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EFFECT OF VARIOUS PRETREATMENTS ON SEED GERMINATION BEHAVIOUR OF *GREWIA VILLOSA* WILLD., AN IMPORTANT MEDICINAL PLANT OF THE INDIAN THAR DESERT

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The present paper deals with the effect of various pretreatments on seed germination behaviour of *Grewia villosa,* an important medicinal plant of the Indian Thar desert. Data on various parameters such as germination, seedling growth, vigour index, etc. as influenced by different pretreatments like acid and mechanical scarifications, nitrate salt solutions, etc. were recorded. The results revealed that maximum values for germination percentage and germination value (GV) in fresh and one-year-old decoated seeds were recorded when pretreated with mechanical scarification (MS). The highest values for vigour index (VI) in fresh (536.64) and one-year-old seeds (584.08) were also reported in this pretreatment.

Key Words: *Grewia villosa*, seed germination, vigour index, seedling growth, Indian Thar desert

Seed germination is one of the most important phases in the life cycle of a plant and is highly responsive to existing environment (Besma and Mounir 2010). Dormancy can be due to various factors like immature embryo, seeds requiring after ripening or chilling treatment, hard and impermeable seed coat, etc. (Goswami and Reddy 2004). The effect of various types of treatments such as presoaking, scarification, acid treatment, chilling, hot water treatment and GA_3 are well known to induce germination in dormant seeds (Bose and Sarma 2000). Mechanical scarification is another device for breaking the hard seed coat dormancy to increase the germination of seeds (Sen 1977).

Roots of *G. villosa* are used as a remedy for antidiarrhoea and cold, while its bark in genitourinary infections, syphilis and smallpox (Khare 2007). Thus, the present investigation has therefore been aimed to assess the effect of various pretreatments such as concentrated sulphuric acid and mechanical scarifications and different concentrations of nitrate salt solutions on seed germination, seedling growth, R/S ratio, germination value (GV) and vigour index (VI) of *G. villosa* under controlled laboratory conditions. The ultimate expression of vigour is the productivity of the plant and germination value (GV) is expression of speed and totality of germination and their interaction.

MATERIALS AND METHODS

Mature fruits of *G.villosa* were collected from Kailana Machia Reserve Park (11 km away from University Campus in west direction) during two consecutive years (2008-09 & 2009-10). The fruits were cleaned and seeds stored in plastic container with parad tablets to protect them insects. During germination studies, seeds were treated with 0.1% $HgCl_2$ for 30 seconds and then kept under running tap water for 3-4 hours for removal of any toxic substances. For enhancing germination parameters, seeds were pretreated with acid & mechanical scarifications and nitrate solutions. The mechanical scarification treatment was conducted by rubbing the seeds gently over emery stone at micropylar end. Acid scarification was done by treating the seeds with conc. H_2SO_4 for various durations (2, 5 and 10 min.). Afterwards, the seeds were washed in running tap water for 3-4 h. Seeds were also presoaked for 24 h in different concentrations (50 and 100 mgl^{-1}) of nitrate solutions, *viz*. NH_4NO_3, KNO_3 and $CoNO_3$.

For germination studies, seeds were placed in sterilized petridishes lined with single layer of filter paper. The filter paper was moistened

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with the required volume of distilled water as and when needed. The germination experiments were performed in alternate white light and dark (12h) obtained from three fluorescent tubes of 40 watts each fitted at a height of half meter from the petridishes (1000 Lux) at 28 °C in seed germinator. After one week of setting the experiments, seeds germination percentage and root & shoot lengths of seedling were recorded. The seedling VI and GV was calculated as proposed by Abdul-Baki and Anderson (1973). GV of the seeds, which is an index combining the speed and completeness of the germination was calculated for each treatment using the formula of Czabator (1962). The experiments were performed in triplicate with each petridish containing 10 seeds and repeated three times for confirmation of results.

All the experiments were executed using CRD design separately during both the years and the data were statistically analyzed by one way ANOVA as suggested by Gomez and Gomez (1984). The mean values of two years for each parameter are presented in tabular form.

