

such as dry kernel weight, recovery percentage, dry fruit weight, kernel length and breadth showed considerable increase in the magnitudes of correlation with chali yield, thus highlighting the favourable impact on yield performance of the accessions and making indirect selection to yield through these components.

Among the accessions VTL-28III and VTL-18I were found to be superior for chali yield performance and also showed consistency in yielding behaviour over the years compared to other accessions evaluated in the present study. The high heritability and genetic gains estimated in fresh fruit weight, dry kernel weight and dry fruit weight, which can be improved through simple selection method. Characters such as dry kernel weight, chali yield, dry fruit weight, kernel length and breadth showed high magnitude of correlation with dry kernel yield. The high yielding promising accessions identified in this study can be utilized either to develop varieties/hybrids through suitable breeding programme or recommended for commercial cultivation.

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Evaluation and Utilization of Introduced Coconut Germplasm

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Coconut, *Cocos nucifera* L., is an important crop of the hot and humid tropics. In India, it is grown in an area of 18.4 lakh hectares with an annual production of 12,597 million nuts. The national productivity is about 6,846 nuts/ ha and 39 nuts/ palm/ year, indicating the vast potential available for increasing the productivity in this crop. However, the improvement of plantation crops, in general, and coconut in particular is tedious and difficult because of the long gestation period, the heterozygosity, large area required for experimentation and the perennial nature of the crop. In spite of these limitations, the Central Plantation Crops Research Institute (CPCRI), Kasaragod (Kerala), has been involved in the

improvement of coconut and has released three hybrids and three varieties for cultivation in the coconut growing regions of the country.

Coconut, though belonging to a monotypic species, exhibits a lot of variability. Coconut varieties are broadly grouped into tall and dwarfs. Tall referred to as var. *typica* and are the most commonly cultivated for commercial production in all coconut growing regions of the world. Tall palms grow to a height of 20-30m and commence flowering 6-10 years after planting. The tall are sturdy and may attain an age of 80-100 years. These palms are normally cross-pollinated and hence highly heterozygous. The dwarfs referred to as var. *nana*

are never grown on a commercial scale. They are of shorter stature, 8-10m high when 20 years old and start bearing three to four years after planting and have a short productive life of 30-35 years. The dwarf palms are more homozygous than tall, due to a high degree of self pollination.

Research on coconut breeding in India is one of the oldest in the world dating back to 1916. Germplasm collection initiated in 1924 with the introduction of cultivars from Fiji, Indonesia, Malaysia, Philippines, Sri Lanka and Vietnam (Cochin China) at the Central Coconut Research Station, Pilicode. Subsequently selfed and open pollinated progenies were planted at CPCRI (then CCRS), Kasaragod, in 1940s. The germplasm collection was further intensified in 1952 and in 1958 the first indigenous germplasm survey and collection was conducted. In 1981, survey and collection was made from six pacific ocean countries under an FAO/ IBPGR (now IPGRI) funded expedition, which added 24 exotic collections. During 1997-2001, Asian Development Bank (ADB) funded germplasm collection expeditions were undertaken by CPCRI, Kasaragod. Fifteen accessions (including three dwarfs) were collected (in the form of embryos) from the three Indian ocean islands of Mauritius, Madagascar and Seychelles during 1997. Eight accessions each from Maldives and Comoros and Reunion were collected during 1999. In the year 2001, four accessions from Sri Lanka and 11 accessions from Bangladesh were introduced. Indigenous germplasm collecting was strengthened under the National Agricultural Technology Project on Sustainable Management of Plant Diversity (1999-2004).

At present, CPCRI has the world's largest germplasm collection in coconut with 351 accessions including 219 indigenous collections (Table 1) and 132 exotic collections from 25 countries of South and South East Asia,

Table 1. Indigenous coconut germplasm at CPCRI, Kasaragod

Place of collection	Tall	Dwarf	Total
Kerala	28	2	30
Tamil Nadu	13	5	18
Karnataka	6	5	11
Andhra Pradesh	4	1	5
Goa	8	0	8
Gujarat	1	1	2
Orissa	14	0	14
West Bengal	11	1	12
Andaman and Nicobar Islands	67	2	69
Lakshadweep Islands	31	5	36
Maharashtra	6	0	6
Assam	8	0	8
Total	197	22	219

Caribbean Islands, Indian ocean islands, pacific ocean islands and African countries (Table 2). In addition, the institute also hosts the International Coconut Genebank for South Asia (ICG-SA) under the umbrella of Coconut Genetic Resources Network (COGENT) of the International Plant Genetic Resources Institute (IPGRI).

The introduced coconut germplasm is being characterized and evaluated for yield. An exotic germplasm introduced from Philippines, was tested under three different agro-climatic regions and found superior with respect to the nut yield and copra yield over the local cultivar, West Coast Tall (WCT). The annual nut and copra yield was 110 nuts/ palm/ year and 20.8 kg copra/ palm/ year, respectively, an increase of 37.5 percent and 50.7 percent over WCT. The increase in nut yield and copra yield over the released variety 'Chandrakalpa' was 12.2 percent and 20.9 percent, respectively. It was released in 1995 as a variety under the name Kera Chandra, for cultivation in all coconut growing regions of the country (Table 3).

Among the germplasm introductions, some other accessions like Fiji Tall, Philippines Laguna, San Ramon and Strait Settlement Green appear to be promising and give high copra yield of more than 20 kg/palm per year (Table 4). The nut yield of Fiji Tall, Philippines Laguna and Strait Settlement Green is also much higher than that of the control WCT. The exotic accession 'San Ramon' produces very large nuts, the largest in coconut genebank, but yields only 64 nuts/ palm/ year. However it gives a very high copra yield as the mean copra content in the accession, San Ramon (350g/ nut) which is double the copra content in the local control WCT (176g/ nut).

In addition to direct evaluation of exotic collections for introduction in the coconut growing regions of the country, these accessions are also being evaluated for their combining ability for utilization in the hybridization programmes. So far, Fiji Tall, Philippines Ordinary, San Ramon, Java Tall, Jamaica Tall, New Guinea Tall and

Table 2. Exotic coconut germplasm at CPCRI, Kasaragod

Place of collection	Tall	Semi-tall	Dwarf	Total
South East Asia	16	1	3	20
Central & South America,	6	-	1	7
Atlantic Region				
African Regions	4	1	2	7
Pacific Ocean Islands	39	-	6	45
Indian Ocean Islands	30	-	8	38
South Asia	14		1	15
Total	109	2	21	132

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