

Florida Department of Agriculture and Consumer Services Division of Plant Industry

Field Detection and Potential Host Plants of *Fiorinia phantasma* Cockerell & Robinson (Diaspididae: Hemiptera), Phantasma Scale, Potential Pest of Palms and Ornamental Plants in Florida

Muhammad Z. Ahmed; Bureau of Entomology, Nematology and Plant Pathology
DPIHelpline@FreshFromFlorida.com or 1-888-397-1517

INTRODUCTION

Fiorinia phantasma Cockerell & Robinson (Diaspididae: Hemiptera), phantasma scale, is a significant pest of nursery plants, particularly of ornamental palms. The scale has been transported to new localities by movement of live nursery stock (Ahmed and Miller 2018). It was first found in the Philippine Islands in 1915 (Cockerell and Robinson 1915). In the last decade, it had a major global expansion and is now known in 22 countries and territories (American Samoa, France, French Polynesia, Grenada, Guam, Hawaii, Hong Kong, Indonesia, Malaysia, Maldives, Nauru, the Netherlands, New Caledonia, Papua New Guinea, Reunion, Saint Martin, St. Barthelémy, Singapore, Solomon Islands, Taiwan, Thailand, United States and Vietnam) (Ahmed and Miller 2018). The first U.S. continental record (FDACS-DPI sample # E2018-789-1) was collected from *Phoenix canariensis* Hort, Canary Island date palm on March 1, 2018 from Miami-Dade County, Florida. More samples (FDACS-DPI sample # E2018-1244-1) from the same host plant species in the same area were collected on March 22, 2018. All trees sampled were heavily infested with *F. phantasma*. Heavy infestations of *F. phantasma* have also been reported from palms in Hawaii and Grenada (Garcia 2011). The scale has been introduced to new areas without its natural enemies and has the potential to cause serious damage (Garcia 2011; Garcia and Hara 2011; Watson et al. 2015). Its preference for palms may be of concern in Florida where palms are important components of natural and ornamental environments.

There are six species of the genus *Fiorinia* in the U.S. [*F. proboscidaria* Green, *F. fioriniae* (Targioni Tozzetti), *F. japonica* Kuwana, *F. externa* Ferris, *F. pinicola* Maskell and *F. theae* Green] (See Table 1). All of them require microscopic analysis to be distinguished.

Table 1. Species of the genus *Fiorinia* reported from the U.S., their geographical distributions and potential occurrences on palms.

<i>Fiorinia</i> Species in the U.S.	Distribution in the U.S.	Reported on Palms	Established in Florida
<i>Fiorinia proboscidaria</i>	Florida only	No, Common on Citrus	Yes, Recently
<i>Fiorinia fioriniae</i>	18 States	Yes, Commonly	Yes, Commonly
<i>Fiorinia theae</i>	22 States	No, Common on Camellias	Yes, Commonly
<i>Fiorinia japonica</i>	California, District of Columbia, Georgia, Maryland, New York and Virginia	Yes, Rarely; Common on Conifers	No
<i>Fiorinia pinicola</i>	California, Georgia	No, Common on Junipers	No
<i>Fiorinia externa</i>	Connecticut, District of Columbia, Georgia, Maryland, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, Rhode Island and Virginia	No, Only on Conifers	No



The first detection of *Fiorinia phantasma* in Florida involved more than 20 heavily infested trees along a roadside in Miami-Dade County (Ahmed and Miller 2018). The number of life stages present and density of scales on the trees indicated the population had been there for an extended period. It is not surprising this infestation remained undetected, as the scale is identical in field appearance to other species in the genus *Fiorinia* that occur in Florida on similar or identical hosts.

Initial scale infestations usually start with the arrival of crawlers (first instar, mobile stage) either blown in the wind, on plant material, or on pruning and gardening tools. Crawlers then settle on plant parts and molt to the second instar within a few days. An initial infestation usually starts within the fold of a leaflet, either near the base or randomly on the upper side of the palm leaves. The first generation commonly stays hidden in the upper leaf fold and is easily missed if only the underside of the palm leaves are inspected. It is necessary to cut leaves and open the upper fold to check for hidden infestations. The second generation may come out of the fold to find new colonizing sites on the lower side of leaves.

