

“Final Project Report to the NYS IPM Program, Agricultural IPM 2002-2003.”

## **1. Title: Detection of Swede Midge in Western New York Crucifer Fields**

### **2. Project Leaders:**

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### **4. Type of Grant:**

Monitoring, forecasting, and economic thresholds

### **5. Project location:**

Western New York

### **6. Abstract:**

The swede midge (*Contarinia nasturtii*) is a tiny insect whose larvae feed on and destroy the growing tips of cruciferous plants such as broccoli, cauliflower, and cabbage. The pest was not known in North America until it was identified in Ontario, Canada in 2000. A 2002 survey conducted by the Canadian Food Inspection Agency (CFIA), confirmed the presence of swede midge in eight Ontario counties, where it has caused serious losses in crop yield and marketability. Neighboring New York State leads the United States in cabbage production with a crop valued at \$87 million per year that could be at risk should swede midge infestation occur. There was a need to educate the NY agricultural industry about this potential pest and to determine its presence in NYS. Cornell Cooperative Extension Educators, Christy Hoepting and Julie Kikkert, along with Cornell Entomologist, Tony Shelton traveled to Ontario, Canada to meet with various university and government experts to learn more about swede midge and

to view the damage it causes first hand. In NYS, the educators presented nine informational sessions to more than 100 growers, research faculty, industry representatives, and United States Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) directors and inspectors. In addition, five educational articles were published in local newsletters and a color fact sheet was developed that will be sent to all crucifer growers in NYS. For the 2002 western NY detection survey, four scouts were hired to inspect crucifer fields on foot. The scouts were trained in Canada to diagnose swede midge infestation. Nearly 1900 acres of crucifer crops were scouted in 30 townships within nine counties in western NY, representing about 15% of the total acreage grown. Fortunately, the SM was not detected. Educating the NY agricultural industry about the swede midge decreased the probability that its occurrence would go undetected or misdiagnosed for several years in NY. The fact that the swede midge was not found during the extensive detection survey may be the basis on which protective measures can be implemented to keep the swede midge out of NYS, thus avoiding production and economic losses valued in millions of dollars.

## 7. Background and justification:

The swede midge (SM), *Contarinia nasturtii* Kieffer, has been a pest throughout Europe for decades. SM appears to feed only on plants in the family Cruciferae such as broccoli, cauliflower, cabbage, brussels sprouts, etc. It has also been reported on ornamentals and common weed species such as pennycress and shepherd's purse. *C. nasturtii* was identified in 2000 in Ontario, Canada, the first record of occurrence in North America (Hallett and Heal, 2001, Canadian Entomologist 133:713). However, it is suspected to have been present in Ontario since around 1994, but was misdiagnosed as a nutrient deficiency. In 2001, University of Guelph researchers surveyed a large number of crucifer fields in Ontario and Quebec by mailing yellow sticky cards to growers. The survey indicated that SM was present in 9 Canadian counties and 1 in Quebec mostly located along Lake Ontario. A nationwide survey in 2002 conducted by the Canadian Food Inspection Agency (CFIA) confirmed SM in 8 counties within Ontario. Currently, SM has quarantine status in Canada, which means that a federal permit is required before transplants, soil or machinery may be transported from an infested area.

*C. nasturtii* is a small (1.5-2.0 mm long) light brown dipteran fly (midge) indistinguishable from many other small midges except by a specialist. In the spring, pupae emerge, mate and typically lay their eggs (0.3 mm, transparent) in clusters on the growing point of the plant (apical meristem). After a few days, the larvae (0.3-4 mm, yellow) hatch from the eggs and begin to feed on plant tissue near the growing point. Full-grown larvae fall or flip themselves to the ground and burrow into the soil to pupate. It has been reported that some overwintering pupae can survive in the soil for more than a year. In Ontario, Canada it appears there are 3-4 overlapping generations with major peaks occurring during June, late-July-early-August and late-August-early-September. Due to the similar environmental conditions of NYS and Ontario, Canada, it is expected that the SM would become established in NYS once it is introduced.

Swede midge injury is difficult to diagnose because similar symptoms can be caused by several other factors such as mechanical injury from cultivation, insect (i.e. flea beetles, aphids) and animal feeding, molybdenum deficiency, hormonal herbicide injury, genetic variation of the plant, and heat or cold stress. For confirmation of injury due to SM, the larvae should be detected in the plant tissue. During feeding, larvae produce a secretion that breaks down the plant surface and liquefies the contents of the cell. Their feeding results in changes in the physiology of the plant resulting in: swollen petioles and flower buds; blind heads (the head does not form); brown corky scarring at the growing point, leaf petioles, and flower stalks; crinkled, puckered, crumpled and distorted leaves; multiple heads and/or stems, and

secondary soft rot. Damage is more severe in plants that are infested at an early growth stage by many larvae. There are differences in plant susceptibility to swede midge infestation among plant types within the Cruciferae family. Broccoli and cauliflower are among the most susceptible followed by (not in order) Chinese cabbage, brussels sprouts, etc., with cabbage being less susceptible. Red cabbage generally appears to be more susceptible than green cabbage. Early in the season, damage symptoms first appear along field edges, especially near sheltered areas such as tree lines and hedgerows.

New York State is the leading cabbage producer in the United States with the 2001 crop valued at \$87 million. New York farmers also produce more than \$6 million worth of cauliflower, broccoli, brussels sprouts, Chinese cabbage, and related crops per year. Thus, SM infestation could have serious economic and trade implications. It is not difficult to envision several modes by which swede midge could move from Canada to New York. Westerly winds prevail from Ontario across New York State. Furthermore, many New York growers obtain transplants from Canada each spring. This project addresses the urgent need to educate the NY agricultural industry about SM and to determine if SM is present in NYS.

