

Establishment of the root-feeding moth, *Bradynoba gilveolella*, a biocontrol agent of rush skeletonweed

Summary of 2009 activities

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Summary

During the summer of 2009, two study sites with populations of rush skeletonweed (RSW) were selected at Craters of the Moon NM and Preserve. At these sites more than 300 larvae of the root-feeding moth, *Bradynoba gilveolella*, were released on over 100 rush skeletonweed plants. We were not able to locate larvae or signs of feeding on roots of inoculated plants 48 hrs (5 plants inspected) and 3 weeks (25 plants inspected) after release. However, a single, mature larva was found about 2 months after release (of 12 plants inspected). These results show that *B. gilveolella* can complete development on RSW plants at Craters of the Moon NM and Preserve, but that the vast majority of them die soon after they are released. Previous attempts to establish populations of this biocontrol agent in Idaho have failed, leading some to hypothesize that high winter morality may be to blame. These findings suggest that winter mortality has not been the problem, and that we should focus on the establishment and survival of early instars of this moth.

Study sites

Two study sites were selected, both on BLM lands within the Craters of the Moon NM (Table 1). These sites were relatively close to established roads and contained many hundreds of RSW plants.

Table 1. Site names, GPS coordinates, date of *B. gilveolella* release, and number of larvae released and plants infested for each site.

Site	GPS	Date of releases	No. larvae released/No. plants
South of Paddelford Flat	N43°15.69' W113°47.29'	22-23 July 2009	195 / 65
South of Carey	N43°10.14' W113°56.36'	24 July 2009	120 / 40

Release of *B. gilveolella*

On 22-24 July 2009, first instar larvae of *B. gilveolella* were released at study sites by placing three larvae on the rosette or base of bolting stems near soil surface of each plant using a small paint brush. Releases were made in the early morning between 6:00 and 8:00AM. Inoculated plants were marked by tying colored flagging tape near the top of flowering stems and by placing a plastic tag around the base at the soil surface. Although we had about 500 eggs, only a subset of these emerged each day. At the final day of releases (24 July) there were approximately 200 eggs that had not emerged – we distributed these eggs across several plants at the South of Carey site. Temperature probes were used to determine air and soil temperature at the South of Paddelford Flat site during the release period. Five pitfall traps were established at the South of Paddelford Flat site and left for 48 hrs to sample arthropods that might prey on *B. gilveolella* larvae.

Monitoring of *B. gilveolella*

At three time points after release (approximately 48hrs, 3 weeks, and 2 months; Table 2), the roots of inoculated RSW plants were dug up and examined for signs of *B. gilveolella* feeding and larvae. Because of fire danger, we were unable to re-visit the South of Carey site after releases and all monitoring was done at the South of Paddelford Flat site. We did not find signs of feeding or larvae two days after release (24 July), but it would be easy to miss such small larvae at this stage. No larvae were found 3 weeks after release (11 August), but we did find one plant that appeared to have some feeding damage. About 2 months after release, we found a mature larva within a feeding tube (Fig. 1). Because digging up the plants could kill larvae, we decided not to sample more plants, but to wait until the summer of 2010 (after adult emergence) when the remaining plants could be inspected for feeding tubes and pupal cases.

Table 2. Monitoring dates, number of plants inspected, and number of larvae or signs of feeding found at the South of Paddelford Flat Site in 2009

Release site	Date	No. plants inspected	No. larvae / signs of feeding
South of Paddelford Flat	24 July 2009	5	0 / 0
South of Paddelford Flat	11 August 2009	25	0 / 1(?)
South of Paddelford Flat	28 September 2009	12	1 / 1(?)



Figure 1. A single, mature *B. gilveolella* larva was found on 28 September 2009 at the South of Paddelford Flat site. The larva is seen here after part of its feeding tube was removed.

Potential factors limiting *B. gilveolella* establishment

Based on field observations and results from the pitfall traps we found no evidence that predators play a significant role in limiting *B. gilveolella* establishment. The traps contained mostly harvester ants (which primarily feed on seeds) and a small number of ground beetles. The remaining insects in the traps were either herbivores (e.g., grasshoppers) or present in very small numbers. However, we cannot completely rule out a role for predators or pathogens.

A more likely scenario is that the small larvae desiccated before they were able to locate roots and establish protective feeding tubes. Although we made releases early in the morning (6-8AM), they were released on hot, sunny days (mid-90s °F). Air temperatures just above the soil surface quickly reached or exceeded 100°F (approx. 38°C) on the days of release (Fig. 2). Soil temperatures were even hotter (Fig. 3). The 24 July release date was different since it was overcast and temperatures were slower to climb. We were not able to return to monitor these releases at the South of Carey site, and it will be

interesting to see if *B. gilveolella* establishment was greater there. If so, this would provide support for this hypothesis.

