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Estimation of Phytochemicals in Chilli (*Capsicum annuum L.*) Accessions under Northern Transition Zone of Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried out for the estimation of phytochemicals in chilli (*Capsicum annuum L.*) accessions at Horticultural Research and Extension Centre, Devihosur, Haveri under northern transition zone of Karnataka. Fifty chilli genotypes collected from different sources were screened for quality components like ascorbic acid, chlorophyll, and phenols. The analysis of variance revealed that the quality components varied significantly among the genotypes. The ascorbic acid content in green chilli and chlorophyll content in leaves varied from 40.73 to 191.15 mg/100 g and 0.26 to 1.80mg/100 g, respectively. Whereas, the phenols in leaves varied between 3.86 to 12.15 mg/100g. The maximum amount of ascorbic acid, chlorophyll, and phenol content were observed in the accessions IC-572470, EC-399572 and Ujwala. respectively, which can be further utilized as potential parenting materials for quality improvement programme in chilli.

Keywords: Ascorbic acid; chlorophyll; phenols.

1. INTRODUCTION

Chilli (*Capsicum annum L.*) belongs to the night shade family Solanaceae. It is a remunerative vegetable, spice cum cash crop of the Indian subcontinent. Chilli is used as condiment, culinary supplement and as an ornamental plant, believed to have originated in the mountain ranges of Peru of South America. It was first introduced to India by Portuguese during the end of 15th century and now is widely distributed in all tropical and sub-tropical countries including India. It is an annual herb, profusely branching bushy plant. Chilli is a rich source of vitamin A (292.04 IU/100 g), vitamin C (143.7 µg/100 g), vitamin E (0.69 mg/100 g) and vitamin K (14 µg/100 g) of chilli, oleoresin, carbohydrates and minerals such as calcium, phosphorus, ferrous, sodium and copper in trace amounts [1].

Ascorbic acid is well known for its antioxidant properties which is essential for human nutrition and proper body functioning [2,3]. It is also used in pharmaceutical industries to prepare vitamin-C supplement tablets and it is added to fruit juices, cereals, fruit-flavoured candies, dried fruit, cured meats and frozen fruits in food and beverages industries for slowing the oxidation process which held in preserving its colour and freshness.

Chlorophyll is a photosynthetic pigment available abundantly in plants as its applications are seen in pharmaceutical, cosmetic and food products as a wound healing, antioxidant or colouring agent.

Phenols is one of the most important classes of organic compounds arise from the shikimate phenyl-propanoids flavonoids pathways [4] used in cosmetic industries, to extract biomolecules, to prepare reagents used in plastic manufacturing industries and phenol with formaldehyde is used commercially to prepare phenolic resins. The aim of this study was to estimate ascorbic acid, chlorophyll, and phenol contents of 50 genotypes of chilli under northern transition zone of Karnataka.

2. MATERIALS AND METHODS

This study was carried out at the Horticultural Research and Extension Centre (HREC) Devihosur, Haveri, Karnataka during 2018-2022. Seeds of the 50 genotypes were sown in nursery beds during kharif 2018-19. Thirty days old seedlings were transplanted to the field with randomized complete block design in two replications at a distance of 60 cm x 45 cm. Proper agronomic and plant protection practices were exercised in order to raise healthy crop. Green leaves of each genotype were used for determination of chlorophyll and phenol content while, green fruits were used for the estimation of ascorbic acid.

a) Ascorbic acid content (mg/100g)

Ascorbic acid content of fruits was determined as per the method suggested by Ranganna (1986) using 2, 6-dichlorophenol indophenol dye. The samples extracted in metaphosphoric acid solution were titrated with dye. The ascorbic acid

content was calculated and expressed as mg per 100 g of fruit weight sample using following formula.

$$\text{Ascorbic acid (mg/100 g)} = \frac{\text{Titre value} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Aliquot of extract} \times \text{Volume made for estimation taken for estimation}}$$

b) Total chlorophyll (mg/g)

