CO 5 attained physiological maturity after 25 days of anthesis with maximum germination and vigour which is the optimum stage harvesting for quality seeds.

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Research Notes

Seed invigouration studies with parental lines of sunflower hybrid BSH 1

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Sunflower is one of the important international oilseed crops with economic importance. The seeds of sunflower exhibit microblotic orthodox behaviour in storage and fall to exhibit the minimum requirement of germination (70 per cent) for certification (Tanwar and Singh, 1988) upto the validity period of 9 months. Physico chemical irreversible deterioration, the prime factor for reduction of seed germination during storage is said to be at higher order in sunflower due to their higher oil content. BSH 1 is the first public sector sunflower hybrid released from Karnataka with the parental lines of CMS 234 A and RHA 274. Studies on mid storage invigouration in these parental lines are very meager. Hence, studies were taken up on invigouration aspect with various antioxidants as such studies would be much useful in prolonging the shelf life of the highly valuable parental lines of sunflower hybrid.

The bulk seeds of parental lines of BSH 1 (CMS 234 A and RHA 274) were cleaned and graded with 9/64" round perforated metal sieve for uniformity and were stored in fresh gada cloth bags at 8-9 per cent moisture content under ambient conditions of Colmbatore (32 ± 2°C and 75 ± 2% RH) during 2000. The germination had reduced to 75 per cent just five per cent higher than the Minimum Seed Certification Standard (MSCS) after five months

Table 1. Influence of HDH treatment on germination (%) of parental lines seeds of BSH 1 hybrid sunflower

Treatment (%)	CMS 234 A			RHA 274		
	Immediate	After 8 months	Mean	Immediate	After 8 months	Mean
Control	75 (60.20)	58 (50.04)	67 (55.12)	74 (59.37)	60 (50.91)	67 (55.14)
Water	86 (68.05)	75 (60.55)	81 (64.30)	84 (66.50)	75 (60.33)	80 (63.42)
p-hydroxy benzoic acid (10^{-5} M)	88 (66.97)	77 (61.69)	83 (65.83)	90 (71.37)	77 (61.71)	84 (66.54)
p-amino benzoic acid (10^{-3} M)	83 (65.69)	69 (56.63)	76 (61.16)	87 (69.36)	80 (63.45)	84 (66.41)
Sodium phosphate monobasic (10^{-4} M)	84 (67.15)	71 (57.74)	78 (62.45)	86 (68.68)	70 (57.11)	78 (62.90)
Sodium phosphate dibasic (10^{-4} M)	88 (69.76)	76 (61.00)	82 (65.38)	91 (72.10)	79 (63.49)	85 (67.80)
Sodium chloride (10^{-3} M)	82 (65.32)	71 (57.42)	77 (61.37)	84 (66.90)	80 (63.45)	82 (65.18)
Sodium thiosulphate (10^{-4} M)	80 (63.83)	69 (56.17)	75 (60.00)	81 (64.35)	70 (57.11)	76 (60.73)
Mean	83 (66.25)	71 (57.66)	77 (61.96)	84 (67.33)	72 (58.82)	78 (63.68)
CD (P=0.05)	T 1.10	P 0.88	T x P NS	T 1.05	P 0.83	T x P 2.34

(Figures in parentheses are transformed values)

of storage. The seeds of one kilogram each in 3 replications were soaked in double the volume of different concentration of chemical solutions, *viz.* p-hydroxy benzoic acid (10^{-5} M), p-aminobenzoic acid (10^{-3} M), sodium phosphate monobasic and dibasic (1 0^{-4} M), sodium chloride (10^{-3} M) and sodium thlosulphate (10^{-4} M) as midstorage invigouration treatments along with water. The seeds were hydrated with occasional stirring upto 3h, and then were dried under shade to bring back the seed to the original moisture content. The treated seeds along with control were evaluated for their germinability in paper medium (ISTA, 1999) and vigour index values were computed as per Abdul Baki and Anderson (1973) by multiplying germination (%) with total seedling length (cm). The treated seeds were again kept under storage for eight more months and evaluated for the above seed quality characters.

The storability of seeds observed through germination and vigour index values were highly significant among the mid storage invigouration treatments and periods of storage in both the parental lines. Even immediately after treatment, all the evaluated chemicals and water improved the germination per cent compared to control by 5-13 per cent in CMS 234 A and 7-17 per cent in RHA 274. The evaluated chemicals exhibited higher germination and the effect was much pronounced with p-hydroxy benzoic acid (10^{-5}M) and sodium dibasic phosphate (10^{-4}M) respectively recording an increase of 13 per cent in the female line (CMS 274 A) and 16 and 17 per cent in male parent (RHA 274) over control which might be due to the beneficial effect of chemicals which were ascribed as antioxidants by Villiers and Edgcumbe (1975). This effect had also been extended to the stamina of the seedling with higher vigour index values. The improvement in germination and vigour index values might be due to physico-chemical treatments which could have repaired the membrane system as reported by Dharmalingam and Basu (1990). The improvement in germination was

Table 2: Influence of HDH treatment on vigour index of parental lines seeds of BSH 1 hybrid sunflower

