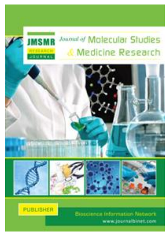
Published with Open Access at Journal BiNET
Vol. 04, Issue 01: 177-186

Journal of Molecular Studies and Medicine Research

Journal Home: www.journalbinet.com/jmsmr-journal.html



Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott)

Emmanuel Essien Bassey
Dept. of Crop Science, Faculty of Agriculture, University of Uyo, Nigeria.

✉ Corresponding author*: emmanuelessien@rocketmail.com.
Article Received: 05.03.19; Revised: 24.04.19; First published online: 25 May 2019.

ABSTRACT

A study was conducted to establish relationship between pigmentation of leaf sinus and petioles, leaf blight and root rot with morphological characters in taro (Colocasia esculenta). The result showed that fresh weight of corms and cormels correlated positively and significantly with plant height, leaf area, number of cormels, leaf blight, and diameter of leaf sinus. The result also showed positive indirect effects of plant height, length of corms, girth of corms, girth of cormels, leaf blight, root rot, colour of leaf sinus and diameter of sinus with fresh weight of corms and cormels. Primary components identified with fresh weight of corms and cormels include plant height, leaf area, length of corms, girth of corms, length of cormels, leaf blight, root rot and colour of sinus. The result indicate that selection for high yield in Colocasia esculenta could be based on pigmentation of leaf sinus and petioles, resistance to leaf blight and root rot.

Key Words: *Colocasia esculenta, Leaf blight, Root rot, leaf sinus, petioles and yield components*

Cite Article: Bassey, E. E. (2019). Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott). Journal of Molecular Studies and Medicine Research, 04(01), 177-186. Crossref: https://doi.org/10.18801/jmsmr.040119.20

I. Introduction

Until the advent of molecular markers, the genetic markers used to develop maps in plants have been those affecting morphological traits (Ubi 2008). They have been used extensively on various crop plant diversity assessments in many places in the world (Kopondo 2011). They are heritable entities that may be associated with economically important traits and have been used by crop breeders as selection tools (Darvasi and Soller, 1994). Morphological markers are indicators, which provide an objective estimate of basic relationship in germplasm and may be considered as a reliable index of plant genotype (Bernatzky and Tanksley, 1989). Despite environmental influences on plant morphology, this direct, inexpensive, time saving and easy to use method of estimation has been considered the strongest determination of agronomic value and taxonomic classification of plants (Li *et al*. 2009) and first step in the assessment of plant diversity (Bos *et al*. 2000).

Published with open access at journalbinet.com
EISSN: 2414-5009,

Morphological marker was used in biology well before being known that DNA is the hereditary material (Paterson *et al.* 1991). Linkages between a genetic marker and morphological trait locus (MIL) was first demonstrated by Sax in 1923, that common bean (*Phaseolus vulgaris*) with different seed coat colours also differed in average seed size (Ubi 2008). Similarly, purple coleoptile colour in some traditional rice varieties is closely linked to the gene that confers resistance to brown plant hopper (BPH). In this case, coleoptile colour is a morphological marker, which is used to assist selection for BPH resistance (Mohapatra and Chopra 2005). Cultivated Ipomoea show extensive variability in terms of stem, petiole, tuber skin and flesh colours (Nedunchezhiyari *et al.* 2012), which are governed by genes. Similarly, cassava, a major staple of people in Nigeria can be distinguished from one another by such morphological characteristics as colour of leaves, stem, petioles, tuber skin and flesh (Nweke 1996), which farmers have used for decades as correlates of yield and other desirable agronomic characters. Therefore, a pigmentation on plant parts can be used as morphological marker during breeding experiments. Morphological markers have been associated with downy mildew resistance in grapevine. When pigmentation was low, anthrocyamin coloration of the tip was needed to screen susceptible plants from resistant ones. With the anthocyanin pigmentation, medium to strong, 63.5% of the plants were selected as resistant. It seems that anthocyanin in petioles or shoot tip might play a role in selecting resistant or susceptible genotypes for the population (Gokbayrak *et al.* 2010).

