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Genetical Studies on Agro Morphological Characters of Some Taro [*Colocasia esculenta* (L.) Schott.] Cultivars of Northeast India

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ABSTRACT

The present investigation was conducted at the experimental farm of SASRD: NU, Medziphema, Nagaland during *kharif* season 2019. Fourteen genotypes were procured from the three states of northeast for the present study. The experiment was carried out in randomized block design. Observations were recorded as average of five randomly sampled plants from each plot. The corms were sown during the month of April 2020. Quantitative characters such as plant height, leaf length, number of leaves, number of corms and corms yield per plant were recorded. Quantitative characters were subjected to statistical analysis. The analysis of variance showed significant difference among genotypes for the studied traits. High GCV (33.881) and PCV (52.349) were registered for corms yield per plant. High estimates of heritability and genetic advance were recorded for number of leaves and plant height. Thus, these traits may be used as selection criteria in breeding programme. Plant height and leaf length showed significant positive correlation with the yield per plant at both phenotypic and genotypic level. Path coefficient analysis revealed that plant height and leaf length exerted positive direct effect and also exhibited significant positive correlation with yield per plant at genotypic level indicating a true relationship among the traits. This suggested that the direct selection for plant height, leaf length and number of leaves would likely be effective in increasing yield per plant.

Keywords : Taro, PCV, GCV, heritability, genetic advance

THE subfamily Aroideae of family Araeaceae consists of three edible tuber crops, namely 'Taro' (*Colocasia esculenta* (L.) Schott.), 'Tannia' (*Xanthosoma* spp.) and 'Giant taro' (*Alocasia* spp.). Among these three tuber crops, taro and tannia are mostly cultivated compare to the giant taro. The generic name of taro is derived from the ancient Greek word *kolokasion*, which in the Greek botanist Dioscorides (1st century AD) meant the edible roots of both *Colocasia esculenta* and *Nelumbo nucifera* (Osbaldeston, 2000).

It is an important tropical tuber crop, used as a staple food or subsistence food by millions of people in the developing countries in Asia, Africa and Central America. The origin of taro is uncertain and however reported as it was originated and first domesticated in Southeast Asia (Hunt *et al.*, 2013).

Taro is grown as a vegetable, ornamental and medicinal plant (Prajapati *et al*., 2011). Since the tribal of northeast largely depends on this crop as a food security, taro becomes a crop of great interest and importance in this area. So, therefore there is an utmost need to improve cultivars found here through breeding programme. But research and study are limited on this crop for releasing an improved variety through selection. Breeders require information about the

desirable morphological traits. Therefore the present study entitled 'Genetical Studies on Agro Morphological Characters of Some Taro [*Colocasia Esculenta* (L.) Schott.] Cultivars of Northeast India' was aim to evaluate the Agro Morphological character of taro of North-eastern state of India. Since the critical assessment of nature and magnitude of variability is one of the important pre-requisites for formulating effective breeding methods as the genetic improvement of any crop depends on magnitude of genetic variability and the extent of heritability of economically important characters, though the part played by environment in the expression of such character also needs to be taken into account. The objective of the study was therefore, to evaluate the quantitative characteristics of taro cultivar using agro-morphological traits and select the promising landraces

Material and Methods

The present study on 'Genetical Studies on Agro Morphological Characters of Some Taro [*Colocasia esculenta* (L.) Schott.] Cultivars of Northeast India' was carried out at the experimental farm of Department of Genetics and Plant Breeding, School of Agricultural Sciences and Rural Development, Nagaland University during the *kharif* season from 17th April, 2019 to 13th December, 2019. The experiment was carried out following Randomized Block Design (RBD) with three replication plot size was of 3 × 2 m consisting of 3 rows. Row to row distance was 100 cm and plant to plant distance was of 50 cm.

The genotypes were collected from some part of Northeastern state *viz.,* Arunachal Pradesh, Assam, Nagaland in the month of March, 2019. Nine genotypes were collected from Nagaland, Four from Arunachal Pradesh and one genotype was procured from Assam Agriculture University, Jorhat, Each germplasm was given a code no. for easy identification. The codes were CD1, CD2, and CD3 etc. The detail list of cultivars name, Genotype collected from and place of collection are presented in Table 1.

