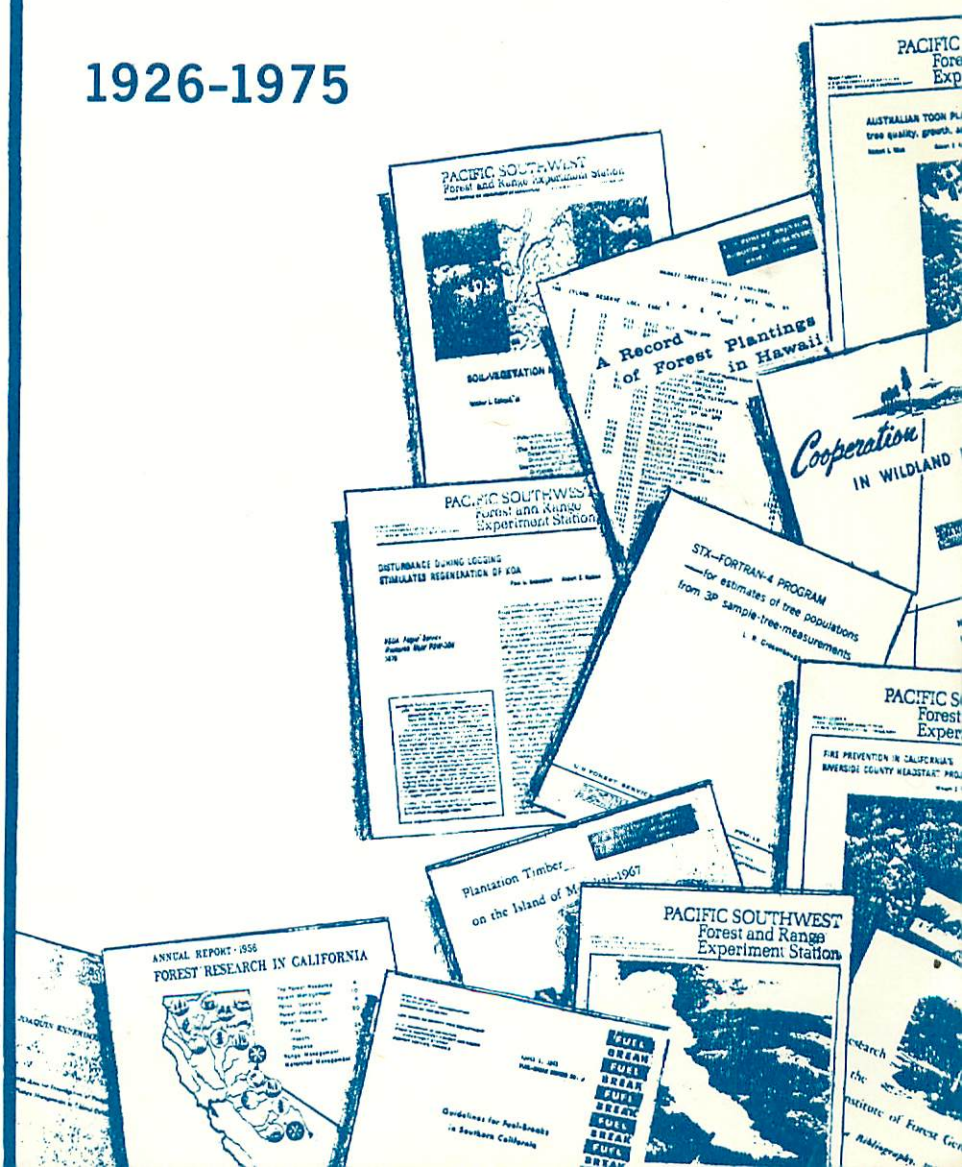
FIFTY YEARS OF FORESTRY RESEARCH:

annotated bibliography of the Pacific Southwest Forest and Range Experiment Station,

1926-1975



PACIFIC SOUTHWEST
Forest and Range Experiment Station

FOREST SERVICE
U.S.DEPARTMENT OF AGRICULTURE
P.O. BOX 245, BERKELEY, CALIFORNIA 94701

USDA FOREST SERVICE
GENERAL TECHNICAL
REPORT PSW-23 /1977

Aitro, Vincent P., compiler

1977. **Fifty years of forestry research: annotated bibliography of the Pacific Southwest Forest and Range Experiment Station, 1926-1975.** USDA Forest Serv. Gen. Tech. Rep. PSW-23, 250 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Lists 2905 publications, with annotations and subject and author indexes, issued during the first 50 years of the Pacific Southwest Forest and Range Experiment Station (formerly the California Forest and Range Experiment Station), headquartered at Berkeley, California.

Oxford: 945.4(048.1)(794)

Retrieval Terms: forest management research, forest insect and diseases research, forest fire research, forest environment research, forest economics and forest products research, management sciences research, California, Hawaii, California Forest and Range Experiment Station, Pacific Southwest Forest and Range Experiment Station.

Compiler:

VINCENT P. AITRO is supervisory librarian, Information Services Group, Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Berkeley, California.

ACKNOWLEDGMENTS

The following persons contributed to the compilation, verification, indexing, and production of this annotated bibliography: James W. Clarke, Patrick Finelli, Dennis F. Galvin, Cynthia K. Jacobs, and Ann Parker.

USDA Forest Serv. Resour. Bull. PSW-11, 42 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Summarizes the results of an inventory of timber in planted forests on the island of Maui.

739. Zinke, Paul J.
1962. *The soil-vegetation survey as a means of classifying land for multiple-use forestry.* Fifth World For. Congr. Proc. Vol. I:542-546.

The information provided is particularly adaptable to multiple-use management of forest and wildland areas.

740. Zinke, Paul J., and Wilmer L. Colwell, Jr.
1965. *Some general relationships among California forest soils.* Forest-Soil Relat. in North Am. Proc.:353-365, illus.

Discusses relation of certain soil properties to sequential soil profile development on various parent rock types.

FOREST MANAGEMENT

Forest Genetics

741. Austin, Lloyd.
1927. *A new enterprise in forest tree breeding.* J. For. 25(8):928-953.

Suggests the development of better strains of trees and ones capable of rapid growth.

742. Austin, Lloyd.
1928. *Breeding pines for more rapid growth.* J. Hered. 19(7):289-301.

Outlines the objectives and methods of selection, pollination and testing of trees at the Eddy Tree Breeding Station, Placerville, Calif.

743. Austin, Lloyd.
1928. *Experiments at Eddy tree breeding station.* Timberman 29(7):42,44.

Describes work concerned mainly with selection and pollination.

744. Austin, Lloyd.
1929. *The Eddy tree breeding station.* Madroño 1(15):203-212.

Discusses several projects concerned with developing superior trees.

745. Austin, Lloyd.
1932. *Eddy tree breeding station carries on under new name.* Forest Worker 8(2):10.

The new title—the Institute of Forest Genetics—is believed to be more expressive of the nature of the research being carried on.

746. Austin, Lloyd.
1932. *Hereditary variations in western yellow pine. Abstract of address before California Botanical Society.* Madroño 2(7):62-63.

Vigor seems to decrease as elevation increases, which may be strictly a result of water supply since only the individuals that are inherently vigorous can survive the long dry season at the lower elevations.

747. Austin, Lloyd.
1932. *Pine and walnut breeding for timber production.* Sixth Int. Congr. Genet., Ithaca, 1932. Proc. 2:2-4.

Describes the production of vigorous hybrids at the Institute of Forest Genetics.

