

An issue of time: Hemlock woolly adelgid development and host plant budburst phenology – a key to resistance?

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BUDBURST RATINGS



INTRODUCTION

- Hemlock woolly adelgid, *Adelges tsugae* (HWA), is an exotic sap feeding insect that attacks hemlocks, *Tsuga* spp.
- Susceptibility to HWA varies among hemlocks, but HWA is fatal to eastern hemlock, *T. canadensis*
- Adult HWA are sessile
- Host acceptance is accomplished by newly hatched nymphs, or 'crawlers'
- The timing of crawler dispersal and settlement with hemlock phenology may play a role in understanding susceptibility



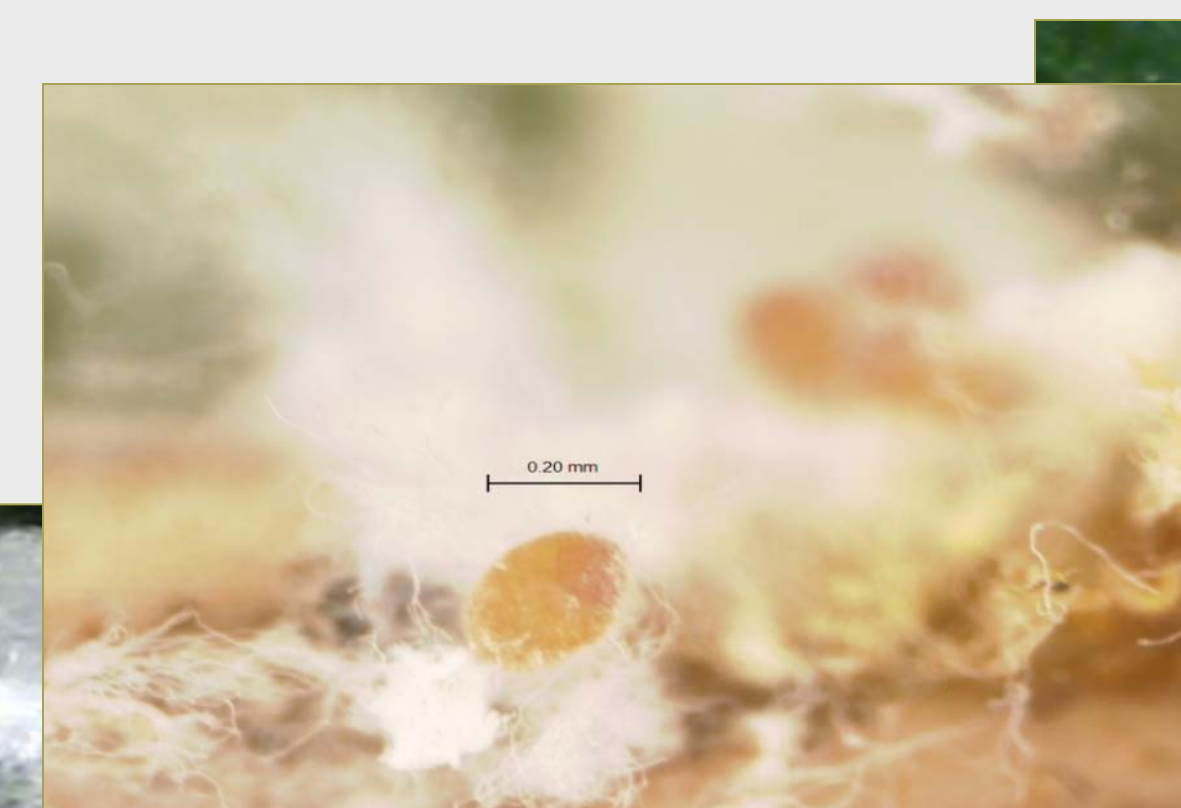
OBJECTIVES

- Monitor HWA development
- Evaluate species-specific and temporal differences in budburst phenology of *Tsuga* along a gradient from adelgid-resistant to adelgid-susceptible hemlocks
- Correlate HWA development with budburst phenology for potential keys to resistance

METHODS AND MATERIALS

HWA Development:

- Three HWA infested trees were selected from Natural Bridge State Park (N 37°46.947', W 083° 40.997')
- At 2-3 day intervals (Feb 25, 2011-present), 3 branch tips (~3.8 cm) were clipped from each tree
- Branch tips were examined for:
 - Number of ovisacs
 - Eggs per ovisac
 - Crawler activity (no. dispersing, no. settling)



