PLANT INDUCED RESISTANCE TO INSECTS

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Abstract

Plants are exposed to very different attackers, including microbial pathogens and herbivorous insects. To protect themselves, plants have evolved defensive strategies to counteract potential invaders. Recent advances in plant defence signaling research have revealed that plants are capable of differentially activating inducible, broad-spectrum defence mechanisms, depending on the type of invader encountered. The plant hormones salicylic acid (SA), jasmonic acid (JA) and ethylene (ET) are major players in the network of defence signaling pathways (Pieterse et al, 2001**)**.

Kogan and Paxton (1983) defined induced resistance as the qualitative and/or quantitative enhancement of a plant's defense mechanisms against pests in response to pest related injury or extrinsic physical or chemical stimuli. The extrinsic stimuli are known as inducers or elicitors. The post challenge or injury-dependent responses of plants are compounds of induced resistance.

Induced defence against herbivorous insects is triggered upon insect feeding and involves two levels. The first level is direct defence, such as the production of secondary chemicals that act as toxins or feeding deterrents. The second level is an indirect defence, and consists of the production of a blend of volatiles to attract carnivorous enemies of the herbivores (Farmer and Ryan 1992; Karban and Baldwin 1997; Dicke 1999). The signaling pathway leading from insect wounding to production of these chemicals, involves four signaling molecules (systemin, jasmonic acid, oligogalacturonides and hydrogen peroxide), which are viewed as operating in a sequential manner (Gatehouse, 2002).

Phytophagous arthropods that cause extensive tissue damage induce changes in plant gene expression and accumulation of secondary metabolites similar to mechanical wounding. Multiple wound signaling pathways are active in plants. Wound-signaling pathways control the profound changes in plant cell biochemistry that facilitate recovery and healing at the site of injury. Many proteins and secondary metabolites that accumulate after wounding and JA-treatments interfere with insect feeding, oviposition, growth and development, and fecundity or attract herbivore predators. These compounds limit plant injury or restrain insect population expansion (Walling, 2000). Leaves normally release small quantities of volatile chemicals, but when a plant is damaged by herbivorous insects, many more volatiles are released. The chemical identity of the volatile compounds varies with the plant species and with the herbivorous insect species. These volatiles attract both parasitic and predatory insects that are natural enemies of the herbivores. They may also induce defense responses in neighboring plants. Volatile phytochemicals can serve as airborne semiochemicals, promoting or deterring interactions between plants and insect herbivores (Pare and Tumlinson, 1999).