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Multi-stranded Chromosomes in the Differentiated Tissue of *Hordeum vulgare*

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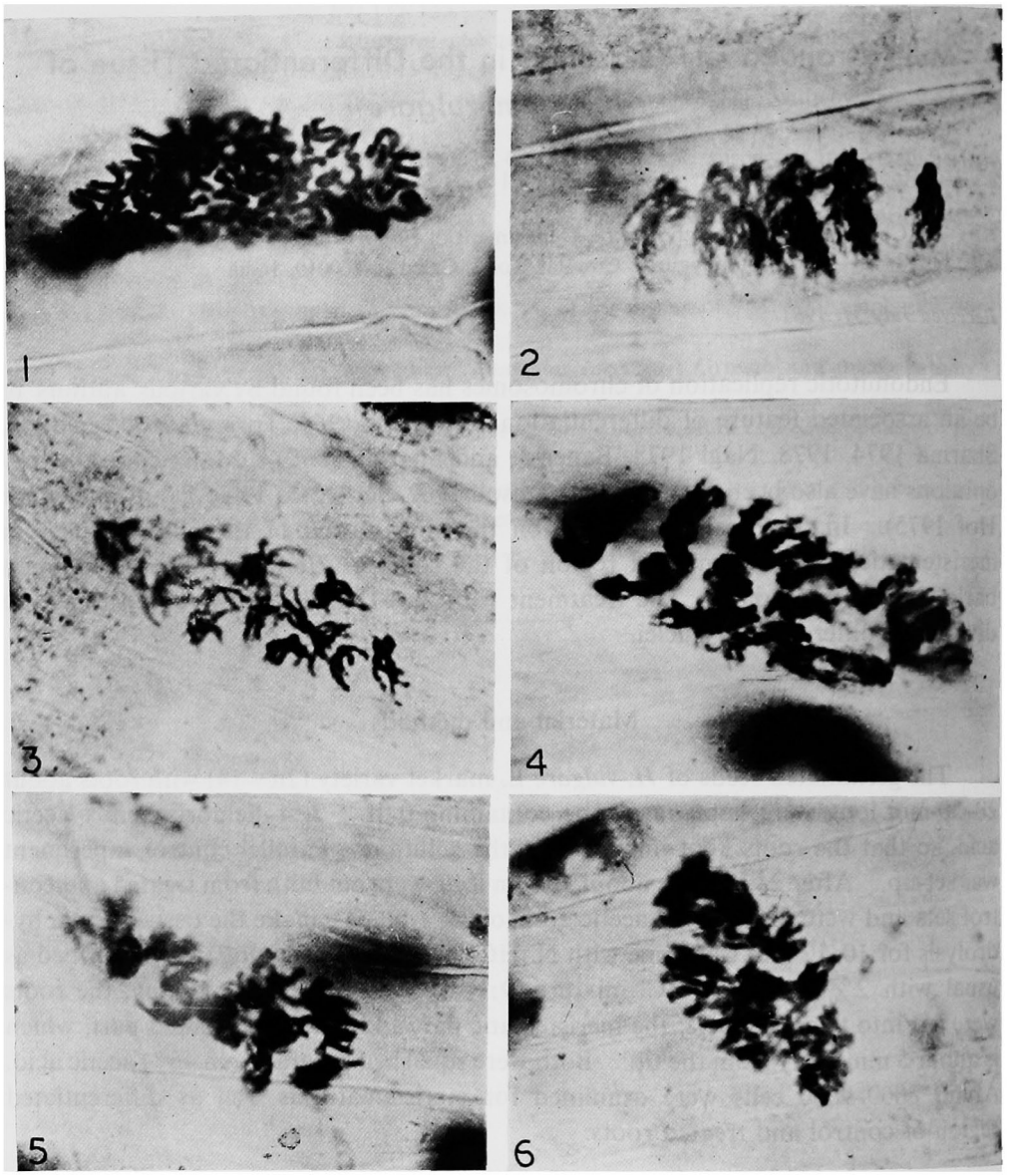
Endomitotic replication of chromosomes has been found by various authors to be an associated feature of differentiation (D'Amato 1964, Torrey 1965, Sen 1974, Sharma 1974, 1978, Nagl 1978, Banerjee and Sharma 1979). Many contradictory opinions have also been expressed (Adamson 1962, Settlefield 1963, Evans and Van't Hof 1975). In the present investigation the constitution of the chromosomes in meristematic and differentiated region of the roots of *Hordeum vulgare*, common barley has been studied. The treatment with 2, 4-D had to be adopted to secure division in differentiated nuclei.

Material and methods

The germinated seeds of *H. vulgare* L. market variety ($2n=14$) with roots about 20–30 mm long were kept on a tube containing 0.01% 2, 4-dichlorophenoxyacetic acid, so that the roots kept immersed in the solution. Parallel control experiment was set-up. After 24 h, roots about 10 mm long were cut both from treated and control sets and were fixed in 1:2 acetic ethanol for 1 h. To make the tissue soften, hydrolysis for 10–12 min was done with N. HCl at 60°C and staining was performed as usual with 2% orcein N. HCl mixture (9:1) for 1 h. Before squashing, the roots were cut into two parts, viz. the meristematic part and the differentiated part, which is about 5 mm away from the tip. Both were squashed separately in 45% acetic acid. About 8000–9000 cells were examined for meristematic as well as differentiated region of control and treated roots.

Results and discussion

Meristematic region of the treated roots showed only diploid division and differentiated region was marked by the presence of both diploid and polyploid nuclei in all mitotic stages (Fig. 1). Control roots on the other hand lacked division in the differentiated region due to non-application of 2, 4-D but showed fairly high percentage of giant, endopolyploid nuclei. In the polyploid cells of the treated roots, in addition, multi-stranded chromosomes were recorded (Figs. 2–6). These cells display chromosomes forming groups of very closely apressed chromatids (Hervas 1975). The high frequency of polyploidy (14.70) in treated and that of giant endopolyploid nuclei in control (11.24) as well as in treated roots (2.74) in the differentiated region (vide Table) indicates a clear tendency of the adult cells to



Figs. 1–6. 1, polyploid metaphase. ×2300. 2–6, cells showing multi-stranded chromosomes. ×2350.

Table 1. Polyploid and giant nuclei (Data are Mean±S. E.)

Treatment	Tissue	MI	Polyploid nuclei	Giant nuclei
Control	t_1	3.56±0.04	—	—
	t_2	No division	—	11.24—0.19
Treated	t_1	3.38±0.19	—	—
	t_2	3.97±0.03	14.70±0.29	2.74±0.48

t_1=Meristematic region; t_2=Differentiated region.

undergo endomitotic replication. The presence of multi-stranded chromosomes representing endoreduplication further substantiates the endomitotic mode of replication of the chromosomes of adult differentiated cells.

The occurrence of multi-stranded chromosomes may suggest that the endoreduplicated strands do not separate following induction of division. The strands may, instead, first separate in halves, equal or unequal, with each half containing several replicated strands. Possibly with further refinements in the procedure for induction all the strands may be made to separate, indicating clearly the degree of replication. It would be worth-while to find out the extent to which the other organs of *H. vulgare* resort to endomitotic replication.

Summary

In the differentiated tissue of root cells of *Hordeum vulgare* 2, 4-d induces division. Multi-stranded nature of the chromosomes has been recorded in this zone. The endomitotic replication of chromsomes seems to play an important role in cell differentiation in *H. vulgare*.

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