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First Florida State Record of *Chrysomphalus bifasciculatus* Ferris (Diaspididae: Coccidomorpha: Hemiptera), False Florida Red Scale, Potential Pest of Ornamentals and Citrus

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INTRODUCTION: *Chrysomphalus bifasciculatus* Ferris (Hemiptera: Diaspididae), false Florida red scale, was first found in California in 1938 (Ferris 1938). Since then, it is known in 12 U.S. states (Alabama, California, Delaware, Georgia, Louisiana, Maryland, New Jersey, North Carolina, Oklahoma, South Carolina, Texas and Virginia), two of which border Florida. It is also reported from several countries in Asia and South America (García et al. 2016). The first Florida sample (E2017-4531-1) was collected by Mary Jane Echols, Florida Department of Agriculture and Consumer Services, Division of Plant Industry (FDACS-DPI), from cast-iron plant, *Aspidistra elatior* Blume (Liliaceae), on November 28, 2017, from Macclenny, Baker County, Florida. More samples (E2018-153-1) from the same host plant species in the same area were collected on January 12, 2018, confirming that the host plants were locally grown and had not been imported from out of the state, and that this scale species was established in Florida. All samples were confirmed as *C. bifasiculatus*.

The genus *Chrysomphalus* Ashmead includes seventeen species, some of which are major pests. Three species other than *C. bifasiculatus* are found in the U.S., *C. aonidum* Linnaeus (reported from Alabama, California, Florida, Georgia, Mississippi, Missouri and Texas), *C. dictyospermi* (Morgan) (Alabama, California, Colorado, Florida, Georgia, Louisiana, Mississippi, Missouri and Texas), and *C. diversicolor* Green (Alabama) (García et al. 2016). There are two species of *Chrysomphalus* in Florida, *C. aonidum* and *C. dictyospermi*. The false Florida red scale, *C. bifasciculatus*, is an invasive species in the United States; its area of origin is most likely East Asia (Miller and Davidson 1990; Smith-Pardo et al. 2012).

HOST PLANTS: *Chrysomphalus bifasciculatus* is polyphagous occurring on plants in 41genera of 28 families (García et al. 2016). Some of the more noteworthy hosts include aspidistra, camellia, citrus, cycads, euonymus, holly, ivy, oleander and viburnum.

DESCRIPTION: In the field, the adult female cover (dorsal side) of this species is slightly convex, circular, brown, dark gray, or black; the shed skins are central, reddish yellow to reddish brown (Fig. 1). The male cover is the same color as the female cover, but more elongate; the shed skins are submarginal. The body of the adult female is pale yellow when first mature, but becomes darker later. The eggs are yellow. The false Florida red scale cover is usually lighter in color than that of Florida red scale, and therefore does not contrast as strongly with the shed skins as in the latter (Fig. 2) (Miller and Davidson 2005).

Diagnostic characters of the genus *Chrysomphalus* when mounted on a microscope slide and examined with a compound scope, are: three pairs of lobes that are all about the same size and shape; paraphyses that are relatively long, much longer than the lobes, and the plates anterior of the third lobe are fringed. *Chrysomphalus bifasciculatus* differs from all other species by having clusters of macroducts on abdominal segments II and III, and having about 28 macroducts and six perivulvar pores on each side of the body (Fig. 3). *Chrysomphalus aonidum* has a single cluster of macroducts on abdominal segment II only, and has about 49 macroducts and 11 perivular pores on each side of the body. *Chrysomphalus dictyospermi* lacks dorsal clusters of macroducts on either abdominal segment II or III, and has about 27 macroducts and six perivular pores on each side of the body (Miller and Davidson 2005).

BIOLOGY: Not much is known about the biology of the false Florida red scale. In 1970, Murakami reported that there are two generations each year in Japan, with crawlers appearing in late May to early June. Adults of the first generation are present in July and August. Eggs of the second generation are laid in late July and August, and mated adult females overwinter. Azim (1961) reported that the species develops continuously in Japan with several overlapping generations, and Gill (2013) reported crawlers active on the leaves of holly in Maryland in May.

DAMAGE: *Chrysomphalus bifasciculatus* mostly occurs on the leaves of its hosts. It has been reported as a pest of several ornamentals including euonymus, aspidistra, and holly (Azim 1961; McKenzie 1956). Species in the genus *Chrysomphalus* cause damage by sucking plant juices, causing yellowing on the leaves, sometimes leading to leaf drop. A heavy infestation can cause stunting of corresponding plant parts. Woody plants infested for long periods of time can wilt and their young shoots can die (Smith-Pardo et al. 2012).