CLOSELY RELATED SPECIES

Currently, phantasma scale is present only in Miami-Dade County along with the closely related species *F. floriniae*. One other closely related species, *F. japonica*, is found in California and several east coast states in the U.S., but is not known to occur in Florida.

POTENTIAL THREAT

The presence of *F. phantasma* in Florida poses a serious threat to nursery and landscape industries as well as to homeowners, because it can infest plants in 24 families and 49 genera (Watson et al. 2015; García et al. 2016; Ahmed and Miller 2018), including many important ornamentals and several fruit crops (see Table 2). An example of the heavy damage this pest can cause comes from the Maldives, where over 6,000 palm trees were infested in a single resort (Watson et al. 2015). The infestation caused yellowing of the leaves, leaf drop, loss of plant vigor, stunting of the host and even death (Watson et al. 2015). This scale insect could be especially problematic for Florida's commercial palm industry, where palms account for approximately \$400 million in sales. (Khachatryan and Hodges 2012).

FIELD GUIDE

Species in the genus *Fiorinia* are unusual because adult females are encased within the second-instar shed skin (Miller and Davidson 2005). Male and female scales usually intermingle on the undersides of leaves and if populations reach high densities, crawlers colonize the topsides of foliage (Fig. 1). The illustrations in figures 1-4 serve as a guide to recognize the possible presence of phantasma scale. Figure 1 illustrates characteristics of a mature infestation. Figure 2 demonstrates where to locate an early hidden infestation. Figure 3 shows three different species of palm-infesting scale insects. Inspect palms by looking at the lower sides of the leaves and searching for any sign of damage, particularly for the whitewash areas on leaves as shown in Figure 1a. Any small, white, snow-like spots on the leaves could be male *F. phantasma* as shown in Figures 1b and 1c. Adult females (Fig. 1c) often have red stripes running the width of the scale covering, but many Florida specimens lack these stripes and have an entirely darkish red body. If the infestation is at an early stage, signs might not be obvious. A pole saw may be used to cut leaves and inspect the basal folds of the upper side carefully (Fig. 2). Adult females have an unusual body shape that is wide in the thorax and anterior abdomen, but abruptly narrows to the body apex (Fig. 4a). Slide-mounted specimens are unique by having a rounded process between the antennae bearing several small projections (Fig 4d). *Fiorinia phantasma* is almost identical to *F. floriniae* which also infests palms. Suspect phantasma scales must be examined and confirmed by an expert in a laboratory setting.

IDENTIFICATION AND TEMPORARY SLIDE MOUNTING PROCEDURE

Field specimens of scale insect species can often look very similar to one another and to ensure proper species identification, specimens must be slide mounted in order to view the diagnostic characters utilized to distinguish an individual scale insect species. Both the preparation process and items needed for this procedure are illustrated in Figures 4 and 5. To begin the preparation process, remove several of the largest specimens from the host and place them in a small watch glass containing 10% KOH. Cover the watch glass and heat it for approximately 10 minutes. Remove the watch glass and allow it to cool, then use a micro-spatula to press the specimens to force the adult female from the previous shed skin. Gently press the scale insects to remove body contents, this is referred to as clearing of the specimens. Place the cleared specimens in distilled water and heat for two or three minutes to remove any excess KOH. Place a very tiny drop of Hoyer's mounting medium on a slide and place the cleared specimens in the drop being sure the specimens are immersed in the liquid not floating on the surface. Carefully place a cover slip on the Hoyer's drop and label the slide.

To view the taxonomic characters utilized for identification, view the slide mounts through a compound microscope to observe the diagnostic characters of the phantasma scale (i.e., a "crown" between the antennae and no conspicuously large macro ducts on the pygidium, see Fig. 4). *Fiorinia phantasma* is nearly identical to *Fiorinia floriniae* in the field, but is easily distinguishable under a microscope (characters in parentheses are those of *F. floriniae*) with the shape of the body being broad and abruptly narrowing to the body apex (body long and narrow) (Figure 4a) and the presence of a process between the antennae resembling a crown (process is absent) (Figure 4D).

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 after the dispersal of scale insects and in particular the phantasma scale. The aforementioned dispersal mechanisms highlight the importance of monitoring the movement of plants and plant parts into and around Florida and demonstrates the significance of quarantine programs.

