The hordes: emerging pest threats to plants in the Western USA©

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Numerous studies have shown that movement of horticultural products is a frequent pathway for invasive pests. This knowledge suggests there is an awesome responsibility that comes with moving plants from place to place. When it comes to new pests, the nursery industry is both at risk and a risk. Those propagating plants play a key role in the prevention and detection of invasive plant pests. Growers need to regularly update their knowledge of new exotic species risks as the topic of invasive species is dynamic with frequent changes. Scrutiny of nurseries by the government, public, and industry will continue to tighten. This paper highlights a few of the emerging invasive species of concern in the western US.

EMERGING INVASIVE PESTS

Hemerocallis gall midge, daylily gall midge (*Contarinia quinquenotata*)

The *Hemerocallis* gall midge is thought to have originated from Asia. It was detected in Vancouver, British Columbia, in 2001, and found in the state of Washington in 2007. In Washington, there are reports of this pest in Whatcom, Skagit Valley, Bellevue, Everett, Granite Falls, and the Puget Sound area (Rosetta, 2017b).

The *Hemerocallis* gall midge overwinters in the soil. The adult midge emerges from the soil and begins to lay eggs on the developing daylily buds in the late spring and early summer, usually from May through June. Tiny white maggots hatch from these eggs and can be found feeding within (and sometimes outside) the daylily buds. Feeding by the maggots on developing lily buds causes distorted growth. Buds become swollen and discolored. Damage may cause buds to shrivel and not completely form. Blossoms from affected buds are deformed and often have crinkled petal edges.

Cultural management has relied on avoidance of early-blooming cultivars (particularly yellow-colored selections) and removal and disposal (but not in compost) of infested daylily buds. Bringing in only bareroot plants, a strategy used with a similar midge, the rose midge (*Dasineura rhodophaga*), might help to reduce the risk of introduction of this midge via bringing in plants with the soil-based stages of the insect. Chemical management generally is timed to protect the new buds during the time adult midges lay eggs. Both contact and systemic insecticides have been used. A report by Halstead (2012) on insecticide management of *Hemerocallis* gall midge is available at the Royal Horticultural Society website.

Allium leafminer, onion leafminer (*Phytomyza gymnostoma*)

The *Allium* leafminer is a key pest of concern for *Allium* spp. (such as garlic, leek, and onion). It was first detected in Pennsylvania in 2015. *Allium* leafminer infestations have been found in Pennsylvania in 17 counties, in three New Jersey counties, and may have been found in one county in New York (Oregon Department of Agriculture, 2017a). Native to Germany and Poland, the *Allium* leafminer is now distributed more widely in Europe and more recently reported in Asia, Turkey, and Russia. This pest is considered a threat to Oregon's $125 million onion industry. The fly pupates within bulbs, including bulbs with no vegetative growth, which increases the risk of importation. Greatest risks are associated with importing from any infested area. The USDA has deregulated this new pest, and Oregon is considering a quarantine on *Allium* from infested states. The Oregon Department of Agriculture intends to eradicate this pest if it is detected.

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The *Allium* leafminer affects both ornamental species as well as native species of *Allium*. Economic hosts include onions, garlic, shallots, and green onions, with leeks and chives as preferred hosts. Larval feeding causes curled and twisted leaves. Small plants can succumb to larval feeding. Severe infestations can result in complete crop failure. *Allium* leafminers overwinter as pupae. There are two predicted generations. The spring generation occurs when adults emerge from the soil after overwintering and lay their eggs at the base of leaf stems, generally from March through April and possibly May. These larvae feed and eventually pupate and remain in diapause through the summer until fall, September to October, when adults emerge and lay eggs of the second generation. The larvae from these eggs emerge, feed, and then pupate to overwinter.

Damage from the *Allium* leafminer is most apparent as lines of feeding scars or punctures made by the female and the curling leaf damage from larval feeding. Adults are gray flies about 3 mm (1/8 inch) long with yellow heads, dark eyes, and yellow markings on the sides of their abdomen. Larvae are maggots and yellowish-to-white up to 8 mm (5/16 inch) long. They mine the leaf stalks toward the base of each leaf. They then pupate at the end of the mine, sometimes down in the bulb. The pupal stage is red to brown in color and approximately 3.5 mm (a little over 1/8 inch) long.

Some states may, like Oregon, choose to eradicate this pest if detected. Rutgers and Penn State have some cultural (row covers) and chemical management recommendations for both conventional and organic vegetable growers in the mid-Atlantic area (Rutgers University, 2017; Fleischer and Elkner, 2016).

