GERMPLASM CHARACTERIZATION OF THREE JABUTICABA TREE SPECIES[1]

MOESES ANDRIGO DANNER[2], IDEMIR CITADIN[3], SIMONE APARECIDA ZOLET SASSO[2], MARCOS ROBSON SACHET[4], SÉRGIO MIGUEL MAZARO[3]

ABSTRACT - The purpose of this study was to characterize cultivated genotypes of three jabuticaba species (*Plinia cauliflora*, *P. trunciflora*, and *P. jaboticaba*). Phenology and fruit growth, as well as leaf, flower and fruit traits were evaluated. Variability in all traits was observed among genotypes of the three jabuticaba species. The trait peduncle size is indicated for differentiation of the three species under study. The leaf and fruit sizes of the genotypes *P. trunciflora* 3, *P. trunciflora* 4, *P. trunciflora* 5 and *P. jaboticaba* 1 differ from those described in the literature for these species, indicating the formation of ecotypes. Jabuticaba fruit skin contains high anthocyanin and flavonoid concentrations, with potential use in food and pharmaceutical industries.
Index terms: *Plinia* sp., germplasm bank, genetic variability, fruit quality.

CARACTERIZAÇÃO DE GERMOPLASMA DE TRÊS ESPÉCIES DE JABUTICABEIRA

RESUMO - O objetivo deste trabalho foi caracterizar genótipos cultivados de três espécies de jabuticabeira (*Plinia cauliflora*, *P. trunciflora* e *P. jaboticaba*). Foram avaliadas a fenologia e o crescimento de frutos e características de folhas, flores e frutos. Observou-se que existe variabilidade entre os genótipos das três espécies de jabuticabeira para todos os caracteres avaliados. O caractere tamanho de pedúnculo do fruto é o maior indicativo para a diferenciação entre as três espécies de jabuticabeira estudadas. Os genótipos *P. trunciflora* 3, *P. trunciflora* 4, *P. trunciflora* 5 and *P. jaboticaba* 1 apresentam dimensões de folhas e frutos diferentes daquelas descritas na literatura para genótipos dessas espécies, indicando a formação de ecótipos. A casca de jabuticaba apresenta elevados teores de antocianinas e flavonoides, apresentando potencial para utilização na indústria alimentícia e farmacêutica.
Termos para indexação: *Plinia* sp., bancos de germoplasma, variabilidade genética, qualidade de frutos.

INTRODUCTION

The jabuticaba tree (*Plinia* sp.) belongs to the Myrtaceae family and is endemic to Center/South/Southeast Brazil. Nine species are known, but only three are still naturally dispersed and also cultivated in Brazil: *Plinia trunciflora* (Berg) Mattos, *Plinia cauliflora* (DC.) Berg and *Plinia jaboticaba* (Vell.) Berg (MATTOs, 1983).

The commercial fruit production is low and restricted to certain areas of natural occurrence. However, the cultivation and marketing potential is great, due to the organoleptic properties of the fruit (BARROS et al., 1996) which may arouse the interest of the food and pharmaceutical industries, in view of the high contents of essential oils in the leaves (APEL et al., 2006) and anthocyanins in the fruit skin (TEIXEIRA et al., 2008). Its use as an ornamental plant is also indicated (DEMATTÊ, 1997). The jabuticaba tree is already being tested for cultivation in Florida, USA, and in countries of Central and South America (BALERDI et al., 2006).

The clearing of forests, the lack of knowledge about the properties of this fruit and the consequent low commercial use have contributed to genetic erosion. Therefore, the *ex situ* conservation and characterization of genetic resources of this species are essential to develop breeding and commercial cultivation. Moreover, there is considerable confusion in the literature regarding the identification of different jabuticaba species. In this sense, characterization studies are needed for a clearer botanical identification.

The characterization of jabuticaba fruits has been discussed in the literature. However, the genotypic variability at the different cultivation sites in Brazil is great, even within a same species (JESUS et al., 2004; OLIVEIRA et al., 2003; PEREIRA et

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[2]Eng. Agrônomo, MSc., Programa de Pós-Graduação em Agronomia, UTFPR, Câmpus Pato Branco. E- mails : moesesandrigo@yahoo.com.br; iosasso@ibest.com.br
[3]Eng. Agrônomo, Dr., Programa de Pós-Graduação em Agronomia, UTFPR, Câmpus Pato Branco. Via do Conhecimento, km 01, Pato Branco-PR. 85503-390. C.P.: 571. E-mails: idemir@utfpr.edu.br, sergio@utfpr.edu.br
[4]Acadêmico do curso de Agronomia, UTFPR, Câmpus Pato Branco. E-mail: marcos.sachet@gmail.com

al., 2000).

