ARTIFICIAL POLYPLOIDS OF THE PEA

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The plant materials used for po1yploidization were genetic lines derived from hybrids obtained through crossing of local populations of Polish and Russian pea. After treating seeds and plants in different stages of development with various C-mitotic agents (both physical and chemical) it became evident that the only effective combinations involved treating germinating seeds with water solutions of colchicine 0.005% x 12h and 0.05% x 2 4h (1).

The obtained autotetraploids of pea (4x=28) were characterized by changes in whole plant anatomy, morphology, and development in comparison with the diploidal initial line (2x=14). For example:

(1) Polyploids showed gigantism, manifesting as enlarged leaves, stomates, flowers, and pollen grains, thick stems, increased 1OOO-seed weight, and seed protein content. These plants also had more intensive pigmentation of green parts and flowers as well as a tendency toward prolonged vegetative and reproductive development (especially evident in years of great rainfall).

(2) Polyploid plants in comparison with diploid plants had fewer stomates, a tendency toward bushy growth, fewer pods on branches, and fewer two-podded nodes, as well as fewer seeds per plant and seeds per pod. Polyploids, in spite of their luxuriant growth during the vegetative period, were clearly inferior to the diploid initial form during the reproductive phase.

A considerable reduction of fertility of autotetrap1oid plants prompted us to search for the cause oi this phenomenon. There were no significant differences between 2x and 4x plants in the number of ovules per pod (2x=6.6-7.4; 4x=6.5-7.3). Examination of mitosis revealed certain disorders (chromosomes beyond the equatorial plate in metaphase, chromosome bridges and lagging chromosomes in anaphase), hut these disorders were relatively rare (2.07% cells with disorders out of 5800 dividing cells examined). A greater number of irregular configurations was observed during the meiotic division, analyzed during microsporogenosis. Polyvalents, multivalent chromosome associations, chromosome bridges, metaphase II with an unequal number of chromosomes in the equatorial plates, chromosomes remaining outside the daughter nuclei, tetrads with micronuclel, and polyades appeared in 11.4% of the ceils in a total of 4696 analyzed. Thus, the number of irregularities observed during meiosis was comparatively small. Pollen viability was also rather high and pollen grain stainability, using the Belling agent, revealed only a slight reduction in vitality of the tetraploid lines (87.9%-94.6%) as compared with the initial diploid line (98.4%). Therefore we may have to look to megasporogenesis or to abnormalities in the zygotic phase or the emhryo-forming stage for the reasons for low fertility in the autotetrap1oids.

The low percentage of irregularities observed in mitosis and meiosis was the reason for the high stability of the mutant karyotype. In several succeeding pedigreed generations no plants were found with an unbalanced chromosome set; aLl plants examined were euploids of 4x=28 chromosomes.

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