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Research Article

Influence of chemical treatments on seed germination and seedling emergence of *Syzygium cumini* (L.) Skeels

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Abstract

The plant *Syzygium cumini* (L.) Skeels, is commonly known as Jambul plant. Jambul plant has multiple uses; it has economical valuable and medicinally important plant. *Syzygium cumini*.is commercially most propagated by seeds. Presently it is also being propagated by vegetative means of grafting and budding. Seed germination is controlled by environmental, physiological and pathological factors. Pre-sowing seed treatment, including chemical and physical treatment are known to improve the seed performance. Considering this fact seeds of Jambul plant were treated with different chemical for understanding the germination and seedling growth. For this treatments chemicals viz.-Thiourea (CH_4N_2S), Kinetin ($C_{10}H_9N_5O$), inorganic compound-Potassium hydroxide (KOH),Sodium hydroxide (NaOH), Potassium nitrate (KNO_3), Hydrochloric acid (HCl), Sulphuric acid (H_2SO_4), and hot water (100 ^{0}C) were used. An experiment was carried out at College campus. The experiment was laid out randomized block design with three repetitions and nine treatments consist of control (T_9). It was observed that the highest percentage of seed germination, shoot length, root length, number of leaves was recorded in kinetin ($C_{10}H_9N_5O$) for 10 minutes followed to KOH and KNO_3. Whereas the Hydrochloric acid and Sulphuric acid was not significant as compare to the other chemicals.

INTRODUCTION.

Syzygium cumini (L.) Skeels belongs to family Myrtaceae and it commonly known as Jambul, Asian evergreen tropical tree native to Bangladesh, India, Nepal, Pakistan, Sri Lanka, the Philippines and Indonesia. It is multipurpose with diverse economic and medicinal significance fruit tree. The fruits are sources of sugars, minerals, iron, calcium, phosphorus, sodium, potassium and vitamin-**c**. Chronic diarrhea and other enteric disorders are control by Jambul fruits, (Shing S *et al.*, 2020).The fruits are used as a mouth freshener, stomachic, astringent, antidiabetic and diuretic (Ahmand N *et al.*, 2019). The extract of seeds is externally used in skin problems, mouth and throat (Chandrasekaran and Venkatesalu, 2004, Sharma V B *et al.*, 2019). Bark is acrid, digestive, astringent, anthelmintic and used for the treatment of, bronchitis, asthma, thirst, sour throat, dysentery and ulcers. The seeds of jamun are sweet, astringent to the bowels and good for diabetes (Raphaela M B *et al.*, 2017). The juice of the ripe fruit is useful for the preparation of Vinegar; it is carminative and diuretic (Chaudhary B *et al.*, 2012). *Syzygium cumini* bark decoction is used in treating dibetes mellitus in Ayurveda medicine .This work attempted to prove the presence of the Antidiabetic compound in the Syzygium cumini decoction and the ready to serve (RTS) herbal drink developed using the decoction, (Perera P R D *et al.*, 2017). Traditional and

medicinal importance of *Syzygium cumini* was given by; Agrwal P *et al.,* (2019).Such underutilized fruits have been long sustained due to their importance for their nutritional value and as a source of rural and tribal household income. Now days *Syzygium cumin* is commercially propagated by seeds, it is also being propagated by grafting and budding. Propagation by vegetative methods were done for raising of healthy and vigorous seedling .The survival of seeds are depends on seed moisture content and storage environment. The germination of seeds in a particular situation and season is determined by the dormancy releasing factors. Seeds lost viability within 2-3 weeks when stored at 25-30^{O}C (Rawat and Nautiyal, 1997). Freshly harvested *Syzygium cumini* seeds gave better germination percentage within 1-2 weeks and may lose their viability soon after shedding (Patil*et al.*,, 1997). Therefore seeds are not possible to store for longer duration and thus are sensitive to drying (Srimathi*et al.*,, 2001). Seed viability can be retained, in short term, if the seeds have maintained above critical moisture content i.e. 40-50% (Ouedraogo *et al.,* 1999). Sivasubramaniam K, Selvarani K (2012) was worked on viability and vigor of Jamun (Syzygium cumini) seeds and reported that Decoated seeds germinated faster than coated seed under nursery conditions, with high significant germination percentages, dry matter production rates and vigor indices.