The purpose of this study was to characterize cultivated genotypes of three jabuticaba species (*Plinia cauliflora*, *P. trunciflora*, and *P. jaboticaba*), aiming at the development of cultivation and breeding.

MATERIALS AND METHODS

Nine 35 to 40-year-old jabuticaba trees of three species (*Plinia cauliflora*, *P. trunciflora* and *P. jaboticaba*) were used, identified as *P. cauliflora* 1, *P. cauliflora* 2, *P. cauliflora* 3, *P. trunciflora* 1, *P. trunciflora* 2, *P. trunciflora* 3, *P. trunciflora* 4, *P. trunciflora* 5 and *P. jaboticaba* 1, located in Itapejara D'Oeste, Paraná, Brazil (25°57'34"S, 52°48'54"W, 518 m asl). The phenology and fruit growth of these plants was described and the leaves, flowers and fruits were evaluated.

Phenology and fruit growth. In July 2007 and July 2008 six genotypes (*P. cauliflora* 2, *P. cauliflora* 3, *P. trunciflora* 2, *P. trunciflora* 3, *P. trunciflora* 4 and *P. jaboticaba* 1) were selected and five branches were marked on each. On these branches, the beginning (10%) and end (90%) of blooming was observed, and also the beginning and end of maturation, when 10% and 90% of the fruits were ripe, respectively. The phenological data of 2007 and 2008 were plotted. Also, fruits were collected from the same branches every seven days in 2007, from the 7th day after anthesis (DAA) until full maturity (35 DAA). Each sample consisted of 10 fruits per branch of which the fresh weight was determined. The data were analyzed by descriptive statistics (mean and standard deviation) and used to construct the growth curve of the fruit, for a comparison of the genotypes.

Leaf traits. In August 2007, five samples of 100 leaves without petiole were collected from nine genotypes. The leaf length and mid-leaf width were measured with a ruler. The data were subjected to analysis of variance ($P \leq 0.05$), in a completely randomized design, with five replicates, and the means compared by the Scott-Knott grouping test ($P \leq 0.05$), using software Genes (CRUZ, 2006).

Flower traits. In August and September 2007 five samples (replications) of 10 flowers in balloon stage (just before anthesis), were collected from nine genotypes. The number of anthers per flower was counted, using a stereoscopic microscope. From the flowers, 50 anthers per genotype (one of each flower) were also collected to count the number of pollen grains per anther. These anthers were placed in unclosed glass flasks for drying at room temperature. After complete dehiscence of the anthers (3 days), 1 ml of 85% lactic acid was added to each recipient, forming a suspension of pollen grains, which were counted in a hemacytometer (TUITE, 1969). Five slides (replications) from each sample were observed under a light microscope. The number of pollen grains per anther was transformed by $\sqrt{x}$. The data were subjected to analysis of variance in a completely randomized design, with five replicates, and the means compared by the Scott-Knott grouping test ($P \leq 0.05$), using software Genes (CRUZ, 2006).

Fruit traits. For the physicochemical fruit characterization five samples were collected, each containing 25 mature fruits, totaling 125 fruits of each genotype. This evaluation was carried out in two harvests, the first in September/October 2007 and the second in March/April 2008.

In the first harvest, the fruits of nine genotypes were evaluated for 12 physicochemical properties: weight, equatorial diameter and fruit composition (seed, pulp and skin); peduncle length and number of fruits per peduncle; pH, total soluble solids (TSS) and titratable acidity (TA) of the pulp; anthocyanins and flavonoids levels in the fruit skin.

The fruit composition was determined based on the total weight of the fruit, skin and seeds, and the values expressed in percentage. The TSS was measured with a digital refractometer. TA was determined by titration and the values were expressed in grams of citric acid per 100 mL (Instituto Adolfo Lutz, 1985). Samples of the fruit skin were deep-frozen (- 18 ° C) for the quantification of anthocyanins and flavonoids, according to the methodology described by Lees and Francis (1972).

The experiment was evaluated in a completely randomized design, with five replications. The data were subjected to analysis of variance and the means compared by the Scott-Knott grouping test ($P \leq 0.05$), using software Genes (CRUZ, 2006).

In the second harvest, March/April 2008, fruits were collected from seven genotypes, which were assessed for 13 physicochemical traits: weight, equatorial diameter and fruit composition (seed, pulp and skin); pH, TSS and TA of the pulp; anthocyanins and flavonoids levels in the fruit skin; and Ca, K and Mg content in pulp and skin.