748. Austin, Lloyd.
1932. *Tree breeding for timber production.* Int. Congr. Genet. 6th, Ithaca, 1932. Proc. 2:387-388.

Describes equipment and methods for pollinating the ovulate flowers of pines at the Institute of Forest Genetics, Placerville, Calif.

749. Austin, Lloyd.
1937. *Forest genetics, a new science utilized to advance American forestry.* Am. Forests 43(9):444-446,466-467.

Summarizes some of the results of the first 10 years of work at the Institute of Forest Genetics, Placerville, Calif.

750. Austin, Lloyd.
1938. *Work of the Institute of Forest Genetics.* Plant. Q. 7(3):1-3.

Lists three new experiments designed to investigate the behavior of different strains of ponderosa pine in a variety of climatic and soil conditions.

751. Austin, Lloyd, J. S. Yuill, and K. G. Brecheen.
1945. *Use of shoot characters in selecting ponderosa pines resistant to resin midge.* Ecology 26(3):288-296.

The fact that viscid shoots suffer greater damage than glaucous and glabrous ones enables susceptible trees to be quickly selected for removal from the stand.

752. Bingham, R. T., A. E. Squillace, and J. W. Duffield.
1953. *Breeding blister-rust-resistant western white pine.* J. For. 51(3):163-168.

Summarizes results of earlier breeding experiments and discusses need for future work.

753. Bingham, W. E., S. L. Krugman, and E. F. Estermann.
1964. *Acrylamide electrophoresis of pine pollen proteins.* Nature 202:923-924.
Discusses methods and results of albumins and globulins extraction from the pollen of eight pine species and hybrids.

754. Buchholz, John T.
1945. *Embryological aspects of hybrid vigor in pines.* Science 102(2641):135-142.
Concludes that a hybrid embryo larger than that of the parents is the result rather than the cause of hybrid vigor.

755. Callaham, Robert Z.
1956. *Needle oils of three pine species and species hybrids.* Forest Sci. 2(2):101-105.
No striking differences between species were found and oils of hybrids had properties intermediate between those of the parents.

756. Callaham, Robert Z.
1958. *Better trees through systematic breeding.* Thirty-third Natl. Shade Tree Conf. Proc. 1957:271-275.
Discusses the roles of genetic research and tree breeding in improving the characters of forest tree species and gives the techniques and procedures used.

757. Callaham, Robert Z., and A. A. Hasel.
1958. *Height growth of ponderosa pine progenies.* Soc. Am. For. Proc. 1957:61-62.
Discusses the interrelationships of seed-size, germination, height growth, crop year, and elevation.

758. Callaham, Robert Z., and Woodbridge Metcalf.
1959. *Altitudinal races of Pinus ponderosa confirmed.* J. For. 57(7):500-502, illus.
At 20 years of age, ponderosa and Jeffrey pines under test in the North Coast Range of California showed an essentially similar relation between vigor and elevation of seed-source as when tested for 12 years at different elevations in the Sierra Nevada.

759. Callaham, Robert Z.
1960. *Observations on pine susceptibility to weevils.* U.S. Forest Serv. Pacific Southwest Forest and Range Exp. Stn. Tech. Paper 51, 12 p. Berkeley, Calif.
Reports the effect of attacks on the progenies of intraspecific ponderosa pine crosses and that the susceptibility transmitted by individual parent trees to progenies varies considerably.

760. Callaham, Robert Z., and A. R. Liddicoet.
1961. *Additional variation at 20 years in ponderosa and Jeffrey pines.* J. For. 59(11):814-820, illus.
Progenies of seed trees growing between 1000 and 2000 feet grew best at low (960 feet) and medium (2730 feet) elevation plantations whereas at 5650 feet the progenies from lower elevations seemed to be falling behind.

761. Callaham, Robert Z., and A. A. Hasel.
1961. *Pinus ponderosa—height growth of wind-pollinated progenies.* Silvae Genetica 10(2):33-42, illus.
A study after 15 years shows that seed size, germination time, seed-tree elevation, and crop year of the seed all had a significant effect on second-year growth of progenies.

762. Callaham, Robert Z., and John W. Duffield.
1961. *Stretching the pollen supply.* J. For. 59(3):204-207, illus.
Results from a test using dilutions of pollen in controlled pollinations of Jeffrey and ponderosa pines suggest that dilution to 50 percent viable pollen may not reduce seed production.

763. Callaham, Robert Z.
1962. *Geographic variability in growth of forest trees.* In *Tree growth.* p. 311-325, illus. The Ronald Press Co., New York.
Examples from research on ponderosa pine are used to show the relationship between characteristics of trees and their environments.

764. Callaham, Robert Z.
1962. *Resistance of three interspecific white pine hybrids to blister rust.* J. For. 60(6):409-410.
Resistance of hybrids was directly related to resistance of the parental species: *Pinus monticola* Dougl., very susceptible: *P. strobus* L., susceptible; and *P. griffithii* McClell., resistant.

765. Callaham, Robert Z., and John W. Duffield.
1963. *Heights of selected ponderosa pine seedlings during 20 years.* Forest Genet. Workshop Proc. 1962:10-13. (South Forest Tree Improv. Comm. Publ. 22, Macon, Ga.)
Seedlings selected within a one-parent progeny according to the length of the epicotyl showed no relation between tree height and epicotyl length or number and length of cotyledons, although length of cotyledons accounted for 20 percent of height at 2 years.

766. Callaham, Robert Z.
1964. *Provenance research: investigation of genetic diversity associated with geography.* Unasylva 18(2-3):73-74.

Reviews concepts of the species, of variation within species, and of the relation of this variation to environment.

767. Callaham, Robert Z.
1966. *Hybridizing pines with diluted pollen.* Proc. Eighth South. Conf. Forest Tree Improv. 1965:110-111.
Studies on three interspecific hybrids showed that diluted pollens can produce large amounts of seed with limited amount of pollen.

768. Callaham, Robert Z.
1966. *Nature of resistance of pines to bark beetles.* Proc. N.A.T.O. and N.S.F. Symp. 1964:197-201, illus.
Species of dendroctonus tend to attack only certain of pine trees, which suggests that living pines have a mechanism for resisting some types of bark beetles.

769. Callaham, Robert Z.
1966. *Needs in developing forest trees resistant to insects.* Proc. N.A.T.O. and N.S.F. Symp. 1964:469-473.
Suggests the need to anticipate forestry's needs for resistant planting stock, and to find and exploit inherent resistance to forest insects.

770. Callaham, Robert Z., and R. J. Steinhoff.
1966. *Pine pollens frozen five years produce seed.* U.S. Forest Serv. Res. Paper NC-6, p. 94-101. North Central Forest Exp. Stn. St. Paul, Minn.
Pollens from different trees varied in ability to produce seeds after freezing; pollens refrigerated at 5° C. rapidly lost their ability to produce seed.

771. Callaham, Robert Z.
1967. *Hybridizing pines with diluted pollen.* Silvae Genetica 16(4):121-125, illus.
Pollen dilution did not influence cone set, but dilutions having only 10 or 20 percent viable pollen produced significantly fewer seeds per cone.

772. Conkle, M. Thompson, William J. Libby, and J. L. Hamrick.
1967. *Winter injury among white fir seedlings . . . unusual pattern in seed source study.* U.S. Forest Serv. Res. Note PSW-138, 7 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Observations made in February 1966, show seedlings from northern sources sustained more winter injury than did southern-origin seedlings and seedlings from low elevations were less severely damaged than seedlings from higher elevations.

773. Conkle, M. Thompson.
1971. *Inheritance of alcohol dehydrogenase and leucine aminopeptidase isozymes in knobcone pine.* Forest Sci. 17(2):190-194, illus.
A new technique of starch gel electrophoresis and staining for separating and making visible enzymes from embryos at germination has been developed.

