A RAPID PRELIMINARY TECHNIQUE TO SCREEN FROST TOLERANT GENOTYPES OF BRASSICA.

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INTRODUCTION

Brassica is prone to frost damage in several parts of world. Seed damage amounting to as high as 70 per cent has been reported in India (Yadava & Bhola, 1977). Therefore, it is essential to develop some frost tolerant genotypes. Screening of genotypes need some laboratory/field techniques. In most of the laboratory techniques (Fowler et al, 1973; Bringham and Jenkins, 1975) either leaves or exposed seeds are frozen. The freezing damage to the leaves may not necessarily be correlated to its seed damage whereas, seeds get damaged during separation from siliqua wall. The field test using Movable Freezing Chamber (Ohlsson,1985) is very suitable as the freezing treatment is given directly to field grown plants, but test speed is extremely low. Therefore, it is essential to develop some preliminary technique which is rapid, involves freezing to unexposed seeds and can be used extensively. The comprehensive account of the present technique is described.

MATERIAL AND METHODS

Record the date of flowering initiation of the genotypes to be screened for freezing tolerance. Thirty-five to forty days after flowering initiation, 10 main shoots (bearing siliquae) from each genotypes are cut from the plant during early morning hours at about 4.00 A.M. Fix these twigs in six inches pots containing sandy soil already maintained at field capacity. The genotypes (the number depending upon the size of the freezing chamber) are placed randomly in the chamber already fixed at 2°C. Allow this temperature for 30 minutes. Bring down the temperature to -3.0°C for 60 minutes, followed by -4.0°C for another 30 minutes. Switch off the cooling unit and open the chamber after 30 minutes so as to allow gradual and slow thawing. Keep these pots in open. It is desired that the complete freezing treatment is complete before visible sunrise. Maintain these treated plants under natural climatic conditions alongwith control plants at field capacity for next about 10-15 days. This period depends primarily upon the ambient temperature and humidity. A critical period has to be noted when there are apparent differences in living and killed seeds. The living seeds are green and hard whereas killed seeds turn dark brown and watery. This period is very critical and visual judgement is the simple and best criterion. If observations are recorded too early, there may not be apparent differences; if too late, all the seeds may turn brown. Freezing tolerance/susceptibility can be

calculated from the per cent unkilled seeds.

$$\% \text{ unkilled seeds} = \frac{\text{No. of unkilled seeds per siliqua}}{\text{No. of total seeds per siliqua}} \times 100$$

RESULTS AND DISCUSSION

During 1987-88, about 30 genotypes of Brassica were screened for frost tolerance. Screening was done by using Movable Freezing Chamber on the intact field grown plants. The per cent reduction in number of unkilled seeds/siliqua in frozen over unfrozen control plants was used as the criterion for screening (Table I). To examine the applicability of new twig test 12 selected genotypes, 4 each belonging to highly frost tolerant, moderately frost tolerant and frost susceptible were screened by giving freezing treatment to the cut twigs in the Movable Freezing Chamber (method described above). Similarly per cent reduction in unkilled seeds/siliqua in frozen plants over unfrozen control plants was calculated. It was observed that the trend among the three group of genotypes remained same (Table 2). This implies that this method can be used effectively in screening large number of genotypes. This technique should be used as preliminary screening technique. The selected frost tolerant genotypes from this technique can be reconfirmed by giving freezing treatment to the intact plants.

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Table 2. Per cent reduction in number of unkilled seeds per siliqua in frozen over unfrozen control plants subsequent to freezing treatment to(I) intact plants (II) cut twigs.

Genotype	% reduction in No. of unkilled seeds/ siliqua in F over UF plants			
	Freezing to intact plants	Freezing to cut twigs		
		Set I	Set II	Set III
Frost Tolerant :				
RH-781	5.7	6.5	4.9	6.0
RH-8574	9.0	8.5	10.5	7.3
RC-1426	10.5	10.3	9.9	8.8
Varuna	11.6	12.3	11.6	11.8
Moderately frost tolerant:				
RH-7513	19.4	16.5	20.5	19.0
RH-7561	19.7	19.3	21.4	18.7
RH-7846	19.9	20.6	19.7	18.5
RC-781	29.9	26.6	29.0	28.2
Frost susceptible :				
RH-839	60.0	62.3	60.0	65.7
RH-8569	69.4	73.5	70.0	68.2
RH-8519	75.9	69.3	85.3	75.0
RH-838	87.7	90.0	97.3	88.9

Table I. The number of unkilled seeds/siliqua of different genotypes subsequent to specified freezing treatment to intact field grown plants by Movable Freezing Chamber.

Genotype	No. of unkilled seeds/siliqua in frozen(F) and unfrozen(UF) plants		% reduction in No. of unkilled seeds/ siliqua in F over UF plants
	Frozen(F)	Unfrozen(UF)	
Varuna	11.4	12.9	11.6
RH-781	11.5	12.9	5.7
RC-1426	11.1	12.4	10.5
RH-8519	7.9	13.9	75.9
RH-8569	11.0	14.9	26.2
RH-8574	11.0	12.2	9.0
RK-8602	5.1	10.7	52.3
RH-8565	5.4	12.4	56.9
RH-8114	9.7	11.4	14.9
RH-8520	9.3	12.1	23.1
RH-848	9.4	13.8	16.8
RC-5	7.3	11.6	37.0
RC-199	9.0	11.3	19.5
RC-819	9.2	11.0	16.4
RH-8528	4.1	11.0	62.7
Prakash	10.2	12.3	17.0
RH-7860	4.8	13.1	63.3
RH-8574	4.6	13.1	64.8
RH-7513	8.7	10.8	19.4
HNS-8	6.5	17.1	61.9
Sangam(Toria)	7.7	14.1	45.3
RH-838	1.5	12.2	87.7
BSH-1	5.0	16.8	70.0
RH-30	4.9	9.6	48.9
RH-7561	11.4	14.2	19.7
RH-8570	1.4	14.7	90.5
RH-839	5.0	12.5	60.0
RC-781	7.5	10.7	29.9
RC-1359	9.6	11.8	18.6
RH-7846	12.0	13.2	19.9