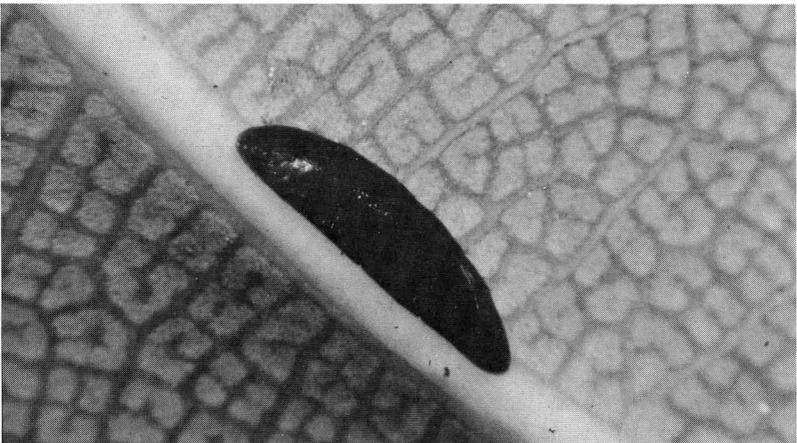


Figure 3. *Coccus acutissimus* (Green).

in width. *DORSUM*—Derm strongly sclerotized in older specimens; with scattered minute microducts usually associated with small round or oval clear areas. Eyespots on oval clear area on each submargin of head. Setae spine-like with pointed or blunt apices, clavate, or cylindrical with almost truncate apices; in irregular submedial and submarginal rows; submarginal setae from one-half times shorter to subequal in length to submedial setae. Submarginal tubercles 8–19 around body. Preopercular pores with sclerotized rims, 8–13. Anal opercula shield-like, the part posterior to the rounded lateral angles longer than the anterior part; each operculum with 2 subapical setae, 3 apical setae and a subdiscal setae.

*MARGIN*—Marginal setae slender, pointed, sparse, usually 4 longer setae at anterior apex and 3 or 4 longer setae near anal cleft on each side; 7 to 12 between the anterior and posterior spiracular clefts. Spiracular cleft with 3 setae, median seta about 4 times longer than short, conical lateral setae. *VENTER*—Derm membranous to slightly sclerotized; older specimens with distinctive submarginal thickening around body. Antennae reduced, 161–198  $\mu$ , 3-segmented, sometimes with membranous divisions indicating 5 segments. Interantennal setae usually 4, median pair longer. Legs greatly reduced (prothoracic 67–96  $\mu$ ; mesothoracic 101–135  $\mu$ ; metathoracic 106–138  $\mu$ ), longer than thoracic spiracles; tibia and tarsus fused or articulated; claw short, claw digitules 2 of different sizes. Spiracular quinquelocular pores usually in a single row extending from anterior of spiracle to spiracular cleft. Tubular ducts absent. Multilocular pores usually with 7(5–8) loculi, few in anal area and on preceding 2–3 abdominal segments. Small sharply pointed setae in segmental rows on median part of abdomen, slightly concentrated in anal area and becoming more dispersed anteriorly. Preulvar setae 3 pairs. Anal ring slightly anterior to anal opercula. Anal fold with 2 pairs of fringe setae.



*Coccus acutissimus* (Green)

**Type Material Examined:** 5 syntypes on 1 slide labeled: Type *Lecanium acutissimum* Green, from *Areca catechu*, Peradeniya, Ceylon (BM).

**Other Material Examined:** UNITED STATES: FLORIDA: *Dade Co.*; 3, *Ardisia* sp., 10-IV-74; Homestead 4, *Litchi chinensis*, 2-VII-56; 2, *Licaria triandra*, 20-I-73; Miami 5, *Cycas revoluta*, 9-II-73; 3, *Cycas* sp., 29-III-73; 6, *Magnolia grandiflora*, 4-III-69; South Miami 1, *Litchi chinensis*, 15-X-66; Redlands 3, *Cycas revoluta*, 7-XII-70; Rivera Beach 6, *Cycas revoluta*, 24-IX-74; Vero Beach 1, *Hedychium* sp., 23-V-60; 3, *Mangifera* sp., 12-V-59. HAWAII: Hilo 3, *Litchi chinensis*, 29-VII-55; 1, *Litchi chinensis*, 6-II-63; 2, *Litchi chinensis*, 25-II-63. TEXAS: Harlingen 1, *Cycas* sp., 9-IV-62. ASIA: CEYLON; 2, *Calophyllum* sp., 15-I-02. Royal Botanical Garden 1, X-10. FORMOSA: Suisha 1, *Euphorbia longana*, 24-V-29; 2, 26-I-30. INDONESIA: 2, *Stanhopea* sp., 24-IV-71. SUMATRA 1, VII-13. MALAYA: 4, orchid, 3-VIII-67. RYUKYU ISLANDS: 2, *Nephelium longana*, 14-XI-27. VIETNAM: 1, orchid plant, 1-IV-68.

**Distribution:** In North America, *Coccus acutissimus* was recorded initially from Homestead, Florida in 1956 and subsequently found in other localities in that state and Texas. Elsewhere it is known from India, Kenya, Mauritius, Philippine Islands, Thailand and those countries previously cited.

**Host Plants:** Polyphagous. Recorded North American hosts are listed above.

**Biology:** The species is usually found on the underside of the leaves. Ferris (*in* Zimmerman 1948) states that individuals tend to take up a position alongside a leaf vein and to become asymmetrical. The male is unknown.

**Economic Importance:** There is no report of economic damage in the literature.

**Comments:** Although we are treating *acutissimus* as a *Coccus*, we agree with Steinweden (1929) that the species is not congeneric. The correct generic assignment is still uncertain.

The distinctive slender body with pointed extremities, dark coloration of older specimens and the reduced appendages easily distinguish this species from other *Coccus* species in the New World. On the basis of descriptions, *Coccus cambodiensis* Takahashi (1942b) from Cambodia and *Coccus cameronensis* Takahashi (1952) from Malaya appear to be closely related to *C. acutissimus*.

The dorsal setae of this species vary considerably in shape and size. Type material from Ceylon has dorsal submarginal setae that are clavate, cylindrical or pointed and are shorter and more slender than the setae on submedial area. The latter setae are usually pointed and are up to three times longer and two times thicker than the submarginal setae. The

material from Florida has pointed dorsal setae; those on the submargin vary in length from about  $\frac{1}{2}$  times shorter to only slightly shorter than the submedial setae. The latter setae are normally thicker than the submarginal setae but are never as thick as those of the types.

A specimen from Formosa and one from Sumatra have cylindrical dorsal setae with almost truncate apices as illustrated by Ferris (*in* Zimmerman 1948). Some dorsal setae also appear to be slightly clavate. Otherwise, the morphological characters of these specimens are similar.

### *COCCUS CAPPARIDIS* (GREEN)

Figure 4

*Lecanium capparidis* Green 1904d: 187

*Lecanium (Coccus) capparidis* Green: Green 1937:229

*Coccus capparidis* (Green): Fullaway 1938: 46; Beardsley 1972: 142; Anon. 1975: 416.

**Suggested Common Name:** capparid soft scale

**Diagnosis:** Body broadly oval to deltoid, flat or slightly convex, pale green.

**Description:** Mounted adult females 2–3.5 mm in length, 1.5–2.5 mm in width. **DORSUM**—Derm membranous or slightly sclerotized; well stained specimens often with many oval pale areas more numerous and noticeable on submarginal area. Eyespots round, on lateral margin of head. Submarginal tubercles 10–16 around body. Setae small (Ca  $7\mu$ ), clavate to almost capitate, randomly distributed. Microducts scattered, each usually surrounded by small clear area. Preopercular pores small, 5–18 in one or two loose groups. Anal opercula on caudal one-fifth of body; caudolateral margin longer than cephalolateral margin; each operculum with 3 subapical setae (anterior 2 setae longer than fringe setae) and 4 short apical setae. **MARGIN**—Marginal setae slender, pointed, bifid or slightly fimbriate; usually 1–3 longer setae on each side by anal cleft. Spiracular clefts each with 3 setae; middle seta ca. 3 times longer than laterals. **VENTER**—Derm membranous. Antennae 6 to 7-segmented; terminal segment subequal to or longer than combined lengths of two penultimate segments; when 6 segmented third segment longest, occasionally with pseudoarticulation. Interantennal setae 4, sometimes 5; median pair longer. Legs well developed, without tibio-tarsal articulatory scleroses; claw digitules 2 of equal size; claw with tiny denticle. Tubular ducts 4–13 on submarginal areas of posterior and usually middle abdominal segments on each side; absent from remainder of venter. Microducts sparse, scattered, light concentration by beak. Spiracular quinquelocular pores in single or sometimes two irregular rows, extending from anterior of spiracle to spiracular depression. Multilocular disc pores usually with 7–8 (5–10) loculi in anal area; few on preceding

abdominal segments. Preulvar setae 1 pair. Anal ring usually anterior to anal opercula by about two-thirds the length of the opercula. Anal fold with 4 fringe setae, inner pair shorter.

Type Material Examined: 1, slide labeled *Lecanium capparidis* Green, Pundaluoya, Ceylon, from *Capparis moonii* (BM).