Resistance to cocoyam leaf blight has been observed in pink, red and yellow flesh cultivars (Pacumbaba *et al.* 1992). Morphological markers have been used as indices to correlate certain characters in plants for example fibre content in sugar cane and rind hardiness (Bhat *et al.* 1985). Similarly, Walker (1971) found correlation of about 0.6 between fibre content and rind hardiness. Rind hardiness also correlated significantly with stem borer tolerance in sugarcane. The purpose of this study was to assess the association of pigmentations of leaf sinus and petioles with yield components leaf blight and root rot of taro (*Colocasia esculenta*).

II. Materials and Methods

The experiment was conducted both in the screen house and field. Tarogeramplasm were collected from farmers in four Local Government Areas of AkwaIbom State, namely Abak (IkotEkangand Midim) Basin Development Authority, Itu (Ayadehe), IbionoIbom (Ikot Ada Idem) and Uyo (Afaha Oku), The six collection were properly washed and labeled and placed in a cool dry place for two days before being in planted in perforated polythene bags filled with rich forest soil and spaced 1mx1m in a completely randomized block design and replicated three times. The crops were watered with clean tap water at the base of the plants No fertilizer, insecticide or fungicide was applied. Morphological characters collected were plant height, leaf area, number of leaves, number of corms and cormels, length of corms and cormels, fresh weight of corms and cormels symptoms of leaf blight and root rot disease, pigmentation (shape diameter) of leaf sinus and pigmentation of petroles. Planting in the screen house was done in October, 2013 and harvested in April, 2014, about 6 months after planting.

Corms and cormels of the six collections were harvested, washed and planted at the University of Uyo Teaching and Research Farm Use Offot in 2014 cropping seasons. The experiment occupied land area of 35m X 23m and laid out in a randomized complete block design at 1m X 1m apart. The experiment was replicated four times. No fertilizer or agro-chemical was applied to the crops. Agronomic practices carried out were similar to that of the screen house. Similarly, the data collected were similar to those of the screen house. The crops were harvested in October, 2014.

Based on some vital morphological characteristics, the six germplasm were grouped into four accessions and designated Ce - Uy - 1, Ce - Uy - 2, Ce-Uy - 3 and Ce-Uy-2 and planted in 2015 and 2016 cropping seasons. For each year, the four accessions were laid out on a land area 16m X 15m using a randomized complete block design with four replications. Ce-Uy-1 germplasm was designated, Congoma; Ce-Uy- 2 Favourite, Ce-Uy- 3 Medium Local, while Ce-Uy-4 was designated nkengeikpong. Analysis of variance was conducted on all the characters and the means separated with the Least Significant Difference (LSD) at 5% probability level. Similarly, the four accessions were assessed for resistance to cocoyam leaf blight and root rot disease, following the procedure of Stather *et al.* (2003).

$$\frac{\text{Total number of plant/tubers affected per accession}}{\text{Total number of plants/tubers per accession in the field}} \times \frac{100}{1}$$

The scale and descriptors used to categorize the observed variations into classes of resistance and susceptibility were:

No apparent damage of cocoyam by leaf blight/root rot disease (shorts or tubers) = high resistance
Very little damage (1-25% of shoots (leaves) or tubers) by blight disease/root rot= resistance
Moderate damage (26-50% of shoot or tuber) infected by blight disease/root rot = weak susceptibility
Considerable damage (51-75% of shoot or tubers) infected by blight disease/root rot = susceptibility
Severe damage (76-100% of shoot or tubers) infected by cocoyam blight disease/root rot = high susceptibility.

Also, the diameters of leaf sinus pigmentation, (oval, aster or arms) were measured, where applicable in millimeter. Colour chart was used for identification of colours of leaf sinus and petioles into categories such as green, yellow and purple. Correlations were conducted to establish associations between and among the characters, using the Pearson Product Moment Correlation. Also, path coefficient correlation analysis and principal component analysis were estimated to identify direct and indirect effects and primary and secondary components in *Colocasia esculenta*.

