RESEARCH ARTICLE

IMPROVEMENT IN SEED GERMINATION IN SENNA (*CASSIA ANGUSTIFOLIA*) THROUGH PRETREATMENTS

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Abstract: *Cassia angustifolia* popularly known as Senna is a valuable plant drug in Ayurvedic and modern system of medicine. Leaves and pods are used as natural laxative. Leaves of this plant contain sennosides A, B, C and D and are in demand internationally and preferred as ingredient of herbal tea in Europe. The drug is used as the most reliable and least harmful laxative agent. Pods and leaves are also used in the form of decoction, powder and many other herbal preparations. Senna is a sun-loving crop and requires bright sunshine for its successful growth. The crop is raised from seed and has a hard and tough seed coat. Poor germination of seeds affects nursery production for its mass propagation. Therefore pre-treatment of seeds is necessary to induce quick germination. The improvement in seed germination through chemical pre-treatments was reported in the present study that was conducted under completely randomized block design under polyhouse at Experimental farm, College of Horticulture and Forestry Neri- Hamirpur, Himachal Pradesh. The statistical analysis revealed significant effect on seed germination due to different pre-treatments. Pre-treatment T_4 i.e.GA_3 10ppm for 24 hrs soaking resulted in maximum germination (68.00 per cent) which was followed by GA_3 5ppm (60.00 percent) and minimum germination (28.00 per cent) was recorded in control. There was 142 per cent increase in germination percentage in treatment T_4 over control.

Keywords: Senna, Pre-treatments, Germination, Laxative, Sennosides

INTRODUCTION

The study of seed germination of medicinal plant species has received special attention due to the increased demand for these plants in the pharmacological industry, coupled with the need to make rational crops for the production of herbs (Hassan (2012); Pereira (1992) and Sajjadi, (2006). High seed quality and seedling establishment are the cornerstones of profitable, efficient, and sustainable crop production (Finch-Savage, (1995). Seed dormancy is defined as the failure of an intact viable seed to complete germination under favorable conditions and is controlled by several environmental factors such as light, temperature, and the duration of seed storage (Macchia *et al*., (2001). Depending on the plant species and type of dormancy, various methods like scarification, pretreatment with plant growth regulators (PGRs), and temperature shocks are used to break dormancy (Copeland and McDonald (2001) and Hidayati *et al*., 2012). Plant seed germination depends on both intrinsic and extrinsic factors. The principle factors that influence seed dormancy include certain PGRs and notably among them the abscisic acid is involved in germination inhibition while gibberellins participate in the termination of seed dormancy (Dewir *et al*., (2011); Halter *et al*., (2005). External application of PGRs to seeds could break seed dormancy and enhance seedling establishment of many aromatic and medicinal plants (Ali *et al.*, (2010); Gholami *et al*., (2013); Gupta, (2003); Kandari *et al.*, (2008); Shivkumar *et al*., (2006) and Zare *et al*., (2011).

Senna (*Cassia angustifolia*) belonging to the family Caesalpinaceae, is a perennial shrub, but grown as an annual in the rainfed areas, mainly for its medicinal properties particularly for its laxative principle. This crop is cultivated significantly in Gujarat (Anand), Rajasthan (Jodhpur) and Maharashtra (Pune district) and Tamil Nadu. Senna is being exported mainly to countries like USA, Germany and Japan. Other senna importing countries are Spain, France, China, Hong Kong, Thailand, Australia and Singapore. Nearly 75 % of senna produced in India is exported, especially through Tuticorin port. The present area under cultivation of of senna is around 6,000 ha located in various regions of India and in southern districts of Tamil Nadu, which dominates in commercial cultivation. Besides this Gujarat and Rajasthan are also emerging as potential suppliers of senna in India. The leaves and pods of senna contain sennosides A, B, C and D, which are well known for the preparation of laxatives and purgatives all over the world. The drug is used as the most reliable and least harmful laxative agent. The Sennosides had been extracted from Senna leaves, stems, pods, buds and flowers but no Sennosides were found in the seeds. Cultivation of Senna does not require much expenditure on irrigation, manuring, pesticides, protection and other pre- and post-harvest care. This makes the plant ideal crop for arid regions where water provision, wasteland development; desertification control and sand dune stabilization are the major challenges (Tripathi, (1999). Senna pods and leaves are also used in the form of decoction, powder and many other herbal preparations. It is popular in European countries for its use along with 'herbal tea'. It is a valuable plant drug in Ayurvedic and modern system of medicine for the treatment of constipation (Atal

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and Kapoor, (1982); Das *et al*., (2003); Martindale, (1977) and Sharma, (2004). Senna is a sun-loving crop and requires bright sunshine for its successful growth. The crop is raised from seed and has a hard and tough seed coat; therefore pre-treatment of seeds is necessary to induce quick germination.