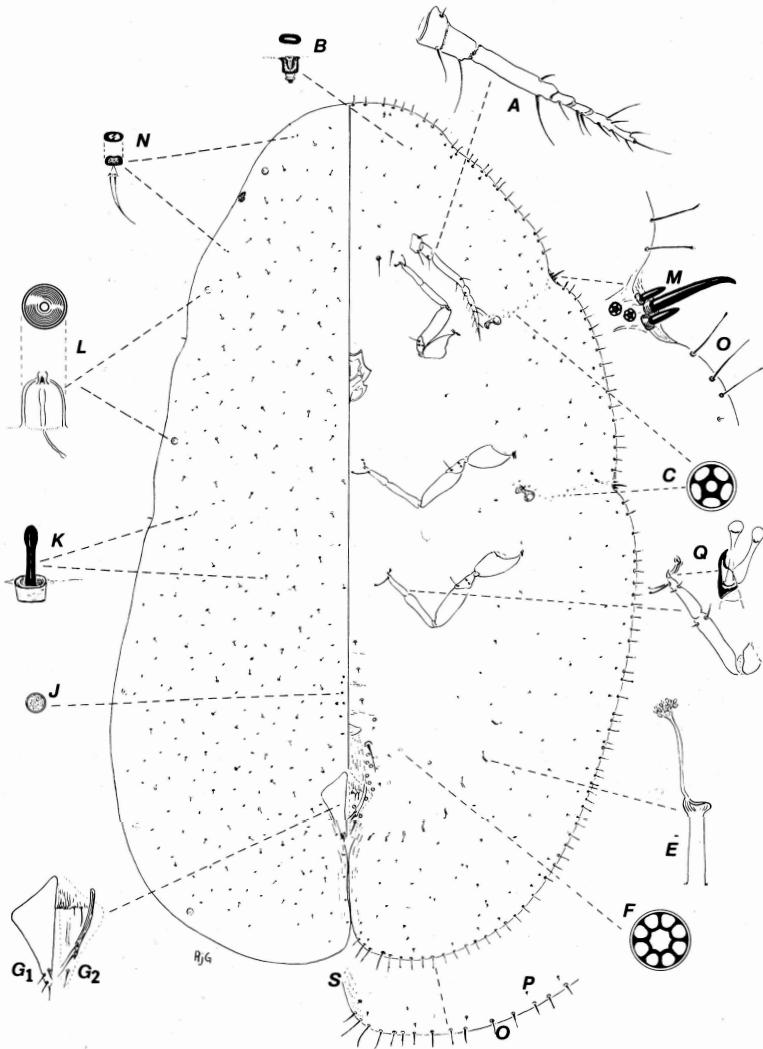


Figure 4. *Coccus capparidis* (Green).

**Other Material Examined:** UNITED STATES: FLORIDA: Miami 3, *Citrus* sp., 9-VII-74; Stuart 2, *Acrostichum aureum*, 23-VIII-76. HAWAII: 1, *Alyxia olivaeformis* 16-VI-52; Honolulu 1, mock orange, 29-I-55. FOREIGN COUNTRIES: BAHAMAS: 1, *Codiaeum* sp., 6-III-47. HONDURAS: 2, *Codiaeum* sp., 19-VIII-70; 2, 4-VIII-70; 1, 12-V-70. CEYLON: Colombo 1 (parasitized), Croton?, 8-I-02. INDIA: 1, croton, 20-XI-35; 1, *Cypridium villosum*, II-VII-47; 2, *Cypridium* sp., 15-VIII-46; 2, 14-V-53; 4, 14-XII-53; 2, 7-III-60; Darjeeling 1, wild *Dendrobium* sp., 23-VI-35.

**Distribution:** In the United States the species is in Florida (Anon. 1975) where it is now known from Dade, Martin and Polk Counties, and in Hawaii where it is uncommon (Beardsley 1972). Records for India, Bahama Islands and Honduras are based on specimens found in agricultural quarantine. Although records indicate a limited distribution, the species probably will be found in contiguous areas.

**Host Plants:** Other host plants not previously cited are *Brassaia* sp., *Pyrus* sp., and probably *Clermontia* species.

**Biology:** The only available information on the biology is that *C. capparidis* occurs on the undersurface of the leaves. No male has been found.

**Economic Importance:** No reports of economic injury were found in the literature.

**Comments:** Specimens examined show some variation in enlargement of the apices of the dorsal setae from slightly clubbed to almost capitate. Marginal setae also vary slightly in length, number of fimbriate setae and in degree of fimbriation.

*C. capparidis* apparently belongs with the group of species centered around *C. hesperidum*, but the correct relationship of this species cannot be resolved until other Oriental species are thoroughly studied. It can be distinguished from other North American species by the following combination of characters: Dorsal setae clavate to almost capitate; shape of anal opercula; one pair of prevulvar setae; absence of ventral tubular ducts from the mid-region of the thorax; and the presence of submarginal tubercles.

## *COCCUS HESPERIDUM* LINNAEUS

Figure 5

*Coccus hesperidum* Linnaeus 1758:455; Fernald 1903b:168; Sanders 1909:436; Andison 1940:3; Ferris in Zimmerman 1948:301; Borchsenius 1957:294; Essig 1958:288; Merrill 1953:90; Annecke 1959:245; Ebeling 1959:186; De Lotto 1959:160; Boratynski and Williams 1964:-

108; Saaskyan-Baranova 1964:268; De Lotto 1965a:192; Hodgson 1967:4; Avidov and Harpaz 1969:158; Ezzat and Hussein 1969:393; Williams and Kosztarab 1972:55; Talhouk 1975:21

*Chermes hesperidum*: Geoffroy 1762:505

*Calymnatus hesperidum*: Costa 1828a:6

*Calypticus hesperidum*: Costa 1835:8

*Calypticus laevis* Costa: 1835:11

*Coccus patelliformis* Curtis 1843a:517

*Chermes lauri* Boisduval 1867:340

*Lecanium angustatum* Signoret 1873:398

*Lecanium maculatum* Signoret 1873:400

*Lecanium hesperidum*: Newstead 1903:78

*Lecanium alienum* Douglas 1886b:77

*Lecanium depressum* var. *simulans* Douglas 1887:28 (Manuscript name cited in synonymy)

*Chermes aurantii* Alfonso, Targioni-Tozzetti 1891:10

*Lecanium minimum* Newstead 1892:141

*Lecanium assimile* var. *amaryllis* Cockerell 1893g:53

*Lecanium terminaliae* Cockerell 1893j:254\*

*Lecanium ceratoniae* Gennadius 1895:cclxxvii

*Lecanium nanum* Cockerell 1896h:19

*Lecanium flaveolum* Cockerell 1897d:52, 53\*

*Lecanium minimum* var. *pinicola* Maskell 1897:310

*Lecanium ventrale* Ehrhorn 1898:245\*

*Lecanium (Calymnatus) hesperidum pacificum* Kuwana 1902a:30

*Lecanium hesperidum* var. *minimum* Newstead 1903:85

*Lecanium signiferum* Green 1904d:197\*

*Lecanium punctuliferum* Green 1904d:205\*

*Lecanium mauritiense* Mamet 1936:96

The synonyms listed above were obtained from the works of Fernald (1903b), Newstead (1903), Sanders (1909), De Lotto (1959, 1965a) and Boratynski and Williams (1964)

**Common Name:** brown soft scale

**Diagnosis:** Adult females elongate oval, ovate to almost rotund; flat to slightly convex; pale yellowish-green to yellowish-brown, often flecked with brown spots.

**Description:** Mounted adult females 1.5–4.5 mm in length, 1–4 mm in width. **DORSUM**—Derm membranous to moderately sclerotized with small clear areas. Eyespot oval or round near margin of head and surrounded by paler area. Submarginal tubercles 2–12 around body. Submarginal tubular ducts range from 0–21, at upper ranges with few ducts paired; each duct subequal in size to tubular ducts on thoracic venter. Setae spine-like, small (6–11  $\mu$  or occasional setae up to 22  $\mu$ ), varying in stoutness, apices blunt to sharply pointed, randomly distributed. Microducts often associated with clear areas. Preopercular pores

6–33, often in two or three loose groups; small, flat, indiscernible in older chitinized specimens. Anal opercula either quadrate, wider than long or the part posterior to the lateral angles longer than the anterior part; each operculum with 4 apical setae and normally with 2 or rarely 3 subapical setae. *MARGIN*—Marginal setae slender, simple or slightly fimbriate, often curved, set apart usually by more than the length of seta. Spiracular clefts each with 3 setae, median seta 2–4 times longer than lateral setae. *VENTER*—Derm membranous to slightly sclerotized. Antennae 7-segmented, infrequently 8-segmented or appearing to be 8-segmented when segment 4 partially articulated. Interantennal setae 4, seldom 5 and

