The plants visited by bees in Canada, with focus on *Eucera pruinosa* Say, 1837 (Apidae, Eucerini)

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Introduction

This study was partially developed on Peter Kevan's laboratory, at the School of Environmental Sciences, University of Guelph (Figure 1). Peter Kevan's studies have been concentrated on applied ecology in terrestrial ecosystems from the far northern Arctic to the tropics. The work has focused especially on insect and plant interactions, notably pollination ecology in both natural and agricultural settings, and some emphasis in plant protection, plant reproductive biology and pollinator behavior. The overall thrust has been elucidation and use community functionality for basic evolutionary ecological understandings and application to "ecological intensification" a.k.a. "ecosystem stacking". Most recently, the work has been on apivectoring (using managed pollinators to disseminated biocontrol agents to crop plant flowers to protect them, and the crop, from pests (fungi to insects; Kevan et al. 2020a) and on micrometeorology within plants' stems, fruits and flowers (Kevan et al. 2020b).

The first author worked as a post-doctoral fellow on Peter Kevan's laboratory in 2017 and 2018, developing the project "The role of *Cucurbita* spp. (Cucurbitaceae) microclimate and floral morphology in their interaction with *Eucera pruinosa* Say (Apidae, Hymenoptera)". Although it was not exactly related to the main question of her study, she knew squash bees (*E. pruinosa*) are known to be oligolectic, collecting pollen only mostly from *Cucurbita* species

Figure 1. The building where Peter Kevan's laboratory is located at the School of Environmental Sciences at University of Guelph.

(Hurd and Linsley 1964). During field work on agricultural areas, squash bees were observed visiting the flowers of various plant species (Figure 2) other than *Cucurbita pepo* (Figure 3). The first author was intrigued by the lack of information on which the flowers of non-*Cucurbita* plant species that are visited by those bees for nectar (Hurd and Linsley 1964), reasoning that because those nectar sources may be important energy sources for the maintenance of squash bees in agricultural areas.

Material and Methods

To evaluate the diversity of nectar sources of squash bees, males and females were collected at 9 sites (Table 1) in Ontario, Canada. The sites are within ecoregions whose lands have been heavily converted (from around 60% to 80%) into cropland, pasture and urban areas. In fact, these ecoregions are the most densely populated, urbanized and industrialized in Ontario. Where natural vegetation remains, the forest cover includes deciduous, conifer-

Figure 2. Some of the plants visited by squash bees. A - C) Male on an Asteraceae. D - E) Female on Asteraceae. F) Female (bottom) and male (upper) on chicory flowers.

