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Kumar R
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Dogra BS
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Singh SP
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Thakur N
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Meenakshi
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Corresponding Author:
Kumar R
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India

Studies on genetic variability, heritability and coefficients of correlation for yield and qualitative traits in Arvi [*Colocasia esculenta* (L.) Schott

Kumar R, Dogra BS, Singh SP, Thakur N and Meenakshi

Abstract
The present investigation "Studies on genetic variability, heritability and coefficients of correlation for yield and qualitative traits in Arvi [*Colocasia esculenta* (L.) Schott]" was carried out at Vegetable Research Farm, Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur (HP) during summer-rainy season, 2019. Twenty-three genotypes were evaluated in Randomized Complete Block Design with three replications to ascertain extent of variability, heratibility, genetic advance and gain and correlation 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. High PCV and GCV existed 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. High heritability estimates were observed 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 while, high estimates of genetic gain were observed for number of cormels per plant, tuber yield per plot, disease severity, plant height and weight of cormels per plant.

Keywords: Genetic variability, heritability, genetic advance, genetic gain (%), correlation

Introduction
Colocasia (*Colocasia esculenta* (L.) Schott) is a monocotyledonous plant belongs to family Araceae, largely cultivated for its edible corms and leaves. All plants and members belonging to family Araceae are known as aroids (Van and Wyk, 2005) [7]. 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) [8]. It is an important tuber crop, used as 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 sculenta var*. *aquatilis* either in North East India or South East Asia (Matthews, 1991) [5].
In natural habitat, it is commonly found near water sources. 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 od 0.052 million hectares with production of 0.0654 million tons and productivity of 12.57 tons per hectare (Reddy, 2012) [6]. It is widely cultivated in Bihar, Uttar Pradesh, West Bengal, Assam, Himachal Pradesh, Uttrakhand, Orissa, Arunachal Pradesh and Tamil Nadu. The corms and cormels 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) [3]. Genetic diversity is an essential component of any breeding programme. Yield is a complex qualitative trait, such studies are beneficial in identification of yield components during the procedure of selection. Hence, provides great help in conducting selection and using them efficiently in crop improvement programme. Therefore, it is desired to divide whole variability into non-heritable and heritable components with the help of genetic parameters such as genetic coefficient of variation, genetic advances and heritability.
Knowledge of coefficient of variation is important in the assessment of genetic variability for desired traits. Heritability is the concept that summarizes how much of the variation in a trait is due to the variation in genetic factors.

Material Methods

The study was carried out at Experimental Farm, Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur, (H.P.). The data for fourteen characters of twenty three genotypes was collected.

Data was analyzed by Randomized Complete Block Design as suggested by Gomez and Gomez (1984) [3]. The parameters like genotypic and phenotypic variation and correlation coefficients were calculated as per methods of Burton and De Vane (1953) [2] and Al- Jibouri *et al.*, (1958) [1] respectively. All the cultural practices and plant protection measures as per package of practices were followed from time to time to ensure a good crop stand.

Variability for different characters was estimated as suggested by Burton and Devane (1953) [2]. Coefficients of variability (phenotypic and genotypic), Heritability, Genetic advance, Genetic gain and Correlation coefficients.

Results and discussion:

The ANOVA depicted high significant differences among all the genotypes for various horticultural traits under study. Highest plant height was observed in LC-A-6-18 (126.22 cm) while smallest height was recorded for LC-A-11-18 (45.67 cm). Maximum number of leaves per plant were recorded in LCA-7-18 (4) which was statistically at par with LC-A-1-18. Length and breadth of leaf lamina were recorded highest in genotypes LC-A-7-18 (35.07 cm) and LC-A-21-18 (27.20cm), respectively. Maximum number of petioles per corm were observed in LC-A-7-18 (4). Genotype LC-A-7-18 (10) gave maximum number of cormels per plant whereas genotype LC-A-9-18 (2) produced maximum number of corms per plant. Width of corms and width of cormels were recorded maximum in genotypes LC-A-19-18 (6.57 cm) and LCA-21-18 (3.28 cm) respectively. Maximum weight of corms per plant was observed in genotype LC-A-6-18 (170.35 g) while it was minimum in LC-A-21-18 (109.67 g). Maximum and minimum weight of cormels per plant were recorded in LC-A-16-18 (166.05 g) and LC-A-21-18 (101.80 g), respectively. Maximum dry matter percentage in tubers was observed in genotype LC-A-10-18 (45.13%). Genotype LC-A-14-18 was least infected with leaf blight. Maximum tuber yield per plot was produced by genotype LC-A-5-18 (4.39 kg).

