

and studies on its biology were conducted at St. Lucie, Fla., from 1939 to 1943, in order to be better able to investigate control measures.

#### Methods of Spread:

In investigations conducted at St. Lucie, settled larvae were found as far as 19 inches from the mother scale on a citrus tree, and the crawlers probably could have traveled farther, if necessary, to find a suitable place for settling. They may also be distributed within a tree by being blown from leaf to leaf. It is doubtful, however, whether many that fall to the ground get back to the tree through their own locomotion. Other insects may aid in the distribution of the crawlers, but ants probably have less to do with the distribution of this scale than they do with some other insects, since no honeydew is secreted by the scales to attract the ants. Heavily infested leaves that fall may be blown about in a grove, and low branches that come in contact with the ground may be a source of infestation. Scales may also be distributed on infested host plants that are carried into uninfested areas, and on equipment that is moved from grove to grove.

#### ECONOMIC IMPORTANCE

In Florida this species is classed as one of the most destructive pests of citrus (8, p.5) and it also infests many other plants. On citrus, after a Florida red scale has been on a leaf for some time, a yellow spot appears under the scale, and as the infestation increases the entire leaf turns yellow. Heavily infested leaves eventually fall, and a severe infestation will almost defoliate a tree, lowering the vitality and the yield of the fruit. Fruits infested with this species have an unattractive appearance, inasmuch as the contrast in color makes the scales very noticeable, and infested fruits do not color uniformly. This results in a lowering of the grade and a reduction in returns to the grower. Heavily infested fruits are sometimes refused at canning plants, because of the difficulty of removing the scales during washing, and the possibility of their being incorporated into the finished product.

#### HOST PLANTS IN FLORIDA

Records of occurrence of the Florida red scale in Florida were made available by G. B. Merrill, entomologist of the State Plant Board. In the preparation of the following host list from these records, valuable assistance in classification was given by Mr. Merrill and Erdman West, mycologist at the Florida Agricultural Experiment Station.

SCIENTIFIC NAME (Species and Family)	COMMON NAME
<i>Acacia</i> sp. (Leguminosae)	Acacia
<i>Acrocomia</i> sp. (Palmaceae)	Acrocomia palm
<i>Agave</i> sp. (Amaryllidaceae)	Agave
<i>Agave americana</i> L. (Amaryllidaceae)	Centuryplant

