Native Bees that Pollinate Wild Blueberries

The goal of this fact sheet is to familiarize wild blueberry growers with the main native bees involved in blueberry pollination.

Introduction

Native or wild bees were once able to supply the pollination needs for wild blueberry fields. However, as fields have developed, the need for pollination services from alternative bees has emerged. Fields have filled in and become larger, crop management though the use of fertilizer and pest management as increased stem density and the number of flowers per area which influence the need for pollination.

Native bees still play an important role in wild blueberry pollination, but are now often supplemented with commercially managed bees, such as honey bees, alfalfa leafcutter bees, and bumble bees.

There are nearly 200 different species of native bees in the Maritimes, approximately 1,000 across Canada, roughly 4,000 in North America, and about 20,000 known bee species worldwide. More than 75 species are known to visit wild blueberry in the Maritimes (Sheffield et al. 2003).

At least 23 different bee genera have been observed in wild blueberry ecosystems in the Maritimes throughout the season (not just during blueberry pollination).

In New Brunswick, both social and solitary bees are present.

Native bees often have adaptations to make them effective and efficient at foraging, and thus pollinating, wild blueberries. Bumble bees (Figure 1), for example, have large bodies to move pollen from flower to flower, and are well-adapted to cooler temperatures associated with the early pollination season of wild blueberries. Bumble bees are also able to buzz pollinate or perform ‘sonication’- this involves shaking the flowers, which is an advantage to release pollen in blueberry’s poricidal anthers.

Fig. 1. A bumble bee visits wild blueberry flowers- note the enormous pollen loads on her back legs.

The efficacy of various blueberry-visiting bees has been studied. Native bees including bumble bees, andrenid bees, and halictid bees were found to be more effective at pollination than the managed honey bees and leafcutter bees (Figure 2, Javorek et al. 2002). Furthermore, bumble bees visit more flowers per minute and have greater success of pollination than honey bees. Native bees are also able to carry greater pollen loads and deposit more pollen grains per minute than other bees recorded (Javorek et al. 2002; Moisan-Deserres et al. 2014). Monolectic behaviour (visiting only one type of flower) was recorded for certain *Andrena* species (Moisan-Deserres et al. 2014). Although andrenid bees are smaller than bumble bees, their ability to enter the blueberry flower and potentially carry more pollen per unit of body size, paired with their loyalty to blueberry, make this bee a valuable pollinator of wild blueberries.

Table 4. Pollination rate equivalency matrix for bees foraging at *Vaccinium angustifolium*

Taxa	1	2	3	4	5	6	7	8
1. *A. mellifera*	1.0	—	—	—	—	—		
2. *M. rotundata* (♂)	0.4	1.0	—	—	—	—	—	—
3. *M. rotundata* (♀N)	0.4	1.1	1.0	—	—	—	—	—
4. *M. rotundata* (♀P)	3.4	9.3	8.1	1.0	—	—	—	—
5. *Bombus* spp. (Q)	6.5	17.7	15.5	1.9	1.0	—	—	—
6. *Bombus* spp. (W)	5.4	14.7	12.9	1.6	0.8	1.0	—	—
7. *Andrena* spp.	3.6	9.9	8.6	1.1	0.6	0.7	1.0	—
8. *Halictus* spp.	2.7	7.4	6.5	0.8	0.4	0.5	0.8	1.0

Pollination rate comparisons with taxa occupying the highest column tier represented down columns as the equivalent number of flowers pollinated per unit time as the taxa in the far left column. N, nectar; P, pollen; Q, queen; W, worker.

Fig. 2. Table from Javorek et al. 2002.

Although there are many native bees found in wild blueberry ecosystems, this fact sheet will focus on four important groups: bumble bees, andrenid bees, halictid bees, and mason bees.

Bumble bees

Bumble bees exist in mostly a social phase, in a colony of approximately 150-300 individuals. A mated queen emerges in the spring and proceeds to forage for food and a nest. It is typically the queen bumble bee that is involved in wild blueberry pollination due to the timing of her emergence, as many of her offspring do not emerge until later in the season, although some workers may be present at the end of pollination. In the late summer, many females are produced to become future queens. They mate with males and overwinter in a nesting location, often underground or in an abandoned mouse nest.

Fig. 3. Queen bumble bees foraging on wild blueberry flowers in New Brunswick, 2018.

Life cycle. Bumble bees (Figure 3) have an annual colony cycle that begins early in the spring when overwintered queens emerge from their hibernation sites in the soil to feed on spring flowers and search for a suitable location (often a former rodent nest) for the new colony. Once the site has been found, the queen collects pollen, forming it into a lump upon which she lays her first brood of 7 or so worker eggs. The eggs hatch soon after, and begin feeding on the pollen lump, and on additional pollen and nectar collected by the queen. Adults emerge from a short pupation about 21 days after the eggs are laid. This first group takes over pollen and nectar collection while the queen continues to lay successive waves (broods) of worker eggs. By mid-summer, a colony contains between 20 and 300 workers, depending on the species. It is around this time that the colony begins to produce males and queens. The new queens leave the nest, and after mating

dig 5-10 cm into the soil for hibernation (Figure 4). As autumn approaches, the remainder of the colony declines and dies. The hibernating queen emerges the following spring to begin the cycle again.

