The Review Of
DIABETIC
STUDIES OPENACCESS

Screening and Profiling of Pytochemical Compounds in the Teja, Byadagi and Us-341 Chilli Varieties

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Abstract
Chilli (Capsicum annuum L.) is one of the most widely cultivated spice crops and holds significant importance due to its nutritional richness, pungency, and therapeutic potential. It contains a broad spectrum of bioactive compounds along with essential nutrients, including proteins, macro- and micro-minerals, and water-soluble vitamins. The characteristic heat of chilli is primarily attributed to capsaicin, an alkaloid responsible for its sensory and biological properties. In addition to its culinary relevance, chilli has been recognised for its role in supporting human health through antioxidant and metabolic functions.The present investigation was undertaken to comparatively evaluate the phytochemical constituents, physical characteristics, mineral composition, and vitamin profile of three commercially important chilli varieties, namely Teja, Byadagi, and US-341. Systematic screening and quantitative analyses were performed using standardised laboratory protocols to assess varietal differences. The outcomes of the study demonstrate significant variation among the selected varieties in terms of their biochemical composition and nutritional attributes. Each variety exhibited distinct characteristics that influence its suitability for food processing, nutritional enhancement, and market demand. These findings provide valuable insights for breeders, food technologists, and the nutraceutical industry, highlighting the importance of varietal selection in improving the nutritional quality and commercial utilization of chilli.
Keywords: Teja chilli, Byadagichilli, US-341 chilli, Phytochemical profiling, Mineral analysis, Vitamin composition.

1. Introduction

Pungency, intense colors and multifaceted flavors belonging to the Solanaceae family, called chillies (Capsicum spp.) are of great nutritional, medicinal and economic value Tripodiet al., (2021). It has been used in culinary and named as a treasure house of bioactive compounds in the form of capsaicinoids, vitamins (A, C, E), minerals, antioxidants and dietary fiber, which are the basis of their functional and health-benefitting properties by Lal et al., (2023). Thereforechillies market is growing rapidly at a global level, in food processing, drugs, functional foods and nutraceuticals applications by Ken Research, (2025). Regional and commercially important cultivars were the big problem and created a gap in the market and it hinders the possibilities of optimizing their exploitation in dietary interventions as well as value-added product innovation by Agro crops, (2025). Henceforth it's been produced commercially valuable horticulturally, contributing to tropical as well as subtropical rural economies Efroymson et al., (2011). Chillies are a corner stone in combating micronutrient deficiency as a result of their extremely high content of vitamin C as well as minerals by Agri Bot (2024) and Sarıyer et al., (2022). Capsaicin, as being a pre-eminent molecule for pungency, has been largely held accountable for inflammation, pain and antimicrobial properties, there by yielding a high potential for a therapeutic value by Banshi Saboo et al., (2024) and Lal et al., (2023).

After ripening variety to variety, based on genetic factors, field circumstances, some varieties may have capsicum content that is higher, while others are superior in vitamin content or pigmentation content by Lahbib et al., (2023) and Lee et al., (2024). These varietal differences are very essential to farmers, processors, and consumers in meaningful decisions affecting cultivation, Use and consumption.

India is a major chilli producer and exports globally. Some of the states belong to India cultivating chilli as an economic crop namely Teja, Byadagi and US-341 for farmer economic source.

Pungency, colour, disease resistance with high yield also play the key role by Adaskaveg A and Barbara Blanco-Ulate, (2023). Hence forth details of the chemical composition and their functional profiling need to be analyzed to enhance the productivity and independent assortment of compound application by Végh et al., (2024) led foundation for new era in the market could be the feature scope of chilli cultivars hybridization and development of new verities reveals the new demand in the human health prospective to the Teja, Byadagi and US-341.

Materials And Methods

Collection and Preparation of Sample: Teja, Byadagi and US- 341(Capsicum annuum) were sourced from certified local agricultural farms and reputable spice vendors in Guntur, Andhra Pradesh, India. A threshold maximum of 5% moisture content was maintained for the selection of raw materials. Before the extraction, the stalks were removed and after that, seeds were separated from the dried fruits. Fruits (without seeds) were pulverised to a particle size of 20-30 mesh and were finally stored in an airtight container at 4 °C until use (certificate will be provided).

Phytochemical Analysis of Chilli: The phytochemical analysis of Teja chilli reveals a rich profile of compounds that contribute to its nutritional and therapeutic properties. The study highlights the presence of capsaicinoids, capsorubin, capsanthin, and other bioactive compounds, which are known for their pungency, color, and potential health benefits. The analysis also indicates the presence of carotenoid pigments, which are responsible for the red color of the Chilli. These compounds, along with other phytochemicals, play a significant role in the health benefits associated with Teja chilli.

Proximate Composition Analysis: The proximate composition of the chilli samples was determined using standard analytical methods as prescribed by the Association of Official Analytical Chemists (AOAC International, 2023).

Statistical analysis: All the experiments were performed using three replicates. Datasets were analyzed using R (version 4.3.2). The effects of drying methods on the total phenolics, antioxidant properties, and color changes of Chilli powder were examined using one-way analysis of variance (ANOVA). Tukey's HSD test was used for post-hoc comparisons to identify significant differences at $p<0.05$.

Results And Discussion

Teja, Byadagi, and 341 chilli varieties detailed profiling has done which includes physical, proximate chemical, and vitamin analysis resulted findings suggest that individual variant has its own composition variability with one another. And also predictable varietal differences, with unique potentiality for diverse culinary, nutritional, and industrial applications reported by Locally grown 341 chilli variety outshines Teja, Byadagi at Guntur market; (2025), Times of India news paper.

Physical Properties: 90 samples (30/variety) were screened for morphological or textual examination or physical features of the individual variant found one another among the three had shown different morphological features incorporated similar studies carried out by Brar et al., (2025) in the below Table: 1. In the present research findings Byadagichilli was conformed that having highest and suitable qualities for marketing because easy drying with the following pod dimensions, median length, greater than 11cm, weight 1.4g, arithmetic mean diameter 75 mm, and surface area upto110.5mm². In the case of Teja pods were 7 and 9 cm in length and a median weight 0.65g comparatively it was the small and compact variety. But in the case of US-341 found intermediate physical traits rather than byadagi and Teja chilli pods but notably had the highest pod width, median1.7 cm, indicating a potentially fleshier fruit compared and similar results found by Angelo, (2019). The sphericity values were consistently low, with a mean of 0.034, across all varieties, confirming the typical elongated, non-spherical shape of chilli pods similar findings could be compared with agro crop publishers, (2025). These physical distinctions are not merely aesthetic; they directly influence post-harvest handling, drying kinetics, and consumer selection was compared with Kelvine, (2013) research findings. Byadagi's larger size may make it preferable for whole-pod products, while Teja's compactness could be advantageous for grinding into uniform powders similar results obtained by Meghana et al., (2025).

