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CHLOROPHYLL AND MORPHOLOGICAL CHANGES INDUCED BY GAMMA RAYS IN COMMON BEAN (*Phaseolus vulgaris* L.) 1/

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1. INTRODUCTION

Mutation induction has made possible the artificial generation of genetic variability in many plant species. The mutant types created have been used in breeding programs and/or in basic genetic research. BARBOSA *et alii (4)* has recently emphasized the importance of such studies in common beans (*Phaseolus vulgaris* L.) in view of the relatively low number of genetic markers known in this species.

A mutation induction program in beans was started in our laboratory using the high-yielding Milionário 1732 (BAT 65) as the parent variety. Following seed treatment with ethyl-methanesulfonate (EMS), mutants have been induced which affect several plant characteristics (*3, 4*). We now report on the induction of chlorophyll mutants and morphological changes by gamma rays in the same variety.

2. MATERIAL AND METHODS

Dry seeds (ca. 13% moisture) of cv. Milionário 1732 (BAT 65) were obtained from Empresa de Pesquisa Agropecuária de Minas Gerais. Individual 300-seed lots were exposed to 6, 12, 18, 24, and 30 krads of gamma rays from a ^{60}Co source at the Centro de Energia Nuclear na Agricultura, Piracicaba, SP. The dose rate was 3.5 krad/min. An additional 300-seed lot was the control.

Seeds were planted in the field at Viçosa, MG, four days after treatment according to a randomized complete block design with six replications. Each plot was two rows 5m long and 0.6m apart. In the row seeds were spaced 0.20m apart.

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morphological changes, some of which, related to the umber of leaflets, of the same types reported here. When the treatment was discontinued, the plants recovered normal growth. The leaf shape abnormalities reported by Hofmann were transmitted through the female parent only and persisted for six generations. However, while Hofmann found deformed leaves in plants grown from treated seeds, the changes reported here were not found in the M_1 generation (*19*). Likewise, morphological changes similar to the ones described here have been found only in the M_2 generation following treatment of bean seeds with X-rays (*7*) or EMS (*4*). This response of bean seeds to ionizing radiation or EMS is different from that found in many other species in which morphological abnormalities are found in M_1 plants grown from treated seeds. Such examples are found in maize (*18*), wheat (*5*), tomato (*8*), coffee (*11*), cacao (*17*), cowpea (*1*), etc. Induced changes that are detected only in M_2, but not in M_1, have usually ben interpreted as resulting from recessive mutations. If many or most of the morphological deviates reported here are of cytoplasmic origin, as they appear to be, why are they not observed in the M_1 generation? Although the answer is unknown, it may be hypothesized that some preformed substance(s) is (are) available in the bean seed so as to enable the plant to maintain morphologically normal growth. Whatever the nature of these induced changes may be, they are of significance in mutation induction experiments and should not be confounded with heritable chromosomal changes.

4. SUMMARY

Dormant seeds (water content ca. 13%) of common bean (*Phaseolus vulgaris* L.) were exposed to O (control), 6, 12, 18, 24, and 30 krads of gamma rays from a 60_{Co} source. Chlorophyll mutants were detected in highest frequency in the M_2 generation derived from seeds treated with 18 or 24 krads depending on the estimation method. Many different morphological deviates were found. Their frequency was highest for the 6-krad treatment and decreased with increased radiation dose. It is proposed that most of the morphological anomalies found were caused by injurious effects of the mutagem on cytoplasmic material.

5. RESUMO

(MODIFICAÇÕES CLOROFILIANAS E MORFOLÓGICAS INDUZIDAS POR RADIAÇÃO GAMA EM FEIJOEIRO-COMUM (*Phaseolus vulgaris* L.))

Sementes de feijão (*Phaseolus vulgaris* L.) foram tratadas com O (controle), 6, 12, 18, 24 e 30 krads de raios gama. A maior freqüência de mutantes clorofilianos foi encontrada na geração M_2 proveniente de sementes tratadas com 18 ou 24 krads, dependendo do método de estimação. Foram detectadas em M_2, mas não em M_1, muitas anormalidades morfológicas, cuja freqüência reduziu com o aumento da dose de radiação a partir de 6 krads. Propõe-se que a maioria das anomalias morfológicas encontradas seja resultante de efeitos deletérios da radiação em material citoplasmático.

6. LITERATURE CITED

1. ALBERTONI, M.R.; ARAUJO, J.P.P. de & WATT, E.E. Indução de mutação em caupi visando resistência ao vírus do mosaico-severo e cor das sementes. *Pesq. Agrop. Bras. 22:613-620.* 1987.