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Majjiga Sreenivas

Department of Plantation,
Spices, Medicinal and Aromatic
Crops, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Amit Baran Sharangi

Department of Plantation,
Spices, Medicinal and Aromatic
Crops, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Swadesh Banerjee

Department of Vegetable
Science, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Tridip Bhattacharya

Department of Vegetable
Science, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Praveen Kumar Maurya

Department of Vegetable
Science, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Arup Chattopadhyay

Department of Vegetable
Science, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Correspondence**Swadesh Banerjee**

Department of Vegetable
Science, Faculty of Horticulture,
Bidhan Chandra Krishi
Viswavidyalaya, Mohanpur,
Nadia, West Bengal, India

Characterization and evaluation of indigenous and exotic genotypes for identification of spice chilli lines

Majjiga Sreenivas, Amit Baran Sharangi, Swadesh Banerjee, Tridip Bhattacharya, Praveen Kumar Maurya, and Arup Chattopadhyay

Abstract

Chilli is one of the most popular and diverse vegetable cum spice crops grown throughout the World. Variability study of agro-morphological characteristics is important for varietal improvement program. The complexity of folk nomenclature in crops generally leads to the existence of duplicates within germplasm that need to be clarified. In the present study 12 qualitative characters and 15 quantitative characters were recorded from 45 genotypes to characterize the chilli germplasm as per documented descriptor and to identify genotype (s) suitable for spice purpose. Genotypes varied considerably in plant growth habit, branching habit, leaf size, leaf shape, leaf colour through RHS colour chart, pigment at node, fruit surface, number of flowers/axil, anther colour, ripe fruit colour through RHS colour chart, fruit position and fruit shape. But significant divergence was lacking in case of seed colour, leaf margin and blossom end fruit shape. Most of the genotypes belong to *C. annuum*, and only one genotype Ujawala possessed purple anther and had two or more flowers/node was true *C. frutescens*. All the 45 chilli genotypes under study showed wide range of variations in the quantitative characters namely, plant height (37.60-110.60 cm), plant spread (E-W) (19.20-103.40 cm), plant spread (N-S) (20.46-100.60 cm), primary branches/plant (2.66-9.58), days to 50% flowering (34.42-72.54), days to ripe fruit maturity from anthesis (38.24-53.47), fruit length (13.92-95.26 mm), fruit diameter (5.26-15.92 mm), seeds/fruit (24.51-75.84), 1000 seed weight (3.97-7.36 g), fruits/plant (8.54-82.45), ripe fruit weight (0.87-8.33 g), dry fruit weight (0.20-1.61 g), ripe fruit yield/plant (22.30-267.42 g) and dry fruit yield/plant (3.88-51.70 g). Three genotypes Srinagar, BCCH Sel-4 and Beldanga were found most promising as spice chilli in respect of dry fruit yield/plant and could be recommended for large scale cultivation in the Gangetic plains of West Bengal after critical testing.

Keywords: Chilli, characterization, genotypes, dry fruit yield, spice

Introduction

The genus *Capsicum* consists of twenty-five distinct species (Baral and Bosland, 2002) [2]. Almost all *Capsicum* species are diploid with 12 chromosome pairs (Moscone *et al.*, 1996) [13]. Out of these five species are domesticated: *C. annuum*, *C. frutescens*, *C. chinense*, *C. baccatum* and *C. pubescens* (Pickersgill, 1997) [18]. *Capsicum annuum* is the most cultivated species worldwide. It is also the most important species from an economic and nutritional point of view (Djian-Caporalino *et al.*, 2006) [9].

Chilli is presently grown widely throughout the country, both under rainfed and irrigated conditions, in almost all the states covering an area of 0.83 million hectares with annual production of 1.872 million tonnes (Anonymous, 2017) [1]. Andhra Pradesh, Karnataka, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Madhya Pradesh are the leading chilli growing states. China, Mexico, Turkey, Indonesia and Spain are top five fresh pepper producers while India, China, Pakistan, Thailand and Peru are the largest dried pepper producing countries in the world today.

Chilli has diverse uses as spice, condiment, culinary supplement, medicine, vegetable and ornamental plant. Chilli is an indispensable spice, due to its pungency, taste, appealing colour and flavour. It is the second largest commodity comes just after black pepper (*Piper nigrum* L.) in the international spice trade. In India, it is an important ingredient in daily cuisine and is also used in the preparation of pickles, chutneys, sauces etc. The fruit is a rich source of vitamin A, E, C and P (Hosmani, 1993) [10]. The pungency in chilli is due to a crystalline, acrid, volatile alkaloid, capsaicin which is present in placenta and pericarp of the fruit.

Capsaicin has high diverse prophylactic and therapeutic uses in Allopathic and Ayurvedic medicine (Sumathy and Mathew, 1984)^[21]. Chilli is known as a good source of oleoresin which has varied uses in food processing and beverage industries and got high export potential. The natural color extracts of chilli are also finding increased value in place of artificial colours in the food items especially in developed countries.

