

MUTAGEN INDUCED MEIOTIC CHROMOSOMAL ABNORMALITIES IN VARIETY ASHA OF MUNGBEAN

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ABSTRACT

Present Investigation was carried out to find out the meiotic chromosomal abnormalities induced in the M_1 generation of Mungbean variety Asha. Meiotic chromosomal abnormalities of different frequencies observed, are univalent, Trivalents, Multivalents, Laggards, bridges and micronuclei which were recorded with Ethylmethane sulphonate (EMS) and Hydrazine hydrate (HZ). There is a dose dependent increase in the meiotic abnormalities and the highest frequency was recorded in EMS (0.4%) followed by HZ (0.04%).

KEYWORDS: Mungbean, Asha, mutagens, chromosomal abnormalities

Grain legumes, commonly known as pulses, constitute a group of crops belonging to the family leguminosae (alternate name, Fabaceae). Pulses are rich in proteins and meet the need of a large section of people of the country. Proteins the basis of life, is the main component of brain, blood, muscles and skin. Hence, the importance of protein in human nutrition needs no elaboration.

Mungbean a self-pollinated crop and induced mutagen provided a modern and fruitful tool in crop plants for creating genetic variability (Swaminathan, 1969, Gottschalk, 1972; Khan and Siddigui 1992, Siddigui and Azad 1998). The possibility offered by mutagenic agents to induce new genetic variation is, therefore, of extreme interest. It might in many cases be the only answer to problems posed upon the practical aspects to a breeder. Mutagenic event indeed is very important even when it has a small effect for a specific morphological or physiological character, because it changes the balance established by natural selection in co-adapted blocks of genes and it, therefore, offers new situations for natural or artificial selection.

The degree of cytological aberrations either in mitosis or meiosis is regarded as one of the dependable criteria for estimating the effect of a mutagen. An attempt has therefore, been made to observe the effect of mutagens to induced chromosomal abnormalities in M_1 generation of mungbean variety Asha.

MATERIALS AND METHODS

Variety Asha

This variety semi erect in growth habit was released in 1991 for general cultivation in irrigated areas of Haryana state. The variety is especially suitable for Kharif season. The seeds are medium, smooth and shining in colour. It matures in 70-75 days. Average yield is 9-11 q/ha.

Mutagens Used

i. Ethylmethane sulphonate (EMS) $CH_3SO_2OC_2H_5$.

It is a mono-functional alkylating agent, causes depurination, transition and formation of triesters in the back bone of DNA molecules.

ii. Hydrazine hydrate (HZ)- $NH_2-NH_2-H_2O$.

It is a base analogue of nucleic acid and thereby causing gene mutation in the DNA molecules.

Mutagenic Concentrations

The following concentrations of different mutagens were used for treating the pre-soaked seeds.

EMS: 0.1%, 0.2%, 0.3% and 0.4%

HZ: 0.01%, 0.02%, 0.03% and 0.04%

Sample size: 350 seeds used for each treatment.

Treatment time: The treatments were given at room temperature ($27 \pm 1^\circ C$) for 6 hours duration.

Controls: 350 pre-soaked seeds were again soaked in phosphate buffer for 6 hours to serve as control.

Cytological Studies

For meiotic analysis young flower buds from 50 individual plants for treatment and control were fixed in Cornoy's fluid (1 parts Glacial acetic acid: 3 parts chloroform: 6 parts Ethyl

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alcohol) for at least 30 minutes. The fixed material was treated with saturated ferric acetate solution for 24 hours. The flowers buds were washed and then preserved in 70% alcohol. Anthers were smeared in 1% propiono-carmin and pollen mother cells (PMC'S) were examined for detecting stages of microsporogenesis.

OBSERVATIONS

Different kinds of meiotic chromosomal abnormalities with different frequencies were observed in M_1 generation of mungbean in different mutagenic treatments. The frequency of meiotic chromosomal abnormalities has been presented in table-1. While equal proportions of Trivalent, multivalent, bridges and micronuclei were recorded in the variety Asha. The Univalents and laggards were observed in high frequencies in all the mutagenic treatments, while the Multivalent were observed in low frequencies and trivalent and micronuclei in moderate frequencies. The frequencies of chromosomal abnormalities increased with the increase in mutagenic treatments. The highest frequency was recorded in EMS followed by HZ.

DISCUSSION

The degree of chromosomal aberrations either in mitosis or meiosis is considered as one of the most reliable index for estimating the effects of the mutagen. In the present study, irrespective of the type of the mutagenic treatment and genotype, mean value of various meiotic abnormalities in percent were found to be increased and this increase was dose dependent. Dose dependent increases in meiotic abnormalities were observed in this variety mungbean with both EMS and HZ treatment. Earlier dose dependent increase in meiotic abnormalities have also been reported in mungbean (Ignacimuthu and Babu, 1989), in field pea. Scumpu and Ionscu, 1968), in cereals (Swaminathan et al., 1962; Reddy et al., 1991).

The meiotic spectrum of chromosomal abnormalities is broad during diakinesis, metaphase and a high proportion of them belongs to univalents. The occurrence of univalents may be the result of non pairing of homologous chromosomes. Reduction in chromosomes pairing has been attributed to mutations in the genes governing homologous chromosomes pairing (Gottschalk and Villalobos-Pietrinic, 1965; Reddy et al., 1991).

Table: 1 Induced meiotic chromosomal abnormalities (expressed as percent pollen mother cells showing different kinds of abnormalities at a specific stage) in M_1 generation of var. Asha with two different chemo- mutagenic treatments

Treatment	Diakinesis to Metaphase I					Anaphase I			Telophase I & II		
	Total no. of PMC's observed	Univalent's (%)	Trivalents (%)	Multivalent (%)	No. of cells observed	Laggards (%)	Bridges (%)	No. of cells observed	Laggards (%)	Bridges (%)	Micronuclei (%)
Control	886	-	-	-	122	-	-	105	-	-	-
0.1% EMS	843	0.94	0.23	0.11	130	0.76	-	112	0.89	-	-
0.2% EMS	869	1.66	0.48	0.23	125	1.07	-	1.4	1.28	-	0.96
0.3% EMS	825	2.04	0.72	0.48	140	2.01	0.71	108	1.35	0.96	1.62
0.4% EMS	805	2.73	0.99	0.74	139	2.87	1.43	110	2.72	1.81	2.72
0.01%HZ	866	0.92	0.23	0.11	123	0.49	-	103	0.64	-	-
0.02%HZ	872	1.49	0.42	0.23	129	0.99	-	112	1.22	0.60	-
0.03%Hz	865	2.04	0.72	0.40	115	1.92	-	110	1.29	0.75	0.80
0.04% HZ	849	2.72	0.82	0.49	123	2.61	0.92	109	2.49	1.65	0.86

Similarly the occurrence of trivalent and multivalent is in accordance with the observations reported in *Vigna radiata* by Grover and Tejpaul (1982). Who have maintained that mutagenesis results in alterations leading to the rearrangement of chromosomes. The presence of laggards, bridges and micronuclei suggests that fragmentations and rejoining of broken ends of the chromosomes are the result of chemo mutagens. The

occurrence of laggards and bridges at Anaphase and Telophase stages as observed in present investigation could be due to delayed terminalization, Stickiness of chromosomes ends or because of abnormal chromosomal movements (Sax, 1940). The similar types of meiotic abnormalities were also observed by Azad et al., (2002) in *Cestrum diurnum*.

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