III. Results

Tables 01, 02 and 03 show the morphological characters, pigmentation of leaf sinus and petioles and leaf blight and root rot disease of *Colocasia esculenta* in 2014 to 2016 cropping seasons. Significant differences ($p < 0.05$) were observed for all the characters studied. The result showed the superiority of Ce - Uy - 2 over over all other genotypes in four primary yield components: girth of corms, number of cormels, girth of cormels, fresh weight of corms and cormels and diameter of sinus. Ce - Uy- 1 was superior in four characters, namely plant height, leaf area, length of corms and length of cormels, while Ce - Uy - 4 was superior in number of leaves, together with resistance to leaf blight and root rot disease. Ce - Uy - 3 exhibited intermediate characteristics between Ce - Uy- 2 and Ce - Uy- 4, with resistance to leaf blight and root rot disease. The result further revealed both positive and negative correlations among characters in *Colocasia esculenta* (Table 04). Plant height correlated positively and significantly with girth of corms (0.548*) fresh weight of corms and cormels (0.67*) and number of cormels (0.686) but negatively with length of cormels (-.520*) girth of cormels (-0.408), resistance to leaf blight (-0.418) and root rot (-0.226). colour of leaf sinus (-0.182) and diameter of sinus (-.337). Number of leaves was positive and significantly correlated with leaf area (0.829**), length of corms (0.559*), number of cormels (0.589*), length of cormels (0.990**), colour of sinus (0.513*) and diameter of sinus (0.515*), though they negatively correlated with girth of cormels (-0.234), fresh weight of corms and cormels (-0.267) and resistance to leaf blight (-0.455). Similarly, leaf area showed positive significant correlation with number of leaves (0.829**), girth of corms (0.569*), number of cormels (0.543*), length of cormels (0.930**), fresh weight of corms and cormels (0.567*), resistance to leaf blight (0.567*), root rot (0.871**) and diameter of sinus (0.651*), but negatively correlated with girth of corms (-0,562*). Length of corms exhibited negative correlation with girth of cormels (-0.345), fresh weight of corms and cormels (-0.789**), root rot disease (-0.349), colour of sinus (-0.397), diameter of sinus (-0.672*) but positively correlated with girth of corms (0.451), number of cormels (0.218), length of cormels (0.844**), resistance to leaf blight (0.484), plant height (0.246), leaf area (0.559*) and leaf area (0.344).

Girth of corms correlated significantly with leaf area (0.569*), length of cormels (0.728**) and girth of cormels (0.567*), but negatively with number of cormels (-0.349), fresh weight of corms and cormels (-0.569*), resistance to leaf blight (-0.231), resistance to root rot (-0.551*), colour of sinus (-0.598*). Number of cormels was positive and significantly correlated with plant height (0.686*), leaf area (0.543*), length of cormels (0.921*) and diameter of leaf sinus (0.872**), but negatively correlated with girth of cormels (-0.349), resistance to leaf blight (-0.321) and root rot disease (-0.148).

Length of cormels was positive and significantly correlated with number of leaves (0.990**), leaf area (0.930**), length of corms (0.844**), girth of corms (0.728**), number of cormels (0.921**) and resistance to leaf blight (0.567*). Similarly, positive significant correlations were observed between girth of cormels and girth of corms (0.567*), and resistance to root rot disease (0.517*). However, the character was negatively correlated with number of leaves (-0.234), leaf area (-0.562*), length of corms (-0.345), fresh weight of corms and cormels (-0.345), colour of leaf sinus (-0.371) and diameter of sinus (-0.198).

Fresh weight of corms and cormels correlated positive and significantly with plant height (0.678**), leaf area (0.587*), resistance to leaf blight (0569*), number of cormels (0.551) and diameter of sinus (0.763**), but negatively with number of leaves (-0.569*), girth of cormels (-0.345) and resistance to root rot disease (-0.293). Leaf blight diseases correlated significantly with length of cormels (0.567*), fresh weight of corms and cormels (0.569*) and colour of sinus (0.562*), but negatively with plant height (-0.418), number of leaves (-0.321), resistance to root rot disease (-0.318). Similarly, root rot disease was positive and significantly correlated with leaf area (0.871**) and girth of cormels (0.517*) but negatively correlated with other characters, namely, plant height (-0.226), length of corms (-0.349), girth of corms (-0.551), number of cormels (-0.148), length of cormels (-0.291), fresh weight of corms and cormels (0.293) resistance leaf blight (-0.318) and colour of sinus (-0.129). Colour of leaf sinus correlated negatively with plant height (-0.182), length of corms (-0.397), girth of corms (-0.598*), length of cormels (-0.129) girth of cormels (-0.371), resistance to root rot (-0.129) and diameter of leaf sinus (-0.352). Similarly, diameter of Sirius was positive and significantly correlated with leaf area (0.651*), number of cormels (0.872**), and fresh weight of corms and cormels (0.763**), but negatively correlated with plant height (-0.337), length of corms (-0.672*), girth of cormels (-0.198) and colour of leaf sinus (-0.352).

