



Citrus flat mite feeding causes dark, roughened blotches on pistachio nuts (bottom). Top row of nuts was uninfested.

This citrus pest has been seen in pistachio plantings in northwestern Kern County.

Citrus flat mite on pistachios in California

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Rapid expansion of commercial pistachio plantings in California during the past 10 years has presented a unique opportunity to observe the evolution and development of pest problems on this important nut crop. For two years, a new arthropod has been observed infesting pistachios in northwestern Kern County. This potential pest has been identified as the citrus flat mite, *Brevipalpus lewisi* McGregor (Acarina: Tenuipalpidae). The citrus flat mite is much smaller than the more common tetranychid mites, is flattened dorsally, and is oblong in shape. The body is wider near the front end. The motile stages of this mite are slow moving; they are reddish brown to bright red or pink. The eggs are very small, oval shaped, and bright red in color.

These mites are reported to overwinter as adults in colonies in bark cracks or under bark or bud scales. They emerge in the spring when temperatures reach about 70° F and begin to feed on developing shoots and small fruit. On most hosts (except grapes) citrus flat mites show a preference for feeding on the fruit and fruit stem areas of the plant. Highest populations are usually observed in mid- to late summer; they are not adversely affected by hot summer temperatures.

Citrus flat mite has been known primarily as a citrus pest. It was first found in California in 1942 attacking lemons near Porterville in Tulare County. Populations of the mite

can also reach damaging levels on pomegranates, grapes, walnuts, and numerous ornamental plants. It is reported from many parts of the world, primarily the United States, southeastern Europe and the Mediterranean countries, Japan, and Australia.

Increased importance of the mite on California citrus appeared to be correlated with the replacement of sulfur and lime-sulfur sprays by organophosphate and chlorinated hydrocarbon pesticides in the late 1940s and early 1950s. Damage to citrus mainly consists of roughened, scablike scarring of the fruit, especially near the stem end, whereas in pomegranates the rind often cracks under the scars caused by flat mite feeding. Severe surface injury can result in excessive culling of damaged fruit.

Following limited observations of infestations on pistachios in 1979, a sampling program was designed to monitor flat mite populations and observe damage on pistachios through the 1980 season. Beginning in early May, mite samples were taken at about two-week intervals from an orchard south of Kettleman City. Five nut clusters were taken from each of seven trees (replicates) on each sample date. All samples were taken from the same seven trees throughout the season. Mites were removed from each nut cluster by washing in an emulsifier-hot water solution, then filtering by vacuum. Along with the bi-

weekly mite counts, mean temperatures from the orchard were calculated and plotted weekly.

Citrus flat mite populations were extremely low but detectable from late May until early July, when mean temperatures were in the 70° ± 5° F range. Between July 2 and 23, flat mite populations began to increase, along with a rise in mean temperatures to about 80° F. A sharp increase in mite populations occurred in late July and early August, along with mean temperatures significantly above 80° F. During this period daily maximum temperatures averaged 104° F, which supports previous observations that these mites are not inhibited by hot weather. In late August and early September mite numbers began to decline, along with declining temperatures. It should be pointed out that in years with normal (higher) temperatures in late June and July, flat mite populations might be expected to increase earlier in the season than was observed in 1980.

The injury caused to pistachios by citrus flat mite is similar to that seen on oranges and pomegranates. The mites feed on the nut cluster petioles and stems, as well as the nuts, forming dark, roughened, scablike blotches on the surface tissues. On the nut hulls these injured areas may be slightly raised or blistered. Continued feeding on the petioles and stems causes them to wither and dry. The

mites seem to prefer feeding within and near the margins of damaged areas, which tends to rapidly expand the damaged tissue. Heavily damaged hulls also crack and dry, which might interfere with clean hulling.