Syzygium cumini seeds quickly lose its viability; hence it should be sown immediately after drawing out or harvesting of fruits. Jamun seeds are known to be recalcitrant, chlorotic, multicotyledonous and have multi embryos. Several efforts were put forth by many researchers for enhancing germination**,** Bareke T (2018**)**. The very effective work was done by ,Chongtham A D *et al.,* (2018) on seed germination improvement of Jamun, they had used Charcoal powder, Carbendazim and *Trichoderma harzianum* for the treatment, there was significantly effect on vegetative parameters like seedling height and number of leaves . By the use of H_2SO_4 scarification for 10 minutes duration result in better germination percentage (Stephen A *et al.,* 2012).Growth regulator like thiourea, and KNO3, *etc*. besides soaking in water with varied success (Shanmugavelu, 1970). Sadrollah et al (2010) was reported that the effect of different acids had a significant effect on seed germination and dormancy braking of *Prosopis* species. The graftable stage can be attained rapidly if Jamun seeds are treated with 0.1% colchicines and sown in Arka fermented coco-peat substrate, (Barman P *et al.,* 2015). Youssef (2009) was done the experiment and reported that the seed germination were increased with increasing Sulfuric acid concentration and treatment time in medicinal plants i.e. *Tamarindus indica* , *Retama raetam, Ononis serrata* and *Mesembryanthemum crystallinum,* respectively. Experimental results of Jetti A *et al.,* (2017) showed that successful utilization of mechanical and chemical scarification, chilling, treatment with growth regulators and Hot water treatment used to overcome the problem of prolonged seed dormancy in *Givotia rotileriformis*. There is a need to conservation of dry land plants for the preservation of their diversity. Seeds are an effective means of achieving this goal for need of healthy, quick growing of seedlings in short span of time from their sowing time. With this importance, to understand the effect of seed treatment on germination, seedling growth and seed associated fungal pathogens of *Syzygium cumini,* the present research work was planned.

MATERIALS AND METHODS

Collection of seed material.

For the study, seeds of the *Syzygium cumini* were collected from the region of Jalna District (India). Seeds were collected on the harvesting session (month of May to Jun). Collected seeds were then packed in sterile polythene bags in first week of June 2018. The harvested seeds were fresh and had 15 days of age. The chemical were purchased from Deepa Chemical Enterprises Aurangabad and some from Chemistry Department of our college.

Sowing of *Syzygium cumini* seeds.

Experiment was carried out in first week of June 2018 at Department of Botany, Swami Vivekanand Senior College, Mantha Dist-Jalna (M.S.) India. Ten to Fifteen day's fresh harvested seeds were sown during the months of June 2018. Seeds were first' surface sterilized for 1 min by immersing in 0.1 % $HgCl_2$solution for 5 min and subsequently washed with diluted water.

Treatments to the seeds

Total nine treatments (T_1 to T_9) were given to the seeds by different chemicals at different concentrations. Seeds were treated with Thiourea (T_1) (CH_4N_2S) 0.5 % for 10 minutes, Kinetin (T_2) ($C_{10}H_9N_5O$) 0.5% for 10 minutes, Potassium hydroxide (T_3) (KOH) at 5% for 4 minutes, Sodium hydroxide (T_4) (NaOH) at 5% for 4 minutes, Potassium nitrate (T_5) (KNO_3) 0.5% for 4 minutes, Hydrochloric acid (T_6) (HCl) 1N, 5% for 4

minutes, Sulphuric acid (T_7) (H_2SO_4) 1N ,5% for 4 minutes, Hot water (T_8) 100 ^{0}C for 10 sec, and pre soaked (T_9) used as control. The preferred polybags having size of 22.5 x 12.5 cm were used for sowing. Polybags were filled with mixed soil. The experiment was laid out in completely randomized block pattern with three repetitions. To each polybags in which already soil filled, single seed was sown at the depth of 6 cm. The pots were shower with water by surface irrigation. During plant growth pots were irrigated daily by spraying with water until water drained from the bottom of the pot. Regular observations of experiment were done for 60 days. After the 60 days of seedling growth all plants were harvested for determination of germination percent, shoot height, root length, number of leaves and stem diameter of shoots (Asgharipour, 2011).

Identification of fungi.

The seeds which were not germinating, these seeds may associate with the fungal pathogens. The fungi occurring on non germinated seed were preliminary identified on the basis of sporulation with the help of stereoscopic binocular microscope. The identification and further confirmation of fungi was made by preparing slides of the fungal growth and observing them under compound microscope. The identification was made with the help of manuals, Mukadam *et al*, (2006). Similarly confirmation of identification was made at Department of Plant Pathology Laboratory, Dr. Babasaheb Ambedkar Marathwada University Aurangabad. Pure cultures of these fungi were prepared and maintained on potato dextrose agar (PDA) slants.

RESULTS AND DISCUSSION.

