



Scale insects in Kashmir

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Oystershell scale (*Lepidosaphes hirsigica*)

Homoptera-Diaspididae: Oyster shell scale, as the name implies, looks like a miniature oyster encrusted on a small limb or twig. It is of European origin but has been a common pest in the northwestern United States since 1850 and has since spread throughout the United States. It infests trees of all sizes and ages and can kill young trees. However, it thrives on neglected trees and has rarely been an orchard pest. It lives primarily on bark but can affect fruit also.

Hosts: Oystershell scale infests apple and a large number of other fruit, shade and ornamental trees and shrubs.

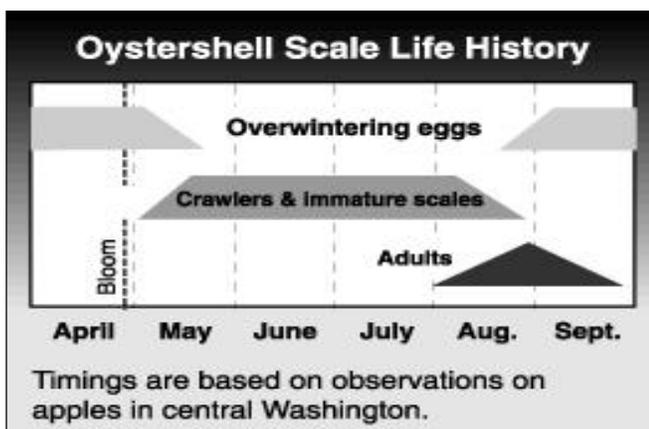
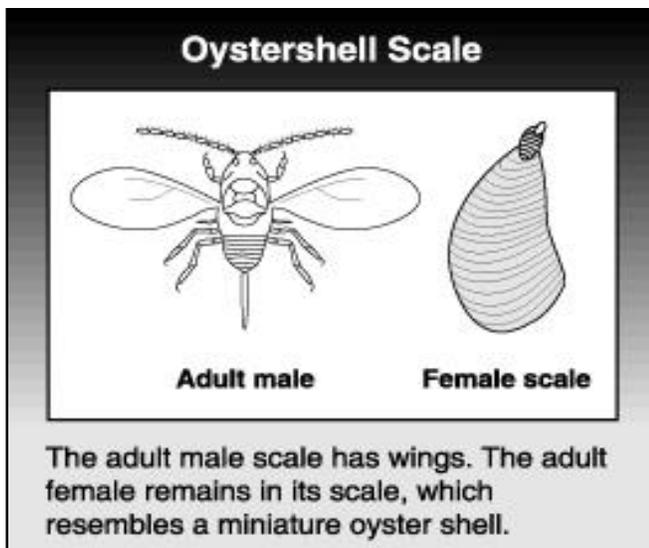
Life stages:

Egg: The egg is oval and pearly white.

Crawler: The newly hatched crawler of either sex is pale yellow in colour and has six legs. It resembles a San Jose scale crawler. After a few days it sheds its skin and loses its legs and antennae and begins to form the waxy scale coating. After the second molt, the male develops wings. The female continues to grow in the same globular form and secretes a new, larger scale at each molt.

Adult: The adult scale resembles a miniature oyster shell. The female scale is shiny, light to dark grayish brown, with parallel ridges across, and is from 1/16 to 1/8 inch (1.5 to 3 mm) long. The male is much smaller and has wings.

Life history: The insect has one generation per year in the Northwest. It passes the winter in the egg stage under the scale of the mother. There can be from 40 to 100 eggs under one scale. Crawlers emerge from the scale in May and June. They can crawl some distance before settling down on the bark. They then insert their long mouthparts into the host and secrete a waxy covering. Females never move again, but the males, which have wings, eventually emerge from their coverings and mate. Females continue to grow in the same form and mature in



August or September. As eggs are laid, the body of the mother gradually shrinks into the smaller end of the scale and the eggs occupy the rest of the space. The female dies after the last eggs are laid.

Damage: Heavy oyster shell scale populations on limbs and twigs weaken trees, but this damage is seldom seen in commercial orchards. Crawlers may settle on bark or fruit.

Monitoring: Look for scale on branches.

