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# Germination study in Gokhru *(Pedalium murex L.*) seeds

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## ABSTRACT

*Gokhru (Pedalium murex L.*) is one of the important medicinal plants propagated through seeds but no germination test has been standardized for this crop yet. Germination test is mandatory for seeds sale which is required for labelling. The fruits of *Pedalium murex L.* are four angled indehiscent hard pyramidal with four sharp spines and it is very difficult to extract the seeds from fruits. Hence, study was conducted to find out suitable method and optimum temperature for germination test of fruits as well as seeds of gokhru. The study was conducted by using three germination testing methods *viz.*, Top of Paper (TP), Between Paper (BP) and Sand (S) methods and three temperatures *i.e.* 25, 30 and one alternating temperature of 20-30℃. The results revealed that during germination test of fruits, 'Sand' method showed superiority by registering maximum germination (29.67%) over 'Between Paper' (23.33%) and 'Top of Paper' (3.11%) methods. Viogur index-I (213) and Vigour Index-II (2.20) were also observed maximum in 'Sand' method while maximum seedling length (8.00cm) and seedling dry weight (0.075mg) were observed in 'Between Paper' method. Among the temperatures, maximum germination (22.78 & 36.00%), seedling length (8.00 & 9.44cm), seedling dry weight (0.142 & 0.077mg), Vigour index-I (186 &341) and Vigour index-II (2.26 & 2.79) were observed at 30℃ in fruits and seeds respectively. No germination was recorded below 20℃. Good germination was observed in seeds compared to fruits. In case of seeds, maximum germination (38.33%), seedling length (9.00cm), seedling dry weight (0.076mg), vigour index-I (329) and vigour index-II (2.77) were recorded in 'Between Paper' method. It is concluded that 30℃ temperature is optimum for germination test of both seed as well as fruit in Gokhru and 'Sand' method is best for fruit germination test while in case of germination test of seeds 'Between Paper' method is best.

**Keywords:** *Pedalium Murex,* Medicinal Plant, Germination, Seed Quality, Fruit.

## INTRODUCTION

Medicinal plants have been used in healthcare since time immemorial which are resources for new drugs. Gokhru is an important medicinal plant used as an ingredient of food supplements which is of two types- Chhota Gokhru (*Tribulus terrestris*) and Bada Gokhru (*Pedalium murex L.).* Bada Gokhru (*Pedalium murex L.*) belongs to family *Pedaliaceae* is perhaps the most useful traditional medicinal plant in India. *Pedalium murex* with chromosome number n=8 is an annual plant widely distributed in east Africa, Indonesia & India. Within India, it occurs commonly in waste places in the Deccan Peninsula, particularly near the coast, river belts, sandy areas of Tamil Nadu, Andhra Pradesh, Haryana, Rajasthan, Punjab, Gujarat and Madhya Pradesh, Uttar Pradesh. It is diffuse annual, much branched, spreading, succulent, glandular, up to 60 cm tall. Almost every plant parts *i.e.* leaf, fruit, roots is often used for treatment of infertility, low sex drive and erectile dysfunction. The plant has industrial value and fruits are traded as raw medicine in Indian herbal mandies and used by Aurvedic medicines manufacturers for the medicinal preparations.

*Pedalium murex L.* have a better profile with potential natural source for the treatment of various range of either acute or chronic disease [1]. According to Ayurveda, *Pedalium* murex is mainly used as tonic, aphrodisiac, improves appetite and useful in strangury, urinary discharges, vesicular calculi, cough, asthma, pain, cures skin diseases and heart troubles, piles and leprosy. It purifies blood, removes stone from bladder [2-4]. The side effect of medicines has been observed on human health that's why use of medicinal plants in ayurvedic medicines is increasing. Commercial cultivation of Gokhru crop is not started yet. It is found on waste land having sandy soil. After maturity fruits of gokhru drop down in the soil and next year when they get optimum temperature and moisture, they grow themselves. Due to scarcity of planting material, lot of emphasis is being given to the propagation of medicinal crops. For the successful cultivation of any crop, knowledge of propagating material is very important. Seed testing is an essential step for evaluation of planting value of seeds and to minimize the risk of failure in planting. Seed testing is mandatory to determine the quality standards under seed law enforcement and deterministic of the sowing rate. Gokhru domestication and commercialization of seed will be facilitated by the development of seed quality testing methods. Germination depends on the intrinsic characteristics of seeds and environmental factors such as temperature, moisture and substrate. Temperature affects the rate of imbibitions and chemical reactions during germination process which influences uniformity and overall germination rate [5]. Some species respond better at constant temperature while others best germinate

at alternate temperature [6]. The choice of substrate should take into account the seed characteristics, such as size, requirement of water and light, counting facility and seedling evaluation [7]. Currently no seed standards have been developed for this crop so far. Therefore, it is necessary to develop seed standards for certification. The developed seed standards will be utilized by certification agencies to ensure seed quality and seed testing procedure will be used in seed testing laboratories. Hence, this work aimed at developing methodology to establish standard for routine in gokhru seed quality assessment.

