Swede Midge - A New Insect Pest for Cole Crops

Tuesday morning 11:15 am

Where: River Overlook (upper level) Room C & D

Swede midge is an invasive insect pest of cabbage, broccoli and other cole crops that is already affecting vegetable growing areas in New York and Ontario. In 2015, this pest was identified for the first time in two organic cabbage fields in the eastern part of Michigan. This session will help growers become more familiar with this pest and learn about its management.

MI Recertification credits: 1 (1B, COMM CORE, PRIV CORE)
OH Recertification credits: 0.5 (presentations as marked)
CCA Credits: PM(0.5)
Moderator: Zsofia Szendrei, Entomology Dept., MSU

11:15 am	How Can Growers Deal with Swede Midge for the Long Term? (OH: 2B, 0.5 hr) • Anthony Shelton, Entomology Dept., Cornell Univ., Geneva, NY
12:00 noon	Session Ends

How Can Growers Deal with Swede Midge for the Long Term?

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Sources of Information

This summary provides condensed information on the swede midge in North America. The most complete and up to date source of information on swede midge is the website, Swede Midge Information Center for the US, http://web.entomology.cornell.edu/shelton/swede-midge/. This site contains text about the insect and pictures of the insect and damaged plants. Updates on the site will be completed by the end of 2015. Another source of information is a review article: Chen, M., A. M. Shelton, R. H. Hallett, C. A. Hoepting, J. R. Kikkert and P. Wang. 2011. Swede midge, 10 years of invasion of crucifer crops in North America. J. Econ. Entomol. (Forum) 104: 709-716.

History of Pest

Swede midge (*Contarinia nasturtii* Kieffer) (Diptera: Cecidomyiidae) is a gall-forming pest of cruciferous plants that is common and endemic in Europe and southwestern Asia. In many parts of Europe, swede midge is considered a major pest with frequent crop losses in spite of regular chemical treatments. Prior to 2000, it was not known to occur in North America, although damage symptoms typical of swede midge on crucifer crops were observed in Ontario, CN in 1996.

In June 2000, the first swede midge in North America was captured using yellow sticky traps in Ontario, CN. Subsequently, Canadian researchers launched a swede midge survey in cruciferous crops, and good evidence was found that swede midge occurred in nine counties in Ontario and one county in Quebec in 2001. The number of infested counties in these provinces increased from 18 in 2005 to 49 in 2006 and 65 in 2008. In 2007 and 2008, additional Canadian infestations were found in Nova Scotia, Prince Edward Island, Manitoba and Saskatchewan and it continues to spread.

In the United States, swede midge was first reported in Niagara County, NY in September 2004, although symptomatic plants had been observed in the field for several years. By the end of 2005, swede midge was detected in five major cabbage-producing counties (Erie, Genesee, Monroe, Orleans and Wyoming) in NY. By 2011, swede midge had been detected in a total of 26 counties in NY, in addition to three surrounding states. A swede midge infestation in Ohio was confirmed in late 2009 and another in Michigan in 2015.

In the last 10 years, swede midge infestations in North America have spread rapidly and caused losses for vegetable and canola farmers, especially in some areas of Canada. Crop losses due to swede midge on some farms in Ontario, CN have been reported to be as high as 85%.

Swede Midge Detection and Identification

Swede midges are small and hard to detect- the adults are only 1.5-2 mm. It is difficult to detect swede midge in the field because adults are short-lived, pupae burrow into the soil, and the small larvae feed cryptically, near growing tips of plants and between tightly compressed leaves and petioles. Depending upon sampling time, larvae may be absent from plants exhibiting damage symptoms making positive determination of an infestation difficult.

The only way swede midge can accurately be identified is through molecular methods. However, adults, not larvae, can generally be distinguished by certain morphological characteristics. However, it is often very difficult to observe these characteristics in field-collected specimens captured on sticky card traps or sticky surfaces in pheromone traps.

Pheromone traps are essential tools for detecting swede midge in an area. However, based on our experience other midge species are regularly captured in New York State by the pheromone blend. Thus, capture in a pheromone trap and the accompanying molecular identification is required for accurate identification of the insect.

Life Cycle

Adults emerge in mid to late May, after overwintering in the soil in larval cocoons. Mating occurs soon after emergence and females then begin to look for suitable hosts. Eggs are laid in clusters of 2-50 eggs on growing points of plants, young leaves, or flowers of their host plants, with each female laying ca. 100 eggs during her short lifetime (1-5 d). Eggs are small (~0.3 mm) with color changing from transparent to a creamy white during the egg development period. The larval stage is the only life stage that can damage cruciferous plants. Swede midge larvae inject salivary fluids into the plant via highly specialized mandibles and these substances react with plant cell components and cause physiological alterations in the plant, which allow the larva to suck liquids through its mouth. Larvae are initially ca 0.3 mm in length and reach a final size of 3-4 mm. They are transparent and become increasingly more yellow with age and are lemon-yellow at maturity. The larvae feed for 7-21 d, before they drop to the ground to pupate. Adults emerge 7-14 days later to start another generation. During periods of drought, larvae in the soil may remain dormant, with growth resuming following rainfall or irrigation. A small percentage of pupae may remain in the soil for 2 years before adults emerge.

