GROWERTALKS

Pest Management

3/1/2023

Thrips Management Using Banker Plant Systems

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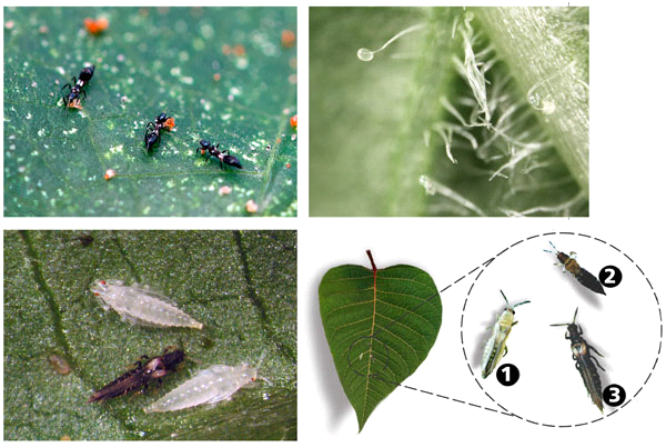

Pictured clockwise from top left: Predatory thrips feeding on alternate food.

• This is the most important part of the banker plant—these leaves have tuffed domatia. These structures are missing from many plants and could be why some predators do not establish on roses.

• 30x magnification of: 1. Chilli thrips, Scirtothrips dorsalis*; 2. Pepper thrips,* Thrips parvispinus*; 3. Poinsettia thrips,* Echinothrips americanus*.*

• Two pupae and an adult Echinothrips.

Thrips (*Thysanoptera*) are major global pests of vegetables and ornamentals grown within protected agriculture. Thrips feeding activity deprives the plant of nutrients, causes physical damage and may transmit viral pathogens. This can ultimately lead to reduced crop yield, aesthetic value, marketability, regulatory consequences and economic losses.

Historical thrips management has relied heavily on chemical pesticide use; however, there's an increased need for alternative eco-friendly management solutions. Achieving reliable chemical control has proven challenging due to their small size (typically < 2 mm), which allows them to feed cryptically within flowers and on the underside of leaves and avoid pesticide residue. Increasing incidence of pesticide resistance observed for some major pest species, such as western flower thrips (*Frankliniella occidentalis*) has raised additional concerns over the exclusive use of chemical control for thrips management.

Over the last few decades, researchers have made significant strides in developing alternative strategies for chemical use for thrips pest management. Arguably the most successful of these strategies is biological control. One of the key components of successful biological control programs in protected agriculture is reducing pest populations while simultaneously maintaining natural enemy populations, especially during periods of low prey numbers. Protective agriculture, by design, inhibits the movement of both pests and their natural enemies, which

can lead to the collapse of natural enemy populations due to starvation. Natural enemy population collapses not only increase grower costs associated with their repurchase and release, but can also lead to the resurgence of pests and subsequent crop damage.

Starvation of natural enemies can be prevented by providing them supplemental food either continuously or only during periods of low prey numbers. One of the most successful methods for providing biological control agents with supplemental resources, which can be applied continuously or periodically, is using banker plants. Banker plants are non-crop plants placed within or adjacent to the crop that support natural enemy populations directly or indirectly. This support can come not only from a food resource, but by providing natural enemy populations a suitable shelter or reproductive substrate that the crop lacks.

The types of food that banker plants provide can come directly from the plant, such as pollen or nectar, or from other suitable prey feeding on the banker plant. While this prey can be the same species attacking the crop, which poses various risks, more frequently another prey species is used that doesn't feed on the crop, but supports natural enemy populations.

Many of the thrips problems we have in foliage plant production in Florida greenhouses are the result of three major species: *Echinothrips americanus*, *Scirtothrips dorsalis*, and most recently, the invasive *Thrips parvispinus*. These thrips species feed and cause significant damage even if there's no flower pollen available. The banker plant systems utilized for thrips management in Florida are quite different than those used in Europe, where most banker plant systems adoption has occurred due to stricter pesticide regulations in the European Union. Outcry in the U.S. for stricter use of certain pesticide classes, such as neonicotinoids and organophosphates, has been increasing, and growers in the U.S. need to be prepared with alternative pest management strategies to replace these chemicals if their use is ever banned.

