BY KURT PARBST

Keep Thrips Out with Screening

Western flower thrips (*Frankliniella occidentalis*) are nasty greenhouse pests. They feed on many kinds of floral and vegetable plants, can create great damage, carry viruses and are spread readily across the continent via our plant and materials deliveries. Thrips are also tiny and very mobile, and they can protect themselves very well deep inside flowers. They lay their eggs in leaf and flower tissue, where they're well protected, and the pupal stage is protected even in soil media.

The reproductive cycle is, therefore, difficult to break. No pesticide provides complete control and thrips have proven to be quite difficult to effectively control with insecticides alone. An integrated approach is necessary, including preventative biological strategy such as predatory insects, mites and nematodes; monitoring with sticky cards; and well-planned responsive action with pesticides minding best practices with timing and coverage.

Still, thrips complaints seem to be escalating. Their population growth depends mainly on temperature, expanding most rapidly around 86F (30C). Perhaps populations are exacerbated by relatively warm winters and an incomplete frost kill. But as thrips can overwinter in greenhouses, perhaps it's related to a combination of poor understanding of prevention and control and perhaps partly due to pesticide resistances.

The acceptable population size of Western flower thrips is no population. Therefore, prevention is, in essence, the cure. This includes not inviting them in with purchased raw materials, such as plugs and cuttings, and screening out ambient populations. Using insect screens for thrips exclusion is rather simple, but the design and operation require attention.

It's a good idea for most growers afflicted significantly by Western flower thrips to use micro screening. It's absolutely necessary for those shipping plant materials, such as vegetative cuttings to other growers, to be rooted and finished. This is especially true when any insects found at a border crossing by federal inspectors put a shipment and production schedule at risk.

Details about screening

In the early 1990s, significant investigations were made regarding insect micro screening and it was reported that, due to their slender size, thrips are excluded only by screens with very fine holes. The recommended maximum hole size to exclude the Western flower thrips is 192 micrometers (µm). Given that the diameter of a human hair ranges from 17 to 181 µm, this indeed requires a fine screen.

Due to the solid space of a very fine screen, care must be taken to significantly reduce the area of ventilation air inlets, which would reduce volumetric air flow rates and drive up air temperature (Figure 1). Greenhouses may be mechanically and/or passively ventilated to control overheating and the two types require a different approach in designing the required screen area.

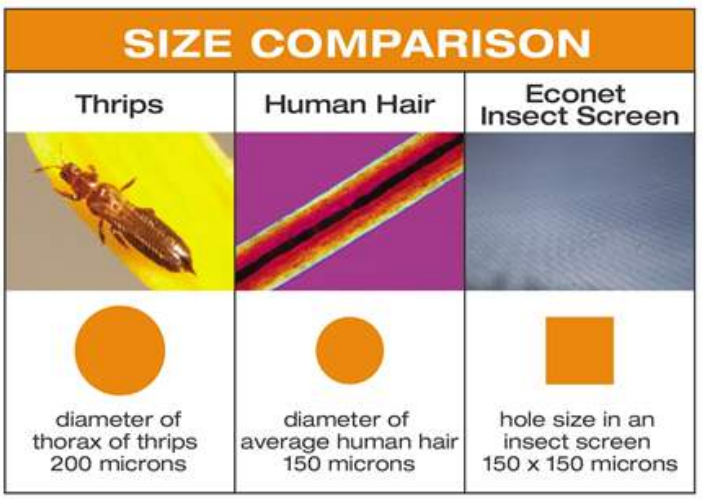

Figure 1: A size comparison of thrips, human hair and screen hole size.

STEPS TO TAKE

- Select screen hole size for smallest insect of interest. For Western flower thrips, a maximum width and length of the hole should be less than 192 µm.
- Evaluate areas to screen: inlet, exhaust, personnel entry
- Mechanical ventilation: select area of screen according to pressure velocity relationship
- Natural ventilation: select area of screen according to the discharge coefficient and acceptable decrease in vent area
- Mount so the screen will stay dry in rain, as the screening pores will be filled with water held in with capillary forces
- Maintain: repair holes immediately, clean at least annually

Mechanical ventilation

Mechanical negative pressure ventilation systems for greenhouses are rather simple and the most common. Fans are mounted in a wall to create a pressure difference across the wall. Air inlets are mounted on the opposite wall to relieve that pressure by introducing fresh outside air, which replaces the air that has picked up heat in the greenhouse. This heated air is then exhausted through the fans.