## **8. Objectives: (from original proposal)**

- i) Intensively survey for the presence and flight patterns of SM through season-long monitoring in a total of 12 crucifer fields we believe may have the highest probability of SM infestation.
- ii) Conduct a focused survey of a large number of crucifer fields for the presence of SM adults during suspected peak flight times.
- iii) Educate scouts and growers about the SM and train them to look for damage.

## **9. Procedures:**

We originally proposed to use yellow sticky cards to monitor the flights of SM adults as was done by the University of Guelph. However, officials from the Canadian Food Inspection Agency (CFIA) strongly discouraged our use of sticky cards, because i) *C. nasturtii* are extremely difficult to distinguish from other small midges, especially when they are covered in sticky glue, ii) SM are not attracted to yellow and, iii) SM are weak fliers. According to University of Guelph researchers, even when there is a fairly high infestation in the field, the trap catch is low (i.e. 2 SM/trap/week). Consequently, it was decided to scout fields on foot to look for potential SM damage and larvae within the plants.

### **i) SEASON-LONG MONITORING:**

This objective was abandoned with our decision to not use sticky traps. Also, we learned from the Canadians that the largest flight occurred in August, which would have made selecting fields for season-long monitoring difficult, especially since the presence of SM in NYS was unknown.

### **ii) DETECTION OF SWEDE MIDGE:**

The first step was to figure out how to most effectively conduct a detection survey of the SM. On June 17, a major conference call was organized where 11 individuals representing Cornell, NYS Ag & Markets, the CFIA, and the Ontario Ministry of Agriculture and Food (OMAF) discussed the biology of SM and how best to conduct a survey. On July 3, Kikkert, Hoepting, and Shelton attended a CFIA/OMAF sponsored field day to train CFIA agricultural inspectors on the identification of SM damage and larvae. USDA-APHIS agricultural inspector, Lewis

Tandy, from Batavia, NY also attended the training. Tour stops included two farms that were heavily infested with SM and the University of Guelph/OMAF SM field research sites.

It was decided to follow a similar survey protocol to that used by CFIA. Four field scouts (2-full time and 2-part time) were hired to walk crucifer fields and closely inspect plants. The scouts were trained to identify SM damage and larvae first hand in Ontario, Canada. Field scouting took place from July 16<sup>th</sup> to September 13<sup>th</sup>, with the majority occurring from July 29<sup>th</sup> through August 23<sup>rd</sup>. According to the University of Guelph trap catch records, the scouts were in the fields during the time that the largest generation was active and when damage from multiple generations could have been seen if SM was present. Thus, the timing of our survey was optimal. Our strategy was to survey as many fields as possible within that time frame. Crucifer fields were scouted in Niagara, Orleans, Genesee, Erie, Chautauqua, Monroe, Ontario, Wayne and Yates counties with emphasis on Niagara and Orleans due to their close proximity to infested areas in Canada and due to their acreage of crucifer production.

Grower-cooperators were mostly enrollees of the CCE Lake Plains and Ontario, Wayne, Yates and Steuben (OWYS) vegetable programs. Cabbage represents the largest acreage of crucifer crops in NYS, and nearly all of the major growers were surveyed. Each cabbage grower was asked to identify fields with red cabbage (generally more susceptible than green cabbage), fields that were sheltered (SM damage tends to be more apparent in sheltered areas), and fields in which the plants were in the pre-cupping stage if possible (SM larvae are easier to find at this stage). Since the larger growers generally had an intensive spray program, a range of growers with less intensive spray programs (including some organic growers) and different cropping systems were also surveyed. Also, because broccoli, cauliflower, Chinese cabbage, brussels sprouts, collards and kale are more susceptible to SM than cabbage, we scouted as many of these fields as we could. With the time and resources available, scouts were able to visit individual fields only one time during the survey. Crop rotation and plant source were also considered important factors, and that information was collected from the growers.

Scouts were instructed to walk all borders that were along tree lines or other sheltered areas (in most fields all borders were walked) and also a diagonal or zig-zag through the middle of each field. Scouts generally worked in teams of two. Plants with suspect symptoms were examined in the field for SM larvae. The hearts of suspect plants were collected into plastic bags and brought back to the laboratory at the end of the day where they were stored at 4°C. The plants were examined for SM larvae and eggs within a few days using a lighted magnifying glass and a stereo-dissecting microscope when needed.

Throughout the process of the SM detection survey, close communication was kept with the Cooperative Agricultural Pest Survey Program (CAPS) and data was entered into the National Agricultural Pest Information System (NAPIS) database <http://ceris.purdue.edu/napis> by Carolyn Klass, Cornell.

### **iii) EDUCATE NY AGRICULTURAL INDUSTRY ON SWEDE MIDGE AND THE DAMAGE IT CAUSES:**

#### **Newsletter articles:**

- 1) The Swede Midge – An Unwelcome Addition to Ontario Crucifer Fields, by Hannah Fraser, Jim Chaput and Rebecca Hallet. Printed in the Lake Plains Vegetable News 10(12): 12-13 and Vegetable Notes (OWYS program) 23(12):5-6.
- 2) The Swede Midge – Should New York Growers be Concerned? By Christy Hoepting, LPVP, adapted from Hannah Fraser et al. January 2002, OMAFRA. Printed in Lake Plains Vegetable News 11(3): 7-10 and Vegetable Notes (OWYS program) 24(4):6-9.

