COGENT SOUTH ASIAN & MIDDLE EAST SUB-NETWORK

(India, Sri Lanka, Bangladesh, Pakistan & Oman)

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LUNUWILA, SRI LANKA

17th Steering Committee Meeting
13th-16th July 2012
CRI, Lunuwila, Sri Lanka
### Status of Coconut Conservation in the South Asian & Middle East Region

<table>
<thead>
<tr>
<th>Country</th>
<th>Site</th>
<th>No. of Acc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>BARI, Gazipur</td>
<td>40</td>
</tr>
<tr>
<td>India</td>
<td>CPCRI, Kasaragod</td>
<td>212</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Research Station, Islamabad</td>
<td>32</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Coconut Research Institute, Lunuwila</td>
<td>147</td>
</tr>
<tr>
<td>Oman (Joined COGENT in 2012)</td>
<td>Salalah Agricultural Research Station</td>
<td>?</td>
</tr>
</tbody>
</table>

### International Gene Bank for South Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of germplasm designated in the MOA</th>
<th>Germplasm currently conserved in the ICG</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDIA</td>
<td>49</td>
<td>99</td>
</tr>
</tbody>
</table>
Collection, Conservation, Evaluation & Utilization of Coconut Germplasm

Sri Lanka 2012-2014
Objectives:

• Multiply and conserve indigenous coconut varieties through Selfing

• Collect and conserve phenotypically distinguished coconut varieties/genotypes (Biased collections) and materials with specific traits (Pest & disease tolerant, cold & drought tolerant) through island wide germplasm expeditions

• Import, conserve and multiply exotic coconut germplasm for broadening the genetic base in Sri Lanka

• Morphological & molecular characterization and evaluation of germplasm

• Maintain and manage *ex-situ* gene banks

• Maintain CGRD database

Duration:

Long-term, continuous programme
Expected output:

• Arrest genetic erosion

• Availability of characterized & diverse genetic materials for the present and future coconut breeding programmes

Methodology:

• Biased collections through island wide surveys & information from public

• Multiplication by self pollination or by open pollination

• Importation from other countries through bilateral agreements as embryos

• Conserve in field gene banks

• Characterize and evaluate according to IPGRI descriptors

• Data entry as per the guide lines of CGRD data base
Results:

Status of collections (end 2011)

- 147 germplasm including 18 exotic materials conserved in local gene banks

<table>
<thead>
<tr>
<th>Location</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandirippuwa</td>
<td>41</td>
</tr>
<tr>
<td>Lenawa</td>
<td>17</td>
</tr>
<tr>
<td>Pallama</td>
<td>49</td>
</tr>
<tr>
<td>PRS</td>
<td>26</td>
</tr>
<tr>
<td>Middeniya</td>
<td>12</td>
</tr>
<tr>
<td>Raddegoda</td>
<td>11</td>
</tr>
<tr>
<td>Total (with duplicates)</td>
<td>159</td>
</tr>
<tr>
<td>BE exotic Gene bank</td>
<td>18</td>
</tr>
</tbody>
</table>

Status of CGRD database

- All passport data pertaining to 147 conserved materials in Sri Lanka entered/updated in the CGRD data
Global Crop Diversity Trust: Award Scheme for Enhancing the Value of Crop Diversity

“Characterization of Indigenous Coconut Germplasm in Sri Lanka”

Project Leader: L Perera (GPBD)

CO-Investigators/Collaborators:

S A C N Perera (GPBD)

H D M A C Dissanayake (GPBD)

M G M K Meegahakumbura (GPBD)

S C Fernando (TCD)

C Yalagema (CPRD)

Gamini Gunawardena (TTD)

• Morphological characterization
• Molecular characterization (EST-SSRs)
• In vitro screening for water stress
• Characterization for chemical properties
• Medicinal value
• Purification & Multiplication for conservation
Morphological Characterization (Crop Diversity Trust Project)

Fruit component analysis - Nine coconut forms belonging to the three coconut varieties conserved in *ex-situ* field gene banks

<table>
<thead>
<tr>
<th>Variety</th>
<th>Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall (<em>Typica</em>)</td>
<td>Bodiri, Ran thembili, Gon thembili, Pora pol, Nawasi, Kamandala, Sri Lanka Tall (SLT)</td>
</tr>
<tr>
<td>Dwarf (<em>Nana</em>)</td>
<td>Red dwarf</td>
</tr>
<tr>
<td>Intermediate</td>
<td>King coconut</td>
</tr>
<tr>
<td></td>
<td><em>(Aurantiaca)</em></td>
</tr>
</tbody>
</table>
Morphological Characterization
(Crop Diversity Trust Project)

• Nut Yield & Fruit component analysis:

• Nine coconut forms belonging to the three coconut varieties conserved in *ex-situ* field gene banks
Morphological Characterization
(Crop Diversity Trust Project)

• Revealed the superiority of RT and GT as pure cultivars
In Vitro Characterization for Water Stress Tolerance

Varieties screened:

Ran thembili, Gon thembili, Porapol, Bodiri & Red dwarf

Mature zygotic embryos from self pollinated nuts of each variety germinated and developed into plants with one photosynthetic leaf in Y₃ medium.

Water stress condition was induced by application of Polyethylene Glycol (PEG) into the culture medium.

Embryos produced with the first photosynthetic leaf (Variety Ran thembili)
Percentage of plantlets survived water stress caused by different PEG levels

- Variety Ran thembili showed the highest survival rate (27%) at 6% PEG
- Overall best plant growth performances at 4% PEG among the five coconut varieties tested.
- Zygotic embryos of Ran thembili showed the highest drought tolerance potential

*In vitro* symptoms of water stress: yellowing and necrosis of leaves
Characterization of coconut oil in different varieties in Sri Lanka

- Quality parameters of extracted oil

All Dwarf varieties, King Coconut, Nawasi and San Raman varieties has high Iodine Value. This emphasizes that these varieties have higher un-saturated fatty acids.

