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Assessment of morphological genetic diversity in groundnut genotypes through Dus descriptors

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Abstract
The study evaluated the Distinctness, Uniformity, and Stability (DUS) characteristics of 27 groundnut (*Arachis hypogaea* L.) genotypes for varietal identification under the PPV&FR Act, 2001. The experiment was conducted during Kharif 2025 at S.V. Agricultural College, Dry land Tirupati, using a Randomized Block Design. Assessment of eight qualitative morphological descriptors revealed considerable variability among genotypes. Most lines exhibited tall stature, medium leaflet size, green elliptic leaflets, erect growth habit, sparse stem pubescence, and sequential flowering and medium 100-kernel weight. The observed diversity confirms the effectiveness of DUS descriptors for varietal identification, registration, and selection of diverse parental lines in groundnut breeding programs under dryland conditions. Substantial variability was observed among the breeding lines for all the traits studied, indicating the presence of a broad genetic base. The clear expression and stability of these morphological traits facilitated effective discrimination among genotypes. The study confirms the usefulness of qualitative descriptors in establishing varietal distinctness and maintaining genetic purity. The findings provide a scientific basis for varietal registration, intellectual property protection, and selection.

Keywords: Groundnut, DUS descriptors, genetic variability and seed yield

Introduction
Groundnut (*Arachis hypogaea L.*) commonly known as peanut is a major self-pollinated legume crop belonging to the family Leguminosae and sub-family Papilionaceous. It is a selfpollinated allotetraploid species with a chromosome number of 2n = 4x = 40. The crop originated in South America. Groundnut is also known as the "King of Oilseeds" because it contains a high proportion of polyunsaturated fatty acids (PUFA) (40-50%) and monounsaturated fatty acids (MUFA).
Characterization of varieties based on DUS (Distinctness, Uniformity, and Stability) criteria is essential for varietal registration and intellectual property protection under the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act 2001. DUS testing ensures that a candidate variety is clearly distinguishable from existing varieties, sufficiently uniform in its characteristics, and stable across successive generations. Morphological descriptors such as Plant stature, leaf colour, size, and shape, growth habit, stem pubescence, flower arrangement and kernel weight among genotypes.
A well-characterized groundnut germplasm represents an essential genetic resource, offering diverse genetic material to support effective breeding initiatives. Systematic characterization not only facilitates varietal protection and registration but also aids breeders in selecting diverse parental lines for crop improvement programs. In the present study 27 groundnut genotypes were evaluated using standardized DUS descriptors for assessing varietal distinctiveness and genetic purity.

Materials and Methods
The experiment was conducted using 27 genotypes of groundnut along with standard and distinct varieties such as Visistha and K-6. The genotypes were grown in three rows of 4 m length each, maintaining a spacing of 30×10 cm in a Randomized Block Design (RBD) during *Kharif* 2025 at the dryland farm of S.V. Agricultural College, Tirupati, and Andhra Pradesh. The recommended dose of fertilizers was applied uniformly, and gypsum was applied at 500 kg ha $^{1-}$ during the peg initiation stage. Observations were recorded for qualitative traits including plant stature, leaf size, leaf colour, leaf shape, growth habit, stem pubescence, and arrangement of flowers on side branches and 100- kernel weight The study was undertaken to assess the extent of morphological variability among the breeding lines and to identify promising genotypes with desirable qualitative characteristics suitable for southern agro climatic zone.

Results and Discussion

Significant variability was observed among the qualitative characters studied (Table 2) with respect to plant height three categories were recorded namely tall, medium and short plants. Among these tall plants was the most frequent accounting for 44.44% of the total genotypes. This was followed by medium plant height with 33.33% while short plants constituted 22.22% of the genotypes. The mean frequency for plant height classes was 33.33% (Table 2 Fig. I).

Leaflet size also exhibited noticeable variation among the genotypes. The majority of the lines possessed medium-sized leaflets (66.66%) indicating that this trait was highly dominant among the evaluated materials. In contrast small leaflets were observed in 22.22% of the genotypes, while the remaining proportion was represented by other size categories. The mean frequency for leaflet size was 33.33% (Table 2 Fig. II).