Budburst Phenology:

- Phenology of five hemlock species, growing in a common garden and varying in susceptibility to HWA, were monitored (N=3 trees per species)



- 20 terminal buds on 2 branches were assessed for bud expansion every 2-3 days
- Buds were rated on a scale of 0-5¹ and the mean was determined for each species on each date

Degree Day Correlation:

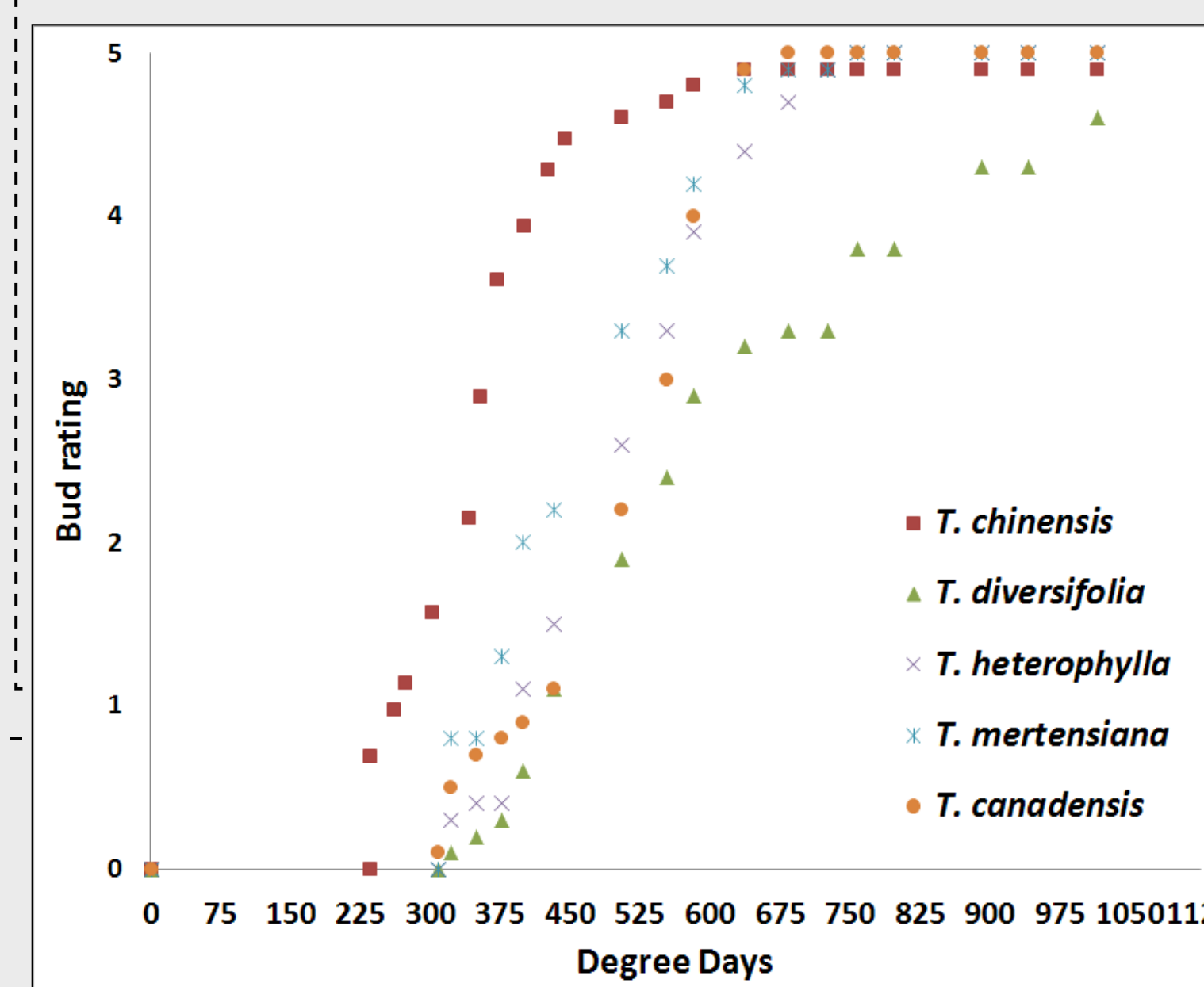
- Average daily temperature was obtained ² for the duration of the research period. Using a 3.8°C developmental threshold³, degree days (dd) were calculated and correlated with HWA development and hemlock phenology

