Platonia insignis Mart. ("bacuri")

Subjects: Food Science & Technology

Contributor: Simone Kelly Rodrigues Lima , Angélica Gomes Coêlho , Massimo Lucarini , Alessandra Durazzo , Daniel Dias Rufino Arcanjo

Bacuri (*Platonia insignis*) is a monotype belonging to the *Clusiaceae* family. From Amazonian origin, it is highly appreciated for fresh consumption, mainly due to its peculiar sensory characteristics. It is also widely used in the food industry, mainly in pulp (endocarp), used in the manufacture of beverages, jellies, and ice cream.

antioxidant bacuri Clusiaceae Platonia insignis

1. Introduction

Brazil has the most diversified flora in the world, with approximately 33,161 plant species, corresponding to 26.5% of the total number of species currently known [1]. In this context, biodiversity is associated with a wide variety of natural compounds, with a wide possibility of developing new drugs, agrochemicals, fragrances, cosmetics, ingredients, and food supplements, providing a catalog of opportunities for biotechnological innovation and an unbeatable competitive advantage [2][3]. Nowadays, modeling the strict linkage between environmental, ecological and food resources in the biodiversity and health benefits perspectives represent great challenges [4][5].

Bacuri (*Platonia insignis*) is a tree species of the *Clusiaceae* family, which encompasses approximately 1000 species belonging to 47 genera, although bacuri is a monotype. Plantations occur in the wild, and propagation occurs through seeds or sprouts that arise spontaneously in the roots of adult plants [6][7]. The Amazon is its original area, although it also has a distribution along the Atlantic coast, going from the Guianas to the mid-northern region of Brazil. The area of greatest concentration is in the estuary of the Amazon River, and the largest production and marketing centers are in the states of Pará, Maranhão, and Piauí [8][9].

The fruits are usually collected through the extractive system, with the use of trees that already exist in the producing regions. However, besides the extractive system, at least two more types of systems are known: regrowth management and planting systems. Regrowth management is a process of improvement of simple extractivism, in which more favorable conditions are created for bacuri trees by using low-cost technologies. The system of planting saplings, seeds, and grafting, which is considered the most recent and promising, allows faster production of fruits while maintaining the preservation of the system [10].

Regarding the botanical aspects, the fruit is of berry type and presents shapes that can vary from pear-shaped to rounded [11] and may also present other intermediate types. However, in the same tree, the shape of the fruits is uniform, which demonstrates that the bacuri tree has genetically well-fixed characters [12]. The length of the fruit is

7–15 cm, and the diameter is 5–15 cm, with a weight that usually varies from 200 to 500 g [13], although some types can reach a weight of more than 1000 g [11]. The shell has a very thick structure (1–3 cm), responsible for the largest volume of the fruit, with a color that can vary from green to yellow-citrine and reddish-brown. On the other hand, the pulp has a creamy-white color and an essentially floral flavor with fruity notes [14][15].

Bacuri (**Figure 1**) is a fruit with very different characteristics from a physiological perspective. It presents a non-climacteric breathing pattern at all stages of maturation from the third day of harvest (ambient conditions with a relative humidity of 75.1% and 25.2 °C) [16][17]. Although there may still be a slight softening and color change when harvested before the sweet spot, no considerable improvement in their sensory and nutritional characteristics can be observed [14].