**MATERIAL AND METHODS**

The freshly harvested seeds of Gokhru (*Pedalium murex L.*) were collected from Bhaleri (28°32'15.3"N 74°46'22.4"E) and Dadreva (28°40’22”N 75°13’58”E) village of Distt. Churu (Rajasthan) and study on seed quality parameters was conducted at the Department of Seed Science & Technology, CCS Haryana Agricultural University, Hisar during 2021. The fruits of *Pedalium murex L.* are four angled indehiscent and hard pyramidal with four sharp spines (Figure 1). It is very difficult to extract the seeds from fruits. Hence, study was conducted on both fruit and seed. Seeds were extracted from the fruits after removing the spines by using mechanical scarifier for 10 seconds. Observations on germination percentage, seedling length, seedlings dry weight and vigour indices were recorded. Germination test was conducted according to the rules of International Seed Testing Association [8] with four replications of 100 fruits/seeds by using three methods viz., Top of Paper (TP), Between Paper (BP) and Sand (S) methods were used at two constant temperatures of 25, 30 and one alternating temperature of 20-30oC (20°C for 16 h and 30°C for 8h) 90-95% relative humidity in seed germinator.

The final count was taken when no further increase in germination noted and only normal seedlings were considered for percent germination. Test weight of seeds as well as fruits was estimated by counting thousand fruits/seeds at random in three replications and weighed individually on electronic balance and the mean of these observations was recorded as test weight in grams. For estimation of seedling length, ten randomly selected normal seedlings were taken from each replication during germination test and average length of seedlings was recorded in centimetres for final calculation. After measuring the seedling length, these ten fresh seedlings were taken and dried in a hot air oven for 24 h at 80±1$^0$C. The dried seedlings from each replication were weighed and average seedling dry weight was expressed in milligram. Seedling vigour indices were calculated according to following method suggested by Abdul-Baki and Anderson [9]:

Vigour Index–I = Germination (%) x Average seedling length (mm)

Vigour Index–II = Germination (%) x Average seedling dry weight (g)

The experiment was conducted in factorial completely randomized design as per standard method suggested by Panse and Sukhatme [10] and data was analyzed by using the online statistical tool (OPSTAT) developed by Sheoran [11].


**Figure 1:** Fruits and seeds of Bada Gokhru (*Pedalium murex* L.)

**Table 1:** Effect of temperature and testing method on seed quality parameters of Bada Gokhru (*Pedalium murex L.*), fruits

| Temperatures in °C (T) | Germination (%) | | | | Seedling Length (cm) | | | | Seedling Dry Weight (mg) | | | | Vigour Index- I | | | | Vigour Index- II | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seed germination testing methods (M) | | | | | | | | | | | | | | | | | | | |
| | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean |
| 25 | 3.00 (9.88) | 22.67(28.41) | 28.67(32.35) | 18.11(23.55) | 6.00 | 8.33 | 7.33 | 7.22 | 0.061 | 0.072 | 0.075 | 0.069 | 18 | 189 | 211 | 139 | 0.18 | 1.64 | 2.14 | 1.32 |
| 30 | 5.33(13.26) | 27.67(31.72) | 35.33(36.45) | 22.78(27.14) | 7.33 | 9.00 | 7.67 | 8.00 | 0.265 | 0.086 | 0.075 | 0.142 | 39 | 249 | 270 | 186 | 1.74 | 2.37 | 2.67 | 2.26 |
| 20-30 | 1.00(5.74) | 19.67(26.30) | 25.00(29.98) | 15.22(20.67) | 5.33 | 6.67 | 6.33 | 6.11 | 0.053 | 0.066 | 0.072 | 0.063 | 5 | 132 | 158 | 98 | 0.05 | 1.29 | 1.79 | 1.04 |
| Mean | 3.11(9.63) | 23.33(28.81) | 29.67(32.93) | | 6.22 | 8.00 | 7.11 | | 0.126 | 0.075 | 0.074 | | 21 | 190 | 213 | | 0.66 | 1.77 | 2.20 | |
| C.D. at 5% | T=1.525, M=1.525, TxM= 2.641 | | | | T=0.693, M=0.693, TxM= NS | | | | T=NS, M=NS, TxM= NS | | | | T=18.13, M=18.13, TxM= 31.40 | | | | T=0.839, M=0.839, TxM= NS | | | |

