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Seed Germination and Plant Growth in Ocimum Varieties by Physical Treatment Methods

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ABSTRACT

Ocimum one of the largest family of Lamiaceae,it comprised about 150 species distributed all over tropical and subtropical region of world. The essential components of family is eugenol found which is used for cosmetic product, culinary uses,food and drug industry. sweet basil or Indian basil, is an industrially important source of essential oil, oil painting and aroma chemicals. the present study entitled "Germination and growth responses in Ocimum specie's to seed pretreatments " has been accepted with the ideal of homogenizing pretreatment of seeds for enhanced germination and growth plants. The main objective of studies is to carried physical treatment of seeds were vanquished to various physical treatments analogous as scarification(using sandpaper), water soaking(overnight), hot water(25°C) treatment for 5 min to study their effect on seed germination to obtain maximum germination percentage and growth of seedlings. In this study there are four specie'sof Ocimum, Ocimum tenuiflorum L., Ocimum basilicum L., Ocimum grattisum L., Ociumum thrysiflorum L. selected for seed pretreatment and evaluation of pretreatment seeds. Study area analysis taken different measurements were germination percentage, survival percentage, Mean germination time, shoot length,root length, seedlings height, Allometric index observed. The highest germination percentage and height also lowest rate and height calculate by using formula.

Keywords: Physical treatment, Seed germination, Growth, Ocimum varieties.

INTRODUCTION

The Ocimum, one of the largest family Lamiaceae encompasses sweet periodic or imperishable shrubs native to the tropical and subtropical regions of the world. The family comprises of more than 150 species(Pandeyetal., 2014), that are distributed throughout the tropical and warm temperate regions of the world, especially Asia, Africa, and Central and South America (Simonetal., 1990;Moghaddametal., 2015). The essential components from Ocimum species find different uses in medicinal, perfumery and food industries. In India, basil is cultivated over an area of 25,000 ha and it accounts for an periodic product of about 250- 300tn (Smithaetal., 2014). Ocimum tenuiflorum L. (syn. Ocimum sanctum L.), popularly known as Tulsi, Holy basil or Sacred basil, is an important essential oil, painting oil bearing medicinal seasoning. It's indigenous to the Indian key and distributed throughout the tropical regions of Southeast Asia(Kirtikar and Basu, 1984). It's used in the treatment of respiratory conditions and general fragility(Kumaretal., 2004). It's commercially cultivated for its shoots in hot and sticky regions of India. The essential oil from this species contains eugenol, as the major chemical element, which contributes to the remedial exertion of the plants. The essential oil from O. tenuiflorum is well exploited in the flavouring and medicinal industries. (Smithaetal., 2014;Malavetal., 2015). Ocimum basilicum L., generally known

as sweet basil or Indian basil, is an industrially important source of essential oil, oil painting and aroma chemicals. This has been used in the treatment of headaches, diarrhoea, respiratory disorder conditions(Joshi, 2014). O. basilicum is also a vastly used culinary seasoning. The essential canvases are pulled from the leaves and the flowering covers. O. basilicum has a distinctive aroma and flavor due to the presence of benzenoids and terpenoids.(Abdollahetal., 2013). Its essential oil vastly used in high grade scents, aromatherapy, spicing liquors, mists, and gravies, and as herbal spice, fly repellant, in dental and oral products and drug(Bahletal., 2018). tenuiflorum and O. basilicum are the most cultivated and exploited species. The species being seed propagated, is liable to parade erratic germination and establishment in the field. Seed germination and seedling vigour influences plants stand, establishment and growth. According to Rehman etal.(2015), seedling vigour influences the plants growth processes that have a profound reflection on yield. Hence, effective seed germination is important in the cultivation of the species. Seed priming would enable effective germination with the imbibition of water by the inert dry seed and attendant extension of the embryonic axis. The growth of the seedlings would be posterior to the rallying of the major storehouse reserves and results in visible germination indicated by the emergence of the radicle, piercing structures girding the embryo.(Bewley, 1997; Galhautetal., 2014). Seed priming or pretreatment using plants growth promoting agents would elicit a range of biotic and physiological responses in the seeds and the seedlings, which would reflect in seed germination, seedling vigour, plants establishment, crop stage and latterly, in the yield. In this terrain, the present study entitled “Germination and growth responses in Ocimum specie’s to seed pretreatments ” has been accepted with the ideal of homogenizing pretreatment of seeds for enhanced germination and growth in *Ocimum tenuiflorum L., Ocimum basilicum L., Ocimum grattisum L., Ociumum thrysiflorum L.*

