

ONE-YEAR PONDEROSA PINE SEEDLING  
PRODUCE POLLEN

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ABSTRACT.—A greenhouse-grown *Pinus ponderosa* var. *scopulorum* produced pollen at the early age of 1 year. Stress is hypothesized as the cause of the precocious cone-production. Pollen viability tests were negative.

Minimum age of staminate cone production in *Pinus ponderosa* var. *scopulorum* Engelm. (Rocky Mountain ponderosa pine) has not previously been ascertained. Generally, onset of reproductive maturity does not occur until an age of 6 to 20 years. However, Righter (1939) found that ovulate cones may be produced as early as 5 years, but did not report a minimum age for staminate cone development. Staminate cones were found by Righter (1939) on *P. ponderosa* var. *ponderosa* Laws. (typical ponderosa pine) at 2 years. Because Rocky Mountain ponderosa pine currently is the object of tree improvement research, reduction in breeding cycle length is of great practical importance. Production of precocious cone-bearing trees is a means of shortening the generation time. Stress has been shown to induce precocious cone-production (Pharis, 1977; Quirk, 1973; Sweet and Will, 1965) and as such was employed in this study.

MATERIALS AND METHODS.—In November 1977, Rocky Mountain ponderosa pine seed were planted in Ray-Leach 65-cm<sup>3</sup> containers and placed in a greenhouse at New Mexico State University, Las Cruces, New Mexico. The seed was a sample from a bulk supply collected from squirrel caches throughout the Sacramento Mountains, New Mexico. Potting media was 1:1 mix (by weight) of peat and vermiculite. No pre-planting seed treatment was utilized. In order to induce stress, the greenhouse-grown seedlings were not fertilized, did not receive supplemental light, were watered at infrequent intervals extending from 7 to 12 days, and the small containers with open bottoms caused root confinement and root pruning.

RESULTS AND DISCUSSION.—In July of 1978, three of the approximately 600 seedlings had produced reproductive buds (total of five buds). During November 1978, one reproductive bud burst on one seedling and produced a pollen bearing cone (Fig. 1). The remaining buds aborted. No ovulate cones were observed, but pine species typically initiate staminate cones earlier.

Slow rate of vegetative growth was indicated by mean heights of 7 cm at 1 year, less than one-third the growth commonly observed under optimal conditions. Stress apparently was a factor in the seedlings slow growth and seems the probable cause of the precocious cone-production. Previous studies involving seedlings of the same source grown under less stressful conditions yielded no precocious cone production (unpubl.). The pollen produced was morphologically comparable to mature ponderosa pine. Pollen from 1-year seedlings averaged 37 mm across the bladders and 28 mm from cap to furrow, whereas pollen from mature trees measured 38 mm and 25 mm respectively.

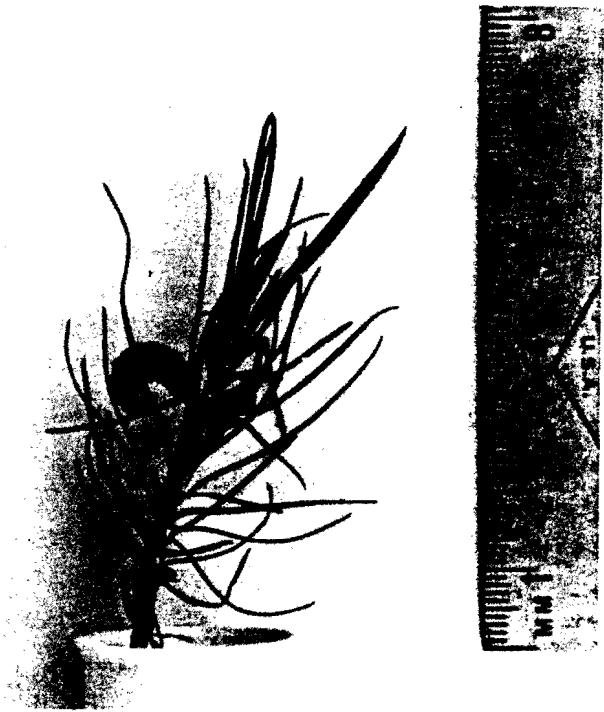


FIG. 1.—One-year Rocky Mountain ponderosa pine with mature staminate cone (left side of stem) and aborted reproductive bud (right side of stem).

The pollen was found non-viable by the distilled water (Dillon and Zobel, 1957) and tetrazolium chloride (Cook and Stanley, 1960) viability tests. However, such tests must be interpreted with caution since they may fail to adequately simulate germination conditions found in the micropyle of ovulate cones. Johri and Vasil (1961) found that germination may be enhanced by natural secretions not duplicated in artificial media.

No crosses were made with the pollen because insufficient quantities were produced. Although precocious seedlings frequently produce infertile reproductive organs, viable pollen has been reported in *P. mugo* Turra (Mergen and Cutting, 1957) and *P. contorta* Dougl. (Johnson and Critchfield, 1978).

The three seedlings with reproductive buds were transplanted to larger containers. Any pollen produced in coming years will be used in crossing experiments to determine whether it is functional and to study heritability of early cone production.

New Mexico Agricultural Experiment Station Journal Article 798.

#### LITERATURE CITED

- COOK, S. A., AND R. G. STANLEY. 1960. Tetrazolium chloride as an indicator of pine pollen germinability. *Silvae Genet.*, 9:134-136.
- DILLON, E. S., AND B. J. ZOBEL. 1957. A simple test for viability of pine pollen. *J. Forestry*, 55:31-32.

- JOHNSON, L. C., AND W. B. CRITCHFIELD. 1978. The production of functional pollen and ovules by pine seedlings less than 1 year old. *Forest Sci.*, 24:467-468.
- JOHRI, B. M., AND I. K. VASIL. 1961. Physiology of pollen. *Bot. Rev.*, 27:235-381.
- MERGEN, F., AND S. G. CUTTING. 1957. Male flowers on one-year-old mugo pine seedlings. *Forest Sci.*, 3:355-356.
- PHARIS, R. P. 1977. Promotion of flowering in the Pinaceae by hormones—a reality. *Proc. 13th Lake States Tree Improv. Conf., USDA Forestry Serv. General Tech. Rep., NC-50:1-10.*
- QUIRK, J. T. 1973. Cone production stimulus related to transplanting in red pine. *Silvae Genet.*, 22:71-72.
- RIGHTER, F. I. 1939. Early flower production among the pines. *J. Forestry*, 39:935-938.
- SWEET, G. B., AND G. M. WILL. 1965. Precocious male cone production associated with low nutrient status in clones of *Pinus radiata*. *Nature*, 206:739.

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