INT J CURR SCI 2013, 5: 133-137
RESEARCH ARTICLE ISSN 2250-1770

Induced on chemical mutagens in Bhendi, *Abelmoschus esculentus* l. moench

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Abstract

The seeds of Bhendi (*Abelmoschus esculentus* L. Moench) variety Arka Anamika were subjected to the chemical mutagens. The investigation using ethyl methane sulphonate (EMS) and diethylsulphate (DES) on various morphological and yield parameters in M_1 generation were studied in morphological and yield characters, economic importance and medicine use recorded significant reduction and significant variation among the Bhendi cultivars were observed in germination, days to first flower, plant height, number of fruits per plant, fruit length per plant, seed yield per plant, 100 seed weight, fresh weight and dry weight per plant showed variability for both mutagens of all concentration in Bhendi.

Keywords: EMS, DES, mutagens, Bhendi

Received: 12th August; Revised: 16thOctober; Accepted: 20th November;

Introduction

Bhendi (*Abelmoschus esculentus* L.) is a warm season annual herbaceous vegetable crop which can be found in nearly every market in Africa. It is grown primarily for its young immature green fruits and fresh leaves used in salads, soups and stews. The crop which is generally self pollinated (Martin, 1983) belongs to the family Malvaceae (Mallow) and has its origin from West Africa (Joshi et al., 1974). The Bhendi provides important source of vitamins and minerals (Lamont, 1999). Grubben et al. (1977) have also reported significant levels of carbohydrate, potassium and magnesium. The seeds of Bhendi are reported to contain between 15 and 26% protein and over 14% edible oil content (NARP, 1993). The crop is the fourth most popular vegetable in Ghana after tomatoes.

The World Bhendi production was estimated at 4.8 million tons (Gulsen et al., 2007). In Ghana, Bhendi is found in its fresh state in almost all markets in Ghana during the rainy season and in a dehydrated form during the dry season. Particularly in northern Ghana due to its strong commercial value. Bhendi has vital importance as food diet among the inhabitants of cities and villages. The fresh fruits of *Abelmoschus esculentus* (L.) are a common component of is being used Indian diet. In addition the plant has been used medicinally in treatment of several disorders. Anticancer, antimicrobial and hypoglycemic activities of plant are reported. The anti ulcer activity of fresh fruits is recently reported. This is a coarse, erect branched more or less hairy, annual herb 0.6 to 1.5 meters in height. The only published work so for on the potential application of this mucilage's as a binder in tablet formulation was on sodium salicylates a highly water soluble drug that is no longer in therapeutic usage. The present work is an attempt to extract and investigate the pharmaceutical properties of the mucilage's to assess its suitability as a suspending agent in the pharmaceutical formulation, suspending ability and suspension stability

were used as the basis for evaluating the performance of *Abelmoschus esculentus* mucilage as a suspending agent.

Materials and Methods

The dry and dormant seeds of Bhendi variety Arka Anamika were obtained from vegetable and research centre, Pallur, Cuddalore District. The chemical mutagens ethyl methane sulphonate (EMS) and diethyl sulphate (DES) obtained from sigma chemical company, USA were used in various concentrations. The concentrations were 30, 35, 40, 45 and 50 mM and EMS and 05, 10, 15, 20, 25 mM DES. For all treatments, seeds pre-soaked in distilled water for 6 hrs ensured complete hydration of the seeds. There after the seeds were treated with solution of EMS and DES for a period of 6 hrs in laboratory condition. The seeds were given intermittent shaking throughout the period of treatment to maintain uniformity, seeds of individual M_1 plants were sown to raise the M_2 population was screened for mutations at regular intervals from seedling stage until the maturity of the crop.

Various mutants were identified at each stage of the crop and tagged for separate harvesting. The M_1 generation was grown during March 2011 followed by M_2 generation during 2012 in the Botanic Garden, Department of Botany, Annamalai University, Annamalai nagar. The M_1 plants were harvested separately and the seeds sown in the next season in plants progeny rows to raise M_2 generation. Chlorophyll mutants were scored when seedlings were 8-15 day old. They were identified and classified according to Gustafsson (1940) and their frequency was calculated according to the method given by Gual (1964). The biological abnormalities such as injury and lethality in M_1 generation and mutation frequencies in M_2 generation were used to determine the mutagenic efficiency and effectiveness according to the formulas suggested by Konzak et al. (1965).

