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Postharvest quality of cocona (*Solanum sessiliflorum* Dunal) stored under ambient condition

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ABSTRACT

Cocona (*Solanum sessiliflorum* Dunal) is an important genetic resource that has been traditionally used for a variety of purposes, including food, medical and cosmetics applications. The objective of this study was evaluated the quality and the period of postharvest shelf life of cocona 'Mosquet", through the physical, chemical and physiological characterization of fruits stored under the ambient conditions. Physiologically mature fruits were harvested from an orchard, washed with tap water and soaked in a solution of the fungicide Prochloraz (49.5 g/100 L of water) for 5 minutes. After air drying, the fruits were packed in plastic containers and stored at 24 ± 2 °C and relative humidity 60 ± 5% for 15 days. The fruits developed a respiratory climacteric respiratory patern and remained fit for consumption up to day 6 of storage, that is, without visual symptoms of loss of water and firmness. At this stage, the fruits showed firmness of 117,42 kPa, soluble solids of 6.62° Brix and citric acid of 1.22 %.

Key words: *Solanum sessiliflorum* Dunal, storage, shelf life.

RESUMO

Qualidade pós-colheita do maná-cubiu (*Solanum sessiliflorum* Dunal) armazenado sob condição ambiente

O maná-cubiu (*Solanum sessiliflorum* Dunal) é um importante recurso genético, porque produz frutos tradicionalmente utilizados como alimento, medicamento e cosméticos. O objetivo deste trabalho foi avaliar a qualidade e o período de conservação pós-colheita de maná-cubiu 'Mosquet', por meio da caracterização física, química e fisiológica dos frutos mantidos sob condição ambiente. Os frutos foram colhidos fisiologicamente maduros em pomar e, em seguida, lavados com água corrente e imersos em solução do fungicida Prochloraz (49,5 g/ 100 L de água), por 5 minutos. Após secagem ao ar, os frutos foram postos em caixas plásticas e armazenados à temperatura de 24 ± 2 ºC e umidade relativa de 60 ± 5%, durante 15 dias. Os frutos apresentaram o comportamento respiratório climatérico e mantiveram-se adequados ao consumo até o sexto dia de armazenamento, o que significa que estavam visualmente sem sintomas de perda de água e firmes, com firmeza da polpa de 117,42 kPa, sólidos solúveis de 6,62° Brix e a acidez titulável de 1,22 %.

Palavras-chave: *Solanum sessiliflorum* Dunal, armazenamento, vida de prateleira.

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INTRODUCTION

Solanum sessiliflorum Dunal or Cocona is a tropical shrub belonging to the Solanaceae family. In Brazil, cocona is known as maná-cubiu, maná, topiro and "tomate de índio" (Yuyama *et al*., 2007). Cocona is native to the western Amazon and was domesticated by pre-Columbian Amerindians (Lopes & Pereira, 2005). It is a semi-hardwood, fast-growing plant and can reach up to two meters high. The flowers are complete, 4-5 cm wide, arranged in inflorescences of short racemes (Rascio *et al*., 2002). The trees produce up to 100 ton/ha of fruits, which are used in juices, ice creams, sweets and sauces for meats (Silva Filho *et al*., 2003).

Fruits are mostly globose, 31-92 mm long, 33-77 mm in longitudinal diameter, 1.5-19.5 mm of pulp thickness and 18.5-30.1 grams of mass. Cocona is a low-calorie food with carbohydrates and lipids ranging from 1.3 to 27.2% and 58.5 to 87.3% per 100 g of pulp, respectively. Potassium (54.6 mg to 463.5 mg per 100 g of pulp) and iron (97.3 to 352.0 µg per 100 g of pulp) are among the macro and micro elements occurring in higher concentrations (Silva Filho *et al*., 2003).

Because cocona contains high levels of niacin (vitamin B3), higher than in eggplant, cashew, star fruit, sugar beet and persimmon, it can be considered a medicinal fruit, fighting cholesterol and high triglyceride levels, anemia, diabetes, high blood pressure, migraine and depression (Salick, 1989).

The fruits grow rapidly in the early development, up to 80 days after anthesis. At this stage, they are yellow, changing to orange, around 90 days, to deep orange, around 100 days, and orange-brown, around 110 days after anthesis. The whole cycle of fruit development and ripening, on the plant, is around 90 days (Souza *et al*., 2008).

Studies on this species have been especially related to the floral biology and genetic improvement (Paiva, 1999; Rascio *et al*., 2002, Bezerra & Machado, 2003; Silva Filho, 2003). However, there is a lack of studies on fruit quality and postharvest life.

