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Germination Improvement in *Solanum surattense* Seeds through Dormancy Breaking Treatments

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ABSTRACT: Yellow berried nightshade (*Solanum surattense*) is a perennial, prickly diffuse herb distributed mainly in arid and semi arid regions. It forms an integral part of traditional medicine in India. As the fresh seeds of this plant possess dormancy which leads to uneven germination and non-uniform crop stand. The objective of this experiment is to identify an effective method to break the dormancy of fresh seeds, in order to achieve uniform germination and optimum seedling population at nursery level. Various physical (water soaking, hot water soaking, acid scarification) and physiological (GA_3, KNO_3, Thiourea) seed treatments were imposed to the seeds with various concentration of solution and duration of soaking hours. Untreated dry seeds were used as control. The results disclosed that physical treatments were not able to break the dormancy of the seeds. However, the physiological treatments were able to improve germination and other seedling quality characters. Among the physiological treatments, GA_3 @ 600 ppm for 18 h soaking recorded the highest germination of 88 per cent. It was also accompanied with the highest vigour attributing characters *viz*., speed of germination (5.9), root length (3.4 cm), shoot length (3.8 cm), dry matter production (5.4 mg) and vigour index (634), and recorded minimum abnormal seedling (8%) and nil fresh ungerminated seeds.

Keywords: Yellow berried nightshade, physical and physiological seed treatments, Germination.

INTRODUCTION

Solanum surattense is a wild perennial medicinal herb, distributed throughout the India mainly along roadside and drylands. It is an important base material for traditional medicine in India. It is a diffuse wild perennial herb distributed in Australia, Ceylon, India, Malaysia, Polynesia, and Southeast Asia (Parmar *et al.,* 2017). It belongs to the family solanaceae. It is known for its steroidal alkaloid namely solasonine, solanocarpine and solmargine. *Solanum surattense* (Syn: *Solanum xanthocarpum* schrad and *Solanum viriginianum* L.) is also known as yellow berried nightshade in English commonly called as Indian nightshade. Its vernacular names are Kantkari (Sanskrit), Kateri or Kattay (Hindi), Kantankattiri (Tamil), Nelagulle (Kannad), Nelamulaka (Telugu). It is a prickly diffuse perennial herb woody at base with zig-zag stem bearing numerous branches, the entire plant is covered with prickles, spines are compressed straight, 1-3 cm long, shiny and yellow in color, spines are present all over the plant except the flower region. Leaves are ovate– elliptical 4-12.5 cm length and 2-7.5 cm wide, deeply lobed, veins and margins with spines. Flowers are axillary but some flowers are cyme bluish-violet in color, 5 lobed, calyx free, obovate, prickly acuminate, corolla is widely ovate–triangular, with five sharp lobes. Fruit is Berry, globose, green color with white stripes, when matures it becomes yellow in color, seeds circular, numerous, and smooth (Singh and Singh 2010).

Phytochemically the plant is endowed with sterols, flavonoids, alkaloids, saponins and polyphenols (Parvez *et al.,* 2019). The herb is defined as pungent, bitter,

digestive, and alternative astringent in ancient Ayurveda. Entire plant is used for medicinal purpose, fruits are bitter in taste, carminative and the root decoction is diuretic, expectorant and used as febrifuge (Vadnere *et al.,* 2008). Its leaf extracts substantially reduces blood glucose levels while increasing insulin levels (Poongothai *et al.,* 2014). In siddha system of medicine the powder of entire plant is used to treat respiratory disease. The active component in any medicinal plant determines its value, therefore consistency in quality, as well as the quantity of planting material is critical (Singla & Jaitak 2014). As a result, a reliable source of high-quality seed is essential for growing healthy medicinal plants, and high-quality seeds can be obtained using standard seed procedures. Germination of these seed is inconsistent with poor vigour, which necessitate to investigate the issues surrounding the germination and dormancy of seed in order to improve the quality of seed. To overcome the issues, seeds were exposed to certain physical and physiological treatments for breaking the dormancy. Thereby germination can be improved, crop failure is avoided and the planting value of seed is ensured.

