Indian J. Plant Physiol., Vol. 8, No. 2 (N.S.) pp. 133-137 (April-June, 2003)

EVALUATION OF RELATIVE SALT TOLERANCE IN BRASSICAS ON THE BASIS OF POLLEN PERFORMANCE

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Received on 10 May, 2002, Revised on 10 July, 2003

SUMMARY

Sodium chloride, in general, inhibited both pollen germination and pollen tube growth in different species of *Brassica* and inhibition varied with the species and the cultivar studied. Based on the overall pollen performance among four tested species, inhibition was maximum in *B. juncea* cv. Varuna and hence adjudged as the most salt sensitive. The inhibition, however, decreased from *B. alba, B. carinata* to *B. napus*, thereby, indicating that *B. napus* is the most salt tolerant. Similarly among different cvs. of *B. juncea*, Varuna, RH-8812, RH-8113 were adjudged as salt sensitive; RH-781, RH-819 as moderately tolerant and RH-7846, RH-8701, Domo-4 and Pusa bold as salt tolerant. These results indicated a positive correlation between pollen performance and known whole plant response.

Key words: ***Brassica*, pollen germination, pollen tube length, salt stress.**

INTRODUCTION

The predominant occurrence of saline and alkaline soils in arable lands of arid and semi-arid regions has been a matter of great concern to all those involved in maximizing food and oilseed production. Identification and evaluation of salt tolerant genotypes are the first and foremost task in achieving the above goal. The criteria used in the past for screening of crop plants have failed to prove their legitimacy as the final economic yield is not positively correlated with any of the these parameters. Thus, need of the hour is to have a simple, efficient, economically viable and dependable technique for screening of salinity tolerant genotypes of crop plants that is reflected in economic yield as well.

Pollen grains, like microbial organisms, are characterized by large population, genetical simplicity and easy amenability for *in vitro* studies. These features make pollen a suitable system for the study of adaptability to stressful environment. Recent studies have provided sufficient evidences to believe that a substantial complement of structural genes (60-80%) of sporophyte are superimposed in pollen also (Ottaviano and Mulcahy 1989, Frova *et al.* 1991). Therefore, culturing of pollen in a suitable germination medium adjuncted with a stressing agent should permit germination of tolerant pollen more successfully than the non-tolerant ones and thus selection pressure can be applied to pollen independent of the parent plants. A positive correlation between pollen performance and known whole plant response to white rust and *Alternaria* blight has been reported from this laboratory (Anjali *et al.* 1999, Kiran 2000) Present study seeks corroboration of previous work with regard to salt stress.

MATERIALS AND METHODS

Freshly collected pollen from field grown different species/cultivars of *Brassica* were hydrated for 1h in a humid atmosphere, at room temperature and used for *in vitro* germination on semi-solid medium (Roberts *et al.* 1983) with and without NaCl. Three petriplates per

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treatment were used and incubated at 20±2°C for 6h. After incubation, pollen activity was terminated by flooding the surfaces of media with killing and fixing solution (Sass, 1951). The petriplates were stored in an incubator at 10±1°C until observations were recorded. Twenty readings for pollen germination and thirty for pollen tube growth from different microscopic fields were made.

RESULTS AND DISCUSSION

Among four different species of *Brassica*, *B. carinata* pollen showed highest germination. Addition of NaCl to the germination medium reduced germination and the reduction increased with the increasing level of salt. Reduction was minimum in *B. napus* and *B. carinata*, moderate in *B. alba* and maximum in *B. juncea* (Table 1). Pollen tube length in general, ranged from 180-300 µm. However, *B. alba* produced the shortest tubes (53 µm). Tube length decreased with the increase in the conductivity level of the germination medium (Table 2). The extent of reduction in tube length was nearly 80% in *B. juncea* while the values were <50% *B. alba* and *B. napus* at 0.8 dS/m. Reduction in tube length was minimum in *B. carinata*.

Table 1. Effect of salt stress on percentage pollen germination in Brassicas.

Species/	Conductivity (dS/m)				
cultivar	Control	0.4	0.6	0.8	Mean
B. juncea cv. Varuna	58.46±1.94	56.05±1.54 (4.14)	45.57±1.03 (22.16)	24.45±1.98 (58.18)	46.13
B. carinata cv. HC-2	83.64±1.15	78.17±1.59 (6.54)	76.06±1.41 (9.06)	64.56±1.65 (22.81)	75.61
B. napus cv. GSH-1	66.56±0.44	64.59±0.65 (2.95)	58.47±1.22 (12.15)	52.28±0.73 (21.45)	60.48
B. alba cv. Local	76.96±1.03	63.27±0.94 (17.79)	59.33±0.75 (22.90)	50.79±1.17 (34.00)	62.58

CD at 5% LS = 4.11
Values is parentheses indicate per cent reduction over respective control.

Table 2. Effect of salt stress on *in vitro* tube length (µm) in different species of *Brassica*.

Species/	Conductivity (dS/m)				
cultivar	Control	0.4	0.6	0.8	Mean
B. juncea cv. Varuna	233.14±3.00	94.79±4.22 (59.34)	66.61±3.35 (71.43)	40.99±0.88 (82.43)	108.88
B. carinata cv. HC-2	299.62±3.42	278.40±10.67 (7.08)	263.78±32.28 (11.96)	217.77±19.57 (27.32)	264.89
B. napus cv. GSH-1	184.19±8.42	176.70±10.67 (4.07)	144.24±6.00 (21.69)	106.03±5.68 (42.43)	152.79
B. alba cv. Local	52.95±6.47	44.16±0.84 (22.59)	36.47±1.20 (31.12)	26.50±0.45 (49.95)	40.02

CD at 5% LS = 25.06
Values is parentheses indicate per cent reduction over respective control.

