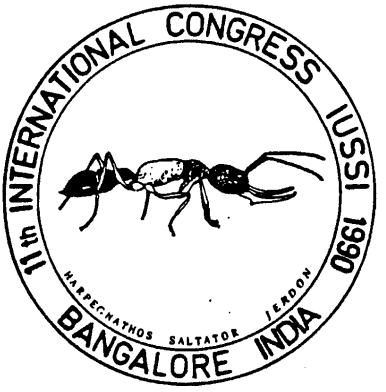
SOCIAL INSECTS AND THE ENVIRONMENT

PROCEEDINGS



Editors

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ICAL CONTROL OF FIRE ANTS : CURRENT CH

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nported fire ants (IFA), Solenopsis richteri Forel and Solenopsis invicta Buren, uced into the United States from South America ca. 1920 and 1940, respectively. ical and agricultural pests now infest over 10^8 ha in 11 southeastern states and o, and are threatening the west coast. In addition, a polygynous form having ulations and which is sometimes more difficult to control with chemicals is ithin the population. The diminished territorial behavior of polygynous colonies, ay render them more vulnerable to biotic agents.

nts are difficult subjects for biological control due to colony longevity, and the nvironment and high reproductive potential of their queens. In addition, they cal generalists, thriving in a wide variety of habitats and environmental conditions. as been directed both to the development of microbial formicides and to the st-specific natural enemies as candidates for introduction.

cides effectively eliminate colonies only if they kill or sterilize the queens. This serious obstacle to the development of a microbial formicide, for fire ant queens ered in subterranean nests, and are surrounded and defended by tens to hundreds ds of aggressive workers. They are fed only highly filtered, regurgitated liquids bly) glandular products; the gut is usually sterile (Jouvenaz, unpublished). They ed meticulously, and their chambers are fumigated with venom, which has ial properties. IFA also relocate their nests more frequently in response to s of biotic agents. The straw-itch mite, Pyemotes tritici, and a variety of non-ecific viruses, bacteria, fungi, protozoa, and nematodes have not been effective A. A strain of the fungus Beauveria bassiana under study by Stimac et al (1987) exception. Despite these obstacles, developing a microbial formicide is not a ndeavor. Through biotechnology, the endoparasitic yeasts of fire ants may have s microbial formicides, and non-specific nematodes and fungi may yet become through selection, formulation improvement, or special applications. As an f the latter, we are currently evaluating the use of commercially available on nursery stock prior to shipment into uninfested areas.

ajor goal of our research is to establish a complex of specific natural enemies ogens and arthropods) of IFA in the United States. The specific natural enemy e ants includes pathogens, parasites, social parasites, and symbiotic predators. The ising candidates for introduction appear to be the socially parasitic ant, Solenopsis na) daguerri, and the little-known nematode Tetradonema solenopsis. The former destroys IFA colonies, albeit slowly; the latter is a stressful parasite which may be vade adult queens.

The remaining specific natural enemies appear to be debilitating agents well adapted to their hosts; however, the stress they engender may shift the competitive balance in favor of our native ant fauna, or even deliberately introduced exotic species (Buren 1983; also see Jouvenaz, elsewhere in this proceedings).

Biotechnology presents exciting new vistas for biological control research, such as the development of genetically engineered microbial insecticides or avirulent symbionts being made virulent. We have isolated endoparasitic yeasts from fire ants which are prime candidates for genetic engineering. They can be mass-produced, transmitted, and I am optimistic that they will to be prove genus specific. 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. We have determined that one species, which appears to be an obligate parasite, is susceptible to the antibiotic hygromycin B, for which a cloned resistance gene is available. We plan to conduct a model transformation test for hygromycin resistance when taxonomic studies in progress are complete. Even without genetic modification, they may prove valuable as stressing agents in concert with other natural enemies or control practices.

Several pesticides are registered for control of IFA (none for use on crops), and will probably always be needed for local suppression of these pests. The Establishment of a complex of specific natural enemies, however, may provide a permanent amelioration of the IFA problem.

Literature Cited

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Stimac, J. L., S. B. Alves, and M. T. Vieira Camargo. 1987. Sucetibilidade de Solenopsis spp. a diferentes especies de fungos entomopatogenicos. An. Soc. Entomol. Brasil 16: 377-387.