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 because they are cell bursters and do not feed in the phloem. Horticultural oils can be used in some situations. Combinations of oils and insecticides have been used effectively. Scale insects are particularly susceptible to biological control. Since this scale is native to the Philippines, a search for natural enemies for biological control should be concentrated there. In Hawaii, *Aphytis* sp. (Aphelinidae: Hymenoptera) was found attacking about 10 percent of the scales (Garcia 2011). In addition, scales were found preyed upon by *Telsimia nitida* Chapin (Coccinellidae: Coleoptera), *Cybocephalus nipponicus* Endrödy-Younga (Cybocephalidae: Coleoptera), *Chrysoperla comanche* (Banks) (Chrysopidae: Neuroptera), and *Aleurodothrips fasciapennis* (Franklin) (Phlaeothripidae: Thysanoptera) in Hawaii (Garcia 2011). When using insecticides, it is important to spray when there is as little impact on natural enemies as possible. Under certain circumstances, mechanical control using high-pressure water sprays or hand picking visible infestations may be possible.

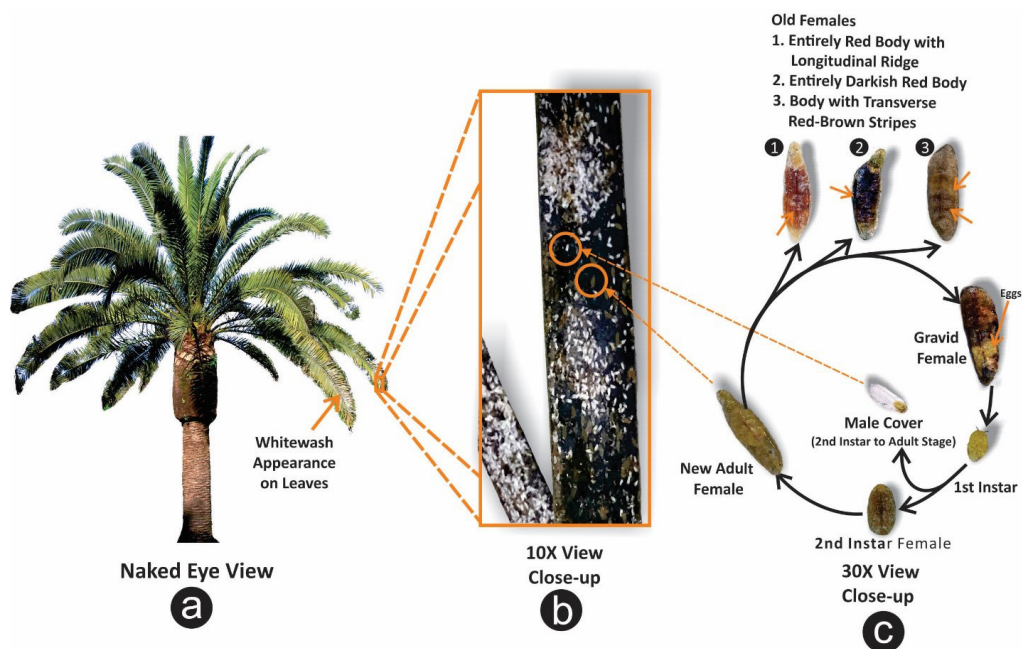


Fig 1. A mature infestation of *Fiorinia phantasma* on *Phoenix canariensis*, Canary Island date palm in Miami showing (a) infested leaves, (b) infested leaflet, and (c) life cycle of *F. phantasma* showing different stages. Photo by Muhammad Z. Ahmed, FDACS-DPI.

