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In vitro screening of coriander genotypes for moisture stress tolerance using polyethylene glycol-6000 (PEG-6000)

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Abstract
The experiment on "*In vitro* screening of coriander genotypes for moisture stress tolerance using polyethylene glycol-6000 (PEG-6000)" was carried out at the Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka during the year 2021-2022. The local genotype DWD-3 was evaluated for germination of seeds for drought stress using different concentrations of PEG-6000 at 0, 5, 10, 15, 20 and 25%. The germination percentage decreased as the concentration of PEG-6000 increased. Further, the probit analysis was done to determine LD_{50} value of PEG-6000 for coriander and it was observed as 12.70%. PEG-6000 at two concentrations derived from the standardization studies (12.70% as LD_{50} dose and another 10% as just below the LD_{50}) along with control (0%) were imposed for screening the available twenty genotypes. Results indicated that seedling parameters of coriander differed significantly with respect to different stress levels, genotypes and their interactions. Seed germination, shoot length and seedling vigour index were decreased under stress conditions imposed by increased PEG concentrations from 0 to 10 and 12.70%. On the contrary, the root length increased under 10% PEG as compared to non-stress condition and decreased further at 12.70%. Whereas, root to shoot ratio increased linearly as the PEG concentration increased. The shoot length stress tolerance index and root length stress tolerance index were found to be the highest at 10% PEG and declined later as the concentration increased to 12.70%. Finally, eight genotypes *viz*., RCr-728, RCr-41, ACr-2, RCr-446, RCr-20, RCr-435, CO-3 and ACr-1 were identified as drought tolerant.

Keywords: Coriander, *Coriandrum sativum*, drought, genotypes, LD_{50}, moisture stress, polyethylene glycol, PEG, screening, root length stress tolerance index, seedling vigour index and shoot length stress tolerance index

Introduction
Coriander (*Coriandrum sativum* L.) is the most popular spice crop, native to the Eastern Mediterranean region and Southern Europe, having chromosome number 2n=2x=22 and belongs to the family Apiaceae. India enjoys the leading position in the cultivation and production of coriander, with an estimated area of 6.61 lakh ha and annual production of 8.31 lakh MT [1]. The major coriander growing states in India are Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh, Assam, Karnataka, Tamil Nadu, Orissa, and Uttar Pradesh. The crop is valued for its tender leaves and seeds, where leaves are used in sauce, curry, chutney and other preparations because of its pleasant aroma. On the other hand, seeds are used as spice and has a unique value in Indian cuisine for flavouring curries, pickles and soups. Further, steam distillation of coriander seeds yields 0.2 - 1.2 per cent essential oil. The seeds are carminative, refrigerant, diuretic and aphrodisiac [2].

Despite its importance, crop cultivation is mainly limited to rainfed farming in India, where the productivity is low, with an average of 12.57 q ha^{-1} [1]. Coriander cultivation in rainfed conditions is notably reliant on the monsoons. Drought stress adversely affects the crop at all the growth stages including germination and seedling emergence. Seedling establishment depends not only upon the potential of the genotype to absorb water and hydrolyze the reserved food but also to transport the food efficiently from cotyledons to epicotyls and root [3]. Successful crop establishment depends on the rapid and uniform seed germination, which is strictly associated with the ability of seeds to germinate under low water availability [4]. This situation emphasizes the urgent need to screen the variability for drought tolerance among coriander genotypes and select the tolerant genotypes for an increased productivity in drought affected areas. Unpredictability of drought stress in natural field conditions makes the selection procedure of tolerant genotypes difficult. The *in vitro* screening method using polyethylene glycol (PEG) can overcome these difficulties and large number of genotypes can be screened economically in short period of time. Hence, the objective of this study was to evaluate and identify the drought tolerance of coriander genotypes using PEG-6000 as an osmotic stress inducer by petri plate method.

