VIRGINIA COOPERATIVE EXTENSION SERVICE

VIRGINIA TECH

VIRGINIA STATE

No. 174
MARCH 3, 1988

INSECT NOTES

HORTICULTURAL OILS

One of the oldest insecticides, petroleum oil, is still an effective means of controlling certain insect pests. Modern products provide much better insecticidal efficacy and greater safety to plants. At a time when people object to using synthetic chemical insecticides, oils are an acceptable alternative. However, a good understanding of their nature, mode of action, uses and limitations is necessary. This information is provided for Extension Agents toward achieving that goal.

The many names may be confusing: spray oil, petroleum oil, mineral oil, white mineral oil, paraffinic oil, insecticidal oil, horticultural oil, dormant oil, summer oil, superior oil, miscible oil, emulsive oil, and spray oil emulsion. Do you know the difference or sameness between them? A number of brand names may be encountered: Scalecide, Volck, Volck Supreme, Unico Spray Oil, Orchard Spray D, Sun Superior 70, Orchex, Orthol-D, Spray Oil 6E, and others, depending on the company marketing the product and its regional merchandising.

Understanding the nature of oils. Horticultural oils are poorly understood by most users. The product labels give little information on the contents, and the label uses vary greatly from product to product. There has been little developmental research on pests of ornamental plants; most of our technology has come from research on tree fruits in New York, Florida, California, and Texas.

Oils are complex hydrocarbons that vary greatly depending on geographic sources of crude and the refining processes used. Mineral oil is defined as any oil that is found in the rock strata of the earth. Petroleum oil is synonymous and a more common term of reference. Naphthenic and asphaltic oils are aromatic, highly unsaturated and used for motor fuels, fuel oil, and solvents. They are highly toxic to plants. The paraffinic oils are highly saturated, used as lubricating oils, and are the source from which horticultural oils are refined. They are safe to use on plants. Horticultural oils or insecticidal oils, then, are those paraffinic oils used on plants to control insects. The term white mineral oil refers to any of various colorless, tasteless oils from petroleum used for pharmaceutical or medicinal purposes, such as laxatives, baby oil, and petroleum jelly (vaseline, petrolatum); these oils are completely saturated.

Horticultural oil technology advanced markedly from 1945 to 1970. Prior to that time, oil sprays were limited to use on plants before buds opened, hence the common term, "dormant oil". They were high in viscosity (heavy) and often called 100 second oils. Researchers, based on knowledge of components that increased insecticidal action and saftey to plant tissues, developed specifications for oil that could be used when

Its use on green plants led to the term "summer oil". It can be used both in the dormant and growing season. Thus dormant oil and summer oil refer to timing of treatments, not the type of oil product. It is true that some oils are intended only for dormant use, but that is beside the point of definition.

Modern superior or horticultural oils are refined to standards of volatility (distillation range), flow rate (viscosity), paraffinicity (gravity or density). and saturation (unsulfonated residue or UR). Oils marketed in the East are available at distillation rates of 412, 435, and 468 degrees F. The 468 oil is least volatile and labeled only for dormant use. Viscosity is indicated in terms of seconds of flow in a standard Saybolt test, ranging from 60 to 90 seconds. A 60 second oil is the lightest used, but not common presently. Gravity provides an index of paraffinicity in terms of degrees API, with a minimum of 30, but is most informative to an oil chemist. The unsulfonated residue is the portion of saturated compounds in the oil. It is the percentage that does NOT react with sufuric acid in a standard test. A UR of 92% means that 8 percent of the oil reacted with the sulfuric acid (was sulfonated) and thus, is the unsaturated portion; 92% is saturated oil.

Unfortunately, the ingredient labels are not standardized. All specifications for the product are seldom given. The most important is the UR, and is usually stated. Some labels may also give the viscosity and the gravity. Few if any list the distillation range. The flash point is required since it is an oil product. When the distillation range is not known, be sure to check the directions for use to determine if the product is intended only for dormant treatments. That product is likely to have the highest distillation range and may be less safe as a summer spray.

When oils are applied to plants as a spray, they must be mixed with water. An emulsifier is essential and is added to the oil by the producer when it is formulated. It is included as an inert ingredient on the label, not stated separately. Some oil products are called "miscible oil" or "emulsive oil" to indicate they contain an emulsifier. Decades ago, but no longer, suppliers provided ready-to-apply oil spray that was called a spray oil emulsion or white oil emulsion.

In summary, modern horticultural oils are derived from highly saturated paraffinic petroleum and refined to the following specifications:

UR, precent (minimum - 92)	92-96
Viscosity, seconds Saybolt (maximum - 90)	60-90
Gravity, degrees API	30-35
Distillation range, degrees F.	412-468
Flash point, degrees F. (one example)	345

The higher the UR, the safer the oil. The lower the viscosity and distillation range, the lighter the oil.

