## First Nearctic record of the swede midge (Diptera: Cecidomyiidae), a pest of cruciferous crops from Europe

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In 1996, damage symptoms typical of the swede midge, *Contarinia nasturtii* (Keiffer), were observed on broccoli, *Brassica oleracea* L. var. *italica* (Brassicaceae), crops east of Toronto, Ontario. Early attempts to identify an associated insect larva were unsuccessful, and damage symptoms became mistakenly attributed to nutrient deficiencies (T Clarke, personal communication). Between 1996 and 1999, damaged plants were seen by growers regularly, and resulted in up to 85% loss of marketable yield (T Clarke, personal communication). In June 2000, we initiated investigations at two sites 12 km apart to determine the causal organism of this damage. Both sites were located at farms where cole crops are primarily grown and from where the first damage reports originated.

Ten yellow sticky traps  $(10.2 \times 12.2 \text{ cm}; \text{Cooper Mill Ltd}, \text{Ontario})$  were placed in and around broccoli fields at site 1  $(43^{\circ}54'\text{N}, 79^{\circ}22'\text{W})$  on 9 June, and eight traps were placed within mixed cole crop fields at site 2  $(43^{\circ}58'\text{N}, 79^{\circ}16'\text{W})$  on 6 July. All traps were replaced weekly and maintained at a height of 10 cm above the vegetation canopy (range 40–100 cm).

On 28 June, when damage symptoms were first noted in grower's fields, four whole damaged plants were collected from each site, planted in 15-cm pots with Premium Pro-Mix PGX (Premier Horticulture Ltd, Québec) and maintained in partially screened cages ( $80 \times 24 \times 23$  cm) at  $23 \pm 1^{\circ}$ C and 16L:8D photoperiod. On 20 July, plants without visible damage symptoms were collected from the same fields for comparison of insect taxa between damaged and undamaged plants. All cages were checked daily for insects, which were collected by aspirator and identified to family. An undetermined cecidomyiid species was collected from both damaged and undamaged plants (Table 1). Flies which emerged from apparently healthy plants may have originated from pupae present in soil around plant roots or from plants with infestations below detectable limits. Differences in the number of flies emerging from damaged versus healthy plants may have been due in part to collection dates. Flies were collected and preserved in 70% ethanol, and samples of these Cecidomyiidae were taken to the Systematic Entomology Laboratory, United States Department of Agriculture, Washington, DC, for identification. In addition, tissue samples from other damaged plants were dissected. Larvae and eggs typical of Cecidomyiidae were found within these plant samples.

The swede midge, *C. nasturtii*, is a serious pest of cole crops (Readshaw 1966) heretofore of only Palearctic distribution (Barnes 1946; USDA 1962; Gagné 1989). The following diagnosis was offered by RJ Gagné (personal communication): "Adults of *C. nasturtii* are light brown flies, 1-2 mm long, excluding antennae. Antennae are about twice as long in the male as in the female. Both sexes have 12 segments in the flagellum. In the male, flagellar segments are each made up of two nodes separated by a narrow internode and followed by a narrow neck. The ovipositor is as long as the

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FIGURE 1. Weekly mean number of *Contarinia nasturtii* adults captured per sticky trap from two cole crop field sites near Markham, Ontario, 9 June – 26 October 2000.

TABLE 1.	. Mean 🗄	± SE daily	/ number	of Conta	rinia n	asturtii a	adults	recov	ered p	per fo	our caged	Brassica
oleracea	var. itali	ca plants	removed	from the	field fi	rom two	sites	пеаг I	Markh	am, (	Ontario.	

Plant condition*	Site	Days from removal to last midge	Days from first to last midge collected	Mean $\pm$ SE daily number of midges per four plants <sup>†</sup>	Total number of midges on four plants
Damaged	1	55	44	4.16±1.17	266
	2	54	46	1.28±0.33	82
Healthy	1	31	16	0.55±0.21	35
	2	54	41	$0.97 \pm 0.34$	62

\* Damaged and healthy plants removed from the field on 28 June and 20 July 2000, respectively.

