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RESEARCH ARTICLE

MORPHOAGRONOMIC AND BROMATOLOGICAL CHARACTERIZATION OF JABOTICABA TREES 'SABARA' FOR EXPLORATORY ANALYSIS OF FRUITS AND SEEDS

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ABSTRACT

26 accesses of "Sabará" jaboticaba tree (Myrciariajaboticaba) were characterized in Diamantina-MG by the exploratory analyses of their morfoagronomic and physicochemical characteristics for the selection of promising matrixes for the in natura and the agroindustry market. Physical, physicochemical and chemical's characteristics of fruits and physiologic characteristics of seeds were analyzed. Was realized the principal componentanalysis (PCA). Were verified that the six mainly components were sufficient to accumulate 82% of total variance, being 39.63% of total variance described by the first principal component (PC1) and by the second component (PC2) 13.10% of variance. Through PCA and hierarchical cluster analysis (HCA) was possible to select variables capable to explain the formation of groups, being effective to synthesize the judgment of the characteristics of jaboticaba trees "Sabará". There is variation between the physical, physicochemical and chemical characteristics of the fruit and physiological variation of the seeds of the different accesses.

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INTRODUCTION

Jaboticabatrees belongs to the *Myrtaceae* family, is a native fruit plant from Brazil, originated from the South- Center of the country. The trees presents medium to large sized, with dimensions ranging from 6 to 8 m of high, could reaching 12m of high. Jaboticaba trees presents good rates of growth and preferential production in silico clayey and clayey siliceous soils, fertile, rich in organic matter, humid, and deep soils. The flowering is annual, with new flowers covering the branch surroundings, been necessary low temperatures during the winter to flourish, with large period of juvenility of eight to fifteen years long, the fruit is a berry, subglobosa, black in Color when ripe, with diameter ranging of 1,6 to 2,2 cm, containing1 to 4 seeds, with smooth, thin and very weak peels, sweet pulp with light acidity and white color or translucent. The period of ripening varies of 45 to 65 days, depending of the cultivation region. In this process, the starch is degraded in soluble sugars and can be consumed in natura or like wines, liquors, sweets and jellys (DONADIO *et al*., 2002). The absence of studies about the origin of mother plants and the plantings with seeds, results in big variability of size, shape and physical and physical-chemical characteristics, being necessary the characterization of fruits related to each region where the plants widespread. Studies conducted with different varieties of jaboticaba trees have found differences in the analyzed characteristics like; size and weight of the fruits, yield, seed germination, among others (MENDONÇA, 2000). This variability is important for the continuity of the species, and

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especially promising for genetic(CRUZ, 2005). The use of this fruit plant species can establish a promising economic activity, given the several utilities and quality of this fruit. The city of Diamantina and region exhibit powerful potential for farming jaboticaba trees, system economically practicable that ensures, in long term, the maintenance and preservation of native species, representing an alternative of rent for local producers. However, the expansion of fruit farms, presents obstacles related to obtaining varieties and quality seedlings. Furthermore, the characterization allows identifying genotypes potentially useful for fruits production both for in natura consume, or for the obtaining of processed products. At industrial level, the knowledge of the physical, chemical and physico-chemical properties of fruit pulps helps to optimize the processing as well as cost reduction. With this, the aim of this work was to characterize the jabuticabeiras 'Sabara' (*Myrciaria jaboticaba*) accesses in Diamantina-MG through their morphoagronomic and bromatological characteristics using exploratory analysis, for the purpose of selecting promising matrices for the fruit market in natura and the agribusiness.

