
David M. Gordon, Department of Biology, Pittsburg State University, Pittsburg, KS 66762  
Brian W. Thorp, Department of Environmental Science, University of California, Davis.

Abstract:

The study was conducted within what is now the Lamprey Lagoon Unit of the Humboldt Bay National Wildlife Refuge Complex on the North Spit of Humboldt Bay near Arcata, California between June 1989 and May 1990. The site included the least disturbed coastal dune system in the Northern Pacific Border Region.

Megachile (Scsmymonomorphae) vehicle-bred is a ground-nesting solitary bee that constructs a single, distinctive brood cell. Adults fly from mid-June to mid-September, producing one generation per year. The bee overwinters as a pupa in a tough cocoon buried 3-5 cm. below the surface. It was one of most abundant bees in the Preserve during the study. Overwintering mortality was examined with multiple treatment life tables. Marked brood cells were baited for two treatments that allowed or eliminated surface access. Five replicates included each early successional site, one in mid- and one late successional site adjacent to a young pine forest and one in a large clearing within the same forest.

Overall mortality was 95%, caused mainly by mammal predation (32%), a diapause failure bee, Coelius rufitarsus (Smith), caused the least mortality (4%). Hostile soil arthropods and "other causes" contributed mortality (3%). Each. Several weevil cocoons with dead larvae contained numerous dead Tyrophagus sp. mites. Eliminating mammal predation would reduce overall mortality to 34%. Total mortality varied among habitats. It was lowest (11-15%) in the sparsely vegetated pioneer succession, resulting mainly from "other causes," which were the main cause. The variation in mortality among sites and the impact of combinations of mortality agents is discussed.

Introduction:

The objective of this study was to assess the overwintering mortality of the brood of Megachile (Scsmymonomorphae) vehicle-bred with particular interest in nest predators and the impact of predator removals. Previous studies suggested that diapause bees and bee, fungal infections and small mammals (particularly rodents and gophers) would be the main mortality agents (Gordon 1984, 1992, 2000).

Materials and Methods:

Study Organism. Megachile vehicle-bred is a ground-nesting solitary bee that constructs a single, distinctive brood cell. Adults fly from mid-June to mid-September, producing one generation per year. The bee overwinters as a pupa in a tough cocoon buried 3-5 cm. below the surface. It was one of the most abundant bees in the Preserve during the study. Overwintering mortality was examined with multiple treatment life tables. Marked brood cells were baited for two treatments that allowed or eliminated surface access. Five replicates included each early successional site, one in mid- and one late successional site adjacent to a young pine forest and one in a large clearing within the same forest.

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Study Site.

The study was conducted within the boundaries of the original Lamprey-Christensen Dunes Preserve on the North Spit of Humboldt Bay near Arcata, California between June 1989 and May 1990. The site included the least disturbed coastal dune system in the Northern Pacific Border Region.

Mammal predation. Mammal overwintering brood nests were examined between mid-September 1989 and mid-May 1990. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

Background mortality for diapause-failing bees was determined because brood cells from the experimentally baited plots were classified as mortality. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

Results:

The big surprise was the amount of mortality inflicted by soil arthropods that are probably feeding on buried bee larvae. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

Analysis of Mortality. Multiple life table analysis (Carey 1989) were used to partition the mortality caused by several agents acting together and to predict the mortality that would result from various combinations of agents by eliminating specific causes of death. From the life tables were plotted into two or six access allowed or not allowed.

Mortality Agents:

Parasite. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

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Other Potential Predators and Parasites. Mutilid and chrysidid wasps have been collected in the dunes and bombilid flies are common in the dunes. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

Summary and Conclusions. This study focused on the mortality in the overwintering brood. Rodent predation is the major cause of mortality in overwintering brood in some dune habitats, but minor or non-existent in pioneer succession habitats. Because missing brood was attributed to removal by mammals, mammal mortality may be slightly overestimated and "other" mortality slightly underestimated.

Acknowledgments.

Lamprey-Christensen Dunes Preserve manager and the Preserve's Humboldt State University Research Advisory Committee granted permission to work on the Preserve. Berlin Smith, Jeanne T. Doyen, Doyen and Locke, Doyen and Locke, and Locke and Eickwort helped with data collection. John Neves took radiographs of several of the brood cells. Mortality in brood cells containing dead larvae in pollen and cocoons was classified as "other" causes. Mortality in brood cells containing dead larvae in cocoons was classified as "other" causes. Mortality in brood cells containing dead larvae in cocoons was classified as "other" causes. Mortality in brood cells containing dead larvae in cocoons was classified as "other" causes.

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