A New Leaf Mutation in Black Walnut (*Junglans nigra* L.)

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Abstract

A new leaf mutation in black walnut (*Juglans nigra* L.) has been discovered. The new form has a large, round terminal leaflet with 2-4 very small lateral leaflets. Seedlings with the new form were produced by one parent tree and 19 percent of the seedlings from that tree have the peculiar form. The remainder of seedlings from that parent have normal leaves.

The cause is suspected to be a single-gene recessive mutation. Studies are planned to determine the exact genetic cause.

A new mutation in black walnut (*Junglans nigra* L.) has been found (Fig. 1). The new form is unique, has not been reported before, and differs from the normal black walnut in the following characteristics:

1. The new leaf form has a large round terminal leaflet (approximately 7.0 cm diameter) with an indented apex and 2, 3, or 4 very small lateral leaflets (approximately 2.5 x 2.0 cm) (Fig. 2). The normal black walnut leaf has 9-23 lanceolate leaflets approximately 10 cm x 4 cm.

2. Total leaf length of the new type was approximately 12.5 cm while the normal is approximately 50 cm (Fig. 2).

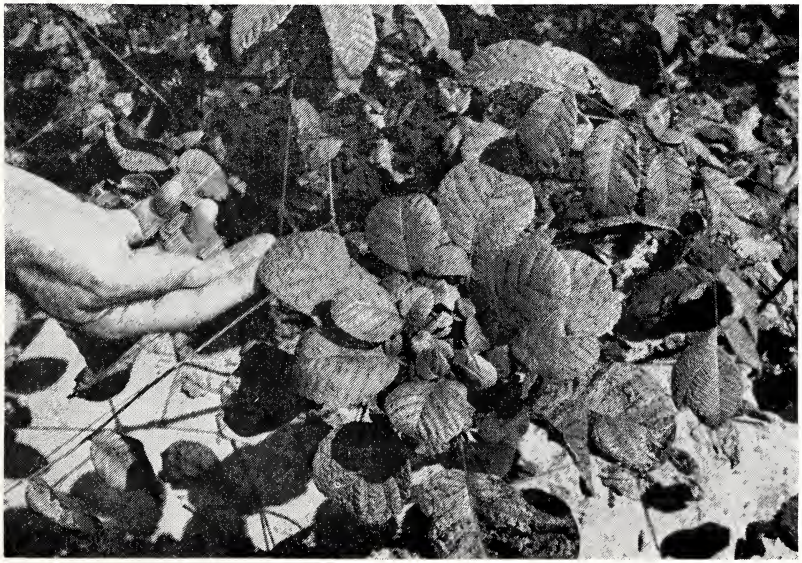

Figure 1. *Mutated leaves of black walnut in the nursery bed at Vallonia State Tree Nursery.*

3. In some mutated leaves the first lateral leaflet is fused to the terminal leaflet giving a lobed appearance.

4. The buds of the mutant were smaller and more rounded than a typical bud. This is probably due to the small leaf size of the new type.

5. First year height of the mutated seedlings averaged 27.4 percent taller than normal seedlings in the same family (seed collected from one parent tree) (Table 1). However, when compared to seedlings from the other sources, this family was shorter than average. Thus, even the taller mutated seedlings were not superior in growth to other sources.

6. The mutated seedlings appeared to be very susceptible to anthracnose (*Gnomonia leptostyla* Fr.) which caused defoliation to begin in mid-August. Seedlings were essentially leafless by September 7, 1976.