Considering the scarce information on quality and shelf life of cocona, we highlight the need for studies on postharvest biology. In this study, we evaluated quality and postharvest shelf life cocona fruits during storage under the ambient conditions.

MATERIALS AND METHODS

Physiologically matured (uniform yellow skin) fruits of cocona var. 'Mosquet' were harvested from an experimental orchard located in the Mesoregion of Zona da Mata of Minas Gerais (20°45'14" S latitude, 42°52'55" E longitude, 648 m altitude), in September 2006. The climate of the region is classified as tropical of altitude, with average annual temperatures around 19°C, varying between 14°C (minimum average) and 26°C (maximum average).

After harvesting, the fruits were washed with tap water and soaked in a solution of the fungicide Prochloraz (49.5 g/100 L of water) for 5 minutes. After drying, the fruits were packed in plastic containers, previously disinfected with sodium hypochlorite and lined with paper towels, and stored at 24 ± 2 °C and relative humidity 60 ± 5%, for 15 days. The evaluations were carried out at regular intervals, every three days.

The CO_2 production was determined by gas chromatography. Fruits were placed in sealed glass jars of 1680 mL volume. Sixty minutes after closing the jars, 1.0 mL aliquots were taken with a hypodermic syringe and injected into a Gow Mac Series 550P gas chromatograph equipped with a thermal conductivity detector and aluminium column filled with Porapak Q. The working conditions were: helium as a carrier gas at a flow rate of 40 mL/min; electric current of 150 mA; column temperature of 50 ºC; detector temperature of 70 ºC; injector temperature of 80 °C, and room temperature of 20-23 ºC. CO_2 was measured by comparing the peak areas of the sample, in the chromatogram, with those produced by the injection of a standard aliquot consisting of 5.96% mol CO_2 per mol of the mixture $CO_2 + N_2$. The results were expressed as mg $CO_2 kg^{-1} h^{-1}$.

The weight loss was evaluated gravimetrically, by subtracting the initial weight of the fruit from the weight obtained in each sampling period; the fruit volume was measured by the volume of water displaced after immersing the fruit in a 1000 mL measuring cylinder.

Skin and pulp resistance was determined by a digital penetrometer Shimpo model DFS 100 (Digital Force Gauge) with 12 mm circular flat head. Firmness of fruit with skin was measured by pressing the epicarp, and pulp firmness was measured by pressing the fruit mesocarp without skin, with two readings per fruit. The results were expressed in kPa. Determination of soluble solids was carried out with a digital refractometer and expressed in ° Brix. Titratable acidity was determined by titration of an aliquot of 5 mL of juice with NaOH (0.1 N) previously standardized, and the results expressed as a percentage of citric acid per 100g of pulp.

The experiment was arranged in a completely randomized design with six treatments: storage periods (0, 3, 6, 9, 12, and 15 days) and four replications. Each experimental unit consisted of two fruits. Data were examined using analysis of variance and regression analysis using the SAEG software (2007).The models fit by regression were chosen based on the significance of coefficients at 5% probability level by the *t* test, the coefficient of determination and the potential to explain the biological phenomenon.

RESULTS AND DISCUSSION

There was an increase in the production of CO_2 with storage (Figure 1A). The lowest value was observed on day 3 (30.13 mg CO_2. kg^{-1} h^{-1}) and the highest on day 9 (194.52 mg CO_2 kg^{-1} h^{-1}). From the day 9 after harvest, there was a decrease in CO_2 production, reaching 88.66 mg CO_2 kg^{-1} h^{-1} on day 15 of storage. This respiratory pattern of cocona is typical of climacteric fruits.

Mass loss of fresh weight increased with storage (Figure 1 B). Mass loss of accumulated fresh weight reached 17.10% on day 15. According to Silva *et al*. (2009), the mass loss of fresh weight has marked effects on the physiology of plant tissues, anticipating, in some cases, ripening and senescence of fruits.

The storage temperature can affect cell turgor, mass loss and mechanical properties of the fruit (Silva *et al*., 2010). Fruit volume decreased during storage possibly due to tissue dehydration (Figure 1 C).

Skin and pulp resistance decreased with increasing storage time and reached reductions corresponding to 62.98 and 85.9%, from harvest to the end of day 15 (Figures 2 A, B). On day 6, when the fruits were apparently firm, firmness corresponded to 532.30 kPa for skin and 117.42 kPa for pulp. Fruit softening, characterized by the decrease in resistance, is generally associated with lower adherence between cells. This results from the dissolution of pectic polysaccharides and hemicellulose in the middle lamella, leading to disruption of the cell wall, thus providing separation of cells, changes in turgor and dehydration of the membrane (Waldron *et al*., 2003).

