INSIGHTS INTO SWARTZIA SPECIES OF THE BRAZILIAN CERRADO

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ABSTRACT

The Cerrado is Brazil's second-largest biome, characterized by high biodiversity and a high degree of endemism, although it is under intense anthropogenic pressure. Among the botanical families present in this biome, the Fabaceae stands out, as it includes the genus *Swartzia*. Its species are known to contain bioactive compounds of chemical, biological, and functional

significance. In this context, *Swartzia multijuga*, a species endemic to Brazil, produces fruits whose morphology and composition have not yet been sufficiently studied. Research conducted on related species indicates considerable differences in the nutritional composition between pulp, peel, and seeds, influenced by environmental and physiological factors. Furthermore, these fruits can be significant sources of nutrients, such as fiber and carbohydrates, as well as bioactive compounds linked to antioxidant activity and potential health benefits. Moreover, the residues produced during the processing of these fruits have the potential to be reused in industrial processes. Thus, it is essential to expand research on *S. multijuga*, with the aim of exploring its nutritional, functional, and technological potential, as well as its possible applications in various industrial sectors.

Keywords: Fiber; Carbohydrate; Proteins; Carotenoids; Weight.

INTRODUCTION

The Cerrado is considered Brazil's second-largest biome, covering approximately 23% of the country's territory and spanning states such as Minas Gerais, Goiás, Tocantins, and the Federal District. It stands out for its significant biological diversity, surpassed only by the Amazon Rainforest (De Oliveira Santana and Simon, 2022). Characterized as a tropical savanna, this biome plays a fundamental role in maintaining Brazilian biodiversity among the six recognized biomes in the country (Sousa *et al*., 2026).

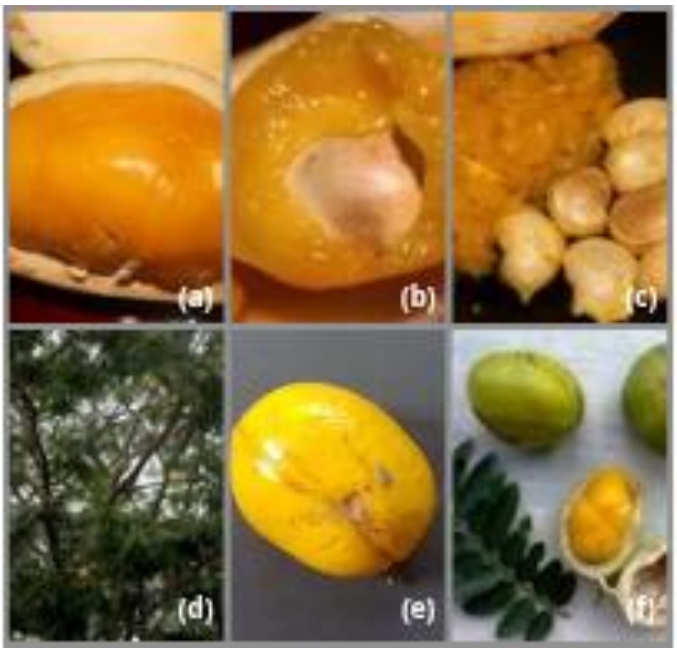
The predominant soil conditions in the Cerrado include acidic, highly porous soils with low natural fertility (Melo and França, 2025). Despite its ecological importance, the biome has been under intense pressure due to agricultural expansion and deforestation, and is classified as one of the global biodiversity hotspots (Andrade and De Figueiredo Ribeiro, 2025). It is estimated that the Cerrado is home to more than 12,000 plant species, 44% of which are endemic (Santos *et al*., 2024).

Among this plant diversity are several families of angiosperms, notably the Fabaceae family, also known as Leguminosae. This family exhibits broad morphological diversity among its subfamilies, including tree species ranging in height from 2 to 20 meters, widely distributed in tropical and subtropical regions (BFG *et al*., 2015; Brazil Flora Group *et al*., 2022; Maurão Jr. and Souza Filho, 2010; Tukur *et al*., 2026). Among these subfamilies, the genus *Swartzia* stands out (Zalko, 2025).

Species of the genus *Swartzia* are characterized by the presence of secondary metabolites such as saponins, carotenoids, phenolic compounds, flavonoids, and substances associated with potential biological and functional activities (Jadhavar and Deshpande, 2022; Negreiros and Nunez, 2023; Rahaman and Hossen, 2025; Taype-Landeo *et al*., 2026). In this

context, *Swartzia multijuga*, shown in Figure 1, stands out; it is popularly known as "banha de galinha," an endemic species of Brazil, belonging to the subfamily Papilionoideae and the genus Swartzia (De Souza, 2023; Vieira and Scariot, 2006). This fruit has limited information regarding its characterization and properties, highlighting the need for further investigation into these aspects. In view of this, the present study aims to highlight the existing scientific gap concerning the constituents of Swartzia multijuga and its potential for industrial applications.