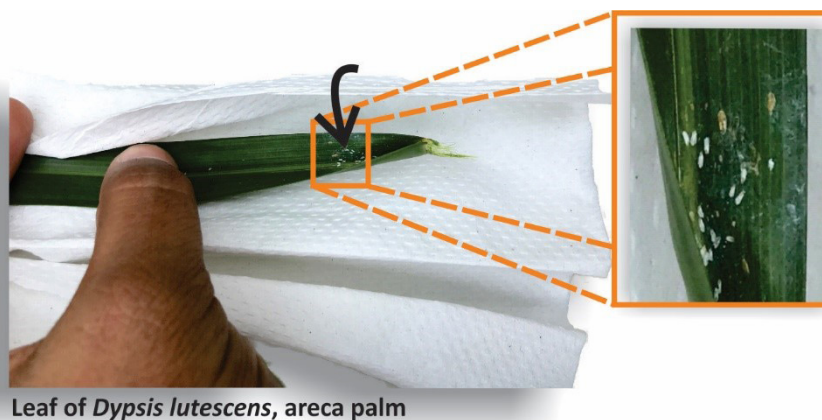


Fig 2. Initial infestation hidden in a fold on upper side of leaf of *Dypsis lutescens*, areca palm. Photo by Muhammad Z. Ahmed, FDACS-DPI.



Fig 3. *Fiorinia phantasma* and other common species of armored scale on palms in Florida. Photo by Muhammad Z. Ahmed, FDACS-DPI.

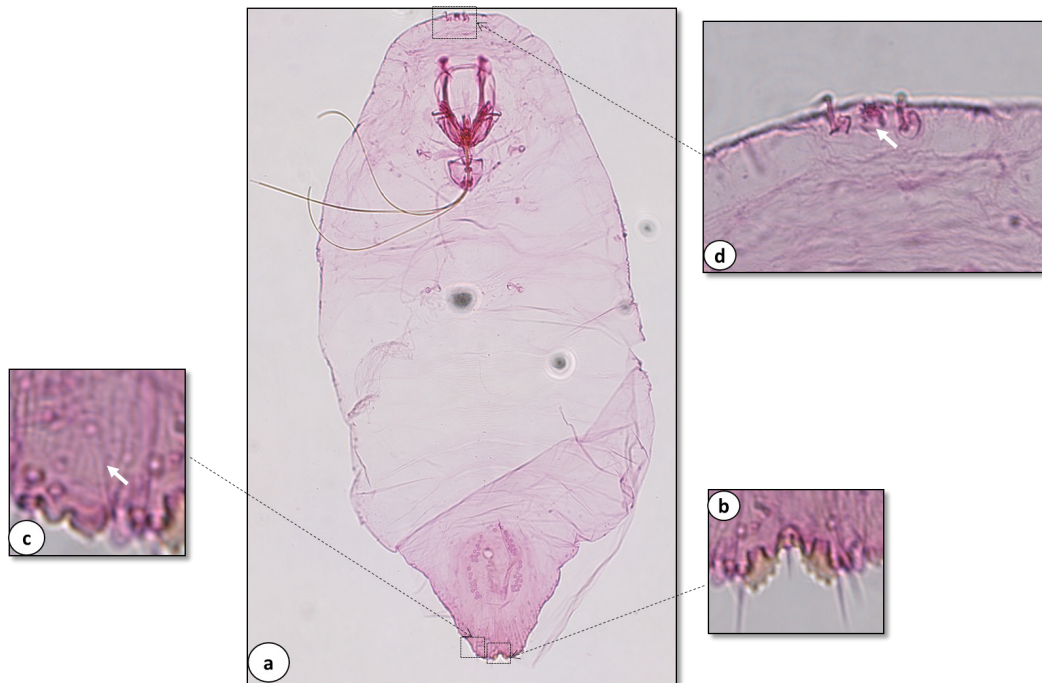


Fig. 4. (a) Slide-mounted view of body of adult female, about 0.65 mm long and widest at about second abdominal segment, then narrowing abruptly to a triangular pygidium, (b) pygidium with notch at apex formed by parallel median lobes separated by about the width of one lobe, (c) pygidial margin with 4 marginal macroducts, each duct about 2x longer than wide and arrow show the shape of first one, (d) rounded process between the antennae bearing several small projections shown by arrow. Slide prepared by Jessica Awad and photo by Muhammad Z. Ahmed, FDACS-DPI.