Material and Methods

The laboratory experiment was carried out at the Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad during the year 2021-2022. The coriander variety DWD-3 was used to standardize the optimal concentration of polyethylene glycol (PEG 6000). Healthy and seeds of uniform size were lightly pressed to separate inter mericarps and soaked in water for 16 hours [5]. Seeds were surface sterilized with 1% sodium hypochlorite solution for five minutes and then washed three times with distilled water. Twenty sterilized seeds were placed in petri dishes containing moistened germination paper with PEG-6000 solutions of various water potentials *viz*., 0, 5, 10, 15, 20 and 25% concentrations with four replications under CRD design. All the petri dishes were kept uniformly in a germination chamber. One ml solution of PEG 6000 from each of the five concentrations was added to the petri dishes separately at the interval of 24 hours. The emergence of 2 mm radicle was set as the criteria for germination. The number of seeds germinated was counted and the germination percentage was calculated. Then, the concentration of PEG-6000 was standardized based on 50% lethality. Later, two concentrations of PEG-6000 (50% lethal dose and another concentration just below the LD_{50}) along with control were used for the screening the twenty genotypes with three replications under factorial CRD. The procedure used for standardizing the LD_{50} of PEG-6000 as explained in standardization of optimal concentration of PEG 6000 for induction of drought was employed. Further, seed germination and seedling growth observations were recorded on five randomly selected seedlings at fifteen days after sowing and were further used for calculating stress tolerance indices. The number of seedlings that emerged were counted eight days after sowing in each of the genotypes tested and the mean was expressed in percentage (%). The germination percentage was calculated as given below.

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds kept for germination}} \times 100$$

Root length was measured from the collar region to the tip of the primary root in each of the genotype seedlings and the mean was expressed in centimetre. Similarly, the shoot length of the seedling was measured from the collar region to the tip of the shoot in each of the genotypes and the mean value was expressed in centimetre. The seedling vigour index was calculated by multiplying the germination per cent with the seedling length [6].

Seedling vigour index = Seedling length (cm) × Germination per cent (%)

Root to shoot ratio is the ratio of the length of the root to the length of the shoot, which was calculated by using the formula,

$$\text{Root to shoot ratio} = \frac{\text{Length of root}}{\text{Length of shoot}}$$

Root length stress tolerance index is the ratio of root length of stressed plants to the root length of control plants, which was calculated by the formula [7].

$$\text{Root length stress tolerance index} = \frac{\text{Root length of stressed plants}}{\text{Root length of control plants}} \times 100$$

Shoot length stress tolerance index is the ratio of the plant height of stressed plants to the plant height of control plants and was calculated by the formula given by Ashraf *et al.* (2006) [7].

$$\text{Shoot length stress tolerance index} = \frac{\text{Shoot length of stressed plants}}{\text{Shoot length of control plants}} \times 100$$

Results and Discussion

Standardization of optimal concentration of PEG-6000 for induction of drought: For screening the genotypes for water stress, it is necessary to standardize the dose of PEG-6000. Hence, the local genotype DWD-3 was evaluated for drought stress using different concentrations of PEG-6000 at 0, 5, 10, 15, 20 and 25% and germination of seeds was observed (Table 1). The germination percentage decreased as the concentration of PEG-6000 increased from 0% PEG (85) to 25% PEG (0). Further, the probit analysis was done to determine LD_{50} value of PEG-6000. The effect of substances on living organisms in the environment is accomplished by bioassay. A substance found in the environment is tested at several concentrations with living organisms to determine what concentrations are beneficial or harmful to living things. A standard measure of toxicity in organisms is LD_{50}. The LD_{50} value of PEG-6000 for coriander was 12.70% (Fig. 1).

Performance of coriander genotypes for water stress under controlled conditions: The germination percentage, shoot length and root length differed significantly with respect to different stress levels, genotypes and their interactions (Table 2). Among the different moisture stress levels, the control (non-stress) condition reported significantly higher mean germination (89.58%) as compared to 10 and 12.7% PEG (64.17 and 58.36%, respectively). The per cent reduction was about 28.37 in 10% PEG and 34.85 in 12.70% of PEG over control. When seedlings were exposed to water deficit, the germination percentage decreased due to the increased osmotic stress level which might have damaged cellular machinery. Among the genotypes, RCr-446 recorded significantly higher germination (83.33%) and was on par with RCr-41 (80.56%) and ACr-1 (80%). These were superior to check DWD-3 (63.89%) and the rest of the genotypes. The lowest germination was observed in DCC-3 (55%). Among the interactions of different PEG concentrations, RCr-446 recorded significantly higher per cent of germination in all the conditions (98.33, 78.33 and 73.33% in control, 10 and 12.70% PEG, respectively). This was on par with RCr-20 (98.33%), RCr-41 (96.67%), ACr-1 (96.67%), RCr-435 (94.99%) and RCr-728 (94.99%) under control, with RCr-41, ACr-1 (each with 75%) and RCr-728 (73.33%) under 10% PEG; and with RCr-41 (70%), RCr-435 (68.33%), RCr-728 (68.33%) and ACr-1 (68.33%) under 12.70% PEG concentration. The check variety DWD-3 registered comparatively lesser germination (85, 56.67 and 50% in control, 10 and 12.70% PEG, respectively). The germination was significantly the lowest in DCC-3 (78.33, 46.67 and 40% in control, 10 and 12.70% PEG, respectively). The per cent reduction was the highest under increased osmotic potential induced by increased PEG concentration which may be related to the moisture deficit in the seeds below the threshold level for germination. The decreased imbibition of water by seeds might have led to a series of metabolic changes, including a general reduction in hydrolysis and utilization of the seed reserve. Further, increased osmotic stress might have limited the mobilization of reserves and damaged cellular machinery in cotton genotypes [8]. However, extended drought phases allowed plants to cope better [9]. Similar observations were observed [10] that seed germination percentage of coriander seeds decreased as the PEG 6000 concentration increased from 0 to -0.15 MPa.