Figure 1 – Image all the fruit fractions of the banha de galinha (*Swartzia multijuga*).



(a) Pulp and peel; (b) Pulp and seed; (c) Pulp separated from the seed; (d) Tree; (e) Unripe fruit; (f) Pulp, peel, and leaf. **Source:** (PANC do Cerrado 2026; Clube da Semente Brasil, 2026).

BOTANICAL ASPECTS OF SWARTZIA MULTIJUGA

Swartzia multijuga produces oval-shaped fruit containing between one and six seeds surrounded by a viscous pulp, the color of which can vary from orange to yellowish tones (Barbosa, 2011). In addition, the species grows as a tree and can reach up to 5 meters in height (Magalhães, 2016). Regarding the fruiting period, there is a lack of specific information in the literature for this species. However, as shown in Table 1, studies on other varieties of banha de galinha indicate that fruiting can occur between August and November. This behavior may be related to phenological patterns characteristic of the family, subfamily, and genus to which the species belongs (Dias, 2025; Barbosa, 2011; Machado *et al*., 2025; Mahant and Thakur, 2025; Vaz *et al*., 2018).

Table 1 – Reported fruit harvest period for *Swartzia* species.

Species	State and collection period	References
S. parvipetala	October 2023, Morrinhos, Goiás	Dias, 2025
S. burchellii	September through November, DF, GO, and RO	Barbosa, 2011
S. langsdorffii	November 2022, MG	Machado *et al*., 2025
	August 2013 and September 2014, Lavras, MG	Vaz *et al*., 2018
S. multijuga	No reports in the literature	—

Abbreviations: GO = Goiás; DF = Federal District; RO = Rondônia; MG = Minas Gerais; S. = *Swartzia*.

NUTRITIONAL AND PHYSICO-CHEMICAL COMPOSITION

According to Table 2, the fractions (pulp, peel, and seed) of *S. lagsdorffii* had a moisture content of 80.70% for the pulp, 80.85% for the peel, and 48.23% for the seed; the protein content was 3.17% (pulp), 1.73% (peel) and 7.36% (seed), and fiber content (pulp 12.83%, peel 1.35%, and seed 22.41%), which were higher than the moisture contents of the pulp (12.2 g 100 g^{-1}), peel (9.8 g 100 g^{-1}) and seed (7.8 g 100 g^{-1}), protein (1.66, 1.77, and 1.47 g 100 g^{-1}), and fiber (2.1, 16.90, and 5.27 g 100 g^{-1}) found in *S. parvipetala*. In contrast, the carbohydrate content was higher in *S. parvipetala*, where the pulp contained 79.06 g 100 g^{-1} , the peel 68.19 g 100 g^{-1} and the seed 81.54 g 100 g^{-1}, than that present in *S. lagsdorffii* , where the pulp was 3.17 g 100 g^{-1}, the peel 13.38 g 100 g^{-1}, and the seed 20.43 g 100 g^{-1}. When comparing the different yields between the two *Swartzia* species, it is not possible to accurately determine an average yield between them. This behavior may be related to the different environmental conditions in which the fruits developed. Thus, it is possible to verify which properties are present in the different fractions, such as the pulp, peel, and seed. (Guimarães et al., 2024; Negreiros and Nunez, 2023; Negreiros, 2024; Velasquez-puentes *et al*., 2023).

Table 2 – Physical characteristics, percentage composition, and physicochemical analysis.

AN	*S. parvipetala*			*S. langsdorffii*			*S. multijuga*		
	PL	CS	S	PL	CS	S	PL	CS	S
C	—	—	—	—	reddish-yellow	—	—	—	cream and orange-colored
P	—	—	—	48,62g			11,86g		
D	—	—	—	1,04 mm			—	—	—
DF	—	—	—	66,45 mm			27,84mm		
DT	—	—	—	45,29 mm			32,05mm		
pH	—	—	—	5,11	6,27	6,11	—	—	—
AT	—	—	—	0,54	0,91	0,68	—	—	—
SS	—	—	—	7,6	12,6	10,33	—	—	—
T	—	—	—	—	—	—	—	—	—
U	12,2g	9,8g	7,8g	80,70 %	80,85 %	48,23	—	—	40,04%
PC	—	—	—	18,11	13,73	11,44	—	—	—
PT	1,66g	1,77g	1,47g	3,17%	1,73%	7,36%	—	—	—
CZ	—	—	—	0,84%	0,55%	1,37%	—	—	—
L	0,33g	0,29g	1,69g	—	—	—	—	—	—
CA	79,06g	68,19g	81,54g	3,17%	13,38 %	20,43 %	—	—	—
F	2,1g	16,90g	5,27g	12,83	12,83 %	22,41 %	—	—	—
Kcal	325,85	282,45	347,25	—	—	—	—	—	—