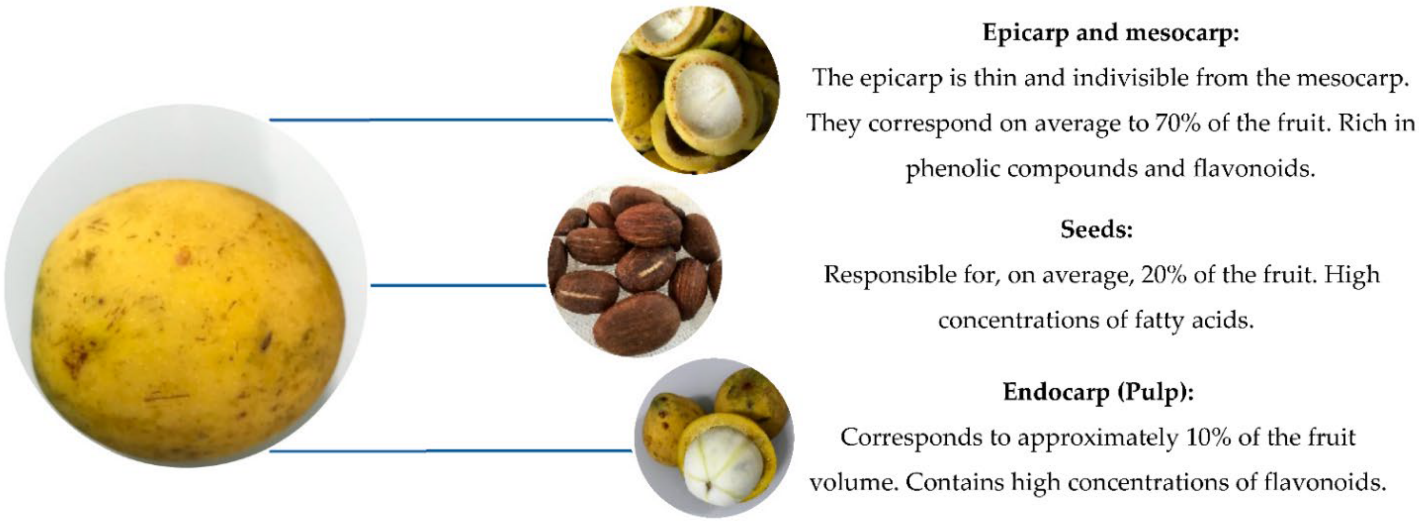

Figure 1. Contribution of bacuri (*Platonia insignis*) components to fruit volume.

The fruits are predominantly provided with seeds with an ellipsoidal shape, with an average weight of 24.4 g. The intensity of the angularities depends on the number of seeds that form in the fruit [18]. Although seeded bacuri is the most commonly found type, in 1970, seedless bacuri, a variety initially found on the island of Marajó, was reported [11]. The phenomenon of parthenocarpy occurs when none of the ovules located in one or more locules is converted into seed. It is assumed that the fraction of the pulp represented by the parthenocarpic segments is tastier, mainly due to its lower acidity. However, more studies are still needed to prove it [19].

2. Bacuri Composition: Characteristics and Applications

Bacuri is one of the most prominent Amazonian fruits. Its organoleptic characteristics allowed its success both in the group of fruits for in natura consumption and industrial use [20]. The pulp, in addition to the nutritional aspects, presents properties that allow its wide application in the industry, mainly for the production of juices, jellies, and ice creams. [6].

The centesimal composition, composition of minerals, vitamins, and amino acids, and physicochemical characteristics are reported of bacuri pulp (*Platonia insignis* Mart.) are reported in **Table 1** and **Table 2**. In quantitative terms, carbohydrates are the main macronutrients that compose the pulp and are almost entirely responsible for energy values (**Table 1**). Among the total sugars, sucrose comprises 18.5%, while glucose and fructose comprise 15.5% and 15.6%, respectively [21].

Table 1. Centesimal composition of bacuri pulp (*Platonia insignis* Mart.).

Components	Quantity	Reference
Carbohydrates (g)	17.83–22.80	[22][23]
Proteins (g)	1.22–1.90	[22][23][24]
Lipids (g)	1.37–2.01	[22][23][24]
Total dietary fiber (g)	5.20–7.40	[22][23]
Moisture (g)	74.35–79.77	[22][23][24]
Ashes (g)	0.35–1.0	[22][23][24]
Energy value (Kcal)	84–105	[22][23]

Table 2. Composition of minerals, vitamins, and amino acids in bacuri pulp (*Platonia insignis* Mart.).

Components	Quantity	References
Minerals		
Calcium (mg)	17.09–20.00	[21][22]
Phosphorus (mg)	10.76–36.00	
Iron (mg)	0.45–2.20	
Potassium (mg)	149.81	
Vitamins		
Thiamine (mg)	0.04	[22]
Riboflavin (mg)	0.04	
Niacin (mg)	0.50	
Ascorbic acid (mg)	33.00	
Amino acids		

Components	Quantity	References
Lysine (mg)	8.13–316.00	[22][23]
Methionine (mg)	33–178.00	[22][23]
Threonine (mg)	4.7–219.00	[21][22]
Tryptophan (mg)	57.00	[22]

Table 3. Bacuri shell composition (*Platonia insignis* Mart.).

