Moldy seed and poor germination linked to seedbug damage in slash pine

by
S. J. Rowan and Gary L DeBarr[1]

The South's tree improvement programs have experienced relatively few major crises since their establishment. Recently, however, routine seed germination tests have shown that the germination percentage of slash pine seed harvested from seed orchards is much lower than that of seed harvested from the wild. This unforeseen problem has caused considerable concern, and a number of explanations have been suggested. This article describes our study of some possible causes.

Standard germination tests of seven seed lots of slash pine (Pines elliottii engelmn. Var. elliottii) were conducted at the Forest Service's Eastern Tree Seed Laboratory, Moron, Ga. The overall germination percentages for five of the lots averaged less than 80 percent (table 1). Extensive molding occurred on three of the lots during the germination tests. Standard testing procedure involves the cracking of each seed which does not germi iat' by the end of the test period to determine whether it is fall or empty. The data indicated that while almost 90 percent of the seed appeared to be full, the percentages of full-seed germination for the three moldy lots ranged from 31 to 79 percent (table 2). Based upon these standard test results, it appeared that a large proportion of the full seed in these lots might have been affected by the mold observed in the germination trays. Therefore, samples of the seven seed lots were sent to the Forestry Science Laboratory, Athens, GA, for further examination.

Study Methods

Two seedlings, a leaf-footed bug, *Leptoglossus corculus* (Say), and a shield-back bug, *Tetyra bipunctata* (Herrich-Schaeffer), are known to damage slash pine seed *(2)*. Therefore, send from each lot were separated and classed by X-ray and microscopic examination (3) as (A) sound seed (B) unsound seed, and (C) seedbug-damaged seed. Seed were classified as sound if the endosperm was undamaged, had no necrotic area, and appeared as a solid white mass within the seedcoat. The seedcoat of sound seed was also determined by ocular examination to he without a stylet puncture hole and the seed was partially or totally empty of gametophytic tissue. Seed were classed as seedbug damaged if the seedcoat had one or more stylet puncture holes, and its endosperm was shrunken, partially destroyed, collapsed. or almost entirely missing.

Seed of each of the three classes were planted in plastic dishes on layers of moistened cellulose paper (the standard germination test procedure at the Eastern Tree Seed Laboratory). For each lot, the percentages of seed germinating and fungi associated with the three seed classes were recorded. Additional groups of seed were surface-sterilized and plated onto an agar medium to make fungal isolations.

1 Plant pathologist and entomologist, respectively, Southeastern Forest Experiment Station, USDA Forest Service, Forestry Service, Forest Sciences Laboratory, Athens, GA.

TABLE 1.—*Comparison of germination percentages of slash pine seed in standard tests and after separation into sound, seedbug-damaged, and unsound seed classes by radiographic and microscopic techniques*

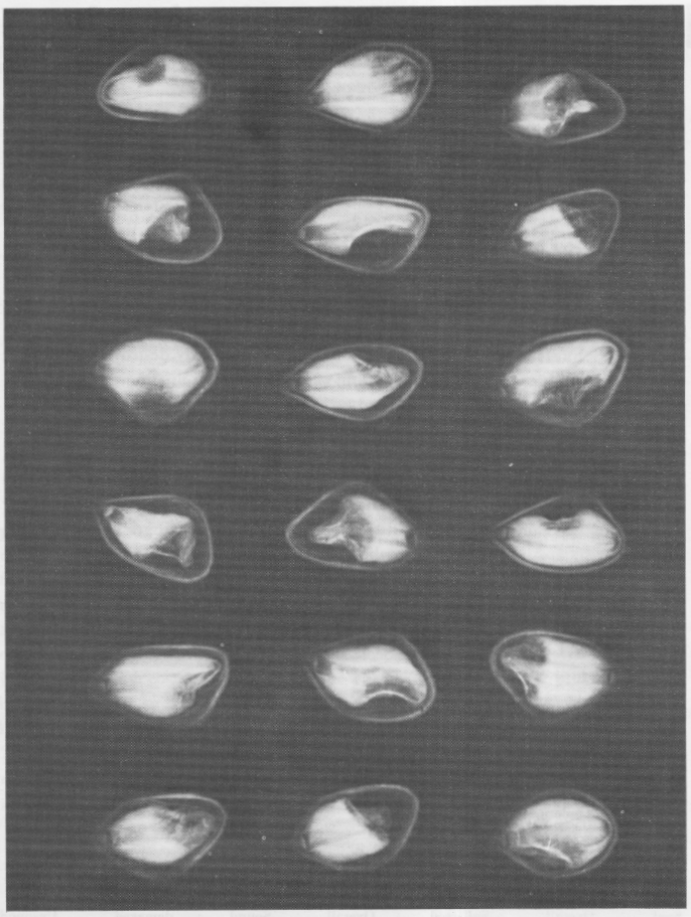
Seed lot	Standard germination test data[1]		Germination by X-ray classes			
				Contribution by class		
	Overall for lot	Full-seed only	Overall for lot	Sound seed[2]	Seedbug-damaged seed[2]	Unsound seed[2]
	Percent					
A[3]	28	31	31	29	1	1
B[3]	53	57	65	63	1	1
C[3]	72	79	66	65	0	1
D	72	84	84	83	0	1
E	77	88	80	80	0	0
F	96	99	94	93	0	1
G	98	99	98	97	0	1

[1]Provided by Eastern Tree Seed Laboratory, Macon, Ga. Full-seed percentages determined in standard test by cracking seed which did not germinate.

[2]Determined after microscopic examination of X-rayed seed and observation of the same seed on radiographs.