774. Conkle, M. Thompson.
1971. *Isozyme specificity during germination and early growth of knobcone pine.* Forest Sci. 17(4):494-498, illus.
Alcohol dehydrogenase isozymes in embryos of dry seed were most active at the time of radicle emergence, but faded below the level of detection when seed coats were shed.

775. Conkle, M. Thompson.
1972. *Analyzing genetic diversity in conifers . . . isozyme resolution by starch gel electrophoresis.* USDA Forest Serv. Res. Note PSW-264, 5 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Describes a procedure that has proved useful in resolving isozymes from pine materials.

776. Conkle, M. Thompson.
1972. *Forest tree improvement in California—1970.* USDA Forest Serv. Res. Note PSW-275, 4 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Reports data from a 1970-71 survey of organizations that document the artificial regeneration and tree improvement efforts.

777. Conkle, M. Thompson.
1973. *Growth data for 29 years from the California elevational transect study of ponderosa pine.* Forest Sci. 19(1):31-39, illus.
Reports that the relationship of seed sources differs between plantations and contributes to a significant genotype by environment interaction.

778. Conkle, M. Thompson.
1974. *Enzyme polymorphism in forest trees.* In *Third Am. Forest Biol. Workshop, Colo. State Univ., Sept. 9-12, 1974,* p. 95-105, illus.
Isozymes offer a means of studying phenotypic response over environmental gradients where genetic material can be identified by specific allelic combination.

779. Cook, Stanton A., and Robert G. Stanley.
1961. *Tetrazolium chloride as an indicator of pine pollen germinability.* Silvae Genetica 9(5):134-136.
The color reaction provided a measure of germination which, in fresh pollen, correlates fairly well with that of

the more laborious germination procedures commonly used.

780. Coyne, John F., and William B. Critchfield.
1974. *Identity and terpene composition of Honduran pines attacked by the bark beetle Dendroctonus frontalis (Scolytidae).* Turrialba 24(3):327-331.
Tree hosts for the large epidemic in Honduras from 1963 to 1966 were identified as *Pinus oocarpa, P. Caribaea* var. *hondurensis* and *P. tenifolia.*

781. Critchfield, William B.
1963. *The Austrian × red pine hybrid.* Silvae Genetica 12(6):187-192, illus.
Discusses the 1955 cross of *Pinus nigra* and *P. resinosa* at the Institute of Forest Genetics, and analyzes the effect of weather on pollen ripening.

782. Critchfield, William B.
1963. *Hybridization of the southern pines in California. Forest Gent. Workshop Proc. 1962:40-48.* Southern Forest Tree Improvement Com. Pub. 22, Macon, Ga.
Presents results of the crosses of 16 species pairs, and suggests that southern pines are not closely related to western species, contrary to former belief.

783. Critchfield, William B.
1965. *A new hybrid Christmas tree.* Southern Lumberman, 211(2632):132-133, illus.
Describes *Pinus contorta* intra-species cross and plans to test its adaptability for Christmas tree production.

784. Critchfield, William B.
1966. *Crossability and relationships of the California big-cone pines.* U.S. Forest Serv. Res. Paper NC-6, p. 36-44. North Central Forest Exp. Stn., St. Paul, Minn.
Reports on hybridization studies that have helped clarify the relationships of the California big-cone pines.

785. Critchfield, William B.
1966. *Phenological notes on Latin American Pinus and Abies.* J. Arnold Arbor. 47(4):313-318.
Reports observations on the time of pollen shedding in two species of *Abies* and 14 species and varieties of *Pinus.*

786. Critchfield, William B.
1967. *Crossability and relationships of the closed-cone pines.* Silvae Genetica 16(3):89-97, illus.
A long-term program of species hybridization at the Institute of Forest Genetics at Placerville, California, is aimed at clarifying the relationships of the closed-cone pine group.

787. Critchfield, William B., and Stanley L. Krugman.
1967. *Crossing the western pines at Placerville, California.* Arbor. Bull. 30(4):78-81, 92, illus.
Hard pines can generally be crossed successfully only with similar species native to the same part of the world whereas soft pines of the Western Hemisphere have been crossed successfully with soft pines of the Eastern Hemisphere.

788. Critchfield, William B.
1975. *Interspecific hybridization in Pinus: a summary review. In, Symposium on Interspecific and Interprovenance Hybridization in Forest Trees.* D. P. Fowler and C. W. Yeatman, ed. Proc. 14th Meet. Can. Tree Improv. Assoc., Part 2, 1975.
Pinus does not appear to be very different from many other genera in the ability of its species to cross with each other, but it does differ in the fertility of its hybrids.

789. Cumming, W. C., and F. I. Righter.
1948. *Methods used to control pollination of pines in the Sierra Nevada of California.* U.S. Dep. Agric. Circ. No. 792, 18 p. U.S. Gov. Print. Off. Washington, D.C.
Outlines techniques including how to isolate the ovulate flowers, collecting and preparing pollen for use, pollination procedures, and protecting cones and seeds.

790. Day, Besse B., and Lloyd Austin.
1939. *A three-dimensional lattice design for studies in forest genetics.* J. Agric. Res. 59(2):101-119.
Presents a progeny test method which minimizes variables in the selection of seed trees for the improvement of the strains of timber trees.

791. Day, Besse B., and Lloyd Austin.
1941. *The use of the three-dimensional quasi-factorial design for testing a large number of Pinus ponderosa varieties.* Proc. Seventh Int. Congr. Genet. Edinburgh, 1939:98-99.
Reports on the effectiveness of the design for eliminating variations in two principal measurements, two-year height and diameter.

792. Duffield, John W.
1947. *Dates and places of pollen collection by the Institute of Forest Genetics.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 56, 5 p. Berkeley, Calif.
Includes notes on collection techniques and presents a table compiled from 10-year breeding records, furnishing dates and places of pollen collection.

793. Duffield, John W., and Palmer Stockwell.
1949. *Pine breeding in the United States.* U.S. Dep. Agric. Yearb. 1949:147-153.

Hybrids and strains of superior growth rate, hardiness, insect resistance, gum yield, and other qualities have been produced with trees from widely separate localities.

794. Duffield, John W., and A. R. Liddicoet.
1949. *Variability of rooting in a small second generation population of the hybrid Pinus attenuradiata.* J. For. 47(2):107-109.
Wide differences in rooting ability among members of the hybrid population corresponded in 2 successive years, thus indicating that individuals may be selected which can be readily propagated by cuttings.

795. Duffield, John W.
1950. *Techniques and possibilities for Douglas-fir breeding.* J. For. 48(1):41-45.
Recommends a new technique used to control pollination in breeding programs.

796. Duffield, John W.
1952. *Relationships and species hybridization in the genus Pinus.* Ztschr. Fur Forstgenetick und Forstpflanzenzuchtung 1(4):93-97.
Recommends a scheme to indicate species with the greatest degree of "crossability".

797. Duffield, John W., and Francis I. Righter.
1953. *Annotated list of pine hybrids made at the Institute of Forest Genetics.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 86, 9 p. Berkeley, Calif.
Lists hybrids by common names of parental species with short descriptions of each.

798. Duffield, John W.
1953. *It's the ancestor that makes the tree.* Am. Forests 59(11):37, 46-47.
Recent trends in forest products utilization have placed a high priority on the genetic improvement of forest trees for the development of intensified silvicultural practices.