PEST DISPERSAL: The first instar nymphs, which are short-lived in the absence of suitable feeding sites, are the primary dispersal agents through short-term crawling, dispersal through wind, and attachment to birds or mammals. Movement of contaminated plant material or horticultural tools is potentially a significant mechanism of dispersal of this pest (Anonymous 2017).

As indicated above, the first report of *C. bifasciculatus* in Florida is from Baker County which is near the southern border of Georgia. *Chrysomphalus bifasciculatus* has been in Georgia since 1982 (Nakahara 1982), and there is a possibility that *C. bifasciculatus* was moved with plant material from Georgia to Baker County, Florida. This highlights the importance of monitoring the movement and possible establishment of plant products into Florida, and demonstrates the importance of quarantine programs and interdiction.

MANAGEMENT: Armored scale insects are difficult to control using traditional contact insecticides because they spend the majority of their life cycle in a relatively impervious wax cover. Timing of the application of contact insecticides when first instar nymphs are without a scale cover is a common method of control, but accurate timing is crucial. Soil treatments of systemic insecticide also do little to control armored scales. Use of horticultural oils is used in some situations, and combinations of oils and insecticides have been used effectively. Scale insects are particularly susceptible to biological control using various kinds of chalcidoid wasps, lady beetles, and even entomopathogenic fungi, and nematodes. When using insecticides, consult with your local county Extension office to find out which insecticides are appropriate and could be utilized in a program that would also help reduce the impacts on the natural enemies of scale insects. Under certain circumstances, mechanical control using high-pressure water sprays or hand picking visible infestations may be possible.

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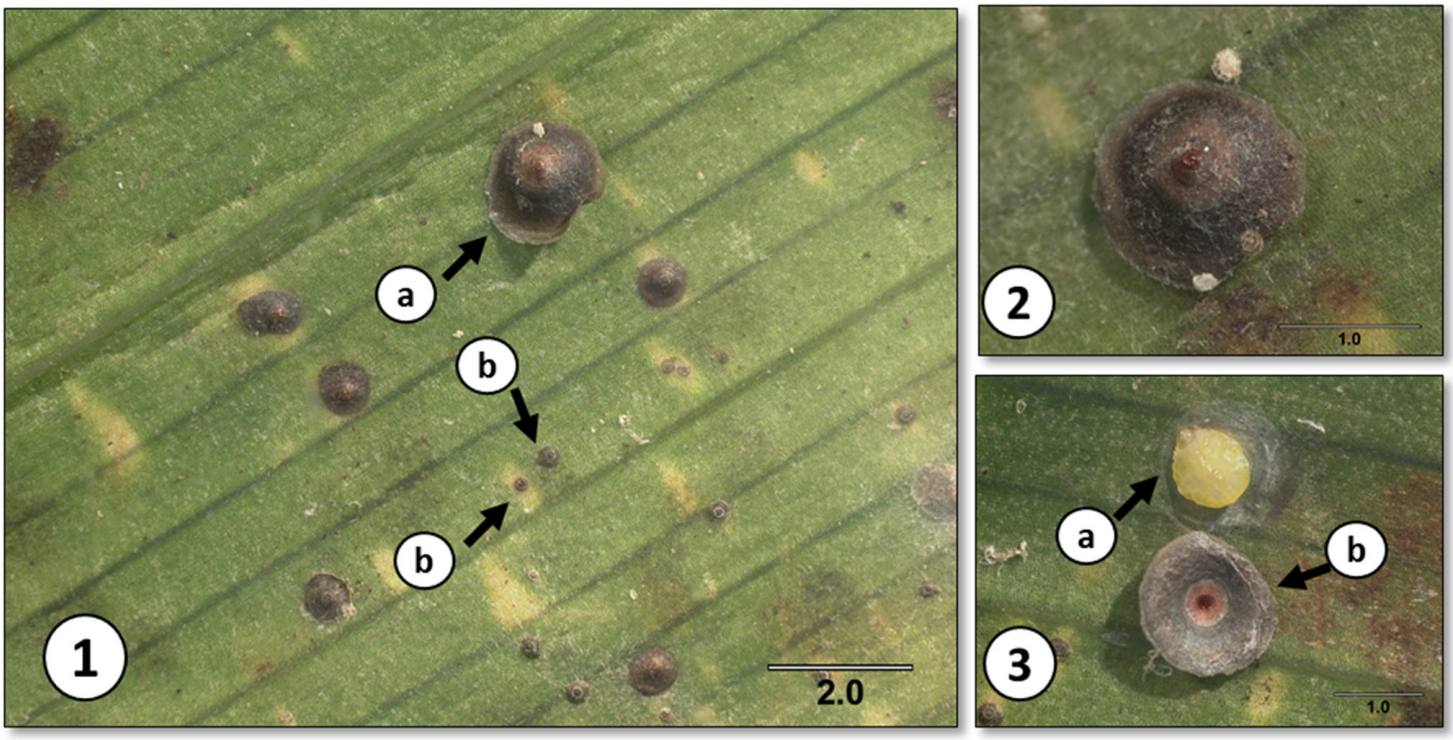