Parameters	Values (%)	References
Moisture	75.30–78.80	[25][26][27]
Ashes	0.5–1.02	
Proteins	1.16	
Lipids	1.58	
Carbohydrates	20.94	
Pectin	5.00	
Resins	1.40	
Cellulose	3.90	
Reducing sugars	2.70	

The shell constitutes about 70% of the total volume of the fruit. Its composition has high water content, representing more than 70% of its constitution. Even with a low lipid content, oleic, linoleic, stearic, and palmitic acids are constituents of this matrix (**Table 3**).

Bacuri seeds are characterized by a high content of lipids and being rich in dietary fiber. Lipids constitute, on average, 31.88% of its composition, while moisture, proteins, and fixed mineral residue contribute with 31.91%, 3.15%, and 1.03%, respectively. From the 32.02% carbohydrate content, dietary fiber represents around 19.57% [28]. Previously considered just waste, the seeds began to attract attention for their constitution of lipids and biologically active compounds. The oil extracted from the seed, commonly called bacuri butter, although still used on a small scale, already appears as a promising possibility for better use of the fruit [29][30].

Due to its characteristics and lipid composition, the oil extracted from bacuri seed is of particular interest to the food industry. Furthermore, studies have shown that bacuri seed oil possesses an important healing activity and it can be used in the treatment of burns and wounds [31][32]. Moreover, recently, in vivo studies point to an important potential antioxidant and cardioprotective action [33][34].

References

1. Lustosa, A.K.M.F.; Bezerra, É.A.B.; Rodrigues, K.A.d.F.R.; Amorim, L.V.A.; Lima Neto, J.d.S. Antileishmanial effect of fruit seeds from Platonia insignis against macrophage- internalized amastigote forms of Leishmania Amazonensis. Rev. Cuba. Plantas 2018, 2, 1–14.
2. Lustosa, A.K.M.F.; Arcanjo, D.D.R.; Ribeiro, R.G.; Rodrigues, K.A.F.; Passos, F.F.B.; Piauilino, C.A.; Silva-Filho, J.C.; Araújo, B.Q.; Lima-Neto, J.S.; Costa-Júnior, J.S.; et al. Immunomodulatory and toxicological evaluation of the fruit seeds from Platonia insignis, a native species from Brazilian Amazon Rainforest. Rev. Bras. Farmacogn. 2016, 26, 77–82.
3. Lima, G.D.M.; Brito, A.K.D.S.; De Farias, L.M.; Rodrigues, L.A.R.L.; Pereira, C.F.D.C.; Lima, S.K.R.; Frota, K.D.M.E.G.; Rizzo, M.D.S.; Nunes, P.H.M.; Lucarini, M.; et al. Effects of “bacuri” Seed Butter (Platonia insignis Mart.) on Metabolic Parameters in Hamsters with Diet-Induced Hypercholesterolemia. Evid.-Based Complement. Altern. Med. 2021, 2021, 1–8.
4. Lindoso, J.V.d.S.; Alencar, S.R.; dos Santos, A.A.; Mello Neto, R.S.; Mendes, A.V.d.S.; Furtado, M.M.; da Silva, M.G.; Brito, A.K.d.S.; Batista, E.K.F.; Baêta, S.d.A.F.; et al. Effects of “Bacuri” Seed Butter (Platonia insignis Mart.), a Brazilian Amazon Fruit, on Oxidative Stress and Diabetes Mellitus-Related Parameters in STZ-Diabetic Rats. Biology 2022, 11, 562.
5. Durazzo, A.; Lucarini, M.; Zaccardelli, M.; Santini, A. Forest, Foods, and Nutrition. Forests 2020, 11, 1182.
6. Villachia, H. Frutales y hortalizas promisorios de Ia Amazonia. Tratado Coop. Amaz. 1996, 44, 50–55.
7. Carvalho, J.E.U.d. Aspectos botânicos, origem e distribuição geográfica do bacurizeiro. In Bacuri: Agrobiodiversidade; Instituto Interamericano de Cooperação para a Agricultura: São Luis, Brazil, 2007; p. 210.
8. Bezerra, G.D.S.A.; Maia, G.A.; de Figueiredo, R.W.; de Souza Filho, M.d.S.M. Agroeconomic Potential of Bacuri: Review. Bol. Cent. Pesqui. Process. Aliment. 2005, 23, 45–58.
9. Nascimento, W.M.O.; De Carvalho, J.E.U.; Müller, C.H. Ocorrência e distribuição geográfica do bacurizeiro. Rev. Bras. Frutic. 2007, 29, 657–660.
10. de Menezes, A.; Homma, A.K.O.; de Matos, G. From extractivism to domestication: The case of the bacurizeiro in northeastern Pará and on the island of Marajó. Soc. Bras. Econ. Adm. Sociol. Rural 2018.
11. Calzavara, B.B.G. Fruteiras: Abieiro, abricozeiro, bacurizeiro, cupuaçuzeiro. In Série Culturas da Amazônia,2.; Instituto de Pesquisas e Experimentação Agropecuárias do Norte (IPEAN): Belém, Brazil, 1970; p. 84.
12. Mourão, K.S.M.; Beltrati, C.M. Morfologia dos frutos, sementes e plântulas de Platonia insignis Mart. (Clusiaceae). II morfo-anatomia dos frutos e sementes maduros. Acta Amaz. 1995, 25, 33–46.