The effect of organic, inorganic chemical and hot water treatments were studied. In organic chemicals, Thiourea (CH_4N_2S) at 0.5% for 10 minutes and Kinetin ($C_{10}H_9N_5O$) at 0.5% for 10 minutes had given treatment to the seeds where as inorganic compound-Potassium hydroxide (KOH) at 5% for 4 minutes, Sodium hydroxide (NaOH) 5% for 4 minutes, Potassium nitrate (KNO_3) at 0.5% for 4 minutes, Hydrochloric acid (HCl) for 4minutes and Sulphuric acid (H_2SO_4) for 4 minutes. In physical treatment hot water (100 ^{0}C) for 10 sec were used for seeds treatment, presoaking treatment on seeds of *Syzygium cumini* were treated. Germination percentages, shoot length, root length, number of leaves and stem diameter were observed. At the end of the experiment all data were collected and results are mentioned in table number 1 .It is clear from result summarized in table No. 1, that seeds of *Syzygium cumini* treated by Kinetin for10 minutes were proved favorable to show maximum germination percent, shoot length, root length, number of leaves followed the treatment of KOH (5% for 4 minutes) for shoot length and root length. Whereas the treatment of Con. H_2SO_4 (1N, 5%) for 4 minutes and Con. HCl (1N,5%) for 4 min were showed less germination percentage. Mostly all results when compared with the control it show significant. Very interesting result that both organic chemicals treatment that was Thiourea and Kinetin showed statistically significant as compared to the control. Hence, above treatment are recommended for *Syzygium cumini* to the nursery growers. Several workers had performed such types of experiment on seeds of medicinal plants. Gaisamudre and Dhabe (2011) studied that the seeds of *Meizotropis buteiformis* were treated with NaOH and KOH and concluded that highest percentage of seed germination for KOH (85.2) and NaOH (72.2) treatment. Patil H et.al (2018) were studied effect of seed treatment on germination and seedling growth of Jamun, they showed that seeds soaked in water for 24 hrs found better for initiation of percentage and germination percentage where as maximum height, number of leaves and stem diameter of seedling was recorded GA_3 @200mg for 10 minutes. Utami E P *et al* (2021) were worked on to break dormancy and increasing vigor of Sunan candlenut seed by treating chemicals.

All the results were statistically analyzed using analysis of variance, means of the treatments were compared using the least significant difference (C.D., p = 0.05) which allowed determination of significance between different applications (Mungikar, 1997; 2003). From the Table No.1, results for shoot length were significant as compared to the control except H_2SO_4 - acid. Where result for root length was significant when seeds treated with Kinetin, KOH and NaOH. Similarly it was significant in number of leaves when seeds treated with Thiourea, Kinetin, KOH and KNO_3. Whereas treatments of Kinetin and Hot water were only significant for stem diameter.

Seed germination is controlled by environmental and physiological factors. Seeds of many land plants germinate after passing through the phase of dormancy, which may delay the life cycle of plant,

Table 1: Effect of chemicals treatment on seed germination and seedling growth of *Syzygium cumini*.

Treatment	Germination (%)	Mean			
		Shoot length (cm)	Root length (cm)	No. of leaves	Stem Diameter (mm)
T_1-Thiourea 10 Min.	30	12.84	10.61	10.6	4.6
T_2-Kinetin 10 Min.	60	18.32	16.89	10.5	4.8
T_3-KOH 4 Min.	40	15.41	16.71	9.3	3.7
T_4-NaOH 4 Min.	40	12.31	14.59	8.2	4.2
T_5-Con.KNO_3 4 Min.	50	14.87	10.47	9.9	4.1
T_6-Con. HCl 4 Min.	30	14.64	9.24	8.8	4.6
T_7-Con .H_2SO_4 4 Min.	20	10.61	9.93	8.6	4.2
T_8-Hot Water10Min.	30	12.33	10.30	8.7	4.7
T_9-Control. (pre-soaked)	30	9.12	9.44	8.4	3.4
S. E		**0.92**	**1.04**	**0.30**	**0.16**
C. D. (p=0.05%)		**2.12**	**2.40**	**0.69**	**0.36**

All the values are means of three replicates

Table 2: Incidence of fungal population on infected seeds of *Syzygium cumini.*

Fungi	*Syzygiumcumini*								
	Incidence of fungi on seeds treated by								
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Alternaria alternata	+	+	+	+	+	+	+	+	+
Alternaria tenius	--	--	--	--	--	+	+	--	--
Aspergillus niger	+	+	+	+	+	+	+	+	+
Aspergillus fumigatus	+	--	+	+	+	+	--	+	+
Aspergillus flavus	+	+	+	+	+	+	+	+	+
Fusarium oxysporum	+	--	+	+	+	+	+	+	+
Mucor spp	+	+	+	+	+	--	+	+	+
Penicillium spp	--	--	--	+	--	+	--	--	+
Rhizopus stolonifer	+	--	+	+	+	+	+	+	+

-- =Absent + = Present.