The Ca, K and Mg contents were measured in pulp and skin, based on fresh weight, to assess the differences in concentration between the fruit parts, using a method described by Tedesco et al. (1995). Data were subjected to analysis of variance in a completely randomized design, with five replications, in a 7 x 2 factorial design, including seven genotypes (*P. cauliflora* 1, *P. cauliflora* 2, *P. cauliflora* 3, *P. trunciflora* 1, *P. trunciflora* 2, *P. trunciflora* 4 and *P.*

trunciflora 5) and two fruit parts (pulp and skin). The other evaluations and statistical analysis followed the methodology described above for the first harvest.

RESULTS AND DISCUSSION

Phenology and fruit growth. The flowering dates were very similar in both years for *P. cauliflora* 2, *P. cauliflora* 3 and *P. trunciflora* 2, which were earlier than the other genotypes. The flowering of *P. jaboticaba* 1 differed between years, and was earlier in 2008 than in 2007, while fruit maturation lasted longer in 2008. In turn, flowering and fruiting of the genotypes *P. trunciflora* 3 and *P. trunciflora* 4 was later than of the others, in 2007 and well as in 2008. It was observed that *P. trunciflora* 2, although belonging to the same species as *P. trunciflora* 3 and *P. trunciflora* 4, has a rather different phenology, indicating genetic variability (Figure 1).

The cycle from full flowering to full fruit maturity (35 to 50 days) was influenced by the climatic conditions of each year, and was on average eight days longer in 2008 than in 2007. This was a consequence of the lower mean temperatures (20 °C in 2007 and 18 °C in 2008) and higher rainfall (234 mm in 2007 and 547 mm in 2008), which resulted in reduced insolation and delayed fruit growth in 2008. In the genotypes evaluated here, flowering lasted 7 - 10 days and maturation 10 - 17 days. In the orchard consisting of genotypes of the three jabuticaba species fruit production lasted 45 days, from mid-September until late October.

The observation of flowering and fruiting phenology is essential for future studies on the floral biology and reproduction mode of the species. It is also important for breeding programs and for the planning of crosses between genotypes and of harvesting of fruits for the establishment of open-pollinated or crosses progenies.

The fruit growth curve based on fresh weight was similar among the genotypes. There was an initial phase of slow growth until about the 20th day after anthesis (DAA). From this period onwards there was an accelerated accumulation of fresh matter, mainly in fruits of *P. trunciflora* 3 and *P. trunciflora* 4. The final fruit weight of these two genotypes was highest, and lowest in *P. jaboticaba* 1. The total cycle lasted 35 days (Figure 2). For Magalhães et al. (1996), the fruit growth period was 60 days for 'Sabará' jabuticaba (*P. jaboticaba*), in winter conditions, in Viçosa, Minas Gerais, Brazil.

The change in fruit color, indicating the maturation degree, occurred in the last seven days. The fruit color is first green, then turns reddish-purple and last black. These changes at the end of fruit development are related to chlorophyll degradation and anthocyanin synthesis in the fruit skin (MAGALHÃES et al., 1996).

Leaf traits. The leaves of the jabuticaba genotypes were 4.7 - 6.7 cm long and 1.3 - 2.3 cm wide. The leaf size of *P. trunciflora* 5 was significantly larger than of all other genotypes (Table 1).

The size of the leaf blade observed in this study for the three genotypes of *P. cauliflora* and *P. trunciflora* 1 and *P. trunciflora* 2, match the description given by Mattos (1983). Moreover, the leaf size of *P. jaboticaba* 1 was larger than described by this author for the specie, and the leaves of the genotypes *P. trunciflora* 3, *P. trunciflora* 4 and *P. trunciflora* 5 were much larger than described by the author, i.e., 2.5 - 3.8 cm long and 0.8 - 1.6 cm wide. This suggests great variability in the leaf size of genotypes of this species and the occurrence of ecotypes that differ from those studied by Mattos (1983).

Flower traits. The number of anthers per flower was significantly higher for *P. cauliflora* 1, *P. cauliflora* 2 and *P. trunciflora* 2 (> than 52) and lower for *P. jaboticaba* 1 (36.4), compared with the other genotypes. These same genotypes had significantly fewer pollen grains per anther, which did not significantly affect pollination, since fruiting was abundant. The genotypes *P. trunciflora* 3, *P. trunciflora* 4 and *P. trunciflora* 5 had an intermediate number of anthers, but a high number of pollen grains, highest by far for *P. trunciflora* 4 (1512). The flowers had a mean number of 47.3 anthers and 421.8 pollen grains per anther. These values are clearly lower than in other fruit plants, mainly in allogamous species. Dall'Orto et al. (1985) observed an average of 2700 pollen grains per anther in 18 apple cultivars.

