EENY054

UF UNIVERSITY of FLORIDA
IFAS Extension

Hydrilla Tip Mining Midge (unofficial common name), *Cricotopus lebetis* (Insecta: Diptera: Chironomidae)[1]

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Introduction

Insects of the family Chironomidae, commonly known as midges, are often the most abundant group of insects inhabiting freshwater environments (Pinder 1986). Midges are fragile and mosquito-like in appearance but they do not bite. The larvae of most midges are aquatic and feed primarily on algae and decaying organic matter. A few species, however, are capable of mining the soft tissues of submersed plants and utilizing the living plant material as a food source (Pinder 1986). Recently, this feeding strategy has been studied in some detail in the genus *Cricotopus* because of the realization that it could be exploited for the biological control of the alien aquatic weed Eurasian watermilfoil, *Myriophyllum spicatum* L. (MacRae et al. 1990) and possibly hydrilla, *Hydrilla verticillata* (L.f.) Royle (Cuda et al. 2002).

Hydrilla is a submersed aquatic plant endemic to the Old World tropics that was introduced into Florida by the aquarium industry in the late 1950's from Sri Lanka (Langeland 1990). After its discovery in the Crystal River watershed in 1960, hydrilla continued to expand its range statewide and to increase in severity in water bodies already infested. The dense surface mats associated with severe hydrilla infestations cause problems because they hinder navigation and flood control, interfere with recreational activities, and reduce the biodiversity in aquatic ecosystems (Haller 1978). Between 1980 and 2004, approximately $158 million in state and federal funds were spent managing hydrilla in Florida public waters with non-biological control methods (FLDEP 2004). With the recent discovery of herbicide resistance in hydrilla (Michel et al. 2004), there is renewed interest in biological control.

In 1992, USDA researchers discovered midge larvae attacking the apical meristems of hydrilla in the Crystal River watershed in Citrus County, Florida (G.R. Buckingham, personal communication), and that the damaged hydrilla at one site was stunted and unable to grow to the surface. The hydrilla-attacking midge was subsequently identified as *Cricotopus lebetis* Sublette, a species possibly new to Florida (Epler et al. 2000). Because previous research implicated midge larvae as causal agents of damaged stem tips on stunted hydrilla plants in Africa

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(Markham 1986), this tip mining midge may have some potential as a biological control agent.

Distribution

The midge genus *Cricotopus* is represented in North America by four subgenera (Epler, 1995). Two of these subgenera occur in Florida and contain at least eight species (Epler, 1995). The actual distribution of *C. lebetis* will not be known with any certainty until it can be determined if it is an immigrant that was accidentally introduced along with hydrilla, or an indigenous species that has developed a new association with hydrilla.

Description

Adult: The adult midge is small, only 3 to 4 mm in length, and fragile. Both sexes are pale green in color with black markings on the thorax and a pair of adjacent dark bands on abdominal segments 2 & 3 and 5 & 6. The black markings on the thorax and the coarse banding pattern on the abdomen give the midge a darker appearance. The sexes can be readily distinguished by the condition of the antennae and the shape of the abdomen. In females, the antennae are short and the abdomen is as wide as the thorax. In contrast, the males possess long antennae with distinct whorls of hair and have a narrow, tapering abdomen.

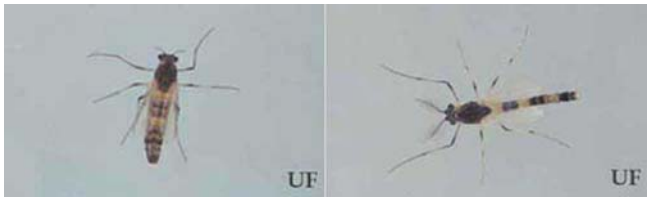

Figure 1. Dorsal views of adult female (left) and male (right) "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Figure 2. Lateral views of adult female (left) and male (right) "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Egg: The egg mass is linear shaped, and contains from 50 to 250 eggs diagonally-arranged in one or two rows encased in a sticky gelatinous tube. The eggs are white in color when first laid, and resemble a string of pearls. Within 24 hours the eggs that have been fertilized turn grayish-brown, and red eyespots of the fully formed embryo appear just prior to hatching.

