The California pepper tree is an evergreen, ornamental shade tree grown in much of the state. A pest new to California, the peppertree psyllid, is spreading rapidly in the coastal areas from San Diego to San Francisco. In its nymphal stage, the insect causes disfiguring pitting and discoloration of leaflets. High psyllid populations give infested trees a grayish color and cause heavy foliage drop during winter and early spring (right).

New psyllid pest of California pepper tree

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A new psyllid pest of California pepper trees was first discovered in Long Beach, California, in July 1984. Since then, the insect has spread rapidly, particularly in coastal areas, and now occurs from San Diego County to the San Francisco Bay region. There are scattered records of its occurrence inland in San Bernardino and Kern counties.

Identified as the peppertree psyllid, *Calophya schini* Tuthill, this insect is native to Peru, which is also the native home of the California pepper tree, *Schinus molle*. Observations indicate that the Brazilian pepper, *S. terebinthifolius*, is not susceptible to attack by this psyllid, and plants of other genera have not been reported infested.

Damage and biology

Damage is caused by the nymphal stage of the insect. Each nymph makes a deep pit in the leaflet, and several dozen pits may occur on the same leaflet. Pitting and nymphal development occur also on petioles, immature flower buds, slender green twiglets, and occasionally on heavier wood. The pitting and associated discoloration and distortion of leaflets and twiglets disfigure trees. High psyllid populations result in a grayish appearance of infested trees, followed by extensive foliage drop, particularly during the winter and early spring before the new flush of foliage is produced.

Adult female psyllids deposit translucent white eggs, which darken before hatching, on several types of tender new growth of the pepper tree. To find out where the most eggs are laid, we took 10 samples (1 cm long) of each type of terminal growth—unexpanded leaves, vegetative or floral buds, leaflets, and leaf midribs—from three trees in Ventura County on July 1, 1986, and counted the unhatched eggs. An average of 22 ± 16 eggs were present on samples of unexpanded leaves, significantly more ($P<.05$) than the averages of 9 ± 7, 9 ± 7, and 7 ± 5 eggs found on buds, leaflets, and leaf midribs, respectively. Unexpanded leaves therefore seem to be the preferred site of egg-laying.

On hatching, the nymphs settle on nearby plant growth. Of 170 nymphs found on 192 leaflets examined from 16 leaves, 55 percent were on the lower surface and 45 percent on the upper surface.

To determine the number of nymphal instars, we collected about 1,000 nymphs in all stages of development from infested pepper trees in Alameda County over a 10-week period, June to August 1986. The width of each nymph's head was measured under magnification; the smallest was 0.075 mm wide and the largest 0.438 mm wide. A frequency distribution of these measurements revealed four distinct peaks, indicating that the peppertree psyllid has four nymphal instars. The adult psyllid emerges through the dorsum of the exoskeleton of its last nymphal instar, and the cycle is repeated.

Three infested pepper trees in Ventura County were sampled for adults approximately weekly from February 1986 through March 1987. Sampling was done by holding an 8.5- by 11-inch pad of paper

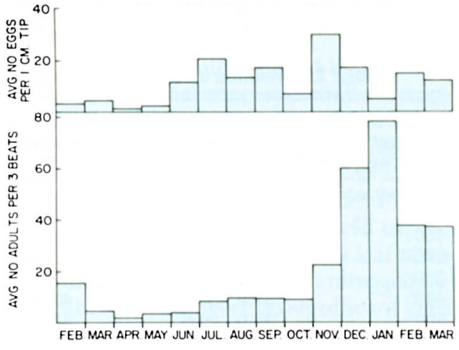

Fig. 1. Peppertree psyllid adults and eggs varied seasonally in number but were present year-round in Ventura County.