HDH treatments (%)	CMS 234 A			RHA 274		
	Immediate	After 8 months	Mean	Immediate	After 8 months	Mean
Control	2930	1484	2207	1881	980	1430
Water	4194	2917	3556	2622	1735	2179
p-hydroxy benzoic acid (10^{-5} M)	5219	3914	4567	3497	2662	3080
p-amino benzoic acid (10^{-3} M)	4651	3053	3852	2978	2123	2551
Sodium phosphate monobasic (10^{-4} M)	4371	2875	3623	2894	1864	2379
Sodium phosphate dibasic (10^{-4} M)	4930	3805	4368	3305	2440	2873
Sodium chloride (10^{-3} M)	4122	2803	3463	2769	1789	2279
Sodium thiosulphate (10^{-4} M)	3786	2415	3101	2416	1444	1930
Mean	4275	2908	3592	2798	1879	2339
CD (P=0.05)	T	P	T x P	T	P	T x P
		114	NS	122	97	NS

by 11 and 10 per cent, respectively in CMS 234 A and RHA 274 by mere water soaking compared to control which indicated that water counteracted the accumulated free radicals as suggested by Basu (1984). The effect of this simple hydration treatment had also been reflected in the vigour index values of both parental lines.

The experimental results on storage of treated seed expressed that seed quality characters were maintained at higher order (Table 1 and 2) by the various chemicals with antioxidant property including water compared to control. The germination percentage recorded by CMS 234 A and RHA 274 were 58 and 60 per cent, respectively after 8 months of storage in control, while the seeds invigourated with water, p-hydroxy benzoic acid (10^{-5} M) and sodium phosphate dibasic (10^{-4} M) maintained the germination above the MSCS (70%) in both the parents upto 8 months.

Dey and Mukherjee (1984) opined that the increased enzymatic activity and quenching of free radicals as the causes for maintenance of viability and vigour in the treated seeds during further storage. Similar results were.reported by Rajasekaran (2001) in Niger.

Thus, the present study highlighted that the microbiotic storage behaviour of sunflower could be modified to mesobiotic in parental lines of BSH 1 sunflower hybrid by imposing mid storage hydration dehydration treatment either with p-hydroxy benzoic acid (10^{-5} M) or sodium phosphate dibasic (10^{-4} M) for 3h in double the volume of solution (2:1) to seed. Further, the study also indicated that simple water hydration and drying back to original moisture content could also be ascribed as a simple mid storage correction technique for sunflower parental lines to serve as a low cost adoptive technology at situations of non-availability of antioxidant chemical at farmers level.

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Research Notes

Management of mulberry thrips *Pseudodendrothrips mori* (Nawa) by chemical method

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Mulberry (*Morus* spp.) leaf is the only natural food for the silkworm, *Bombyx mori* L. It is a perennial, evergreen, luxuriant crop cultivated in all types of soils, both under rainfed and irrigated conditions. The crop is prone to depredation of diverse organisms, because of its fast growth and green foliage throughout the year, in varying proportions either for space, food or both. So far, over 300 insect and non-insect species of pests are known to infest mulberry in varying intensities during different stages of the crop and seasons (Naik, 1997). Among the sap feeders infesting mulberry, incidence of thrips was the highest (42.55%) followed by mealy bugs (20.80%), jassids or leaf hoppers (20.28%) and scale insects (1.65%) (Sathyaprasad and Manjunath, 1993).

In Tamil Nadu, thrips was considered as less important pest of mulberry earlier. But during January 2000, leaf damage by *Pseudodendrothrips mori* (Nawa) ranged from 14.02 to 49.14 per cent in 24 mulberry genotypes at TNAU campus, Coimbatore (Subramanian, 2000). During August - September 2001, the variety, S54 showed very high level of thrips damage (upto 70%) with hundreds of nymphs and adults in each leaf, showing characteristic symptom of leaf cupping. Due to severe infestation of thrips, there was loss in leaf weight ranging from 14.71 to 27.94 per cent among six mulberry varieties *viz.* Kanva2, MR2, S36, S54, DD and V1. Realizing the importance of this sucking pest, investigation was made to find out the effective insecticides for its management.

A field experiment was conducted in Kanva 2 mulberry crop at Tamil Nadu Agricultural University, Coimbatore during 2000-2001 to evaluate the efficacy of four chemical insecticides *viz.* malathion 50 EC 01.% dichlorvos 76 WSC 0.15%, triazophos 40 EC 0.08% and endosulfan 35 EC007% and three botanicals *viz.* TNAU neem oil 60 EC (A) 2% and TNAU neem oil 60 EC (C) 2% and *Thuja* 30 (alcohol extract to *Thuja occidentalis*) 0.03% in comparison with untreated control against mulberry thrips. The trial was conducted in Randomized Block Design with three replications. The plot size used was 20 x 10m. The above treatments were given in the respective plot using a high volume knapsack sprayer with a spray fluid of 500 litres/ha on 30th day after pruning. Neem oil of desired concentration was preparation with 1% soap solution.

Population of thrips was recorded one day prior to and three days after treatment. In each plant, three leaves at random were selected for observation and 10 plants were observed in each plot. Based on the pretreatment and post treatment count on thrips population,