Variation was also observed in leaflet colour, which ranged from light green to dark green. Most of the genotypes showed green leaflet colour (48.14%), followed by dark green (40.74%), while light green leaflets were observed in only 11.11% of the genotypes. The mean frequency across categories was 33.33% (Table 2 Fig III).The distribution of leaflet colour classes is illustrated in Figure III. Considerable variation was also observed for leaflet shape. Among the different shapes recorded, elliptic leaflet shape was the most common (29.62%), while other shapes occurred at comparatively lower frequencies, with an overall mean frequency of 11.10% (Table 2 Fig. IV).

In terms of plant architecture, erect growth habit was found to be predominant, accounting for 59.25% of the genotypes (Table 2 Fig. V). The maximum frequency for erect growth habit was recorded 59.25% followed by 40.74% semi-spreading (Table 2, Fig V). The overall frequency distribution for growth habit is 33.33%. The maximum frequency for stem pubescence was recorded sparse is 59.25% followed by 33.33% for absent and 7.40% for medium (Table 2, Fig.VI). The overall frequency distribution for stem pubescence is 33.32%.

The maximum frequency for flower arrangement of flowers on side branches was recorded as sequential 59.25% followed by 22.22% irregular and 18.51% for alternate (Table 2, Fig.VII). The overall frequency distribution for flower arrangement is 33.32%. 100-kernel weight was observed mostly medium frequency of 88.88% followed by high 11.11% (Table 2, Fig.VIII) and the overall frequency distribution for 100-kernel weight was observed as 24.99%.

Table 1: List of Groundnut genotypes assessed for DUS descriptors

S. No	Genotype
1.	TCGS-2580
2.	TCGS-2583
3.	TCGS-2584
4.	TCGS-2585
5.	TCGS-2586
6.	TCGS-2578
7.	TCGS-2581
8.	TCGS-2648
9.	TCGS-2636
10.	TCGS-2635
11.	TCGS-2650
12.	TCGS-2647
13.	TCGS-2651
14.	TCGS-2657
15.	TCGS-2658
16.	TCGS-2649
17.	TCGS-2656
18.	TCGS-2643
19.	TCGS-2654
20.	TCGS-2644
21.	TCGS-2652
22.	TCGS-2660
23.	TCGS-2645
24.	TCGS-2642
25.	TCGS-2631
26.	VISISTHA
27.	K-6

Table 2: Frequency distribution of groundnut genotypes for DUS descriptors

S.No	Characters	State of character	No.of Genotypes	Frequency Distribution (%)
1	Plant Height	Tall	12	44.44
		Medium	9	33.33
		Short	6	22.22
		Total	27	33.33
2	Leaflet size	Large	3	11.11
		Medium	18	66.66
		Small	6	22.22
		Total	27	33.33
3	Leaflet colour	Light green	3	11.11
		Green	13	48.14
		Dark green	11	40.74
		Bottle green	0	0
		Total	27	33.33
4	Leaflet shape	Ovate	2	7.40
		Elliptic	8	29.62
		Oblong elliptic	4	14.81
		Narrow elliptic	2	7.40
		Wide elliptic	2	7.40
		Oblong	5	18.51
		Lanceolate	3	11.11
		Obovate	1	3.70
		Oblong lanceolate	0	0
		Total	27	11.10
5	Growth habit	Erect	16	59.25
		Semi-spreading	11	40.74
		Spreading	0	0

		Total	27	33.33
6	Stem pubescence	Absent	2	33.33
		Sparse	9	59.25
		Medium	16	7.40
		Total	27	33.32
7	Flower arrangement	Sequential	16	59.25
		Alternate	5	18.51
		Irregular	6	22.22
		Total	27	33.32
8	Kernel weight	Low	0	0
		Medium	24	88.88
		High	3	11.11
		Veri high	0	0
		Total	27	24.99

