GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

www.scienceandnature.org

EVALUATION OF VARIOUS PHYSICAL SEED TREATMENTS FOR ENHANCING GERMINATION AND SEEDLING QUALITY PARAMETERS IN TURKEY BERRY (*Solanum torvum Sw.*)

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ABSTRACT
Laboratory studies were carried out in Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2014-2015 with the aim of improving the germination and seedling quality characters of turkey berry. The seeds were germinated only under open atmospheric condition (32°C and 20°C during day and night, respectively) when compared to controlled condition (25°C and 95± 5% RH) both in paper and protray nursery medium. So the seeds were exposed to various physical treatments *viz.*, soaking in cold water, hot water, mechanical scarification (sand) and acid scarification (H_2SO_4) with different durations revealed that seeds scarified with H_2SO_4 for 60 seconds registered maximum seed quality characters than control. Acid scarification (H_2SO_4) for 60 seconds improved the speed of germination, germination (%), root length (cm), shoot length (cm), dry matter production (g/10 seedlings) and vigour index. The increases over control seeds for these parameters were 25, 5, 11.3, 53.4, 47.3, and 29.2% respectively

KEY WORDS: *Solanum torvum*, Cold and hot water, Sand, H_2SO_4.

INTRODUCTION

Vegetables plays a vital role in providing nutritional security to eliminate malnutrition of the global concern. India is the second largest producer of vegetables in the world next to China and produces 162897 thousand metric tonnes from an area of 93.96 lakh hectare and productivity of 17.3 metric tonnes per hectare. Tamil Nadu has 2.89 lakh hectares under vegetable with a production of 8678.8 thousand metric tonnes and productivity of 30 metric tonnes per hectare to its credit (Anon, 2014). So, we are in the stage of increasing the production and productivity to increase the uptake, generate employment and income to the people. Turkey berry (*Solanum torvum*) belonging to the family Solanaceae is known as a popular traditional vegetable but can't cultivate like other vegetables. It is normally propagated by seed and branch cuttings taken from high yielding shrubs. Turkey berry used horticulturally as a rootstock for eggplant. Grafted plants are very vigourous and tolerate diseases affecting the root system, thus allowing the crop to continue for a second year (Petran and Hoover, 2014). But the seeds didn't germinate uniformly and studies on improvement of germination are very meagre and scanty.

Good quality seed acts as a catalyst for realizing the potential of all other inputs in agriculture. Production of quality seed and maintenance of high seed germination over the storage period are of most importance in a seed programme. To provide higher quality seeds, many researchers have developed new technologies called seed quality enhancement techniques. Seedlings are the basic unit of production which can be produced through nursery and requires suitable medium for production of quality seedlings at nursery (Ramesh *et al.*, 2001 and Khelikuzzaman, 2007). In view of the above facts, the present study was taken up in turkey berry (*S. torvum*) with the objectives of standardizing the suitable pre-sowing seed treatments.

MATERIALS & METHODS

Seeds of turkey berry (*Solanum torvum*) collected from Orchard, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study. The laboratory experiments were carried out at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. The *S. torvum* seeds were subjected to various physical treatments *viz.*, soaking in cold and hot water (6,8,10 and 12 h duration), mechanical scarification with sand (5,10,15 and 20 minutes) and acid scarification with H_2SO_4 (30,60,90 and 120 sec) along with control to standardize suitable treatment by adopting seed to solution ratio of 1:1 as volume by volume basis by using different durations, kept in germination room maintained with 25 ± 2°C temperature and 90 ± 3 % RH for 28 days, normal room temperature and also were sown in nursery along with control. The experiment was carried out with four replications in factorial completely randomised design (FCRD).and evaluated the following seed quality parameters.

Speed of germination

Four replicates of hundred seeds each were used to test the speed of germination of seeds from different treatments in paper medium. The seeds showing radical protrusion were counted daily from fourth day after sowing until twenty days. From the number of seeds germinated on each day, the speed of germination was calculated using the following formula and the results were expressed in number (Maguire, 1962).

$$\text{Speed of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} + \ldots\ldots\ldots + \frac{X_n - X_{n-1}}{Y_n}$$

X_1- Number of seeds germinated at first day
X_2- Number of seeds germinated at second day
X_n- Number of seeds germinated on n^{th} day
Y_1- Number of days from sowing to first day
Y_2- Number of days from sowing to second day
Y_n- Number of days from sowing to n^{th} day

Germination (%)

Four replicates of 100 seeds each were germinated by using paper (Between papers) medium under nursery condition. After the test period of 28 days the number of normal seedlings in each replication was counted and expressed in percentage (ISTA, 2007).

Root length (cm)

At the time of germination count, ten normal seedlings were selected at random from each replication and used for measuring the root length of seedlings. Root length was measured from the point of attachment of seed to the tip of primary root. The mean values were calculated and expressed in centimetre.

Shoot length (cm)

The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured from the point of attachment of seed to tip of the leaf and the mean values were expressed in centimetre.

Drymatter production (g seedlings^{-10})

The ten normal seedlings were placed in a paper cover and dried in shade for 24h and then, they were kept in an oven maintained at 80°C for 48h and allowed to cool in a desiccators for 30 minutes. The dried seedlings were weighed and the mean values were expressed in g seedlings^{-10}.

Vigour index

Vigour index values were computed using the following formula and the mean values were expressed in whole number (Abdul-Baki and Anderson, 1973).

