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MORPHOLOGICAL VARIATION WITHIN PROGENY AND DEVIATIONS FROM MOTHER PLANT REVEAL THE ALLELE RICHNESS IN *Cinnamomum verum* GERMPLASM: A CASE STUDY FROM DEIYANDARA, MATARA COLLECTION AT THE EARLY VEGETATIVE STAGE.

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ABSTRACT

Protogynous dichogamy in cinnamon leads to cross pollination. Morphological variation among mother plants, progenies and other plants in more than 50 year old population due to possible cross pollination was determined. Cuttings of two mother plants and four seedlings from each mother plant were grown in a nursery. Age-independent morphological characters of leaf shape, leaf base and leaf apex were taken. None of the progenies were 100% similar to mother plants. New phenotypes for leaf shape and leaf base were found in progenies. This work indicates contribution of cross pollination for allele richness leading to morphological variation in cinnamon germplasm.

***Key words*:** allele richness, *Cinnamomum verum* germplasm, morphological variation, progeny

INTRODUCTION

Cinnamon (*Cinnamomum verum* Persl.) is a major spice crop that originated in Sri Lanka. Morphological variation in cinnamon germplasm is useful for adaptation to adverse environments and for higher yield. Genus *Cinnamomum* belongs to the family Lauraceae and comprises of about 110 species of evergreen trees and shrubs (Purseglove, 1969). Among eight available *Cinnamomum* species in Sri Lanka, *Cinnamomum verum* is indigenous and rest of the species are endemic to Sri Lanka. Wild cinnamon species making the secondary gene pool of cultivated cinnamon are at a risk of extinction and conservation of the secondary gene pool is essential for genetic diversity (Kumarathilake *et al*., 2010). Protogynous dichogamy in cinnamon leads to cross pollination. Each flower of cinnamon opens on two consecutive days; on the first day the stigma is receptive and on the second day the anthers undergo dehiscence. Cinnamon is usually pollinated by insects, especially flies and honey bees (Ravindran *et al.*, 2004). In Sri Lanka, cinnamon plants bloom in January and the fruit matures 6 months later (Orwa *et al.*, 2009). Sri Lanka is the centre of origin of cinnamon where a high morphological variation has been observed. Vegetative propagation ensures the progeny plants containing the same genetic material of parent for uniformly high yielding populations and for propagating elite lines (Rema *et al.*, 1997). Two cinnamon varieties have been released by National Cin-

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namon Research and Training Center, Department of Export Agriculture, Palolpitiya named Sri Gemunu and Sri Vijaya ((Department of Export Agriculture, 2013). Department of Export Agriculture possesses 700 accessions. There are 19 high quality and high yielding selections, recognized after screening of 210 accessions by the Department of Export Agriculture as well. The Indian Institute of Spices Research had exploited the collection of one Indian accession IN189 (Nithyasree) and one Sri Lankan accession SL63 (Navasree) to develop high yielding variety on the basis of morphological characters and leaf and bark oil content (Krishnamoorthy *et al.*, 1996).

Genetic basis for high morphological variation in Sri Lankan cinnamon germplasm should be exploited to breed new varieties. This study was carried out to determine the contribution of possible cross pollination for genetic diversity depicted through morphological variation among mother plants, progenies and other cinnamon accessions.