Table: 1: Teja, Byadagi and US-341 chilli varieties Morphological features:

	Length	Stalk Length	Thickness	Width	Weight	Da	Dp	Sphericity	Surface Area
count	90	90	90	90	90	90	90	90	90
mean	9.95111	4.121111	0.477778	1.27222	1.03889	52.6073	20.045778	0.033889	62.9962

Std	2.138 16	0.50313 5	0.156 347	0.37 537	0.42 513	8.14 623	3.2212 16	0.005 547	10.1242
Min	6.5	3	0.2	0.3	0.39	39	14.34	0.02	45.06
25	8.2	3.7	0.4	1	0.70	45.6	17.91	0.03	56.28
%					25	6			
50%	9.65	4	0.5	1.2	0.96	52.8 3	19.735	0.03	62.02
75%	11.47 5	4.475	0.6	1.6	1.41 75	57.9 15	21.667 5	0.04	68.0925
Max	15.5	5.2	1	2.1	2.14	75.3 3	34.85	0.04	109.52

Table: 2: Teja, chilli variety Morphological features:

Sl. No	Leng th of Peric arp (cm)	Len gth of Stal k (cm)	Thick ness (cm)	Wi dth (c m)	Wei ght (gm)	Da A. M (m m)	Dp G.M(mm)	Spheri city mm	Surf ace area mm 2
1	8.5	3.5	0.5	0.9	0.41	44. 6	17.54	0.04	55.1 2
2	8	4	0.5	0.9	0.59	44. 66	17.54	0.04	55.1 2
3	7	4	0.5	0.9	0.75	41. 66	18.11	0.04	56.9 1
4	8.2	5	0.6	0.9	0.55	49	17.97	0.03	56.4 7
5	8.4	3.5	0.4	1.1	0.5	44. 33	16.82	0.04	52.8 6
6	8.2	4	0.4	1	0.78	46. 33	20.44	0.04	64.2 4
7	7.4	3.5	0.7	1	0.62	41. 33	17.59	0.04	55.2 8
8	7.2	3.5	0.5	1	0.62	41. 66	19.75	0.04	62.0 7
9	7.5	4.5	0.6	1.2	0.6	45	18.17	0.04	57.1
10	8	4	0.5	1	0.63	46. 33	21.6	0.04	67.8 8
11	7.4	4.4	0.7	1.2	0.51	44	17.82	0.04	56
12	8	4	0.6	0.8	0.62	45. 66	19.93	0.04	62.6 3
13	7.8	3.8	0.6	1.1	0.48	43. 66	17.96	0.04	56.4 4
14	8.3	4.5	0.5	1	0.83	47. 33	17.92	0.04	56.3 2
15	8.1	4	0.5	0.9	0.58	45. 33	18.22	0.04	57.2 6
16	8.7	3.5	0.5	1	0.61	46	18.02	0.04	56.6 3
17	8.2	3.5	0.4	1.2	0.74	43. 66	15.68	0.04	49.2 8
18	7.6	4.5	0.3	1.1	0.71	45	17.97	0.04	56.4 7
19	8.3	3.5	0.6	0.8	0.75	44	16.77	0.04	52.7
20	8	4.3	0.4	1	0.46	46	18.79	0.04	59.0 5
21	6.5	3.5	0.6	0.9	0.6	39	18.17	0.04	57.1
22	9	4.4	0.5	1.2	0.83	49. 33	17.5	0.03	55

23	8	4	0.4	1	0.49	45	18.64	0.04	58.58
24	7.2	3.8	0.6	0.9	0.78	41	15.82	0.04	49.72
25	7.8	4.5	0.4	0.9	0.63	44.66	14.34	0.04	45.06
26	8.2	5	0.3	0.8	0.44	49.33	20.36	0.04	63.98
27	8.9	4	0.8	0.8	0.5	47.66	17.28	0.04	54.3
28	7.5	3.5	0.4	1	0.94	42	18.22	0.04	57.26
29	8.5	4	0.5	1.1	0.39	45.66	15.87	0.04	49.87
30	7.3	3.5	0.4	0.8	0.48	41.33	18.11	0.04	56.91