Fig. 1. Infestation of false Florida red scale, *Chrysomphalus bifasciculatus* on *Aspidistra elatior*. 1) Infested upper leaf surface of *A. elatior* with an adult female (a), and immature stages (b); 2) close-up of adult female; 3) dorsal view of adult female without dorsal cover (a), and ventral view of dorsal cover of adult female (b). Photograph courtesy of Muhammad Z. 'Zee' Ahmed, FDACS-DPI

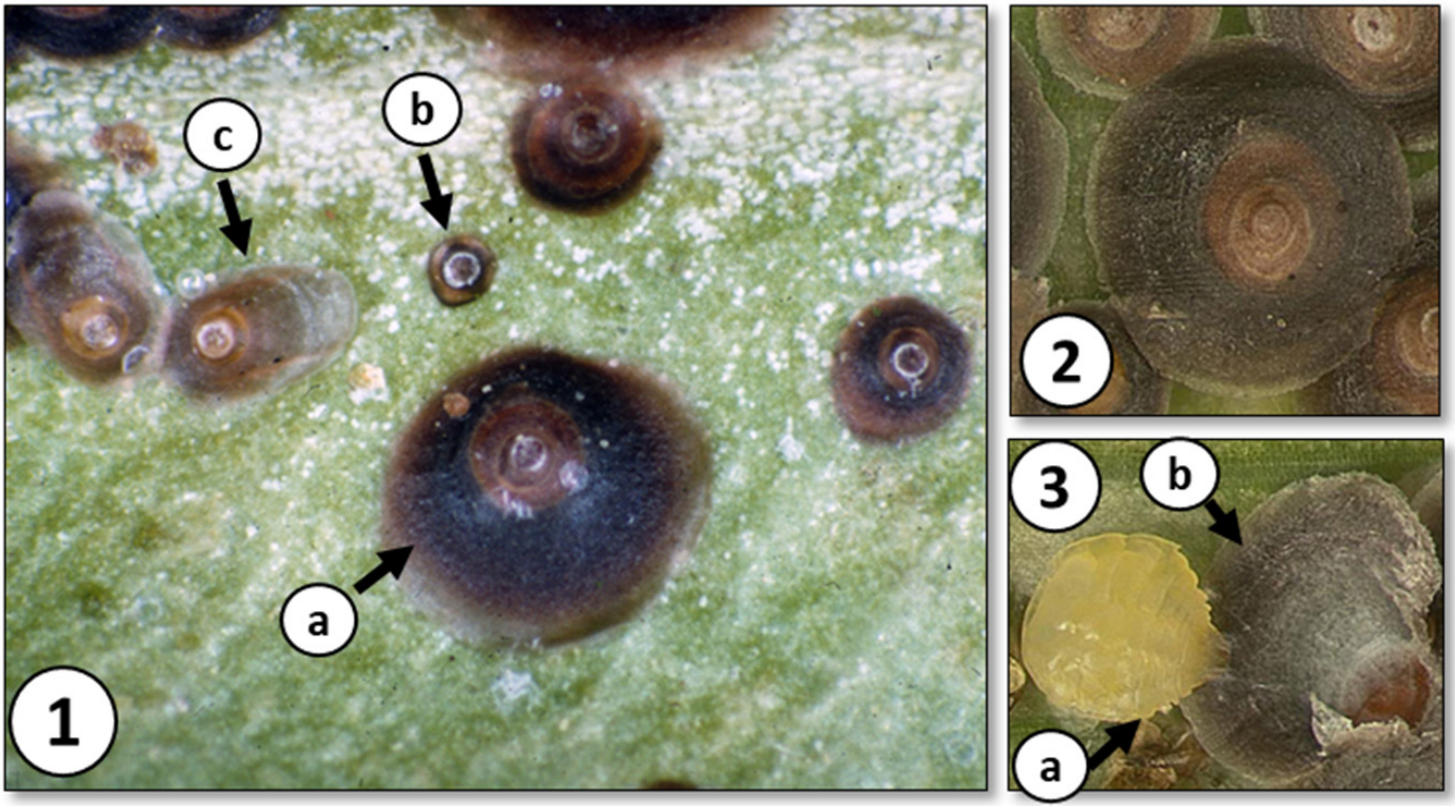

Fig. 2. Infestation of Florida red scale, *Chrysomphalus aonidum* on *Citrus* sp. The infestation looks very much like an infestation of false Florida red scale, *C. bifasciculatus* on *Aspidistra elatior*. 1) Infested leaf of citrus with an adult female (a), immature stages (b), and male (c); 2) close-up of adult female; 3) dorsal view