MATERIALS AND METHODS

The work was conducted in five orchards of jaboticaba tree "Sabara" in the city of Diamantina-MG. The analyzes were conducted at the Laboratory of Technology of Biomass from Cerrado and in the Seeds Laboratory of JK Campus of the Universidade Federal dos Vales do Jequitinhonha e Mucuri – UFVJM in Diamantina, Minas Gerais, in the period August 2012 to November 2013. In each orchards were chosen 5 plants randomly, being codified with numbers from 1 to 26. Fruits were harvested by their sanity, vigorandhomo geneous distribution in the local study and the fruit harvesting was conducted in two seasons, in November 2012 and in October 2013. In the five orchards, from the 26 plants (access) analyzed, were collected about 5 kg of fruit randomly, covering the entirearborealstratum. The fruits were conditioned in polyethylene bags and transported to the laboratory and selected by the presence of injuries and washed in running water. The sensorial analyses happened in three phases: the physical, physical-chemical and morphoagronomic analyzes. For this, in the characterization were selected 30 fruits of there maining sampler and only, around 3 kg of fruits were used forchemical and physico-chemical evaluation and 2kg offruits were used form orpho agronomic analysis. In the physical characterization were determined: fruit mass (g) quantified in analytical balance; the longitudinal diameters (LD) and transverses (TD) determined with a digital paquimeter; the relation LD/TD, was obtained through the quotient between the values of the longitudinal and transverse diameters, revealing the shape of the fruits, beyond the number of seeds per fruit.

For the chemical and physical-chemical characterization, the fruits were manually pulped, the fractions pulp and peel were separated and conditioned in plastic bags and frozen at -18ºC ± 2°C until the realization of tests. Were evaluated the fractions of pulp and peel from each access. Were determined the solublesolids (SS) with the aid of hand-heldrefracto meter with 0-90^{o}Brixscale, according to the methodology of the Institute Adolfo Lutz, total acidity (TA) by titration with solution of sodium hydroxide standardized(IAL, 2008), being the results expressed in citric acid in 100g of fresh sample; the relation SST/ATT was obtained by the quotient between SST and ATT; the pH was determined by the direct reading in digital potentiometer (IAL, 2008); the flavonoids were extracted with 80% methanol and quantified spectrophotometrically using the analytical curve of pirocatequina (Zhishen *et al*., 1999) and the total phenolics were dosed by the method Folin-Denis (AOAC, 2000), using the analytical curve of tannic acid. In the morfoagronomic evaluation for the determination of physiological quality of jaboticaba tree seeds, the fruits of each access were fermented in plastic bag, passed through sieve for complete elimination of the pulp, washed in distilled water and placed on a towel paper for 24 hours in environment temperature for drying. After this time, were visually selected, eliminating those which are disproportionate to the average lot size. The seeds were placed to germinate in BOD on germi test paper in four replications of 50 seeds each one, obtaining the percentage of normal, abnormal deformed, abnormal infected seedlings and dead seeds in the germination test at 25 ° C (BRASIL, 2009); the germination speed index (GSI); the shoot length (mm) and root lenght (mm); the fresh mass and the dry mass of seedling (g). Due to the large number of descript or sused and their contributions to the grouping of jaboticaba trees access, were used the principal component analysis (PCA) and hierarchical cluster analysis (HCA), with the objective of discriminate the characteristics with greater importance in the divergence of jaboticaba 'Sabara' accessandgroup them according to their similarities. Statistical analyzes were performed using the software MATLAB 5.3, and the chemometric package PLS- Toolbox. The statistical design was a randomizedblock design (RBD), being the treatments 26 accesses of jaboticaba tree 'Sabara'.

RESULTS AND DISCUSSION

Through the analysis of PCA, the jaboticaba access were separated into two groups in function of physical, physical-chemical and morphagronomic characteristics analyzed and of their major compounds, as shown in Figure 1. By the analyzes of PCA was observed that 6 mainly compounds, were efficient to accumulate 82% of total variance, being 39,63% of total variance described by the first principal component (PC1) and by the second compound (SC2) 13,10% of variance. By the scores graphic (Figure 1) it is observed that exists the separation of jaboticaba trees according with the year of collection, being the weights shown in Figure 2, demonstrating the responsible variables by the separation of jaboticaba trees. Still according with Figure 1, can be note the evident separation and formation of groups of jaboticaba access according with the year of study, being separated in two distinct groups, the group 1 refers to the access of jaboticaba trees analyzed and represented by the plants 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12 and 13. The second group is formed by the access of jaboticaba trees numbered by14,15, 16, 17, 18, 19, 20, 21, 22, 23, 24,25 and 26. The variable responsible by the separation of access in two distinct groups were: number of seeds, reason between the longitudinal and transversal diameter, pH of peel, soluble solids of peel and pulp fractions, fresh mass and dry mass of shoot and root parts of seeds, beyond the moisture content of seeds for the group 1. The formation of group 2 was given by the compounds: mass of