<sup>†</sup> Observations were performed on all plants daily for 64 d after removal from the field.

abdomen, extremely tapered and protrusible. Adults can be identified to *Contarinia* Rondani using keys (McAlpine *et al.* 1981), but species identification requires slide mounting of specimens and comparison with known male *C. nasturtii* specimens or with a good illustration of the male genitalia, such as is available in Harris (1966)."

Following identification of *C. nasturtii*, all sticky traps were examined for adult swede midges. Swede midges were found on sticky traps from the first trapping period (9–16 June) and were captured regularly until early September (Fig. 1). Trap captures from site 1 suggest the occurrence of at least two generations of adults from June to September. An earlier peak of adults in late May – early June is likely, but was not covered during the 2000 sampling period. The assertion that multiple, and possibly overlapping, generations occur in Ontario is consistent with the extended time period over which swede midge adults emerged from plants (Table 1). Duration of larval and pupal stadia are 7–21 d (at 25–15°C) and 10–48 d (at 25–12°C), respectively, (Readshaw 1966). In Europe, there is a range from two generations per year in Norway

(Rygg and Braekke 1980) to three or four generations per year in the Netherlands (Bouma 1996).

Eggs are laid on rapidly growing vegetative and generative tissue of a wide range of cruciferous plants (Barnes 1946). Larvae feed by extraintestinal digestion, and secretions of the salivary glands cause plant tissue to become twisted and deformed (Mamaev 1975). The characteristic symptoms are distortion of leaf tissue and "blindness", a disruption or cessation of growth at the terminal growing point of the plant, where the broccoli or cauliflower, *B. oleracea* var. *capitata*, head would form. We have observed "blind" seedlings prior to transplanting, distortion of leaves and blindness in transplants, and distortion or loss of the broccoli or cauliflower head in older plants. Loss of seed production due to larval feeding on developing florets has been reported in Europe (Barnes 1946). Research is ongoing to determine the developmental parameters and distribution of this insect in Ontario and to develop effective control methods.

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- Barnes HF. 1946. Gall midges of economic importance. Volume 1, Gall midges of root and vegetable crops. London: Crosby Lockwood and Son Ltd
- Bouma E. 1996. Contapré, prototype of a model for prediction of emerging of the swede midge (Contarinia nasturtii). Proceedings of a Workshop on Decision Support Systems in Crop Protection, Münster, Germany, 4–8 November 1996. SP-Report, Danish Institute of Plant and Soil Science 15: 25–30

Gagné RJ. 1989. The plant-feeding gall midges of North America. Ithaca: Cornell University Press

- Harris KM. 1966. Gall midges genera of economic importance (Diptera: Cecidomyiidae). Part I: Introduction and subfamily Cecidomyiinae; supertribe Cecidomyiidi. Transactions of the Royal Entomological Society of London 118: 313–58
- Mamaev BM. 1975. Evolution of gall forming insects gall midges. Leeds: WS Maney Ltd and the British Library Board
- McAlpine JF, Peterson BV, Shewell GE, Teskey, Vockeroth JR, Wood, DM. 1981. Manual of Nearctic Diptera. Volume 1. Agriculture Canada Research Branch Monograph 27
- Readshaw JL. 1966. The ecology of the swede midge, Contarinia nasturtii (Kieff.) (Diptera, Cecidomyiidae). I. Life history and influence of temperature and moisture on development. Bulletin of Entomological Research 56: 685-700
- Rygg TD, Braekke HP. 1980. Swede midge (Contarinia nasturtii Kieffer) (Diptera, Cecidomyiade): investigations on biology, symptoms of attack and effects on yield. Meldinger fra Norges landbrukshogskole 59: 1–9
- United States Department of Agriculture (USDA). 1962. Insects not known to occur in the United States. Cooperative Economic Insect Report 12

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