

Sri Lanka Brown Dwarf (SLBD) coconuts: a potential coconut variety for future breeding

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Summary

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A new coconut variety of *nana*, or the dwarf coconut of Sri Lanka, with brown nuts, petioles and inflorescence has been identified using AFLP DNA markers and comparison of morphological characters, precocity and breeding behaviour. This variety was named 'Sri Lanka brown dwarf'.

Key words: DNA marker analysis, dwarf coconut, morphological characterization, Sri Lanka

Résumé

Cocotiers nains bruns du Sri Lanka (SLBD) : une variété de cocotier prometteuse pour les sélectionneurs

Une nouvelle variété, le cocotier « nana » ou cocotier nain du Sri Lanka, à noix, pétioles et inflorescences bruns, a été identifiée par l'utilisation de marqueurs AFLP de l'ADN ainsi que par la comparaison de caractères morphologiques, la précocité et les performances en reproduction. Cette variété est désignée, 'nain brun du Sri Lanka.' »

Resumen

Los cocos enanos castaños de Sri Lanka: una variedad potencial del COCO para cultivos futuros
Una nueva variedad del coco 'nana', o coco enano de Sri Lanka, con nueces, peciolas e inflorescencia de color castaño, ha sido identificada utilizando marcadores del ADN con el método PLFA (polimorfismo de la longitud de los fragmentos de amplificación) y comparando caracteres morfológicos, precocidad y comportamiento reproductor. Se ha denominado esta variedad "coco enano castaño de Sri Lanka" ('Sri Lanka brown dwarf').

The available coconut germplasm in Sri Lanka has been categorized into three main varieties based on their morphology and breeding behaviour: Typical—the tall coconuts, *Nana*—the dwarf coconuts and *Aurantiaca*—the variety considered to be an intermediate between tall and dwarf (Liyanage 1958). The variety *nana* or the dwarf—in Sri Lanka locally named *kundira*—includes three colour forms: red (*regia*), yellow (*eburnea*) and green (*puhilla*). Other than these three colour forms no others have been reported in Sri Lanka. However, brown forms of dwarf coconuts are reported in the International Coconut Genetic Resources Database (CGRD Version 4), but the number of its geographical variants (i.e. ecotypes) is restricted to only a few [e.g. the Madang Brown Dwarf (MBD) from Papua New Guinea, Eo Brown Dwarf (EOD) from Vietnam, Raja Brown Dwarf (RBD) and Ternate Brown Dwarf (TBD) from Indonesia, Surinam Brown Dwarf (SUBD) from Surinam and Thailand Brown Dwarf (THBD) from Thailand], compared with numerous variants from other colour forms.

Under the coconut germplasm collection and conservation programme of the Coconut Research Institute of Sri Lanka, which was financially supported by the Asian Development Bank (ADB) through the Coconut Genetic Resources Network (COGENT) of the International Plant Genetic Resources Institute (IPGRI), a single, dwarf-like coconut palm with brown colour nuts, petioles and inflorescence was initially identified in a home garden near Madampe in the Puttalam district. Later a few more palms with similar morphological characters were found in Kirimatiyana and Mawathagama within the coconut triangle, mostly as single trees in home gardens. These palms were initially inspected for their breeding behaviour by observing the male and female phase of the inflorescence, and for other common morphological characters of coconuts such as stature, stem girth, length and width of fronds and leaflets, nut components, inflorescence character and germination speed.

The short (4 m in height) and narrow stem, absence of bole formation at the base of the stem, short and narrow fronds and

leaflets, large number of small nuts (50–80 nuts per bunch), presence of large number of female flowers per inflorescence (average 64, range between 15 and 208) and overlapping of male and female phase within the inflorescence—an indication of inbreeding behaviour—all of which are typical characters of dwarfs, confirmed the identified palm as another form of variety *nana*. A bearing palm, an inflorescence and a typical bunch of nuts of Sri Lanka Brown Dwarf form are shown in Figures 1–3. The results of the fruit component analysis carried out for nuts from the original palms are presented in Table 1.

These palms were self-pollinated for purification and multiplication and for conservation for use in future breeding programmes. In addition, open pollinated nuts were collected from the original palms and laid in the nursery. Seedlings raised from selfed nuts produced seedlings with typical dwarf seedling characteristics i.e. early leaf splitting, with its specific brownish petiole, confirming the genetic identity of them. Further, this phenomenon elucidates the fact that the dwarf brown coconut identified show homology for its colour. The majority of the seedlings raised from open pollinated nuts also produced similar seedlings further confirming their predominantly self-pollinating behaviour.

