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SEX RATIO AND HERMAPHRODITISM IN A NATURAL POPULATION OF QUAKING ASPEN(1)

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The flowers of quaking aspen (Populus tremuloides Michaux) are borne in a characteristic scaly spike called an ament or catkin. Most references works consider the flowers to be typically imperfect (unisexual) and the species dioecious, i.e., with the pistillate and staminate flowers segregated such that individual trees are wholly female or male. Exceptions to this "normal" condition, particularly the occurrence of perfect (hermaphroditic or bisexual) flowers, have been observed on individual trees and reported from time to time. No systematic attempt to determine the frequency of sex abnormality in wild populations of quaking aspen was made until Santamour (3) reported a sex analysis of 67 seedling-origin trees native in north central Massachusetts.

In order to collect additional data on the incidence of hermaphroditism in wild populations of quaking aspen, a 206 tree sample of a native Minnesota population was collected in the spring of 1956 and analyzed. Since such studies should obviously be confined to sexually reproduced offspring in the population, the sampling method used must take into consideration the strong tendency of this species to establish clones by root suckering. In the Massachusetts study this difficulty was overcome by using roadside trees growing at intervals of not less than 1/4 mile. In the present study the population sampled was composed of trees established at the base of the mineral soil fill of U. S. Highway 2, ca. 3 miles northwest of Floodwood, Minnesota. The highway in this area passes through a black spruce swamp for a distance of several miles (Fig. 1). Since the age of the highway is 23 years, and the trees are younger (18-20 years) and confined to the fill, the plants sampled are all believed to be of seedling origin.

The collection was made April 29, 1956, at which time the catkins were emerging from the bud. A single branch from each of the trees was removed and forced in the greenhouse until the catkins were 1 to 2 inches in length. Ten catkins from each branch were then removed, placed in polyethylene bags, deep frozen, and subsequently analyzed with the aid of a dissection microscope during the past summer and autumn.

Results of this analysis (see Table), confirms earlier observations by various workers that males typically outnumber females in wild populations of this species. In the present instance the ratio of sex imbalance is ca. 3 males : 1 female.

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(3) Santamour, Frank S. Hermaphroditism in Populus. Proc. 3rd Northeastern Forest Tree Improvement Conf. pp. 28-30. 1956.

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Incidence of hermaphroditism among females (20.6%) was considerably higher than among males (4%): a similar result was reported by Santamour (females 10.7%; males 5.1%) in the Massachusetts population. Whatever the sex mechanism in quaking aspen, the control is apparently less rigid in females.

The majority of bisexual trees showed only very small percentages of hermaphroditic flowers (1-2%), and these usually on a single catkin. This suggests that a 10-catkin sample was inadequate to detect hermaphroditism in many trees and the incidence of bisexual trees may thus be assumed to be higher than the figures indicate. Present evidence suggests that quaking aspen might be better described as "polygamodioecious," i.e., with bisexual flowers, and unisexual flowers of one sex only, on the same plant.

Typical bisexual flowers consist of a single pistil and several stamens (Fig. 2) but various structural abnormalities were also noted in bisexual or unisexual flowers: fused pistil and stamen, 2-4 fused pistils, fused discs, etc. Further studies to determine if hermaphroditic trees are self-fertile and the sex mechanism involved in quaking aspen are planned.

Table

	Trees Classified by Predominant Sex		Trees with unisexual flowers		Trees with bisexual flowers	
	No.	%	No.	%	No.	%
Male or predominantly male trees	148	71.8	142	96.0	6	4
Female or predominantly female trees	58	28.2	46	79.4	12	20.6
Total	206	100.0	188	----	18	----

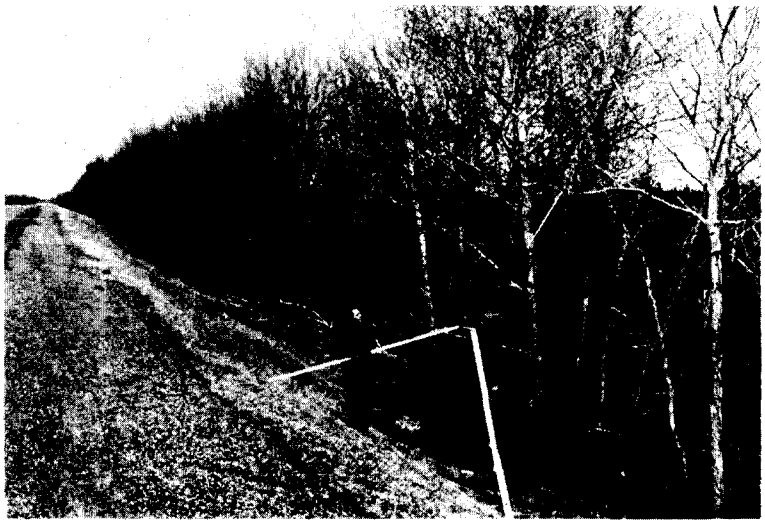

Fig. 1. Seedling-origin trees of quaking aspen growing at the base of fill, U.S. Highway 2, near Floodwood, Minnesota. A 3-legged orchard-type ladder and short pruner were used to collect flowering branches used in this study.

Fig. 2. A typical hermaphroditic flower of quaking aspen consisting of a pistil (a) and stamens (b).

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