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SCREENING SALINITY TOLERANT GENOTYPES OF INDIAN MUSTARD (*B. JUNCEA* (L.) CZERN & COSS.) AT SEEDLING STAGE

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Thirty two diverse but promising genotypes of Indian mustard (B. juncea (L.) Czern. & Coss.) were screened under two chloride predominating salinity levels viz; 125 meq/l and 175 meq/l in petriplates. Per cent reduction in seedling vigour, speed of germination and per cent germination, respectively were used as preferential parameters for screening the genotypes under salinity. Salt stress delayed the seed germination but had little or no effect on the ultimate seed emergence. Seedling vigour increased at 125 meq./l salinity, whereas it decreased at 175 meq/l salinity level. Based upon per cent reduction in seedling vigour, speed of germination and per cent germination in salinity over control, genotypes RH-7846, RH-7859 and RH-781 were identified as tolerant to salinity, whereas genotypes RH-8315, RWH-1 and RH-8113 as susceptible.

Key words : *Brassica juncea*, germplasm, evaluation, salinity tolerance

Rapeseed and mustard are generally grown in dry land conditions which are manifested with soil salinity and alkalinity problem which is one of the responsible factor for low crop productivity (Srivastava and Jana, 1984). Among rapeseed and mustard group, the Indian mustard (*Brassica juncea* (L.) Czern. & Coss.) is high yielding and widely grown species in India. The breeding for salt tolerance has progressed slowly particularly due to limited sources of genes, lack of efficient screening procedures and poor understanding of genes involved in controlling salt stress problems (Balum, 1988). Screening procedure important for any breeding programme, used to efficiently identify salt tolerant plants have not been conclusively defined for any plant species (Shannon, 1979). However, among the vegetative growth phase, the seedling stage was the most efficient stage for screening of large number of genotypes for salt tolerance (Devine, 1982). In the present study, 32

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promising but diverse genotypes of Indian mustard were screened for salt tolerance at seedling stage.

MATERIALS AND METHODS

The seeds of thirty two genotypes of Indian mustard were surface sterlised with 0.1 per cent solution of sodium hypochloride for 5 minutes and then thoroughly washed with water. Ten seeds of uniform size were put on whatman filter paper in 23 cm dia meter petriplates. Each petriplate contained 10 ml double distilled deionized water (control), 125 or 175 meq/l chloride predominating salinity solution prepared by addition of NaCl, $CaCl_2$, $Mgcl_2$ and $MgSO_4$ (Using Na: Ca + Mg ratio as 1 :1 and Ca: Mg ratio as 1 : 3 and Cl : SO_4 ratio as 7 : 3 on meq. basis) in distilled water. Each salinity level including control was replicated thrice. The petridishes were kept at room temperature (usually max. temp. ranging between 20-25°C and min. temp. 10-15°C). Daily record of germination was recorded and speed of germination was calculated using formula given by Maguire (1962).

Speed of germination (index)

$$= \frac{\text{Number of normal seedlings}}{\text{Days to first count}} + \frac{\text{Number of normal seedlings}}{\text{Days to final count}}$$

At the end (Eight days after sowing), data was recorded on root length and shoot length of seedlings. Five seedling from each genotype were oven dried at 80°C and weighted. Seedling vigour was calculated as :

Seedling vigour = (root length + Shoot length) × seedling dry weight.

Higher the value, more will be seedling vigour. The per cent reduction in seedling vigour was used as preferential parameter over others for final screening purpose followed by speed of germination and reduction in germination per cent, respectively.

RESULTS AND DISCUSSION

(a) *Germination per cent* : In control, the germination usually ranged between 90 to 100 per cent (except in Krishna). Germination in general was not affected by 125 meq salinity and there was very low reduction in 175 meq/l salinity level (Table 1). Out of 32 genotypes, 10 showed no reduction at this salinity level. Maximum per cent reduction in salinity over control was noticed in genotype Krishna followed by RH 7513. Contrary to the present findings, a significant decrease in germination has earlier been observed by Kumar (1984) and Dhawan *et al.* (1987) in *Brassicas*. These differences may be attributed to the

varying salts and their concentrations used by various workers (Levitt, 1980; Sheoran and Garg, 1983). When varieties show similar level of germination, as in the present experiment, the speed of germination or seedling vigour may be helpful in bringing the differences in varietal responses (Singh Rana, 1989).

