Evaluation of Aestival Diapause in Hemlock Woolly Adelgid

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Abstract

Hemlock woolly adelgid, *Adelges tsugae* Annand (Homoptera: Adelgidae), has two generations/year that feed and reproduce on hemlock, *Tsugae* spp. The spring generation, present from March to June, is called progrediens. The next generation, present from June until the following March, is called sistens (McClure 1987, Gray and Salom 1996). In June, after sistens eggs hatch, they settle at the base of needles and immediately go into an aestival diapause that lasts until October, a duration of 4 months. The occurrence of aestival diapause in HWA sistens is a barrier when trying to continuously rear its predators. *Pseudoscymnus tsugae* Sasaji and McClure (Coleoptera: Coccinellidae), a biological control agent brought in from Japan (Cheah and McClure 1998), do not produce eggs when feeding on diapausing sistens (Bob Chianese, N.J. Dept. of Agric., personal communication). Year-round production of *P. tsugae* could be achieved if we could prevent HWA from going into diapause. The goals of our research were to: 1. determine if diapause in HWA is obligative or facultative and 2. if facultative, determine what conditions are optimal for continuously rearing HWA.

An experiment conducted in 1997 was the first demonstration that aestival diapause in HWA sistens is facultative, with up to 50% of sistens developing without delay at 12°C and a 12L:12D photoperiod. It also provided the first evidence that response by progrediens to environmental cues is necessary for the induction of diapause.

In 1998 experiments at 12°C, molting and development of sistens was delayed under photoperiods shorter than 12L:12D. Molting was not delayed under longer photoperiods, at both 12 and 14.5°C. Therefore, a 12L:12D photoperiod was determined to be a standard for rearing HWA. The necessity of pre-conditioning progrediens was confirmed when "wild sistens" went into diapause for two months. However, the lower temperature of 14.5°C may have shortened the duration of diapause, as it lasted ca. 5 weeks longer at 17°C in the 1997 experiment.

In a 1999 experiment, we showed that by removing 2nd instar progrediens from pre-conditioning conditions of 14.5°C, that diapause can be avoided. This suggests that the lifestages sensitive to diapause inducing cues range from progredien eggs to 2nd instar. We also were able to shorten development time by placing these nymphs at higher temperatures, making the rearing process for HWA more efficient.

Further experiments are planned to try to identify the precise lifestages sensitive to diapause inducing cues. This could help us shorten pre-conditioning period even further.

References

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