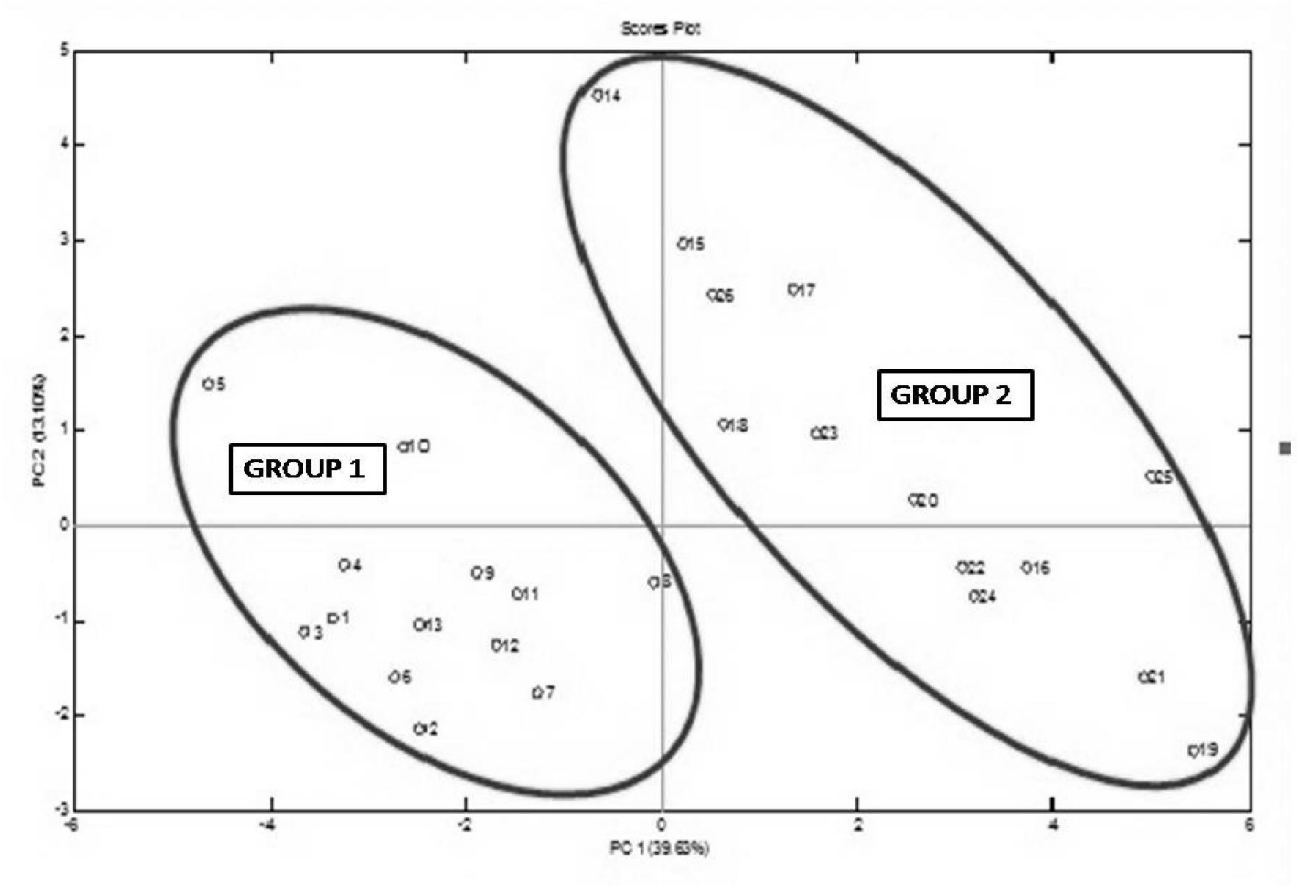

Figure 1. Graphics showing the formation of distinct groups of Jaboticaba trees access through the Principal Component Analysis (PCA)