Biological control: Several predators feed on the scales but are rarely able to control them. Larvae of several parasites attack the eggs and some birds also feed on scales.

Management: This pest can be controlled with delayed-dormant sprays of oil or oil with an organophosphate insecticide. Oystershell scales are difficult to target with insecticides, as they spend almost 75 per cent of their lives as eggs protected by the scale. The insect is most vulnerable in June when newly hatched young are crawling about. Generally, pesticides used in commercial orchards prevent the build-up of this pest.

San Jose scale (*Quadraspidotus perniciosus*):

Introduction: San Jose scale is a key pest in almost all the fruit growing districts of the Kashmir. It was introduced to India from China on flowering peach in the early 1870s and soon became a serious pest in the San Jose area. By the late 1890s it had spread to all parts of the apple growing states.

The scale is a tiny insect that sucks the plant juices from twigs, branches, fruit and foliage. Although an individual scale cannot inflict much damage, a single female and her offspring can produce several thousand scales in one season. If uncontrolled, they can kill the tree as well as make the fruit unmarketable.

San Jose scale is a problem particularly in large, older trees where it is difficult to achieve good spray coverage, but young, unsprayed trees may also be vulnerable. The pest has become of increasing concern to the fruit industry due to the importance of exports.

Although scale lives primarily on the tree bark, surviving under scales and in crevices, the first indication it is in the orchard may be small red spots on the fruit or leaves.

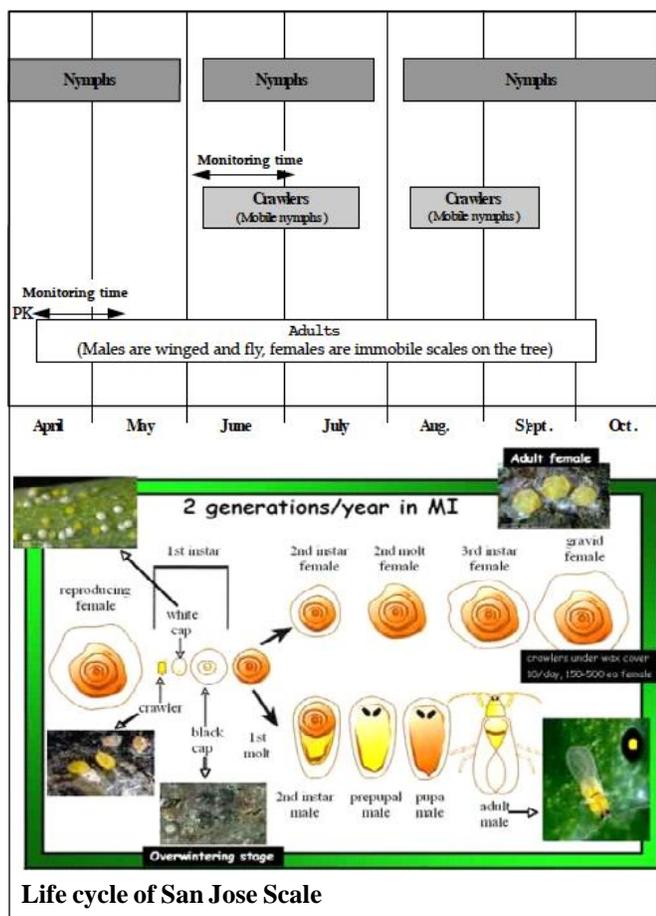
Hosts: San Jose scale is most destructive on apple and pear, but it can be a serious pest of sweet cherry, peach, prune and other tree fruits. It also attacks nut trees, berry bushes and many kinds of shade trees and ornamental shrubs. Infestations in backyard or wild trees can spread to nearby orchards.

Life stages:

Crawler: The female San Jose scale produces live young. The newly hatched crawler of either sex is yellow. It has six legs, two antennae and a bristle-like sucking beak that is almost three times the length of its tiny, oval body. The crawler seeks a suitable site to settle and immediately begins to secrete a waxy covering over its body, which hardens into a scale. The scale turns from white to black and then to gray and goes through several molts before maturing. The differences in sexes become apparent after the first molt, although the scales covering them are identical. The females are smaller and rounder than the males and have lost their eyes, legs and antennae. The males have eyes but no legs or antennae.