799. Duffield, John W.
1953. *Pine pollen collection dates—annual and geographic variation.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 85, 9 p. Berkeley, Calif.
Gives dates and places of collection by the Institute of Forest Genetics, Placerville, Calif., and describes the resulting hybrids.

800. Duffield, John W., and Robert Z. Callaham.
1959. *Deep-freezing pine pollen.* Silvae Genetica 8(1):22-24.
Presents method and results of deep-freezing pollen of seven species.

801. Franklin, E. C., and Robert Z. Callaham.
1970. *Multinodality, branching, and forking in lodgepole pine (Pinus contorta* var. Murrayana Engelm.). Silvae Genetica 19(5):180-184, illus.
Genetic control of branching and forking traits was indicated from a study in six wind- and nine control-pollinated 6-year-old families.

802. Griffin, James R., and M. Thompson Conkle.
1967. *Early performance of knobcone × Monterey hybrids . . . on marginal timber sites.* U.S. Forest Serv. Res. Note PSW-156, 10 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Hybrids appear more promising than either parents in plantations at 2200 to 3200 feet elevation; damage from snow and windthrow suggests high risk of storm damage to hybrids planted at higher elevations.

803. Griffin, James R.
1971. *Variability of germination in Digger pine in California.* USDA Forest Serv. Res. Note PSW-248, 5 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Unstratified seeds germinated slowly; germination of stratified seeds revealed distinct population differences.

804. Haagen-Smit, A. J., C. T. Redemann, and N. T. Mirov.
1947. *Composition of gum turpentine of Torrey pine.* Am. Chem. Soc. J. 69(8):2014-2017.
Physical constants of typical samples are presented together with data showing yields of turpentine from an an average tree.

805. Haagen-Smit, A. J., C. T. Redemann, T. H. Wang, and N. T. Mirov.
1950. *Composition of gum turpentines of pines, a report on Pinus ponderosa, P. banksiana, P. canariensis, canariensis, and P. washoensis.* J. Am. Pharm. Ass-39(5):260-265.
Reports chemical analysis later summarized *Composition of gum turpentines of pines,* USDA Tech. Bull. 1239(1961).

806. Haagen-Smit, A. J., T. H. Wang, and N. T. Mirov.
1950. *Composition of gum turpentines of Pinus aristata, P. balfouriana, P. flexilis, and P. parviflora.* J. Am. Pharm. Assoc. Sci. Ed. 39(5):254-259.
See item 805 above.

807. Haagen-Smit, A. J., T. H. Wang, and N. T. Mirov.
1951. *Composition of gum turpentines of pines. XIII. A A report on Pinus albicaulis.* J. Am. Pharm. Assoc. Sci. Ed. 40(11):557-559.
See item 805 above.

808. Hall, Ralph C.
1959. *Field tests of the resistance of hybrid pines to the pine reproduction weevil.* U.S. Forest Serv. Pacific Southwest Forest and Range Exp. Stn. Tech. Paper 33, 21 p., illus. Berkeley, Calif.
The backcross hybrid of Jeffrey and Coulter pines showed a marked resistance to pine reproduction weevil attacks when tested from 1948 through 1956 on three field plantings in northern California.

809. Iloff, P. M., Jr., and N. T. Mirov.
1953. *Composition of gum turpentines of pines. XVI. A report on Pinus oocarpa and P. pseudostrobus* var. *oaxacana from Chiapas and P. cooperi from Durango.* J. Am. Pharm. Assoc., Sci. Ed. 42(1):46-49.
See item 805 above.

810. Iloff, P. M., Jr., and N. T. Mirov.
1953. *Composition of gum turpentines of pines. XVII. A report on Pinus montezumae from Chiapas and P. oocarpa* var. *trifoliata and P. durangensis from Durango, Mexico.* J. Am. Pharm. Assoc., Sci. Ed. 42(8):464-467.
See item 805 above.

811. Iloff, P. M., Jr., and N. T. Mirov.
1954. *Composition of gum turpentines of pines. XXI. A report on Pinus quadrifolia from southern California, P. Lumholtzii, from Durango, Mexico, and P. caribaea from Nicaragua.* J. Am. Pharm. Assoc. Sci. Ed. 43(12):738-741.
Gives methods and results of turpentine analyses which showed that Caribbean pines from Nicaragua differ considerably from slash pine of Southeastern United States.

812. Iloff, P. M., Jr., and N. T. Mirov.
1954. *Composition of gum turpentines of pines XXII. A report on Pinus rudis and P. hartwegii from Mexico and P. insularis from the Philippines.* J. Am. Pharm. Assoc. Sci. Ed. 43(12):742-745.
Gives methods and results of turpentine analyses which suggested that Rudis pine and Hastweg's pine should not be considered merely varieties of Montezuma pine but rather as independent species.

813. Iloff, P. M., Jr., and N. T. Mirov.
1954. *Composition of gum turpentines of pines, XIX. A A report on Pinus ponderosa from Arizona, Colorado, South Dakota and northern Idaho.* J. Assoc. Sci. Ed. 43(6):373-378.
Results from analysis provide a basis for distinguishing three forms of ponderosa pine: a Pacific Coast form, an Intermountain form, and an east-of-the-Rockies form.

814. Jenkinson, James L.
1974. *Ponderosa pine progenies: differential response to ultramafic and granitic soils.* USDA Forest Serv. Res. Paper PSW-101, 14 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
Growth differences among progenies tested were related to differences in their ability to take up calcium from soils that are low in available calcium.

815. Jenkinson, James L.
1975. *Increasing planting stock size by family selection in California ponderosa pine.* USDA Forest Serv. Res. Paper PSW-108, 10 p., illus. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.
After one growing season, inherent height growth differences among families from within stands were evident, after two seasons, volume growth among families from single stands and areas ranged from 76-133 to 44-161 percent of the area mean.

816. Johnson, LeRoy C.
1969. *FTI (Forest Tree Improvement) in California traced from 1925.* Forest Indus. 96(4):33, illus.
Research on individual tree and geographical/elevational races has contributed to the emphasis that is presently placed on single tree selection for seed orchards and on identifying select stands for cone collecting.

817. Johnson, LeRoy C., and Leroy C. Saylor.
1972. *El Dorado pine: an aneuploid Monterey pine cultivar.* J. Hered. 63(5):293-296, illus.
Pinus radiata "El Dorado" cv. nov. is so distinctly different from normal Monterey pine that it should be named as a cultivar.

818. Johnson, LeRoy C.
1974. *Hybrid Christmas trees, good news—bad news.* Calif. Christmas Tree Growers Assoc. Bull. 89, p. 19-22.
Even though specific tree-by-tree crosses that result in high production have been identified, it is not feasible now for commercial tree breeders to use either the pollen or seed parents.

819. Johnson, LeRoy C., and William B. Critchfield.
1974. *A white-pollen variant of bristlecone pine.* J. Hered. 65(2):123.
A variant of bristlecone pine more than 2500 years old, growing in the Schulman Grove, White Mountains, California, produces white pollen rather than the usual yellow pollen.

820. Keng, Hsuan, and Elbert L. Little, Jr.
1961. *Needle characters of hybrid pines at Institute of*

Forest Genetics, Placerville, California. Silvae Genetica 10(5):131-146, illus.

Gross morphology and microscopic anatomy of needles of 43 pine hybrids are described, with needle characters presented in 18 tables to facilitate identification of hybrids.

821. Kinloch, Bohun B., Jr., Gaylord K. Parks, and Carl W. Fowler.

1970. White pine blister rust, simply inherited resistance in sugar pine. Science 167:193-195, illus.

Segregation ratios of offspring from four disease free sugar pines suggest that resistance is under major gene control and simply inherited.

