Red-headed flea beetle larvae can be found in container nursery plants.

Danny Lauderdale

How to handle the red-headed flea beetle

Supplement - State of the market: Insect control report

Research has provided several options to help control the red-headed flea beetle, a pest that quickly eats into nursery profits.

September 8, 2021

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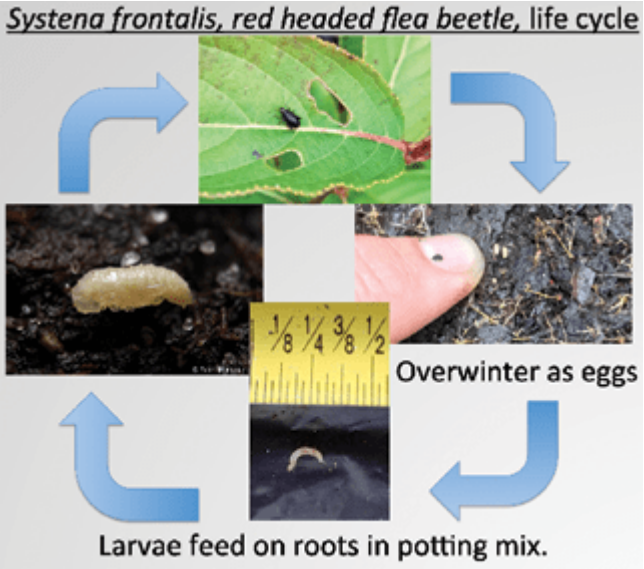
The beetle battle

Red-headed flea beetle (RHFB) adults, *Systena frontalis*, feed on many ornamentals in container nursery production making plants unmarketable due to skeletonizing or holes in leaves.

I know of or have heard grower concerns with this insect throughout the Southeast, Northeast, and in Ohio and Michigan. It is native to the majority of the United States. I don't know exactly when RHFB became a problem for container nursery growers. It seems to have coincided with or followed the Great Recession of December 2007 through June 2009.



Graphic and photo below by Danny Lauderdale

Management challenges

Traditional management has consisted of repeated adult foliar sprays. In 2017 I surveyed eastern North Carolina growers and found that acephate, bifenthrin, carbaryl, and chlorpyrifos were most commonly used to manage adult populations by making applications from weekly to monthly depending on pressure. Growers indicated managing RHFB was their greatest production concern which guided me to search for more information and conduct nursery research.

Lifecycle

In nature and soil-based systems this insect has one generation per year (egg, larva, pupa, adult) and is not of concern except in North American cranberry production in the Northern U.S. and Canada and possibly in other small fruit production. In container nursery production, RHFB may have up to four generations per year. I am confident that in eastern North Carolina container nurseries there are three to four. The insect overwinters as eggs in soil and substrate. In eastern North Carolina eggs hatch and larvae emerge in container substrate around 400 GDD50 (Growing Degree Days with base temperature of 50°F) in plants overwintered outdoors (300 GDD50 for plants overwintered in structures). Plants overwintered in structures can result in first generation larvae detection as early as 240 GDD50 (Brian Kunkel, 2013). Larvae don't seem to cause significant injury to plant root systems. Following a period of pupation, adults emerge beginning at 500 GDD50 from plants overwintered in structures (Brian Kunkel, 2013) and as late as 900-1000 GDD50 if overwintered outdoors in North Carolina. Generations seem to overlap starting with the second.

IR-4 research

Research conducted for the IR-4 program from 2012-2019 by Braman, Frank, Kunkel, and Gilrein showed that foliar applied active ingredients acetamiprid, bifenthrin, cyantraniliprole, cyclaniliprole, cyfluthrin + imidacloprid, dinotefuran, imidacloprid (granular applied exception), lambda-cyhalothrin, sulfoxaflor + spinetoram, thiamethoxam, and tolfenpyrad resulted in less RHFB damage over a 7 to 49 day period (depending on rates, varying levels of insect population and number of applications) when compared to untreated controls.

