Variability in Taro Seedling Populations

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Abstract

To determine whether sufficient genetic variability exists in taro, two lots of seedlings (one from *Colocasia esculenta* var. *esculenta* cv Yandina and another from *C. esculenta* var. *antiquorum* cv UCI Runner) were analyzed for variability of the following:

1. Leaf dimensions.
2. Morphology of leaves.
3. Anthocyanin content in petioles.
4. Alkaloid levels of leaf blades.
5. Chlorophyll concentration in petioles.
6. Amounts of calcium oxalate in leaf laminas.
7. Hydration of corms.
8. Yellow pigments in corms.
9. Anthocyanin content in corms.
10. Nitrogen levels of corms.
11. Percent protein in corms.
12. Calcium oxalate concentration in corms and leaves.

In addition we examined the physical characteristics of starch from a number of cultivars of both botanical varieties. We found varieties in all characters. Our findings suggest that there is abundant variation among taro cultivars and that a breeding program can lead to the production of significantly improved cultivars.

Tissue Culture of Edible Aroids

Propagation of crops through tissue culture can be used to produce virtually unlimited numbers of planting material and to free plants from viral, fungal, or bacterial infections. In taro, the culture of shoot tips has proven useful in the elimination of Dasheen Mosaic Virus (DMV) and the alomae and bobone viruses. Published tissue culture methods exist for several *Xanthosoma* species and for *Colocasia esculenta* var. *antiquorum*, but not for *C. esculenta* var. *esculenta*. However, a method we have developed recently has proven successful with a number of cultivars of the latter.

Tissue culture procedures can, in some cases be used to overcome incompatibility problems which are the reasons for the lack of seed production by some crosses. Using such procedures we have been able to raise normal seedlings from newly fertilized ovules. The use of our method should enable breeders to produce crosses which are currently believed to be impossible.

Methods for the culture of shoot tips and newly fertilized ovules which could be used in almost any field or research station will be demonstrated and explained.

Little is known about the genetic potential of taro because this root crop is (and always has been) propagated vegetatively. To obtain an indication regarding the extent of genetic variability in taro, we studied a number of characters in two seedling populations.

Seeds of cv UCI Runner were obtained from hand pollinated flowers in California. Dr. G. V. H. Jackson (Solomon Islands Department of Agriculture) collected and supplied seeds of cv Yandina. The seeds were germinated in our laboratory and the seedlings were cultured in the UCI greenhouses (Strauss, Michaud and Arditti, in press). Determinations of hydration values, yellow pigments, anthocyanins, protein levels, calcium oxalate content, alkaloids and chlorophyll concentrations will be described elsewhere.

All of the parameters we measured varied considerably (Table 1). This is an indication that the genetic potential of taro warrants the establishment of breeding programs.

Literature Cited

STRAUSS, M. S., J. MICHAUD and J. ARDITTI. In press. Seed storage and germination and seedling proliferation in taro, *Colocasia esculenta* (L.) Schott. Ann. Bot.

Table 1. Variability of taro seedling

Parameter	UCI Runner				Yandina			
	Parent Plants		Seedlings		Parent Plants		Seedlings	
	Range	Average	Range	Average	Range	Average	Range	Average
CORM								
Hydration value, (FW-DW/DW)	7.36 13.05	8.90	1.43– 39.74	9.10	0.50– 0.64	0.57	0.31– 4.70	0.98
Pigments								
Yellow (OD_{378}/g FW)	0.40– 1.04	0.62	0.30– 0.91	0.51			0.201– 0.625	0.427
Anthocyanin (OD_{525}/g FW)	0.10– 0.24	0.15	0.04– 0.43	0.12	none	none	0.12– 0.50	0.37
Protein (percent)	4.19 5.19	4.85	3.56– 6.69	4.05	3.88 4.25	4.07	3.94– 5.38	4.6
Calcium oxalate, mg/g FW)	5.64– 5.88	5.74	4.08 12.00	7.0	0.42	0.42	0.18– 0.72	0.42
Alkaloids (Klett units)								
Primary, secondary, tertiary, amine oxides								
Mayer's reagent	24-27	25	15-58	28	28	28	16-50	19
Wagner's reagent	15-20	18	9-31	18	45	45	50-230	110
Quaternary								
Mayer's reagent	31-40	37	27-110	50	46	46	12-80	41
Wagner's reagent	21-40	33	8-69	27	49-53	51	35-170	70

LEAF BLADE								
Calcium (oxalate, mg/g FW)	3.36 3.72	3.50	0.48 5.64	2.62	1.74	1.74	0.11 2.42	0.9
Length/width ratio	1.96 1.99	1.97	1.63– 2.04	1.85	1.68– 1.93	1.80	1.46 2.50	1.62
Color Sinus	Red only		Green and Red		Red only		Red and Green	
Leaf Margin	Green only		Green and Red		green only		Red and green	
Alkaloids								
Primary, secondary, tertiary, amine oxides								
Mayer's reagent	58-110	89	48-127	89	80-81	81	89-210	153
Wagner's reagent	27-54	44	21-80	43	48-50	49	43-13	82
Quaternary								
Mayer's reagent	69-179	142	58-14	106	69-70	70	27-3	56
Wagner's reagent	150-58	116	38-121	84	35	35	7-8	36
PETIOLE								
(chlorophyll, mg/mg FW)								
Tip	0-0.47	0.42	0-1.13	0.68		0-0.98	0-0.98	0.50
Middle	0.30 0.40	0.37	0-1.20	0.54			0-0.90	0.45
Anthocyanin content (OD_{525}/g FW)								
Tip	0.23 0.27	0.25	0-1.55	0.52			0-5.25	2.30
Middle	0.03 0.04	0.03	0-0.12	70.01			0-1.04	0.65