Table 3. Yield performance of Philippines Ordinary

Cultivar	Mean Nut yield/ palm/ year	Mean Copra yield		Oil content (%)	Agency responsible for release
		Per nut (g)	Per palm/ year (kg)		
Philippines Ordinary (Kera Chandra)	110	189	20.8	66	CPCRI

Table 4. Comparative performance of promising exotic accessions at CPCRI, Kasaragod

Cultivar	Oil content	Mean yield nuts/ palm/ year	Annual copra yield	
			g/ nut	kg/ palm
Fiji Tall	65.2	106	199	21.1
Strait Settlement Green	67.0	108	186	20.0
Philippines Laguna	66.5	88	259	22.7
San Ramon	68.0	64	350	22.4
WCT (Control)	68.0	80	176	14.1

Strait Settlement Green have been evaluated for their combining ability and this work is in progress. The exotic germplasm has helped enhance the genetic diversity in the germplasm collection for utilization in the coconut improvement programmes in the country. It has also contributed to improving coconut productivity, through direct introductions and also through use in hybridization programmes.

Variations in Chlorophyll and Polyphenols in Exotic Arecanut (*Areca catechu* L.) Accessions

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Introduction

About 76 species are known to exist in the genus *Areca* (Murthy and Pillai, 1982; Ananda, 2004). Among these, *Areca catechu* is the only cultivated species, the nuts of which are chewed as mild stimulant and only the major use of the crop. Arecanut considered as one of the major cash crops of South and North Eastern parts of India. Crop improvement work in arecanut has been mainly through introduction of exotic and indigenous accessions and refinements of selection procedure in mother palms, seed nuts and seedlings. Presently the efforts were underway to study the variations among the accessions with respect to biochemical traits *viz.*, chlorophyll and total phenol content. Among the chemical constituents of arecanut, polyphenols constitute about twenty per cent of the dried kernel (Jayalakshmi and Mathew, 1982). The plant phenolics play a major role against the biotic stresses. Also arecanut polyphenols may be utilized as the natural colouring agent and pharmaceuticals (Amudhan and Bhat, 2002). It has been reported that the plant polyphenols have been associated with their antioxidant, antimicrobial, anti-inflammatory and antiallergenic properties (Billot *et al.*, 1990). Leaf polyphenols were taken as a population parameter to describe the genetic variability observed in coconut cultivars based on earlier work in coconut (Jay *et al.*, 1989) and other seasonal crops (Jambunathan and Martz, 1973; Eggum, 1977). Therefore, it is not only important to study the variations for biochemical but also their association for different traits among the accessions. Hence, an attempt was made to study the variability for polyphenolic content in dried kernel and fresh leaf and also estimation of total chlorophyll (seedling stage) in seventeen exotic accessions along with the nature of association for various traits.

Materials and Methods

The study was undertaken at CPCRI, Regional Station, Vittal (Karnataka), during 2001-03 with seventeen exotic collections of *Areca catechu* L. maintained in the main field gene bank with two replications (8 palms/ replication). Sampling of 250 ripe nuts from each accession with two replications were collected and dried under sunlight and made into fine powder. 0.05g of dry kernel powder and 0.5g (twenty-five seedlings/ accessions) of leaf samples were utilized for the estimation of polyphenol following modified Folin-Ciocalteu method (Bray *et al.*, 1954). Similarly 1.0 g of fresh leaf samples were used for estimation of chlorophylls and same was

extracted in 80 percent acetone and read the absorbance at 663nm and 645nm in UV spectrophotometer and calculated using absorption coefficients (Thimmaiah, 2004). To establish the relationship between the different traits correlation coefficients were worked out.

Results and Discussions

Significant variations were observed for the total phenolic contents and chlorophyll among the exotic accessions. The maximum total phenolic contents observed in dried kernel of accession VTL-26 (19.60%) followed by VTL-28III (17.54%), VTL-11 (16.85%) and VTL-1 (16.04%) while accession VTL-18I (13.6%) showed lowest poly phenols (Table 1). However, among the accessions polyphenol content ranged from 99.72 to 213.97mg/ g in ripe nuts. Similar results were observed in arecanut varieties and cultivars by Amudhan and Bhat (2002) and Jayalakshmi and Mathew (1982). It is also reported that the wild relatives/ species of arecanut had higher phenolic contents in ripe nuts as compared to *Areca catechu* cultivars (Rajesh and Ananda, 2004). Decreasing trend in polyphenol content with maturity have been reported and during the maturation of the fruit the rapid formation of polysaccharides, fat and fibre, increases the bulk of the nut diluting the total polyphenolic content in *Areca catechu* (Mathew *et al.,* 1964). The total phenolics showed significant differences in respect of fresh leaves, which ranged from 1.10 to 2.12 mg/g. Among the exotic accessions, maximum polyphenols (2.01mg/g) was recorded in VTL-26 followed by VTL-5 (1.90), VTL-1 (1.81) and VTL-12 (1.66) while seedlings of accession VTL-13 showed lowest of 1.18mg/g poly phenol content. The higher leaf polyphenol content in a cultivar of coconut Chowghat Green Dwarf (CGD) can be correlated to its relatively better tolerance to root (wilt) diseases (Champakam and Ratnambal, 1993).