MATERIALS AND METHODS

The experiment was performed at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2021-2022. To conduct the dormancy breaking experiment, dried berries of *Solanum surattense* were collected from the germplasm maintained by Department of Medicinal and Aromatic Crops and seeds were extracted manually by crushing the dried berries. In order to identify the suitable dormancy breaking treatment with optimum concentration the seeds were exposed to certain physical and physiological seed treatments. Details of dormancy breaking treatments are as follows:

(i) Physical seed treatments. First the fresh seeds were imposed with the following Physical treatments

T_0-control
T_1- Water soaking for 6 hrs
T_2- Water soaking for 12 hrs
T_3- Water soaking for 18 hrs
T_4- Hot water treatment for 1 min (90-100°C)
T_5- Hot water treatment for 2 min (90-100°C)
T_6- Hot water treatment for 3 min (90-100°C)
T_7- Acid scarification with H_2SO_4 @ 100 ml/kg of seed for 1 min
T_8- Acid scarification with H_2SO_4 @ 100 ml/kg of seed for 2 min
T_9- Acid scarification with H_2SO_4 @ 100 ml/kg of seed for 3 min

Based on the result of physical treatments, the following physiological treatments were carried out.

(ii) Physiological Seed treatments

T_0- Control
T_1- GA_3 @ 200 ppm for 6 hrs soaking
T_2- GA_3 @ 200 ppm for 12 hrs soaking
T_3- GA_3 @ 200 ppm for 18 hrs soaking
T_4- GA_3 @ 400 ppm for 6 hrs soaking
T_5- GA_3 @ 400 ppm for 12 hrs soaking
T_6- GA_3 @ 400 ppm for 18 hrs soaking
T_7- GA_3 @ 600 ppm for 6 hrs soaking
T_8- GA_3 @ 600 ppm for 12 hrs soaking
T_9- GA_3 @ 600 ppm for 18 hrs soaking
T_{10}- KNO_3 @ 0.5% for 6 hrs soaking
T_{11}- KNO_3 @ 0.5% for 12 hrs soaking
T_{12}- KNO_3 @ 0.5% for 18 hrs soaking
T_{13}- KNO_3 @ 1.0% for 6 hrs soaking
T_{14}- KNO_3@ 1.0% for 12 hrs soaking
T_{15}- KNO_3 @ 1.0% for 18 hrs soaking
T_{16}- Thiourea @ 0.5% for 6 hrs soaking
T_{17}- Thiourea @ 0.5% for 12 hrs soaking
T_{18}- Thiourea @ 0.5% for 18 hrs soaking
T_{19}- Thiourea @ 1.0% for 6 hrs soaking
T_{20}- Thiourea @ 1.0% for 12 hrs soaking
T_{21}- Thiourea @ 1.0% for 18 hrs soaking

Design: CRD Replication: 2

Seeds of *Solanum surattense* were subjected to the above mentioned seed treatments, and soaked upto the specified durations. Dry seeds were used as absolute control for comparison. For water soaking, seeds were soaked in distilled water for the specified durations. For hot water treatment, the seeds were kept in small cloth bag and immersed in hot water bath maintained at a temperature of 95 ± 5˚C. After soaking for the required durations, the seed were separated from water and shade dried at room temperature (28 ± 2˚C). Similarly, the other treatments were performed with the specified chemicals for the required durations and surface dried. Treated seeds were subjected to germination test as per ISTA rules (ISTA, 2015). The experiment was conducted with top of the media method. Twenty-five seeds of eight replications were placed on top of the paper and the Petri plates were kept in the germination room sustained at a temperature of 25 ± 2˚C and 95±3 % relative humidity. Observations were recorded every day for germination and final count was noted at the end of 21st day. The number of normal seedlings in each replication was noted and the mean value expressed in percentage.

Seeds possessing radicle size of 3-5 mm are considered as germinated and the speed of germination was calculated using the following formula (Magurie, 1962).

Speed of Germination =

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

Where X_1, X_2 and X_n are the number of seeds germinated on first, second and nth day respectively. Y_1, Y_2 and Y_n are the first, second and nth day of germination.

The number of abnormal seedlings were noted from each treatment and mean value was expressed in percentage. Seed which do not absorb moisture until the end of the germination test was considered as hard seeds. Hard seeds from each replication were counted and mean value was expressed in per cent. Seeds which absorbs moisture but do not germinate at the end of germination test was considered as fresh ungerminated seeds and were noted from each replication and the mean value was expressed as percentage. Seed which absorbs moisture and do not germinate when pressed milky paste comes out of the seeds are considered as dead seeds. Similarly, dead seeds were counted from each replication of a treatment and the mean value was expressed in percentage. At the end of 21st, day ten normal seedlings were selected randomly from each replication and root and shoot lengths were measured and expressed in cm. Those seedlings taken for seedling measurement were again forwarded for measuring dry matter production. These ten seedlings were covered with paper cover and shade dried for 24 hours, then dried in a hot air oven maintained at a temperature of 85 ± 2˚C for 24 hrs. Weight of dried seedlings were noted and mean values were expressed in mg 10 seedlings^{-1}. Vigour index was calculated using the formula given by Abdul-Baki and Anderson (1973) and the mean value was expressed as whole number.