Japanese flower thrips (*Thrips setosus*)

Japanese flower thrips were first detected in a nursery in Michigan in 2016. Hostas from this nursery were shipped to nurseries throughout the USA. Since then the pest has been detected in Rhode Island, Minnesota, Oregon (one location, under eradication), and possibly Colorado (not confirmed) (Oregon Department of Agriculture, 2017b). APHIS is no longer regulating this pest.

Japanese flower thrips feed on plants in at least 14 plant families. They are fond of solanaceous hosts, such as tomato, pepper, and eggplant. A partial list of hosts includes: camellia, chrysanthemum, cucumber, dahlia, hellebore, hosta, hydrangea, impatiens, iris, petunia, poinsettia, soybean, and strawberry. The list of hosts also includes several weed species, such as thistle and sow thistle (Vierbergen and Loomans, 2016). This pest can be a vector of *Tomato spotted wilt virus*. It can survive year-round in greenhouses and outdoors in USDA plant hardiness Zones 4 to 11, which includes all of Oregon. Their damage, seen as silvery streaks and spots and deformed leaves, is similar to damage caused by other thrips. Although called a flower thrips, this species is actually a leaf feeder and does not eat pollen.

Adult females are dark brown with a pale color on the basal quarter of the wing. Adult males are yellow and difficult to distinguish by non-experts. Their initial detection in Michigan was due to a thrips biocontrol program failure. An Oregon Department of Agriculture fact sheet has a list of insecticides that are known to be effective.

OTHER PESTS TO KEEP ON YOUR RADAR

Greenhouse thrips (*Heliothrips haemorrhoidalis*)

We are also concerned about introduced pests moving into natural areas. Greenhouse thrips have been found in damaging numbers on salal (*Gaultheria shallon*) in landscapes and natural areas in Oregon and Washington. Greenhouse thrips are not just greenhouse pests (Rosetta, 2017a).

Greenhouse thrips adults generally have dark-colored heads and thoraxes with a dark or orange abdomen. Larvae are light-colored with red eyespots. Damage from greenhouse thrips on salal resembles that of azalea lace bug, with silvering of the leaves and fecal spotting. Entire plantings can have a white or silver cast to them. Additional affected hosts in Washington and Oregon include viburnum, Oregon grape (*Berberis* syn. *Mahonia* sp.), Pacific wax myrtle [*Morella* (=*Myrica*) *californica*], rhododendron, and native fern (*Polystichum*

imbricans syn. *P. imbricans* subsp. *imbricans*).

Rose stem girdler (*Agrilus cuprescens*)

Rose stem borer has been trapped in the Portland area (2015) and found in crops in southwest Washington (2014), as well as east of the Cascade Mountains. It was identified in caneberries (*Rubus* species) in August 2017 at the North Willamette Research and Extension Center in Aurora, Oregon. This beetle borer has the potential to cause damage to important plants in the Northwest, including caneberries and roses.

A buprestid beetle, the rose stem girdler feeds in the cambium and girdles the plant. Damage symptoms include swollen stems, sometimes with spiraling tunnels in evidence. These galls may have dark coloration or have more woody epidermis. Bark or stem cracking or splitting is often seen. Wilting of infested stems is common. Areas of the stems with beetle tunnels are weak and break easily.

The adult beetles are small, copper-colored, and metallic with a bullet shape. The larvae are narrow, cream-colored and segmented with a large flat "head" (actually its pronotum). Adults are seen in the late spring and early summer (May through June) when they mate and lay eggs on roses and caneberries. Larvae hatch from these eggs and feed in the cambial area of the plant. The third instar larvae then move toward the pith of the stem. The beetles overwinter as a fourth instar larva. There is one generation per year.

Management includes cultural controls, such as pruning and disposing of infested canes and reducing plant stress. Chemical controls are timed to protect plants during the emergence and egg-laying of the adults. This often overlaps with bloom, so caution must be taken to protect pollinators (Alston, 2015).

Ash whitefly (*Siphoninus phillyreae*)

Ash whitefly was first detected in the USA in California in 1988. They were noted in Oregon in 2014. In the late summer and early fall, they can noticeably swarm as they search for preferred evergreen hosts on which to overwinter. Toyon (*Heteromeles arbutifolia*) was found to be the dominant overwintering host in California. In Oregon, they appear to be overwintering on firethorn (*Pyracantha* sp.). Also, in Oregon, preferred summer hosts on which they have been noted reproducing include pear, hawthorn, and Oregon ash (Rosetta, 2016c, 2017a).

