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BIOLOGY OF THE FLORIDA RED SCALE IN FLORIDA

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DISTRIBUTION

The Florida red scale is widely distributed over the world, especially in tropical and subtropical regions. In the United States it has been found in practically every State, but in the Northern States it occurs chiefly on plants in greenhouses. In Florida, where it is the most abundant and destructive, the distribution is general over the State, but the heaviest infestations occur along the lower east coast, where the temperatures are most favorable for continuous development. In the northern part of the State, where citrus trees are occasionally defoliated by freezes, it is not so abundant, and when a tree is defoliated, infestations may be practically eliminated.

HISTORY OF THE SPECIES IN FLORIDA

The Florida red scale (*Chrysomphalus aonidum* (L.)) was first described in 1758 by Linné (5) under the name *Coccus aonidum* from specimens collected in India. He gave nondeciduous trees as hosts and mentioned *Camellia* specifically. In 1879 Ashmead (1) received citrus leaves infested with the Florida red scale in a letter from Orlando, Fla. He sent some of these to C. V. Riley, then entomologist of the Department of Agriculture in Washington, who gave the manuscript name *Chrysomphalus ficus* to the species, and informed Ashmead that the insect had been collected previously from *Ficus nitida*, now *F. retusa*, but that he had published no description of it. Ash-

¹ Acknowledgments are due Herbert Spencer for planning the first methods of study and assisting in the collecting of historical data, Max R. Osburn for advice and suggestions throughout the work, and F. M. Wadley for assistance in presenting the statistical data.

mead described the eggs, the crawling larvae, and the covering of the female from additional specimens from Florida, and recorded his correspondent's remedy of strong salt water applied just before the growing season, which was an effective control, since it caused defoliation of infested (and uninfested) leaves. There is no reference in the paper to the earlier description by Linné, and it was probably overlooked by Riley and Ashmead.

In 1880 Comstock (3) added many details to the Ashmead description and gave the microscopic characters from the last abdominal segment of the mature female and a drawing of the pygidial fringe. His characters for the male and its scale covering are excellent, and he gave useful drawings of infested orange leaves, male and female scales, newly hatched larvae, and the formation of the dorsal scale over a newly settled larva. He reared the insect through five generations on potted orange plants in Washington, D. C., and from his work surmised that in Florida there would be at least six generations per year. After thorough searches in orange groves of California and Florida, he found this scale present at that time only in the Florida grove near Orlando, from which specimens had been sent to Ashmead, and he traced this infestation to the shipment of a sour orange tree from Havana, Cuba, in 1874. The conclusion of his paper was prophetic: "The species is certainly one that is greatly to be feared, and there is no doubt that it would be a good investment for the orange growers of Florida to eradicate the pest, even if in doing so it is found necessary to purchase and destroy all infested trees. This could be done now easily, but if delayed a few years the species will doubtless become permanently established." In a short paper in 1881 Comstock (2) called attention to the differences between the Florida red scale and the California red scale, which he described as *Aspidiotus citri*, now *Aonidiella aurantii* (Mask.). He stated that the species *Chrysomphalus ficus* (Riley MS) Ashmead was simply an *Aspidiotus* and should be called *Aspidiotus ficus*, and that it was not present in California. Comstock (3) stated that up to 1883 he had obtained specimens only from Cuba and Florida, and in this paper referred the species to the genus *Aspidiotus* Bouché.

Although the Florida red scale has been present in Florida for more than 60 years, very little has been published on its biology in this state. The economic importance of this scale has increased in recent years, especially on the lower east coast,

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