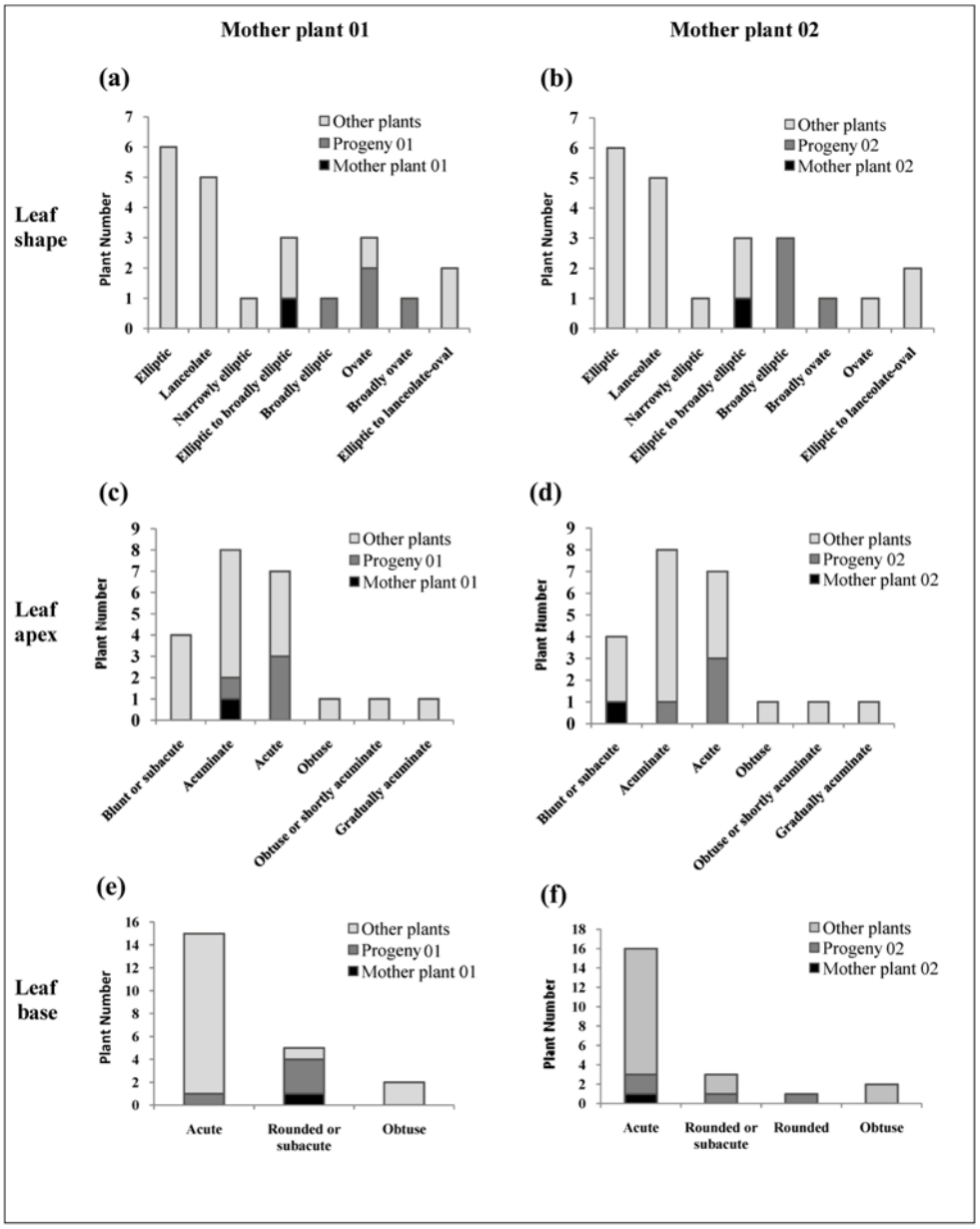

Figure 1. Leaf characters of shape, apex and base of two mother plants, their progenies and other plants

METHODOLOGY

Stem cuttings were collected from eighteen accessions from a cultivated land of more than fifty years of age from Deiyandara in the Matara District (6°9'16.97"N, 80° 36'15.93"E) and planted in a nursery at Faculty of Agriculture, University of Ruhuna for further studies. Age independent morphological characters of leaf shape, leaf apex and leaf base of total 18 accessions were recorded during field survey. The two accessions, which were included in eighteen accessions were considered as mother plants. Seeds were collected from two mother plants during field visit and grown in the same nursery. After 10 weeks of planting at a considerable maturity, environment independent morphological characters of leaf shape, leaf apex and leaf base were measured as described by Dassanayake *et al.* (1995).

RESULTS AND DISCUSSION

Accessions collected from the Deiyandara field showed a considerable variation in three morphological traits of leaf. As the mother plants and progenies were of different maturity levels, only age independent characters were considered for comparison of mother