Vigour index = Germination percentage x Total seedling length (cm).

Statistical Analysis

The data obtained from different experiments were analysed for 'F' test of significance following the methods described by Panse and Sukhatme (1985). Wherever necessary and the per cent values were transformed to angular (arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical signifinance (*). If F test is non-significant, it was indicated as NS

RESULTS & DISCUSSION

In the present study, the seed doesn't germinate under controlled condition and normal room temperature. Treated seeds sown in nursery condition were germinated. Among the different treatments, the maximum germination percentage was recorded in the acid scarified seeds with H_2SO_4 for 60 seconds (78%), followed by seeds soaked in cold water for 12 h, hot water for 10 and 12 h, mechanical scarification for 5 minutes and acid scarification with H_2SO_4 for 30 seconds (77%) which was on par with each other. The minimum germination percentage was recorded in control (73%) (Table 1).

TABLE 1. Effect of physical seed treatments on different seed quality parameters

	Treatments	Speed of germination	Germination (%)	Root length (cm)	Shoot length (cm)	DMP (mg seedlings^{-10})	Vigour index
T_1	Soaking in cold water for 6h	2.3	75 (60.00)	4.6	2.1	0.0021	504
T_2	Soaking in cold water for 8h	2.2	75 (60.00)	4.7	2.2	0.0024	519
T_3	Soaking in cold water for 10h	2.4	76 (60.67)	4.7	2.3	0.0025	523
T_4	Soaking in cold water for 12h	2.4	77 (61.34)	4.7	2.3	0.0025	533
T_5	Soaking in hot water for 6h	2.3	75 (60.00)	4.3	2.2	0.0024	495
T_6	Soaking in hot water for 8h	2.3	75 (60.00)	4.4	2.2	0.0025	496
T_7	Soaking in hot water for 10h	2.4	76 (60.67)	4.6	2.2	0.0026	517
T_8	Soaking in hot water for 12h	2.2	77 (61.34)	4.7	2.3	0.0026	536
T_9	Mechanical scarification for 5 min.	2.4	77 (61.34)	4.5	1.9	0.0023	492
T_{10}	Mechanical scarification for 10 min.	2.5	76 (60.67)	4.7	2.2	0.0024	523
T_{11}	Mechanical scarification for 15 min.	2.2	76 (60.67)	4.5	2.2	0.0022	506
T_{12}	Mechanical scarification for 20 min.	2.2	75 (60.00)	4.5	2.0	0.0021	485
T_{13}	Acid scarification with H_2SO_4 soaking for 30 sec.	2.4	77 (61.34)	4.8	2.2	0.0025	540
T_{14}	Acid scarification with H_2SO_4 soaking for 60 sec.	2.5	78 (62.03)	4.9	2.3	0.0028	557
T_{15}	Acid scarification with H_2SO_4 soaking for 90 sec.	2.2	75 (60.00)	4.7	2.1	0.0023	506
T_{16}	Acid scarification with H_2SO_4 soaking for 120 sec.	2.1	74 (59.34)	4.6	2.0	0.0021	485
T_{17}	Control	2.0	73 (58.69)	4.4	1.5	0.0019	431
	Mean	2.3	76 (60.67)	4.6	2.1	0.0024	509
	SEd	0.15	0.77	0.08	0.03	0.0001	7.61
	CD (P=0.05)	0.31	1.57	0.16	0.08	0.0002	15.48

(Figures in parentheses indicates arcsine values)

For vigour index, it was significantly influenced by seed treatments. Among the different treatments, the maximum vigour index was obtained in the acid scarified seeds with H_2SO_4 for 60 seconds (557), followed by acid scarified seeds with H_2SO_4 for 30 seconds (540) and seeds soaked in hot water for 12 h (536). The minimum value was recorded in control (431) by registering 29 per cent reduced vigour value over best treatment. Acid scarified seeds with H_2SO_4 for 60 sec. increased the speed of germination by 25 per cent, germination by 5 per cent, root length by 11.3 per cent and shoot length by 53.4 per cent over untreated seeds. The per cent increase over

untreated seed for the dry matter production and vigour index was 47.3 and 29.2 per cent, respectively. This might be due to softening of seed coat as supported by (Wei *et al.*, 2010). Such beneficial effect of suitable treatment over higher or longer duration were reported by Vasconcelos *et al.*(2011), Estaji *et al*. (2012) and Rouhi *et al.* (2013).

Seed treatments with dilute sulphuric acid solutions induced germination of witch weed seeds by selectively softening the aleurone layer over the tip of the radicle and expressed that the significance of a physical resistance to germination would depend upon the integrity of the tissues surrounding the embryo, particularly over the radicle and may vary with seed species (Egley, 1999). The hike in germination due to the sulphuric acid treatment might be due to the disintegration of seed coat material and the micropylar plug that increased water absorption capacity through the hilum and micropylar end besides that of the seed coat (Bhattacharya and Saha, 1997) (Plate 1).

PLATE 1. Comparison of acid (H_2SO_4) scarified seeds with control

The results are in the accordance with Kalavathi (1996) in cassia and Reshma (2001) in desmanthus which is due to increase in normal seedlings and reduction the hard seed by dissolving the lignins and pectins present on the epidermal layer by the chemical property of the acid and render them permeable to water and oxygen. In the present study revealed that, seeds scarified with H_2SO_4 for 60 sec. improved the germination and seed quality characters by supplementing required light and temperature for germination of *Solanum torvum* seeds.

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