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GERMINATION BEHAVIOR OF *CASSIA TORA* SEEDS IN VARIOUS PRE-SOWING TREATMENT METHODS

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ABSTRACT

Cassia tora seeds, like those of many leguminous species, have hard and impermeable coats. Germination is thought to be enhanced when seeds are scarified or soaked in concentrated sulfuric acid or hot water. This experiment shows the effect of various pre-sown treatments on *C. tora* with respect to its germination behavior. Germination percentages were significantly affected by different pretreatments in *C. tora*. A 24 h soaking after mechanical scarification showed a significant level of improved germination (76.88%) when compared to all other treatments. Acid treatment showed the same level of significant in germination percentage when the seeds were treated for 5 and 10 min. Though hot water treatment showed an increased percentage of germination at 50°C (44.54%), further increase in temperature drastically reduced the germination. Alcohol treatment did not show any significant increase in germination percentage when compared to control but reduced the germination at prolonged exposure.

KEYWORDS: ***Cassia tora,*** **dormancy, germination, physical treatments.**

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INTRODUCTION

Cassia (caesalpiniaceae) is one of the largest genera with about 2500 species widely distributed throughout the tropical and subtropical regions of the world. This genus is prized for its agricultural, economical, and medicinal virtues. Hence, *Cassia* has drawn the attention worldwide. One such important medicinal plant species which belongs to this genus is *Cassia tora. Cassia tora* is an annual herb used as a source of medicine for constipation, conjuctival congestion, and blurred vision. Leaves have the potential of being hepato-protective.[1] The paste of the ground, dried roots of the plant is used in Ayurveda as a treatment for snake bite, ringworm, skin ailments, and allergies. It also serves as a mild laxative, liver stimulant, and heart tonic. Leaves and stem are used in vegetable and soups which show the edible nature of the plant. *C.tora* has also shown the allelopathic effect on *Parthenium hysterophorus* L.[2] The seeds possess antimicrobial activity.[3] Besides being used as a medicinal herb, seeds are used as mordant in dying and as a substitute for coffee. Being wild, *C. tora* can easily be grown from seed, but due to their hard seed coat the germination appears to be a limiting factor. Many legminous seeds have wide dormancy durations induced by the appearance of a hard water proof coat. These seeds exhibit seed coat-imposed dormancy which may be due to impermeability of testa to water.[4-6] Among legumes, damaging the coat or breaking dormancy, the most widely used pre-germination treatments are soaking of seeds in hot water or mechanical scarification or piercing of the coat.[4] Many authors reported the dormancy induced by seed coat and the presence of inhibitor chemicals in the genus *Cassia.*[7,8] For germination to start, the impermeable seed coat must be rendered permeable. Hence, pre-sowing treatment of *Cassia* seed is deemed necessary and needs definite treatments for breaking of seed dormancy.[8,9] Though reports on the pre-sowing and breaking dormancy treatment of other *Cassia* species are available, the information on *C. tora* is inadequate and scanty. Therefore, an investigation on seed treatments of *C. tora* was conducted with a view to determine treatments that promote maximum germination and the effect of various treatments in breaking the dormancy of *C. tora.*

MATERIALS AND METHODS

Mature dry seeds of *C.tora* were collected from local population. Seeds were separated from pods and then washed with water. Thereafter, seeds were dried and stored in the air-tight container for further use. The experimental design was Completely Randomized Block Design (CRBD) with five replications. There were four treatments of different time interval with five replications and a control. As many as 30 seeds were tested for each replication. The four pre-sowing seed treatments used in the experiment for *C. tora* were as follows:

Mechanical scarification

It was carried out by rubbing the seeds with sand paper until the surface of the coat was partially eliminated. Seeds were then subjected to soaking in water for 20, 22 and 24 h at room temperature.

Acid scarification

Seeds were dipped in concentrated sulfuric acid for 5, 10, and 15 min, respectively. They were then washed with running water.

Hot water treatment

It was carried out by dipping the seeds in hot water at 50, 60 and 70°C. Seeds were then kept at the room temperature for 30 min and subsequently washed with running tap water.

Alcohol treatment

Seeds were dipped in 70% alcohol for 5, 10, and 15 min followed by washing with running water. Before sowing, seeds were washed with running water four times to remove pericarp.

Treated seeds were planted in germination trays in five replications with 30 seeds each. The entire setup was maintained in a tissue culture facility. The time of sowing for all treatments was uniform. Seed germination was recorded daily, with the radical emergence (2 mm) serving as an index of germination. Germination test has the final count at 15 days.

Statistical analysis

The data were analyzed using the SAS software and the means were compared with the F test at $p = 0.05$.

