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RESEARCH ARTICLE :

Morphological characters of different regions of cowpea (*Vigna ungiculata* L.)

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SUMMARY : The cowpea, *Vigna unguiculata* (L.) WALP is an important grain legume crop in tropical and sub-tropical areas. Cowpea exhibits a considerable variation in leaf shape. Cowpea leaves are compound, having two asymmetrical side leaflets and one central terminal leaflet which is symmetrical. Typically, the central leaflet of the trifoliate is used in classifying the leaf shape due to variability of the side leaflets. In the present work morphological characters of all the five cultivars are almost similar without much deviation. The average values of all the parameters studied did not reveal the differences among the cultivars. PEG induced drought tolerance in the cultivars indicated the differential sensitivity among the cultivars. The growth parameters like root length, shoot height, leaf length, leaf area etc., clearly differentiated the cultivars for their sensitivity to induced drought by PEG. The cultivar Gangothri is more resistant and Pusakomal is more sensitive to induced drought with PEG among five cowpea cultivars from Telangana.

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KEY WORDS :
Legume, Asymmetrical, Trifoliate, Drought, Poly ethylene glycol

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BACKGROUND AND OBJECTIVES

Cowpea, *Vigna unguiculata* (L.) Walpers ($2n = 2x = 22$), is an important food legume in developing countries of the tropics and subtropics, especially in sub-Saharan Africa, Asia, and Central and South America (Singh *et al.*, 1997). A widely used classification system subdivides all domesticated forms into four cultivar groups based primarily on seed and pod characteristics (Westphal, 1974; Ng and Marechal, 1985). Cowpea exhibits a considerable variation in leaf shape. Cowpea leaves are compound, having two asymmetrical side leaflets and one central terminal leaflet which is symmetrical. Typically, the central leaflet of the trifoliate is used in classifying the leaf shape due to variability of the side leaflets. In cowpea, the leaf shape is important for taxonomic classification and also for distinguishing cowpea varieties. Cowpea shoots and leaves are rich sources of calcium, phosphorus and vitamin B. Dual purpose cowpea varieties which are bred for quality seeds, vegetables and fodder may add to a farmer's revenue. For example, in Nigeria, farmers who sold dried cowpea fodder during the peak of the drought season saw a 25% increase to their annual income.

RESOURCES AND METHODS

Morphological characters of five cultivars of *Vigna ungiuculata*:

Five domesticated cultivars of cowpea Gangothri, Pusakomal, Navarathna, Gowathmi and Gomchi were obtained from National Seeds Corporation, Hyderabad, Telangana (Fig. 1-5). These five are the most commonly cultivated cowpea cultivars in all the regions of Telangana.

The plants are grown near Department of Botany, University College of Science, Saifabad, Osmania University. The average values of the characters such as days of first germination, percentage of germination, inter node length, leaf stalk length, leaflet length, leaflet petiole length, number of leaves, number of pods, number of seeds per pod are noted for all the five cultivars, to observe the morphological differences among them.

Water stress induced by PEG :

Poly ethylene glycol:

Poly ethylene glycol is a polyether compound. PEG acts as osmaticum to decrease the water potential of the culture solution, for studies of higher plant response to water stress. PEG is a neutral polymerase available in a range of molecular weights, highly soluble in water, with low toxicity to mammals. Because of these properties it has been used by several investigators to impose water stress on plant by decreasing the water potential of the rooting medium and so the water potential of the plant. Other properties of PEG which makes it less suitable for use as anosmaticum include lowering the surface tension and increasing the viscosity of the solution.

OBSERVATIONS AND ANALYSIS

Cowpea is the most suitable for cultivation in Telangana region as it is drought tolerant and requires less cultivation practices. This crop yield more productivity and enrich the soil with its root nodules for the next cereal crop to be raised in the field, as a crop rotation. Cowpea crop is the most widely cultivated in Telangana region as the soil conditions are most suitable. The young pods are used as vegetable and dried seeds

