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EVALUATION OF MORPHOLOGICAL DIVERSITY IN CHILLI (*Capsicum annum* L.) GERMPLASM USING IPGRI DESCRIPTORS

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ABSTRACT

Chilli (*Capsicum annum* L.) is one of the most important vegetable and spice crop cultivated worldwide because of its economic, nutritional and medicinal importance. The present investigation was undertaken to characterize the morphological characters of chilli germplasm using the standard descriptors prescribed by IPGRI. The experiment was conducted during Kharif 2025 at the University Farm, Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telangana Horticultural University (SKLTGHU), Mulugu, Siddipet, Telangana. A total of 53 chilli genotypes, comprising 50 test genotypes and three check varieties, were evaluated in an Augmented Block Design. Qualitative morphological observations were recorded on five randomly selected plants of each genotype for six descriptors, namely plant growth habit, leaf shape, leaf pubescence, flower orientation, fruit bearing habit and fruit shape. Considerable phenotypic variation was observed among the evaluated genotypes for all the qualitative morphological characters. Erect plant growth habit (50 genotypes), lanceolate leaf shape (49 genotypes), sparse leaf pubescence (50 genotypes), pendant flower orientation (48 genotypes), solitary fruit bearing habit (51 genotypes) and elongate fruit shape (47 genotypes) were the predominant characteristics. A few genotypes exhibited distinct morphological features, including intermediate plant growth habit, deltoid and ovate leaf shapes, intermediate leaf pubescence, erect and intermediate flower orientation, cluster fruit bearing habit, and triangular, pointed, campanulate, almost round and sunken pointed fruit shapes, indicating the presence of appreciable phenotypic diversity within the germplasm. The study demonstrated that standardized morphological descriptors are effective for the characterization and documentation of chilli germplasm. The information generated provides a useful baseline for germplasm identification, cataloguing, conservation and future utilization of chilli genetic resources in research and breeding programmes.

Key words : *Capsicum annum* L., Morphological diversity, Germplasm characterization, IPGRI descriptors.

Introduction

Chilli (*Capsicum annum* L.; $2n = 2x = 24$) is one of the most important vegetable and spice crop belonging to the family Solanaceae. It is cultivated extensively in tropical, subtropical and temperate regions of the world because of its wide adaptability, economic importance and diverse uses. The fruits are consumed in fresh, dried

and processed forms and are valued for their characteristic pungency, colour and flavour. Chilli is also an excellent source of vitamins A, C and E, carotenoids, capsaicinoids, phenolic compounds and other antioxidants, which contribute to its nutritional and medicinal importance (Bosland and Votava, 2012, Maeda *et al.*, 2013). India is the world's largest producer, consumer and exporter of chilli, and Telangana is one of the leading chilli-producing

states, where the crop plays a significant role in agricultural production and farmers' livelihoods.

Chilli germplasm exhibits wide variation in morphological characters such as plant growth habit, leaf shape, leaf pubescence, flower orientation, fruit bearing habit and fruit shape. These qualitative traits are stable, easily distinguishable and less influenced by environmental conditions, making them useful for the identification and characterization of germplasm. Morphological characterization using standardized descriptors provides a systematic approach for documenting genetic resources, distinguishing accessions and assessing the extent of phenotypic diversity available within a germplasm collection. Such information forms the basis for germplasm conservation, maintenance and effective utilization in crop improvement programmes.

Systematic characterization of germplasm is an essential prerequisite for the management and utilization of plant genetic resources. Standardized descriptor lists developed by the International Plant Genetic Resources Institute (IPGRI) facilitate uniform characterization and comparison of germplasm across different locations and breeding programmes. Therefore, the present investigation was undertaken to characterize the morphological characters of chilli (*Capsicum annuum* L.) germplasm using the standard descriptors prescribed by IPGRI (1995).

Materials and Methods

The present investigation was conducted during *Kharif* 2025 at the University Farm, Post Graduate Institute for Horticultural Sciences, Sri Konda Laxman Telangana Horticultural University (SKLTGHU), Mulugu, Siddipet, Telangana. The study was undertaken to characterize chilli (*Capsicum annuum* L.) germplasm using standard morphological descriptors.

The experimental site is located at 17°43' 02" N latitude and 78°37' 34" E longitude in the Central

Telangana Agro-climatic Zone. The soil was sandy loam with good drainage and adequate water-holding capacity.

