

# Corn wireworm *Melanotus communis* Gyllenhal (Insecta: Coleoptera: Elateridae)<sup>1</sup>

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## Introduction

Insects in the family Elateridae are commonly known as “click beetles”. Their name comes from the clicking sound they make while attempting to right themselves after falling or being placed on their backs. The larvae of click beetles are called wireworms. The corn wireworm, *Melanotus communis* Gyllenhal, is a serious agricultural pest and was added to the EPPO A1 action list of quarantine pests in 2002 (OEPP/EPPO 2005).



Figure 1. Larva of *Melanotus communis* Gyllenhal.  
Credits: Lyle Buss, University of Florida, Entomology and Nematology Department.

The corn wireworm is the most common wireworm of corn (*Zea mays*) fields in the northern central states of the U.S. and constitutes up to 85% of the total click beetle population present in the region (Riley et al. 1974, Baranowski and Waddill 1975). Wireworms are usually most severe in wet soils, and in fields that have been planted with sod, grasses, alfalfa, carrots or potatoes. In southern Florida, at least 12 species of wireworms have been found, but the corn wireworm, *Melanotus communis* is considered to cause significant economic damage to sugarcane (*Saccharum officinarum*) (Cherry et al. 2011) especially in soils rich in organic matter (Cherry and Hall 1986, Cherry 1988).

Corn wireworms are the most serious insect pests of potato. In potatoes, corn wireworms destroy planted seeds, bore into roots, crown tissues and eventually tunnel up the plant stems (Andrews et al. 2008). They feed on the seed pieces, causing weak stands, but the major yield losses are due to tunneling into tubers. These tunnels are entry points for pathogens like fungi and bacteria, leading to rotting of tubers. Out of 39 species of wireworms, 21 genera have been documented to cause damage to potatoes (Jansson and Seal 1994). During the 1980s, more than 40% of the total potato tuber harvest was down-graded or rejected because of wireworm injury in some regions of the USA (Jansson and Lecomte 1989). Southern Florida potato and

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sugarcane production suffer economic losses due to corn wireworm as well (Jansson and Seal 1994, Hall 1990).

## Distribution

Corn wireworms occur in almost all corn growing areas of world. Corn wireworms are most abundant in the mid-western and southeastern states. They tend to be common in newly planted sod or no-till corn fields (Sorensen and Baker 1994).

## Host Range

The corn wireworm is a major pest of corn, sugarcane, potatoes (*Solanum tuberosum*) and sweet potatoes (*Ipomoea batatas*), although wheat (*Triticum aestivum*), sorghum (*Sorghum bicolor*), unspecified grasses, small grain crops, flower and vegetable crops can also be attacked (Sorensen and Baker 1994). In addition to the above crops, corn wireworms also attack carrots (*Daucus carota*), cucurbits, rutabagas (*Brassica napus*), onions (*Allium cepa*), sugar beets (*Beta vulgaris*), beans (*Phaseolus vulgaris*), peas (*Pisum sativum*), peppers (*Capsicum* spp.) and celery (*Apium graveolens*) (Bessin and Townsend 2004, Chaput 2011, Wilson 1940).

## Life History

Overwintering adults become active in early summer, and start feeding on pollen. They mate and females lay eggs in the soil near the roots of grasses or other host plants. First-instar larvae emerge in July and begin feeding on roots. The larvae develop throughout the summer and overwinter as second instar larvae in the soil. Most larval stages continue to develop over the next five years and undergo molting once or twice each year, but some larvae develop fully in three years. In the spring, mature larvae construct oval cells in the soil to pupate. Adults emerge 7-39 days later and feed on pollen before hibernating in sheltered areas (Fenton and Florence 1926). In Florida, adult *Melanotus communis* are most numerous during April to August, with peak oviposition in May to June (Cherry and Hall 1986). The life cycle ranges from 2-6 yrs depending upon species and location. In Ontario, all life stages (adult, larva, and pupa) can overwinter in infested fields (Chaput 2011).

**Eggs:** The eggs are tiny, white, spherical to oval shaped, 0.011 inches (0.3 mm) in diameter, and are usually laid in batches of 50-130 (Andrews et al. 2008, Kuhar et al. 2008). Eggs are usually laid singly but are sometimes widely scattered on corn and other crops in Pennsylvania (Gesell 1983).

**Larvae:** The larvae are hard-bodied and darker colored than most maggots or grubs (Chaput 2011). The larvae are glossy and yellow-brown, with a wire-like hard, cylindrical, jointed body ranging from 0.51-1.5 inches (13-38 mm) in length. First instar larvae are pale yellow and change to reddish brown in later stages. First year larvae do not cause significant damage. This larval stage continues throughout summer and second instar larvae overwinter in soil. Larval period may take two to several years with one to two moltings per year. Depending on temperature and moisture, larvae move through the soil vertically on a seasonal basis. They migrate near the surface during moderate temperatures (near 70°F) and burrow in the soil in extreme heat and cold (Kuhar et al. 2008).

