DIVERSITY IN COCONUT

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Cocos is a genus in the family Arecaceae, which includes 27 genera and 600 species. Distributed mainly in coastal regions between 20° N & 20° S, from sea level to 1000 m above sea level, the coconut – Cocos nucifera L. (2n = 2x = 32) – the only species in the genus, is an important perennial tropical plantation crop with no known truly wild forms. This palm grows in more than 86 countries which can be grouped into eight distinct coastal/ oceanic regions on four continents.

There are two main categories of coconut palms. The Talls ('typica') are naturally cross-pollinating types, have more economic value, are vigorous growing, comparatively late flowering and the fruits are with intermediate colors of brown, green, yellow, orange among individual palms. The Talls can grow at a rate of more than 45-50 cm annually when young and flower at 6-10 years with an economic life span of 60-70 years. Dwarfs ('nana'), in contrast, are naturally self-pollinating types with reduced growth habitat, early flowering and produce large number of medium to small, distinctly colored (green or yellow or orange or brown) fruits. Dwarfs can grow at a rate of 15 to 30 cm annually, have a productive life span of 30-40 years but usually start flowering in the third year.

Information on genetic diversity is of relevance from the breeding point of view, especially in the context of hybrid variety development. Genetic diversity is usually thought of as the amount of genetic variability among individuals of a variety, or population of a species. It results from the many genetic differences between individuals and may manifest in differences in DNA sequence, in biochemical characteristics (e.g. in protein structure or isoenzyme properties), in physiological

properties (e.g. abiotic stress resistance or growth rate) or in morphological characters such as flower colour or plant form.

Beside the Tall-Dwarf duality, there is considerable morphological variability between ecotypes including the characteristics of the fruit and vegetative organs. This variability is expressed in the size, shape and colour of the fruit and has been used to propose diversification model for the coconut palm based on a comparison between a wild type (Niu kafa) and a selected type (Niu vai). Many efforts are ongoing in coconut growing countries to conserve the rich natural diversity existing in coconut germplasm collections for further utilization in crop improvement programs so that it becomes a more profitable crop for small-farm holders, who constitute the vast majority of coconut growers. As a first step towards this goal, assessment of genetic diversity assumes significance for germplasm conservation and their subsequent utilization.

During 1992, the Bioversity International (former International Plant Genetic Resources Institute), with the endorsement of the Consultative Group on International Agricultural Research (CGIAR) and its donors, established the International Coconut Genetic Resources Network (COGENT) with the aim of promoting an international collaborative programme on the conservation and use of coconut genetic resources. Bioversity International coordinates the coconut genetic resources network (COGENT), which aims to improve the conservation of this crop which is important for the livelihoods of people living in rural poverty. The network includes 39 member countries (representing more than 98% of the global production) that works not only to conserve coconut diversity but also to make it available for use by scientists and breeders, facilitating the development of improved varieties that are resistant to pests and diseases, and can grow in changing local conditions.

Collecting, conserving, evaluating and enhancing coconut germplasm of member countries, and locating and characterizing genetic diversity using morphometric and molecular biology techniques, have been some of COGENT's major concerns. Under the auspices of COGENT, the activities related to genetic resources collection and genetic diversity in coconut have been streamlined and significant progress in these areas has been made. ICAR-Central Plantation Crops Research Institute (CPCRI) is involved in collection and conservation of coconut germplasm in India. ICAR-CPCRI hosts the International Coconut Genebank for South Asia (ICG-SA). The field genebank in Kidu Farm, Karnataka, which is the ICG-SA field genebank, is supported technically by the laboratory

facilities at ICAR-CPCRI, Kasaragod. CPCRI maintains the world's largest assemblage of germplasm by undertaking the planting and maintenance of the field gene bank and activities on embryo culture, assessment of diversity using molecular markers and disease indexing.

The establishment of gene pools and the conservation of genetic resources are basic to crop improvement. Hence, maintenance of large assemblage of genetic diversity is a vital aspect since crop improvement objectives change over time and it is difficult to predict the future needs accurately. Being a perennial crop with a persistent capacity for sexual reproduction, coconut gene pools serve in two ways; as a collection for breeder's work and as a base collection for conservation. Despite the necessity, it is very important to the country because there are original populations native to areas, which has not being subjected for any artificial selection. Initially the information regarding diversity in coconut ecotypes in collected during exploratory visits undertaken to different coconut growing regions (within India and abroad). Coconut farmers recognize varieties mainly based on colour, shape and size of nuts. The colour of nut varies from dark green to deep orange or brick red. The shape of nuts may be globular, while others may be spindle shaped or even distinctly triangular.