Soluble solids (SS) responded quadratically to time intervals (Figure 2 C). There was increase in SS up to day 9 of storage, from 4.05 ° Brix, at the beginning of storage, to 6.53 ° Brix, on day 9. Values found for SS in this study confirm those reported by Souza *et al*. (2008) in cocona var. 'Santa Lucia'. From day 9 after harvest, SS decreased and reached a minimum of 4.56 ° Brix on day 15 of storage. This reduction in SS has probably occurred because of the use of substrates in the tissue fruit, due to the climacteric pattern of respiration.

The soluble solids content is related to sugar content and therefore, is often used to assess the quality (Silva et al., 2009). SS content has been used as an indicator of the fruit quality in melon (Mendonça *et al*., 2004), guava (Natale et al., 1995) and apple (Ventura *et al*., 1998).

Titratable acidity (TA) responded quadratically to day of evaluation (Figure 2 D). Similar to SS content, acidity also decreased after day 6, from 1.04% at time zero to the minimum value of 0.28% on day 15. The level of TA observed in this study is in agreement with that reported by Souza *et al*. (2008), with variations ranging from 1.1 to 2.0% of citric acid. The authors found a negative correlation between the SS content and TA level during fruit development: while there is an increase in the SS content, there is a decrease in TA, a phenomenon possibly related to the climacteric respiration.

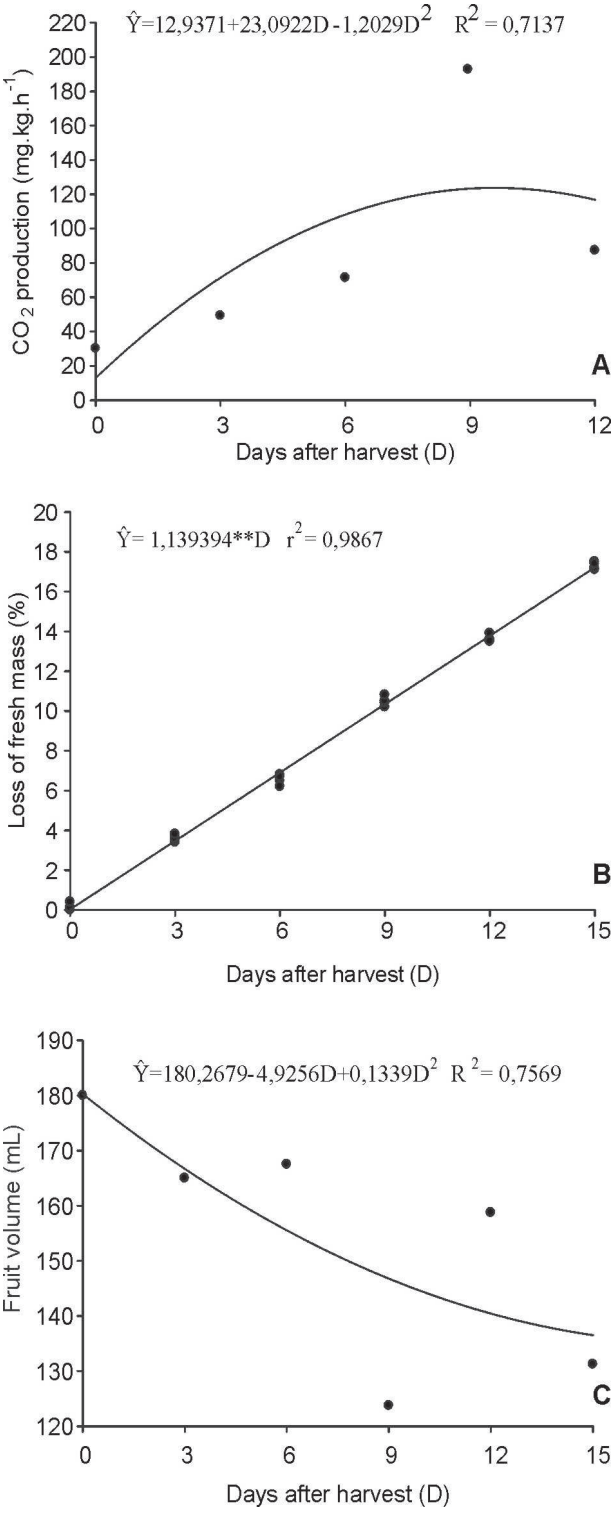

Figure 1. CO_2 Production (A), mass loss of fresh weight (B) and volume (C) of cocona fruits of var. Mosquet, stored at 24 ± 2 °C and 60 ± 5 relative humidity, as a function of storage period.