Data on the basis of five randomly selected competitive plants were recorded on plant height (cm), Leaf length (cm), number of leaves per plant, number of cormels and yield per plant (g) correlation

Table 1

Detail list of genotypes along with their respective code and place of collection

Code no.	Local name	Place of collection	State	Collected from
CD1	Dzürinuo	Socünoma	Nagaland	Mr.Akono
CD2	Kerilla	Socünoma	Nagaland	Mr.Akono
CD3	Tsuphizhü	Socünoma	Nagaland	Mr.Akono
CD4	Dzüduno	Medziphema	Nagaland	Mr.SariImchen
CD5	Sereca	Medziphema	Nagaland	Mr.SariImchen
CD6	Rüphezhie	Socünonu	Nagaland	Mr.Akono
CD7	Dzüdi	Socünonu	Nagaland	Mr.Akono
CD8	So-amra	Roing	Arunachal Pradesh	Mrs.EmuhuMeya
CD9	So-pitru	Roing	Arunachal Pradesh	Ms.UmaliMeya
CD10	So-Lo	Roing	Arunachal Pradesh	Mrs.EmuhuMeya
CD11	Soo-ja	Anini	Arunachal Pradesh	Mrs.Anjili Mega
CD12	Ahina	AAU	Assam	Dr. H. Alam
CD13	Honbal	Medziphema	Nagaland	Mr. AkaitoKiba
CD14	Thupela	Medziphema	Nagaland	Mr. Thefukoli

TABLE 2

Analysis of variances for 14 genotypes in 5 characters of taro

Sources of Variance	df	Mean Square				
		Plant height	Leaf length	No. of leaves	No. of corms	Yield per plant
Replications	2	125.578	130.987	2.758	11.361	23027.640
Genotypes	13	740.915 **	149.991 **	30.426 **	15.603 **	421681.212 **
Error	26	115.761	28.063	4.511	3.378	133334.491

coefficient and path coefficient were worked out as per method suggested by Searle (1961) and Dewey and Lu (1959), respectively.

RESULTS AND DISCUSSION

Analysis of variance revealed presence of significant variation for all the characters indicating the presence of sufficient amount of genetic variability among the genotypes for yield per plant and other yield contributing traits. Mandal *et al.* (2013) reported the same result. The experimental findings showed a wide range of variation for yield per plant, number of corms, number of leaves and leaf length. So-amra (1425.9g), Tsuphizhü (1425.4g) and So-lo (1385.9g) recorded with high corm yield per plant. Dzürinuo (11.266) and Ahina (9.8) recorded high number of corms per plant.

TABLE 3

Mean performance of 14 genotypes of taro for 5 characters

Characters Genotypes	Plant height (cm)	Leaf length (cm)	No. of leaves	No. of corms	Yield per plant (g)
1	83.913	36.04	10.8	11.266	991.283
2	82.033	34.6	6.9	6.333	689.933
3	110.266	48.167	11	3.866	1425.407
4	113.866	36.90	13.283	4.733	887.433
5	79	29.467	9.166	5.6	502.52
6	85	44.267	10.4	5.216	585.0167
7	107.9	44.367	10.566	7.9	1241.35
8	85.033	44.24	11.066	3.866	1425.9
9	95.966	51.967	10.466	5.1	1235.1
10	94.633	43.44	13.716	7.183	1385.967
11	53.956	31.97	9.066	5.033	279.033
12	88.9	30.77	15.7	9.8	837.733
13	73.2	34.733	5.133	4.733	656.033
14	93.33	45.57	5.2	3.7	667.566
Mean	89.071	39.74	10.176	6.023	915.019
SEd±	8.78	4.325	1.734	1.500	298.1436
CD (5%)	18.061	8.893	3.565	3.085	612.98
CD (1%)	24.413	12.020	4.819	4.170	828.541

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Therefore, these landraces could be utilized in further breeding programme for the yield improvement.

The estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) indicated that the values of PCV was higher than the corresponding GCV for all the characters due to partly interaction of the genotype with the environment or other environmental factors influencing the expression of these characters. A similar result was reported by Eze *et al.* (2016) and Mulualem (2013). High GCV and PCV were recorded for yield per plant, number of corms and number of leaves. Similar results have been reported by Eze *et al.* (2016) for number of leaves. Moderate PCV and GCV were recorded for leaf length and plant height indicating the prevalence of additive gene action in controlling of these characters similar result have been reported by Mulualem *et al.* (2013) for moderate PCV for leaf length.

In the present study the maximum heritability (broad sense) was observed for number of leaves (65.5%) followed by plant height (64.2%), leaf length (59.1%) and number of corms (54.6%). High heritability estimates indicated that the characters were less influence by the environment effects and high capacities of the characters for transmission to subsequent generation. This also suggests that the phenotypes were the true representatives of genotypes for these characters and selection based on phenotypic value will be reliable. The similar result was reported by Mulualem *et al.* (2013) for number of leaves and leaf length and by Mezill (2015) for plant height. The estimates of genetic advance expressed as % of mean was found maximum for number of corms, number of leaves and yield per plant. Heritability and genetic advance when consider together would be more reliable and useful in predicting the resultant effects of selection. In the present study high heritability coupled with high genetic advance expressed as % of mean were observe for number of corms, number of leaves, leaf length and plant height which may be attributed to the preponderance of additive gene action and possess high selective value and thus selection