Fruit traits. In the first harvest (September/October 2007), weight and fruit diameter of the genotypes *P. trunciflora* 3, *P. trunciflora* 4 and *P. trunciflora* 5 were significantly larger than of the others. In terms of fruit composition, it was observed that *P. trunciflora* 1 had a significantly higher seed proportion (9%) than the other genotypes, which makes this genotype less attractive for fresh consumption. The opposite is true for the genotypes of *P. cauliflora*, which had higher pulp yield, especially *P. cauliflora* 1 (68.9%). The higher pulp yields allow a greater production of juice or frozen pulp, which is attractive to industry. The fruit skin of the *P. trunciflora* 3, *P. trunciflora* 4 and *P. trunciflora* 5 was thicker (Table 1). Although considered a drawback for fresh consumption, the greater skin thickness of these genotypes may represent an enhanced shelf-life.

The fruit weight of genotype *P. jaboticaba*

1 was lowest (4.2 g), consistent with the result obtained by Oliveira et al. (2003), in 'Sabará' jabuticaba (*P. jaboticaba*) from 10 growing regions in São Paulo, Brazil. However, Pereira et al. (2000) obtained fruits of two genotypes of 'Sabará' in Viçosa, Minas Gerais, Brazil, with 6.8 g and 10.7 g. Also, found a fruit weight of 15.4 g of the genotype 'Açú' (*P. cauliflora*) and 6.5 g for *P. trunciflora* (synonymy of *Myrciaria peruviana*), in disagreement with the results of our study.

The genetic variability in fruit quality of jabuticaba tree growing in different parts of Brazil is therefore remarkable and this potential should be exploited in the development of breeding in the specie.

Regarding the fruit peduncle length, the longest peduncles were observed in the genotype *P. trunciflora* 3, secondly *P. trunciflora* 5 followed by *P. trunciflora* 4, *P. trunciflora* 1 and *P. trunciflora* 2, in the third place, with the peduncle is 6.5 - 9.7 mm long. The fruit peduncles of *P. jaboticaba* 1 were in the mean 4.3 mm, and of the three genotypes of *P. cauliflora* 2.8 and 2.9 mm long (Table 1). Therefore, this trait seems to be the best indicator for a differentiation of the jabuticaba species under study: *P. cauliflora* has shorter peduncles, *P. jaboticaba* intermediate peduncle size and *P. trunciflora* the longest fruit peduncles (Figure 3).

The number of fruits per peduncle was higher than 5.6 for the genotypes *P. trunciflora* 1, *P. trunciflora* 2, *P. trunciflora* 4 and *P. jaboticaba* 1, which differed significantly from the other genotypes (Table 1). The genotypes of the *P. cauliflora* had fewest numbers of fruits per peduncle, with 1.5 or 1.6. It is believed that the short peduncle of *P. cauliflora* restricts the development of a greater number of fruits per peduncle.

It was observed that the pH of the pulp of *P. cauliflora* 2, *P. trunciflora* 2 and *P. trunciflora* 4 was significantly higher than of the other genotypes, while *P. jaboticaba* 1 had the lowest pH (Table 1). The TSS content was significantly higher for the genotypes of *P. cauliflora*, which makes them more attractive for fresh consumption and more efficient for industry. The titratable acidity (TA) of the pulp was significantly higher in fruits of *P. jaboticaba* 1, in agreement with the pH values, but not different from *P. trunciflora* 1. Values varied from 0.24 to 0.51 g of citric acid per 100 mL^{-1} pulp, lower than reported by Oliveira et al. (2003) for 'Sabará' jabuticaba (*P. jaboticaba*) and similar to those found by Pereira et al. (2000) for genotypes of *P. jaboticaba*, but lower than the values found for *P. trunciflora* and *P. cauliflora*.

In general, the fruits of the genotypes of *P. cauliflora* had a high TSS content, but medium TA, while the TSS in genotypes *P. trunciflora* 3, *P. trunciflora* 4 and *P. trunciflora* 5 were low, and low TA as well. This makes the fruits of the genotypes of *P. cauliflora* tastier than those genotypes. In turn, the fruits of *P. trunciflora* 1 and *P. jaboticaba* 1 are more acid, which also makes them less palatable.

The anthocyanins content in fruit skin ranged from 126.4 to 657.7 mg 100 g^{-1} and was significantly higher for *P. jaboticaba* 1 than for the other genotypes (Table 1). In the second place was genotype *P. cauliflora* 1, which also differed significantly from all other genotypes. The genotypes of *P. cauliflora* and *P. jaboticaba* 1 had the highest flavonoid contents.

