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C_{13} GENERATION IN AUTOTETRAPLOID SWEET CLOVER

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ABSTRACT

Cytomorphological studies were carried out in advanced generation (C_{13}) autotetraploid *Melilotus alba* to find out the extent of meiotic stabilization and its correlation with vigour and fertility. In spite of greater degree of meiotic regularization, the seed fertility is still 54% to their diploid progenitors even after 12 years of selection. This leads to the conclusion that some factors other than meiotic anomalies are responsible for poor fertility in autotetraploid sweet clover.

Key words: Tetraploid clover, fertility, meiotic stabilization.

Melilotus alba Desr. (4X = 32), commonly known as sweet clover, is an economically important leguminous crop grown in several parts of India, especially in western U.P. Colchicine induced raw autotetraploids were quite luxuriant than diploid progenitors but less fertile which was the major drawback for their commercial exploitation [1]. Selection for improved fertility and luxuriant growth was carried out for 12 generations. The present paper describes cytomorphological studies in C_{13} generation of *M. alba* to find out the effect of meiotic stabilization on vigour and fertility.

Seeds from C_{12} autotetraploid and diploid *M. alba* were grown under uniform agroclimatic conditions to obtain sizeable progenies for investigations in C_{13} generation. Chromosomal preparations were made as per Raghuvanshi et al. [1]. Cytomorphology was studied from 20 randomly selected plants.

The average chromosomal association per cell in C_1 was 0.310±0.033IV±0 III±15.200±0.347II±0.815±0.155I; and in C_{13} 0.29±0.015IV+0.011±0.004III+15.238 ±0.358II+0.313±0.049I. Pollen fertility in C_1 and C_{13} was 90.7 and 94.8%, respectively. Thus, C_{13} plants had lower frequency of multi- and univalents and higher frequency of bivalents coupled with increase in pollen fertility. Absence of trivalents in C_1, their appearance in later generations and further decrease in advanced generation has also been reported in *M. alba*. The mean chiasma frequency per chromosome in C_1 and C_{13} was 0.77±0.003 and 0.760±0.005, respectively, showing a decrease with the advancement of generation. Reports are available that meiotic regularization is not always associated with increase in chiasma frequency. Several workers attributed it to redistribution of chiasma points or genetical control of chiasma distribution pattern.

Many workers are of the opinion that uni- and trivalents at metaphase I are the main reason for meiotic irregularities because in most autotetraploids quadrivalents disjoin regularly. Hazarica and Rees [2], therefore, used an estimate of the proportion of PMCs without tri- and univalents as an index (disjunction index), from which they predicted the proportion of viable gametes. But our correlation studies showed that occurrence of uni- and trivalents is not correlated with disjunction at AI and pollen viability (correlation coefficients for unequal separation with frequency of univalents 0.226; unequal separation with frequency of trivalents 0.185; normal segregation at AI with disjunction index −0.263; and PMCs carrying unequal separation at AI with pollen fertility −0.111).

Table 1. Morphology and fertility in C_{13} generation of sweet clover

Character	Character mean	t values	Per cent of diploid level (2x=100)
Height of main shoot (cm)	99.00 ± 0.53	−1.890	109.3
Stem girth (cm)	1.76 ± 0.02	0.243	119.4
Number of branches/plant	5.40 ± 0.18	−0.559	104.9
Number of nodes/plant	33.00 ± 0.25	3.922*	118.9
Internodal length (cm)	2.88 ±0.05	1.668	111.3
Number of inflorescences/plant	39.30 ± 0.77	0.455	113.4
Fruit flower ratio	0.61 ± 0.01	2.531*	65.1
Pollen fertility (%)	90.70 ± 1.14	1.232	95.6
Number of seeds/pod	1.91 ± 0.03	−2.719*	57.2
100-seed weight (g)	0.32 ± 0.01	1.601	150.7
Seed yield/plant (g)	4.33 ± 0.19	−3.291*	54.1

* Significant at 5% level.

Though autotetraploids are more vigorous with heavier and bigger seeds but seed yield is only 54% of their diploid progenitors even after 12 years of selection and higher degree of diploidization (Table 1). Reports are available regarding genetical control on fertility, because in some autotetraploids seed fertility is completely normal in spite of higher frequency of multivalents. Many workers are of the opinion that poor fertility in autotetraploids can be mainly attributed to genetic physiological dysbalance of unexplained nature which are yet to be explored.

REFERENCES

1. S. S. Raghuvanshi, S. Mahajan and A. K. Singh, 1980. Meiotic behaviour and fertility of raw and evolved autotetraploid sweet clover (*Melilotus alba*). New Botanist, **7**: 1–5.
2. M. H. Hazarica and H. Rees. 1967. Genotypic control of chromosome behaviour in rye. X. Chromosome pairing and fertility in autotetraploids. Heredity, **22**: 317–332.