Adult: The mature male is a very small, yellowish-tan insect with wings and long antennae. The female is wingless and legless, and its yellow body is soft and globular. The covering of a full grown female is about the size of a pin head, with a central, nipple-like bulge. The color is often obscured by a sooty fungus.

Life history: San Jose scale has two and half generations a year in Kashmir. It overwinters in the black-capped, immature stage. Being unable to move, the scales must survive wherever they happen to be on the tree, and in severe winters many may be killed. Scales that are further developed than the black-cap stage in the fall are usually killed by cold weather. Increased scale problems can be expected after mild winters. In the spring, surviving scales continue to mature. After developing through larval and pupal stages, the males mature and back out from their scales about 4 to 6 weeks after birth. Adult males fly for only a few days and are capable of mating immediately with the females, which remain under their scales. Female scales release a pheromone to attract males for mating. Each female produces several hundred live crawlers over a 6-week period. Timing of the different stages varies from year to year, depending on temperatures. Usually, crawlers of the first generation appear in early June and may continue to be produced until early August. The young crawlers move over the plant during the first few hours of their lives. They can be carried to other trees by the wind, on the feet of birds, on the clothing of farm workers or on orchard equipment. Within a few hours they settle on the bark, leaves or fruit, insert their long, bristle-like beaks, and begin feeding and forming a scale covering. Females of the first generation mature in late July and second generation crawlers appear in August. The two generations often overlap and during the summer all stages can be found on the tree at the same time. Second



generation crawlers continue to be produced until October or November.

Damage: If neglected, scale populations can quickly grow into a problem because the insect multiplies so rapidly. An infested apple can have 1,000 or more scale on it. A red spot will appear around the scales as they start to feed on the fruit and often the feeding causes a slight depression. The spots are a brilliant red at first, but as the fruit grows and the spots increase in size, they fade to light red or pink. On red apples, spots are difficult to see. Trees infested with San Jose scale produce small, immature apples and infested apples do not colour properly. If the trees are seriously infested, the apples crack and have a musty smell. The pest can be detected in an orchard bin or in the packing house by the odor.

Besides making fruit unmarketable, San Jose scale kills twigs and limbs. If not controlled, it can kill the tree. More commonly, infestations of San Jose scale are light in commercial orchards. A small number of scales will infest an occasional fruit in or near the calyx. These scales may be difficult to locate on the sorting table. Packed fruit may be rejected, particularly in export markets, if it

has scale or markings from scale feeding.

Monitoring: It is usually not practical to sample to determine density or potential for fruit infestation, because the pest is seldom distributed uniformly throughout a tree and may infest only a few trees in an orchard block. However, if scale-infested fruit are found after the first generation of crawlers have settled, measures against the second generation are indicated. Scale may be noticed during pruning or on fruit as it is harvested. In cherry orchards, leaves of scale infested trees do not drop in fall, making it easy to detect infested areas of the orchard. Mark infested areas as they are noticed so they can be given special attention when control treatments are applied. Place two-sided sticky tape on small limbs in infested areas to determine when crawlers are active, or use the degree day model to time summer sprays. Adult male flight can be monitored with pheromone traps. However, it has been difficult to relate trap catch with potential fruit damage. A biofix can be established using the traps and development can be predicted using a degree day model.

Biological control: Several parasites and predators attack San Jose scale. In Washington, the parasitoids recorded from San Jose scale include *Encarsia perniciosi* and *Aphytis* sp. Although they destroy many scales, they do not provide enough control to prevent damage. Natural enemies may become numerous in orchards that are not sprayed with insecticides, but even under these conditions biological control has not been adequate. Currently, biological controls are only a supplement to chemical control.

Control:

Management:

Cultural/Mechanical control:

- Infested nursery plantation, buds, graft materials should be avoided.
- Shade trees especially willow, poplar etc. should not be planted in and around fruit orchards.
- Pruning of heavily infested branches during dormant period and their burning helps in preventing the build up of the pest.
- Scrap off the SJS from infested branches with gunny bags particularly in nursery plantation without causing any injury.