HWA Development:

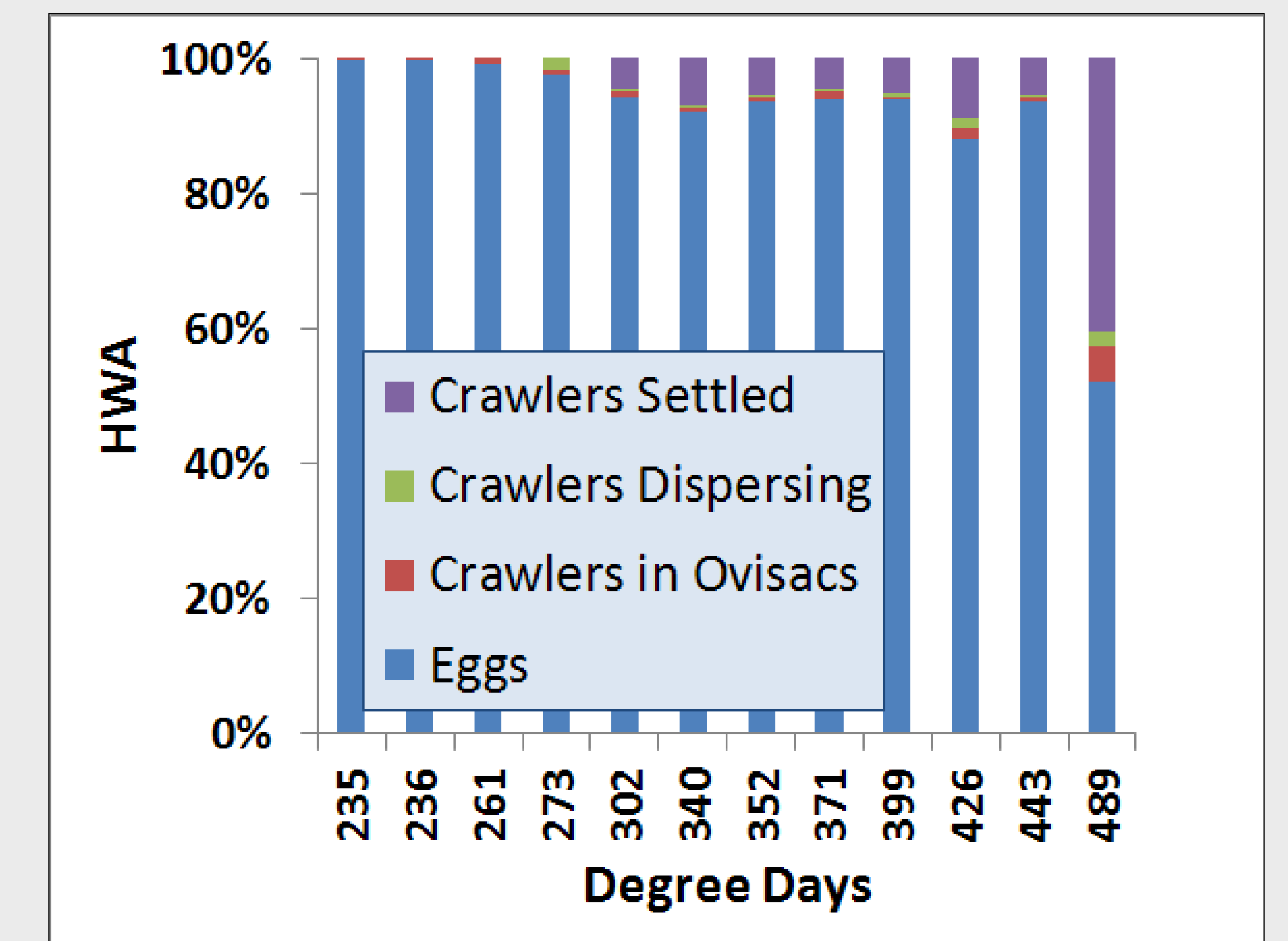
- 1st eggs - 86 dd
- 1st crawler - 234 dd
- Crawler dispersal - 272 dd
- Crawler settlement - 302 dd
- Development is ongoing

Budburst Phenology:

