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Morphological characterization of bird eye chilli grown as intercrop in arecanut plantation

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Abstract
To characterize the 31 genotypes of bird eye chilli for various Horticultural characters an investigation was carried out in Sirsi, Uttara Kannada district. Out of 31 genotypes characterized, high coefficient of variation (C.V) was observed for yield characters like, fruit length (16.78 %), fruit yield per plant (11.12 %) followed by dry weight of 100 fruits (10.84 %) suggesting that these traits should be given top priority during selection programme. Accessions viz., 7, 6 and 28 showed superior performance for above parameters, hence these lines may be directly used for cultivation or as a source of desirable traits in a breeding programme for the improvement of fruit yield in bird eye chilli.

Keywords: Bird eye chilli, characterization, yield.

1. Introduction
Bird eye chilli, it is botanically *Capsicum frutescens* L., belongs to family Solanaceae and it is one among the five cultivated species of the genus and is closely related to *C. chinese* Jacq. Numerous local land races of *Capsicum frutescens* are cultivated in tropical and subtropical regions of the world. It is one among the ten hottest chilli in the world. Besides its culinary use, it possesses many medicinal and nutritional values [8]. Many a large number of farmers are cultivating this bird eye chilli crop by using local varieties/genotypes mainly for their fruits which have got high demand with better price in market. The bird eye chilli is a slow growing short term perennial or perennial sub-shrub.
The morphological characters of a crop although subjected to variation through environmental influences are undoubtedly the best indicators of yield and they are useful in varietal identification and genetic purity testing. Many tools are now available to study relationships among genotypes, including various types of molecular markers; however, morphological characterization is the first step in the description and classification of germplasm [6].
The data base of bird eye chilli genotypes generated by morphological characterization may be useful for the selection of suitable germplasm for further improvement or cultivation. Under normal mono cropping of arecanut the normal spacing leaves good amount of inter space for exploitation by way of inter and filler cropping. Chilli is a day neutral plant and according to review of earlier research works its capsaicin, oleoresin and ascorbic acid content won't get vary significantly due to shade when grown as intercrop. However, the information on compatibility of intercrop in main crop of areca and the yield obtained is need documentation. Keeping these points in view, morphological characterization was carried out to identify the superior bird eye chilli genotypes under arecanut.

2. Materials and Methods
The present experiment was conducted at the ICAR-KVK farm, Sirsi, Uttara Kannada. Experimental material used in the present study comprised of 31 genotypes of bird's eye chilli (*Capsicum frutescens* L.) which were collected from different locations. Experiment was laid out in a randomised complete block design with two replications. The sowing of all genotypes was done in pro trays filled with coco peat and after 30 days, seedlings were transplanted to polythene covers filled with potting mixture. The 60 days old seedlings were planted in main field at 2.7m X 2.7m spacing. Other package of practices of chilli were followed for raising good crop. The observations were recorded on five randomly selected plants of each genotype.
Collection and characterization of the existing variability is the first step a priori to any breeding programme. In the present study, 31 diverse genotypes of bird's eye chilli were characterized for different qualitative and quantitative parameters as per the PPV and FR Authority specific DUS test guidelines for chilli [1]. The genotypes were grouped into different categories based on the variations present within the parameter. Morphological characterization has been done based on characters like, plant habit, stem pubescence, leaf

color, intensity of green color, leaf shape, undulation of leaf margin, leaf pubescence, flower petal color, flower anther color, flower orientation, stem shape, fruit orientation, fruit color at mature unripe stage, fruit shape, fruit curvature, neck at basal end of fruit, sinuation of pericarp, texture of fruit surface, fruit color at ripe maturity, intensity of fruit color at maturity, fruit color transition, fruit glossiness, fruit shape at base, fruit shape at apex, fruit calyx cover, fruit calyx margin, fruit pedicel attachment, blossom end appendage in fruit, length of first internode, plant height, plant spread, length of leaf blade, width of leaf blade, days to 50% flowering, fruit length, fruit diameter, fruit stalk length, fresh weight of 100 fruits, dry weight of 100 fruits and fruit yield per plant.

The genotypes were categorized into different groups which are discussed here under (Table 1). Mean data were subjected to statistical analysis to calculate range, standard deviation and coefficient of variability and these were used to group germplasm into different categories.

