GMR
The Original

"EVALUATION OF BASTAR CHILLI GENOTYPES FOR PUNGENCY, PIGMENT, NUTRITIONAL QUALITY AND DRY MATTER CONTENT"

[1]Heena*, Dr. Ganesh Prasad Nag[2], Dr. Eshu Sahu[3],Dr. Sevan Das Khunte[4], Dr. Richa Sao[5],

[1]Department of Vegetable Science, Krantikari Debridhur College of Horticulture and Reserch Station Jagdalpur,Bastar (C G), MGUVV Sankara Patan Durg (C.G)
[2]Department of Vegetable Science, Krantikari Debridhur College of Horticulture and Reserch Station Jagdalpur,Bastar (C G), MGUVV Sankara Patan Durg (C.G)
[3]Department of Vegetable Science, College of Horticulture and Research Station, Sonarpal,Bastar (C.G) MGUVV Sankara Patan Durg (C.G)
[4]Department of Fruit Science,College of Horticulture and Research Station Sankara Patan Durg (C.G) MGUVV Sankara Patan Durg (C.G)
[5]Department of Genetics and Plant Breeding, College of Horticulture and Research Station, Sankra Patan, Durg (C.G) MGUVV Sankara Patan Durg (C.G)
***Corresponding author:** Heena, heenasahu964@gmail.com

ABSTRACT
Chilli (*Capsicum annum* L.) is a very valuable spice as well as vegetable which is governed by many parameters like pungency, fruit colour, nutritional value, and dry matter content. The present study is aimed at understanding the variability in important biochemical quality characters in Bastar chilli germplasm. A total of 20 accessions of Bastar chillies (CGBC-1 to CGBC-20) along with standard check Pusa Jwala were evaluated during 2024–25 and 2025–26 at Research-cum-Instructional Farm of K.D. College of Horticulture and Research Station, Jagdalpur, Bastar, Chhattisgarh, through Randomized Block Design having three replications. Characters studied in genotypes included capsaicin, capsanthin, ascorbic acid, and dry matter content. Significant variation was found in all the quality parameters studied. Pusa Jwala showed maximum values of pooled capsaicin (0.76%), capsanthin (1.07%) and ascorbic acid (235.40 mg/100 g). CGBC-19 was the best accession in terms of capsaicin (0.72%) and capsanthin (0.99%) content among the Bastar germplasms. CGBC-13 possessed the maximum ascorbic acid content (201.35 mg/100 g) among the Bastar germplasms.The dry matter percentage was found to be 23.54% for Pusa Jwala, 22.43% for CGBC-19, 19.29% for CGBC-6, and 19.12% for CGBC-15. This variation suggests significant variability in the germplasm of Bastar chillies for quality traits. Specifically, CGBC-19 possessed a desirable combination of high capsaicin, capsanthin, and dry matter percentages, while CGBC-13 possessed a high percentage of ascorbic acid. These accessions might be used as genetic material for breeding chillies of improved quality and with special purpose.

KEYWORDS: *Capsicum annuum*, Bastar chilli, capsaicin, capsanthin, ascorbic acid, and dry matter

INTRODUCTION
Capsicum annuum L., commonly known as chilli, belongs to the family Solanaceae and is one of the most important spice-cum-vegetable crops grown in the tropics and sub-tropics of the world. The genus Capsicum includes several species; however, *C. annuum, C. frutescens, C. chinense, C. baccatum,* and *C. pubescens* have been considered to be domesticated species. Chilli is a diploid crop having somatic chromosome number 2n = 24 (Kaur and Singh, 2009). The evidence based on archaeobotany using starch microfossils suggests that Capsicum crops were domesticated in the Americas more than 6,000 years ago and *C. annuum* is most probably domesticated in Mexico or northern Central America. After the Columbian exchange, the spread of chilli crop occurred rapidly throughout the tropics and sub-tropics of the world and thereafter it became an important crop in Asia, Africa, Europe, and the Americas. Presently, the crop of chilli is being grown as a fresh green and ripe dry form, (Chattopadhyay, *et al.,* 2011)
In India, the introduction of chilli took place in the sixteenth century and thereafter it has become an integral part of Indian agriculture, food habits and cuisines. The crop is now grown widely in different types of agro-climatic regions and has an important place among spice crops. Green chilli is used as a vegetable, condiment and as a flavoring agent while the ripe red fruits are mostly dried and used as spices (Poornima, *et al.,* 2024). Chilli is also the raw material for making chilli powder, crushed chilli, pickles, sauces, oleoresins, natural colour extracts and many other value added products. Hence chilli enjoys a special dual status as a vegetable and a spice crop, (Basavaraja, N. 1997).

The economic significance of chilli has something to do with the special biochemical nature of this crop. Capsaicin and related capsaicinoids impart the spicy character of chilli which has much culinary, medicinal and industrial importance (Reddy, *et al.,* 2023). Capsaicinoids are used in pharmaceutical preparations, topical pain relievers and many other special applications. Likewise, capsanthin and other carotenoid pigments play a major role in imparting the red color to the ripe chilli which determines the quality of dried chilli and chilli oleoresin, (Ahmed *et al.,* 2022).

India is a major producer, consumer, and exporter of chilli. The crop contributes significantly to the country's economy as a spice crop and supports a big value chain that involves production, drying, processing, marketing, and exports. The rising demands of chilli both in domestic and foreign markets have necessitated a need for genotypes with clearly defined quality attributes besides productivity. Sometimes industries involved in processing and exports require certain combinations of pungency, color, dry matter content, and other biochemical properties. As such, breeding programs should increasingly target yield coupled with development and characterization of quality genotypes, (Chaudhary, *et al.,* 2013).