**Pupae:** Larvae pupate in the soil in oval cells 5.9-11.8 inches (15-30 cm) deep for 2 weeks. Pupae are white to cream colored, oval shaped and 0.51 inches (13 mm) in length. They are soft and fragile, seldom seen, and resemble adult beetles in size and shape (Gesell 1983). They become darker just before adult emergence.

**Adults:** Adults are smooth or with very short hairs, slender, 0.51 inches (13 mm) long, reddish brown to black in color with a backward-pointing anterior projection near the middle of the narrow, tapering body. This is the only stage of wireworms that is found above ground (Gesell 1983). They have a large tooth-like projection between the hind legs that fits into a groove on the undersurface of the abdomen. Adults feign death when disturbed and can then upright themselves from their backs by quick flexion at the juncture of the thorax and abdomen. Overwintering adult beetles emerge from soil in late March or early April and are crepuscular or nocturnal. Mated females prefer weedy or grassy fields for egg laying (Fenton and Florence 1926).



Figure 2. Adult *Melanotus communis* Gyllenhal. To give an idea of this beetle's size, the large circle in the photo is the head of a pin. Credits: Lyle Buss, University of Florida, Entomology and Nematology Department.

## Damage

Wireworms attack mostly seeds, roots, shoots, and crowns of plants below the soil surface. In corn, damage appears in the form of hollowed out corn kernels, leaving only the seed coat. In later stages, larvae may also cut off small roots or tunnel into underground portions of the root or stems of young corn plants. The damage can be recognized in a field by the presence of gaps in rows or stunted or wilted plants with whorl leaves wilting first (Gesell 1983). The larvae cause damage primarily to the younger plants. More damage is noticed when corn is planted in cold and wet field conditions. As soil temperatures warm, wireworms move deeper in the soil profile, eventually to where they are no longer a threat to the growing corn.



Figure 3. Sugarcane stalks on left show *Melanotus communis* Gyllenhal, corn wireworm, damage to germinating buds versus the stalk on right protected with a soil insecticide.

Credits: Ronald Cherry, Entomology and Nematology Department, University of Florida.

On potato and carrot, narrow holes (about 1-3 mm deep) are made by third-instar larvae, while deeper holes up to 3 mm in diameter and 2 mm deep are due to older larval instars (Jansson and Seal 1994). In potato and sweet potato, corn wireworms create larger holes in roots than holes created by other species. In northern sweet potato growing areas, *Melanotus communis* is the most damaging wireworm. Damaged tubers and roots are degraded and discarded due to wireworms attack (Sorensen and Baker 1994).

In sugarcane, wireworms chew into the plant base and then hollow out the stem, leading to wilting and desiccation of the youngest plants, and eventually resulting in stand loss. Soil within 8 inches diameter around affected plants should be excavated in search of larvae in or near these plants. Wireworm damage symptoms can sometimes be confused with symptoms from [lesser cornstalk borer](#).

## Monitoring

Scouting of wireworms is very important for its management and it can be achieved by using bait traps. The University of Missouri has developed wireworm traps for monitoring purposes. Traps can be placed 2-3 weeks before planting, but a week before planting is recommended when the soil temperatures are high enough for wireworms to come near soil surface. The trap consists of a 1/2 cup of soaked seed mixture of 1:1 corn: wheat, placed in a hole (6-8 inches deep in soil) and covered with soil. Soaking promotes germination and wireworms are attracted to swollen and germinating seeds (Fenton and Florence 1926). A black plastic trash bag should be placed on the soil surface surrounding bait to maintain temperature and moisture. The edges of the trash bag should be covered with soil to keep the wind from blowing it away. Clear plastic should be placed on top of the black plastic trash bag to create a greenhouse effect.

To detect wireworms in corn, four traps per acre are needed, but it is recommended that 10 traps be used in any field as a baiting technique. To determine the threshold where economic injury occurs, collect baits after one week and count the number of wireworms. The threshold where economic injury to a corn crop can occur is more than one wireworm per trap (Rice and Simmons 1999). Sequential sampling of sugarcane fields at the pre-planting stage can be helpful to growers in determining the need for an insecticide application for controlling wireworms in Florida. Cherry et al. (2013) established an economic injury level for sugarcane of 9 or more wireworms in their sampling plan. However, the effects of 9 or more wireworms in terms of potential economic loss were not determined in their study (Cherry et al. 2013).

## Management

Fields with high wireworm densities in the past tend to retain populations over the years. Fields with a long history of grass pasture or seed production were reported to be correlated with large wireworm populations, as grasses are host of wireworms (Anonymous 1944, Fox 1961). Low lying areas and high organic matter also promote wireworm populations.