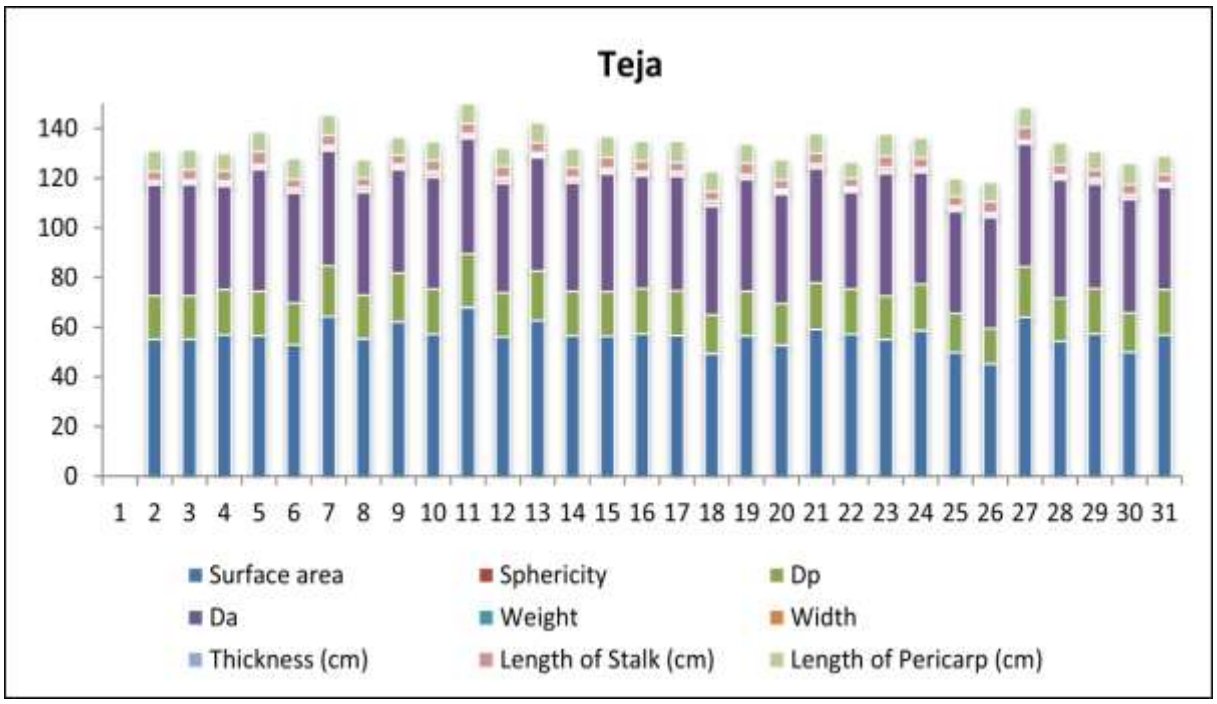


Table: 3: Byadagi, chilli variety Morphological features:

Sl. No	Length of Pericarp (cm)	Length of Stalk (cm)	Thickness (cm)	Width (cm)	Weight (gm)	Da A.M (mm)	Dp G.M (mm)	Sphericity mm	Surface area mm 2
1	15.3	5.2	0.8	1.3	1.57	75.33	27.72	0.02	87.12
2	15.3	5	1	1.2	2.14	75	28.98	0.02	91.08
3	11.4	4.3	0.5	1	1.74	57.33	19.87	0.03	62.44
4	14.2	4.2	0.9	0.3	1	67	23.66	0.03	74.36
5	9.6	3.5	0.4	0.8	0.98	47.66	16.12	0.03	50.66
6	10.8	3.6	0.6	1.2	1.1	54	21.8	0.03	68.51

7	11.5	5	0.5	1.1	1.21	60.33	20.85	0.03	65.52
8	10	3.3	0.3	1	0.7	48.66	15.86	0.03	49.84
9	9	5	0.6	1.2	1.14	52.66	21.6	0.03	67.88
10	11.5	4	0.6	1.1	0.98	57.33	21.7	0.03	68.2
11	10.5	4	0.6	0.9	0.82	53.33	19.85	0.03	62.38
12	12	4.4	0.6	1	1.09	60	21.42	0.03	67.32
13	8.5	3.5	0.5	0.9	1.48	44.66	17.54	0.04	55.12
14	11	4.4	0.6	1.1	1.05	57	21.66	0.03	68.07
15	8.3	3.7	0.6	1.1	0.8	45.66	19.93	0.04	62.63
16	12.5	3.5	0.4	1.2	0.87	58.66	19.72	0.03	61.97
17	12	4	0.4	1	0.83	58	18.56	0.03	58.33
18	8	4.5	0.6	1.1	0.94	47.33	20.2	0.04	63.48
19	8	3.6	0.4	1.2	0.74	44	17.72	0.04	55.69
20	14	4.9	0.3	1	0.85	67.33	17.83	0.03	56.03
21	14.5	4.9	0.4	1.3	1.62	57	20	0.03	62.85
22	13.5	4	0.7	1	1.23	64	23.05	0.03	72.44
23	15.5	4.5	0.7	1.1	1.81	72.66	24.87	0.03	78.16
24	13	4.5	0.5	1.5	1.38	65	23.58	0.03	74.1
25	13.3	5	0.4	1.2	1.34	66.33	20.63	0.03	64.83
26	12	5	0.6	1.6	1.64	64	25.36	0.03	79.7
27	10.5	3.8	0.7	1.8	0.9	56	26.21	0.03	82.37
28	11.5	4.7	0.7	1.3	1.61	60.66	24.51	0.03	77.03
29	13.5	3	0.6	1	0.72	60.33	21.47	0.03	67.47
30	11	4.2	0.5	1.3	1.65	56.66	21.45	0.03	67.41

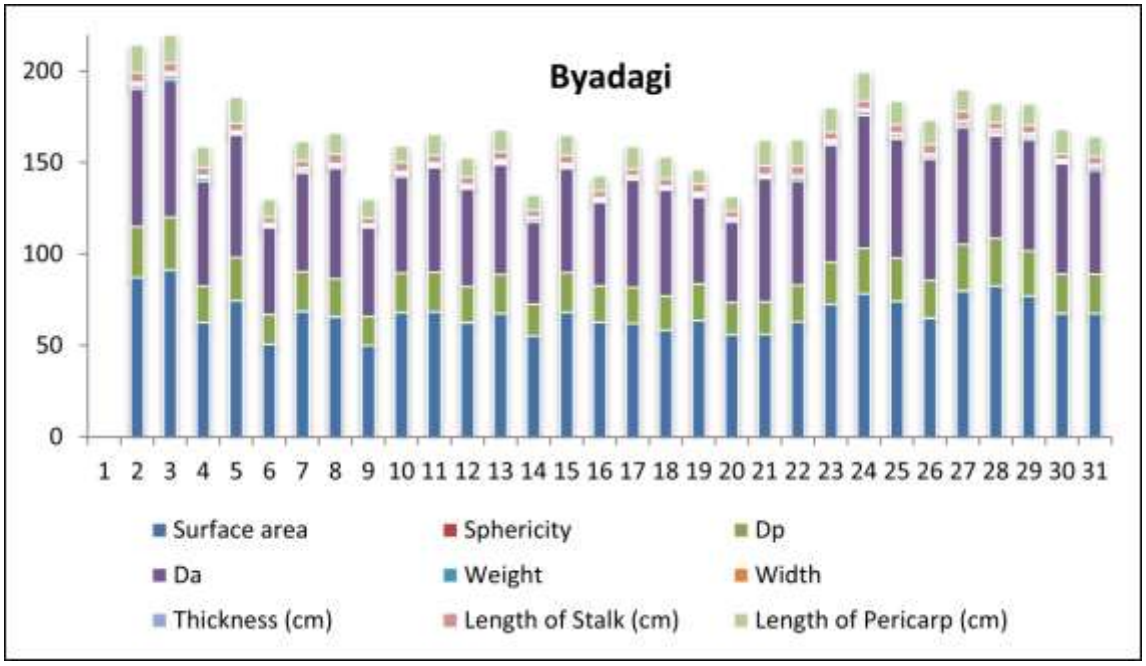
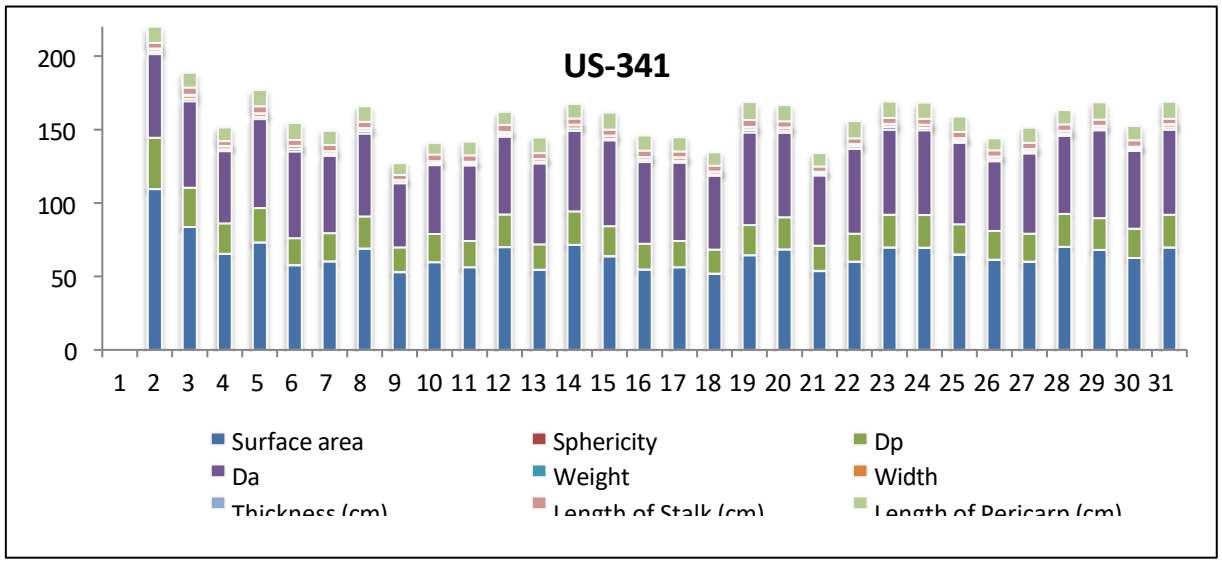