The study on “ Germination and plant growth responses in Ocimum specie’s to seed pretreatments ” was carried out at the Department of Botany, Government College of Arts and Science, Aurangabad (MH) the ideal to homogenize pretreatment of seeds for enhanced germination and plant growth in *Ocimum basilicumL.,Ocimum tenuiflorumL., Ocimum grattisum L., Ociumum thrysiflorum L.* The rubric Ocimum encompasses therapeutically precious imperishable or periodic sweet shrubs. Ocimum species are most important species which are considerably distributed and domesticated. All four the species are conventionally seed propagated. Physical manipulation and pretreatments of seeds using various growth promoting agents could have affirmative effect on seedling growth, crop stage and subsequently, on the yield.

Pretreatment And Priming of Seeds

The primary goal of seed pretreatment is to enhance germination, reduce mean germination time and meliorate growth and vigor of seedlings. Seed pretreatments or priming treatments, would either enhance or grease the process of water imbibition that initiates germination. Ellis and Roberts(1981) are of the view that pretreatments are set up successful in shops of profitable significance like medicinal shops and small seeded shops that bear quick and steady emergence of the seedlings for proper crop establishment and good yield. According to Roa and Philipse(1993), low germination per cent and the diversity in seedling emergence have a reflective influence on plant growth performance and posterior biomass product, which could be overcome by seed pretreatments or seed priming treatments.

According to Gupta(2003), one of the main impediments in the successful cultivations of medicinal plants which readily germinate in their natural niche may not readily germinate when tried to domesticate down.

This makes quality enhancement of seeds via seed pretreatments. Seed pretreatments and priming are pre-sowing treatments which would lead to a physiological state that facilitates effective germination of seeds. The seed treatments are mainly predicated on seed imbibition. Seeds are constantly dehydrated and stored until sowing. posterior to sowing, primed seeds are observed to have a hastily and further accompanied germination performing in farther vigorous seedlings than those attained from unprimed seeds(Luttsetal., 2016). Seed priming also improves seedling growth in water stressed conditions as reported by Kaur etal.(2002). The pre- sowing seed treatments comprise of enhancement ways that enable the seed to rally its own resources along with the addition of external resources to gain maximum enhancement in establishment of plant stage and yield. The seed enhancement ways encompass physical, biochemical and natural treatments of the seeds former to sowing(Nagarajetal.), Effect of Physical Pretreatments on Germination and seedling Growth. The physical pretreatments of seed include scarification using sand paper, water soaking, hot water treatment etc.

Seed Pretreatment via Scarification Scarification is a medium to overcome external dormancy in seeds. It a system which disrupts the impermeable seed coat furnishing the entry of water and oxygen into the seeds. In nature, hard seed coats are cracked or softened by fire, extreme temperatures, digestive acids in the guts of brutes, or by the bruise of blowing sand. Once the seed coat is disintegrated, oxygen and water enter the seeds and initiate germination. The choice of the system of scarification depends on the species and its seed coat. The system chosen should be analogous that it doesn't damage the endosperm, cotyledons, or embryo during the treatment Lunaetal., 2014). Mechanical scarification of Ocimum americanum seeds by gently filing with a fine grade sand paper for 3 min, enhanced the seed germination(Amritphaleetal., 1984). It was concluded that the reduced resistance of the seed coat by scarification might have altered the balance between the restrictive seed coat and the expansive force of the embryonic axis, performing in enhanced germination.

