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Investigations on Radiosensitivity of Some Grape Varieties

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Abstract: The responses of 10 buds taken from single cuttings to gamma-ray irradiation and the survival rates of each variety were investigated. To determine the radiosensitivities of these buds, materials grown to single bud cane phase in automatically controlled greenhouses and then planted in groups and vegetative growing parameters were investigated on vines. Gamma-ray affected vegetative growth parameters in different ways and the radiosensitivies of buds on the same cane were different. Also, according to the survival rate, the following order in the radiation resistance given to gamma-rays irradiation (3.8 krad) can be set up: Mevlana (the most sensitive), Pembe gemre and Misket (the most resistant).

Key words: Grape, radiosensitivity, gamma-rays, buds, mutation.

Introduction

The Geographic distribution of grapes growing is as follows; Europe, 5.686.000 hectare (68.7%); Asia, 1.385.000 hectare (16.7%); America, 793.000 hectare (9.6%); Africa, 347.000 hectare (4.2%); Australia and New Zeland, 70.000 hectare (0.80%); Turkey 570.000 hectare (6.4%).

Grapes, *Vitis vinifera* L. and other genera of the family *Vitaceae*, are widely distributed in the tropics and suptropics with ranges extending into the temperate regions (Einset and Pratt, 1975).

Grapevines may be propagated from seeds, cuttings, layers, or grafts. Normally new vines grown from seeds differ markedly from the parent vine and from each other. However, propagation, by cuttings, layers, buds, or grafts, in contrast, produce vines identical with the parents in all varietal characteristics (Gulcan and Ilter, 1975). Spontaneous somatic mutation has played a considerable role in improvement of vegetatively propagated plants and many of the varieties under cultivation are of this origin, therefore the rate of spontaneous mutation is too low to be efficient means (Donini, 1993).

Mutant has improved cultivar with wide application. In grapevine several mutants, are now growing in preference to the original cultivar. There is great clonal variability among grapevine varieties and this is widely used by plant breeders to develop new varieties (Botta and Me, 1989; Alleweldt *et al.*, 1990; Çoban, 1998). However, chemical and physical mutagenens were also used to increase the variability (Rathjen and Robinson, 1992). To determine the radiosensitivity of grapevine species, cultivars and clones are essential for assessing repair, recovery capacity of the vine from radiation injuries, to measure the influencing factors of these and the radioprotective agents (Milosavljeviç and Mijajiloviç, 1965; Da Silva and Doazon, 1995). For the radiosensitivity determination the dose-effects in relation to the survival, seedling and plant heights, root and shoot growth are measured most commonly (Shin *et al.*, 1998; Hajdu *et al.*, 1994; Körösi *et al.*, 1995).

In order to evaluate gamma–ray (^{60}Co) irradiation as a possible aid to increase the clonal variability, varietal responses to gamma-ray irradiation and bud responses of each variety were studied.

The aim of present study is to determine the behaviour of Mevlana, Misket and Pembe gemre verieties against radiation.

Materials and Methods

The study has been carried out using three widely grown grapevine varieties Mevlana, Misket and Pembe gemre between the years of 1998-2001.

For the irradiation study 10-bud cuttings were collected in the autumn of 1998 at Viticultural Research Institute of Manisa. The cuttings were put in polythene bags in hundreds and stored. Gamma-rays irradiation was performed at the Atomic Energy Agency of Turkey, Gamma-ray Laboratory. According to our preliminary studies, 3.8 Krad proved to be the effective dose to evaluate the response of radiations (Çoban, 1998). The 3.8 Krad was applied to 10-bud cutting (380 rad/minutes) (Hajdu *et al.*, 1995).

Plant materials were irradiated at M_0 stage, an efficient propagation system for M_1V_1 and M_1V_2 (Donini, 1975). The M_1V_1 shoots (100 in each variety) were cut back at the end of season at two basal buds, while the other buds, from the third to tenth node, were individually propagated. In the M_1V_2 a number of morphological mutations affect the leaf area, shoot number, root weight, root lenght, shoot weight and shoot length (Donini, 1993). In this research for isolation Donini (1975) methods were used.