Table 05 shows the path coefficient correlation analysis for morphological characters, pigmentation of leaf sinus and petioles, leaf blight and root rot disease in taro. The result showed that plant height had positive indirect effects on leaf area, length of corms, length of cormels, girth of cormels, fresh weight of corms and cormels, leaf blight, colour of sinus and diameter of sinus, but expressed negative indirect effects on number of leaves, girth of corms, number of cormels and root rot disease. Number of leaves showed negative indirect effect on three characters, namely, leaf area, number of cormels, girth of cormels and colour of leaf sinus, while it exhibited positive indirect effects on others. Leaf area showed negative indirect effects on six characters: plant height, number of leaves, length of corms, girth of cormels, fresh weight of corms and cormels and root rot disease, while it exhibited positive indirect effects on the rest of the characters (Table 05). Similarly, length of corms exhibited negative indirect effects on plant height, number of cormels, leaf blight and colour of sinus, while girth of cormels exhibited negative indirect effects on three characters, namely, number of leaves, leaf ares, number of cormels, leaf blight and root rot disease, while it produced positive indirect effects on other characters. Length of cormels and girth of cormels produced negative indirect effect, 5 by length of cormels and 6 by girth of cormels.

Fresh weight corms and cormels had negative indirect effects on number of leaves, girth of corms, length of cormels, leaf blight, colour of leaf sinus and diameter of leaf sinus. There was negative indirect effect of leaf blight on length of corms, length of cormels, girth of cormels, colour of leaf sinus and diameter of leaf sinus, while root rot disease exhibited negative indirect effects on plant height, number of leaves, length of corms, girth of corms, girth of cormels. Similarly, colour of sinus produced negative indirect effects onplant height, leaf blight, root rot, and diameter of sinus. Negative indirect effects was observed between diameter of sinus and plant height, length of corms, number of cormels, root rot disease and colour of leaf sinus (Table 05).

Principal component analysis shows high Ogen value (7.5 24). The values of primary principal components ranged from 0.128 to 0.984, the highest value being produced by resistance to leaf blight (0.984), root rot disease (0.925), length of cormels (0.952), length of corms (0.925), leaf area (0.898), colour of leaf sinus (0.889) and plant height (0.886) in that order (Table 06).

Table 01. Morphological characters, petiole and leaf sinus, pigmentation and leaf blight and root rot of *Colocasia esculenta* accessions in 2014

Cocoyam cultivars	Plant height (cm)	No. of leaves	Leaf area (cm^2)	Length of corm	Girth of corms (cm)	No. of cormels corm	Length of cormels (cm)	Girth of cormels (cm)	Fresh weight of corms and cormels (g)	LB	RR	CS	DS (cm)	SS	CP
Ce-uy-1	76.9	17.6	466.7	14.0	27.4	8.4	15.2	8.6	589.4	4.5	3.6	5	1.0	Oval	G
Ce-uy-2	73.3	28.4	412.0	12.3	36.0	18.4	12.6	15.4	2118.4	3.2	2.5	3	6.3	Aster	P
Ce-uy-3	64.4	14.8	259.6	4.4	9.6	9.6	7..0	10.2	356.6	2.4	1.8	3	2.4	Oval	P
Ce-uy-4	57.6	20.4	302.8	5.8	16.6	6.2	8.4	6.3	426.5	2.0	1.0	1	0.5	Oval	LY
LSD (p<0.05)	*3.02*	*1.04*	*6.8*	*1.08*	*3.07*	*1.16*	*1.24*	*1.72*	*12.76*	*0.04*	*NA*	*NA*		*NA*	*NA*

Ph = Plant height; NL = No. of leaves; LA = Leaf area; LC = Length of corms; GC = Girth of corms; NCo = No. of cormels; LCo = Length of cormels; GCo = Girth of cormels; FWCCo = Fresh weight of corm and cormels; LB = Leaf blight; RR = Root rot; CS = Colour of sinus; DS = Diameter (cm) of sinus; SS = Shape of sinus; CP = Colour of petioles; P = Purple; LY = Light yellow; G = Green, NA = not applicable.

