

**NEW ONTARIO RECORDS FOR *NANOPHYES M. MARMORATUS*
(GOEZE, 1777) (COLEOPTERA: BRENTIDAE), INTRODUCED
INTO NORTH AMERICA FOR CLASSICAL BIOLOGICAL
CONTROL OF PURPLE LOOSESTRIFE**

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Scientific Note

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In 1992, *Nanophyes marmoratus marmoratus* (Goeze) (Coleoptera: Brentidae), the Purple Loosestrife Flower Weevil, native to Eurasia (Thompson et al. 1987), was identified as a candidate for biological control of Purple Loosestrife, *Lythrum salicaria* (L.) (Lythraceae), an alien weed invasive in North America. Although *N. m. marmoratus* was assessed as having a lower potential impact than the other biological control candidates, *Neogalerucella californiensis* L., *N. pusilla* (Duftschmid) (Chrysomelidae) and *Hylobius transversovittatus* (Goeze) (Curculionidae), it was still released due to its high likelihood of establishment (Blossey and Schroeder 1995). From 1994–2005, *N. m. marmoratus* was released in several US states (Skinner 1996; Blossey 2001). In Canada, 720 adults were released in 1997 in southern Manitoba in three marshy sites (Lindgren et al. 2002). In Ontario there is no record of this species ever having been released (D. Mackenzie, personal communication). The present study is the first to monitor the spread of *N. m. marmoratus* in Canada since its release in North America, thus addressing Corrigan et al.'s (2013) recommendation to assess its establishment in Canada.

Nanophyes m. marmoratus adults are small (1.4–2.1 mm long), with light yellowish-brown elytral markings and a long rostrum. Females (Fig. 1a) are slightly larger and with more yellow on the elytra than males (Fig. 1b). The life cycle (egg to adult emergence) is about four weeks. The weevils first appear in mid-spring, when they mate on the flowering inflorescences before laying eggs singly in flower buds (Batra et al. 1986; Blossey and Schroeder 1995). The young whitish larvae feed on the stamens and ovary of unopened flower (Wilson et al. 2004). The adult beetles emerge, feed on foliage and mate in late August before overwintering in leaf litter (Lindgren et al. 2002).

In 2012 and 2013 several Purple Loosestrife populations in eastern Ontario were surveyed. Only the well-established, leaf-feeding *Neogalerucella* beetles were expected to be found but *Nanophyes m. marmoratus* was repeatedly discovered as well, on Purple Loosestrife flowers from mid-June to late August. One of these specimens, from Pakenham, ON, 45.3333°N 76.2833°W, 10 September 2012 (1 female, CNC), was reported by Douglas et al. (2013) along with specimens collected in Quebec in 2011 from the area between the Ottawa and St. Lawrence Rivers (Fig. 2). *Nanophyes m. marmoratus* has now been identified at eighteen sites in eastern Ontario (Fig. 2) and quantified in fourteen of them. The average density was 0.78 (\pm 0.55) weevils per stem ($n=513$ stems), with a range of 0–14 weevils per stem.

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FIGURE 1a. (left) Female and 1b. (right) male *N. m. marmoratus* showing elytral patterns.

Attacked buds do not flower; they become blackened, filled with frass and usually fall off the plant (Wilson et al. 2004). In populations where *N. m. marmoratus* is common, Purple Loosestrife fruit densities are noticeably lower, with higher proportions of aborted seedpods (Fig. 3). Flower bud abortion was often seen on the lower half of the inflorescence with many to all of the buds along this section missing. Affected buds that remain on plants each have a single small exit hole—additional subtle evidence of the weevils’ presence. The damaged bud can look very similar to fully developed fruits (seed capsules). Weevil damage is easily spotted and distinguishable from that caused by *Neogalerucella* beetles. The weevils’ presence reduces overall seed production. At high weevil densities, larval feeding can reduce fruit output of a Purple Loosestrife plant by up to 70% (Van Dreische