(b) *Speed of Germination* : In control, the speed of germination ranged from 2.85 (Krishna) to 4.67 (RH-7859). Speed of germination reduced in 125 meq/l salinity and a further reduction was observed in 175 meq/l (Table 1). Reduction in speed of germination has earlier been reported in many crop species viz., pea and Chickpea (Bishnoi, 1984); alfalfa (Allen *et al.*, 1986) and wheat (Francois *et al.*, 1986) etc.

(c) *Seedling vigour* : Lower salinity level i.e. 125 meq/l increased seedling vigour over non saline medium for all the genotypes except Krishna, RC-199, Purple mutant and Prakash with a grand mean of 143.77 and 220.73 in control and 125 meq/l salinity, respectively. But it reduced in 175 meq/l salinity over control in all the genotypes ranging from 8.6 per cent (RH-7846) to 75.0 per cent (RH-8113).

The effectiveness of screening at the seedling stage has though been questioned by Millington *et al.* (1951) and Shannon (1979), but, a positive correlation for salt tolerance between the seedling stage and later development stage in India mustard was found by Jain (1991). Thus the genotypes which show more tolerance at this stage are likely to establish better in saline soils. Moreover, if the correlation does not exists between seedling and adult stage, the germination in itself is one of the most essential part and screening at seedling stage is hence extremely important.

The genotypes RH-7846, RH-7859, RH-781 and RLM-514 were having less than 30 per cent reduction in seedling vigour, whereas RH-8113, Prakash, RWH-1 and RH-8315 were having more than 70 per cent reduction in 175 meq/l over control. The genotyopes RH-7859, RH-7846 and RH-781 were having comparitively faster speed of germination alongwith high seedling vigour and hence are tolerent to salinity, whereas the genotypes showing reverse trend i.e. RH-8315, RWH-1 and RH-8113 were identified as susceptible to salinity. Variability for salt tolerance at seedling stage has also been reported by Dhawan *et al.* (1987) and Kuhad *et al.* (1989). Therefore it is suggested that these characters can be effectively employed in screening large collection at a very early stage to identify tolerant genotypes.

Table 1. Screening of Indian mustard (*Brassica juncea*) genotypes under two levels of salinity for germination per cent and seedling characteristics

Genotypes	% Germination				Speed of germination				Seedling vigour			
	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1
	1	2	3	4	5	6	7	8	9	10	11	12
RC 1425	100.0	97.0	97.0	3.0	3.87	2.73	2.05	47.0	95.14	120.56	42.39	55.4
RH 8602	97.0	97.0	93.0	4.1	4.16	3.20	1.73	58.4	83.42	268.64	63.02	65.6
RH 781	90.0	90.0	87.0	3.7	3.68	2.70	2.27	38.3	97.86	145.36	75.60	22.7
RH 819	97.0	97.0	97.0	0.0	3.87	3.00	2.16	44.2	161.86	237.995	92.31	43.0
RH 8605	100.0	100.0	100.0	0.0	4.30	3.55	1.79	58.4	209.50	262.08	88.91	57.6
RH 8315	100.0	100.0	93.0	7.0	3.45	3.33	1.42	58.8	217.65	248.25	61.54	71.7
RH 8812	97.0	97.0	97.0	0.0	3.39	3.03	1.67	50.7	238.07	444.03	110.82	60.1
RH 7846	100.0	100.0	100.0	0.0	4.50	3.22	2.56	43.1	132.30	425.71	120.90	8.6
RH 7859	100.0	100.0	100.0	0.0	4.67	3.49	2.89	38.1	161.55	310.26	132.74	17.8
RC 781	100.0	100.0	97.0	3.0	3.92	3.15	1.93	50.8	37.38	41.13	18.59	50.3
RH 839	97.0	100.0	93.0	4.3	3.86	3.57	1.90	50.8	164.70	253.96	116.54	29.3
Krishna	67.0	60.0	57.0	14.9	2.85	1.80	1.78	37.5	114.14	105.98	75.04	34.3