European banker plant systems have focused primarily on the use of minute pirate bugs (*Orius species*) or the mirid *Macrolophus pygmaeus* to manage the major thrips pest in these countries, *F. occidentalis*. Unlike the three major pest thrips in Florida, *F. occidentalis* prefers to feed in enclosed spaces, such as flowers, instead of on the surface of leaves. Both *Orius sp.* and *M. pygmaeus* forage better in enclosed spaces, so their use in Florida isn't ideal for managing foliage-feeding thrips species, which are the most problematic here. Thankfully, research on banker plant systems utilizing other biological control agents for various greenhouse pests in Florida has provided a foundation for developing new systems targeting foliage-feeding thrips.

A variety of banker plant systems in Florida have been developed against major greenhouse pests, including whiteflies and aphids. These banker plant systems arose due to the need for alternative predator release and retention strategies for existing biological control programs. One example of these programs uses the predatory mite *Amblyseius swirskii* for controlling whitefly pests, such as *Bemisia tabaci* for poinsettia production. Originally, banker plants weren't used in conjunction with *A. swirskii* for *B. tabaci* control, and instead, slow-release sachets containing *A. swirskii* were hung from the plants.

While effective, sachets get wet from irrigation and can cause high mortality of mites still inside. Additionally, once food inside the sachets is depleted and the pest populations have been reduced or eliminated, A. swirskii populations collapse, as poinsettias don't provide the necessary resources to sustain mite populations. Thus, banker plants began being investigated as an alternative strategy to release and support *A. swirskii* populations.

One of the earliest banker plant systems investigated to support Orius was the ornamental pepper variety Black Pearl. While capable of supporting *Orius insidiosus*, this variety was found to be too slow-growing and flower production was low, resulting in *A. swirskii* population densities often being too low to achieve successful biological control.

Additional studies were conducted to select a superior ornamental pepper variety to support *A. swirskii* populations as a banker plant and the variety Red Missile was found to be one of the best varieties for this purpose. As use of Red Missile in greenhouses increased for whitefly control, it was observed that *A. swirskii* was successfully managing co-occurring thrips in the crop such as *S. dorsalis*. As a result, these banker plants began being used for *S. dorsalis* control in the absence of other pests with a high degree of success.

These ornamental pepper banker plants have shown to be effective in managing *S. dorsalis* with mites on crops, such as roses, which are notoriously poor hosts for predatory mites. Some thrips species, such as *E. americanus*, however, continue to be problematic, as predatory mites have difficulty controlling it due to its large size, sedentary behavior and defensive behavior when attacked.

Current research in the last few years has expanded greatly upon the discussed banker plant systems in Florida to include new biological control agents and alternative methods to manipulate their population sizes and persistence in the crop. One of these recently investigated new species is the predatory mite *Amblydromalus limonicus*, which has proven to also be effective using an ornamental pepper banker plant system for *S. dorsalis* control. As predatory mites were proving ineffective for managing *E. americanus*, a large aggressive predator option needed to be discovered.

Recent studies using the large predatory thrips *Franklinothrips vespiformis* native to Florida have shown very promising results for *E. americanus* control in greenhouses. This predator is also effective in managing whitefly and spider mites in the crop. Studies have shown the addition of supplemental food, such as decapsulated brine shrimp eggs to the crop, can promote the persistence of *F. vespiformis* during periods when prey are absent. This species can also be maintained on banker plants containing an alternative prey and studies are currently being conducted on the best practices for a banker plant system.

As frequent invasions of new thrips species, such *T. parvispinus*, continue to challenge growers' abilities to manage an ever-growing suite of greenhouse pests, novel integrated pest management (IPM) tactics are needed to prevent the over-use of chemical pesticides and crop loss. Banker plant systems have a successful and growing history for use in biological control programs and we see a bright future for their implementation in greenhouse pest management in Florida.

One of the biggest hurdles for the implementation of banker plant systems going forward is convincing growers of their utility. The most effective way to do this is to provide systems that are attractive alternatives to chemical pesticides, and continued and expanded research into banker plant system development is critical to achieve this. **GT**

Funding for this research was provided by the USDA-ARS Floriculture and Nursery Research Initiative.

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