13. Souza, V.A.B.D.; Araujo, E.C.; Vasconcelos, L.F.; Lima, P.S. Variability of physical and chemical fruit characteristics of bacuri germplasm from mid-north region of Brazil. Rev. Bras. Frutic. 2001, 23, 677–683.
14. Fontenele, M.A.; de Figueiredo, R.W.; Maia, G.A.; Alves, R.E.; de Sousa, P.H.M.; de Souza, V.A.B. Conservação pós-colheita de bacuri (Platonia insignis Mart.) sob refrigeração e embalado em PVC. Rev. Ceres 2010, 57, 292–296.
15. Uekane, T.M.; Nicolotti, L.; Griglione, A.; Bizzo, H.R.; Rubiolo, P.; Bicchi, C.; Rocha-leão, M.H.M.; Rezende, C.M. Studies on the volatile fraction composition of three native Amazonian- Brazilian fruits: Murici (Byrsonima crassifolia L., Malpighiaceae), bacuri (Platonia insignis M., Clusiaceae), and sapodilla (Manilkara sapota L., Sapotaceae). Food Chem. 2017, 219, 13–22.
16. Henrique, G.; Teixeira, D.A.; Durigan, J.F.; Lima, M.A. Postharvest changes and respiratory pattern of bacuri fruit (Platonia insignis Mart.) at different maturity stages during ambient storage. Acta Amaz. 2005, 35, 17–21.
17. Aguiar, L.P.; Figueiredo, R.W.D.; Alves, R.E.; Maia, G.A.; Aurélio, V.; Souza, B. De Caracterização física e físico-química de frutos de diferentes genótipos de bacurizeiro (Platonia insignis Mart.). Cienc. Tecnol. Aliment. 2008, 28, 423–428.
18. Cravalho, J.E.U.; Nascimento, W.M.O.; Müller, C.H.; Carvalho, J.E.U. Sistemas alternativos para formação de mudas de bacurizeiro (Platonia insignis Mart.). Comun. Técnico no° 11 Embrapa Amaz. Orient. 1999, 1–5.
19. Cardoso, R.C.D.; Carvalho, J.E.U.; Barbosa, W.C. Caracterização Físico-Química das Frações Polpa Aderida às Sementes e Segmentos Partenocárpicos do Bacuri (Platonia insignis Mart.). In Contribuição ao Desenvolvimento da Fruticultura na Amazônia; SBF: Belém, Brazil, 2006; pp. 143–149.
20. Carvalho, J.E.U.; De Nazaré, F.R.; Do Nascimento, W.M.O. Características físicas e físico-químicas de um tipo de bacuri (Platonia Insignis Mart.) com rendimento industrial superior. Rev. Bras. Frutic. 2003, 25, 326–328.
21. Rogez, H.; Buxant, R.; Mignolet, E.; Souza, J.N.S.; Silva, E.M.; Larondelle, Y. Chemical composition of the pulp of three typical Amazonian fruits: Araça-boi (Eugenia stipitata), bacuri (Platonia insignis) and cupuaçu (Theobroma grandiflorum). Eur. Food Res. Technol. 2004, 218, 380–384.
22. Morton, J. Fruits of Warm Climates. Banana, 1st ed.; Echo Point Books & Media: Brattleboro, VT, USA, 1987; ISBN 0-9610184-1-0.
23. Brasil Sistema de Informação Sobre a Biodiversidade Brasileira (SiBBr). Available online: https://ferramentas.sibbr.gov.br/ficha/bin/view/FN/ShortName/4192_bacuri_polpa_crua (accessed on 28 August 2021).