Therefore, the jabuticaba skin is rich in anthocyanins and flavonoids. The contents are higher than in many other fruits containing considerable amounts of these compounds, such as açaí tree, *Euterpe oleracea* (POZO-INSFRAN et al., 2004). A growing interest in the use of anthocyanins and flavonoids is currently observed in the cosmetic industry because of the anti-aging effect (ARCT et al., 2002), in the food industry as natural coloring agent (GIUSTI et al., 1998) and in the pharmaceutical industry, against a number of diseases, e.g., cancer (KAMEI et al., 1995). Thus, these genotypes are promising sources of these compounds and their cultivation should be encouraged.

In the second harvest (March/April 2008), the weight and fruit diameter of the genotypes *P. trunciflora* 4 and *P. trunciflora* 5 again was significantly greater than of the other genotypes (Table 2), although lower than in the first harvest (Table 1). The seed content also was significantly higher in those genotypes than the others. Their seed content was also significantly higher than in the first harvest. In relation to pulp yield, again the genotypes of the *P. cauliflora*, especially *P. cauliflora* 2 (65%) had significantly higher values than the others, while the fruit skin content was significantly higher for *P. trunciflora* 1 (55.8%).

The pulp pH values were generally much lower (average 3.5) than in the first one (average 3.9, Table 1) and were significantly higher for genotype *P. trunciflora* 4 than for the other genotypes (Table 7). This reduction was also observed in the TSS, which was significantly higher for *P. cauliflora* 2 than for other genotypes, while there was an increase in TA from the first to the second harvest, with exception of the *P. trunciflora* 4 and *P. trunciflora* 5. TA was again significantly higher for genotype *P. trunciflora* 1. Thus, *P. cauliflora* 2 can be qualified as sweetest.

The values of anthocyanins and flavonoids

were 2.0 and 4.3 times lower, respectively, than in the first harvest; but, again the contents were highest in the genotypes of *P. cauliflora*, since *P. jaboticaba* 1 was not evaluated in the second harvest, because it did not bear fruit.

It is believed that the reduction in anthocyanin contents in the second harvest in relation to the first was due to a reduction in sugar content (TSS). This fact can be explained, because the gene activation of the enzyme chalcone synthase, responsible for the synthesis of anthocyanins, requires sugars (BOSS et al., 1996). In turn, the reduction of sugar content (TSS) in fruit was due to less insolation during the growing season. In the second growing season (mid-February to mid-April 2008), the insolation period was 453 hours, versus 505 hours in the first (mid-August to mid-October 2007).

The Ca, K and Mg contents in the fruit skins of the jabuticaba tree genotypes were on average 7.8 times, 96 times and 7.1 times higher than in the pulp, respectively. There was no significant difference among the genotypes regarding these parameters (Table 3).

Oliveira et al. (2003) observed high variability in the mineral content of the fruit pulp of 'Sabará' jabuticaba (*P. jaboticaba*) from 10 different growing regions in São Paulo. The Ca content ranged from 20 to 1110 mg 100 g^{-1}; the K content from 100 to 1060 mg 100 g^{-1}; and Mg from 70 to 600 mg 100 g^{-1}. These values are far higher than those found in this study for jabuticaba pulp.

This study presents additional information, which is the nutritional composition of jabuticaba fruit skin, where high levels of anthocyanins and flavonoids, as well as minerals were found. Therefore, the consumption of the fruit skin is therefore recommended, be it fresh or in the form of products such as fermented beverages, liquor, vinegar and jelly, or in the form of flour to be used in cereal bars, cookies and bread (ASCHERI et al., 2006). Thus, the fruit skin of jabuticaba is yet another advantage to be exploited by the food and pharmaceutical industries.

This study on the characterization of genotypes of three jabuticaba species should be utilized in future breeding programs for the formation of genebanks, detection of genotypes with the best agronomic traits and planning of crosses (CRUZ et al., 2004; THUL et al., 2009). For example, we suggest the crossing of *P. jaboticaba* 1 x *P. trunciflora* 3, since the first genotype is very productive and has the highest levels of anthocyanins and flavonoids in the fruit skin, although its fruits are small, while the second genotype has large fruits. Or the crossing of *P. jaboticaba* 1 x *P. cauliflora* 1 because the latter has larger and better-tasting fruit and is more suitable for fresh consumption.