Table: 4: US-341, chilli variety Morphological features:

Sl. No	Length of Pericarp (cm)	Length of Stalk (cm)	Thickness (cm)	Width (cm)	Weight (gm)	Da A.M (mm)	Dp G.M (mm)	Sperocity mm	Surface area mm 2
1	11	3.7	0.6	1.8	1.47	57	34.85	0.03	109.52
2	10	5	0.6	2.1	1.62	59	26.63	0.03	83.69
3	9.3	3.2	0.4	1.8	1.47	49	20.8	0.04	65.37
4	11	4.8	0.4	2	1.48	60.66	23.29	0.03	73.19
5	11.5	4	0.2	2	1.62	59	18.37	0.03	57.73
6	9.6	4.2	0.3	1.7	1.29	52.66	19.16	0.03	60.21
7	10.5	4.2	0.4	1.8	1.59	56.33	21.95	0.03	68.98
8	8	3.4	0.3	1.4	0.61	43.66	16.85	0.04	52.95
9	7.8	4.5	0.4	1.4	0.8	47	19.02	0.04	59.77
10	9.3	4.4	0.3	1.4	0.85	51.33	17.91	0.03	56.28
11	9	4.8	0.5	1.6	1	53	22.26	0.03	69.96
12	10.5	4	0.2	1.8	1.17	55	17.34	0.03	54.49
13	10	4	0.4	2.1	1.7	55	22.74	0.03	71.46
14	11.5	4	0.3	1.8	1.08	58.66	20.3	0.03	63.8
15	10.3	4.4	0.2	1.8	1.48	55.66	17.42	0.03	54.74
16	9.7	4	0.2	2.1	1.3	53.	17.	0.03	56.2

						33	91		8
17	9.2	4	0.2	1.7	0.8	50.33	16.49	0.04	51.82
18	12	4.9	0.3	1.7	1.78	63	20.5	0.03	64.42
19	11.1	4.1	0.4	1.7	1.43	57.66	21.78	0.03	68.45
20	9.1	3.7	0.3	1.3	0.81	48	17.09	0.04	53.71
21	11.8	3.7	0.3	1.5	1.64	57.66	19.1	0.03	60.02
22	11.2	4	0.4	1.8	1.77	58	22.2	0.03	69.77
23	11	4.1	0.4	1.8	1.65	57.66	22.15	0.03	69.61
24	10.5	4.2	0.4	1.5	1.33	55.33	20.66	0.02	64.93
25	8.3	4.1	0.4	1.5	1.24	47.66	19.52	0.04	61.34
26	10.3	4.2	0.3	1.6	1.16	54.66	19.09	0.03	59.99
27	9.7	4.2	0.5	1.6	1.32	53.33	22.32	0.03	70.14
28	11.7	4.2	0.4	1.6	1.17	59.66	21.67	0.03	68.1
29	9.8	4.3	0.4	1.4	1.07	53	19.91	0.03	62.57
30	11.5	3.7	0.4	1.8	1.45	58	22.2	0.03	69.77



Teja, Byadagi and US-341 chilli varieties Morphological features:

Teja chilli has obtained results namely 9 cm length pericarp, length of stalk was 4.5 cm, thickness was 0.7 cm, width of the seed 1.1 cm weight of the pericarp 0.94 gm, 0.04 mm sphericity and 63.98mm2 diameters in size description. Byadagi has shown comparatively highest length, greater than 15cm, length of the stalk 5.2 cm in diameters, pod weight, approximately 1.74g, sphericity 0.04 mm, pod diameter 75 mm, and surface area up to 68mm². Obtained physical parameters said that the chilli was larger in size and greater surface area indicates that well-suited for drying processes due to enhanced exposure. These characteristics enhance the product manufacturing. US-341 has shown intermediate characters comparatively byadagi and tejachillivarities, but notably had the highest pod width, 2.1cm, indicating a potentially fleshier fruit. The sphericity values were consistently low, with a mean of 0.03, across all varieties, confirming the typical elongated, non-spherical shape of

chilli pods similar reported by Joshi, Udit et al., (2021).

