Developing management for a new snail pest

By Lauren Diepenbrock

A recently established snail species, *Bulimulus bonariensis* (also known as *Bulimulus sporadicus*), has been growing in population throughout the Southeast for the past few years. Growers first reported concerns about this snail in 2020 when they found the pest covering microjets and interfering with irrigation in the late spring/early summer (Figure 1). At the time, it was assumed that this organism would not be a large challenge for citrus growers. That assumption was incorrect.

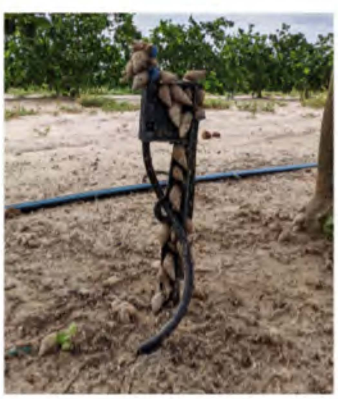

Photo by L. Diepenbrock, UF/IFAS

Figure 1. *Bulimulus bonariensis* can clog microjets.

Since the early finds of this pest in 2020, populations have increased within groves and spread throughout much of the state. These snails have also been found in Georgia, South Carolina, Alabama, Mississippi and Texas. In these regions, the snail affects several crops, making this a multi-crop regional pest issue.

The quickness of the snail's spread and population increase raises questions about the pest. These include the biology of the pest, how it is so readily moved and how its impacts can be reduced in groves.

BIOLOGY

Snails develop from eggs through juvenile stages into reproductively mature adults (Figure 2, page 11). Their development time is not yet known, nor is the number of populations that occur per year.

Eggs are buried under the surface of the soil and appear as small, shiny white balls. Upon hatching, the small juveniles have a soft shell and must acquire calcium to grow and strengthen their shells.

Adults reproduce sexually and are hermaphroditic, so any snail can inseminate another to produce viable offspring. This reproduction style is likely one of the factors that has enabled such seemingly rapid population growth.

DISPERSAL

B. bonariensis snails are highly mobile on their own and are capable of hitching rides on equipment (Figure 3, page 12). In a trial performed in row crops, snails traveled up to 71 feet within 22 days (Rabelo, et al. 2022). This illustrates how rapidly they can move to new locations.

The same study found an increase in snail activity correlated to temperature increases. Trap counts increased once the ambient air temperature reached 64 degrees, and activity decreased once summer rains began. This is not surprising as snails require moisture to maintain their mucous membranes.

Figure 2. Snails develop from eggs (left) to juveniles (center) to adults (right).

DAMAGE

One of the biggest challenges with these snails is their propensity to migrate to microjets (Figure 1, page 10). They remain there and clog the jets, disrupting irrigation patterns. This is problematic for maintaining tree vigor and supporting the establishment of young trees during dry periods. Once the summer rains begin, the snails move off the microjets to graze on weeds.

B. bonariensis does not appear to cause primary damage to mature trees, though it feeds at sites of previous trunk and fruit damage (Figure 4, page 12). Snail damage has been documented as a secondary issue on trunks of young trees impacted by winter freezes (Figure 5, page 13) and more recently on some varieties of immature citrus with green bark.

ONGOING RESEARCH

As a recently established pest in the region, there is much to be learned about *B. bonariensis* before robust management programs can be developed. In January 2023, University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) researchers received funding to develop the knowledge needed to manage this snail.

In coordination with growers in Central Florida, a two-year trapping study was begun at the UF/IFAS Citrus Research and Education Center (CREC) to track population activity while also evaluating two styles of traps. The traps are a flat board trap similar to one used in the research performed in Northwest Florida and a pyramid style trap similar to what is used for diaprepes. At the end of

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Figure 3. *Bulimulus bonariensis* snails can be spread by farm equipment.

Photo courtesy of K. Dickens, Florida Department of Agriculture and Consumer Services Division of Plant Industry

Figure 4. Feeding spots on fruit are a result of snails consuming canker lesions.

Photo courtesy of Ajia Paolillo, UF/IFAS

this study, researchers will have a well-documented seasonal biology of the snail to use in developing management plans. While these traps have been deployed for only a few months, the first major emergence of offspring were captured in early May 2023. It is expected that the traps will be useful in the future for timing management activities.

With emerging populations of *B. bonariensis*, field trials and smaller-scale field cage trials of baits have been initiated at CREC. These baits were previously evaluated in the lab in small containers with similar efficacy at the completion of the trial (Table 1). However, there is no guarantee that these numbers will translate to field efficacy when snails have the option of other foods, such as weeds, to choose from. The field trials will help determine which materials are the most promising for future recommendations.

While field biology and molluscicide-based management is evaluated at CREC, the UF/IFAS Indian River Research and Education Center laboratory has begun looking for potential predators. Many molluscan pests are controlled using predatory nematodes. Researchers hope to find a species that may be efficacious in the management of *B. bonariensis* while having minimal impact on native snail populations.

MANAGEMENT OPTIONS

Prevention is always ideal for managing pests, but that is not a realistic option for *B. bonariensis* in groves. This pest is here, so now growers need to think about how and when to manage it. For many snail and slug pests, management is best achieved by either using a predator, which researchers are currently looking for, or by using baits. There are only a few chemistries available as baits for snail management in commercial fields. These include metaldehyde, iron phosphate and sodium ferric EDTA (Table 2, page 13).

Metaldehyde causes snails and slugs to dehydrate by interfering with their ability to produce protective

Table 1. Data from laboratory trials of baits

Product Name	Active Ingredient	Rate*	Mortality at 7 Days (Mean ± Standard Deviation)
Deadline GT	Metaldehyde	33.3 lb/a (100x)	9.00 ± 1.22
Deadline MP	Metaldehyde	40 lb/a (100x)	9.60 ± 0.54
Iron Fist	Sodium ferric EDTA	1 lb/1,000 sq ft	9.20 ± 0.84
Ferroxx	Sodium ferric EDTA	0.5 tsp/sq yd (100x)	10.00 ± 0.00
Sluggo	Iron phosphate	1 tsp/sq yd (100x)	9.20 ± 0.84
Control	N/A	N/A	0.20 ± 0.63

*Rates listed as treated at 100x were done so because the maximum field rate was too small to weigh out for the smaller containers based on bait mass.

Figure 5. Secondary feeding damage can occur from *Bulimulus bonariensis* feeding on bark cracked from freezes.

Photo by L. Diepenbrock, UF/IFAS

Table 2. Molluscicidal baits labeled for use in citrus.

Product Name	Active Ingredient
Deadline GT	Metaldehyde
Deadline MP	Metaldehyde
Iron Fist	Sodium ferric EDTA
Ferroxx	Sodium ferric EDTA
Ferroxx AQ	Iron phosphate
Sluggo	Iron phosphate

mucus. This is a very effective way to kill an organism that relies on a mucus coating for survival. However, this chemistry is broadly toxic to all animals and is not recommended in areas where wildlife or pets may consume it. This material may only be applied in commercial settings. See the label for full limitations.

Iron phosphate and sodium ferric EDTA baits work by triggering snails and slugs to stop feeding. They then seek shelter and often die a few days after ingesting the bait. It can take longer than metaldehyde to see the impact of these types of baits. These active ingredients are nontoxic to mammals and can be used in a wide variety of settings, including residential and commercial. See the product labels for more information.

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