RESULTS AND DISCUSSION

The data on effect of various pretreatments on different parameters of seed germination are presented in Table1. The moisture percentage on dry weight basis in freshly collected fruits and one-year old seeds were 48.670 and 3.875, respectively. Freshly collected seeds showed maximum 83.33% germination under controlled laboratory conditions in MS pretreatment. The value of all parameters such as root and shoot lengths, R/S ratio, GV and VI were maximum in this treatment as compared to others. However, in control conditions seeds exhibited only 6.66% germination.

In case of one-year-old seeds, the maximum values for seed germination (86.66%), root (3.04 cm) and shoot (3.70 cm) lengths of seedlings were recorded in MS pretreatment. The highest R/S ratio (0.946) and GV (320.0) were recorded in 10 min. of conc. H_2SO_4 pretreatment. No significant results were observed in various nitrate solutions pretreatments. Tiryaki (2006) reported that pretreatment significantly improve the final germination percentage and germination rate as compared to untreated seeds in *Amaranthus* sp. The scarification pretreatments improved the germination significantly in plant species. The effect of sulphuric acid pretreatments may be due to softening of seed coat resulting in to

Table 1. Effect of various pretreatments on seed germination (%), seedling growth (cm), root/shoot lengths (R/S), vigour index (VI) and germination value (GV) in fresh and one-year-old seeds of G. villosa.

	Germination		Seedling growth				R/S ratio		VI		GV	
	fresh	old	Root length		Shoot length		fresh	old	fresh	old	fresh	old
			fresh	old	fresh	old						
Control	6.66	10.00	2.65	2.56	3.15	2.76	0.841	0.927	36.08	53.20	1.99	50.00
Acid scarification	16.66	36.66	2.43	2.09	2.93	2.95	0.829	0.708	89.29	184.47	13.32	65 .98
(min) 2	80.00	76.66	2.34	2.18	3.23	2.98	0.724	0.731	445.60	395.56	21.33	145 .60
5												
10	66.66	80.00	2.28	2.68	2.75	2.83	0.829	0.946	335.29	440.80	219.90	320 .00
Mechanical scarification	83.33	86.66	2.94	3.04	3.50	3.70	0.842	0.821	536.64	584.08	205.54	149 .03
CD	0.438*	0.476*	0.240*	0.409*	0.321ns	0.319*	0.0375*	0.438ns	24.696*	103.346*	2.766*	6.587*
Nitrate solutions (mg l-1)	16.33	20.00	2.30	2.00	2.81	2.20	0.818	0.909	83.44	84.00	13.05	13.32
KNO_3 50												
100	40.00	13.00	2.22	1.20	2.83	1.92	0.784	0.625	202.00	40.56	40.00	8.45
$NH4NO_3$ 50	42.00	46.00	2.35	2.50	2.89	2.98	0.813	0.838	220.08	252.08	88.20	52.90
100	13.33	20.00	2.25	2.09	2.86	2.31	0.786	0.904	68.11	88.00	5.90	13.32
$CoNO_3$ 50	40.00	46.00	2.23	2.65	2.93	2.81	0.841	0.943	206.40	251.16	53.32	105.80
100	18.33	26.33	2.40	1.98	2.87	1.35	0.836	0.725	96.59	14.74	5.96	1.26
CD	0.293*	0.169ns	0.167ns	0.417*	0.461ns	0.437*	0.0420*	0.0201*	6.035*	104.867*	1.118*	1.654*

ns = Non-significant; and * = Significant at P < 5% probability level.

water influx and breaking hard coat seed dormancy (Bhatt *et al*. 2000). Verma and Kasera (2006) observed maximum germination in *Sida cordifolia* by MS pretreatment. Saharan *et al*. (2001) reported cent percent seed germination in *Evolvulus alsinoides* by this pretreatment. Data obtained from present studies clearly revealed that MS pretreatment was suitable for maximum germination and seedling growth in one-year-old seeds as compared to fresh ones. The data obtained for all parameters were significant at 95% probability levels, except for root and shoot length of seedlings in fresh seeds and germination percentage in one-year-old ones.

Based on the present study, it is concluded that seeds of *Grewia villosa* possess hard seed coat dormancy, which can be removed by mechanical scarification pretreatment. Hence, for large-scale multiplication of this plant under field conditions, seeds should be scarified mechanically.

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