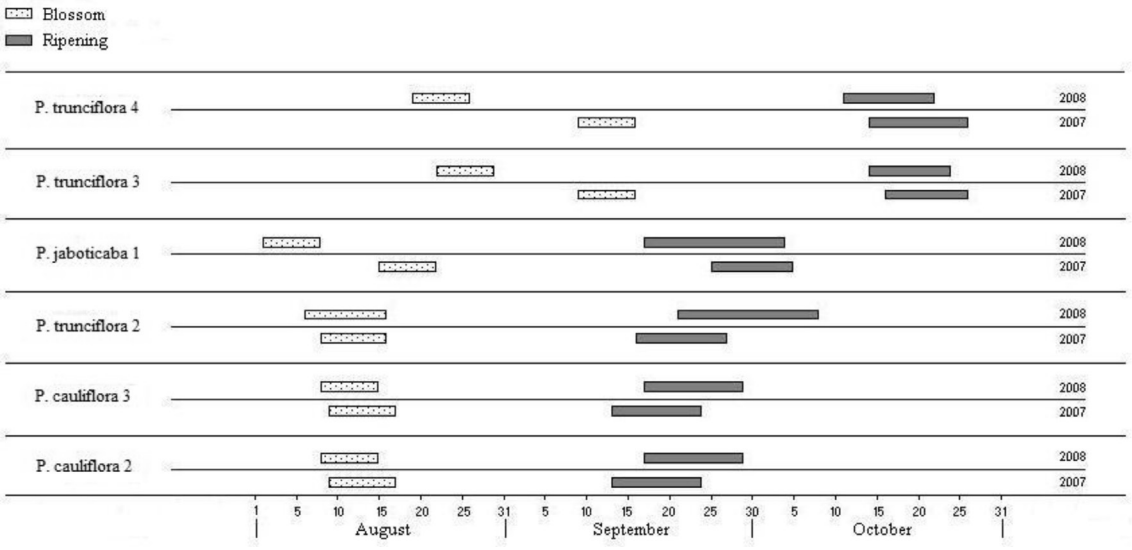

FIGURE 1 - Date of blossom and ripening of six jabuticaba tree genotypes in Itapejara D'Oeste, Paraná, Brazil, in 2007 and 2008.

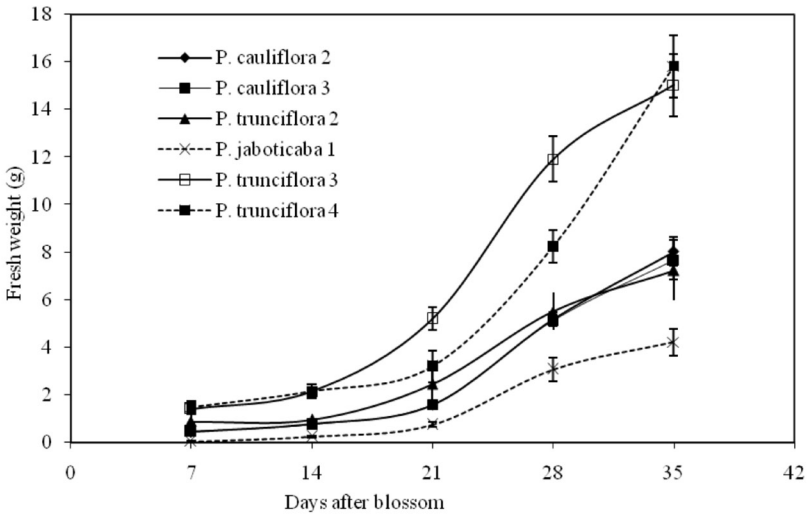

FIGURE 2 - Fresh weight evolution of fruits of six jabuticaba tree genotypes. Standard error bars represent variation among five sampled of ten fruits.