In West Bengal, chili is one of the most important, cultivated and consumed vegetable cum spice crops that generate substantial income for small and marginal farmers. In spite of its high nutritive values, well acceptability among growers and consumers and wide range of available genetic variability, the State is still lagging behind to attain the optimum productivity particularly in dry chilli (1.0 t/ha). Production of chili pepper in West Bengal faces many constraints among which the unavailability of improved varieties, and heavy pressure of biotic and abiotic stresses are the most important (Chattopadhyay *et al.*, 2011, Bhutia *et al.*, 2015)^[6,3]. Therefore, much concentrated efforts are necessary to improve its dry fruit yield. The characterization of genetic diversity and relation between or within different species, populations and individuals is known to be a prerequisite for effective utilization and protection of plant genetic resources. Hence, evaluation of the potentialities of the indigenous and exotic germplasm is essential because promise for further improvement programme depends on the genetic diversity of the crop. Genetic cataloguing based on standard descriptors helps to easily describe the morphological features of a genotype and thus helps exchange of information about new genotypes. The present study was thus undertaken to characterize chilli germplasm collected from different sources based on agro-morphological characteristics and to identify suitable dry chilli lines used as spice purpose in the Gangetic plains of West Bengal.

Materials and Methods

Field experiments of the present study were conducted during 2015-16 to 2017-18 at C Block Farm under the research plot of AICRP on Vegetable Crops, BCKV, Kalyani, Nadia, West Bengal. The farm is located at 23.5 °N latitude and 89 °E longitude at an elevation of 9.75 m above the mean sea level. Topographic situation of the experimental site comes under Gangetic new alluvial plains of West Bengal.

Forty five (45) advanced lines/varieties/accessions of chilli collected from different sources constituted the plant materials for this study. The genotypes were grown in Randomized Block Design with three replications.

Seed beds were prepared in a sandy loam soil and were 20 cm high and 1.0 m wide. Weathered cowdung manure at 4 kg/m² was mixed into the beds. Beds were drenched with chlorothalonil (2g) + carbendaxim (1 g) to avoid damping off disease. Seeds, after treatment with Thiram (3 g/kg of seed), were sown during the 1st week of October, 2015 at a shallow depth 5 cm apart and covered with finely sieved well rotten leaf mold (leaves left to decompose for two year) which acts as soil improver and to prevent the soil drying out. After sowing, beds were covered with straw until germination which normally takes five to seven days and hand watered regularly up to 3rd week of October, 2015. Nursery beds were covered with 200 µm ultraviolet (UV)-stabilized polyethylene film supported by bamboo poles with open sides to protect seedlings from rain and direct sunlight. Seedlings were hardened by withholding water 4 days before transplanting. Thirty days old seedlings were transplanted to the main field during 1st week of November, 2015 in the afternoon hours. As

the crop remains in the field for a number of months, the experimental field was prepared thoroughly by repeated deep ploughing and laddering by tractor to get a fine tilth before transplanting of the seedlings. Well rotten FYM @ 15 tons/ha was applied in the field during the final land preparation. The crop was fertilized with 120 kg N, 60 kg P₂O₅ and 60 kg K₂O/ha. These seedlings were spaced by 50 cm in both ways in each plot measuring 2.5 m × 2.5 m accommodating 25 plants in each plot. Management practices as scheduled for cultivation were followed as per Chattopadhyay *et al.* (2007)^[5].

Observations were recorded from 10 randomly selected plants of each plot in each replication as per documented descriptors of chilli. The characters studied were as follows:

Qualitative parameters: Plant growth habit (Intermediate /Spreading /Erect), Branching habit (Dense /Sparse /Intermediate), Leaf size (Small /Medium /Large), Leaf shape (Ovate /Lanceolate), Leaf color (The leaf colour of the genotypes was recorded by using RHS colour chart), Pigment at node (Absent /Present), Fruit surface (Smooth/Wrinkled /Semi wrinkled) Number of flowers/axil (One /More than two), Anther colour (Bluish / yellow /Pale blue /Blue /Purple/others), Ripe fruit color (The fruit colour of the genotypes at ripe stage was recorded by using RHS colour chart), Fruit position (Pendant/ Erect), Fruit shape (Conical /Long/ Very long)

Quantitative parameters: Plant height (cm), Plant spread (E-W) (cm), Plant spread (N-S) (cm), Primary branches/plant Days to 50% flowering, Days to ripe fruit maturity from anthesis, Fruit length (cm), Fruit diameter (cm), Seeds/fruit, 1000 seed weight, Fruits/plant, Ripe fruit weight (g), Dry fruit weight (g), Ripe fruit yield/plant (g), Dry fruit yield/plant (g).

Results and Discussion

Twelve qualitative characters were recorded from 45 genotypes of chilli to characterize the present diversity of chilli (Table-1a and 1b). Frequency distribution of the inbreds according to different characters expressed in them was presented in Table-2.