Chilli is characterized by great diversity in fruit size, shape, color, pungency, pericarp thickness, period of maturity, fruit weight and biochemistry. This kind of diversity represents an important genetic resource for crop improvement (Deepika,*et al.,* 2026). Several genotypic variations have been identified for capsaicin, capsanthin, ascorbic acid, oleoresin, carotenoids and other quality attributes in chilli germplasm. In evaluating chilli germplasms in eastern India, (Chattopadhyay *et al.*2011) found considerable genetic diversity for horticulture and quality traits. Similarly, investigations of Indian chilli germplasm have identified significant variability for yield, fruit characteristics and biochemical constituents, indicating the availability of useful genetic resources for varietal improvement, (Farwah, *et al.,* 2022).

Evaluation, characterization, and preservation of germplasms are considered the basic prerequisites for efficient utilization of genetic resources. Evaluation of germplasms helps in finding out the extent of variability present in the germplasm and the accessions having desirable combination of characters which could be used directly or as parents in hybridization programs. If the purpose of selection is quality improvement, then the germplasm evaluation becomes important since the required level of pungency, color, nutritive value and dry matter vary with different purposes. This way, multiple characterization of the germplasm for various quality factors would help in developing the cultivars suitable for fresh consumption, production of dry chillies, spice making and industrial purposes, (Janaki *et al.,* 2015).

Out of various quality factors, the capsaicinoid content is responsible for pungency in chillies. The concentration of capsaicinoid varies greatly among various genotypes and is affected by the genetic makeup along with the environment and fruit maturity (Nayak, S. A. (2022). The variation helps in identifying high pungent types for manufacturing spices and oleoresins as well as low pungent types for fresh consumption. Various researches have indicated that there is significant variation among various genotypes for capsaicin content in chillies and pungency can efficiently be used for selection criteria, (Chaudhary, *et al.,* 2013).

The level of capsanthin is one more trait that should be considered during assessment of quality characteristics of chilli, especially ripened red one. The accumulation of capsanthin plays a great role in creating the red coloration of ripened fruit, thus affecting the color and the commercial value of dried chilli and other chilli products. High-pigment genotypes may prove useful in selection of varieties with higher color intensity and efficient natural color extract production. Capsanthin and carotenoid variability in different genotypes of chilli has been studied by several scientists, which proves high potential for creating colorful genotypes and processing material, (Sran *et al.,* 2021).

The content of ascorbic acid can be referred to nutritional traits of chilli. Green and ripened chilli fruits can be a rich source of vitamin C in people's diet, although the content of this substance varies in dependence on genotype, maturation and other factors. Thus, the selection of genotypes with high content of ascorbic acid will lead to improvement of nutritional properties of chilli while increasing utilization of chilli germplasm. Ascorbic acid variation has been found in different studies involving diverse chilli samples, (Banyal, N. 2021).

Content of dry matter is of particular importance for dried chilli. The higher content of dry matter gives more dry product yield from a certain amount of fresh fruit and may have some additional advantages in the process of drying, conservation and processing. Content of dry matter thus is of economic significance for regions where dried chilli is an important component of production and marketing. Large variation in dry matter content among various genotypes of chilli is known; it implies opportunities for selection of genotypes adapted to the cultivation of dried chilli, (Kumar *et al*., 2018).

Correlation among different biochemical quality traits is also of interest from the point of view of selection work. Improvement of one quality component by means of selection does not imply improvement of the rest of desirable attributes (Diwan, Y. (2021). Thus, very pungent variety is not necessarily rich in pigment and has good nutritional properties. Simultaneous selection for capsaicin, capsanthin, ascorbic acid and dry matter content thus is more effective than selection for any single component. Genotypes with high values of two or more economically valuable quality components are especially valuable material for breeding programme for multiple-use varieties, (Rashid, *et al*., 2026).

These traits are known to show marked variability. (Yatung *et al*. 2014) reported variability among chilli genotypes for some important biochemical and fruit quality traits while Saisupriya *et al*. (2022) have recorded high levels of genetic variability for quality traits like ascorbic acid, capsaicin and capsanthin. These results clearly highlight that biochemical assessment is a useful means to supplement the conventional morphological and yield-based assessment of chilli germplasm. Multi-season evaluation is even more important since the quality traits can be affected by environment and genotypes having more stable performance across seasons could hold more promise for breeding and cultivation, (Deepo, D. M. 2016).

Bastar plateau of Chhattisgarh state is an important area for exploration and use of genetic material of chilles. This region is known for its unique agro-climatic conditions and agricultural practices including cultivation of locally adapted germplasm. Germplasm of indigenous chillies preserved by local farmers and communities could constitute a rich source of genetic variation for traits like adaptation, pungency, color, quality and dry matter accumulation. But the use of these germplasms to the identification of superior genotypes with respect to various biochemical traits becomes all the more crucial for Bastar due to the significant end-use importance of dried chilli, where the quality parameters play a vital role in the value addition process of the crop. A genotype that possesses high pungency, high pigment content, and high dry matter will have great potential in the production of dry chilli and spices, while a genotype that contains high ascorbic acid along with good fruit characteristics can be valuable for fresh vegetables (Hongal, D. A. 2019). Likewise, accessions with different degrees of pungency can be utilized for breeding programs for pungent and mild types of chillies. Hence, the characterization of Bastar chilli germplasm for different biochemical traits can facilitate the development of cultivars with special quality characteristics.

Although the genetic diversity has been well reported in chilli, systematic information regarding the quality characteristics of locally adapted Bastar chilli germplasm has been insufficient. In particular, systematic data for capsaicin, capsanthin, ascorbic acid, and dry matter evaluated for several years is necessary to identify accessions with stable and desired quality traits. This is not only required for the purpose of breeding but also for germplasm conservation and value-chain development a scientific manner needs their characterization under replicated field conditions.