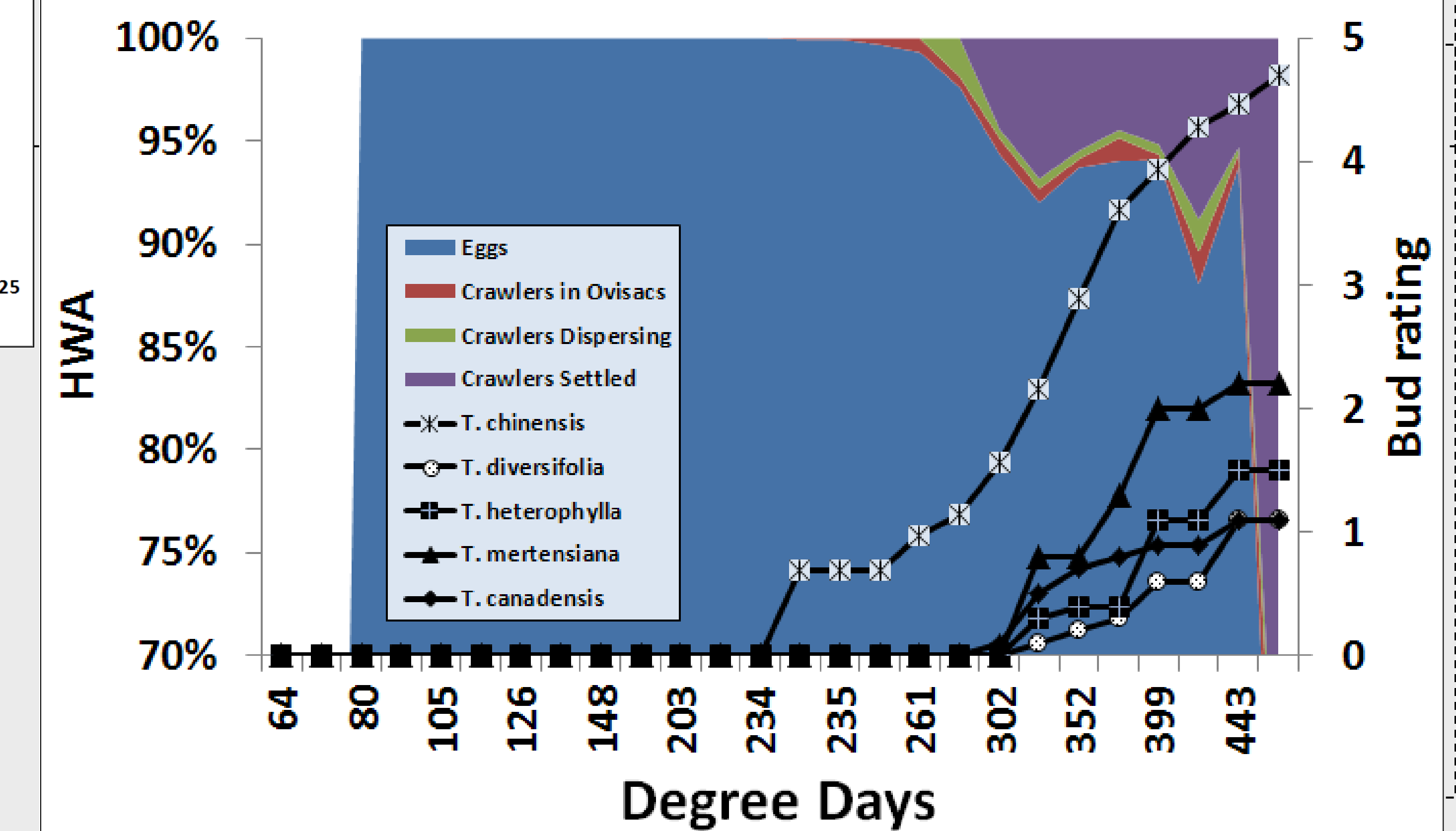
- T. chinensis* broke bud earliest (235 dd)
- T. canadensis* broke bud second (307 dd)
- Other *Tsuga* broke later (321 dd)
- Budburst and leaf expansion is ongoing



RESULTS



HWA Development and Hemlock Budburst Phenology



IMPLICATIONS

- Clear differences in hemlock phenology during the period of HWA development suggests one potential mechanism of resistance
- This project is ongoing. Further analysis of the complete dataset will evaluate these differences in more detail and lend insight to the potential role of host phenology in HWA susceptibility

REFERENCES

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