

# Waterlily Leafcutter, *Elophila oblitalis* (Walker) (Insecta: Lepidoptera: Crambidae: Acentropinae) <sup>1</sup>

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## Introduction

*Hygrophila polysperma* (Roxb.) T. Anderson (Polemoniales: Acanthaceae) is a rooted submersed or emerged aquatic plant in shallow water areas and saturated shorelines throughout Florida. This invasive aquatic plant also is known as hygrophila, hygro, East Indian hygro, green hygro, Miramar weed, oriental ludwigia, and Indian swampweed (hereafter referred to as hygrophila).

Hygrophila is a federally listed noxious weed (USDA 2012), a Florida state listed Category II prohibited plant (FDACS 2008), and a Florida Exotic Pest Plant Council Category I invasive species (FLEPPC 2019). The submersed growth habit displaces native vegetation in many canals and drainage ditches in south Florida. The plant forms dense strands that occupy the entire water column, clogging irrigation and flood-control systems (Schmitz and Nall 1984, Sutton 1995) and interfering with navigation (Woolfe 1995). Hygrophila also creates problems as an emergent plant in some shoreline areas, including rice fields (Krombholz 1996).

In October 2007, we received a report from researchers at the UF/IFAS Center for Aquatic and Invasive Plants of an insect attacking hygrophila. Samples of the insect were collected, and it was identified as the waterlily leafcutter, *Elophila oblitalis* (Walker). Of the more than twenty Acentropinae species occurring in Florida, *Elophila oblitalis* (Walker) is the most common. Although its common name implies that it is a pest of waterlilies, it actually has a wide host range. Most of the damage caused by the larvae is superficial and rarely endangers the plant, but the damage observed on the hygrophila plants in this instance was severe (Figures 1 and 2).



Figure 1. Hygrophila showing feeding damage caused by larvae of the waterlily leafcutter, *Elophila oblitalis* (Walker).

Credit: J. P. Cuda, University of Florida



Figure 2. Larva of the waterlily leafcutter, *Elophila oblitalis* (Walker), attacking hygrophila.

Credit: J. P. Cuda, University of Florida

In addition to the invasive aquatic weed hygrophylla, the waterlily leafcutter also feeds on another invasive plant, hydrilla, *Hydrilla verticillata* (L.f.) Royle. Numbers of *Elophila oblitalis* collected from hydrilla from field sites in Florida and Louisiana were similar to the numbers of the hydrilla leafcutter, *Parapoynx diminutalis* Snellen that were collected (Balciunas and Minno 1985).

## Synonymy

According to Dyar (1906) and Zimmerman (1958) the following synonyms have been used for *Elophila oblitalis*:

- *Synclita oblitalis* Walker, 1859
- *Synclita proprialis* Fernald, 1859
- *Isopteryx oblitalis* Walker, 1859
- *Parapoynx obscuralis* Walker, 1859
- *Parapoynx obscuralis* M?schler, 1972
- *Hydrocampa proprialis* Fernald, 1888
- *Hydrocampa oblitalis* Fernald, 1891
- *Nymphula oblitalis* Hampson, 1897

## Distribution

This common moth occurs throughout Florida, westward to Texas, northward to western Nova Scotia, and southern Manitoba (Munroe 1972). It also has been introduced into Hawaii (Williams 1944), England (Shaffer 1968), and British Columbia (Munroe 1972). In a study in South Carolina, *Elophila oblitalis* was found in both lentic (still freshwater) and lotic (fast moving freshwater) water bodies (Stoops et al. 1998). Out of 65 surveyed sites in South Carolina, *Elophila oblitalis* was present in 6.2% of those sites with a water temperature between 23 and 27°C, a width of 3.2 to 45.7 m, a depth of 0.3-1.0 m, and a pH of 6.6 to 7.5 (Stoops et al. 1998).

## Description

### Eggs

The eggs are whitish in color and appear domelike (oval and flattened). The flattened side is glued to the leaf and the domed side has wrinkles down the length of the egg (Dyar 1906). The eggs are 0.6 mm in length and 0.4 mm wide (Dyar 1906). They are deposited singly or in overlapping, ribbon-like masses near the edges of submersed leaf surfaces.

### Larvae

Most members of the crambid subfamily Acentropinae have aquatic larvae with tracheal gills. However, the larva of this moth lacks gills and is sometimes referred to as "the sandwich man" due to its habit of living between two pieces of leaf (leaf case) that it cuts from its host plant (Figure 3 and 4).