- 3) Swede Midge Detection Survey, by Christy Hoepfing. Printed in Pestminder 9(6): June 19, 2002.
- 4) Wanted Dead or Alive: The Swede Midge, by Julie Kikkert. Vegetable Notes, 24(7):3, July 10, 2002.
- 5) The Swede Midge – A Potential Threat to Crucifer Crops in the USA? by Julie Kikkert. Northwest Transplants Newsletter, Vol. 1 (2), Spring 2002.

**Talks presented: (number of attendees)**

- 1) Bejo Seed Co. Storage Cabbage Show and Tell, West Kendall, NY, February 27, 2002 (25)
- 2) Cooperative Agricultural Pest Survey (CAPS) Meeting, Ithaca, June 21, 2002 (20)
- 3) Swede Midge Information Session 1: In conjunction with the Cornell Weed Science Field Day, Freeville, NY, July 17, 2002 (16)
- 4) Swede Midge Information Session 2: New York State Agricultural Experiment Station, Geneva, NY, July 18, 2002 (14)
- 5) CCE Lake Plains Team, 2002 Cabbage Grower’s Twilight Tour, Spencerport, NY, August 7, 2002 (15)
- 6) Agriculture Production Week, Ithaca, NY, November 21, 2002 (10)
- 7) Lake Plains Fresh Market Vegetable Growers Workshop, Lockport, NY, December 11, 2002 (52)
- 8) Windmill Produce Auction Meeting, Penn Yan, NY, January 9, 2003
- 9) New York State Vegetable Conference, Syracuse, NY, February 11, 2003
- 10) Ontario Horticultural Crops Congress, Swede Midge Workshop, St. Catherine’s, Ontario, February 18, 2003.

**Fact sheet**

A fact sheet on the SM is in press at this time and will be available for distribution during winter meetings. The fact sheet will be mailed out to all crucifer growers in New York and will also be posted on the World Wide Web. Separate IPM funding was obtained for the fact sheet production.

**10. Results and discussion:**

The 2002 Cornell SM project had three important facets: 1) fact finding on SM biology and survey methods, 2) education of growers, crop consultants, USDA APHIS inspectors, and Cornell faculty and extension personnel, and 3) a physical survey of crucifer fields throughout nine counties in western New York State. All aspects of the project required close communication and cooperation with researchers and officials in Canada and the United States. Our Canadian colleagues were extremely cooperative in providing information about the SM and their survey protocol. This, along with participation in the CFIA/OMAF sponsored training day (Figure 1), equipped us with the knowledge and skills needed to conduct a survey of the same caliber as that conducted by the federal surveillance service (CFIA) in Canada. Furthermore, we worked very closely with our field scouts, who were extremely conscientious and hard working. The scouts received training in Canada where they observed first hand SM larvae and the damage they cause. Consequently, our survey is highly credible and the results were entered in the NAPIS database. The numerous photographs taken during our two trips to Canada enhanced the educational content of our informational sessions and the fact sheet.



Figure 1. Cornell team receives training on swede midge diagnosis in Ontario Canada.

The scope of the 2002, SM detection survey included almost 1900 acres of crucifer crops in 30 townships within 9 counties in western, NY, representing approximately 15% of the estimated acreage grown (Figure 2, Table 1). The counties most intensively surveyed were Orleans and Niagara due to the large acreage of cabbage grown and close proximity to infested areas in Canada. In retrospect, more acreage should have been scouted in Monroe and Genesee as these two counties have the highest crucifer acreage of the counties surveyed.

