Bombus spp. in New Zealand

Revising the distribution of *B. hortorum* and investigating the nesting behaviour of *B. terrestris*

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Abstract

Four species of bumblebee have been introduced to New Zealand: *Bombus terrestris, B. ruderatus, B. hortorum* and *B. subterraneous*. They were shipped to the South Island from England in the late 1880s where they quickly established in the Canterbury region. The purpose of their introduction was to facilitate pollination of red clover as very little seed was being set with only the honey bee *Apis mellifera* (also introduced) and New Zealand's small native bees present. Their success in the South Island led to introductions into the North and all but *B. subterraneous* are now present in the North Island.

The bumblebee's ranges and abundances vary between species. *B. terrestris* is ubiquitous in both islands, *B. ruderatus* is found almost everywhere but in lower densities than *B. terrestris, B. hortorum* has been reported as being present only in the South Island, Wellington and Manawatu regions and *B. subterraneous* has a very restricted range in the Canterbury region.

Recent sightings suggested *B. hortorum* was occupying a larger range than reported and this was investigated in the present study. *B. hortorum* and *B. ruderatus* share a cryptic morphology making them almost impossible to differentiate. A new tool has been developed allowing their distinction using a digestion site present in the mitochondrial DNA of *B. hortorum* but not *B. ruderatus*. Specimens from around the country had DNA extracted using the HotSHOT protocol then were subjected to digestion using the Tsp45I enzyme. This led to confirmation that the range of *B. hortorum* does extend into the Waikato region. Further research is needed to determine exactly how far north the species spreads.

Bumblebees are important pollinators of many plants, not just red clover, and the ability to increase population densities in areas growing certain crops is desirable. One way to achieve this is by providing queens with artificial nesting sites known as domiciles. Studies conducted so far on domiciles show large variations in results but most often they are not selected preferentially by queens and do little to increase nest densities, especially for *B. terrestris*. By learning more about what attracts *B. terrestris* queens to natural nest sites the design and placement of domiciles may be altered to encourage higher nest establishment rates.

The present study used random transect walks across field sites in the Netherlands and New Zealand to look for queens exhibiting nest search behaviour. Each time a queen was encountered various pieces of information were recorded about her movements and location. The study culminated with the conclusion that *B. terrestris* queens displayed a preference for searching under trees, more specifically, mixed forest plots in the Netherlands and evergreen trees in New Zealand. They also seemed drawn to areas with moss and leaf litter as the primary ground cover. This information can be applied to domicile design and placement to see if higher nest acceptance rates can be achieved than in previous research.

Also considered as part of this research was the efficacy of radio telemetry tracking of queens to help locate early nests in the wild. Five queens were successfully tagged with 0.2 gram miniaturised radio transmitters in the Netherlands but only one nest site was located. No queens were tagged and tracked in New Zealand. Continued advances in technology relating to radio telemetry may allow the methodology to be more useful in the future.

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"Let us be grateful to the people who make us happy,

they are the charming gardeners who make our souls blossom."

- Marcel Proust

Thesis Structure

This thesis is divided into 5 chapters: a general introduction, three research chapters written in the form of stand-alone papers and a final chapter of general conclusions and recommendations.

Due to presenting chapters two, three and four as separate entities there is some repetition between introductions and conclusions.

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