Among the different levels of stress, the mean shoot length of seedlings was found to be significantly higher in control (6.12 cm) as compared to the stress conditions induced by 10 and 12.70% PEG (3.34 and 2.90 cm, respectively). Higher reduction of the shoot growth under water stress may be due to less mobilization of reserve carbohydrates and fats, which are essential for metabolism and growth of the seedlings. Similar observations were reported by several workers in different crops like soybean [11] and groundnut [12]. Among the genotypes, the variety RCr-446 produced significantly longer shoots (5.28 cm) and was at par with RCr-41, RCr-20 and RCr-435 (5.21, 5.14 and 5.03 cm, respectively). These were significantly superior to check DWD-3 (3.41 cm) as well as the rest of the genotypes. However, the minimum shoot length (2.89 cm) was recorded in DCC-3. Among the interaction effects of different concentrations of PEG, the variety RCr-446 registered significantly higher shoot length at all the levels (6.93, 4.65 and 4.25 cm in control, 10 and 12.70% of PEG, respectively). This was on par with RCr-41 (6.85 cm), RCr-20 (6.81 cm), ACr-1 (6.75 cm), RCr-435 (6.72 cm) and RCr-728 (6.59 cm) in control. However, it was on par only with RCr-41 (4.57 and 4.20 cm), RCr-20 (4.50 and 4.12 cm) and RCr-435 (4.38 and 3.98 cm) under 10 and 12.70% PEG, respectively. The shoot length of check DWD-3 was comparatively less in all the levels of stress (5.54, 2.56 and 2.12 cm under control, 10 and 12.70% PEG, respectively). However, it was the lowest in DCC-2 under control (5.10 cm) while in DCC-3 under 10 and 12.70% PEG (2 and 1.48 cm, respectively). Hence, it was observed that 10 and 12.70% of PEG concentrations inhibited the shoot growth of all the genotypes to a remarkable extent except RCr-446, RCr-41, RCr-20, RCr-435, ACr-1 and RCr-728. Hence, these genotypes were considered as best performed genotypes under drought condition. Similar findings were noted among various sunflower genotypes [13].

Among the different stress regimes, 10% of PEG reported the highest mean root length (7.30 cm) followed by 12.70% PEG and control (6.77 and 6.47 cm, respectively). These findings are in agreement with studies carried out in soybean [11] and groundnut [12], where it was confirmed that moderate and low osmotic stress induced by PEG-6000 (10%) triggered radical growth and low osmotic stress (-2 and -4 MPa) increased the root length of the seedlings. The increased root length might be due to better partitioning of more photosynthates for the growth of roots rather than shoots, which might have facilitated in absorption higher quantity of water from deeper layers. It is well known that the roots are water absorbing organs, while shoot organs are meant for photosynthesis and transpiration. Thus, the water/ nutrient absorption of plants occurs by altering the growth of shoot morphology to alleviate the water stress. The decreased shoot organs help in reducing transpiration loss from shoot surfaces. Among the genotypes, the root length was the highest in RCr-41 (8.29 cm) followed by RCr-446 (8.27 cm), RCr-20 (8.20 cm) and RCr-435 (8.12 cm). These were on par with each other and were significantly superior to check DWD-3 (6.04 cm). However, it was the lowest in DCC-2 (5.16 cm). Among the interactions, RCr-446 attained significantly the highest root length under control (7.39 cm), being on par with RCr-20 (7.33 cm), RCr-41 (7.27 cm) and RCr-435 (7.26 cm) and these were superior to check DWD-3 (5.86 cm) and other genotypes. However, it was found to be significantly low in DCC-3 and DCC-4 (each with 5.49 cm). While, it was the highest in RCr-41 under both the stress situations (8.95 and 8.65 cm in 10 and 12.70% PEG) followed by RCr-446 (8.87 and 8.55 cm), RCr-20 (8.82 and 8.44 cm) and RCr-435 (8.73 and 8.36 cm) respectively. These did not differ significantly from each other pertaining to PEG concentrations (10 and 12.70%) and superior than check DWD-3 (6.45 and 5.82 cm in 10 and 12.70% PEG, respectively). DCC-2 genotype recorded the lowest root length under stress conditions (5.48 and 4.66 cm in 10 and 12.70% PEG, respectively). The increase in root length of various sunflower genotypes under stress due to the diversion of dry matter towards the rooting system in search of moisture has been well documented [13].