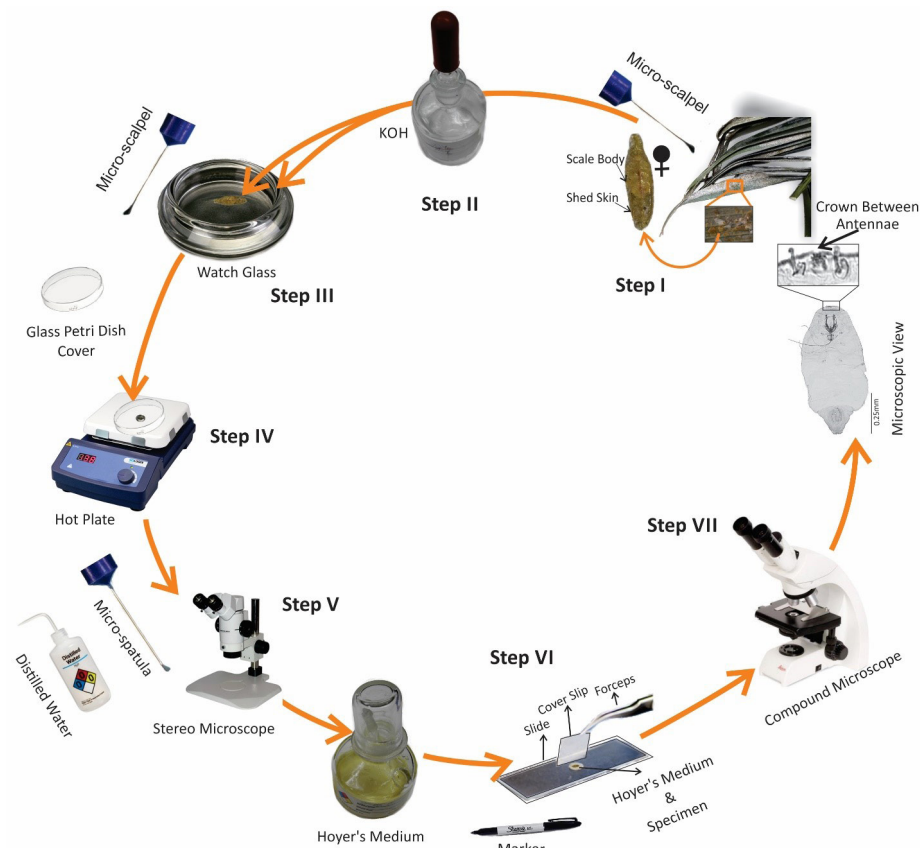


Fig 5. Visual demonstration of rapid slide mounting procedure. Please see the identification section in the text for further detail. Also see figure 6 for the list of tools needed in this procedure. Photo by Muhammad Z. Ahmed, FDACS-DPI.

