All the observations point to the fact that ageing induced by flowering/fruiting causes disorganization of pigment–protein complexes and loss of electron transport capacity in chloroplasts, particularly in leaves close to the region of flowering. In higher crop plants, flowering is not accompanied by ageing but fruit setting marks the onset of ageing. In this respect *B. monosperma* differs from higher crop plants and is an interesting example for studies of ageing in trees under field conditions.

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POLYPLOIDY AND GENE DOSAGE EFFECTS ON PEROXIDASE ACTIVITY IN MULBERRY

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THE effect of increased ploidy in mulberry has been studied only with reference to chromosome affinities, morphological and anatomical comparisons[1,2]. Little information is available on the possible relationship of increased ploidy level and certain bio-chemical parameters[3,4]. A crude enzyme extract when fractionated on a suitable gel medium produces a spectrum of bands which is diagnostic for the species relationship and may also for ploidy differences. The present study deals with the electrophoretic pattern of peroxidase isozymes in mulberry in relation to ploidy level.

S_{30}, S_{36} and S_{41} diploids and their colchicine-induced autotetraploids were utilized for the present study. The peroxidase isozyme separation was carried out with gel electrophoresis apparatus GE-2/4 LS connected with electrophoresis power supply EPS 500/400 of pharmacia fine chemicals, Sweden. The polyacrilamide gel electrophoresis method of Clarke[5] and for peroxidase enzyme staining Scandalios[6] were adopted. For the leaf peroxidase analysis the third to sixth leaf, from the top, youngest leaf expanded were used. Equal amounts of enzyme extract were loaded on the top of each gel. The gels were preserved in 7% acetic acid for photography.

The tetraploids exhibit reduction in length of the shoot, the number of branches per plant, the internodal distance and rooting percentage (table 1). The leaf became slightly larger, thicker, coarser and dark green. Flowering was somewhat delayed and the blooming duration was prolonged in tetraploids. The inflorescences of tetraploids were larger in size and lax with more flowers in comparison to diploids. Among the auto-tetraploids, S_{30} (116.50 cm) showed decreased height in comparison with S_{36} (121.77 cm) and S_{41} (125.70 cm).

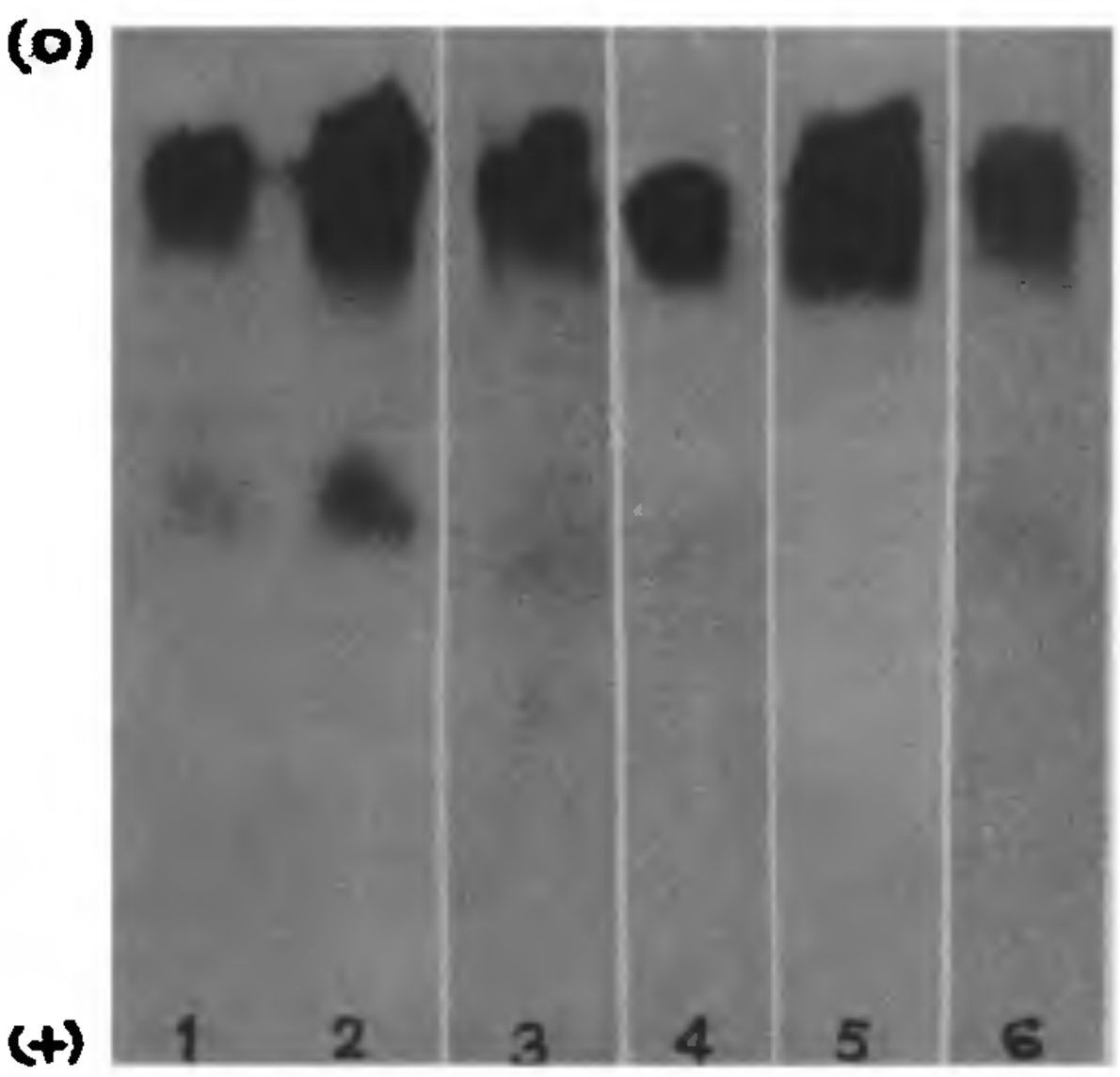
The allozymes of diploids and tetraploids of mulberry did not show much differentiation in banding pattern. Among the diploids studied, S_{30} and S_{36} showed one thick and one light band whereas S_{41} showed only one thick big band (figures 1 and 3). Three autotetraploids showed 2 bands, viz. one dark and one light band (figures 2, 4, 6). Among the autotetraploids in S_{36} and S_{41}, the intensity of the first band was less than that of the parent diploids whereas in S_{30} autotetraploid the first band intensity was more than that of its parent diploid (figures 1–6). In S_{41} (4×) a new faint band appeared which was not present in the parent diploid (figures 3 and 6). The R_f values of diploids and tetraploids also differed significantly (table 1).