SCIENTIFIC NAME (Species and Family)	COMMON NAME
<i>Aleurites moluccana</i> Willd. (Euphorbiaceae)	Candlenut-tree
<i>Allamanda</i> sp. (Apocynaceae)	Allamanda
<i>Aloe</i> sp. (Liliaceae)	Aloe
<i>Aloe vera</i> L. (Liliaceae)	True, or Barbados aloe
<i>Annona</i> sp. (Annonaceae)	Annona hybrid
<i>Annona muricata</i> L. (Annonaceae)	Soursop
<i>Annona squamosa</i> L. (Annonaceae)	Sugar-apple
<i>Aralia</i> sp. (Araliaceae)	Aralia
<i>Araucaria araucana</i> Koch. (Pinaceae)	Monkeypuzzle tree
<i>Archontophoenix</i> sp. (Palmaceae)	Archontophoenix palm
<i>Archontophoenix cunninghamiana</i> Wendl. & Drude (Palmaceae)	Seaforthia palm
<i>Ardisia</i> sp. (Myrsinaceae)	Ardisia
<i>Areca aliciae</i> Muel. (Palmaceae)	
<i>Areca madagascariensis</i> Mart. (Palmaceae)	
<i>Areca triandra</i> Roxbg. (Palmaceae)	
<i>Arecastrum romanzoffianum</i> Becc. (Palmaceae)	Plumy coconut palm
<i>Artabotrys</i> sp. (Annonaceae)	Artabotrys
<i>Artabotrys odoratissimus</i> R. Br. (Annonaceae)	Climbing ylang-ylang
<i>Asparagus plumosus</i> Baker (Liliaceae)	Asparagus fern
<i>Aspidistra</i> sp. (Liliaceae)	Aspidistra
<i>Azalea</i> spp. (Ericaceae)	Azaleas
<i>Balaka</i> sp. (Palmaceae)	Balaka palm
<i>Bauhinia</i> sp. (Leguminosae)	Mountain ebony
<i>Belamcanda chinensis</i> DC (Iridaceae)	Blackberry-lily
<i>Bischofia</i> sp. (Euphorbiaceae)	
<i>Bougainvillea</i> sp. (Nyctaginaceae)	Bougainvillea
<i>Butia capitata</i> Becc. (Palmaceae)	Pindo palm
<i>Calophyllum inophyllum</i> L. (Guttiferaceae)	Kamini
<i>Calycanthus</i> sp. (Calycanthaceae)	
<i>Camellia</i> spp. (Ternstroemiaceae)	Camellias
<i>Camellia japonica</i> L. (Ternstroemiaceae)	Camellia
<i>Cananga odorata</i> Hook. f. & Thoms. (Annonaceae)	Ylang-ylang
<i>Canna</i> sp. (Cannaceae)	Canna
<i>Carissa</i> sp. (Apocynaceae)	
<i>Carya pecan</i> Ascerts. & Graebn. (Juglandaceae)	Pecan
<i>Caryota</i> sp. (Palmaceae)	Fishtail palm
<i>Casimiroa edulis</i> Llave & Lex. (Rutaceae)	White sapote
<i>Castanospermum australe</i> Cunn. (Leguminosae)	Moreton Bay chestnut
<i>Cassia</i> sp. (Leguminosae)	
<i>Cedrela odorata</i> L. (Meliaceae)	West Indian cedar; Spanish cedar
<i>Ceiba pentandra</i> Gaertn. (Bombacaceae)	Silk-cotton tree
<i>Chamaedorea</i> sp. (Palmaceae)	Chamaedorea palm
<i>Chrysalidocarpus</i> sp. (Palmaceae)	Areca palm
<i>Cinnamomum camphora</i> Nees & Eberm. (Lauraceae)	Camphor-tree
<i>Cinnamomum zeylanicum</i> Breyn. (Lauraceae)	Cinnamon tree
<i>Citrus aurantifolia</i> (Christm.) Swingle (Rutaceae)	Lime
<i>Citrus aurantium</i> L. (Rutaceae)	Sour orange
<i>Citrus grandis</i> Osbeck (Rutaceae)	Grapefruit
<i>Citrus limonia</i> Osbeck (Rutaceae)	Lemon
<i>Citrus mitis</i> Blanco (Rutaceae)	Calamondin
<i>Citrus nobilis</i> var. <i>deliciosa</i> (Tenore) Swingle (Rutaceae)	Tangerine
<i>Citrus nobilis</i> var. <i>unshiu</i> (Mak.) Swingle (Rutaceae)	Satsuma
<i>Citrus sinensis</i> (L.) Osbeck (Rutaceae)	Orange
<i>Coccolobis uvifera</i> Jacq. (Polygonaceae)	Seagrape
<i>Cocos nucifera</i> L. (Palmaceae)	Coconut palm
<i>Codiaeum</i> sp. (Euphorbiaceae)	Croton (ornamental)