Estimation of chlorophyll content was carried out as per the method suggested by Yashida et al. [5]. One gram of leaf sample was weighed and chlorophyll was extracted using mortar and pestle with 80 per cent acetone. The extracted chlorophyll was filtered using Whatman No. 42 filter paper. The volume was made up to 100 ml using 80 per cent acetone and percentage of transmittance was read using spectrophotometer at 645 nm and at 663 nm. The absorbance values were applied in the equations for calculating chlorophyll content (mg/g).

$$\text{Chlorophyll a (mg/g)} = [12.7\,(A663) - 2.69\,(A645)] \times \frac{V}{1000 \times w}$$

$$\text{Chlorophyll b (mg/g)} = [22.9\,(A645) - 4.68\,(A663)] \times \frac{V}{1000 \times w}$$

Where,

A = absorbance of specific wave length (645 and 663 nm)
V = final volume of acetone extract of sample

w = weight of sample in grams

$$\text{Total chlorophyll} = 20.00\,(A645) + 8.02\,(A663) \times \frac{V}{1000 \times w}$$

A: Absorbance of specific wave length 645 and 663 nm
V: Final volume of the chlorophyll extract in 80% acetone
W: weight of tissue extracted.

c) Phenol content (mg/g)

Total phenol content of chilli leaves was estimated by Folin Ciocalteu reagent (FCR) method and the procedure is given below.

A sample of 0.5 g of fresh leaf tissue was taken and grinded in 10 ml of ethanol with the help of pestle and mortar and filtered the solution using filter paper from which one ml filtered solution was taken in a test tube and boiled at 100° C till the solution was evaporated. One ml of distilled water was added to the test tube and from this 0.5 ml of solution was taken into another test tube to which 2.5 ml of distilled water, 1 ml of FCR reagent and two ml of sodium carbonate was added, cooled and finally absorbance was measured at 650 nm by using spectrophotometer. Total phenol content was calculated with the help of standard graph and expressed in mg per g of fresh leaves [6].

3. RESULTS AND DISCUSSION

3.1 Analysis of Variance

The results of analysis of variance among the 50 genotypes of chilli revealed that the mean sum of squares due to genotypes were highly significant for all the quality traits studied *viz*., ascorbic acid, chlorophyll and phenols. This suggested the presence of substantial amount of genetic variation among the genotypes that could be exploited in selection for desirable quality traits. All the above findings are in close agreement with the findings of Manju and Sreelathakumary [7], Munshi et al. [8] and Yatung et al. [9]. The result of analysis of variance for all the characters under study is presented in Table 1.

3.2 *Per se* performance of genotype for different quality traits

Per se performance of 50 chilli genotypes for various quality traits is presented in Table 2 and the results are explained below:

3.3 Ascorbic Acid in Green Chilli (mg/100g)

Among the quality traits, the mean performance of the genotypes for ascorbic acid content was 81.80 mg/100g in green chilli. The highest content was observed in the genotype IC-572470 (191.15 mg/100g) in Fig. 1. Similar range for ascorbic acid content were reported by Lee et al. [10], Datta and Das [11], Pandiyaraj [12] and Grojja et al. [13].

Table 1. Analysis of variance for quality parameters of chilli accessions during the kharif season in 2018-19

Sl. No.	Source of variation	Replications	Treatments (Genotypes)	Error	S.Em±	CD (5%)	CD (1%)
	Degrees of freedom	**1**	**49**	**49**			
1.	Ascorbic acid green fruit (mg/100g)	12.48	1409.56**	9.11	2.13	6.06	8.09
2.	Chlorophyll content in leaves (mg/100g)	0.0049	0.121**	0.0007	0.02	0.06	0.07
4.	Phenol content in leaves (mg/100g)	0.03	4.84**	0.08	0.20	0.56	0.74