The seedling vigour index, root to shoot ratio, root length stress tolerance index (RLSTI) and shoot length stress tolerance index (SLSTI) differed significantly with respect to different stress levels, genotypes and their interactions (Table 3).

The non-stress environment registered seedling vigour significantly the highest (1135) when compared with the stress environments created by 10 and 12.70% PEG (699 and 580, respectively). Among the genotypes, this was the highest in RCr-446 (1135) followed by RCr-41 (1093). These were significantly superior to others and on par with each other. However, the value was 625 in the check variety DWD-3 and the lowest was registered under DCC-3 (482). Among the interaction effects, it was noticed as significantly the highest in RCr-446 under normal, 10 and 12.70% PEG induced stress environments (1407, 1059 and 938, respectively). This was followed by RCr-20, RCr-41, ACr-1 and RCr-435 (1391, 1364, 1341 and 1328, respectively) under normal environment; by RCr-41, ACr-1 and RCr-435 (1014, 943 and 940, respectively) under 10% of PEG induced stress; and by RCr-41, RCr-435 and RCr-728 (900, 844 and 820, respectively) under 12.70% PEG induced stress. All these were significantly on par with each other and superior to rest of the genotypes in all the stress regimes. The seedling vigour was found comparatively lower in the check DWD-3 (969 in non-stress, 510 and 396 in 10 and 12.70% PEG induced stress levels, respectively); however, the values were significantly the least in DCC-3 (837, 356 and 254 under non-stress, 10 and 12.70% PEG induced stress levels). The index being highest was mainly due to higher germination percentage and seedling length observed under respective conditions. Thereby, the present investigation was conformity with the results where cotton seedling vigour indices were decreased with the increased PEG concentrations [14].

The root to shoot ratio increased as the stress levels increased and the mean was significantly higher under stress induced by 12.70% PEG (2.47) followed by 10% PEG induced stress (2.24) as compared to the lowest under stress free situation (1.06). Among the genotypes evaluated, the ratio was the highest in DCC-3 (2.41) followed by DCC-2 (2.26), DCC-6 (2.30) and DCC-4 (2.29). While check DWD-3 reported a ratio of 2.11. However, the lowest (1.66) was noticed under AGCr-1. Among the interactions, this ratio did not differ significantly under normal condition. However, DCC-3 recorded maximum values (2.82 and 3.34) under stress induced by 10 and 12.70% PEG, respectively. This was followed by DCC-2 (2.61), DCC-6 (2.59) and DCC-4 (2.53) under stress induced by 10% PEG, while by DCC-4 (3.29), DCC-6 (3.26) and DCC-2 (3.13) under stress by 12.70% PEG. The check DWD-3 registered the ratio of 2.53 and 2.75 under 10 and 12.70% PEG induced stress situations, respectively. However, the lowest ratio (1.91) was noticed in RCr-446 under 10% PEG stress while 1.98 in AGcr-1 under 12.70% PEG stress. The trend was in accordance with the findings observed in sunflower genotypes [15]. This increase in ratio with increasing stress could be due to the fact that under water stress, shoot growth is more severely affected than root and on contrary, stress induces better root growth because of synthesis of ABA [10].

