

8) *Detoxifying herbicides.* Activated charcoal can absorb and detoxify a wide variety of pesticides. It is used to overcome injury from high rates of herbicides accidentally applied to turf and tree areas. Apply the charcoal, available from industrial chemical or drug supply companies, at the rate of 150 pounds times the suspected aia (active ingredient/acre) of herbicide applied (9). For example, is simazine was broadcast at the rate of 6 pounds aia to cover 1000 sq. ft. then  $6 \times 150 = 900$ . Divide 900 by 44 (thousand sq. ft./A) and 20 pounds of activated charcoal is required for 1000 sq. ft.

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## ARTHROPOD PESTS ON JUNIPER

by J.R. Steinhauer

In the area of agricultural research, there is a serious lack of work on ornamentals or environmental plants. These plants have traditionally taken a back seat to the "important" food and fiber crops. The few scientists working on environmental plants have generally limited the scope of their investigations. Most research has consisted of biological information about one pest on a particular environmental plant. A lack of effort also exists in the area of chemical control of pests on environmental plants. The rate at which pesticides are falling into disuse is alarming. To keep up with changes we must be constantly looking for new pest control chemicals and developing new uses for existing chemicals.

The Pennsylvania Department of Agriculture, Bureau of Plant Industry, has recognized the need for research on environmental plants. Several years of basic research in the form of surveys and compilation of species lists, led to the funding of a three-year research project. This project will involve an in-depth study on the arthropod fauna associated with conifers in

Pennsylvania. Results from the preliminary surveys have given us a fairly complete list of arthropods occurring on several environmental plants. Because of the basic information available on the fauna associated with juniper and the economic value of juniper as a nursery crop in Pennsylvania, the initial scope of the conifer project was limited to the arthropods associated with juniper.

This article will report on the results of the basic surveys on juniper and the first season of intensive study on the arthropods associated with juniper. As with most scientific articles, the information contained here is not the result of just one person's effort. The entire staff of the Entomology Division of the Bureau of Plant Industry was involved in taxonomic work, basic surveys, and biological studies. The Plant Pathology Division assisted with diagnostic work. Our chief entomologist, Finley Negley, was instrumental in formulation of the project.

During the preliminary survey, 54 species of arthropods were collected from juniper. Of the 54 species 20 were considered plant feeders and

the rest were potentially beneficial species. Based on damage to plants and frequency of collection, only two of the 20 species were considered pests of primary importance: spruce spider mite (*Oligonychus ununguis*) and juniper scale (*Carulaspis juniperi*).

Generation time for spruce mites is about one month and the reproductive potential of individual females is very high. Consequently, a spruce mite population can explode suddenly. Spruce mites feed by sucking juices from the leaves resulting in a yellowish area at the point of feeding. Moderate numbers of mites cause yellowish mottled appearance of the foliage noticeable only under magnification. More severe infestations can cause the plant or portions of it to turn yellow or brown and may even kill entire plants. Spruce mites may feed on several conifers including spruce, hemlock, arborvitae, juniper and probably others. We have found that spruce mites, unlike most mites, build up large numbers in the spring and reach a population peak in June. Their numbers may stabilize or even decline during the hot months of July and August, and a second peak is reached in late September or October when they lay their overwintering eggs. Our data confirms what other workers have found (Matthysse and Naegele 1952, Neiswander 1952).

Juniper scale has only one generation annually, but its reproductive potential is high. Population outbreaks do not occur suddenly but if left unchecked, large numbers of scales can accumulate. Heavy scale infestations cause a greying or browning of the foliage and curling of the terminal branches. In cases of extremely high scale populations or prolonged infestations death may result.

In the course of some biological studies with juniper scale, another species, minute cypress scale (*Carulaspis minima*), was found. This discovery of minute cypress scale was a new record for Pennsylvania (Stimmil 1974). In the field minute cypress scale appears identical to juniper scale and the two species can be separated only after microscopic examination. A statewide survey showed that the distribution of minute cypress scale is generally limited to

the southeastern quarter of the state. The biology of minute cypress scale appears to be very similar to juniper scale.

During the preliminary study a species of the family Coniopterygidae was found for the first time in North America (Henry 1974). This insect (*Aleuropteryx juniperi*) was found in association with juniper scale and further investigations showed that it was an efficient predator of juniper scale and minute cypress scale. In some plantings the coniopterygids were believed to have kept scale populations below the damaging level.

In talking with nurserymen and horticulturalists at the start of the intensive study into the arthropods on juniper, the predominant opinion was that the most important problem with juniper was a fungus blight which caused extensive dieback of the terminal branches. Length of the dead portions ranged from ½ to 4 inches. After examining previous plant pathology survey records the frequency of occurrence of juniper blight caused serious doubt that it was the cause of the problem. Samples showing the blight symptoms of dieback were sent to Harrisburg from throughout the state. The samples were processed jointly by entomologists and plant pathologists. From about 150 samples processed there was only one positive case of juniper blight. Most of the branch dieback was caused by the boring of a midge larva tentatively identified as juniper midge (*Contarina juniperina*). Adult midges emerge from the soil in the spring. After mating the females oviposit on the juniper stems and leaves. On hatching the larvae bore into the stems and feed on the plant tissue. Larval development requires the entire season. Mature larvae drop from the stems in late fall and burrow into the soil where they overwinter. Damaged stems may show browning in the fall, but most stems maintain their healthy color until the following spring when the weather begins to warm up. Juniper midge damage generally does not kill a plant, but a moderate infestation causes a very unsightly appearance.

After discovering the juniper midge, a more thorough search of the literature revealed that it

was not a new discovery. The juniper midge has been reported from Missouri (Haseman and McLane 1940) and Ohio (Neiswander 1951). Ohio experienced the same confusion with juniper blight that we did in Pennsylvania and unfortunately this situation has not been brought to the attention of the growers. There are growers in Pennsylvania who are now spraying with fungicides to control the damage caused by the juniper midge.

Another midge tentatively identified as juniper tip midge (*Oligitrophus betheli*) was found on junipers. The tip midge does not cause as much damage as the juniper midge because it attacks only the extreme tips of the branches. The larva bores into the bud-like branch tip and hollows it out while completing its development. The branch tip will turn brown after the adult emerges. The tip midge has about four or five generations per year with considerable overlap of the generations. A heavy infestation of tip midge is noticeable only upon close examination. The major damage is probably a reduction in growth of nursery plants.

More work is planned on the biology and

control of the midges and a more detailed report will follow. A miticide screening laboratory has been set up and procedures established for evaluation of miticide. Several chemicals have been tested and we plan to test many more with the ultimate goal of gaining registration for the more promising miticides.

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## ABSTRACT

Cathey, H. M., and L. E. Campbell. 1974. **Lamps and lighting—a horticultural view**. *Lighting Design and Application*, November. 12 p.

One of the major determinants of plant growth is light, both outdoors and under artificial culture. We are now finding that, through the proper use of light, many plants can be timed or regulated to flower or fruit at any period of the year. To adjust these growth characteristics, we need to understand the changes that are caused in plants by the natural day length and how we can supplement, override, or substitute for the light regimes controlling these changes by using light from artificial lamps.

The first cultural step in the growing of many plants is to select the proper amount and duration of light. Only a minimum of regulation can be exerted on plants that are grown outdoors. Daily and seasonal fluctuations in light, temperature, or other environmental factors may nullify the manipulations made by the grower. Yet the grower who decides to propagate plants must seek ways to control growth. This article describes progress during the last 50 years in regulating lighting systems for economic plants. It includes research on light for photosynthesis, light to extend the photoperiod, and light to regulate specific growth responses of plants.