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THE WAX SCALES OF THE GENUS CEROPLASTES GRAY  
(HOMOPTERA: COCCIDAE) AND THEIR PARASITES  
IN ISRAEL

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ABSTRACT

A countrywide survey was carried out as to the species of Ceroplastes occurring in Israel. The distribution of the two species, Ceroplastes floridensis Comstock and C. rusci (L.), is given, with an annotated list of their host plants and parasites.

Five species of wax scales belonging to the genus Ceroplastes Gray (Homoptera: Coccidae) were hitherto recorded from Israel, namely C. floridensis Comstock, C. rusci (L.) (Bodenheimer, 1924); C. actiniformis Green, C. mimosae Signoret (Bodenheimer, 1927) and C. sinensis Del Guercio (Bodenheimer, 1951).

A countrywide survey was conducted during 1966-1969 as to the occurrence and distribution of Ceroplastes species and their parasites in this country. This survey was carried out in the context of a study on the life history of Tetrastichus ceroplastae (Girault) (Hymenoptera: Eulophidae), the dominant parasite of the Florida wax scale (C. floridensis) in Israel (Ben-Dov, in preparation).

Two species, namely C. floridensis and C. rusci, were found to be widely distributed over the country. Ceroplastes actiniformis and C. sinensis, recorded by Bodenheimer (1927, 1951) from introduced plants, were not found during this survey, and it is assumed that these species have not been established in Israel. Ceroplastes mimosae was collected by Bodenheimer (1927) on Tamarix sp. at the Allenby Bridge (Jordan Valley) and in the Snej Peninsula on Tamarix sp. (Bodenheimer, 1929). The latter species was recorded recently by Bytinski-Salz (1954), (under the specific name C. africanus Green\*), from Acacia sp. in

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\* De Lotto (1965) synonymized C. africanus Green with C. mimosae Signoret, and transferred the latter to the genus Gascardia.

the Negev area and in the Lower Jordan Valley. However, C. mimosae was not found during this survey.

These three species can be separated by using the following provisional key:

1. Stigmatic spines set in a compact group extending into the dorsum at right angles to the margin, ..... Gascardia mimosae (Signoret)  
Stigmatic spines extending along the margin on either side of the stigmatic clefts ..... 2.
2. Numerous tubular ducts on body, arranged in a ventral submarginal band; dorsal pores of the modified type. .... Ceroplastes floridensis Comstock  
Only few tubular ducts on body, located between the antennae; dorsal pores of the simple type. .... Ceroplastes rusci (L.)

Ceroplastes floridensis Comstock

Ceroplastes floridensis Comstock, 1881.

Ceroplastes floridensis Comstock; Ben-Dov, 1970.

A redescription of this species which has a world wide distribution, was recently published by Ben-Dov (1970).

In the course of the present survey, this wax scale was found to infest 84 species of host plants belonging to 43 families, in Israel, as summarized in Table 1. This wax scale is currently regarded as the most injurious soft scale pest of citrus in this country. It occurs and causes injury to citrus in all the areas where this crop is grown in Israel (Fig. 1). This citrus pest develops two annual, well defined generations in the mild Coastal Plain as well as in the hotter Jordan Valley (Ben-Dov, 1970). The first generation develops from June through August and the second (overwintering) from August-September through May-June.

Table 1: A list of the host plants of C. floridensis in Israel. (An asterisk denotes host plants recorded for the first time).

ANACARDIACEAE

Mangifera indica

Pistacia lentiscus

+ Pistacia palaestina

Schinus molle

Schinus terebinthifolius

ANNONACEAE

Annona cherimola

Annona squamosa

APOCYNACEAE

Carissa grandiflora

Nerium oleander

+ Plumeria rubra

+ Thevetia peruviana

Table 1 Contd.