The mean root length stress tolerance index was about 113.86 under 10% PEG stress regime, which was significantly higher when compared with 103.65 in 12.70% PEG stress. Among genotypes, the index value was about 122.75 in ACr-2, which was significantly the highest and on par with RCr-41, RCr-728, CO-3, RCr-446, ACr-1 and RCr-20 (122.56, 122.49, 119.47, 118.91 and 118.41, respectively). The index value was 106.06 in DWD-3, which was pretty less and the value was the lowest in DCC-4 (95.64). Among the interactions, the highest index value of 127.19 was observed in ACr-2 under 10% PEG stress followed by 126.05, 125.31, 123.88, 122.80, 122.56 and 121.59 in RCr-41, RCr-728, CO-3, ACr-1, RCr-446 and RCr-20, respectively. Under 12.70% PEG induced stress, the highest value of 119.68 was found in RCr-728 and was significantly superior but on par with the values of 119.08, 118.31, 115.79, 115.23, 115.11 and 115.05 in RCr-41, ACr-2, RCr-446, RCr-20 RCr-435 and CO-3, respectively. The index values of check DWD-3 were of 112.76 and 99.35 in 10 and 12.70% PEG stress regimes, respectively. However, significantly the least index values of 102.30 and 87.40 were noticed under DCC-4 and DCC-2, respectively. The highest index values were due to the highest root length observed under stress conditions. Similar findings were noted among various sunflower genotypes [16].

The shoot length stress tolerance index was significantly high (53.82) in 10% PEG induced stress as compared to 46.22 by 12.70% PEG. Among the genotypes, the index value was the highest in RCr-446 (64.23) followed by RCr-41 (64.07), RCr-20 (63.29) and RCr-435 (62.42). These were found at par with each other and significantly superior to all other genotypes. The same trend was also continued in stress imposed by 10% PEG under interactions, where RCr-446 reported 67.13 followed by 66.76 in RCr-41, 66.04 in RCr-20 and 65.34 in RCr-435. And, under stress induced by 12.70% PEG, the index was high in RCr-41 (61.37), followed by RCr-446 (61.33), RCr-20 (60.53), RCr-435 (59.50) and ACr-1 (57.71). These were on par with each other and significantly superior to all others. The check DWD-3 recorded the index value of 42.20 among genotypes and, 46.23 and 38.18 respectively under 10 and 12.70% PEG stress levels among interactions. However, the variety DCC-3 showed the lowest index value among genotypes (33.58) and interactions (38.64 and 28.51 in 10 and 12.70% PEG stress levels, respectively). The results were in line with the findings of sunflower genotypes [16].

Table 1: Effect of different concentrations of PEG-6000 on seed germination of coriander

Concentration of PEG-6000 (%)	log_{10} (Concentration of PEG-6000)	Total number of seeds kept for germination	Number of seeds germinated	Germination%	Mortality%	Corrected mortality%	Working probit
0	0	20	17	85	15	-	-
10	1	20	13	65	35	23.53	4.26
15	1.176091	20	6	30	70	64.71	5.39
20	1.30103	20	1	5	95	94.12	6.55
25	1.39794	20	0	0	100	100.00	8.09

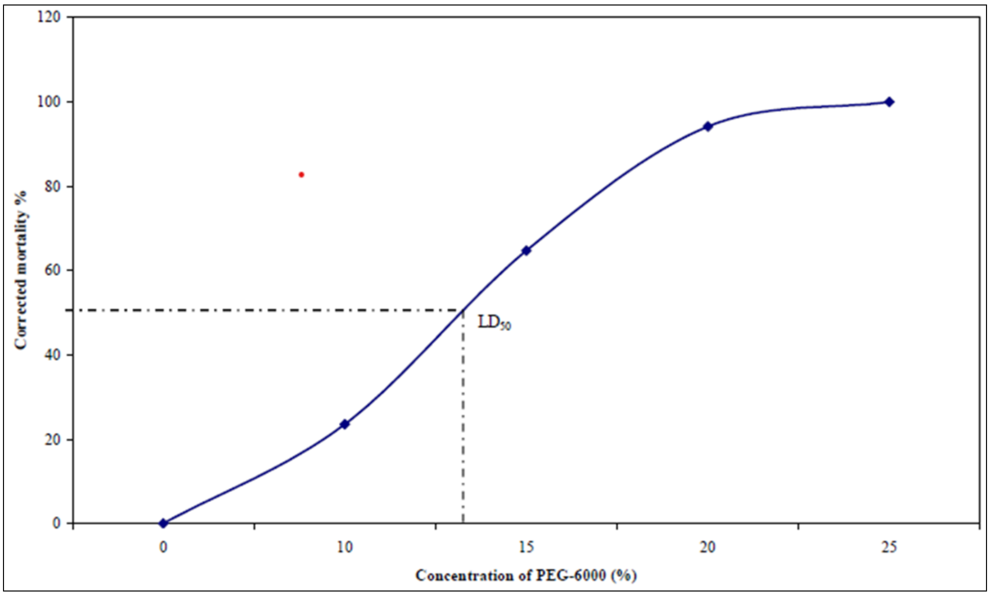

Fig 1: Effect of different concentration of PEG-6000 on seed germination of coriander