Vigour index = Germination (%) ×
Dry matter production (mg10 seedlings^{-1})

The data recorded from the above experiment were analysed for its level of significance as described by (Panse and Sukhatme 1985). The per cent values were transformed to arc sine values wherever necessary. The critical difference (CD) was calculated at 5 % probability level.

Table 1: Influence of different dormancy breaking treatments on germination and related parameters of *Solanum surattense.*

Treatments	Speed of germination	Germination(%)	Abnormal seedlings(%)	Hard seeds(%)	FUGs (%)
T_0	0	0	0	0	100
T_1	3.5	48	18	0	34
T_2	3.9	52	16	0	32
T_3	4.1	68	12	0	20
T_4	4.3	52	20	0	28
T_5	4.6	62	18	0	20
T_6	4.8	76	12	0	12
T_7	5.4	60	20	0	20
T_8	5.6	72	14	0	12
T_9	5.9	88	8	0	0
T_{10}	2.1	40	22	0	38
T_{11}	2.4	44	20	0	36
T_{12}	2.8	50	20	0	30
T_{13}	2.2	42	22	0	36
T_{14}	2.5	48	20	0	32
T_{15}	3	54	18	0	28
T_{16}	1.9	44	20	0	36
T_{17}	2.1	48	20	0	32
T_{18}	2.3	48	20	0	32
T_{19}	2.2	48	16	0	36
T_{20}	2.4	50	15	0	35
T_{21}	2.8	50	15	0	35
CD	0.1853	2.8475	0.9333	-	1.8820
SEd	0.0920	1.4129	0.4631	-	0.9338

Table 2: Influence of different dormancy breaking treatments on seedling quality parameters of *Solanum surattens.*

Treatments	Dead seeds(%)	Root length(cm)	Shoot length(cm)	DMP(mg/10seedlings)	VI
T_0	0	0	0	0	0
T_1	0	2.4	2.5	4.5	235
T_2	0	2.6	2.8	4.6	280
T_3	0	3	3	4.8	408
T_4	0	2.5	2.7	4.7	270
T_5	0	2.7	3	5.1	353
T_6	0	3.2	3.3	5.3	494
T_7	0	2.7	3	4.5	342
T_8	2	3	3.5	5	468
T_9	4	3.4	3.8	5.4	634
T_{10}	0	1.5	2	3.9	140
T_{11}	0	1.7	2.2	4.3	172
T_{12}	0	2	2.2	4.5	210
T_{13}	0	1.8	2.4	4.4	176
T_{14}	0	2	2.6	4.7	221
T_{15}	0	2.5	2.9	4.9	292
T_{16}	0	2	2.4	4	194
T_{17}	0	2.2	2.6	4.2	230
T_{18}	0	2.5	2.8	4.7	254
T_{19}	0	2.2	2.4	4.2	221
T_{20}	0	2.3	2.8	4.5	255
T_{21}	0	2.5	3	4.9	275
CD	0.0427	0.1389	0.1484	0.2343	15.8717
SEd	0.0212	0.0689	0.0736	0.1163	7.8753

Where

T_0- Control
T_1- GA_3 @ 200 ppm for 6 hrs soaking
T_2- GA_3 @ 200 ppm for 12 hrs soaking
T_3- GA_3 @ 200 ppm for 18 hrs soaking
T_4- GA_3 @ 400 ppm for 6 hrs soaking
T_5- GA_3 @ 400 ppm for 12 hrs soaking
T_6- GA_3 @ 400 ppm for 18 hrs soaking
T_7- GA_3 @ 600 ppm for 6 hrs soaking
T_8- GA_3 @ 600 ppm for 12 hrs soaking
T_9- GA_3 @ 600 ppm for 18 hrs soaking
T_{10}- KNO_3 @ 0.5% for 6 hrs soaking
T_{11}- KNO_3 @ 0.5% for 12 hrs soaking
T_{12}- KNO_3 @ 0.5% for 18 hrs soaking
T_{13}- KNO_3 @ 1.0% for 6 hrs soaking
T_{14}- KNO_3 @ 1.0% for 12 hrs soaking
T_{15}- KNO_3 @ 1.0% for 18 hrs soaking
T_{16}- Thiourea @ 0.5% for 6 hrs soaking
T_{17}- Thiourea @ 0.5% for 12 hrs soaking
T_{18}- Thiourea @ 0.5% for 18 hrs soaking
T_{19}- Thiourea @ 1.0% for 6 hrs soaking
T_{20}- Thiourea @ 1.0% for 12 hrs soaking
T_{21}- Thiourea @ 1.0% for 18 hrs soaking