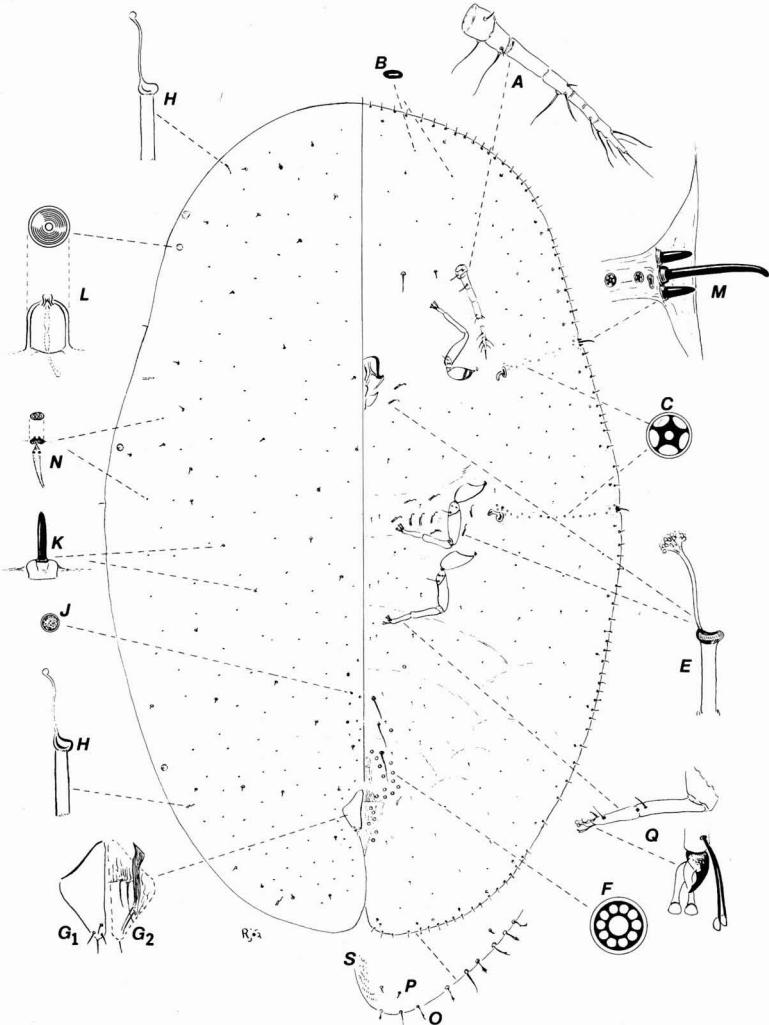
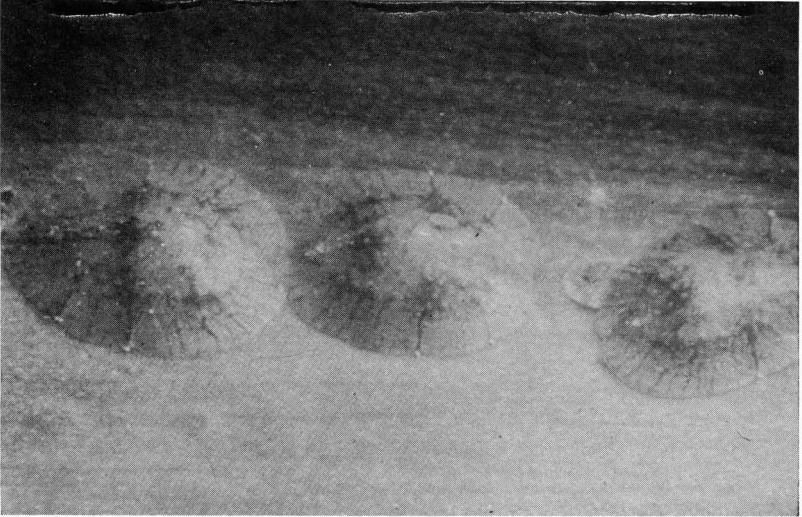


Figure 5. *Coccus hesperidum* Linnaeus.

rarely 6; medial pair longest. Legs well developed, usually with tibio-tarsal articular sclerites; claw digitules 2, broad, longer than claw, of equal size. Spiracular quinquelocular pores in one or two irregular rows. Tubular ducts always present near attachment of mesothoracic legs; often extending across mesothorax posterior to legs, sometimes anterior to legs; often between prothoracic legs and beak, between mesothoracic and metathoracic legs, sometimes 1 or 2 posterior to metathoracic coxae; 1-3 may be present on submargin of abdomen laterad of anal area.



*Coccus hesperidum* Linnaeus

Microducts sparse, randomly distributed. Multilocular disc pores usually with 10 loculi; confined generally to anal area, few on one or two preceding abdominal segments. Prevalvar setae 3 pairs. Anal ring inverted anteriorly up to two-thirds the length of the anal operculum. Anal fold with 2 pairs of fringe setae.

**Type Material Examined:** *Lecanium flaveolum* Cockerell—3, stems of *Pilea* sp. in greenhouse, Mesilla Park, New Mexico, coll. Ckll. Mch. 1897 (USNM). *Lecanium punctuliferum* Green—15 cotypes, *Michelia champaca*, Peradeniya, Ceylon, E. E. Green, rec'd Aug. 7, 1905 (mounted from dry material) (USNM). *Lecanium signiferum* Green—part of type 1, *Begonia* sp., Pundaluoya, Ceylon, E. E. Green Colr. 14643 (USNM). *Lecanium terminaliae* Ckll—2, *Terminalia catappa*, Kingston, Jamaica, coll. Cockerell. 1893 (USNM). *Lecanium ventrale* Ehrhorn—7 cotypes, tuberous plant in Japanese Nursery, San Jose, Cal., 1898, Ehrhorn coll. (USNM).

**Other Material Examined:** UNITED STATES: FLORIDA: 4, *Bilbergia* sp., 28-VII-55; 2, *Conocarpus erecta*, 4-V-75. HAWAII: 1, *Cordyline terminalis*, 11-II-57. IOWA: 3, Norfolk pine, 10-X-75. MARYLAND: 6, *Citrus medica*, 20-XII-75. MISSOURI: 2, ivy, 2-VIII-72. TEXAS: 3, grapefruit, XII-60; 1, *Gossypium* sp., 28-V-68. WYOMING: 4, *Brassica actinophylla*, 24-IX-74. OTHER COUNTRIES: New World ARGENTINA: 2, orchid, 6-X-69. CANADA: 4, *Cedrus* sp., 2-VI-67. COLOMBIA: 1, *Laurus nobilis*, 29-VIII-70; 2, *Pinus elliotti*, IX-67. ECUADOR: 10, *Stanhopea* sp., 14-VII-70; 4, *Carica papaya*, 1-X-72. JAMAICA: 1, *Impatiens* sp., 27-II-74. MEXICO: 5, *Chamaedorea* sp., 7-VIII-74; 1, *Calocarpum* sp., 14-I-71. SAN SALVADOR: 5, *Bauhinia* sp., VIII-67. SURINAM: 3, orchid, 6-II-70. EUROPE: BELGIUM: 5, *Clivia* sp., 17-XI-71. ENGLAND: 2, *Hydrangea integrifolia*, 12-XII-58; 1, *Rhododendron* sp., 15-III-72. FRANCE: 1, *Pelargonium* sp., 19-VII-57; 1, *Laurus* sp., 4-V-65. GREECE: 3, *Gardenia* sp., 27-IV-67; 1, *Laurus* sp., 18-VIII-73. ITALY: 1, *Diospyros kaki*, 21-X-67. PORTUGAL: 5, *Hibiscus* sp., 11-IV-57. YUGOSLAVIA: 4, *Nerium oleander*, 10-VII-71. AFRICA: MADEIRA ISLANDS 1, *Musa* sp., 17-VI-72. RHODESIA: 1, *Plumeria acutifolia*, 30-V-68. ASIA: AFGHANISTAN: 6, ivy, 20-VIII-61. INDIA: 1, *Camellia* sp., 17-VII-65. IRAN: 2, *Citrus limon*, 5-VI-72. IRAQ: 2, *Ligustrum* sp., 23-IX-65. JAPAN: 4, *Fatsia* sp., 17-IV-57; 1 *Cotoneaster* sp., 31-I-72. PHILIPPINE ISLANDS: 1, *Mangifera indica*, 15-III-54; 3 *Melastoma* sp., III-58. THAILAND: 1, *Vanda* sp., 4-IX-70.

**Distribution:** Cosmopolitan in tropical and subtropical regions and in greenhouses in colder regions. In North America, the species occurs out of doors in the southern states, north to the eastern seaboard of Virginia where it overwinters as second instars (Williams and Kosztarab 1972) and as far north as southern Vancouver Island on the west coast (Andison 1940).

**Host plants:** *C. hesperidum* is one of the most polyphagous species in the Coccoidea. Extensive lists of host plants can be found in the publications by Merrill (1953), Borchsenius (1957), Essig (1958), De Lotto (1959), Saakyan-Baranova (1964) and Hodgson (1967). Although found on many different host plants, it does not seem to infest grasses.

**Biology:** The developmental threshold in Israel is 13°C. and 515 day degrees are required to complete a generation (Avidov and Harpaz 1969). There are six generations per year out of doors in Israel (Avidov and Harpaz 1969), 3–5 generations in southern California (Ebeling 1959) and more than one generation in Victoria, Vancouver Island (Andison 1940). All stages are found throughout the year in the warmer regions and in greenhouses. When the temperature in tropical greenhouses in USSR was kept between 18–25° C., six to seven generations developed (Saakyan-Baranova 1964).

The ovoviviparous females molt twice before maturity. Males undergo four molts before emerging as winged adults but are rarely found. Ebeling (1959) states that males have not been seen in California and Anneck (1959) did not find this sex in South Africa. Saakyan-Baranova (1964) reports finding males in laboratory and greenhouse populations in USSR, but rarely and only few in numbers.

The species attacks the leaves and twigs. They settle on the upper surfaces of the leaves mainly along the vein (Borchsenius 1957). Second instars and adult females produce a considerable amount of honeydew which fosters the growth of sooty fungi. Ants feed on the exudates of the scale and attend the colonies.

*C. hesperidum* is attacked by numerous natural enemies. The names of some of these species are found in the works of Ebeling (1959), Avidov and Harpaz (1969) and Williams and Kosztarab (1972). The entomogenous fungi, *Cephalosporium lecanii* Zimmerman, parasitizes this scale (Saakyan-Baranova 1964).

**Economic Importance:** According to Talhouk (1975), *C. hesperidum* is a *Citrus* pest of major economic importance in Peru and Cyprus, economically important in China, Brazil, Israel, Italy, Mexico, Republic of South Africa, Rhodesia and United States (Texas) and is of little economic importance in Algeria, Argentina, Australia, Chile, Egypt, Greece, India, Lebanon, Morocco, Pakistan, Tunisia, Turkey, USSR, United States (Arizona, California, Florida) and Venezuela. The species is a pest of orchids in Florida (Dekle and Kuitert 1968). Although reported as an important pest species of many host plants in many countries, it is kept under effective control by natural enemies in many areas. In California, parasites effectively control the species and chemical controls are seldom required (Ebeling 1959). Merrill (1953) states that the species is occasionally abundant but usually controlled by natural enemies in Florida.