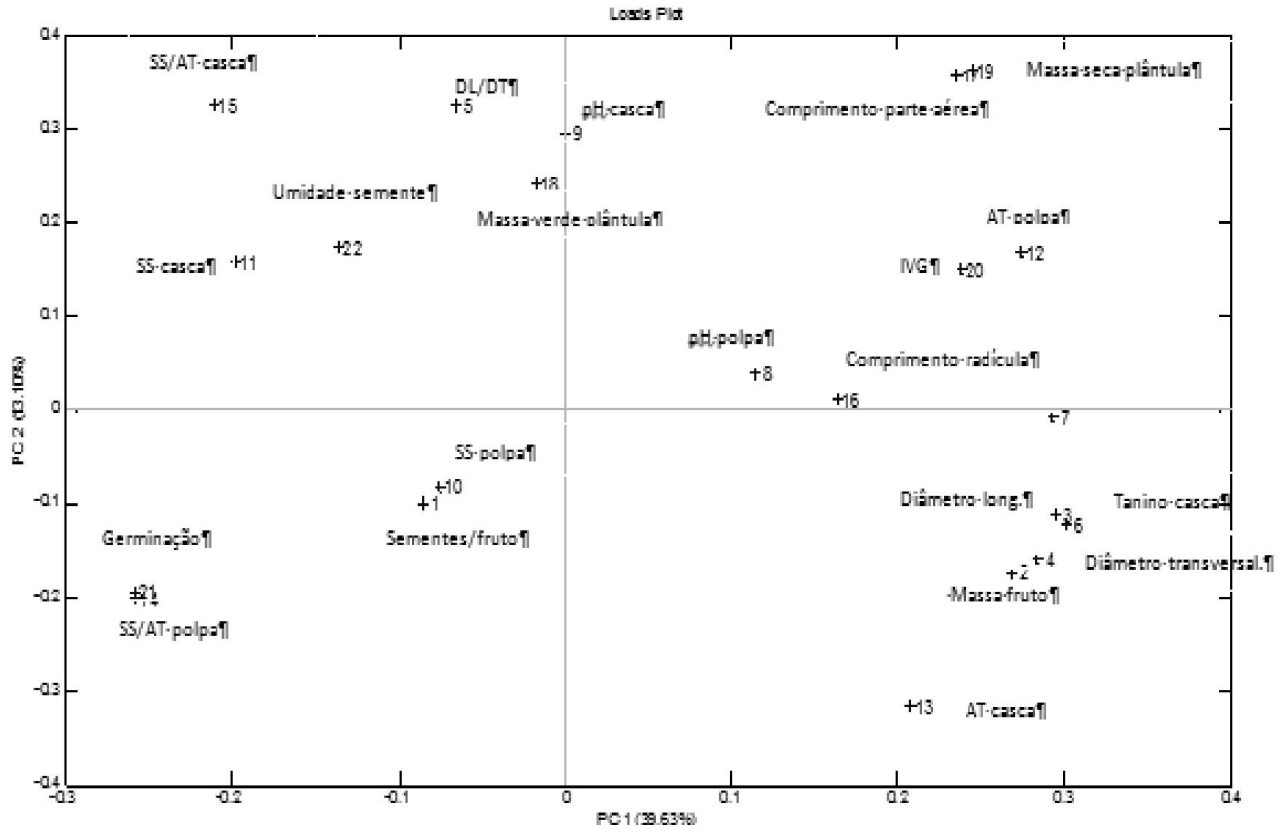

Figure 2. Graphic showing the variables (weights) responsible by the grouped and formation of distinct groups of Jaboticaba access

Table 1. Mean values of major components evidenced by the Principal Component Analysis (PCA) for jaboticaba access

