

CHROMOSOME CHANGES IN ALLIUM CEPA AND VICIA FABA PLANTS

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Abstract

Attempts were made to produce polyploid forms in broad bean (*Vicia faba*) with colchicine, and in onion (*Allium cepa*) with colchicine and ethyl methanesulphonate.

The results indicated that a 1-hour colchicine treatment stimulated the course of the division cycle in the root meristem cells of *Allium cepa*, while the same treatment led to tetraploidy in the root meristem cells of *Vicia faba*.

On the action of colchicine the chromosome number is doubled in 50% of the plants treated. Phenotype aberrations were observed on the application of colchicine to *Sorghum* seedlings (BERAHO and OLEMBO, 1971). A colchicine emulsion affected the mitotic cycle, and caused autotetraploidy and giant growth (DHILLON, 1970; MACLEOD, 1971; 1972). Ethyl methanesulfonate and colchicine gave rise to polyploidy in pea (DUDITS, 1971). Attempts were made in our experiments to produce polyploid forms with colchicine in broad-bean (*Vicia faba*) plants, and with colchicine and ethyl methanesulfonate in onion (*Allium cepa*).

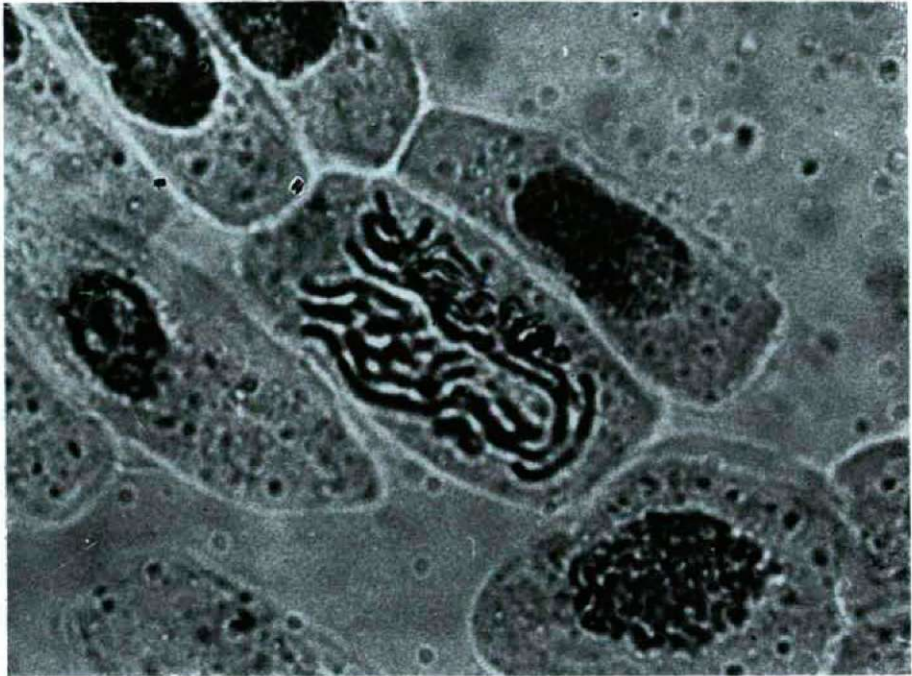
Materials and Methods

Pre-swollen and germinating seeds of *Vicia faba* and *Allium cepa* were treated for 1 and 10 hours with a colchicine solution containing 1 or 5 mg per 100 ml deionized water. In the case of the onion seeds 0.1 and 1% ethyl methanesulfonate solutions were also used. The treated seeds and seedlings were kept in a 23 °C thermostat. In another series of experiments both plants were pre-treated with a 1 mg/1000 ml kinetin solution. Colchicine-treated broad-bean plants were grown to seed-bearing in the field. Under semi-conditioned circumstances in a light-thermostat (HORVÁTH and LASZTITY, 1965), the incipient flowers of broad-bean were treated with colchicine to supplement the seed-treatment. The experiments were repeated 3—4 times, and on every occasion the chromosomes were examined with carmine-acetic acid staining on fresh preparations.

Results and discussion

In both concentrations applied the 1-hour colchicine treatment gave rise to polyploidy in broad-bean (*Vicia faba*) seeds. This is presented in the following photograph.

As regards the colchicine concentration and the age of the seedlings, no limits could be distinguished for the appearance of the polyploid cells. The effect of colchicine was manifested even when polyploidy had not yet appeared. The mitotic

Tetraploid root meristem cell of *Vicia faba*

cycle was retarded, as shown by the relatively large number of cells to be found in the prophase as compared with the control. Study of the mitotic phases did not lead to a result (see Table). After 1-hour colchicine treatment at a similar concentration in onion (*Allium cepa*), the percentage mitosis increased in comparison to the control, the mitosis of the root-tip meristem cells being stimulated. Every division

Study of cell division on samples taken from the division zone of rootlets of colchicine-treated *Allium cepa* and *Vicia faba*

Variants	Colchicine concn. mg/100 ml	Treatment time min	No. of cells	No. of dividing cells	% Division	Phase distribution of dividing cells			
						Pro-phase	Meta-phase	Ana-phase	Telo-phase
4-day <i>Allium cepa</i>	1	60	365	153	49.86	132	9	9	3
	5	60	337	149	45.73	141	6	2	0
	control	—	507	138	35.25	116	17	5	0
4-day <i>Vicia faba</i>	1	60	515	84	18.00	49	9	12	15
	5	60	297	77	27.70	49	15	6	6
	control	—	467	145	31.50	53	23	27	37

phase occurred in greater number than in the control. In onion the colchicine treatment stimulated the course of the entire mitotic cycle. The effect depends not only on the concentration of the colchicine and the duration of the treatment, but also to a large extent on the species and age of the seedling (Table).

In onion, polyploid cells were observed after the 10-hour colchicine treatment, but not in the case of ethyl methanesulfonate treatment.

When colchicine-treated broad-bean seeds were grown to seed-bearing, the tetraploidy did not remain. Treatment of the incipient flowers was effective.

References

- BERAHO, E. K.—OLEMBO, R. J. (1971): Albino and nonpolyploid mutants induced by colchicine in *Sorghum*. — *J. Hered.* 60, 376—379.
- DHILLON, T. S. (1970): Cytogenetics of colchicine induced autotetraploides. — *Jap. J. Genet.*, Tokyo 54, 305—312.
- DUDITS, D. (1971): Mutation genetics and breeding studies on pea. — (C. Sc. thesis) (in Hungarian).
- HORVÁTH, M.—LASZTITY, D. (1965): The quantitative changes of pigments in intact and detached barley leaves. — *Bot. Közl.* 52, 79—82.
- MACLEOD, R. D. (1971): The response of apical meristems of primary roots of *Vicia faba* L. to colchicine treatments. — *Chromosoma* 35, 217—232.
- MACLEOD, R. D. (1972): Cell progression through the mitotic cycle in lateral root apical meristems of *Vicia faba* L. following colchicine treatment. — *Caryologia* 50, 83—94.

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