Spider Mites[1] on Almond in the Southern San Joaquin Valley of California[2]

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ABSTRACT

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Six species of tetranychid mites were found feeding on almond foliage in the southern San Joaquin Valley of California. Two species, the brown mite, *Bryobia rubrioculus* (Scheuten), and the European red mite, *Panonychus ulmi* (Koch), were rare. The citrus red mite, *Panonychus citri* (McGregor), was present on the east side of the valley, annually renewing infestation on almond by 'ballooning' from the citrus of that area in spring and dispersing south and west on almond over a period of months. Most of the *Tetranychus* spp. populations sampled were mixed populations consisting of 2 or occasionally 3 species. These 3 principal pest species were not uniformly encountered across the valley. The twospotted spider mite, *Tetranychus urticae* Koch, was present in all areas of the valley and was the dominant species in lower elevation mid-valley orchards. The Pacific spider mite, *T. pacificus* McGregor, was common or predominant in east and westside foothill orchards above 120 m in elevation and was rare in mid-valley orchards. The strawberry spider mite, *T. turkestani* (Ugarov and Nikolski) was not encountered in westside orchards and accounted for 1/4 to 1/3 of the *Tetranychus* populations sampled in mid-valley and eastside orchards.

Twenty-six thousand ha of almonds, 20% of the state's plantings, are located in southern San Joaquin Valley of California, which includes Kern, Tulare, and Kings Co. The great majority of these orchards are less than 10 yr old. On the west side of the valley, large and often isolated orchards (150–6500 ha) may be found at elevations of 120–240 m. Large plantings of various sizes are located in the eastern portion of the valley at 120–240 m. Many of the orchards on both sides of the valley are on hilly terrain and either sprinkler or drip irrigation systems are used. Plantings located on the flat valley floor, below 120 m, are often of smaller acreages. These orchards are almost all flood irrigated.

Two 2-yr studies documenting the impact of spider mites on the growth and yeild of almonds on the east side of the valley have been reported (Barnes and Andrews 1978). The year following infestation there was an average of 16% loss in yield, and, on young trees, a 48% reduction in length of terminal growth. The effect of Pacific spider mite feeding on photosynthesis and transpiration was studied by Andrews and La Pre (1979). These authors correlated mite-days per leaf with depression of photosynthesis and transpiration. Surveys were conducted in 1976 and 1977 to determine identities, distributions, and frequencies of spider mite species across the valley on almonds in this area. The area in question is a diversified agricultural ecosystem of large and small holdings, including, besides almond orchards, very extensive acreages of cotton and vineyards as well as citrus, alfalfa, pistachios and ca. 70 other field, vegetable, nursery and orchard crops. In addition to providing information on the diverse occurrence of mite pests depending on location of almond orchards in the valley, this paper documents the annual invasion of a mite pest from one of these crops (citrus) to another (almond).

Materials and Methods

Procedure I

Tetranychid mites were routinely collected during the course of studies on mite biology, ecology and control in Kern and Tulare Counties in 1976 and 1977. Specimens were mounted on slides in Hoyer's medium according to Jeppson et al. (1975). Most collections were made when mites were abundant, mid-June through mid-Aug., but a few were made as early as mid-Apr., and as late as the last of Sept. Throughout 1976 and 1977, 2 orchards along the eastern foothills were checked at least once a month. Another 6 orchards throughout the valley were visited ca. monthly during one of the 2 yr. Many other orchards were sampled infrequently in this period.

Procedure II

On Apr. 27, 1977, 29 orchard sites located throughout the almond growing areas of Kern and southern Tulare Co. were checked during a 5-min search for the presence of citrus red mites. Five-min searches were again made on the same sites May 11–16, May 25–June 2, and July 13–16.

Procedure III

In July, 1977, a mite survey was conducted in Kern and southern Tulare and Kings Co. Twenty-seven orchards located in topographic and geog-

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raphic areas where almonds are grown were checked for mites. *Tetranychus*-infested leaves from 5–10 trees were collected, placed in paper bags and frozen until they could be scanned under a stereoscope. Up to 2 males and 2 females were taken from each leaf until either all leaves had been checked or 15 males had been mounted. Cleared specimens were identified using a phase contrast microscope.