The plants generally showed intermediate growth habit with only 2.22 % genotypes had erect growth habit. Branching habit of the genotypes varied from dense (22.22 %), intermediate (71.11 %) and sparse (6.67 %). Most of the genotypes produced medium sized leaves (91.11 %), however, 6.67 % of the genotypes produced large sized leaves and 2.22 % produced small leaves. Predominant leaf shape was lanceolate (93.33 %), however 6.67 % of genotypes have ovate leaves. Leaf colour was mostly green although intensity of green colour varied from brown to dark green. 55.56 % of the genotypes showed brown green, 42.22 % of the genotypes showed dark green and only one genotype (2.22 %) was recorded black colour leaf. Pigmentation in the stem node was recorded in 20 % genotypes and rest (80 %) showed no pigmentation. Fruit surface at harvest maturity in the genotypes showed two distinct smooth and wrinkled characters, but most of the genotypes (97.78 %) produced smooth surface and only 2.22 % with wrinkled surface. Most of the genotypes produced only one flower/axil and only one showed more than one flower per axil. Anthers are found in different colours, 28.89 % of the genotypes produced purple anthers, 2.22 % produced purple yellow anthers, 20 % produced blue anthers, 8.89 % produced light yellow anthers, 6.67 % produced yellowish green anthers, 6.67 % produced

light green anthers, 13.33 % produced light blue anthers, 4.44 % produced pale blue anthers, 2.22 % produced bluish green anthers, 2.22 % produced yellow anthers and 4.44 % produced bluish yellow anthers. Most of the genotypes produced red colour (95.56 %) fruits except two genotypes (4.44 %). Fruit position in the genotypes was predominantly pendant (93.33 %) and remaining genotypes (6.67 %) produced erect fruit position. Most of the genotypes found to have elongate shaped fruits (93.33 %) and only 6.67 % of the genotypes produced round shaped fruits.

The character constellation of 45 genotypes was thoroughly studied in view of the chief species identifying characters of *Capsicum* genus as per Bosland and Votava (1999)^[4]. It was established beyond doubt that most of the genotypes belong to *C. annuum* and only one genotype Ujawala possessing purple anther and had two or more flowers/node was true *C. frutescens*.

All the 45 chilli genotypes under study showed wide range of variations in the quantitative characters. Genotypes showed highly significant variations among the different characters as revealed from Table-3.

The maximum plant height was observed in BCC-15 (110.60 cm) followed by White chilli (108.24 cm), Beldanga (97.20 cm). The minimum plant height was observed in EC-628891 (37.60 cm). The maximum plant spread in E-W direction was observed in White chilli (103.40 cm) followed by Beldanga (88.80 cm), BCC-25 (85.62 cm) and G-4 (81.60 cm). The minimum plant spread (E-W) was observed in IC-572492 (19.20 cm). The maximum plant spread in N-S direction was observed in White chilli (100.60 cm) followed by G-4 (86.80), BCC-25 (84.68 cm) and Beldanga (84.50 cm). The minimum plant spread (N-S) was observed in IC-342465 (20.46 cm). The maximum number of primary branches/plant was observed in Beldanga (9.58) followed by Srinagar (9.36), Banihari (8.72) and BCC-1 (8.03). The minimum number of primary branches/plant was observed in IC-572492 (2.66). The character days to 50% flowering was influenced significantly by the genotypes under study. The minimum days to 50% flowering was taken by the germplasm Banihari (34.42 days) followed by Shitari-Shitari (36.12 days), IC-342465 (37.73 days). Therefore, these two genotypes could be used to breed early chilli variety. On the other hand, White chilli was found to take maximum days (72.54 days) to 50% flowering. Nahak *et al.* (2018)^[15] recorded had recorded days to 50% flowering ranging from 42.16 days- 61.16 days. Yogeshkumar *et al.* (2018)^[23] also reported that days to 50% flowering varied from 49.5-53.5 days. The minimum days taken to ripe fruit maturity from anthesis was taken by Beldanga and Arudsil (38.24 days) followed by Srinagar (39.34 days), BCC-1 (39.16 days), BCC-30 (39.16 days), BCCH Sel-4 (40.57 days), BCC-25 and Banihari (41.25 days). However, the maximum days was taken by IC-537664 (53.47 days). Vaishnavi *et al.* (2018)^[22] and Srinivas *et al.* (2017)^[20] had recorded 24.25 days to 44.75 days and 85 days to 116.33 days, respectively to ripe fruit maturity from anthesis. The longest fruit length was observed in 2016-CHI Var-1 (95.26 mm) followed by Srinagar (83.56 mm), BCCH Sel-4 (69.60 mm), Beldanga (63.77 mm). The shortest fruit length was observed in BCC-15 W.B. (13.92 mm). The maximum fruit diameter was observed in BCC-1 (15.92 mm) followed by IC-572492 (15.82 mm), BCC-15 (15.50 mm). The minimum fruit diameter was observed in IC-342400 (5.26 mm). Previous studies had also recorded fruit length as 4.03-7.98 cm (Yogeshkumar *et al.*, 2018)^[23], 1.37-3.42 cm (Vaishnavi *et al.*, 2018)^[22] 3.92-10.47 cm (Murmu *et al.*,