**Significant at 1%*

Table 2. *Per se* performance of chilli genotypes for quality parameters 2018-19

Sl. No.	Genotypes	Ascorbic Acid content (mg/100g)	Chlorophyll content in leaves (mg/100g)	Phenol content in leaves (mg/100g)
1	Ujwala	68.83	0.78	12.15
2	Anugraha	65.01	0.35	10.49
3	Khandari	86.15	0.30	9.12
4	Utkal Rasmi	78.29	0.55	6.32
5	Utkal Ava	81.15	0.49	7.35
6	Pusa Jwala	72.10	0.50	4.85
7	Pant C-1	60.82	0.33	6.48
8	Phule Jyothi	99.21	0.45	5.28
9	KDC-1	87.27	0.80	5.60
10	DCA-21	75.24	0.66	6.60
11	GCS-94/68	72.73	0.48	4.84
12	Byadgi Kaddi	79.70	0.69	3.86
13	Byadgi Dabbi	59.10	0.74	3.93
14	IC-264468	67.18	0.72	4.36
15	IC-265198	40.73	0.48	4.54
16	IC-265199	52.00	0.55	4.89
17	IC-275953	126.98	0.26	5.08
18	IC-278306	84.92	0.71	5.00
19	IC-283328	65.96	0.33	4.80
20	IC-343788	54.18	1.16	4.18
21	IC-347044	56.88	0.83	4.62
22	IC-362007	73.13	0.48	5.30
23	IC-362010	63.65	0.38	4.87
24	IC-362012	99.06	0.54	6.04
25	IC-362020	108.36	0.46	4.60
26	IC-362023	78.51	0.47	6.30

Sl. No.	Genotypes	Ascorbic Acid content (mg/100g)	Chlorophyll content in leaves (mg/100g)	Phenol content in leaves (mg/100g)
27	IC-362025	101.43	0.68	5.27
28	IC-369588	56.08	0.72	5.52
29	IC-369592	77.93	0.55	6.41
30	IC-413048	49.90	0.46	6.54
31	IC-505241	101.34	0.73	5.37
32	IC-505305	54.38	0.61	6.31

Table 2. Continued….

Sl. No.	Genotypes	Ascorbic Acid (mg/100g)	Chlorophyll content in leaves (mg/100g)	Phenols in leaves (mg/100g)
33	IC-505476	84.73	0.67	5.64
34	IC-537588	97.02	0.50	5.20
35	IC-537595	99.14	0.42	6.71
36	IC-537650	61.22	0.45	4.54
37	IC-565066	56.31	0.37	4.41
38	IC-565072	101.41	0.62	4.34
39	IC-572456	107.38	0.51	5.55
40	IC-572468	96.88	0.36	4.15
41	IC-572470	191.15	0.83	4.70
42	IC-572475	147.62	0.50	5.24
43	IC-572487	108.44	0.39	5.28
44	IC-572491	96.04	0.72	6.39
45	IC-572493	60.97	0.50	4.43
46	IC-572495	57.35	0.34	4.43
47	EC-399562	82.37	0.57	6.14
48	EC-399565	72.87	0.50	5.45
49	EC-399572	75.20	1.80	4.41
50	EC-402101	95.74	0.69	4.46
	Mean	**81.80**	**0.58**	**5.56**
	SEm±	**2.13**	**0.02**	**0.20**
	CD @5%	**6.06**	**0.06**	**0.56**
	CD @1%	**8.09**	**0.07**	**0.74**
	CV (%)	**3.69**	**4.81**	**4.99**