T_1=Thiourea 10 Min., **T_2**= Kinetin 10 Min, **T_3**= KOH 4 Min, **T_4**=NaOH 4 Min, **T_5**= Con. KNO3 4 Min **T_6**=Con. HCl4 Min, **T_7**= Con .$H_2SO_4$4 Min, **T_8**= Hot Water 10 Min, **T_9**= Control (pre-soaked).

Gupta M *et al.,* (2016) were studied the fungal contamination of powdered samples of different plant parts of *Syzygiumcumini, Aspergillus niger, A. fumigatus, A. nidulam* and *Alternaria* were found in stored powder sample of seeds and fruits. Another worker ,Hanin N A , (2019) ,who identify the *Phomopsis sp, Colletotrichum* from the seeds of Jambolana (Syzygium cumini). In order to study the incidence and infection of fungi which make adverse effect on seeds germination and seedling growth of *Syzygium cumini*, the experiment was conducted. The results are mentioned in Table No. 2. The seeds of *Syzygium cumini* which treated by different chemicals, but these were not germinated such seeds were examined for fungal incidence. Seeds treated with Thiourea, showed,7 different types of fungi namely *Alternaria alternata, Aspergillus niger, A. fumigatus, Aspergillus flavus, Fusarium oxysporum, Mucur*spp, and *Rhizopus stolonifer* .Seeds treated by Kinetin were observed 4 types of fungi was found namely *Alternaria alternata, Aspergillus niger, Aspergillus flavus, Mucor* spp.

By the KOH treatment, 7 different types of fungi showed their incidence namely *Alternaria alternata, Aspergillus niger, A. fumigatus, Aspergillus flavus, Fusarium oxysporum, Mucur*spp, *Rhizopus stolonifer* whereas in case of NaOH, 8 different types of fungi were found namely *Alternaria alternata, Aspergillus niger, A. fumigatus, Aspergillus flavus, Fusarium oxysporum, Mucur*spp, *Penicillium* spp, and *Rhizopus stolonifer*. Similarly Seeds treated with Con. KNO_3 treatment, 7 types of fungi were found. Very interesting things was that when seeds of *Syzygium cumini* treated with the acid, they also showed the incidences of fungi. Con. HCl treated seeds showed 8 fungi, and Con .H_2SO_4 treatment showed the incidence of 7 fungi. A seed borne pathogens present externally or internally or associated with the seed as contaminant, may cause seed abortion, seed rot, seed necrosis, reduction or elimination of germination capacity as well as seedling damage resulting in development of disease at later stages of plant growth by systemic or local infection, Total seven fungi namely *A. flavus, A. niger, A. repenns Fusarium avenaceum, F. semiltetum, Rhizopus stolonifer* and *Trichoderma roseum* were recorded on fresh and stored sample of Syzygium cumini Singh P K (2018). In a particular situation and season the germination of seeds is determined by many dormancy releasing factors which impact on the termination of dormancy. The germination and seedling growth in many plants influenced by plant hormones, light, temperature, water, nutrients, moisture and other mechanical cause. Plant seeds need different pretreatment to get vigor seedling and even for production .Therefore real attention should be given to the plant propagation particularly for indigenous, economical and medicinally valuable plants. The future development and commercial use of technology for seed treatment is dependent on important factors such as economic, social, environmental safety and practical utility for that particular crop. For this reason in future researcher may be attained on advanced physical and biological seed treatment, Sharma K K *et al.,* (2015).

CONCLUSIONS.

Pre-sowing treatment of seed plays major role to enhance the seed germination under nursery conditions, chemical and physical treatment are known to improve seed germination and seedling growth. Physical treatment methods are low cost and significant without any adversely affecting the environment. Among the pre-sowing treatments, the best treatments for the sowing of Syzygium cumini seeds are Kinetin, at0.5% for 10 minute. Which proved favorable to showed maximum germination percentage; shoot length, root length, number of leaves and Thiourea at0.5% for 10 minutes was responsible for increase the diameter of stem as compared with other treatments. Therefore, Kinetin at 0.5% for 10 minutes, Thiourea at 0.5% for 10 minutes may be recommended for plantation programme. But at the same time we should be care about healthy seeds which not infected by mycoflora because fungi may affect the seed germination and seedling growth. Particularly *Alternaria, Aspergillus, Fusarium* and *Penicillium* they showed adverse effect on germination and seedling.

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