# CURRENT ISSUES IN NURSERY PEST MANAGEMENT IN BRITISH COLUMBIA[1]

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## INTRODUCTION

In recent years, there has been a number of improvements to the management of reforestation container nursery insect pests and pathogens in BC. These have centered on three main themes; 1) better monitoring and timing systems, 2) a more comprehensive understanding of their impact on seedling outplanting performance and 3) a reduction in pesticide use. As with all things, nursery production systems are in constant change to meet shifting client priorities and demands. As such, some of these destructive agents are now having an impact on seedling quality because of their adaptation to changes in nursery production. In addition, there is the introduction of new insect pests or pathogens that adapt to our conifer seedling production systems. This paper will briefly summarize current developments in reforestation container nursery pest management in the areas of insect and pathogen control.

## NURSERY INSECTS

### *Lygus* Bug Trapping Program

The pest status of the *Lygus* spp. complex has been recognized for many decades in North America. Though considered a pest of agricultural crops, in the last fifteen years *Lygus* bugs have gained recognition as important pests in bare-root and container conifer nurseries. Feeding by the adults causes deformation of seedling terminal shoots, which later become undesirable multiple leaders or crooked terminals. All conifer species grown in BC reforestation nurseries are susceptible to feeding damage but *Lygus* bugs appear to prefer 1+0 pine seedlings particularly lodgepole pine. To date there had been no effective monitoring system for *Lygus* bugs and control of this pest has depended entirely on repetitive applications of one insecticide. In 1995, a small scale monitoring program and a caging study was initiated at one BC reforestation nursery. Results from this preliminary study showed that yellow sticky traps could be used to monitor *Lygus* bugs. The caging study, which introduced *Lygus* at biweekly intervals, found that lodgepole pine seedlings were most susceptible during the first 11 weeks after germination. In addition, outplantings of these seedlings based on the biweekly *Lygus* introductions found no terminal leader or flushing problems with seedlings 11 weeks or older from germination. In 1996-97, studies were conducted to; 1) determine the *Lygus* spp. complex at coastal and interior reforestation nurseries, 2) construct a life history profile of the most common *Lygus* species, 3) develop an efficient trapping system, 4) review the efficacy of the current control program and 5) assess the effect and timing of *Lygus* damage on the outplant performance of 1+0 lodgepole pine seedlings.

In 1997, five *Lygus* species were positively identified from lodgepole pine seedlings in 3 coastal (Fraser Valley) and 2 interior (Okanagan) nurseries. *Lygus elisus* Van Duzee was found in all surveyed nurseries indicating that this species is broadly distributed in southern BC. *L. shullii* Knight was located at 1 interior and at all 3 coastal facilities where it was most abundant. *L. hesperus* Knight was collected at 1 coastal and interior nursery respectively. The remaining two species, *L. robustus* Uhler and *L. lineolaris* P. de Beauvois, were found only in the interior. Life history studies on the two predominant *Lygus* species found that *L. shullii* developed from egg to adult in 93 days at 12.5°C and 24 days at 25°C. *L. elisus* matured in 67 days at 15°C and 23 days at 25°C. Timed caging studies of both species found that the expression of feeding damage on 1+0 lodgepole pine occurred only after 72 hours. This would suggest that there is a lag between the time a *Lygus* bug enters a susceptible crop and when it begins to feed.

Results from the 96/97 studies showed that yellow sticky traps (#611, PheroTech Inc.) can effectively monitor populations of *Lygus* species. The visual response of *Lygus* species to traps of various sizes and heights found that 1+0 lodgepole pine container seedlings could be monitored by placing one small (15.5 x 19 cm) trap every 300-500 $m^2$ of seedling area approximately 5 cm above the crop canopy. Also, vegetation surrounding the susceptible crop could be monitored by placing one large (31 x 19 cm) trap every 500-700 $m^2$ of area about 30 cm above the ground vegetation. In all cases, monitoring should start soon after germination and continue weekly throughout the susceptible growth period of 11 weeks. A preliminary weekly threshold of a mean of 0.5 *Lygus*/trap across all in-crop traps is currently being tested as an operational decision criterion.

Reforestation nurseries in BC use a preventative insecticide program for control of *Lygus* spp. Under this program 2-4

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applications of cypermethrin (Cymbush) are made each season to prevent *Lygus* bug damage particularly on 1+0 container lodgepole pine. Control with cypermethrin appears to be effective but over the years there have been efficacy inconsistencies at some nursery facilities. In 1996, a study was conducted to review the residual efficacy of cypermethrin in comparison to another *Lygus* insecticide, dimethoate (Cygon). The effectiveness of the two insecticides was compared at four seedling ages (8, 13, 16, & 22 weeks) with *Lygus* bugs being introduced to caged 1+0 lodgepole pine container seedlings at 4 post-spray intervals (3, 7, 11 & 15 days). Cypermethrin was significantly more effective than dimethoate in preventing *Lygus* damage but both residues only provided adequate protection for 2 - 3 weeks. Overall, only the 8 week old seedlings sustained the highest proportion of damage. By 13 weeks, the damage was negligible regardless of insecticide efficacy. These results were very similar to the 1995 caging study

The results of these studies along with our experience with *Lygus* bug indicate that an effective control program can be implemented at most facilities. This will involve a commitment to a trapping program coupled with the understanding of the susceptibility window of the seedlings. Life history information can be used to develop degree-day counts to help predict the appearance of adults. Unfortunately, it would appear that the efficacy period of cypermethrin is reduced but our ability to better target these sprays has been enhanced.