Therefore, the present investigation was undertaken to evaluate 20 Bastar chilli accessions along with the standard check Pusa Jwala for important quality attributes during 2024–25 and 2025–26. The study specifically assessed capsaicin content, capsanthin content, ascorbic acid content and dry matter content and compared the performance of genotypes across two seasons. The major objective was to quantify the extent of variation in these economically and nutritionally important traits and to identify promising Bastar accessions possessing desirable combinations of pungency, pigment concentration, nutritional quality and dry matter content for their potential utilization in chilli improvement and dry chilli production.

MATERIALS AND METHODS

The field experiment was carried out in the Rabi season 2025-26 in the Research cum Instructional Farm of K.D. College of Horticulture & Research Station, Jagdalpur, Bastar, Chhattisgarh - 494001. The experiment was made up of 21 treatments which included 20 genotypes of Bastar chilli (*Capsicum annuum* L.), i.e., CGBC-1 to CGBC-20 and standard check Pusa Jwala. The experiment was set up in a Randomized Block Design (RBD) with three replications which accounted for a total of 63 experimental plots. Each plot was of size 3 × 2 m (6 m²) with a planting distance of 60 × 45 cm. The Bastar genotypes were sourced from different locations of Bastar region, namely Kalipur, Bhataguda, Durkiguda, Ghatkawali, Birlinga, Tikralonga, Bastar, Mavliguda, Birlingpal, Kaccharpar, Pujariguda, Dogaghat, Bejaripadar, Garawand Kalan, Adawal, Nainar, Netanar, Bhatpal, Kamarawand and Dharmapura. The variety Pusa Jwala, released by IARI, New Delhi.

Four essential quality attributes of the harvested chilli fruits were considered, such as capsaicin (%) content, capsanthin content (%), ascorbic acid (mg/100 g) content and dry matter content (%). The necessary samples of chilli fruits were collected from each of the genotypes, for the measurement of these quality parameters. The measurements taken for each of the quality parameters were used to determine the level of variability present among the Bastar chilli genotypes along with selection of the genotypes having desirable quality traits.

The data obtained for different quality parameters were subjected to the analysis of variance (ANOVA) test following the procedure recommended for randomized block design, as mentioned by Panse and Sukhatme (1985). Differences among the treatment means were found significant at 5% level of probability through F-test. Standard error of mean [SE(m)±] and critical difference (CD) at the 5% level of significance were determined for comparing the treatment means, while the coefficient of variation (CV%) was calculated for evaluating the precision of the experiment. Comparison between individual genotypes of Bastar chillies and check variety Pusa Jwala was done based on the capsaicin, capsanthin, ascorbic acid, and dry matter content to identify those possessing desirable characteristics and suitable for future breeding programmes in chillies.

RESULTS AND DISCUSSION

Quality parameters

Quality parameters are important attributes in chilli because they determine the suitability of genotypes for fresh consumption, dry chilli production, processing and value-added products. In the present investigation, important quality traits viz., capsaicin content, capsanthin content, ascorbic acid content and dry matter content were evaluated in 21 chilli genotypes comprising 20 Bastar accessions and the standard check Pusa Jwala during 2024–25 and 2025–26. Considerable variation was observed among the genotypes for the quality characteristics, indicating the presence of useful variability for quality improvement.

Capsaicin Content (%)

Capsaicin content, which is the major biochemical constituent responsible for pungency in chilli, showed considerable variation among the genotypes in both years of evaluation (Table-1and Fig.-1). During 2024–25, capsaicin content ranged from 0.13% in CGBC-16 to 0.75% in the standard check Pusa Jwala, whereas during 2025–26 it ranged from 0.13% in CGBC-16 to 0.77% in Pusa Jwala. The pooled mean values further demonstrated substantial genotypic variation, with capsaicin content ranging from 0.13 to 0.76%.The standard check Pusa Jwala recorded the highest pooled capsaicin content (0.76%), with values of 0.75% and 0.77% during 2024–25 and 2025–26, respectively. Among the Bastar genotypes, CGBC-19 recorded the highest pooled capsaicin content (0.72%), with 0.69% in 2024–25 and 0.75% in 2025–26. This was followed by CGBC-13 (0.62%) and CGBC-15 (0.62%), while CGBC-6 recorded 0.56%. Other genotypes exhibiting comparatively higher pooled capsaicin content were CGBC-2 (0.53%), CGBC-3 (0.53%), CGBC-11 (0.47%) and CGBC-8 (0.49%), similar result reported as (Deepo, D. M. 2016 and Farwah,*et al*., 2021).

In contrast, CGBC-16 recorded the lowest pooled capsaicin content (0.13%), followed by CGBC-14 (0.17%) and CGBC-4 (0.20%). CGBC-17 (0.29%), CGBC-20 (0.27%), CGBC-7 (0.34%) and CGBC-9 (0.34%) also exhibited comparatively low pungency. Thus, the germplasm comprised both high-pungency and low-pungency types, providing useful material for developing chilli cultivars with contrasting pungency levels.The year-wise comparison indicated that most genotypes showed relatively consistent performance across the two seasons, although moderate changes in capsaicin concentration were observed. For example, CGBC-19 increased from 0.69% in 2024–25 to 0.75% in 2025–26, while CGBC-15 increased from 0.59 to 0.65%. Conversely, CGBC-14 decreased slightly from 0.18 to 0.16%. Such differences may reflect the influence of seasonal environmental conditions on the accumulation of capsaicinoids, (Sran, *et al*., 2021and Rashid, *et al*., 2026)

