

SHORT STAPLE BREEDING, GENETICS & CYTOLOGY

Cytogenetic Analysis of Lf Marker Gene and Monotelodisome 12L.

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Kohel, Lewis and Christiansen have reported that the Leaf fleck mutant is linked with Naked seed, N_1 , of linkage group V which is located on chromosome 12. In view of this, the Leaf fleck mutant was crossed to normal leaf monotelodisomic 12La plants to determine whether the Lf locus is in the long or short arm of the chromosome. Both the monotelodisomic 12La and disomic F_1 sibs were backcrossed as males to normal leaf (1flf) plants. Due to an early season freeze, only small samples of mature testcross were obtained. The results of those crosses are given in Table 3.

Table 3. Segregation ratios of a test of chromosome 12 and the leaf fleck gene Lf

	Lf-	1flf	Total	χ^2	1:1	P
1flf x F_1 monotelodisome 12La	Lflf 36	8	44	17.82		>>.01
1flf x F_1 disome	Lflf 23	18	41	0.61		.3-.5
% recombination between Lf and centromere = $18.2 \pm 5.8\%$.						

The data show that the disomic F_1 segregated in a 1:1 ratio in the testcross as expected, but there was a highly significant departure from a 1:1 ratio in the testcross population involving the monotelodisomic 12La F_1 . This indicates that Lf is indeed located on chromosome 12 and a member of linkage group V. There wasn't any evidence among the 44 testcross progeny that telo 12L was transmitted by the male gametes.

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Plants that are monotelodisomic have one heteromorphic bivalent consisting of a telocentric chromosome and a normal homolog. In the present case, the monotelodisomic 12L means that the heteromorphic bivalent has a telocentric chromosome of the long arm of chromosome 12, i.e., the heterobivalent is disomic for the long arm and monosomic for the short arm.

If the Lf locus is located in the disomic arm of monotelodisomic 12L, then the frequency of lflf progeny would be determined by two factors, the map distance between the centromere and Lf, and the frequency of male transmission of the telocentric chromosome. If the Lf locus is located in the short (monosomic) arm of the monotelodisomic F_1 , then the testcross progeny of the F_1 as female should consist entirely of the leaf fleck phenotype, unless there is some male transmission of the telocentric chromosome, in which case the resulting testcross progeny would be lflf in phenotype. This can be determined by examining the phenotype and cytotype of the lflf progeny.

All of the lflf as well as the Lflf testcross progeny of the monotelodisomic 12La F_1 did not show the typical phenotypic characteristics of monotelodisomic 12L plants. In addition, one lflf plant and one Lflf plant (suspected of having the telocentric chromosome) had 26 normal bivalent chromosome on cytological examination. Thus, there was no evidence that the telocentric chromosome was transmitted through the male in this small population.

The tentative data therefore show that the Lf locus is located in the long arm of chromosome 12 and about 18 map units from the centromere. We had reported in 1979 that the N₁ locus was located in long arm

of chromosome 12 and 11 map units from the centromere. Kohel, Lewis and Christiansen reported that Lf and N₁ were 7 map units apart. Thus, if Lf is 18 map units from the centromere, the linkage relationship of the two genes with the centromere is: centromere 7 N₁ 11 Lf.