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INSECT CONTROL IN PLANT PROTECTION: WHAT ENTOMOLOGY HAS IN STORE FOR BIOTECHNOLOGY

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Public concern over the widespread use of synthetic pesticides and the needs of producers for alternative control strategies require the development of new methods for pest control that are efficacious, improve food safety and quality, and that are acceptable to the public. Among the most promising alternatives to chemical pesticides are the use of biotechnology-based natural products or organisms for pest suppression. In contrast to broad-spectrum chemical pesticides, these "bioinsecticides" can specifically target pest species, reducing adverse impacts on food safety, nontarget organisms, and the environment. Microrganisms, animals, and plants produce compounds that affect growth, development, and immune system of insect pests. Some of these molecules are produced by pathogens or parasites of insect pests, while others are produced by plants to protect themselves from insect attack (direct defenses). Many of these factors are only active against insects and therefore have great potential for use as environmentally safe bioinsecticides. Plants do also protect themselves by producing volatile compounds which are attractive for the natural enemies of phytophagous insects (indirect defenses). The growing information on the molecular bases of these interactions among plants, pest insects and their natural enemies, in a tritrophic context, provides new exciting opportunities for developing biotechnology-based approaches for sustainable plant protection. To effectively face this challenge, joint efforts in Insect Science and Plant Science/Biotechnology should be developed to define innovative (bio)technologies to be exploited in the framework of IPM (Integrated Pest Management) strategies.

The biotechnologies for insect control already available are presented and discussed and the current research directions aiming at developing environmentally friendly innovations are outlined. In particular, this presentation will focus on strategies for isolating new and selective insecticide molecules and genes from natural sources, as well as on the development of safe and sustainable delivery strategies of these molecules in the environment, which may also include transgenic plants. Furthermore, the possibility of enhancing both direct and indirect plant defenses, either by genetic manipulation or breeding, is also explored. Only a truly integrated approach to these fascinating research topics can significantly contribute to the development of sustainable new tools and methods of plant protection against pest insects.