were obtained when this process was repeated through each of nine successive cultural generations with subtransfers made to PDB from colonies with abnormal cells.

Representatives of the many variants with normal cell characters were isolated from the dilution plates for each of the 10 abnormal cell lines and tested for sex type by inoculating corn seedlings. As many as six different sex genotypes were found among the descendants from each original abnormal cell. However, no mutations were found in the genes for sexual compatibility. Thus, it is apparent that exposure to alpha radiation induced an unstable condition in vegetative cells of this diploid line that resulted in the segregation and recombination of the factors for sexual compatibility during multiplication of the affected cell.

References and Notes

1. This research was supported in part by a grant from the U.S. Atomic Energy Commission, contract No. AT(11-1)-42. Paper No. 3225 Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul.
2. E. C. Stakman and J. J. Christensen, *Phytopathology* **17**, 827 (1927).
3. W. F. Hanna, *ibid.* **19**, 415 (1929).
4. J. J. Christensen, part II, *Minnesota Agr. Expt. Sta. Tech. Bull. 65* (1929).
5. ———, *Phytopathol. Z.* **4**, 129 (1931).
6. A. H. Eddins, *Phytopathology* **19**, 885 (1929).
7. E. C. Stakman *et al., Am. J. Botany* **30**, 37 (1943).
8. S. J. P. Chilton, *Phytopathology* **33**, 749 (1943).
9. M. L. Gattani, *ibid.* **36**, 398 (1946).
10. J. B. Rowell, E. C. Stakman, and E. E. Butler, *U.S. Atomic Energy Comm. AECU-1823* (1952).
11. J. B. Rowell and J. E. DeVay, *Phytopathology* **43**, 664 (1953).
12. ———, *ibid.* **44**, 356 (1954).

27 September 1954.

Number and Size of Radial Resin Ducts in Slash Pine

François Mergen

Yale University School of Forestry, Valhalla, New York

R. M. Echols

Lake City, Florida, Research Center, Southeastern Forest Experiment Station

Rate of flow of oleoresin from freshly made wounds on slash pine (*Pinus elliottii* Engelm.) is determined in part by the number and size of radial resin ducts. In this study, the relationships of these two anatomical factors with age of tree and width of growth ring were determined as part of a study on inheritance of factors that determine oleoresin yield.

Microtome sections were prepared at five-ring intervals from the vascular cambium to the pith of 10 parent trees. Wood samples, approximately ½ by 1½ in., were removed from the selected trees at breast height by boring two holes to the pith, one above the other, and sawing out the connecting wood. The samples were separated at every fifth ring, and tangential sections, 25 to 30μ thick, were cut with a sliding microtome. These were stained with haematoxylin and safranin that sharply differentiated the resin ducts and accompanying cells (*1*).

A complete count was made of the horizontal resin ducts within each section with the aid of a mechanical stage. The ducts were counted in parallel strips, using the diameter of the field of vision as the width of each strip. Counts were made under 100× magnification. The area of each section was determined from measurements with a graduated mechanical stage. The average area for each measured sample was 3.03 cm^2. Radial resin canals in tangential section appear elliptical; hence, the major and minor axes were measured to include thickness of the epithelial cells (Fig. 1). Ten ducts per section were measured with an ocular micrometer under a magnification of 440×.

Results of the relationships between number and size of ducts and age of ring, and between number and size of ducts and average ring width, are presented in Fig. 2. Inspection of the data showed the following relationships.

1) The number of radial ducts formed per unit area was highest during the early age (rings near the pith) and decreased rapidly until about the 20th year, after which it leveled off. In the wood close to the pith, most of the ducts are found in those vascular rays initiated contiguously with medullary rays. As the diameter of the tree increases, there is a decrease in the number of these rays per unit area of tangential surface. This decrease in number of resin ducts is partially offset by formation of additional vascular rays containing resin ducts.

2) A similar relationship existed when number and size of resin ducts were plotted against average width of ring. The gradual decrease in ring width with age contributed to the stabilization in the number of ducts.

3) Average size of resin ducts decreased linearly with age of ring. Since the size of tracheids is reflected by age of ring, this effect is probably associated with resin-duct size.

With the measurements taken it was not possible

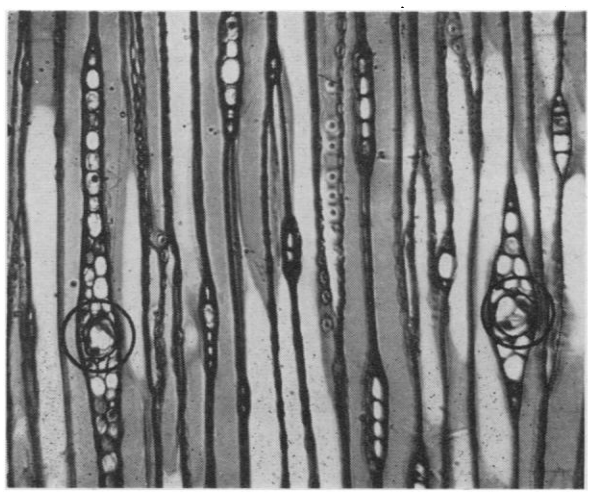

Fig. 1. Photomicrograph of two radial resin ducts on a tangential surface. The resin ducts (within circles) are contained in fusiform rays.