The experimental material comprised 53 chilli (*Capsicum annuum* L.) genotypes, including 50 test genotypes and three check varieties (LCA-625, LCA-657 and Warangal Chapata). The test genotypes consisted of 40 germplasm accessions obtained from JVR Horticultural Research Station, Malyal, seven locally collected lines (L1, L2, L3, L4, L8, L9 and L10) maintained at SKLTGHU, two released varieties (Byadgi Dabbi and Byadgi Kaddi) obtained from the University of Horticultural Sciences, Bagalkot, and one exotic accession (EC 402105) procured from ICAR–National Bureau of Plant Genetic Resources (NBPGR).

The experiment was laid out in an Augmented Block Design (ABD) consisting of five blocks. The 50 test genotypes were evaluated without replication, while the three check varieties were replicated once in each block to estimate block effects and adjust treatment means. Each experimental unit was maintained at a spacing of 60 cm × 60 cm under recommended agronomic practices.

Chilli seedlings were raised under greenhouse conditions at the Centre of Excellence for Fruits (COE), Mulugu, using 98-cell protrays filled with cocopeat. One seed was sown per cell and lightly covered with cocopeat. The trays were irrigated using a rose can and covered with polythene until germination. After seedling emergence, the trays were arranged separately and irrigated on alternate days. A water-soluble fertilizer (19:19:19 NPK) was applied at 4 g L⁻¹ at 15-day intervals. Healthy seedlings were hardened for one week before transplanting by reducing irrigation and exposing them to sunlight.

The experimental field was prepared and maintained as per the prescribed package of practices. Qualitative morphological characters were recorded according to the Descriptors for *Capsicum* developed by IPGRI.



Fig. 1 : Morphological diversity among chilli (*Capsicum annuum* L.) germplasm based on IPGRI descriptor traits.

Observations were made on five randomly selected healthy plants from each genotype and used for morphological characterization of the germplasm.

Results and Discussion

Morphological characterization is the first step in the identification and documentation of plant genetic resources. The qualitative descriptors recommended by IPGRI were used to characterize the 53 chilli genotypes based on plant growth habit, leaf shape, leaf pubescence, flower orientation, fruit bearing habit and fruit shape. The observed variation among the genotypes reflects the phenotypic diversity available in the germplasm collection and provides useful information for germplasm characterization and management. The observations are presented in Tables 2.

The 53 chilli genotypes were grouped into two growth habit categories, namely erect and intermediate (Table 2). Among them, 50 genotypes exhibited an erect growth habit, whereas three genotypes (L1, L2 and L3) showed an intermediate growth habit. Erect growth habit was the predominant type observed in the present investigation. Similar variation in plant growth habit has been reported by Saisupriya *et al.* (2021), Sran and Jindal (2021) and Babu *et al.* (2025).

Based on leaf shape, the genotypes were classified into lanceolate, deltoid and ovate types (Table 2). Lanceolate leaves were recorded in 49 genotypes, indicating that this was the predominant leaf shape. Deltoid leaves were observed in L1 and L10, while L2 and L3 exhibited ovate leaves. Similar observations were reported by Saisupriya *et al.* (2021), Rahul and Singh

(2022) and Divyabharathi *et al.* (2025).

Leaf pubescence was classified into sparse and intermediate categories. Among the evaluated genotypes, 50 exhibited sparse leaf pubescence, whereas MCC-5, L2 and L3 showed intermediate pubescence. Sparse pubescence was the predominant type in the germplasm. Similar findings were reported by Saisupriya *et al.* (2021) and Divyabharathi *et al.* (2025).

Flower orientation showed variation among the genotypes and was classified into pendant, erect and intermediate types. Pendant flowers were observed in 48 genotypes, erect flowers in L1, L2, L3 and MCC-6-1, while L10 exhibited intermediate flower orientation. Pendant flower orientation was the predominant character. Similar observations were reported by Saisupriya *et al.* (2021), Divyabharathi *et al.* (2025) and Deepika *et al.* (2026).

The chilli genotypes exhibited two types of fruit bearing habit, namely solitary and cluster. Solitary fruit bearing habit was observed in 51 genotypes, whereas L2 and L3 exhibited cluster bearing habit. Solitary fruit bearing was the predominant character among the germplasm evaluated. Similar results were reported by Sran and Jindal (2021), Rahul and Singh (2022) and Divyabharathi *et al.* (2025).