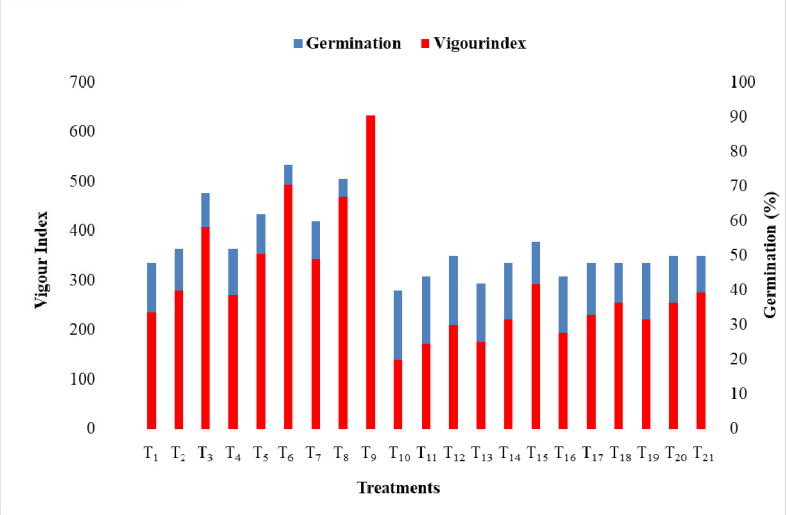

Fig. 1. Influence of different dormancy breaking treatments on germination and vigour index of *Solanum surattens.*

RESULTS AND DISCUSSION

The freshly harvested seeds possess dormancy and recorded nil germination. Therefore, to improve the germination and other physiological seed quality parameters, seeds were exposed to physical and then physiological dormancy breaking treatments. The results showed that the fresh seeds of *Solanum surattense* were not responded to any of the physical treatments *viz.,* water soaking, hot water treatment and acid scarification. Therefore, the seeds were exposed to physiological treatments *viz.,* GA_3, KNO_3, Thiourea. Among the different physiological treatments used for dormancy breaking of *Solanum surattense*, GA_3 @ 600

ppm for 18 hrs of soaking was superior to other treatments in terms of quality parameters. It recorded the maximum germination of 88 per cent accompanied with the highest speed of germination (5.9), root length (3.4 cm), shoot length (3.8 cm), dry matter production (5.4), and vigour index (634) and nil fresh ungerminated seeds. Whereas, control seeds recorded nil germination because of dormancy. The result of the present experiment is in agreement with the findings of Jayamani (2020) in black cumin and Shobarani (2018) in isabgol. Nirawane *et al*. (2018) reported that seeds of *Solanum virginianum* when exposed to GA_3 at 1100 mg/Lachieved maximum germination. Boomiga *et al.* (2021) revealed that seeds of *Solanum surattense* treated with GA_3 @ 1500 ppm for 12 hrs recorded maximum germination percentage. GA plays two important roles in the dormancy process, the first is the stimulation of expression of genes encoding for endosperm-hydrolyzing enzymes which breaks down the storage reserves and transports to the growing point, and the second is a direct stimulating influence on the growth potential of embryo (Brady and McCourt, 2003). It accelerated vegetative development, weakens the endosperm layerthat constrained embryo expansion, and mobilizes the reserved food materials from endosperm (Bareke, 2018). Ghodrat and Rousta (2012) found that GA_3 has positive effect on dormancy breaking, cell expansion, acceleration of seed germination and increased internodal length and plant height. It also helps in activation of other physiologically active substances which aids in absorption of more water as a result of increased cell wall elasticity and leads to formation of efficient root system which exhibits an improved vigour index. According to Grappin *et al.* (1999), GA plays an inhibitory effect on ABA accumulation which is the primary hormone involved during the step of dormancy maintenance, thereby it plays an active role in control of this process.