822. Kinloch, Bohun B., Jr.

1972. *Genetic variation in resistance to cronartium and peridermium rusts in hard pines.* In *Biology of rust resistance in forest trees.* U.S. Dep. Agric. Misc. Publ. 1221, p. 445-462, illus.

New approaches to the analysis of genetic interactions between hosts and pathogens in wild, heterozygous populations are discussed in the context of the gene-for-gene theory.

823. Krugman, Stanley L.

1963. *Ten-year performance of a California planting of progenies of 'elite' and 'non-elite' Pinus radiata from Australia.* U.S. Forest Serv. Res. Note PSW-32, 2 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

After 10 years there is still no evidence, from diameter and height growth and branching habit, that the two outstanding phenotypes from Australia produce genetically superior wind-pollinated progenies for California planting.

824. Krugman, Stanley L.

1970. *Incompatibility and inviability systems among some Western North American pines.* Proc. Sexual Reprod. of Forest Trees, IUFRO Sec. 22, Working Group, Finland 1970:13 p.

Summarizes the reproductive barriers found in the species reciprocal crossing of four western hard pines—Jeffrey, ponderosa, Rocky Mountain ponderosa, and Coulter pine—and one soft pine—western white pine.

825. Lanner, Ronald M.

1962. *Controlling the moisture content of conifer pollen.* Silvae Genetica 11(4):114-117.

Reports tests with pollen of nine species of *Pinus, Abies, Pseudotsuga,* and *Cedrus* which provided a method for achieving a predetermined moisture content.

826. Lanner, Ronald M., and Stanley L. Krugman.

1963. *Abies: a bibliography of literature for tree improvement workers.* U.S. Forest Serv. Res. Paper PSW-10, 25 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Lists 373 references pertaining to tree improvement.

827. Liddicoet, A. R.

1948. *Pinus: pollination bag construction.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 57, 4 p. Berkeley, Calif.

Outlines plans for constructing a bag used to cover the female flowers excluding air-borne pollen, yet porous enough to allow moisture to be dissipated and with a window for examining the conelets without removing the bag.

828. Linhart, Y. B., B. Burr, and M. Thompson Conkle.

1967. *The closed-cone pines of the Northern Channel Islands.* Symp. on Biology of the Calif. Islands, Santa Barbara Bot. Gardens, Proc. 1966:151-177, illus.

Describes the populations and includes analyses of data from collected specimen as well as related mainland populations of *Pinus muricata.*

829. Little, Elbert L., Jr., and Francis I. Righter.

1965. *Botanical descriptions of 40 artificial pine hybrids.* U.S. Dep. Agric. Tech. Bull. 1345, 47 p., illus.

Provides botanical descriptions of 40 artificial first-generation pine hybrids growing at the Institute of Forest Genetics, Placerville, Calif.

830. McMinn, H. E., E. B. Babcock, and Francis I. Righter.

1949. *The Chase oak, a new giant hybrid oak from Santa Clara County, California.* Madroño 10(2):51-55.

Describes *Quercus chasei,* a giant hybrid between *Quercus agrifolia* and *Quercus kelloggii.*

831. Miller, J. M.

1950. *Resistance of pine hybrids to the pine reproduction weevil.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 68, 17 p. Berkeley, Calif.

Lists 10 hybrids and species of pines which are resistant and suggests further work be directed to field trials of these trees.

832. Mirov, N. T.

1929. *Chemical analysis of the oleoresins as a means of distinguishing Jeffrey pine and western yellow pine.* J. For. 27(2):176-187.

Studies in differentiation indicate that when the morphological characters overlap widely, the only diagnostic character which is constant and stable is the chemical composition of the oleoresins.

833. Mirov, N. T.
1932. *A note on Jeffrey and western yellow pine.* J. For. 30(1):93,94.
Calls attention to a yellow pine that shows certain of the morphological characters of Jeffrey pine and also describes a twin tree formed by the union of a Jeffrey and western yellow pine.

834. Mirov, N. T.
1937. *Application of plant physiology to the problems of forest genetics.* J. For. 35(9):840-844.
Discusses how to apply principles of plant physiology to develop better strains of trees without hybridization.

835. Mirov, N. T.
1938. *Phylogenetic relations of Pinus jeffreyi and Pinus ponderosa.* Madroño 4(6):169-171.
Points to evidence in the chemical composition of seed oil that *Pinus jeffreyi* has a more ancient origin than *Pinus ponderosa.*

836. Mirov, N. T., and Palmer Stockwell.
1939. *Colchicine treatment of pine seeds.* J. Hered. 30(9):389-390.
Most of the treated seeds showed delayed development resulting in weak seedlings with swollen crowns; however, it may be possible to produce stable polyploid plants that can be used in breeding.

837. Mirov, N. T.
1941. *Forest genetics: Present status and outlook for the future.* Pacific Sci. Congr. 6th, Berkeley, Stanford, and San Francisco, 1939. Proc. 4:727-730.
Outlines past investigation into improving forests through genetics and developing superior trees by hybridization.

838. Mirov, N. T.
1942. *Possibility of simple biochemical tests for differentiation between species of genus Pinus.* J. For. 40(12):953-954.
Reports the identification of *Pinus jeffreyi* and *Pinus ponderosa* based upon a simple colorimetric test of their pitch.

839. Mirov, N. T.
1946. *Composition of gum turpentine of Coulter pine.* Indus. Eng. Chem. 38(4):405-408.
Analysis revealed two terpenes and two paraffin hydrocarbons, indicating that turpentine obtained from pine oleoresins is not always a mixture of terpenes alone.

840. Mirov, N. T.
1946. *Pinus: a contribution of turpentine chemistry to dendrology and forest genetics.* J. For. 44(1):13-16.
The pattern of occurrence of different chemical compounds in the turpentines facilitates the delineation of phylogenetic relationships.

841. Mirov, N. T.
1947. *Composition of gum turpentine of bishop pine.* J. For. 45(9):659-660.
The turpentine obtained from oleoresin consists almost entirely of D-α-pinene.

842. Mirov, N. T.
1948. *The terpenes (in relation to the biology of genus Pinus).* Annu. Rev. Biochem. 1948, Vol. 17:521-540.
Discusses the status of biochemistry of turpentines, and includes tables demonstrating that taxonomic and phylogenetic information can be obtained through biochemical analysis.

843, Mirov, N. T., T. H. Wang, and A. J. Haagen-Smit.
1949. *Chemical composition of gum turpentines of pines: a report on Pinus strobus, P. cembra, P. taeda, P. radiata, and P. virginiana.* J. Am. Pharm. Assoc. Sci. Ed. 43(6):373-378.
Composition of turpentines of the five pine species studied is simple, consisting in four cases chiefly of α and β pinenes and in one case (*P. virginiana*) of α pinene alone.

844. Mirov, N. T., and A. J. Haagen-Smit.
1949. *Composition of gum turpentine of knobcone pine.* J. For. 47(9):721-722.
The turpentine of *Pinus attenuata* differs from bishop pine by the total absence of camphene.

845. Mirov, N. T., A. J. Haagen-Smit, and James Thurlow.
1949. *Composition of gum turpentine of Pinus lambertiana.* J. Am. Pharm. Assoc. Sci. Ed. 38(7):407-409.
Results indicate the presence of 65 percent L-α-pinene and 13 percent L-β-pinene and other compounds in proportions different than those ascertained by previous investigators.

