

Full Length Research

Enhancement of Seed Germination and Seedling Growth of Cardamom (*Elleteria cardamomum*) at Tepi South-western Part of Ethiopia

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Cardamom (*Elleteria cardamomum*) is herbaceous, perennial and aromatic spice. Production is much lower mainly due to constraints such as lack of improved variety, Poor agronomic practices and seed dormancy. Thus, the current study was conducted with the objective of determining effects of different seed treatments on seed germination and seedling growth of cardamom. Cardamom seeds were subjected to nine seed treatments viz., T1 (Control/ no pretreatment), T2 (Soaking seeds in tap water for 12 hrs.), T3 (Soaking seeds in tap water for 24 hrs.), T4 (Soaking seeds in 5% sulfuric acid for 10 min.), T5 (Soaking seeds in 10% sulfuric acid for 5 min.), T6 (Soaking seeds in 25% nitric acid for 10 min.), T7 (Soaking seeds in 50% nitric acid for 15 min.), T8 (Soaking seeds in 25 per cent acetic acid for 10 min.) and T9 (Soaking seeds in 80% alcohol for 30 minutes). Analysis of variances of the results revealed that, T9 was the most effective treatment for improving seed germination (78.11%), followed by T8 (69.55%) at six weeks after sowing. Treatment two and four were revealed relatively higher mean germination value compared to the control. While T3, T5, T6 and T7 revealed lower mean germination value even less than to the control treatment performance. Therefore, it can be concluded that soaking of korerima seeds with 80% alcohol for 30 minutes duration, improved both seed emergence and growth of seedlings performance.

Key word: Cardamom, *Elettaria cardamomum*, Seed germination, Seed treatment

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INTRODUCTION

Cardamom (*Elettaria cardamomum* Maton - small) is the queen of spices, in the home land for spices. It was only a wild growth in the evergreen forests of Western Ghats in South India. It is also a clumping plant of up to 20 leaf shoots arising from the rhizome. The shoots are composed of overlapping leafy sheaths, lanceolate in shape with dark green color (Korikanthimath, 2008). Some shoots produce flowers on a drooping pinnacle. The cardamom fruits are pale green to yellow in color but

turns in to brown when dried and contains 15 to 20 small aromatic seeds about 3 mm in length which are highly valued as flavoring. Cardamom thrives well over an altitude of 600 to 1200 m.a.s.l., rainfall between 1500 mm to 4000 mm and temperature ranging between 10° C to 35°C. Over a period of time people have realized the use and economic potential of Cardamom and systematic cultivation was initiated. Apart from being used in food preparation as a flavoring agent, it is also used in confectionary, beverages and liquors. It also has medicinal use in

Allopathy and Ayurveda system, (Ankegowda, S.J. 2015).

Cardamom is propagated either by seed or cutting of its clumps, though the latter is by far the most common method, as it yields earlier and ensures a true-to-type propagation than the former. However, vegetative propagation through cuttings results in the destruction of the productive garden, on top of the commonly associated shortage of planting materials to cover wider areas of land. Consequently, seed propagation of cardamom is undertaken to cover large areas of land retaining the mother productive stand intact. But germination of cardamom is not fast and/or many seeds not germinate due to the presence of some kind of dormancy, possibly associated with its hard seed coat of *Elettaria* species (Eyob, 2009). The presence of low food reserve in the seed endosperm might be a reason for the very slow germination and subsequent seedling growth of cardamom. Therefore, the objective of this study was to explore the effects of different seed treatment on seed germination and subsequent seedling growth of cardamom.

MATERIALS AND METHOD

Description of the study area

The experiment was conducted at Tepi Agricultural Research Center, during 2014-2016 at nursery condition. It is located in southwest of Ethiopia, SNNP regional state at an elevation of 1200 m.a.s.l. and it situated at latitude of 7° 10' 54.5" N and with a longitude of 35° 25' 04.3-28.2" E of Ethiopia. The research station receives average rainfall of 1559 mm annually with maximum and minimum temperatures of 29.7°C and 15.5°C, respectively.

Experimental design and preparation of planting material

Fully red ripen fruits of released variety Gene of cardamom was collected from Tepi Agricultural Research Center. The pericarp of collected seeds were carefully removed and washed thoroughly to remove mucilage around the seeds. Selected and clean seeds were divided into nine groups (300 seeds each) and subjected to different seed treatments based on each treatment setup. Each group of treated seeds were divided into three (100 seeds each) and sown in plastic pots containing forest soil, clay loam and sand (3:1:1) mixture at nursery. The experiment was arranged in a Randomized Complete Block Design (RCBD) in three replication. The pots were watered once a day.

Treatments were:-

T1: Control (no pretreatment)

T2: Soaking seeds in tap water for 12 hr

T3: Soaking seeds in tap water for 24 hrs.

T4: Soaking seeds in 5% sulfuric acid (H₂SO₄) for 10 min

T5: Soaking seeds in 10% sulfuric acid (H₂SO₄) for 5 min

T6: Soaking seeds in 25% HNO₃ for 10 min

T7: Soaking seeds in 50% HNO₃ for 15 min

T8: Soaking seeds in 25 per cent Acetic acid for 10 min

T9: Soaking seeds in 80% alcohol for 30 minutes

Data collection

Number of germinated seeds in each treatment based on weekly interval, days of 50% germination attained, Percentage of normal seedlings, seedling length (cm), leaf area (cm²), number of roots and root length (cm) were recorded.