TABLE 4

Estimates of mean range, variance, coefficient of variation, heritability and genetic advance as % of mean

Character	Mean ±S.E	Range	Variance			Coefficient of variation		Heritability	Genetic advance	Genetic advance as % of mean
			GV	PV	EV	GCV	PCV	h^2bs		
Plant height	89.071 ± 8.78	53.956 - 113.866	208.384	324.145	115.761	16.206	20.213	64.2	23.810	26.731
Leaf length	39.74 ± 4.325	29.467 - 51.967	40.64	68.705	28.063	16.039	20.854	59.1	10.090	25.390
No. of leaves	10.176 ± 1.734	5.133 - 15.7	8.638	13.149	4.511	29.230	36.065	65.6	4.900	48.152
No. of corms	6.023 ± 1.500	3.7 - 11.266	4.075	7.453	3.378	33.591	45.430	54.6	3.07	50.971
Yield per plant	915.019 ± 298.143	279.033 - 1425.407	36115.573	229450.064	133334.491	33.881	52.349	41.8	412.465	45.077

TABLE 5

Estimates of phenotypic (r_p) correlation coefficient and genotypic (r_g) correlation coefficient between different characters of taro

Characters	Plant height	Leaf length	No. of leaves	No. of corms	Yield per plant
Plant height	G	0.584 *	0.408	-0.023	0.704 **
	P	0.516 *	0.380	-0.012	0.636 **
Leaf length		G	-0.012	-0.419	0.764 **
		P	0.095	-0.277	0.572 *
No. of leaves			G	0.436	0.423
			P	0.387	0.486 *
No. of corms				G	-0.013
				P	0.153

*=Significant at 1%, **=Significant at 5%, G = Genotypic correlation coefficient, P = Phenotypic correlation coefficient

pressure could profitability be applied on these characters for their rational improvement similar results were reported by Mulualem *et al.* (2013) for number of leaves and Singh *et al*. (2017) for leaf length.

In general, the values of genotypic correlation were higher than their corresponding phenotypic correlation. This indicated that though there was high degree of association between two variables at genotypic level, its phenotypic expression was depleted by the influence of environment. At genotypic level plant height (0.704) and leaf length (0.764) were found to be significantly and positively correlated with yield per plant. Thus these traits were found to be the outstanding characters influencing yield per plant in taro and needs to be given due importance in selection to achieve higher yield. Paul *et al.* (2011) reported positive correlation between yield per plant and leaf length in *Colocasia* yield. Similar observation was found by Eze *et al.* (2016) for positive correlation with plant height.

All the characters were associated positively with the yield except number of corm which was negatively correlated with the yield. This finding is supported by Mezhii (2015).

Path analysis revealed that leaf length (0.759), number of leaves (0.296) number of corms (0.178) and plant height (0.1438) contributed positively direct effect towards yield. Plant height, leaf length and number of leaves exerted positive direct effect and also exhibited significant positive correlation with the yield indicating a true relationship between the traits. This suggested that the direct selection for these traits would likely be effective in increasing corm yield. Similar report was reported by Paul *et al.* (2011). Eze *et al.* (2016) also recorded positive direct effect for number of cormels per plant (0.388) and number of corms (0.220).

TABLE 6

Direct and Indirect effects of different characters of different genotypic level in taro

Characters	Plant height	Leaf length	No. of leaves	No. of corms	Yield per plant
Plant height	0.1438	0.4441	0.121	-0.004	0.7046
Leaf length	0.083	0.759	-0.003	-0.074	0.7647
No. of leaves	0.058	-0.009	0.296	0.077	0.4236
No. of corms	-0.003	-0.318	0.129	0.178	-0.0140

Residual Effect: 0.4419

The residual effect estimated were 0.4419 indicating that the trait under study are not sufficient to account for variability and these might be a few more pertinent characters other than those studied in the present investigation and thus solicits inclusion of some more characters. Inclusion of some physiological characters like corm weight, number of cormels, petiole length etc. could be considered important in order to derive a much clear picture of the causal relationship.

From this study, it can be concluded that agro morphological characterization was useful in identifying variations among the cultivar. The positive correlation and positive direct effect effects between yield components and leaf length, number of leaf per plant and plant height indicates that the yield of taro can be improved by concentrating on these characters. The study also indicates that yield per plant, number of leaves and number of corms have the highest GCV, heritability and genetic advance, genotype So-amra, Ahina and Dzürinuo showed highest mean for above mention traits which could be exploited for varietal development of taro in Nagaland. Therefore, there is need to consider effort in conservation and research into taro.

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