Morphoagronomic and Bromatological characterization of Jaboticaba trees. (Means ± standard deviation).			
Variables	Group 1	Group 2	Literature datas
Fruit mass (g)	4,16 ± 1,30	6,02 ± 2,10	8,27g (LIMA *et al*. 2008)
Seeds/fruit	1,69 ± 0,63	1,53 ± 0,34	1,96 to 3,82 (SOPRANO *et al*. 2008)
Longitudinal diameter (LD) (mm)	18,09 ± 1,56	21,07 ± 2,36	17,70 to 24,70 mm (OLIVEIRA *et al*. 2003)
Transversal diameter (TD) (mm)	18,02 ± 1,92	20,88 ± 2,59	17,30 mm (HICKEL, 2002)
LD/TD (mm)	9,70 ± 0,3	10,90 ±0,3	9,6 to 9,9 mm (OLIVEIRA et. al. 2003)
pH (peel)	3,26 ± 0,20	3,34 ± 0,12	3,39 (LIMA *et al*. 2008)
Soluble solids peels (°Brix)	14,90 ± 0,82	13,13 ± 1,23	11,60 ° Brix (LIMA *et al*. 2008)
Soluble solids pulp (°Brix)	10,93 ± 2,28	11,27 ± 2,73	14,09 ° Brix (LIMA *et al*. 2008)
Dry mass of seedling (g)	0,45 ± 0,23	2,28 ± 0,40	-
Fresh mass of seedling (g)	2,30 ± 1,11	5,96 ± 2,36	-
Moisture content seeds (%)	48,22± 3,82	43,81 ± 11,28	42,10% (AMBRÓSIO et. al. 2008) 47,55% (MENDONÇA, 2000)
Flavonoids peel (mg/100g)	42,02 ± 6,46	75,86 ± 19,14	37,75 mg/100g (SOARES *et al*. 2008)
Total phenolics (mg/100g)	13,76 ± 1,28	22,74 ± 7,42	11,9mg/100g (LIMA *et al*. 2008)
Percentage og germination (%)	63,00 ± 22,53	76,00 ± 11,84	42,50 to 66,80% (DELGADO *et al*. 2007)
GSI (%)	1,74 ± 1,05	5,97 ± 2,39	6,63 % (JÚNIOR *et al*. 2007)

