RANGE EXPANSION BY CUT-LEAVED TEASEL (*DIPSACUS LACINIATUS*) IN WISCONSIN AND MINNESOTA, WITH A CONSIDERATION OF GERMINATION SUCCESS

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ABSTRACT

Cut-leaved teasel, *Dipsacus laciniatus*, an exotic herbaceous plant, has been reported primarily in the southern half of Wisconsin, and its distribution in Minnesota has not been well defined. We documented the occurrence of *D. laciniatus* in Langlade County, Wisconsin, and both *D. laciniatus* and *D. fullonum* in Winona County, Minnesota. Viability of seeds harvested from the site in Langlade County was assessed by planting them in a greenhouse. Overall germination success was comparable to previously published values and indicated that the growing season in northern Wisconsin is sufficient for teasel to produce viable seeds. Seeds chilled for two months prior to planting did not differ significantly in germination success from seeds that were planted immediately (without chilling), although they germinated more quickly. Seeds that had undergone a cold treatment produced seedlings that exceeded the height of the rosettes produced by seeds without a cold treatment. The results of our germination trials may reflect an adaptive flexibility that helps *D. laciniatus* invade new habitat. The results also emphasize the need to eliminate the few teasel plants that are present in Langlade County before the population expands from its current limited distribution.

Keywords: *Dipsacus*, germination, Minnesota, teasel, Wisconsin

INTRODUCTION

Cut-leaved teasel, *Dipsacus laciniatus*, is an invasive plant established throughout much of the northeastern and midwestern United States (Solecki 1993, and references therein). Prior to this study, it was known from several counties in southern and central Wisconsin (Salamun & Cochrane 1974, N. A. Harriman in Love 1978, Wisconsin State Herbarium 2000), with additional unpublished records for Waupaca and Green Lake counties documented by specimens in the University of Wisconsin-Oshkosh herbarium (Harriman, personal communication). In Minnesota, Ownbey & Morley (1991) listed *D. laciniatus* as “introduced” but did not provide a distribution map, apparently because they did not consider the species to be naturalized. Solecki (1993) plotted the edge of the range as just reaching the southeastern tip of the state, and only two specimens (from St. Louis County) were listed in the holdings of the University of Minnesota Plant Herbarium (J. F. Bell Museum). A related species, *D. fullonum* (= *D. sylvestris* of some workers), has not been reported from Minnesota but is widespread in much of the U.S. (Solecki 1993). The purpose of this paper is to report new localities for *D. laciniatus* in Wisconsin and for both *Dipsacus*
species in southeastern Minnesota and to discuss the results of germination experiments involving *D. laciniatus*.

**METHODS**

Locality records for *D. laciniatus* in Wisconsin were obtained opportunistically during 1999–2000 and 2006 by searching for the conspicuous mature flowering stalks along roadsides during travel via automobile throughout the state. Records for Minnesota were obtained during field work from 2000 to the present. Voucher specimens were placed in the University of Wisconsin-Green Bay (UWGB), University of Minnesota (MIN), or Saint Mary’s University (SMUMN) herbaria.

One of the new populations of *D. laciniatus* discovered during the present study occurred in Langlade County in northern Wisconsin (see results). Median growing season in this area falls in the range of 115–128 days between killing frosts, much shorter than the range of 143–170 days in the main portion of the range occupied in southern Wisconsin (Moran & Hopkins 2002). To test the ability of *D. laciniatus* to produce viable seeds during the shorter growing season in Langlade County, seeds harvested from several mature stalks on 2 December 1999 were planted in a greenhouse. A haphazard selection of approximately half (36) of the seeds were planted on 6 December 1999, whereas the remaining 34 seeds were held under refrigeration (mean daily temperature: 2.7–5.2°C) on moist paper toweling in a darkened container for 63 days and planted on 7 February 2000. Seeds were planted three per pot (8.2 cm by 8.2 cm) in commercial potting soil, and pots were held in trays of water under natural light. Pots were checked for seedlings daily.

**RESULTS**

We observed *D. laciniatus* at three locations in two Wisconsin counties where it had been collected previously near the edge of its range. Two locations were in northeastern Winnebago County along U.S. Highway 41: (a) small stands of plants (UWGB30407) were scattered along both sides of the highway over a distance of approximately 1.6 km between State Highway 44 and 9th Avenue in Oshkosh (T18N, R16E, S27,28,33,34) and (b) approximately 23 km northeast of the first site, a large, dense stand occurred at the U.S. Highway 10/ State Highway 441 exit ramp in Menasha (T20N, R17E, S9). In Waupaca County, several plants occurred at a rural residence on the north side of State Highway 54 approximately 0.5 km east of the Green Bay and Western railroad crossing near Royalton (T22N, R14E, S6). The plants were far enough from the roadside and close enough to ornamental plants that they may have been the result of a deliberate planting.

A small, widely disjunct population in Langlade County, Wisconsin, was located just south of State Highway 64 on Elton South Road (T31N, R14E, S16). Three mature, flowering stalks occurred on the east side of the road, across from six mature plants on the west side (UWGB20409). Approximately ten similar roadsides within 3 km of the Elton South Road site were surveyed without finding additional plants.

In 2006, several dozen plants were observed in Vernon County (SMUMN PC001) in the right-of-way between the west side of State Highway 35 and the Burlington Northern railroad tracks just south of County Road UU (T12N, R7W, S28). They were also observed but not collected further north along State High-
way 35 between Genoa and Stoddard. The Vernon County locations are not unexpected in light of a previous collection in the northwest corner of Crawford County (Wisconsin State Herbarium 2000).