(Cont. on next page)

Genotypes	% Germination				Speed of germination				Seedling vigour			
	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1
	1	2	3	4	5	6	7	8	9	10	11	12
RWH-1	90.0	90.0	87.0	3.7	3.32	2.82	1.66	50.0	92.96	93.94	25.77	72.3
Varuna	97.0	93.0	90.0	7.2	4.08	2.34	1.78	56.4	222.34	296.34	126.78	43.0
RH 8113	97.0	93.0	90.0	7.2	3.98	3.33	1.83	54.0	127.52	184.72	31.86	75.0
RH 30	90.0	90.0	87.0	3.3	3.85	3.04	1.40	63.6	244.02	339.89	106.41	56.4
RLM 514	100.0	100.0	100.0	0.0	3.98	2.83	2.18	46.5	95.45	142.04	68.98	27.7
RC 199	90.0	90.0	87.0	3.3	3.85	3.04	1.40	63.6	51.24	41.26	18.27	64.3
Purple Mutant	93.0	83.0	83.0	10.8	2.86	2.34	1.29	54.8	64.13	64.06	26.32	59.0
Prakash	100.0	97.0	97.0	3.0	4.28	3.14	2.80	34.6	118.38	116.52	31.26	73.6
RH 8313	97.0	97.0	97.0	0.0	3.76	3.05	2.13	43.4	150.87	324.99	49.15	67.4
RLC 1105	100.0	100.0	100.0	0.0	4.63	3.49	2.08	55.1	112.76	197.16	49.86	55.8
RH 8702	100.0	100.0	97.0	3.0	3.97	3.46	2.02	49.1	160.31	315.39	92.73	42.4
Pusa Bold	100.0	97.0	97.0	3.0	3.93	2.90	1.82	53.7	190.10	222.66	75.88	60.1
RH 846	100.0	100.0	97.0	3.0	4.04	3.36	2.24	44.5	182.97	221.08	104.32	43.0

(Cont. on next page)

Genotypes	% Germination				Speed of germination				Seedling vigour			
	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1	E_1	E_2	E_3	% reduction in E_3 over E_1
	1	2	3	4	5	6	7	8	9	10	11	12
NDR 841	97.0	97.0	90.0	7.2	4.14	3.28	1.82	56.0	212.02	371.54	102.03	51.8
Kranti	97.0	93.0	93.0	4.1	3.91	3.03	2.02	48.3	177.23	273.98	57.75	67.4
Vaibhav	100.0	100.0	100.0	0.0	3.18	2.85	1.40	56.0	80.33	115.62	39.55	50.8
Rohini	100.0	100.0	100.0	0.0	3.54	3.29	1.52	57.1	143.52	238.02	58.50	59.4
RH 8606	97.0	93.0	87.0	10.3	4.00	3.28	1.93	51.8	201.19	244.20	100.17	49.7
RH 7513	100.0	100.0	87.0	13.0	3.89	3.12	2.02	48.1	96.84	182.24	41.31	57.3
Wardan	100.0	100.0	93.0	7.0	4.00	3.69	1.81	54.8	101.29	145.08	37.01	63.5
Grand mean	96.56	95.34	92.59		3.85	3.06	1.93		143.77	220.73	70.12	
	±2.19	±2.83	±2.94		±0.25	±0.20	±0.19		±18.19	±15.05	±6.99	
C.D. at 5%	6.08	7.84	6.66		0.72	0.57	0.53		52.49	43.43	20.18	
Range	67.0	60.0	57.0	0.0	2.85	1.80	1.40	34.6	41.23	41.26	18.27	86
	to 100.0	to 100.0	to 100.0	to 14.9	to 4.67	to 3.69	to 2.89	to 63.6	to 238.07	to 444.03	to 132.74	to 75.0

where, E_1 = contril; E_2 = 125 ,eq/1 litre; E_3 = 175 meq/litre Salinity levels

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