Larvae management research

Following extensive discussions with Dr. Brian Kunkel from the University of Delaware and reviewing his research targeting larvae management with drenches of entomopathogenic fungi (*Beauveria bassiana and Metarhizium anisopliae*), several products as drenches directed at active larvae in containers (*dinotefuran, imidacloprid, thiamethoxam, cyantraniliprole, azadiractin, bifenthrin*), and drenches with beneficial nematodes (*Steinernema carpocapsae* found to be most effective), I decided to conduct my own drench research targeting larvae.

My first replicated nursery trial targeting active larvae in 2017 showed that while azadirachtin, chlorpyrifos, cyclaniliprole, *Isaria fumosorosea*, and tolfenpyrad provided 25-47% control, acephate applied at a mix rate of 12 oz./100 gallons and drench volume of 12 fl. oz. per 3-gallon container provided 92% control of RHFB larvae.

A 2018 replicated nursery trial targeting larvae showed acephate at 12 oz./100 gallons, chlorpyrifos at 50W at 16 lb/100 gallons (the max label rate for beetles), and *Steinernema carpocapsae* nematodes at 250 million nematodes/100 gallons applied at a drench volume of 8 fl. oz. per full 1 gallon container provided 100% control of RHFB larvae. *Isaria fumosorosea*, provided 94% control.

Another 2018 replicated nursery trial showed that many labeled neonicotinoid insecticides applied at their recommended rates prior to egg hatch/larvae emergence (212 GDD50) provided the best control (most 100%) and all other products significantly reduced numbers of larvae compared to the untreated control (UTC).

Foliar applications are often applied using air blast sprayers and hand guns. Photo courtesy of Danny Lauderdale

Foliar, drench, & potting demos

With heavy adult pressure, monthly foliar application of neonicotinoids or biweekly application (once every two weeks) of contact insecticides is not enough to maintain marketable plants (< 10% injury). Foliar contact insecticides often must be applied weekly to maintain marketable plants. The challenge is that many insecticide labels restrict number of applications a year (for example carbaryl is 6) or have a maximum total rate per growing season or generation of insect. This is an opportunity to implement insecticide rotations that work within label restrictions and prevent insect resistance.

Neonicotinoids applied as drenches at potting or to existing plants prior to RHFB egg hatch/larvae emergence (approximately 200 to 300 GDD50), as granular topdress, or by granular incorporation can provide at least 60 to 90 days of adult control with less than 10% foliar injury without using foliar insecticides (depending on rate).

It is important to note (due to concern of neonicotinoid use and pollinators) that many newly spring potted plants (like *Itea virginica*) do not typically flower during their first growing season. Many modified varieties of Hydrangea with double flowers or sterile sepals attract few bees (Mach, 2018). Also, spring or summer flowering plants that are potted in the fall will not be attractive to pollinators at time of application.

Large numbers of larvae can be

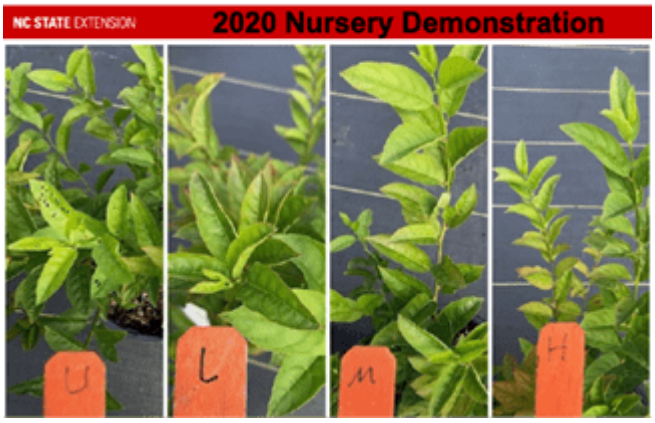
Where are we now?