MATERIALS AND METHODS

The experiment was conducted under completely randomized block design in polyhouse at Experimental farm, College of Horticulture and Forestry Neri- Hamirpur, Himachal Pradesh.Seeds were procured from DMAPR (Directorate of Medicinal and Aromatic Plants Research) Anand, Gujarat. In the present study to enhance seed germination seeds were subjected to eight pre-treatments as follows:

Table 1.

Treatment code	Details of treatments
T1	Hot water soaking for 24 hrs.
T2	Cold water soaking for 24 hrs
T3	Soaking in GA_3 5ppm solution for 24 hrs
T4	Soaking in GA_3 10ppm solution for 24 hrs
T5	Soaking in IAA 5ppm solution for 24 hrs
T6	Soaking in IAA 10 ppm solution for 24 hrs
T7	Soaking in IBA 5ppm solution for 24 hrs
T8	Soaking in IBA 10 ppm solution for 24 hrs
T9	Control (Untreated)

The experiment was conducted to study the effect of different pretreatments on seed germination of *cassia angustifolia.* Seeds were soaked in hot water, cold water and different concentrations of IAA, IBA and GA_3 for 24 hours before sowing. Seeds were sown in polybags with three replications under polyhouse in the month of July 2019.

RESULTS AND DISCUSSION

Table 2. Seed germination studies in *Cassia angustifolia (Senna)*

Treatments		Germination %
Hot water soaking for 24 hrs.	**T1**	44.00 (41.53)
Cold water soaking for 24 hrs	**T2**	52.00 (46.12)
Soaking in GA_3 5ppm solution for 24 hrs	**T3**	60.00 (50.74)
Soaking in GA_3 10ppm solution for 24 hrs	**T4**	68.00 (55.52)
Soaking in IAA 5ppm solution for 24 hrs	**T5**	32.00 (34.43)
Soaking in IAA 10 ppm solution for 24 hrs	**T6**	40.00 (39.21)
Soaking in IBA 5ppm solution for 24 hrs	**T7**	36.00 (36.85)
Soaking in IBA 10 ppm solution for 24 hrs	**T8**	56.00 (48.42)
Control (Untreated)	**T9**	28.00 (31.93)

*Values in parenthesis are arc sine transformed values

C.D.	1.729
SE(m)	0.577
SE(d)	0.816
C.V.	2.163

The data presented in table 2 revealed that maximum germination percentage (68.00 per cent) was recorded in treatment T_4 i.e GA_3 10ppm, followed by T_3 i.e. GA_3 5ppm (60.00 percent), whereas the minimum germination percentage (28.00 per cent) was recorded in treatment T_9 i.e control. The treatment T_4 is statistically superior to all other treatments. There was 142 per cent increase in germination percentage in treatment T_3 over control.

Seed germination is controlled by specific endogenous growth promoting and inhibiting compounds (Fang *et al.*, (2006); Farhoudi *et al.*, (2007) and Hartmann *et al.*, (1997) and there is a strong correlation among applied hormones, hormone concentration, specific developmental stage, and metabolic activities (Pedroza-Manrique *et al.*, (2005). GA_3 is an important endogenous growth regulator that mobilizes stored reserves and weakens the mechanical resistance of the endosperm cells around the radicle tip (Gulzar *et al.*, (2001). GA_3 also eliminates the natural chilling requirement for dormant seeds (Fang *et al.*, (2006). In general, application of GA_3 increased seed emergence percentage of many plant species including *Arbutus unedo* (Demirsoy *et al.*, (2010), black gram and horse gram (Chauhan *et al.*, (2009), and coriander (Kumar *et al.*, (2014). However, the stimulatory effects of GA_3 on seed germination have been reported to be species/dose dependent.

In the present study GA_3 treatment was the most effective as compared to other treatments. GA_3 improved germination percentage by 142% in treatment T_3 over control. This improvement in seed germination by GA_3 treatment might be due to the activity of GA_3 as a-denovo synthesis which also helps in dormancy breaking action. The growth regulator treatments through enzymatic and hormonal mechanism stimulated metabolic processes such as sugar mobilization, protein hydrolysis, oxidation etc (Jagadish, (1993). These results are in lines with the findings of Rawat and Pandey (2019) Kumari and Kohli (1984), Mehta and Sen (1991) and Kalavathi (1996) in *Cassia angustifolia* and Sivakumar (2005) in *Abelmoschus moschatus.* This study clearly concluded that soaking the senna seed in GA_3 treatment substantially improved the seed germination.

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