**Comments:** The description of *C. hesperidum* by Ferris (in Zimmerman 1948) is inadequate for current usage and therefore, we have followed the species concepts of De Lotto (1959) and Hodgson (1967). Hodgson found considerable morphological variation in the specimens he examined from Rhodesia. He states "These variations have been found within one population occurring on both the stems and leaves, and appears to be correlated with the position on the host plant." In material examined, the dorsal submarginal tubular ducts ranged from 0–21 around the body but one specimen on *Pelargonium* sp. from France has 37 ducts. Ventral tubular ducts also show considerable variation in numbers and distribution, but none of the specimens examined have ducts across the metathorax as illustrated by De Lotto (1959), Ezzat and Hussein (1969) and Williams and Kosztarab (1972). This discrepancy (in De Lotto's description) was noted by Hodgson (1967).

*C. hesperidum* is closely related to *C. gymnospori* (Green) from India. The major differences appear to be that *C. gymnospori* has eight-segmented antennae and three subapical setae on each anal operculum while *C. hesperidum* has seven-segmented antennae and two subapical setae. Unfortunately the median ventral parts of the thorax and abdomen of the syntypes of *C. gymnospori* are damaged and some of the morphological characters could not be seen. Nevertheless, in our opinion, they are distinct species.

*C. moestus* De Lotto also resembles *C. hesperidum*, but the former species has clavate dorsal setae and decidedly larger dorsal submarginal tubular ducts than the ventral ducts on the thorax. Conversely, *C. hesperidum* has pointed dorsal setae and the submarginal tubular ducts, when present, are subequal to the ventral ducts.

## **COCCUS LONGULUS (DOUGLAS)**

Figure 6

*Lecanium longulum* Douglas 1887b: 97\*

*Lecanium chirimoliae* Maskell 1889: 137 (1890 in Morrison & Renk)

*Lecanium ficus* Maskell 1897a: 243\*

*Lecanium wistariae* Brain 1920a: 8

*Coccus longulus* (Douglas): Fernald 1903b: 171; Ben-Dov 1977:89

*Lecanium frontale* Green 1904d: 192

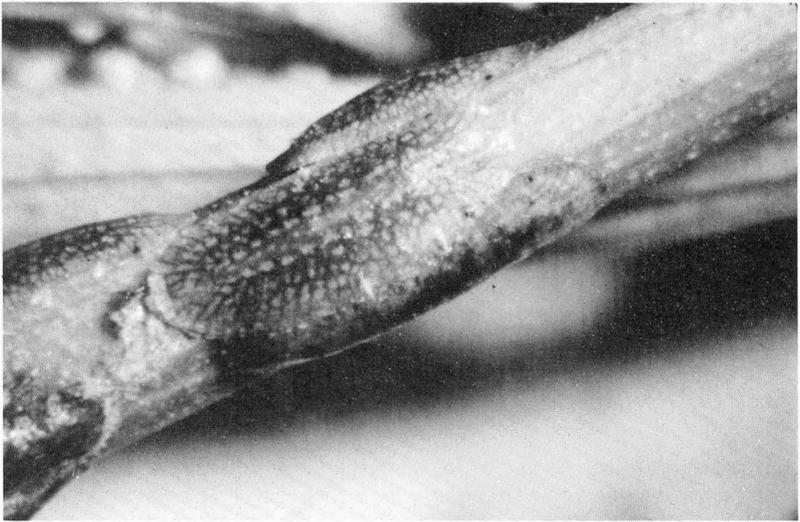
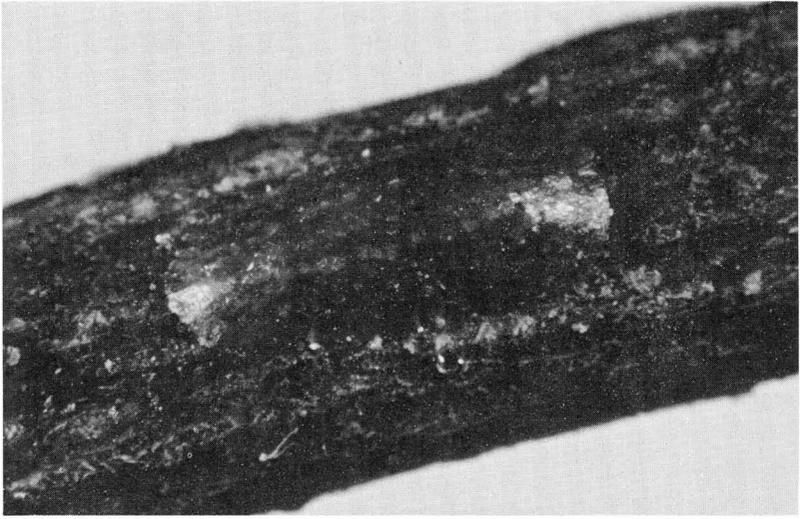
*Lecanium (Coccus) celtium* Kuwana 1909a: 162

*Coccus elongatus* (Signoret): Sanders 1909: 438; Zimmerman 1948: 300; Merrill 1953: 89; De Lotto 1965a: 192.

*Lecanium kraunhiarum* Lindinger 1928: 107

*Parthenolecanium wistaricola* Borchsenius 1957: 349

**Suggested Common Name:** long brown scale



*Coccus longulus* (Douglas)

**Diagnosis:** Adult females oval to elongate-elliptical, dorsum moderately convex and smooth. Color yellowish to grayish brown (Merrill 1953). Mounted adult females 2–6 mm in length, 1–3 mm in width. **DORSUM**—Derm membranous or slightly sclerotized with many small clear areas. Eyespot on submargin of head surrounded by large oval pale area. Submarginal tubercles 9–19 around body. Setae short, curved, apically pointed; randomly distributed. Microducts fewer in marginal-

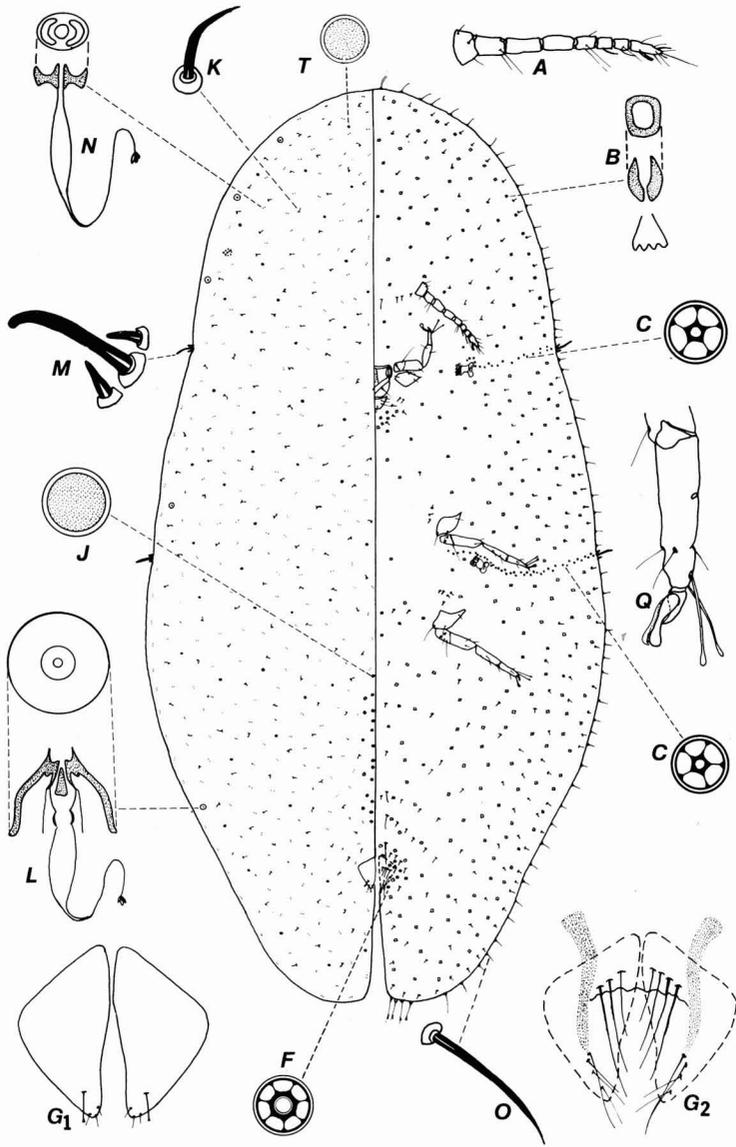


Figure 6. *Coccus longulus* (Douglas).

submarginal area than submarginal-median area; each duct usually associated with small clear area. Preopercular pores 7–25, small, flat, occasionally indiscernable. Anal opercula with cephalo-lateral margins usually concave, shorter than caudolateral margins; each operculum with 3 subapical setae, 3 apical setae and a subdiscal seta. **MARGIN**—Marginal setae slender, curved, set far apart; mostly acute, few bifurcate,

3-4 fimbriate by anal cleft. Spiracular cleft with 3 setae; median seta 2-3 times longer than laterals. *VENTER*—Derm membranous. Antennae 8-segmented. Interantennal setae 4 to 7. Legs well developed with tibio-tarsal articulatory scleroses; claw digitules 2 of equal size. Spiracular quinquelocular pores in bands, occasionally with median section in single row; some pores between posterior spiracle and positioned between the mesothoracic and metathoracic legs. Tubular ducts absent. Microducts sparse; light concentration alongside beak. Multilocular disc pores confined to anal area; pores mostly with 6-7 (5-8) loculi. Preulvar setae 3 pairs. Anal ring slightly anterior to anal opercula. Anal fold with usually 7-8 (5-9) fringe setae.

**Type Material Examined:** *Lecanium longulum* Douglas. One slide one specimen, labeled as follows: right label-*Lecanium longulum* Douglas 1887, Lectotype designated, Y. Ben-Dov 1976; left label-*Lecanium longulum* Doug., Ac. Catechu Type Lot, ex Coll. Doug., B. M. 1945, 121. *Lecanium ficus* Maskell, 5 specimens on 3 slides, China, Swatow, ex *Ficus*, Koebele (UCD).