Table 02. Morphological characters, petiole and leaf sinus, pigmentation and leaf blight and root rot of *Colocasia esculenta* accessions in 2015

Cocoyam cultivars	Plant height (cm)	No. of leaves	Leaf area (cm^2)	Length of corm	Girth of corms (cm)	No. of cormels corm	Length of cormels (cm)	Girth of cormels (cm)	Fresh weight of corms and cormels (g)	LB	RR	CS	DS (cm)	SS	CP
Ce-uy-1	75.8	17.6	466.4	14.6	26.9	8.4	15.8	8.6	568.6	4.6	3.8	p-5	1.0	Oval	G
Ce-uy-2	72.5	27.8	422.5	11.4	37.4	18.2	12.1	16.2	2018.6	3.2	2.5	y-3	6.3	Aster	P
Ce-uy-3	65.2	15.0	256.3	4.0	10.8	10.7	8.4	10.4	374.5	2.0	1.2	y-3	2.4	Oval	P
Ce-uy-4	57.5	21.8	318.4	6.4	16.5	5.4	9.2	6.2	466.2	2.0	1.0	Ly-1	0.5	Oval	LY
LSD (p<0.05)	*3.08*	*1.46*	*8.42*	*0.92*	*2.69*	*1.00*	*1.67*	*0.41*	*16.74*	*0.004*	*0.06*	*NA*	*0.08*	*NA*	*NA*

Ph = Plant height; NL = No. of leaves; LA = Leaf area; LC = Length of corms; GC = Girth of corms; NCo = No. of cormels; LCo = Length of cormels; GCo = Girth of cormels; FWCCo = Fresh weight of corm and cormels; LB = Leaf blight; RR = Root rot; CS = Colour of sinus; DS = Diameter (cm) of sinus; SS = Shape of sinus; CP = Colour of petioles; P = Purple; LY = Light yellow; G = Green, NA = not applicable.

Table 03. Morphological characters, petiole and leaf sinus, pigmentation and leaf blight and root rot of *Colocasia esculenta* accessions 2016

Cocoyam cultivars	Plant height (cm)	No. of leaves	Leaf area (cm^2)	Length of corm	Girth of corms (cm)	No. of cormels corm	No. of cormels corm	Length of cormels (cm)	Girth of cormels (cm)	LB	RR	CS	DS (cm)	SS	CP
Ce-uy-1	76.3	18.0	466.6	14.4	27.1	8.4	15.3	8.5	572.6	4.6	3.8	p-5	1.0	Oval	G
Ce-uy-2	73.4	28.2	416.4	11.4	36.4	18.6	12.1	15.6	2112.6	3.2	2.5	y-3	6.4	Aster	P
Ce-uy-3	64.2	15.2	257.1	4.1	9.8	9.3	7.6	10.1	256.7	2.5	1.2	y-3	2.6	Aster	P
Ce-uy-4	56.8	20.0	306.8	5.9	16.2	6.0	8.8	6.2	428.5	2.0	1.0	Ly-1	0.51	Oval	LY
LSD (p<0.05)	*3.05*	*1.62*	*8.62*	*0.84*	*2.68*	*0.41*	*1.64*	*0.60*	*16.84*	*0.04*	*0.06*	*NA*	*0.08*	*NA*	*NA*

Ph = Plant height; NL = No. of leaves; LA = Leaf area; LC = Length of corms; GC = Girth of corms; NCo = No. of cormels;
LCo = Length of cormels; GCo = Girth of cormels; FWCCo = Fresh weight of corm and cormels; LB = Leaf blight; RR = Root rot;
CS = Colour of sinus; DS = Diameter (cm) of sinus; SS = Shape of sinus; CP = Colour of petioles; P = Purple; LY = Light yellow;
G = Green, NA = not applicable.

