Zusammenfassung

Titel der Arbeit: *Über* die Vererbung von gelbem Oleoresin und vireszenter Benadelung bei Pinus *elliottii*.

Eine einzelne Kiefer, von der die Bildung gelben Oleoresins bekannt war, wurde geselbstet und zu Kreuzungen verwendet. Alle Selbstungssämlinge produzierten ebenfalls gelbes Oleoresin, doch die Kreuzungen nicht. Dss Merkmal wurde homozygot rezessiv vererbt, die Anzahl der beteiligten Gene muß aber noch festgestellt werden. Zwei weitere Kiefern dieser Species mit vireszenter Benadelung wurden geselbstet, zu Kreuzungen verwendet und untereinander gekreuzt. Die erhaltenen Sämlinge verhielten sich so, wie dies bei der Vererbung von Chlorophylldefekten zu sehen ist. Die Klärung des Vererbungsmodus erfordert aber noch weitere Züchtungsschritte. Die mögliche Ausnutzung dieser aberranten Genotypen in der Forstgenetik und Physiologie wird diskutiert.

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Sex Ratio and Sex-Related Characteristics in Eastern Cottonwood

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This paper deals with sex ratio and secondary sex characteristics in a Mississippi Valley cottonwood (Populus *deltoides* BARTR.) population. Early empirical observations in natural populations of Populus species (P. trernuloides, P. *tremula,* P. deltoides) revealed a preponderance of males (1, 8, 9). More recently PAULEY and MENNEL (7) have reported a sex ratio of 3:1 (male : female) in a P. tremuloides population, while EINSPAHR (3) has published data on P. *tremuloides* showing no significant departure from a 1 : 1 ratio. Several studies have pointed to the possibility of male superiority in vigor and form (4, 5, 6). Variance in reported sex ratios in aspen and lack of data on eastern cottonwood provided the stimulus for the study described below.

Methods

In August 1962, ten 30-foot-wide transects were established in natural, even-aged cottonwood stands in the flood plain of the Mississippi River between Vicksburg and Clarksdale, Mississippi. The first 60 dominant and codominant trees intersected by each transect were numbered from 1 to 60 with white marking paint. In December 1962, after leaves had fallen, each tree was sexed on the basis of the external characteristics of its flowerbuds (Fig. 1) as seen from the ground with 7 X 50 binoculars. Trees were visited again during flowering in March 1963, when positiv? sex identification was established and the first five males and first five females on each transect were measured for age, d. b. h., height, form class, stem straightness, and degree of branching. Specific gravity determinations based upon large-core (11.3 mm. diameter) samples from each tree were made on four transects. Two cores were removed from each tree, and six wood samples were obtained by taking one 2-cc. section from inner, middle, and outer portions of each core.

Results

A total of 551 trees flowered out of the 600 marked; 54 percent of these were males and 46 percent females (table *1).* A chi square test revealed no significant departure from a 1 : 1 sex ratio on any of the transects or in the pooled sample. Male trees predominated on 7 out of 10 transects.

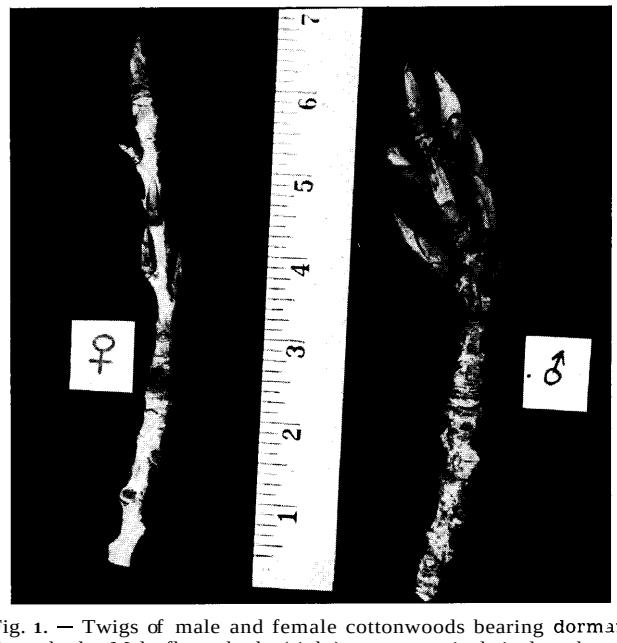

Fig. 1. — Twigs of male and female cottonwoods bearing dormant flowerbuds. Male flowerbuds (right) average 1 inch in length and typically have a curved shape. Female flowerbuds are smaller and similar to leafbuds in external appearance.