Table 2: Effect of different concentrations of PEG-6000 on germination percentage, shoot length and root length of coriander genotypes

Stress levels	Germination percentage (%)				Shoot length (cm)				Root length (cm)			
Genotypes	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean
RCr-20	98.33	70.00	66.67	78.33	6.81	4.50	4.12	5.14	7.33	8.82	8.44	8.20
RCr-41	96.67	75.00	70.00	80.56	6.85	4.57	4.20	5.21	7.27	8.95	8.65	8.29
RCr-435	94.99	71.67	68.33	78.33	6.72	4.38	3.98	5.03	7.26	8.73	8.36	8.12
RCr-436	93.33	68.33	60.00	73.89	6.28	3.33	2.90	4.17	6.66	7.50	7.02	7.06
RCr-446	98.33	78.33	73.33	83.33	6.93	4.65	4.25	5.28	7.39	8.87	8.55	8.27
RCr-480	91.67	65.00	58.33	71.67	6.35	3.55	3.13	4.34	6.60	7.28	6.79	6.89
RCr-684	93.33	68.33	61.67	74.44	6.24	3.14	2.76	4.04	6.51	7.14	6.63	6.76
RCr-728	94.99	73.33	68.33	78.89	6.59	4.05	3.76	4.80	6.87	8.60	8.21	7.89
ACr-1	96.67	75.00	68.33	80.00	6.75	3.97	3.90	4.87	7.11	8.60	8.18	7.96
ACr-2	91.67	66.67	60.55	72.96	6.54	3.85	3.37	4.59	6.78	8.48	8.02	7.76
AGCr-1	88.33	63.33	56.67	69.44	6.12	3.43	3.02	4.19	6.42	6.65	5.96	6.34
CO-3	88.33	65.00	60.00	71.11	6.41	3.69	3.24	4.45	6.82	8.32	7.84	7.66
DCC-1	86.67	58.33	53.33	66.11	5.98	2.96	2.45	3.79	6.33	6.50	5.92	6.25
DCC-2	78.33	51.67	45.00	58.33	5.10	2.10	1.50	2.90	5.33	5.48	4.66	5.16
DCC-3	78.33	46.67	40.00	55.00	5.18	2.00	1.48	2.89	5.49	5.62	4.87	5.33
DCC-4	83.33	56.67	50.00	63.33	5.24	2.22	1.50	2.99	5.49	5.60	4.88	5.32
DCC-5	85.00	58.33	53.33	65.56	5.68	2.90	2.32	3.63	6.07	6.28	5.73	6.03
DCC-6	81.67	53.33	46.67	60.56	5.31	2.20	1.55	3.02	5.56	5.70	4.99	5.42
Varadevi-1	86.67	61.67	56.67	68.33	5.82	2.78	2.37	3.66	6.22	6.39	5.85	6.15
DWD-3 (check)	85.00	56.67	50.00	63.89	5.54	2.56	2.12	3.41	5.86	6.45	5.82	6.04
Mean	89.58	64.17	58.36	70.70	6.12	3.34	2.90	4.12	6.47	7.30	6.77	6.84
For comparing means of	S.Em (±)		C.D (0.01)		S.Em (±)		C.D (0.01)		S.Em (±)		C.D (0.01)	
Stress levels	0.35		1.29		0.03		0.10		0.03		0.10	
Genotypes	0.90		3.32		0.07		0.25		0.07		0.25	
Interaction	1.55		5.75		0.12		0.44		0.12		0.43	

T_1: Control T_2 : 10% PEG T_3 : 12.70% PEG

Table 3: Effect of different concentrations of PEG-6000 on seedling vigour, root to shoot ratio, root length stress tolerance index (RLSTI) and shoot length stress tolerance index (SLSTI) of coriander genotypes

