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BIOLOGICAL CONTROL OF FIRE ANTS : A LOOK INTO THE FUTURE

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The red and the black imported fire ants (IFA), Solenopsis invicta Buren and Solenopsis richteri Forel, currently infest ca 10^6 ha in the southeastern United States and Puerto Rico. Recently, they have been accidentally transported across the arid Southwest to Arizona and California. Should they become established in the West, their range will increase substantially. In addition, a polygynous form having denser populations and which is sometimes more difficult to control with chemicals is spreading within the population.

As medical and agricultural pests, IFA have been quarantined and assaulted with a succession of pesticides at a cost of at least $200,000,000 (1990 dollars). Despite these efforts, IFA are thriving in the United States. Pesticides are useful for temporary, local suppression, but cannot provide a permanent solution. Biological control, however, may provide at least a permanent amelioration of the problem.

The primary goal of USDA research is the establishment of a complex of specific natural enemies of IFA in the United States, where they are now essentially absent. In South America, IFA are beset by a complex of pathogens, parasites and social parasites, and symbiotic predators. Two of these, a nematode and a socially parasitic ant, may be able to destroy established colonies (Jouvenaz, elsewhere in this proceedings); a virus of unknown virulence also occurs. The remaining organisms appear to be debilitating agents well adapted to their hosts. They should not be neglected, however, for a complex of these organisms may exert sufficient stress on IFA to alter the competitive balance in favor of our native ant fauna.

Polygynous IFA may prove especially vulnerable to natural enemies, for their intercolonial barriers are diminished (at least within nest complexes) and, due to their high population densities, they may be under greater food stress as well. In addition, the large and numerous corpse piles associated with polygynous populations present a problem of hygiene. Could the apparent absence of polygynous IFA in Mato Grosso be due to natural enemies?

Parasites and their hosts tend to coevolve towards mutual tolerance. Hokkanen and Pimentel (1984) contend that introductions for biological control involving new parasite-host associations were successful 75% more often than those employing evolutionarily old associations. Since many of the natural enemies of IFA seem to be debilitating rather than directly lethal to colonies, the probability or degree of successful biological control might be increased by utilizing new associations and/or increasing the virulence of old pathogens through biotechnology.

New parasites and pathogens of IFA might be sought from other species of ants, especially other Solenopsis spp., but the probability of success does not appear high due to a prevailing pattern of host-specificity. Competitors, however, may hold brighter prospects. Buren (1983) proposed the introduction of a complex of 20-30 carefully selected exotic species of ants to competitively displace IFA. Despite obvious technical and regulatory difficulties and the potential for environmental harm, this approach may have merit, especially in concert with a complex of specific natural enemies.

Biotechnology presents the possibility of transforming old, attenuated pathogens into new, virulent ones. The endoparasitic yeasts of IFA are prime candidates for genetic engineering. Since they produce no toxins or histopathology, it may be possible to transform them to produce toxins of our choice, insect hormones, or even semiochemicals to disrupt colony organization. They may well prove host-specific for Solenopsis spp., and can be mass-produced and transmitted per os. Their invasive ability declines during in vitro culture, but this common problem with entomopathogenic fungi might be overcome through biotechnology and/or improved culture techniques.

In view of the behavioral complexity, ecological versatility, and high reproductive potential of IFA, it is easy to be pessimistic about biological control. Yet, Sr. Antonio C. C. Pereira, EMBRAPA entomologist and USDA collaborator, showed me a farm in the State of Mato Grosso, Brazil on which an IFA population crash appeared to have occurred. We found the site almost devoid of IFA, whereas less than a year before it had been heavily infested with IFA having a Thelohania solenopsae (Microsporida) infection rate of at least 70%, and other pathogens were also present. Porter et al. (elsewhere in this proceedings) found fire ant populations to be significantly lower in Brazil than in the United States, but the causes are unknown.

Literature Cited

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