In Ontario CN there are 4 overlapping generations of swede midge per year with the last adult flights occurring in late September to early October.

Hosts

Host plants of swede midge include most cultivated cruciferous vegetables (e.g. broccoli, cabbage, cauliflower, Brussels sprouts, kale), cruciferous weeds and canola.

Plant Damage

Swede midge injury is often difficult to distinguish from other factors that can damage the growing tip of a plant, such as mechanical injury from cultivation, insect and animal feeding, molybdenum deficiency, herbicide injury, genetic variation of the plant, and heat or cold stress. For confirmation of injury due to swede midge, the larvae should be found on or within the plant tissue

Plant damage results from larval feeding. During feeding, larvae produce a secretion that breaks down plant tissue, creating a moist environment. The secretion is toxic to the plant and results in a series of tissue reactions within the plant causing misshapen plants with twisted stems, crumpled leaves, swollen growing tips, multiple heads, and the formation of galls on leaves and flowers, all of which can severely reduce product quantity, quality and marketability.

Control

Host Plant Resistance. Some plant types are more susceptible than others (e.g. broccoli is more susceptible than cabbage), but we are not aware of any that are fully resistant.

*Start with Clean Seedlings***.** Buy transplants from sources where swede midge is not present or where they have certified plants as free from swede midge.

Biological Control. In Europe where swede midge has been established for centuries, there are predators and parasites that reduce pest populations, but outbreaks are still common. Recent work in Canada by Rebecca Hallett and colleagues has shown that nematodes applied to the soil for control of the pupae reduced adult emergence in some years but not others. At this point in time, this strategy can't be recommended.

Cultural Control. Swede midge adults emerge from pupae laid in the soil during the last generation. Since swede midge adults are weak fliers, rotation out of crucifers for 2 or more years can provide excellent control. This is likely the main reason large commercial farmers in NY have avoided devastating infestations. Although it is not known how far swede midge adults can fly to start an infestation, it is best if a new crucifer planting is >100 yds from a previous one. In addition to rotating fields to avoid swede midge, good weed management practices are needed since swede midge can survive on cruciferous weeds. If fields become infested or when harvest is complete, destroy the crop to limit its potential to harbor swede midge.

Insecticides. Many foliar sprays, except Bt, will be lethal to swede midge adults, however, under high infestations they will likely fail unless they have systemic properties that allow the material to move to the growing tips of plants were swede midge larvae feed. For example, under very high infestations even weekly applications of broad-spectrum, non-systemic insecticide failed to provide adequate control. Under lower infestations, Rebecca Hallett and colleagues in CN have shown that a threshold-based spray program (5 swede midge per pheromone trap per day) provided adequate control in cabbage, but not in the more susceptible broccoli. The best control we have found is to use a drench of imidacloprid soon after transplanting and this will provide control for well over a month, and then follow up with sprays of a systemic insecticide. Always check labels before applying any insecticide and apply it properly.

Organic control. Even after years of testing many organic insecticides, we have not found a consistently effective product. Yolanda Chen in Vermont recently initiated work on swede midge testing various intercropping combinations and sprays of plant extracts. No intercrop prevented damage and use of garlic sprays provided only marginal control. Christy Hoepting in NY had good results with insect netting, but such netting was expensive ($4,000/acre). At this point, they concluded that it is "still too premature to really recommend any tactic."

Future

Since swede midge was first identified in North America in 2000, it has spread through many areas in Canada and the northern parts of the US. It is likely to be around for a long time and upset many of the crucifer pest management programs that have been developed in the Great Lakes Region. The best control has been rotation of crops in which a crucifer is followed by non-hosts such as sweet corn, beans, soybean, etc. However, in small farms in which host and non-host crops are grown in close proximity, rotation would be far less effective since adult swede midge fly to hosts. Use of a systemic insecticide like imidacloprid could provide control in such situations, but is not allowed under organic standards. Host plant resistance would be ideal for control of swede midge for conventional and organic growers, but such resistance has not been found.

Swede midge tends to be particularly problematic when it is not detected early and builds up to high populations. Factors that contribute to high populations include lack of rotation to non-crucifer crops and leaving crucifer debris in the field after harvest. Insecticides can be an important tool in swede midge management, but may not be effective if populations are too high. Currently, there are no effective products that meet organic standards. Small farms that grow multiple crucifer crops are particularly at risk because they often have too small a land base for adequate crop rotation.