SCIENTIFIC NAME (Species and Family)	COMMON NAME
<i>Crotalaria</i> sp. (Leguminosae)	Crotalaria
<i>Cycas circinalis</i> L. (Cycadaceae)	Queen sago palm; fern palm
<i>Cycas revoluta</i> Thunb. (Cycadaceae)	Sago palm
<i>Dictyosperma</i> sp. (Palmaceae)	Dictyosperma
<i>Dictyosperma album</i> Wendl. & Drude (Palmaceae)	
<i>Dictyosperma album</i> var. <i>rubrum</i> (Palmaceae)	
<i>Dictyosperma alexandra</i> (Palmaceae)	
<i>Diospyros kaki</i> L. f. (Ebenaceae)	Japanese persimmon
<i>Dizygotheca elegantissima</i> Vig. & Guill. (Araliaceae)	
<i>Dracaena</i> sp. (Liliaceae)	Dracena
<i>Duranta</i> sp. (Verbenaceae)	Duranta
<i>Elaeagnus</i> sp. (Elaeagnaceae)	Elaeagnus
<i>Elaeagnus angustifolia</i> L. (Elaeagnaceae)	Russian-olive
<i>Epibaterium</i> sp. (Menispermaceae)	Coral bead
<i>Eriobotrya japonica</i> Lindl. (Rosaceae)	Loquat
<i>Erythea armata</i> Wats. (Palmaceae)	
<i>Eucalyptus</i> sp. (Myrtaceae)	Eucalyptus
<i>Eucalyptus rudis</i> Endl. (Myrtaceae)	Desert gum
<i>Eugenia</i> sp. (Myrtaceae)	Syzygium
<i>Eugenia jambos</i> L. (Myrtaceae)	Rose apple
<i>Eugenia uniflora</i> L. (Myrtaceae)	Surinam-cherry
<i>Euonymus</i> sp. (Celastraceae)	
<i>Euphorbia pulcherrima</i> Willd. (Euphorbiaceae)	Poinsettia
<i>Ficus</i> sp. (Moraceae)	Fig
<i>Ficus benjamina</i> L. (Moraceae)	Weeping laurel
<i>Ficus elastica</i> Roxb. (Moraceae)	Rubber plant
<i>Fortunella</i> sp. (Rutaceae)	Kumquat
<i>Gardenia</i> sp. (Rubiaceae)	Gardenia
<i>Gladiolus</i> sp. (Iridaceae)	Gladiolus
<i>Glycosmis pentaphylla</i> (Retz.) DC. (Rutaceae)	
<i>Gordonia lasianthus</i> (L.) Ellis (Ternstroemiaceae)	Bay
<i>Grevillea robusta</i> Cunn. (Proteaceae)	Australian silk-oak
<i>Hedera</i> sp. (Araliaceae)	Ivy
<i>Hedera canariensis</i> Willd. (Araliaceae)	Algerian ivy
<i>Hedera helix</i> L. (Araliaceae)	English ivy
<i>Hibiscus</i> sp. (Malvaceae)	Hibiscus
<i>Howea</i> sp. (Palmaceae)	Kentia palm
<i>Hydriastele wendlandiana</i> Wendl. & Drude (Palmaceae)	Hydriastele palm
<i>Hyophorbe</i> sp. (Palmaceae)	Hyophorbe palm
<i>Ilex</i> spp. (Aquifoliaceae)	Holly
<i>Illicium</i> sp. (Magnoliaceae)	Anisetree
<i>Iris</i> sp. (Iridaceae)	Iris
<i>Ixora</i> sp. (Rubiaceae)	White ixora
<i>Jasminum</i> sp. (Oleaceae)	Jasmine
<i>Jasminum humile</i> L. (Oleaceae)	
<i>Jasminum primulinum</i> Hemsl. (Oleaceae)	
<i>Jasminum pubescens</i> Willd. (Oleaceae)	
<i>Jasminum sambac</i> Soland (Oleaceae)	Arabian jasmine
<i>Lagerstroemia indica</i> L. (Lythraceae)	Crapemyrtle
<i>Latania</i> sp. (Palmaceae)	Latania palm
<i>Laurus nobilis</i> L. (Lauraceae)	
<i>Ligustrum</i> sp. (Oleaceae)	Ligustrum
<i>Ligustrum lucidum</i> Ait. (Oleaceae)	
<i>Lilium</i> sp. (Liliaceae)	Lily
<i>Lilium longiflorum</i> Thunb. (Liliaceae)	White lily
<i>Linum</i> sp. (Linaceae)	Flax
<i>Liriope</i> sp. (Liliaceae)	Liriope

