Pest control problems encountered in seedling production of Arizona cypress in Alabama

by

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Arizona cypress *(Cupressus arizonica* Greene) Christmas trees are becoming increasingly popular throughout the South. Alabama nurserymen have encountered many problems during the past two decades in establishing and maintaining nursery stands of this species through the first year. These problems are complex in nature and involve entomological. pathological, and physiological factors that may appear alone or in various combinations.

Background

The pathology of Arizona cypress ha, been summarized by Wagener (6). He states that low disease incidence in the species in native habitats is more a matter of environmental factors not being conducive to disease development than inherent disease resistance. Wagener also stresses that Arizona cypress appears to be particularly subject to disease in areas of high relative humidity. These two statements explain to some extent why growing Arizona cypress in Alabama is difficult. The pathology of Arizona cypress in Southern nurseries was summarized by Hepting (4). He stated that Phomopsis *juniperovora* blight is the most serious problem. This opinion is shared by Hodges (5). who earlier did considerable research to explain pathological problems of Arizona cypress in southern nurseries and outplantings. Some foliage problems encountered with seedling production are intermittent in nature (1.2).

Perhaps the greatest problem concerning Arizona cypress in Alabama nurseries during the past 3 years has been damage caused by larvae of the lesser cornstalk borer *(Elasmopalpus lignosellus Zeller)*. In many cases, borer damage provides infection courts for secondary fungi. Similar problems have been described preciously (.3). Damage can be classified as follows: (1) Root lesions: (b) lower stem lesions (with occasional girdling); (e) hasnal mining of lowermost branches; (d) small circular feeding lesions in upper sterns and larger branches; (e) elongated feeding lesions in crotches of upper branches; and (f) foliage clipping. These problems can occur alone (mostly involving rout lesions or lower stem lesions) or in various combinations. The most serious type of damage appears to be basal mining of lowermost branches (fig. 1) that leads to invasion and subsequent necrosis *by weakly parasitic fungi. A Dothiorella* species appears to he the most common invader in these cases.

Previous studies by the senior author of this article and by Kelley' (unpub lished) in the Auburn Forest Nursery during 1969-71 were conducted to clarify the complex pest problem of Arizona cypress commonly referred to as "seedling blight." Although treatments in these studies with various fungicides, insecticides, and anti-transpirants (alone and in various combinations) generally yielded seedlings that graded better than those of control plots, wide variation within individual plots precluded significant tests of differences. Four insecticides, Systox, Monitor 6S (both systemics), malathion, and methoxychlor, apparently gave very little control of the lesser cornstalk borer. Two anti-transpirants, Wilt-Pruf and pinolene, appeared ineffective in reducing losses, except that pinolene did produce a temporary improvement in appearance of seedlings. Previous studies by Kelly (unpublished), using the fungicides benoml, liquid copper (TC90), Difolatan 4F. Cyprex, Manzate, and Duter produced results almost identical to those of the senior author with respect to variation and significance. However, plots that had been partially shaded (63 percent) did produce significantly better results than unshaded plots, indicating that perhaps some physiological factor had been circumvented.

This study discussed here was conducted at the Auburn Forest Nursery during 1972 to investigate control of the lesser cornstalk borer and the complex fungal invasions that follow.

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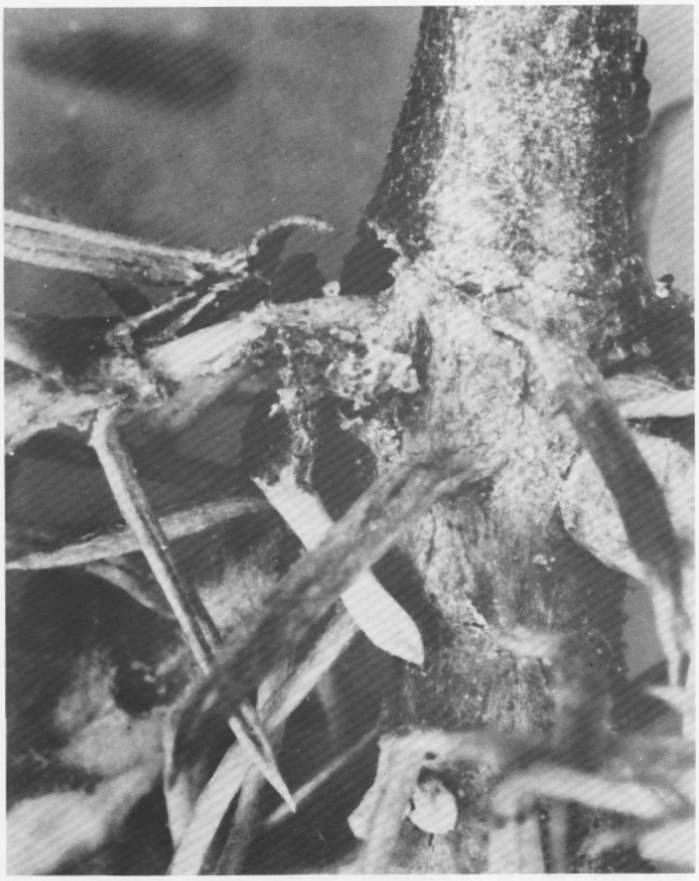

Figure 1.—Basal mining of lowermost branches of an Arizona cypress seedling (5 months of age) by the lesser cornstalk borer *(Elasmopalpus lignosellus)*.