Table 1. Fruit characteristics of the Sri Lanka Brown Dwarf variety

Fruit	Mean	SD
Fruit weight (g)	569.1	64.17
Husk weight (g)	257.7	31.07
Nut weight (g)	311.4	59.52
Split nut weight (g)	248.8	36.88
Volume of nut water (g)	63.5	28.4
Thickness of shell (mm)	2.4	00.20
Thickness of kernel (mm)	8.6	01.13
Fresh weight of kernel (g)	173.0	25.14
Dry weight of kernel (g)	88.7	15.81
Estimated copra weight (g)	99.5	



Figure 1. A Sri Lanka Brown Dwarf bearing palm (between 5 and 6 years old).



Figure 3. A typical bunch of Sri Lanka Brown Dwarf coconuts.



Figure 2. An inflorescence of Sri Lanka Brown Dwarf coconut.



Figure 4. A young Sri Lanka Brown Dwarf coconut palm (about 2.5 years old).

Seedlings raised from open pollinated nuts, including both naturally inbred and naturally crossed with tall coconuts (natural hybrids) were planted in the Pothukaulam coconut genebank in 1993, and seedlings raised from self-pollinated nuts (through hand pollination) were planted in the Rathmalagara and Uandirippuwa sub-research stations for evaluation in 1996. The time taken to flower from the date of field planting was recorded for 83 seedlings resulting from self-pollinated seeds and was on average three years (a young palm that came into bearing in 2.5 years after field planting is shown in Figure 4). Interestingly the time taken to flower averaged over 10 natural hybrids was 3.5 years elucidating the fact that inheritance of early flowering is partially dominant and therefore Sri Lanka Brown Dwarf x tall hybrids are promising for early flowering.

The number of nuts per bunch produced in brown dwarfs ranged between 60 and 100 under average management conditions and, in contrast, the natural hybrids produced 30 and 40 medium size nuts. It is noted that the bunch stalks of both natural hybrids and pure brown dwarfs were stronger and therefore immature nut falling because of breakage of the bunch stalk in heavy bunches, which is a common observation in other dwarfs and dwarf x tall hybrids in Sri Lanka, is less common.

The dwarf variety was, however, observed to be highly susceptible to red-weevil attack and almost all the dwarf brown palms in the genebank were attacked by red weevils. But in the

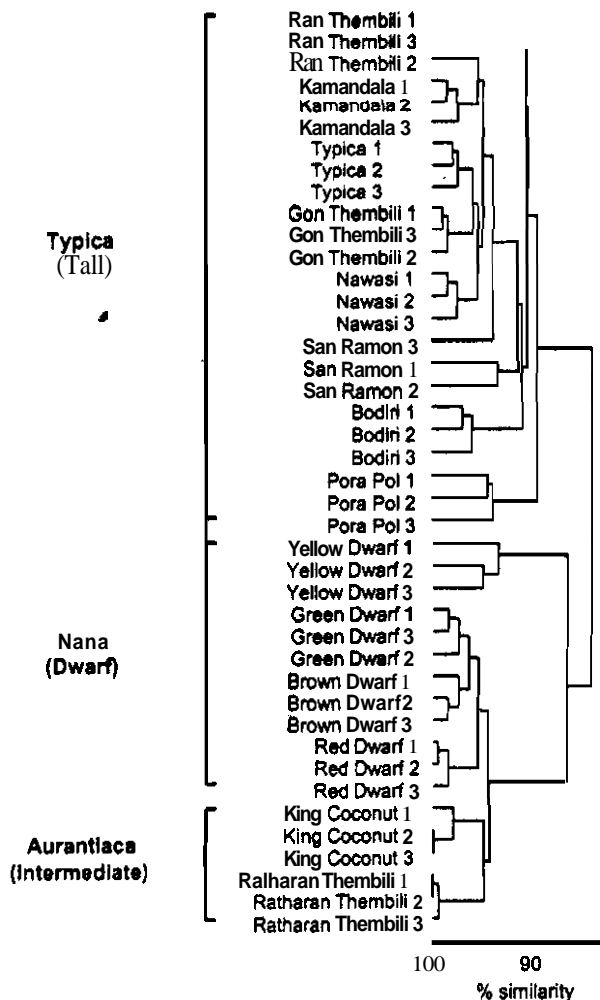


Figure 5. Dendrogram based on AFLPs showing the genetic relationships between Sri Lankan coconut varieties.

same field, none of the 14 natural hybrids in planted intermingled with pure dwarfs was attacked by the red weevil, indicating that red-weevil susceptibility in this brown dwarf form is recessive and is not expressed in dwarf x tall crosses.

The Sri Lanka Brown Dwarf variety was further subjected to DNA analysis using the DNA marker system, amplified fragment length polymorphism (AFLP) (Perera 1999) in order to confirm their dwarf identity and to study their genetic relationships with other local varieties. The dendrogram resulting from AFLP analysis is shown in Figure 5. The Sri Lanka Brown Dwarf variety was grouped with the main dwarf cluster and, moreover, they showed a closer relationship with the dwarf green variety. This DNA analysis further confirmed that the dwarf-like brown palms identified in Sri Lanka, is of another form of dwarf coconut.

References

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