[3]Seed lots in which extensive mold was observed in germination test trays.

FIGURE 1.—Radiograph of a slash pine seed with seedbug-damaged seed which appear to be full (sound) seed by standard cracking procedures. All seed on this radiograph are seedbug damaged.



Results and Discussion

Isolation revealed relatively low percentage of Fusarium solani (Mart.) App & Wr. em. Snyd. & Hans. This was the only fungus which increased in numbers as germination decreased (table 2), and it was principally isolated from unsound and seedbug-damaged seed.

Reduced germination in the three moldly lots appeared to be best correlated with the number of seedbug-damaged seed (tables 1 and 2). Radiographic and microscopic examination of these three moldy lots showed that many seed that appeared full upon cracking were actually seedling damaged (fig. 1).

Moldy slash pine seed were also observed in germination tests of seed harvested from an Alabama orchard in which the full-seed germination averaged only 65 percent (4). Although poor germination was initially attributed to the mold present in germination trays. 21 percent of the seed harvested was seedbug damaged and many of the seed that appeared full upon cracking were, in fact, seedbug damaged.

These observations implicate seedbugs as a major cause of the decreased germination and associated moldy condition of slash pine seed produced in Southern seed orchards. This study does not indicate if the fungi causing moldy seed in germ in al ion test trays are transported by the seedbugs are inserted on or within seed during feeding, or if the stylet puncture hole is a natural infection court for seed decay fungi. Fusarium solani is a pathogen of slash pine seedlings, and its presence in seedbug-damaged seed lots may increase the amount of damping-off and root rot in seedlings originating from such seed loll. Although the presence of the mold in germination trays does not reduce germination (1), certain fungi, including F. solani, can reduce germination. We still need to determine if germination may he reduced during storage of seedling-damaged and moldy seed.

Simply cracking the seed which fail to germinate to determine if they are full does not distinguish sound from unsound seed. Radiography is the only reliable method that can he used to distinguish sound from unsound seed, and it should be used routinely to determine the amount of insert injury or other damage in seed lots subjected to germination tests.

Literature Cited

1. Belcher, E.W. and B.T. Waldrip 1972. Effect of thiram on seed mold and germination of slash pine seed. Assoc. Off seed Anal. Proc. 62:91-93.

2. DeBarr, Gary L. 1967. Two new sucking insect pests of seed in southern pine seed orchards. Southeast. For. Exp. Stn. USDA Forest Service Res. Note SE-78, 3. pp.

TABLE 2.—*Comparison of condition of slash pine seed by standard cracking procedure, radiography, and fungal isolations*

Seed lot	Standard test data[1]		Radiographic test data[2]			Isolation frequency of *Fusarium solani*
	Full	Empty	Sound	Seedbug-damaged	Unsound	
	Percent					
A[3]	89	11	39	56	5	8
B[3]	93	7	76	10	14	8
C[3]	91	9	75	14	11	3
D	86	14	84	7	9	2
E	88	12	87	0	13	3
F	97	3	93	2	5	1
G	99	1	98	0	2	0

[1]Determined in standard tests by cracking seed which did not germinate. Data provided by Eastern Tree Seed Laboratory.

[2]Determined by microscopic examination of X-rayed seed and by observation of the same seed on radiographs.

[3]Seed lots in which extensive mold was observed in germination test trays.

3. _____
1970. Characteristics and radiographic detection of seed bug damage to slash pine seed. Fla. Entomol. 53:109-117.

4. _____Edward P. Merkel. Claude H. O'Gwynn, and Marvin H. Zoerb, Jr.
1972. Differences in insect infestation in slash pine seed orchards due to phorate treatment and clonal variation. For. Sci. 18:56-64.

Tubeling Propagation of Eucalyptus Appears Successful in Texas Test

by

Ray R. Hicks, Jr., Frankline Y. Adekiya and Seymour I. Som berg[1]

The authors wish to acknowledge International Paper Company's Long-Bell Division for providing the planting site and for pre-planting site preparation.

1 Assistant professor, grad assistant, and director of research, respectively, Stephen F. Austin State University, School of Forestry, Nacogdoches, Tex. 75961.

2 Spiral wound kraft paper tubes, 10 inches long by 1.5 inches in diameter, wall thickness 0.06 inches, available commercially.

Containerized seedlings offer an attractive alternative to planting barerooted stock in species, such as eucalyptus, which undergo no dormant growth phase. An objective of this study was to investigate the feasibility of planting eucalyptus seedlings in paper tubes (tubelings). The species and hybrids tested were: (1) Eucalyptus tereticormis x maculata. (2) E. camaldulensis Dehn, (3) E. citriodora Hook, (4) E. grandis (Hill) Maiden. (5) E. saligna Sm.

Methods

Plants grown from seed in greenhouse flats during the winter of 1972 were transplanted into paper tubes[2] about 5 weeks after germination. The tubelings remained in the greenhouse until April 4, 1972 at which time they were trans planted to the field. Fifty plants from each of the five species were out-planted in a randomized complete-block design at a spacing of 9 x 9 feet. The planting site had been cleared, burned, and disked prior to out-planting. Tubelings were planted by extracting a core of soil the proper size and depth and inserting the labeling into the hole.

Based on results of elemental analysis of the soil (Nacogdoches series), dolomite lime (1 lb. per tree) and 10-20-10 (.25 lb. per tree) were applied, in a circle 3 feet in diameter, to half the plants of each species.

Final height and survival measurements on the plantation were taken in late September 1972; therefore; frost hardiness was not evaluated.