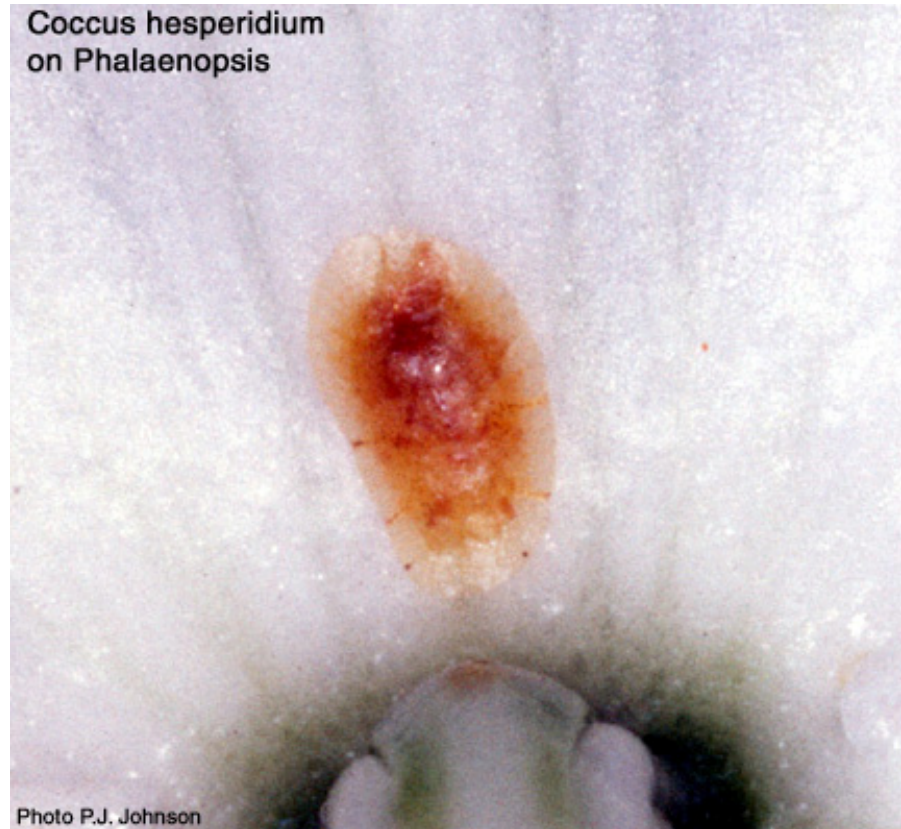


# Scale Insects on Orchids




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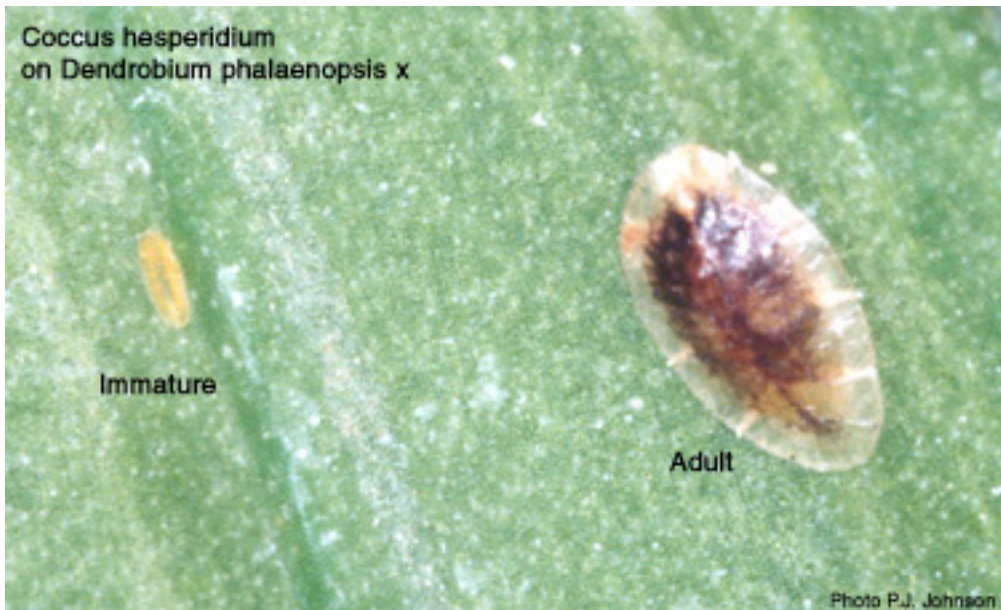
This note is written for the orchid keeper or grower in northern states of the U.S., and Canada, that generally has a small to medium sized indoor collection.