SCIENTIFIC NAME (Species and Family)	COMMON NAME
<i>Litchi chinensis</i> Sonn. (Sapindaceae)	Litchi
<i>Livistona</i> sp. (Palmaceae)	Livistona palm
<i>Livistona australis</i> Mart. (Palmaceae)	
<i>Magnolia</i> sp. (Magnoliaceae)	Magnolia
<i>Magnolia soulangeana</i> Soul (Magnoliaceae)	
<i>Magnolia virginiana</i> L. (Magnoliaceae)	White bay
<i>Mammea americana</i> L. (Guttiferae)	Mamey apple
<i>Mangifera indica</i> L. (Anacardiaceae)	Mango
<i>Marantá</i> sp. (Marantaceae)	Maranta
<i>Melaleuca leucadendra</i> L. (Myrtaceae)	Cajeput-tree; punk tree
<i>Meratia praecox</i> Rehd. & Wils. (Calycanthaceae)	
<i>Michelia fuscata</i> Blume (Magnoliaceae)	Banana-shrub
<i>Monstera deliciosa</i> Leibm. (Araceae)	Ceriman
<i>Moraea iridioides</i> L. (Iridaceae)	
<i>Morus</i> sp. (Moraceae)	Mulberry
<i>Muehlenbeckia</i> sp. (Polygonaceae)	Muehlenbeckia
<i>Musa</i> sp. (Musaceae)	Banana
<i>Myrtus</i> sp. (Myrtaceae)	Myrtle
<i>Myrtus communis</i> L. (Myrtaceae)	
<i>Nerium oleander</i> L. (Apocynaceae)	Oleander
<i>Ochrosia parviflora</i> Hemsl.	
<i>Olea</i> sp. (Oleaceae)	Olive
<i>Ophiopogon</i> sp. (Liliaceae)	Ophiopogon
<i>Osmanthus</i> sp. (Oleaceae)	European osmanthus
<i>Osmanthus fragrans</i> Lour. (Oleaceae)	
<i>Pachysandra</i> sp. (Buxaceae)	
<i>Paurotis wrightii</i> (Griseb. & Wendl.) (Palmaceae)	
<i>Persea</i> sp. (Lauraceae)	Avocado
<i>Phoenix</i> sp. (Palmaceae)	Phoenix palm
<i>Phoenix canariensis</i> Chaub. (Palmaceae)	Canary date palm
<i>Photinia serrulata</i> Lindl. (Rosaceae)	
<i>Pittosporum</i> sp. (Pittosporaceae)	Pittosporum
<i>Podocarpus</i> sp. (Taxaceae)	Podocarpus
<i>Pritchardia</i> sp. (Palmaceae)	Pritchardia palm
<i>Prunus</i> spp. (Rosaceae)	Cherry, plum
<i>Prunus caroliniana</i> Ait. (Rosaceae)	Cherry-laurel
<i>Prunus laurocerasus</i> L. (Rosaceae)	English-laurel
<i>Psidium</i> sp. (Myrtaceae)	Guava
<i>Pyracantha</i> sp. (Rosaceae)	Firethorn
<i>Pyrus malus</i> L. (Rosaceae)	Apple
<i>Rapanea guianensis</i> Aub. (Myrsinaceae)	Myrsine
<i>Ravanela madagascariensis</i> Gmel. (Musaceae)	Travelers-tree
<i>Rosa</i> sp. (Rosaceae)	Rose
<i>Roscheria melanochoetes</i> Wendl. (Palmaceae)	
<i>Roystonea regia</i> O. F. Cook (Palmaceae)	Royal palm
<i>Sabal</i> sp. (Palmaceae)	Palmetto, Sabal palm
<i>Sabal palmetto</i> Lodd. (Palmaceae)	Cabbage palmetto
<i>Schaefferia frutescens</i> Jacq. (Celastraceae)	Boxwood
<i>Scindapsus</i> sp. (Araceae)	Pothos
<i>Senecio mikanioides</i> Otto. (Compositae)	German ivy
<i>Serenoa repens</i> Sm. (Palmaceae)	Saw palmetto
<i>Severinia</i> sp. (Rutaceae)	Severinia
<i>Spiraea</i> sp. (Rosaceae)	Spirea
<i>Strelitzia</i> sp. (Musaceae)	Bird-of-paradise
<i>Syringa</i> sp. (Oleaceae)	Lilac
<i>Tabernaemontana</i> sp. (Apocynaceae)	Tabernaemontana
<i>Tamala</i> sp. (Lauraceae)	Redbay
<i>Ternstroemia</i> sp. (Ternstroemiaceae)	
<i>Thea sinensis</i> L. (Ternstroemiaceae)	Tea plant
<i>Thrinax</i> sp. (Palmaceae)	Thrinax palm

