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Glabrous Seedstalk in Carrot: Inheritance and Use as a Genetic Marker[1]

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Abstract. **The mutant trait glabrous seedstalk was observed in carrot (*Daucus carota* L.) inbred W93 and, in crosses with pubescent inbred MSU 1558, was found to be controlled by a single recessive gene, *gls*. Cytoplasmic effects on the expression of the character were not detected. Glabrous seedstalk has practical application as a genetic marker to detect outcrosses in hybrid carrot seed production fields.**

Hybrid carrot cultivars are produced commercially through the use of cytoplasmic-genetic male sterility (1, 4, 5, 9, 11). The production of hybrids using this method places a heavy burden on seedsmen to guarantee the genetic purity of seed parent inbreds. This objective is accomplished with difficulty in carrots because flowers are protandrous (2, 6) and the degree of cross pollination is high (7, 10). In spite of isolation and meticulous supervision of stock-seed maintenance, some outcrossing occurs.

Lack of suitable marker genes in existing inbred lines hampers roguing of outcrosses in hybrid seed fields. A distinct recessive genetic marker is needed (3). Normally, carrots have pubescent leaves and floral axes ("seedstalks") but plants of inbred W93 are completely devoid of seedstalk hairs (Fig. 1). Plants of W93 were crossed reciprocally with a pubescent inbred, MSU 1558, to determine the inheritance of glabrous seedstalk and the feasibility of its use as a genetic marker in hybrid seed production.

Reciprocal crosses between parents were made using emasculation, protandry, and male-sterility. The following generations were grown and plants classified in the field at Madison, Wisconsin: P_1 (W93), P_2 (MSU 1558), F_1, F_2, BC to P_1 and BC to P_2.

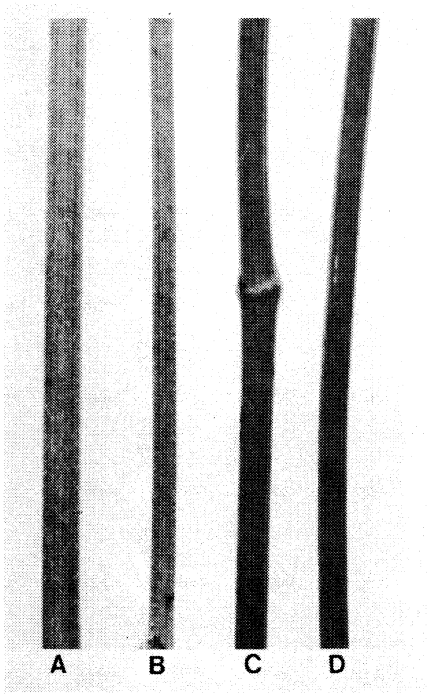

Fig. 1. Carrot seedstalk sections of pubescent inbred MSU 1558 (A and B) and glabrous inbred W93 (C and D).

All F_1 plants were pubescent in both sterile and fertile cytoplasm, indicating the glabrous-seedstalk is a recessive trait. Cytoplasmic or maternal effects on the expression of the trait were not detected. Homogeneity Chi-square analyses on F_2 and backcross progenies were not significant at the 5% level of probability. Chi-square tests calculated on pooled data (8) of F_2 and BC to P_1 generations showed no significant deviations from the expected 3:1 and 1:1 ratios of pubescent vs. glabrous plants, respectively (Table 1). All plants were pubescent in the BC to P_2 generation. These data indicate that glabrous seedstalk in carrot is controlled by a single recessive gene. The symbol *gls* for glabrous seedstalk and *Gls* for the dominant allele (pubescent) is proposed.

It would be more desirable to identify outcrosses in the vegetative stage of carrot development (3). Nevertheless, the glabrous seedstalk, although expressed only in the reproductive phase, has practical significance. If incorporated into the seed parent during inbred development, this trait would allow seedsmen to effectively rogue any outcrosses to the prevalent pubescent types.

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Table 1. Segregation data of crosses between W93 glabrous (P_1) and MSU 1558 pubescent seedstalk (P_2) carrot inbreds.

Generation	No. of progeny	No. of plants		Expected ratio	Chi-square	P
		Pubescent	Glabrous			
F_1	4	821	0	1:0		
F_2	9	869	309	3:1	0.95	.25 – .50
BC (F_1 x P_1)	6	178	208	1:1	2.33	.10 – .25
BC (F_1 x P_2)	3	346	0	1:0		

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