

NYMPHS**San Jose scale***Quadraspidiotus perniciosus* (Comstock)**INTRODUCTION**

The San Jose scale (SJS) is a pest of tree fruit. Trees attacked include apple, peach, and pear. Originating in the Orient, it was introduced into California's San Jose Valley on infested plant stock in 1870. The SJS has since spread throughout the United States and Canada. The SJS may have up to 3 generations per year, depending upon the locality and the length of the growing season.

ADULTS

Adult male SJS are minute, winged insects, about 1 mm long and golden brown in color (Fig. 1). Following a period of maturation beneath elongate scale covers (Fig. 2), males emerge in flights to search out female SJS and mate. Male SJS flights coincide with the females' period of receptivity and their production of a sex pheromone. The seasonal male flight pattern is characterized by a distinct spring flight which often occurs during apple bloom. This is followed by a series of up to 3 overlapping flights from mid-summer through autumn.

The scale covering secreted by adult female SJS is circular and composed of concentric rings of grey-brown wax radiating from a tiny white knob and measures about 1.4 mm across (Fig. 3). The actual insect body, found beneath the scale, is bright yellow, lacks appendages, and is almost circular in outline (Fig. 4). Female SJS do not deposit eggs, but rather produce live crawlers within 4 to 6 weeks following mating. A female may produce crawlers for 6 to 8 weeks at a rate of about 10 per day.

Crawlers are bright yellow, mobile forms which resemble larval spider mites and measure about 0.24 mm by 0.1 mm (Fig. 5). After exiting from beneath the female's cover, the crawlers walk or are air-borne to new sites of infestation on the bark, fruit, and leaves. Within 24 hours following birth, crawlers settle, tuck in their legs and antennae, and insert their mouthparts into the host.

After settling, the first instar nymph secretes a white waxy covering and is known as the "white-cap" form. The third and final phase of the first instar (the "black-cap") is initiated as peripheral rings of darkened wax are secreted and the "white-cap", except for its center tuft, blackens (Fig. 6).

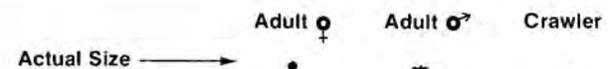
The first molt occurs beneath the "black-cap" within 3 weeks following crawler emergence. The scale covering of the immobile second instar females gradually increases in diameter to accommodate the growing insect beneath. A second and final molt to the adult stage female occurs 3 to 4 weeks later. Males become distinguishable from females during the second instar as their scale coverings elongate. Following the second molt, male SJS pass through two non-feeding instars prior to the final molt to adults.

The SJS overwinters on bark in the "black-cap" phase of the first instar. Development resumes as spring temperatures exceed 10 C (50 F). In warmer climates, gravid females may also survive the winter. First generation crawler production by all overwintering stages is synchronized, and usually occurs within 4 to 6 weeks following bloom.

PLANT INJURY

SJS infestations on the bark (Fig. 7) contribute to an overall decline in tree vigor, growth, and productivity.

Actual Size → Adult ♀ Adult ♂ Crawler




Feeding on the fruit induces local red to purple discoloration around the sites of feeding (Fig. 8) and decreases the cosmetic quality of the crop. Early season fruit infestations may result in small deformed fruit. Since crawlers are produced continuously over the season, fruit infestations are a constant threat once crawlers begin to emerge.

CONTROL

Several chalcid wasps are known to parasitize the SJS, but none has demonstrated effective control in commercial orchards.

Insecticidal sprays may be applied to developing

overwintered individuals, first flight males, or first generation crawlers, depending upon the regional relationship between crop development and timing of the pest.

Control measures for SJS are recommended when the scale or their feeding blemishes have been found on fruit at harvest during the previous season. Examination of the bark and twigs during pruning may also be valuable in detecting infestations which are not otherwise apparent since populations are often irregularly distributed within orchards and may be hidden beneath loose bark in older trees. Pruning is also important in removing infested branches and suckers, as well as opening up the canopy to allow for better spray coverage in tree tops where SJS are often concentrated.

GUIDE TO STAGES

STAGE	TIMING	WHERE TO LOOK
Adult females	Pink through leaf drop	On trunk and branches prior to fruit set. Check beneath loose bark on older trees. Mid-season through harvest, spurs and fruit, especially stem and calyx ends.
Adult males	Pink through petal fall. Mid-season through leaf drop.	Difficult to detect without pheromone traps.
Crawlers and "white-caps"	Approximately 4 to 6 weeks after bloom, through leaf drop.	Trunk and branches, often beneath loose bark. On suckers, spurs, and fruit.
"Black-caps"	Dormant and approximately 5 to 7 weeks after bloom, through leaf drop.	On trunk and branches. Also on suckers, spurs and fruit.