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BOTANY

Sex Ratio, Hermaphroditism, and Flower Abnormalities in Quaking Aspen

INTRODUCTION

Most authors have considered the flowers of quaking aspen, *Populus tremuloides* Michaux to be imperfect and the species to be dioecious. However, the occurrence of perfect flowers has been noted on individual trees and reported in several instances.

The flowers are apetalous and borne in a characteristically scaly spike commonly referred to as a catkin. When in full flower, according to Rosendahl (1955:66), both the male and female catkins are three to six cm long.

Santamour *et al.* (1956) were the first to attempt systematically to determine the frequency of hermaphroditism in a native population of quaking aspen. Their work of sex analysis was concerned with material from 67 trees of seedling origin collected in a native population of quaking aspen in Massachusetts.

In the spring of 1956 Prof. Scott Pauley of the University of Minnesota School of Forestry, supplementing and enlarging upon the work of Santamour, and aided by a grant from the Charles K. Blandin Foundation of Grand Rapids, Minnesota, initiated a more detailed study using material collected from a native Minnesota population of seedling origin in order to determine the sex ratio in a natural population, and the frequency of occurrence of hermaphroditic flowers.

In the course of examining the material, various other flower abnormalities were noted and drawings of these were made.

METHODS

Since aspen has a decided tendency to sucker from the horizontal roots and form clonal groups and since this study could only be concerned with individuals of seedling origin, the collection of multiple

samples within a clone had to be avoided. This was done by gathering flowers from a population of trees at the base of the fill on U. S. Highway No. 2, three miles northwest of Floodwood, Minnesota. The highway, which passes through a black spruce swamp of considerable extent, was built twenty-three years ago. This fairly well assures that the trees are all of seedling origin.

Samples were collected without regard as to placement on the tree. A single branch containing a dozen or more flower buds was gathered from each of 206 trees. On April 29, 1956, when the material was gathered, each branch was tagged when removed from the tree and then placed in the greenhouse at Green Hall on the St. Paul Campus of the University where the flowers were forced to near maturity. Then, ten catkins were collected from each branch, inserted into polyethylene bags, tagged, and placed in a deep freeze. The material was examined by the present writer using a binocular dissecting microscope, during the latter part of the summer and early fall of 1956.

RESULTS

Sex Ratio. Of the 206 trees examined, 148 trees or 71.8 percent were classified as being predominately female. This gives a ratio of approximately three males to one female, results similar to those of Santamour *et al.*, and of other workers.

Hermaphroditism: A typical male flower consists of the flower stalk, a lacinate bract bearing fine hairs at the margin, a somewhat flattened disc, and stamens ranging from six to twelve, each with relatively short filaments.

The typical female flower resembles the male in that the stalk and bract are quite similar. However, the disc is more conical and it appears to enclose the base of the pistil which is capped by a six lobed stigma. The stigma is divided into two like parts each of which is composed of two slender upright lobes and a shorter, heavier, lower lobe.

The bisexual flower (hermaphroditic) most nearly resembles a typical female flower in most of its makeup. The stalk and bract are similar to either the male or female, but the disc is definitely full as in a typical female flower. One or more normal stamens may be

present in no obvious orderly arrangement. The range of stamens present on such flowers was one to nine, and usually one to three were formed on the same disc as the pistil. Most aberrant flowers occurred at either the apex or basal portion of the catkins. The bud scales quite frequently covered the bisexual flowers if only one or two were present per catkin.

In the ten catkin sample per tree examined, quite often only one or occasionally two bisexual flowers were found. Such a small representation tends to indicate that had a larger sample per tree been examined, a higher percentage of bisexuality might occur.

Based on the ten catkin samples from the 206 trees examined, 188 trees or 91.3 percent showed unisexual flowers only, and 18 trees or 8.7 percent showed some bisexual flowers. Further study revealed that of the 142 samples from male or predominantly male trees only six trees or 4.0 percent had some bisexual flowers, but of the samples from the 46 female or predominantly female trees twelve trees or 20.6 percent had some bisexual flowers.

By way of summary, these figures reveal that most of the trees (91.3%) seem to have unisexual flowers only, but of the trees (8.7%) which did have some bisexual flowers, twice as many (12) of those trees classed as female or predominantly female had some bisexual flowers as compared with those (6) classed as male or predominantly male.

These observations further substantiate similar results obtained by Santamour in Massachusetts.

Flower Abnormalities: In the course of examining the material several abnormal flowers, aside from typical bisexuals, were noted. Both male or female catkins sometimes were found to bear two fused discs on which twice the normal stamen or pistil count was observed. Such instances were not infrequent in the females. One especially interesting flower observed bore a pistil with a stamen fused to it near the middle. The pistil in this case seemed to be smaller than normal, but it bore a normal stigma at the apex. Also present on the same disc were four free, normal stamens. Another interesting characteristic noted was the fusion of two pistils. These appeared as oversized pistils of normal pistil height with double the usual number of stigma lobes.

After noting the frequency of hermaphroditism, especially in female trees, perhaps a more true description of this species would be "polygamodioecious", i. e. with bisexual flowers and unisexual flowers of one sex only on the same plant.

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- SANTAMOUR, F. et al, 1956. Hermaphroditism in *Populus*. *Proc. Third North-eastern Forest Tree Improvement Conf*: 28-30.