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Correlation and path coefficient analysis for yield and horticulture traits in different genotypes of Colocasia (*Colocasia esculenta* var. *antiquorum* (L.) Schott)

Manvendra Singh and GC Yadav

Abstract

Correlation and path coefficient analysis studies conducted in forty diverse genotypes of taro with objective to know association among character viz., Days to sprouting, length of leaf (cm), width of leaf (cm), girth of plant (cm), petiole length (cm), sheath length (cm), height of Plant (cm), length of cormels(cm), girth of cormels(cm), number of cormels/plant, weight of cormels/plant(g), length of corm (cm), girth of corms (cm), weight of corms/plant (g), dry matter (%), yield/plant(g). Present study revealed that the trait yield/plant had significant and positive phenotypic and genotypic correlation with Weight of cormels per plant(g), weight of corms per plant (g), number of cormels per plant and dry matter (%). Inter relationship study revealed that for improvement of taro weight of cormels/plant (g), weight of corms/plant, girth of cormels (cm) and dry matter (%) at phenotypic level. Path coefficient analysis revealed by weight of cormels per plant followed by weight of corms per plant, length of leaf (cm), dry matter (%), girth of cormels per plant (cm), days to sprouting. exhibited greater direct effect on tuber yield p/plant (g). Therefore, these character appear to be the most important traits for colocasia improvement programme.

Keywords: Colocasia (*Colocasia esculenta* var. *antiquorum*), Tuber yield/plant (g), Correlation and path analysis

Introduction

Taro (*Colocasia esculenta* var. *antiquorum*) is one of the oldest and most important tuber crop. It is also known as eddoes type taro, arvi and ghua. It is grown mostly as staple or subsistence crop throughout the tropics and subtropics.

The corms and cormels are mostly used as vegetables or as subsidiary food after roasting, baking or boiling. Young leaves and petioles are widely consumed as vegetable. The corms and cormels are rich in starch which contains 17-25 percent amylase. Its flour is considered good baby food because its starch is easily digestible. It helps in constipation problems and supplements iron (Onwueme, 1999). The nutritive value of colocasia per 100g of corms and cormels are moisture 73.1g, Carbohydrate 21.1g, Protein 3.1g, Fat 0.1g, β -carotene 24 μ g, Thiamine 0.09mg, Riboflavin 0.03mg, Calcium 40mg, and Iron 1.7mg which can be used as supplements of these nutrients.

The corms are acrid due to presence of calcium oxalate crystals. However, it has got a very good potential as an important tuber crop because of its higher yield potential and better keeping quality. In addition to this, it has got very good medicinal values too. Various parts of the plant are also used in traditional medicine practice (Tsitsiringos, 2002). The juice of the leaves is used against colic and constipation, the acrid juice extracted from leaf stalk is astringent and styptic. The corm is mild laxative and diuretic. It is generally used against piles, constipation and dropsy in the form of gruel. The ash of the corm is used as antihelminthic, mixed with honey, and it is applied in the aphthous condition of the mouth.

Material and Method

The experimental were comprised of forty genotype collected from All India Coordinate Research on Tuber Crops. The experiments were carried out at two location i.e. NDUAT Kumarganj, Faizabad, UP and Farmer's field Belakhra, Faizabad, UP for two consecutive seasons i.e. 2015 and 2016 in the randomized block design with three replications. Cormels of each genotype was planted in the month of March at inter and intra row spacing of 60 cm having plot size of: 2.40m x 1.80 m. The standard packages of practices were followed to raise the crops was harvested in November.

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Morphological observation were recorded on five randomly selected plants from each plot and replication for days to sprouting, length of leaf (cm), width of leaf (cm), girth of plant (cm), petiole length (cm), sheath length (cm), height of plant (cm), length of cormels (cm), girth of cormels (cm), number of cormels /plant, weight cormels /plant (g), length of corm (cm), girth of corms (cm), weight of corms /plant (g), dry matter (%), yield / plant (g) were estimated.