From a breeding and utilization perspective, CGBC-19 appears particularly promising as a high-pungency Bastar genotype, owing to its consistently high capsaicin content across both years and its close performance to the standard check. Such genotypes may be useful in breeding programmes aimed at improving pungency and in the development of material suited to dry chilli, spice and oleoresin-oriented uses. On the other hand, CGBC-16, CGBC-14 and CGBC-4 represent useful low-pungency sources and may be exploited for developing mild chilli types suitable for fresh consumption and products where excessive pungency is undesirable. The contrasting performance of these genotypes demonstrates the usefulness of the evaluated Bastar germplasm as a source of variability for manipulating pungency in future chilli breeding programmes. The relatively narrow experimental error, as indicated by the CV values of 5.60% and 6.87% in 2024–25 and 2025–26, respectively, suggests satisfactory experimental precision. The pooled CV of 6.29% further indicates reliable estimation of genotypic differences for capsaicin content. The significant differences among genotypes, together with the broad range of values, indicate considerable scope for selection and breeding for pungency. The present findings are in agreement with earlier reports of substantial genotypic variability for capsaicin content in chilli. Saisupriya *et al.* (2022) also reported significant variation among chilli genotypes for capsaicin content, supporting the existence of exploitable genetic diversity for this quality attribute.

Capsanthin Content (%)

Capsanthin content also exhibited pronounced variation among the chilli genotypes during both years of evaluation (Table-1). In 2024–25, capsanthin content among the Bastar genotypes ranged from 0.32% in CGBC-16 to 1.04% in CGBC-19, whereas in 2025–26 it ranged from 0.31% in CGBC-16 to 1.10% in CGBC-19. The pooled values ranged from 0.30 to 1.07%, demonstrating substantial variation in pigment accumulation among the evaluated genotypes.

The standard check Pusa Jwala recorded the highest pooled capsanthin content (1.07%), with values of 1.05% and 1.09% during 2024–25 and 2025–26, respectively. Among the Bastar accessions, CGBC-19 recorded the highest pooled capsanthin content (0.99%), followed by CGBC-13 (0.99%), CGBC-15 (0.90%), CGBC-6 (0.94%) and CGBC-2 (0.85%). CGBC-3 also showed a relatively high pooled value of 0.78%.The lowest capsanthin content was observed in CGBC-16 (0.30%), followed by CGBC-4 (0.35%), CGBC-14 (0.39%) and CGBC-9 (0.40%). The remaining genotypes exhibited intermediate levels of capsanthin. The broad range observed in this study indicates considerable diversity in fruit colour intensity and pigment accumulation among the Bastar germplasm.A generally consistent ranking of genotypes was observed across the two seasons. For instance, CGBC-19 maintained a high capsanthin content, increasing from 1.04% in 2024–25 to 1.10% in 2025–26. Similarly, CGBC-13 maintained a high level, with 0.97% and 1.00% in the respective years. CGBC-15 also showed an increase from 0.86 to 0.93%. In contrast, the comparatively low-pigment genotypes, particularly CGBC-16 and CGBC-4, remained at the lower end in both years. This consistency suggests that the observed differences were not solely due to seasonal variation but were also associated with inherent genotypic differences, closed as result reported Chaudhary*et al*., 2013 and Ahmed *et al*., 2022).

Capsanthin is an important carotenoid pigment associated with the characteristic red colour of ripe chilli fruits and is of considerable importance for dry chilli quality and colour value. Therefore, the high-capsanthin genotypes identified in the present study, particularly CGBC-19, CGBC-13, CGBC-6 and CGBC-15, may serve as valuable sources for improving fruit colour and pigment concentration in chilli breeding programmes. The contrasting low-capsanthin genotypes may also be useful where specific fruit colour intensity is required. The simultaneous occurrence of variation for capsaicin and capsanthin content among the accessions provides an opportunity to identify and utilize genotypes possessing desirable combinations of pungency and colour for different end-use requirements, (Sran *et al*., 2021).

Overall, the results demonstrate substantial variability among the Bastar chilli germplasm for biochemical quality attributes. In particular, CGBC-19 emerged as a promising accession for both high capsaicin and high capsanthin content, making it a potentially valuable donor for improving pungency and colour simultaneously (Ahamd, *et al*., 2022). The identification of contrasting high- and low-quality types provides useful genetic resources for future selection and hybridization programmes aimed at developing chilli cultivars with specific quality profiles. The low CV values of 2.02% in 2024–25, 2.28% in 2025–26 and 2.16% for the pooled analysis indicate high experimental precision for capsanthin estimation. The relatively low experimental variation strengthens the reliability of the observed differences among genotypes, similar as result reported by (Janaki, 2019 and Gopali 2019).

Ascorbic acid (mg/100 g)

The genotypes differed significantly for ascorbic acid (vitamin C) content (Table-2 and Fig.-2). The check Standard variety - Pusa Jwala recorded the highest pooled ascorbic acid content (235.40 mg/100 g). Among the accessions, CGBC-13 recorded the maximum (201.35 mg/100 g), followed by CGBC-3 (191.95 mg/100 g), CGBC-15 (191.62 mg/100 g) and CGBC-6 (190.82 mg/100 g). The lowest ascorbic acid content was recorded in CGBC-20 (106.92 mg/100 g), followed by CGBC-16 (118.00 mg/100 g) and CGBC-14 (122.13 mg/100 g).Chilli is one of the richest vegetable sources of vitamin C, and genotypes with high ascorbic acid content, such as CGBC-13, add nutritional value to the produce and are preferred for fresh consumption and processing. The substantial variation observed among the Bastar accessions offers scope for selecting nutritionally superior types. Similar genotypic differences for ascorbic acid content in chilli germplasm have been reported by (Saisupriya *et al.* 2022 and Gor, *et al*., 2024).