ARACEAE

- + Monstera deliciosa

ARALIACEAE

- + Dizygotheca veitchii
- Hedera helix

ASCLEPIADACEAE

- + Periploca graeca

BIGNONIACEAE

- + Kigelia pinnata
- + Stenolobium stans
- + Tecomaria capensis

CAESALPINIACEAE

- Ceratonia siliqua

CELASTRACEAE

- Euonymus japonicus

COMBRETACEAE

- + Terminalia arjuna

COMPOSITAE

- Chrysanthemum indicum
- + Erigeron crispus

CONVOLVULACEAE

- Convolvulus sp.

CYCADACEAE

- + Cycas revoluta

EBENACEAE

- Dyospyros spp.

ELAEAGNACEAE

- + Elaeagnus angustifolia

EPHEDRACEAE

- + Ephedra alte

ERICACEAE

- + Arbutus andrachne
- + Arbutus unedo

EUPHORBIACEAE

- Antidesma bunius

LAURACEAE

- Laurus nobilis
- Persea americana

LOGANIACEAE

- Strychnos spinosa

MELIACEAE

- Melia azedarach

MIMOSACEAE

- Acacia farnesiana

MORACEAE

- Artocarpus integrifolia
- + Ficus benghalensis
- Ficus carica
- + Ficus obliqua
- + Ficus retusa
- Ficus sycomorus
- Morus alba

MUSACEAE

- Musa cavendishii

MYOPORACEAE

- + Myoporum acuminatum
- + Myoporum laetum

MYRTACEAE

- + Callistemon phoeniceus
- Eugenia jambolana
- Eugenia jambos
- Feijoa sellowiana
- Melaleuca armillaris
- Myrtus communis
- Psidium cattleianum
- Psidium guajava

PALMACEAE

- Washingtonia filifera

PAPILIONACEAE

- + Retama roetam

PITTOSPORACEAE

- + Pittosporum undulatum

POLYGONACEAE

- + Polygonum baldschuanicum

POLYPODIACEAE

- + Nephrolepis exaltata

PUNICACEAE

- Punica granatum

RHAMNACEAE

- + Rhamnus alaternus

ROSACEAE

- + Cotoneaster pannosa
- + Crataegus azarolus
- Cydonia oblonga
- Eriobotrya japonica
- + Prunus amygdalus
- + Prunus armeniaca
- Prunus persicae

Table 1 Contd.

<u>Pyrus communis</u>	SAPOTACEAE
<u>Pyrus malus</u>	<u>Achras zapota</u>
<u>Raphiolepis umbellata</u>	<u>Chrysophyllum cainito</u>
RUBIACEAE	SCROPHYLARIACEAE
+ <u>Coffea arabica</u>	+ <u>Russelia equisetiformis</u>
RUTACEAE	SEBESTENACEAE
<u>Casimiroa edulis</u>	+ <u>Cordia myxa</u>
<u>Citrus</u> spp.	SOLANACEAE
SALICACEAE	<u>Solanum villosum</u>
+ <u>Populus deltoides</u>	VERBENACEAE
SAPINDACEAE	+ <u>Duranta repens</u>
+ <u>Dodonea viscosa</u>	
+ <u>Nephelium lappaceum</u>	

#### Parasites

A comprehensive survey of the parasites of the Florida wax scale in citrus groves was carried out by Rosen during the years 1960-1963 (Rosen 1967, 1969), who reported 10 species of primary and 4 species of secondary parasites of C. floridensis.

In the course of the present survey about 2900 specimens of hymenopterous parasites were reared from about 250 samples of the Florida wax scale, collected on 25 species of host plants, other than citrus, throughout the country. These parasites are listed below according to their relative abundance:

#### Primary parasites:

Tetrastichus ceroplastae (Girault)  
Scutellista cyanea Motschulsky  
Microterys flavus (Howard)  
Botriophryne fuscicornis Compere  
Coccophagus lycimnia (Walker)  
Moranila californica (Howard)  
Enargopelte nigra (Mercet)  
Metaphycus zebratus (Mercet)  
Diversinervus sp.\*

#### Hyperparasites:

Tetrastichus ceroplastophilus Domenichini  
Pachyneuron siculum Delucchi

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\* Thanks are due to Dr. D. Rosen, Rehovot, Israel, for verifying the identification.

