



Flowers Canada (Ontario) Inc.

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Developing Mealybug Biocontrol Solutions for Floriculture Crops in Ontario

This article is part one of a two-part series describing this Flowers Canada (Ontario)'s project. This article provides a background on mealybug and two common biological control agents. Part two will describe the trials and results conducted at greenhouse farms in the spring/summer of 2017. That article will be released in a few weeks.

Introduction:

Mealybug have traditionally been a minor pest in Ontario floriculture. However, this pest's impact in the sector is expanding because of a variety of factors. In 2015, many poinsettia growers in Ontario noticed mealybug in their crops, one of the first times this has occurred.

Currently there are few foliar pesticides in Canada with more than 40-50 per cent efficacy for mealybug; the situation is similar in the United States. Due to their waxy coating, mealybug are hard to kill with contact insecticides. They are also hard to control with many systemic insecticides, due to their propensity to feed on flower stems (where there are low levels of available active ingredient compared to other plant tissues). Further, many retailers will no longer purchase flowers that have been treated with certain chemicals (e.g. neonicotinoids). Regardless, most growers in Ontario rely on biological control for other pests, so many traditional pesticides can no longer be used without jeopardizing existing biological control programs.

Mealybug are also difficult to control for more reasons than just the absence of effective pest control products. Importers of tropical plants or cuttings from the Southern U.S. must be on constant watch for hitchhiking mealybug on these materials. They are difficult to identify, as they look similar to armored scale and soft scale, or can be mistaken for whitefly nymphs, and the first instar "crawler" stage is incredibly small. As well, once they are established in the greenhouse, mealybug can hide in crevices and pipes and remain unnoticed, reappearing when a suitable host plant returns.

Due to the constant threat of this pest from the U.S., and with few effective or biocontrol-compatible chemical options, an effective biocontrol solution for mealybug in floriculture crops is necessary. With the impetus from grower members, and shared funding from *Growing Forward 2 (GF2)*, Flowers Canada (Ontario) instigated a mealybug working group and four grower trials to aid in the development of effective biological control programs for floriculture crops grown in Ontario.



Broadly sharing the results from this project is meant to provide all FCO members with information and control strategies for mealybug in floriculture crops.

Mealybug – good things to know about them:

Mealybug are sucking insects. Like aphids, nymphs and adults feed on the phloem of the plant. They produce a lot of honeydew, which aids in the development of black sooty mold and contributes to the visual clues that you have a mealybug problem. Mealybug can hide in pipes, under benches and in old pots and survive there until a plant host becomes available again.

There are 200 species of mealybug from 20 different families. But in this trial, and for the most part in Ontario floriculture, there are primarily two species that we are concerned with - **citrus mealybug** (*Planococcus citri*), and the **long tailed mealybug** (*Pseudococcus longispinus*). **Obscure or tuber mealybug** (*Pseudococcus viburni*) may also show up in Ontario greenhouses but is not as common as the other two.

Citrus mealybug (*Planococcus citri*)

Citrus mealybug tends to be the most common species in ornamentals. After mating, female citrus mealybugs lay 100-400 yellow-orange eggs in a relatively large ovisac made of waxy threads. Often, these ovisacs are what a grower first notices. These eggs hatch after two-ten days (depending on temperature). The first stage of development is the crawlers. These can spread over long distances as they search for a place to feed, or are dispersed through wind or recirculated water. It is also extremely likely that they will move around on clothes of greenhouse workers, or even tools. The other stages can also move, but do so much more slowly. Prior to the adult stage, females have three nymphal stages while males have two nymphal stages plus a prepupal and pupal stage. The lifecycle (egg-to-adult time) of the citrus mealybug is 81 days at 18°C, which dwindles to 29 days when temperatures reach 30°C. The optimum temperature for citrus mealybug is 24-26°C and 60 per cent relative humidity.

Female citrus mealybug adults (4th instar) have a grey band along their backs, and do not have a tail. Some males will be present in the population, but are rarely seen, and are very different from the female, looking more like a small fly

Long tailed mealybug (*Pseudococcus longispinus*)

This mealybug gets its common name from the two long, waxy filaments protruding from the last abdominal segment of adult females. There is no visible egg stage of the longtailed mealybug. Nymphs hatch immediately upon oviposition (laying) and the female produces around 200 live young (which she deposits under her body) over a two to three week period. The lack of a waxy egg sac actually makes them easier to control compared with other mealybug species.

Female longtailed mealybug nymphs undergo three instars before reaching adulthood, whereas males undergo four. Female longtailed mealybug adults resemble third instars, except they are less flattened in appearance due to the development of their reproductive organs. Males of this species are more slender, darker in color, and as adults are winged. They are not as commonly noticed as the female long tailed mealybug, as they do not feed on the host plant.

