

## 32. Bumblebees as Complementary Pollinators in Wild Blueberry Fields

### INTRODUCTION

Bumblebees are insect pollinators of the genus *Bombus* that exist in the wild (native bumblebees). While native bumblebees are excellent pollinators of wild blueberries, intensive cultivation requires greater numbers of pollinators for production to be profitable.

Years ago, blueberry producers turned to the domestic bee (honeybee) to optimize the pollination of their crop. However, in recent years it has become difficult to obtain a sufficient supply of honeybees, so producers have been looking for other options. Domesticated bumblebees are now being used as a complement to honeybees in blueberry production.

### NATIVE BUMBLEBEES

In a study conducted from 2004 to 2008, eight species of bumblebees were identified in the blueberry fields of Saguenay–Lac-Saint-Jean (Figure 1).

#### Life cycle of the native bumblebee

The native bumblebee lives by an annual cycle, meaning that colonies are recreated each year. The cycle begins in the early spring, when the queens leave their hibernation burrows to forage and seek an appropriate location to start a new colony. The site chosen is often an old rodent nest. Once she has chosen a site, the queen gathers pollen, depositing it in a pile on which she will lay seven eggs; these in turn will become workers. After hatching, the young workers feed on the pollen and nectar prepared by the queen. Passage from the pupal to the adult stage occurs around 21 days after the eggs were laid. Now the workers take over the gathering of pollen and nectar to supply the colony with food, while the queen continues laying successive masses of worker eggs. By mid-summer, a colony will contain 20 to 100 workers depending on the species. This is when the colony starts to produce males and queens. The young queens leave the nest, and after mating, burrow into the ground to a depth of 5 to 10 cm to hibernate. At the approach of autumn, the rest of the colony declines and dies. The hibernating queens emerge from the ground the following spring and begin the cycle anew.

### DOMESTICATED BUMBLEBEES

The species of bumblebee called *Bombus impatiens* cresson, which is native to Québec, has been domesticated for commercial use on crops. The northern limit of its range used to be Québec City, but it is increasingly found further north.

When bumblebees are domesticated for use on crops, they are supplied either in individual mini-hives or in “quads” of four mini-hives.

#### Effectiveness of domesticated bumblebees

Studies of *B. impatiens* have been conducted in Québec and Maine. In research by the Université du Québec à Montréal, it was found that ensuring an optimal density of bumblebees in a blueberry field resulted in a 10% increase in fruit set. The principal reason for the improvement is that pollination by *B. impatiens* increases the number of seeds per fruit (i.e. increases pollination effectiveness), thereby increasing the weight of each blueberry. The same research team also showed that *B. impatiens* is very well adapted to the climatic conditions of experimental blueberry fields in Saguenay–Lac-Saint-Jean. The only conditions that affected it negatively were temperatures below 10 °C and weak solar radiation at dawn and dusk. The active period of *B. impatiens* lasts 13 hours a day, which is considered high. One recommendation resulting from this study was that the distance between groups of mini-hives be no greater than 300 m.



Figure 1. Native bumblebee  
Source: Ève-Catherine Desjardins, CRLB

## 32. Bumblebees as Complementary Pollinators in Wild Blueberry Fields

In a study comparing bumblebees and honeybees, the University of Maine found no significant difference in their effectiveness for pollinating blueberry fields. In Québec, a mini-hive of bumblebees will contain 60 to 120 individuals, compared to 30 000 to 45 000 individuals in a hive of honeybees. However, only some of the honeybees are foragers, and strong colonies are not always available in spring.

The advantages of the bumblebee as a pollinator are considerable, despite its lower numbers:

- it moves more quickly from flower to flower;
- it uses buzz pollination to make the flower vibrate, causing it to release more pollen for deposition;
- it achieves a higher percentage of fruit set than the honeybee, and more large seeds per blueberry (increasing their weight and advancing their maturity);
- it displays much greater “flower constancy” than do honeybees, which have no particular affinity for blueberry flowers; alfalfa leafcutter bees are also faithful to the blueberry, but not to the same degree;
- it remains active and effective at cooler temperatures and in light rain;
- the bumblebee’s greater effectiveness lets producers use far fewer of them than the number of honeybees required for the same results;
- given the light weight of the mini-hives, they are easy to transport.

The main disadvantages of bumblebees are:

- they are costly;
- they cannot be recovered from year to year, unlike honeybees and domesticated alfalfa leafcutter bees.

