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Phenology of leafy spurge biocontrol agents

RICH HANSEN

USDA-APHIS, Forestry Sciences Lab, Montana State Univ., Bozeman, MT 59717-0278.

The seasonal occurrence of “collectable” life stages of leafy spurge biocontrol agents must be known to schedule sampling and redistribution collections at field insectary sites (FIS). Since 1992, I have been quantifying the occurrence of adult leafy spurge flea beetles (*Aphthona cyparissiae*, *A. czwalinae*, *A. flava*, and *A. nigriscutis*) at sites in southwestern Montana (Gallatin Co. and Sweet Grass Co.). Eight emergence cages per release were employed in 1992, while sweep-net samples (120 sweeps/release) were used in 1993 and 1994. Samples were collected once or twice a week, from early June through September. On-site weather stations recorded daily minimum and maximum temperature of 0 C and a Jan. 1 starting date.

Peak *A. czwalinae* and *A. nigriscutis* populations were observed at about 1250 accumulated degree-days (ADD), while peak *A. cyparissiae* and *A. flava* populations occurred at about 1450 and 1650 ADD, respectively. Generally, 200 degree-days (>0°C) are accumulated in a 6-10 day period, depending on location. We schedule three sampling visits to each FIS; sampling during the week when 1450 ADD are “expected”, two weeks previous, and two weeks after should adequately bracket peak populations for all *Aphthona* spp. Local temperature data are used to estimate the occurrence of 1450 ADD and, hence, schedule sampling visits in the 15 states involved in the APHIS redistribution project.

The occurrence of larvae, pupae, and adults of the gall midge *Spurgia esulae* has also been monitored from 1992 through 1994 at a site in Gallatin Co. Beginning in early May and continuing into September, the site was visited at least weekly, and, if present, 5-10 *S. esulae* galls were randomly collected. Galls were dissected and all larvae, pupae, and adults (pupal exuviae) counted. Degree-day data were collected as described above.

Three larval but only two pupal (and adult) “peaks” were observed in 1992 and 1993, demonstrating three generations per year in Montana (third-generation larvae overwinter in the soil). Pupal peaks were observed at about 1000 and 1600 ADD. Experience has shown that galls collected during the “peak” first-generation pupal stage are best suited for redistribution collections, so this effort will be scheduled around the anticipated accumulation of 1000 degree-days.

Plants can be reliable monitors of air and soil heat accumulation (hence, degree-days) and thus may serve as useful indicators of biocontrol agent activity in the field. Since

1992, I have also attempted to quantify vegetative, flowering, and fruiting developmental patterns for selected wild and cultivated plants in southwestern Montana. Generally, adult *Aphthona emergence* appears to begin concurrently with bloom initiation in Wood's rose (*Rosa woodsii*); unfortunately, there is a dearth of recognizable plant phenological events during adult population "peaks". First-generation *Spurgia esulae* galls first appear around the beginning of flowering in chokecherry (*Prunus virginiana*), while first-generation pupal "peaks" seem to coincide with "full" flowering of death camas (*Zygadenus gramineus*).