Table 04. Correlation analysis of morphological characters with pigmentation of leaf sinus and petioles and leaf blight and root rot disease in taro (*Colocasia esculenta*)

	PH	NL	LA	LC	GC	NCo	LCo	GCo	FWCCo	LB	RR	CS	DS
PH	1												
NL	0.189	1											
LA	0.162	0.829**	1										
LC	0.246	0.459*	0.344	1									
GC	0.448*	0.351	0.569*	0.451	1								
NCo	0.686*	0.489*	0.543*	0.218	-0.349	1							
LCo	-0.570*	0.990**	0.930**	0.844**	0.728**	0.921**	1						
GCo	0.408	-0.234	-0.562*	-0.345	0.567*	0.289	-0.456	1					
FWCCo	0.678**	-0.267	0.567*	-0.789**	-0.569*	0.551*	0.268	-0.345	1				
LB	0.418*	-0.455*	0.567*	0.484*	-0.231	-0.321	0.567*	0.239	0.569*	1			
RR	-0.226	0.265	0.871**	-0.349	-0.551*	-0.148	-0.291	0.517*	0.293	-0.318	1		
CS	-0.182	0.513*	0.138	-0.397	-0.598*	0.531*	-0.421	-0.371	0.232	0.562*	0.129	1	
DS	0.337	0.415	0.651*	-0.672*	0.438	0.872**	0.349	-0.198	0.763**	0.320	0.147	-0.352	1

Ph = Plant height; NL = No. of leaves; LA = Leaf area; LC = Length of corms; GC = Girth of corms; NCo = No. of cormels; LCo = Length of cormels;
GCo = Girth of cormels; FWCCo = Fresh weight of corm and cormels; LB = Leaf blight; RR = Root rot; CS = Colour of sinus; DS = Diameter (cm) of sinus;

Published with open access at journalbinet.com
EISSN: 2414-5009, © 2019 The Authors, Research Paper.

Table 05. Path coefficient correlation analysis of morphological characters with pigmentation of leaf sinus and petioles and leaf blight and root rot disease in taro (*Colocasia esculenta*)

Characters	PH	NL	LA	LC	GC	NCo	LCo	GCo	FWCCo	LB	RR	CS	DS
PH	**-0.0034**	0.0023	-0.0045	-0.0084	0.0045	0.0105	0.0045	-0.0187	0.0049	0.0106	-0.0155	-0.0071	-0.0132
NL	-0.0032	**0.0561**	-0.0345	0.0456	-0.0026	-0.0426	0.0026	0.0098	-0.0056	0.0024	-0.0510	0.0237	0.0178
LA	0.0056	-0.0132	**0.6678**	0.0065	0.0087	0.0107	0.0187	-0.0056	0.0037	0.0043	0.0297	0.0076	0.0104
LC	0.0004	0.0178	-0.0076	**0.0043**	0.0098	-0.0191	-0.0098	-0.0067	0.0098	-0.0077	-0.0093	0.0089	-0.0090
GC	-0.0034	0.0104	0.0165	0.0360	**0.0012**	0.0081	-0.0056	0.0071	-0.0045	0.0019	-0.0054	0.0043	0.0071
NCo	-0.0071	-0.0090	0.0510	-0.0517	-0.0071	**0.0042**	0.0067	0.0237	0.0026	0.0187	0.0065	-0.0091	-0.0207
LCo	0.0237	0.0071	0.0892	0.0391	0.0237	0.0006	**-0.0062**	-0.0076	-0.0087	-0.0098	0.0010	0.0009	0.0106
GCo	0.0076	-0.0207	-0.0093	0.0315	0.0076	-0.0042	0.0042	**0.0073**	0.0198	-0.0056	-0.0890	0.0023	0.0045
FWCCo	0.0089	0.0106	-0.0054	0.0061	0.0089	-0.0076	-0.0021	0.0043	**0.8156**	0.0067	0.0093	0.0345	0.0026
LB	0.0043	0.0024	0.0056	-0.0732	0.0043	0.0097	0.0085	-0.0071	-0.5045	**-0.0349**	0.0054	-0.0072	0.0187
RR	-0.0071	0.0043	-0.0091	0.0084	-0.0071	0.0357	0.0167	0.0009	0.4026	0.0071	**0.0341**	-0.052	-0.0098
CS	0.0009	-0.0077	0.0034	-0.0009	0.0009	0.0005	-0.0650	0.0023	-0.0087	-0.0015	0.0054	**-0.0234**	-0.0056
DS	0.0023	0.0019	0.0012	0.0056	0.0023	-0.0041	-0.0031	-0.0013	-0.0098	-0.0021	0.0137	-0.0075	**-0.0021**