SCIENTIFIC NAME (Species and Family)	COMMON NAME
<i>Trachelospermum</i> sp. (Apocynaceae)	Rhynchospermum
<i>Trachelospermum jasminoides</i> Lem. (Apocynaceae)	Starjasmine
<i>Trachycarpus fortunei</i> H. Wendl. (Palmaceae)	Fortunes palm; windmill palm
<i>Trevesia palmata</i> Vis. (Araliaceae)	
<i>Viburnum</i> sp. (Caprifoliaceae)	Virburnum
<i>Viburnum tinus</i> L. (Caprifoliaceae)	Laurestinus
<i>Vinca major</i> L. (Apocynaceae)	
<i>Washingtonia</i> sp. (Palmaceae)	Washingtonia palm
<i>Wisteria</i> sp. (Leguminosae)	Wisteria
<i>Zamia</i> sp. (Cycadaceae)	

In addition to these host plants, the following have been found in St. Lucie County:<sup>2</sup>

<i>Bidens pilosa radiata</i> Sch. Bip. (Compositae)	Beggarticks
<i>Carica papaya</i> L. (Caricaceae)	Papaya
<i>Croton glandulosus</i> L. (Euphorbiaceae)	Croton (wild)
<i>Smilax tamnifolia</i> Michx. (Liliaceae)	Smilax

## DESCRIPTION OF THE STAGES

### Egg:

The egg is oval in shape, lemon yellow in color, and has a smooth chorion that is slightly sticky. The color remains about the same from the time the egg is oviposited until it hatches. The first noticeable change in the shape is a considerable flattening and widening, which occurs immediately before hatching. One hundred eggs, measured before any change in shape occurred, averaged 0.18 mm. in length and 0.10 mm. in width.

### First Instar:

The active larva, or first instar, is bright yellow, broadly oval in outline, and widens toward the anterior end of the body. The antennae are 5-jointed, and two very short setae are found on the posterior end of the body. One hundred active larvae averaged 0.20 mm. in length and 0.15 mm. in width. The dorsal scale of the settled larva is dark gray with a white tip (the remains of the white cap) in the center. No change, except growth, occurs in the body of the larva from the time it settles until the first molt. As the larva enters the first molt, the body becomes tightly stuck to the dorsal scale, the color of which changes to a light brown.

### Second-Instar Female:

The larva sheds its legs, setae, and antennae during the first molt. The upper portion of the cast skin is incorporated with the dorsal scale, and the lower portion forms the first part of the very thin ventral scale. The dorsal scale in this stage has two distinct rings, the inner one being light brown and the outer one much darker. As in the first instar, the body becomes tightly stuck to the dorsal scale immediately before the second molt, and the color of the dorsal scale becomes reddish brown.

<sup>2</sup> Identification of these plants was made by the Bureau of Plant Industry, Soils, and Agricultural Engineering.