Sex pheromones and plant volatiles for control of orchard insects

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Pheromone-based methods for control of orchard insects

Four decades of pheromone research have provided the tools for environmentally safe control of insects through manipulation of male mate-finding behaviour. In Europe, disruption of mating by aerial dissemination of synthetic pheromones is used to control several economically important tortricids in orchards and vineyards on ca. 50 000 ha. The importance of pheromone-based methods is accentuated in view of increasing problems associated with the use of conventional insecticides. However, for a more widespread use of pheromones, application techniques must become more reliable and more economic. The key to further development is closer communication and collaboration between academic research institutions, plant protection industry and extension services.

Codling moth Cydia pomonella is used to illustrate current issues. Pheromone-based mating disruption of codling moth is the most promising alternative to conventional insecticides, and this method is already commercially available. However, current dispenser formulations do not prevent damage at higher population densities. Shortcomings of the mating disruption technique concern insufficient pheromone release rates during the diel flight period of codling moth and the use of a suboptimal pheromone blend. Another most important issue is that field-implementation of the mating disruption method is as important as basic research, and laboratory and field studies should not be done in isolation. In the absence of insecticide sprays, other insects may gain importance, not all of which can be controlled with pheromones. This calls for an integration of pheromones and other available control methods, especially the use of microbial insecticides

Codling moth attraction to plant volatiles

Olfactory cues from the host plant provide an essential ingredient to the mate-finding process and they are essential mediators of female reproductive behaviours. There is growing evidence that host-finding in moths is largely guided by secondary plant metabolites. Gravid females make the critical host choice prior to and during oviposition, since newly hatched larvae cannot migrate over long distances. The attraction of gravid codling moth females to apple odour is well-documented.

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Plant volatiles will become valuable monitoring tools in codling moth and other species, as both male and female moths are attracted. Methods based on plant compounds will undoubtedly soon be available to enhance the efficacy of mating disruption by pheromones. The combination of male and female attractants are expected to lead to control methods which will become far more efficient than conventional insecticides. It is, however, unlikely that plant volatiles will replace pheromone-based methods. Among the drawbacks are that they may be less species-specific than pheromones, that much larger amounts are needed to stimulate behaviours, and that the host plant continuously releases large amounts of volatiles. Some plant compounds, especially terpenoids, are rather volatile or unstable and their purification or synthesis may be costly. In addition, registration of some compounds may pose considerable difficulties.

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