Seed Pretreatment via Water Soaking Water soaking or hydropriming is a simple, profitable and safe fashion of soaking seeds in water for enhancing the capability of seeds towards bibulous adaption, enhancing germination, seedling establishment and crop product. (Kauretal., 2002, Golezanietal., 2008). Farahani and Maroufi(2011) estimated the effect of different periods of exposure(0, 6 and 12 h) to hydropriming on the quality seedling product in basil(Ocimum basilicumL.). The topmost germination(90.66 per cent) and seedling vigour(2.99) were achieved in hydropriming exposure for 12h.

Seed Pretreatment Using Hot Water

Rita et al. (2011) observed that when seeds of Ocimum were exposed to hot water (25°C) for 2, 3 and 5 min, a higher germination percent (93) was observed for 5 min exposure than that at 2 and 3min, which recorded lower germination of 67 and 47 per cent, respectively.

Control Without Any Pretreatment

Control is medium which seeds are sown without any treatment randomly for germination and growth of plants. This method shows that germination percentage of seed is lower than other methods. Sometime hard seed coat not absorbed water and germination reduce due to this seeds required advanced pretreatment to obtain maximum percentage of germination.

MATERIALS AND METHODS

The present study " Germination and plant growth responses in Ocimum species to seed pretreatments " was carried out at the Department of Botany, Government College of Arts and Science, Aurangabad (MH) during 2022. The ideal of the study was to homogenize pretreatment of seeds for enhanced germination and plant growth in *Ocimum basilicumL.,Ocimum tenuiflorumL., Ocimum grattisum L., Ociumum thrysiflorum L.*

The study was carried out in two phases Phase 1- Pretreatment of seeds for enhanced germination Phase 2- Evaluation of scattered seedlings for enhanced plant growth The paraphernalia used and the methodology espoused for the studies.

Source Of Planting Material The seeds of *Ocimum basilicumL.,Ocimum tenuiflorumL., Ocimum grattisum L., Ociumum thrysiflorum L.* Department of Botany, Government College of Arts and Science, Aurangabad (MH) during 2022.

Phase I Pretreatment Of Seeds For Enhanced Germination The seeds of species of Ocimum were vanquished to treatments to physical treatments. The seeds vanquished to germination without any pretreatments were taken as the control. The seeds after pretreatments were sown in protrays filled with replanting amalgamation composed of coirpith compost. The seedlings were maintained in the protrays upto 30 days after sowing to study the effect of pretreatments on germination. The trials were laid out in completely Randomised Design. Each treatment was replicated thrice and each replication comported of 50 seeds. The seeds were vanquished to various physical treatments analogous as scarification(using sandpaper), water soaking(overnight), hot water(55°C) treatment for 10 min to study their effect on seed germination.

Table 1. various physical treatments is presented as follow.

Treatment	Physical treatment
T1	Scarification(using sand paper
T2	Water soaking(over night)
T3	Hot water (25°Cfor 5min)
T4	Control (without treatment)

Compliances on the Effect of Pretreatments on Seed Germination, Germination per cent is an estimate of viability of a population of seeds. Seeds were sown in 50 cell protrays at the rate of one seed per cell and observed for germination upto 5 days, after which no seed germination was observed in both the Ocimum species. The germination per cent was calculated by the following equation

$$\text{Germination per cent} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds initially sown}} \times 100$$

The survival per cent was recorded daily from the day of first germination to the end of the trial on seed germination.

$$\text{Survival percent \%} = \frac{\text{Number of surviving plants at end of the study}}{\text{Number of planted seeds}} \times 100$$

Germination indicator

The seeds showing radicle projection were counted for the number of seeds germinated each day. Germination indicator was calculated using the following formula.

$$\text{Germination index} = \frac{X1}{Y1} + \frac{X2 - X1}{Y2} + \ldots\ldots\ldots + \frac{Xn - Xn-1}{Yn}$$