Commercial growers or those with relatively large collections may have environmental conditions and access to chemicals not available to us with smaller plant collections. The keeper or grower in southern states enjoys the potential of many more scale problems because of outdoor growing, but also benefits from natural environmental population management by the weather, and predatory and parasitic enemies of scales!



## Sources and Identification

Scales are probably the most important insect pests of cultivated orchids in northern climates. Mealybugs and aphids may tie for second in importance and are controllable with the same methods. According to a 1976 publication from the Florida Department of Agriculture and Consumer Services, there are no fewer than 27 species of scale identified from cultivated orchids. Fortunately, few of the hard or armored scales common on woody plants are also pests on orchids or other non-woody indoor ornamentals. Rather most are the soft scales, usually referred to as brown soft scales or hemispherical scales, and will survive indoor or greenhouse plants. Especially common is the brown soft scale (*Coccus hesperidum*) shown above, and possibly the similar elongate soft scale (*Coccus longulus*). Boisduval's scale (*Diaspis boisduvali*), also called Boisduval scale,   , the scourge of the southern orchidists, is rarely encountered in northern home collections and apparently does not survive well here, except in the larger collections. This may probably be due to the relatively higher level of personal attention given to individual plants in smaller collections. However, when introduced on infected plants



it can spread quickly to a variety of orchids and be extremely difficult to control. Boisduval's scale will also seriously debilitate or kill orchids.

The more common species of these odd insects that infest orchids are immediately recognized in the adult stage by the light yellowish to greenish-brown, tan, or dark brown, oval to circular, objects that show-up on leaves, petals, sepals, petioles, pseudobulbs, and sometimes rhizomes and roots. Mature females

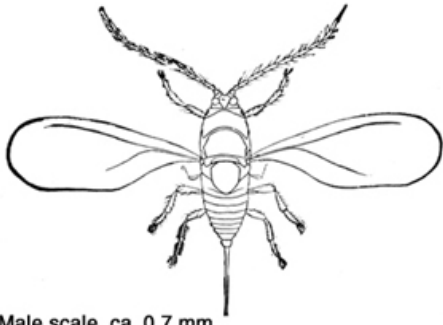
of Boisduval's scale are a rather typical rounded and light-colored scale type, while males are easily recognized by the cottony appearance of aggregated males (see small images above), and these may be confused with mealybugs if not examined closely. The immatures, or crawlers (above far-left), of all scale species are tiny and yellowish to pinkish, and not easily seen without a magnifier.

In the home orchid collection scales are acquired by plants in some combination of three sources. The most common way of acquiring scales is by purchasing an infested plant. Scales are also easily transmitted from infested to clean plants when your plants touch each other and the crawlers to move from plant to plant. The final source is colonization of your plants by windblown crawlers. Colonization is usually done during the summer when your plants are outdoors, but it can also occur indoors in greenhouses and sunrooms by floating on currents produced by circulating and heater fans. This occurrence appears to produce the odd effect of having pockets of infestation when the crawlers settle on plants where the air currents are the weakest and early during a spreading infestation. Similar effects are found with aphids, mealybugs, whiteflies, and spider mites.



## Life Cycle

Scale insects have a three-stage life history: egg, larva (or nymph), and adult. Eggs are laid by females, with the eggs usually retained in the body and under the outer "scale" covering when the female dies. These hatch into the mobile nymphs, called crawlers. The crawlers are the active stage that can move between plants. After finding a suitable place for feeding, the crawler will settle and begin feeding, and



Male scale, ca. 0.7 mm

transform into the next nymphal stage. At this point the female begins to form the hard protective “scale” covering. The covering enlarges as the insect grows. Nymphs often have a light yellowish scale, which darkens to tan or brown as the insect matures. Males of soft scales do not form the hard coating or scale, but are small winged creatures whose primary, if not sole, role is to mate and die.

