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EFFECT OF DIFFERENT CHEMICALS ON GERMINATION AND SEEDLING GROWTH OF CHIRONJI (*BUCHANANIA LANZAN* SPRENG.)

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Abstract

The seeds of Chironji (*Buchanania lanzan* Spreng.) were treated with H_2SO_4 (5 per cent), Mechanical scarification, GA_3 (200 and 300 ppm), KNO_3 (1 and 2 per cent), Thiourea (1 per cent), Biomix (50 g per kg seed), Cow urine (5 per cent), Cow dung slurry (5 per cent) and soaking in distilled water as control for 24 hours. Maximum germination (71.27) percentage and minimum number of days taken (22.19) for initiation of germination was noticed in seeds subjected to GA_3 200 ppm treatment, which was at par with mechanical scarification and dipping in H_2SO_4 (5 per cent). The maximum seedling height (36.78 cm), seedling diameter (0.45 cm), number of leaves per plant (14.63 cm) and leaf area (48.47 cm^2) was found in seeds treated with GA_3 200 ppm treatment at 180 DAS. Maximum survival (64.13) percentage of chironji seedling was also noticed in seeds subjected to GA_3 200 ppm treatment at the end of the experiment (180 DAS). Pre sowing treatment like GA_3 200 ppm, mechanical scarification and H_2SO_4 (5 per cent) found equally better on germination and growth parameters of Chironji seedlings at 180 days after sowing.

Key words : Chironji, charoli, *Buchanania lanzan* Spreng., germination, GA_3, KNO_3, scarification.

Introduction

Chironji or Charoli (*Buchanania lanzan* Spreng.), a member of the family Anacardiaceae, originated in the Indian sub-continent, is an excellent tree of agro forestry. It assumes great significance due to its multifarious uses and capacity to withstand adverse climatic conditions. At present, it is growing under forest condition as an under exploited fruit and gives monitory reward to tribal community of the country. The oily kernels are the most important part and are used in preparation of puddings. The kernel is highly nutritious and rich in protein (25-30%) and yield sweet oil, which can be used to substitute olive and almond oil. It is a medium size tree, up to 40-50 ft. height with a straight trunk. Trees have the alternate bearing nature as present in the mango. It flowers in the month of January-February and ripen in April-May. Kernels are of very high value and fetch Rs. 800-1000 per kg in market. The tree is found growing as wild in the tropical deciduous forests of north, west and central India mostly in the states of Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Chhattisgarh, Jharkhand, Gujarat, Rajasthan and Maharashtra. In Gujarat, it is found mainly in Dang, Valsad, Vadodara and Dahod district. *Buchanania lanzan* being a vulnerable medicinal plant is included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources (IUCN).

This species has high socioeconomic value providing livelihood to tribal population of the area and has high potential as commercial horticulture species. Unfortunately, over-exploitation and indiscriminate harvesting (lopping and cutting) leading severe threat to it, hence urgent conservation efforts are required at all levels. Chironji seeds exhibits poor germination percentage even if exposed to favourable conditions of germination owing to seed dormancy. It may be due to morphological factors such as hard seed, thick testa or due to incorrect storage or handling (secondary dormancy). Such seeds may reuire special treatments like stratification, scarification, soaking in water, growth regulators etc., for overcoming dormancy. Pre-sowing treatment with chemicals like GA_3, KNO_3 and thiourea (Rajamanickam *et al*., 2002) improve the seed germination of chironji.

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It is felt that chironji plantation can be conserved and increased by bringing more area under new plantations. Keeping these facts in mind and also to meet out the local demand of quality planting material of chironji, the research work on effect of different chemicals on germination and seedling growth of chironji (*Buchanania lanzan* Spreng.) was conducted for developing a suitable technology facilitating easy multiplication, regeneration and conservation of this important species.

Materials and Methods

The present investigation was carries out at Agriculture Experimental Station, Navsari Agricultural University, Paria, Valsad (Gujarat), India during 2016-2017. The experimental design was Completely Randomized Design (CRD). Eleven different treatments were imposed including control. Fresh seeds from fruits were collected from the forest area of Rajpipla region (Narmada, Gujarat). Healthy seeds of uniform size were selected and used for the experiment. Hundred seeds were used for each treatment, which was replicated thrice. The treatments were $\mathbf{T_1}$-H_2SO_4 at 5% (10 min.), $\mathbf{T_2}$-Mechanical scarification (Breaking hard seed coat by hammering), $\mathbf{T_3}$-GA_3 at 200 ppm (24 hr), $\mathbf{T_4}$-GA_3 at 300 ppm (24 hr), $\mathbf{T_5}$- KNO_3 at 1% (24 hr), $\mathbf{T_6}$-KNO_3 at 2% (24 hr), $\mathbf{T_7}$-Thiourea at 1% (24 hr), $\mathbf{T_8}$-Biomix at 50gm/kg seed (24 hr), $\mathbf{T_9}$-Cow urine at 5% (24 hr), $\mathbf{T_{10}}$-Cow dung at 5% (24 hr), $\mathbf{T_{11}}$-Control (Water soaking for 24 hr). Before sowing all seeds were soaked in water for 24 hours and after that seeds were dipped in chemicals for 24 hour except seeds treated with concentrated H_2SO_4, which were dipped for 10 minutes. Hard seed coats were broken down by hammering in seeds which are treated with mechanical scarification before sowing. Germination parameters at definite intervals were recorded to find out the effect of these treatments on Chironji seeds. Biomix solution is made up by mixing equal amount of Phosphate solubilising bacteria*, Azospirillum*, *Trichoderma viridae* and *Pseudomonas fluroscence.* After imposing treatments, the seeds were shade dried for 10 minutes and were sown in polythene bag containing media 1:1:1 ratio (Soil, FYM, Sand) at 1 cm depth and were kept in the poly house. The polythene bags were watered daily till final data were recorded. Observations were recorded daily on germination parameters and monthly for vegetative parameters since the date of seed sowing. The date of first plumule emergence was recorded and computing the difference between date of sowing and plumule emergence was recorded as a number of days taken for germination. The germination percentage was calculated by using below formula :