TABLE 1. Evaluation of insecticides applied as sprays for control of the peppertree psyllid, 1986-87

Insecticide	Formulation per 100 gal water	Avg. no. psyllid adults per 6 beats (posttreatment) after (weeks)*: 1	2	3	4	5	7	9	10	11	12	13	15
Ventura County, Applied Jan. 28, 1986													
Asana (esfenvalerate) (0.6 lb/gal EC)	0.34 pt	—	1a	1a	29ab	23b	7ab	6b	5a				
Orthene (acephate) (75 S)	1.0 lb	—	3a	1a	3a	4a	3a	2a	3a				
Sevin (carbaryl) (80 S)	1.25 lb	—	26b	7b	32b	55b	25c	9b	9a				
Untreated	—	—	55b	37c	31b	35b	15bc	11b	9a				
Santa Barbara County, Applied Feb. 25, 1986													
Orthene (75 S)	1.0 lb	2b	5a	4a	4a	8a	3a	4a	5a	—	20a		
Orthene (9.4% EC)	1.17 gal	3b	5a	6a	7ab	10a	5ab	5a	8a	—	31a		
Asana (0.6 lb/gal EC)	0.34 pt	1a	4a	11ab	22bc	21ab	9b	6a	7a	—	27a		
Untreated	—	31c	30b	25b	29c	34b	14b	17b	20b	—	45a		
Santa Clara County, Applied Dec. 4, 1986													
Volck Oil	1.0 gal	10bc	14b	12bc	25bc	7cd	8a	18c	12c	14c	19c	22bc	17a
Safer Insecticidal Soap	2.5 gal	11cd	12b	6bc	15bc	7cd	4a	19c	5bc	12c	12bc	21bc	10a
Dursban (chlorpyrifos) (4 lb/gal EC)	1.0 pt	6bc	7b	7bc	5ab	5bc	6a	7b	2ab	6ab	6b	10ab	8a
Danitol (fenpropathrin) (2.4 lb/gal EC)	0.67 pt	0a	<1a	0a	1a	<1a	1a	<1a	1a	2a	<1a	3a	8a
Orthene (9.4% EC)	0.8 gal	1ab	<1a	1ab	1a	2ab	1a	1a	2ab	6ab	4ab	8ab	26a
Untreated	—	25d	19b	20c	30c	14d	6a	14c	11c	12c	12bc	38c	15a

* Means in individual columns followed by the same letter do not differ significantly at the 5% level (DMRT).

TABLE 2. Evaluation of trunk implants in California pepper tree for control of the peppertree psyllid, Ventura County, 1987

Treatment*	Avg. no. psyllid adults per 6 beats (posttreatment) after (weeks): 1	2	3	4	8	10	14	16	20	22
Acecaps†	45	27	12	6	9	5	3	2	10	17
Untreated	44	50	36	39	25	16	8	11	27	30
% reduction	0	46	67	85	64	69	62	82	63	43

* Six trees implanted Jan. 6; comparisons made to six adjacent untreated trees.
† Containing 87% acephate.

TABLE 3. Evaluation of trunk injection and implantation of California pepper tree for control of the peppertree psyllid, Ventura County, 1987

Treatment*	Avg. no. adults per 6 beats (posttreatment) after (days):† 11	18	25	41	46	52	60	67	76	82
Injectacide	2a	3a	1a	6b	3a	3a	1a	6a	9a	10ab
Acecaps‡	1a	2a	1a	1a	2a	4a	2a	6ab	7a	6a
Untreated	7b	12a	10b	9b	9b	12b	16b	22b	19a	24b

* Treated Mar. 20.
† Means in each column followed by the same letter do not differ significantly at the 5% level (DMRT).
‡ Containing 97% acephate.

under each tree, striking the foliage sharply three times, and quickly counting the adult psyllids dislodged onto the paper. This process was repeated on another portion of the same tree. At the same time, a total of 10 samples of 1-cm-long terminal growth of bud or unexpanded leaf tissue on three nearby trees was collected and examined under magnification to determine the number of unhatched eggs on each.