24. de Santana, M.d.F.S.; de Carvalho, J.E.; Nascimento, W.M.O.d. Determinação Química da Polpa em Genótipos de Bacuri (Platonia insignis Mart.); Embrapa Amazônia Oriental: Belém, Brazil, 2008; Volume 13, pp. 129–130.
25. Paula, R.D.d.G.; Estudos químicos de mesocarpo de bacuri.. *An. Assoc. Química Bras.* **1945**, *4*, 173–176.
26. Barbosa, W.C.; De Nazaré, R.F.R.; Nagata, I.. Estudo tecnológico de frutas da Amazônia; EMBRAPA-CPATU: Belém, PA, 1978; pp. 19.
27. Silva, D.C.; Silva, I.A.; Cunha, J.S. Propriedades físico-químicas e isotermas de sorção de mesocarpo de bacuri. XXI Congr. Bras. Eng. Química 2016, 1, 1–8.
28. Soares, A.G. Caracterização Físico-Química do Resíduo Agroindustrial dos Frutos do Bacurizeiro (Platonia Insignis Mart.) com o Objetivo de Produção de Insumos Para a Indústria de Alimentos e Química; Universidade Federal Rural do Rio de Janeiro: Seropédica, Brazil, 2010. https://tede.ufrrj.br/jspui/handle/jspui/3059. Accessed on 17/11/2022.
29. Carvalho, J.E.U.; Nascimento, W.M.O.; Technological innovations in the propagation of Açaí palm and Bacuri. *Rev. Bras. Frutic.* **2018**, *40*, e-679, https://doi.org/10.1590/0100-29452018679.
30. Botelho, M.G.L.; Homma, A.K.O.; Furtado, L.G.; Lima, M.d.C.S.; Costa, M.d.S.S.; Productive and market potential of bacuri fruit (Platonia insignis Mart.) in Pará, Brazil. *Res. Soc. Dev.* **2020**, *9*, e989975124, 10.33448/rsd-v9i7.5124.
31. Lustosa, A.K.M.F.; Bezerra, É.A.B.; Rodrigues, K.A.d.F.R.; Amorim, L.V.A.; Lima Neto, J.d.S. Antileishmanial effect of fruit seeds from Platonia insignis against macrophage- internalized amastigote forms of Leishmania Amazonensis. Rev. Cuba. Plantas 2018, 2, 1–14.
32. Lustosa, A.K.M.F.; Arcanjo, D.D.R.; Ribeiro, R.G.; Rodrigues, K.A.F.; Passos, F.F.B.; Piauilino, C.A.; Silva-Filho, J.C.; Araújo, B.Q.; Lima-Neto, J.S.; Costa-Júnior, J.S.; et al. Immunomodulatory and toxicological evaluation of the fruit seeds from Platonia insignis, a native species from Brazilian Amazon Rainforest. Rev. Bras. Farmacogn. 2016, 26, 77–82.
33. Lima, G.D.M.; Brito, A.K.D.S.; De Farias, L.M.; Rodrigues, L.A.R.L.; Pereira, C.F.D.C.; Lima, S.K.R.; Frota, K.D.M.E.G.; Rizzo, M.D.S.; Nunes, P.H.M.; Lucarini, M.; et al. Effects of “bacuri” Seed Butter (Platonia insignis Mart.) on Metabolic Parameters in Hamsters with Diet-Induced Hypercholesterolemia. Evid.-Based Complement. Altern. Med. 2021, 2021, 1–8.
34. Lindoso, J.V.d.S.; Alencar, S.R.; dos Santos, A.A.; Mello Neto, R.S.; Mendes, A.V.d.S.; Furtado, M.M.; da Silva, M.G.; Brito, A.K.d.S.; Batista, E.K.F.; Baêta, S.d.A.F.; et al. Effects of “Bacuri” Seed Butter (Platonia insignis Mart.), a Brazilian Amazon Fruit, on Oxidative Stress and Diabetes Mellitus-Related Parameters in STZ-Diabetic Rats. Biology 2022, 11, 562.