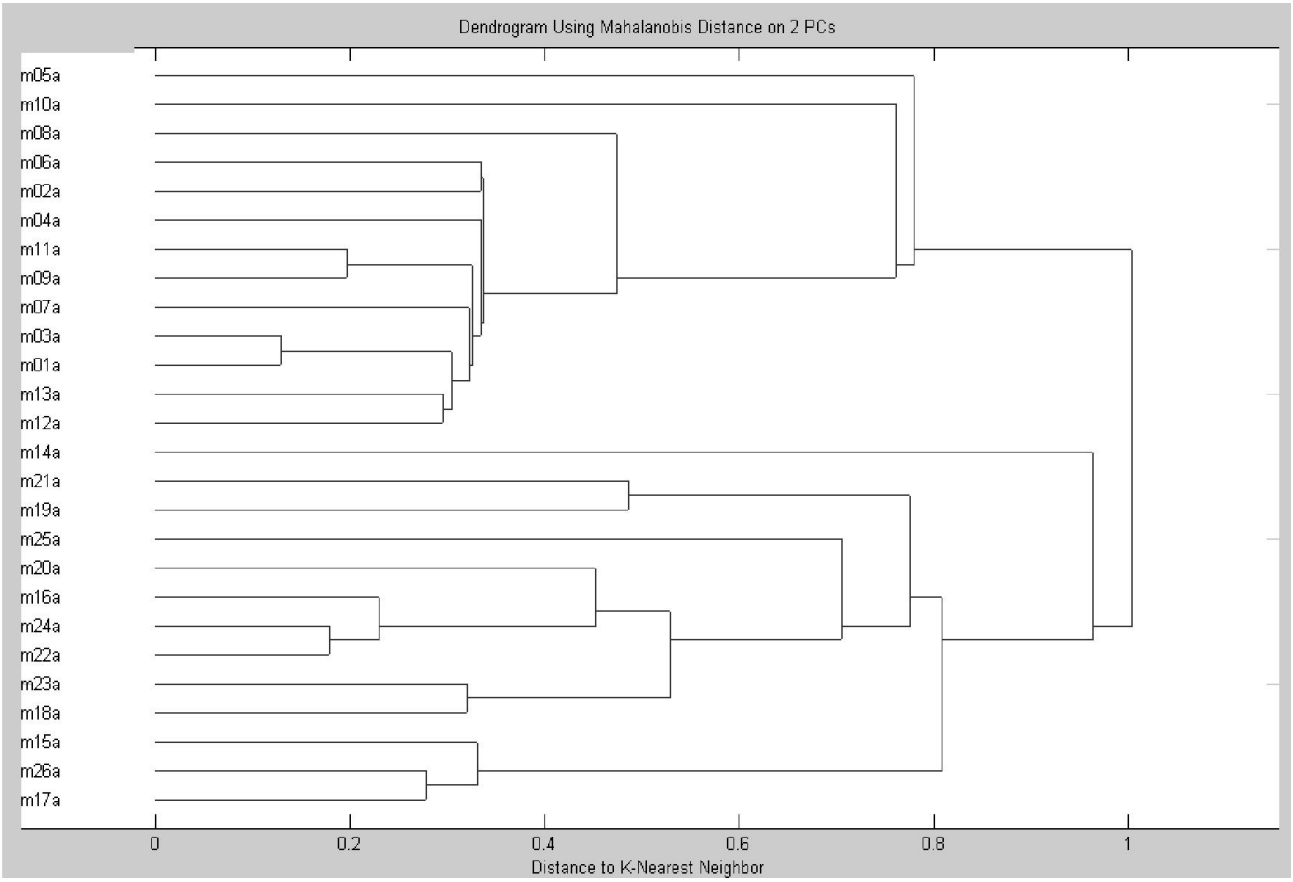

Figure 4. Dendrograma obtido pelo método de Agrupamento Hierárquico do vizinho mais próximo, para os 26 acessos de jabuticabeiras, evidenciando a formação de grupos e sub grupos

fruit, longitudinal and transversal diameter of fruits, total flavonoids and phenolics in the peel fraction, radicle and shoot length of seeds, beyond the germination speed index and germination taxes (Table 1). The average mass of fruits was of 4,16 ± 1,30g in group 1 and of 6,02 ± 2,10g for the group 2, being these values next to the results founded by Lima *et al*. (2008) of 8,27g. The average of seeds per fruit was of 1,69 ± 0,65 for the access of group 1 and 1,53 ± 0,34 for the access of group 2, having like extremes: 1,1 e 2,85 seeds/fruit, being next to the founded by Soprano *et al*. (2008) of 1,96 to 3,82 seeds per fruit of jaboticaba. The average dimensions of fruits obtained by the longitudinal diameters were of 18,09 ± 1,56mm and 21,07 ± 2,36mm for the fruits of groups 1 and 2 respectively, as 18,02 ± 1,92mm and 20,88 ± 2,59mm for the transversals diameters in the 2 years of study. The quotient between the longitudinal and transversal diameters (LD/TD) varies between 9,7mm to 10,9mm for both groups, being the average 11,0 ± 0,3mm. It is knew that the isolate analyze of the longitudinal and transversal diameter have few importance for fruits of jaboticaba trees. However, the relation between

LD/TD is very representative, indicating the fruit shape, closer than 10,0 mm more rounded is the shape of fruit. The values of shape index of fruit were similar to the founded by Oliveira *et al*. (2003), ranging from 9,6mm to 9,9mm for the specie *Myrciariajabuticaba* 'Sabara'. For the peels, the average value of pH was next for the groups 1 and 2 of 3,26 ±0,20 and 3,34 ± 0,12, respectively. The peels can be considered acids and the results founded were similar to the related by Lima *et al*. (2008) of 3,39 for the peel fruits fraction of jaboticaba trees 'Sabara'. The contents of SS of the pulp and peel fractions presented values of 14,90 ± 0,82º Brix and 13,13 ± 1,23°Brix for the group 1. The group 2 obtained 10,93 ± 2,28º Brix and 11,27 ± 2,73° Brix; being superiors and next to the values founded by Lima *et al*. (2008) whose founded contents of 11,60ºBrix for the fraction of peel fruit of jaboticaba trees 'Sabara'. The contents of SS of fruits were used like an approximate determination of the sugar content and many times, like maturation index, becoming important for both in natura consumption and for the industry. This content can be indicated mainly for the industrial processing, cause high levels of soluble solids constituents in the raw material imply in less addition of sugars, less time of water evaporation, less waste of energy and higher yield of the product, resulting in higher economy in the processing (CHITARRA& CHITARRA 2005). For the flavonoids presented in the peel of fruits of jabuticaba trees the access obtained average values of 42,02 ± 6,46mg/100g (group 1) and 75,86 ± 19,14mg/100g (group 2). Archivio *et al*. (2007) reported that the pluviosity and the exposition to the light exercise a considerable effect on the most flavonoids. With this, can be justified the variation in the content of flavonoids in the peel fruits of jaboticaba trees in this study. Studies realized with phenolic compounds, with emphasis on flavonoids show edits antioxidant capacity, presenting significant effect in prevention of various diseases, among them are: the cardiovascular, cancer and neurological (SÁNCHEZ-MORENO, 2002).