- Kaitha thali: Among the tall palms of the West Coast there is a variety called kaitha thali which is rare. It has soft fleshy edible husk. In the tender nut, the fibres are poorly developed that the husk sometimes eaten raw and is said to be a very good antidote against sea sickness
- Spikeless or spicata: this is quite distinct from ordinary coconut palm in having no branches or spikes in the inflorescence. In the variety, femaleness is most and maleness is least expressed, because of the number of male flowers is as low as 50. It is found that about 50 per cent of the progeny of this variety breed true to type.
- San Ramon: this is a very high yielding type with large nuts mearly twice as large as the ordinary. It requires about 3270 nuts to produce a ton of copra whereas ordinary tall palms require about 6000 nuts.
- Caumanis: sweet tender husk which is eaten like artichoke which it resembles much in flavor
- Makapuno: white, viscous translucent and jelly like meat approaching the consistency of hard boiled rice with delectable flavor. Makapuno nuts themselves will not germinate but are likely to be produced on trees along with normal nuts. The makapuno nut is valued as a delicacy. Such types are known by different

local names (viz., Dikri in Srilanka, Thairu thengai in South India.

- Thairu thengai: There are certain palms among tall type of the West Coast, which is locally known as thairu thengai (curd coconut). In the nut there is no milk, but is completely filled with a jelly of the consistency of thick curd from which the name is derived. The kernel is not hard to make copra but it is good for eating. These nuts do not germinate but a few in every bunch produced in such trees are quite normal and when planted may give rise to trees of this type.
- Palavan: the palms in this type grow almost side by side like fingers on a hand, although they are widely dispersed over head. The nuts sprout on the palms themselves before falling to the ground.
- Klapawangi: Fragrant endosperm

Certain coconut palms which flowered at the seedling stage are referred to as 'midget' palms. The inflorescence produced in such cases is terminal and they soon die after producing the first inflorescence. The inflorescence is conspicuous for the absence of spathe.

- Kappadam: this is grouped along with ordinary tall type, but is more robust in all characters particularly in the size of nut which is one of the largest on record.
- Laccadive micro: the nuts are very small and yield is about 160 nuts per palm per year. Average copra content is about 80 to 95 g per nut with oil content of 75 per cent.

Rare traits such as plicata, late flowering, bispatheate (spadix covered by two spathes instead of one) and secondary spikelets (further branching of spikelets) have been reported in Talls. Dwarfs possess other rare traits such as polyembryony, vivipary (general observation) and variegation (pigment variation in leaf / nuts). There are other morphological variants (Menon and Pandalai 1960) such as albinism (lack of chlorophyll), aromatica (fragrant endosperm), change in sex expression and plicata (fused leaflets), bulbils (emergence of shoots from the normal inflorescence with a green spathe covering in the leaf axil), midget palm (flowering in early infant stage), pink husked palm, horned coconut. The variations in such traits could be either genetic or physiological in nature. These unexploited traits have lot of scope for use in the breeding program and they are not been used to their potential.

PINK HUSKED COCONUT

Coconut palms with pink husked mesocarp have been reported from different coconut growing countries. Tender nuts harvested from pink husked selections are used in traditional systems of medicine for curing jaundice and for treating many eye infections.

MIDGET COCONUT PALM

Rarely certain coconut palms which flowered at the seedling stage are referred to as 'midget' palms. The inflorescence produced in such cases is terminal and they soon die after producing the first inflorescence. The inflorescence is conspicuous for the absence of spathe. They bear only female flowers which ranged upto eleven in an inflorescence. In midget palm, the inflorescence is a simple spadix without a regular spathe but the two leaves/bracts found just below this terminal inflorescence serves the function of spathes.

HORNED COCONUT

Certain coconuts bearing one or more horn-like outgrowths varying in size, shape and origin are observed. These outgrowths are the highly developed staminodes as reported by some researchers, while in the opinion of others they are the developed supernumerary segments of the gynaecium where such extra carpels were present in some flowers. Horns are also formed as a result of the enlargement of some perianth. One or two separating carpels of an apocarpic ovary may also resemble horns