INDUCTION OF CHROMOSOME DUPLICATIONS IN PEAS

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There is general agreement among geneticists that chromosome duplications may provide an important source of new genetic material. For this reason, the production of duplications is considered as a plant breeding technique. Hagberg (Hereditas 48:243-246, 1962) used translocation lines to induce duplications in barley. In our experiments we obtained pea lines with duplicated chromosome segments by using lines with dicentric chromosomes.

After pollen irradiation of the fodder pea 'Parvus', some variegated mutants were obtained in M1 which in M2 segregated different phenotypes. Only after cytological characterization of the variegated mutants was this abnormal segregation explained on the basis of the behavior of some unstable chromosomes which were present in this material. Variegated phenotype is characterized by leaves with irregular margins and with small light-green spots and variable thickness of the veins; lighter areas are due to lack of palisade tissue and of chloroplasts.

Cytological analysis of such variegated mutants has shown a mixochimeric structure due to the presence of dicentric chromosomes which can go through "breakage-fusion-bridge" cycles. Dicentric chromosomes found in pea mutants were demonstrated to be persistent and transmissible also through male gametes. At meiosis the dicentric chromosomes gave rise to associations with their homologues. From the disjunction of such associations normal gametes, aneuploid gametes, or gamates with dicentrics can be formed; by breakage of dicentric chromosomes in anaphase I and II deleted or duplicated chromosomes can also be produced.

On the basis of such findings and considerations, the progenies descending from four M^ variegated mutants (2n=12+l dic.+l telo.) isolated after X-irradiation of pollen of the canning variety 'Sprinter', were examined with particular care. Three different phenotypes were found in M, corresponding to three different genomes: normal phenotype with 14 chromosomes, variegated phenotype with dicentric chromosomes, and abnormal types which were found to be aneuploids (partial trisomies).

The progenies of the normal plants were carried into succeeding generations, with the same selection procedure as the mutant plants. In M6 two lines descending from such material showed good yield and better processed quality than the mother line. Two longer chromosomes were found at the mitotic metaphase in both lines. No translocations were found in the meiotic analysis of F1 plants obtained after crossing the two lines with the mother variety. The pollen and the pod fertility in F1 was normal (Table 1), so it was concluded that the longer chromosomes had some duplicated segments.

The two lines with chromosome duplication will be analyzed for different parameters, mainly disease resistance and chemical characters of the seeds, in order to check any possible effect of these chromosome rearrangements in the Sprinter background and also, by crossing, in other genetic backgrounds.

Table 1. Cytological analysis, pollen fertility, and seed setting in two mutant pea lines and in their crosses with cv. Sprinter

Material	Chromosome number at mitotic metaphase 2n=	Bivalents at meiotic metaphase 1	Pollen fertility %	Ovules per pod no.	Seeds per pod no.
Lines					
Sprinter	14	7	99	5.0	3.1
7631	12 + 2 with duplic.	7	98	6.2	4.6
76124	12 + 2 with duplic.	7	99	6.2	5.0
F_1					
Sprinter x 7631	13 + 1 with duplic.	7	95	6.0	4.1
7631 x Sprinter	13 + 1 with duplic.	7	80	6.6	4.0
Sprinter x 76124	13 + 1 with duplic.	7	96	6.2	3.8

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