Morphological characterization of present investigation helps to develop the desirable fruit verities to meet the demand of the present market and also enhance the cultivation practice. Similar findings were reported by Joshia et al., (2020). Fruit diameter is a crucial morphological trait influencing both consumer preference and industrial applications. Narrow fruited genotypes are often associated with higher pungency and are preferred for spice production, whereas broader fruits may be desirable for fresh consumption, stuffing, or processing. The predominance of medium-sized fruits suggests a balanced genetic diversity within the germplasm, providing opportunities for breeding programs to develop varieties tailored to specific market demands. Understanding such variations in fruit morphology is essential for cultivar improvement, ensuring enhanced adaptability and marketability of chilli genotypes. The findings are in line with Parthsinh et al., (2019) and Saisupriya et al., (2020).

Preliminary Phytochemical Analysis:

Qualitative Tests: phytochemical analysis have shown medicinal applications, bioactive compounds was there in the three samples had shown contrast results with the preliminary screening of Teja, Byadagi and US-341 chilli verities data presented in the Table: 5. Obtained results in the case of carbohydrates concentration found more than 39.7% rather than the remained two strains of chillivarities. In the case of total sugars were reported zero in the case of Byadagi variety comparatively remained two chilli verities were tested. To find out the total phenols and tannins analyzed with Ferric chloride test obtained results were more than 249mh/mL concentration. In the case of Flavanoids Alkaline Reagent Test conducted to check the concentration of Flavonoids and have shown the more than 3 mg/mL Teja chillies but remained under 2 to 3 mg/mL concentration. Absolutely there is no traces of saponins conformed by foam test. Steroids were in the form of glucosides present in the three chillivarities cases. Steroid tests showed very weak presence in all the cases whereas terpenoid test did not positive result in all the cases. Alkaloid test showed very mild concentrations.

Table: 5: Qualitative Analysis:

Test Parameter	Test Method	Teja chilli	Byadagi	US-341
Carbohydrate	Fehling Test	++	++++	++
	Benedict Test	+++	++++	+++
	Molisch Test	++++	++++	+++
	Iodine Test	-	-	-
Phenols & Tannins	Phenols & Tannins	++++	++++	+++
Flavonoids	Alkaline Reagent Test	+++	++++	+++
Saponins	Saponin Test	+		
Glucoside	Salkowski Test	+++	++	+++
	Keller-Kiliani Test	+	_	_
Steroid	Steroid Test	+	+	+
Terpenoid	Terpenoid Test	-	-	-
Alkaloid	Alkaloid Test	-	-	-

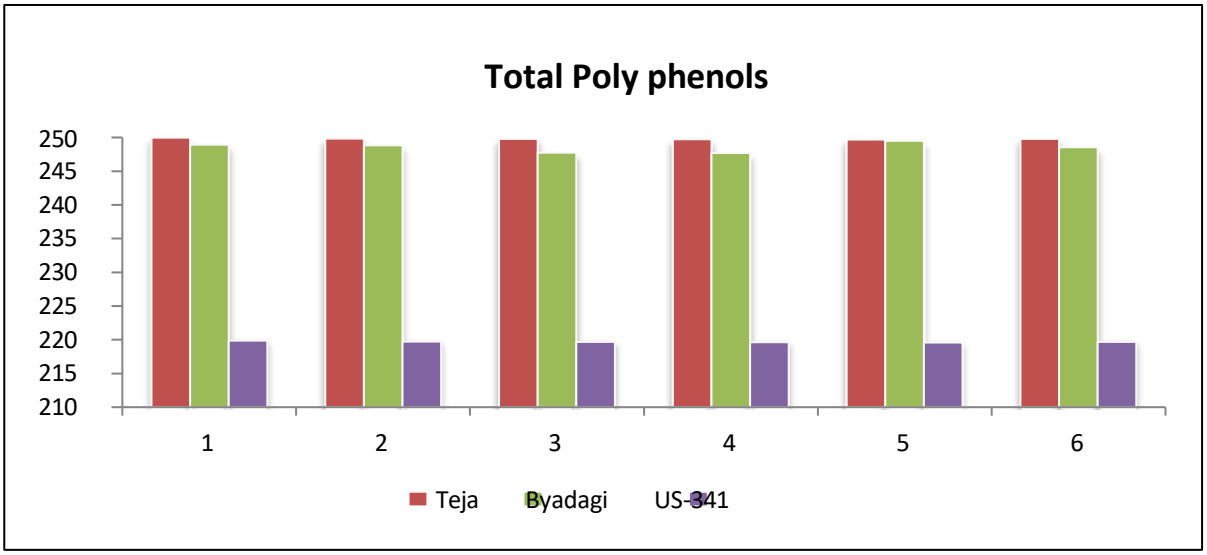
Quantitative Analysis:

Total poly phenols: Both the phenolic compounds and tannins with flavanoids were the highest concentration of secondary metabolites of the plant by Singh et. al.,(2007). These two kinds of bioactive compounds have much biological application and such as antiapoptosis, antiaging, anticarcinogen, antiinflammation, antiatherosclerosis, cardiovascular protection and improvement of endothelial function, as well as inhibition of angiogenesis and cell proliferation activities reported by Han et. al., (2007). Mostly phenolic compounds have shown the best antioxidant activity in the many kinds of plants rather than chilli observed by Brown & Rice-Evans, (1998); Krings& Berger, (2001). Tannins also one kind of phenolic derivative and that have participated in the protein synthesis reported by Yadav &Agarwala, (2011). In the present study, fruit exhibited total phenols 219 to 249 (US-341, Byadagi and Teja chilli) concentrations found in the three types of varities of chilli that shows the strong antioxidant activity.

Table: 6

Sl. No	Teja	Byadagi	US-341

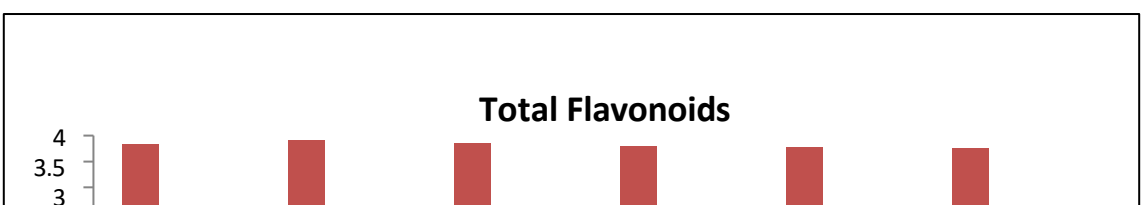
1	249.95	248.91	219.85
2	249.85	248.85	219.75
3	249.8	247.75	219.68
4	249.75	247.68	219.62
5	249.68	249.52	219.58
6	249.8	248.54	219.69



Total Flavanoids: Flavonoids also known as hydroxylated phenolic compounds and are used screen for antimicrobial activity with high antioxidant activity reported by Yadav &Agarwala, (2011). Antimicrobial activity because of the complex formation with extracellular and soluble proteins and to complex with bacterial cell wall observed by Marjorie, (1996). Flavonoids are powerful antioxidants that help neutralize free radicals and oxidative stress, protecting cells from damage and aging. They also possess antimicrobial properties as well as UV protection ability helping in plant defense. Present study reveals that the Teja, US-341 and Byadagi strains gradual decree in respective of their names given 3.9mg, 2.6 and 1.5mg concentrations. Flavonoids may have strong anti-inflammatory and cardioprotective properties.