Dry matter content (%)

Dry matter content showed significant variation among the genotypes (Table-3 and Fig.-3). The check Standard variety - Pusa Jwala recorded the highest pooled dry matter content (23.54%). Among the accessions, CGBC-19 recorded the maximum dry matter content (22.43%), which was at par with the check, followed by CGBC-6 (19.29%), CGBC-15 (19.12%) and CGBC-8 (18.11%). The lowest dry matter content was recorded in CGBC-14 (10.07%), followed by CGBC-4 (11.96%) and CGBC-17 (12.22%).High dry matter content is desirable for dry chilli production as it ensures better dry recovery, quicker field drying and lower post-harvest losses. CGBC-19, combining high dry matter with high capsaicin content at par with the check, emerged as the most suitable accession for the dry-chilli purpose, which is the principal form of chilli trade in the Bastar region. Variation for dry matter content among chilli genotypes has also been reported by (Kaur, and Singh, 2009 And Yatung *et al.*2014).

Table-1. Mean performance of chilli genotypes for capsaicin content (%) during 2024–25, 2025–26 and pooled

Genotype	Capsaicin content (%)			Capsanthin content (%)		
	2024–25	2025–26	Pooled mean	2024–25	2025–26	Pooled mean
CGBC-1	0.45	0.48	0.46	0.59	0.63	0.61
CGBC-2	0.51	0.54	0.53	0.82	0.88	0.85
CGBC-3	0.52	0.54	0.53	0.76	0.80	0.78
CGBC-4	0.20	0.20	0.20	0.33	0.36	0.35
CGBC-5	0.35	0.36	0.35	0.49	0.53	0.51
CGBC-6	0.54	0.59	0.56	0.92	0.96	0.94
CGBC-7	0.35	0.33	0.34	0.42	0.45	0.44
CGBC-8	0.49	0.49	0.49	0.67	0.70	0.68
CGBC-9	0.33	0.34	0.34	0.38	0.41	0.40
CGBC-10	0.35	0.37	0.36	0.44	0.50	0.47
CGBC-11	0.46	0.48	0.47	0.63	0.66	0.65
CGBC-12	0.39	0.38	0.38	0.51	0.57	0.54

CGBC-13	0.61	0.64	0.62	0.97	1.00	0.99
CGBC-14	0.18	0.16	0.17	0.37	0.40	0.39
CGBC-15	0.59	0.65	0.62	0.86	0.93	0.90
CGBC-16	0.13	0.13	0.13	0.29	0.31	0.30
CGBC-17	0.28	0.30	0.29	0.45	0.51	0.48
CGBC-18	0.38	0.40	0.39	0.61	0.66	0.63
CGBC-19	0.69	0.75	0.72	0.87	0.91	0.89
CGBC-20	0.27	0.27	0.27	0.43	0.43	0.43
Standard variety Pusa Jwala	0.75	0.77	0.76	1.05	1.09	1.07
SE(m)±	0.01	0.02	0.01	0.01	0.01	0.01
CD (P=0.05)	0.04	0.05	0.03	0.02	0.02	0.02
CV (%)	5.60	6.87	6.29	2.02	2.28	2.16

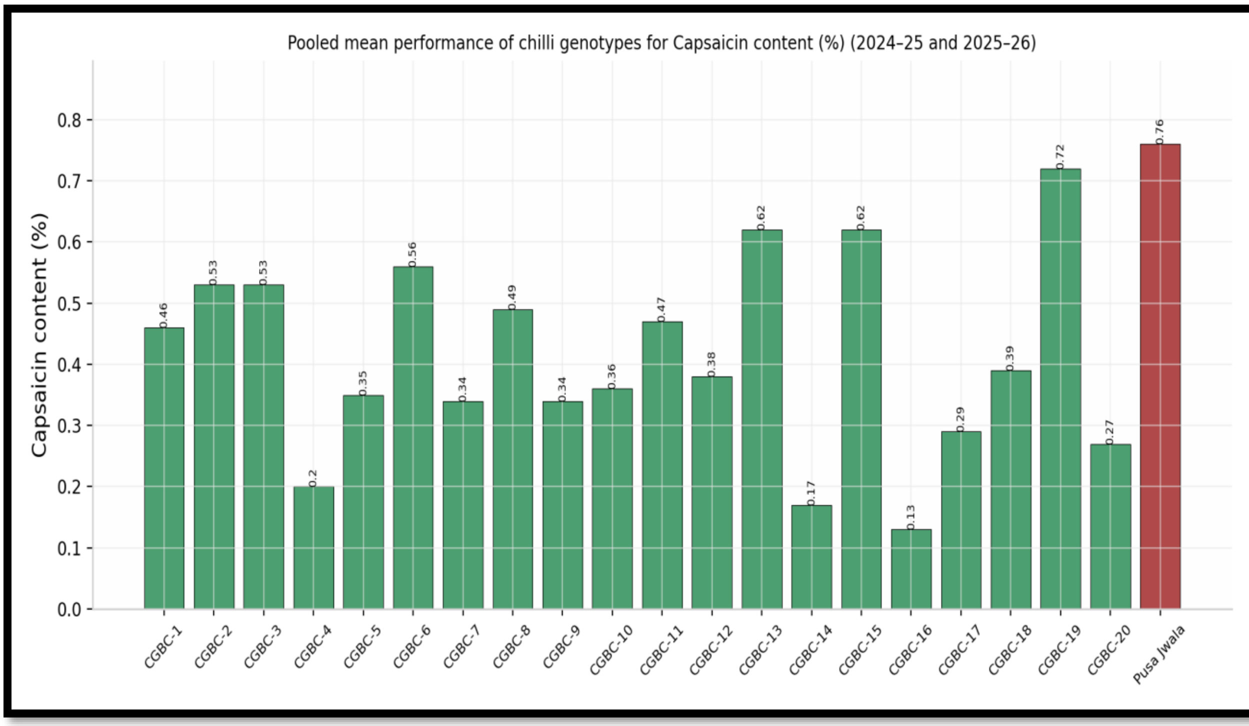

Fig. 1. Pooled mean performance of chilli genotypes for capsaicin content (%). (Green bars: Bastar accessions; red bar: check Standard variety – Pusa Jwala)