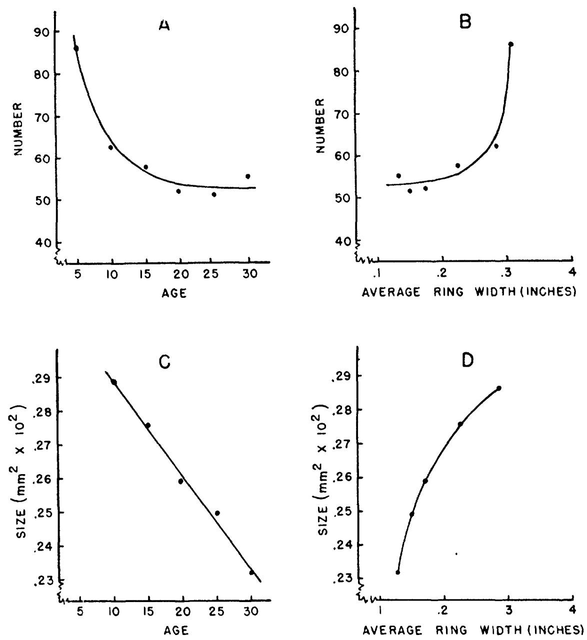

Fig. 2. Relationships of number and size of the radial resin ducts to age of the ring ($A+C$) and average ring width ($B+D$). The number of ducts per square centimeter is given.

to determine definitely whether the effect of age or the effect of ring width was more important. In the 10 trees studied, average ring width decreased with age of tree. By sampling a larger number of older trees it should be possible to find trees with an irregular growth pattern, and thereby evaluate the respective importance of age and width of ring. In a study on the gradient of wood density in trees that had wider growth rings toward the outside, Turnbull (*2*) was able to demonstrate that the density of wood formed in a particular year is not determined by the growth rate, but is proportionate to a function of age.

The relationship of number and size of resin ducts to age and width of ring exhibits a pattern similar to that of wood density and strength characteristics. The volume of resin ducts probably accounts in part for this pattern by directly influencing density and strength of the wood. Their influence is probably greatest in the first five rings where they are most abundant. On the average for the 10 trees studied, the number of horizontal resin ducts at ring 5 was 100 percent greater than at ring 25. The slight increase in the number of ducts at ring 30 is probably a result of traumatic resin ducts formed as a result of wounding for naval stores.

References and Notes

1. Acknowledgment is given A. Philips of the University of Florida who assisted in sectioning and staining the material.
2. J. M. Turnbull, *J. South African Forestry Assoc.* No. 16, 22 (1947).

23 November 1954.

Pheasant-Turkey Hybrids

V. S. Asmundson and F. W. Lorenz

Poultry Department, University of California, Davis

Hybrids from pheasants (*Phasianus colchicus*) and the domestic fowl (*Gallus* sp.) have been known for a long time (*1*) and have recently been more fully investigated (*2*). All hybrids out of these two species are apparently sterile. Artificial insemination (*3*), which overcomes some of the isolating mechanisms between species (*4*), has been used (*5, 6*) to obtain hybrids from the domestic fowl and turkey (*Meleagris gallopavo*), but only one hybrid hatched (*6*). Two centuries ago, Edwards (*7*) described, with an illustration, a hybrid "supposed to be bred between a turkey and a pheasant." The pheasant-turkey cross, however, has been neglected, although Sokolow *et al.* (*8*) recently reported that the chromosomes of the turkey and pheasant are more alike than those of the latter and the domestic fowl.

During an investigation of crosses between gallinaceous species made by artificial insemination in 1952, ring-neck pheasant hens were mated with bronze turkey males. At least 10 fertile eggs were obtained; six survived 2 wk or longer, and two were alive after the 24th day of incubation but did not hatch.

In 1953 reciprocal matings were made on a more extensive scale. The results are summarized in Table 1. No similar difference in fertility between the reciprocal crosses was observed in 1954 (*9*). The difference in fertility in 1953 may therefore reflect variations in intervals between inseminations, amount of semen used, and variations in the technique of insemination rather than more fundamental differences between the reciprocal crosses. Early embryo mortality of the hybrids was high, but most of the live 10-day-old embryos survived to 24 days.

The hybrids from pheasant eggs hatched after about 26 days' incubation; those from turkey eggs required 27 to 28 days. The average incubation period for pheasants is 24 days, for turkeys, 28 days. Time of hatch usually varies considerably but the hybrids in pheasant eggs clearly required a longer incubation period than pheasants.

Of the embryos that survived to 10 days of age in the 1953 hatches, the percentage hatched varied from 0 to 50 percent. In 1954 about 50 percent of the eggs

Table 1. Number of eggs set and hatched, 1953.

Type of cross	Set	Fertile	Embryo survival 10 days	Embryo survival 24 days	Hatched
Pheasant ♀♀ × turkey ♂♂	381	100	44	43	13
Turkey ♀♀ × pheasant ♂♂	231	100	50	39	11