INSECT MANAGER

How Insects and Mites Obtain Food From Plants, and How This Impacts Management

Insects and mites that feed on plants have different feeding behaviors, which include chewing, sucking, mining, boring, or galling. The majority of insect and mite pests that attack ornamental plants grown in greenhouses have sucking or piercing-sucking mouthparts, including aphids, whiteflies, mealybugs, soft scales, and thrips. These insects insert their mouthparts into the vascular tissues of plants, primarily in the food-conducting tissues (phloem), and withdraw plant fluids.

Those insects with piercing-sucking mouthparts that feed in the phloem may produce large quantities of honeydew, which is a clear, sticky liquid. These insects require protein, in the form of amino acids, for development and reproduction. In order to obtain the necessary quantities of amino acids, the insects must consume large amounts of plant sap, which contains an assortment of other materials in larger quantities than amino acids. The excess is then excreted as honeydew.

Insects that feed within the phloem such as aphids, mealybugs, whiteflies, and scales tend to exhibit a high degree of host specificity because certain plant-specific chemical compounds tend to serve as important host selection cues. This is why, for example, aphids may prefer certain cultivars of chrysanthemum to others.

Insects that feed in the water-conducting tissues (xylem) such as true bugs (Order: Hemiptera), which are generally not a major pest in greenhouses, must cope with negative tension and very low concentrations of nutrients in the xylem fluid. As a result, these insects feed faster as the water potential becomes more negative and they extract extremely large quantities of plant fluids, which is one reason why xylem-feeders tend to be larger than phloem-feeders.

Insect Feeding

Because insects with piercing-sucking mouthparts feed within the food-conducting tissues, they are susceptible to applications of systemic insecticides. Systemic insecticides are applied to the leaves, stem, or soil. Systemics are generally very water soluble, which allows them to be taken into the roots or leaves. In addition, plants do not readily metabolize them. In general, the active ingredient is taken up and moved throughout the plant (translocated) in the water-conducting or food-conducting tissues, or both. Additionally, once inside the plant, the

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active ingredient may move back-and-forth from the water-conducting tissues to the food-conducting tissues or vice versa. As an insect feeds, it takes up a lethal dose of the insecticide and is killed. For example, the piercing-sucking mouthpart or proboscis of an aphid is inserted into plant tissue and reaches the conductive cells (sieve tubes) through which water and food are transported. The aphid takes up the insecticide as it withdraws fluids. Systemic insecticides include imidacloprid (Marathon), acephate (Pinpoint/Orthene), pymetrozine (Endeavor), and thiamethoxam (Flagship).

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In addition, insects with piercing-sucking mouthparts that feed on the underside of leaves (i.e., whiteflies) are susceptible to insecticides with translaminar properties or local systemic activity. After an application, these materials penetrate leaf tissues and form a reservoir of active ingredient within the leaf. This provides residual activity against foliar-feeding insects and mites. Examples of insecticides with translaminar properties include abamectin (Avid), pyriproxyfen (Distance), spinosad (Conserve), and acephate (Orthene).

Leafminer larvae feed between the leaf surfaces in the mesophyll layer of cells. Generally, this protects the larvae from applications of contact insecticides; however, products with translaminar properties are effective against the larvae, as these materials are capable of entering the leaf and killing the larvae.

Spider mites including twospotted spider mite, Lewis mite, broad mite, cyclamen mite, and eriophyid mites do not feed in the vascular tissues. Twospotted spider mites primarily feed on leaf undersides within plant cells and obtain food by removing chlorophyll (green pigment) with their stylet-like mouthparts. Because spider mites don't feed in the vascular tissues, they are not susceptible to systemics; however, spider mites are susceptible to insecticides/miticides with translaminar properties such as abamectin (Avid), chlorfenapyr (Pylon), and etoxazole (TetraSan). GB

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