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CYTOLOGICAL EFFECTS OF DIFFERENT MUTAGENS IN BARLEY

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Cytological effects due to gamma rays, EMS and their combined treatments were analysed in two barley varieties viz. K-168 and SMV-2. The gamma rays induced more aberrations than EMS and combined treatments produced even higher aberrations. The variety SMV-2 was found to be more sensitive to the mutagens than K-168.

Keywords: Barley; Cytological characters; Mutagens.

Introduction

The role of induced mutation in developing new cultivars has now been well recognised. The degree of cytological aberrations either in mitosis or meiosis is considered as one of the criteria for estimating the potency of mutagen. The present paper deals with the effect of gamma rays, EMS, and their combinations on various cytological parameters in M 1 generation in two diploid barley varieties.

Materials and Methods

Seeds of two barley varieties viz K-168 and SMV-2 were subjected to 10kR, 20kR and 30kR of gamms rays; 0.5%-EMS for 6h, 8h and 10h; combined treatments of gamma rays and 0.5% EMS (10kR+10h; 20kR+8h; 30kR+6h). One hundred seeds were used for each treatment. For meiotic studies spikes of ten randomly selected plants were fixed in Carnoy's fluid. Standard staining and squashing techniques weere followed. Data on various cytological characters were recorded at appropriate stages.

Results and Discussion

Data on the chromosomal associations suggest that irrespective of the type of mutagen, the frequency of quadrivalents, rod bivalents, univalents, laggards, fragments and micronuclei were increased, while the frequency of ring bivalents and chiasmata was decreased (Table 1). A linear relationship between dose and duration of mutagens and the frequency of various cytological aberrations including translocations were reported earlier in several crops like wheat and triticale[1,2]. Gamma rays caused more aberrations compared to EMS, either in individual treatments or in combined treatments, supporting the view that, gamma rays either alone or in combination produced more chromosomal rearrangements.

Increase in the frequency of quadrivalents was noticed with increase in dose and duration of mutagen, indicating an increase in structural alterations, leading to rearrangements of chromosomes. The translocations and inversions may be involved in this process. According to Coldecott *et al.*[3] the frequency of translocations were dependent on the increase in dose of ionizing radiations. Increase in rod bivalents and univalents, and decrease in ring bivalents may be

Table 1. Chromosome associations and other cyotlogical characters in gamma rays & EMS induced mutagenic populations of two barley varieties K-168 and SMV-2 (first line is the mean & standard error and second line is the range)

Variety/ Treatment	IV	II		I	Laggard/ Dividing univalents	Fragments/ Bridges	Micronuclei/ Microspore	Chiasmata/ cell
		Rod	Ring					
1	2	3	4	5	6	7	8	9
K-168 Control	-	0.52±0.06 (0-1)	6.48±0.07 (6-7)	-	-	-	-	13.52±0.06 (13.2-13.8)
Gamma rays								
10kR	0.48±0.10 (0-1)	**0.74±0.05 (0-3)	**5.52±0.06 (4-7)	0.26±0.04 (0-2)	0.08±0.04 (0-2)	0.04±0.06 (0-1)	0.04±0.04 (0-1)	**13.22±0.06 (12.8-13.8)
20kR	0.54±0.05 (0-1)	**0.96±0.04 (0-3)	**5.20±0.08 (4-7)	0.30±0.03 (0-2)	0.10±0.05 (0-2)	0.08±0.03 (0-1)	0.06±0.05 (0-1)	**13.18±0.08 (13.0-13.5)
30kR	0.68±0.05 (0-1)	**1.08±0.07 (0-3)	**4.88±0.09 (3-7)	0.36±0.05 (0-2)	0.12±0.05 (0-2)	0.08±0.03 (0-1)	0.06±0.05 (0-1)	**13.08±0.08 (13.3-13.5)
EMS (0.5%)								
6h	-	0.60±0.04 (0-3)	*6.30±0.06 (4-7)	0.10±0.06 (0-2)	-	-	-	13.48±0.08 (13.0-13.6)
8h	-	*0.64±0.06 (0-3)	**6.20±0.07 (3-7)	0.16±0.04 (0-2)	-	-	-	*13.36±0.06 (12.9-13.5)
10h	0.10±0.05 (0-1)	**0.70±0.05 (0-3)	**5.98±0.08 (3-7)	0.22±0.06 (0-2)	0.06±0.06 (0-2)	-	0.04±0.06 (0-1)	**13.24±0.08 (12.9-13.4)
G.R. + EMS								
10kR + 10h	0.58±0.06 (0-1)	**1.10±0.03 (0-3)	**4.92±0.06 (3-7)	0.40±0.05 (0-2)	0.14±0.06 (0-3)	0.10±0.04 (0-1)	0.10±0.03 (0-1)	**12.68±0.08 (12.1-13.3)
20kR + 8h	0.68±0.06 (0-1)	**1.22±0.06 (0-3)	**4.66±0.06 (3-7)	0.44±0.07 (0-2)	0.16±0.04 (0-3)	0.12±0.03 (0-1)	0.10±0.03 (0-1)	**12.58±0.10 (12.1-13.3)
30kR + 6h	0.82±0.05 (0-1)	**1.38±0.06 (0-3)	**4.28±0.08 (3-7)	0.52±0.06 (0-2)	0.22±0.05 (0-3)	0.14±0.03 (0-1)	0.14±0.04 (0-1)	**12.40±0.10 (13.1-13.3)