Mode of Action. Oil acts as a contact insecticide until it evaporates. It interferes more physically than chemically with respiration. Insects and mites are affected in 3 ways: 1) prevention of gaseous exchange, disrupting respiration; 2) interference with membrane function, and some toxicity to cells from oil penetration; and 3) interference with feeding of certain leafhoppers and aphids on oil-covered surfaces. Oil sprays are effective only against exposed eggs and insects that are coated with a layer of oil. The oil must be present long enough to suffocate the pest without doing the same to the plant. The heavier the oil, the more effective it is in control, and the more likely it is to cause plant damage. One way to achieve effective results is to use the lighter oils for both dormant and summer treatments, but use higher concentrations in the dormant season.

Often the question is asked about spraying in the fall when the leaves have dropped or in the winter when the weather turns warm for extended periods. This is not advised. In the fall, plants have not "hardened off" and injury often results. In the fall and in winter when insects are in hibernation, the metabolic rate is very low and the demand for oxygen is low. Oils evaporate before the insects are killed and poor control is the result.

Primary targets for horticultural oils. Oil sprays are effective for a relatively limited number of pests, but those are some of the more difficult to control with synthetic chemical insecticides: spider mites, rust mites, scale insects, mealybugs, aphids, adelgids, psyllids, whiteflies, a few caterpillar pests, and certain bugs, a number of which are on fruit. Dormant treatments are directed primarily at mites, scale insects, and eggs of overwintering aphids. Summer treatments are affective against other stages that are present.

Phytotoxicity. Plants appear to have inherent variability in sensitivity to oil sprays. Yet little is known about which is which, since there are so many kinds of ornamental plants and so few studies to obtain quantitative data. Generally, modern oil products are very safe to use on plants, and many of the older cautions for plant injury still on the labels may not be valid. Limited studies where more than 130 plants were treated with summer oil showed little or no injury. Some arborists have used oils continuousy, according to surveys, without problems.

Many factors may contribute to phytotoxic effects of oils on plants; some are well known from fruit tree research. They include: moisture deficit in leaves, high humidity, high temperature, treating very young foliage, and genetic variability in the plants. There is very little documented evidence that proper applications of oil result in phytotoxicity. However, it is well known that improper application can cause damage: overdosing, wrong timing, oil emulsion breakdown, using oil with incompatible materials, (especially any sulfur compounds), and other misuses. Plant injury may be twig dieback, leaf burn, and killing of new growth.

At the present time there is some indication that the following are oil sensitive: maples, hickories, and black walnut (dormant sprays); smoke tree and azalea (certain varieties) (summer sprays); and cryptomeria (both). Plants showing a tendency toward sensitivity include: beech, redbud, spruce and douglas fir (dormant); savin junipers and photinia (summer) and Japanese holly (both). Oil sprays will remove the bluish bloom from needles of conifers, especially blue spruce and similar types, leaving a dark green oily appearance. It may take 2 or more years for new growth to return the natural bloom to the trees.

Appying oil sprays. The amount to use for spraying is difficult to state simply, since there are differences between oil products in terms of lightness (viscosity), distillation rate, and intended use. There are also differences between insect groups and species in sensitivity to oils. In general the lightest oils should be used at the rate of 3-4% for dormant spraying and 2-3% for summer sprays, using the higher rate for hard-to-control pests; 1% less is suggested if oil sensitive plants must be treated. A simple rule of thumb is to use 2% for summer treatments and 3% for dormant, but remember this is oversimplification. The safest approach is to follow the label directions explicitly. Dosage rates for oils are based on volume; thus, a 1% spray is 1 gal. of oil in 100 gal. of water (2.66 Tblsp. per gal.)

In general, armored scales are more difficult to control with oil than soft scales or other soft-bodied insects. Even at the higher rate, it is difficult to control oystershell scale, pine needle scale, obscure scale, and several others. For these pests, adding an insecticide to the oil gives better results. Some commercial products contain oil plus ethion, and occasionally some other contact insecticide. Some custom applicators add malathion, diazinon, or trithion to oil sprays for hard-to-control species. Oils with insecticides added are more hazardous to handle, since oil enhances skin penetration.

Horticultural oils have the advantages of safety to the applicator and the environment, minimal effect on natural enemies, effectiveness against inactive scales and eggs of insects and mites; they can be applied to extend the spraying season in early spring, and are an acceptable alternative to people who do not choose to use chemical insecticides.

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NOTE: Much of the information in this article was adapted from recent publications by Dr. Warren T. Johnson, Cornell University.