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VARIABILITY ANALYSIS IN COLOCASIA (*COLOCASIA ESCULENTA* L. SCHOTT) UNDER THE LOW HILL CONDITIONS OF HIMACHAL PRADESH INDIA

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ABSTRACT

The present research was carried out at Vegetable Research Farm, Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur (HP) during summer-rainy season. Twenty-three genotypes were evaluated in Randomized Complete Block Design with three replications to ascertain extent of variability, heritability, genetic advance and gain, correlation and path coefficient analysis for yield and other horticulture traits among the genotypes. Analysis of variance showed significant differences among all the genotypes for all the characters under study. Three genotypes namely LC-A-5-18, LC-A-16-18 and LC-A-13-18 were found to be high yielding as well as better from consumer's point of view. They could be the promising parents for utilization in further breeding programmes.
***Keywords*:** Colocasia, ANOVA, variability and RBD.

Introduction

Colocasia (*Colocasia esculenta* (L.) Schott) is a monocotyledonous plant belongs to family Araceae, largely cultivated for its edible corms. All plants and members belonging to family Araceae are known as aroids (Van and Wyk, 2005). It is very popular crop of ancient time and Indo-Malyalam region. Bangladesh and Eastern India were considered as the native place of origin (Yen and Wheeler, 1968). It is an important tuber crop, used a staple crop or subsistence food by millions of people in developing countries like Africa, India and Central America. Colocasia is evolved and domesticated from its wild ancestor *i.e. Colocasia esculenta var. aquatilis* either in North East India or South East Asia (Matthews, 1991).

Colocasia performs well in moist conditions. In natural habitat, it is commonly found near water sources. The crop can be grown in hills if frost free condition remains throughout the growth season. Colocasia is grown well in fertile loamy to clay soil but well drained and fertile sandy soils with an optimum pH of 5.5-7.0 is ideally suited for its production. In India, colocasia occupies an area of 0.052 million hectares with production of 0.0654 million tons and productivity of 12.57 tons per hectare (Reddy, 2012). It is widely cultivated in Bihar, Uttar Pradesh, West Bengal, Assam, Himachal Pradesh, Uttrakhand, Orissa, Arunachal Pradesh and Tamil Nadu. The corms and tubers of colocasia are used as vegetable after the thorough cooking because corms are acrid due to the presence of calcium oxalates. The corms of colocasia are rich in starch (13-30%) but contains comparatively low amount of fats and proteins. Colocasia contains water (63-85 %), proteins (1.3-4.0%), fiber (0.6-1.2%), fats (2.0-4.0%) etc. (Coursey, 1968). Though, colocasia is one of the popular and important edible tuber crop, but still not much attention is given for genetic improvement of this crop. The introduction about the sexual reproduction of this crop is very fragmentary. Most of the improvement programmes are generally depend on the genetic variability among various cultivars (Kuruvila and Singh, 1981).

The nature and magnitude of variability and the extent to which the desired character is heritable decides the improvement of particular crop (Dudley and Mull, 1969). Genetic diversity is an essential

component of any breeding programme. The value of germplasm collection depends not only on the number of collected accessions but also on the nature of genetic diversity present in the accessions. Therefore, knowledge of genotypes and its selection history largely affects the extent of genetic variability in a particular breeding programme.

Material and Methods

The present research work was carried out in summer-rainy season of 2019 during the months of June-November. The experiment field was laid out at the experimental farm of Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur, (H.P.). The vegetable science research farm of CoH&F, Neri, Hamirpur (H.P.) is located in sub montane low hill zone (Zone-I) of Himachal Pradesh. Geographically, it is situated at an altitude of 650 meters above mean sea level between 31°41'47.6" N & 72°28'0 6.3" E. The area falls under the subtropical zone having hilly and mountainous relief in Himachal Pradesh.

The experimental material comprised of 23 genotypes of colocasia (*Colocasia esculenta* (L.) Schott) were used for the present research investigation. The genotypes were maintained at experimental farm, College of Horticulture and Forestry, Neri, Hamirpur (H.P.). All the various genotypes were diverse with respect to morphological and important economical traits. The list of genotypes is mentioned in Table-1.

Experimental layout

Sowing of 23 genotypes of colocasia was done on 24 of June 2019 in randomized complete block design with three replications. Details of experimental plans are described below:

Experiment Site	Experimental Farm, Department of Vegetable Science, CoH&F, Neri
Time period of experiment	Summer Rainy Season, 2019
Experimental material	23 genotypes of Colocasia
Design of experiment	RBD
Spacing	30×20 cm
Number of plants per plot	16

Table 1: List of genotypes of colocasia along with their sources.