In the present study seed germination per cent was significantly increased when the concentration of GA_3 increased and there was a significant increase in percentage germination when there is increase in duration of soaking.

Likewise, fresh seeds treated with different concentrations of KNO_3 also improved the germination and other quality parameters, but not higher than GA_3 treatment. Among the various concentration of KNO_3, seeds recorded higher germination at a concentration of KNO_3 1% and soaking duration of 18 hrs. The other seedling quality parameters recorded were, root length (2.5 cm), shoot length (2.9 cm), DMP (4.9 mg) and vigour index (292). Similar observations were recorded by Gupta *et al.* (2011), where germination and other quality parameters were increased when the seeds of *Hippophae salicifolia* treated with KNO_3 @ 0.1% for 48 hrs. Barathkumar (2019) found that seeds of *Phyllanthus emblica* L treated with 2% KNO_3 for 24 hrs followed by 500 ppm GA_3 for 24 hrs soaking had the greatest germination percentage and vigour index. According to McIntyre *et al*. (1996) application of KNO_3 speed ups the uptake of water and oxygen and also improves the seed nutritional status, such as amino acid content. Bewley and Black (2012) reasoned that KNO_3 raises the ambient oxygen level by making less oxygen available for citric acid cycle. At low temperature more oxygen dissolves in water and therefore more oxygen is prepared for embryo hence improves the rate of germination. Similar to GA_3 treatment, the germination and other seedling quality parameters were improved when the concentration of chemical and duration of soaking were increased.

However, in case of seed treatment with thiourea, the percentage germination was maintained when the concentration and duration of soaking were increased. But other seedling parameters recorded were increased when the concentration and duration were increased. It showed maximum root length (2.5 cm), shoot length (3.0 cm), dry matter production (4.9 mg) and vigour index (275) @ thiourea 1.0% for 18 hrs soaking. Thiourea is a chemical which promotes the germination of light requiring seeds. Effect of thiourea on seed germination due to the alteration in the nucleic acid metabolism of seeds was observed by Poljakoff-Mayber and Mayer (1960). Thiourea enhances germination by acidifying and weakening cell walls, which erodes the seed coat and thereby increases cell wall permeability (Ali *et al.,* 2010).

CONCLUSION

The primary obstacle to plant growth is seed dormancy, which occurs mostly naturally in seeds. It is impossible to grow plantlets in any season without breaking seed dormancy. From the present study it is concluded that seed dormancy of *Solanum surattense* can be broken by exposing the seeds to GA_3 @ 600 ppm for 18 hrs soaking. Since the physiological treatment of GA_3 improved the germination of fresh seeds by breaking the dormancy it can be inferred that the dormancy presents in the yellow berried night-shade (*Solanum surattense*) might be due to excess accumulation of ABA.

FUTURE SCOPE

The demand for medicinal plant is increased during these days due to its effective disease curing property and zero side effects. Since the plant endowed with therapeutic value, the plant needs more commercial cultivation to supply the raw materials to the pharmaceutical industries. Prevalence of seed dormancy will restrict the uniform crop stand. From this study it is concluded that dormancy of *Solanum surattense* seeds can be broken through seed treatment with GA_3. In future, the action of GA_3 inside the seed throughout the germination period may be studied in detailed manner.

Conflict of Interest. None.

REFERENCES

Abdul-Baki, A. A., & Anderson, J. D. (1973). Vigor determination in soybean seed by multiple criteria 1. *Crop Science*, *13*(6), 630-633.

Ali, T., Hossein, P., Asghar, F., Salman, Z., & Ali, Z. C. M. (2010). The effect of different treatments on improving seed germination characteristics in medicinal species of *Descurainia sophia* and *Plantago ovata*. *African Journal of Biotechnology*, *9*(39), 6588-6593.

Barathkumar, T. R. (2019). Studies on influence of different seed treatments on dormancy breaking in aonla (*Phyllanthus embolic* L.). *J. Pharmacogn Phytochem*, 131-133.

Bareke, T. J. A. P. A. R. (2018). Biology of seed development and germination physiology. *Adv. Plants Agric. Res*, *8*(4), 336-46.

Boomiga, M., Suresh, J., Nalina, L., Kumar, M., Gnanam, R., Rajamani, K., & Uma, D. (2021). Effect of different seed treatments on germination and seedling growth of *Solanum surattense*. *Medicinal Plants-International Journal of Phytomedicines and Related Industries*, *13*(4), 596-600.

