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Genetic variability and evaluation studies on Taro [*Colocasia esculenta* var. *antiquorum* (L.)] genotypes

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Abstract
An experiment was carried out to analysed genetic variability analysis for corm yield and its contributing traits in nine taro genotypes during *kharif* season of 2021-22. The experiment was conducted using a randomized complete block design with three replications. Maximum mean performance was recorded for the character yield and no. of cormels per plant in Indira Arvi-1 (33.09 t/ha, 15.67) which was followed by TTr 17-1 (23.08 t/ha, 12.67) and TTr 17-5 (21.11 t/ha, 12.33). High magnitude of phenotypic and genotypic coefficient of variation was observed for cormel weight per plant followed by corm weight per plant, yield, corm length, number of cormels per plant, petiole length and plant height. High heritability coupled with high genetic advance in percent of mean were recorded for the characters petiole length, yield, cormel weight per plant, corm length, corm weight per plant, plant height, no. of cormels per plant and corm diameter. These characters will play a significant role for future breeding programme and selection of parents in heterosis.

Keywords: Taro, genetic variability, heritability, genetic advance, tuber yield

Introduction
Colocasia [*Colocasia esculenta* var. *antiquorum* (L.)] also known as Taro and Arvi. Colocasia belongs to the monocotyledonous family Araceae. It is origin of South-east-Asia. Taro is one among the few edible species in genus colocasia. Cultivated taro type are mostly diploid (2n=2x=28) although some triploids are found (2n=3x=42). The edible vegetable parts are corms, leaves and petioles and are high in proteins, minerals vitamins and carbohydrates, they are also rich source of thiamin, phosphorus, zinc riboflavin and iron very good source of niacin, potassium, copper, and manganese. Corms having water content (63-85%), protein (1.3-4.0%), fat (2.0-4.0%), carbohydrate (13-29%), ash (0.6-1.3%), fiber (0.6- 1.2%) and vitamin B and C in considerable amounts (Coursey, 1968) [5]. The phenotypic variation of taro is due to continuous vegetative propagation and selection. Only by measuring genetic variability to establish varietal identity and the breadth and distribution of genetic variation can the origin of current landraces or farmer varieties be determined. Genetic parameter studies provide insight into the expected response of various traits to selection and aid in the development of an optimal breeding technique. Hence, the present study was planned to evaluate colocasia genotypes suitable for cultivation in Chhattisgarh and to study genetic parameter for corm yield and yield contributing characters.

Materials and Methodd
The study was performed during *Kharif* season 2021 at Research-cum Instructional Farm of S.G. CARS, Jagdalpur (C.G). The experiment was planned in a randomized complete block design with three replications at a row to row spacing of 60cm and plant to plant spacing of 45cm. Data were noted on five randomly selected plants with respect to characters *viz*., plant height (cm), number of leaves per plant, petiole length (cm), corm length (cm), corm diameter (cm), corm weight per plant (g), cormel weight per plant (g), number of cormels per plant, total yield per plant, yield (t/ha). The mean data were studied to statistical and biometrical interpretation (Singh and Choudhary, 1985) [17]. Genotypic and phenotypic CV was calculated using the formula proposed by Burton (1952) [1], heritability (h^2 (broad sense)) was estimated using the formula suggested by Burton and De Vane (1953) [2] and genetic advance was estimated using the formula suggested by Johnson *et al.*, (1955) [6].

Results and Discussion

The ANOVA of all the characters under experiment is presented in Table 1. This analysis of variance represented that mean sum of squares due to genotypes was highly significant for all studied traits. This is an indication of presence of enough variability amongst the genotypes for yield and its components characters. Statistically significant mean sum of squares due to tuber yield and yield attributing characters revealed presence of enormous variability in material considered for improvement for various traits.

