Phenotypic Traits of Genetic Twins in Coconut Palm (*Cocos nucifera* L.) and their Utility in Seed Production

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ABSTRACT

Genetic identity is important in seed production of such sexually propagated, cross-fertilized, heterozygous crops as coconut palm (*Cocos nucifera* L.), which are exclusively propagated by seeds. Due to their uniform nature, twins are used in genetic studies, breeding and to determine identity. The objective was to identify uniform phenotypic traits withii twins for use in determining genetic identity. Phenotypic correlation was determined among twin pairs for 11 important foliar traits in coconut. Of the traits under study, leaf sheath fiber thickness, petiole length and number of leaflets had high correlation and are either highly heritable or have adaptive significance. These traits have practical applications in seed production and breeding.

INTRODUCTION

Seed purityand identityare important aspects of seed production and breeding for all crops. Coconut palm (*Cocos nucifera* L.) is an important tropical multi-purpose perennial crop. In the absence of vegetative propagation, the long pre-bearingage and the heterozygousnature of predominately cross-pollinated plants are impedimentsto breeding and propagation of wconut palm.

Twins have long been used in genetic studies due to their uniform nature (Christian et al., 1974). Twins are reported to occur in plants and have been used for multiplication,breeding (Bertrand and Cilas, 1990) and genetic identity studies (Cameron and Swra, 1973). However, the occurrence of twins or triplets is a rare phenomenon in wconut (Davis et al., 1953; Davis, 1979; Kumar and Rokhade, 1984). Polyembryony is a common feature in few varieties of mango (Aron et al., 1998) and citrus (Russo and Starrantino, 1975) controlled by single or multiple dominant gene(s), respectively, but it only occurs in low frequency in coconut (Whitehead and Chapman, 1962).

Protein (Cardena et al., 1998) and molecular markers (Perera et al., 1999; Meerow et al., 2003) are used to analyze the genetic variation in coconut; however, identification of stable phenotypic traits would have great utility for breeding and selection. The cross sectional area of the petiole can provide an indirect estimate of the dry weight of the entire leaf (Friend and Corley, 1994). Leaf and petiole traits have also been shown to be important in diversity (Sugimura et al., 1997; Zizumbo and Garcia-Marin, 2001). The importance of leafsheath characters in classification (Nauman and Sanders, 1991), basic study (Tomlinson, 1964) and diversity of coconut palm (Arunachalam et al., 2005) have been reported by many-workers. Therefore, this study was undertaken to

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evaluate 11 foliar traits in coconut twin pairs and their usefulness in identity determination.

MATERIALS AND METHODS

Seven twin pairs of 13 yr old coconut palms were used in the study. For each palm, observations were recorded on the oldest green leaf, which was removed from the stem. Petiole width, circumference and thickness were measured as described by Friend and Corley (1994). Thickness was measured with a vernier caliper.

The sheath from the youngest visible leaf on the crown of each palm was used in the study. Leaf sheaths were scored for presence or absence of dichotomous branching of the strands. If dichotomous branching was present for even a few strands, it was recorded as present. Three random fiber strands were separated from both warp and weh layers. A screw gauge was used to measure the thickness of these fiber strands. Correlation coefficient was determined between the pairs of twins for the foliar traits under study by use of chi-square tests (P = 0.01).

RESULTS AND DISCUSSION

Data on 11 foliar traits of seven coconut palm twin pairs is presented in Table 1. The phenotypic traits of leaf sheath fiber, number of Leaflets, length of petiole, cross sectional area of petiole and the leaflet number were highly correlated. However, the traits of petiole circumference and length of leaf bearing portion showed no relationship.

Most traits are similar among twins except for fruit weight, yield, female flower production, husk thickness and girth of nut (Krishna Marar and Kunhiraman, 1957). Louis (1981) observed that the number of leaves produced per year and the leaf length shows high genotypic variation in coconut and that these two traits are highly genetically advanced with strong potential

TABLE I. Comparison of 11 foliar traits in seven coconut palm twin pairs using chi-sqawre tests.

No.	Trait	Observed	X^2	P X^2
1	Number of leaves	0.82	0.04	0.99
2	Petiole circumference	0.08	10.58	0.1
3	Leaflet width	0.16	4.41	0.62
4	Petiole length	0.64	0.20	0.99
5	Length of leaf bearing portion	0.098	8.30	0.22
6	No. of leaflets	0.86	0.02	1
7	Leaf sheath fiber branching (+ or –)	0.98	0.000	I
8	Leaf sheath warp fiber	0.798	0.05	0.999
9	Leaf sheath weft fiber	0.69	0.14	0.999
10	Ratio of warp to weft fiber	0.93	0.005	1
11	Cross sectional area of petiole	0.25	2.25	0.895

P = 0.01

for heritability due to the predominance of additive genes. Of 19 morphological and physiological traits studied by Zizumbo and Garcia-Marin (2001), the number of leaves per unit time, leaf length and percentage of proximal rachis in leaf were reported to be discriminating traits useful in classifying five Mexican ecotypes of coconut.

Bourdeix (1999) utilized the number and width of coconut palm leaflets to describe the variation between talls, dwarfs and atypical dwarfs. He also noticed that dwarf ecotypes possess few leaflets and a smaller leaflet surface area than tall ecotypes. Níu Leka Dwarf, an allogamous (atypical) dwarf, had an equal number of leaflets to that of talls, but had the total surface area like dwarfs. The number of leaflets was also found to be one of the discriminating traits (Sugimura et al., 1997).

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