## Biological control

Few predators and parasitoids are reported for biological control of wireworms. In Virginia in 2002, it was found that augmentative release of entomopathogenic nematodes such as *Steinernema feltiae*, *Steinernema riobrave* or *Heterorhabditis megidis* was effective for wireworm control.

However, replicated studies did not yield similar results. Entomopathogenic fungi such as *Metarhizium anisopliae*, naturally active in the soil, and pathogenic to many different kinds of insects can be exploited for biological control of wireworms.

Preliminary research in Virginia from 2007 to 2008 reported up to 50% less wireworm damage in potato when granular formulations of *Metarhizium anisopliae* spores were applied over the furrow at planting (Kuhar et al. 2008). *Metarhizium anisopliae* strain V1002 had shown considerable potential (~100 % mortality) for the control of the wireworm, *Agriotes lineatus* (Ansari et al. 2009). In southern Florida, biological control of wireworms by beneficial insects and diseases has been insignificant. Birds such as the cattle egret (*Bubulcus ibis*) may sometimes help in reducing wireworm populations because they may consume wireworms that are exposed at the surface of the soil after field cultivation or disking (Cherry et al. 2011).

## Cultural control

Pre-plant disking and summer plowing of fallow fields can reduce *Melanotus communis* populations by physically injuring the larvae and bringing them to the soil surface where they can be desiccated by sunlight or eaten by birds. However, this does not prevent *Melanotus communis* from reaching economically damaging levels in Florida sugarcane, where soil insecticides or flooding of fields are tactics that are also used (Hall and Cherry 1993). Flooding for wireworm control can be an effective, but slow process.



Figure 4. Fallow field flooding is used in Florida to control *Melanotus communis* Gyllenhal, corn wireworm.

Credits: Ronald Cherry, University of Florida, Entomology and Nematology Department.

Several weeks of continuous flooding are necessary to control *Melanotus communis* in the summer and longer in cooler months. Rice (*Oryza sativa*) as a rotation crop or fallow field flooding may eliminate the need to use a



Figure 5. *Melanotus communis* Gyllenhal, corn wireworm, control is generally not needed after rice crops because of the extended flooding.

Credits: Ronald Cherry, University of Florida, Entomology and Nematology Department.

soil insecticide at sugarcane planting the following season (Cherry et al. 2011). In southern Florida, Jansson and Lecrone (1991) reported that oatmeal-corn flake and rolled oat baits were found the most attractive food baits tested for *Melanotus communis* and required less time for processing of these traps. In southern Florida, fields are planted with cover crops in summer, and baits can be placed in the field during that time interval (1-2 months) between the disking of cover crops (September-October) and planting of crop (October- December). This reduced tuber damage by nearly 10% and saved up to \$3300/ha in Florida (OEPP/EPPO 2005). Genung (1970) reported a 3-2-3 weekly alteration of flooding, drying and flooding was effective for controlling *Melanotus communis*. Delayed planting of corn is another method to reduce damage. Early planted corn is susceptible to attack due to germinated seedlings growing slowly in cool and wet soil conditions. In Florida, different sugarcane varieties tolerant to wireworm attack have been studied. In a greenhouse study, out of 11 genotypes of sugarcane, CP 88-1762, CP 89-2143 and CP 03-1912 were reported to tolerate stand or biomass loss due to wireworm attack (Larsen et al. 2013). Cherry and Nuessly (2010) reported repellent effects of neem, *Azadirachta indica* (Aza-Direct®), treated soil on *Melanotus communis* for 14 days with repellency decreasing afterwards.

## Chemical control

No insecticides are available for wireworm control once the crop is planted (Chaput 2011). Preplant broadcasting and furrow application of soil insecticides are common methods in potato fields in USA as preventative measure. Until the 1980s, cyclodiene insecticides were used effectively in the U.S. for the control of wireworms, but due to their occurrence in non-target species and slow degradation,

they were eventually banned. After 1980, organophosphates and carbamates became insecticides of choice for wireworm control. In the U.K., the organophosphate insecticide Mocap 10G gave 100% control of the wireworm, *Agriotes lineatus*, in potatoes (Ansari et al. 2009).



Figure 6. Soil insecticides are frequently used when planting crops to prevent *Melanotus communis* Gyllenhal, corn wireworm, damage. Credits: Ronald Cherry, University of Florida, Entomology and Nematology Department.

The organophosphate insecticide Phorate was found to be effective for reducing stand loss and number of wireworms in sugarcane (Larsen and Nuessly 2009). Application of organophosphates also gave inconsistent and contradictory results due to wireworm pressure, soil type and prevailing climatic conditions. In Virginia, insecticide application of fipronil, imidacloprid, thiamethoxam, and bifenthrin to the soil at potato planting provided 50-80% wireworm control (Kuhara and Alvarez 2008). These new insecticides provide effective wireworm control with less environmental impact and fewer potential human safety concerns compared to organophosphates.

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