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PREFACE

Delivering on the Promise of Pheromones – Part 2

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Because of the overwhelming response to the concept of a special issue of the Journal focusing on practical applications of semiochemicals, it was not possible to include all the invited manuscripts in one issue. This issue contains the remainder of the reviews and research papers on this overall subject, but with topics different from the first issue. Thus, the present collection leads off with a review by Mattias Larsson, which presents an overview of the prospects and technical details of using semiochemicals for detection and sampling of rare and endangered species for global biodiversity and conservation, a novel application of semiochemicals that has been largely overlooked. As Larsson so aptly points out, the front-end investment in the identification and synthesis of a pheromone for a target species is likely to be miniscule in comparison to the downstream savings in manpower and resources that will be realized by having much more effective tools for monitoring the target species. As a follow-on, the next manuscript by Millar et al. describes the identification of the pheromone of the luna moth, an iconic saturniid moth that has become one of many unintended targets of egg parasitoids released for control of gypsy moth in North America. To finish up the theme of using semiochemical tools to detect insect populations at low densities, Bau and Cardé present the results of in silico studies aimed at determining the effectiveness of widely spaced pheromone traps in detecting target species at low levels. Although their main intent was to assess the efficacy of pheromone-based surveillance systems for invasive species, the same principles apply to the detection of rare and endangered species. Wilson et al. present a useful practical study in which they establish the effective trap radius for the invasive lepidopteran pest, *Eoreuma loftini*, which can be applied immediately in determining trap spacing for this pest. Baker et al. follow these papers with a manuscript that is part review and part research paper, summarizing the evolution of ideas that have led to some unique schemes for using pheromone mega-dispenser designs for implementation in commercial sex pheromone mating disruption systems. Combining years of field trials testing various dispenser designs with some new research on pheromone plume concentrations, they argue that widely-spaced mega-dispensers should be designed to release highly concentrated pheromone plumes in order to be most effective and economical. This cluster of papers then finishes with the description of a new pheromone structure for a cossid moth pest by Bergmann and coworkers. In addition to providing a useful tool with immediate application, the structure of the main component of the pheromone, (7*Z*,10*Z*)-7,10-hexadecadienal, and some of the other components in the pheromone gland, suggest that the pheromone might be a hybrid between the two main biosynthetic pathways used to produce lepidopteran pheromones.

The remainder of the issue touches on a variety of topics. First, Clark and Ray delve into the details of the neurobiology and molecular biology underlying insect olfaction. They focus primarily on general principles of odor detection. While these mechanisms have emerged from studies of model systems, the

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authors suggest how this detailed knowledge might be manipulated and exploited for insect control. Cunningham et al. present what could be a fundamentally important insight into plant-insect interactions by suggesting that at least some fruit-feeding insects should be classified not according to the types of fruits that they attack, but by the stage of ripeness of those fruits. They illustrate this idea with the Queensland fruit fly *Bactrocera tryoni*, showing how augmentation of vegetables with odor components from ripe guava renders these (normally unattractive) substrates attractive to the flies. The plant-insect interaction theme is continued with a paper from Lapointe et al., who identified a phagostimulant blend that might find use in controlling an extremely important invasive pest, the Asian citrus psyllid, the primary vector of a pathogen which could devastate citrus crops worldwide. Moving from insect-plant to insect-fungal interactions, Kandasamy et al. provide an overview of the relationships between bark beetles and their symbiotic or mutualistic fungi. This suggests ways in which the volatile compounds produced by the fungi could be exploited for bark beetle management. Hansen et al. finish up the issue by reviewing the literature on attempts to use plant secondary metabolites for rodent control. A take-home message from this review seems to be that the translation of laboratory bioassays into effective operational systems has been problematic, with the result that relatively few products based on phytochemicals have been commercialized for management of pest rodents.

Overall, as guest editors and chemical ecology practitioners, we hope that these two issues of the Journal provide some sense of how far the discipline has come, both in terms of the basic science and in terms of the massive expansion of chemical ecology into the study of essentially all life forms and taxa. We also hope that the reviews and accompanying research papers will catalyze new ideas and new collaborations. Chemical ecology has a tremendous amount to offer the modern scientific world, from a deeper understanding of how the complex ecosystem that we call Earth functions, through to the development of practical tools and methods for the betterment of our society and our environment.