**Other Material Examined:** UNITED STATES: CALIFORNIA: Downey 1, *Begonia* sp., 13-VI-45. FLORIDA: Oneca 1, *Acacia longifolia*, 15-I-32; Dade Co. 1, *Persea borbonia*, 9-IV-74. HAWAII: Maui 3, *Anthurium* sp., 15-I-55. LOUISIANA: New Orleans 3, croton, 2-II-44. OHIO: Painesville 5, *Euphorbia* sp., 23-V-29. PENNSYLVANIA: 2, *Ficus* sp., 8-IV-41. OTHER LOCALITIES: NEW WORLD: COLOMBIA: Anapoima 4, *Acacia* sp., 4-IV-72; Palmira 6, *Annona* sp., 7-X-71. ECUADOR: Imbabura Prov. 2, grape stem, 13-XI-59. HONDURAS: 2, *Codiaeum variegatum*, 21-XII-73. MEXICO: Vera Cruz 2, *Acacia* sp., 27-II-72. PUERTO RICO: 3, *Tabebuia heterophylla*, 18-V-74. VIRGIN ISLANDS: St. John 1, *Gliricidia sepium*, 31-X-73. ASIA: CHINA: 1, *Litchi chinensis*, 3-I-35. FORMOSA: Taihoku 5, croton, 16-IX-31. LEBANON: Beirut 4, *Acacia* sp., 10-IV-51. PHILIPPINE ISLANDS 1, *Rosa* sp., 28-XII-75. OCEANIA: Guam Is. 3, *Pithecolobium dulce*, 10-IX-57. FIJI 2, *Hibiscus* sp., 2-XII-47. SAMOA 2, *Casuarina equisetifolia*, 4-II-46.

**Distribution:** Widespread in the tropical and semi-tropical areas of the world. Also occurs in greenhouses in colder climatic areas. In addition to the state records already cited the species has been recorded from Alabama, District of Columbia, Delaware, Georgia, Illinois, Massachusetts, Maryland, Missouri, New York and Texas.

**Host Plants:** *Coccus longulus* is a polyphagous species which does not seem to have a preferred host. However, in California the species is most frequently found on *Acacia*.

**Biology:** Little is known about the life history. It is found on the branches, leaves and twigs. The male is unknown. For natural enemies, see the work of Zimmerman (1948).

**Economic Importance:** Although a widespread species on many host plants, *C. longulus* has not caused excessive economic injury. In Florida it is not considered to be of economic importance (Merrill 1953).

**Comments:** The species is morphologically similar to *Coccus nyika* Hodgson, *C. oculatus* (Brain), *C. pseudelongatus* (Brain) and *C. sordidus* De Lotto which also have moderately long marginal setae, a subdiscal seta on each anal operculum, 8-segmented antennae, legs with tibio-tarsal articulatory scleroses, tubular ducts absent and dorsal setae not conical. *C. longulus* differs from the four aforementioned species by having submarginal tubercles and multilocular disc pores confined to the anal area.

In North America, *C. longulus* may resemble *Eucalymnatus tessellatus* (Signoret) when the latter species is still membranous. They can be differentiated by the setae on the anal operculum. Most members of the similar appearing New World genus *Mesolecanium* have curved dorsal setae but do not have subdiscal setae on the anal operculum or tibio-tarsal articulatory scleroses, and the antennae are 5 to 7-segmented.

## **COCCUS MOESTUS DE LOTTO**

Figure 7

*Coccus moestus* De Lotto 1959:164; Beardsley 1966:485; Panis, Ferran & Torregossa 1974:25.

**Suggested Common Name:** moestus soft scale

**Diagnosis:** Adult females oval. According to De Lotto (1959) "Dried specimens flat, uniformly bright ochraceous in colour." Beardsley (1966) comments that in preparing specimens preserved in alcohol, the thin transparent layer of wax was dislodged in small polygonal patches.

Mounted adult females 2–3.5 mm in length, 1–2.5 mm in width. **DORSUM**—Derm membranous to slightly sclerotized in older specimens with oval or round areolations. Eyespot round, on submargin of head and lateral to antenna. Submarginal tubercles 9–15 around body. Submarginal tubular ducts 24–31 around body, decidedly larger than ventral ducts on mesothorax; occasionally few ducts in pairs. Setae short, clavate, arranged in reticulated pattern with minute pores. Microducts numerous, often associated with small clear areas, in one or more rows in reticulated pattern; some transverse rows terminating at margin associated with either tubular duct and/or submarginal tubercle. Preopercular pores small, 4–12 usually in one or two loose groups. Anal opercula about as long as width; cephalolateral margin concave; each operculum with 3 subapical setae and 4 short apical setae. **MARGIN**—Marginal setae fimbriated, 11–20 between the anterior and posterior spiracular clefts. Spiracular cleft with 3 setae; median seta 4–5 times longer than lateral setae. **VENTER**—Antennae usually 8-segmented, or 7-segment-

ed with segment four partially articulated. Interantennal setae 2 pairs, median pair longest. Legs well developed with tibio-tarsal articulatory scleroses; claw digitules 2 of equal size, longer than claw, apices enlarged. Spiracular furrow with band of quinquelocular pores. Tubular ducts 1-6 mesad to mesothoracic legs, sometimes between the mesothoracic and

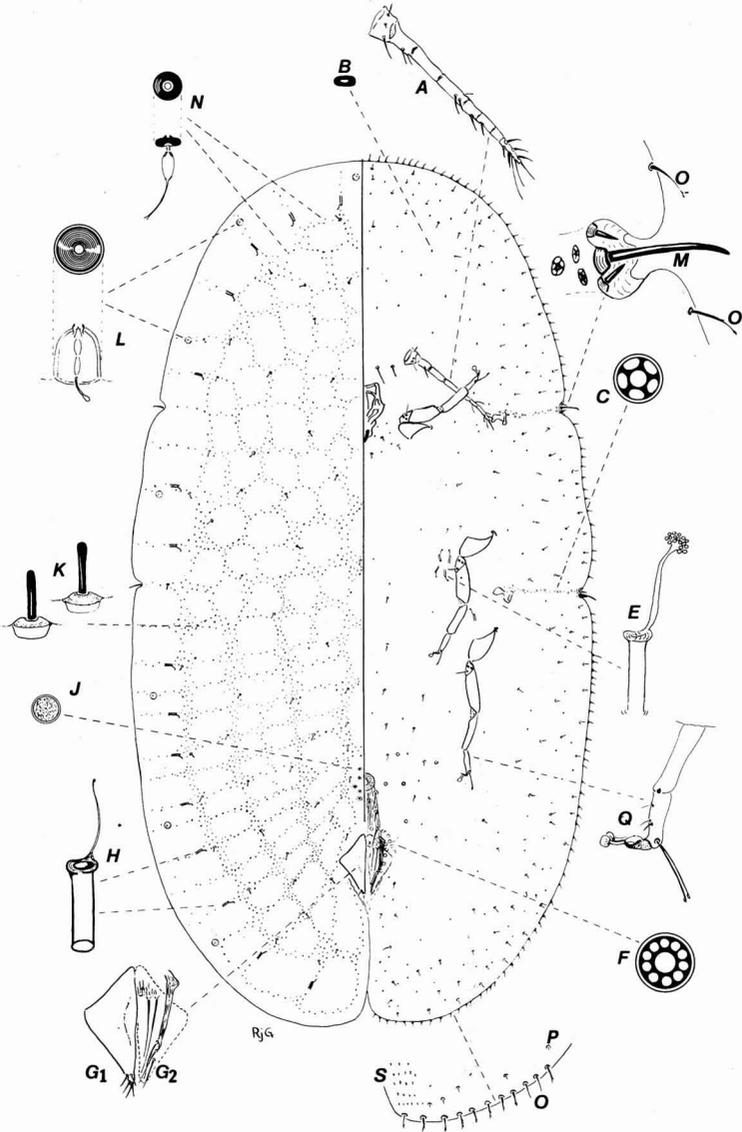


Figure 7. *Coccus moestus* De Lotto.

metathoracic legs. Microducts randomly distributed over surface. Multilocular disc pores with 10 loculi concentrated in anal area, few on preceding 2 or 3 abdominal segments. Preulvar setae 3 pairs. Anal ring often anterior to operculum by about three-fourths the length of the opercula. Anal fold with 2 pairs of fringe setae.

**Type Material Examined:** Paratype 1. Zanzibar, clove tree, 11-II-56 (USNM).

**Other Material Examined:** NEW WORLD: COSTA RICA: 4, *Artocarpus* sp. leaf, 5-I-73. GUYANA: 1, mango, 25-IX-18. HAITI: 1, *Mangifera indica*, 16-VIII-72. JAMAICA: 2, *Artocarpus altilis* leaf, 29-V-74. PUERTO RICO: 1, mango, 21-IV-41. TRINIDAD: 1, mango, 12-VII-44. MICRONESIA: GUAM: 1, mango, IV-46. PALAU ISLANDS: 1, *Artocarpus altilis*, 24-VII-46; 1, breadfruit, 15-XII-47. TRUK ISLANDS: 1, breadfruit, 2-III-49.

**Distribution:** In addition to the localities cited, this species is known from Barbados, Guadeloupe (Panis, Ferran and Terregossa 1974) and Kenya.

**Host Plants:** Recorded hosts are *Anacardium occidentale*, *Artocarpus altilis*, *Artocarpus* sp., clove tree, *Mangifera indica*, and *Scaevola* sp. The species seems to prefer *Artocarpus* and *Mangifera indica*.