Future plans

In the summer of 2010, the remaining *B. gilveolella*-inoculated plants will be examined to determine total survival of larvae released in 2009. The South of Carey site will also be re-visited to determine if there were differences in survival between sites (which might tell us something about temperature effects). The potential for predators and desiccation of young larvae to limit *B. gilveolella* establishment should be further investigated. Predators can easily be excluded by encircling plants with metal flashing (and perhaps applying Tanglefoot to the flashing). A subset of plants could be encircled and the establishment of *B. gilveolella* be compared with control plants. To address possible desiccation, we could release larvae at or just after sunset – giving them the entire night to locate and begin feeding on roots. Supplying supplemental water just before release is another option that might reduce desiccation.

Notes

We verified the presence of three other biocontrol agents of RSW at Craters of the Moon NM and Preserve: the RSW gall midge, gall mite, and a rust fungus. The gall midge and gall mite was variable, but present at all RSW populations examined. The distribution of the rust fungus is unknown, but a few, scattered severely-infested RSW plants were found.

A notable observation is that RSW occurs in distinct clumps or patches within sites. I wondered whether these clumps were composed of individual plants or a single plant that had spread clonally via roots. Six clumps were chosen and the plants within these clumps were examined to determine if their roots were connected. We found that these clumps were composed of individual plants and are likely the offspring resulting from seeds that fall from a ‘mother’ plant once it is established.

Figure 2. Air temperatures at the South of Paddelford Flat site during the time of *B. gilveolella* release. The temperature probe was placed at the base, and in the shade of a large sagebrush.

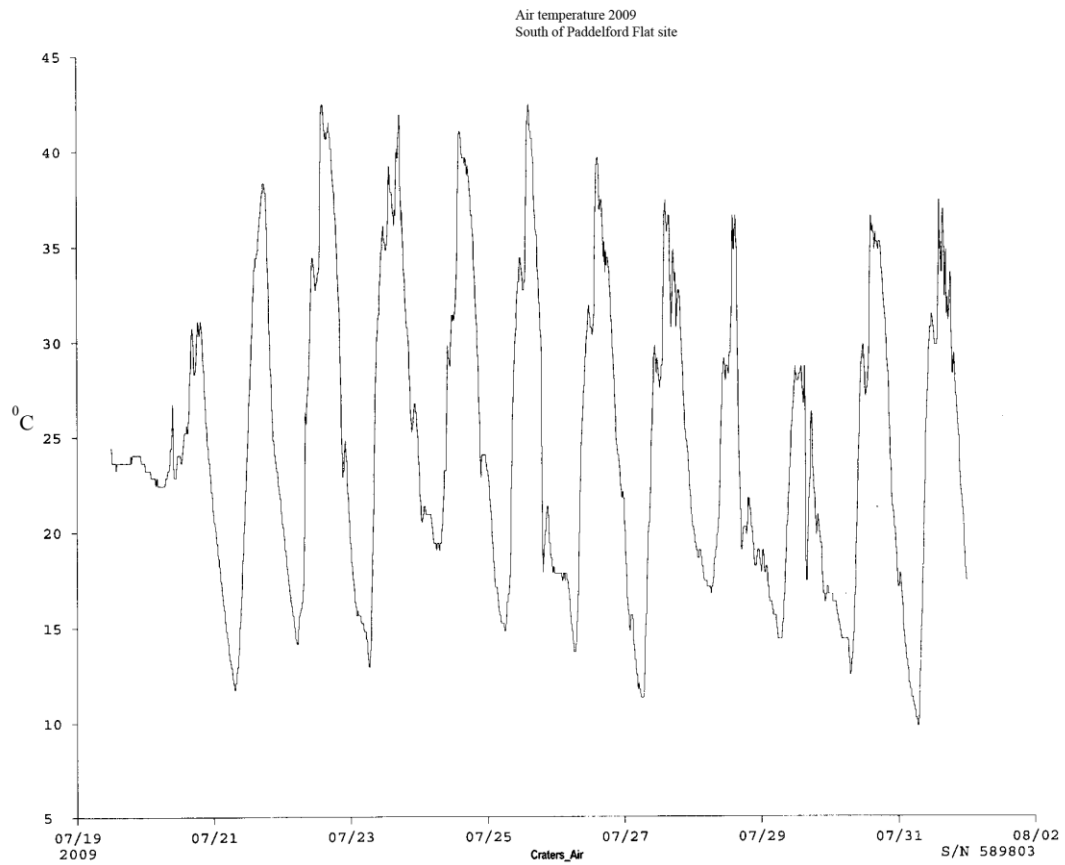


Figure 3. Soil temperatures at the South of Paddelford Flat site during the time of *B. gilveolella* release. The temperature probe was buried in about 10 cm of sandy soil.