X1- Number of seeds germinated at first count
X2- Number of seeds germinated at alternate count
Xn- Number of seeds germinated on utmost day
Y1- Number of days from sowing to first count
Y2- Number of days from sowing to alternate count
Yn- Number of days from sowing to utmost count

Mean Germination Time

Mean germination time(MGT) is a measure of the rate and time- spread of germination. MGT was reckoned using the formula described by Schelin etal. 2003).

$$\text{Mean germination time(MGT)} = \frac{\Sigma fini}{\Sigma N}$$

fi = Day during germination period ni = Number of germinated seeds on fi
N = Total number of germinated seeds

Shoot Length

Five seedlings were aimlessly named from each replication and using a measuring tape recording, length was measured from the base to the loftiest point of the plants at 7 days period after sowing.

Root Length

Five seedlings were aimlessly named per replication and pulled precisely. The root length was calculated from the base of the plant to the tip of primary roots at 7days period after sowing.

Allometric indicator

The shoot length and root length recorded at 7days period after sowing were used to calculate the allometric indicator using the formula described by Hosseini et (2013).

$$\text{Allometric Index} = \frac{\text{Root length}}{\text{Shoot length}}$$

Statistical Analysis The trials in the first phase of the study were laid out in fully randomized design. The data generated from the trials were subordinated to analysis of friction.

Phase 2 Evaluation Of Scattered Seedlings For Enhanced Plant Growth.

Thirty day old seedlings of Ocimum specie's attained from pretreated seeds of phase I trials were scattered in grow bags. Ten seedlings in three replicates planted in grow bags were grown organically and estimated for plants growth and yield. The seedlings from untreated seeds were taken as control.

RESULTS

The study entitled " Germination and plants growth responses in Ocimum species to put in pretreatments " was carried out during 2022 at the Department Department of Botany, Government College of Arts and Science, Aurangabad (MH) The data collected from the field trials were statistically analysed and the results are presented.

Phase 1 Pretreatments Of Seeds For Enhanced Germination In Ocimum tenuiflorum
Effect of Physical Pretreatment of Seeds on Germination and Seedling Growth Parameters inO. Tenuiflorum The various physical pretreatments viz., scarification, water soaking (overnight), hot water(25℃ for 5 min) were tried to study the effect on seed germination parameters in Ocimum specie's.

The data on the effect of physical treatments on various parameters is presented in Table. Germination per cent The seeds exposed to (T4) recorded maximum germination of85.33 per cent, which was significantly advanced than all other treatments tried. The smallest(57.33 per cent) germination was observed in scarification treatment(T1). This was on par with the treatments T2, T3 and. Survival per cent Significant variation was observed among various physical pretreatments with respect to survival per cent. T4(seeds treated with d) recorded maximum survival of85.33 per cent. The smallest(57.33 per cent) survival rate was observed in T1(scarification),which was on par with the treatments T2, T3 and T5. Germination indicator The data indicated that various physical treatments tried had no significant influence on germination indicator.

Mean Germination Time As in the case of germination indicator, no statistically significant variation was observed among physical treatments tried, on mean germination time.

Shoot Length Shoot length displayed significant variation among the physical treatments tried(Fig. 1). The treatment T3(hot water treatment of the seeds) recorded the loftiest shoot length of17.17 cm which was on par with T1 and T2. The smallest shoot length(10.53 cm) was observed in the control. This was on par with T4.

Root Length Significant variation was observed among the physical treatments with respect to root length(Fig.1). analogous to shoot length, the loftiest root length (10.66 cm) was recorded on hot water treatment(T3), which was on par with T1 and T2. The smallest root length(6.73 cm) was observed in the control. This was observed to be on par with T2 and T4.

Seedling Length Significant variation was observed among the physical treatments with respect to seedling length(Plate 1 andFig.1). T3(hot water treatment) recorded the loftiest length(27.83 cm) which was on par with T1 and T2. The smallest seedling length(17.26 cm) was observed in the control(T5). This was observed to be on par with T4.