**Biology:** The only information available is that the species is found on the leaves and fruit.

**Economic Importance:** The literature does not report damage to plants by this soft scale.

**Comments:** Specimens now recognized as *C. moestus* were collected in the New World long before the type specimens in Kenya and Zanzibar. Although the species has never been recorded from the Oriental Region, it may be indigenous to this region. It apparently prefers *Artocarpus* species and *Mangifera indica*, which are of Asian origin. Moreover, it is similar morphologically to *C. hesperidum* and *C. gymnospori* (Green) which are indigenous to the Orient. *C. moestus* differs from the aforementioned taxa by possessing clavate dorsal setae and dorsal submarginal tubular ducts that are decidedly larger than the ventral ducts on the mesothorax.

### ***COCCUS PSEUDOHESPERIDUM* (COCKERELL)**

Figure 8

*Lecanium pseudoesperidum* Cockerell 1895h: 380

*Coccus pseudoesperidum* (Cockerell): Fernald 1903b: 173; Ferris in Zimmerman 1948: 310; Steinweden 1945: 264; Borchsenius 1957: 305; Dekle and Kuitert 1968: 25.

**Suggested Common Name:** orchid soft scale

**Diagnosis:** Adult females elongate-oval to broadly oval, slightly convex; light to dark brown.

**Description:** Mounted adult females 4–7 mm in length, 2–4 mm in width. *DORSUM*—Derm moderately to strongly sclerotized with many oval, paler areas; those on submarginal areas more distinct and in clusters. Eyespot round, near margin of head, either pale or surrounded by pale area. Microducts often associated with tiny clear areas, in poorly defined reticulated pattern. Submarginal tubercles 6–17 around body. Setae curved, bluntly pointed, randomly distributed. Preopercular pores numerous, slightly convex with sclerotized rims, in loose groups or band

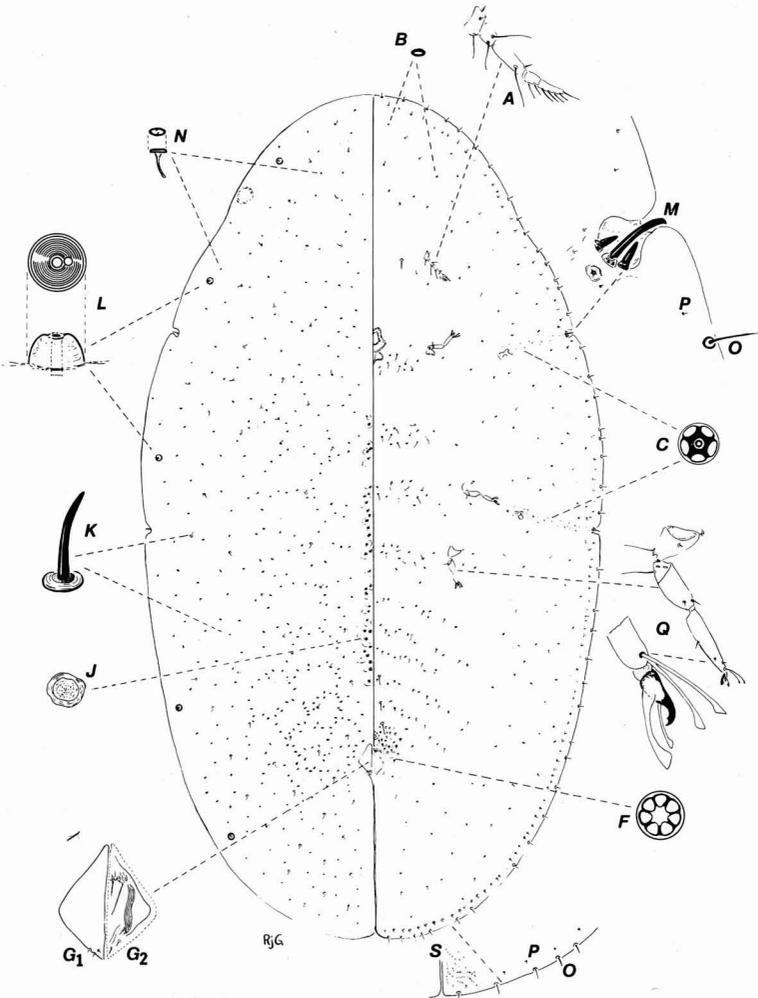


Figure 8. *Coccus pseudohesperidum* (Cockerell).

often extending anteriorly to position between mesothoracic and prothoracic legs or occasionally over beak. Anal opercula about as long as wide, the cephalolateral margin longer than the caudolateral margin; each operculum normally pointed distally; with 3 subapical setae and 3 apical setae, anterior 2 apical setae set along the lateral margin. **MARGIN**—Marginal setae simple, curved, set far apart; 7–12 between anterior and posterior spiracular clefts on each side. Spiracular cleft with 3 setae, median seta about 2–3 times longer than laterals, cephalo-lateral seta usually smaller than caudo-lateral seta. **VENTER**—Derm membranous to slightly sclerotized. Antennae reduced, 145–205  $\mu$  in length; 5 to 6-segmented, often segments 3 and 4 partially articulated. Interantennal setae 2–4 pairs, median pair more than 3 times longer than lateral setae. Legs reduced (prothoracic 230–280  $\mu$ ; mesothoracic 250–290  $\mu$ ; metathoracic 250–285  $\mu$ ); tibia and tarsus articulated, partially fused or completely fused; claw with tiny denticle; claw digitules 2 of different widths. Spiracular furrow with quinquelocular pores in 1 or 2 irregular rows. Tubular ducts absent. Setae on median parts of thorax and abdomen in segmental row or bands, longer on thorax, present between forelegs and beak. Multilocular disc pores confined to anal area, with 5–8 loculi. Preulvar setae 3 pairs. Anal ring slightly anterior to opercula. Anal fold with 2 pairs of fringe setae.

**Type Material Examined:** 2 syntypes on 1 slide labeled *Coccus pseudohesperidum* (Ckll), on *Cattleya*, Greenhouse, Ottawa, Canada, Dr. Fletcher, Type; 1 syntype, slide with same data except: sent by J. Fletcher 1895 (USNM).

**Other Material Examined:** UNITED STATES: CALIFORNIA: Los Angeles 2, *Cymbidium* sp., 29-V-35; Larkspur 9, *Cattleya* sp., 2-II-38; San Leandro 2, *Phalaenopsis* sp., 9-II-44; 2, *Oncidium* sp., 7-III-47. MARYLAND: 1, *Cattleya skinneri*, 18-III-40. MASSACHUSETTS: 3, orchids, 4-VIII-27. NEW JERSEY: 1, *Epidendrum* sp., 21-X-35; 1, *Oncidium* sp., 18-II-42. NORTH CAROLINA: 2, German iris, 23-VII-35. PENNSYLVANIA: 2, *Cymbidium* sp., 5-XII-30. OTHER LOCALITIES: ENGLAND: 2, Orchid, 21-VI-32; 1, *Cymbidium* sp., 20-IV-33. BRAZIL: 1, *Cattleya* sp., 20-X-39; 1, *Laelia purpurata*, 19-II-47; 1, *Octomeria* sp., 10-IX-47. GUATEMALA: 1, *Cattleya mossiae*, 13-X-47; 1, *Cattleya* sp., 18-V-49. JAVA: 3, *Vanda teres*, 28-X-30.

**Distribution:** In addition to the previously cited localities, the species is recorded from District of Columbia, Florida, Hawaii, Indiana, Missouri, New Hampshire and New York in the United States and is known from France and Latvia (Borchsenius 1957).

**Host Plants:** The species feeds on various members of the Orchidaceae. The only exception is the record on German iris from North Carolina.

**Biology:** There is no information on the life cycle in the available literature. The species is found on the stems and leaves.

**Economic Importance:** According to Steinweden (1945) the species was a pest of orchids in California but apparently insecticides and other chemical treatments available in recent times have effectively controlled the species. It has not been collected in California for a number of years. Dekle and Kuitert (1968) do not consider it to be of economic importance in Florida.

**Comments:** *C. pseudohesperidum* is not congeneric with *C. hesperidum* but is closely related to members of the New World genus *Mesolecanium* Cockerell, which is poorly defined at present. Ferris (in Zimmerman 1948) states that *Coccus aequale* (Newstead) described from British Guiana on *Avicennia nitida* is identical with *C. pseudohesperidum*. Our opinion is that *C. aequale* is a different species probably belonging to the genus *Mesolecanium*. Of the eight species of *Coccus* treated in this paper, we conclude that *C. pseudohesperidum* is the only species that is endemic to the Neotropical Region.

The distinctive features of the species are the strongly sclerotized dorsum, curved dorsal setae, reduced appendages and its almost exclusive restriction to the host plant family Orchidaceae.

### *COCCUS PSEUDOMAGNOLIARUM* (KUWANA)

Figure 9

*Lecanium pseudomagnoliarum* Kuwana 1914:7

*Coccus citricola* Campbell 1914:222

*Coccus pseudomagnoliarum* (Kuwana): Clausen 1923:225; Gressitt, Flanders & Bartlett 1954:5; Borchsenius 1957:301; Essig 1958:288; Ebeling 1959:187; Talhouk 1975:21, Tranfaglia 1976:128.

*Coccus aegaeus* De Lotto 1973:291; Tranfaglia 1974:141; De Lotto (in Tranfaglia) 1976:128.

**Common Name:** citricola scale

**Diagnosis:** Kuwana (1914) described the adult female as being "Elongated oval, slightly convex; dark olive in color with dark brown dots." According to Essig (1958), the females are decidedly mottled gray when fully mature.