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Table 1. — Chi square test of sex ratio in eastern cottonwood.

Transect no.	Trees flowering		Chi square	df
	Male	Female		
	Number	Number		
1	30	26	0.286	1
2	34	23	2.122	1
3	25	26	.020	1
4	26	27	.019	1
5	25	24	.020	1
6	32	21	2.284	1
7	28	29	.018	1
8	33	27	.600	1
9	34	25	1.372	1
10	30	26	.286	1
			7.027	10
Total	297	254	3.356	1
Interaction			3.671	9

Table 2. — Relationship of sex to height and diameter in even-aged cottonwood stands.

Transect no.	D. b. h. (inches)		Height (feet)	
	Male	Female	Male	Female
1	14.9	14.6	99	102
2	16.0	14.7	104	97
3	13.1	10.7	93	88
4	13.3	13.7	97	100
5	15.6	14.2	105	103
6	14.9	16.5	96	86
7	13.6	13.0	96	88
8	12.2	12.0	88	88
9	12.4	12.1	90	87
10	14.6	13.4	100	97
Mean	14.1	13.5	97	94

No relationship was observed between sex and form class, stem straightness, branchiness, or specific gravity, which ranged from 0.32 to 0.42. Male trees were slightly but consistently superior in d. b. h. and total height *(table 2)*. Analyses of variance indicated that the d. b. h. difference due to sex was not significant, but that male trees were significantly taller than females at the 0.05 level of probability.

Mean tree age for transects varied from 17 to 23 years. Although slight differences between tree age (1—3 years) were recorded within transects, mean ages of males and females were identical, and the differences probably resulted mostly from error in determining age via increment cores. Thus the stands sampled are believed to be truly even-aged.

Approximately 8 percent of the trees did not flower. In the highly unlikely event that they were all females, the sex ratio among the 600 trees would be exactly 1 : 1. However, since these trees were all smaller codominants (mean d. b. h. 10.7 inches), such an event would further substantiate evidence of male vigor. It is more likely that flowering of this relatively small percentage of trees would not substantially change results presented above, and no effort was made to induce flowering.

Eighty-seven percent of the flowering trees were correctly identified as male or female via binoculars in December. Eight percent of the incorrectly sexed trees were males called females and 5 percent were females called males. A tendency to misidentify more males than females was observed on 7 out of 10 transects. In most cases, missexed males had few or exceptionally small flowerbuds. Of the trees that did not flower, all were called females in the December appraisal.

Discussion

Although the chi square test of data indicated no significant departure from a 1 : 1 sex ratio, the fact that males were predominant and slightly larger than females substantiates some previously published evidence of male vigor. MUHLE LARSEN (4) observed that the average height of groups of aspen *(P. tremula* × *P. tremuloides)* seedlings was positively correlated with the proportion of males in them. European and American work with superior poplar phenotypes selected for breeding purposes has indicated the possibility of male superiority in growth and form (5, 6). In contrast to these reports, EINSPAHR (3) observed no significant sex-related differences in vigor and form of *P. tremuloides.*

Because of this evidence of male vigor, however, sampling in older stands (20—30 years) of cottonwood may not give a realistic estimate of a genetically determined sex ratio. Given even slight male superiority in vigor, sex ratio may vary considerably depending upon age and competitive conditions during ontogeny. Thus an original sex ratio of 1 : 1 may have been slightly altered in the sampled stands by superior male competitiveness.

Natural populations of aspen have been the subjects of most *Populus* sex-ratio investigations to date. In contrast to cottonwood, the possible relationship between sex ratio and male vigor in aspen species may be influenced by their clonal growth habit (2), which results from a tendency to regenerate vegetatively via root suckers. Male vigor would have a cumulative effect over many root sucker regenerations while each new cottonwood stand begins with a genetically fixed sex ratio, probably 1 : 1. Clonal spreading in aspen via root suckers also presents sampling problems in that a single clone may be represented by stems several hundred feet apart. These factors may account for the wide variance in reported data on sex ratio in aspen.

Eighty-seven percent successful sex determination of dormant trees via binocular flowerbud identification indicates that the technique may be of practical use, e. g., in seed tree selection. It should be noted, however, that such identification is restricted to positive identification of males and determination of females by process of elimination. Leafbuds and female flowerbuds are difficult to separate accurately except by internal examination.

