

Genetic Relationship Analysis among Oakleaf Loquat, Daduhe Loquat and Common Loquat Based on Morphologic Traits

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Abstract: Based on morphologic traits including 18 traits of leaf and fruit, the genetic relationships among Oakleaf loquat (*E. prinoides*), Daduhe loquat (*E. prinoides* var. *dadunensis*) and Common loquat (*E. japonica*) were investigated in this study. The results showed that Oakleaf loquat, Daduhe loquat and Common loquat displayed very significant differences. Many traits of Daduhe loquat were between Oakleaf loquat and Common loquat and some of the other traits were lean to Oakleaf loquat while some were lean to Common loquat. The results of comparative analysis and cluster analysis support that Daduhe loquat was hybrid of Oakleaf loquat and Common loquat.

Key words: Oakleaf loquat, Daduhe loquat, Common Loquat, genetic relationship, morphologic traits, China

INTRODUCTION

Loquat (*Eriobotrya japonica* Lindl.), originating in China and cultivating between 20 and 35° latitude is an important perennial fruit crop because of both its economic and ecological attributes (Lin *et al.*, 2004; Hu *et al.*, 2006).

The genus *Eriobotrya* includes about 30 species. Daduhe loquat a new taxa discovered by Zhang *et al.* (1990) in Southeast part of Gongga mountain, Sichuan province was classified as a botanical variety of oakleaf loquat.

However, its taxonomic status is questioned. In the researches of Zhang *et al.* (1990) and Cai (2000) the systematic position of Daduhe loquat was between Oakleaf loquat and Common loquat but slightly leaning to Oakleaf loquat based on the external morphology characteristics of flowers and isozyme; Li *et al.* (1992) concluded that Daduhe loquat belongs to the same species as Common loquat based on isozyme analysis Tang (1997) analyzed the karyotype of the three genotypes and considered that Daduhe loquat was a separate species from Oakleaf loquat and originated from a hybrid between Oakleaf loquat and Common loquat. Recently, molecular marks such as RAPD, AFLP and ISSR were used to discussed their relationship (Yang *et al.*, 2007; Luo *et al.*, 2011) and the results were consistent with Tang (1997).

In summary, there were two different views about the systematic position of Daduhe loquat. One is Daduhe loquat is a original species of common loquat the other

one is it is a hybrid of Oakleaf loquat and Common loquat. In this study, morphologic traits of leaf and fruit were used to analyze the genetic relationships among Oakleaf loquat, Daduhe loquat and Common loquat in order to provide more evidence of the taxonomic status of Daduhe loquat.

MATERIALS AND METHODS

Shimian, located at Sichuan province of China is recognized worldwide as one of loquat origin place. There are extremely rich in wild loquat.

The material of this study were collected from Shimian and specific circumstances of their geographical and distribution scales were shown in Table 1. Evaluation criterion and assignment of qualitative characters were based on the method described by Zheng *et al.* (2006). Data were standardized and converted by DPS v3.01, significance between means was tested by Duncan's multiple range test and cluster analysis was carried out by the Unweighted Pair Group method with Arithmetic Mean (UPGMA) method.

Table 1: Geographical and distribution scales by global positioning system

Species (Cultivars)	Latitude	Longitude	Altitude (m)
Oakleaf L.	29°13'50"-29°14'42"	102°19'59"-102°24'55"	857-870
Daduhe L.	29°13'11"-29°14'57"	102°14'39"-102°22'14"	940-1168
Common L. (wild)	29°15'00"	102°18'58"	910
cv. Dawuxing	29°14'10"	102°20'34"	927

Table 2: Leaf traits description

Species (Cultivar)	Leaf shape	Length	Width	L/W	Petiole length	Floss of old leaf back	Leaf margin
Oakleaf L.	Ellipse	15.29 ^a	6.98 ^b	2.34 ^b	2.24 ^a	No	Crinkle
Daduhe L.	Ellipse	17.30 ^a	6.48 ^b	2.71 ^{ab}	1.15 ^b	Grey or brown	Serrate
Common L.	Obovate	23.93 ^b	7.03 ^b	3.43 ^a	0.85 ^c	Brown	Sparse serrate
cv. Dawuxing	Obovate	28.37 ^a	7.98 ^a	3.57 ^a	1.06 ^{bc}	Brown	Sparse serrate

Means following the same letter within columns were not significantly different. According to Duncan's multiple range test ($p = 0.05$)