**Description:** Mounted adult females 2–7 mm long, 1.5–3.5 mm wide. **DORSUM**—Derm membranous to slightly sclerotized in older specimens with small clear areas; slightly larger round or oval paler areas more numerous on submarginal area. Eyespot indistinct, on submargin of head. Submarginal tubercles and tubular ducts absent. Setae short, pointed, sparse, scattered over surface. Microducts, usually associated

with small clear areas randomly distributed. Preopercular pores 4–12, small, indiscernible in older chitinized specimens. Anal opercula quadrate, caudal lateral margin occasionally emarginated; each operculum

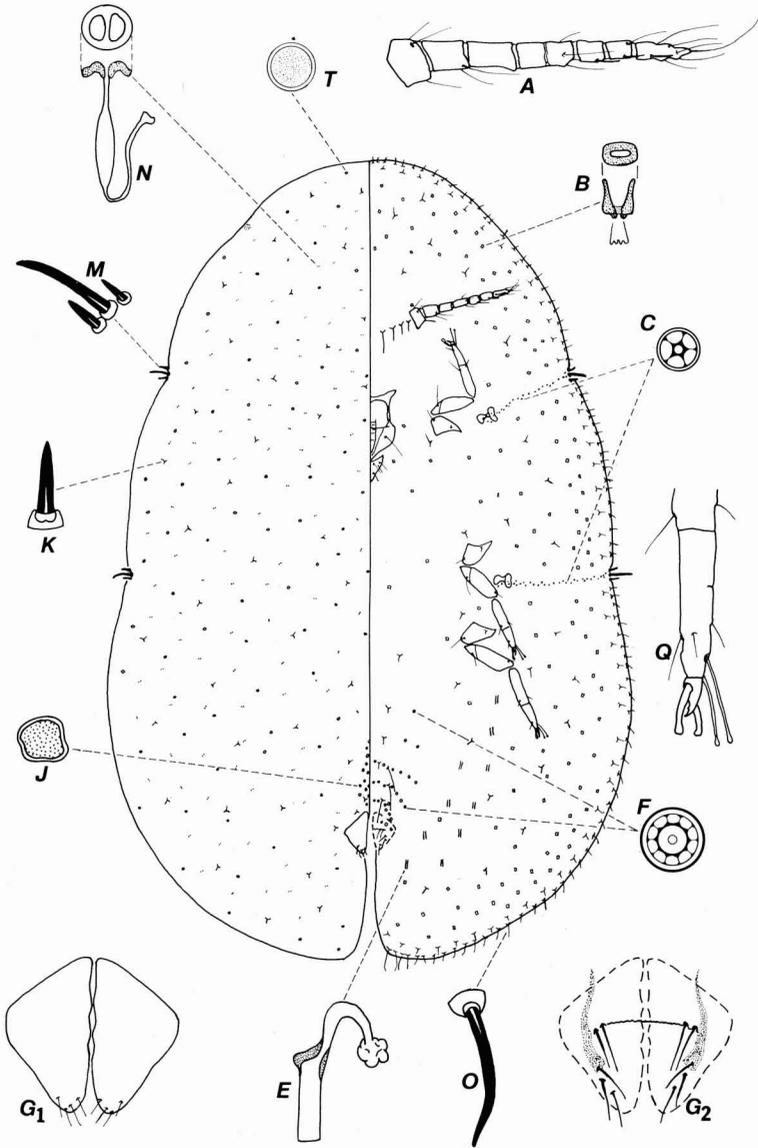
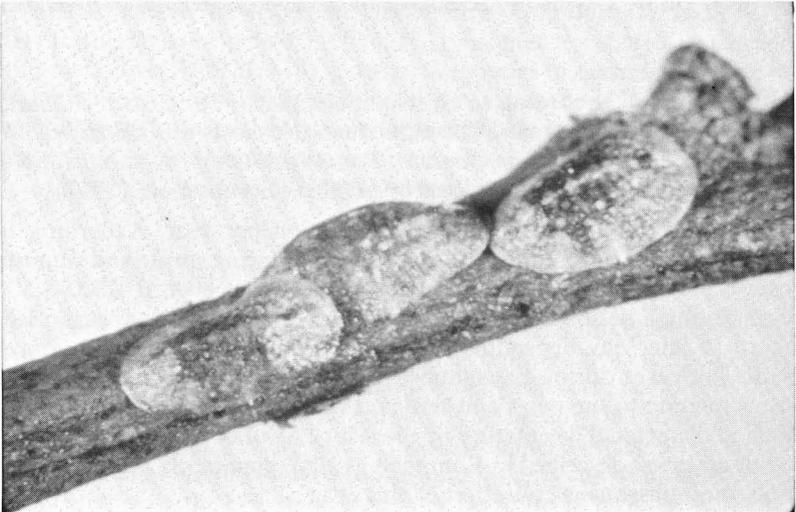
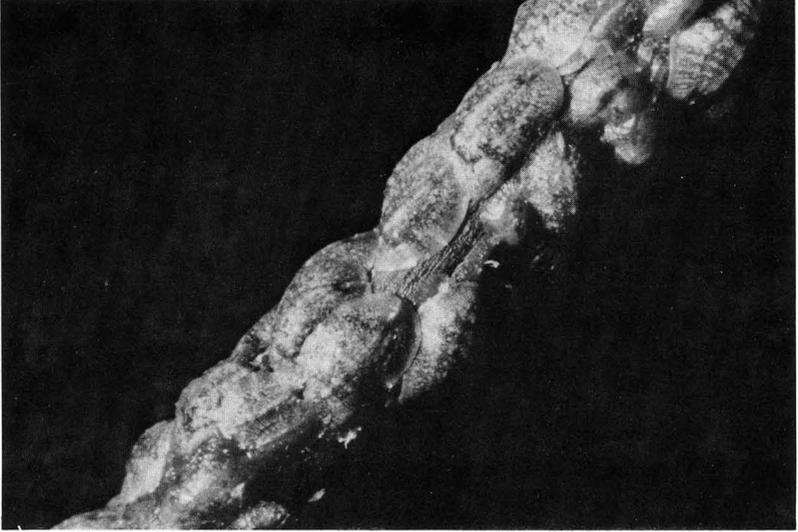


Figure 9. *Coccus pseudomagnoliarum* (Kuwana).

with 3 subapical and 4 apical setae. *MARGIN*—Spiracular clefts each with 3 setae, middle seta 2–3 times longer than lateral 2 setae. Marginal setae slender, apices acute, curved or straight; 14–21 between the anteri-



*Coccus pseudomagnoliarum* (Kuwana).

or and posterior spiracular clefts. *VENTER*—Derm membranous to slightly sclerotized. Antennae usually 8-segmented, occasionally 7-segmented. Interantennal setae 8, occasionally 7. Legs well developed; tibio-tarsal articulatory sclerosis absent; claw digitules 2 of equal size. Spiracular furrow with single row of quinquelocular pores. Tubular ducts 4–8 on each side of abdomen laterad to anal area. Microducts sparse, randomly distributed. Miltilocular disc pores with mostly 7–9 (6–12) loculi, concentrated in anal area, fewer on preceding abdominal segments. Preulvar setae 3 pairs. Anal ring anterior to opercula by one-third length of opercula. Anal fold with 2 pairs of fringe setae.

**Type Material Examined:** 8 syntypes on 1 slide labeled *Coccus citricola* n. sp., Type, Aug. 12, 1913, Claremont, Cal., R. E. Campbell; 9 syntypes on 1 slide labeled *Coccus citricola*, cotype, April, 1913, Claremont, Cal., R. E. Campbell; 6 syntypes on 1 slide labeled *Coccus citricola*, on orange, Type, carbol fuchsin, April 8, 1913, Colton, Calif., R. E. Campbell (UCR).

**Other Material Examined:** UNITED STATES: ARIZONA: Peoria 2, grapefruit, 4-III-52. CALIFORNIA: Upland 24, orange, 9-V-19; Visalia 8, *Citrus* sp. MARYLAND: 1, *Poncirus trifoliata*, 1-VI-54. FOREIGN COUNTRY: JAPAN: 30, *Citrus* sp., 7-V-21.

**Distribution:** United States—Arizona, California, Maryland (greenhouse). Foreign—Australia, China, Greece, Japan, Iran, Italy, Mexico, Turkey, USSR (Armenia, Azerbaidzhan, Georgia, Krasnodar Territory).

**Host Plants:** According to Gressit et al (1954), *Poncirus trifoliata* is the referred host in Japan. The other recorded hosts are *Citrus*, *Celtis*, *Daphne*, *Feijoa sellowiana*, *Juglans*, *Punica granatum*, *Rhamnus*, *Solanum*, tea plant, *Ulmus*, and *Laurus nobilis*. (Borchsenius (1957).

**Biology:** Citricola scale has one generation per year. According to Ebeling (1959), in California the eggs are laid during spring and summer over a period of 3 to 4 months. Each female lays between 1,000–1,500 eggs during a period of 30 to 60 days. The first crawlers appear in late April to late May depending on the location in the state. Immatures settle on leaves during the summer. From November to March immatures migrate to the twigs and settle on branches not more than half an inch in diameter. They mature by the last of April or May. Although the adult male was described by Campbell (1914), apparently there has been only one subsequent collection of this sex.

Natural enemies are listed in the publications by Borchsenius (1957) and Ebeling (1959).

**Economic Importance:** The species has been a serious pest of *Citrus* in Arizona and California (Ebeling 1959). However, it is not quite as serious in recent years possibly because of good control by insecticides and introduced natural enemies. The species occurs at a subeconomic level in Iran and appears to be effectively controlled by natural enemies in Japan (Gressitt et al 1954). However, Talhouk (1975) records the species as an economically important species in Japan and USSR on *Citrus*.

**Comments:** *C. pseudomagnoliarum* probably is native to the drier areas of Asia and was introduced into California via Japan (Gressitt et al 1954).

The type of *C. pseudomagnoliarum* was unavailable.

We consider this species congeneric with the type species. It is similar to *C. hesperidum* and *C. gy: nospori* (Green) but differs in the absence of submarginal tubercles and tibio-tarsal articulatory scleroses which are present in the other 2 species.

### *COCCUS VIRIDIS* (GREEN)

Figure 10

*Lecanium viride* Green 1889:248

*Coccus viridis* (Green): Fernald 1903b:174; Miller 1931:18; Fredrick 1943:12; Ferris in Zimmerman 1948:311; Wolcott 1948:171; Merrill 1953:93; Ebeling 1959:227; De Lotto 1960:397; Talhouk 1975:21.