Table: 7: Teja, Byadagi and US-341 chillis total flavanoids:

Sl.No	Teja	Byadagi	US-341
1	3.82	1.45	2.46
2	3.91	1.48	2.49
3	3.85	1.47	2.48
4	3.8	1.45	2.45
5	3.78	1.46	2.46
6	3.75	1.43	2.44



Proximate Chemical Analysis: Mineral compound analysis was observed in this analysis but not covers all the macro and micro elemental presence or absence and screened and enlisted the mineral composition of the three verities reported by similar findings in OmeeraAyob et al., (2021) in the Table: 8. A one-way ANOVA confirmed that all differences were statistically significant ($p < 0.001$) in Table: 8.

Table: 8: Mean and Standard Deviation of Proximate and Chemical Composition of Chilli Varieties.

Component	Mea n	Standa rd Deviati on	Component	Mean	Standa rd Deviati on
Moisture_Teja	12.0 42	0.2521 31	Protein_Teja	0.628	0.0637 97
Moisture_Byadag i	11.0 2	0.0724 57	Protein_Byadagi	0.878	0.0571 84
Moisture_341	11.0 94	0.1575 75	Protein_341	0.374	0.0512 84
Total Ash_Teja	4.62	0.2060 34	Fat_Teja	0.338	0.0277 49
Total Ash_Byadagi	5.27 6	0.1205 4	Fat_Byadagi	13.01 6	0.0482 7
TotalAsh_341	4.80 4	0.1757 27	Fat_341	0.448	0.0258 84
Soluble Ash_Teja	3.27 8	0.0506 95	Carbohydrate_Tej a	1.31	0.0254 95
Soluble Ash_Byadagi	3.47	0.0946 04	Carbohydrate_By adagi	16.62 2	0.0414 73
SolubleAsh_341	3.50 6	0.0691 38	Carbohydrate_341	1.918	0.0526 31
Insoluble Ash_Teja	1.37 6	0.0658 03	Energy Value_Teja	142.4 2	1.5515 8
Insoluble Ash_Byadagi	1.22 8	0.0370 14	Energy Value_Byadagi	56.80 2	0.0892 75
Insoluble Ash_341	0.88 4	0.0931 67	EnergyValue_341	58.75 6	0.0779 74
CrudeFibre_Teja	5.43 2	0.0192 35	Iron Content_Teja	1.462	0.0238 75
CrudeFibre_Byad agi	5.57 8	0.0443 85	Iron Content_Byadagi	19.82 4	0.1085 36
CrudeFibre_341	6.08 8	0.0228 04	IronContent_341	1.448	0.0481 66
			Calcium Content_Teja	249.8 06	0.1021 27
			Calcium Content_Byadagi	248.5 42	0.7995 44
			CalciumContent_ 341	219.6 96	0.1073 78

Table: 9: One-Way ANOVA Results for Proximate and Chemical Composition of Chilli Varieties.

Component	F-value	p-value	Significant (p< 0.05)
Moisture	52.0199	0.000001	Yes
Total Ash	19.5475	0.000168	Yes
SolubleAsh	13.8258	0.000768	Yes
InsolubleAsh	66.4645	0	Yes
Crude Fibre	622.1608	0	Yes
Protein	95.5446	0	Yes
Fat	211338.4668	0	Yes
Carbohydrate	219374.8171	0	Yes
Energy Value	14798.9066	0	Yes
Iron Content	115003.5133	0	Yes
Calcium Content	6579.7888	0	Yes

Table No: 9: explains about the extreme composition of the Byadagi variety. It possessed an exceptionally high fat content, 13.02 percent, dropped values found in Teja, 0.34 percent, and US-341,
0.45 percent reported due to high carbohydrate content, 16.62, resulting from the increasing effect of these macronutrients. In contradiction, Byadagi recorded the lowest energy value, 56.80 kilocalories per 100 grams, while Teja, with moderate carbohydrates and low moisture, showed the highest,
142.42 kilo calories per 100 grams. Furthermore, Byadagi demonstrated a phenomenal mineral profile, particularly for iron, 19.82 milligrams per 100 grams, a concentration nearly 13 times greater than that in Teja and 341, approximately 1.45 milligrams per 100 grams. This positions Byadagi as a potent dietary source for combating iron deficiency. Protein content was also highest in Byadagi, 0.88 percent, while variety 341 led in crude fibre, 6.09 percent, suggesting its potential for fibre-enriched food applications were similar reports by Mohd Ali et al., (2025).
Vitamin Profiles: present analysis for vitamins present in the given varities of chilli, among the three each variety has a unique antioxidant and micronutrient quantity incorporated in the Table: 9. The ANOVA results confirmed statistically significant differences ($p < 0.05$).

Table: 10: Standard Deviation of Vitamin Content in three Chilli Varieties:

Component	Mean	Standard Deviation
VITAMINC_Teja	101.381667	4.946273
VITAMINC_Byadagi	85.79	3.73686
VITAMINC_341	68.77	4.565151
VITAMINA_Teja	2257.8	189.64472
VITAMINA_Byadagi	1811.466667	153.207398
VITAMINA_341	1318.133333	111.410712
VITAMINE_Teja	1.896667	0.053914
VITAMINE_Byadagi	2.353333	0.068313
VITAMINE_341	0.88	0.055857
VITAMINB6_Teja	0.062	0.021354
VITAMINB6_Byadagi	0.164	0.018547
VITAMINB6_341	0.201667	0.031252

VITAMINB9_Teja	24.216667	2.744884
VITAMINB9_Byadagi	29.481667	2.372454
VITAMINB9_341	19.34	2.877909

