Radioactive measurement of brown mite injury on avocados

Frank V. Sances  □  Nick C. Toscano  □  Michael P. Hoffmann
Larry F. LaPre’ □  Marshall W. Johnson  □  J. Blair Bailey

Avocado brown mite can reach high population densities in southern California avocado-growing areas with a coastal or intermediate climate. Its feeding on avocado leaves is initially confined to the area surrounding the midrib on the upper leaf surface. Later, feeding extends along the smaller veins and may eventually cover the entire leaf if mite densities become high. The upper surfaces of recently expanded avocado leaves are the most favorable for adult survival, population increase, egg-laying, and development of immatures as compared with new leaves and the lower surfaces of mature leaves. Many workers have also observed that the accumulation of webbing and mite cast skins on the leaves can limit brown mite population growth.

Feeding by avocado brown mite, Oligonychus puniceus (Hirst), causes a brownish discoloration of the leaves commonly referred to as bronzing. Heavy infestations may cause complete bronzing of the upper leaf surface with only small portions of the lower leaf surface showing visible injury. Large populations for extended periods lead to partial defoliation of the tree. This leaf drop can occur when population densities average 70 adult females per leaf during short periods or 50 females per leaf for several weeks. However, it has not been determined if partial defoliation affects growth or fruit yields during the season in which the injury occurs.

Plant productivity

Reductions in photosynthesis rates have been detected in apple, citrus, strawberry, and cotton heavily infested with spider mites. Photosynthesis, the process by which sugars (photosynthates) are produced by the binding of carbon and water molecules into carbon-based chains, occurs within the chloroplasts of leaf cells and is powered by solar energy absorbed by the pigment chlorophyll. The required water is brought up from the roots by translocation. Carbon dioxide enters leaf tissue through small closable apertures in the epidermis (stomata), but at the same time, large quantities of water are lost by evaporation to the atmosphere (transpiration). When transpiration rates exceed the rate of water uptake by the roots, plants

G. Steven Sibbett is Farm Advisor; Larry Bettiga is Staff Research Associate; and Marion Bailey is Field Assistant. All are with University of California Cooperative Extension, Tulare County, Visalia.
feeding on chlorophyll in cells adjacent to upper and lower leaf surfaces. (Each data point = mean of 20 readings.)

Chlorophyll content in the upper cell layer remained the same at all injury levels, but in the lower cell layer, it decreased as mite damage increased (fig. 2). Leaves sustaining 46 percent damage on the upper surface showed a 30 percent reduction in photosynthesis rates, as compared with leaves with 91 percent damage, where rates decreased 41 percent. Transpiration was also negatively correlated with mite injury. Reduced transpiration not only indicates decreased loss of water from the leaf, but signifies reduced uptake of carbon dioxide through stomata, which also limits photosynthesis. We further found that photosynthesis was reduced not only by decreased stomatal opening, but also by the destruction of mesophyll cells and reduction of chlorophyll content of injured leaves (fig. 3).

These results indicate that avocado brown mite feeding injury on avocado leaves reduces rates of important processes in the plant. The extent of feeding and time of season that injury occurs is important when considering chemical or other control methods for this pest.

Although the study indicates the physiological stress caused by various infestation levels of avocado brown mite, the relation between this stress and avocado yield reduction has not been demonstrated. These critical pest levels probably vary with avocado variety, overall plant condition, and environmental factors. Information of this type is thus necessary before accurate economic threshold levels can be established.