## BUMBLEBEES AND SUSTAINABLE DEVELOPMENT

### Native bumblebees

Native bumblebees are very faithful to the flower of the blueberry. Regardless of what other flowers may be nearby in windbreaks and woodlots, bumblebees will do 95% of their foraging from blueberry flowers.

However, since queens become active in the early spring and workers continue until the end of summer, it is important to find other species of flowering plants that will attract bumblebees both before and after the blueberry’s blooming period.

Among native species of plants found in and around blueberry fields, the bumblebee is generally drawn to the flowers of willow, fireweed, goldenrod, lambkill, aster, bush honeysuckle and spreading dogbane. Trefoil and clover species also attract bumblebees.

Along with floral resources, the bumblebee must also be able to find sites for nesting. Bumblebees usually nest in cavities in the ground or under a tiller of vegetation, often in green spaces at the edges of fields. This makes it important to protect (or create) such spaces, using greenery, bushes and trees. Pesticide should never be applied to these areas, and they must not be mowed, since bumblebees often nest under long shoots of bent-over grass.

It is possible to build artificial nests, but it is time-consuming and the occupancy rate will rarely be over 30%.

### Domesticated bumblebees

Domesticated bumblebees are viewed by researchers as an interesting alternative, but one that needs further study to evaluate their risk as a vector of disease and their potential impact on native pollinators in competing for resources.

For a given field, the number of mini-hives required depends on the number of native pollinators present and whether honeybees and/or alfalfa leafcutter bees are also being used. If no other commercial pollinator is used, the University of Maine researchers recommend an average of 10 mini-hives/ha (3-4 mini-hives/acre; a quad contains 4 mini-hives). They also suggest using a combination of commercial pollinators, such as honeybees with bumblebees. The latter will complement the work of the honeybees, particularly during a cool, wet spring.

If there is a noticeable abundance of native pollinators, the Maine researchers recommend reducing the number of colonies to 2.5 mini-hives/ha (1 mini-hive/acre).

At the end of the season, it is essential to remove the quads from the blueberry field. This will prevent the transmission of disease to any wild bumblebees that might otherwise enter them.

## COMPLEMENTARY LEAFLETS

26. *Pollinating Wild Blueberries*  
 27. *Foraging Patches to Attract Native Pollinators*  
 30. *Managing Native Pollinators in Wild Blueberry Fields*

## REFERENCES

- Desjardins, È.-C. 2003. *Bourdon fébrile domestiqué - Pollinisateur efficace du bleuet nain?* Université du Québec à Montréal. 88 pp.
- Desjardins, È.-C. and D. Oliviera. *Potentiel du bourdon fébrile comme vecteur pollinique du bleuetier nain.* Université du Québec à Montréal. PowerPoint presentation.
- Drummond, S. and D. Yarborough. 2000. *Commercial Bumble Bee (Bombus impatiens) Management for Wild Blueberry Pollination.* Fact Sheet No. 302. The University of Maine. Cooperative Extension. [Online]. <http://umaine.edu/blueberries/factsheets/bees/302-commercial-bumble-bee-bombus-impatiens-management-for-wild-blueberry-pollination/> (Page consulted on September 15, 2010).
- Stubbs, C.S., H.A. Jacobson, E.A. Osgood and F.A. Drummond. 1992. *Alternative Forage Plants for Native (Wild) Bees Associated with Lowbush Blueberry, Vaccinium spp. in Maine.* The University of Maine. Maine Agricultural Experiment Station. Orono, Maine. 54 pp.
- Vaughan, M., M. Shepherd, C. Kremen and S. Hoffman Black. 2007. *Farming for Bees: Guidelines for Providing Native Bee Habitat on Farms.* The Xerces Society for Invertebrate Conservation. Oregon. 43 pp.

### PROJECT COORDINATION AND WRITING

Sophie Gagnon, Agronomist, Project Management Coordinator, Agrinova, Alma

### REVISION

Madeleine Chagnon, Ph.D., Entomologist, Associate Professor, Université de Montréal, Montréal

Ève-Catherine Desjardins, Ph.D., Entomologist, Researcher, Centre de recherche Les Buissons, Pointe-aux-Outardes

### PUBLISHING

Chantale Ferland, M.Sc., Publishing Project Officer, CRAAQ, Québec

Lyne Lauzon, Publications Coordinator, CRAAQ, Québec

### TRANSLATION

Rod Willmot, M.A.

### LAYOUT AND GRAPHIC DESIGN

Sylvie Robitaille, Computer Graphics Technician, CRAAQ, Québec

### PRODUCED BY



### FUNDED BY



Association  
des producteurs  
de bleuets de  
la Côte-Nord