Genotype	Source
LC-A-1-18, LC-A-2-18, LC-A-3-18, LC-A-4-18, LC-A-5-18, LC-A-6-18, LC-A-7-18, LC-A-8-18, LC-A-9-18, LC-A-10-18, LC-A-11-18, LC-A-12-18, LC-A-13-18, LC-A-14-18, LC-A-15-18, LC-A-16-18, LC-A-17-18, LC-A-18-18, LC-A-19-18, LC-A-20-28, LC-A-21-18, LC-A-22-18 and LC-A-23-18	Department of Vegetable Science, CoH&F, Neri

Results and Discussion

The experiment was laid out with 23 genotypes of colocasia and were grown in Randomized Block Design (RBD) with three replications. The data were recorded on the basis of various characters viz., plant height (cm), number of leaves per plant, length of leaf lamina (cm), Breadth of leaf lamina (cm), number of petioles per corm, number of cormels per plant, number of corms per plant, width of corms (cm), width of cormels (cm), weight of corms per plant (gm), weight of cormels per plant (gm), dry matter percentage in tubers (%), disease severity (%), tuber yield per plot (Kg).

High estimates of phenotypic and genotypic coefficient of variation were reported for number of cormels per plant, disease severity, tuber yield per plot, number of corms per plant, weight of cormels per plant, plant height and width of cormels. Moderate range of phenotypic and genotypic coefficient of variation was observed for width of corms, weight of corms per plant and length of leaf lamina. While, lowest genotypic coefficient of variation was recorded for breadth of leaf lamina. High heritability was recorded for width of corms, tuber yield per plot, plant height, weight of cormels per plant, disease severity, length of leaf lamina, dry matter percentage in tubers, width of cormels and weight of corms per plant. Whereas high range of genetic gain was recorded for number of cormels per plant, tuber yield per plot, disease severity, plant height and weight of cormels per plant.

Table 2 : Mean performance of colocasia genotypes for plant height (cm), leaf number, length of leaf lamina (cm) and breadth of leaf lamina (cm).

Genotypes	Plant height (cm)	Leaf number	Length of leaf lamina (cm)	Breadth of leaf lamina (cm)
LC-A-1-18	82.00	3.67	29.47	22.93
LC-A-2-18	56.20	2.00	22.27	21.73
LC-A-3-18	54.67	3.07	29.00	22.60
LC-A-4-18	114.80	2.47	34.00	25.87
LC-A-5-18	109.33	1.93	24.20	19.27
LC-A-6-18	126.22	2.40	33.73	26.07
LC-A-7-18	104.53	3.93	35.07	25.27
LC-A-8-18	69.33	2.60	32.27	26.47
LC-A-9-18	95.53	2.87	26.73	21.87
LC-A-10-18	99.67	3.27	31.40	26.73
LC-A-11-18	45.67	1.87	24.60	19.73
LC-A-12-18	52.80	2.27	27.47	23.93
LC-A-13-18	62.20	2.00	29.60	23.33
LC-A-14-18	98.33	3.20	32.13	22.40
LC-A-15-18	106.67	3.13	31.27	22.73
LC-A-16-18	86.27	3.33	31.07	25.73
LC-A-17-18	96.50	2.73	28.87	23.07
LC-A-18-18	80.89	2.93	25.27	21.67
LC-A-19-18	70.67	3.40	28.47	22.60
LC-A-20-18	66.53	2.87	29.13	22.00
LC-A-21-18	100.67	3.07	30.13	27.20
LC-A-22-18	111.07	3.20	27.73	23.80
LC-A-23-18	96.27	2.53	29.47	24.67
Mean	**86.38**	**2.81**	**29.28**	**23.55**
Range	**45.67-126.22**	**1.87-3.93**	**22.27-35.07**	**19.27-27.20**
± SE(m)	**1.44**	**0.21**	**0.74**	**0.69**
CV (%)	**2.89**	**12.63**	**4.35**	**5.10**
C.D. (0.05)	**4.12**	**0.59**	**2.10**	**1.98**

Table 3: Mean performance of colocasia genotypes for number of petioles per corm, number of cormels per plant and number of corms per plant.

Genotypes	Number of petioles per corm	Number of cormels per plant	Number of corms per plant
LC-A-1-18	3.67	5.00	2.27
LC-A-2-18	2.00	3.20	1.60
LC-A-3-18	3.07	3.33	2.07
LC-A-4-18	2.47	8.13	1.40
LC-A-5-18	1.93	9.40	2.33
LC-A-6-18	2.40	7.87	1.47
LC-A-7-18	3.93	9.60	2.33
LC-A-8-18	2.60	7.73	2.00
LC-A-9-18	2.87	8.33	2.80
LC-A-10-18	3.27	5.27	2.40
LC-A-11-18	1.87	5.13	1.87
LC-A-12-18	2.27	4.43	1.40
LC-A-13-18	2.00	8.00	1.60
LC-A-14-18	3.20	4.13	1.53

LC-A-15-18	3.13	4.00	1.27
LC-A-16-18	3.33	8.60	2.00
LC-A-17-18	2.73	4.07	1.80
LC-A-18-18	2.93	4.20	1.07
LC-A-19-18	3.40	8.13	1.73
LC-A-20-18	2.87	4.33	1.73
LC-A-21-18	3.07	3.93	1.07
LC-A-22-18	3.20	0.00	1.60
LC-A-23-18	2.53	4.47	2.07
Mean	**2.81**	**5.71**	**1.80**
Range	**1.87-3.93**	**3.20-9.60**	**1.07-2.80**
± SE(m)	**0.21**	**0.40**	**0.23**
CV (%)	**12.63**	**12.00**	**21.64**
C.D. (0.05)	**0.59**	**1.13**	**0.64**

Table 4: Mean performance of colocasia genotypes for width of corms (cm), width of cormels (cm) and weight of corms per plant (gm).