Table-2. Mean performance of chilli genotypes for ascorbic acid content (mg/100 g) during 2024–25, 2025–26 and pooled

Genotype	**2024–25**	**2025–26**	**Pooled mean**
CGBC-1	182.50	185.67	184.08
CGBC-2	165.27	170.30	167.78
CGBC-3	190.70	193.20	191.95
CGBC-4	159.20	155.63	157.42
CGBC-5	133.90	136.87	135.38
CGBC-6	195.20	186.43	190.82
CGBC-7	132.67	128.63	130.65
CGBC-8	142.43	130.73	136.58
CGBC-9	113.83	131.77	122.80
CGBC-10	138.03	146.43	142.23
CGBC-11	160.67	152.30	156.48
CGBC-12	144.93	158.57	151.75
CGBC-13	201.53	201.17	201.35

CGBC-14	114.13	130.13	122.13
CGBC-15	195.50	187.73	191.62
CGBC-16	116.10	119.90	118.00
CGBC-17	122.37	127.27	124.82
CGBC-18	142.03	135.23	138.63
CGBC-19	184.83	192.43	188.63
CGBC-20	112.93	100.90	106.92
Standard variety - Pusa Jwala	235.40	235.40	235.40
SE(m)±	5.56	4.25	3.50
CD (P=0.05)	15.89	12.14	9.85
CV (%)	6.16	4.67	5.46

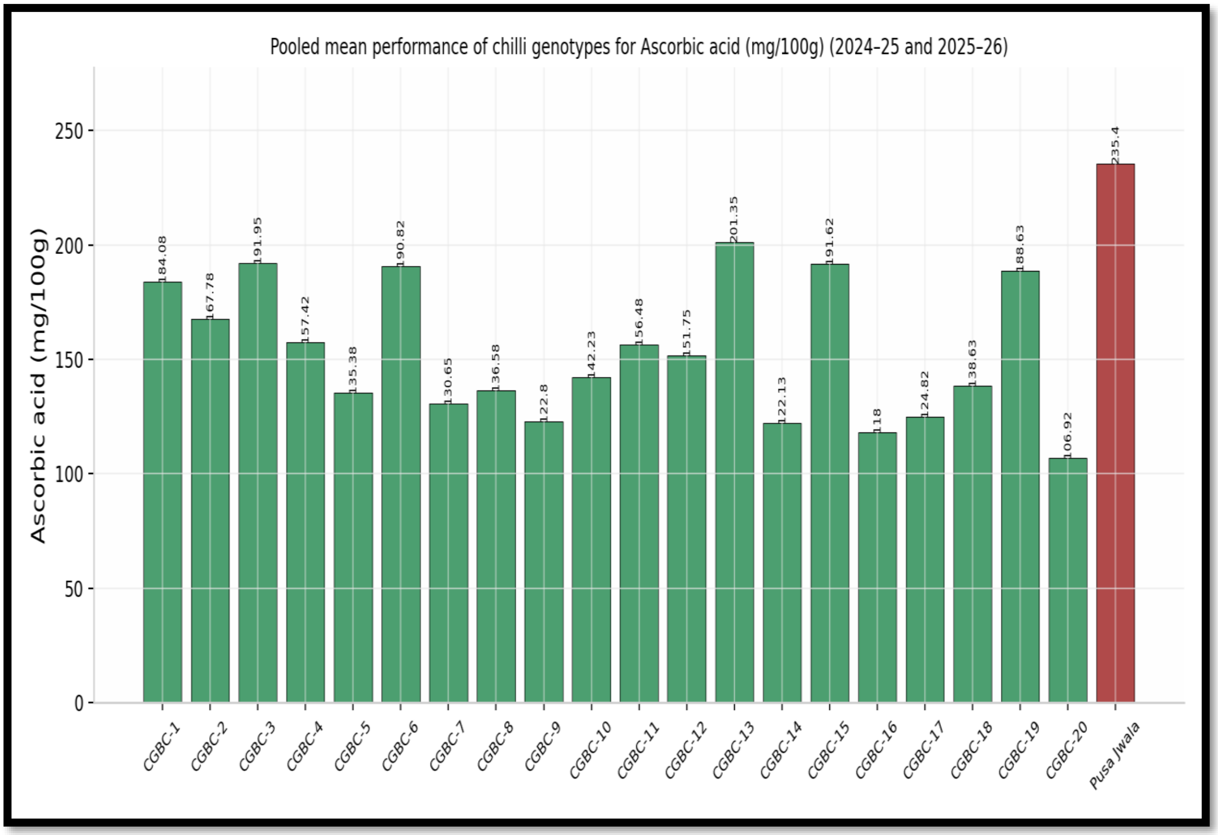

Fig-2. Pooled mean performance of chilli genotypes for ascorbic acid content (mg/100 g). (Green bars: Bastar accessions; red bar: check Standard variety - Pusa Jwala)

Table-3. Mean performance of chilli genotypes for dry matter content (%) during 2024–25, 2025–26 and pooled