The following species mentioned by Rosen (1969) were not found in my material:

Diversinervus elegans Silvestri

Marietta exitiosa Compere

Cheiloneurus paralia (Walker)

Tetrastichus sicarius Silvestri

T. ceroplastae was the most abundant species, comprising about 84% of all the emerging parasites and occurring in all the distribution areas of its host.

M. californica is a widely distributed parasite of soft scale insects and mealybugs (Krombein and Burks, 1967). Its biology and economic importance in California were discussed by Smith and Compere (1928) and by Flanders (1958). In Israel it was found to develop as an egg predator of Ceroplastes floridensis (on Persea americana Mill.: 2 ♀♀, Rosh Haniqra, 20.1.69; 3 ♀♀, Kabri, 6.10.69; 4 ♀♀, Kabri, 22.12.69. On Eriobotrya japonica Lindl.: 2 ♀♀, Kabri 20.1.69; 4 ♀♀, Kabri, 6.10.69; 6 ♀♀, Kabri, 22.12.69) and of Saissetia oleae (Bernard) (On Asparagus aphyllus L.: 8 ♀♀, Rosh Haniqra, 5.2.70, Coll. S. Kamburov). It should be noted that in all samples, from which M. californica emerged, S. cyanea was absolutely absent.

Diversinervus sp. is an apparently undescribed species, the adults of which emerged from females of C. floridensis (3 ♀♀, on Hedera helix L., Rehovot, 2.10.69) and from females of Saissetia coffeae (Walker) (on Coffea arabica L., Rehovot, 31.8.66).

#### Ceroplastes rusci (L.)

Coccus rusci Linnaeus, 1758.

Ceroplastes rusci (L.); Hodgson, 1969.

All specimens of C. rusci from Israel examined in the course of this survey agree very closely with the redescription presented by Hodgson (1969).

The fig wax scale was regarded as a minor pest of fig in Israel mainly in the hills region (Bodkin, 1927), rarely infesting citrus (Bodenheimer, 1951; Rosen, 1967). The present survey showed that a considerable change took place in the distribution of this wax scale, in the range of its host plants and in its status as a citrus pest.

The fig wax scale occurs throughout the country (Fig. 1) and has a wider distribution than the Florida wax scale. It was found to infest 26 species of host plants belonging to 15 families, as summarized in Table 2. Of special interest is the occurrence of the fig wax scale in the Judean Hills and in the Upper Galilee (700-800 meters above sea level), as well as in the hot and dry Dead Sea region (about 400 meters below sea level).

During the period covered by the presnet survey, severe outbreaks of Florida wax scale infestations on citrus occurred throughout the country. Samples collected from infested groves revealed that these outbreaks were accompanied with relatively high infestations by the fig wax scale, mainly in the Jezreel Valley and the Jordan Valley (Dafna 11.9.66, 27.8.67; En Dor 19.12.67, 9.12.68; Maagan 9.12.68, 11.11.69; Migdal 24.11.69; Bet She'an 24.2.69; Ginnegar 9.12.68, 11.11.69). The abundance of the fig wax scale in the sampled groves was about 10% - 20% of the Florida wax scale population.

Table 2: List of the host plants of C. rusci in Israel. (An asterisk denotes host plants recorded for the first time).

ANACARDIACEAE	MYRTACEAE
+ <u>Pistacia lentiscus</u>	+ <u>Myrtus communis</u>
+ <u>Mangifera indica</u>	+ <u>Psidium guajava</u>
<u>Schinus terebinthifolius</u>	PLATANACEAE
APOCYNACEAE	+ <u>Platanus orientalis</u>
+ <u>Thevetia peruviana</u>	PROTEACEAE
ARALIACEAE	+ <u>Grevillea robusta</u>
<u>Hedera helix</u>	ROSACEAE
CYPERACEAE	<u>Crataegus azarolus</u>
+ <u>Cyperus flabelliformis</u>	+ <u>Cydonia oblonga</u>
LAURACEAE	+ <u>Pyrus communis</u>
+ <u>Persea americana</u>	RUTACEAE
MORACEAE	<u>Citrus paradisi</u>
+ <u>Ficus benghalensis</u>	SALICACEAE
<u>Ficus carica</u>	+ <u>Populus deltoides</u>
+ <u>Ficus obliqua</u>	SAPINDACEAE
+ <u>Ficus retusa</u>	+ <u>Nephelium lappaceum</u>
+ <u>Ficus rubiginosa</u>	SEBESTENACEAE
<u>Ficus sycomorus</u>	+ <u>Cordia myxa</u>
+ <u>Morus alba</u>	VITACEAE
	<u>Vitis vinifera</u>