Parameters of variability

Table 1 shows estimates of different of parameters of variability.

High estimates of phenotypic and genotypic coefficient of variation were recorded 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 46 leaf lamina. While, low genotypic coefficient of variation was observed for breadth of leaf lamina only.

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. Number of cormels per plant, tuber yield per plot, disease severity, plant height and weight of cormels per plant reflected high range of genetic gain.

Correlation studies

Correlation coefficient analysis was undertaken at both phenotypic and genotypic levels as shown in Table 2 and Table 3. The data revealed that tuber yield per plot had a significant and positive correlation with width of corms, number of cormels per plant, weight of corms per plant, length of leaf lamina, number of corms per plant, width of cormels and plant height at both genotypic and phenotypic levels. Therefore, it is concluded that the selection should be followed as criteria for the improvement of tuber yield in colocasia.

Type of seed priming

Seed priming techniques includes: hydro-priming, halo-priming, osmopriming, hormonal priming, solid matrix priming and biopriming. Seed priming improves germination percentage of seed (Kausar *et al.*, 2009) [8]

Table 1: Estimates of phenotypic and genotypic coefficients of variation, heritability, genetic advance and genetic gain for various characters in colocasia

Characters	Range	Mean± SE(d)	Coefficients of variability (%)		Heritability (%)	Genetic advance	Genetic gain (%)
			Phenotypic	Genotypic			
Plant height (cm)	45.66-126.22	86.38±2.04	26.40	26.24	98.80	46.41	53.72
Number of leaves per plant	1.87-3.93	2.81±0.29	22.63	18.77	68.82	0.90	32.08
Length of leaf lamina (cm)	22.27-35.07	29.28±1.04	11.63	10.79	86.02	6.03	20.61
Breadth of leaf lamina (cm)	19.27-27.20	23.55±0.98	10.06	8.67	74.28	3.63	15.39
Number of cormels per plant	3.20-9.60	5.71±0.56	44.32	42.66	92.67	4.83	84.60
Number of corms per plant	1.07-2.80	1.80±0.32	30.40	21.36	49.36	0.56	30.91
Width of corms (cm)	4.10-6.56	5.46±0.05	14.93	14.88	99.40	0.56	30.57
Width of cormels (cm)	2.27-3.28	2.51±0.17	25.15	23.82	89.72	1.17	46.48
Weight of corms per plant (gm)	109.67-177.35	137.45±5.39	14.53	13.71	89.07	36.65	26.66
Weight of cormels per plant (gm)	101.80-166.05	120.94±4.97	26.71	26.23	96.45	64.18	53.07
Dry matter percentage in tubers (%)	21.20-45.13	33.49±2.12	20.66	19.15	85.93	12.25	36.58
Disease severity (%)	6.67-37.33	18.46±2.21	40.81	38.09	87.10	13.52	73.22
Tuber yield per plot (Kg)	0.96-4.39	3.03±0.07	36.24	36.12	99.38	2.25	74.18

Table 2: Phenotypic coefficients of correlation among different traits in colocasia.