Obscure or tuber mealybug (*Pseudococcus viburni*)

Obscure mealybug are common in rose and cut gerbera crops, and greenhouse vegetables. They can have up to eight generations per year in the greenhouse. Mating is necessary for the female to lay eggs, which she lays in groups of ovisacs over a period of four to thirteen days. About 50-300 yellow-orange eggs are laid per female, which hatch after two to nineteen days. The optimum temperature is 20-28°C and 60 per cent relative humidity. The lifecycle of the obscure mealybug is 46 days at 22°C and 30 days at 30°C.

Biological control options:

As most Ontario flower growers are using some form of biological control to manage other pests in their crops, the option to spray for mealybug when they are noticed is limited. Coupled with this, there are few effective registered pesticide products for mealybug. When applied by foliar spray, these are only effective in the nymphal stage, prior to the development of the waxy outer covering. The older, more toxic chemistries certainly cannot be recommended in a greenhouse using biocontrol. There is a great downloadable spreadsheet of registered insecticides at [ONfloriculture](#) that also makes note of toxicity and compatibility issues. ([ONfloriculture Dec 8 2016](#))

But there are some biological control options readily available from suppliers in Ontario. The main biological control agents are the **ladybeetle** *Cryptolaemus montrouzieri* and the **lacewing** *Chrysoperla carnea*. There are also some mealybug **parasitoids**, such as *Leptomatrix dactylopii*, but the availability of these may be limited in Canada. Thus, *C. montrouzieri* was the main biological control agent used in these trials. A small sub-trial was conducted in gerbera with *C. carnea*.

***Cryptolaemus montrouzieri* - “a wolf in sheep’s clothing”**

C. montrouzieri is often described as a wolf in sheep’s clothing because the larvae of this biocontrol agent are covered with waxy threads and strong hairs, and look very much like female mealybug nymphs and adults. *C. montrouzieri* is not specific and will predate on different species of mealybug. They are originally from Australia and their life cycle consists of an egg stage, four larval stages, pupa and adult. In the greenhouse, they can undergo four generations of their lifecycle per year. As biocontrol agents they are sold as either larvae or adults for release into the crop. Adults can fly, but larvae can only find their prey by physical contact. All mobile stages of *C. montrouzieri* eat mealybug, but the adults and older larvae are the most aggressive.

Eggs are white/yellowish and laid in colonies of mealybug (within the cottony ovisacs) in the first two weeks after release. Each female lays one to three eggs per day, and can lay up to a total of 385 eggs in 41 days. Larvae are blind and can eat 30-70 mealybugs per day. They do not move quickly or far from introduction points. Pupae can live on stems, leaves or greenhouse structures. The adult beetles are black and orange/rust colored. Female adults have black forelegs, while the male adult has orange ones.

The optimal temperature for *C. montrouzieri* is 20-25°C with relative humidity of 70-80 per cent. At less than 16°C these predators are inactive. Adults are most active around 30°C but at 40°C all

adults will die within two days. At 10°C, they will survive but will not lay any eggs. In optimal temperatures females will survive on average for 68 days and males for 62 days.

Do not apply *C. montrouzieri* preventatively, since they can only survive when mealybug is present. However, if mealybug is detected in the crop, *C. montrouzieri* is effective when released in hot spots. Recommended rates for release from commercial biocontrol companies:

Larvae:

- 10 per plant, or 10-20/m², every week – light infestations, curative
- 50-100 per plant, or 20-40/m², 7 times at 7 day intervals – high infestation, curative

Adults:

- 2-3/m² – light infestations, curative
- 10/m² – heavy infestations, curative

Chrysoperla carnea – green lacewing

C. carnea are generalist predators. They will eat aphids, eggs of *Lepidoptera*, thrips, whitefly, mites and mealybug. The adult is not a predator, and feeds on nectar, honeydew and pollen. The larvae are the life stage that is active in predation.

Each female lacewing lays 600-700 grey/green oval eggs on a mucus thread. There are then three stages of larvae that are brown/grey and in the shape of an alligator. They have strong jaws and are active through the night, consuming up to 400 prey per lacewing larva.

Lacewings pupate inside 8mm long white cocoons from which the adults emerge. The adults are 4-12mm in size with long antennae and large transparent green wings. At 16C the lifecycle of the green lacewing is 69 days, while at 28C the lifecycle shortens to 25 days. The larvae are sensitive to drought, and the adults need a source of nectar, honeydew or pollen or they will cease laying eggs.

C. carnea will eat as many mealybugs as *C. montrouzieri* (30-70 per day), if you can keep them on the plant. Recommended rates for release from commercial biocontrol companies:

- 10-20/m² every 2 weeks – preventative introductions
- 10 per plant (hotspot) every week – light curative introductions
- 50-100 per plant (hotspot), 7x, 7 days interval – heavy curative introductions

Though mealybug is a challenging pest due to its longevity and fecundity (high egg laying), the next installment of this series will demonstrate how, with patience, these biocontrol strategies are working for Ontario growers.

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