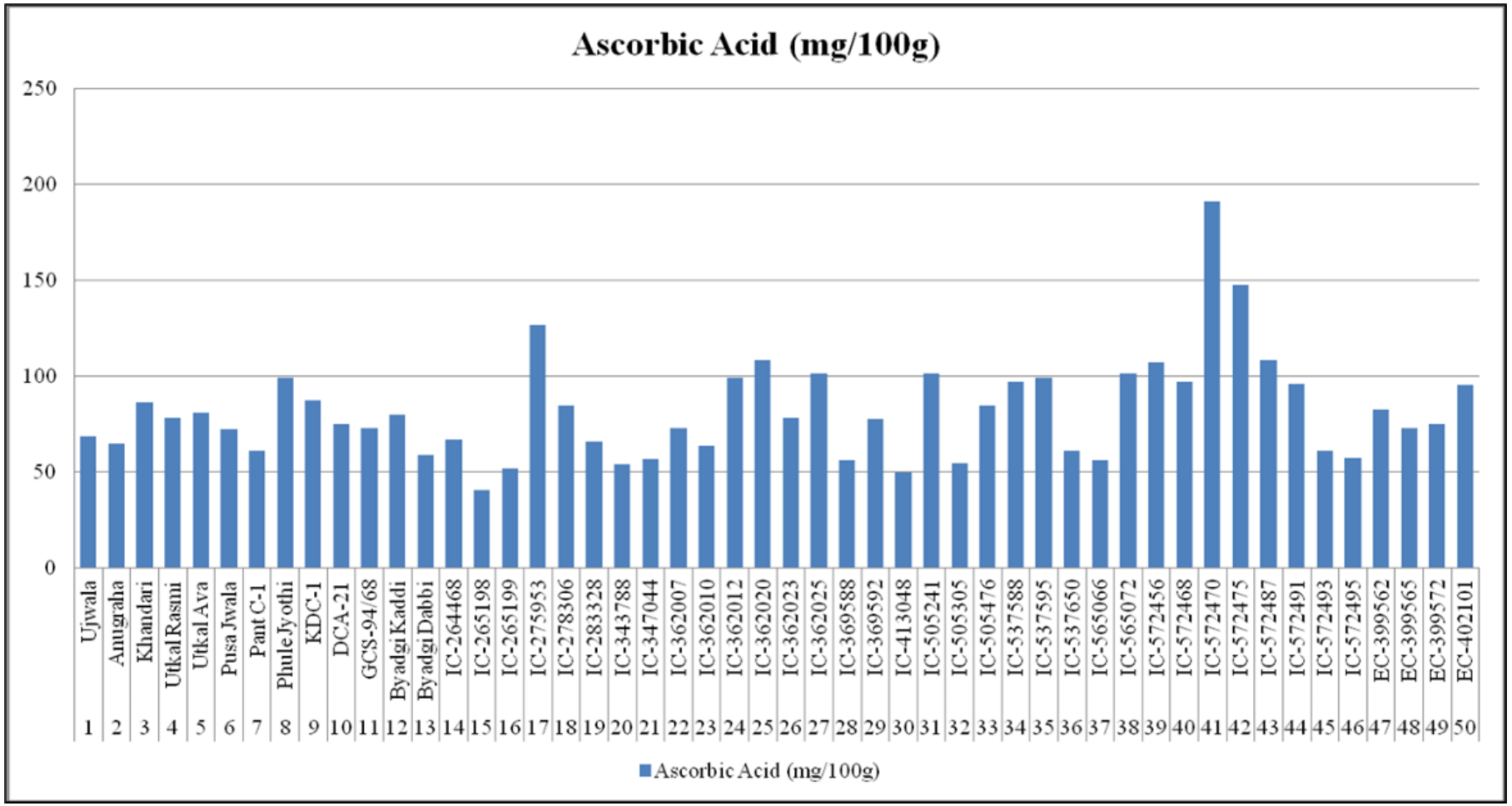

Fig. 1. Performance of chilli genotypes for quality parameters (Ascorbic acid)