Among the accessions VTL-18III, VTL-3, VTL-14 and VTL-28II showed maximum 2.88, 2.82, 2.80 and 2.65mg /g of total chlorophyll content in fresh leaves of the seedlings, respectively and VTL-18I measured lowest content of chlorophyll (1.81mg/g). Photosynthetic efficiency (chlorophyll a: chlorophyll b) also calculated (Table 1) and accession VTL18III showed maximum of 2.57 and minimum of 2.11 observed in accession VTl-9.

In order to establish the relationship between characters *viz.*, chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a: chlorophyll b, polyphenol content of fresh leaves (seedlings) and dried kernel, total palm and stem height, the correlation coefficients were worked out in seventeen accessions of arecanut (Table 2). Chlorophyll a positively significant correlated with chlorophyll b (0.936), total chlorophyll (0.995) and chlorophyll a: chlorophyll b (0.995) and negatively correlated with dry kernel polyphenol (-0.017), palm height (-0.491) and stem height (-0.466) which were not significant. Total chlorophyll, photosynthetic

Table1. Estimation of chlorophylls and total phenolics in arecanut accessions

Accessions	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Total chlorophyll (mg/g)	Chl a/ Chl b	Total phenolic contents in leaf (mg/g)	Total phenolic contents in dried kernel (mg/g)	Total phenolic contents in dried kernel (%)
VTL-1	**1.72**	**0.70**	**2.42**	**2.46**	**1.81**	160.41	16.04
VTL-3	**2.01**	**0.81**	**2.82**	**2.48**	**1.53**	151.84	15.18
VTL-5	**1.54**	**0.66**	**2.20**	**2.33**	**1.90**	146.07	14.61
VTL-9	**1.54**	**0.73**	**2.27**	**2.11**	**1.34**	155.46	15.55
VTL-11	**1.39**	**0.64**	**2.03**	**2.17**	**1.35**	168.49	16.85
VTL-12	**1.29**	**0.56**	**1.85**	**2.30**	**1.66**	145.39	14.54
VTL-13	**1.54**	**0.66**	**2.20**	**2.33**	**1.18**	139.75	13.98
VTL-14	**1.95**	**0.85**	**2.80**	**2.29**	**1.47**	165.41	16.54
VTL-15	**1.85**	**0.75**	**2.60**	**2.47**	**1.62**	147.16	14.72
VTL-17	**1.61**	**0.69**	**2.30**	**2.33**	**1.42**	130.47	13.05
VTL-18I	**1.27**	**0.54**	**1.81**	**2.35**	**1.63**	130.66	13.07
VTL-18II	**1.44**	**0.56**	**2.00**	**2.57**	**1.20**	139.66	13.97
VTL-18III	**2.05**	**0.83**	**2.88**	**2.47**	**1.51**	133.36	13.34
VTL-26	**1.71**	**0.75**	**2.46**	**2.28**	**2.01**	196.04	19.60
VTL-28I	**1.90**	**0.75**	**2.65**	**2.53**	**1.58**	136.78	13.68
VTL-28II	**1.90**	**0.75**	**2.65**	**2.53**	**1.46**	131.59	13.16
VTL-28III	**1.38**	**0.57**	**1.95**	**2.42**	**1.32**	175.42	17.54
GM	**1.65**	**0.69**	**2.35**	**2.38**	**1.53***	**150.23***	**15.23**
CV%	**6.36**	**4.50**	**5.30**	-	**12.89**	**11.55**	-
CD+/- 0.05	**NS**	**NS**	**NS**	-	**0.37**	**3.12**	-

Table 2. Correlations among the different biochemical parameters

Correlation	Chloro a	Chloro b	Total chlorophyll	Chloro a/ Chloro b	Leaf Polyphenol	Dry kernel phenol	Palm height	Stem height
Chloro a		0.936**	0.995**	0.995**	0.426	-0.017	-0.491*	-0.466
Chloro b			0.966**	0.966**	0.083	0.154	-0.417	-0.383
Total chlorophyll				1.00	0.336	0.030	-0.476	-0.242
Chloro a / Chlorob					0.336	0.030	-0.476*	-0.449
Leaf Polyphenol						-0.421	-.0.315	-0.326
Dry kernel phenol							-0.123	-0.014
Palm height								0.832**
Stem height								

* Significant at 5% level ** Significant at 1% level

efficiency, leaf polyphenol and kernel polyphenol positively associated with chl b but not significant while negatively correlated with palm height (-0.417) and stem height (-0.383). Rai *et al.* (1999) reported that chl b is positively correlated with leaf polyphenol, which corroborated with the present findings. Total chlorophyll is positively correlated with leaf polyphenol (0.336), kernel total phenol (0.030) and negatively correlated with palm height (-0.476) and stem height (-0.449). Leaf polyphenol negatively correlated with dry kernels polyphenol (-0.421), palm height (-0.315) and stem height (-0.326).

The exotic accessions have exhibited greater variability for polyphenol content in dry kernel and leaves and also observed the variability for pigment contents in leaves. Accession VTL-26 found to be superior for polyphenols in leaves as well as matured fruits and accessions VTL-18III and VTL-3 had higher chlorophyll contents. The accession with desirable higher content of polyphenols can be exploited in quality breeding and further screened for pharmaceutical uses.

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