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Summary

Sex ratio and possible sex-related characters were investigated in ten natural *Populus deltoides* stands in the lower Mississippi Valley. A total of 551 flowering trees were observed; 54 percent were males and 46 percent females. A stratified subsample of 50 male and 50 female trees revealed that males were slightly, but insignificantly, larger in diameter and significantly taller than females. No relationship was found between sex and form class, stem straightness, branchiness, or specific gravity of wood. Eighty-seven percent of the flowering trees were correctly identified as male or female by examination of flowerbuds via binoculars in December.

Résumé

Titre de l'article: *Proportion des sexes et caractères liés au sexe chez Populus deltoides.*

On a étudié dans 10 peuplements naturels de *Populus deltoides* de la Basse Vallée du Mississippi la proportion des sexes et les caractères éventuellement liés au sexe. On a observé au total 551 arbres en floraison; 54% étaient mâles et 46% femelles. Un échantillon stratifié de 50 mâles et 50 femelles a montré que les mâles étaient légèrement (mais pas de façon significative) plus gros en diamètre et significativement plus hauts que les femelles. On n'a trouvé aucune relation entre le sexe et la forme, la rectitude, le type de branches, la densité du bois. On a pu identifier correctement à la loupe binoculaire au mois de Décembre 87% des arbres comme mâle ou femelle.

Zusammenfassung

Titel der Arbeit: *Geschlechterverhältnis und geschlechtsgebundene Merkmale bei Populus deltoides.*

Das Geschlechterverhältnis und möglicherweise vorhandene geschlechtsgebundene Merkmale wurden in 10 natürlichen *Populus-deltoides*-Beständen im unteren Mississippi-Tal untersucht. Dazu wurden insgesamt 551 blühfähige Bäume herangezogen; 54% waren ♂ und 46% ♀. Bei einer geeigneten Teilprobe von 50 ♂ und 50 ♀ Bäumen zeigte sich, daß die ♂♂ etwas (nicht signifikant) dicker, dagegen signifikant höher waren, als die ♀♀. Aber keine Beziehungen wurden gefunden zwischen dem Geschlecht und der Form, der Geradheit des Stammes, der Verzweigung oder dem spezifischen Gewicht des Holzes. 87% aller dieser später blühenden Bäume konnte man bereits im Dezember vorher durch die Prüfung der Blütenknospen mit dem Fernglas korrekt als ♂ oder ♀ identifizieren.

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Rooting, Shoot Development, and Flowering of Jack Pine Needle Fascicles

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Vegetative propagation has found wide application in tree improvement work. The technique is a useful tool, not only for preserving and multiplying valulable tree germ plasm but also in analyzing the inherent characteristics of individual trees, establishing breeding arboreta where controlled pollinations can be made on a large scale, developing seed orchards, and conducting a wide range of experiments where it is desirable or essential to use clonal lines.

The present study was prompted by a need for a technique whereby large clones of jack pine (*Pinus banksiana* Lamb.) could be established in a relatively short time. The technique desired should provide not only a way of producing ramets on their own roots but also a means of vegetatively propagating the smallest possible unit of a jack pine. The smallest part of a pine tree which can be propagated *in vivo* is the needle fascicle. The ability to propagate individual trees by rooting fascicles would provide a most useful technique for isolating somatic mutations in our present studies of induced mutation.

Previous Studies

Needle fascicles of the genus *Pinus* have been rooted previously by numerous investigators including Delisle (1), Thimann and Delisle (5), Toda (6, 7, 8), Jeckalejs (3), Zak and McAlpine (9), Isikawa and Kusaka (2), and Reines and McAlpine (4).

Delisle (1) noted that in eastern white pine (*Pinus strobus* L.) rooted needle fascicles failed to survive unless adventitious buds had previously been caused to develop in them. Thimann and Delisle (5) later reported that white pine fascicles rooted at least as well as cuttings. Because of the inability of the rooted fascicles to survive without an active bud, these investigators concluded that the application of this technique in tree propagation would be limited.

Toda (6, 7) found that over one-half of the fascicles of Japanese red pine (*Pinus densiflora* Sieb. & Zucc.) and of Japanese red pine-black pine (*Pinus thunbergii* Parl.) hybrids rooted when taken from 1-year-old trees but none rooted from 13-year-old trees. He does not mention shoot development on the rooted fascicles. In some cases roots were formed from the fascicular buds in the position where shoots normally develop. Toda (8) was later able to improve the rootability of the fascicles by subjecting the twigs to red light during the summer previous to propagation.

Jeckalejs (3) was able to root up to 70% of the fascicles from 2-year-old red pine (*Pinus resinosa* Ait.). He speculated on the possibility of inducing shoot development from the fascicles but provided no data showing such development. To induce fascicular buds to develop, he suggested excision of the distal portions of new shoots at the beginning of the growth period.

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