

Narrow pollen diets are associated with declining Midwestern bumble bee species

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Abstract. Many species of bumble bee (*Bombus*) have declined in range and abundance across Europe, the Americas, and Asia, whereas other species have persisted and remain common and widespread. One explanation as to why some species have declined, based primarily on studies of the European bumble bee fauna, is that declining species have relatively narrow pollen-foraging niches and are less able to use alternative host plants in the absence of their preferred hosts. Though extensively explored in Europe, this hypothesis has not been investigated in North America, in part due to incomplete information on the foraging niche of many species. We selected 12 bumble bee species found in Michigan and quantified their pollen diets using museum specimens. We also extensively resurveyed the state to understand their contemporary status and distribution. Compared to a pre-2000 baseline, six species remain relatively common and widespread, whereas six species show range contractions of over 50%. There was a significant relationship between dietary breadth and distributional range change, with declined or declining species collecting around one-third fewer pollen types than stable species. Though there were significant compositional differences, we found no differences in the number of pollen types collected by species with differing tongue lengths. Overall, these results support the hypothesis that species with narrower dietary niches are at greater risk of decline. However, it is not clear if narrow dietary niches are a cause of declines, or if both are driven by an underlying factor such as proximity to the edge of climatic niches. Further research is needed to improve our understanding of dietary niche in bumble bees, and how it interacts with other factors to influence population trajectories of stable and at-risk species.

Key words: dietary specialization; Fabaceae; introduced weeds; low-intensity agriculture; niche breadth; pollen analysis; tongue length.

INTRODUCTION

Bumble bees (*Bombus* species) are a moderately large genus of eusocial or socially parasitic bees containing around 250 described species globally (Williams et al. 2008). They are found predominantly in the Northern

100 yr. In Europe, bumble bee species began to decline dramatically after the Second World War, particularly in more agriculturally intensified regions (Williams 1982, Kosior et al. 2007, Casey et al. 2015). In North America, regional declines have been reported from southern Ontario (Colla and Paquer 2008), Illinois (Gristi et al.