2017)^[14] and 2.9-10.41 cm (Pandiyaraj *et al.*, 2017)^[17]. The maximum number of seeds/fruit was observed in 2016-CHI Var-1 (75.84) followed by IC-344636 (72.56), Srinagar (67.44), IC-537595 (66.48) and IC-537623 (65.84). The minimum number of seeds/fruit was observed in Ujawala (24.51). Vaishnavi *et al.* (2018)^[22] and Chowdhury *et al.* (2015)^[7] had recorded number of seeds per fruit ranging from 10.79-66.35, 24.67-87.67, 29.67-87.33 and 30.8-60.6 respectively. 1000 seed weight varied from 3.97 g to 7.36 g. The maximum 1000 seed weight was observed in Srinagar (7.36 g) followed by EC-628891, Arudsil (4.92 g), 2016-CHI Var-1 (4.80 g) Beldanga and Banihari (4.77 g). The lowest 1000 seed weight was observed in White chilli (3.97 g). Pandit *et al.* (2014) and Pandiyaraj *et al.* (2017)^[17] had also recorded the 1000 seed weight ranging from 3.46-6.80 g, 6.12-9.02g and 2.87-4.96 g, respectively. Fresh fruit weight varied from 0.87 g to 8.33 g. The maximum fresh fruit weight was observed in Srinagar (8.33 g) followed by 2016-CHI Var-1 (4.21 g), BCC-25 (3.06 g), Beldanga (2.71 g). The lowest fruit weight was observed in Blue chilli (0.87 g). Dhaliwal *et al.* (2015)^[8], Kadwey *et al.* (2016)^[11] and Murmu *et al.* (2017)^[14] had also recorded the fruit weight ranging from 1.71 - 5.19 g, 1.6-5.0 g, 2.98-5.97 g and 4.76-9.58 g respectively. Dry fruit weight varied from 0.20 g to 1.61 g. The maximum dry fruit weight was observed in Srinagar (1.61 g) followed by 2016-CHI Var-1 (0.82 g), BCC-25 (0.62 g), IC-342438 (0.60 g). The lowest dry fruit weight was observed in Blue chilli (0.20 g). Kranthirekha (2016)^[12] and Kadwey *et al.* (2016)^[11] had also recorded the dry fruit weight ranging from 0.43-1.17 g, 0.72-1.43 g and 0.68-1.54 g respectively. The maximum number of fruits per plant was observed in BCCH Sel-4 (82.45) followed by Beldanga (74.77), Banihari (73.43), BCC-25 (63.54), BCC-1 (60.91) etc. The minimum number of fruits per plant was observed in IC-342458 (8.54). Murmu *et al.* (2017)^[14] and Nahak *et al.* (2018)^[15] had recorded number of fruits per plant ranging from 5.2-76.2, 13.83-72.60 and 22.64-94.84 respectively. The highest ripe fruit yield/plant was observed in Srinagar (267.42 g/plant) followed by BCCH Sel-4 (218.07 g/plant), Beldanga (202.74 g/plant). However, the lowest ripe fruit yield/plant was observed in IC-342458 (22.30 g/plant). Yogeshkumar *et al.* (2018)^[23] and Nahak *et al.* (2018)^[15] had recorded fruit yield per plant ranging from 110.51-241.99 g, 20.3 167.6 g and 48.54-161.74g respectively. The highest dry fruit yield/plant was observed in Srinagar (51.70 g/plant) followed by BCCH Sel-4 (46.19 g/plant), Beldanga (43.69 g/plant). In our earlier study, BCCH Sel-4 has also been identified as potential donor in chilli breeding programme (Bhutia *et al.*, 2015)^[3]. However, the lowest dry fruit yield/plant was observed in IC-342458 (3.88 g/plant). Chattopadhyay *et al.* (2011)^[6] and Sharma *et al.* (2014)^[19] had recorded dry fruit yield per plant ranging from 8.36-54.56 g and 14.23-59.7 g, respectively.

Conclusion

Wide variations in both qualitative and quantitative traits among 45 chilli genotypes were observed. Most of the genotypes belong to *Capsicum annuum*, except Ujawala which was true *Capsicum frutescens*. The comparative analysis between qualitative and quantitative traits also revealed that within our collection, there are qualitatively identical landraces that are quantitatively different. Similarly, there are quantitatively identical landraces that are qualitatively different. It is therefore difficult to clarify the links between these germplasm without making reference to

other characterization procedures. It is therefore important to carry out biochemical and molecular characterizations in order to know better the number of varieties that really exists in India to facilitate the establishment of conservation and improvement programs of chili varieties. On the basis of

mean dry yield/plant, three genotypes namely Srinagar, BCCH Sel-4 and Beldanga were identified as most promising and could be either recommended for large scale cultivation after critical testing or used in chilli breeding programme to enhance the productivity of dry chilli in the country as a whole.

Table- 1a: Characterization of 45 chilli genotypes based on qualitative traits.