Delayed dormant spray : To ensure the suppression of scale spray the orchard during late dormant stage (before green tip stage) with any HMO's recommended by SKUAST @ 2% (i.e. 2 lit in 100 lit. of water). The spray should be applied thoroughly to all parts of the tree. In case, rain washes the spray within 24 hours, spray should be repeated. The light infestations of San Jose scale may

be controlled by the normal orchard practice of delayed dormant spraying but heavy encrustations often require additional applications of insecticides.

Biological control : Two parasitoids namely *Encarsia perniciosi* and *Aphytis proclia* and a predatory Coccinellid beetle, *Chilocorus infernalis* are found actively associated with San Jose scale in the orchards of Kashmir. For their safety, it is essential to avoid indiscriminate use of insecticides.

Chemical control :

– Pink bud stage : Where spraying of HMO during delayed dormancy has been missed, then spray the fruit trees with Dimethoate 30 EC @ 100 ml/100 lit. of water.

Petal Fall (Need based): At 80 per cent petal fall if 6-12 SJS crawlers/cm² are observed on twigs, sprays the trees with any of the insecticides *i.e.* Dimethoate 30 EC or Quinalphos 25 EC @ 100 ml in 100 lit. of water.

– Fruit let (Pea size) (Essential) : Spray SJS infested trees with Chlorpyrifos 20 EC or Dimethoate 30 EC@100 ml/100 lit. of water.

– Fruit development-II (Essential): Spray Dimethoate 30 EC @ 100 ml/100 lit. of water at this stage.

– Fruit development-III (Need Based): If more than 13 crawlers/cm² of SJS are observed on twigs, spray Dimethoate 30 EC (100 ml) or Summer spray oil (750 ml) per 100 lit. of water.

Walnut scale (*Quadraspidiotus juglansregiae*):

Description of the pest: The walnut scale is often found in daisy-shaped groups that develop when male crawlers settle under the margin of the circular female cover and begin forming their elongated covers. If the circular scale covering is lifted off the female, the body underneath is yellowish and has indented margins; these two characteristics help distinguish walnut scale from other armored scales on walnuts.

The walnut scale has two generations a year in the Central Valley. It overwinters as second instar females and males. In spring, both sexes resume development and mature at the same time. Adult males emerge from the scale covering as tiny winged insects to mate with the mature females, who remain under the scale covering. After mating, females lay eggs in mid-May; eggs hatch in 2 to 3 days. Female crawlers move around the branches for a short time before they settle down, begin feeding, and secrete the scale cover. Male crawlers move to the margins of a female cover and settle. Initially the scale cover is white (white cap stage), but it changes to gray or brown after about a week. The first generation completes development by mid-July; females lay eggs in mid-August.



These eggs hatch and the crawlers settle and molt once before winter.

Damage: Armored scales suck plant juices from the inner bark by inserting their mouth parts into twigs and branches. Infested trees look water stressed, and inside fruiting wood on lateral bearing cultivars may die back when encrusted with scale insects. Extremely heavy populations can cause the bark to crack; however, walnut scale rarely causes economic damage.

Management: Natural enemies often can be relied on to keep walnut scale from causing damage. However, insecticide sprays may disrupt natural control and cause scale populations to flare upto damaging levels. If control is needed, sprays may be applied at the delayed dormant period, or, if oil is to be used, in late spring to target the susceptible crawler stage.

Biological control : Several natural enemies of the walnut scale often hold it in check. Two predators - the twicestabbed lady beetle, *Chilocorus orbus* and another small beetle, *Cybocephalus californicus* - often occur in large numbers and will control low to moderate population levels of the walnut scale. If populations are high, however, the time required for these two predators to bring the population numbers down may be excessive.

Two parasitic wasps, an *Aphytis* and an *Encarsia* species, also are prevalent on walnut orchards and help control this pest.

Organically acceptable methods: Biological control and sprays of narrow range oils can be used in an organically certified crop.

Monitoring and treatment decisions: Start monitoring for walnut scale during the dormant season to determine the need for a treatment. Walnut scale monitoring can be combined with the monitoring of other pests as described in DORMANT MONITORING. If a treatment becomes

necessary, make it during the delayed dormant period before shoot growth begins. If a high degree of parasitization is observed, treatments may be delayed until after crawlers emerge in late spring and oils, which are less disruptive to natural enemies, can be used. Put out double-sided sticky tape (in May) to monitor for crawler emergence.