#### Parasites

About 1000 specimens of hymenopterous parasites were reared from 94 samples of the fig wax scale collected on 14 species of host plants. These parasites are listed below according to their relative abundance:

#### Primary parasites:

Tetrastichus ceroplastae (Girault)  
Scutellista cyanea Motschulsky  
Botriophryne fuscicornis Compere

Paraceraptocherus italicus (Masi) ·  
Coccophagus lycimnia (Walker)  
Metaphycus zebratus (Mercet)

Hyperparasites:

Tetrastichus ceroplastophilus Domenichini  
Marietta exitiosa Compere

T. ceroplastae and S. cyanea were the most abundant species, each comprising about 40% of all the emerging parasites. Both occurred through all the distribution regions of the fig wax scale.

B. fuscicornis was reported in Israel as a parasite of the Florida wax scale (Rosen, 1967). C. rusci is a new host record of B. fuscicornis in this country. It was reared from samples collected on various host plants throughout the country almost the year round: 1 ♀ on Cyperus flabelliformis Rehovot, 5.11.69; 3 ♀♀ on populus deltoides, Rehovot, 6.11.69; 1 ♀ 1 ♂ on Citrus paradisi, En Dor, 9.12.68; 25 ♀♀ 6 ♂♂ on Ficus carica, Mt. Tabor, 12.12.69; 1 ♀ 1 ♂ on Ficus obliqua, Mt. Tabor, 12.12.69; 1 ♀ 1 ♂ on Ficus obliqua, Maagan, 13.1.69; 1 ♀, on Ficus rubiginosa, Maagan, 18.4.69; 1 ♀ on Ficus carica, Qiriati Shemona, 22.10.69; 1 ♀ 1 ♂ on Ficus carica, Abu Ghosh, 6.8.69.

P. italicus, here recorded for the first time from Israel\*, is known as a parasite of Ceroplastes spp. in some Mediterranean countries (Annecke, 1967). In Israel it was found to parasitize the fig wax scale on various host plants throughout the country: 1 ♀, on Ficus retusa, Ramatayim, 19.9.68; 2 ♀♀ on Ficus rubiginosa, Nahariyya, 6.10.69; 3 ♀♀ 1 ♂ on Ficus rubiginosa, Maagan, 11.11.69; 2 ♀♀ on Ficus sycomorus, Kinneret, 5.7.69; 5 ♀♀ 1 ♂, on Ficus sycomorus, Mavqi'im, 25.3.69; 3 ♀♀ 3 ♂♂, on Pistacia lentiscus, Kefar Vitkin, 6.10.69; 1 ♀ on Populus deltoides, Rehovot, 24.3.69; 2 ♀♀ on Psidium guajava Petah Tiqwa, 17.12.69; 3 ♀♀ on Thevetia peruviana, Afula, 28.3.68. It was often reared from samples taken on lightly infested, isolated plants.

C. lycimnia was a rare parasite of the fig wax scale (4 ♀♀ on Populus deltoides, Rehovot, 6.11.69). This is a new host record of this parasite.

M. zebratus was a rare parasite reared from samples collected on citrus (on Citrus paradisi - 1 ♀ 1 ♂, Dafna 11.9.66; 1 ♀, Ginnegar, 11.11.66).