Genotype	Plant growth habit	Branching habit	Leaf size	Leaf shape	Leaf colour	Pigment at node
Beldanga	Intermediate	Dense	Medium	Lanceolate	Green N-137-B	Present
White chilli	Erect	Intermediate	Large	Ovate	Green N-137-A	Abscent
Ujwala	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Abscent
Blue chilli	Intermediate	Intermediate	Medium	Lanceolate	Green Purple N-186-A	Present
Athulya	Intermediate	Intermediate	Medium	Lanceolate	Green -137-A	Abscent
Bobbili collection-1	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Present
Bobbili collection-1	Intermediate	Intermediate	Large	Ovate	Green -N-137-A	Abscent
Bobbili collection-1	Intermediate	Intermediate	Medium	Lanceolate	Green-137-A	Abscent
Banihari	Intermediate	Dense	Medium	Lanceolate	Yellow Green-147-A	Abscent
Debgiri	Intermediate	Dense	Medium	Lanceolate	Green N-137-C	Abscent
BCC-1	Intermediate	Intermediate	Medium	Lanceolate	Green N 139-A	Abscent
Sel-4	Intermediate	Dense	Medium	Lanceolate	Green N-137-A	Abscent
Shitari-Shitari	Intermediate	Dense	Small	Lanceolate	Green N-137-C	Abscent
Chuta Bowa	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
BCC-15	Intermediate	Intermediate	large	Ovate	Green-N-137-A	Present
G-4	Intermediate	Dense	Medium	Lanceolate	Green Group-N-137-B	Absent
Tej Amina	Intermediate	Intermediate	Medium	Lanceolate	Green-139-B	Absent
Chuli lanka	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Absent
Arudsil	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Absent
Arka Haritha	Intermediate	Intermediate	Medium	Lanceolate	Yellow Green-147-A	Absent
Arka Meghana	Intermediate	Dense	Medium	Lanceolate	Green N-137-B	Absent
IC-572492	Intermediate	sparse	Medium	Lanceolate	Green N-137-A	Absent

Genotype	Plant growth habit	Branching habit	Leaf size	Leaf shape	Leaf Colour	Pigment at node
EC-628891	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
IC-537664	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Present
IC-537658	Intermediate	sparse	Medium	Lanceolate	Green N-137-C	Absent
IC-537646	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-A	Absent
IC-537623	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Absent
IC-537595	Intermediate	Dense	Medium	Lanceolate	Green N-137-A	Present
IC-344636	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
IC-344386	Intermediate	sparse	Medium	Lanceolate	Green N-137-C	Absent
IC-344370	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-A	Absent
IC-344350	Intermediate	Dense	Medium	Lanceolate	Green N-137-C	Absent
IC-342465	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
IC-342458	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Absent
IC-342438	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
IC-342400	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-A	Present
IC-338782	Intermediate	Intermediate	Medium	Lanceolate	Green-137-A	Absent
IC-336754	Intermediate	Intermediate	Medium	Lanceolate	Green 137-A	Present
IC-119746	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
IC-119611	Intermediate	Dense	Medium	Lanceolate	Green-137-A	Present
BCC-30	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
BCC-25	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-B	Absent
Pahelgaon	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-C	Absent
Srinagar	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-A	Absent
2016/CHI Var-1	Intermediate	Intermediate	Medium	Lanceolate	Green N-137-A	Absent

Table- 1b: Characterization of 45 Chilli genotypes based on qualitative traits.

Genotype	Fruit surface	No of flowers per axil	Anther Colour	Ripe fruit colour	Fruit position	Fruit shape
Beldanga	Smooth	1	Purple	Red 44-A	Pendant	Elongate
White chilli	Smooth	1	Purple yellow	Red-45-A	Pendant	Elongate
Ujwala	Smooth	More than 1	Purple	Red-44-A	Erect	Elongate
Blue chilli	Smooth	1	Purple	Red-44-b	Pendant	Round
Athulya	Smooth	1	Blue	Red-44-A	Pendant	Elongate
Bobbili collection-1	Smooth	1	Light yellow	Red-44-A	Erect	Elongate
Bobbili collection-1	Smooth	1	Blue	Red-44-A	Pendant	Elongate
Bobbili collection-1	Smooth	1	Yellowish green	Red-46-B	Erect	Round

Banihari	Smooth	1	Light yellow	Red-44-A	Pendant	Elongate
Debgiri	Smooth	1	Light green	Red-44-b	Pendant	Elongate
BCC-1	Smooth	1	Light blue	Red-46-B	Pendant	Elongate
Sel-4	Smooth	1	Purple	Red group 44-B	Pendant	Elongate
Shitari-Shitari	Smooth	1	Blue	Red-45-B	Pendant	Elongate
Chuta Bowa	Smooth	1	Light yellow	Red-45-A	Pendant	Elongate
BCC-15	Smooth	1	Blue	Red-44-A&B	Pendant	Round
G-4	Smooth	1	Pale blue	Red-42-A	Pendant	Elongate
Tej Amina	Smooth	1	Bluish green	Red-42-A	Pendant	Elongate
Chuli lanka	Smooth	1	Purple	Red-44-B	Pendant	Elongate
Arudsil	Smooth	1	Light green	Orange-Red Group N 30-A	Pendant	Elongate
Arka Haritha	Smooth	1	Purple	Red-44-A	Pendant	Elongate
Arka Meghana	Smooth	1	Purple	Red-42-A	Pendant	Elongate
IC-572492	Smooth	1	Purple	Red-44-A	Pendant	Elongate