Figure 3. Waterlily leafcutter, *Elophila oblitalis* (Walker), leaf case.

Credit: Lyle J. Buss, University of Florida



Figure 4. Larva of the waterlily leafcutter, *Elophila oblitalis* (Walker), with opened leaf case.

Credit: Lyle J. Buss, University of Florida

The epidermis (skin) of the larvae is covered with minute papillae (bumps). The body is creamy-white, but increasingly brownish from abdominal segment four forward to the prothorax. The prothoracic coxae (proximal leg segments) are touching while the mesothoracic coxae are nearly touching. The head is yellowish-brown with a faint brown genal (cheek) stripe. The prothoracic spiracle (respiratory opening) is vestigial (non-functioning), and the spiracles on abdominal segments three and four are distinctly larger than others. The crochets (gripping hooks) are arranged in two biordinal (sometimes partially triordinal) transverse bands, with the anterior band distinctly larger than the posterior band.

## Pupae

The pupae are pale yellow and the wings and head appear darker (Figure 5) (Dyar 1906). The head has two distinct black spine-like hairs. The spiracles on abdominal segments 2–4 are large, round, elevated and red brown in color (Dyar 1906). The anterior spiracles are much smaller. The pupae are found inside silk cocoons inside the leaf cases formed by the larvae.



Figure 5. Pupa of the waterlily leafcutter, *Elophila oblitalis* (Walker).

Credit: Stephen P. L. Luk

## Adults

Adults are sexually dimorphic and readily distinguishable (Figures 6 and 7). Females have a 15 to 19 mm wingspan, and the female's wings are paler in color appearing grayish-brown with orange-brown markings. The wingspan of the male is smaller, about 11 to 13 mm, and the male's wings are grayish-brown interspersed with brownish and white markings.



Figure 6. Adult female waterlily leafcutter, *Elophila oblitalis* (Walker).

Credit: J. Lotz, Division of Plant Industry



Figure 7. Adult male waterlily leafcutter, *Elophila oblitalis* (Walker). Wingspan of this specimen is 11 mm.

Credit: L. J. Buss, University of Florida

## Life Cycle and Biology

No published information is available about the development times of this species. The female moth lays her eggs on the exposed edges of submersed aquatic plants (Gill et al. 2008). Upon hatching, the larvae enclose themselves inside cut leaf pieces. The leaves are webbed together with silk. Cases made by young larvae are water-filled and oxygen uptake occurs cutaneously (presumably via the epidermal papillae), whereas cases of older larvae are air-filled. The cases of young larvae remain attached to the leaf from which they were made. Older larvae detach the case from the leaf and are free-floating. Larvae abandon smaller cases as they mature and construct larger cases from new leaves. The case may consist of two entire leaves, parts of leaves, or of parts of many plants tied together with silk. The larvae extend out of the case to feed on plant material, but usually the body remains in the case. Prior to pupation, larvae attach their cases to petioles or leaf blades of their host plants above or below the water surface and spin a silk cocoon inside their leaf cases.

## Hosts

*Elophila oblitalis* has a wide host range and is known to feed on nearly 60 plant species (Table 1).

## Damage

*Elophila oblitalis* has a wide host range and is known to feed on waterlilies and other ornamental pond plants as well as the invasive aquatic weeds, salvinia (Tipping et al. 2012), water lettuce (Dray et al. 1993), hygrophila, and hydrilla. The larvae are the stage that feeds on the plant and causes damage to the plant tissue. In addition to feeding, the larvae cut the leaves to prepare a leaf case for shelter. As the larvae develop, they cut new, progressively larger leaf cases. This action in itself can provide quite significant damage to the infested plant (Nachtrieb et al. 2007). In a field study, to compare the

effect of herbivory on different aquatic plants, *Elophila oblitalis* was one of the three species that caused the most damage (Nachtrieb et al. 2007). When feeding the larvae remove chunks from the leaves, usually feeding on the basal or middle portions (Balciunas and Minno 1985). This feeding often causes the leaves to break away from the stem. If the population density is high and plant material becomes scarcer, the larvae will begin to feed on the stems, which can cause the entire plant to fragment (Balciunas and Minno 1985).

Due to its broad host range, this insect frequently is a pest in aquatic plant nurseries, especially on waterlilies, *Nymphaea* spp. In the nursery setting, this insect can cause economic losses as the larval feeding makes the plants unattractive to customers. Extensive feeding may even lead to reduced plant health and death (Gill et al. 2008).