RESULTS

Germination percentages were significantly affected by different pretreatments in *C. tora*. A 24 h soaking after mechanical scarification showed a significant level of improved germination (76.88%) when compared to all other treatments. Acid treatment showed the same level of significance in germination percentage when the seeds were treated for 5 and 10 min. Though hot water treatment showed an increased percentage of germination at 50°C (44.54%), further increase in temperature drastically reduced the germination. Alcohol treatment did not show any significant increase in germination percentage when compared to control but reduced the germination at prolonged exposure (Table 1).

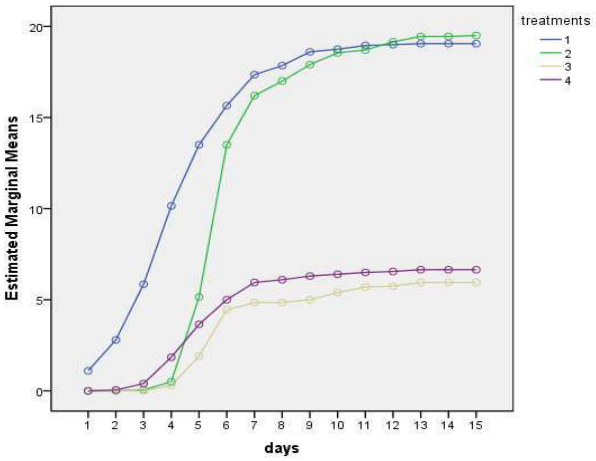
Table 1
Effect of different treatments on germination of Cassia tora seeds.

Treatment 1	**Time (h)**	**Mean germination (%)**
Mechanical scarification	Control	24.66+0.18
	20	64.33+0.65
	22	74.43+0.47
	24	76.88+0.37*
Treatment 2	**Time (min)**	**Mean germination (%)**
Acid treatment	Control	28.33+0.12
	5	78.44+0.42*
	10	76.32+0.39
	15	41.55+0.65
Treatment 3	**Temperature (degrees)**	**Mean germination (%)**
Hot water treatment	Control	31.13+0.17
	50	44.54+0.19*
	60	28.33+0.11
	70	32.34+0.16
Treatment 4	**Time (min)**	**Mean germination (%)**
Alcohol treatment	Control	29.33+0.13
	5	38.64+0.56*
	10	14.56+0.38
	15	8.33+0.45

Statistically significant at 0.05 level.

The marginal means of germination represented in Graph 1 clearly explain the estimated marginal means of germination among treatments: (1) mechanical scarification; (2) acid scarification; (3) hot water treatment; and (4) alcohol treatment.

Graph 1
Estimated marginal means of germination



DISCUSSION

Many leguminous seeds have wide dormancy durations induced by the appetence of a hard water proof coat or enclosed embryo. From the present investigations that are carried out, the treatments like mechanical scarification and acid treatment were found to induce the germination of *C. tora* seeds. Hence, one can infer that dormancy of the seeds was probably associated with the seed coat since the above treatments that induce germination can affect disruption of the seed coat. Immersion of seeds in highest concentrated sulfuric acid disrupts the seed coat.[10] The 98% concentrated sulfuric acid with 5 min treatment of these seeds gave the highest percentage of germination; 15 min treatment severely reduced the germination percentage. This indicates that the seed coat is rapidly ruptured; however, the faster rate of germination for the prolonged exposure may be injurious to the seeds as the acid may rupture vital parts of embryo. Sulfuric acid is thought to disrupt the seed coat and expose the lumens of macroscleretic cells, permitting imbibitions of water[11] which triggers germination. Acid scarification is known to be highly effective in improving germination of species with hard seed coats.[12] The results of acid scarification treatment in *C. tora* in this study agree with those in *Cassia fistula* by Karaboon et al.[7]; however, in both the studies, the time for acid scarification treatment varies.

Sudden dip of dry seeds in boiling water may lead to the rupture of seed coat that allows water to permeate the seed tissues causing physiological changes, especially oxygen permeability and subsequent germination of embryo.[13-15] Germination decreases when seeds are allowed for more temperature exposure, suggesting that embryo may get destroyed in contact with boiling water at 60 and 70 °C. Alcohol treatment has been reported to enhance germination of hard seed coat. In our case, it did not induce much germination when compared to control. However, prolonged exposure significantly reduced the germination percentage. In general, seed dormancy resulting from an impermeable seed coat may be overcome by peeling off the coat.[11,16] Todaria and Nigam[17] noted that mechanical scarification is effective in breaking dormancy of *Cassia nodosa* seeds, and Menaie et al.[18] reported that mechanical scarification, combined with the effect of hot water, rendered more permeable seed coat, resulting in better germination for *Cassia fistula*. Thus, germination of seeds whose coats were mechanically scarified is therefore not surprising. Where seed coat is softened, the process of hydrolysis could commence to release simple sugars that could

be readily utilized in protein synthesis. This will further synthesize hormones such as auxins and ethylene, which could increase nucleic acid metabolism and protein synthesis.[19,20]