Genotype	Fruit surface	No of flowers per axil	Anther colour	Ripe fruit colour	Fruit position	Fruit shape
EC-628891	Smooth	1	Blue	Red-44-B	Pendant	Elongate
IC-537664	Smooth	1	Blue	Red-44-B	Pendant	Elongate
IC-537658	Smooth	1	Yellow	Red-44-A	Pendant	Elongate
IC-537646	Smooth	1	Bluish yellow	Red-42-A	Pendant	Elongate
IC-537623	Smooth	1	Light blue	Red-44-A	Pendant	Elongate
IC-537595	Smooth	1	Light blue	Red-42-A	Pendant	Elongate
IC-344636	Smooth	1	Blue	Red-46-B	Pendant	Elongate
IC-344386	Smooth	1	Blue	Red-46-B	Pendant	Elongate
IC-344370	Smooth	1	Yellowish green	Red-46-B	Pendant	Elongate
IC-344350	Smooth	1	Purple	Red-45-A	Pendant	Elongate
IC-342465	Smooth	1	Purple	Red-46-B	Pendant	Elongate
IC-342458	Smooth	1	Yellowish green	Red-44-B	Pendant	Elongate
IC-342438	Smooth	1	Light yellow	Red-44-A&B	Pendant	Elongate
IC-342400	Smooth	1	Light green	Red-42-A	Pendant	Elongate
IC-338782	Smooth	1	Purple	Red-44-A	Pendant	Elongate
IC-336754	Smooth	1	Purple	Orange-Red Group N 30-A	Pendant	Elongate
IC-119746	Smooth	1	Purple	Red-46-B	Pendant	Elongate
IC-119611	Smooth	1	Pale blue	Red-44-A	Pendant	Elongate
BCC-30	Smooth	1	Bluish yellow	Red group 44-B	Pendant	Elongate
BCC-25	Smooth	1	Light blue	Red group 44-A	Pendant	Elongate
Pahelgaon	Smooth	1	Light blue	Red group 44-A	Pendant	Elongate
Srinagar	Smooth	1	Light blue	Red group 46-A	Pendant	Elongate
2016/CHI Var-1	wrinkled	1	Blue	Red group 44-A	Pendant	Elongate

Table- 2: Frequency distribution for different qualitative characters in chilli genotypes.

Characters	Specification	No. of genotypes	% of genotypes
Plant growth habit	Moderately viny	10	55.5
	Highly viny	8	44.4
Leaf margin	Wavy	11	61.1
	Serrated	5	27.7
	Entire	2	11.11
Leaf colour (RHS cc)	G.G.N 137A	7	38.8
	G.G.N 137B	8	44.4
	G.G.N 137C	3	16.6
Fruit colour (RHS cc)	Y.G.G - 1518	3	16.66
	Y.G.G 150C	3	16.66
	Y.G.G.N 144B	3	16.66
	Y.G.G.N 146A	2	11.11
	Y.G.G 144C	4	22.22
	Y.G.G 145A	2	11.11
	Y.G 7A	1	5.55
Lobe tip	Obtuse	11	61.11
	Acute	7	38.8
Leaf odour	Foetid	10	55.5
	Mild	8	44.4
Leaf pubescence	Dense	3	5.55
	Medium	8	44.44
	Sparse	7	38.88
Extent of lobing	Broadly lobed	11	61.11
	Non- lobed	2	11.11

	Shallowly lobed	5	27.77
Leaf lobing at flowering stage	Mixed occurrence	5	27.77
	Lobed	11	61.11
	Non-lobed	2	11.11
Fruit surface echination	Mild-sparse echinate	12	66.66
	Densely echinate	6	33.33
Fruit surface bumps and ridges	Clearly ridged	12	66.66
	Obscurely ridged	6	33.33
Fruit shape	Round oval	8	44.44
	Ellipsoid	6	33.33
	Ellipsoid oblong	4	22.22
Fruit (blossom end) rostration	Faint	12	66.66
	Medium	8	44.44
	Appreciable length	4	22.22

Table- 3a: Characterization of 45 chilli genotypes based on quantitative traits.