Data Analysis

Data collected from the experiment was subjected to analysis of variance for the design and treatment setup using Statistical Analysis System (SAS, 2001) computer software version 9.1. Data collected on the basis of percentage was analyzed after angular transformation (arcsine) conducted. Where significant differences were detected, the means separation was carried out using the least significant differences (LSD) at 0.05 level of probability.

RESULTS AND DISCUSSION

Cardamom seed germination was significantly ($P \leq 0.05$) improved by seed treatment (Table 1). Cardamom seeds were started germination at four weeks after sown and the highest number seedling (8.11) were germinated for T3 (seed soaked for 24 hrs. in tap water) but the lowest mean value of germinated seeds (3.11) was recorded for T7 (50% HNO₃ for 15 min). The highest number of days (53) registered for 50% of seed germination was by T5 (seed soaked with 10% H₂SO₄ for 5 min.) but relatively the least number of days (31) for 50% seed germination was recorded by treatment 9 (seed soaked with 80% alcohol for 30 min.). The highest seed germination value (78.11%) was revealed by treatment 9 (seed soaked with 80% alcohol for 30 min), while the lowest rate of germination (46.33%) was registered for T5 (seed soaked with 10% H₂SO₄ for 5 min) at six week after sowing. Seed germination was not observed in all treatments after six weeks (Table 1).

The longest seedling and root length (2.40 cm, 2.85 cm) were observed for T9 and T5 while the shortest seedling and root length were observed for T5 and T3 (1.98 cm,

1.75 cm), respectively. The overall highest mean value of leaf area (cm²) and number of roots were observed for T9 (seeds soaked with 80% alcohol for 30 min.) but the lowest mean value of leaf area (cm²) and root number were observed for T1 (control). Highest number of normal seedling (78%) was recorded for T9 but the lowest mean value of normal seedling (42) was recorded for T5. Generally, T9 and T8 were significantly improved cardamom seed germination, seedling length, leaf area, roots number and root length, (Table 2).

The results of the present study indicated that seed treatment had significant and positive effect on different aspects of seed vigor indices improvements, such as seed germination, growth and biochemical parameters. The response of crop for different seed treatments were interpreted in terms of germination percentage, speed of germination, seedling vigor, seedling length, root length, shoot length test. The result of the present study is in agreement with Amarnath, *et al.*(2015) stated that seed treatment increase germination percentage, germination rate, and decreased abnormal seedlings in sunflower plants.

CONCLUSION

The present study revealed that, soaking cardamom seeds in 80% alcohol for 30 minutes was significantly improved seed germination and subsequent seedling growth. Therefore, soaking seeds in 80% alcohol for 30 minutes is recommended to promote the cardamom seed

multiplication process and improving growth characteristics of the subsequent seedlings quality of the crop.

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Appendix

Table 1. Effects of seed treatment on seed germination and seedling growth of cardamom

Treatments	Days to 50% germination	Germination % in weeks interval from sowing			
		Four	five	six	seven
T1 (Control)	40.33cd	3.50e	17.6b-d	59.55e	59.55e
T2 (H2O for 12 hr)	42.00cd	5.55b-e	22.66ab	67.41c	67.41c
T3 (H2O for 24 hour)	47.66b	8.11a	26.00a	58.11f	58.11f
T4 (5% H2SO4 10 min)	44.66bc	6.22a-d	22.1 ab	66.33d	66.33d
T5 (10% H2SO4 for 5 min)	53.00a	7.11abc	15.10d	46.33i	46.33i
T6 (25% HNO3 for 10 min)	48.00b	4.88c-e	20.7a-c	56.33g	56.33g
T7 (50% HNO3 for 15 min)	52.66a	3.11e	16.33cd	49.55h	49.55h
T8 (25% Acetic Acid for 10 min)	38.00d	4.55b	14.86d	69.55b	69.55b
T9 (80% alcohol for 30 min)	31.66d	8.00ab	25.66a	78.11a	78.11a
LSD (0.05)	4.44	2.49	5.50	0.25	0.26
CV (%)	5.71	5.4	5.78	9.24	7.24

Means with the same letter in the column are not significantly different, LSD = least significant difference, CV (%) = coefficient of variation

Table 2. Effects of seed treatment on seed germination and seedling growth of cardamom

Treatments	Seedling length (cm)	Leaf area (cm ²)	Number of root	Root length (cm)	Percentage of normal seedling
T1 (Control)	2.16d	2.63d	3.33c	2.46ab	52cd
T2 (H2O for 12 hr)	2.18cd	3.03bc	4.78ab	1.85bc	64bc
T3 (H2O for 24 hour)	2.10de	2.95cd	4.84ab	1.75c	54bc
T4 (5% H2SO4 10 min)	2.23b-d	3.37b	3.63c	2.27a-c	59bc
T5 (10% H2SO4 for 5 min)	1.98e	2.97b-d	4.31b	2.18a-c	42f
T6 (25% HNO3 for 10 min)	2.36.5a	3.11bc	4.55ab	1.96bc	51cd
T7 (50% HNO3 for 15 min)	2.33ab	3.07bc	3.55c	2.35a-c	47cd
T8 (25% Acetic Acid for 10 min)	2.37a	3.87a	4.94a	2.01bc	68ab
T9 (80% alcohol for 30 min)	2.40a	3.92a	5.00a	2.85a	78a
LSD (0.05)	0.13	0.39	0.54	0.67	11
CV (%)	6.47	7.13	7.28	7.85	7.86

Means with the same letter in the column are not significantly different, LSD = least significant difference, CV (%) = coefficient of variation