## Importance as a Biological Control Agent

In addition to having a pest status in aquatic nurseries, due to its wide host range, *Elophila oblitalis* also plays a minor role as a beneficial insect, as it feeds on invasive species, such as hydrilla, salvinia, and hygrophila. As a native species this type of biological control is known as natural regulation. However, due to the extensive host range of this species it would not be advisable to attempt to increase wild numbers through mass releases or conservation, as they would likely feed non-specifically on other desirable plants as well as the weeds.

A study that attempted to identify the biotic and abiotic factors that limited growth of common salvinia, an exotic floating aquatic plant, found that herbivory by *Elophila oblitalis* and a weevil, *Cyrtobagous salviniae* Calder and Sands, were two of the most influential factors inhibiting growth (Tipping et al. 2012).

## Monitoring and Management

To monitor for the waterlily leafcutter, observe leaves for the characteristic holes created by this insect (Gill et al. 2008). The adults can be trapped by UV black lights, and the larvae can be extracted from the plant material by handpicking or using a Berlese funnel.

*Elophila oblitalis* is a pest of greenhouses and may require control in aquatic plant nurseries. As with other aquatic moth pests, *Bacillus thuringiensis* subspecies *kurstaki* would likely provide control with little or no adverse effects to other aquatic organisms (see Baniszewski et al. 2016). In support of this hypothesis, the closely related organism *Bacillus thuringiensis* subspecies *israelensis* was found to cause significant mortality to the waterlily leafcutter (Haag and Buckingham 1991).

## Related Species

Three other species of *Elophila* occur in the United States with one, *Elophila tinealis* Munroe, in Florida. The adult of *Elophila tinealis* is much smaller than that of the waterlily leafcutter and has longer, narrower, and darker wings. The larvae of *Elophila tinealis* are not well known, but seem to feed on and most often make their cases out of duckweed, *Lemna* sp.

The larvae of *Elophila gyralis* (Hulst) and *Elophila icciusalis* (Walker) are similar to those of the waterlily leafcutter, but the anterior and posterior transverse bands of crochets (i.e., the gripping hooks on the prolegs) are the same size. *Elophila gyralis* and *Elophila icciusalis* adults are more brightly colored than *Elophila* and are yellowish-orange and white or brownish in color. Although *Elophila gyralis* and *Elophila icciusalis* larvae may make portable cases, they usually cut only one leaf piece and attach it to a whole leaf and live between the two layers.

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## Tables

Table 1. Host plants of the waterlily leafcutter, *Elophila oblitalis* (Walker). Plant hosts arranged by families and genera.

Family	Genera	No. of species
Acanthaceae	<i>Hygrophila</i>	1
	<i>Nomophila</i>	1
	<i>Synema</i>	1
Alismataceae	<i>Enchinodorus</i>	3
	<i>Sagittaria</i>	1
Amaranthaceae	<i>Amaranthus</i>	1
Apiaceae	<i>Hydrocotyle</i>	3
Aponogetonaceae	<i>Aponogeton</i>	3
Araceae	<i>Orontium</i>	1
	<i>Pistia</i>	1
Brassicaceae	<i>Cardamine</i>	1
	<i>Nasturtium</i>	1
Cyperaceae	<i>Eleocharis</i>	1
Gentianaceae	<i>Nymphoides</i>	2
Haloragaceae	<i>Myriophyllum</i>	2
Hydrocharitaceae	<i>Egeria</i>	1
	<i>Elodea</i>	1
	<i>Hydrilla</i>	1
	<i>Limnobium</i>	1
Lemnaceae	<i>Lemna</i>	1
	<i>Spirodela</i>	1

Family	Genera	No. of species
Lythraceae	<i>Rotala</i>	1
Marsileaceae	<i>Marsilea</i>	1
Nymphaeaceae	<i>Brasenia</i>	1
	<i>Nelumbo</i>	1
	<i>Nuphar</i>	1
	<i>Nymphaea</i>	7
Onagraceae	<i>Ludwigia</i>	2
Poaceae	<i>Hydrochloa</i>	1
Polygonaceae	<i>Polygonum</i>	3
Pontederiaceae	<i>Eichhornia</i>	1
	<i>Pontederia</i>	1
Potamogetonaceae	<i>Potamogeton</i>	3
Salicaceae	<i>Salix</i>	1
Salviniaceae	<i>Azolla</i>	1
	<i>Salvinia</i>	1
Scrophulariaceae	<i>Ambulia</i>	1
	<i>Bacopa</i>	1
	<i>Lindernia</i>	1
	<i>Micranthemum</i>	1
Typhaceae	<i>Sparganium</i>	1

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