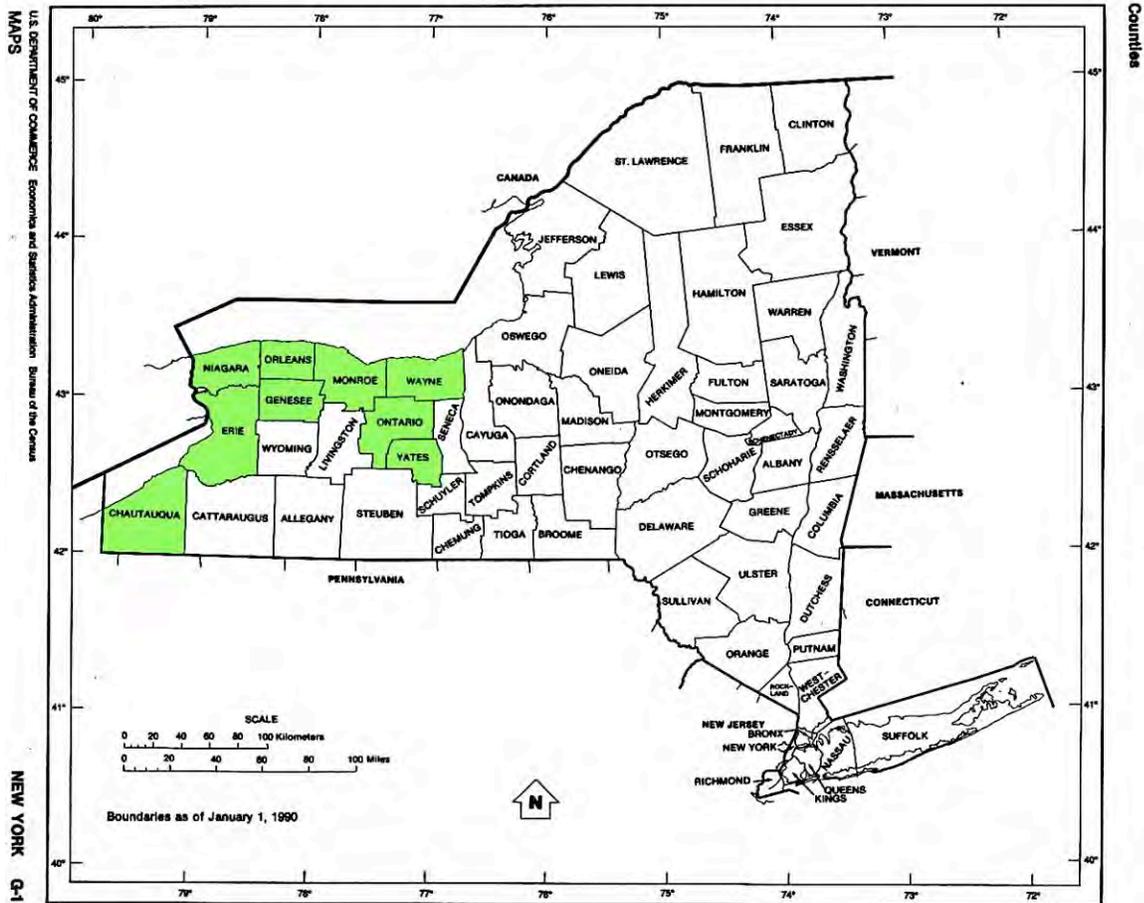


Figure 2. Counties (highlighted) included in the 2002 western NY swede midge survey.

Table 1. Summary of the number of fields scouted for swede midge infestation.

County	No. Townships	No. Growers	No. Fields	No. Acres	Acreage Grown <sup>x</sup>	Percent Acreage Surveyed
Chautauque	3	3	3	55.3	23	100%
Erie	1	5	9	34	202	17%
Genesee	2	4	7	157	2,950	5%
Monroe	5	5	7	155	2,233	7%
Niagara	4	8	19	493	2,156	23%
Ontario	6	12	28	337	1,793	19%
Orleans	5	5	10	516	1,965	26%
Wayne	1	2	6	4.3	241	2%
Yates	3	8	11	132	613	21%
<b>Total</b>	<b>30</b>	<b>52</b>	<b>100</b>	<b>1,883.6</b>	<b>12,176</b>	<b>15%</b>

<sup>x</sup>1997 Census of Agriculture

A total of 100 fields (ranging in size from 110 acres to less than one acre) from 52 grower-cooperators were surveyed (Table 1). Most of the fields had several blocks that represented different planting dates, varieties, or crop types. Of the 100 surveyed fields, 76 had green cabbage, 35 had red cabbage and 63 had the more susceptible crucifer crops such as cauliflower and broccoli (Table 2). Suspect SM damage including blind heads, multiple heads, twisted or distorted leaves, and brown scarring was observed in many fields. Cauliflower plants were the most challenging to scout because their leaves tend to twist naturally as they grow. However, the plants that looked suspicious in the field did not look exactly like the SM-infested plants that we had seen in Canada. In fact, no swede midge larvae or eggs were found in any plant in the field or in the 429 plant samples that were examined in the laboratory (Table 2).

Table 2. Crop types scouted for swede midge infestation.

<b>Crop Type</b>	<b>No. Fields Scouted</b>	<b>No. Samples Observed in the Laboratory</b>
Green Cabbage	76	208
Red Cabbage	35	65
Cauliflower	27	119
Broccoli	15	8
Brussels Sprouts	9	26
Chinese Cabbage	7	3
Kale	4	0
Collards	1	0
<b>Total</b>	<b>170<sup>x</sup></b>	<b>429</b>

<sup>x</sup>Total number of fields scouted is higher here than in Table 1 because fields with mixed crop types were counted as a single field in Table 1.

Table 3. Source of plants in scouted fields.

<b>Plant Source</b>	<b>Number of Fields</b>
New York Plugs	45
New York Bare-Root	32
Canadian Plugs	8
Direct Seeded	6
Southern US Bare-Root	5

New York growers source their transplants from southern States, from Canada, and within NYS. Since the original means of SM introduction into Canada is unknown, we surveyed crucifer fields from a variety of plant sources. The majority of plants in our survey originated from greenhouses or seedbeds in New York State (Table 3). However, there are actually a higher proportion of out-of-state plants grown in NYS. Early in the season growers typically start with bare-root plants shipped in from the southern U.S. Later, local and Canadian-grown plants become more prevalent. At the time of our survey, the earliest planted southern-grown plants were often past the cupping stage optimum for detection of SM damage and larvae, and were not selected for our survey. Large acreages of Canadian-grown plug plants are grown by some of the major cabbage producers. We generally surveyed only two fields per grower and Table 3 lists only the number of fields and not acreage. It should be noted that to date, the greenhouses where NY growers obtain most of their Canadian-grown plug plants are located in non-infested counties.

Because SM is specific to crucifers and its pupae can remain dormant in the soil for more than one year, crop rotation is important in the probability that this pest would become established if it were introduced. Of the fields that were surveyed, a crop rotation of four years out of crucifers was the most common (Figure 3). Since this practice prolongs the time for the SM to become established, it is more challenging to detect the SM under these conditions. However, good crop rotation practices on some of the smaller farms may not be as much of a deterrent to the establishment of the SM, because of the close proximity and small acreage of crops on such farms.