Genotypes	Width of corms (cm)	Width of cormels (cm)	Weight of corms per plant (gm)
LC-A-1-18	5.37	2.68	147.84
LC-A-2-18	4.28	2.37	120.94
LC-A-3-18	4.24	2.29	159.82
LC-A-4-18	6.37	2.65	159.53
LC-A-5-18	6.40	2.35	152.60
LC-A-6-18	6.17	2.41	177.35
LC-A-7-18	6.35	2.38	153.03
LC-A-8-18	6.06	2.46	144.88
LC-A-9-18	6.34	2.61	138.65
LC-A-10-18	5.17	2.65	143.81
LC-A-11-18	5.31	2.69	125.56
LC-A-12-18	5.19	2.32	118.67
LC-A-13-18	6.40	3.13	154.13
LC-A-14-18	5.46	3.00	113.20
LC-A-15-18	5.27	2.89	115.13
LC-A-16-18	6.29	2.56	148.27
LC-A-17-18	5.25	2.68	112.37
LC-A-18-18	5.35	2.88	128.13
LC-A-19-18	6.56	2.56	160.00
LC-A-20-18	4.34	2.27	117.13
LC-A-21-18	4.10	3.28	109.67
LC-A-22-18	5.01	0.00	122.57
LC-A-23-18	4.36	2.64	138.07
Mean	**5.46**	**2.51**	**137.45**
Range	**4.10-6.56**	**2.27-3.28**	**109.67-177.35**
± SE(m)	**0.04**	**0.12**	**3.81**
CV (%)	**1.16**	**8.06**	**4.80**
C.D. (0.05)	**0.10**	**0.33**	**10.90**

Table 5: Mean performance of colocasia genotypes for weight of cormels per plant (gm), dry matter percentage in tubers (%), disease incidence (%) and tuber yield per plot (Kg).

Genotypes	Weight of cormels per plant (gm)	Dry matter percentage in tubers (%)	Leaf Blight/Disease severity (%)	Tuber yield per plot (Kg)
LC-A-1-18	115.60	33.40	24.00	2.62
LC-A-2-18	104.27	32.53	26.00	1.72
LC-A-3-18	109.67	33.73	15.33	1.78
LC-A-4-18	143.00	31.60	7.33	4.28
LC-A-5-18	116.27	30.80	16.00	4.39
LC-A-6-18	122.92	32.00	18.67	4.06
LC-A-7-18	137.26	26.93	20.00	4.17
LC-A-8-18	134.99	23.67	25.33	4.31
LC-A-9-18	121.73	36.80	16.67	4.20
LC-A-10-18	114.33	45.13	14.67	3.28
LC-A-11-18	121.97	29.93	22.00	2.23
LC-A-12-18	154.25	24.07	17.33	2.29
LC-A-13-18	151.28	35.53	14.00	4.33
LC-A-14-18	140.74	21.20	6.67	3.12
LC-A-15-18	123.84	41.73	18.67	2.66
LC-A-16-18	166.05	38.60	9.33	3.93
LC-A-17-18	152.94	43.60	8.67	3.14
LC-A-18-18	113.80	25.73	18.00	2.31
LC-A-19-18	122.02	38.47	37.33	4.21
LC-A-20-18	105.99	42.53	27.33	2.17
LC-A-21-18	101.80	38.47	18.67	2.03
LC-A-22-18	0.00	33.40	26.00	1.49
LC-A-23-18	106.87	30.33	16.67	0.96
Mean	**120.94**	**33.49**	**18.46**	**3.03**
Range	**101.80-166.05**	**21.20-45.13**	**6.67-37.33**	**0.96-4.39**
± SE(m)	**3.51**	**1.50**	**1.56**	**0.05**
CV (%)	**5.03**	**7.75**	**14.66**	**2.87**
C.D. (0.05)	**10.04**	**4.29**	**4.47**	**0.14**

On the basis of overall performance, out of 23 genotypes LC-A-5-18, LC-A-16-18 and LC-A-13-18 were found superior for tuber yield per plot and other important yield attributing traits. Similar findings were reported for variability in Colocasia in reference to the studies undertaken by Kumar *et al.* (2017), Singh *et al.* (2018), Yadav *et al.* (2018), Chaudhary *et al.* (2011), Kumar *et al.* (2007), Paul *et al.* (2011), Shellikeri *et al.* (2018) and Mukherjee *et al.* (2016).

Plate 1 : View of experimental field of colocasia crop.

Plate 2 : Some elite genotypes of colocasia with overall good performance showing variability among genotypes.

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