Scales have short life cycles, but may have many generations per year. In a warm greenhouse or indoors the life cycle may be accelerated, though typically a month or more is required for completion of a generation. It is the overlapping of generations that creates the biggest scale management problem. All control methods are at their greatest effectiveness against the the crawlers. By the time the scales have formed the hardened cover (the scale), it is too late to easily kill those adults with chemicals. Also, the large dry brown scales are already dead and the “shells” may be full of eggs which will spill when the shell is ruptured.

## Management

Scale management is usually a protracted and serious effort, and never much fun. Light infestations restricted to one or a few plants can usually be treated with household products rather than concentrated insecticides. When possible, immediately isolate infested plants from others to prevent the crawlers from moving amongst them.

Because the life cycle of scales can be so short combined with the overlapping of generations, in order to bring a serious problem under control you will need to do a treatment every 2-5 weeks, depending on the life cycle period of your particular problem scale species. Consequently, the key to scale control is persistence and regular scheduling of control methods.

Management methods that are the least toxic to people, pets, and plants, are the most time consuming and laborious. Insecticidal methods, including horticultural oils, soaps, and synthetic insecticides are progressively more toxic (to both the insects and humans!) and more expensive, but less work. Regardless of method or chemical used, you must remain vigilant and expect to make at least 2-3 applications 10-16 days apart.

Because of plant costs, personal attachment to orchids by owners, and the over-riding desire to avoid insecticides whenever possible a number of effective “home remedies” for scale control are available. Be aware that non-insecticidal treatments may not be highly effective for elimination of scales. Thus, they should be viewed as controls, not eradicators. Also, many common home chemicals are extremely toxic to humans, pets, and plants even in diluted forms, often being proportionately more toxic than the feared insecticides.

## Rubbing Alcohol

Probably the most popular home remedy is to swab and daub plants with a Q-tip or ball of cotton dipped in isopropyl (rubbing) alcohol. Do not use other alcohols, such as ethanol or methanol, that can penetrate the plant tissues rapidly and cause considerable damage! The concentration of the isopropyl seems to make little difference; the common 70% available in hardware and drug stores is satisfactory. On hard-leaved plants, gentle rubbing with the fingers or a soft toothbrush is effective, with or without the alcohol. Remove all scales, large and small. Afterwards, you will still need to repeat the alcohol treatment to remove the tiny yellowish spots which are the recently hatched crawlers. Pay particular attention to the midrib, other veins, and leaf edge areas. Closely monitor your plants to get an idea of the life cycle of the particular species of scale that is your problem, but expect to repeat treatment against the immatures every 1-2 weeks.

A common alternative to the swab and daub method is to spray alcohol with a misting bottle or small pump sprayer. Many home growers will also mix-in a small amount of mild liquid dish detergent, and sometimes mineral oil, neem oil, or horticultural oil. One recipe for a 1.5 liter spray bottle is to mix a 50:50 solution of isopropyl and water, with a few drops of liquid soap to act as a spreader, and 1/2 to one teaspoon of one of the oils. But, it seems that every grower has their own proportions of these ingredients, none of which seem to work significantly better than another. Caution is urged, however, as excessive amounts or too strong of a detergent, or use of an ammonia-based chemical cleaner may damage your plants, especially buds and flowers. This is particularly true of dish-soaps and household detergents that could remove natural protective waxes from plant tissues. Also, alcohol sprays are not effective against eggs protected by the scale covering, hence the physical removal of the scales by hand is more effective and provides more rapid control.

A potential rare problem with alcohol treatment is chilling of the plant. The rapid evaporation of alcohol cools the plant tissues, especially with air movement that increases evaporative cooling. This chilling is suspected of over-cooling tissues and creating zones of dead cells that may become necrotic from bacteria or fungi. On warm or breezy days consider wiping any residual alcohol with a tissue instead of permitting it to evaporate off the plant. Such problems and tissue drying are found particularly on soft or thin-leaved orchids (e.g. *Oncidiinae*).

## Repotting

Given an extreme infestation you may see scale developing on the roots and rhizomes. At this time, or anytime you observe a heavy infestation, then you may need to consider replacing the potting medium. The potting medium can harbor eggs and crawlers, so dispose of it in a compost pile or in the garbage. When repotting, a close inspection and if necessary a very gentle cleaning of scale and spraying of the roots before repotting is essential. Use care with the cleaning of roots because of their fragility.