Fig. 4. A bumble bee nest entrance in an old hay field.

Rearing bumblebees. Several bumble bees species have been commercialized globally, including *Bombus impatiens*. Although not native to our region, this species is now considered a 'wild' bee, as it has moved its range into the Maritimes. Blueberry growers are now able to order bumble bee colonies, or 'quads' (a box comprised of four colonies) to place in their fields to supplement pollination (Figure 5).

Although bumble bees are important pollinators of wild blueberry, their season-long lifespan means they require food sources from early spring (April) until October. Plants such as willow, clovers, roses, fireweed, St. John's wort, goldenrod, dandelion, vetch, raspberries, blackberries, rhodora, and asters provide varying levels of nutrition, and pollen and nectar sources throughout the season. By maintaining hedgerows and field edges for bees and leaving these areas undisturbed or enhancing the floral composition, bumble bees can enjoy food and habitat sources in close proximity to blueberry fields. Woodpiles, old buildings, brush piles, and old hay fields are all examples of habitats that bumble bees will nest in.

Fig. 5. Example of a commercial bumble bee quad (four colonies per box).

Andrenid bees

Common solitary native bees in wild blueberry pollination include the andrenid bee (*Andrena* species). Males emerge slightly before the females in the spring. Once both sexes emerge and mate, the female forages for pollen and locates a nest to lay and provide for her offspring. Lifespans of these solitary bees rarely exceed 4-6 weeks. Ground nesting bees including andrenids will seek out sandy, warm soil while many mason bee species will seek out plant stems or sticks to lay their eggs. Solitary bee females typically live alone in a nest of her own construction

Fig. 6. Various *Andrena* bees foraging on wild blueberry flowers in New Brunswick, 2018. Note the telltale black, teardrop-shaped abdomen.

which she provisions with no cooperation from other females, but some species nest in close proximity to one another, forming aggregations.

Life cycle. Andrenid bees ("digger bees" or "mining bees" as they are also referred) are solitary ground nesters (Figure 6). They are important pollinators of wild blueberry both in number and pollination effectiveness. Both adult males and females of certain species emerge before blueberry bloom from nests constructed the previous season. After mating, the female excavates a burrow in the soil that consists of an entrance similar to that of an anthill, a vertical shaft and a series of lateral tunnels terminating in brood chambers. These burrows may be as deep as 45 cm (18 inches). Within the burrow, the female applies a waterproof lining to the walls of the brood chamber, then lays an egg on a mass of pollen and nectar. This mass sustains the larva until the fall, when bees reach the overwintering adult stage. Early in the spring, the bees emerge from the ground to begin the cycle again. Digger bees often nest within wild blueberry fields, choosing sites that have sandy well drained soils and some protective cover by vegetation. The choice of suitable sites often means that several nests are dug relatively close to each other.

Although Andrenid bees are able to forage on a wide variety of plants, they tend to remain loyal to blueberry once they have begun to forage on it.

Halictid bees

Life cycle. Halictid bees are often called sweat bees because some species are attracted to human perspiration during hot weather. These small bees share a life cycle similar to that of andrenid bees. The female halictid excavates nests in the soil, with burrows consisting of a horizontal shaft and a series of brood chambers. There are several variations on the nest architecture. The lining of the halictid brood cells have a shiny, varnish-like finish.