Results and Discussion

Six tetranychid species belonging to 3 genera were encountered. In Procedure I, *Bryobia rubrioculus* (Scheuten), the brown mite, was encountered 3 times in Apr. or May in foothill orchards. The brown mite is not the serious threat to almonds in the southern San Joaquin Valley that it is in more northern areas of the valley (Summers and Stocking 1972). Similarly, *Panonychus ulmi* (Koch), the European red mite, was encountered in only 4 orchards and always in low numbers during the 2-yr survey. These low populations were causing no apparent damage. This species was not found on the valley floor.

Panonychus citri (McGregor), the citrus red mite, was encountered frequently and often in high numbers (> 20/leaf) on the east side of the valley. The citrus red mite had not been recognized as a pest of almonds in California until our observations were made as it had been mistaken for the European red mite. Citrus red mites were found earliest in the year in almond orchards along the eastern foothills of Kern and Tulare Co. Almond trees are initially colonized in spring by individuals which "baloon" into almonds from citrus orchards. The first individuals seen in early season were always adult females. These females were generally concentrated on leaves in the upper periphery of trees and usually solitary.

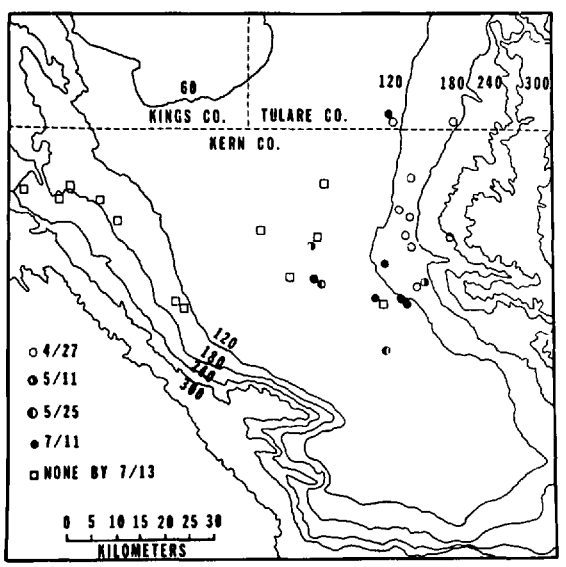

FIG. 1.—First appearance of the citrus red mite in almond orchards of southern San Joaquin Valley, 1977.

Fig. 1 shows the locations of the orchards sampled by Procedure II and the date on which citrus red mites were first observed at each site. All but one of the eastern foothill orchard sites were infested when first checked on Apr. 27. All of the orchards infested at that time are in close proximity to citrus. On subsequent sample dates, a general movement of the species was observed southward and westward to the valley floor. This pest species was not detected through mid-July in orchards in the western half of the valley where little citrus in grown.

Table 1 shows the frequency of occurrence of the 3 principal mite pests, *Tetranychus* spp., taken in the 27 orchards sampled (Fig. 2) in different parts of the valley by Procedure III. These were the Pacific spider mite, *T. pacificus* McGregor, the twospotted spider mite, *T. urticae* Koch, and the strawberry spider mite, *T. turkestani* (Ugarov and Nikolski). The latter is reported for the 1st time as a pest of almonds. All 3 species occur on extensive plantings (ca. 120,000 hectares) of cotton in the area (Leigh and Burton 1976). Of these, only twospotted and Pacific mite are reported on almond in the northern part of the valley (Stanislaus Co.) (Hoy et al. 1978), where cotton is not grown. The strawberry mite has a wide geographic distribution and host range (Jeppson et al. 1975), and its occurrence on almond only in areas where cotton is grown suggests an association with this crop.