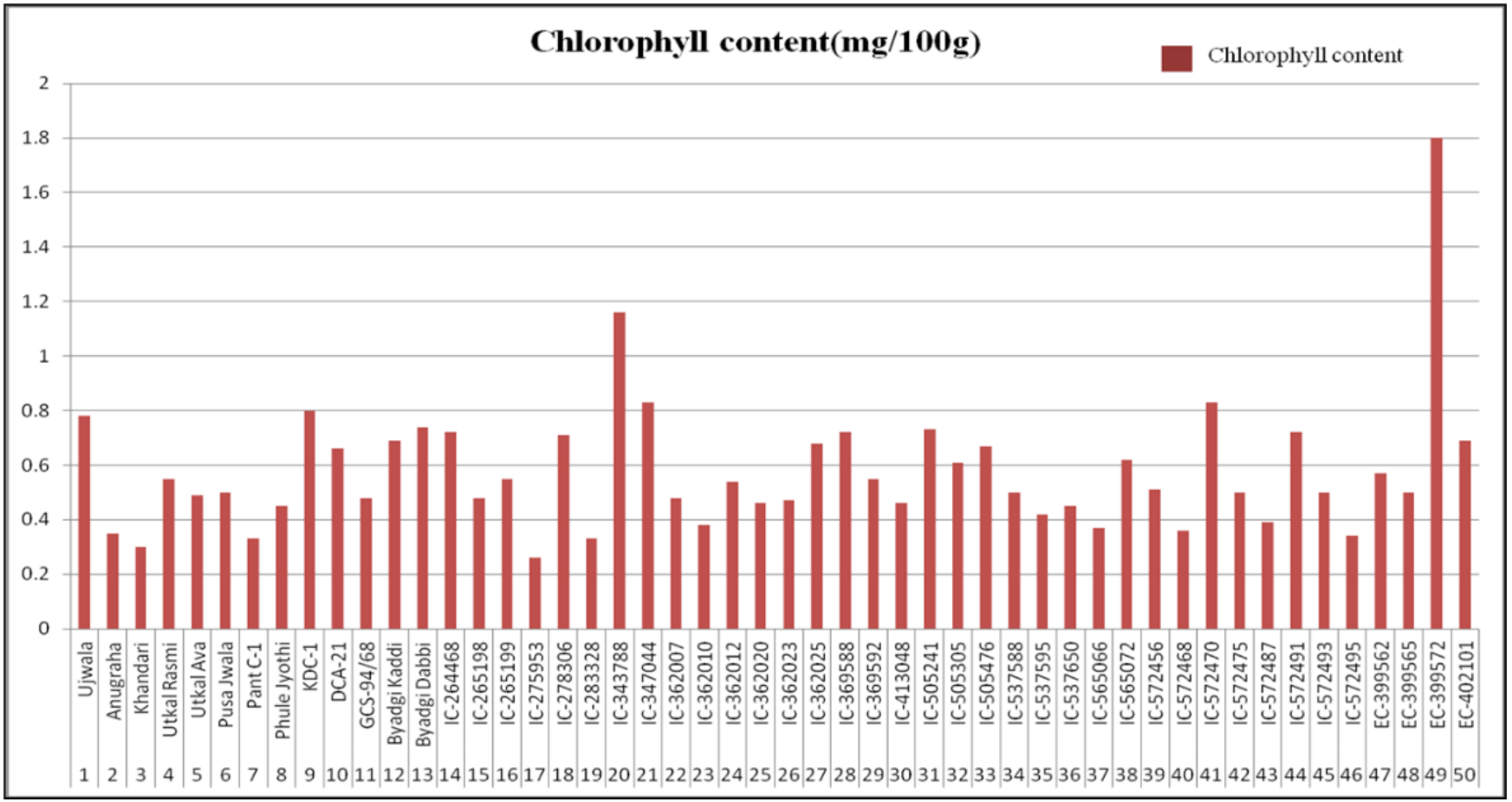

Fig. 2. Performance of chilli genotypes for quality parameters (Chlorophyll content)

