

Occurrence of *Sitodiplosis mosellana* (Diptera: Cecidomyiidae) and its parasitoid, *Macroglenes penetrans* (Hymenoptera: Platygasteridae), in northeastern Montana

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Abstract—The wheat midge, *Sitodiplosis mosellana* (Géhin), is an infrequent but devastating pest that has been present in western North America for at least 100 years. This note provides the first published report of the presence of the wheat midge and its parasitoid, *Macroglenes penetrans* (Kirby), in Montana. Annual surveys were conducted in Daniels, Roosevelt, Sheridan, and Valley counties of northeastern Montana for 5 years (2000–2004) using a systematic soil sampling method to collect overwintering wheat midge larvae. In addition, in 2004, infested wheat heads were collected from 10 fields in Sheridan County, and wheat midges and parasitoids were reared. The wheat midge occurred in all four counties, though at relatively low levels. Densities fluctuated across years and locations, with the highest densities (>200 midge larvae/m²) occurring in Sheridan and Roosevelt counties. *Macroglenes penetrans* was found at all 10 sample sites and constituted up to 52% of the emerged adults (midges + parasitoids).

Résumé—La cécidomyie du blé, *Sitodiplosis mosellana* (Géhin), est un ravageur peu fréquent mais dévastateur qui est présent dans l'ouest de l'Amérique du Nord depuis au moins 100 ans. Ceci est la première mention publiée de la présence de la cécidomyie du blé et de son parasitoïde *Macroglenes penetrans* (Kirby) au Montana. Des inventaires annuels ont été réalisés dans des comtés de Daniels, Roosevelt, Sheridan et Valley du nord-est du Montana pendant 5 ans (2000–2004) à l'aide d'une méthode systématique de prélèvement des sols pour récolter des larves de la cécidomyie du blé qui y hivernent. De plus, en 2004, des épis de blé infestés ont été récoltés dans 10 champs dans le comté de Sheridan et les cécidomyies du blé et leurs parasitoïdes ont été mis en élevage. La cécidomyie du blé se retrouve dans les quatre comtés, bien qu'en nombres réduits. Les densités varient en fonction des années et des sites et les densités les plus fortes (>200 larves de cécidomyies/m²) s'observent dans les comtés de Sheridan et de Roosevelt. *Macroglenes penetrans* est présent dans les 10 sites d'échantillonnage et représente jusqu'à 52 % des adultes (cécidomyies et parasitoïdes) qui émergent.

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The wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), occurs in Europe, Asia, and North America and has become an increasingly important pest in western Canada (Berzonsky *et al.* 2003). The wheat midge has tremendous potential for crop damage. In 1983, wheat (*Triticum* spp; Poaceae) yields in northeastern Saskatchewan were reduced by an average of 30%, with a gross economic loss of CAN\$30 million (Olfert *et al.* 1985). Significant infestation levels and damage were also reported in Manitoba in the mid-1990s (Lamb *et al.* 1999).

Wheat midge management consists of early planting, the use of insecticides, and, more

recently, the use of resistant or tolerant wheat cultivars (Berzonsky *et al.* 2003). Several natural enemy species also contribute to wheat midge control. The most common, *Macroglenes penetrans* (Kirby) (Hymenoptera: Pteromalidae), was first recorded in Canada in the mid-1980s (Doane *et al.* 1989). In addition, a classical biological control project conducted by Agriculture Canada and the International Institute for Biological Control beginning in 1985 resulted in the release and establishment of the exotic wheat midge parasitoid *Platygaster tuberosula* Keiffer (Hymenoptera: Platygasteridae) (Olfert *et al.* 2003).

This note reports the results of surveys conducted across all or parts of Daniels, Roosevelt, Sheridan, and Valley counties in northeastern

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Montana, United States of America, from 2000 to 2004 to determine the presence and abundance of the wheat midge. In addition, once wheat midge was found, the composition and abundance of wheat midge natural enemies were assessed.

Wheat midge abundance was determined by sampling soil for the presence of overwintering wheat midge larvae using a systematic sampling grid (North Dakota State University 2005). The sampling grid covered all of Roosevelt, Sheridan, and Daniels counties and, beginning in 2001, the eastern portion of Valley County. Sample sites were located at 19.3-km (12-mi.) intervals starting at the Montana – North Dakota state line and moving west. Samples were taken from the same fields each year unless wheat or durum wheat was not being grown in that field; in such cases, the adjacent wheat field was sampled. Samples were collected after harvest was completed. The first samples were collected in the spring of 2001 and all other samples were collected in the fall. The sample collected in spring 2001 contained wheat midge larvae overwintering from 2000.