Table 1: Grouping of 31 bird eye chilli germplam with respect to qualitative parameters

S. No.	Characters	Category	
1	Plant habit	a	Upright (27)
		b	Semi upright (4)
2	Stem pubescence	a	Sparse (31)
3	Stem shape	a	Round (31)
4	Leaf color	a	Green (31)
5	Intensity of green color	a	Light (5)
		b	Medium (23)
		c	Dark (3)
6	Leaf shape	a	Lanceolate (31)
7	Undulation of leaf margin	a	Weak (31)
8	Leaf pubescence	a	Sparse (31)
9	Flower petal color	a	Greenish white (31)
10	Flower anther color	a	Pale blue (31)
11	Flower orientation	a	Semi drooping (31)
12	Fruit orientation	a	Erect (31)
13	Fruit color at mature unripe stage	a	Green (31)
14	Fruit shape	a	Moderately triangular (31)
15	Fruit curvature	a	Absent (31)
16	Neck at basal end of fruit	a	Absent (31)
17	Sinuation of pericarp	a	Weak (6)
		b	Medium (25)
18	Texture of fruit surface	a	Smooth (7)
		b	Slightly rough (24)
19	Fruit color at ripe maturity	a	Red (31)
20	Intensity of fruit color at maturity	a	Dark (9)
		b	Medium (22)
21	Fruit color transition	a	One (31)
22	Fruit glossiness	a	Weak (4)
		b	Medium (27)
23	Fruit shape at base	a	Acute (31)
24	Fruit shape at apex	a	Acute (31)
25	Fruit calyx cover	a	Enveloping (31)
26	Fruit calyx margin	a	Dented (31)
27	Fruit pedicel attachment	a	Weak (31)
28	Blossom end appendage in fruit	a	Absent (31)

3. Results and Discussion

Presence of variability is prerequisite to start any breeding programme. In bird eye chilli the plant characters like days taken for 50% flowering play an important role in the selection of superior genotypes with early yield. Further fruit yield and its attributes in bird's eye chilli are the most important characters deciding the superiority of the genotypes. Much variation has been observed in most of the characters studied. This variability could be attributed to the different eco-geographical back ground to which they have been exposed and the operation of natural and human selection [3, 7, 10].

A wide range of variability was observed among the genotypes for length of first internode (4.60-10.15 cm), plant height (51-106.5cm), plant spread (43.5-91 cm), length of leaf blade (6.25-11), width of leaf blade (4.1-8.3cm), days to 50% flowering (71-112), fruit length (0.85-2.85 cm), fruit diameter (0.79-2.65 cm), fruit stalk length (2-3.2 cm), fresh weight of 100 fruits (9.17-25 gm), dry weight of 100 fruits (3.8-10.75gm) and fruit yield per plant (165-412g) indicating the scope for selection of suitable initial material for breeding (Table 2).

Table 2: Characterization of 31 genotypes of bird eye chilli

S. No.	Genotypes	Length of first internode (cm)	Plant Height (cm)	Plant spread (cm)	Length of leaf blade (cm)	Width of leaf blade (cm)	Days to 50% flowering	Fruit Length (cm)	Fruit diame-ter (cm)	Fruit stalk length (cm)	Fresh wt. of 100 fruits (gm)	Dry wt. of 100 fruits (gm)	Fruit yield per plant (g)
1	A1	7.85	91.50	80.00	9.00	6.50	86.00	1.90	2.12	3.00	20.80	7.50	382.25
2	A2	4.60	58.50	60.00	6.75	4.15	71.50	0.90	0.83	2.00	9.75	4.00	177.25
3	A3	5.00	71.50	51.50	6.65	4.10	71.00	1.00	0.85	2.10	9.90	4.00	180.00
4	A4	7.25	85.00	71.00	8.00	6.40	86.00	1.50	1.38	2.60	17.50	5.90	330.00
5	A5	5.95	66.00	61.00	7.10	5.05	77.00	1.00	0.85	2.20	10.35	3.80	186.25
6	A6	8.80	106.50	91.00	11.00	7.15	93.00	2.30	2.14	3.20	22.65	10.75	408.00
7	A7	10.15	101.00	81.00	10.15	8.30	91.00	2.20	2.24	3.10	25.00	10.70	412.00
8	A8	5.40	72.50	63.00	7.60	5.10	74.50	1.10	0.89	2.40	11.66	4.80	210.00
9	A9	6.35	73.75	62.00	7.50	5.15	78.00	1.15	0.89	2.40	12.20	3.95	225.30
10	A10	8.40	102.50	87.50	10.75	6.50	89.00	2.00	2.07	3.00	21.50	8.30	390.40
11	A11	6.95	76.50	66.00	7.75	5.25	79.50	1.25	0.98	2.50	13.50	4.80	260.20
12	A12	6.50	74.00	67.50	7.85	5.40	80.50	1.15	1.03	2.50	13.95	5.00	263.50
13	A13	8.10	92.00	76.00	8.70	6.35	85.50	1.75	2.00	2.80	19.60	7.00	365.00
14	A14	6.40	80.00	67.00	7.85	5.75	81.00	1.30	1.23	2.50	15.20	5.60	285.00
15	A15	7.60	91.00	72.00	8.65	6.50	85.00	1.63	1.73	2.80	18.40	7.05	340.00
16	A16	7.15	83.00	68.50	8.25	5.90	83.00	1.25	1.26	2.60	16.20	6.70	316.50
17	A17	7.55	84.50	69.50	8.55	6.10	83.50	1.40	1.30	2.60	16.75	6.90	322.00
18	A18	5.30	63.50	49.50	6.25	4.30	74.50	0.95	0.84	2.10	10.20	4.50	184.80
19	A19	7.35	82.50	73.00	7.90	6.25	84.00	1.50	1.56	2.70	18.00	7.20	335.50
20	A20	7.20	87.50	71.00	7.90	6.35	80.50	1.60	1.72	2.70	18.20	7.30	337.50
21	A21	7.10	85.00	66.00	7.75	5.60	80.50	1.25	1.08	2.60	15.95	6.85	310.00
22	A22	8.35	99.00	79.00	8.75	6.10	85.50	1.60	1.90	2.80	19.10	7.10	355.50
23	A23	6.50	80.00	66.50	7.80	5.75	82.50	1.20	0.91	2.50	14.75	5.00	274.00
24	A24	7.85	93.00	71.00	8.65	6.55	82.00	1.80	2.08	2.80	20.10	8.20	375.75
25	A25	4.65	51.00	43.50	6.25	4.20	73.00	0.85	0.83	2.00	9.17	4.26	165.00
26	A26	7.75	104.00	80.50	9.70	6.60	88.50	1.88	2.05	3.00	21.25	8.90	380.00
27	A27	6.35	77.50	64.50	7.70	4.70	75.00	1.15	0.81	2.40	12.75	5.50	240.40
28	A28	8.50	103.50	83.00	10.70	7.55	92.50	1.93	2.21	3.10	22.10	9.05	398.00
29	A29	5.75	62.50	63.00	7.65	5.15	74.00	1.10	0.88	2.30	11.30	4.60	195.00
30	A30	5.50	71.50	61.00	7.50	4.70	76.00	1.10	0.79	2.20	11.00	4.20	192.00
31	A31 Chattipparambu	7.85	94.00	84.00	10.04	6.90	112	2.85	2.65	3.05	21.00	7.95	380.00
	Range	4.60-10.15	51-106.5	43.5-91	6.25-11	4.1-8.3	71-112	0.85-2.85	0.79-2.65	2-3.2	9.17-25	3.80-10.75	165-412
	Mean	6.97	82.72	69.35	8.28	5.82	82.44	1.47	1.33	2.60	16.12	6.37	296.04
	C.D.	0.92	10.14	5.82	1.01	0.45	6.98	0.50	0.11	0.57	2.63	1.41	67.57
	S.E±	0.31	3.49	2.00	0.35	0.15	2.40	0.17	0.03	0.19	0.90	0.48	23.28
	C.V %	6.44	5.97	4.09	5.98	3.82	4.12	16.78	3.81	10.70	7.97	10.84	11.12