Hulls with premature surface cracks from mite injury may also be more attractive and susceptible to oviposition by navel orangeworm, *Amyelois transitella*. This pest was the first, and currently most severe, insect problem in pistachios, reaching infestation levels of 10 percent or more on late-harvested orchards in some years. Female orangeworm moths typically lay their eggs on nuts as the hulls begin to crack and split, or directly on nut meats after hulls and shells split open.

Flat mite eggs were not observed in the samples until populations began to increase

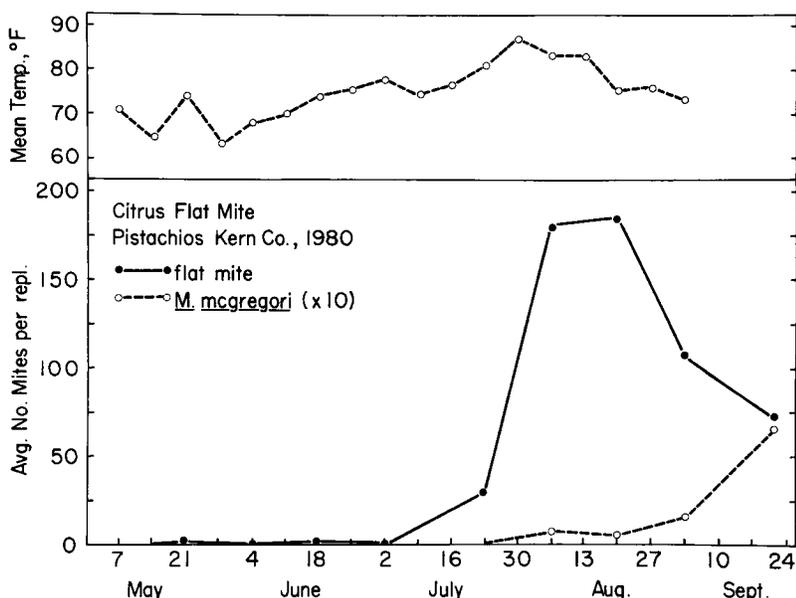
in late July, although earlier samples contained some immature mites. Samples taken in August and September also revealed the presence of a predaceous phytoseiid mite, *Metaseiulus mcgregori* (Chant). This predator mite is common throughout California and has been collected from several crops, including figs, walnuts, and grapes. Its prey includes other *Brevipalpus* (flat mite) species, and eriophyid and tetranychid mites. It is not known to what extent this predaceous mite would be able to regulate populations of citrus flat mite in pistachios. It did not appear in the nut samples until August, corresponding with the increase in *Brevipalpus* populations. It was randomly distributed throughout all replicates in this study and continued to increase until sampling was terminated at

harvest on September 21. Females of *M. mcgregori* outnumbered males at a ratio of three to one. Other phytoseiid mites collected from pistachio nut clusters in September were single female specimens of *Typhlodromus occidentalis* (Nesbitt) and *Amblyseius aure-scens* Athias-Henriot.

Twig samples taken in December from the trees previously sampled revealed overwintering adult flat mites distributed primarily on current year (1980) and one-year-old (1979) wood. Favored sites were in or on nut-cluster petiole scars on one-year-old wood, and under bud scales and at bases of buds on new wood. Less favored overwintering sites were leaf petiole scars, and bark cracks and scars on older wood. Overwintering phytoseiid females were also found in the twig samples, usually in association with flat mites in the nut-cluster petiole scars. One group of seven phytoseiids, however, was found under a parasitized scale cover of the European fruit lecanium, *Lecanium corni* (Bouché).



Left: Nut cluster stem injury from citrus flat mite feeding; infested stem on left, uninfested stem on right. Upper right: Adult flat mites feeding on pistachio hull. Lower right: Overwintering adult flat mites on leaf petiole scar on one-year-old wood.



Collections of citrus flat mite, *Brevipalpus lewisi* McGregor, and a mite predator, *Metaseiulus mcgregori* (Chant) from pistachio nut clusters, Kern County, California, 1980.

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