Table: 11: One-Way ANOVA Results for Vitamin Content in Chilli Varieties

Component	F-value	p-value	Significant($p < 0.05$)
VITAMINC	80.7976	0	Yes
VITAMINA	55.3472	0	Yes
VITAMINE	957.4751	0	Yes
VITAMINB6	52.9017	0	Yes
VITAMINB9	21.5929	0.000038	Yes

Teja was the better source of the water-soluble antioxidant Vitamin C 101.38mg and fat-soluble Vitamin A 2257.80µg or 2.25mg. In the case of vitamin A richness in the Teja chilli because of presence of carotenoids namely beta-carotene, it gives rich red colour to the pod, due to that benefit the vision and immunity similar research findings got by Muhammad Abdullah et al., (2023). In contrast, Vitamin E 2.35mg is a strong lipid-soluble antioxidant in the byadagichilli variety. In the case of US-341 chilli variety consists of B-complex vitamins, richest in Vitamin B6 0.202 mg, necessary for amino acid metabolism, and also richest in folate or Vitamin B9, 29.48 µg, necessary for cell division and synthesis of DNA similar findings obtained by Maimunah Mohd Ali et al., (2025). Teja for immunity and vision (Vitamins A and C), Byadagi for antioxidant defense as well as prenatal health (Vitamins E and B9), and 341 for metabolic well-being (Vitamin B 6) similar studies and resulted by Azlan et al., (2022). Profiling of Teja, Byadagi, and US-341 chilliesvitamine analysis and proximate chemical analysis indicates that each individual variety have unique identities that control their optimal use.

Conclusion:

present research findings suggest that the Teja, Byadagi, and US-341 chillies are independent in their functional and morphological proximal composition differences with lots of applications. Iron content useful for natural colorant and mineral concentrate applications seen in the case of Byadagichilli. Teja was found as the richest source of vitamin C and vitamin A, with immunological and visual health applications. Variety US-341 yielded the greatest fiber and vitamin B6, thus providing digestive and metabolic health benefits. For nutritionists as well as functional food industries, there is demonstration of variety selection tailoring potential in correcting micronutrient deficiencies and functional food innovation. Future scope of research focuses on bioavailability of nutrients and correlation of compositional variations with sensory and pungency attributes in order to reinforce applications in nutraceutical and food technology industries.

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References:

1. Ken Research (2025). India's ₹40,000 Crore Chilli Market: From Export Dominance to the Challenge of Sustainable Growth.
2. Agro crops (2025).The Future of Chillies: Global Demand, Indian Exports & Price Trends: India: Market Stabilization and Policy Support.
3. Agri Bot (2024).Management Of Micronutrients In Chilli Crop,.
4. Banshi Saboo, Amit Gupta, Mangesh Tiwaskar, Shashank Joshi, Anuj Maheshwari, Lakshminarayanappa Sreenivasa Murthy, Jayanta Panda, Narsingh Verma, JothydevKesavadev, Swati Srivastava, Divya Saxena, Arumugam Muruganathan, Smita Singh, Atul Sharma, Fortifying Micronutrient Supplementation in India: Expert Consensus by the American College of Physicians (India Chapter) (2024); Journal of the Association of Physicians of India, Vol 72 (4):81-90.
5. Jaclyn A Adaskaveg, Barbara Blanco-Ulate, (2023). Targeting ripening regulators to develop fruit with high quality and extended shelf life,Current Opinion in Biotechnology, Vol (79):

6. Lahbib, K.; Bnejdi, F.; Pandino, G.; Lombardo, S.; El-Gazzah, M.; El-Bok, S.; Dabbou, S.(2023). Changes in Yield-Related Traits, Phytochemical Composition, and Antioxidant Activity of Pepper (Capsicum annuum) Depending on Its Variety, Fruit Position, and Ripening Stage. Foods: Vol:12 (21):3948.
7. Adaskaveg A and Barbara Blanco-Ulate, (2023).Targeting ripening regulators to develop fruit with high quality and extended shelf life Jaclyn Current Opinion in Biotechnology: 79:
8. Végh, R., Sipiczki, G., Csóka, M., Mednyánszky, Z., Bujna, E., & Takács, K. (2024). Chemical Characterization, In Vitro Analysis of Functional Properties, and Volatile Profiling of Sixteen Nutraceuticals Marketed as "Superfood". Applied Sciences, 14(23), 11069.
9. Locally grown 341 chilli variety outshines Teja, Byadagi at Guntur market; (2025), Times of India news paper.
10.Brar, D.S., Singh, B. & Nanda, V. (2025). Comprehensive profiling of prominent Indian red chilli powder varieties: physicochemical properties, bioactive constituents, and specific volatile compound analysis. Eur Food Res Technol, Vol: 251, 4397–4427.
11.Meghana HR, Maheshwarappa HP, Maruthi Prasad BN, Vijakumar B Narayanpur, Prabhudeva S Ajjappalavara, Fakruddin B and Lakshmidevamma TN (2025). Assessment of variability for distinctness, uniformity and stability in Byadagichilli genotypes, International Journal of Advanced Biochemistry Research 2025; 9(2): 332-335.
12.Angelo (2019). A Gardener's Guide to Identifying Different Chilli Species.
13.Kelvine, (2013).19 types of Trees With Long Seed Pods (With Pictures).
14.Joshi, Udit & Rana, Deepak & Singh, Vivek & Bhatt, (2021). Morphological characterization of chilli (Capsicum annum L.) genotypes. 10.13140/RG.2.2.14397.28642.
15.Mohd Ali M, Khalid NI, Wondi MH, Haris NIN, Megat Ahmad Azman PN. (2025). Exploring the nutritional values, volatile compounds, health benefits, and potential food products of chilli (Capsicum annuum): A comprehensive review. Food Chem, Epub 2025.
16.OmeeraAyob, Peerzada Rashid Hussain, Prashant Suradkar, Farah Naqash, Sarver Ahmed Rather, Sweta Joshi, Z.R. Azaz Ahmad Azad, (2021). Evaluation of chemical composition and antioxidant activity of Himalayan Red chilli varieties, LWT, Vol (146):2021.
17.Azlan A, Sultana S, Huei CS, RazmanMR.(2022).Antioxidant, Anti-Obesity, Nutritional and Other Beneficial Effects of Different Chilli Pepper: A Review. Molecules.Vol:28; 27(3):898.
18.Muhammad Abdullah; Radia T. Jamil; Fibi N. Attia. (2023), vitamin c Ascorbic Acid: NIH, National centre for Biotechnology Information.
19.Maimunah Mohd Ali, Nurul Izzah Khalid, Mohd HafizzWondi, Nur Izzah Nabilah Haris, PuteriNurainMegat Ahmad Azman, (2025). Exploring the nutritional values, volatile compounds, health benefits, and potential food products of chilli (Capsicum annuum): A comprehensive review, Food Chemistry, Vol (490):2025. Almeida, B., Feitoza, L., Lopes, Â., Gomes, R., Almeida, R., Martins, L., … and Silva, V. (2023). Morphological diversity among Brazilian Capsicum peppers. Ciência Rural, 53(1).
20.AOAC International (2023) Official methods of analysis: 22nd edition. Oxford University Press https://doi.org/10.1093/9780197610145.002.001 (Accessed: 15 July 2025).
21.Bharathi, S. and Ganapathy, D. (2024). Exploration of Sargassum wightii: extraction, phytochemical analysis, and antioxidant potential of polyphenol. Cureus.
22.Chauhan, D. and Sharma, S. (2024). Biochemical analysis of fruiting bodies of Cordyceps militaris grown on brown rice. Journal of Advances in Microbiology, 24(11), pp.62–69.
23.Efroymson, D., Pham, H., Jones, L., Fitzgerald, S., Thu, L., &Hiền, L. (2011).Tobacco and poverty: evidence from vietnam. Tobacco Control, 20(4), 296-301.
24.Esonu,C.(2024).Investigation of proximate composition and bioactive components in banana (Musaacuminata)peels using advanced analytical techniques. Nutrition and Food Processing, 7(10):01–09.
25.Jang, H., Choi, M. and Jang, K. (2024). Comprehensive phytochemical profiles and antioxidant activity of Korean local cultivars of red Chilli pepper (Capsicum annuum L.). Frontiers in Plant Science, 15.
26.Karim, K., Rafii, M., Misran, A., Ismail, M., Harun, A., Khan, M., … & Chowdhury, M. (2021). Current and prospective strategies in the varietal improvement of chilli (capsicum annuuml.)specially heterosis breeding. Agronomy, 11(11): 2217.
27.Komala, M.,Lakshmi,K.,&Madhavi,N. (2023).Recent advances in crop improvement of chilli(capsicum annuum l.) for high fruit yield and quality. Journal of Experimental Agriculture International, 45(8), 21-29.
Lal,B.,Kamboj,A.,Singh,V.,Singh,B.,Singh,A.,&Mishra,S.(2023).Phytochemicalandbiological propertiesof domesticated capsicum species: a review. International Journal of Plant & Soil Science, 35(18), 427-437.