Adult numbers were highest in the fall and winter (fig. 1). Eggs were least numerous on samples taken in the late winter and spring, perhaps because the rapid tree growth and increase in foliage volume at that time diluted egg numbers. The fact that adult psyllids and eggs were found each time trees were sampled over the one-year period suggests that psyllid reproduction takes place year-round.

Chemical control experiments

At one location each in Ventura, Santa Barbara, and Santa Clara counties, we sprayed 4- to 10-foot-tall, infested pepper trees with various insecticides to determine how the psyllid might be controlled. Applications were made to the point of complete coverage with hand compression equipment. Plots consisted of single trees, and a randomized complete block design, with four replications of each treatment, was used in each of the three experiments.

Periodically after treatment, each tree was sampled for adult psyllids by the beating method described earlier, with two sets of three beats per tree (table 1).

Orthene 75 S controlled adult psyllids for 9 to 10 weeks after treatment. The garden and home Orthene product (9.4% EC), a liquid concentrate, performed at about the same level, but when it was applied at double the maximum label dosage to pepper trees not in the experimental plot, an unacceptable level of leaflet drop occurred. Danitol's performance was excellent, providing long-term control comparable to that given by Orthene. Dursban gave good control, yet more adults persisted in that treatment than in the Orthene or Danitol treatments. No other insecticides evaluated provided the long-term control deemed necessary for this insect.

Two trials were conducted in Ventura County to evaluate the effectiveness of trunk-implanted or injected systemic insecticides against the psyllid. Acecaps, each unit of which contains a solid formulation of Orthene, were used in the first trial (table 2). Units were implanted around the lower bole of pepper trees at 4-inch intervals in accordance with the manufacturer's specifications. Both Acecaps and Injectacide, which contains Meta-Systox-R in a liquid state, were used in the second trial (table 3). Trees were injected at 6-inch intervals around the lower bole. The completely randomized design was used in this second trial, with four replications of all treatments. In both trials, only adults were sampled.

Both Acecaps and Injectacide reduced adult psyllid numbers substantially below those of the untreated controls. It appears that either injection or implantation provides control for at least as long as sprays of Orthene or Danitol. Bleeding of trunks at the sites of implantation of Acecaps and occasional burning of branch tips of trees treated with Injectacide were noted. The possible long-term harmful effects on the trees, of either implanting or injecting them, cannot be predicted at this time.

In these five insecticide trials, only adult insect numbers were recorded. We believe that reducing the adult population causes egg laying and subsequent nymphal numbers to diminish. Observations and limited sampling support this belief, yet because the nymph is the stage that damages the tree, further work will be necessary to determine the relationships between adult numbers, nymphal numbers, and tree appearance.

(More photos on p. 32)

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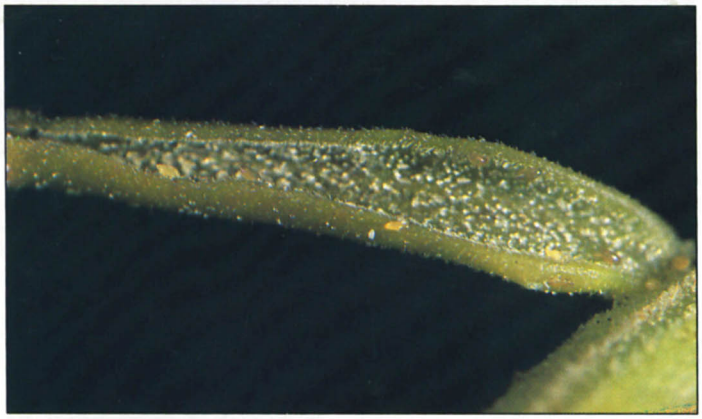

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Adult female psyllids (top) deposit translucent white eggs (above left) on tender new growth of the California pepper tree. When the eggs hatch, the nymphs (right) create pits on leaflets and other plant parts. The pits cause discoloration and disfigurement of leaflets (below) and extensive loss of leaves in the winter and early spring before the new flush of foliage is produced.

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