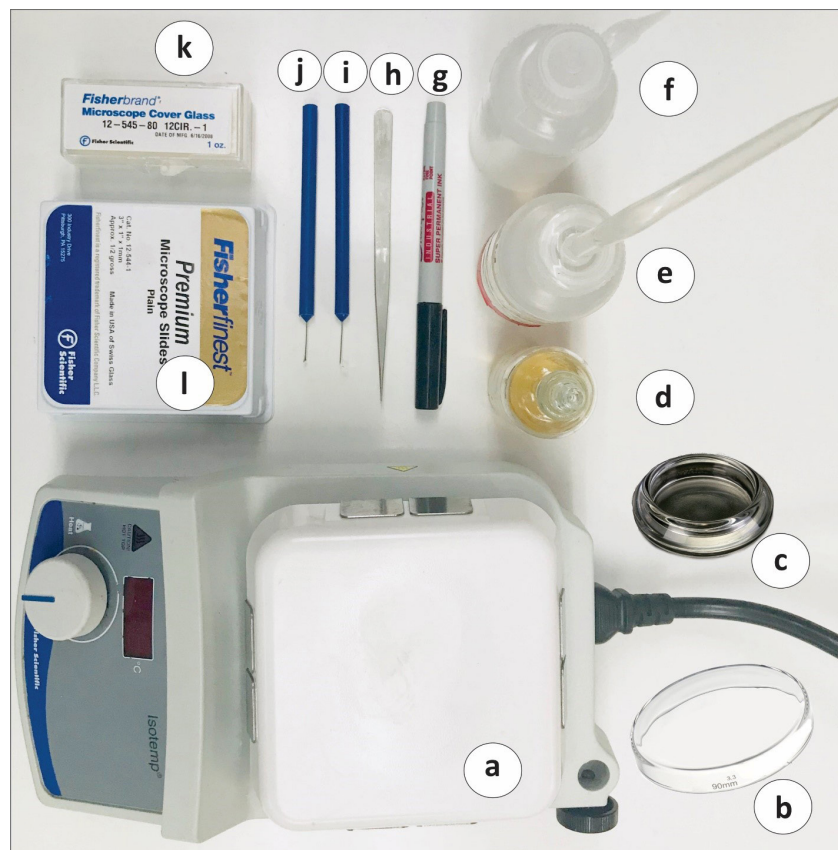


Fig 6. List of the tools needed in rapid slide mounting procedure. (a) Hot Plate, (b) Petri Dish Cover, (c) Watch Glass, (d) Hoyer's Mounting Medium, (e) 10 % Potassium Hydroxide, (f) Distilled Water, (g) Marker, (h) Forceps, (i) Micro-spatula, (j) Micro-scalpel, (k) Microscope Cover Glass 12CIR, and (l) Microscope Slides 3"x 1"x 1mm. Photo by Muhammad Z. Ahmed, FDACS-DPI.

Table 2. Recorded important host plants of *Fiorinia phantasma* known to occur in Florida. Names in **red** indicate hosts found infested in the Miami area.

PALMS	COMMON NAME
<i>Adonidia merrillii</i>	Christmas palm
<i>Arenga undulatifolia</i> *	n/a
<i>Cocos nucifera</i>	coconut palm
<i>Dictyosperma album</i>	princess/hurricane palm
<i>Dypsis decaryi</i>	triangle palm
<i>Dypsis lutescens</i>	areca/butterfly palm
<i>Howea forsteriana</i>	kentia palm or thatch palm
<i>Hyophorbe lagenicaulis</i>	bottle palm
<i>Nypa fruticans</i>	nipa palm, mangrove palm
<i>Livistona chinensis</i>	the Chinese fan palm
<i>Phoenix</i> species including <i>canariensis</i> , <i>reclinata</i> , <i>robellinii</i> , <i>sylvestris</i>	Canary Island date palm, wild date palm/Senegal date palm, pygmy date palm, silver date palm/Indian date
<i>Pinanga coronata</i>	ivory cane palm
<i>Raphia farinifera</i>	raffia palm
<i>Sabal mexicana</i>	Rio Grande palmetto or Mexican palmetto or Texas palmet
<i>Tahina spectabilis</i>	tahina palm
<i>Wallichia disticha</i>	wallich palm
<i>Wodyetia bifurcata</i>	foxtail palm
FLOWERING/ORNAMENTAL PLANTS	COMMON NAME
Bambusoideae	bamboo
<i>Calophyllum inophyllum</i>	beauty leaf
<i>Cycadales</i>	cycads
<i>Ficus benjamina</i>	weeping fig
<i>Ficus racemosa</i>	cluster fig
<i>Ficus rubiginosa</i>	rusty fig
<i>Heliconia caribaea</i>	lobster-claws
<i>Jasminum</i>	jasmine
<i>Monstera deliciosa</i>	monstera/tarovine
Orchidaceae	Orchids
<i>Pittosporum tobira</i>	Japanese cheesewood
<i>Plumeria</i>	Frangipani
<i>Schinus terebinthifolia</i>	Brazilian peppertree

SHRUBS/TREES (ORNAMENTALS AND FRUITS) COMMON NAME

<i>Artocarpus heterophyllus</i>	jackfruit
<i>Azadirachta indica</i>	neem tree
<i>Calophyllum neoebudicum</i> *	n/a
<i>Jatropha integerrima</i>	peregrina
<i>Litchi chinensis</i>	lychee
<i>Mangifera indica</i>	mango
<i>Murraya koenigii</i>	curry-leaf
<i>Murraya paniculata</i>	orange-jasmine
<i>Nerium oleander</i>	oleander
<i>Noronhia emarginata</i>	Madagascar olive
<i>Podocarpus</i>	Japanese yew
<i>Ravenala madagascariensis</i>	traveler's tree
<i>Senna alata</i>	candlestick

*Uncommon in Florida.

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