The mean values of different growth and yield characters regarding genotypes are presented in Table 2. The tuber yield was recorded highest in genotype Indira Arvi-1 (33.09 t/ha), which was followed by TTr 17-1 (23, 08 t/ha), TTr 17-5 (21.11 t/ha). The highest plant height, maximum number of leaves per plant and maximum petiole length was recorded in Indira Arvi-1 (100.53 cm, 11.43 & 89.33cm) followed by TTr 17-12 (88.33 cm, 11.31 & 68.43cm). Maximum corm length was obtained in TTr 17-12 (15.00 cm) followed by TTr 17-1 (12.67 cm) and TTr 17-2 (11.67 cm). Indira Arvi-1 was recorded for maximum corm diameter *i.e*., 6.33 cm which was followed by TTr 17-12 (5.50 cm) and TTr 17-1 (5.33 cm). Maximum weight of corm per plant recorded in TTr 17-12 (473.33 g) followed by Indira Arvi-1 (406.67 g) and TTr 17-1 (400.00 g). Maximum cormels weight per plant was recorded in Indira Arvi-1 (1580 g) followed by TTr 17-5 (1040 g), TTr 17-1 (983 g). Indira Arvi-1 was recorded for maximum number of cormels and total yield per plant (15.67 & 1.99 kg) which was followed by TTr 17-1 (12.67, 1.39 kg) and TTr 17-5 (12.33, 1.27 kg).

The mean range and genetic variability were estimated and presented in Table 3. Wide range of mean variation observed for the characters like plant height (51.25 cm – 100.53 cm), petiole length (42.27cm – 89.33 cm), corm weight per plant (146.67g to 405.33 g) and number of cormels per plant (6.00 to 15.67). High magnitude of genotypic as well as phenotypic coefficient of variation were recorded for traits *viz*., cormel weight per plant (39.97% and 42.11%), corm weight per plant (37.13% and 40.12%), yield (33.73% and 35.39%), corm length (30.87% and 33.12%), number of cormels per plant (28.09% and 31.69%), petiole length (26.66% and 27.01%) and plant height (23.06% and 25.70%). High GCV and PCV in colocasia was also reported earlier by Singh *et al*., 2003 [15]; Pandey *et al*., 2009 [10]; Sarma *et al*., 2010 [13]; Poddar *et al*., 2015 [11]; Mukherjee *et al*., 2016 [9] for number of cormels per plant, weight of corms per plant. Kumar *et al*. 2017 [7] also reported high GCV and PCV for number of cormels per plant, weight of cormels per plant and tuber yield. Moderate GCV and PCV was recorded for corm diameter (15.49% and 17.91%). Number of leaves per plant (8.30% and 12.60%) had low GCV and PCV. Related finding was also reported by Kumar *et al*. 2017 [7].

Phenotypic coefficient of variation was superior than the genotypic coefficient of variation for all the characters representing that eco factor were impacting their expression. The traits/characters which showed high phenotypic and genotypic coefficient of variations are of economic interest and there is field of action for improvement of these traits through selection.

In the current study high magnitude of heritability was observed for most of characters. The highest heritability was recorded for the traits petiole length (97.42%), yield (90.81%), cormel weight per plant (90.11%), corm length (86.87%), corm weight per plant (85.62%), plant height (80.49%), number of cormels per plant (78.57%) and corm diameter (74.79%). These traits showed that they were least affected by environmental changes, implying that phenotypic performance would be a valid basis for selection. Similar results were also reported by Choudhary *et al.* (2011) [4], Poddar *et al.* (2015) [11], Kumar *et al*. (2017) [7], Kumar *et al.* (2020) [8], Shellikeri *et al.* (2020) [14], Sangeeta *et al.* (2021) [12]. None of the traits observed for moderate heritability. The low heritability was observed for number of leaves per plant (43.45%). Similar finding was supported by Choudhary *et al.* (2011) [4], Poddar *et al.* (2015) [11], Kumar *et al.* (2017) [7].

Genetic advance (%) of mean was noted high for cormel weight per plant (78.17%), corm weight per plant (70.80%), yield t/ha (66.22%), corm length (59.28%), petiole length (54.20%), number of cormels per plant (51.30%), plant height (42.62%) and corm diameter (27.60%). The higher value of genetic advance for these characters indicated that these attributes are governed by additive genes and selection will be beneficial for the further improvement of such traits. The moderate genetic advance as percentage of mean was observed for number of leaves per plant (11.28%). Kumar *et al*. 2017 [7] reported moderate genetic advance of mean (%) for number of leaves per plant. Characters revealing moderate genetic advance shows importance of both additive and non-additive gene effects.

Heritability (h^2) estimates genetic advances are more useful than the heritability value alone for opting the best individual. High heritability combined with high genetic advance was recorded for petiole length, yield, cormel weight per plant, corm weight per plant, corm length, plant height, number of cormels per plant and corm diameter studied that the most likely the heritability is due to additive gene effects and selection may be efficient. Similar research findings were also concluded by Cheema *et al.* (2007) [3], Kumar *et al.* (2017) [7], Kumar *et al*. (2020) [8], Thakur *et al.* (2021) [18].

