

Sonication, or Buzz Pollination: Selection of Preferred Forage for Buzz Pollinators

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Nutritional Requirements of and Pressures on Pollinators

Bees and other arthropods pollinate the majority of flowering plant species and play a crucial role in pollination of many agricultural crops. As demand for food production and agricultural intensification increases, so also does the need for pollination services places growing pressures on wild native bees.

Bees, like all foraging animals, must obtain appropriate sustenance and nutrients for growth, development, and reproduction. This is especially true not only during but both before and after the bloom periods of crops requiring bee pollination. Research has linked declines in pollinator populations to reductions in diversity and abundance of forage species, which place bees under nutritional stress.



Penstemon digitalis (Foxglove beardtongue)

The bumblebee species *Bombus impatiens* – one of the largest contributors to sonication pollination of crops – meets its specific fat-protein-carbohydrate macronutrient ratios by selectively foraging among different plant species and pollen sources (Vaudo *et al.*, 2016). *Bombus impatiens* discriminate among plant species based on pollen nutritional qualities, using ratios of such macronutrients as proteins, lipids, and carbohydrates presented by the flowers as their basis for selection. When foraging in the same landscapes, bumblebees forage preferentially upon plant species with higher protein content than do honeybees (*Apis mellifera*) (Leonhardt & Bluthgen, 2011). As a result, the preponderance of lists developed by conservation organizations, academics,

government agencies, and lay people that recommend the same selection of plants for both bumblebees and other pollinators do not take into consideration the distinct foraging behaviors and specific nutritional needs of bumblebees and other sonication pollinators.

Common garden experiment

In 2018 we planted a common garden at the University of Connecticut Research Farm at Storrs, CT, to determine which native plant species buzz pollinators prefer as forage. The garden included 43 species of flowering forbs native to the New England region as well as near-



Pycnanthemum muticum (Broad-leaved mountain-mint)

native species – species native to the regions in close proximity to the New England region.

As it is important to have forage resources for pollinators throughout the growing season, we divided the growing season into three bloom periods: Early (mid-May to late June), Middle (mid-May to late June), and Late (mid-August to late September). The following plant species were visited by the largest number of *Bombus* spp. during our study in 2019 and they can be recommended for inclusion into the buzz pollinator habitats to achieve maximum return on investment. However, our data are derived from one year of data collection and additional observations are recommended to confirm these results.



Symphyotrichum cordifolium (Heart-leaved American-aster)

Table 1. Plant species recommended for the inclusion into the buzz pollinator habitats

Botanical name	Common name	Bloom periods	Native to New England	Attracts Beneficial insects
<i>Coreopsis lanceolata</i>	Lance-leaved tickseed	Early	near-native	
<i>Penstemon digitalis</i>	Foxglove beardtongue	Early	yes	
<i>Zizia aurea</i>	Common golden Alexanders	Early	yes	yes
<i>Agastache foeniculum</i>	Lavender giant-hyssop	Middle	near-native	
<i>Agastache scrophularifolia</i>	Purple giant-hyssop	Middle	yes	
<i>Eryngium yuccifolium</i>	Button eryngo	Middle	near-native	
<i>Eupatorium perfoliatum</i>	Boneset thoroughwort	Middle	yes	yes
<i>Monarda fistulosa</i> *	Wild bee-balm, wild bergamot	Middle	yes	
<i>Pycnanthemum tenuifolium</i>	Narrow-leaved mountain-mint	Middle	yes	
<i>Pycnanthemum muticum</i>	Broad-leaved mountain-mint	Middle	yes	
<i>Senna hebecarpa</i>	Northern wild senna	Middle	yes	
<i>Chelone glabra</i>	White turtlehead	Late	yes	
<i>Cirsium discolor</i>	Field thistle	Late	yes	
<i>Lobelia siphilitica</i>	Blue lobelia, great lobelia	Late	yes	
<i>Solidago speciosa</i>	Showy goldenrod	Late	yes	
<i>Symphyotrichum cordifolium</i> **	Heart-leaved American-aster	Late	yes	
<i>Symphyotrichum lateriflorum</i>	Calico American-aster	Late	yes	yes

* Tendency to spread rapidly, overtaking and dominating plantings **Suitable for partial shade

References:

Leonhardt, S.D. and Bluthgen N. 2011. The same, but different: pollen foraging in honeybee and bumblebee colonies. *Apidologie*. 43:449–464.

Vaudo, A.D., Patch, H.M., Mortensen, D.A., Tooker, J.F. and Grozinger, C.M. 2016. Macronutrient ratios in pollen shape bumble bee (*Bombus impatiens*) foraging strategies and floral preferences. *Proceedings of the National Academy of Science* 113(28).