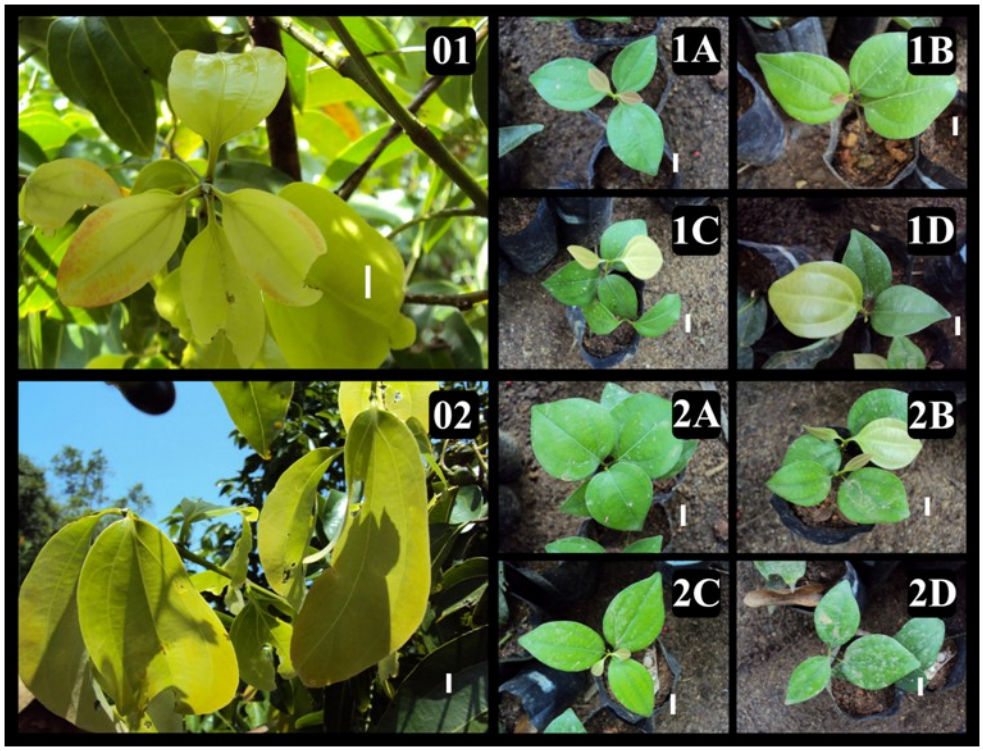

Figure 2. Variation in leaf shape, leaf apex and leaf base within mother plants and their progenies (Scale = 1 cm); **01.** Mother plant-01 (LS- Elliptic to broadly elliptic, LA- Acuminate, LB - Rounded or subacute); **1A.** Progeny-1A (LS- Broadly elliptic, LA- Acute, LB- Acute); **1B.** Progeny-1B (LS- Ovate, LA- Acuminate, LB- Rounded or subacute); **1C.** Progeny-1C (LS- Ovate, LA- Acute, LB- Rounded or subacute); **1D.** Progeny-1D (LS- Broadly ovate, LA- Acute, LB- Rounded or subacute); **02**. Mother plant-02 (LS- Elliptic to broadly elliptic, LA- Blunt or subacute, LB- Acute); **2A.** Progeny-2A (LS- Broadly ovate, LA- Acute, LB- Rounded); **2B.** Progeny-2B (LS- Broadly elliptic, LA- Acute, LB- Rounded or subacute); **2C.** Progeny-2C (LS- Broadly elliptic, LA- Acuminate, LB- Acute); **2D.** Progeny-2D (LS- Broadly elliptic, LA- Acute, LB- Acute).

* LS = Leaf shape, LA = Leaf apex and LB = Leaf base

plants, progenies and other plants of the population. Young leaves from the older plants were considered to compare with the leaves of the progenies.

Leaf shape of 50% progeny originated from mother plant-01 showed different characters from their mother and other plants, as 25% progeny were broadly elliptic while 25% progeny showed broadly ovate (Fig 1(a) and Fig 2. 01, 1A, 1D). These two leaf shape characters appeared as new characteristics in the population. Meanwhile, 25% of progeny with acuminate leaf apex (Fig 1(c) and Fig 2. 1B) and 75% progeny with rounded or subacute leaf base (Fig 1(e) and Fig 2. 1B - 1D) resembling to their mother and other plants indicated that progeny derived those characters either from mother or other plants on that particular population. On the other hand, 75% progeny with acute leaf apex (Fig 1(c) and Fig 2. 1A, 1C, 1D) and 25% with acute leaf base (Fig 1(e) and Fig 2. 1A) were similar to other plants of the population indicating that progeny inherited those characters from out crossing.

Out of whole progeny derived from mother plant-02, 75% with broadly elliptic (Fig 1(b) and Fig 2. 2B - 2D) and 25% with broadly ovate leaf shape (Fig 1(b) and Fig 2. 2A) were completely different from its mother and other collected plants. Only leaf base of 50% progeny was similar to their mother and other plants (Fig 1(f) and Fig 2. 2C, 2D). However 25% progeny showed new character with rounded leaf base (Fig 1(f) and Fig 2. 2A). Additionally, all progeny bear same leaf apex with acuminate and acute shape similar to other plants.

Having different alleles in a population, cross pollination can help different allelic combinations in the progeny. Such different allelic combinations can lead to new phenotypes in the progeny.

CONCLUSION

Whole progenies from both mother plants showed new characters for leaf shape and whole progeny from mother plant-02 produced a new leaf base. There could be a variety of alleles responsible for each leaf character derived from the population through cross pollination.

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