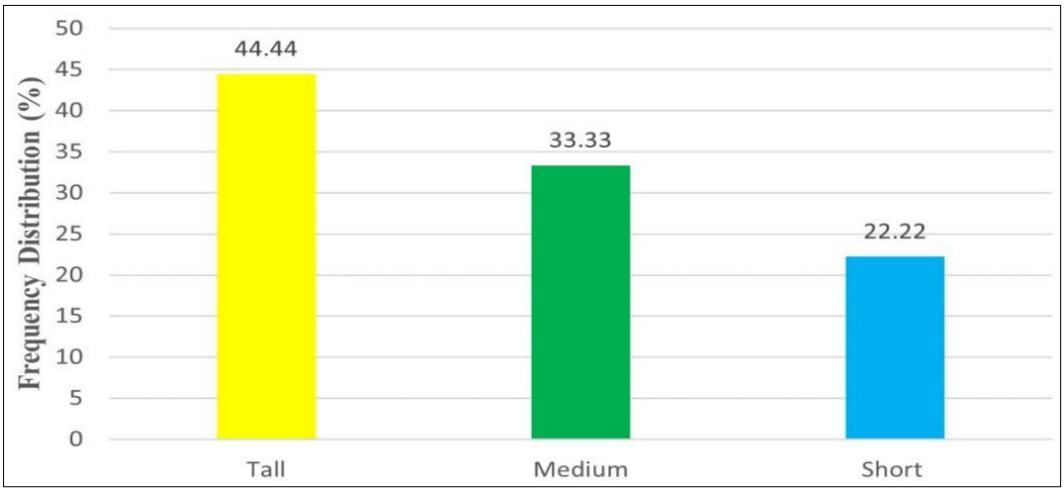

Fig 1: Plant Stature

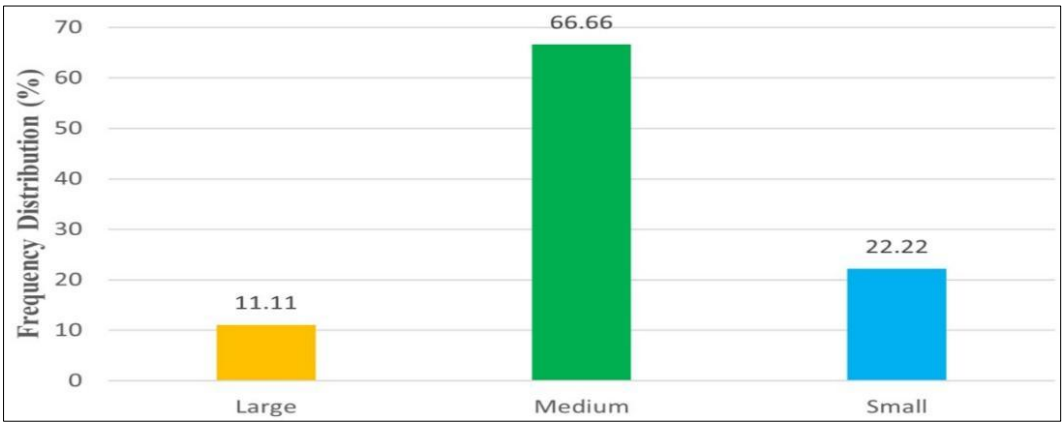

Fig 2: Leaflet Size

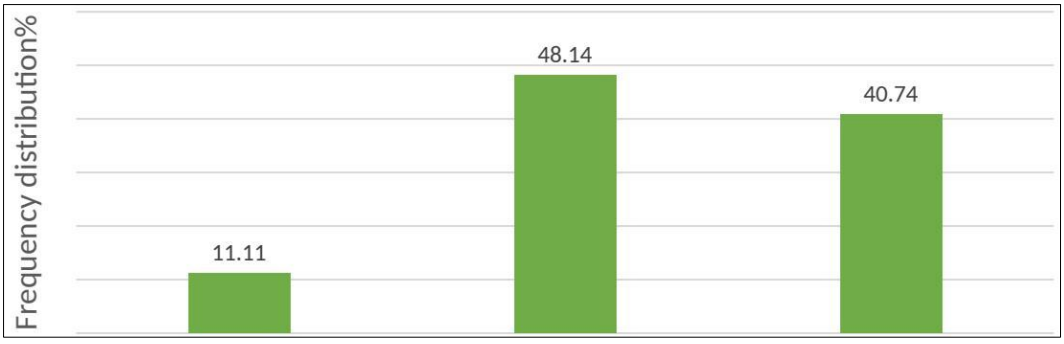

Fig 3: Leaflet colour

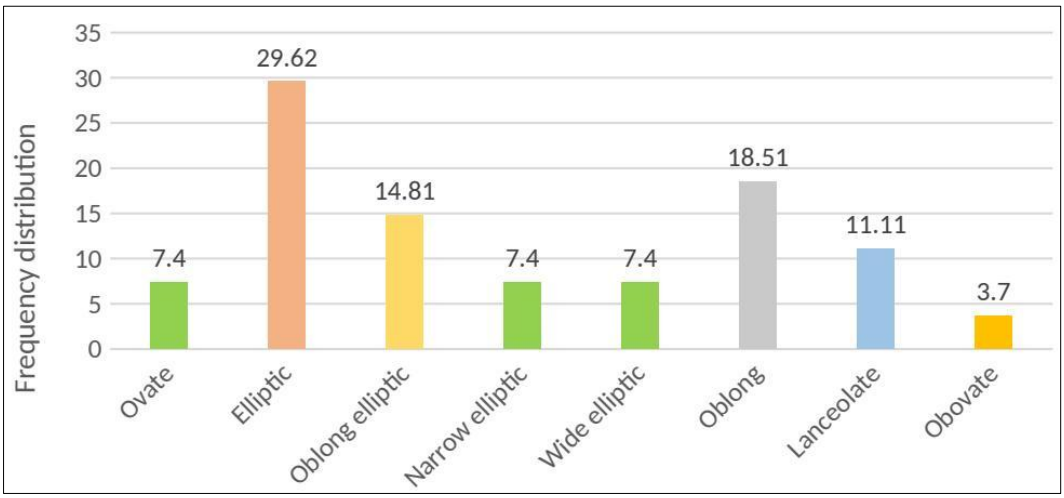

Fig 4: Leaflet shape

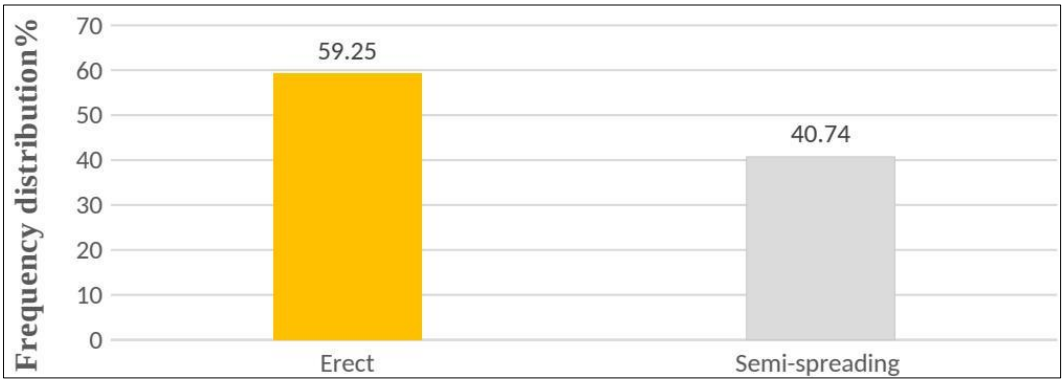

Fig 5: Growth habit

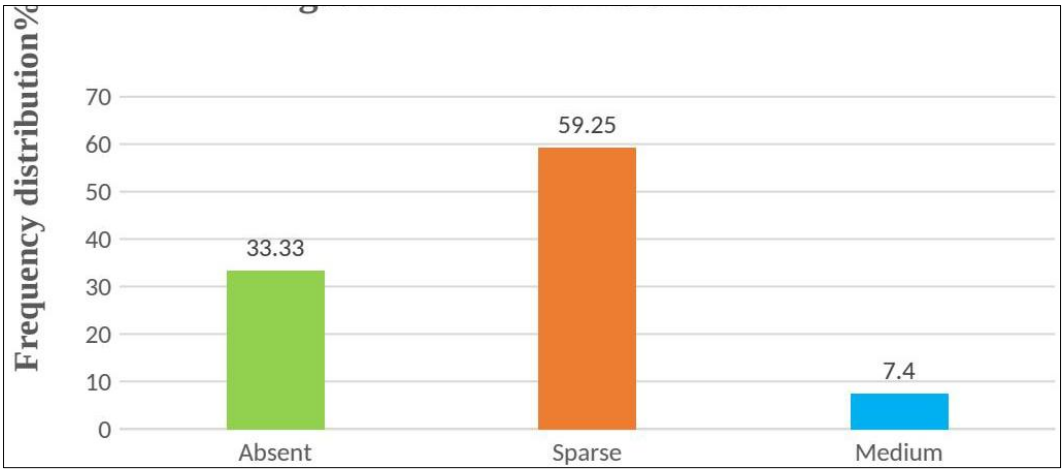

Fig 6: Stem pubescence

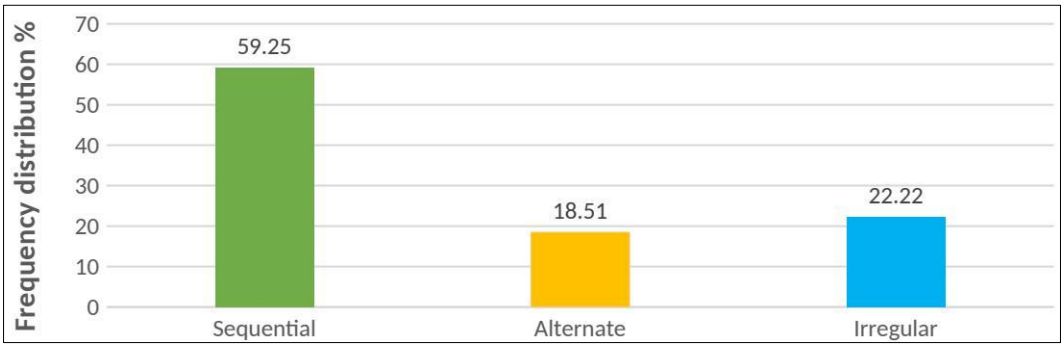

Fig 7: Flower arrangement

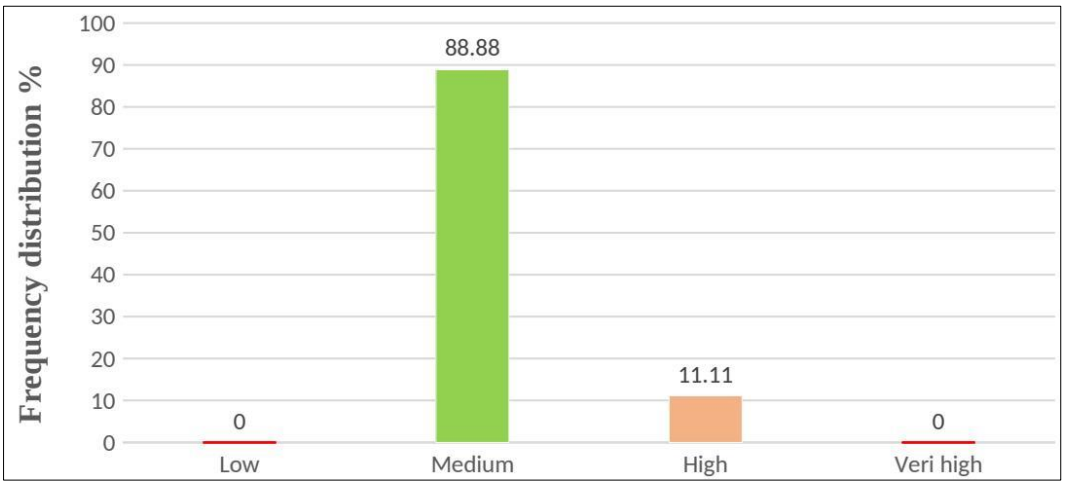

Fig 8: 100 - Kernel weight

Conclusion

The study revealed considerable morphological variability among the 27 groundnut genotypes across eight DUS descriptors indicating a broad genetic base for all DUS traits such as tall stature, medium leaflet size, green colour, erect growth habit, sparse pubescence, and sequential flowering and medium 100-kernel weight. The results confirm that DUS descriptors are effective for varietal identification, ensuring purity, and selecting diverse parents for future breeding and varietal registration. The predominance of tall plant stature, medium leaflet size, green leaflet colour, elliptic leaflet shape, erect growth habit, sparse stem pubescence, sequential flower arrangement and medium 100-kernel weight highlights the common morphological patterns, while the presence of diverse trait expressions confirms the distinctness of genotypes and also help in identification of varieties. DUS characterisation aid in the selection of superior parents for key economic traits focussed on climate resilient and sustainable breeding programs.

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