## Oils, Soaps, and Sterilants

Horticultural oil, neem oil, mineral oil, insecticidal soaps, and sterilants form the next stage of chemical control of scale insects. The oils and soaps are often regarded as “organic” or non-chemical methods,

but this is a misconception or an extremely broad concept of “organic.” Indeed, neem oil is extracted from the neem tree, but horticultural oils and mineral oil are petroleum distillates. Likewise, insecticidal soaps are a solution of synthetic pyrethroids mixed with a detergent (soap) that is made from petroleum products. Sterilants are anti-bacterial and anti-fungal chemicals that are also often effective on algae. However, all of these solutions are generally considered safer for humans, pets, and plants than usual insecticides. None provide absolute control over pests, but frequent use during the presence of pests frequently reduce insect populations to below self-sustainable levels in small orchid collections.

Horticultural, mineral, or neem oil solutions smother the insects, so complete coverage of all sprayed plants is essential. These oils are mixed with water and usually a plant-safe detergent for enhancing the spreading and sticking of the oil. The main caution with these oil solutions is that they should never be applied to plants on hot days (>80 degrees F) or in direct sunlight, as to prevent burning of tissues. Leave the plant in shade until the application has dried. Usually mineral or horticultural oils are best as plant derived oils may spoil rapidly in heat and create gummy blobs or decay malodorously.

Insecticidal soaps are usually solutions of a synthetic pyrethrin, piperonyl butoxide as a synergist (to enhance the effectiveness of the pyrethrin), and sometimes a plant-safe detergent. As with oils the detergent acts as a surfactant and spreader for dispersing the pyrethrin evenly, and as a mild caustic against the insects. Also, to prevent sunburn apply the chemical and allow it to dry in shade. Pyrethroids are synthetic analogs of pyrethrum, the natural extract from certain Asteraceae. Caution should be urged with so-called “safe” insecticidal soaps as some plants are sensitive, particularly tender new tissues, and when mixed with hard water. Some non-orchid ornamentals will drop leaves and abort flowers when sprayed with insecticidal soaps, so caution is urged with prized orchids. Though piperonyl butoxide is usually regarded as safe for plants, it can cause allergies and respiratory problems for users and may contribute to phytotoxicity problems.

Sterilants are usually Physan 20, RD20, or Consan 20, and these are used as anti-bacterial, anti-algal, and anti-fungal agents. These solutions are all composed of isomer cocktails of quaternary ammonium chloride and all have the same antibiotic activity. Quaternary ammonium chloride solutions are common cleaners used by commercial kitchens, janitorial services, and bathing pool maintenance, and are commonly available in concentrated forms at hardware and home repair stores. These chemicals can be used in diluted form, according to label directions, usually for controlling bacterial and fungal diseases on orchids. However, at these same dilutions there is some limited effectiveness on scale crawlers and other delicate insects. Frequent use of sterilants for insect control is not recommended, due particularly to potential damage on new growth, buds, and flowers, and should be done under shade to prevent sunburn.

## **Insecticides**

Persistent populations of scale or infestation in many plants often demand the need for use of synthetic insecticides. There are few insecticides specifically registered for use on orchids, but there are several common, inexpensive, home-and-garden chemicals labeled for ornamental plants. Insecticide

formulations not labeled for ornamental plants are often mixed with solvents that aid in the application of the active ingredient for specific purposes. These solvents, not necessarily the insecticide itself, often produce phytotoxicity and may seriously damage or kill plants. Thus, never use any insecticide that is not specifically labeled for ornamental plants.

There are many insecticides available for ornamental plants, but some are not tested on orchids, and others are generally too expensive or otherwise readily available for the small keeper or grower. Some of the more available and effective insecticides that come in various brand names are acephate (e.g., orthene [wetttable powder or liquid]), imidacloprid (liquid), malathion (liquid), and carbaryl (water-based emulsifiable concentrate). Other chemicals are available, but in some states you may need a commercial license to purchase them. A current garden center insecticide mixture of acephate and the miticide fenbutatin-oxide is effective for many common orchid pests. Fertilizer/systemic combinations for roses and other ornamentals, usually with disyston/disulfoton, may be effective but are not widely tested on orchids. Also, caution should be given to the fertilizer effect on your plants in combination with other nutrients. Of course, always follow label directions and never, never, never exceed the minimum recommended concentration given in mixing directions! Recommended solutions are based on extensive testing for selected pests and plants. Orchids are tough plants, but many are sensitive to various chemicals, particularly under direct sunlight or high heat, and while certain species may not react to a given formulation others may, so testing is justifiable.

