Oviposition Strategies in Beneficial Insects

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AIMS AND SCOPE: The aim of this special collection is to highlight the importance of reproduction (ie, oviposition) in the life history, population dynamics, survival, and fitness of beneficial insects, broadly defined. Specific areas of interest include the (1) identification of natural products to boost oviposition; (2) importance of chemical cues in oviposition site selection; (3) influence of host plant defenses on oviposition success; (4) reproductive physiology and the frequency of egg laying; (5) trade-offs between maternal size and egg size; (6) foraging behavior, host selection, and oviposition in parasitoids; and (7) oviposition decisions in the face of intraguild predators.

Introduction

Successful oviposition leading to egg hatch is essential to the survival and fitness of beneficial insects. Several theories have been proposed to explain how females make decisions on when and where to oviposit. In short, oviposition strategies rely on chemical and/or physical cues that facilitate female predators choosing suitable substrates or female parasitoids choosing the host environment and suitable hosts.[1,2] These cues influence oviposition decisions thus increasing the likelihood that immature stages will develop successfully to the adult stage. In this special collection, the oviposition strategies of 2 tachinid flies, salvinia weevil, and a ladybird beetle are described, from an applied (rather than fundamental) perspective.

Brief Summary

Tachinid flies are important parasitoids of herbivorous insects, especially larval lepidopterans.[3] A few species have been used in applied biological control to manage populations of the gypsy moth (*Lymantria dispar*). The authors indicate that 2 tachinids, *Exorista larvarum* and *Exorista japonica*, have the potential to control other lepidopterans, if knowledge of their biology, behavior, and host-parasitoid interactions can be increased and their mass rearing capacity optimized. The salvinia weevil (*Cyrtobagous salviniae*) is an effective herbivore of giant salvinia (*Salvinia molesta*), an aquatic plant introduced into the United States from South America in the late 1990s which causes major ecological and infrastructural problems in more than 20 tropical and subtropical countries.[4] The authors developed methods and techniques to assess the physiological age of the ovaries of *C salviniae*.[5] These techniques can be used to predict the reproductive health of a population. They can also be used to maximize the release of individuals in prime reproductive condition for biological control of giant salvinia. The predatory ladybird beetle *Coleomegilla maculata* is an important predator of insect pests (eg, aphids) on small fruits, vegetables, and several field crops. The authors discovered that polyphenols and bioflavonoids, identified in Eastern redcedar heartwood, stimulated oviposition behavior by *C maculata*.[6] This research could be used to design cost-effective mass rearing operations with the goal of producing large quantities of ladybird beetles for biological control of plant pests, such as aphids.

Future Directions

Although this special collection included just 3 papers, this does not diminish the importance of oviposition strategies to the success of many species of beneficial insects. The 3 papers, however, illustrate different case studies and may thus stimulate research in the field of oviposition strategies in a variety of beneficial insects. Areas of study that researchers could pursue in the near future include an examination of the chemical and physical cues involved in selection of hosts by parasitoids and oviposition substrates by predators. The influence of these factors regarding oviposition strategies is largely unknown, for most species. The elucidation of these cues will involve collaborative research between various disciplines, especially biochemistry and entomology, and likely from different countries. The results of this research should lead to technological advancements fostering applied biological control of insect and weed pests, throughout the world.

Author Contributions

All authors contributed equally to the writing and editing of the first and final drafts of this article.

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