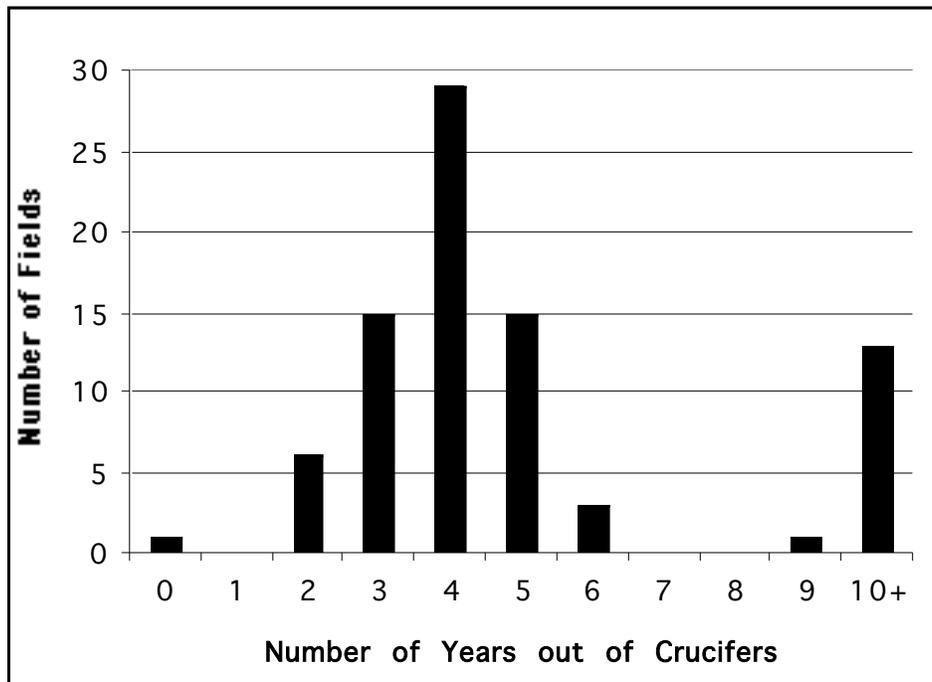


Figure 3. The number of years prior to 2002 that fields scouted for swede midge infestation had been rotated out of cruciferous crops.

The fact that SM was not detected during the thorough and extensive detection survey in western NY does not mean that this pest is not present. SM is a very tiny insect and is extremely difficult to find unless it is causing severe crop damage. If it is in western New York, it is at undetectable levels and has not yet caused significant crop damage. There are several reasons why the SM may not have become established in NYS, in addition to the possibility that it might not have been introduced. First, NY growers use excellent crop rotation practices. Secondly, many NY growers routinely use Warrior (lambda-cyhalothrin) and SpinTor (spinosad), two insecticides that are known to kill SM and are used in SM management in Europe. Canada has not had these chemicals available for use in crucifers, until an emergency exemption was granted for use of Matador (lambda-cyhalothrin) in 2002. However, it should be noted that once this pest becomes established it is difficult to manage because larvae are well protected in crevices in the plant crown. The results of our detection survey may be the basis on which protective measures can be implemented to keep SM out of NYS, thus avoiding production and economic losses valued in millions of dollars.

More than 100 individuals involved with crucifer production in NYS were educated about SM through nine informational sessions, five educational articles, and a color fact sheet. Through these educational efforts, we have reduced the probability that the occurrence of SM would go undetected or misdiagnosed in NY, as happened in Canada, where it resulted in grower frustration and serious crop losses. Furthermore, the chances that NY growers will unknowingly spread SM have now been minimized. Our SM educational programs will continue at Cornell Cooperative Extension sponsored winter meetings and in newsletter articles.

There is a continuing need to survey for SM in NYS because of the high probability that this pest will move from neighboring Ontario, Canada. Additionally, only 15% of the overall western NY acreage was surveyed, including only 5 and 7% in Genesee and Monroe counties. Furthermore, in Monroe, Genesee, and Orleans counties, large cabbage growers owned most of the surveyed acreage. Ideally smaller growers with more of the susceptible crucifer crops should be surveyed in these counties. There is also a need for SM detection surveys in other U.S. states that produce crucifer transplants and/or those with major areas of crucifer crop production. Lastly, pro-active research needs to be conducted to determine the best management strategies for SM should it be found in New York or other areas of the United States.

**11. References:** n/a

**12. Samples of materials:**

Comments from the swede midge informational sessions included, “the first I ever heard about this was from Cornell Cooperative Extension”, and “thank you for taking a heads up approach to this [swede midge]”.

Included as separate files are the 3 newsletter articles we authored.

## The Swede Midge – A Potential Threat to Crucifer Crops in the USA?

Julie Kikkert, Cornell Cooperative Extension, Canandaigua, New York

The swede midge (*Contarinia nasturtii* Kieffer) is an insect new to North America, although it has been a pest of crucifer fields throughout Europe for a long time. The common name comes from the fact that it is a frequent pest of swedes (*Brassica napus*), a cruciferous root crop grown in Europe that is similar to a rutabega. However, the insect will attack all cruciferous crops including broccoli, cabbage, and cauliflower. *C. nasturtii* is a small (1.5 mm long) fly that lays its eggs in shoot meristems, young leaves, or flowers. Larvae feed gregariously, destroying considerable surface areas of the tissues. Seedlings become twisted and have a brown spot at the middle. Damage to young plants may cause blind heads. In older plants, the heads may become twisted and asymmetrical. Brown scarring may be visible in the head and along leaf stalks. Furthermore, wounds created by larvae make the plants more susceptible to diseases such as soft rot. The end product is often unmarketable. Photographs of the damage may be found at the following web site <<http://www.oac.uoguelph.ca/env/new%20pests.htm>>.

