

# INHERITANCE OF THE "Y-BRANCHED" CHARACTER IN SUNFLOWER (*HELIANTHUS ANNUUS* L.) AND IMPLICATIONS IN BREEDING

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The "Y-branched" character in sunflower was first observed in a 1975 nursery row at Lubbock, Texas, which segregated 3 branched: 7 normal plants. The parent line was a selection of PI 228,345 (originally from Iran) obtained earlier from the University of Minnesota breeding program at Crookston. The stem of the affected plants branched below the heads, and produced two heads of equal size.

In selfed progeny of branched plants, fewer branched plants were observed than expected for a character conditioned by a single recessive gene. Selected heads on both branched and normal plants were selfed in 1976, and a total of 124 progeny rows were grown in 1977.

Both branched and normal plants produced some branched progeny. The frequency of normal: branched plants was 1234: 169, which most closely approximated a 57:7 ratio, suggesting three recessive genes may condition the character (Table 1). In this ratio, branching is expressed only when at least two of the three gene pairs are recessive, and epistasis is present in one gene pair.

Branching of various types has been extensively studied in sunflower. Putt (2, 3), in 2 papers published in 1940 and 1964, reported both dominant and recessive types of branching in sunflower. Hockett and Knowles (1), in a 1970 paper, reported that branching in sunflower is complex, and that four or more genes may have been involved in the material studied, with a variety of expression in different crosses.

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Other research workers have reported on the inheritance of multi-heading in sunflower. Skaloud and Kovacic (4, 6), in papers published in 1976 and 1978, reported both "fascial" and "palmette" multi-heading to be conditioned by three genes with the expected 63:1 ratio. In another report (5) in 1976, they stated that two heads which developed simultaneously interfered with each other, and concluded that it was more reasonable to have a large and a small head ripen together without mutual interference.

Gene symbols were designated in the publications cited above. As the Y-branched character is apparently unique and different from the other types of branching reported, the gene symbols *Ibr1*, *Ybr2*, *Ybr3* are suggested.

Dr. V. T. Rozhkova of the Kuban Experiment Station of N.I. Vavilov USSR Plant Breeding Research Institute (VIR) has concluded that the inheritance of equilateral branching resulting in two identical heads is complex, and that it is difficult to stabilize genetically in populations (personal communication to senior author in July, 1976 at the Kuban Experiment Station). The authors have also experienced this difficulty, coupled with the fact that the population investigated has almost continuous variation for time of branching. Plants may branch early (after 3-4 nodes) to late (after the last node is formed, and immediately below the head). Early branching plants may be more susceptible to lodging, as the two stems are reduced in size in comparison to a plant with a single stem.

I would like to add at this point that several research workers at this Conference have mentioned this type of branching in reports or discussions, so it appears to be a common genetic character. Dr. Patrice Leclercq showed a picture of such a plant in his presentation Monday noon, and Dr. Robles Sanchez also had an excellent slide in his talk Tuesday morning. Dr. Murray Kinman referred to similar genetic material in a discussion period.

From a practical standpoint, it appears desirable to have the branching occur near the last formed node so that the two heads can turn downward and face the earth similar to single-headed plants. This offers the mature seed protection from the elements and some protection from birds.

The Y-branched character may have potential in a breeding program if it can be stabilized and incorporated in suitable lines or hybrids. If two heads of desired size can be produced on one stem of a commercial hybrid, the amount of seed required for planting can be reduced. The same would be true if a cytoplasmic male sterile Y-branched line was used as a female parent in a crossing block.

In a breeding nursery, Y-branched plants offer some flexibility and ease of manipulating not possible with single-headed plants. One of the two heads could be selfed and the other emasculated and outcrossed, or the two heads could be outcrossed to different parents. This would be an improvement on the "split head" method reported on at this Conference Tuesday morning. Use of a gametocide on one head and not on the other might also be useful in making crosses. The Y-branched character may also have possibilities as a genetic marker, and in linkage investigations.

TABLE 1. Segregation for the "Y-branched" character in sunflower (*Helianthus annuus* L.), Lubbock, Texas, 1977.

	Normal	Y-branched	Total number of plants
Observed	1234	169	1403
Calculated 57:7	1249	154	1403
	$\chi^2 = 1.64$	$P = .10-.25$	

## REFERENCES

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- (4) SKALOU, V., and A. KOVACIK, 1976. Genetic prerequisite of ordinary sunflower for the creation of the productive multi-head type. Proceedings, VII International Sunflower Conference (27 June-3 July, Krasnodar, URSS), Vol. I, p. 437-441.
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