Male fertility of the first generation offspring of andronotes

Cytoplasm of W23 ig ig +	Pollen parent	Andronotes		Number of offspring		
		Monoploid or Diploid	Cases	Sterile	Partially sterile	Fertile
T-sterile	WA374	M	14	29	0	0
		D	1	1	0	0
T-sterile	W23R	M	6	8	0	0
		D	1	23	0	0
T-sterile	A632	M	24	165	0	0
		D	1	49	0	0
Fertile	WA374	M	1	0	0	1
		D	1	0	0	25
Fertile	W23R	M	2	0	0	2
		D	1	0	0	23
Fertile	A632	M	2	1	1	28
		D	0	0	0	0

characterized the material of T x N extraction. All but two plants, one completely sterile and the other partially so, were scored as fertile. The sterile plant was morphologically atypical relative to the inbred involved. Both exceptions proved partially female sterile, furthermore, indicating the male sterility had a basis other than that observed in the T x N series.

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3. Nucleo-cytoplasmic interaction in the determination of a defective seed trait.

A strain whose maternal lineage traces to Euchlaena perennis through six successive crosses to maize was furnished by J. B. Beckett. The early parentage is complex, including a backcross of the hybrid with a stock of elongate; the final two crosses were with inbred W23. Second backcrosses with W23, made in 1971, gave an unexpected outcome. All of

the ears segregated kernels of defective as compared to normal endosperm in approximately 1:1 proportion.

Recurring segregation in each backcross population could not be reconciled with expectation based solely on a consideration of nuclear genes. It was postulated, accordingly, that the defective condition resulted from the combination of W23 nuclear material and E. perennis cytoplasm. The plump seed class, on this view, reflects action of a nuclear factor which can offset the effect of the perennis cytoplasm to restore normal seed development. Various tests performed in 1972 and summarized below support this conjecture.

1. Reciprocal crosses between standard (std.) and derived (E.p.) forms of W23 yielded defective kernels only when the derivative was ♀ parent (seven identical reciprocal cross pairs; plants having perennis cytoplasm grown from plump seed). The ratio of kernel types on ears of E.p. maternity was approximately 1 plump : 1 defective.

2. Plants grown from defective seed and then pollinated by W23 (std.) yielded only defectives (17 ears, 2 progenies).

3. Offspring from a W23 (std.) x W23 (E.p., plump seed selections) cross gave normal ears when pollinated with W23 (std.) (single progeny of 12 ears).

4. Four out of nine plants from the progeny referred to in (3) gave only defectives when tested as male on plants reared from defective seeds, whereas five when similarly tested yielded plump and defective, 1:1.

5. Self-pollinated offspring from the reciprocal cross, (E.p., plump seed) x (std.), produced ears that segregated approximately 3:1 for plump vs. defective (8 ears).

Two additional features of this material were revealed in the matings outlined above. Seedlings grown from seed of the defective class were small and retarded in development beyond the stage which would be expected due to the effect of reduced seed size alone. Field grown plants were pale green and although retarded, eventually gave fertile ear shoots when not grown in competition with normals. Pollen is shed. Secondly, all of the backcross plants that received the nuclear factor which restores normal kernel development also carried a recessive white-endosperm mutation (15 plants tested by selfing). Further indicating close linkage between

the two effects, four backcross plants which lacked the nuclear restoring factor did not segregate white-endosperm. Kernels of the white-endosperm class yield albino seedlings.

Plants of perennis cytoplasm and heterozygous for the nuclear restoring factor gave one of three reactions when pollinated by various inbreds: (a) plump and severely defective, such as is characteristic of the W23 material, (b) plump and only moderately defective (partial restoration), and (c) no defectives (full restoration). The 16 inbreds tested are assigned to the following respective categories:

Group (a): Ml4 and W22

Group (b): A632, C123, WA374 and W513

Group (c): A619, Oh43, W64A, W182E, W153R, W59E, W629A, W749, SA 1490 and N6

The widespread distribution of a nuclear factor (or factors) in maize populations which offsets the effects of perennial teosinte cytoplasm makes it plausible that the one carried by the W23 (E.p.) strain analyzed may have come from a maize stock involved in the derivation of this strain rather than from teosinte itself. The close linkage, or possible pleiotropism, of the restoring factor with the recessive white-endosperm effect may afford a means of tracing its source.

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