Materials and Methods

Seed for this study were collected from local plantation. and test plantings were established at Auburn Forest Nursery in Early April. 1972. A splitplot design was used with insecticides in whole plots and fungicides in subplots. Fungicides were assigned randomly within insecticide plots previously assigned randomly. plots were replicated four times.

Three insecticide treatments were as follows:

(1) Dieldrin applied to surface as granules at a rate of I pound active ingredient per acre. Granules were mixed into the top 4 inches of soil with a rototiller prior to seeding.

(2) Benzenehexachloride (BHC) applied at a rate of 2 pounds active ingredient per acre. This solution was made using 11 percent emulsifiable concentrate in water. Applications were made with a CO_2 pressurized hand sprayer at 40 pounds constant pressure. Applications were made every two weeks from the first week in June through mid-July, and weekly applications were made afterwards until mid October.

(3) Control

Three fungicide treatments were as follows:

(1) Difolatan at a rate of 2.5 pounds active ingredient per acre applied biweekly beginning June 5 and continuing until mid-October.

(2) Benlate at a rate of 0.4 pound active ingredient per acre applied on the same schedule as Difolatan.

(3) Control

Sampling Procedure

In early September, four random samples of 25 seedlings each were taken from each subplot. Seedlings were examined individually for damage caused by lesser cornstalk borers and fungi. Borer damage was classified as root damage. top damage. or both. Damage by fungi. expressed as percentage of dead crown, was put in one of the following three classifications: 0 to 33 percent. 34 to 67 percent. and 68 to 100 percent. In add ii ion, all seedlings having less than 5 percent dead crown were placed in a group called "perfect" and all completely (it-ail seedlings were placed in a group called "dead". Examinations of seedlings were made h,, four observers, each reporting on one replication so that differences caused by observers could he removed as variation caused by replicates. Analyses of variance acre made for each damage classification.

Results and Discussion

Table 1 summarizes results of fungicide treatments. All differences between means are highly significant (significant at the .01 level) except the differences between Difolatan and control in the <5 percent dead foliage category and between Ben late and Difolatan in the (lead category. These two differences were not significant. These results show

TABLE 1.—*Arizona cypress seedlings in each fungicide treatment classified by seedling condition and fungus damage based on dead or dying foliage*

Fungicide treatment	Seedling condition		Fungus damage based on dead or dying foliage		
	<5 percent dead foliage	Mortality	0-33 percent	34-67 percent	68-100 per cent
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Benlate	82	1a	92	5	3
Difolatan	10a	13a	42	34	24
Control	1a	50	8	20	72

Means not followed by the same letter significantly (.01 level of testing).

Benlate superior in controlling foliage blight. This is especially evident when out compares the percentage of seedlings having less than percent dead foliage.

Results of insecticide treatments for borer control are presented in Table 2. The only significant differences found were in the reduction of root and root and top damages. The difference between BHC and Dieldren in controlling root damage was highly significant while the difference between BHC and the control was significant (significant at the .05 level). In controlling damage to both root and top of one seedling, the differences between BHC and Dieldren and BHC and the control were highly significant. No significant interactions between insecticides and fungicides were found. Although the control of borer root damage by BHC is statistically significant. the percent gain is so small that it probably has little practical value.

Conclusions

Although the number of seedlings damaged by the lesser cornstalk borer was high, seedlings showed little or no serious effects when secondary fungi were controlled. Seedling mortality was reduced to an acceptable level. Borer-inflicted wounds in Arizona express seedlings heal by a rapid formation of callus tissue when secondary fungi are controlled. Benlate provided adequate control of secondary fungi. resulting in seedling stands that were larger and healthier than in any other treatment or combination of treatments.

A similar study is currently being conducted using higher insecticide rates than in 1972 and similar fungicide rates.

Literature Cited

1. Davis, T.C. 1967. Curvularia tip blight- A new disease of Arizona cypress. South Wide Forest Dis. Workshop Abstr..3.

2. Davis, T.C., W.D. Kelley & J.F. Goggans 1972. Curvularia intermedius associated with seedling tip blight of Arizona cypress and eastern red cedar. Plant Dis. Rep. 56(2):192.

3. Foster, A>A. & R.P. Harrison. 1957 Seedling losses in Arizona cypress. USDA Forest Serv. Tree Planters' Notes 29:20-21.

4. Hepting, G.H. 1971 Diseases of forest and shade trees of the United States. USDA Forest Serv. Agric. Handbook 386. 658p.

5. Hodges, C.S. 1962. Diseases in southern forest nurseries and their control. USDA Forest Serv. SEFES Pap. 142. 16p.

6. Waegner, W.W. 1948. The new world cypresses. Part 2—Diseases of American cypresses. El Aliso 1:257-321.

TABLE 2.—*Arizona cypress seedlings in each insecticide treatment classified as dead and borer damage by location on seedlings*

Insecticide treatment	Dead seedlings	Borer damage by location on seedling		
		Top	Root	Both
	Percent	*Percent*	*Percent*	*Percent*
BHC	21a	59a	25	6
Dieldren	19a	60a	38a	14a
None	24a	59a	34a	11a

Means not followed by the same letter differ significantly (.01 level of testing) except the 35 and 25 in the root column differ at the .05 level.

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