28.Lee,C.,Uy,N.,Kim,C.,Kweon,O.,Lee,S.,&Lee,S.(2024).Hplc/uvquantitativeanalysisofcapsaicinoids:insights into antioxidant potential of various capsicum cultivars. Journal of Applied Biological Chemistry, 67.
29.Nilamsari,E.,Nugroho,L.andSukirno,S.(2023).BioactivecompundprofileofMuntingiacalaburaleafextractwith different polarity solvent. Syntax Literate JurnalIlmiah Indonesia, 8(10):6035–6046.
30.Nornubari, N. (2025). Bioactive analysis of Anthocleistavogelii leaves for therapeutic potential in haemolyticanaemia. Asian Journal of Biochemistry Genetics and Molecular Biology, 17(4):32–40.
31.Osman,A.,Omar,A.,Khatun,M.,Sheikh,M.,Alam,M.,Zaman,M.,…and Sayed,M.(2023).Biochemicalanalysis of Leonurus sibiricus and prediction of its bioactive compound-protein interactions in Homo sapiens. Bioresearch Communications, 10(1):1398–1412.
32.Quresh, W. (2015). Evaluation and characterization of chilli (capsicum annuuml.) germplasm for some morphological and yield characters. Pure and Applied Biology, 4(4), 628-635.
33.Ramírez-Aragón,M.,Troyo-Diéguez,E.,Preciado-Rangel,P.,Borroel-García,V.,García-Carrillo,E.,& Hernández, J.(2022). Antioxidant profile of hot and sweet pepper cultivars by two extraction methods. HorticulturaBrasileira, 40(4), 411-417.
34.Sampaio,A.,Aguilera,J.,Mendes,Â.,Argentel-Martínez,L.,Zuffo,A.andTeodoro,P.(2023).Therofthegenetic diversity of Capsicum spp. in the conservation of the species: qualitative and quantitative characterization. CiênciaeAgrotecnologia, 47.
35.Sarıyer, T., Gündoğdu, M., Akçal, A andŞeker, M. (2022). Some important chemical and aroma characteristics of some new pepper cultivars (capsicum annuumlcva 30706f1, capsicum annuuml cvkılçıkf1, capsicum annuumlcv bitter f1). Black Sea Journal of Agriculture, 5(2), 72-79.
36.Saxena, A., Raghuwanshi, R., Gupta, V., & Singh, H. (2016). Chilli anthracnose: the epidemiology andmanagement. Frontiers in Microbiology, 7.
37.Sottile, F., Napolitano, A., Badalamenti, N., Bruno, M., Tundis, R., Loizzo, M., … and Piacente, S. (2023). A new bloody pulp selection of my robalan (Prunuscerasifera L.):pomological traits, chemical composition, and nutraceutical properties. Foods, 12(5), 1107.
38.Spyrou, S., Chatzikonstantinou, A., Giannakopoulou, A., Fotiadou, R., Priska, S., Simos, Y., … and Stamatis, H. (2023). Fungal laccase-mediated enhancement of the bioactivity of green algae extracts. Catalysis Research, 03(01):1–29.
39.Tanaka, Y., Hosokawa, M., Miwa, T., Watanabe, T., and Yazawa, S. (2010). Novel loss-of-function putative aminotransferase alleles cause biosynthesis of capsinoids, non pungentcapsaicinoid analogues, in mildly pungentChilli peppers (capsicum chinense). Journal of Agricultural and Food Chemistry, 58(22): 11762-11767.
40.Tripodi,P.,Rabanus-Wallace,M.,Barchi,L.,Kale,S.,Esposito,S.,Acquadro,A and Stein,N. (2021).Global range expansion history of pepper (capsicumspp.)Revealed by over 10,000 gene bank accessions. Proceedings of the National Academy of Sciences, 118(34).
41.Xu, Z., L leras, A.andBuetti, S.(2024).Toward a better understanding of target distinctiveness in visual search: how color, shape, and texture information combine to guide search.
42.