In this regard, to determine the radiosensitivities of these buds, materials grown to one bud cane phase in automatically controlled greenhouses were planted in groups and vegetative growing parameters were investigated on vines.

Results and Discussion

Gamma-rays in different doses affected the vegetative growth parameters in different ways. Rates of surviving plants reduced when dose rate increased. Radiosensitivies of buds on the same cane were different. These results are in conformity with those of Hadju *et al.* (1995) and Çoban (1998).

When comparing the survival rate for the controls that characterize the natural background of viability of the varieties, the following increasing order can be established: Mevlana (> 45%), Pembe gemre (> 60%) and Misket (> 73%) (Fig. 1).

It can be concluded that the Mevlana was the least able and the Misket was most capable of developing root and shoot systems. It was apparent that the survival rate under the influence of gamma-ray irradiation differs from the pattern observed for non-irradiated buds. An absolute survival rate (the actual survival) and

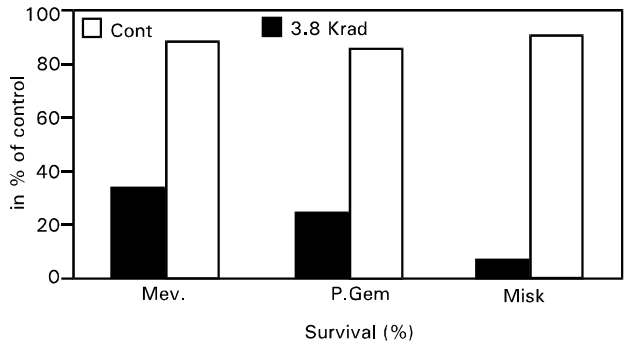

Fig. 1: Survival rate of the irradiated varieties (clones).

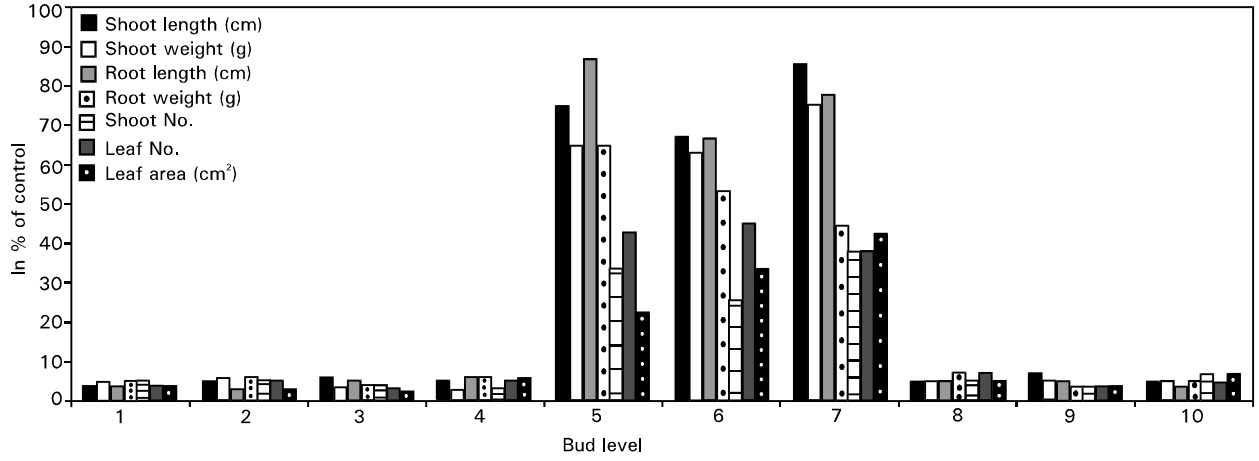

Fig. 2: Radiation resistance of Misket in relation to bud positions.