Allometric Index

The data indicated that various physical treatments tried had no significant influence on allometric index.

Photo Plates 1. A- *Ocimum basilium B.-Ocimum tyrsiflorum C- Ocimum grattisium D-Ocimum tenuiflorum*

A.

B.

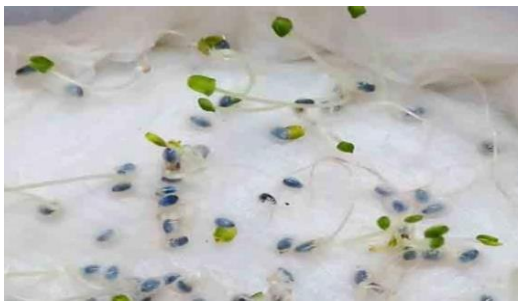
C.

D.

Photo Plates 2. A- *Ocimum basilium B.-Ocimum tyrsiflorum C- Ocimum grattisium D-Ocimum tenuiflorum*

A.

B



C.

D.

Table.1 Effects of seed germination on Ocimum basilium L. Physical methods.

Physical treatment	Gn(%)	S(%)	GI	MGT (days)	SL(cm)	RL(cm)	Sdl L(cm)	AI
SC	72.76±3.45	72.76±3.45	14.09±0.78	3.54±0.12	15.09±0.76	09.76±0.54	24.85±0.23	0.64±.09
WS	78.87±2.46	78.87±2.46	13.27±0.42	3.12±0.21	13.07±0.34	08.87±0.39	21.84±0.28	0.87±0.7
HW	75.65±4.23	75.65±4.23	15.34±0.50	4.44±0.34	12.04±0.42	08.78±0.35	20.82±0.21	0.65±0.8
Control	70.72±3.21	70.72±3.21	10.23±0.55	4.36±0.53	13.17±0.32	09.31±0.80	22.48±0.32	0.48±0.4

Table.2 Effects of seed germination on Ocimum tyrsiflorum L… by Physical methods.

Physical treatment	Gn(%)	S(%)	GI	MGT (days)	SL(cm)	RL(cm)	Sdl L(cm)	AI
SC	70.56±2.15	70.56±2.15	13.29±0.78	3.04±.17	12.29±0.46	08.66±0.14	20.95±0.23	0.61±0.5
WS	71.87±2.86	71.87±2.86	13.42±0.42	3.21±0.42	13.32±0.33	07.80±0.31	21.12±0.88	0.79±0.7
HW	72.25±3.73	72.25±3.73	14.34±0.57	4.08±0.14	14.54±0.41	07.72±0.65	22.26±0.41	0.71±0.8
Control	70.42±3.24	70.42±3.24	12.53±0.85	4.03±0.33	12.33±0.37	07.21±0.82	19.53±0.92	0.68±0.7

Table.3 Effects of seed germination on Ocimum grattisium L. by Physical methods.

Physical treatment	Gn(%)	S(%)	GI	MGT (days)	SL(cm)	RL(cm)	Sdl L(cm)	AI
SC	69.08±2.34	69.08±2.34	14.04±0.78	3.54±0.12	15.09±0.76	07.76±0.54	22.85±0.23	0.64±.05
WS	75.73±1.32	75.73±1.32	13.28±0.42	3.54±0.41	13.07±0.36	08.85±0.39	21.92±0.78	0.81±0.7
HW	75.54±3.27	75.54±3.27	14.34±0.52	4.17±0.34	14.04±0.40	08.78±0.35	23.18±0.31	0.65±0.8
Control	72.65±2.23	72.65±2.23	14.23±0.55	4.24±0.53	13.08±0.32	07.31±0.80	21.02±0.32	0.76±0.4

Abrivations- SC-Scarification; WS-Water soaking; HW-Hot water; Control , Gn- germination; S-Survival; GIGermination Index; MGT- Mean Germination Time; SL- shoot length; RL- Root length; Sdl L- Seedling Length; AI- Allometric Index.

Table.4 Effects of seed germination on Ocimum tenuiflorum L. by Physical methods.