Ph = Plant height; NL = No. of leaves; LA = Leaf area; LC = Length of corms; GC = Girth of corms; NCo = No. of cormels;
LCo = Length of cormels; GCo = Girth of cormels; FWCCo = Fresh weight of corm and cormels; LB = Leaf blight; RR = Root rot;
CS = Colour of sinus; DS = Diameter (cm) of sinus;

Published with open access at journalbinet.com

Table 06. Principal components analysis of morphological characters pigmentation of leaf sinus and petioles, and leaf blight and root rot in *Colocasia esculenta* accessions

	Component	
	1	2
Eigenvalue	7.524	3.424
% of Total Variability	62.704	28.535
Cumulative %	62.704	91.239
Factor Loadings:		
Plant height	0.886	0.355
No. of leaves	0.025	0.914
Leaves area	0.898	0.351
Length of corm	0.925	0.31
Girth of corms	0.574	0.786
No. of cornels corm	0.063	0.934
Length of cormels	0.952	0.221
Girth of corms	0.128	0.898
Fresh Weight of corm and cornels	0.142	0.988
LB	0.984	0.006
RR	0.979	-0.078
CS	0.889	-0.04

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

IV. Discussion

The variability observed among the *Colocasia esculenta* accessions is a desirable attribute for further improvement. Selection is only possible where variability is large. The result for evaluation of the cocoyam accessions has identified resistant, especially Ce - Uy - 04 and Ce - Uy - 03, which have been found to be resistant to both leaf blight and root rot diseases of *Colocasia esculenta*, the crop which is the delight of people of AkwaIbom State for preparation of ekpangnkukwo, porridge and hot soup. The result has identified some important contributing factors to cocoyam yield, namely, plant height, leaf area, resistance to leaf blight, number of cormels and diameter (size) of sinus. These factors could be employed in the breeding and selection of high yielding resistant varieties in cocoyam. Asfaw (2006) reported positive and significant correlation between fresh tuber yield and tuber girth and diameter of taro. Similarly, (Nsalambi *et al.* 2011) reported that all growth parameters in taro correlate positively and accessions significantly among themselves, except for their fresh weight. Furthermore, characters which have significant indirect effects have also been identified for cocoyam improvement: plant height, number of leaves, length of corms, girth of corms, girth of cormels, resistance to leaf blight and root rot disease as well as diameter of leaf sinus. Additional information from the principal component analysis also pin pointed and conformed some contributing factors like plant height, leaf area, length of corms, length of cormels, resistance to leaf blight and root rot diseases and colour of leaf sinus for consideration during breeding and selection in cocoyam.

These discoveries also support the work of (Gokbayrak *et al.* 2010) who used morphological markers such as anthocyanin intensity on shoot tip, young leaf upper surface colour, young leaf lower surface colour, petiole colour to identify foliar disease resistance in grapevine. Recently, cocoyam assessions collected from Malawi were characterized using morphological markers.

IV. Conclusion

Selection for high yield of *Colocasia esculenta* has often been based solely on certain morphological characters, without recourse to the pigmentation of leaf sinus and petioles and resistance to leaf blight

Published with open access at journalbinet.com.
EISSN: 2414-5009,

and root rot. A consideration of these unique factors could highly improve yield and provide guideposts for *Colocasia* breeding and selection in humid tropics.

References

[1]. Asfaw, K. (2006). Characterization and divergence analysis of some Ethiopian taro genotypes, M.Sc Thesis, University of Ethiopia. p.125.

[2]. Bernatzky, R. and Tanksley, S. D (1989). Restriction Fragments as molecular markers for germplasm evaluation and utilization, In: A. H. D. Brown, O. H. Frankel, D. R. Marshall and J. T. Williams (Eds.), The Use of Plant genetic Resources, pp. 353-361. Cambridge University Press, Cambridge.

[3]. Bhat, S. R. Kapin, R. and TRipathi, R. K. (1985). Association analysis of rind hardness and fibre content in sugarcane. Indian Genetics, 45, 130-135.