Table 1 Contd...

1	2	3	4	5	6	7	8	9
SMV 2								
Control	-	0.48±0.06 (0-1)	6.52±0.06 (6-7)	-	-	-	-	13.52±0.08 (13.4-13.6)
Gamma rays								
10kR	0.56±0.05 (0-1)	**1.02±0.06 (0-3)	**5.02±0.06 (4-7)	0.40±0.04 (0-2)	0.16±0.03 (0-2)	0.10±0.03 (0-1)	0.16±0.04 (0-1)	**12.74±0.08 (12.2-13.4)
20kR	0.68±0.06 (0-1)	**1.12±0.05 (0-3)	**4.74±0.07 (3-7)	0.46±0.06 (0-2)	0.18±0.04 (0-2)	0.12±0.04 (0-1)	0.18±0.03 (0-1)	**12.64±0.06 (12.2-13.4)
30 kR	0.74±0.05 (0-1)	**1.24±0.04 (0-3)	**4.54±0.08 (3-7)	0.48±0.03 (0-2)	0.22±0.03 (0-3)	0.14±0.05 (0-1)	0.18±0.04 (0-1)	**12.54±0.08 (13.1-13.4)
EMS (0.5%)								
6h	0.10±0.06 (0-1)	**0.80±0.04 (0-1)	**5.92±0.08 (3-7)	0.18±0.03 (0-2)	0.08±0.04 (0-2)	0.04±0.03 (0-1)	0.10±0.03 (0-1)	**13.14±0.06 (13.0-13.2)
8h	0.16±0.05 (0-1)	**0.88±0.05 (0-3)	**5.72±0.07 (3-7)	0.24±0.04 (0-2)	0.10±0.04 (0-2)	0.06±0.06 (0-1)	0.12±0.04 (0-1)	**13.10±0.06 (13.0-13.2)
10h	0.24±0.05 (0-1)	**0.94±0.06 (0-3)	**5.50±0.06 (3-7)	0.32±0.05 (0-2)	0.12±0.03 (0-2)	0.08±0.04 (0-1)	0.12±0.03 (0-1)	**13.00±0.05 (12.9-13.2)
G.R. + EMS								
10kR + 10h	0.64±0.05 (0-1)	**1.38±0.08 (0-3)	**4.44±0.06 (3-7)	0.54±0.05 (0-2)	0.26±0.04 (0-3)	0.16±0.04 (0-1)	0.20±0.04 (0-1)	**12.18±0.04 (12.0-12.9)
20kR + 8h	0.72±0.06 (0-1)	**1.46±0.04 (0-3)	**4.24±0.08 (3-7)	0.58±0.06 (0-2)	0.30±0.04 (0-3)	0.18±0.03 (0-1)	0.22±0.03 (0-1)	**12.10±0.04 (12.0-12.9)
30 kR + 6h	0.88±0.03 (0-1)	**1.58±0.06 (0-3)	**3.90±0.08 (2-7)	0.64±0.04 (0-2)	0.34±0.04 (0-3)	0.22±0.04 (0-1)	0.24±0.04 (0-1)	**12.00±0.06 (11.8-12.8)

*, ** = Significant at 5% and 1% respectively.

attributed to restriction of chiasma at terminal ends and resulting in the reduction of chiasmata frequency, which are in turn may caused by mutations in the genes governing the homologous chromosome pairing[1,4].

The presence of the chromosomal anomalies such as laggards, fragments and micronuclei were noticed in all the mutagenic treatments. Presence of bridges indicated that there has been some amount of chromosome breakage. The frequency of laggards and univalents were increased in mutagenic populations.

When both the barley varieties (K-168 and SMV-2) are compared in terms of chromosomal associations and cytological characters, the variety SMV-2 is found to be more sensitive to the mutagen than the K-168, thus indicating the genotypic differences.

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