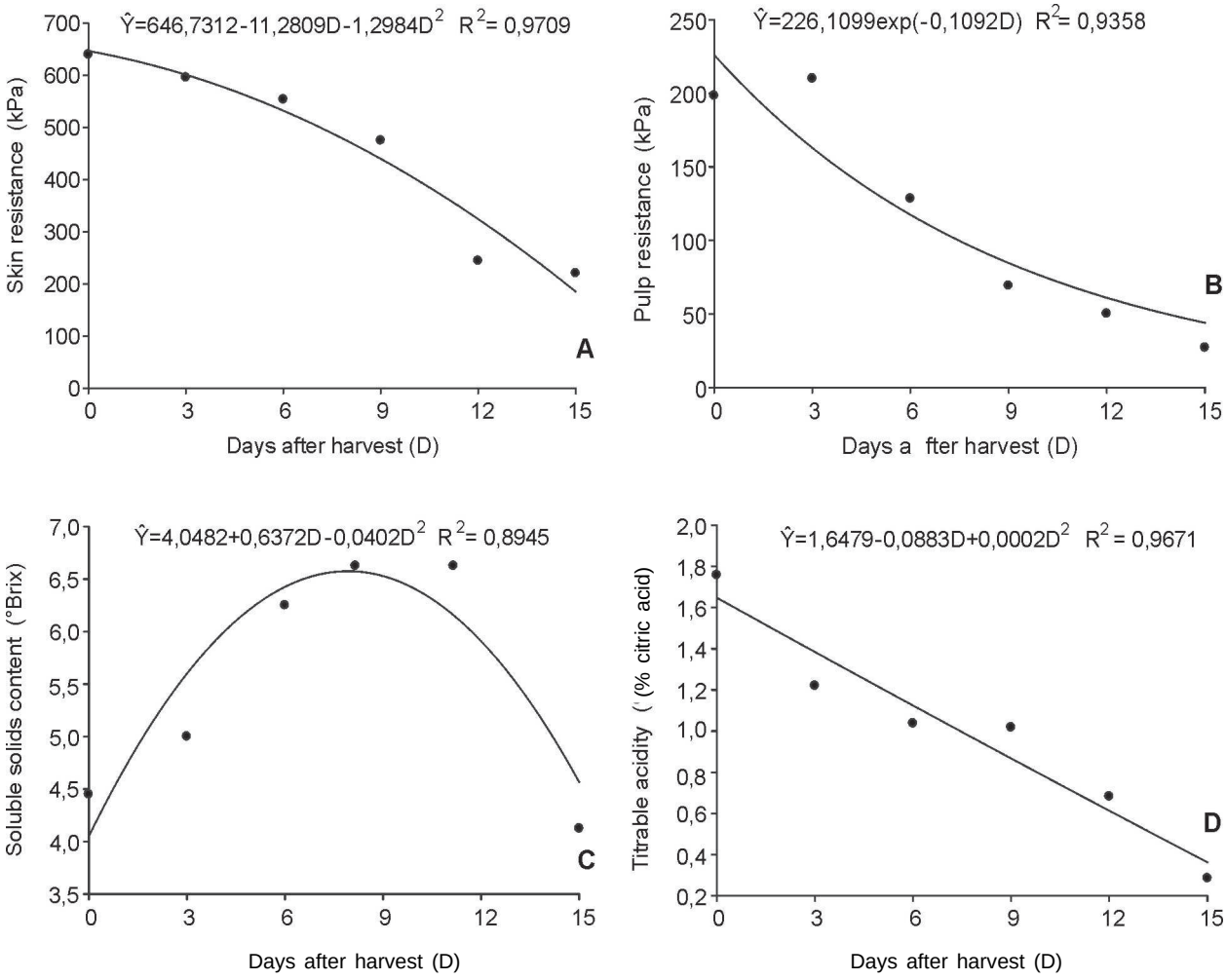

Figure 2. Skin resistance (A), pulp resistance (B), soluble solids (C) and titrable acidity (D) in of cocona fruits of var. Mosquet, stored at 24 ± 2 °C and 60 ± 5 relative humidity, as a function of storage period.

CONCLUSION

Cocona fruits of var. Mosquet have a climacteric pattern of respiration.

The postharvest quality of fruits was maintained proper for consumption up to day 6 of storage.

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