So far, the only confirmed North American location of the swede midge is in eastern Canada. Dr. Rebecca Hallett, and technical assistants Jamie Heal and Coralie Sopher (University of Guelph), conducted a large-scale grower-assisted survey throughout much of Ontario in 2001. Swede midge adults were found in 9 counties in Ontario and 1 county in Quebec. Affected counties are generally located along Lake Ontario (from Niagara to Durham county) and in the Golden Horseshoe region. Swede midge was also found in Sudbury county and the Montérégie region of Quebec (i.e. south of Montreal). Levels of infestation have been locally severe (10-70%), and all major cole crops have been affected.

Cornell Cooperative Extension Vegetable Specialists Julie Kikkert and Christy Hoeping, along with Dr. Anthony Shelton at the New York State Agricultural Experiment Station in Geneva, NY are concerned that the swede midge has or will move into neighboring New York State crucifer fields. Westerly winds and the proximity to Ontario certainly favor this movement. Also, it is unknown how swede midge arrived in Ontario, Canada and a similar mechanism may occur in New York or other USA locations. Transplants purchased from Canadian growers are also a potential means of insect movement, however, swede midge has not yet been detected in the major area of Canadian transplant production (the Chatham-Kent area).

The Cornell team has received funding from the New York State IPM program and will place sticky traps in crucifer fields throughout Western New York during the 2002-growing season to determine if swede midge is present. The general plan is to work with scouts to set up traps in grower fields for a period of one week during the first two peak flights of swede midge adults, which are expected to be in June and then in late-July/early-August. The Cornell team is in contact with Dr. Rebecca Hallett's research group in Canada to obtain the latest information on the distribution and control of this

pest. Should the swede midge be detected in New York State, appropriate steps will be taken to address the control and containment of the new emerging pest.

Dr. Hallett's group at the University of Guelph is working to develop a temperature-dependent predictive model for Ontario conditions to clarify both temperature and moisture requirements for the swede midge's development. Preliminary research in 2001 showed that flights of the adults peak during the month of June, during the end of July and beginning of August and again during the end of August and beginning of September. Pheromone traps for monitoring populations are under development in Europe. Dr. Hallett's group is also evaluating varietal susceptibility and insecticide efficacy.

In summary, establishment of swede midge in New York crucifer fields could lead to substantial damage and economic loss. At this point we do not know if the pest is present in New York or other USA locations. However, if it does migrate to New York it can over-winter and become a persistent problem. Growers and field scouts should be alert for symptoms of swede midge damage described above (the insects themselves are very tiny and will be difficult to detect). If you would like your farm surveyed this summer, suspect the pest in your fields, or have any questions, please contact Christy Hoepting of the Lake Plains Vegetable Team at 585-589-5561 or Julie Kikkert of the Vegetable Program in Ontario, Wayne, Yates, and Steuben Counties at 585-394-3977 x34.

## **The Swede Midge – Should New York Growers be Concerned?**

Christy Hoepting, LPVP, adapted from Hannah Fraser *et. al.* January 2002, OMAFRA

### **A New Emerging Insect Pest on Cole Crops in Ontario, Canada**

Over the last four or five years, a number of broccoli growers east of Toronto have been experiencing an unpleasant surprise as they stroll through their fields at heading time. Instead of nicely formed heads, growers find twisted central leaves and a "blind" centre. Pulling apart the plant reveals brown scarring, particularly along the petioles and stem. For some time now, growers have been wondering what's been causing these symptoms.

From field samples collected this past summer, researchers have determined there's a new pest afield in eastern Ontario. The swede midge, *Contarinia nasturtii*, a member of the family of insects commonly known as gall midges, is a serious pest of European origin. To date, the details of how and when it arrived in Ontario have not been determined, but it was likely present for several years before growers started noting significant damage to their crops.

### **Damage Caused by Swede Midge Results in Unmarketable Product**

Adult flies are small (1.5 mm) and yellowish-brown, with hairy wings. Clusters of eggs are laid on the youngest part of the plant, including the flower buds and central leaves. The developing insect larvae, are tiny and difficult to detect. Damage symptoms and severity depend upon the number of larvae present and the growth stage of the plant attacked. In infested Ontario fields, damage has been observed from the transplanting stage on. Damaged seedlings often appear twisted and have a noticeable brown mark at the growing point. If damage occurs before the plant reaches the button stage, then no heads will be produced (Figure 1). If damage occurs once head formation has already begun, then heads will be twisted and asymmetrical. There are typically brown scars within the head itself and along leaf stalks (Figure 2). In any event, the end product is often unmarketable. Feeding by larvae can also promote the entry of pathogenic bacteria and fungi, causing the plant to rot.



Figure 1. "Blind" head in cabbage caused by Swede midge feeding.



Figure 2. Brown scarring on broccoli caused by swede midge feeding.

### **2001 Large-Scale Grower Assisted Survey in Ontario, Canada**

Before 2001, only a handful of growers in a localized area had confirmed populations. Levels of infestation have been locally severe (10-70%), and all major cole crops have been affected. Dr. Rebecca Hallett, and technical assistants Jamie Heal and Coralie Sopher (University of Guelph), conducted a large-scale grower-assisted survey throughout much of Ontario. Traps were sent to 137 growers in 85 towns in 27 counties in Ontario and 1 county in Quebec. Growers were asked to set yellow sticky traps out in cole crop fields for a two-week period and then to return the sticky traps and a short written questionnaire to the University of Guelph. All sticky traps returned by growers were examined under the microscope for presence of swede midge adults.