The average values of total phenolics founded in the portion of peel fruits were of 13,76mg/100g^{-} ± 1,28mg/100g (group 1), while the fruits of group 2 obtained values of 22,74mg/100g ± 7,42mg/100g, being superiors to the values founded by Lima *et al*. (2008) whose founded 11,99mg/100g^{-1}of fruits of jaboticaba trees 'Sabara'. The moisture content average of seeds were of 48,22% ± 3,82% (group 1) and 43,81% ±11,24% (group 2). Similar results were obtained by Ambrósio *et al*. (2008) for *Pliniacauliflora* with moisture content of 42,10% and Mendonça (2000), for the varieties "Sabará' and 'Cabinho', with moisture of seeds of 47,55% and 47,46%, respectively. The percentage of germination of jaboticaba seeds from the access of the group 1 was of 63% ± 22,53%, and of the 76 % ± 11,84 for the access of the groups 2. Delgado *et al*. (2007) obtained for the six native species of fruits plants, germination of 42,50% to 66,80%. The average values of GSI analyzed was of 1,74% ± 1,05% in the group 1 and of 5,97% ± 2,39% for the group 2, being inferior to the values reported by Junior *et al*. (2007) whose obtained germination speed index of 6,63% for the 'Sabara' variety. The average values of fresh mass and dry mass of seedlings were 0,45g ± 0,23g and 2,30g ± 1,11g for the group 1, since the group 2 presented the values of 2,28g ± 0,40g and 5,96g ± 2,36g respectively. The access of jaboticaba trees were also separated by the hierarchical cluster analysis using the average of variables for each access (Figure 4). In the hierarchical cluster analysis (HCA) occurs the formation of two groups distinct, based on the cut done in the higher distance between groups. The group 1 was formed by the access 02 to 18, 20, 23 and 26, while the group 2 was formed by the access 19, 21, 22, 24 and 25. The group 1 was yet, able to dived in subgroups 1.1, 1.2, 1.3 and 1.4, already the group 2 split off in one subgroup 2.1. Through the HCA can be observed that the plants previously grouped by the PCA differed from the plants grouped by dendogram, once that the hierarchical cluster analysis search to cluster according with the similarities presented in the access considering all the variables. The APC realizes the separation of the groups but in according with the statistically significant variables.

Conclusions

Through the analyses of PCA and HCA was possible to separate the Access of jaboticaba trees "Sabara". In the characterization of jaboticaba trees access, all the selected variables by the method of PCA were important from a commercial standpoint. There was variation between the physical, physical-chemical, chemical of fruits and physiological of seeds from the different access. The evaluated access allowed a selection of promising matrixes for the in natura and the agro industry market.

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REFERENCES

Ambrósio, R., Danner, M. A., Citadin, I., Sachet, M. R.,Sasso, S. A. Z. and Medeiros, J. G. S. 2008. Efeito do período e da temperatura de armazenamento na viabilidade de sementes de jabuticabeira (*Plinia cauliflora*). XX Congresso Brasileiro de Fruticultura, 2008, Anais. Vitória/ES.

AOAC-Association Official Analytical Chemistry, 2000. Official methods of analysis of the Association of Official Analytical Chemistry.12 ed. Washington, 1015p.