Fig. 1 : Navarathna

Fig. 2 : Pusa Komal

Fig. 3 : Gangothri

Fig. 4 : Gomchi

Fig. 5 : Gowathmi

Fig. 6 : Cowpea seeds

Morphology of five cultivars

Table 1 : Morphological data of the five cultivars

Sr. No.	Morphological Parameters	Pusakomal	Navarathna	Gangothri	Gowthami	Gomchi
1.	Days of first germination	4 days	6 days	4 days	6 days	4 days
2.	Percentage of germination	99%	98%	98%	100%	100%
3.	Internodes length	5 cm	21 cm	7 cm	20 cm	8 cm
4.	Leaf stalk length	6.5 cm	7.5 cm	7 cm	9.5 cm	11 cm
5.	Leaflet length	9 cm	10 cm	7cm	10.5 cm	10 cm
6.	Leaflet petiole length	2 cm	3 cm	2 cm	3 cm	2 cm
7.	Number of leaves	3	3	3	3	3
8.	Number of root nodules	4	8	6	4	6
9.	Number of pods	2	2	2	2	2
10.	Number of seeds per pod	10	16	16	15	16

act as good protein nutrient source (Fig. 6). The crop is also a source of fodder and is popularly cultivated in Telangana for its dual utilization as feed and fodder.

The morphological data of the five cultivars was collected and given in (Table 1). The germination period (4 to 6 days) and percentage of germination (98-100) did not show much variation among cultivars. The character number of leaves showed a constant nature as three leaflets at the origin for all the cultivars.

The morphological characters like number of leaves, leaf petiole length, number of pods at flower did not show much deviation among the cultivars. Number of seeds per pod, number of root nodules, leaf stack length, internodes length showed little variation among the cultivars. On an average all the cultivars showed similar type of morphological characters except that Navarathna and Gowathmi cultivars are having long plant stature with more inter nodal length.

Water stress induced by PEG :

The seeds of the five cultivars were inoculated with poly ethylene glycol at various concentrations (5 to 20 ml/l)and germinated in *in vitro* conditions (Fig. 7 to 10). The growth parameters like root length and shoot height, leaf length, leaf width, leaf area, cotyledon length and total length of the seedling were measured and recorded after seven days of treatment. To predict the drought tolerance among the cultivars of the Cowpea, PEG treatment was given to the seeds in *in vitro* condition. Poly Ethylene Glycol is the best solute for a low water Stress induction in plants or seedlings.

The PEG treated seeds were grown in test tubes

Fig. 7 : 5ml/1lit of PEG

Fig. 9 : 15ml/1lit of PEG

Fig. 8 : 10 ml/1lit of PEG in *Vigna* cultivars

Fig. 10 : 20ml/1lit of PEG in*Vigna* cultivars

and the data of various growth parameters were recorded in all the cultivars and presented below. The order of the cultivars to water stress is as follows. Gangothri› Gowathmi› Navarathna› Gomchi› Pusakomal.

Morphological characters of five cultivars of *Vigna ungiuculata* :

The morphological characters of all the five cultivars are almost similar without much deviation. The average values of all the parameters studied did not reveal the differences among the cultivars. On an average all the cultivars showed similar type of morphological characters except that Navarathna and Gowthami cultivars are having long plant stature with more intermodal length.

Drought tolerance with poly ethylene glycol :

PEG induced drought tolerance in the cultivars indicated the differential sensitivity among the cultivars. The growth parameters like root length, shoot height, leaf length, leaf area etc., clearly differentiated the cultivars for their sensitivity to induced drought by PEG. The cultivar Gangothri is more resistant and Pusakomal is more sensitive to induced drought with PEG among five cowpea cultivars from Telangana. In cowpea significant reduction of leaf area, leaf relative water content and grain yield due to water stress were reported (Hayatu *et al*., 2014).

Availability of water is considered as the climatic factor which effects the productivity in the different climate zones around the globe (Rockstrom and Falkenmark, 2000). The effects of drought mainly vary and depend on the intensity, development stage and duration of the hydric stress and adaptive strategies, the species possess to tolerate the abnormal condition (Kramer and Boyer, 1995). Water stress causes an increase in stomatal resistance as a result the capacity of gaseous exchange between the environment and the plant decreases. Water deficit causes low photosynthetic activity, alternation of nutrient absorption and leaf as well as plant growth reduction (Kerbauy, 2004).

The effect of PEG 4000 induced water stress on germination parameters was studied in five cowpea cultivars for drought tolerance. Various seedling parameters like germination, seedling vigor, seedling distribution and seedling density were studied to identity the drought tolerant and susceptible varieties among the five cultivars of cowpea (Jaina and Raghvendra, 2016). Evaluation of seedling density and distribution could be considered as a key factor for water and nutrient uptake from the soil by a plant (Chopart *et al.*, 2008).

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