European scale (*Parthenolecanium corni*):

Description: European fruit lecanium is a soft scale that affects a wide range of host plants including many shade trees and flowering fruit trees. Females are about 5 millimeters long and are brown to a reddish brown and mottled in colour. They are also characterized by their raised, round bodies when mature. This pest can be difficult to identify because the coloration and body shape vary according to the host.

Life cycle males mate with females in early spring and die. Like with many soft scale species, females can lay up to a couple thousand eggs so scale populations can build up quickly. Eggs hatch into crawlers in early June through mid-July. Crawlers move out to the leaves where they settle near the veins until the move back to the tree in late August. Crawlers are initially white but yellow over time.

Monitoring: Look for adult females on the underside of



European fruit lecanium

pencil-sized twigs in May through early June. Begin checking in June for honeydew, sooty mold and crawlers on undersides of leaves. Also watch for twig and branch dieback.

Life stages:

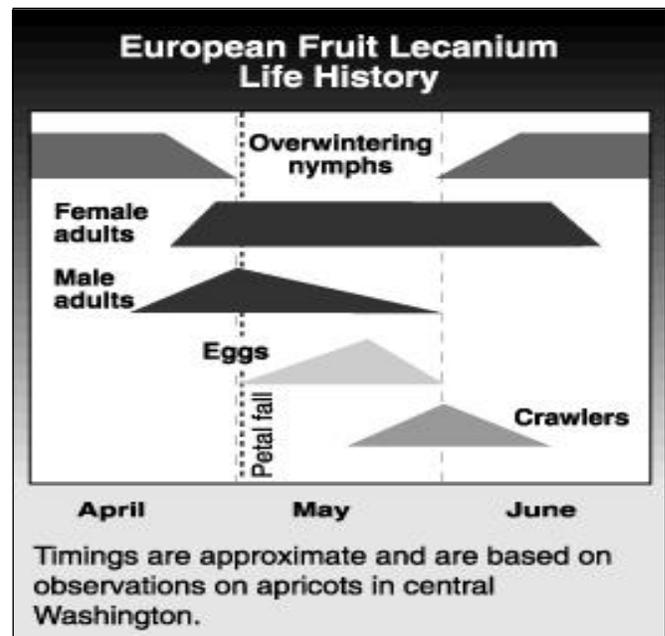
Egg: The egg is oval and pearly white.

Nymph: The newly hatched nymph, or crawler, is oval,

flat and salmon colored. It later develops a hardened shell for protection.

Adult: The adult male has wings held flat over its abdomen. It emerges from under the protective covering after a short resting period or pseudo pupal stage. It can fly and crawl. The female cannot move but remains under its shell where it deposit eggs. The mature female is the most conspicuous stage of this pest. The protective scale is hemispherical and chestnut brown. It measures between 1/8 and 1/4 inch (3 to 5 mm) in diameter. Empty shells often remain attached to the tree bark throughout summer and fall. A few may still be found a full year after the female has died.

Damage : With such a large amount of new crawlers



being produced each generation a fair amount of honeydew is produced. The honeydew leads to a high probability of sooty mold fungus. Dieback of limbs and branches are noticeable symptoms along with an overall weakening of the infested plant.

Biological control : Natural enemies such as ladybird beetles, lacewings and predaceous bugs feed on crawlers as they emerge from under their mothers' scales and crawl to leaves to feed.

Management: Natural enemies normally keep European fruit lecanium at below damaging densities, but when pesticide sprays or other factors disrupt natural control, populations of this pest can reach damaging levels.

It is possible to control this pest with delayed-dormant

sprays of oil and an organophosphate insecticide. Chemical sprays to control this pest are most effective when timed for the crawler stage. Time treatments by checking for crawlers hatching under female scales. Wait until most eggs have hatched or until a few crawlers have settled on leaves before applying the first spray.

If egg hatch is prolonged, a second application may

be necessary for good control. Because crawlers are active in late spring when there is lots of foliage on the trees, dilute sprays are more effective than concentrate applications.

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