*Lecanium (Trechocoris) hesperidum africanum* Newstead 1906:73

**Common Name:** green scale

**Diagnosis:** Adult females oval to elongate oval, pale green, slightly transparent, flat to slightly convex; usually with an irregular, internal u-shaped pattern formed by black spots.

**Description:** Mounted adult females 1.5–3.75 mm in length, 1–2.25 mm in width. **DORSUM**—Derm membranous or slightly sclerotized with sparse, round or oval clear areas. Eyespot round on submargin of head. Submarginal tubercles 4–11 around body. Submarginal tubular ducts absent. Setae short (about 5  $\mu$ ) cylindrical to clavate; sparse and scattered. Minute ducts sparse, usually one per clear area. Pre-opercular pores 0–9, flat, indistinct or indiscernible. Anal opercula about as long as wide; each operculum with 2 subapical setae and 4 short apical setae. **MARGIN**—Marginal setae short, apically fimbriated; set far apart on lateral margin, closer together on head and by anal cleft; 6–16 between the anterior and posterior spiracular clefts. Spiracular cleft with 3, occasionally 4 short, stout setae; longest 16–26  $\mu$  in length, others 5–11  $\mu$ . **VENTER**—Derm membranous. Antennae 7-segmented. Interanten-

nal setae 5-7, often with single median seta slightly posterior to other setae. Legs well developed, tibio-tarsal articular sclerites present; claws occasionally with tiny denticle; claw digitules broad, longer than claw, of equal size. Spiracular furrow with one or occasionally two irregular rows of quinquelocular pores. Ventral tubular ducts extending completely or partially across the meso and metathorax between the legs, and the median part of first abdominal segment; present between and lateral to the mesothoracic and metathoracic legs; occasionally one or



*Coccus viridis* (Green)

two between prothoracic legs and beak; 0-5 on submargin of abdominal segments. Median and submedial parts of abdomen spinulose. Multilocular disc pores mostly with 7 (5-10) loculi normally on all abdominal

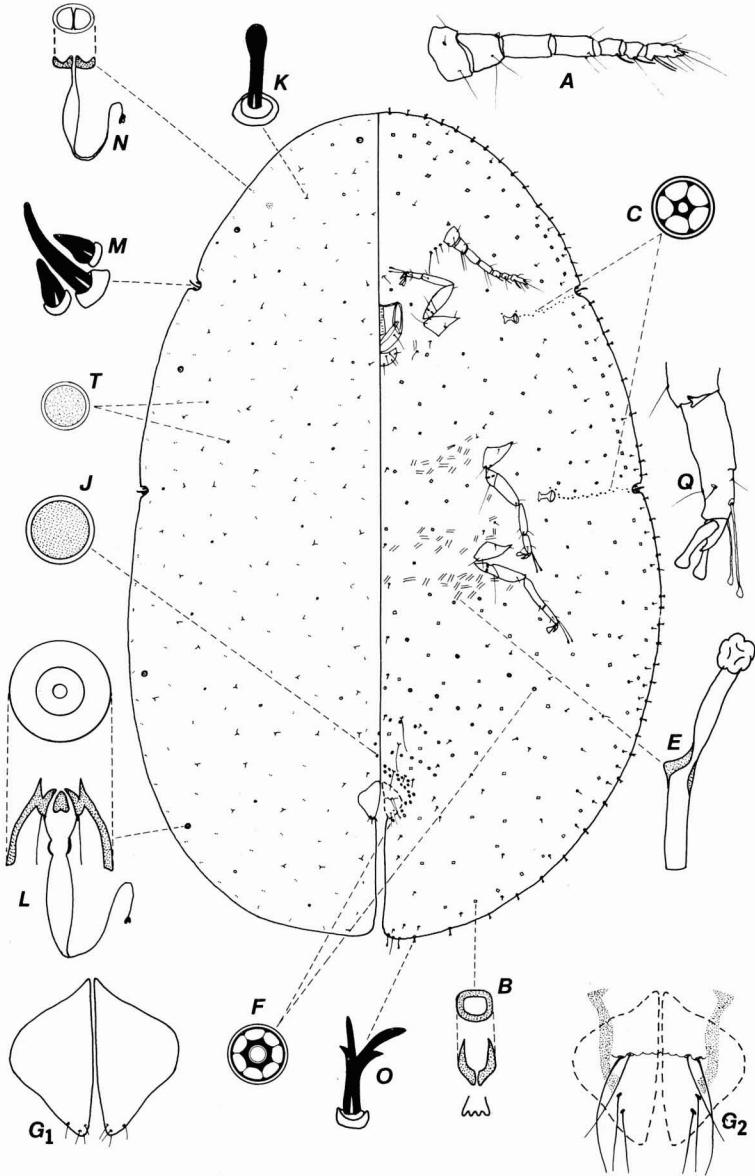


Figure 10. *Coccus viridis* (Green).

segments. Microducts sparse, randomly distributed. Prevulvar setae 3 pairs. Anal ring inverted, slightly anterior to anal opercula. Anal fold with 2 pairs of fringe setae.

**Type Material Examined:** 6 syntypes on 1 slide labeled *Lecanium viride* Green, Pundaluoya, Ceylon, from coffee (BM).

**Other Material Examined:** UNITED STATES: FLORIDA: Miami Beach 3, *Cassia* sp., 11-VII-49, Orlando 5, *Gardenia* sp., 7-II-55. HAWAII: Honolulu 4, *Gardenia* sp., 9-VI-59; Oahu 4, *Gardenia* sp., 23-VII-69. NEW WORLD: BRAZIL: Sao Vincente 5, *Schinus terebinthifolius*, IV-54. COLOMBIA: Bello 3, *Citrus* sp., 14-VI-70. CUBA: Isle of Pine 1, *Psidium guajava*, III-52. DOMINICAN REPUBLIC: 6, *Eucalyptus* sp. 4-IX-73. HONDURAS: 2, *Citrus* sp., 26-VI-70. JAMAICA: 4, *Broughtonia* sp., 21-VII-54. PANAMA: 5, *Ixora macrothrysa*, 5-VII-50. AFRICA: SEYCHELLES: St. Louis 3, *Plumeria* sp., 7-IX-37. ZANZIBAR ISLANDS: 4, *Psidium guajava*, XI-51. ASIA: CEYLON: Perandeniya 3, *Coffea robusta*, 25-VI-37. FORMOSA: Kagi 1, coffee, 1-XI-27. KEITO: 4, *Psidium guajava*, 27-X-27. INDIA: Tinnevely, 2, *Psidium guajava*, 3-V-67. INDONESIA: 1, *Ixora* sp., 2-IX-54. JAVA: 1, *Citrus* sp., 5-V-37. PHILIPPINE ISLANDS: Los Banos 1, *Coffea robusta*, 19-VIII-36. OCEANIA: GUAM ISLAND: 5, *Randia* sp., 10-IX-53. TAHITI: 4, *Gardenia* sp., 13-VIII-64.

**Distribution:** In addition to the localities cited, the species has been recorded from the following countries. NEW WORLD—Caribbean Islands, Central America, Bolivia, Guyana, Mexico, Peru, Surinam, Venezuela. AFRICA—Many countries south of the Sahara Desert, also Cape Verde Islands and Madeira Islands. ASIA: Bangladesh, Burma, China. OTHER LOCALITIES—Australia (Queensland), Carolina Islands, Fiji, Mariana Islands, New Guinea, Samoa, and Tonga.

**Host Plants:** Polyphagous. It is frequently found on *Citrus*, *Coffea*, *Gardenia*, *Plumeria*, *Psidium guajava* as well as others listed above.

**Biology:** The green scale has multiple generations per year. In Florida females mature in 50–70 days during the late summer months (Fredrick 1943). The species is ovoviviparous and apparently parthenogenetic (Green 1904d). The scales are found on the branches, shoots and leaves but on some host plants, the whole plant is infested. On leaves, they are usually found on the under surfaces and frequently along the midrib and veins. In heavy infestations, 250–325 specimens were found per leaf (Fredrick 1943). Several species of ants attend the colonies.

The authors have seen heavy infestations on *Baccharis* sp. in Florida and on *Psidium guajava* and other hosts in Hawaii. These plants were blackened with sooty mold.

Many insect parasitoids and predators attack this scale. For the names of some natural enemies, refer to the works of Miller (1931) and Zim-

merman (1948). The entomogenous fungi, *Cephalosporium lecanii* Zimmerman, apparently keeps the species under control in Florida (Merrill 1953), Puerto Rico (Wolcott 1948) and in other parts of the tropics.

**Economic Importance:** The species is a serious pest of coffee, citrus and other crops in some tropical areas. Talhouk (1975) reports it as a citrus pest of major economic importance in Bolivia, economically important in Central America, Colombia and Venezuela and of little economic importance in S. E. Asia, India and Brazil. Ebeling (1959) lists it as a minor pest of Citrus in Florida. In East Africa, the species is not ranked as a serious pest (De Lotto 1960).

**Comments:** The green scale is one of the few *Coccus* species which can be identified in the field because of the small size, pale green coloration and the internal u-shaped pattern. It is indigenous to the Ethiopian Region where many closely related species are found, and probably was introduced into other areas on coffee plants. *C. viridis* is closest morphologically to *C. alpinus* De Lotto and differs by having 7-segmented antennae and none to few ventral tubular ducts near attachments of the prothoracic legs. Conversely, *C. alpinus* has 8-segmented antennae and many tubular ducts near the attachments of the prothoracic legs. *C. aethiopicus* De Lotto, *C. africanus* (Newstead), *C. celatus* De Lotto and *C. consimilis* De Lotto are also similar to *C. viridis* but the aforementioned species have 8-segmented antennae and pointed dorsal setae.

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