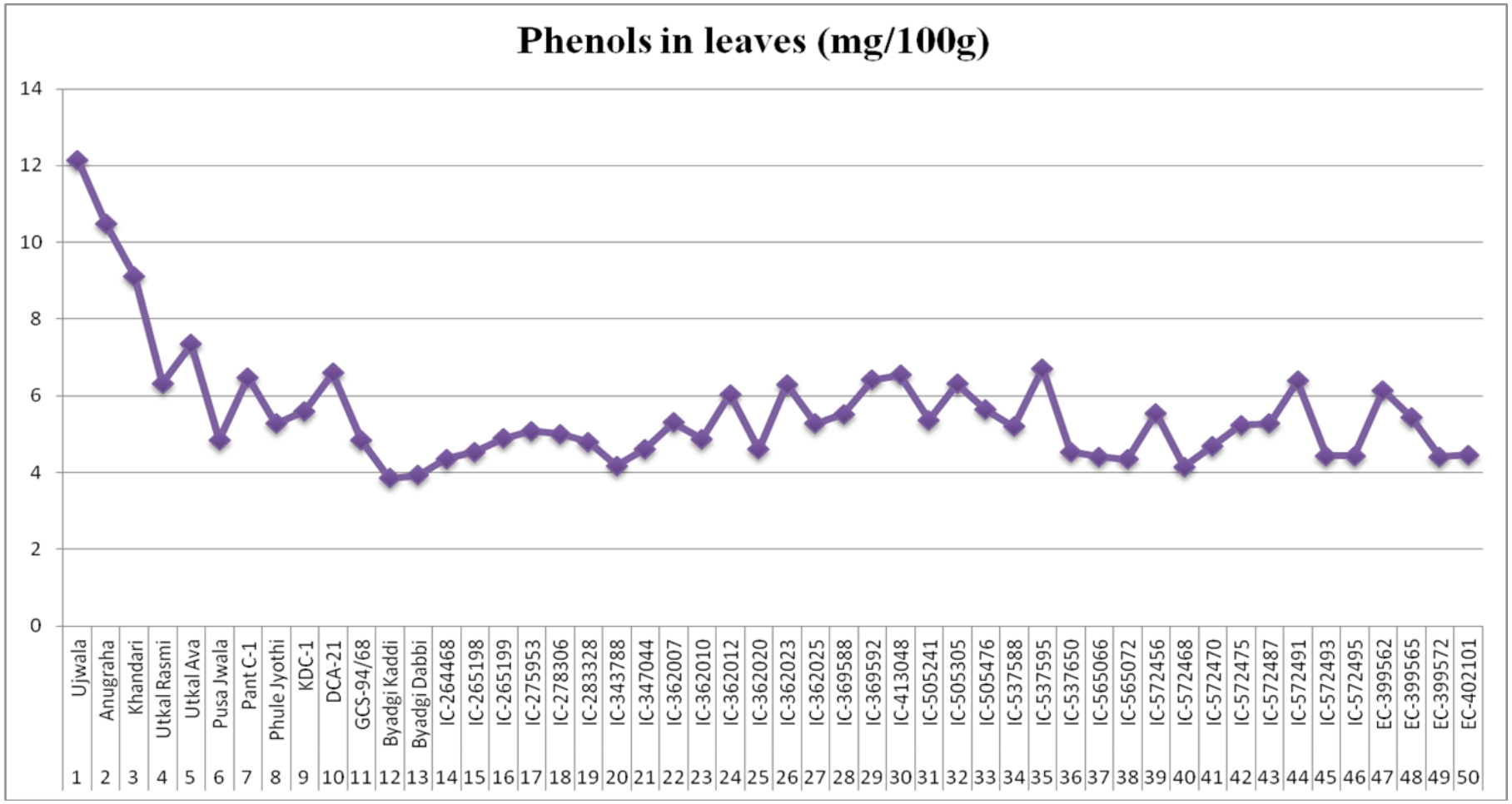

Fig. 3. Performance of chilli genotypes for quality parameters (Phenols)

3.4 Chlorophyll Content in Leaves (mg/100g)

Chlorophyll content in green leaves varied from 0.26 mg/100g to 1.80 mg/100g with a mean of 0.58 mg/100g. High chlorophyll content was seen in the genotype EC-399572 (1.80 mg/100g) followed by IC-343788 (1.16 mg/100g) in green leaves of chilli (Fig. 2). Similar findings were reported in the earlier findings by Saisupriya et al. [14].

3.5 Phenols in Leaves (mg/100g)

Phenol content in leaves in the genotypes varied between 3.86 mg/100g to 12.15 mg/100g with an average mean of 5.56 mg/100g. High phenol content was observed in the cultivar Ujwala (12.15 mg/100g) followed by Anugraha (10.49 mg/100g) leaves of chilli (Fig. 3). Similar findings was reported by Patel et al. [15], Sonaniya et al. [16], Najihah and Muhammad, [17] Ranganna et al. [18].

4. CONCLUSION

The study shows that significant amount of variation was observed among the fifty chilli accessions screened for the quality traits like ascorbic acid, chlorophyll and phenol content. The maximum amount of ascorbic acid, chlorophyll, and Phenol content was observed in the accessions like IC-572470, EC-399572, and Ujwala respectively. The above said genotypes and accessions can be further utilized as potential parenting materials for quality improvement programme in chilli.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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