Results and Discussion

The impact of chemical mutagens in germination percentage, plant height and number of leaves decreased in increasing concentration of DES, but the duration of the first flower increased with increasing concentration of DES and EMS. The reduction of these parameters was prominent in EMS and DES treatment. Such inhibitory effects of various mutagens were reported in several other crops also (Reddy et al., 1992, 1992a). Jana (1964) reported that effect of mutagens on dry seeds of *Phaseolus mungo* showed reduction in growth. The maximum seed germination from lethal dosage value from 40mM EMS then maximum and minimum seed germination percentage observed from (53.10) 40 mM of EMS and (53.75) 20 mM of DES. The maximum and minimum seeding survival percentage observed from (51.05) at 40 mM EMS and (51.36) at 20 mM DES. Root length and shoot length number of branches decreased with increase in concentration of (10.90) 40 mM EMS shoot length (6.60) 20 mM root length DES in Bhendi, lethality and first flower increased with increase in concentration (41.60) 50 mM of EMS and DES (39.50) 25 mM. Similar results from early studies in per Heringa (1964) reported 50% reduction in germination at the doses of 40 mM EMS. Constantin (1976) and Singh (1998) observed linear relationship between dose and reduction in survival of field growth of Bhendi treated with EMS and DES.

A number of morphological mutations have been reported in legume plants and several of this mutation has been shown to exhibit modifications in more than one character. A synergistic effect may cause if the sites of action protected during treatment with first mutagen are exposed to the action of the second (Arnason et al., 1963).

Table 1. Effect of EMS and DES on growth and yield parameters in Bhendi (*Abelmoschus esculentus* L. Moench) in M_1 generation (T – treatments; G – germination; S – Seedling Survival)

T	Growth Parameters				Yield Parameters						
	G (%) 7th day	S (%) 30th day	Shoot length (cm)	Root length (cm)	Days to first flowering (days)	No. of fruits per plant	Fruit length (cm)	Seed yield per plant (g)	Fruit weight per plant (g)	Dry weight per plant (g)	100 seed weight (g)
Control	94.66	94.00	22.05	8.00	35.00	11.05	17.20	16.04	275.49	8.75	5.86
EMS 30 mM	83.46	81.50	15.40	7.50	36.30	11.02	15.10	15.72	250.44	7.97	5.60
35 mM	75.82	73.35	12.50	7.30	37.95	10.90	14.90	15.25	230.59	7.02	5.16
40 mM	53.10	51.05	10.90	7.06	38.70	09.70	13.50	15.05	200.01	6.90	5.05
45 mM	45.95	42.90	08.90	6.50	39.10	08.10	13.00	14.87	180.50	6.15	4.90
50 mM	40.10	38.95	08.85	6.30	41.60	07.50	11.54	12.75	150.75	6.00	4.50
DES 05 mM	96.88	93.95	18.70	8.20	37.10	10.00	15.40	16.35	280.15	8.53	5.47
10 mM	81.50	78.35	15.35	7.80	37.50	09.50	15.00	15.50	240.34	8.10	5.15
15 mM	64.95	61.10	12.40	7.30	38.40	09.10	13.90	14.35	210.25	7.15	5.10
20 mM	53.75	51.36	10.15	6.60	38.90	08.70	13.10	13.85	170.80	6.70	5.05
25 mM	40.50	37.60	08.60	5.15	39.50	08.10	12.50	12.50	150.25	5.50	5.00

An additive effect or even lowering of the effect may result. In case their actions are independent or the two mutagens compete for the same site (Aastveit, 1967). Khan (1981) reported that less additive effect was observed in the combination treatments because of the fact that both the mutagens compete for the same site. Thus it is obvious that combination of mutagenic agent is another useful method for explaining the mechanism of their action. The macro mutations of seed and pod color were induced in the M_1 generation in (Table 1).

The mutagenic efficiency was the highest at the lowest doses of both EMS and DES. Efficiently mutagens and their treatments reface essential for the economic use of the mutagen as a tool for the induction of useful mutations and their direct and indirect utilization. Higher mutagenic efficiency at the lower doses of the mutagens was also reported in mungbean (Khan and Hashim, 1979), Cowpea (Gnanamurthy et al., 2012). Reduction was noted in seedling height. Number of fruits, number of seeds, fresh weight, dry weight, single plant yield and 100 seed weight showed a decreasing trend for the mean value with increasing dosage. The mutagenic effect was found decreasing in quantitative characters in soybean (Pepo, 1989).

Conclusion

In the present investigation of induction using chemical mutagens of EMS and DES, EMS mutagen especially at 40 mM concentration was highly effective then compared other concentrations. DES mutagen at 20mM concentration was highly effective compared with other concentrations. On the whole, EMS was more effective compared other mutagens. The growth and yield parameters then mutants altered agronomical traits which may be possibly utilized in future mutation breeding programme.

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