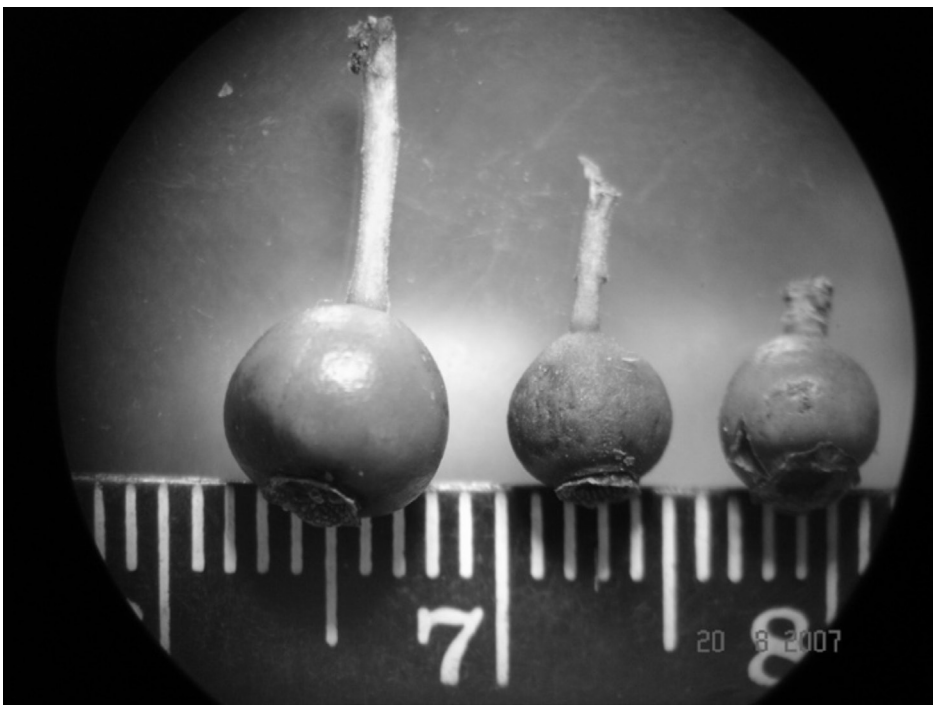

FIGURE 3 - Differences of fruit peduncle length of '*Plinia trunciflora 4*', '*P. jaboticaba* 1' and '*Plinia cauliflora* 3', left to right. View stereoscopic microscope with an increase of 10 X

TABLE 1 - Leaf, flower and fruit traits of nine jabuticaba tree genotypes, harvested in September/October 2007.

Genotype	Length leaf (cm)	Width leaf (cm)	N° anthers by flower	N° pollen grains by anthers	Fruit Weight (g)	Fruit diameter (mm)	Fruit Composition (%)			Peduncle length (mm)	N° fruits per peduncle	pH	TSS (°Brix)	TA	Anthocyanin	Flavonoids
							Seed	Pulp	Skin						(mg 100 g^{-1} of skin)	
P. cauliflora 1	5.8 c	1.5 e	52.2 a	80.0 e	8.2 c	23.3 b	5.5 e	68.9 a	25.6 d	2.8 e	1.6 c	4.0 b	15.8 a	0.34 c	426.3 b	415.6 a
P. cauliflora 2	6.4 b	1.8 d	54.3 a	116.0 e	8.0 c	23.1 b	5.5 e	63.0 b	31.6 c	2.8 e	1.5 c	4.2 a	15.4 a	0.27 d	298.8 c	318.5 a
P. cauliflora 3	4.7 d	1.3 f	41.7 c	60.0 e	7.7 c	22.8 b	8.3 b	63.5 b	28.2 d	2.9 e	1.5 c	3.9 b	16.4 a	0.42 b	358.9 c	294.6 a
P. trunciflora 1	5.4 c	1.8 d	49.6 b	112.0 e	5.1 d	20.1 c	9.0 a	51.9 d	39.1 b	6.7 c	5.9 a	3.9 b	13.6 b	0.49 a	264.9 c	212.1 b
P. trunciflora 2	5.4 c	1.8 d	52.4 a	76.0 e	8.2 c	24.0 b	6.1 d	58.7 c	35.2 b	6.5 c	5.6 a	4.1 a	12.5 b	0.29 d	248.4 c	153.8 b
P. trunciflora 3	6.1 b	2.0 c	49.0 b	1512.0 a	15.0 a	29.3 a	4.4 f	54.8 d	40.8 a	9.7 a	4.2 b	4.0 b	12.0 c	0.24 d	133.3 c	144.3 b
P. trunciflora 4	6.3 b	2.2 b	42.0 c	928.0 b	15.8 a	30.3 a	6.0 d	53.6 d	40.4 a	7.1 c	5.6 a	4.3 a	12.7 b	0.27 d	166.4 c	167.8 b
P. trunciflora 5	6.7 a	2.3 a	47.7 b	552.0 c	14.2 b	29.7 a	6.9 c	48.9 d	44.3 a	9.0 b	4.5 b	3.9 b	11.3 c	0.28 d	126.4 c	137.1 b
P. jaboticaba 1	5.8 c	1.9 c	36.4 d	360.0 d	4.2 d	18.7 d	8.1 b	53.5 d	38.5 b	4.3 d	5.9 a	3.1 c	11.9 c	0.51 a	657.7 a	308.0 a
Average	5.8	1.8	47.3	421.8	9.6	24.6	6.6	57.4	36.0	5.8	4.0	3.9	13.5	0.35	297.9	239.1
CV (%)	5.3	3.9	7.3	15.7	9.6	3.2	8.0	5.8	9.2	9.7	13.8	3.8	6.8	11.3	48.0	39.1

Different letters indicate means significantly different by Scott-Knott's grouping test ($P \leq 0.05$). TSS: total soluble solids. TA: titratable acidity (g citric acid 100 mL^{-1}).