Germination percentage (%) = (Number of seed germinated / Number of seed sown) × 100.

The survival percentage of chironji seedling was calculated at the end of the experiment (180 DAS) using below formula :

Survival percentage (%) = (Number of seedling survived/ Number of seed germinate) × 100.

The data collected from the five labelled seedlings in each treatment in a repetition were averaged and subjected statistical analysis (Panse and Sukhatme, 1967).

Results and Discussion

Seed germination characters

The statistical analysed data presented in the table 1, revealed that number of days taken to germination and germination percentage of chironji were significantly influenced by different pre sowing treatments. The seed subjected to $\mathbf{T_3}$ (GA_3 200 ppm) recorded earliest germination (22.19 days). This was at par with seed treated with T_2 (mechanical scarification) and $\mathbf{T_1}$ (H_2SO_4 at 5%) recording 23.69 days and 24.07 days respectively. The late (41.79 days) germination was observed in control. The seeds under $\mathbf{T_3}$ (GA_3 200 ppm) recorded highest germination percentage (71.27%), which was at par with $\mathbf{T_2}$ (mechanical scarification) and $\mathbf{T_1}$ (H_2SO_4 at 5%) recording 69.71% and 68.33%, respectively. The lowest germination percentage was noticed in control (29.02%). The seed germination in chironji is erratic due to the possession of various degrees of physical dormancy caused due to hard seed coat, which is impermeable of water and oxygen (Bewley and Black, 1982). The treatment with GA_3 200 ppm ($\mathbf{T_2}$) for 24 hours of soaking proved to be a best treatment. The remarkable effect of GA_3 on seed germination might be due to the involvement of GA_3 in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption. GA_3 acts directly on embryo relieving them from dormancy through promoting protein synthesis and elongation of coleoptiles and leaves and also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially amylase, which favors the seed germination (Stewart and Freebairn, 1969). Another reason is that GA_3 stimulates seed germination by formation of a-amylase enzymes which converts insoluble starch into soluble sugars and it also initiates the radical growth by removing some metabolic blocks (Gillard and Walton, 1973). Sharma (2016) also found that chironji seeds treated with GA_3 at 200 ppm for 24 hours have considerably reduced the number of days taken for germination (23.77) and increased the germination

Table 1 : Effect of different chemicals on germination, vegetative growth and survival percentage of chironji seedlings.

Treatment	Days to germinate	Germination percentage (%)	Seedling height (cm)	Stem diameter (cm)	Number of leaves/ plant	Leaf area (cm^2)	Survival percentage (%)
T_1 - H_2SO_4 @ 5%	24.07	68.33	30.31	0.41	13.16	44.23	58.59
T_2 - Mechanical scarification	23.69	69.71	35.26	0.43	13.61	48.37	60.09
T_3 - GA_3 @ 200 ppm	22.19	71.27	36.78	0.45	14.63	48.47	64.13
T_4 - GA_3 @ 300 ppm	30.31	52.61	21.93	0.36	11.25	40.03	52.77
T_5 - KNO_3 @ 1%	33.29	50.49	21.33	0.34	10.51	38.50	55.18
T_6 - KNO_3 @ 2%	33.47	54.13	22.43	0.39	10.64	42.28	58.09
T_7 - Thiourea @ 1%	37.87	42.14	21.32	0.33	10.02	31.30	50.33
T_8 - Biomix @ 50gm/kg seed	38.01	40.38	20.15	0.31	10.00	27.68	50.13
T_9 - Cow urine @ 5%	33.34	33.34	22.39	0.36	10.64	38.38	51.06
T_{10} - Cow dung	34.99	34.99	21.24	0.34	10.38	35.33	55.09
T_{11} – Control	41.79	29.02	14.50	0.24	8.70	18.12	38.39
S.Em±	0.75	1.22	0.63	0.01	0.36	0.36	1.32
C.D. at 5%	2.19	3.57	1.83	0.03	1.07	1.07	3.88
CV%	4.03	4.24	4.45	4.10	5.63	1.68	4.25

