

Prospects for biological control of pest problems in outdoor nursery production in Western Canada

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Abstract: Because of a variety of climates and surrounding vegetation, the nature of pest problems and requirements for seasonal monitoring change from nursery to nursery within Canada. Preservation of naturally-occurring biocontrol agents is currently difficult because of pesticide control for various insect pests. On-going registration of low impact and microbial pesticides will allow the development of new management programs and increased reliance on biological control.

Key words: Canada, pest problems, seasonal monitoring, biological control

Introduction

In Canada, commercial nurseries are found in all regions that offer suitable climate and land.

In 2006, production covered 22,556 hectares and generated 7,600 full-time and 6,500 part-time employees (Statistics Canada 2007). Total sales were Can\$595.2 million, mostly to landscape contractors (28.2%) and garden centres (23.3%). Largest production areas were Ontario (47.7% of sales), British Columbia (28.2%) and Québec (11.8%).

Impact of regional conditions

Nurseries located at the B.C. Coast

This region is characterized by some of the mildest climates in Canada, resulting in a large concentration of nurseries (British Columbia Ministry of Agriculture 2006). Weather conditions are typically 20 to 30°C with periods of rain during the summer and near 0°C with extensive rain during the winter.

Damaging pest problems are the black vine root weevil (*Otiorhynchus sulcatus*), the two-spotted spider mites *Oligonychus urticae*, bacterial canker (*Pseudomonas syringae*), root rot (especially *Phytophthora* spp.) and the weed liverwort (*Marchantia polymorpha*).

Nurseries located in the B.C. Interior

This region is characterized by minimal over wintering requirements, a long growing season, and availability of good quality water (British Columbia Ministry of Agriculture 2003). Weather conditions are typically 25 to 35°C with minimal precipitation during the summer and below 0°C with occasional rain or snow during the winter.

Damaging pests are bronze birch borers (*Agrilus anxius*) and aphids (various species), and the diseases fire blight (*Erwinia amylovora*) and powdery mildew (various species).

Nurseries located in Southern Alberta

Weather conditions are typically 25 to 35°C with minimal precipitation during the summer and prolonged periods at -10 to -20°C with occasional snow during the winter.

Damaging pest problems are insect borers such as bronze birch borer (*Agrilus anxius*) and poplar-and-willow borer (*Cryptorhynchus lapathi*), and the diseases fire blight (*Erwinia amylovora*) and aspen shoot blight (*Venturia* species).

Seasonality of insect pests

In British Columbia, monitoring records indicate insect pest problems are most prevalent in late spring and early summer (see Table 1). Nursery growers are advised to conduct a minimum of 10 monitoring visits each season, especially from May to August, and increase to 18 visits when growing coniferous stock (British Columbia Ministry of Agriculture 2002).

Table 1. Seasonal occurrence of insect pests, based on type of plant damage, for the Southern B.C. Interior, data from 1992 to 2002 (modified from CropHealth Advising & Research 2002)

Month	Sucking	Chewing	Gall forming	Borers	Total
March	5	1	2	0	8
April	13	7	3	1	24
May	10	14	2	3	29
June	14	15	2	7	38
July	16	9	1	8	34
August	8	8	0	3	19
September	5	2	0	0	7

Programs for biological control

Biocontrol of insects

The green peach aphid (*Myzus persicae*) is a pest of ornamental plants world-wide (Blackman, 2000). Native beneficials found in British Columbia nurseries include aphid midges (*Aphidoletes* spp.), parasitic wasps (Braconids, Chalcidids and Ichneumonids) and syrphid flies (*Syrphidae* spp.) (Lanthier 2002).

The black vine weevil (*Otiorhynchus sulcatus*) and other root weevil species are common across North America. Biocontrol with entomopathogenic nematodes (such as *Steinernema carpocapsae*) is effective in container production but less effective in field production, likely because of soil temperatures and structure (Booth 2002). The coming registration of the entomopathogenic fungi *Metarhizium anisopliae* should improve control (Bruck 2007).

The two-spotted spider mite (*Oligonychus urticae*) is a pest of ornamental plants world-wide (Helle 1985). The increased use of insecticides in the chloronicotynyl family, such as imidacloprid and acetamiprid, has resulted in increased spider mite outbreaks (James 2002).

Field research was conducted at an outdoor nursery in 1999. Commercially-available predatory mites were released in container grown *Potentilla fruticosa*. The impact was minimal as naturally occurring predators (especially the minute pirate bugs *Orius* spp.) were present in control plants to feed on aphids and thrips (Custer 1999). Starting in 2000, the grower discontinued the use of acephate, a broad spectrum pesticide. The preservation of the naturally occurring spider mite predators has eliminated the need for miticide sprays.

The spruce spider mite (*Oligonychus ununguis*) is an important pest of conifers in North America (Johnson 1991). There are sporadic reports of biological control (Wheeler 1973).

Field research was conducted at an outdoor nursery in 1994 and 1995. Commercially-available predatory mites were released in container-grown *Thuja*. There was no measurable impact. Field populations of the spruce spider mite are likely controlled by weather conditions, especially ambient temperatures and rainfall (Lanthier 1997).

Biocontrol of weeds

In British Columbia, biocontrol of weeds is currently limited to plants of range land such as spotted knapweed (*Centaurea maculosa*) (Powell 1994).

There is currently no effective biocontrol agent for common nursery weeds. A new herbicide based on the fungus *Sclerotinia minor* offers 80% control of dandelion (*Taraxacum* spp.) when applied post-emergence (Pest Management Regulatory Agency 2007).

Biocontrol of diseases

Fire blight (*Erwinia amylovora*) is a pest of Rosaceae plants world-wide (van der Zwet 1991). Fungicides based on competitive strains of the naturally-occurring bacteria *Pantoea agglomerans* are now available (Pest Management Regulatory Agency 2006). They are most effective when used in combination with traditional control methods (Momol 1999).

Root rot (especially *Phytophthora* spp.) is found on ornamental plants world-wide (Erwin 1996). Competition with native biocontrol agents is obtained in soils containing high quality organic matter or amended with cured compost (Stone 2004). Recent research indicates that biocontrol-fortified potting mixes can trigger Induced Systemic Resistance and help prevent leaf diseases caused by *Botrytis* and powdery mildew (Horst 2005).

Conclusion

Pest management in outdoor nursery production is different from protected cultures.

In greenhouse production, environmental and growing conditions are standardised for optimum plant growth. The result is a set of pest problems relatively constant around the world that includes aphids, whiteflies, two-spotted spider mites and thrips (Heinz 2004). In outdoor nursery production, there is little control over environmental and growing conditions. The result is a complex of pest problems that varies from site to site.

There is a need for more research in conservation of naturally occurring biocontrol agents in outdoor nursery production. One current roadblock is the control of tree borers with broad-spectrum high toxicity pesticides such as chlorpyrifos, dimethoate and endosulfan (Ontario Ministry of Agriculture 2007). Introduction of new methods such as mating disruption (Welter 2005) and tree injection (Doccola 2007) will help preserve natural biocontrol.

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