TABLE 2-Fruit traits, harvested in March/April 2008, of seven jabuticaba tree genotypes.

Genotype	Fruit weight (g)	Fruit diameter (mm)	Fruit composition (%)			pH	TSS (°Brix)	TA	Anthocyanin	Flavonoids
			Seed	Pulp	Skin				(mg 100 g^{-1} of skin)	
P. cauliflora 1	7.19 c	23.12 c	3.37 d	57.15 b	39.47 c	3.24 d	13.5 b	0.40 c	293.9 a	72.6 b
P. cauliflora 2	7.88 b	23.84 c	2.95 d	65.07 a	31.98 e	3.41 c	14.4 a	0.34 d	330.2 a	106.2 a
P. cauliflora 3	6.09 d	21.45 d	3.37 d	55.98 b	40.65 c	3.06 e	11.5 c	0.51 b	125.7 b	53.3 c
P. trunciflora 1	5.21 e	20.95 d	3.93 c	40.23 d	55.84 a	3.24 d	7.7 e	0.60 a	103.7 b	57.7 c
P. trunciflora 2	6.79 c	23.01 c	3.11 d	52.17 c	44.72 b	3.40 c	10.6 d	0.50 b	79.8 b	42.5 d
P. trunciflora 4	11.81 a	27.06 b	8.32 b	55.26 b	36.42 d	4.01 a	11.7 c	0.32 d	36.1 c	27.8 d
P. trunciflora 5	12.48 a	28.14 a	9.11 a	51.24 c	39.65 c	3.85 b	10.9 d	0.28 e	42.0 c	32.5 d
Average	8.21	23.94	4.88	53.87	41.25	3.46	11.5	0.42	144.5	56.1
CV (%)	7.9	2.8	6.9	4.8	6.3	2.2	4.4	4.2	28.8	29.1

Different letters indicate means significantly different by Scott-Knott's grouping test ($P \leq 0.05$). TSS: total soluble solids. TA: titratable acidity (g citric acid 100 mL^{-1}).

TABLE 3 -Levels of Ca, K and Mg of pulp and skin of fruits, harvested in March/April 2008, of seven jabuticaba tree genotypes.

Genotype	Pulp	Skin	Average
	Ca (mg 100 g^{-1})		
P. cauliflora 1	77.6	369.8	223.7^{NS}
P. cauliflora 2	84.0	361.8	222.9
P. cauliflora 3	73.0	434.6	253.8
P. trunciflora 1	54.5	444.0	249.3
P. trunciflora 2	48.8	370.5	209.6
P. trunciflora 4	37.9	414.3	226.1
P. trunciflora 5	44.5	474.0	259.2
Average	60.0 b	409.8 a	
CV (%)	24.6		
	K (mg 100 g^{-1})		
P. cauliflora 1	6.0	517.0	261.5^{NS}
P. cauliflora 2	6.8	543.8	275.3
P. cauliflora 3	8.5	519.8	264.2
P. trunciflora 1	3.1	577.5	290.3
P. trunciflora 2	3.5	543.8	273.7
P. trunciflora 4	6.0	519.1	262.5
P. trunciflora 5	5.3	538.3	271.8
Average	5.6 b	537.0 a	
CV (%)	9.1		
	Mg (mg 100 g^{-1})		
P. cauliflora 1	22.5	135.8	79.1^{NS}
P. cauliflora 2	24.8	126.8	75.8
P. cauliflora 3	30.0	139.8	84.9
P. trunciflora 1	11.3	127.5	69.4
P. trunciflora 2	12.8	129.8	71.3
P. trunciflora 4	12.8	114.6	63.7
P. trunciflora 5	12.6	126.0	69.3
Average	18.1 b	128.6 a	
CV (%)	17.9		

Different letters indicate means significantly different by Fisher's test ($P \leq 0.05$). ^{NS}:Nonsignificant.

CONCLUSIONS

1 -There is genetic variability among genotypes of the three jabuticaba tree species for all traits;

2-The trait peduncle size is appropriate for the identification of the three jabuticaba tree species studied;

3-The genotypes *P. trunciflora* 3, *P. trunciflora* 4, *P. trunciflora* 5 and *P. jaboticaba* 1 have other leaf and fruit sizes than described in the literature for genotypes of these species, indicating the formation of ecotypes;

4-The jabuticaba fruit skin contains high of anthocyanin and flavonoid concentrations and is interesting for use in the food and pharmaceutical industries.

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