*Figures in the parenthesis are the arc-sine transformed values

**Table 2:** Effect of temperature and testing method on seed quality parameters of Bada Gokhru (*Pedalium murex L.*), seeds

| Temperatures in °C (T) | Germination (%) | | | | Seedling Length (cm) | | | | Seedling Dry Weight (mg) | | | | Vigour Index- I | | | | Vigour Index- II | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seed germination testing methods (M) | | | | | | | | | | | | | | | | | | | |
| | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean | TP | BP | S | Mean |
| 25 | 29.67(32.99) | 38.33(38.24) | 28.00(31.93) | 32.00(34.39) | 7.00 | 9.33 | 8.67 | 8.33 | 0.064 | 0.074 | 0.076 | 0.071 | 207 | 357 | 243 | 269 | 1.89 | 2.85 | 2.14 | 2.29 |
| 30 | 35.00(36.26) | 39.33(38.82) | 33.67(35.45) | 36.00(36.84) | 8.33 | 10.33 | 9.67 | 9.44 | 0.068 | 0.087 | 0.076 | 0.077 | 292 | 406 | 325 | 341 | 2.38 | 3.42 | 2.57 | 2.79 |
| 20-30 | 21.67(27.72) | 30.67(33.61) | 23.00(28.64) | 25.11(29.99) | 6.67 | 7.33 | 6.67 | 6.89 | 0.052 | 0.066 | 0.072 | 0.064 | 145 | 224 | 153 | 174 | 1.13 | 2.04 | 1.66 | 1.61 |
| Mean | 29.67(32.32) | 38.33(36.89) | 28.00(32.01) | | 7.33 | 9.00 | 8.33 | | 0.061 | 0.076 | 0.075 | | 215 | 329 | 241 | | 1.80 | 2.77 | 2.12 | |
| C.D. at 5% | T=1.288, M=1.288, TxM= 2.232 | | | | T=0.637, M=0.637, TxM= NS | | | | T=0.002, M=0.002, TxM= 0.004 | | | | T=19.65, M=19.65 TxM= NS | | | | T=0.095, M=0.095 TxM= 0.165 | | | |

*Figures in the parenthesis are the arc-sine transformed values; TP= Top of Paper BP= Between Paper S= Sand

**RSULTS AND DISCUSSION**

Germination test of fruits as well as seeds was conducted. There was significant interaction ($p<0.5$) for all the factors except temperature x substrate interaction in seedling length and vigour index-I of both seed as well as fruit. In case of fruits, sand method showed superiority by registering maximum germination (29.67%) over Between Paper (23.33%) and Top of Paper (3.11%) methods. Minimum germination in TP method may be due to insufficient moisture required for germination. Other seed quality parameters like Viogur index-I (213) and Vigour Index-II (2.20) were also observed maximum in sand method while maximum seedling length (8.00cm) and seedling dry weight (0.075mg) were recorded in Between Paper method. Thousand fruit weight of gokhru ranged between 115.0 to 140.0g. Each fruit bear 1-2 seeds having thousand seed weight around 2.60g. Final count was taken on 30$^{th}$ day in case of fruits and on 7$^{th}$ day in seeds. Among the temperatures, maximum germination (22.78%), seedling length (8.00cm), seedling dry weight (0.142mg), Vigour index-I (186) and Vigour index-II (2.26) were observed at 30$^{o}$C while these parameters were recorded minimum at alternate temperature of 20-30$^{o}$C. Irrespective of substrate, no germination was recorded in fruits when they were exposed to 20$^{o}$C. When seeds were exposed to low temperature, in general, there was a delay in germination from reduced metabolic activities. On the contrary, seeds germinated more rapidly at high temperatures as a result of protein denaturation coming from increased metabolic activities [12]. Temperature plays a pivotal role in germination since it is one of essential requirements for biochemical metabolism. Vigour indices were observed more in sand method due to more germination percentage in this method as vigour indices are calculated by multiplication of seedling lengths and seedling dry weight with germination percentage. Less seedling length and seedling dry weight in sand method may be due to less growth in root length as compared to 'Top of Paper' and 'Between Paper' methods. Temperature and substrata affect both rate as well as final percentage of germination. Medium plays an important role during germination test, because seeds have characteristic requirements of moisture and oxygen for germination. In case of seeds, final count was taken on 7$^{th}$ day and maximum germination (38.33%), seedling length (9.00cm), seedling dry weight (0.076mg), vigour index-I (329) and vigour index-II (2.77) were recorded in 'Between Paper' method. In germination test of seeds also, 30$^{o}$C temperature registered maximum germination (36.00%), seedling length (9.44cm), seedling dry weight (0.077mg), vigour index-I (341) and vigour index-II (2.79). (2.79).Good germination was observed in seeds compared to fruits. It is concluded from the study that 30$^{o}$C temperature is optimum for germination test (for both seed & fruit) in Gokhru (*Pedalium murex L.*) and 'Sand' method is best for fruit germination test while in case of germination test of seeds 'Between Paper' method is best. Maximum germination was recorded in senna by 'Between Paper' method (83.3%) followed by 'Top of Paper' (77.8%) and 'Sand' (70.0%) method [13]. Higher germination in 'Between Paper' method may be attributed to better sustainable supply of moisture and oxygen until completion of germination test.

**CONCLUSION**

It is concluded from the study that 30$^{o}$C temperature is optimum for germination test of both seeds as well as fruits of Gokhru (*Pedalium murex L.*) and 'Sand' method is best for fruit while 'Between Paper' method is best for seed germination test.

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**Conflict of Interest**

None declared.

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None declared.

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