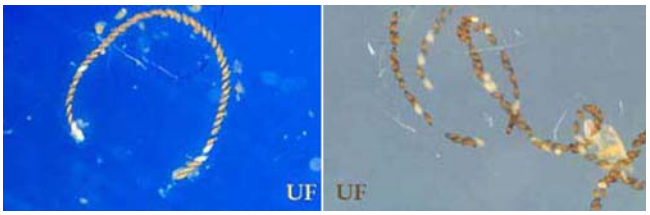

Figure 3. Two views of egg masses of "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Larva: The larvae of *Cricotopus lebetis* can be identified by the color and general appearance of the body. Live or freshly-preserved specimens have a characteristic green body color with a broad dark blue band around the thorax. After the body color fades in preserved specimens, the larvae can be separated from other midge larvae by the presence of a pair of lateral setae on each abdominal segment.

Figure 4. Larva of "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Pupa: The pupa is a nonfeeding stage. The wings and other adult features that have been developing internally are visible. Breathing horns or "trumpets" that are usually present on the prothorax in species that have free-swimming pupae are lacking. A pupa destined to become an adult female of *Cricotopus lebetis* will have a full complement of eggs apparent in the abdomen.

Figure 5. Hydrilla tip damage and larva of "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Figure 6. Female pupa of "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Figure 7. Damaged hydrilla tip with pupa of "hydrilla tip mining midge," *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Life Cycle

Both male and female midges live from 1 to 3 days and do not feed. The adults mate on a suitable substrate in daylight. Male swarming behavior that is a prerequisite for mating in many species of the Chironomidae was not observed in this species. Shortly after mating, the female oviposits on the surface of the water. The female inserts the tip of her abdomen beneath the water surface where she deposits a single ribbon-like egg mass surrounded by a gelatinous matrix and dies soon afterwards. The egg stage lasts 36 to 48 hours.

Figure 8. Mating adults, "hydrilla tip mining midge, " *Cricotopus lebetis* Sublette. Credits: Jerry F. Butler, University of Florida

Larval hatching is synchronous. The neonates (newly-hatched larvae) are very active but remain inside the tubular gelatinous matrix for several hours, crawling from one end to the other. Eventually, they exit the gelatinous matrix from one of its ends, or occasionally from the middle. The larvae at this stage of their development are free-swimming and vulnerable to predation. However, their translucent color and small size may afford them some protection until they can enter a shoot tip. Once inside the plant, the larvae mine and feed on the vascular tissues of the apical meristems of the hydrilla shoots (one larva per shoot tip). As they develop to maturity, their feeding activity creates a 1 to 2 cm tunnel inside the stems which eventually kills the shoot tips and induces their abscission. The tunnels created by the developing larvae inside the shoot tips probably protect them from predators but also function as pupal cases. The larvae complete their development in 9 to 22 days.

Pupation occurs inside the hydrilla stem. Before pupating, the mature larva completely severs the tip of the shoot to create an escape route for the fully-developed pupa, and caps the opening of the tunnel with plant fibers excavated from the stem wall. The preparation of pupal case by the the last instar larva is what actually induces abscission of the shoot

tip. The pupal stage lasts 24 to 48 hours. Adult emergence occurs after the sedentary pupa exits the stem by repeatedly undulating its abdomen to break through the fibrous cap, and slowly swims to the surface aided by an air bubble released inside the pupal skin.

Importance

Cricotopus lebetis may have some potential as a biological control agent of hydrilla. The larvae of this herbivorous midge mine the meristematic tissues of the plant and in the process disrupt shoot growth. By severely damaging or killing the apical meristems, the developing larvae may prevent new stems from reaching the surface. This type of damage is desirable for managing hydrilla because it would eliminate most of the adverse effects caused by the formation of the dense surface mats, such as changes in biodiversity, water chemistry, circulation and temperature.

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