The correlation between different characters at genotypic. Phenotypic level were estimated according to Searle (1965) and as elaborated by Dewey and Lu (1959) by partitioning the genotypic correlation coefficients into direct and indirect effects.

Correlation coefficients

traits either in combination or alone would be beneficial to identify the genotypes having Correlation coefficients among horticulture traits were worked out in all possible combination at phenotypic and genotypic levels. In general genotypic correlation values were higher than those at phenotypic for most of the traits indicating strong inhere association between various characters studies.

In the present study, as same above hypothesis the estimates of genotypic correlation coefficients in general were higher than the phenotypic correlation coefficients, which indicates that, the apparent association of two characters are not only due to genes but also due to favourable influence of environment. This result gets support from the finding of Kamlam *et al.* (1977) and Mukharjee *et al.* (2003).

Yield/ plant (g) was observed positive and highly significant phenotypic correlation with Weight of cormels per plant(g) (0.91), Weight of corms per plant (g)(0.45), Number of cormels per plant(0.43), and Dry matter (%) (0.14) and

negative significant association with days to sprouting (-0.15), and length of leaf (cm) (-0.230). Thus, it may deduce that the selection based on these better yield potential. Similar finding have been reported by Das (1997), Mehta *et al.* (2003) and maini *et al* (1981).

Path coefficient

The correlation coefficients provide information information regarding the association of different characters among themselves whereas better in sight into the cause of association is provided by path coefficients into direct and indirect effects of traits contribution of different characters tuber yield per plant, the path coefficient analysis was carried out.

The path coefficient analysis (Table 3) Path coefficient revealed that the highest positive direct effect on tuber yield per plant was exerted by followed by weight of cormels per plant (0.8708) followed by weight of corms per plant (0.3869), length of leaf (cm)(0.0176), dry matter (%) (0.0137), girth of cormels per plant (cm) (0.0058), days to sprouting (0.0032). The higher magnitude of negative direct effect on tuber yield was exerted by width of leaf (0.0268), girth of plant (0.0102), girth of corms (0.0084), petiole length (0.0028). Considerable positive indirect effect numbers of cormels per plant (0.4614).Where, substantial negative indirect effect on tuber per plant were exhibited by days to sprouting (0.1580), length of leaf (0.0657). weight of cormels per plant and weight of corms per plant have been found as important contribution to tuber yield in colocasia by earlier work Agueguia (19993), Pandey *et al.* (1996), Sarkar *et al.* (1996), Mehta *et al* (2003) Cheema *et al.* and Devi *et al.*(2013).

Table. 1: Estimates of correlation coefficient at phenotypic level for different traits in *Colocasia* over environments (pooled).

Traits	Length of leaf (cm)	Width of leaf (cm)	Girth of plant (cm)	Petiole length (cm)	Sheath length (cm)	Height of plant (cm)	Length of cormel(cm)	Girth of cormels (cm)	Number of cormels per plant	Weight of cormels per plant (g)	Length of corm (cm)	Girth of corms (cm)	Weight of corms per plant (g)	Dry matter (%)	Yield per plant (g)
Days to sprouting	0.07	0.05	-0.03	0.10	0.18	0.07	0.06	0.09	-0.08	-0.18	0.00	0.12	0.01	0.08	-0.15
Length of leaf (cm)		0.87	0.06	0.23	0.07	0.61**	0.21	0.24	0.28	-0.08	0.04	-0.01	-0.12	0.09	-0.11
Width of leaf (cm)			-0.03	0.15	0.04	0.56**	0.16	0.17	0.27	-0.04	-0.01	-0.05	-0.07	0.05	-0.07
Girth of plant (cm)				0.13	0.16	-0.01	0.07	0.08	0.06	-0.05	0.01	-0.04	-0.02	0.12	-0.06
Petiole length (cm)					0.47**	0.25	0.06	0.15	0.27	-0.04	-0.08	-0.05	-0.03	-0.04	-0.05
Sheath length (cm)						0.05	-0.10	-0.07	0.06	-0.07	-0.26	-0.15	0.04	-0.03	-0.05
Height of plant (cm)							0.18	0.22	0.23	0.00	0.00	0.04	-0.02	0.06	-0.01
Length of cormel(cm)								0.77**	-0.02	-0.07	0.13	0.19	0.06	0.18	-0.04
Girth of cormels(cm)									0.01	-0.07	0.11	0.20	0.01	0.12	-0.06
Number of cormels per plant										0.53**	-0.05	-0.12	-0.11	0.09	0.43**
Weight of cormels per plant (g)											0.00	-0.15	0.08	0.09	0.91**
Length of corm (cm)												0.14	-0.03	0.15	-0.01
Girth of corms (cm)													0.21	0.17	-0.06
Weight of corms per plant (g)														0.13	0.45**
Dry matter (%)															0.14