846. Mirov, N. T.
1951. *Composicion quimica del aguarras de los tres pinos de michoacan. (Chemical composition of the terpentines of the Michoacan pines.)* El Mensajero For., Nov. 1951:5, 16.
Reports density, refractive index, optical rotation and composition of *Pinus montezumae, P. oocaipa* and *P. leiophylla.*

847. Mirov, N. T.
1951. *Composition of gum turpentines of pines. XII. A report on Pinus echinata, P. rigida, and P.*

leiophylla. J. Am. Pharm. Assoc. Sci. Ed. 40(11):550-551.
Gives methods and results of oleoresin analysis as part of turpentine inventory studies.

848. Mirov, N. T.
1951. *Composition of gum turpentines of pines: A report on Pinus echinata, P. rigida, and P. ponderosa from Utah*. J. Am. Pharm. Assoc. Sci. Ed. 40(8):410-413.
See item 847 above.

849. Mirov, N. T.
1951. *Inducing early production of pine pollen*. U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 80, 3 p. Berkeley, Calif.
Grafting seedlings onto a mature ponderosa pine induced early formation of flowers and pollen for four pines—Torrey, lodgepole, Digger, ponderosa—and a hybrid of Jeffrey and Coulter pines.

850. Mirov, N. T., J. W. Duffield, and A. R. Liddicoet.
1952. *Altitudinal races of Pinus ponderosa—a 12 year progress report*. J. For. 50(11):825-831.
Seeds from trees between 1500 and 3000 feet elevation produced progeny with greater growth rates and hardiness than progeny of trees from other elevations.

851. Mirov, N. T.
1952. *Composition of gum turpentines of pines. XIV. A report on three Mexican pines, Pinus ayacahuite, P. cembroides, and P. pinceana*. J. Am. Pharm. Assoc. Sci. Ed. 41(12):673-676.
See item 847 above.

852. Mirov, N. T.
1952. *Composition of gum turpentines of pines. XV. A report on Pinus resinosa and Pinus reflexa*. J. Am. Pharm. Assoc. Sci. Ed. 41(12):677-679.
See item 847 above.

853. Mirov, N. T.
1953. *Chemical aspects of diploxylon pines*. Ztschr. f. Forstgenetik u. Forstpflanzenzuchtung 2(5):93-96.
Chemical analysis of turpentines supports G. R. Shaw's 1914 taxonomy of the genus *Pinus*.

854. Mirov, N. T.
1953. *Taxonomy and chemistry of the white pines*. Madroño 12(3):81-89.
Extensive taxonomy based on the chemical relationship of the gums of the trees in section haploxylon of the genus *Pinus*.

855. Mirov, N. T.
1954. *Apache pine and its relation to ponderosa pine*. Madroño 12:251-252.
Judging from chemical composition of turpentines, Apache pine should be considered an independent species from ponderosa pine.

856. Mirov, N. T.
1954. *Chemical composition of gum turpentines of pines of the United States and Canada*. J. Forest Products Res. Soc. 7(1):1-7.
Reviews work to inventory turpentines of the pines of the world.

857. Mirov, N. T., P. M. Iloff, Jr., and L. B. Gordon.
1954. *Composition of gum turpentines of pines. XVIII. A report on Pinus pungens, P. glabra, and P. teocote*. J. Am. Pharm. Assoc. Sci. Ed. 43(1):13-15.
Gives methods and results of oleoresin analysis as part of turpentine inventory studies.

858. Mirov, N. T., and P. M. Iloff, Jr.
1954. *Composition of gum turpentines of pines. XX. A report on Pinus chihuahuana from Durango, P. apacheca from Arizona, and P. monticola from northern Idaho*. J. Am. Pharm. Assoc. Sci. Ed. 43(6):378-381.
See item 857 above.

859. Mirov, N. T.
1954. *Composition of turpentines of Mexican pines*. Unasylva 8(4):167-173.
Summarizes studies on turpentine inventory studies by the California Forest and Range Experiment Station.

860. Mirov, N. T.
1954. *Studies of the chemical composition of turpentine of the genus Pinus in relation to taxonomy*. Eighth Int. Bot. Congr., Paris. p. 47-49.
Reports work done at Institute of Forest Genetics, Placerville, Calif., on application of chemical findings to problems of botany and tree breeding.

861. Mirov, N. T., and P. M. Iloff, Jr.
1955. *Composition of gum turpentine of pines. XXIV. A report on two asiatic pines, Pinus armandi and P. bungeana*. J. Am. Pharm. Assoc., Sci. Ed. 44(7):424-427.
Gives the results of chemical analysis of oleoresins.

862. Mirov, N. T., and P. M. Iloff, Jr.
1955. *Composition of gum turpentines of pines. XXIII. A report on three Mediterranean species, Pinus pinea (cultivated in California), P. halepensis (from Israel) and P. brutia (from Cyprus)*. J. Am. Pharm. Assoc.,

Sci. Ed. 44(3):186-189.
See item 861 above.

863. Mirov, N. T.
1955. *Relationships between Pinus halepensis and other insignes pines of the Mediterranean region.* Bull. Res. Counc. of Israel. Dec. 1955, 5D(1):65-72.
On the basis of well established ecological and morphological differences and the differences in the chemical composition of their turpentines, *Pinus halepensis* and *P. brutia* should be considered distinct biological entities.

864. Mirov, N. T., and P. M. Iloff, Jr.
1956. *Composition of gum turpentines of pines. XXV. A report on two white pines Pinus koraiensis from Korea and P. peuce from Macedonia.* J. Am. Pharm. Assoc., Sci. Ed. 45(2):77-81.
Turpentines of both pines contained large amounts of diterpenes.

865. Mirov, N. T., and P. M. Iloff, Jr.
1956. *Composition of gum turpentines of pines, XXVI. A report on Pinus lawsoni and P. herrerai from Michoacan, Mexico. and P. ponderosa from the California coast.* J. Am. Pharm. Assoc., Sci. Ed. 45(3):153-156.
Turpentine of ponderosa pine from the Santa Cruz mountains had some characters found in that of Coulter pine.

866. Mirov, N. T., and P. M. Iloff, Jr.
1956. *Composition of gum turpentines of pines. XXVIII. A report on Pinus edulis from eastern Arizona, P. tropicalis from Cuba, and P. elliottii* var. *densa from Florida.* J. Am. Pharm. Assoc., Sci. Ed. 45(9):629-634.
A new chemical compound, never previously reported in any plant, was discovered in the turpentine of pinyon.

867. Mirov, N. T.
1956. *Composition of turpentines of lodgepole and jack pine hybrids.* Can. J. Bot. 34:443-457, illus.
Jack pine (bicyclic) turpentines dominated over lodgepole (monocyclic) turpentines in both artificial and natural hybrids.

868. Mirov, N. T., and P. M. Iloff, Jr.
1958. *Composition of gum turpentines of pines. XXIX. A report on Pinus ponderosa from five localities: central Idaho, central Montana, southeastern Wyoming, northwestern Nebraska, and central eastern Colorado.* J. Am. Pharm. Assoc., Sci. Ed., 47(6):404-409.
Results show that regardless of provenance, and despite the existence of several varieties, this species always contains large amounts of Δ^3-carene.

869. Mirov, N. T.
1958. *Composition of gum turpentines of pines XXX. A report on Pinus serotina, P. tenuifolia, and P. yunnanesis.* J. Am. Pharm. Assoc., Sci. Ed., 47:410-413.
The chemical components of the terpenes of each species are given with a summary of the findings presented in this and 29 previous papers.

870. Mirov, N. T.
1958. *The physiology of forest trees. Chapter 12. Distribution of components of turpentine among species of the genus Pinus.* The Roland Press, New York, p. 251-268.
Gives information on the specificity of turpentines, the stability and variability of turpentine composition within a species, and the distribution of terpenes within the genus.