The most abundant hyperparasite of the fig wax scale was T. ceroplastophilus. It was reared from samples collected over all the distribution regions of this host scale all the year round.

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\* Thanks are due to Dr. D.P. Annecke, Pretoria, South Africa, for kindly verifying the identification.

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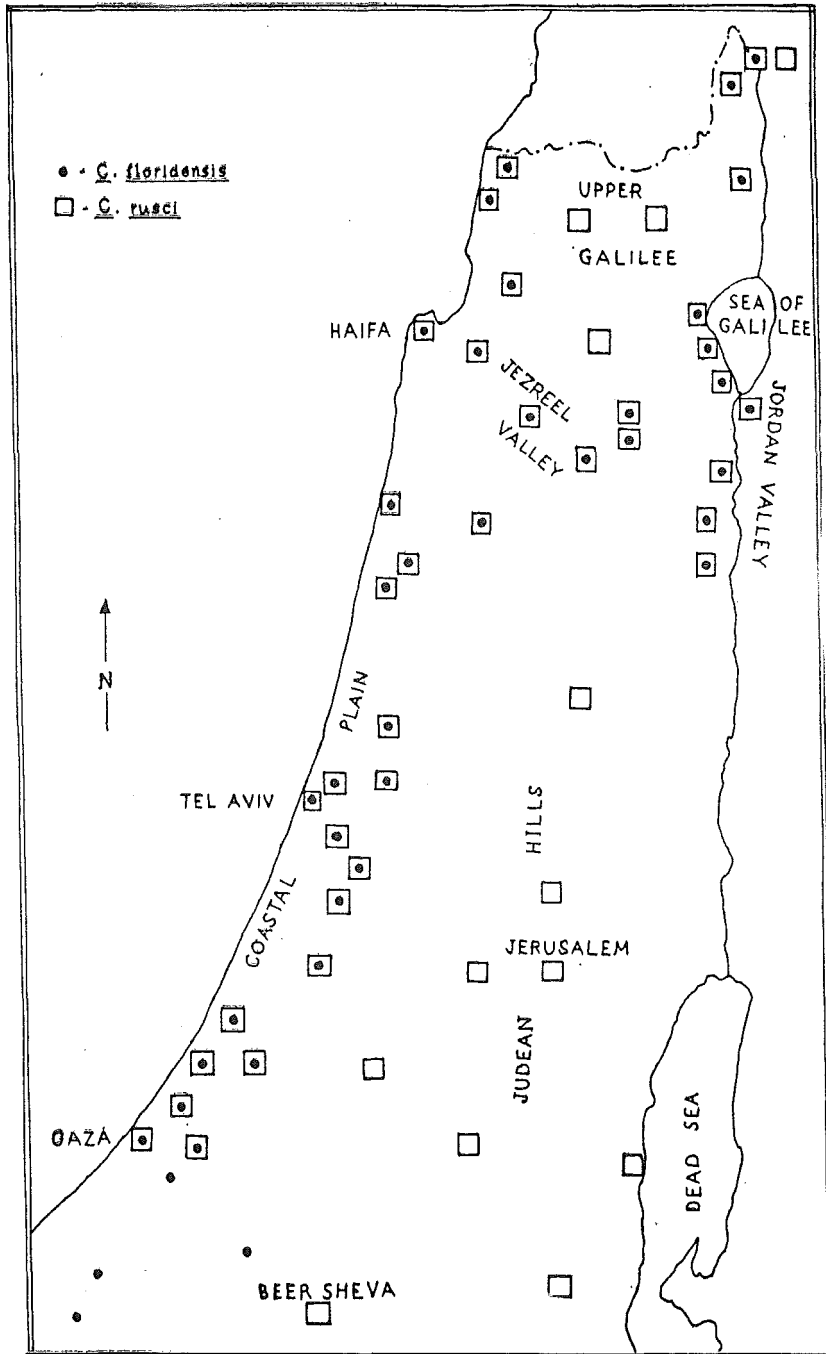


Fig. 1: The distribution of *C. floridensis* and *C. rusci* in Israel (1966-1969).