Some insecticides are occasionally discontinued for use because of some discovered hazard. For example, Cygon used to be available, but it is no longer recommended and labeled for orchids because it will damage many plants, especially the buds and flowers, and is extremely hazardous to use. As of late 31 December 2004 Diazinon is also no longer available for use, even for non-commercial outdoor use. Although most insecticides with discontinued labels are legally allowed to be "used up", it may be best to dispose of such chemicals rather than continue their use and risk damage or loss of plants, or increase your own health hazard.

Most home orchid keepers and growers in northern states that need to apply insecticides during inclement weather need special care for applications. If you cannot spray out of doors, place your plant (s) inside a large plastic bag (remove the bag after the spray has settled!) and let the plant ventilate where the fumes will not be wafted around the house or work area. Again, you may have to consider removing the potting medium, spraying the plant, and repotting it with new media in a clean pot when the spray has dried.

## **Growth Regulators and Chitin Inhibitors**

Research on the use of insect growth regulators, botanical insecticides, and their application to ornamental plants is increasing, but incomplete. Insect growth regulators, such as kinoprene (tradename = Enstar II), are synthetic forms of juvenile hormone which is highly important in insects at critical stages of their metamorphosis. The use of growth regulators interrupts the normal development of the insects, including orchid pests such as scales, mealybugs, aphids, and whiteflies. Apparently, there is

little good and reliable information on their use on orchids, but an increasing number of growers are reporting satisfactory results with Enstar II and there does not seem to be any plant health problems noted thus far. Also, they are regarded as safe for humans and pets. Kinoprene does not work on adult insects and so should never be used to eradicate a pest population, but is best used on incipient infestations and maintenance sprays.

Azadirachtin (tradenames = Azatin and Neemazad) is a plant derived (neem tree) chemical, or botanical insecticide, that is a chitin inhibitor. Chitin is a primary component of the insect integument, or exoskeleton. Azadirachtin reduces the insects' ability to properly develop its integument and causes mortality through incomplete development. There is little information available on this chemical for use on orchids, but it is available on a wide variety of ornamentals and is labeled for greenhouse applications.

## Final Considerations

Heavy infestations of scale, especially on many plants may require severe control methods. In such situations, you may need to consider the use of a synthetic insecticide. On the extreme side if you have a plant showing signs of decline from scale you may have to seriously consider destroying that plant, as the low likelihood of rejuvenating that plant may not justify the expense and effort of continued treatments. After all, the destruction of a sick plant can be used to justify the purchase of a new and healthier plant!

If you are battling scale for long periods of time (e.g., >9 months) and have been using the same insecticidal control method then you may have built a bigger problem that you started with. Depending on the length of time of your problem and the intensity of chemical use you could have selected a population of resistant scales. The best resolution to this is to change methods and chemicals occasionally; that is, do not use the same chemical mix more than 3-4 times sequentially. After isolating infested plants give them a thorough application of something different from what you have been using. For example, if you used insecticide then switch to an oil, soap, or different insecticide.

Generally, never use an insecticide not labeled for ornamental plants. Whenever using oils, soaps, and insecticides, be thorough, change formulations frequently, and do not use less than the minimum concentration of mixture. Too little of a chemical enhances resistance, while too high of a concentration may damage the plant. Never use hard chemicals prophylactically, that is do not routinely use chemicals as a preventative as it is a waste of chemical (and money!) and such use allows resistant scales to develop. Finally, keep up the manual removal of all scales, if possible. Removing the egg laying adults is as important as killing the nymphs. And, remove the dead scales because eggs protected under the shell of the dead female may hatch and re-infest the plant.

The single greatest problem leading to unsuccessful scale management is lack of patience and lack of attention to scheduling. It takes time to eliminate a scale population. It also requires intensive and regular control methods over a minimum of 2-4 month period, and there still may be no guarantee of

eradication.