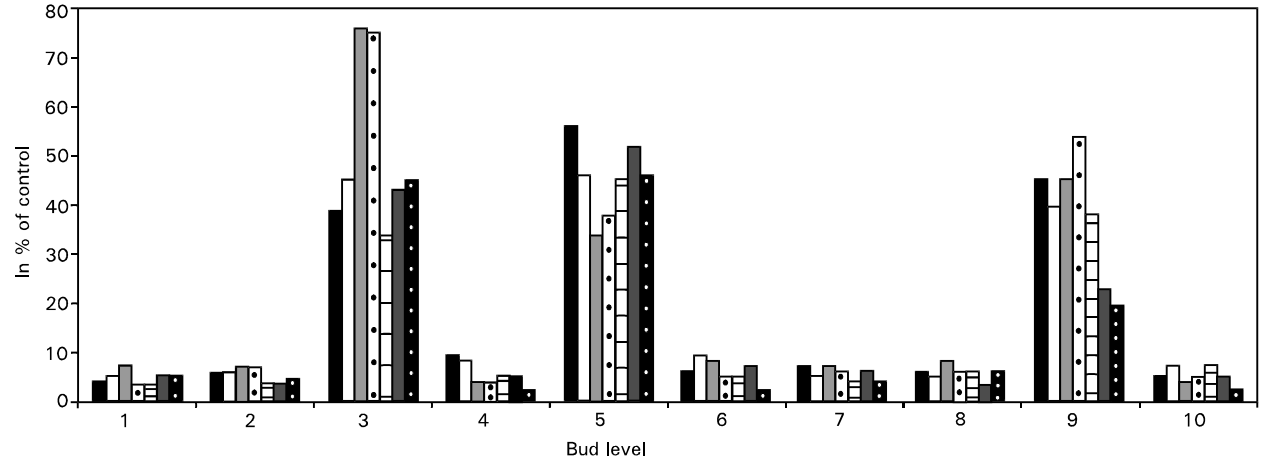

Fig. 3: Radiation resistance of Pembe gemre in relation to bud positions.

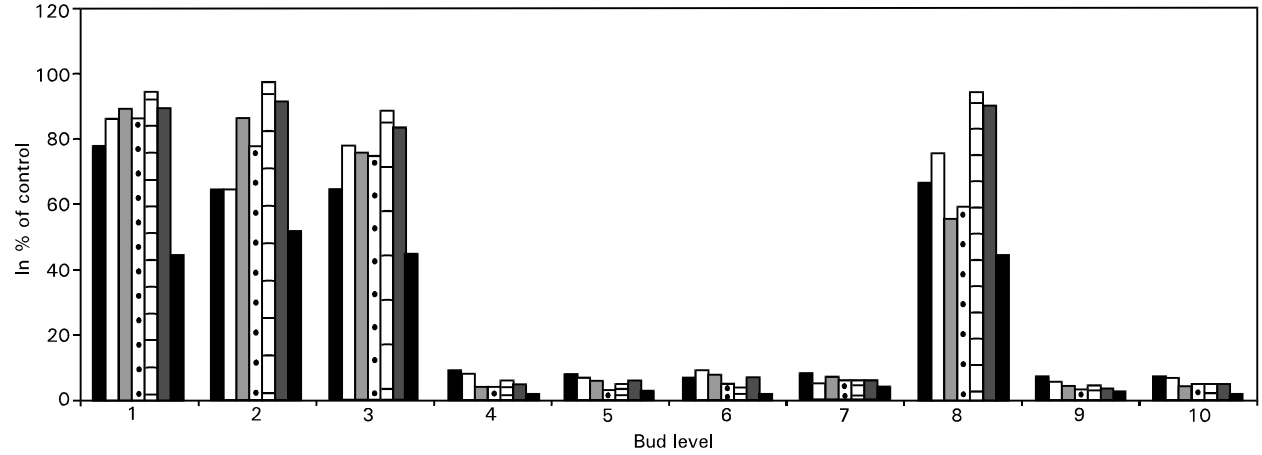

Fig. 4: Radiation resistance of Mevlana in relation to bud positions.

a relative (in % of control) was established. Regarding both the absolute and relative values the following incresing order in the radiation resistance can be set up: Mevlana, Pembe gemre and Misket. The range for absolute values amounts to as much as 4.8 to 49.4%, while the range for the relative values was 6.1 to 62.8%.