871. Mirov, N. T.
1958. *Pinus oaxacana, a new species from Mexico.* Madroño 14(5):145-150.
Based on its morphological and biochemical features, a pine formerly identified as *Pinus pseudostrobus* Lindl. is designated a new species.

872. Mirov, N. T.
1959. *Chemistry in the service of silviculture.* Soc. Am. For. Proc. 1958:144-145.
Chemical methods may help detect variability among forest trees, recognize insect-resistant trees, tell hybrids from their parents, and possibly regulate flowering and seed production.

873. Mirov, N. T.
1960. *Biochemical geography of the genus Pinus.* Ninth Int. Bot. Congr. Proc. 1959:265.
Studies suggest that the area of origin of the genus was located on a land mass, now not existing, between North America and the northeastern part of Asia.

874. Mirov, N. T.
1960. *A strange forest tale.* Am. Forests 67(8):48-50.
Discusses in nontechnical terms the silvicultural management of forests and the gradual relentless effects of genetic principles.

875. Mirov, N. T.
1961. *Composition of gum turpentines of pines.* U.S. Dep. Agric. Tech. Bull. 1239, 158 p., illus.
Discusses general considerations of composition, presents composition of 94 species of the genus, and includes suggestions for further work.

876. Richmond, George B.
1964. *Guide to the Waiakea Arboretum.* 12 p., illus.

Pacific Southwest Forest and Range Exp. Stn., U.S. Forest Serv., Berkeley, Calif.

A nontechnical report listing names, native areas and some geographical floristic relationships for many of the species, and uses of the trees.

877. Righter, Francis I.
1932. *Bisexual flowers among pines.* J. For. 30(7):873.

Reports on a rare occurrence of bisexual flowers on the lateral shoots of a *Pinus densiflora* and a *Pinus massoniana* growing in the arboretum of the Institute of Forest Genetics, Placerville, Calif.

878. Righter, Francis I.
1934. *On the cause of bird's eye maple.* J. For. 32(5):626-627.

Takes issue with an earlier paper which claimed that suppression causes slow growth by pointing to a combination of hereditary and environmental factors.

879. Righter, Francis I.
1939. *Early flower production among the pines.* J. For. 37(12):935-938.

Data shows that many pines produce cones at an average age of 6.2 years, indicating that the breeding of special pine strains and hybrids may not require an exceptionally long period of time.

880. Righter, Francis I.
1939. *A simple method of making germination tests of pine pollen.* J. For. 37(7):574-576.

Describes a convenient, rapid, economical, and accurate method for determining pollen viability by using a specially prepared petri dish and hypodermic syringes.

881. Righter, Francis I.
1945. *Pinus—the relationship of seed size and seedling size to inherent vigor.* J. For. 43(2):131-137.

Experimental results indicate that sizes are controlled by the environment rather than heredity and therefore cannot be used as indicators of vigor.

882. Righter, Francis I.
1946. *New perspectives in forest tree breeding.* Science 104(2688):1-3.

Suggests an interplanting method of testing performance in order to obtain practical benefits quickly from tree breeding.

883. Righter, Francis I., and Palmer Stockwell.
1949. *The fertile species hybrid, Pinus murraybanksiana.* Madroño 10(3):65-69.

Investigates the species hybrid between lodgepole pine and jack pine since its good form and rapid growth may indicate heterosis and may increase the understanding of two economically important North American pines.

884. Righter, Francis I., and John W. Duffield.
1951. *Hybrids between ponderosa and Apache pine.* J. For. 49(5):345-349.

Hybrids showed faster tap root penetration and faster initial growth than ponderosa pine seedlings.

885. Righter, Francis I., and John W. Duffield.
1951. *Interspecies hybrids in pines: a summary of interspecific crossings in the genus Pinus made at the Institute of Forest Genetics.* J. Hered. 42(2):75-80.

Summarizes investigations in which experimenters made 46 successful hybridizations of pines.

886. Righter, Francis I.
1952. *Forest tree improvement research in California.* J. For. 52(9):680-682.

Describes the aims and current program of forest genetics studies in pines.

887. Righter, Francis I.
1955. *Possibilities and limitations of hybridization in Pinus.* Southern Forest Tree Improv. Comm. Proc. 1955:54-63.

Compares progress in pine hybridization to progress in synthesis of chemical compounds, outlines possibilities for crossing different species, and discusses the practicability of mass-producing hybrids.

888. Righter, Francis I.
1955. *Tree improvement activities at Placerville, California, affecting southern species.* South. Forest Tree Improv. Comm. Proc. 1955:97-99.

Lists hybrids and hybrid progenies produced from controlled pollination among southern pines.

889. Righter, Francis I., and Robert Z. Callaham.
1958. *A California planting of progenies of elite and non-elite Pinus radiata from Australia.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Res. Note 135, 2 p. Berkeley, Calif.

A 5-year study provided no evidence that two outstanding elite phenotypes produce wind-pollinated progenies that are inherently superior in growth rate to three wind-pollinated progenies from non-elite phenotypes.

890. Righter, Francis I.
1958. *Summary of forest tree improvement work in California.* Northeastern Forest Tree Improv. Conf. Proc. Aug. 22-23, 1957.

Reports activities by various individuals and organizations and mentions results of several studies at the Institute of Forest Genetics, Placerville, Calif.

891. Righter, Francis I.
1960. *Improvement through inbreeding and in-*

traspecific and interspecific hybridization. Proc. Fifth World For. Congr. Vol. 2, Seattle, Wash., 1960:783-787.

Critically examines mass production incompatibilities between species and between individual trees, improvement for specific characters, and large-scale applications.

892. Righter, Francis I.

1962. *Evidence for hybrid vigor in forest trees.* In *Tree growth,* p. 345-355. illus. T. T. Kozlowski, ed. The Roland Press, New York.

Kinds of heterosis, exploitation of hybrid vigor in agriculture, and opportunities for parallel exploitation in forest tree breeding are discussed.

893. Schubert, Gilbert H.

1955. *Effect of storage temperature on viability of sugar, Jeffrey, and ponderosa pine seed.* U.S. Forest Serv. Calif. Forest and Range Exp. Stn. Forest Res. Note 100, 3 p. Berkeley, Calif.

Best results were obtained for sugar pine at 0° F., for Jeffrey pine at 23° F., and for ponderosa pine at 32° F.

894. Schubert, Gilbert H.

1956. *Effect of ripeness on the viability of sugar, Jeffrey, and ponderosa pine seed.* Soc. Am. For. Proc. 1955:67-69, illus.

Immature ponderosa pine seeds produce abnormal seedlings and immature sugar, and Jeffrey pine seeds did not.

895. Schubert, Gilbert H.

1957. *Seed-tree selection – a problem in juvenile delinquency? New techniques in forestry.* North. Calif. Sec., Soc. Am. For. Proc. 1956:2-6.

Describes the physical characteristics of ponderosa pine, sugar pine, and white fir seed trees and the location and number of trees recommended per acre.

896. Silen, Roy R., William B. Critchfield, and Jerry F. Franklin.

1965. *Early verification of a hybrid between noble and California red firs.* Forest Sci. 11:460-462, illus.

Verification of hybridization between *Abies procera* and *A. magnifica* was provided by statistical analysis of cotyledon number.

897. Silen, Roy R., William B. Critchfield, and Jerry F. Franklin.

1965. *Early verification of a hybrid between noble and California red firs.* U.S. Forest Serv. Res. Note PSW-91, 3 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Hybrids between noble fir and California red fir were produced in adequate proportions to suggest that no significant genetic barriers prevent crossing of the two species where ranges overlap.