Survey traps were returned by 35 growers (26% response rate) in 19 counties (70% of the area). Swede midge adults were found in 9 counties (at least one location) in Ontario and 1 county in Quebec (Table 1). Affected counties are generally located along Lake Ontario (from Niagara to Durham county) and in the Golden Horseshoe region, with the exception of Sudbury. Swede midge was also found on traps from the Montérégie region of Quebec (i.e. south of Montreal). Swede midge adults were not found on any traps from 9 other Ontario counties, but we cannot be sure that it is not present in those counties also. We have no data from 9 additional Ontario counties, as no traps were returned.

Table 1. 2001 Swede Midge (SM) Survey Results, Ontario, Canada

<b>SM present</b>	<b>No SM on returned traps</b>	<b>Traps not returned</b>
Durham	Brant	Elgin
Hamilton-Wentworth	Chatham-Kent	Huron
Niagara	Essex	Lambton
Peel	Haldimand-Norfolk	Lanark
Peterborough	Halton	Lennox & Addington
Sudbury	Hastings	Northumberland
Waterloo	Middlesex	Prescott & Russell
Wellington	Ottawa-Carleton	Simcoe
York	Oxford	Victoria
Monteregie, PG		

### **Research is Underway in Ontario, Canada**

The swede mige over-winters in the soil as diapausing pupa wrapped in a cocoon and can survive in the soil for more than a year. SM has 3-4 overlapping generations per year in Europe. In Ontario, research led by Dr. Rebecca Hallett at the University of Guelph is underway to develop a temperature-dependent predictive model for Ontario conditions to clarify both temperature and moisture requirements for the Swede midge's development. Preliminary research in 2001 has shown that the swede midge adult peaks occur throughout the month of June, during the end of July and beginning of August and again during the end of August and beginning of September. Pheromone traps for monitoring

populations are ongoing in Europe, and may provide useful information in developing strategies for controlling this pest. Dr. Hallett's group are also evaluating varietal susceptibility and insecticide efficacy.

### Should New York Growers be Concerned about the Swede Midge?

Chances are that the swede midge is already here due to the close proximity of New York State to where it is present in Ontario, Canada (Figure 3). Swede midge adults could conceivably be blown in on northwesterly winds or migrate in all on their own, while eggs and larvae could conceivably be transported in on transplants or fresh product. Pupa could be transported in contaminated soil – never under-estimate the capabilities of insects! Also, since it remains unknown how the swede midge was first introduced to Canada, it is possible that it could have been introduced to New York State in the same manner, whatever that may have been.

Of these means of swede midge movement, transport on transplants from Canada is of high concern, because the swede midge could become widely distributed and established throughout western New York. Although the structure of a greenhouse itself does provide a barrier between the swede midge and cabbage plants, complete exclusion is impossible. However, the likelihood of the swede midge coming into New York on Ontario-grown transplants depends on where in Ontario the transplants are grown. For example, the risk of the swede midge being brought in on transplants grown in the Chatham area in Kent county is very low, because the swede midge has not been detected within 140 miles of this area. A look at the map below will give you an idea as to which areas in Ontario you should be concerned about getting transplants from.

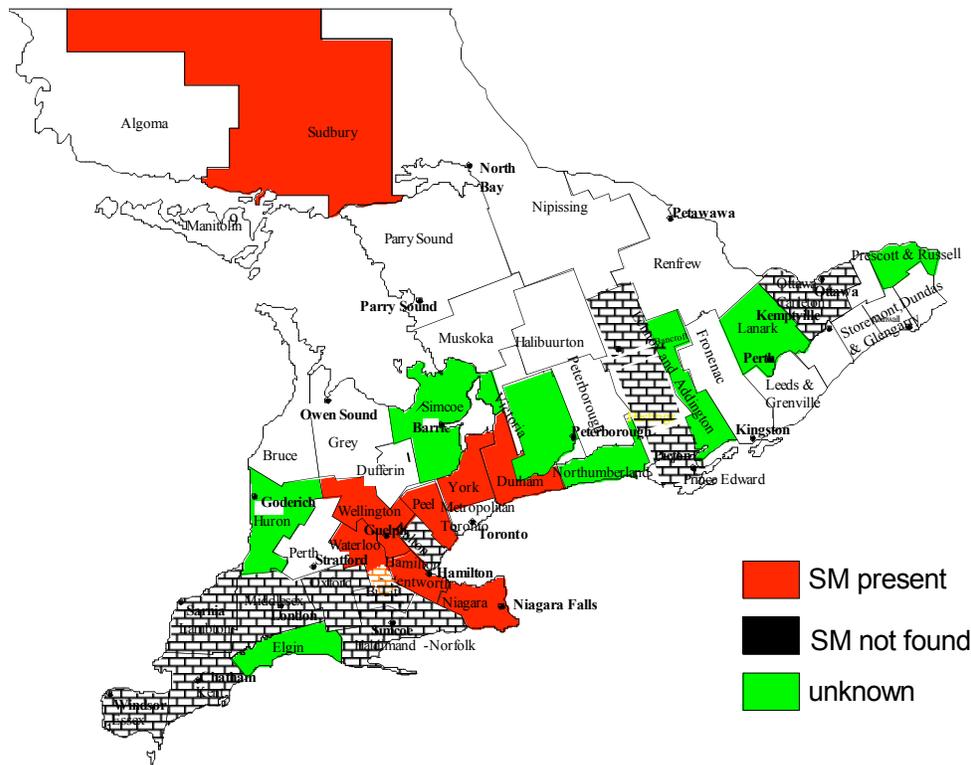


Figure 3. 2001 Swede Midge Survey Results, Ontario, Canada.

