NURSERY DISEASE PROBLEMS - SIROCOCCUS STROBILINUS

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INTRODUCTION

Sirococcus strobilinus is a major problem in the Jeffrey pine and ponderosa pine at the Humboldt Nursery located 300 miles north of San Francisco, on the California Coast. This disease has also been found infecting sugar pines at Humboldt Nursery and coulter pine at another nursery on the California Coast 90 miles south of San Francisco, but it has not caused a problem in these species.

SYMPTOMOLOGY -- This fungus causes a tip dieback of the current years' growth in nursery-grown pine seedlings. The various stages of the disease seen in the field suggest that initial infection occurs in the juvenile needles. From these it spreads down into the succulent stem tissues, where it causes a small purplish canker. The canker enlarges, growing longitudinally up and down the stem more rapidly than around the stem, producing an elongated sunken canker. A small drop of resin is often exuded in the central area of the canker at the needle base where infection first entered the stem. At this stage in canker development, small black pycnidia begin to appear on the dead needles and the older portions of the canker. When infection occurs in the region of elongation, the restricted growth in the cankered area causes the shoot tip to curl over and form a crook. Ultimately, the canker girdles the stem, and the tip distal to the canker dies and turns brown. Infection appears to be confined to the current year's succulent growth.

The fungus forms small, black, superficial to innate pycnidia within the cankered area. The pycnidia occur singly or in groups and at times are confluent. The ostiole is wide and irregular. The spores are hyaline 2-celled asymetrical spindle-shaped, and average 3 by 15.

EPICEMIOLOGY -- Observations at the Humboldt Nursery show the fungus to be active in late spring and in summer but not in Vie winter. Because moisture conditions due to fog at the Humboldt Nursery are frequently favorable all year around, the effect of temperature as a limiting factor was investigated.

EFFECT OF TEMPERATURE ON SPORE GERMINATION -- Spores were incubated at each of seven temperatures: 5^0, 10^0, 15^0, 20^0, 25^0, 300, and 35^0 C. After 17 hours, the plates were removed and random counts of the germinated and ungerminated spores were made.

A count of 100 spores at each temperature yielded these results. No germination occurred at either 50 or 35^0 C. At 10° C (66 percent germination) and 300 C (30 percent germination) the germ tubes were just starting to form and were quite short. The germ tubes were long, well formed, and starting to branch when temperatures and germination percents were: 15° (92 percent), 20^0 (78 percent , and 25° C (82 percent).

EFFECT OF TEMPERATURE ON GROWTH -- No growth occurred at 5° or 300 C In general, growth rate increased at temperatures from 10^0 up to 20^0 C and declined slightly to 250 C. There appeared to be an initial growth lag at the highest temperature, 25^0 C, at which growth occurred.

DISCUSSION -- S. strobilinus on the West Coast has been confined to two coastal nurseries where temperatures are mild and summer fogs provide long periods of high humidity during the growing season. The disease is not expected to appear in the inland nurseries, which have a hot, dry growing season.

In the coastal nurseries temperatures may be a limiting factor to disease development in the winter and early spring. Both germination and linear growth of the pathogen were suppressed at temperatures below 10^0 C. In 1971, at the Humboldt Nursery, the monthly temperature means for the winter and early spring months were all below 9° C. Also, daily temperature fluctuations in this coastal environment are small. In winter, the average maximums and minimums are only 5^0, to 60 C apart with the monthly mean about half way between the two.

Perhaps the availability of succulent host tissues is also a controlling factor of the pathogen's period of activity. The first appearance of the disease in May corresponds roughly with the start of new shoot growth and the appearance of succulent shoot tissue. Field observations indicate that 1-year-old tissue is not susceptible, but the time at which new growth becomes resistant is not known.

This study suggests that this disease will continue to be a problem only in late spring and summer along the coast where mild temperatures prevail and moisture is available. This information suggests a possible timing of effective fungicide applications to control this disease.

SOURCE ON INOCULUM AT HUMBOLDT NURSERY -- The source of Sirococcus strobilinus was not known since the susceptible pines, P. jeffreri, P. ponderosa, and P. lambertiana are not native to the area ancT no ornamental plantings of these species were found in or near the nursery. The native forest, which is on three sides of the Humboldt nursery, consists of Douglas-fir, Pseudotsugae menziesii; Sitka spruce, Picea sitchensis; and bishop pine, P. muricata. No S. strobilinus branch infections of any of these native conifers were found in several surveys.

In spring 1975, a severe infestation of S. strobilinus was observed in the southern ends of several beds of Jeffrey pine where the nursery was bordered by many wildland plants, including one large Sitka spruce. A count oft the number of healthy and infected seedlings per square foot (929 cm) at 6 meter intervals down three of the infected beds revealed that the number of infected pines was greatest close to the spruce and became fewer away from it. This observation suggested that the spruce was the source of inoculum. Although no branch cankers could be found on the spruce, the previous year's old cones, which had been recently shed, were found in and among the infected seedlings.

Robak, in a taxonomic study of S. strobilinus in Europe, reported that some of the isolates he studied came from the cones of Picea abies, Norway spruce. Therefore, we collected fallen Sitka spruce cones in the infested beds and in the nearby roadway. These cones were incubated at room temperature in a moist chamber in a laboratory. After 5 days' incubation, the cones were examined. S. strobilinus was found fruiting on the cone scales of six out of eight cones examined and on cones from both the roadway and the pine nursery bed. The fruiting bodies and spores found on the cone were identical to those studied on diseased Jeffrey pine. After the spruce was removed there was no further incidence of the disease.

Control -- Chemical control studies were begun in 1970 at the U.S. Forest Service's Humboldt Nursery, Arcata, California. These control studies were conducted in a bed of naturally infected 1-year-old Jeffrey Pinus jeffryi.

The plots were sprayed first on November 3, 1970, and then every two weeks thereafter. On February 2, 1971, when it was apparent that the disease was inactive, the spraying schedule was changed to once every four weeks. On May 17, 1971, observations indicated that the disease had resumed activity. Therefore, the spray schedule was changed back to once every two weeks.

RESULTS AND CONCLUSIONS -- On June 29, 1971, the number of infected stems in each plot (4 x 5 ft.) were counted. These counts included all infected seedlings within each plot except those in the two outside rows (one on each side). At this time, the disease was still active and there was no signs of phytotoxicity in any of the treatments. The results indicate that chiorothalonil, Difolitan, and zinc + maneb, when sprayed at a 2week interval, were effective ill Lontrolling Sirococcus tip blight; however, the copper fungicide and the benzimidazole fungicides, benomyl

and thiabendazole, were not effective.

REFERENCES

1. Robak, H. 1956. Some fungi occurring on died - back tops and branches of Picea abies and Abies spp in Western Norway. Friesa Vol. 5. pp. 366-389.

2. Smith, R.S. 1972. Control of Sirococcus tip blight of Jeffrey pine seedlings. Plant Dis. Reptr. 56: 241-242

3. Smith, R.S. Jr. 1973. Sirococcus tip dieback of Pinus spp. in California forest nurseries. Plant Dis. Reptr. 57: 69-73.