*,**Significant at 5 percent and 1 percent probability level, respectively.

Table 2: Estimates of correlation coefficient at genotypic level for different traits in *Colocasia* over environments (pooled).

Traits	Length of leaf (cm)	Width of leaf (cm)	Girth of plant (cm)	Petiole length (cm)	Sheath length (cm)	Height of plant (cm)	Length of cornel (cm)	Girth of cormels (cm)	Number of cormels per plant	Weight of cormels per plant (g)	Length of corm (cm)	Girth of corms (cm)	Weight of corms per plant (g)	Dry matter (%)	Yield per plant (g)
Days to sprouting	0.10	0.08	-0.05	0.17	0.24	0.12	0.18	0.24	-0.13	-0.22	0.02	0.29	0.05	0.17	-0.18
Length of leaf (cm)		0.98	0.11	0.29	0.08	0.70	0.32	0.38	0.33	-0.08	0.03	-0.05	-0.15	0.13	-0.13
Width of leaf (cm)			0.03	0.21	0.04	0.67	0.31	0.33	0.33	-0.05	0.05	-0.06	-0.07	0.09	-0.07
Girth of plant (cm)				0.23	0.28	0.04	0.01	0.07	0.24	-0.11	-0.09	-0.09	-0.09	0.34	-0.13
Petiole length (cm)					0.59	0.31	0.09	0.15	0.33	-0.07	-0.26	-0.17	-0.07	-0.06	-0.09
Sheath length (cm)						0.06	-0.18	-0.14	0.07	-0.10	-0.47	-0.20	0.03	-0.12	-0.08
Height of plant (cm)							0.35	0.40	0.25	0.00	0.02	0.13	-0.03	0.11	-0.01
Length of cornel (cm)								1.00	-0.01	-0.20	0.19	0.37	0.07	0.35	-0.15
Girth of cormels (cm)									0.09	-0.17	0.18	0.36	-0.06	0.34	-0.17
Number of cormels per plant										0.62	-0.02	-0.21	-0.13	0.11	0.51
Weight of cormels per plant (g)											-0.01	-0.27	0.06	0.15	0.93
Length of corm (cm)												0.26	-0.14	0.20	-0.06
Girth of corms (cm)													0.24	0.40	-0.15
Weight of corms per plant (g)														0.22	0.43
Dry matter (%)															0.22

Table 3: Estimates of direct and indirect effects of different quantitative traits on tuber yield per plant in *Colocasia* at phenotypic level over environments (Pooled).