Among the tested cvs. of *B. juncea*, germination ranged from 80-86% in Domo 4, RH-7846 and Pusa bold while RH-8113 showed minimum germination (45.95%). Addition of NaCl to the germination medium decreased germination which accentuated with its increasing level. Reduction in germination by 0.8 dS/m NaCl ranged from 58-73% in Varuna, RH-8812, RH-8113 and 30-45% in other cultivars (Table 3). Cultivar RH-7846 produced longest tube (386 μm) while those of RH-819 had the smallest one (110μm). Sodium chloride inhibited tube growth and inhibition was > 55% at 0.8 dS/m except Domo-4 and Pusa bold (Table 4).

It is thus, evident that the sensitivity of pollen to NaCl varies with the species/ cultivar. On the basis of overall performance, among the four species *B. juncea* is adjudged as the most salt sensitive and *B. alba*, *B. carinata* and *B. napus* are the salt tolerant in the increasing order. Among the cultivars of *B. juncea*,

Table 3. Effect of salt stress on pollen germination (%) in different cultivars of *Brassica juncea*.

	Conductivity (dS/m)				
Cultivars	**Control**	**0.4**	**0.6**	**0.8**	**Mean**
Varuna	58.46±1.94	56.04±1.54 (4.14)	45.57±1.03 (22.06)	24.45±1.98 (58.18)	46.13
RH-7846	80.36±0.90	72.03±0.40 (10.37)	68.93±0.69 (14.22)	50.04±1.37 (37.73)	67.84
RH-8701	77.21±3.14	71.91±2.79 (6.86)	66.80±0.99 (13.48)	52.81±1.28 (31.60)	67.18
RH-781	52.06±1.11	48.44±1.17 (6.95)	46.37±1.32 (10.35)	32.36±1.53 (37.84)	44.81
RH-8812	71.18±2.33	66.54±2.19 (6.52)	57.00±1.50 (19.92)	18.61±0.22 (73.86)	53.33
RH-8113	45.95±0.50	38.05±2.13 (17.19)	30.67±1.06 (33.25)	12.12±0.48 (73.62)	31.70
RH-819	71.54±1.90	62.08±3.81 (13.22)	50.20±2.02 (29.83)	39.87±2.02 (44.27)	55.92
Domo-4	86.49±2.07	81.17±1.27 (6.15)	69.67±2.20 (19.45)	58.70±2.44 (32.13)	74.01
Pusa Bold	80.17±1.34	77.32±0.91 (3.55)	62.55±1.14 (21.98)	56.09±1.67 (30.04)	69.03

CD at 5% LS = 5.21

Values is parentheses indicate per cent reduction over respective control.

Table 4. Effect of salt stress on pollen tube length (μm) in different cultivars of *Brassica juncea*.

	Conductivity (dS/m)				
Cultivars	**Control**	**0.4**	**0.6**	**0.8**	**Mean**
Varuna	233.14±3.00	94.79±4.22 (59.34)	66.61±3.55 (71.43)	40.99±3.96 (82.42)	108.88
RH-7846	386.01±3.55	196.42±4.93 (49.12)	169.95±4.21 (55.97)	148.95±6.21 (61.41)	225.33
RH-8701	338.18±10.67	232.37±19.57 (31.29)	211.87±5.00 (31.35)	153.80±5.56 (54.52)	234.06
RH-781	193.00±6.00	109.31±5.22 (43.36)	88.82±2.61 (53.98)	52.95±1.35 (72.56)	111.02
RH-8812	240.83±8.42	181.90±7.59 (24.47)	117.85±3.55 (51.07)	43.55±4.22 (81.92)	146.03
RH-8113	269.10±2.47	135.67±5.68 (49.52)	125.54±3.00 (53.33)	76.86±4.93 (71.43)	151.80
RH-819	110.17±5.00	98.21±7.36 (10.86)	62.34±3.00 (43.41)	47.60±2.34 (56.79)	79.58
Domo-4	229.43±4.22	141.76±6.60 (38.29)	129.81±5.22 (43.49)	168.16±7.45 (26.80)	167.37
Pusa Bold	193.00±7.05	189.31±3.98 (1.91)	168.82±8.21 (12.53)	152.95±5.21 (20.75)	176.02

CD at 5% LS = 23.22
Values is parentheses indicate per cent reduction over respective control.

Varuna, RH-8812 and RH-8113 are salt sensitive; RH-781 and RH-819 are rated as moderately tolerant and RH-7846, RH-8701, Domo-4 and Pusa bold are salt tolerant.

Available information on the whole plant responses vividly shows that *B. carinata* and *B. napus* perform extremely well under saline conditions (Malik 1990, Ashraf and Naqvi 1992) while *B. juncea* is relatively sensitive (Ashraf and McNiell 1990). Based on yield data, Chhabra and Yadav (1997) categorised RH-8701, RH-8824, RH-819 and RH-8814 as salt tolerant. Cultivars RH-781 and Pb-24 have been reported to perform better in terms of germination and yield under saline conditions (Dhawan *et al.* 1987). Recently, Tyagi and Rangaswamy (1993) have also reported a close correspondence between pollen and whole plant response to salinity in *Brassica*. Thus, pollen assay technique, which is simple, efficient, economical and reliable can be exploited for screening of *Brassica* germplasm for salt tolerance.

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