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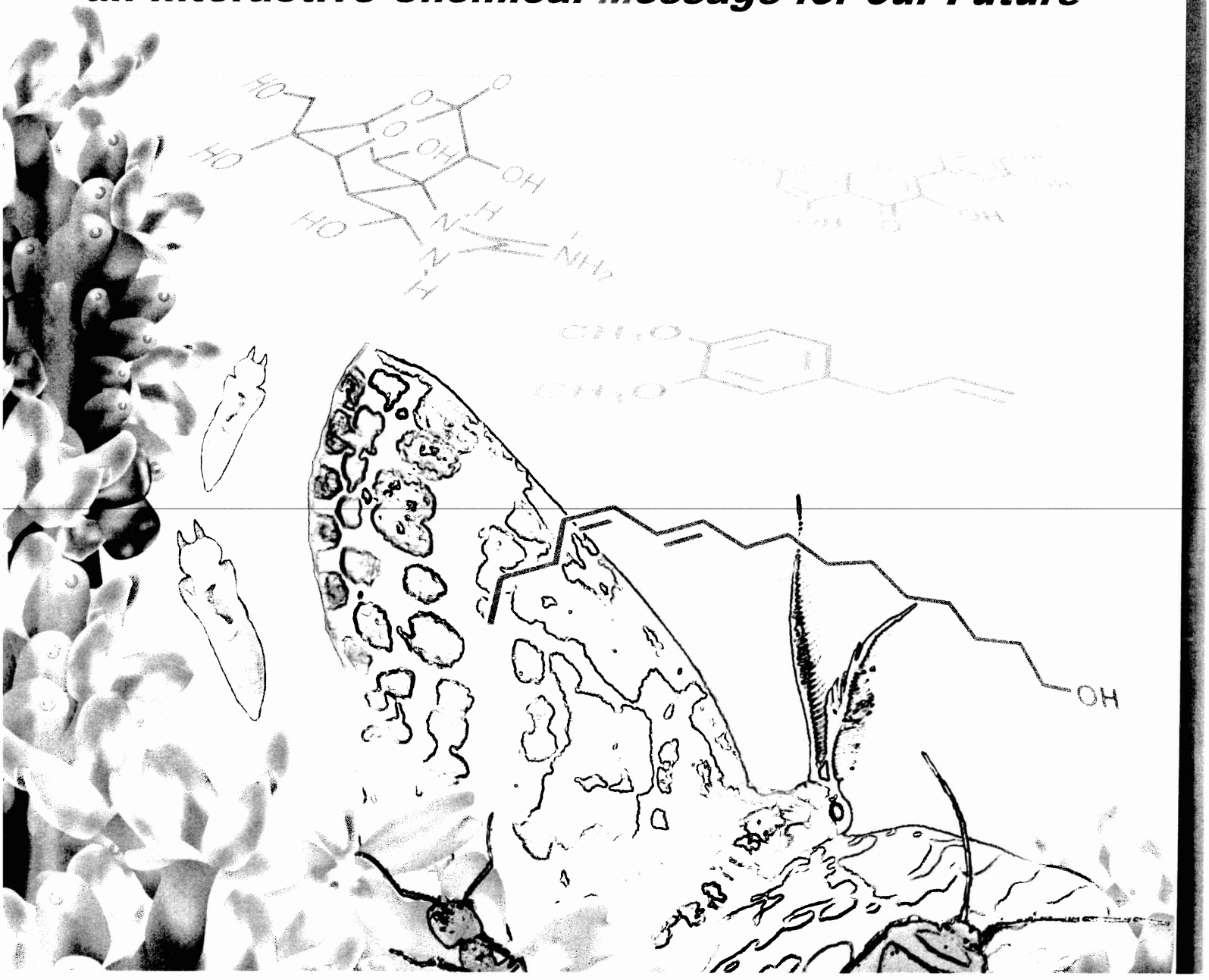

D–02 The Complexity of Fire Ant Nestmate Recognition

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Fire ants, *Solenopsis invicta* and *Solenopsis richteri*, were inadvertently introduced into the United States in the early 1900s and currently inhabit over 129 million hectares in Puerto Rico and twelve southern states from Texas to Virginia. Imported fire ants have also become established in isolated sites in California, New Mexico, and Maryland. They are expected to move upward along the Pacific coast, southward into Mexico and the Caribbean, and northward in Oklahoma, Arkansas, Tennessee, and along the eastern seaboard into Maryland and possibly Delaware. Within the past 10 years populations of *S. invicta* have been found in Australia, Taiwan, and mainland China. Fire ant population densities in the United States are very high. Workers are aggressive and have a potent sting and they have a high reproductive potential. The medical, agricultural, and other costs of fire ant control and damage in the United States are estimated at nearly six billion dollars per year.

Mature monogyne (single queen) fire ant colonies contain 100,000 to 250,000 workers and reach infestation rates of over 130 mounds per hectare. In the last several decades, polygyne fire ant colonies (multi-queen colonies) appear to be proliferating in the southern United States, with mound densities up to 500 per hectare. Monogyne *S. invicta* colony workers are territorial and aggressive toward members of other fire ant colonies. In contrast, polygyne colony workers are not aggressive toward non-nestmates, presumably due to broader exposure to heritable and environmentally derived nestmate recognition cues (broad template). The nestmate recognition system for the two social forms is very complex, and may by correlated with a single gene, *Gp-9*, especially for acceptance or rejection of newly mated queens. Workers from both monogyne and polygyne fire ant colonies execute newly mated queens after mating flights. We discovered that after removal of their colony queen, monogyne worker aggression toward non-nestmate conspecifics quickly drops to investigative levels; however, heterospecific recognition/aggression remains high. Queenless monogyne or polygyne worker groups were also not aggressive toward newly mated queens. Queenless worker groups of both forms that adopted a monogyne-derived newly mated queen became aggressive toward non-nestmate workers and newly mated queens. We suggested that this powerful effect of queens on conspecific nestmate recognition is caused by a queen produced recognition primer pheromone that increases the sensitivity of workers to subtle quantitative differences in nestmate recognition cues. Biogenic amines have been reported to modulate the sensitivity of insects to stimuli. We used this information to probe the primer pheromone/endocrine basis of nestmate recognition in fire ants. Queenright colonies were divided into three components: queenright, queenless, and queenless fed the biogenic amine, octopamine (OA). Queenright colonies maintained high aggression levels. In contrast, queenless workers fed only crickets and aqueous sucrose had low aggression levels. Workers that were fed octopamine had aggression levels that were not significantly different from queenright workers. Feeding OA to fire ant workers was adequate to simulate the presence of the queen, in terms of nestmate recognition. Thus, we have strong evidence that the queen recognition primer pheromone acts on workers to maintain high levels of OA that up—modulates worker sensitivity to the subtle changes in intraspecific nestmate recognition cues. This work was supported in part by BSF Grant No. 2003367.

Key words: fire ant, nestmate recognition, biogenic amine, aggression