percentage (69.75 %). Significant effect of GA_3 on seed germination is also observed by Kumar *et al*. (2008), who recorded quick germination (21.20 days), better percentage of germination (72.15%) in mango seed treated with GA_3 at 100 ppm. Results of present investigation showed favorable response up to 200 ppm of GA_3 treatment for seed germination but the higher dose of GA_3 might have inhibit or suppressed the effect of germination process up to some extent. These findings are in accordance with the results of Hore and Sen (1994). The mechanical scarification treatment (**T_2**) removed the seed coat there by increased the permeability of air and water through seed which favours the early germination. Similar results were found by Shukla and Solanki (2000), they recorded the early seed germination up to 83 per cent by mechanically damaging the seed coat by hammer before sowing the chironji seed. Seed treatment with H_2SO_4 at 5% (**T_1**) for 24 hour also showed reasonably quick germination with higher germination percentage as compare to control. Fadimu *et al*. (2014) also recorded the germination of stony fruits of Hog plum (*Spondias mombins*) in response to 60% concentrated H_2SO_4. They that 60% concentrated H_2SO_4 for 25 minutes gave the highest seed (75%) germination. Hence, we can say that for acquiring early germination and higher germination percentage one should go for soaking of seed in water for 24 hours followed by soaking in GA_3 at 200 ppm concentration for 24 hours. In addition to the above result, the present study has yielded this important information that a comparison between other treatments, Mechanical scarification and acid scarification also showed good results with respect to reduced days to germination and higher germination percentage as compared to the control.

Vegetative growth characters

Height, diameter, number of leaves and leaf area are the important parameters in judging quality of seedlings. All the treatments seem to play positive role (table 1) in improving the vegetative growth characters of chironji under the present study. The maximum seedling height (36.78 cm), stem diameter (0.45 cm) and number of leaves per plant (14.63) at 180 days after sowing were recorded in treatment **T_3** (GA_3 at 200 ppm) followed by mechanical scarification treatment recording seedling height (35.26 cm), stem diameter (0.43 cm) and number of leaves per plant (13.61). Similarly, maximum leaf area (48.47 cm^2) at 180 DAS was also recorded in treatment **T_3**. Minimum seedling height (14.50 cm), stem diameter (0.24 cm), leaves per plant (8.70) and leaf area (18.12 cm^2) was noticed in control at 180 DAS. The increased seedling height with GA_3 treatment might be due to the fact that this hormone increased osmotic uptake of nutrients, causing cell elongation and thus increasing height of the plant and stem diameter was also increased due to greater cell division and elongation at the stem portion (Sen *et al*., 1990). The production of more number of leaves might be due to higher growth of seedlings and also due to activity of GA_3 at the apical meristem resulting in more synthesis of nucleoprotein responsible for increasing leaf initiation (Sen and Ghunti, 1976). The maximum leaf area might be due to increased in leaf

length and width, which ultimately increased in leaf area of the plant. Present findings are supported by (Sharma 2016) in chironji, who revealed that the considerable plant height (31.33 cm) and number of leaves (13) was recorded by seed treatment with GA_3 at 200 ppm concentration. Similarly, Muralidhara *et al*. (2015) also found better plant height (21.6 cm), more number of leaves (22.5) and leaf area (255.4 cm^2) in mango stones treated with GA_3 at 200 ppm. Increase in different growth parameters by mechanical scarification is might be due to early germination and favorable growing conditions under scarification treatment (Sharma, 2016). Centre of forest research and human resource development, Chhindwara (Annual Report, 2006) also reported that the seed of chironji treated mechanically by hammer gave better seedling growth.

Survival percentage

The statistical analysed data presented in the table 1, revealed that the survival of chironji seedlings was significantly affected by different chemicals at the end of the experiment (180 DAS). The results revealed that among different chemicals, survival percentage at the end of the experiment (180 DAS) was found maximum (64.13%), when the seeds were treated with $\mathbf{T_3}$ (GA_3 at 200 ppm). The lowest survival percentage (38.39%) was found in control. A possible reason for such higher survival percentage of chironji seedlings might be due to early germination and favorable growing conditions under GA_3 treatment. The observation analogues to these findings were reported by Manekar *et al*. (2011) in aonla. They found that seed soaked in aqueous solution of GA_3 at 200 ppm for 24 hour gave maximum survival percentage (92.73%) in aonla. Based on the overall performance, seed soaking in GA_3 at 200 ppm concentration for 24 hours was found to be the best treatment for getting higher survival rate in chironji. Thus, nurserymen and growers can use this technique for getting maximum survival of chironji seedlings.

Conclusion

Based on the results of the present investigation entitled "Effect of different chemicals on germination and seedling growth of chironji (*Buchanania lanzan* Spreng.)", it can be concluded that the seeds soaked in water for 24 hrs followed by dipping in GA_3 at 200 ppm for 24 hours gave the early germination, maximum germination percentage with optimum vegetative growth and highest survival percentage of chironji seedlings. Therefore, gibberellic acid can be used for enhancing early germination, germination percentage and production of vigorous seedlings of chironji.

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