CONCLUSION

The results of the present study demonstrate the effects of a number of pre-sowing treatments in improving the germination of *C. tora*. There were highly significant differences between the different germination treatments. However, there was no notable difference between mechanical scarification (for 22 and 24 h) and acid treatment (5 min). The best efficiency methods for breaking dormancy of *C. tora* seeds are mechanical scarification method and acid scarification method.

REFERENCES

1. Dhanasekaran M, Ignacimuthu S, and Agastian P, Potential hepatoprotective activity of ononitol monohydrate isolated from *Cassia tora* L. on carbon tetrachloride induced hepatotoxicity in wistar rats. Phytomed: Int J Phytotherap Phytopharm 16 (9): 891–895, (2009).
2. Prasad S, Singh B, and Todaria NP, Effects of *Cassia tora* on the germination and growth of Partheniumhysterophorus L. Allelopathy J 17: 303–310, (2006).
3. Haritha P and Uma MK, Effect of processing on the antinutritional and antimicrobial activity of sicklesenna seeds (*Cassia tora* L.). Legume Res – Int J 30 (2): Print ISSN: 0250-5371, (2007).
4. Roleston MP, Water impermeable seed dormancy, Bot Rev 44: 365–396, (1978).
5. Ballard LAT, Physical barriers to germination. Seed Sci Technol 1: 285–303, (1973).
6. Cavanagh AK, A review of some aspects of the germination of Acacias. Proc Royal Soc Victoria 91: 161–180, (1980).
7. Karaboon S, Ripona S, Thanapornpoonpong S, Pawelzik E, and Vearasilp S, Breaking dormancy and optimum storage temperature of goldenshower (*Cassia fistula*) seeds, Conference on International Agricultural Research for Development, Stuttgart-Hohenheim, October 11–13, 2005, Tropentag.
8. Ramamoorthy K, Rajendran C, and Sivasubramanian S, Seed treatment of alleviation of hard seededness in senna (*Cassia angustifolia* L.). Adv Plant Sci 18 (1) : 429–430, (2005).
9. Nalawadi UG, Bhandary KR, and Chandrashekar T, Germination of *Cassia fistula* L. Curr Res Hortic Abst 46.3645 4 (3): 42–43, (1977).
10. J. Levitt. Introduction to Plant Physiology. 2nd Edn, CV Mosby Company, Saint Louis, USA: 277–286, (1974).
11. M.G. Nikoleave. Factors Controlling Seed Dormancy Pattern, North Holland, Amsterdam: 51–74, (1977).
12. Youssef AM, Adaptive responses of some desert plants from different ecosystems of Suez road. Res J Agric Biol Sci 4 (5): 595–603, (2008).
13. Agboola DA and Etejere EO, Studies on seed dormancy of selected economic tropical forest species. Nig J Bot 4: 115–125, (1991).
14. Agboola DA and Adedire MO, Response of treated dormant seeds of three species to germination promoters. Nig J Bot 11: 103–109, (1998).
15. Sabongari S, Effect of soaking duration on germination and seedling establishment of selected varieties of tomato (*Lycopersicum esculentum* Mill). M.Sc. Thesis, Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria, 2001.
16. Jamdhade VC, Balkhande SV, and Babasaheb S, Micropropagation of *Taverniera cuneifolia* (Roth) Arn.: A

substitute for commercial liquorice. Int J Pharma Bio Sci 3 (4): 204–212, (2012).
17. Todaria NP and Negim AK, Pre-treatments of some Indian cassia seeds to improve their germination. Seed Sci Technol 20: 583–588, (1992).
18. Menaie HS, Ragam O, Shatti A, Mathew M, and Suresh N, The effects of different treatments on seed germination of the *Cassia fistula* L. and *Cassia nodosa* Buch.-Ham. ex Roxb. in Kuwait. African J Agricul Res 5 (3): 230–235, (2010).
19. P.T. Irwin. Plant Physiology, Addison Wesley, USA: 501–540, (1982).
20. Jackson MB, Root-to-shoot communication in flooded plants: Involvement of Abscisic acid, ethylene and 1-aminocyclopropane-1-carboxylic acid. Argon J 86 (5): 775–781, (1994).