Stress levels	Seedling vigor index				Root to shoot ratio				Root length stress tolerance index				Shoot length stress tolerance index			
Genotypes	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean	T_1	T_2	T_3	Mean
RCr-20	1391	932	795	1040	1.08	1.96	2.05	1.70	-	121.59	115.23	118.41	-	66.04	60.53	63.29
RCr-41	1364	1014	900	1093	1.06	1.96	2.06	1.69	-	126.05	119.08	122.56	-	66.76	61.37	64.07
RCr-435	1328	940	844	1037	1.08	2.00	2.10	1.73	-	120.55	115.11	117.83	-	65.34	59.50	62.42
RCr-436	1208	739	595	847	1.06	2.25	2.43	1.91	-	113.97	105.50	109.74	-	53.04	46.14	49.59
RCr-446	1407	1059	938	1135	1.08	1.91	2.01	1.67	-	122.56	115.79	119.17	-	67.13	61.33	64.23
RCr-480	1187	702	580	823	1.04	2.05	2.17	1.75	-	110.75	103.00	106.88	-	55.92	49.34	52.63
RCr-684	1189	703	577	823	1.04	2.28	2.43	1.92	-	112.21	101.92	107.06	-	50.35	44.15	47.25
RCr-728	1278	928	820	1009	1.04	2.12	2.19	1.78	-	125.31	119.68	122.49	-	61.52	56.99	59.26
ACr-1	1341	943	805	1029	1.05	2.17	2.10	1.77	-	122.80	115.02	118.91	-	58.77	57.71	58.24
ACr-2	1223	823	682	909	1.04	2.20	2.38	1.88	-	127.19	118.31	122.75	-	58.99	51.56	55.28
AGCr-1	1107	638	509	751	1.05	1.94	1.98	1.66	-	106.15	92.94	99.54	-	56.18	49.27	52.73
CO-3	1169	780	665	872	1.06	2.26	2.42	1.92	-	123.88	115.05	119.47	-	57.62	50.54	54.08
DCC-1	1067	551	447	688	1.06	2.20	2.42	1.89	-	104.11	93.60	98.86	-	49.59	40.91	45.25
DCC-2	817	391	278	495	1.05	2.61	3.13	2.26	-	105.18	87.40	96.29	-	41.29	29.35	35.32
DCC-3	837	356	254	482	1.06	2.82	3.34	2.41	-	104.54	88.78	96.66	-	38.64	28.51	33.58
DCC-4	895	443	319	552	1.05	2.53	3.29	2.29	-	102.30	88.98	95.64	-	42.39	28.54	35.47
DCC-5	998	536	429	654	1.07	2.17	2.47	1.90	-	105.64	94.36	100.00	-	51.09	40.79	45.94
DCC-6	887	422	306	538	1.05	2.59	3.26	2.30	-	104.13	89.95	97.04	-	41.50	29.03	35.26
Varadevi-1	1045	566	465	692	1.07	2.30	2.47	1.95	-	105.43	94.04	99.73	-	47.90	40.73	44.31
DWD-3 (check)	969	510	396	625	1.06	2.53	2.75	2.11	-	112.76	99.35	106.06	-	46.23	38.18	42.20
Mean	1135	699	580	805	1.06	2.24	2.47	1.92	-	113.86	103.65	108.76	-	53.82	46.22	50.02
For comparing means of	S.Em (±)		C.D (0.01)		S.Em (±)		C.D (0.01)		S.Em (±)		C.D (0.01)		S.Em (±)		C.D (0.01)	
Stress levels	7.64		28.28		0.02		0.07		0.39		1.47		0.36		1.34	
Genotypes	19.72		73.01		0.05		0.17		1.25		4.65		1.14		4.24	
Interaction	34.16		126.45		0.08		0.30		1.76		6.58		1.61		6.00	

T_1: Control T_2 : 10% PEG T_3 : 12.70% PEG

* RLSTI and SLSTI are calculated based on control values and analysis done with only T_2 and T_3

Conclusion

It was concluded that polyethylene glycol (PEG) 6000 at a concentration of 12.70% was found to be LD_{50} and can be used successfully for screening or inducing moisture stress in coriander genotypes. The present investigation also determined that germination and seedling growth were affected in coriander genotypes by increasing the levels of water stress. In response to water stress, genotypes RCr-446, RCr-41, RCr-435, RCr-728, ACr-1 and CO-3 were found as tolerant under laboratory condition.

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