Table 3: Fruit traits description

Species (Cultivar)	Fruit shape	Apex shape	Caly x cavity	Longitudinal	Transverse	L/T	Fruit weight	Seed no.
				D. (cm)	D. (cm)			
Oakleaf L.	Oval	Concave	Close	1.71 ^c	1.28 ^c	1.34 ^a	1.700 ^c	1.20 ^c
Daduhe L.	Suborbicular	Flat	Open	1.85 ^{bc}	1.81 ^{bc}	1.02 ^b	5.860 ^b	1.45 ^c
Common L.	Suborbicular	Flat	Close	2.20 ^b	2.05 ^b	1.08 ^b	5.730 ^b	2.19 ^b
cv. Dawuxing	Suborbicular	Concave	Open	4.09 ^a	4.16 ^a	0.98 ^{bc}	45.53 ^a	2.74 ^a

Means following the same letter within columns were not significantly different. According to Duncan's multiple range test ($p = 0.05$)

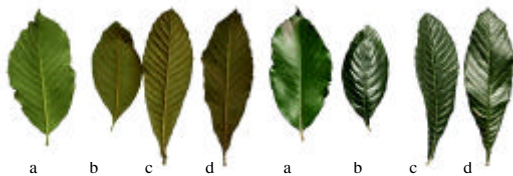


Fig. 1: Leaf picture of loquat; a: Oakleaf loquat; b: Daduhe loquat; c: Common loquat (wild); d: Common loquat cv. Dawuxing

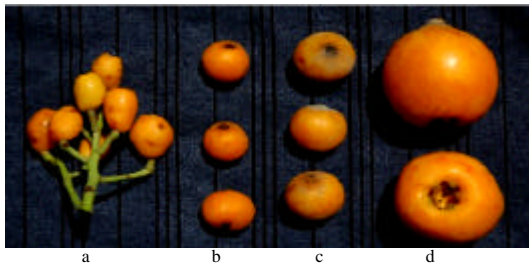


Fig. 2: Fruit picture of loquat; a: Oakleaf loquat; b: Daduhe loquat; c: Common loquat (wild); d: Common loquat cv. Dawuxing

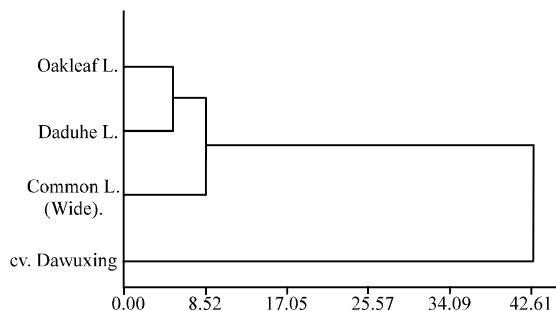


Fig. 3: Clustering result based on the morphologic traits

RESULTS AND DISCUSSION

The result shows that Oakleaf loquat, Daduhe loquat and Common loquat displayed very significant differences

in leaf and fruit morphology (Table 1 and 2; Fig. 1 and 2). The traits of L/W and petiole length of Daduhe loquat were between Oakleaf loquat and Common loquat; leaf shape and width lean to Oakleaf loquat and floss of old leaf back and leaf margin lean to Common loquat (Both wild and cv.).

The traits of longitudinal D. (cm), transverse D. (cm) and seed number of Daduhe loquat were between Oakleaf loquat and Common loquat; fruit shape were the same as Common loquat and L/T lean to Common loquat (Both wild and cv.). Apex shape and fruit weight were the same as wild common loquat; calyx cavity was the same as cv. Dawuxing.

Cluster analysis of Oakleaf loquat, Daduhe loquat and Common loquat was based on 9 morphological traits of leaf and fruit by UMGMP (Fig. 3 and Table 3). The result indicated that there were continuous variation of phenotypic characteristics among Oakleaf loquat, Daduhe loquat and Common loquat.

The systematic position of Daduhe loquat was between Oakleaf loquat and Common loquat but slightly leaning to Oakleaf loquat.

CONCLUSION

In this research, many traits of leaf and fruit of Daduhe loquat were between Oakleaf loquat and Common loquat, cluster analysis showed the same message. The results of comparative analysis and cluster analysis support that Daduhe loquat was hybrid of Oakleaf loquat and Common loquat.

Thus, the taxonomic status of Daduhe loquat reaches a common understanding on the morphological, isozyme and molecular biology levels that Daduhe loquat was hybrid of Oakleaf loquat and Common loquat which laid a solid foundation for the loquat germplasm and genetic research in world.

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