These observations with three diploids and their auto-tetraploids suggest that the increase in ploidy may not bring any significant numerical changes in the spectrum of bands and in their intensity which may be helpful in identifying the ploidy differences.

Bhatia[7] reported an increase in the number of esterase-1 and alcoholdehydrogenase (ADH) iso-

Table 1 *Morphological and biochemical parameters in diploid and tetraploid mulberry genotypes*

Taxon	Ploidy level	Plant height (cm)	No. of primary branches	Internodal distance (cm)	Rooting (%)	Leaf size (cm^2)	No. of bands	R_f values
S_{30}	2×	167.75	6	3.19	76	185.25	2	0.118
	4×	116.50	4	2.73	46	215.65	2	0.094, 0.376
S_{36}	2×	169.95	6	3.95	78	190.75	2	0.129, 0.412
	4×	121.77	4	2.95	36	222.78	2	0.129, 0.435
S_{41}	2×	161.33	5	3.60	78	179.21	1	0.129
	4×	125.70	3	3.09	68	209.35	2	0.118, 0.424



Figures 1–6. Peroxidase isozyme banding patterns. **1.** S_{30}(2×); **2.** S_{30}(4×); **3.** S_{36}(2×); **4.** S_{36}(4×); **5.** S_{41}(2×), and **6.** S_{41}(4×).

zyme bands of tetraploid compared to the diploid wheat. Johnson *et al*[8] observed that tetraploid and hexaploid wheat differed by three additional bands which were attributed to the 'D' genome. Singh and Brewer[9] did not observe any increase in the isoenzyme bands between diploid and polyploids of wheat. Mitra *et al*[10] also reported that the induced tetraploid of *H. vulgare* did not differ qualitatively from its diploid.

Analysis of enzyme heterogeneity at diploid and tetraploid levels suggests that the banding pattern is dissimilar in the three diploid cultivars studied (figures 1, 3 and 5). Peroxidase isozymes are known to differ in different varieties because the genes responsible for the presence of enzymes have different allele(s) in different varieties.

The specific banding pattern and the decreased intensity with ploidy increase, suggest that among the biochemical parameters, electrophoretic characterization of peroxidase isozymes may be used as an additional parameter to supplement the cytogenetic data in understanding the ploidy differences. Genetic tests are required to gain further insight into the problem.

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