Based on fruit shape, the genotypes were grouped into elongate, triangular, pointed, campanulate, almost round and sunken pointed categories. Elongate fruit shape was predominant and was recorded in 47 genotypes. Byadgi Dabbi exhibited triangular fruits, MCC-5-99, 545695-1 and 545695-2 showed pointed fruits, L1

Table 1 : Morphological characters and method of observation.

S. no.	Character	Stage/Time of observation	Method of observation	Descriptor/Classification
1	Plant growth habit	At 50% ripe fruit stage	Plant growth habit was visually assessed.	Prostrate (3), Intermediate (5), Erect (7), Other (9)
2	Leaf shape	At first fruit ripening (50% plants)	Ten fully expanded mature leaves from the main branches were observed.	Deltoid (1), Ovate (2), Lanceolate (3)
3	Leaf pubescence	Youngest fully expanded mature leaf	Leaf pubescence was visually assessed.	Sparse (3), Intermediate (5), Dense (7)
4	Flower orientation	At anthesis	Flower position was recorded visually.	Pendant (3), Intermediate (5), Erect (7)
5	Fruit bearing habit	Mature fruit stage	Fruit arrangement on the plant was recorded.	Solitary (1), Cluster (3)
6	Fruit shape	First harvest (mature fruits)	Fruit shape was recorded based on mature fruits.	Elongate (1), Almost round (2), Triangular (3), Campanulate (4), Blocky (5), Other (6)

Source: IPGRI. Descriptors for Capsicum.

Table 2 : Morphological characters of chilli (*Capsicum annum* L.) germplasm.

S. no.	Genotype	Plant Growth habit	Leaf shape	Leaf pubescence	Flower orientation	Fruit bearing habit	Fruit shape
1	545709-54-3	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
2	MCC-5	Erect	Lanceolate	Intermediate	Pendant	Solitary	Elongate
3	L1	Intermediate	Deltoid	Sparse	Erect	Solitary	Campanulate
4	MCC-6-6-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
5	mcc-5-99	Erect	Lanceolate	Sparse	Pendant	Solitary	Pointed
6	Byadgi Dabbi	Erect	Lanceolate	Sparse	Pendant	Solitary	Triangular
7	545694-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
8	L4	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
9	L8	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
10	545658-PYT-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
11	MCC-8-Malyal-4-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
12	545705-2-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
13	MCC-5-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
14	L10	Erect	Deltoid	Sparse	Intermediate	Solitary	Almost Round
15	mcc-5-single	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
16	PHS-641	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
17	MCC-8-Malyal small-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
18	L3	Intermediate	Ovate	Intermediate	Erect	Cluster	Elongate
19	L2	Intermediate	Ovate	Intermediate	Erect	Cluster	Elongate
20	MCC-6-6-1	Erect	Lanceolate	Sparse	Erect	Solitary	Elongate
21	Byadgi Kaddi	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
22	545727-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
23	545705-1-3	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
24	MCC-5-77	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
25	545657-G-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
26	545658-PYT-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
27	545695-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Pointed
28	L9	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
29	545695-2-Single-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
30	HRS-Malyal-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
31	MCC-8-Malyal(m)	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
32	M-98	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
33	545709-S-G	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
34	MCC-545649-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
35	545710-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
36	MCC-8-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
37	MCC-7-7-8	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate

Table 2 continued...

Table 2 continued...

38	545695-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Pointed
39	545695-2-Single-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
40	MCC-2-2-3-2	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
41	MCC-MH	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
42	MCC-7-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
43	HRS-Malyal-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
44	545658-13-1	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
45	M-87-3	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
46	M-55	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
47	MCC-2-2-4	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
48	MCC-7-G-2-3	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
49	T-7 Germplasm 3	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
50	EC	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
51	LCA625	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
52	LCA657	Erect	Lanceolate	Sparse	Pendant	Solitary	Elongate
53	Warangal chapata	Erect	Lanceolate	Sparse	Pendant	Solitary	Sunken and Pointed

Table 3 : Frequency distribution of qualitative morphological characters in chilli germplasm.

