# Mating behaviour of horehound plume moth: implications for Allee effects

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Simulation models suggest that, in the absence of stochastic environmental effects, the successful maintenance or growth of a population from intentional releases depends on four main factors: release numbers, mate finding distance, reproductive rate in the field and dispersal (Hopper and Roush 1993). This project was undertaken as a part of a larger effort aimed at facilitating efficient release of the horehound plume moth, *Wheeleria spilodactylus* (Curtis), for biological control of the noxious weed horehound, *Marrubium vulgare* L.. Two Ph.D. students at the University of Adelaide, Craig Clarke and Jeanine Baker, are currently collecting data on plume moth establishment, spread and population growth. However, the mate detection distance of the horehound plume moth was previously unknown.

An Allee effect occurs in a population when numbers of individuals decline below a certain threshold level (Hopper and Roush 1993). If numbers drop below this level, the population will be driven to extinction with a much higher probability. One type of Allee effect may occur when emerging adults disperse to a density at which males and females cannot communicate with one another. In this situation, individuals may be unable to find a mate and the population's reproduction rate will decline. The possible occurrence of this form of Allee effect, and the mechanisms of mate finding occurring in the horehound plume moth were the focus of this research project. This information should help to estimate critical minimum release numbers for this biological control agent.

Laboratory experiments indicated that females attract males from a distance with a sex pheromone. Field experiments were conducted with the aim of determining the mate detection distance of the horehound plume moth. Males were released from differing distances downwind from a calling female in order to find the distance from which they could locate her via upwind mate searching. The mate detection distance of *W. spilodactylus* was estimated to be 2–6 m. Males exhibited an unambiguous behavioural response to the female sex pheromone at 10 m downwind. Although males could perceive females at this distance, none successfully travelled the 10 m upwind to reach them. A mate detection distance of 10 m, if proven, would be at the extreme end of the mate detection distance for this type of insect.

The short mate detection distance of the horehound plume moth was combined with field data on its low rate of dispersal and reproduction (Clarke *et al.* 2000) as parameters in the model of Hopper and Roush (1993). The model predicted that very few individuals (in the order of 10 insects) should be needed to establish a new population. This information will be included in future release strategies to optimize the establishment of plume moth in the field.

## References

Clarke, C.R., Baker, J., Keller, M.A. and Roush, R.T. (2000). Biological control of horehound: lessons from South Australia. *Plant Protection Quarterly* 15, 29-32.

Hopper, K.R. and Roush, R.T. (1993). Mate finding, dispersal, number released, and the success of biological control introductions. *Ecological Entomology* 18, 321-31.