### *Cyclamen Tortrix*

A new insect pest to BC reforestation nurseries is the *Cyclamen tortrix* or *Clepsis spectrana*. It has been introduced to BC from Eurasia where it is a problem on a variety of horticultural and berry crops. In 1993, *C. spectrana* was reported in the Lower Fraser Valley as an incidental pest of raspberry. Since then it has become a major pest of currants and strawberry, and has been reported on blueberry and cranberry. Under natural conditions, it has 2 generations per year with the adults flying from May-June and August-September. A female can lay up to 350-400 eggs. The eggs hatch in June/August and the larvae can pass through 4-8 instars depending on food source and environmental conditions. It overwinters as a larva. A mature larva can be up to 1.8 cm length, brown with white spots similar to a spruce budworm and has a black head.

The problem has been further amplified when this insect has been introduced to greenhouse situations. Under these conditions, *C. spectrana* has been found to no longer enter a diapause phase. The result is 8-10 generations within a single field season at 20°C. In the Netherlands, this has resulted in tremendous infestations in horticultural and floriculture greenhouse crops. Studies have shown that insect lights and pheromones within a greenhouse setting are ineffective in controlling the insect. Permethrins have been reported to be effective but only on the early instar larval stage. There is no effect on the eggs or pupae. The larvae actively move from old feeding sites to new ones thus increasing the damage potential of each larva.

In BC, our first encounter with this insect pest started at one coastal facility in 1996. Larvae were found on a 2+0 container *Abies grandis* crop that had been brought into a greenhouse for the winter. The small infestation was not controlled and resulted in the infestation taking hold within the greenhouse complex. In early 1997, with the start of the new growing season, the larvae were found throughout the entire nursery greenhouse complex. They were observed feeding on both container spruce and coastal Douglas-fir. Feeding damage by this insect is similar to most needle tiers as the larvae web the terminal needles of seedlings. The population exploded within these optimal plant conditions resulting in multiple generations in numerous crops. Attempts to control the infestation with dimethoate, diazinon and pyrethrins were unsuccessful. The result was numerous damaged seedlings and a fully infested crop at the time of seedling lift. Subsequently, the infested stock was frozen shipped and stored at -2 to -4°C at a northern BC facility. A re-sort on the seedling crop was recommended due to stock quality problems. When the seedling were thawed and the boxes opened, tremendous numbers of *C. spectrana* larvae were found in every box. It was recommended to this facility that they spray all seedling crops adjacent to the sorting facility with an insecticide and fumigate the sorting building. This past summer, pheromone trapping at this site has found numerous adults in traps placed adjacent to the cull pile area. This facility will continue to monitor its location with pheromone traps for 1999. Nursery facilities, especially in the Fraser Valley, should closely monitor and inspect all greenhouse or overwintering stock for this potentially devastating insect.

## NURSERY PATHOGENS

### *Meria* Needle Cast

*Meria laricis* Vuill. is the fungus responsible for *Meria* needle cast on larch. In BC, most damage is to containerized 1+0 western larch stock. In the United States, occurrence of larch needle cast is most severe on 2+0 bareroot stock. In container production, diseased seedlings can be detected with the appearance of yellowing and wilting of needles near the base of the plant. The needle tips then begin to turn brown and the disease progresses to the base of the needle. The needles the turn reddish-brown, and fall off within six weeks of initial disease expression. Infection is promoted by cool moist conditions. Frequent watering promotes development of the disease both by maintaining high humidity and splashing spores to nearby seedlings. Optimal growth of the fungus in culture is obtained at 17.5°C, while growth is stopped completely at 25°C. Major losses in three of the past five crop years at nurseries in BC has prompted interest in developing a better understanding and more effective management program. Very little information about the effects and control of *Meria* needle cast has been published in the scientific literature.

Two recent studies have looked at the efficacy of fungicides readily available to reforestation nurseries in BC for control of *Meria*. An initial screening of *Meria* isolates *in vitro* was conducted using the following fungicides: benomyl, captan, chlorothalonil, iprodione, mancozeb and propiconazole. Evaluation of fungicide efficacy found only 3 of the fungicides effective in reducing fungal growth; benomyl, propiconizole and mancozeb. In a subsequent container assay, only propiconizole was ranked the most effective in reducing the level of disease. Preliminary results from outplantings studies in 1996/97 demonstarted that *Meria* can severely reduce the outplant success of western larch seedlings. Results indicate that even among seedlings that meet height and caliper specifications, moderate to severe defoliation assessed in the nursery in October could impair root dry weight, stem growth, and height and root collar diameter of outplanted seedlings the following year. In addition, the survival and health of fully defoliated seedlings was significantly reduced at both field assessments. For nursery managers, management of *Meria* needle cast is contingent on reducing seedling canopy humidity and increasing airflow. Every effort must be made to reduce outside inoculum source and to maintain an effective sanitation program to eliminate discarded senescent needles from previous crops. Finally, if disease symptoms are recognized, it is important to use an effective fungicide to reduce both the damage and inoculum build-up in the nursery.

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