[4]. Bos, H. J. Vos, J. and Strulk, P. C. (2000). Morphological analysis of plant density effects on early leaf area growth in maize. Netherland Journal of Agricultural Science, 48, 199-212. https://doi.org/10.1016/S1573-5214(00)80014-7

[5]. Darvasi, A. and Soller, M. (1994). Optimum spacing of genetic markers for determining linkage between marker loci and quantitative trait loci. Theoretical and Applied Genetics, 89, 351-357. https://doi.org/10.1007/BF00225166

[6]. Gokbayrak, Z. Ozer, C. and Soylemezoglu, G. (2010). Use of morphological markers to identify foliar disease resistance in grapevine. The Journal of Animal and Plant Sciences, 20(4), 243-247.

[7]. Kopondo, F. B. (2011). Morphological characterization of selected spider plant (*Cleome gynandra* L.) types from western Kenya. Annals of Biological Research, 2(2), 54 - 64.

[8]. Li, P. Wang, Y, Sun, X. and Han, J. (2009). Using microsatellite (SSR) and morphological markers to assess the genetic diversity of 12 falcata (*Medicago sativa* spp.) populations from Eurasia. African Journal of Biotechnology, 8(10), 2112 - 2108.

[9]. Mahapatra, T. and Chopra, V. L. (2005). Molecular Plant Breeding, In: Chopra, V. L. (ed). Plant Breeding: Theory and Practice, Oxford and IBH Publishing Co. PVT. LTD, New Delhi, Pp. 425 - 430.

[10]. Nedunchezhiyan, M. et al. (2012). Sweet Potato Agronomy, Fruit, Veg. Cereal Sci. Biotech. 6 (Special Issue 1), 1-10. https://doi.org/10.5402/2012/291285

[11]. Nsalambi, V. N. Yamanda, M. and Nakagawa, I. (2010). Effect of polythene mulching on the spatial variability of soil physical properties and growth parameters of taro (*Colocasia esculenta*). Journal of Forestry and Horticulture, 3(12), 359-363.

[12]. Nweke, F. I., Dixon, A. G. O., Asiedu R; and Folayan, S. A. 1994. Cassava varietal needs of farmers and the potential for growth in Africa. Collaborative study of cassava in Africa (COSCA) Working Paper no. 101994.

[13]. Pacumbaba, R. P. Wutoh, J. G and Meboka, M. M. B (1992). Protocal to screen cocoyam root rot disease in cameroon. Plant Diseases, 76, 768-770. https://doi.org/10.1094/PD-76-0768

[14]. Paterson, A. H. Tanksley, S. D. and Sorrel, M. F. (1991). DNA markers in plant improvement. Advances in Agronomy, 46, 39 - 50. https://doi.org/10.1016/S0065-2113(08)60578-7

[15]. Stathers, T. E., Rees, F., Kabi, S., Mbilinyi, L., Smith, N. M., Koizya, H., Jeremiah, S., Nyango, A., Jeffries, D., 2003. Sweet potato infestation by Cylas species in East Africa: 1. Cultivar differences in field manifestation and the role of plant factors. Int. J. Pest Manag. 49, 131-140. https://doi.org/10.1080/0967087021000043085

[16]. Ubi, B. E. (2008). Genetic markers and their utilization in plant breeding. Monograph Series No.1 April. Journal of Agriculture, Biotechnology and Ecology, 1, 1-5.

Published with open access at journalbinet.com.
EISSN: 2414-5009,

HOW TO CITE THIS ARTICLE?

MLA

Bassey, E. E. "Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott)." Journal of Molecular Studies and Medicine Research 04(01) (2019): 177-186.

APA

Bassey, E. E. (2019). Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott). Journal of Molecular Studies and Medicine Research, 04(01), 177-186.

Chicago

Bassey, E. E. "Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott)." Journal of Molecular Studies and Medicine Research 04(01) (2019): 177-186.

Harvard

Bassey, E. E. 2019. Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott). Journal of Molecular Studies and Medicine Research, 04(01), pp. 177-186.

Vancouver

Bassey, EE. Associations of pigmentations of leaf sinus and petioles and leaf blight and root rot with yield components in taro (*Colocasia esculenta* L. Schott). Journal of Molecular Studies and Medicine Research. 2019 May 04(01):177-186.

Published with open access at journalbinet.com.
EISSN: 2414-5009,