Traits	Days to sprouting	Length of leaf (cm)	Width of leaf (cm)	Girth of plant (cm)	Petiole length (cm)	Sheath length (cm)	Height of Plant (cm)	Length of cornel (cm)	Girth of cormels (cm)	Number of cormels per Plant	Weight of cormels per plant (g)	Length of corm (cm)	Girth of corms (cm)	Weight of corms per plant (g)	Dry matter (%)	correlation with tuber Yield per Plant (g)
Days to sprouting	0.0032	0.0012	-0.0012	0.0003	-0.0003	0.0002	0.0001	-0.0002	0.0005	-0.0010	-0.1580	0.0000	-0.0010	0.0039	0.0011	-0.1511
Length of leaf (cm)	0.0002	0.0176	-0.0233	-0.0006	-0.0006	0.0001	0.0011	-0.0006	0.0014	0.0034	-0.0657	0.0000	0.0001	-0.0445	0.0012	-0.1104
Width of leaf (cm)	0.0001	0.0154	-0.0268	0.0003	-0.0004	0.0000	0.0010	-0.0004	0.0010	0.0032	-0.0343	0.0000	0.0004	-0.0253	0.0007	-0.0650
Girth of plant (cm)	-0.0001	0.0011	0.0007	-0.0102	-0.0003	0.0001	0.0000	-0.0002	0.0004	0.0008	-0.0455	0.0000	0.0003	-0.0062	0.0017	-0.0574
Petiole length (cm)	0.0003	0.0041	-0.0040	-0.0013	-0.0028	0.0004	0.0004	-0.0002	0.0008	0.0032	-0.0370	0.0000	0.0004	-0.0121	-0.0006	-0.0481
Sheath length (cm)	0.0006	0.0012	-0.0010	-0.0016	-0.0013	0.0009	0.0001	0.0003	-0.0004	0.0008	-0.0636	0.0001	0.0013	0.0139	-0.0005	-0.0493
Height of Plant (cm)	0.0002	0.0107	-0.0149	0.0001	-0.0007	0.0001	0.0018	-0.0005	0.0013	0.0027	0.0031	0.0000	-0.0003	-0.0094	0.0008	-0.0050
Length of cornel (cm)	0.0002	0.0038	-0.0043	-0.0007	-0.0002	-0.0001	0.0003	-0.0026	0.0044	-0.0003	-0.0611	0.0000	-0.0016	0.0224	0.0025	-0.0373
Girth of cormels (cm)	0.0003	0.0043	-0.0045	-0.0008	-0.0004	-0.0001	0.0004	-0.0020	0.0058	0.0002	-0.0614	0.0000	-0.0017	0.0031	0.0017	-0.0554
Number of cormels per Plant	-0.0003	0.0050	-0.0072	-0.0006	-0.0008	0.0001	0.0004	0.0001	0.0001	0.0119	0.4614	0.0000	0.0010	-0.0414	0.0012	0.4308
Weight of cormels per plant (g)	-0.0006	-0.0013	0.0011	0.0005	0.0001	-0.0001	0.0000	0.0002	-0.0004	0.0063	0.8708	0.0000	0.0013	0.0318	0.0012	0.9109
Length of corm (cm)	0.0000	0.0006	0.0004	-0.0001	0.0002	-0.0002	0.0000	-0.0003	0.0007	-0.0006	0.0023	-0.0003	-0.0012	-0.0130	0.0020	-0.0096
Girth of corms (cm)	0.0004	-0.0003	0.0014	0.0004	0.0001	-0.0001	0.0001	-0.0005	0.0012	-0.0015	-0.1325	0.0000	-0.0084	0.0797	0.0023	-0.0578
Weight of corms per plant (g)	0.0000	-0.0021	0.0018	0.0002	0.0001	0.0000	0.0000	-0.0002	0.0000	-0.0013	0.0726	0.0000	-0.0018	0.3809	0.0018	0.4522
Dry matter (%)	0.0003	0.0015	-0.0013	-0.0013	0.0001	0.0000	0.0001	-0.0005	0.0007	0.0011	0.0795	0.0000	-0.0014	0.0498	0.0137	0.1422

R² = 0.9727 Residual effect = 0.1652

Table 4: Estimates of direct and indirect effects of different quantitative traits on tuber yield per plant in *Colocasia* at genotypic level over environments (Pooled).

