Plant Defense Hormones:

Plants produce a number of chemicals in response to infectious agents and predator attack. Many investigators suggest that these chemicals should be classified as plant hormones since they are naturally occurring, organic substances that influence physiological processes at low concentrations. These substances are sallicyclic acid and the **jasmonates**.

Salicyclic acid, a compound from which aspirin is derived, has only recently been recognized as a potential regulatory compound, and is known to play a role in resistance, to pathogens. When an infectious agent, such as a bacterium, fungus, or virus, is introduced into a resistant plant, - the plant responds to the presence of the invader by turning on a complex set of defensive reactions in which, the infected cells and those nearby self destruct. And, as the cells die they release the acidic contents of their cells, which are harmful to the invading organisms and nearby cells surrounding the dying area begin secreting potent antibiotics. The response is not just a localized response however; an alarm signal spreads outwards until the whole plant body is mobilized and defense mechanisms are triggered in the rest of the plant. Cells throughout the plant begin producing salicylic acid. Salicylic acid is, in turn, responsible for turning on the so-called systemic resistance genes that mediate a broad defensive response against disease-causing organisms throughout the plant.

To summarize the response:

plant pathogen --> localized response and cell death -->alarm signal that travels throughout the plant --> salicylic acid -->activates systemic resistance genes --> systemic resistance

Some researchers have evidence that suggests that salicylic acid itself is the alarm signal that travels throughout the plant and stimulates resistance in undamaged leaves, while others suggest that other chemical signals may be involved. What is clear is that salicylic acid is essential for the systemic response. In fact, spraying plants with aspirin or salicylic acid causes all plants to develop a defensive response to pathogens. Could farmers protect

their crops from pathogens by spraying them with aspirin? Probably not, most researchers feet, because although it does stimulate resistance, it is metabolized very quickly and the effect would be too short-lived to be commercially useful. Synthetic compounds that mimic the effect offer more promise because they are metabolized more slowly.
Several of these compounds have been recently approved for use on certain crop plants.

The defense response to attacks by insect and mammalian herbivores differs from the response to disease pathogens, though there are some similarities. In some plants, the wounding of the leaves by herbivores alerts other unwounded leaves on the plant to produce a defensive response. The alarm signal is still unknown, but many researchers feel that the signal is fragments of cell walls or chemicals that travel through the phloem to more distant parts of the plant. One candidate is a peptide called **systemin**. Other researchers are unconvinced, and have suggested that the signal is electrical in nature. The alarm signal, whether chemical or electrical, stimulates the formation of **jasmonates**, which induce the synthesis of special defensive proteins called protease inhibitors (**PIs**):

Wounding--> alarm signal --> jasmonate production--> PIs

PIs are very powerful enzymes that accumulate in the vacuoles of uninjured cells and block the digestive enzymes of insects that ingest them, so food cannot be properly digested. Consequently, the insect is deprived of the nutrients it needs to grow and develop properly.

In addition to their role in plant defense, jasmonates inhibit many plant processes such as growth and seed germination. They also promote senescence, abscission, tuber formation, pigment formation, and tendril coiling.

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