Archivio, M., Filesi, C., Benedetto, R., Gargiulo, R., Giovannini, C. and Masella, R. 2007. Polyphenols, dietary sources and bioavailability. Ann IstSuperSanitá,43: .348-361. http://www.iss.it/publ/anna/2007/4/434348.pdf

BRASIL, Ministério da Agricultura, Pecuária e Abastecimento. 2009. Regras para análise de sementes. Ministério da Agricultura, Pecuária e Abastecimento. Secretaria de Defesa Agropecuária. Brasília: MAPA/ACS, 395p.http://www.agricultura.gov.br/arq_editor/file/2946_regras_analise__sementes.pdf

Chitarra, M. I. F. and Chitarra, A.B. 2005. Pós-colheita de frutos e hortaliças: fisiologia e manuseio. Lavras: UFLA, 783 p.

Cruz, C.D. 2005. Princípios de genética quantitativa. UFV, Imprensa Universitária. Viçosa, MG. 394p.

Delgado, L.F. and Barbedo, C. J. 2007. Tolerância à dessecação de sementes de espécies de Eugenia. Pesquisa Agropecuária Brasileira, 42: p. 265- 272. http://www.scielo.br/pdf/pab/v42n2/16.pdf

Donadio, L. C., Môro, F. V. and Servidone, A. A. 2002. Frutas Brasileiras. Jaboticabal: FUNEP, 288p.

Hickel, E. R. 2002. Espessura da polpa como condicionante do parasitismo de mosca-das-frutas (diptera:tephritidae) por hymenoptera: braconidae. Ciência Rural, 32: 1005-1009. http://www.scielo.br/pdf/cr/v32n6/12746.pdf

http://ac.els-cdn.com/S0308814698001022/1-s2.0-S0308814698001022 main.pdf?_tid=8e2958b0-6cff-11e5-a96e-00000aacb35f&acdnat=1444228236_13a444854e63423652fc3b04ffc0044

http://www.scielo.br/pdf/rbf/v25n3/18652.pdf

http://www.scielo.br/pdf/rbf/v30n1/13.pdf

IAL- Instituto Adolfo Lutz. 2003. Normas analíticas do Instituto Adolfo Lutz: Métodos químicos e fisicos para análise de alimentos. 3. ed. São Paulo: Instituto Adolfo Lutz, 1000p.

Júnior, A. W., Frazon, R. C., Silva, J. O., DAS; Santos., C. E. M., Gonçalves, R. DA S. and Brucknen, C. H. 2007. Efeito da temperatura na germinação de sementes de três espécies de jabuticabeira. Ceres, 54: 345-350.

Lima, A., de. J. B., Corrêa, A. D., Alves, A. P. C., Abreu, C. M. P. and Barro, A. M. D. 2008. Caracterização química do fruto jabuticaba (Myrciaria cauliflora Berg) e de suas frações. Sociedad Latinoamericana de Nutrición, 58: 416-421.

Mendonça, R. M. N. Maturação, secagem e armazenamento de sementes e propagação vegetativa de Jabuticabeiras (Myrciariasp). 2000. 136p. Tese (Doutorado)- Universidade Federal de Viçosa, Viçosa, MG.

Oliveira, A. L., Brunini, M. A., Salandini, C. A. R. 2003. Caracterização tecnológica de jabuticabas 'Sabará' provenientes de diferentes regiões de cultivo. Revista Brasileira de Fruticultura, 25: 397-400.

Sanchez-Moreno, C. 2002. Methods used to evaluate the free radical scavenging activity in foods and biological systems. Food Sci Technol Int, 8: 121–137. http://fst.sagepub.com/content/8/3/121.full.pdf+html

Soares, M., Welter, L.,KuskoskI, E. M., Gonzaga, L. and Fett, R. 2008. Compostos fenólicos e atividade antioxidante da casca de uvas Niágara e Isabel. Revista Brasileira de Fruticultura, 30: 59-64.

Soprano, E. and Koller, O. L. Avaliação de frutos de espécies frutíferas tropicais com potencial para cultivo em Santa Catarina. XX Congresso Brasileiro de Fruticultura, 2008, Anais. Vitória/ES.

Zhishen, J., Mengchen, G.T. and Jianming, W. 1999. The dtermination of flavonoids contents in mulberry and their scavenging effects on superoxide radicals. *Food Chemistry,* 6: 555-559.

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