Brady, S. M., & McCourt, P. (2003). Hormone cross-talk in seed dormancy. *Journal of Plant Growth Regulation*, *22*(1), 25-31.

Bewley, J. D., & Black, M. (2012). *Physiology and biochemistry of seeds in relation to germination: volume 2: viability, dormancy, and environmental control*. Springer Science & Business Media.

Ghodrat, V., & Rousta, M. J. (2012). Effect of priming with Gibberellic acid (GA3) on germination and growth of corn (*Zea mays* L.) under saline conditions. *International Journal of Agriculture and Crop Sciences (IJACS)*, *4*(13), 882-885.

Grappin, P., Bouinot, D., Sotta, B., Miginiac, E., & Jullien, M. (2000). Control of seed dormancy in *Nicotiana plumbaginifolia*: post-imbibition abscisic acid synthesis imposes dormancy maintenance. *Planta*, *210*(2), 279-285.

Gupta, S. M., Pandey, P., Grover, A., & Ahmed, Z. (2011). Breaking seed dormancy in *Hippophae salicifolia*, a high value medicinal plant. *Physiology and Molecular Biology of Plants*, *17*(4), 403-406.

Jayamani, S. (2020). Seed Technological studies in Black cumin (*Nigella sativa*). M.Sc.(Ag) Thesis, Tamil Nadu Agricultural University, Coimbatore.

ISTA. (2015). International Rules For Seed Testing bassersdorf (Switzerland): International Seed Testing Association.

Maguire, J. D. (1962). Speed of germination-aid in selection and evaluation for seedling emergence and vigor. *Crop Sci.*, *2*, 176-177.

Mclntyre, G. I., Cessna, A. J., & Hsiao, A. I. (1996). Seed dormancy in *Avena fatua*: interacting effects of nitrate, water and seed coat injury. *Physiologia Plantarum*, *97*(2), 291-302.

Panse, V. G., & Sukhatme, P. V. (1985). Statistical method for agricultural PP. 145-155. *ICAR, New Delhi*.

Parmar, K. M., Itankar, P. R., Joshi, A., & Prasad, S. K. (2017). Anti-psoriatic potential of *Solanum xanthocarpum* stem in Imiquimod-induced psoriatic mice model. *Journal of ethnopharmacology*, *198*, 158-166.

Poongothai, K., Ponmurugan, P., Ahmed, K. S. Z., Kumar, B. S., & Sheriff, S. A. (2011). Antihyperglycemic and antioxidant effects of *Solanum xanthocarpum* leaves (field grown & in vitro raised) extracts on alloxan induced diabetic rats. *Asian Pacific Journal of Tropical Medicine*, *4*(10), 778-785.

Poljakoff-Mayber, A., & Mayer, A. M. (1960). Effect of thiourea on germination and growth. *lndian Journal of Plant Physiology*, *3*, 125-138.

Parvez, M. K., Al-Dosari, M. S., Arbab, A. H., Alam, P., Alsaid, M. S., & Khan, A. A. (2019). Hepatoprotective effect of *Solanum surattense* leaf extract against chemical-induced oxidative and apoptotic injury in rats. *BMC Complementary and Alternative Medicine*, *19*(1), 1-9.

Rekha N, Arun G, Soma M, Prasad GP, Mangal G, Anupam KM and Narayanam S (2018). Effect of gibberellic acid treatment on seed germination of Kantakari (*Solanum virginianum* L.). J. Drug Res. Ayurvedic Sci., 3(4): 195-205.

Singh, O. M., & Singh, T. P. (2010). Phytochemistry of *Solanum xanthocarpum*: an amazing traditional healer

Singla, R., & Jaitak, V. (2014). Shatavari (*Asparagus racemosus* Wild): A Review on its Cultivation, Morphology, Phytochemistry and Pharmacological Importance. *International Journal of Pharmacy & Life Sciences*, *5*(3).

Shobharani, M., & Sundareswaran, S. (2018). Effect of different dormancy breaking treatments on seed germination and seedling growth in Shankhapushpi (*Clitoria ternatea* L.). *Journal of Pharmacognosy and Phytochemistry*, *7*(4), 1353-1355.

Vadnere, G. P., Gaud, R. S., & Singhai, A. K. (2008). Evaluation of anti-asthmatic property of *Solanum xanthocarpum* flower extracts. *Pharmacologyonline*, *1*, 513-522.

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