	PH	NLPP	LoLL	BoLL	NCsPP	NCPP	WC	WCs	WoCPP	WoCsPP	DMP	DS	TYPP
PH	1.000												
NLPP	0.256*	1.000											
LoLL	0.467**	0.441**	1.000										
BoLL	0.335**	0.293*	0.655**	1.000									

NCsPP	0.163	-0.024	0.318**	0.116	1.000								
NCPP	-0.002	0.127	-0.037	-0.115	0.330**	1.000							
WC	0.271*	0.019	0.281*	0.027	0.810**	0.225	1.000						
WCs	-0.134	-0.104	0.125	0.054	0.360**	-0.093	0.086	1.000					
WoCPP	0.161	0.045	0.310**	0.175	0.638**	0.295*	0.568**	-0.012	1.000				
WoCsPP	-0.177	-0.089	0.266*	0.092	0.590**	0.057	0.415**	0.718**	0.187	1.000			
DMP	0.129	0.144	0.011	0.081	-0.074	0.143	-0.145	0.022	-0.047	-0.077	1.000		
DS	-0.315**	0.072	-0.280*	-0.153	-0.103	-0.008	-0.098	-0.312**	0.025	-0.452**	0.055	1.000	
TYPP	0.276*	0.014	0.376**	0.132	0.856**	0.240*	0.912**	0.249*	0.555**	0.522**	0.001	-0.160	1.000

*Significant at 5% level of significance
**Significant at 1% level of significance Where,
PH = Plant height (cm), NLPP = Number of leaves per plant, LoLL = Length of leaf lamina (cm), BoLL = Breadth of leaf lamina (cm), NoCsPP = Number of cormels per plant, NCPP = Number of corms per plant, WC = Width of corms (cm), WCs = Width of cormels (cm), WoCPP = Weight of corm per plant (gm), WoCsPP = Weight of cormels per plant (gm), DMP = Dry matter percentage in tubers (%), DS = Disease severity (%) and TYPP = Tuber yield per plot (Kg).

Table 3: Genotypic coefficients of correlation among different traits in colocasia.

	PH	**NLPP**	**LoLL**	**BoLL**	**NCsPP**	**NCPP**	**WC**	**WCs**	**WoCPP**	**WoCsPP**	**DMP**	**DS**	**TYPP**
PH	1.000												
NLPP	0.318**	1.000											
LoLL	0.510**	0.527**	1.000										
BoLL	0.396**	0.376**	0.799**	1.000									
NCsPP	0.171	-0.068	0.322**	0.124	1.000								
NCPP	0.014	0.225	-0.007	-0.128	0.465**	1.000							
WC	0.274*	0.020	0.303*	0.026	0.838**	0.302*	1.000						
WCs	-0.134	-0.090	0.153	0.035	0.392**	-0.108	0.094	1.000					
WoCPP	0.172	0.015	0.364**	0.238*	0.689**	0.427**	0.607**	0.012	1.000				
WoCsPP	-0.184	-0.145	0.295*	0.101	0.618**	0.058	0.424**	0.776**	0.185	1.000			
DMP	0.135	0.224	0.295*	0.107	-0.083	0.116	-0.159	0.058	-0.079	-0.083	1.000		
DS	-0.346**	0.129	-0.306*	-0.191	-0.118	0.021	-0.109	-0.341**	0.037	-0.467**	0.066	1.000	
TYPP	0.279*	0.027	0.405**	0.162	0.893**	0.338**	0.918**	0.263*	0.588**	0.538**	-0.003	-0.174	1.000

*Significant at 5% level of significance
**Significant at 1% level of significance Where,
PH = Plant height (cm), NLPP = Number of leaves per plant, LoLL = Length of leaf lamina (cm), BoLL = Breadth of leaf lamina (cm), NoCsPP = Number of cormels per plant, NCPP = Number of corms per plant, WC = Width of corms (cm), WCs = Width of cormels (cm), WoCPP = Weight of corm per plant (gm), WoCsPP = Weight of cormels per plant (gm), DMP = Dry matter percentage in tubers (%), DS = Disease severity (%) and TYPP = Tuber yield per plot (Kg).

Conclusions

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. The estimates of PCV and GCV were recorded high 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.

High heritability was observed 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.

Gentic advance was recorded high for number of cormels per plant, tuber yield per plot, disease severity, plant height and weight of cormels per plant. 48 Positive and significant correlation coefficient of tuber yield per plot was recorded for width of corms, number of cormels per plant, weight of corms per plant, weight of cormels per plant, length of leaf lamina, number of corms per plant, width of cormels and plant height

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