For the Misket, the buds of the central region of the cuttings, 4th, 5 th, 6 th, 7 th, and 9 th buds, as well as the 10 th, were particularly susceptible to 3.8 Krad irradiation (Fig. 2).

For the Pembe gemre, the basipetal 1st to 4th buds, as well as 8th, 9th and 10th buds were unable to survive the exposure of 3.8 Krad dose of gamma-ray irradiation (Fig. 3).

The 1st, 2nd, 4th, 6th, 7th, 8th and 10th bud positions of the Mevlana varieties were killed as a consequence of the 3.8 Krad dose of irradiation (Fig. 4).

According to the survival rate, the following order in the radiation resistance be set up: Mevlana (the most sensitive), Pembe gemre and Misket (the most resistance).

Basipetal buds appeared to be more sensitive to 3.8 Krad gamma-ray irradiation than the others. The exception was Misket, with over central bud levels (4-10). In addition, when the data were evaluated globally, it was resulted that the dose 3.8 Krad gamma-ray is suited in the Aegean region conditions for the breeding of mutation in three grapevine varieties.

The obtained results can be used for radiomutational work, for nuclear biotechnology as well as regions affected by isotope fallout.

References

Alleweldt, G., P. Spiegel-Roy and B. Reisch, 1990. Grapes (Vitis). Acta-Horticulture, In:Genetic,. resources of temperate fruit and nut crops. Eds. by J.N. Moore and J.R. Ballington, 290: 289-327

Botta, R. and G. Me, 1989. Induced seedlessness in *Vitis vinifera* L. cv. Queen of the Vineyard. Riv. Vitic. Enol., 42: 9-15

Çoban, H., 1998. Investigations on the variations caused by gamma-rays, originating from ^{60}Co, treated to Round seedless grape variety in different doses. Ege Üni. Fen Bilimleri Ens. (Ph.D. Thesis), Bornova-Izmir.

Da Silva, A.L. and A.P. Doazon, 1995. Gamma-ray mutagenesis of grapevine rootstock cultivated in vitro. J. Int. Des. Sci. de la Vigne. Et. Du. Vin., 29: 1-9.

Donini, B., 1975. Induction and isolation of somatic mutations in vegetatively propagated plants, II. Research Coordination Meeting on the Improvoment of Vegetatively Propagated Plants Through Induced Mutations, IAEA, Vienna, pp: 35-51.

Donini, B., 1993. Mutation breeding programmes for the genetic improvement of vegetatively propagated plants in Italy, IAEA-SM-311/152, 247-248

Einset, J. and C. Pratt, 1975. Grapes, In Advences in Fruit Breeding, Janick, J. and Moore, N. (Eds.), Purdue University, Press, West Lafayette, Indiana.

Gulcan, R. and E. Ilter, 1975. Bağcılık Islah Metotları, Atatürk Bahçe Kültürleri Merkezi Araþtırma Enstitüsü, Yalova, s 4-5.

Hajdu, E., F. Körösi and S.E. Jezierska, 1994. Radiosensitivity of grapevine varieties (in Hungarian). Symp. Pl. Breed. Hungarian Acad. Sci., January 11-12, on Budapest, pp: 45.

Hajdu, E., F. Körösi and S. E. Jezierska, 1995. Studies on varietal vine selection. Int. Symp. on Clonal Selection, Yalta (Ukraine), pp: 1-10.

Körösi, F., E. Hajdu and S.E. Jezierska, 1995. Emperical modeling of radiosensitivity of some grape clone to X-ray irradiation. I. Int. Symp. on Agric. and Bio-Industries, Brussels (Belgium), pp: 1-8.

Milosavljeviç, M. and R. Mijajiloviç, 1965. Investigations on the radiation sensitivity of grape buds. Vitis, 5: 88-93

Rathjen, A.H. and P.S. Robinson, 1992. Characterisation of a variegated grapevine mutant showing reduced polyphenol oxidase activity. Australian. J. Pl. Physiologie, 19: 43-54

Shin, Y.U., W.C. Kim, J.Y. Moon and K.H. Chung, 1998. Induction of compact mutants in pears (*Pyrus pyrifolia* Nakai) by gamma irradiation. Horticulture, 30: 73-78.