Table 1: Analysis of variance for tuber yield and its component characters in taro

S. No.	Character (DF)	Mean sums of square		
		Replication	Treatment	Error
		(2)	(8)	(16)
01	Plant height (cm)	49.00	794.65**	59.39
02	No. of leaves per plant	1.53	3.11*	0.94
03	Petiole length (cm)	3.49	706.72**	6.17
04	Corm length (cm)	16.56	28.29**	1.36
05	Corm diameter (cm)	0.13	1.93**	0.19
06	Weight of corm per plant (g)	1348.15	39123.15**	2068.98
07	Weight of cormel per plant (g)	7514.81	333548.15**	11760.65
08	No. of cormels per plant	2.33	27.00**	2.25
09	Total yield per plant (kg)	0.01	0.44**	0.01
10	Yield (t/ha)	3.98	122.16**	3.87

*: Significant at 5%, **: Significant at 1%

Table 2: Mean performance of taro genotypes (*Kharif*, 2021)

Genotype Name	Plant height (cm)	No. of leaves per plant	Petiole length (cm)	Corm length (cm)	Corm diameter (cm)	Weight of corm per plant (g)	Weight of cormel per plant (g)	No. of cormels per plant	Total yield per plant (kg)	Total yield (kg/plot)	Yield (t/ha)
TTr 17-1	55.00	10.33	48.73	12.67	5.33	400.00	983.33	12.67	1.39	20.78	23.08
TTr 17-2	67.66	10.36	56.93	11.67	5.10	270.00	690.00	10.67	0.96	14.39	15.99
TTr 17-3	61.16	10.22	42.47	11.00	5.00	353.33	530.00	9.33	0.88	13.23	14.70
TTr 17-5	59.83	9.33	63.60	9.00	4.60	226.67	1040.00	12.33	1.27	19.00	21.11
TTr 17-8	51.25	8.47	42.27	6.67	3.80	166.67	620.00	7.00	0.79	11.80	13.11
TTr 17-12	88.33	11.31	68.43	15.00	5.50	473.33	606.67	6.00	1.08	16.20	18.00
TTr 17-13	68.36	11.25	59.80	8.00	4.67	146.67	671.00	9.67	0.82	12.27	13.63
Sree Rashmi	58.83	9.39	44.30	5.67	3.83	250.00	653.33	8.67	0.91	13.59	15.10
Indira Arvi-1	100.53	11.43	89.33	7.67	6.33	406.67	1580.00	15.67	1.99	29.78	33.09
Mean (x)	67.89	10.23	57.32	9.70	4.91	299.26	819.26	10.22	1.12	16.78	18.65
S.Em ±	4.45	0.56	1.43	0.67	0.25	26.26	62.61	0.87	0.07	1.02	1.14
CD (p=0.05)	13.30	1.67	4.29	2.01	0.76	78.50	187.15	2.59	0.20	3.06	3.40
CV (%)	11.35	9.47	4.33	12.00	8.99	15.20	13.24	14.67	10.55	10.55	10.45

Table 3: Mean range and genetic parameter of variability for corm yield and its component characters in taro (*Kharif*, 2021)

S. No.	Characters	Mean	Range		Coefficient of variation (%)		Heritability ($h^{2\%}$)	GA as percentage of mean
			Min^m	Max^m	GCV	PCV		
01	Plant height (cm)	67.89	51.25	100.53	23.06	25.70	80.49	42.62
02	No. of leaves per plant	10.23	8.47	11.43	8.30	12.60	43.45	11.28
03	Petiole length (cm)	57.32	42.27	89.33	26.66	27.01	97.42	54.20
04	Corm length (cm)	9.70	5.67	15.00	30.87	33.12	86.87	59.28
05	Corm diameter (cm)	4.91	3.80	6.33	15.49	17.91	74.79	27.60
06	Weight of corm per plant (g)	299.15	146.67	405.33	37.13	40.12	85.65	70.80
07	Weight of cormels per plant (g)	819.63	620.00	1580.00	39.97	42.11	90.11	78.17
08	No. of cormels per plant	10.22	6.00	15.67	28.09	31.69	78.57	51.30
09	Yield (t/ha)	18.64	13.11	33.09	33.73	35.39	90.81	66.22

Conclusion

Study implied that the genotypes Indira Arvi-1, TTr 17-1 and TTr 17-5 performed better in terms of corm yield and yield contributing characters and these genotypes may be used as a parent for the subsequent breeding programme and also recommended for cultivation in Chhattisgarh. And the traits like petiole length, yield tonne per ha., cormel weight per plant, corm weight per plant, corm length, plant height, number of cormels and corm diameter would be considered for direct selection due to highly heritable and high genetic advance as percentage of mean. These traits are important for identifying a superior line and also for selection of parents in future breeding programme.