An inlet free of obstruction creates little resistance. An inlet impeded by an insect screen or cooling pad will create a resistance for the fans to work against. The greater the resistance, the lesser the air exchange rate and the higher the greenhouse temperature rises during sunny periods. This resistance must be considered so that the fans are able to operate within their design parameters. This ensures enough air is exchanged to keep the temperature rises within ranges conducive to plant growth and worker comfort and to let the fan system operate efficiently and cost effectively. >>>

A review of the ventilation system—including the fan type, maximum airflow capacity and inlet area—will reveal how much surface area of insect screen is needed to limit the resistance that will be created by the screen. This is possible by referring to the pressure velocity characteristics that are unique to each insect screen. Pressure-velocity curves (see Figure 2) are developed by evaluating insect screens in a wind tunnel (Figure 3).

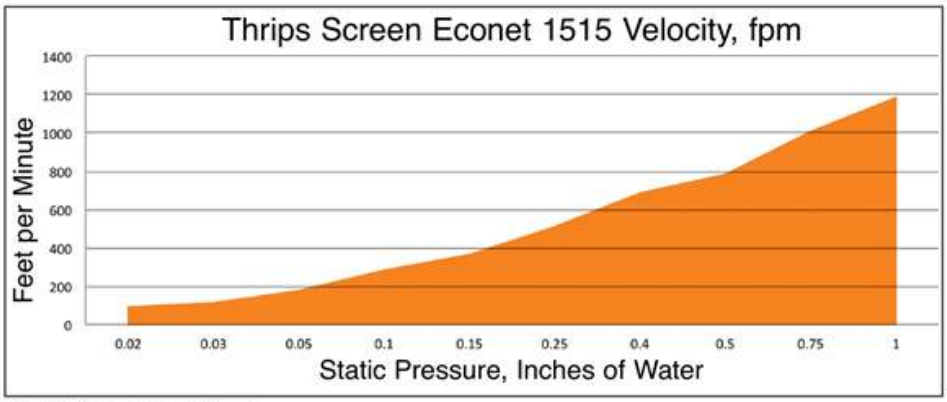

Figure 2: Pressure-Velocity Curve

Figure 3: Wind tunnel used for evaluating airflow performance of screens.

It's important to screen all of the relevant points of entry for thrips and to take each screen crossing into account in the design. This, of course, means the air inlets first and foremost, but also entries where workers and plants and equipment pass through. Hitchhiking pests are often overlooked and a vestibule containing an air shower is a good idea to blow off pests riding on hair or clothing.

When ventilation design is made, often the insect screen area that's needed is greater than the area of the inlet. In this case, additional structure is often required to support the screen. With proper design, thrips screens can be rather easily and cost effectively adapted to any mechanically ventilated house.

Natural ventilation

Naturally ventilated greenhouses are trickier to deal with than those with fans. By nature, passive houses are reliant upon not only good design, but also both wind and sun to ventilate properly. Generally speaking, naturally ventilated greenhouses well designed to receive thrips screens are tall, with air inlets low and exhaust vents high. The vents will be large, relative to the floor area, to accommodate the vent area reduction associated with the addition of screens. >>>

Screening an already under-ventilated greenhouse in a warm climate will only invite overheating challenges, including triggering more rapid biological activity. Selecting the appropriate area of thrips screen requires knowledge of the screen's discharge coefficient, which is also determined via wind tunnel testing. In general, for a given hole size, you want a screen with the highest discharge coefficient possible. The higher the discharge coefficient, the less screen area that'll be needed to achieve an acceptable decline in ventilation rate compared with the unscreened case and vice versa.

Naturally ventilated houses may be screened effectively as well, but it's easier to account for the screen in the initial structure and vent design than to retrofit existing houses.

Good advice

A well-designed screen system is the best prevention against the establishment of a Western flower thrips population. However, operation and maintenance also are important. Make sure workers follow a protocol that allows them to safely enter and exit the greenhouse with their tools without bringing thrips in through doors or on their hair or clothes.

The holes in a thrips screen are very small. Screening panels with any damage or tears in the screen are large invitations to entry and should be replaced or repaired immediately. Repairs can be accomplished by hand stitching a patch over the tear and sealing the perimeter with silicone caulking.

Screens should be brushed with soap and water and rinsed at least annually to limit the accumulation of hole clogging dust and debris. High-pressure washing may be used on some screens, provided it isn't enough pressure to alter the hole size.

For more information, take a look at the video at http://tinyurl.com/thripsscreens. **GT**

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