Character	Plant height (cm)	Plant spread (E-W) (cm)	Plant spread (N-S) (cm)	Primary branches/plant	Days to 50% flowering	Days to ripe fruit maturity from anthesis
Beldanga	97.20	88.80	84.50	9.58	52.10	38.24
White chilli	108.24	103.40	100.60	6.56	72.54	45.26
Ujwala	56.60	36.60	34.96	7.38	46.01	52.84
Blue chilli	57.20	38.00	35.20	6.56	50.41	49.51
Athulya	41.60	21.67	21.80	3.15	51.28	47.34
Bobbili collection-1	84.00	46.38	47.40	6.17	68.54	49.65
Bobbili collection-1	57.80	32.65	28.60	4.33	58.60	48.25
Bobbili collection-1	72.20	36.80	36.00	5.41	65.42	46.52
Banihari	62.40	38.00	43.94	8.72	34.42	41.25
Debgiri	90.35	68.20	76.40	7.50	53.65	42.15
BCC-1	83.24	50.60	47.20	8.03	47.16	39.56
BCCH Sel-4	59.60	46.80	49.40	7.84	45.74	40.57
Shitari-Shitari	46.80	28.20	32.50	6.15	36.12	45.18
Chuta Bowa	54.20	35.40	33.40	3.33	51.50	46.59
BCC-15	110.60	66.20	62.80	4.33	60.33	44.59
G-4	83.20	81.60	86.80	7.45	61.20	42.36
Tej Amina	73.00	45.80	40.80	6.85	56.40	46.26
Chulilanka	41.20	35.20	32.80	3.40	43.18	46.51
Arudsil	68.20	38.23	39.91	7.41	38.60	38.24
Arka Haritha	51.80	29.34	28.80	3.83	53.40	49.62
Arka Meghana	47.80	26.18	29.40	3.50	55.26	51.74
IC-572492	44.40	19.20	20.60	2.66	42.35	50.48
EC-628891	37.60	25.60	24.20	3.50	38.59	42.59
IC-537664	45.60	29.60	26.40	5.08	49.14	53.47
IC-537658	47.60	21.80	22.40	4.05	62.54	49.62

Character	Plant Height (cm)	Plant spread (E-W) (cm)	Plant spread (N-S) (cm)	Primary branches/plant	Days to 50% flowering	Days to ripe fruit maturity from anthesis
IC-537646	44.20	26.57	24.80	4.62	64.36	46.58
IC-537623	50.40	35.20	35.40	5.18	54.38	43.26
IC-537595	57.40	36.20	32.20	5.50	44.12	43.26
IC-344636	53.80	32.60	29.60	5.33	55.95	48.42
IC-344386	44.20	24.60	24.20	5.15	53.59	43.16
IC-344370	48.00	24.60	25.16	4.83	42.52	48.26
IC-344350	39.40	20.40	22.40	5.10	39.54	47.26
IC-342465	42.40	22.60	20.46	5.33	37.73	47.64
IC-342458	55.20	26.20	25.40	5.50	61.34	46.53
IC-342438	48.60	24.20	25.30	5.45	63.58	45.91
IC-342400	51.60	28.60	30.20	5.21	65.38	51.42
IC-338782	48.80	29.80	29.54	5.03	41.56	44.31
IC-336754	56.60	29.34	28.60	5.33	53.68	51.82
IC-119746	50.60	31.80	34.25	5.16	62.35	48.75
IC-119611	50.40	29.25	33.20	5.18	63.15	46.95
BCC-30	68.25	65.24	68.32	6.35	56.61	39.56
BCC-25	83.46	85.62	84.68	6.44	58.26	41.25
Pahelgaon	75.61	74.26	76.38	6.35	49.61	46.38
Srinagar	78.58	65.38	73.28	9.36	41.37	39.34
2016-CHI Var-1	59.80	55.26	53.98	7.39	45.28	46.58
Mean	60.66	41.29	41.43	5.70	52.20	45.89
Range	37.60-110.60	19.20-103.40	20.46-100.60	2.66-9.58	34.42-72.54	34.42-72.54
S.E.	3.25	1.92	1.73	0.21	1.52	1.41
C.D. 5%	9.14	5.38	4.85	0.58	4.28	3.96
C.V.	9.29	8.04	7.22	6.29	5.06	5.32

Table-3b: Characterization of 45 chilli genotypes based on quantitative traits.