References

1. Burton GW. Quantitative inheritance in grases. Proc 6th International Grassland Congress. 1952;1:227-283.
2. Burton GW, De Vane EH. Estimating heritability in tall fesue (*Fesluca arundinacea*) from replicated clonal material. Agronomy Journal. 1953;45:418-481.
3. Cheema DS, Singh H, Dhatt AS, Sidhu AS. Studies on genetic variability and correlation for yield and quality traits in arvi (*Colocasia esculenta* (L.) Schott). Acta Horticulture. 2007;752:255-260.
4. Choudhary VK, Kumar PS, George J, Kanwat M, Saravanan R. Genetic variability and character association in taro (*Colocasia esculenta* (L.) Schott.) under Mid-Hills of Arunachal Pradesh, Journal of Root Crops. 2011;37(2):155-161.
5. Coursey DG. The edible aroids. World crops. 1968;20(4):25-30.
6. Johanson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability of soybean. Agronomy Journal. 1955;47:314-318.
7. Kumar A, Kushwaha ML, Panchbhaiya A, Verma P. Studies on genetic variability in different genotype of taro. Journal of Hill Agriculture. 2017;8(3):274-278.
8. Kumar R., Dogra BS, Thakur N, Meenakshi. Study on genetic variability, heritability and coefficients of correlation for yield and qualitive traits in Arvi [*Colocasia esculenta* (L.) Schott. J. of Pharmacognosy and phytochemistry. 2020;9(6):1361-1363.
9. Mukherjee D, Roquib MA, Das ND, Mukherjee SA. Study on genetic variability character association and path co-efficient analysis on morphological and yield attributing characters of taro [*Colocasia esculenta* (L.) Schott]. American Journal of plant Sciences. 2016;7:479-488.
10. Panday V S, Ojha MD, Singh PK. Genetic variability and correlation studies in arvi (*Colocasia esculenta* var. *antiquorum*). Vegetable Science. 2009;36(3):431-434.
11. Poddar A, Mukherjee A, Sreekumar J, Abraham K, Naskar SK, Unnikrishnan M. Phenotypic variability among germplasm lines of elephant foot yam (*Amorphophallus paeoniifolius*) and taro (*Colocasia esculenta*). International Journal of Tropical Agriculture. 2015;33(2):377-380.
12. Sangeeta, Devaraju, Srinivasa V, Lakshmana D, Kantharaj Y, Arunkumar B. Studies on genetic variability. correlation coefficient and path coefficient

analysis for growth and yield attributes in taro (*Colocasia esculenta* L.). The Pharma Journal. 2021;10(12):1508-1513.
13. Sarma P, Singh VB, Yadav DS. Variability and character association ship study in colocasia. Indian Journal of Horticulture. 2010;67(3):409-413.
14. Shellikeri B, Malshe KV, Mhaskar NV, Parulekar YR. Assessment of herbage yield potential in different colocasia (*Colocasia esculenta* L.) genotypes under konkan region. Journal Pharmacognosy Phytochemistry. 2020;9(2):1821-1824.
15. Singh DN, Mishra A, Samal KC, Variability and character association in colocasia. Environment and Ecology. 2003;21(1):183-185.
16. Singh MK, Dev C, Singh YP, Singh P. Studies on genetic variability under mean, range and coefficient of variation for yield and its contributing traits in arvi (*Colocasia esculenta* var. *antiquorum*) germplasm. Research Environment Life Sciences. 2015;8(2):309-312.
17. Singh RK, Chaudhury BD. Biometrical method of quantitive genetic analysis. Haryana Journal Horticulture Science. 1985;12:151-156.
18. Thakur P, Ramteke V, Naik U. Genetic variability for different quantitative character in colocasia [*Colocasia esculenta* var. *antiquorum*.] International Journal Current Microbiology Applied Science. 2021;10(03):1282-1286.