Traits	Days to sprouting	Length of leaf (cm)	Width of leaf (cm)	Girth of plant (cm)	Petiole length (cm)	Sheath length (cm)	Height of Plant (cm)	Length of cormel (cm)	Girth of cormels (cm)	Number of cormels per Plant	Weight of cormels per plant(g)	Length of corm (cm)	Girth of corms (cm)	Weight of corms per plant (g)	Dry matter (%)	correlation with tuber Yield per plant (g)
Days to sprouting	0.0031	-0.0032	0.0027	-0.0008	0.0009	-0.0013	-0.0003	0.0049	-0.0057	0.0014	-0.2042	-0.0001	0.0017	0.0190	-0.0005	-0.1826
Length of leaf (cm)	0.0003	-0.0312	0.0326	0.0017	0.0016	-0.0005	-0.0019	0.0089	-0.0091	-0.0035	-0.0735	-0.0001	-0.0003	-0.0537	-0.0004	-0.1291
Width of leaf (cm)	0.0002	-0.0305	0.0333	0.0005	0.0011	-0.0002	-0.0018	0.0086	-0.0081	-0.0035	-0.0467	-0.0003	-0.0004	-0.0243	-0.0003	-0.0724
Girth of plant (cm)	-0.0002	-0.0035	0.0010	0.0157	0.0012	-0.0016	-0.0001	0.0003	-0.0018	-0.0026	-0.1053	0.0005	-0.0005	-0.0330	-0.0010	-0.1309
Petiole length (cm)	0.0005	-0.0091	0.0070	0.0037	0.0053	-0.0033	-0.0008	0.0024	-0.0035	-0.0035	-0.0687	0.0014	-0.0010	-0.0237	0.0002	-0.0933
Sheath length (cm)	0.0007	-0.0026	0.0014	0.0045	0.0031	-0.0057	-0.0002	-0.0050	0.0035	-0.0007	-0.0902	0.0025	-0.0012	0.0119	0.0004	-0.0776
Height of Plant (cm)	0.0004	-0.0218	0.0224	0.0006	0.0016	-0.0003	-0.0027	0.0097	-0.0097	-0.0026	0.0033	-0.0001	0.0008	-0.0116	-0.0003	-0.0103
Length of cormel(cm)	0.0006	-0.0101	0.0104	0.0002	0.0005	0.0010	-0.0009	0.0275	-0.0241	0.0001	-0.1822	-0.0010	0.0022	0.0262	-0.0011	-0.1508
Girth of cormels(cm)	0.0007	-0.0117	0.0111	0.0012	0.0008	0.0008	-0.0011	0.0274	-0.0242	-0.0010	-0.1528	-0.0009	0.0021	-0.0230	-0.0010	-0.1715
Number of cormels per Plant	-0.0004	-0.0103	0.0110	0.0038	0.0018	-0.0004	-0.0007	-0.0003	-0.0022	-0.0107	0.5719	0.0001	-0.0013	-0.0482	-0.0003	0.5138
Weight of cormels per plant(g)	-0.0007	0.0025	-0.0017	-0.0018	-0.0004	0.0006	0.0000	-0.0055	0.0040	-0.0066	0.9203	0.0001	-0.0016	0.0228	-0.0005	0.9315
Length of corm (cm)	0.0001	-0.0008	0.0016	-0.0014	-0.0014	0.0027	0.0000	0.0053	-0.0043	0.0002	-0.0108	-0.0053	0.0016	-0.0507	-0.0006	-0.0639
Girth of corms (cm)	0.0009	0.0016	-0.0021	-0.0014	-0.0009	0.0012	-0.0004	0.0101	-0.0086	0.0023	-0.2442	-0.0014	0.0060	0.0848	-0.0012	-0.1535
Weight of corms per plant (g)	0.0002	0.0047	-0.0022	-0.0014	-0.0003	-0.0002	0.0001	0.0020	0.0015	0.0014	0.0583	0.0007	0.0014	0.3601	-0.0007	0.4255
Dry matter (%)	0.0005	-0.0042	0.0032	0.0053	-0.0003	0.0007	-0.0003	0.0098	-0.0082	-0.0012	0.1388	-0.0011	0.0024	0.0806	-0.0031	0.2227

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