The only similar mutations reported in the literature involved California black walnut (*Juglans californica* S. Wats.) and Hinds walnut (*Junglans hindsii* Jeps.) (1). Researchers have no reports of similar mutations in *Junglans nigra*.[1]

This mutation was found in the course of the annual progeny testing phase of the genetic improvement program for black walnut conducted by the Indiana Division of Forestry and Purdue University. Progeny tests annually consist of 1000 to 4000 seedlings from approximately 80 different parent trees. The tests are planted in a randomized complete block design using five replications. The mutated seedlings were observed in the 1976 progeny test in the nursery beds. Nineteen

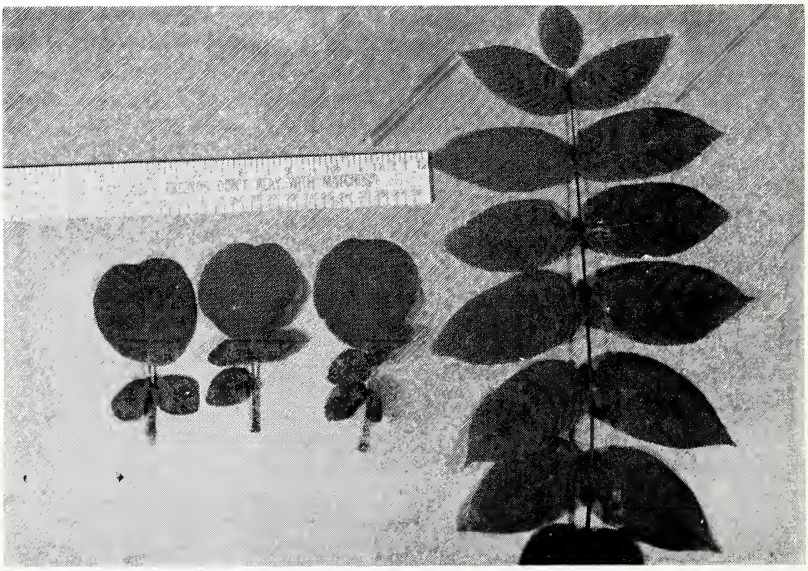

FIGURE 2. *Mutated leaves on the left versus a normal leaf from a seedling in the same family on the right.*

[1] Personal communication—Dr. David Funk, U.S. Forest Service, Carbondale, Illinois 62901.

TABLE 1. *Height growth of mutated vs. normal black walnut seedlings in family 143.*

Block	Mean Height Normal Seedlings (cm)	Mean Height Mutated Seedlings (cm)	Height Increase of Mutated Over Normal (%)
1	24.9	28.5	14.5
2	23.6	35.2	49.2
3	26.0	32.3	24.2
4	26.7	33.7	26.2
5	22.9	28.3	23.6
Mean	24.8	31.6	27.4

percent of the seedlings from a single family showed the new leaf trait (Table 2). The remainer of the seedlings from that family were normal.

Speculation as to the genetic origin of the new type has centered on a single gene recessive trait in the parent tree. Two possible explanations for the ratio of mutated to normal plants have been considered: 1) The mutated seedlings could be the result of self-pollination in the heterozygous parent tree. Black walnut is known to self pollinate provided weather conditions are favorable and dichogamy is lacking (2). 2) Another tree in the vicinity of the parent tree may also be heterozygous for the mutation (sib or progeny) and has cross pollinated to produce the nearly 3:1 ratio.

Inspection of the parent tree and neighboring trees in northern Indiana, and grafts from the parent tree in the clone banks at Purdue University-Martell Forest show no indications of the mutation (3).

This discovery may prove to be extremely important in the breeding of black walnut in that for some studies a "marker gene" is required. This mutation is readily identifiable, occurs in one-year-old seedlings, and unlike most chlorophyll deficiencies is not fatal, thus making it an ideal marker gene in selfing, and controlled pollination studies.

Future tests to define the real genetic causes include grafting of scions to mature walnut trees for future controlled pollination studies, seed collection from trees in the vicinity of the parent tree, and observation of flowering times in the parent and surrounding walnut trees.

TABLE 2. *Occurrence of leaf mutations in family 143 in a black walnut progeny test.*

Block	Seed Planted (No.)	Total Seedlings (No.)	Mutated Seedlings (No.)	Mutated Seedlings (%)	Germination (%)
1	40	23	4	17	58
2	40	34	7	21	85
3	40	11	4	36	28
4	40	29	3	10	73
5	40	31	6	19	78
Mean & Totals	200	128	24	19	64

Literature Cited

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