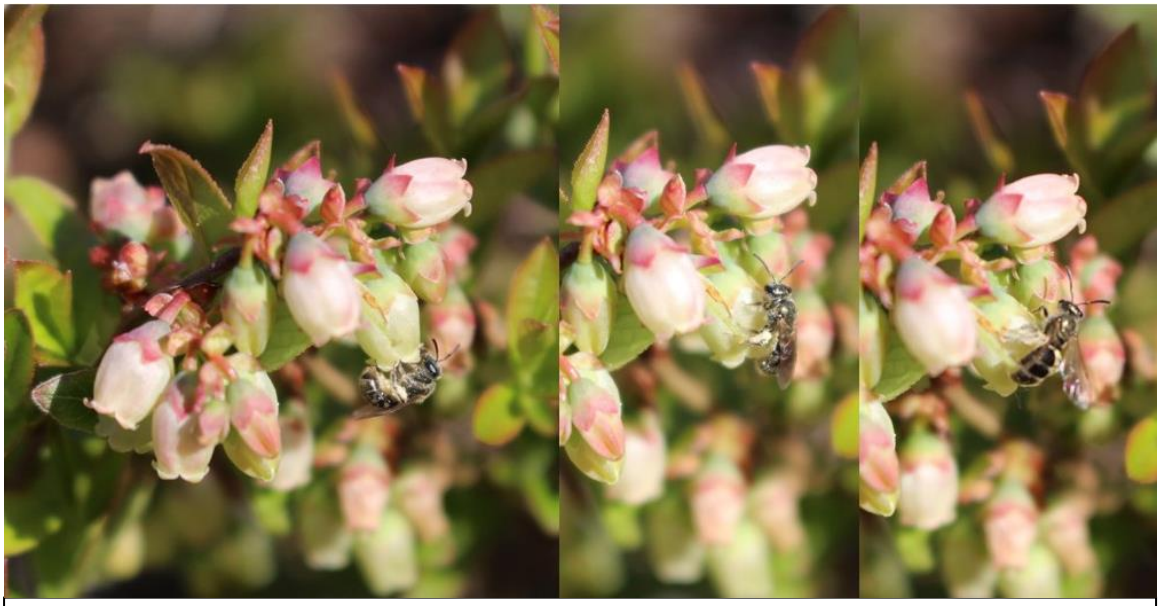

Fig. 7. Bees from the Halictidae family visiting wild blueberry flowers in New Brunswick, 2018.

Mason bees

Life cycle. Though *Osmia* bees (or mason bees as they are commonly called) are not common bees in many NB wild blueberry fields, they are efficient pollinators of the crop. Studies in Maine wild

blueberry fields suggest that their numbers can be increased by trap nesting. Some *Osmia* bees are used as commercial pollinators in Japan, Europe and the US. In Eastern Canada, these bees fly for about 7 or 8 weeks each spring. Females make nests in pre-existing burrows such as those made by bark beetles in dead trees. A nectar-pollen mass is placed toward the end of the tunnel and an egg is deposited on this mass. This cell is then sealed with a thin partition of chewed leaf material, and the female constructs 7 or 8 such cells. The last of these is sealed with a plug. After hatching, the larva feed for approximately 3 weeks, at which time they spin a cocoon. The larvae pupate 2 to 3 weeks later, reaching their adult overwintering stage by late summer. They emerge the next spring to mate and begin the life cycle again.

Fig. 8. Examples of trap nests for mason bees: milk carton top left, wooden top right, overturned clay lids bottom.

Mason bees may take well to certain man-made nesting sites, but this depends on their existing population levels. Some surveys of blueberry fields have found mason bees to be relatively rare (Cutler et al. 2015). Mason bee nests have been made in a variety of forms, including wooden nests, milk carton nests, and clay lids. These can be cut in a variety of forms (figure 8), with a tunnel depth of approximately 15 cm (six inches) and a hole size of approximately 8 mm (5/16 inches). These should be drilled with a sharp bit to ensure a smooth surface. To prevent mold or fungus build-up, cellophane-coated paper tubes should be inserted inside of the tunnels. The blocks should be mounted at eye-level along field edges on trees or buildings, with a southeast orientation so as to capture morning light. The blocks can be brought inside in October and stored at 2 – 4 °C (35-40° F) to improve winter survival.

Mason bees appear to enjoy the presence of other plants as well as wild blueberry. These include willow, shadbush, strawberries, cinquefoil, raspberry, clovers, violet, and many of the spring-flowering plants found in the understory of hardwood forests.

By increasing awareness of native bees present in wild blueberry fields, growers can make informed decisions about adding managed bees to achieve optimal pollination.

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Revised: Robyn McCallum and Sawyer Olmstead, Atlantic Tech Transfer Team for Apiculture (ATTTA).
Photos by Robyn McCallum.

Identifying Bees

Bee	Scientific Name	Size	Coloring	Other Features	Nesting Type
Andrenid bees	*Andrena* (Andrenidae family)	7-15 mm	Black (tear drop shaped abdomen)	Some hair on thorax (appears similar in size and hairiness to bumble bee, but is smaller)	Solitary (ground nester)
Bumble bees	*Bombus* (Apidae family)	Queens = 13-28 mm, workers = 5-20 mm	Varying patterns of black, yellow, white and red (appears orange)	Lots of hair all over body	Mostly social phase; nests underground in colonies
Halictid bees	*Halictus, Lasioglossum* (Halictidae family)	3.5-15 mm	Varying colors of black, metallic green, or striped black and white abdomens	Certain species have hair	Solitary ground nesters
Honey bees	*Apis mellifera* (Apidae family)	12 mm	Golden orange; some are darker	Some hair	Social; live in managed hives in Canada
Mason bees	*Megachile, Osmia* (Megachilidae family)	8-15 mm	Osmia are metallic blue- green; Megachile more likely to be black with yellow-white bands on abdomen	Some hair	Solitary; nest in abandoned twigs. One species, *Osmia inermis*, will nest under rocks.