In the eastern U.S. RHFB survey (Joseph et. al., 2021), we found that 72% of growers had recurring infestations over the past 10 years and species most affected were *Hydrangea paniculata, Itea virginica, Weigela florida, Ilex crenata, Ilex glabra, Rosa spp., Rhododenron spp., Osmanthus fragrans, Cornus* spp. (shrub dogwoods like silky, red-twig, and yellow-twig), *Sedum*, and *Salvia*.

found in container nursery plants.
Photo courtesy of Danny Lauderdale

Growers in eastern North Carolina have also reported damage on *Viburnum, Loropetalum chinense, Forsythia, Lagerstroemia, Buddleija, Abelia, Gardenia, Guara, Illicium, Pyracantha, and Myrica cerifera.* Growers spend an average of $662 per nursery acre per year on RHFB management. And 89% of growers apply insecticides against adults, 47% target larvae, 48% target adults and larvae, 11% were using *Steinernema carpocapsae* nematodes, and 2% were using entomopathogenic fungi. Among the growers surveyed, 36% use neonicotinoids, 23% carbaryl, 21% pyrethroids, 15% organophosphates, and 6% diamides. Some 54% of growers surveyed indicated they need more effective insecticides.

Management recommendations



Itea Scarlet Beauty, 8/20/2020. Untreated (U) compared with Low (L), Medium (M), and High (H) rate of imidacloprid granular topdress. Liners potted to 3 gallons and treated on 2/28/20 (260.5 GDD50).
Photo courtesy of Danny Lauderdale

Start by following growing degree days in your area based on the closest weather station or record and calculate on site. Keep a list of plant bloom at the nursery based on GGD50. This will guide scouting for first generation larvae and adults. In eastern North Carolina I start scouting containers for larvae in plants overwintered in protection structures around 200-300 GDD50 (redbuds in full bloom, when flowering dogwoods start blooms open), for larvae in plants overwintered outdoors around 350-450 GDD50 when *Itea virginica* flower buds start to swell, and for adults when older *Itea virginica* are in full bloom and *Magnolia grandiflora* start bloom around 800-1000 GDD50 (possibly earlier in plants overwintered in protection structures).

Scouting for larvae, adults, and keeping records will help determine application timing including:

- Pre-egg hatch with neonicotinoids (drench or granular topdress available in several formulations), azadirachtin, or cyantraniliprole. Neonicotinoids provide the best control of larvae and adults and the longest protection from foliar injury if applied to rooted cuttings, liners prior to potting, are incorporated in potting substrate, or are applied as drench or topdress after potting.
- After egg hatch target larvae with products like acephate, chlorpyrifos, *Isaria fumosorosea* or beneficial nematodes (*Steinernema carpocapsae*).
- Make applications of adult foliar insecticides just prior to historical first-generation adult emergence or based on scouting susceptible crops closely and frequently.
- Many foliar insecticides kill adults short term but don't break the life cycle. Repeat applications are needed during the summer to control newly emerging adults. Make sure to follow label instructions related to rate and limited number of applications per acre and/or year, growing season or generation of insect. Use a rotation of products based on their IRAC (Insect Resistance Action Committee) classification to avoid resistance.

In my experience, growers with greater numbers of susceptible plants held over from year to year have the greatest problems with RHFB. Know the most susceptible plants and manage production and inventory closely. Growers will have fewer problems with RHFB (and other pests or production issues) if plants are sold long before they have a birthday at the nursery. Consider split potting crops to fill plant sales demands throughout the year. This also provides the benefit of smaller crop blocks, lower pressure, less injury, fewer holds on sales, fewer sales credits, and prevents extra labor costs to prune and flush injured plants.

Finally, consider rotating the location of commonly susceptible plant species. Growers often put all deciduous plants in the same location year after year. Rotate those with conifer production to avoid population build ups. This will also help with prevention of conifer diseases, insects, and mites.

About the author

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