Genotype	2024–25	2025–26	Pooled mean
CGBC-1	17.46	17.47	17.47
CGBC-2	17.54	18.57	18.06
CGBC-3	15.20	15.64	15.42
CGBC-4	11.68	12.24	11.96
CGBC-5	15.71	14.48	15.10
CGBC-6	19.06	19.52	19.29
CGBC-7	14.44	14.36	14.40
CGBC-8	18.19	18.04	18.11
CGBC-9	13.82	13.74	13.78
CGBC-10	17.26	16.90	17.08
CGBC-11	16.98	17.13	17.06
CGBC-12	15.93	15.92	15.92

CGBC-13	17.40	17.96	17.68
CGBC-14	10.33	9.81	10.07
CGBC-15	19.68	18.55	19.12
CGBC-16	13.78	14.03	13.90
CGBC-17	11.77	12.67	12.22
CGBC-18	14.53	15.65	15.09
CGBC-19	22.39	22.48	22.43
CGBC-20	16.06	17.51	16.79
Standard variety - Pusa Jwala	23.54	23.54	23.54
SE(m)±	0.55	0.52	0.38
CD (P=0.05)	1.57	1.47	1.06
CV (%)	5.82	5.42	5.62

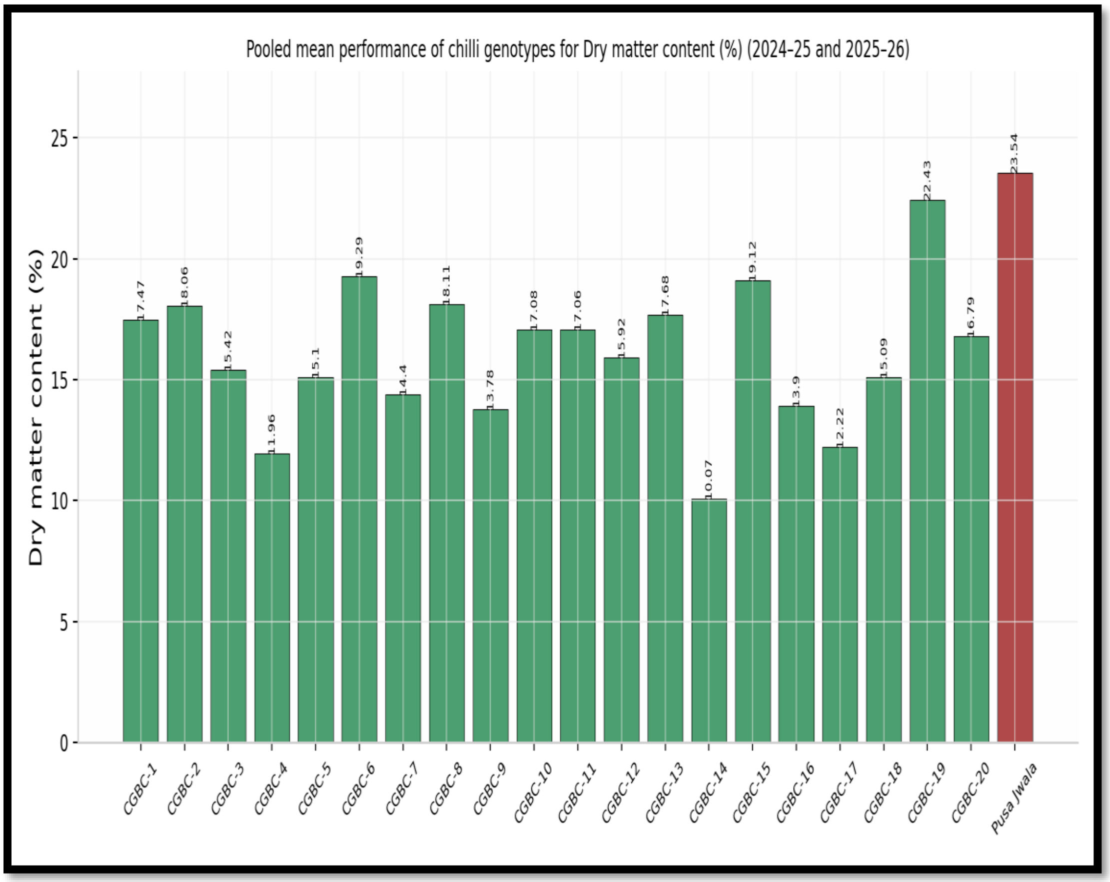

Fig.-3. Pooled mean performance of chilli genotypes for dry matter content (%). (Green bars: Bastar accessions; red bar: check Standard variety - Pusa Jwala)

CONCLUSION

Variability was detected for capsaicin, capsanthin, ascorbic acid and dry matter contents among Bastar chilli accessions indicating that quality based selection and breeding can be done for developing superior genotypes. Among the accessions studied, CGBC-19 emerged as a superior accession because of its high content of capsaicin (0.72%), capsanthin (0.99%) and dry matter content (22.43%). CGBC-13 was the most promising accession with respect to ascorbic acid content (201.35 mg/100 g). Besides, there were other accessions like CGBC-15 and CGBC-6 which possessed desirable traits for quality development. Accessions having contrasting characters like CGBC-16, CGBC-14 and CGBC-4 possessing low capsaicin content may be utilized for development of mild pungency types. The variation seen in terms of pigment, nutritional and dry matter contents will serve as a rich source of variation for developing genotypes suitable for fresh, dry and processing purposes.The whole germplasm of Bastar studied appears to be a genetic resource of immense value for development of superior chillies. Particularly, the accession CGBC-19 needs further evaluation for its use in improving pungency, color and dry matter content together.

