**Diapause induction limits dispersal of *Diorhabda elongata***

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## Abstract

In this study we investigated the role of the developmental state of adult *Diorhabda elongata* (diapause or reproductive) in determining dispersal behaviors as well as dispersal-associated behaviors such as release of aggregation pheromones under laboratory conditions and response to pheromones and plant volatiles in the field.

The induction of reproductive diapause in *D. elongata* occurs under daylengths less than about 14 hr 40 min while most of the population will be reproductive at longer daylengths[a]. This occurs in laboratory reared insects as well as in field populations. The developmental path of laboratory reared insects can be controlled by simple manipulation of photoperiod and in the field the decrease of daylength in the summer induces hibernal diapause.

On live plants, under controlled temperature and photoperiod, adult beetles showed a significantly higher percentage of dispersal behaviors (flight and attempted flight) under long days (16L:8D) than under short days (12L:12D). Under long days the dispersal behaviors were significantly more frequent late in the day than in the morning. In addition the short day treated insects ceased feeding and moved from the plants to the leaf litter beneath the plants after about 15 days. Males emitted the aggregation pheromone blend[b] at a rate approximately 100 times greater under long days than under short days. These laboratory based results suggested that dispersal, aggregation and mating would be dependent on long day photoperiods and thus developmental state in the field.

Dispersal and developmental state of *D. elongata* populations were monitored during two different years at two different field sites. First, at the Lovelock, NV release site beetles were monitored during the summer of 2003. Diapause was induced in early August and the expansion of the population slowed and ceased by August 25. At two field sites on the Colorado River the rate of tamarisk defoliation and the movement of beetles were

greatest in July and early August of 2006. By mid August the beetles had reached the full extent of their summer dispersal, defoliation slowed, and most of the population entered diapause.

Diapause-destined beetles still flew from defoliated areas to nearby areas that had green foliage. Using traps baited with green leaf volatiles[c] or with pheromone we found that the ecological context of diapause destined beetles dictated dramatically different responses to attractants. Adult beetles moving through defoliated areas were strongly attracted to plant volatiles and weakly attracted to the pheromone mixture. In areas adjacent to defoliated trees, where beetles were extremely abundant on green foliage, there was no attraction to either pheromones or green leaf volatiles.

From these results we conclude that reproductive adults are the main dispersal agents in this species. They show dispersal behavior even in the presence of green foliage and our observations indicate that they have at least two different dispersal modes; short distance reproductive swarming and long distance flights. These may be related to population density or resource availability; this is an area for further investigation. As adults enter diapause dispersal is limited to the search for green foliage. Hungry adults are attracted to green leaf volatiles and when they find suitable foliage they remain there, feed and eventually drop to the leaf litter for overwintering.

These results add to an understanding of dispersal in *D. elongata*. The shift in behavior that comes with diapause can be incorporated into predictive dispersal models. Collection of large numbers of insects for biocontrol implementation will be aided by a better understanding of when and where aggregations may be found.

[a]Bean et al. 2006. Environ. Entomol. in press.
[b]Cossé et al. 2005. J. Chem. Ecol. 26:1735-1748.
[c]Cossé et al. 2006. J. Chem. Ecol. in press.