All stages of ash whitefly remain on the leaf underside. Nymphs and "pupal" stages of ash whitefly are very distinctive and covered with white tufts of wax. They have long tubes around their edge that secrete copious waxy droplets.

Biological control agents for this pest are already known due to previous work by researchers at the University of California when this pest became established in California some years ago. A beetle, *Clitostethus arcuatus*, and a wasp parasite, *Encarsia inaron*, was found to be very effective in suppressing ash whitefly below economic and aesthetic thresholds. Those agents have been naturally introduced into many of the areas in which ash whitefly has established and appear to be very effective in those new locations, including Oregon. In general, chemical control is not recommended due to the success of the biological control program. On occasion, chemical treatment may be required if the pest is found on plants to be shipped.

Cabbage whitefly (*Aleyrodes proletella*)

Cabbage whitefly has also become a more widespread pest in the West, particularly on brassicas. It has been a pest in the northeast US since 1993. In the west, it was detected in California in 2001 and in Oregon in 2014 (Oregon Department of Agriculture, 2016; Rosetta, 2017a). It is important to note that cabbage whitefly is also hosted on non-brassicas, including common weeds such as sow thistle and milky thistle in the *Asteraceae* family and herbaceous plants such as columbine. In Oregon, kale has been the most noticeably infested plant. This pest may be an issue for local fresh market growers, perhaps outcompeting the cabbage aphid.

Adult cabbage whiteflies are small, white-winged insects with two pale markings on

each wing. Females lay small, white, oblong eggs, usually on the underside of the leaves, often in a circle or hemicircle with white powdery deposits commonly seen. Tiny nymphs emerge from the eggs and move and settle nearby to remain feeding in one place. The nymphs have three stages which are oval and slightly yellowish, then molt to a "pupal" stage. The red eyes become noticeable in that stage, which is immobile as well (Oregon Department of Agriculture, 2016; Rosetta, 2016c).

Banded-winged whitefly (*Trialeurodes abutilonea*)

Banded-winged whitefly has been found on the east side of Oregon, and has a host range of approximately 140 species in 33 plant families. It has been intercepted in shipments to the United Kingdom from the USA on *Acacia* sp., *Banisteriopsis caapi*, *Brugmansia* sp., and *Hibiscus rosa-sinensis* plants. Where it has been detected, it is considered an occasional pest and it can transmit at least four viruses (Rosetta, 2017a).

This whitefly is named for the two distinctive zigzag bands on its wings. The puparium of this whitefly also has a wide, dark, longitudinal band.

Biological control agents associated with banded-whitefly include *Eretmocerus staufferi*, the fungus *Orthomyces aleyrodes*, minute pirate bugs (*Orius insidiosus*), and several species of lady beetles (Malumphy et al., 2010).

Viburnum leaf beetle (*Pyrrhalta viburni*)

Viburnum leaf beetle is thought to have been introduced from Europe to North America in the 1890s, having been detected in Nova Scotia in 1924 and first detected in the USA in Maine in 1994. It has since spread to many northeastern states in the USA. It was found in British Columbia in 2001 and confirmed in the state of Washington in 2004 (Murray et al., 2016; Rosetta, 2016a).

Both adult and larval stages of the viburnum leaf beetle feed on a number of *Viburnum* species. The adult beetle lays eggs in the late summer into rows of holes it chews into the stems. As viburnum leaf beetle inserts its eggs into the plant stems, it is critical that propagators check their plant material before collecting cuttings. The beetle overwinters in this egg stage from which larvae emerge in the spring. There are three larval instars and one generation per year. Susceptibility varies by *Viburnum* species (Rosetta, 2017a).

QUESTIONS

Dharam Sharma: Is there biocontrol for rose stem girdlers?

Robin Rosetta: I am not aware of any. It will be a while before we see a good list of management tools. Caneberry growers may not know they have this pest until they hear about it; then they go back and realize that this is what they have been seeing in their fields.

Voice: How do you get rid of thrips on edible crops?

Robin Rosetta: I don't work with edible crops. However, for some thrips, like Western flower thrips, there are some very good biocontrol programs, both microbial biopesticides and augmentation with parasitic wasps. In addition, minute pirate bugs and various predatory mite species can be applied. Thrips are a challenge because they get into inaccessible places. It is important to determine which type of thrips you are dealing with.

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