High coefficient of variation (C.V) was observed for yield characters like, fruit length (16.78 %), fruit yield per plant (11.12 %) and dry weight of 100 fruits (10.84 %) [4].

Results from Table 1 shows that two type of plant habit. These are upright (27) and semi upright (4). Round shape stem with sparse pubescence was observed in all the genotypes. Intensity of green leaf color was found to be light (5), medium (23) and dark (3). Lanceolate leaf shape, weak undulation in leaf margin, greenish white petal, pale blue anther, semi drooping flowers, green color erect fruits with moderately triangular shape, without curvature and neck at basal end were observed in 31 genotypes. Leaf pubescence was observed on the youngest mature leaves and it was classified as sparse. Presence of leaf pubescence protects the plants against virus spreading vectors. Sinuation of pericarp was found to be weak (6) and medium (25) with smooth (4) and slightly rough (27) fruit surface. At ripe maturity fruit color was red in all the pepper lines used while intensity of fruit color at maturity was either dark (9) or medium (22). Fruit color transition was occurred in single stage for all the genotypes. Fruit glossiness was found to be weak (4) and medium (27). In 31 genotypes it was observed that acute fruit shape at base and at apex, enveloping type fruit calyx cover with dented margin, weak fruit pedicel attachment and absence of blossom end appendage in fruit.

The growth parameters in terms of plant height, and plant spread were significantly and numerically higher in accession 6, 7 and 28 compared to the other accessions. In terms of length of first internode, leaf blade length and width these accessions significantly differed from the other accessions. The differences in plant height observed in this study can be attributed to the differences in growth rate of the bird eye pepper species studied. The taller plants achieved their heights due to increase growth at their apical meristems [4]. Large canopy width provides large leaf surfaces which enhance the interception of solar radiation with subsequent increase in the amount of photosynthetic activities which may correspondingly increase the plant's assimilatory ability [5].

The results in these studies again revealed that accession 7, 6 and 28 recorded the highest fruit length, diameter and fruit yield per plant compared to the other accessions. The high fruit yield may be due to the fruit length, diameter and weight of 100 fruits as well as the bigger canopy size which is associated with more number of branches. This indicates a positive impact of vegetative growth on yield and yield components of hot pepper [2].

A perusal of the results on the performance of the 31 accessions of bird's eye chilli revealed that accession 7, 6 and 28 were the superior accessions due to their high yield parameters. These lines can be either directly used for commercial cultivation or utilized in inter-varietal hybridization to obtain segregating populations.

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