Ten subsamples were collected from each sample site in an "X" pattern across an area of the field at least 50 m from the field edge. The 10 subsamples were collected approximately 10 m apart using a common bulb-planting tool with a diameter of 5.9 cm (2 3/8 in.). A soil core approximately 5 cm (2 in.) deep was removed and placed in a resealable plastic bag. The 10 subsamples were combined and thoroughly mixed. Bags were kept in a cooler and brought to the laboratory.

Wheat midge larvae were extracted from a 1.66-L portion of the collected soil using the brine flotation method and microscopic examination procedure described by Doane *et al.* (1987). A No. 12 sieve was used to remove large objects from the sample prior to immersion in the brine solution. A separatory funnel was used to remove the heavier nonorganic portion that settled to the bottom of the brine solution.

Sampling for wheat midge parasitoids was conducted in Sheridan County in the area with the highest populations of wheat midge. Approximately 3 weeks after wheat midge oviposition (or 1600 degree-days above the wheat midge emergence threshold of 4.44 °C (40°F)), several hundred wheat heads were randomly collected from 10 locations. Wheat

heads were cut from the stem and placed in plastic bags in a cooler and brought to the laboratory. In the laboratory, the wheat heads were placed on wire mesh (1.27-cm (0.5-in.) opening) above 3–5 cm of water and kept moist. After 1–2 d mature midge larvae began to drop out of the heads and into the water, where they were collected and placed in a cup with a pasteurized soil:sand (3:1) mix. These containers were covered and held at room temperature for 3 weeks, followed by 120 d at 0 ± 2 °C.

After low-temperature treatment, larvae were moved to room temperature and a photoperiod of 16L:8D. Adult wheat midges and parasitoids began to emerge after approximately 5 weeks. Adult wheat midges and parasitoids were counted and placed in 80% ethyl alcohol and sent to the USDA–ARS Systematic Entomology Laboratory for identification.

The wheat midge was found each year (2000–2004) in Daniels, Roosevelt, and Sheridan counties and in 2 of the 4 years (2002, 2003) in Valley County. Positive identification as *S. mosellana* was determined by Raymond Gagné (Systematic Entomology Laboratory, Agricultural Research Service, US Department of Agriculture), and voucher specimens were deposited in the US National Insect Collection (Washington, D.C.). This is the first published report of the wheat midge in Montana, though it has been known from surrounding US states and Canadian provinces for at least 20 years (Lamb *et al.* 1999; Berzonsky *et al.* 2003).

Wheat midge densities were generally low, with no midges recovered at most sites. Wheat midge larvae were found in at least one site in Daniels, Roosevelt, and Sheridan counties every year. The highest wheat midge densities were found in Sheridan County, with four sites exceeding 200 midge larvae/m² in at least one year and one site (in 2004) exceeding 600 midge larvae/m².

The only wheat midge parasitoid that was recovered from the samples collected in Sheridan County was *M. penetrans*. This parasitoid was found at all locations sampled and constituted 0.35 (SE = 0.02) of the adults (midges + parasitoids) that emerged. *Macroglenes penetrans* was identified by Eric Grissell (Systematic Entomology Laboratory, Agricultural Research Service, US Department of Agriculture), and voucher specimens were deposited in the US National Insect Collection. This is the first report of this parasitoid in Montana.

Macroglenes penetrans, an egg–larval parasitoid, was first recorded in Canada in 1984 (Doane *et al.* 1989). In Saskatchewan, *M. penetrans* constituted an increasing proportion of insects emerging from wheat heads from 1996 (0.474) to 2001 (0.642) (Olfert *et al.* 2003), and these proportions were higher than the mean proportion (0.346) observed in Montana.

The exotic wheat midge parasitoid (*P. tuberosula*) collected in Europe and established in eastern Saskatchewan (Olfert *et al.* 2003) was not found in this study. This parasitoid has moved only a few kilometres since its release in 1993 and 1994 (Olfert *et al.* 2003), and thus it is not surprising that *P. tuberosula* was not found in samples from Montana.

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