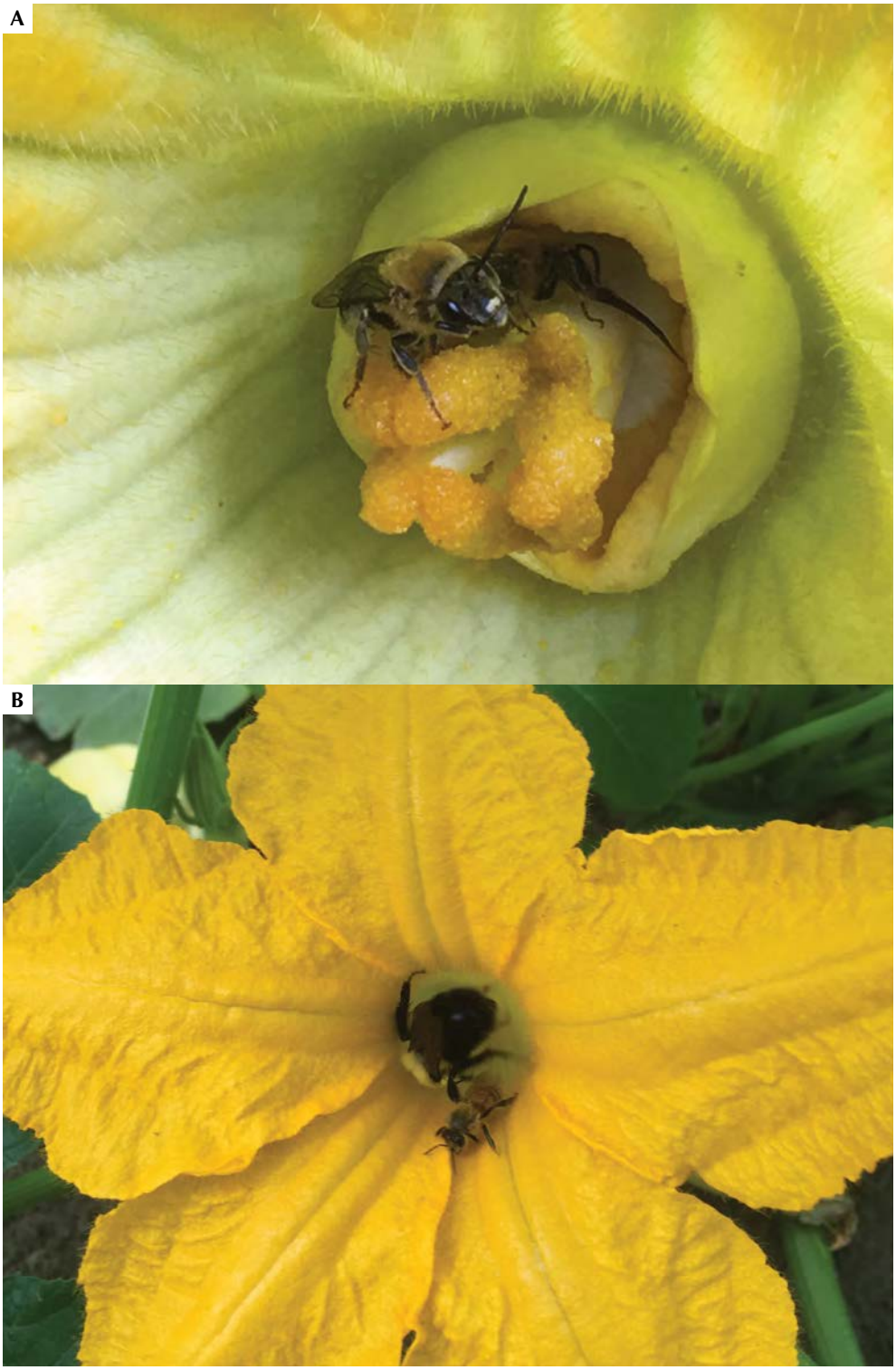

Figure 3. *Cucurbita pepo* flower. A) Squash bee males. B) Bumble bee (*Bombus impatiens*) and honey bee (*Apis mellifera*).

Table 1. Collection sites, geographical coordinates and number of bees collected in each site (N).

Locality	Sites	Geographical coordinates	N
Aylmer	Howe Family Farm	42°43′55.1″N 81°00′25.0″W	53
Guelph	Strom's Farm and Bakery	43°29′51.5″N 80°17′35.1″W	47
Alvinston	-	42°48′23.5″N 81°51′53.6″W	20
Janetville	Lunar Rhythm Gardens	44°08′20.1″N 78°41′46.3″W	24
Indian River	-	44°20′04.8″N 78°08′11.4″W	20
Lakefield	Buckhorn Berry Farm	44°32′23.0″N 78°18′22.7″W	30
Little Britain	StellMar Farm	44°14′36.0″N 78°46′32.8″W	24
Zephyr	Cooper's CSA Farm & Maze	44°08′52.0″N 79°15′06.7″W	23
Petersburg	Shantz Family Farm	43°23′46.5″N 80°34′15.2″W	37
	Total		267

ous, and mixed forest (Crins et al. 2009). All sites were agricultural farms (Figure 4).

Squash bees were collected as they visited flowers of *Cucurbita pepo* and other plant species in the study areas. They were stored in 2mL Eppendorf tubes and kept on ice during transport to the laboratory. There, after being woken up, they were washed, according to Silva et al. (2010), for pollen removal from their bodies (Figure 5) and stored in another 2mL Eppendorf tube. Both the body pollen and the bee specimens were preserved in 70% ethanol solution. The bee specimens were used for other studies, which included the removal of body parts and because of that were not deposited in any entomological collection.

The preparation of the pollen collection from the flowers of *C. pepo*, other plants, and from the bee's bodies followed the protocols described by Silva et al. (2014). For making pollen reference slides, non-dehisced anthers of the blooming plants present on the sites were collected. Pollen slides were deposited on the RCPol pollen collection (www.rcpol.org.br). A branch containing flowers and leaves of each was also collected and pressed. The exsiccates were prepared by the team of the herbarium, following standard methods, and deposited at the BIO (Biodiversity Institute) Herbarium at the University of Guelph. A total of 33 plants were surveyed.

Results

We found 71 pollen types on squash bees' bodies, always at very low amounts (around 4 pollen grains per bee). Of those, 67 are not *Cucurbita* pollen grains, demonstrating that squash bees visited several other plants species (Figure 2), presumably for nectar, which may be important for their survival on such anthropogenically disturbed areas.

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Figure 4. Some of the collection sites. A) Guelph. B) Petersburg. C) Aylmer.

Figure 5. Squash bee male during pollen washing.

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