

Whitefly Predatory Lady Beetle (suggested common name) *Delphastus catalinae* (Horn) (Insecta: Coleoptera: Coccinellidae)¹

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Introduction

Delphastus catalinae (Horn) is considered an effective biological control agent for whiteflies because of its high prey consumption rates, long adult survival, and high reproduction rates (Heinz et al. 1999). *Delphastus catalinae* has received research attention in Florida (and other states) for its value as a predator of the whitefly *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae), which is an economically important pest of ornamental and agricultural crops (Razze et al. 2016a). There is a growing interest to increase knowledge and focus efforts on incorporating integrated pest management (IPM) strategies that are compatible with sustainable and organic production systems. Biological control has the potential to manage key pests in an integrated management program for whiteflies and other pests.

Synonymy

Delphastus catalinae was previously reported as *Delphastus pusillus* (LeConte 1852). Gordon (1994) provided a revision of the genus *Delphastus*. Although there has been uncertainty as to the taxonomic status of the species of *Delphastus* spp. in commercial colonies, Hoelmer and Pickett (2003) concluded that species in commercial insectaries are likely *Delphastus catalinae* instead of *Delphastus pusillus*.

They also concluded that most of the published studies of *Delphastus pusillus* predation on *Bemisia tabaci* actually described *Delphastus catalinae*.

Distribution

There are currently three species of *Delphastus* that occur in Florida: *catalinae* (Horn), *pallidus* (LeConte), and *pusillus* (LeConte). Of the three species, *Delphastus catalinae* is the most commonly used member of this genus being commercially reared for controlling whiteflies. *Delphastus catalinae* is native to Colombia, South America. Currently, established populations can be found in tropical and subtropical regions in the United States, including California and Florida. Intentional releases have been made in Florida, Hawaii, and throughout the southwest region of the United States. *Delphastus catalinae* is commercially available for release throughout the United States and internationally.

Description

Adults are minute, 1.4 mm long black beetles with yellow legs. Head coloration is used to distinguish females from males. Females have a black head (Figure 1), whereas males have an orange head (Figure 2). The larvae are elongated, cream-colored, covered with short fine hairs, and have

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visible legs, unlike a fly larva that has no legs (Figure 3). The pupae are more yellow and spherical (Figure 4).



Figure 1. Adult female *Delphastus catalinae* (Horn) feeding on whitefly eggs.
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Figure 2. Adult male *Delphastus catalinae* (Horn) feeding on whitefly nymphs.
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Figure 3. *Delphastus catalinae* (Horn) larvae feeding on whitefly nymphs.
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Figure 4. *Delphastus catalinae* (Horn) pupa (left) and late instar larva (right).

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Life Cycle and Biology

The complete life cycle from egg to adult takes 21–25 days at 25–30°C (Hoelmer et al. 1993). Eggs are yellowish, oval, and laid in clusters on the underside of leaves. Females can deposit 200–300 eggs in their lifetime (Hoelmer et al. 1993). The larvae are capable of eating 1,000 whitefly eggs before they pupate. Older larvae migrate down the plant to pupate. Pupae are often found clustered along leaf veins on the underside of leaves. A single beetle can consume as many as 10,000 whitefly eggs at 160 per day, and up to 700 larvae during its lifetime (Hoelmer et al. 1993). Adult longevity is approximately 60 days for females and 45 days for males. Both adults and larvae feed on whitefly eggs and immature stages. Eggs of *Bemisia tabaci* are preferred by *Delphastus catalinae* compared to nymphs. *Delphastus catalinae* will avoid parasitized nymphs (Hoelmer et al. 1994), and therefore is compatible with the use of parasitic wasps as biological control agents. If food is scarce, they will also feed on other small arthropods, such as spider mites and aphids (Legaspi et al. 2006). *Delphastus* spp. larvae have been observed feeding on honeydew and dew drops even when whiteflies were abundant. Availability of alternative food sources might allow *Delphastus catalinae* to survive periods of low prey density. While low temperatures are a limiting factor for *Delphastus catalinae*, small populations can survive mild winters where low temperatures are above 0°C. Humidity can also have an effect on *Delphastus catalinae*; low ambient moisture (10% relative humidity) was reported to have a negative impact on oviposition and survival (Simmons et al. 2008).

Economic Importance

Delphastus spp. have been extensively studied as biological control agents for *Dialeurodes citri* (Ashmead), *Aleurocanthus woglumi* Ashby, *Trialeurodes floridensis* (Quaintance), *Dialeurodes citrifolii* (Morgan) (Hemiptera: Aleyrodidae), and *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) in citrus in Florida and for *Bemisia tabaci* in ornamentals and vegetable crops in Florida, California, and Texas. For a list of whitefly species attacked by *Delphastus catalinae*, see Table 1. *Delphastus catalinae* was first noted as a predator of *Bemisia tabaci* biotype B in central Florida during the late 1980s by L. S. Osborne (University of Florida). Greenhouse studies demonstrated that introductions of *Delphastus catalinae* on squash infested with *Bemisia tabaci* biotype B significantly reduced the whitefly populations. Augmentative releases of *Delphastus catalinae* can also be used in conjunction with bioinsecticides and intercropping with buckwheat to achieve significant reductions in whitefly populations on squash (Razze et al 2016b). Hoelmer and Pickett (2003) suggested a high degree of dispersal by *Delphastus catalinae* in the field. Therefore, ornamental and agricultural crops grown in the greenhouse might be better suited for whitefly control using *Delphastus catalinae*. It is recommended to release *Delphastus* in the greenhouse as soon as whiteflies are detected at a rate of 100 adults per whitefly “hot spot” or 10 adults per infested plant, with weekly releases for 3–4 weeks. *Delphastus catalinae* has been successfully mass reared and commercialized for whitefly management for many years. Their ability to quickly reduce high populations of whiteflies may result when combined with parasitoids, including *Encarsia* and *Eretmocerus* spp. (Hymenoptera: Aphelinidae), and other compatible management strategies to further enhance whitefly management in field and greenhouse crops.

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Table 1. Whitefly species attacked by *Delphastus catalinae*.

Common name	Species	Host plant
Greenhouse whitefly	<i>Trialeurodes vaporariorum</i>	Wide variety of ornamental, fruit and vegetable crops (avocado, beans, cucumber, eggplant, melon, squash, tomato)
Bandedwinged whitefly	<i>Trialeurodes abutiloneus</i>	Ornamental plants including poinsettia, geranium, hibiscus, petunia
Silverleaf whitefly, Sweetpotato whitefly	<i>Bemisia tabaci</i>	Wide variety of ornamental, fruit and vegetable crops (tomato, peppers, squash, cucumber, beans, eggplant, watermelon, peanut, soybean, poinsettia, hibiscus, chrysanthemum)
Woolly whitefly	<i>Aleurothrixus floccosus</i>	Citrus, eugenia
Azalea and hibiscus whitefly	<i>Pealius</i> spp.	Azaleas, hibiscus
Cloudywinged, citrus and Rhododendron whitefly	<i>Dialeurodes</i> spp.	Citrus, rhododendrons
Citrus blackfly	<i>Aleurocanthus woglumi</i>	Citrus