Character	Fruit length (mm)	Fruit diameter (mm)	Seeds/fruit	1000 seed weight (g)	Fruits/plant	Ripe fruit weight (g)	Dry fruit weight (g)	Ripe fruit yield/plant (g)	Dry fruit yield/plant (g)
Beldanga	63.77	10.14	50.52	4.77	74.77	2.71	0.58	202.74	43.69
White chilli	27.16	7.67	31.51	3.97	42.04	1.41	0.26	59.33	10.93
Ujwala	28.10	7.35	24.51	4.13	38.37	1.26	0.24	48.26	9.36
Blue chilli	14.70	14.50	37.62	4.22	45.50	0.87	0.20	39.54	9.01
Athulya	29.60	7.26	43.74	4.32	26.40	1.83	0.38	48.33	10.04
Bobbili collection-1	25.59	6.33	41.20	4.38	28.49	1.50	0.25	42.68	7.33
Bobbili collection-1	28.54	6.25	50.27	4.63	30.57	1.68	0.33	51.28	10.10
Bobbili collection-1	14.11	14.58	44.34	4.29	26.32	1.27	0.30	33.52	7.91
Banihari	24.25	8.27	59.26	4.77	73.43	1.39	0.29	102.18	21.46
Debgiri	38.27	13.14	55.36	4.63	41.38	2.11	0.37	87.26	15.53
BCC-1	30.63	15.92	64.87	4.48	60.91	1.69	0.39	103.29	23.79
BCCH Sel-4	69.60	8.77	60.31	4.50	82.45	2.64	0.56	218.07	46.19
Shitari-Shitari	25.36	5.30	55.89	4.36	21.23	2.06	0.41	43.75	8.74
Chuta Bowa	21.74	7.74	51.55	4.09	45.42	1.47	0.33	66.79	14.78
BCC-15	13.92	15.50	44.27	4.33	24.07	1.88	0.36	45.16	8.69
G-4	49.62	7.31	52.84	4.27	54.20	2.56	0.53	138.66	28.90
Tej Amina	47.82	6.93	47.50	4.54	32.33	1.64	0.36	53.01	11.55
Chulilanka	25.64	6.34	39.62	4.19	45.23	1.15	0.26	52.07	11.89
Arudsil	27.92	9.40	56.18	4.92	46.18	1.76	0.36	81.24	16.60
ArkaHaritha	32.20	8.26	42.56	4.02	20.95	2.11	0.44	44.16	9.19
ArkaMeghana	24.60	6.29	51.52	4.48	17.55	2.10	0.41	36.88	7.14
IC-572492	40.40	15.82	42.00	4.27	22.93	1.58	0.36	36.26	8.23
EC-628891	44.46	8.57	54.21	4.92	16.02	2.40	0.57	38.42	9.07
IC-537664	33.52	9.12	48.26	4.34	29.66	2.00	0.43	59.26	12.89

Character	Fruit Length (mm)	Fruit diameter (mm)	Seeds/fruit	1000 seed weight (g)	Fruits/plant	Ripe fruit weight (g)	Dry fruit weight (g)	Ripe fruit yield/plant (g)	Dry fruit yield/Plant (g)
IC-537658	36.45	7.56	54.26	4.47	22.59	1.74	0.35	39.34	7.86
IC-537646	32.15	8.26	48.56	4.23	19.45	2.18	0.42	36.22	7.03
IC-537623	62.34	10.25	65.84	4.25	17.33	2.49	0.46	43.16	7.94
IC-537595	29.65	8.24	66.48	4.56	45.27	1.44	0.35	64.91	15.52
IC-344636	41.20	7.26	72.56	4.37	20.40	1.73	0.40	35.26	8.19
IC-344386	40.15	9.21	43.46	4.05	40.32	1.57	0.36	63.28	14.44
IC-344370	41.29	7.54	48.09	4.54	13.56	2.05	0.46	27.81	6.14
IC-344350	56.82	6.90	43.42	4.22	10.96	2.60	0.48	28.50	5.26
IC-342465	55.23	8.72	49.52	4.13	16.94	2.08	0.42	35.26	7.05
IC-342458	46.85	9.15	51.45	4.74	8.54	2.61	0.46	22.30	3.88
IC-342438	37.59	8.47	42.74	4.19	12.52	2.64	0.60	33.07	7.54
IC-342400	41.27	5.26	36.44	4.52	22.97	1.30	0.28	29.85	6.30
IC-338782	28.64	5.80	42.46	4.38	28.19	1.76	0.37	49.58	10.42
IC-336754	36.49	8.25	49.16	4.16	21.14	1.92	0.37	40.51	7.85
IC-119746	34.90	6.59	45.25	4.58	20.37	1.88	0.35	38.30	7.07
IC-119611	48.26	10.02	26.45	4.29	19.58	2.21	0.39	43.26	7.69
BCC-30	53.26	7.80	48.62	4.45	45.57	2.05	0.45	93.50	20.35
BCC-25	63.29	11.53	56.95	4.64	63.54	3.06	0.62	194.69	39.46
Pahelgaon	58.16	9.26	55.46	4.22	22.31	2.55	0.54	56.91	12.02
Srinagar	83.56	15.26	67.44	7.36	32.14	8.33	1.61	267.42	51.70
2016-CHI Var-1	95.26	8.26	75.84	4.80	30.73	4.21	0.82	129.48	25.30
Mean	40.10	9.03	49.79	4.47	32.91	2.12	0.43	68.99	14.27
Range	13.92-95.26	13.92-95.26	24.51-75.84	3.97-7.36	8.54-82.45	8.54-82.45	0.20-1.61	22.30-267.42	22.30-267.42
S.E.	0.82	0.17	2.28	0.09	2.04	0.09	0.02	4.68	0.97
C.D. 5%	2.29	0.49	6.41	0.26	5.73	0.25	0.05	13.16	2.73
C.V.	3.53	3.34	7.93	3.62	10.74	7.33	7.28	11.75	11.77

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