Physical treatment	Gn(%)	S(%)	GI	MGT(day)	SL(cm)	RL(cm)	Sdl L(cm)	AI
SC	71.38±2.44	71.38±2.44	15.29±0.58	4.24±.12	16.23±0.70	07.12±0.54	23.35±0.26	0.74±.05
WS	70.23±1.12	70.23±1.12	14.27±0.12	3.42±0.21	14.65±0.34	08.27±0.39	22.92±0.38	0.67±0.7
HW	75.54±3.97	75.54±3.97	15.34±0.56	4.65±0.64	15.04±0.47	08.78±0.35	23.82±0.41	0.65±0.7
Control	68.60±2.63	68.60±2.63	13.43±0.58	5.23±0.23	15.47±0.71	09.31±0.80	25.30±0.32	0.61±0.4

Photoplates-3 Seedlings of Two weeks Ocimum species

A B C D

Photo Plates 4 A- *Ocimum basilium B.-Ocimum tyrsiflorum C- Ocimum grattisium D-Ocimum tenuiflorum*

DISCUSSION

The present study entitled " Germination and plants growth responses in Ocimum spp. to seed pretreatments " was carried out during 2022 at the Department of Botany, Government College of Arts and Science, Aurangabad (MH). The results of study are discuss here in. The seeds of the Four Ocimum species were subordinated to different pretreatments, to study their effect on germination and seedling parameters; further scattered to grow bags after 30 days after sowing to study their effect on plants growth. The responses of the four species towards various pretreatments are discussed then. Effect of physical pretreatments of seeds on enhancing germination and plants growth in Ocimum spp. The seeds of the four species when subordinated to different physical pretreatments, O. tenuiflorum seeds exposed to concentrated sulphuric acid for 1 min recorded maximum germination and survival of85.33 per cent. in the present study,O. basilicum seeds treated with H2SO4 were observed to give the smallest germination of 32 per cent. Differential response of the four species to sulfuric acid treatments might be attributed to the structural or biochemical variation in the seed, which needs to be farther illustrated. tenuiflorum seeds treated with hot water recorded the loftiest seedling vigour indicator(19.67) and seedling length(27.83 cm). Among the treatments, advanced plants height and shoot biomass(fresh and dry weight) at crop stage(90 DAS), were also observed in this treatment. still, inO.basilicum, late water soaking treatment recorded maximum germination indicator of16.13 and seedling vigor indicator of18.27. In agreement with our finding, InO. basilicum, though water soaking treatment recorded advanced seedling vigour indicator, this didn't reflect in the seedling length. No significant variation was observed in seedling length among the various physical treatments tried. analogous effect was observed in shoot biomass also.

SUMMARY

The present discussion entitled " Germination and plants growth responses in Ocimum spp. to seed pretreatments " was conducted in the Department of Botany, Government College of Arts and Science, Aurangabad (MH).during period 2022 with the ideal to regularize pretreatment of seeds for enhanced germination and plants growth in *Ocimum tenuiflorumL.* and *Ocimum basilicumL.* The seeds of *Ocimum tenuiflorum* and *Ocimum basilicum* used for the study were sourced from plants nurseries and temple regions all over Maharashtra. The study was carried out in two phases, 1) Pretreatment of seeds for enhanced germination; 2) Evaluation of scattered seedlings derived from pretreated seeds for enhanced plants growth. The seeds of four species of Ocimum were subordinated to treatments such as physical treatments previous to sowing. The seeds subordinated to germination without any pretreatment were taken as the control. In the first phase of the study, O. tenuiflorum seeds when exposed to physical treatments, pretreatment using different treatment in O. tenuiflorum recorded maximum germination(85.33 per cent). Germination indicator, mean germination time and allometric indicator didn't show any significant variation among the physical treatments. Hot water treatment recorded the loftiest shoot length(17.17 cm), root length(10.66 cm), seedling length(27.83 cm) and seedling vigour indicator(19.67) at different time periods.

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