Relationship of Common Foxglove and the long-tongued Garden Bumblebee in the U.K.

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Lay Summary of: Broadbent AAD, Bourke AFG (2012) The bumblebee *Bombus hortorum* is the main pollinating visitor to *Digitalis purpurea* (Common Foxglove) in a U.K. population. *Journal of Pollination Ecology* 8: 48-51.

To understand the relationship between plants and their pollinators fully, it is important to know the degree to which plant-pollinator systems are specialized. For example, if populations of pollinators decline, plants that rely on just one or a few pollinating species for pollination will be more prone to extinction than plants with many pollinating species.

Bumblebees (*Bombus* spp) are key pollinators of wildflowers and food crops in temperate regions. However, in both Europe and North America, several bumblebee species have declined severely because of agricultural intensification and other factors. Bumblebee species with long probosces (tongues) seem particularly hard hit, and yet these species represent an especially important group in conservation terms. This is because wildflowers and food crops with deep flowers (long corollas), whose nectar can only be easily accessed by long-tongued bees, may not receive effective pollination in their absence.

We therefore studied the nature of the relationship between the Common Foxglove (*Digitalis purpurea*), which has flowers with long corollas, and its pollinators. Common Foxglove is a well-known wildflower that typically occurs in woodland and hedgerows in stands of strikingly tall flowering spikes, each one bearing a large number of elongate, bell-shaped pinkish-purple flowers. It is widespread in its native Europe and Asia and has been introduced to other parts of the world such as North America. Various studies have shown that it is dependent on insect pollination for reproduction. These attributes make Common Foxglove a potentially valuable species in which to investigate plant-pollinator specialization.

We studied flowering patches of Common Foxglove in woodland, parkland and gardens in North Yorkshire, U.K., and found that the main pollinating visitor was the long-tongued bumblebee *Bombus hortorum*, or Garden Bumblebee. This one species accounted for 82–92% of all insect visits to the study plants (out of nearly 1700 insect visits recorded). The next most frequent visitor was the Common Carder Bee, *Bombus pascuorum*, and, together, *B. hortorum* and *B. pascuorum* accounted for 95–99% of all insect visits to the Foxgloves. In contrast to all other bees, *B. hortorum* showed a significant preference for visiting Foxgloves over other flowering plants in the surrounding area. These findings suggest that *B. hortorum* is Common Foxglove's main pollinator in the study population. *B. hortorum* is known to visit other plants with long corollas, so its relationship with Common Foxglove is not symmetrical, in that the plant appears to rely heavily on the bee but the bee does not appear so heavily reliant on the plant.

Because *B. hortorum* and *B. pascuorum* have the longest and second longest tongues, respectively, among the common U.K. bumblebee species, our findings also suggest that Common Foxglove relies on long-tongued bumblebees for pollination. Hence, although Common Foxglove is not of conservation concern, these bumblebees are likely to play a major role in the viability of its populations. More broadly, if other species of flowering plants with long corollas likewise exhibit asymmetric, specialized relationships with long-tongued bumblebees, they too would be vulnerable to the effects of declines in these bees.