In Minnesota, *D. laciniatus* was found at two locations in Winona County and *D. fullonum* at a third. (1) We observed a single, mature *D. laciniatus* (MIN 438447) on 21 September 2001 along the railroad tracks that skirt the north side of Farmers’ Community Park (T106N, R8W, S8). We removed the plant after tying a plastic bag around its inflorescences to catch any falling seeds, and we have observed no additional plants in subsequent years. (2) On 29 December 2005, scattered clumps of *D. laciniatus* were observed along several km of State Highway 76 south of interstate Highway 90 (MIN 540914). (3) On 23 July 2006, several dozen flowering *D. fullonum* were found in pastured land along Pine Creek upstream from School Section Road (T105N, R9W, S25). A return visit on 6 August 2006 revealed flowering plants for at least one km upstream and several hundred m downstream from the road crossing (MIN436881).

Germination success in the greenhouse was high, and seeds of *D. laciniatus* apparently did not require additional cold treatment to germinate. Of the seeds planted without a cold treatment, 69.4% germinated, whereas 76.5% of those sown after refrigeration germinated. Seeds that had not been chilled germinated from 11 to 24 days after planting (mean = 16.5 days, standard error = 0.9 day), whereas seeds that were chilled germinated from 9 to 16 days after planting (mean = 10.1 days, standard error = 0.4 day) (Fig. 1). All plants in both groups were measured on March 29, 2000. Although the plants that had undergone cold treatment as seeds were sown 63 days after the others, their mean height was greater (8.4 cm vs. 4.7 cm). We note that temperature in the greenhouse was not well controlled during the germination trials. During the 64 days subsequent to the first planting, mean daily minimum and maximum temperatures were 14.6°C and 38.8°C, respectively, whereas corresponding values during the 60 days following the planting of the chilled seeds were 18.5°C and 43.5°C.

DISCUSSION

Our observations of *D. laciniatus* in Winnebago and Waupaca counties were not unexpected. As discussed by Solecki (1993), highways serve as important dispersal corridors for *D. laciniatus*. The species was first collected in Winnebago County in 1971 in a cemetery adjacent to Wittman Field (Harriman, personal communication), very near the Oshkosh location reported herein. Simple diffusion dispersal along the highway from Oshkosh, however, cannot be used to explain the origin of the Menasha population, because the intervening route includes nearly 2 km of causeway and bridge over Lake Butte des Morts. There is ample evidence for frequent “jump dispersal” of *D. laciniatus* through human intervention, including its association with cemeteries (e.g., Pohl & Sylwester 1962, Salamun & Cochrane 1974).

The Langlade County population of *D. laciniatus* was less expected. This site is widely separated from the main portion of the range, and it occurs in a land-
scape that is much more forested. However, a small horse corral adjacent to the roadside where the larger clump of plants is situated may have contributed to the habitat disturbance that favors establishment of teasel. Also, it is possible that teasel seeds were originally brought into the area with food for the horses.

Previously reported maps of the range of *D. laciniatus* are somewhat inconsistent. Solecki’s (1993) map showed *D. laciniatus* to range well into central and northern Wisconsin, whereas the Wisconsin State Herbarium (2006) implies that *D. laciniatus* was confined to the southern half of the state. The latter map, however, was based only on specimens in the University of Wisconsin-Madison collection.

The small number of plants at the Langlade County site suggested that the population was newly established, perhaps first generation, and we conducted germination trials to assess whether plants at this northern location had had enough time to produce viable seeds during its shorter growing season. We tested the effect of chilling because some workers have implied through their

![Figure 1](image.png)

**FIGURE 1.** Germination times in days for seeds of *Dipsacus laciniatus* collected in Langlade County and provided with an additional cold treatment (upper panel) or not provided with a cold treatment (lower panel).
choice of methodology (Huenneke & Thomon 1995) or descriptions of life history (e.g., Werner & Caswell 1977) that a period of chilling might be necessary prior to germination. Despite our lack of control for the effect of seasonally changing photoperiod and the imprecision of temperature regulation in our greenhouse, the relatively high germination rates that we obtained, comparable to those in previous studies of teasel species (e.g., Solecki 1993, Huenneke & Thomson 1995), indicate that the Langlade County plants are capable of producing fully viable seeds. Moreover, our results are consistent with those of Werner (1979) and Solecki (1989) in that they imply that a period of chilling is not required prior to germination (at least no longer than what our seeds experienced before they were harvested in early December) (Fig. 1).

Teasel species display flexibility in their production of seeds and the timing of their germination. For example, Solecki (1989) found that viable seeds were produced by *D. laciniatus* even within flowering heads that were cut before flowering was complete. Werner & Caswell (1977) reported that *D. fullonum* seeds generally germinate in the first spring after falling from the flowering head, but that some also germinate the second spring. Our results suggest the additional possibility that some teasel seeds may be capable of germinating in the fall of the same year they are produced. Moreover, although our results are preliminary, they suggest the intriguing possibility that seedling growth may be related to the timing of germination in an adaptive way. It would be more advantageous for seeds that germinate in the fall to form winter rosettes, whereas it might be more advantageous for plants that germinate in the spring to invest more quickly in growth in height to permit neighboring plants to be overtopped.

Prior to this study, it might have been supposed that climatic factors had prevented teasel from becoming established in northern Wisconsin and Minnesota. Our results suggest that *D. laciniatus* is physiologically capable of maturing and reproducing well north of the main body of its current range, and they emphasize the importance of early detection and control of newly established populations.

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LITERATURE CITED