REFERENCE

1. Ahmed, I., Nawab, N. N., Kabir, R., Muhammad, F., Intikhab, A., Rehman, A. U., ... & Ali, I. (2022). Genetic diversity for production traits in hot chilli (*Capsicum annuum* L.). *Pak J Bot*, *54*(6), 2157-66.
2. Ahmed, I., Nawab, N. N., Kabir, R., Muhammad, F., Intikhab, A., Rehman, A. U., ... & Ali, I. (2022). Genetic diversity for production traits in hot chilli (*Capsicum annuum* L.). *Pak J Bot*, *54*(6), 2157-66.
3. BANYAL, N. (2021). Genetic diversity in chilli (*Capsicum annuum* L.) genotypes using agro-morphological and molecular markers (Doctoral dissertation, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya).
4. Basavaraja, N. (1997). Genetic variability and genetics of quantitative and quality characters in green chilli *(Capsicum annuum L.) genotypes* (Doctoral dissertation, University of Agricultural Sciences).
5. Chattopadhyay, A., Sharangi, A. B., Dai, N., & Dutta, S. (2011). Diversity of genetic resources and genetic association analyses of green and dry chillies of Eastern India. *Chilean Journal of Agricultural Research, 71*(3), 350–356.
6. Chattopadhyay, A., Sharangi, A. B., Datta, S. and Paria, P. (2011). Textbook on Spices and Condiments. New Delhi: *Daya Publishing House.*
7. Chaudhary, A., Kumar, R., & Solankey, S. S. (2013). Estimation of heterosis for yield and quality components in chilli (*Capsicum annuum* L.). *African Journal of Biotechnology*, *12*(47), 6605-6610.
8. Deepika, D. D., Sharma, V., Mehta, G., Mehta, H., Pandey, C. D., Gaikwad, A. B., ... & 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).
9. Deepo, D. M. (2016). Genetic Diversity Analysis of Chilli *(Capsicum Spp.)* (Doctoral Dissertation, Department of Genetics and Plant Breeding, Sher-E-Bangla Agricultural University, Dhaka, Bangladesh).
10. Diwan, Y. (2021). Genetic Variability and Character Association Analysis in Chilli (Capsicum annum L.) Genotypes.
11. Farwah, S., Hussain, K., Rizvi, S., Hussain, S. M., Rashid, M., Din, S., & Maqbool, S. (2020). Mean performance of various Chilli (*Capsicum annuum* L.) genotypes. *Journal of Pharmacognosy and Phytochemistry*, *9*(3), 1351-1355.
12. Gopali, J. (2019). Assessment of genetic variability, heritability and genetic advance for growth, yield and quality traits of Byadgi Dabbi genotypes of chilli (Capsicum annuum L.). *Journal of Pharmacognosy and Phytochemistry*.
13. Gor, D., Singh, D., Patel, G., Bagadiya, P., Balar, V., & Yadav, A. (2024). Assessment of genetic diversity in different Chilli (*Capsicum annuum* L.) genotypes using morphological, biochemical and molecular characters. *Int. J. Adv. Biochem. Res*, *8*, 385-397.
14. Hongal, D. A. (2019). *Morphological, biochemical and molecular characterization of chilli germplasm* (Doctoral dissertation, Dissertation, ICAR-Indian Agricultural Research Institute).
15. Janaki, M., Naram Naidu, L., Venkata Ramana, C., & Paratpara Rao, M. (2015). Performance of chilli (*Capsicum annuum* L.) genotypes for yield and yield attributing traits. *Plant Archives, 15*(2), 661–666.
16. Kaur, B., & Singh, D. (2009). Evaluation of hot pepper (*Capsicum annuum* L.) germplasm of diverse origin for various horticultural characters. *Indian Journal of Plant Genetic Resources*, *22*(1), 41-45.
17. Kumar, V., Bhandari, S., & Mishra, A. C. (2018). Evaluation of chilli (*Capsicum annuum* L.) genotypes for seed quality parameters. *Journal of Pharmacognosy and Phytochemistry*, *7*(5), 2163-2166.
18. Nayak, S. A. (2022). Characterization and evaluation of chilli (*Capsicum annuum* L.) germplasm.
19. Panse, V.G. and Sukhatme, P.V. (1985). Statistical Methods for Agricultural Workers, ICAR, New Delhi.
20. Poornima, H. P., Srivastava, A., Sharma, V. K., Kundu, A., Singh, K., Parihar, B. R., & Mangal, M. (2024). Assessing the retention of capsaicin and capsanthin compounds in chilli (*Capsicum annuum* L.) genotypes during storage. *Journal of Food Composition and Analysis*, *127*, 105948.
21. Rashid, M. Y., Jaffar, M. A., Faheem, M., Zafar, A., Ullah, A., Khan, N., ... & Keerio, J. M. (2026). Analysis of Chilli (*Capsicum annum* L.) Germplasm based on Multiple Traits through Genotype. *Planta Animalia*, *5*(2), 803-818.
22. Reddy, M., Kumar, R., Ponnam, N., Prasad, I., Barik, S. P., Pydi, R., ... & Pasupula, K. (2023). Chili: breeding and genomics. *Vegetable Science*, 177-188.
23. Saisupriya, P., Saidaiah, P., & Pandravada, S. R. (2022). Analysis of genetic variability, heritability and genetic advance for yield and yield related traits in chilli (*Capsicum annuum* L.). *International Journal of Bioresource and Stress Management*, *13*(4), 387-393.
24. Sran, T. S., Jindal, S. K., & Chawla, N. (2021). Genotype by environment interaction for quality traits in chilli pepper (*Capsicum annuum* L.). *Genetika*, *53*(1), 23-49.
25. Yatung, T., Dubey, R. K., Singh, V., Upadhyay, G., & Pandey, A. K. (2014). Selection parameters for fruit yield and related traits in chilli (*Capsicum annuum* L.). *Bangladesh Journal of Botany*, *43*(3), 283-291.