Some of the variability encountered in our sampling may have been related to small sample size, but definite trends seem to occur in mite distribution across the valley. All 6 westside foothill orchards were infested by Pacific mites (83% of specimens), 3 by twospotted mites as well (17%), but no strawberry mites were encountered. Pacific

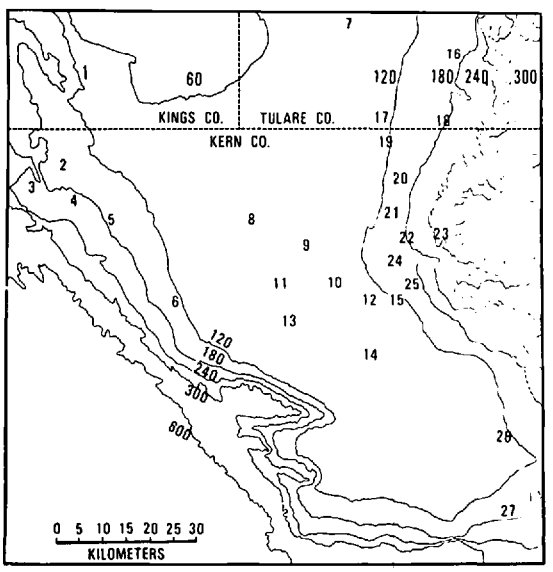

FIG. 2.—Numbers 1–27 refer to the location of orchards in southern San Joaquin Valley, CA, from which *Tetranychus* spp. samples were taken, July, 1977 (see Table 1).

Table 1.—The number of males of each of 3 species of *Tetranychus* collected from almond foliage in the southern San Joaquin Valley, July 1977.

Orchard	*T. pacificus*	*T. urticae*	*T. turkestani*
		Westside orchards	
1	11	0	0
2	9	4	0
3	8	0	0
4	5	9	0
5	15	1	0
6	8	0	0
Total specimens	56	14	0
% of specimens	83	17	0
		Mid-valley orchards	
7	0	5	1
8	0	1	12
9	0	11	3
10	0	13	0
11	0	11	3
12	0	7	3
13	0	2	5
14	3	9	2
Total specimens	3	59	29
% of specimens	3	64	33
		Eastside orchards	
15	0	8	0
16	1	4	4
17	7	3	0
18	0	0	9
19	2	5	3
20	7	4	0
21	4	1	0
22	11	4	0
23	0	4	8
24	0	16	1
25	7	2	0
26	0	2	5
27	3	7	1
Total specimens	42	60	31
% of specimens	33	42	35

mite is also reported to be the dominant species on cotton on the westside (Leigh and Burton 1976). Twospotted mites were consistently present in the 8 orchards sampled in mid-valley and strawberry mites in all but one. Pacific mites were encountered in only 1 mid-valley orchard. On the eastside, all 3 species occurred, the twospotted mite was found in all but one of the 13 orchards sampled (42% of specimens). The Pacific mite was present in 8 out of 13 orchards (33%) and the strawberry mite in 7 (25%).

When mite predators were encountered during the course of these studies, their presence was recorded or they were preserved and later identified. Three species were found frequently, the sixspotted thrips, *Scolothrips sexmaculatus* (Pergande), the common green lacewing, *Chrysopa carnea* Stephens, and the western predatory mite, *Typhlodromus occidentalis* Nesbitt. Sixspotted thrips was observed to reduce high *Tetranychus* populations dramatically on several occasions, but their effectiveness at low prey densities is questionable. Green lacewing larvae were common from Apr. through June at which time their numbers greatly decreased. Their importance in regulating early season mite populations should be investigated. The predacious mite was seldom found until midsummer when prey populations were high. It was observed that predators seldom suppressed prey mites before they reached the high numbers generally encountered in July and Aug., regardless of whether insecticides are used.

Other species encountered less frequently, listed in an order of decreasing frequency, were *Stethorus picipes* Casey, *Orius* sp., syrphid larvae, *Geocoris* sp., *Nabis* sp., cecidomyid larvae, and rarely *Typhlodromus mcgregori* Chant.

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