

A review of new techniques to control the spread of red imported fire ants in the United States

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Introduction

Invasive species have negative effects on native biodiversity and complicate the management of natural ecosystems around the world (Strayer *et al.*, 2006). The red imported fire ant, *Solenopsis invicta*, was inadvertently introduced into Alabama around 1920 and has spread throughout the southern United States at an alarming rate. Fire ants currently infest more than 320 million acres in at least 14 states (Williams and deShazo, 2004). As fire ants spread into new areas and become more abundant, the populations of other insects, particularly native ants, are reduced (Stayer *et al.*, 2006). Fire ant densities are currently as much as five times greater in the United States than in their native South America - most likely because they have escaped their natural enemies (Pereira, 2004). The complete eradication of *Solenopsis invicta* is not likely, so new techniques to control their spread are being introduced. This paper is a review of new techniques to control the spread of fire ants - including using natural enemies of the fire ants, drenches made of essential oils, and planting vegetation as non toxic ant repellants.

Natural enemies as fire ant control

The lack of natural enemies is one reason that the red imported fire ant spread so rapidly in the southern United States. Establishing a complex of natural enemies may put stress on imported fire ant populations (Jouvanez, 1983). Natural enemies of the fire ant currently being introduced in the United States include a microsporidium pathogen and a species specific decapitating fly. One of the most common fire ant diseases in South America is a result of the microsporidium *Thelohaniidae solenopsae*, (*T. solenopsae*). This pathogen is host specific to fire ants causing a chronic disease that is transmitted to other ants as well as the brood (Pereira, 2004). The disease is also known to weaken fire ant queens so they stop the production of new offspring and slowly kills the colony. *T. solenopsae* has been inoculated into colonies in 10 states

and may result in a long term biological suppressant of the imported fire ant (Williams and deShazo, 2004).

Another natural enemy of the fire ant, *Pseudacteon* flies, has been introduced into the United States from South America as a biocontrol agent. *Pseudacteon* flies are host specific decapitating flies that attack fire ants and present no known danger to other ants or organisms. This small fly hovers over fire ant workers, and quickly swoops down to deposit an egg in the thorax of the ant. The egg hatches inside the ant's thorax and chews its way toward the head region of the ant. The larva then seals itself within the ant head and decapitates the ant to complete its development, emerging from the ant head 30 to 90 days later to repeat the life cycle (Williams and deShazo, 2004). Studies show that while the *Pseudacteon* flies cause direct mortality of the fire ants, they are more important in reducing the ant's foraging opportunities, ultimately weakening the entire colony (Pereira, 2004). Worker ants tend to hide or assume a defensive posture whenever the flies are present, so a single fly can stop the foraging of hundreds of workers (Williams and deShazo, 2004). When the red imported fire ant is busy hiding or fending off the attacking flies, a competitive advantage is given to any native ant species that are not being harassed by the flies.

The first decapitating fly to be introduced to the United States is *Pseudacteon tricuspis*. *P. tricuspis* was successfully released in Florida in 1997 and is spreading at a rate of 10 to 18 miles per year (Williams and deShazo, 2004). These flies have more recently been introduced in 11 additional states, and continue to expand their habitat. In 2005, private citizens in Texas began to participate in the spread of *Pseudacteon* flies to new sites by releasing them on their property. The continued release and expansion of decapitating flies may put enough stress on the red imported fire ant to slow their expansion allowing native ant species room to thrive.

Essential oils as mound drenches

When the red imported fire ant was first introduced into the United States chemical insecticides like Mirex and Diazanon were widely used as broadcast baits and as individual mound treatments. With the growing concern over groundwater contamination and the negative affect that chemical insecticides have on non target species, non hazardous solutions for pest control are being explored (Vogt *et al.*, 2002). The question posed by many is whether alternative mound treatments are as effective as traditional chemical insecticides. Some alternatives to products like Mirex and Diazanon as mound drenches include cinnamon essential oil, citrus oil, and a mixture of cow manure that has been allowed to steep in water for about a week – more commonly known as compost tea.

A study in Taiwan, where the fire ant was also introduced, has shown that cinnamon oil is effective as an environmentally benign agent in fire ant control (Cheng *et al.*, 2008). The concentrated oil sprayed directly on the ants proved to be a very good killing agent. Studies have also been conducted comparing the effectiveness of Diazanon with that of orange oil and with an organic mixture that contains orange oil, molasses, and compost tea (Vogt *et al.*, 2002). The results of the test showed that both the orange oil and the organic mound drench were statistically as effective as the commercial Diazanon formula in neutralizing fire ant mounds. Although individual mound treatments are not a long term solution to the fire ant problem, the use of less toxic drenches will result in cleaner groundwater and less harm to non target species.

Using vegetation as a repellent

Chemical pesticides are not economically sound options for larger areas like ranches, pastures, parks or roadsides. Many pesticides may not to be used in locations where food is grown or in environmentally sensitive areas like wetlands (Williams and deShazo, 2004). Some

landscaping material like cedar and cypress mulch is known to be effective repellants of fire ants (Thorvilson and Rudd, 2001). A recent study in Texas tested whether a certain type of Old World Bluestem grass called WW-B Dahl was effective in repelling the red imported fire ant (Sternberg *et al.*, 2006). The results of the study found that the number of fire ant mounds were much lower in WW-B Dahl pastures than in fields planted with other types of grass. WW-B Dahl proves to be an attractive alternative to ranchers and farmers because the Old World Bluestem is favored by cattle and is very productive (Sternberg *et al.*, 2006). City leaders may also find this grass helpful in keeping fire ants out of parks, landscaping, and roadsides.

Conclusion

The red imported fire ant has quickly spread in the United States becoming a threat to fauna, native ants, beneficial insects, and mammals as well as being a nuisance to humans (Kenis *et al.*, 2008). The rapid spread of *Solenopsis invicta* leaves no option for eradication, so new techniques must be utilized in order to control its spread. By combining the use of environmentally friendly mound treatments, planting repellent grass, and introducing natural enemies, the spread of fire ants could possibly be controlled within the United States.

References

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