Variation of Iodine Value
Fatty acid profile of different varieties of coconut

<table>
<thead>
<tr>
<th>Fatty acid</th>
<th>Bodiri</th>
<th>Porapol</th>
<th>Gonthembili</th>
<th>Ranthembili</th>
<th>Dwarf red</th>
<th>Kamandala</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6 (Hexanoic)</td>
<td>0.54904</td>
<td>0.483894</td>
<td>1.428275</td>
<td>0.664138</td>
<td>0.341126</td>
<td>0.488779</td>
</tr>
<tr>
<td>C8 (Caprylic)</td>
<td>7.15347</td>
<td>7.900829</td>
<td>12.84893</td>
<td>9.232185</td>
<td>6.117505</td>
<td>7.552606</td>
</tr>
<tr>
<td>C10 (Capric)</td>
<td>5.62196</td>
<td>6.004256</td>
<td>6.630593</td>
<td>6.666095</td>
<td>5.634573</td>
<td>5.725553</td>
</tr>
<tr>
<td>C12 (Lauric)</td>
<td>43.25776</td>
<td>45.63225</td>
<td>43.5264</td>
<td>46.59736</td>
<td>46.20548</td>
<td>42.5639</td>
</tr>
<tr>
<td>C14 (Myristic)</td>
<td>15.23458</td>
<td>15.89824</td>
<td>15.47026</td>
<td>15.67321</td>
<td>16.2834</td>
<td>13.98758</td>
</tr>
<tr>
<td>C16 (Palmitic)</td>
<td>14.32549</td>
<td>11.75024</td>
<td>12.8863</td>
<td>9.848049</td>
<td>11.04106</td>
<td>11.8962</td>
</tr>
<tr>
<td>C18:0 (Stearic)</td>
<td>0.494566</td>
<td>0.871884</td>
<td>0.8962</td>
<td>0.515331</td>
<td>0.549662</td>
<td>0.99894</td>
</tr>
<tr>
<td>C18:2 (Linoleic)</td>
<td>2.228324</td>
<td>2.082176</td>
<td>1.27765</td>
<td>2.1523</td>
<td>3.054617</td>
<td>2.466614</td>
</tr>
</tbody>
</table>
Purification and multiplication

Following number of seedlings were planted at PSG gene-bank

Five (05) indigenous coconut varieties, 04 new coconut varieties from Southern province and one (01) exotic variety

- 23 Rathran thembili
- 25 Gon thembili
- 27 Ran thembili
- 41 Bodiri and
- 01 Pora Pol
- 04 Ran pol
- 08 Brown Murusi,
- 08 MH
- 01 Yellow Murusi
- 01 BGD (Exotic)
Following number of exotic varieties were planted at exotic gene bank at BE as new entries in 2012 and 2013

- 06 MRD (2012)
- 05 MYD (2012)
- 04 Panama tall Monagre (2013)
- 03 Solomon Island tall (2013)
- 07 Thailand tall Sawi (2013)
- 05 Palu tall (2013)
- 01 Malayan Red Dwarf (2013)

- 22 pure brown dwarf palms were identified in and around Meethirigala and Nittambuwa area and 640 open pollinated nuts were collected from them for multiplication purpose.

- Two brown dwarfs like palms locally named as “Naw Pol” identified near Negombo and nuts were collected for germination and for further DNA testing.

- Five exotic varieties characterized for SSR DNA markers as a under graduate student project.
Determination of the population structure of the Sri Lankan Yellow (Dwarf) Populations in Sri Lanka
Objectives

• To determine the population structure of Sri Lanka Yellow (Dwarf) coconut populations in Sri Lanka by morphological and molecular means

• **Duration:** 2012-2014
Expected output

- Population structure of the yellow dwarf populations will be revealed. This information will be used in selecting parent palms which are used to produce hybrid seednuts involving this variety.
Materials and Methods

1) Selection of a total of 200 yellow dwarf coconut palms for detailed morphological characterization

2) Morphological characterization using Bioversity International descriptors related to stem, leaf, inflorescence and nut morphology

3) Identification of distinct morphological groups

4) Molecular characterization using at least 20 microsatellite markers
5) Analysis of morphological data by descriptive statistics, analysis of variance statistical methods and multivariate data analytical methods principal component analysis to derive distinguished clusters and to derive dendrograms by using statistical software packages SAS and Minitab.

6) Analysis of molecular data to derive genetic relationships and allelic differences at microsatellite marker loci using the statistical analytical package Powermarker.

7) Genetic structure of the studies population will be determined combining the results of both morphological and molecular data.
Genotyping completed at 21 SSR loci. Polymorphism detected indicating population structure within YD population

CNZ40

CAC04
Establishment of a new seed-garden for production of kapruwana hybrid

At Kiniyama estate as a collaborative project between CRI and CPL Pvt.

During 2013, 5855 of Green Dwarf and San Ramon were planted at the Kiniyama seed garden with near 90% completion of the total planting scheduled.

Photo 1: Dr. H A J Gunathilake (Director/CRISL) and Mr. Ajith De Silva (AGM/CPL) shake hands after planting the first seedling at Kiniyama estate (Photo by Ashok Kumara)

Photo 2: Six year old Kapruwana hybrid palm (Photo by K Meegahakumbura)
COCONUT RESEARCH INSTITUTE, SRI LANKA RELEASED TWO NEW HIGH YIELDING COCONUT HYBRIDS

Kapsuwaya (CRISL2012) and Kapsetha (CRISL 2013)