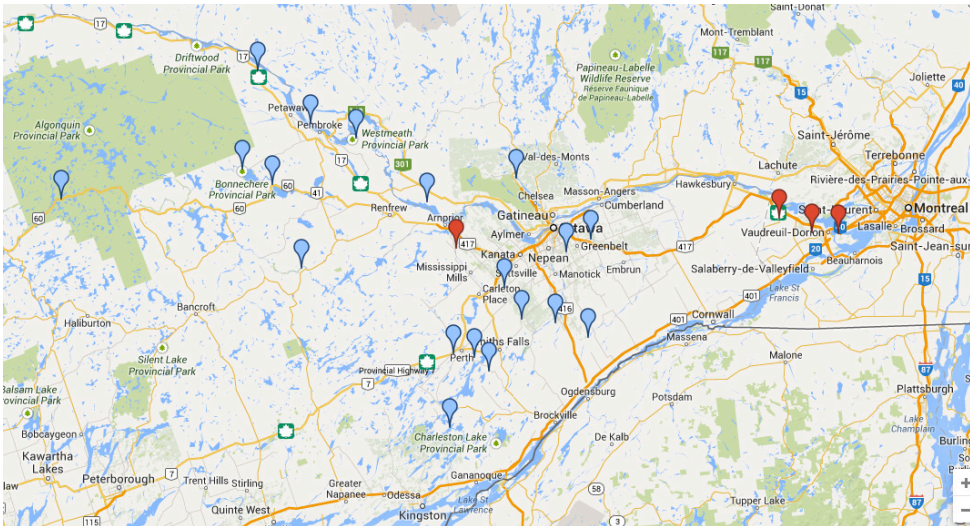


FIGURE 2. Records for *Nanophyes m. marmoratus* in eastern Ontario and southwestern Quebec. Blue points are new reports, red points are those reported in Douglas (2013).



FIGURE 3. Abscission of flower buds caused by *N. m. marmoratus*.

et.al. 2002; personal observation). In the fourteen sites with *N. m. marmoratus*, reductions in reproductive output were measured as the portion (%) of the total lengths of inflorescences bearing aborted flower buds. These reductions averaged 12.6% ($\pm 10.6\%$) with a range of 0–34.5% over all sites. When considering only the damaged plants ($n=85$) within the sites, total reproductive output reductions averaged 53% ($\pm 26.2\%$) with a range of 0–100%.

Early in the biocontrol programme, it was thought likely that combining biological control agents would significantly decrease Purple Loosestrife density (Malecki et al. 1993; Blossey and Schroeder 1995; Wilson et al. 2004; Skinner 2006) but Coombs (2004) suggested that *N. m. marmoratus* would thrive when *Neogalerucella* was low or absent. At one Ontario site, anecdotal evidence suggested that obvious niche partitioning occurred; *N. m. marmoratus* was found primarily on host plants situated in a field, whereas *Neogalerucella* beetles were more concentrated on plants in the adjacent, recently-mowed, roadside ditch. The mowed plants had an increased production of tender, young shoots preferred by *Neogalerucella*, whereas unmowed plants in the field retained their flowers, preferred by *Nanophyes m. marmoratus*.

Nanophyes m. marmoratus is now present in southwestern Quebec and Ontario (Douglas et al. 2013). In Ontario, over 403 individuals were counted at 18 sites (50 vouchers, University of Ottawa). Populations of *N. m. marmoratus* are present through extensive areas of eastern Ontario, having been found along the Ottawa River watershed from above Petawawa to the National Capital Region and throughout the Rideau waterway from Kingston to Ottawa. Over the last 19 years tens of thousands of these weevils have been released and redistributed in several northeastern states (Blossey, personal communication). The origins of the Ontario populations are likely the closest US release sites, i.e., Buffalo (42.8553°N

78.8552°W) and Laurel Marsh, NY (42.8709°N 77.2424°W), about 300 km from the most southerly Ontario site at Queen's Biological Field Station (44.5681°N 76.3201°W). Though *N. m. marmoratus* dispersal has not been described, Ferrarese and Garono (2010) noted that dispersals across large expanses of open water have occurred in Oregon. They suggested that adults are capable of dispersing 100–300 km/year. Blossey (personal communication), also indicated that *N. m. marmoratus* adults are strong dispersers and have generally spread in a northeastern pattern, helped by the prevailing winds. It would be useful to survey additional areas for the presence of *N. m. marmoratus*, especially those between the original release sites in the USA and Manitoba and the sites mapped here.

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