898. Smith, Richard H.

1966. *Genetic improvement for insect resistance of forest trees in Western United States.* Proc. N.A.T.O. and N.S.F. Symp., Breeding Pest-resistant trees, Penn. State Univ., 1964:57-58.

Reviews past and current research, preponderantly related to bark beetles, but also lists work on resistance to other insects.

899. Stanley, Robert G., and E. E. Conn.

1957. *Enzyme activity of mitochondria from germinating sugar pine seed (Pinus lambertiana* Dougl.). Plant Physiol. 32(5):412-418.

Cell particles from pine, which had activities similar to those of angiosperm plants and animals, had activities restored by a substance found in the cytoplasm of ungerminated embryos.

900. Stanley, Robert G.

1957. *Glucose metabolism in germinating pine pollen (Pinus ponderosa).* Plant Physiol. 32. suppl. XLVI.

Describes changes in the pathway of glucose metabolism and the influence of the Pasteur effect on germinating pollen.

901. Stanley, Robert G.

1957. *Krebs cycle enzyme activity of mitochondria from endosperm of sugar pine seed (Pinus lambertiana* Dougl.). Plant Physiol. 32(5):409-412.

Cytoplasmic particles isolated from the haploid endosperm contained enzymes similar to those found in the diploid embryo mitochondria.

902. Stanley, Robert G., and L. C. T. Young.

1958. *Carbon dioxide fixation and glucose metabolism in germinating pine pollen.* Plant Biochem. Sect. Fourth Int. Congr. Biochem., Vienna, Austria, p. 138.

Evidence for the different enzyme pathways by which *Pinus ponderosa* pollen may metabolize glucose, and the role of metals and co-factors on the activity of these systems is discussed.

903. Stanley, Robert G., L. C. T. Young, and J. S. D. Graham.

1958. *Carbon dioxide fixation in germinating pine pollen.* Nature (London) 182:738-739.

The capacity of germinating *Pinus ponderosa* pollen to incorporate radio-active CO_2 into organic acids and amino acids was investigated.

904. Stanley, Robert G.
1958. *Gross respiratory and water uptake patterns in germinating sugar pine seed.* Physiologia Plantarum 11:503-515.
The changes in dry weight, water, oxygen uptake, and respiratory quotients during the first 72 hours of germination were followed.

905. Stanley, Robert G., J. Petersen, and N. T. Mirov.
1960. *Viability of pine pollen stored 15 years.* U.S. Forest Serv. Pacific Southwest Forest and Range Exp. Stn. Res. Note 173, 5 p. Berkeley, Calif.
Pollen stored at 0° C. germinated better *in vitro* than pollen stored at 5° C.

906. Stanley, Robert G., and Warren L. Butler.
1961. *Life processes of the living seed.* Agric. Yearb. 1961:88-94.
Reviews the factors that maintain seeds in a viable condition.

907. Stanley, Robert G., and L. C. T. Young.
1962. *Deoxyribonucleic acid synthesis or turn-over in non-dividing pollen cells of pine.* Nature (London) 196(4860):1228-1229.
After Thymidine-methyl-H^3 was incorporated into tube (vegetative) cell nucleus and generative cell nucleus, enzyme hydrolysis indicated a DNA-like moiety had been formed.

908. Stanley, Robert G., and I. Poostchi.
1962. *Endogenous carbohydrates, organic acids, and pine pollen viability.* Silvae Genetica 11(1):1-28.
Low-molecular-weight sugars and organic acids were higher in viable pollen, which was stored 15 years at 5° C. with 10 percent relative humidity, than in nonviable pollen which was stored 15 years at 5° C. with 25 percent humidity.

909. Stanley, Robert G.
1962. *Viable pine pollen stored 15 years produces undound seed.* Silvae Genetica 11(5/6):164.
Controlled pollination with viable and nonviable stored *Pinus ponderosa* pollen failed to produce viable seed, but induced cone maturation.

910. Stanley, Robert G., and E. A. Lichtenberg.
1963. *The effect of various boron compounds on in vitro germination of pollen.* Physiologia Plantarum 16:343-352, illus.
Pollen of *Amaryllis hybrida* and *Pyrus communis* differed slightly in response optima to different organic and inorganic compounds.

911. Stanley, Robert G., and F. A. Loews.
1964. *Boron and myo-inositol in pollen pectin biosynthesis.* In *Pollen physiology and fertilization,* p. 128-136, illus. H. F. Linskens, ed., Amsterdam, North Holland.
Evidence suggests that boron plays a definite role in pectin synthesis in germinating pollen.

912. Stanley, Robert G., and H. F. Linskens.
1964. *Catabolism of C^{14} labeled glucose, sucrose, and fructose by germinating pollen.* Abstr. 6th Int. Congr. Biochem., N. Y. 6:111.
Analyzes the effects of enzyme cofactors, partial pressure of oxygen and cation concentrations on sugar metabolism by germinating pollen.

913. Stanley, Robert G., and H. F. Linskens.
1964. *Enzyme activation in germinating petunia pollen.* Nature 203(4944):542-544, illus.
Enzyme activity, assayed by radioactive sucrose, is very high in germinating pollen long before the pollen tube is apparent.

914. Stanley, Robert G.
1964. *Physiology of pollen and pistil.* Sci. Prog. 52(205):122-132.
Pollen growth patterns in pistil tissue preceding fertilization are reviewed.

915. Stanley, Robert G.
1965. *Physiology and uses of tree pollen.* Agric. Sci. Rev. 111(1):9-17.
Reviews problems and methods of handling pollen in forest and fruit tree production, including methods of collecting, storing, and testing pollen and relates pollen chemical composition and ability to utilize external compounds to pollen survival and growth.

916. Stanley, Robert G., and H. F. Linskens.
1965. *Protein diffusion from germinating pollen.* Physiologia Plantarum 18(1):47-53, illus.
Levels of protein diffusing from germinating petunia pollen were measured and results given.

917. Stanley, Robert G., and Andrew W. G. Yee.
1966. *Ribonucleic acid base composition in subcellular fractions of pine pollen (Pinus ponderosa* Laws.). Nature 210(5032):181-183.
Compares the purine and pyrimidine base compositions of the ribonucleic acid of the subcellular fractions of pollen.

918. Stark, N. B.
1964. *Field test of hybrid pines in central California.* U.S. Forest Serv. Res. Note PSW-45, 6 p. Pacific Southwest Forest and Range Exp. Stn., Berkeley, Calif.

Results from planting of eight hybrid and native pines at high elevation indicate that the most promising hybrid at 5200 and 5400 feet elevation is Jeffrey × (Jeffrey × Coulter) which shows little insect, snow, or porcupine damage.

919. Stockwell, Palmer.
1939. *Preembryonic selection in the pines.* J. For. 37(7):541-543.
Examines the phenomenon of natural selection in the seedbed during the initial stages of seed development; some are chance selections, others are competitive and reflect inherent vigor or genetic superiority.

920. Stockwell, Palmer.
1939. *Tree improvement by breeding.* Western Shade Tree Conf. Proc. 1939:49-53.
Discusses the history, methods of selection and hybridization, and some special treatments for plant breeding.

921. Stockwell, Palmer.
1942. *Pinus: Embryo size compared with growth rate.* Am. Nat. 76(765):431-432.
Experiments showed no significant correlation between any of the embryo measurements and the relative size of the seedlings grown from them.

922. Stockwell, Palmer, and F. I. Righter.
1946. *Pinus: The fertile species hybrid between knobcone and Monterey pines.* Madroño 8(5):157-160.
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