### **Cornell Cooperative Extension to Conduct a Swede Midge Survey in Western New York State in 2002**

Cornell Cooperative Extension Vegetable Specialists Christy Hoepting of the Lake Plains Vegetable Program and Julie Kikkert of the Ontario, Wayne, Yates and Steuben Vegetable Program with the cooperation of Anthony Shelton, Department of Entomology, NYSAES, are heading up a large-scale grower survey in western New York during the 2002 growing season. The general plan is to work with scouts to set up traps in grower fields for a period of one week during the first two peak flights of swede midge adults, which are expected to be in June and then in late-July/early-August. Christy and Julie will visit Ontario to experience first hand the damage caused by the swede midge and receive training on the identification of this pest. Then, Christy and Julie will put on a training session for cabbage scouts in New York State to help them identify swede midge damage. They will also remain in contact with Dr. Rebecca Hallet's research group in Canada to obtain the latest information on the distribution and control of this pest. Should the swede midge be detected in New York State, appropriate steps will be taken to address the control and containment of the new emerging pest. If you would like your farm surveyed this summer or have any questions, please contact Christy Hoepting, 585-589-5561 or Julie Kikkert, 585-394-3977 x34.

## WANTED DEAD OR ALIVE: THE SWEDE MIDGE

Julie Kikkert, Cornell Cooperative Extension

As we reported in the April 1, 2002 issue of Vegetable Notes, the swede midge (*Contarinia nasturtii*) is a small insect pest native to Eurasia that has become established in Ontario and Quebec, Canada. It is a pest of plants in the cruciferae or mustard family including both cultivated and weedy species. Swede midge has caused severe losses to broccoli, cauliflower, and cabbage in Canada.

It is not known whether swede midge is present in the United States. However, the New York State crucifer industry is threatened by this insect. The insect is likely to be carried by wind or soil. Transplants are also a likely means of insect movement. So far, swede midge has not been detected in the major transplant growing areas of Canada (the Chatham-Kent area). This spring, Canadian scientists placed sticky traps in the greenhouses of the large transplant growers and so far have not detected the insect. However, swede midge adults are not specifically attracted to sticky traps and this method of detection is not fool-proof. The USDA border patrol is inspecting loads of cabbage transplants coming from Canada into the USA and we have heard local growers state that some shipments have been held up at the border until inspectors could arrive. Produce itself is not considered to be a major means of insect dispersal and is not being regulated at this time. The Canadian Food Inspection Agency (CFIA) has implemented a control program to limit the spread of swede midge <http://www.inspection.gc.ca/english/corpaffr/newcom/2002/20020529e.shtml>. Basically, a quarantine has been placed on affected counties which limits the movement of *Brassica* plants out of the quarantine areas. The CFIA is also conducting an intensive survey of other areas in Canada to determine if the swede midge is present.

Cornell Cooperative Extension Vegetable Specialists Julie Kikkert and Christy Hoepting, and Entomology Professor Anthony Shelton, received a \$6,380 grant from the New York State Integrated Pest Management Program to conduct a survey for the detection of the swede midge insect in Western New York during 2002. The IPM grants are administered through the New York State Department of Ag & Markets. The counties to be surveyed are: Chautauqua, Erie, Genesee, Monroe, Niagara, Ontario, Orleans, Wayne, and Yates. The Cornell group (as well as 2 USDA representatives) traveled to Ontario, Canada on July 3, 2002 to attend a CFIA sponsored training on scouting for swede midge damage. The Cornell survey will follow the protocol developed in Canada. Crucifer fields will be scouted during the months of July and August. Suspect plants will be brought back to the laboratory and examined microscopically for larvae and eggs. The adult flies are very small (1.5 to 2 mm long) and are nearly impossible to see in the field. They are not specifically attracted to yellow sticky traps and this, coupled with interference from other insect species and difficulty in identification from sticky cards, led the Canadian and American teams to focus instead on scouting fields for damage.

We are asking that all field scouts, growers, and others involved with the crucifer industry be on the lookout for potential swede midge damage. Symptoms include swelling, distortion, twisting, and death of the main shoot or growing point of the plant.

Flower buds of broccoli and cauliflower remain closed and become swollen. Heart leaves become crinkled and crumpled. Brown scarring may be observed along petioles and stems. Where the main stem has been destroyed, the development of secondary stems may be enhanced, resulting in a multi-stemmed plant. Tiny (3-4 mm long), yellow larvae may be seen “jumping” about areas of the plant that show damage. Photos of the insect and its damage may be seen at the following web sites:

<http://www.gov.on.ca/omafra/english/crops/facts/swedemidge.html> or

<http://www.inspection.gc.ca/english/ppc/science/pps/datasheets/connase.shtml>.

The Cornell team will be mailing out information sheets within the next few weeks and are also hosting swede midge scouting workshops. The first workshop will be Wednesday, July 17<sup>th</sup>, 1 to 2 pm immediately following the Vegetable Weed Science Field Day in Freeville, NY. A second workshop will be held Thursday, July 18<sup>th</sup> from 3:30 to 4:30 pm, room G-19 Hedrick Hall (location of previous cabbage scout meetings), New York State Agricultural Experiment Station, Geneva, NY. For workshop information and reservations or to report suspected swede midge damage, call Julie Kikkert at 585-394-3977 ext. 34 or Christy Hoepfing at 585-589-5561.