of adult female without dorsal cover (a), and ventral view of dorsal cover of adult female (b). Photograph courtesy of Lyle Buss, University of Florida; John Davidson, University of Maryland; Douglass R. Miller and Muhammad Z. 'Zee' Ahmed, FDACS-DPI

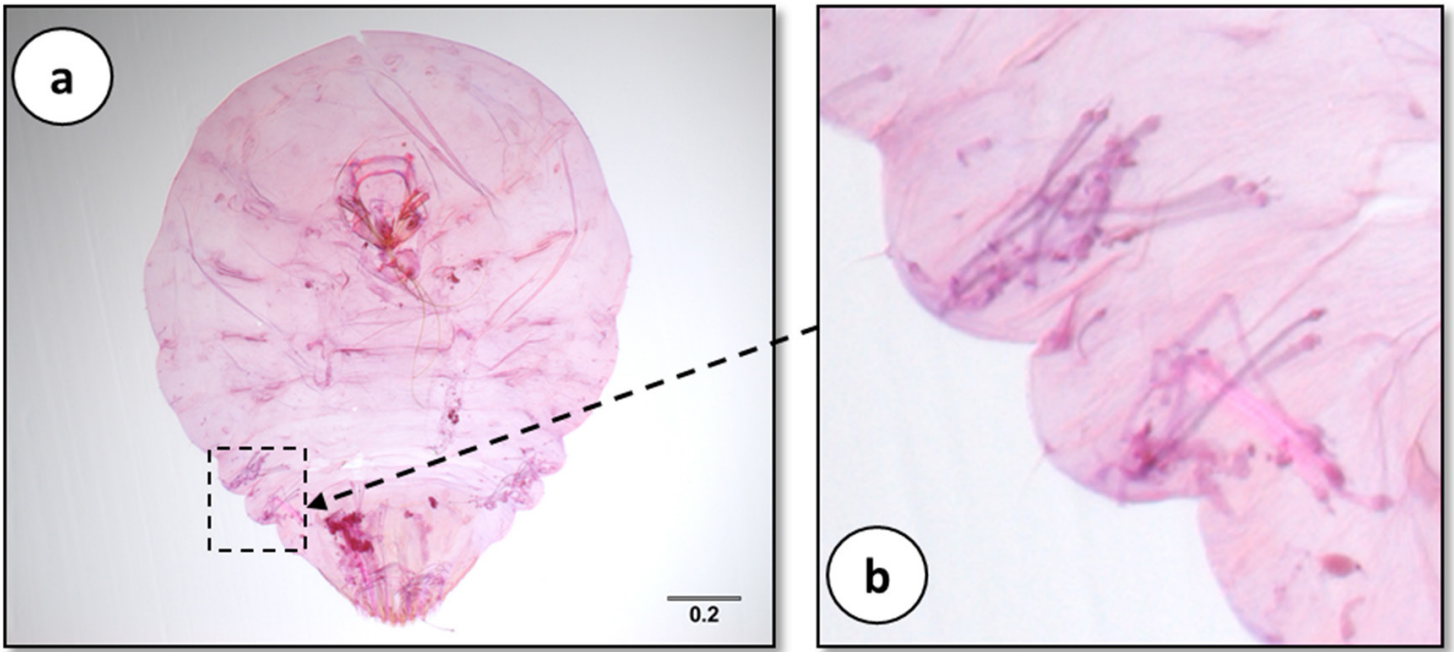

Fig. 3. Slide-mounted view of adult female of *Chrysomphalus bifasciculatus* (a), and close-up of cluster of ducts on prepygidial segments A2 and A3 (b). The main difference between false Florida red scale, *C. bifasciculatus,* and Florida red scale, *C. aonidum*, is the cluster of ducts on prepygidial segments A2 and A3 (arrow); present in the former, absent in the latter. Photograph courtesy of Muhammad Z. 'Zee' Ahmed, FDACS-DPI

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