Character	Category	Number of genotypes
Plant growth habit	Erect	50
	Intermediate	3
Leaf shape	Lanceolate	49
	Deltoid	2
	Ovate	2
Leaf pubescence	Sparse	50
	Intermediate	3
Flower orientation	Pendant	48
	Erect	4
	Intermediate	1
Fruit bearing habit	Solitary	51
	Cluster	2
Fruit shape	Elongate	45
	Pointed	3
	Triangular	1
	Campanulate	1
	Almost round	1
	Sunken pointed	1

possessed campanulate fruits, L10 had almost round fruits, while Warangal Chapata exhibited sunken pointed fruits. Similar variability in fruit shape has been reported by Sran and Jindal (2021), Divyabharathi *et al.* (2025) and Deepika *et al.* (2026).

The frequency distribution of qualitative morphological characters recorded in the 53 chilli (*Capsicum annum* L.) genotypes is presented in Table 2. Considerable variation was observed for all the qualitative descriptors evaluated. Erect plant growth habit, lanceolate leaf shape, sparse leaf pubescence, pendant flower orientation, solitary fruit bearing habit and elongate fruit shape were the predominant characteristics among the germplasm. However, a few genotypes exhibited distinct morphological features such as intermediate plant growth habit, deltoid and ovate leaf shapes, intermediate leaf pubescence, erect and intermediate flower orientation, cluster fruit bearing habit and diverse fruit shapes including triangular, campanulate, almost round and pointed fruits. The observed variability indicates the existence of appreciable phenotypic diversity among the evaluated chilli germplasm, which is useful for germplasm characterization and documentation.

Conclusion

The present investigation revealed considerable variation in the qualitative morphological characters of the 53 chilli (*Capsicum annum* L.) genotypes evaluated

using the standard IPGRI descriptors. Most of the genotypes exhibited erect plant growth habit, lanceolate leaf shape, sparse leaf pubescence, pendant flower orientation, solitary fruit bearing habit and elongate fruit shape, while a few genotypes showed distinct morphological characteristics such as intermediate growth habit, deltoid and ovate leaves, intermediate leaf pubescence, erect flower orientation, cluster fruit bearing habit and diverse fruit shapes. The observed variation demonstrated the presence of appreciable phenotypic diversity within the germplasm collection.

Morphological characterization using standardized descriptors proved effective for distinguishing and documenting chilli germplasm. The information generated in the present study provides a useful baseline for germplasm identification, cataloguing, conservation and future utilization of these genetic resources in chilli breeding programmes.

References

- Babu, P.V., Desai N., Kandpal K., Swamy T.S. and Palanna K.B. (2025). Performance of chilli (*Capsicum annuum* L.) Genotypes for yield and yield attributing traits. *Plant Archives*, **25**(1), 09725210.
- Bosland, P.W., Votava E.J. and Votava E.M. (2012). *Peppers: vegetable and spice capsicums*. *Cabi*. (Vol. 22).
- Deepika, D.D., Sharma V., Mehta G., Mehta H., Pandey C.D., Gaikwad A.B. and Sharma V.K. (2026). Dissecting the Genetic Diversity of Chilli (*Capsicum annuum* L.): A Germplasm wide Analysis of Agro-Morphological traits. *Crop Breeding, Genetics and Genomics*, **8**(1).
- Divyabharathi, D., Yuvaraj K.M., Jayaprada M., Venkata Ramana C., Sarada G. and Balakrishna M. (2025). Morphological Characterization of chilli (*Capsicum annuum* L.) Genotypes. *J. Scientific Res. Rep.*, **31**(12), 233–243.
- Maeda, H., Saito S., Nakamura N. and Maoka T. (2013). Paprika pigments attenuate obesity induced inflammation in 3T3 L1 adipocytes. *Int. Scholarly Res. Notices*, **1**, 763758.
- Rahul, S. and Singh S.K. (2022). Morphological characterization of Chilli (*Capsicum annuum* L.) Germplasm for the Mining of Breeding Traits. *Biological Forum : An Int. J.*, **14**(2a), 120-130.
- Saisupriya, P., Saidaiah P. and Pandravada S.R. (2021). Morphological characterization of chilli (*Capsicum annuum* L.) Germplasm. *Biological - An Int. J.*, **13**(4), 866-872.
- Sran, T.S. and Jindal S.K. (2021). Genetic diversity analysis of chilli genotypes based on qualitative morphological traits. *Agricult. Res. J.*, **58**(4), 603-610.