Abbreviations: AN = Analysis; C = Color; P = Weight; D = Whole fruit density; DF = Whole fruit diameter; DT = Whole fruit cross-sectional diameter; TA = Titratable Acidity; SS = Soluble Solids; M = Moisture; PC = Pectin; PT = Protein; AS = Ash; L = Lipids; CA = Carbohydrates; F = Fiber; Kcal = Energy value; PL = Pulp; CS = Peel; S = Seed; Unit of measurement *S. langsdorffii* AT = 100 g - 1 g of citric acid; PC = mg of galacturonic acid per 100 g; *S. parvipetala* All: g 100 g^{-1}; *S. multiluga* All: mm. **Sources:** (Dias 2025; Machado et al., 2025; Magalhaes, 2016).

These properties can be attributed to nutritional and antinutritional compounds. Nutritional compounds are characterized by high levels of carbohydrates, fiber, and minerals,

which may exhibit anti-inflammatory and antioxidant properties (Haider *et al*., 2025; Zubairu *et al*., 2025). In contrast, antinutritional compounds can reduce nutrient absorption in the body, and in more extreme cases, high concentrations of these compounds can be toxic in food (Narvaez-Padilla *et al*., 2026).

BIOACTIVE COMPOUNDS AND ANTIOXIDANT ACTIVITIES

Fruit consumption offers health benefits, helping to prevent chronic diseases such as cancer, hyperglycemia, and kidney disease (Jadhavar and Deshpande, 2022; Rahaman and Hossen, 2025). This effect is associated with the presence of bioactive compounds in these fruits, such as carotenoids, phenolic compounds, flavonoids, and tannins, as well as other secondary compounds (Brilhante *et al*., 2025; Jia, Ren, and Liu, 2025; Negreiros and Nunez, 2023). Furthermore, these compounds exhibit antioxidant activities, widely recognized for extending the shelf life of pharmaceuticals and foods (Hossain *et al*., 2025; Shahidi and Samarasinghe, 2025).

To analyze and identify these compounds, it was necessary to use quantification methods, such as the determination of phenolic compounds using the Folin-Ciocalteu method, as well as the measurement of flavonoid content and total carotenoid content (Vuono *et al*., 2026). These methodologies were used for the characterization, antioxidant profile, and phytochemical profile of the analyzed samples, as shown in Table 3 (Barbosa, 2011; Bisaria, Madhubala, and Patel, 2026; Dias, 2025; Machado *et al*., 2025).

Table 3 – Analytical methods used for the characterization of *Swartzia* species.

Type of analysis	**Quantification method**	***S. langsdorffii***	***S. parvipetala***	***S. burchellii***
Humidity	AOAC Method	AOAC (2019)[C]	Moisture determination[B]	AOAC 925.10[A]
Ashes	AOAC Method	AOAC (2019)[C]	Ash content determination[B]	AOAC 923.03[A]
Proteins	Kjeldahl Method	AOAC (2019)[C]	Kjeldahl[B]	AOAC 960.52 (factor 5,83)[A]
Lipids	Solvent extraction	AOAC (2019)[C]	Bligh & Dyer[B]	AOAC 920.39[A]

Fibers	Laboratory method	Equation for total dietary fiber[C]	Adapted method[B]	Adolfo Lutz Institute [A]
Carbohydrates	Difference calculation	100 - (U + l + P + C + F)[C]	Difference calculation[B]	—
Calories	Atwater factors	—	Total energy value calculated (Atwater)[B]	—
Starch	specific method	—	—	Method by Cereda et al. (2004) [A]
Physical characteristics	instrumental measures	Length, width, mass, density, and color (caliper, scale, and colorimeter)[C]	—	Fruit morphological measurements [A]
Phenolic compounds	Colorimetric method	Folin-Ciocalteu and Fast Blue[C]	—	—
Antioxidant activity	Antioxidant tests	Phosphomolybdenum and ABTS[C]	—	—
Vitamin C	Colorimetric method	2,4-dinitrofenilhidrazina (DNPH)[C]	—	—
Carotenoids	Spectrophotometry	Rodriguez-Amaya Method[C]	—	—

Viscosity/Rheology	RVA	—	—	Rapid Visco Analyzer [A]

Abbreviations: S. = *Swartzia*. **Source:** Barbosa, 2011[A]; Dias, 2025[B]; Machado et al., 2025[C].

Table 3 shows that, in all the analyzed studies, fruit drying was necessary in order to remove the excess water present in the sample, a factor that extends the shelf life of foods. This process is also widely used in the food industry as a preservation method for products that require longer storage periods (Li and Shao, 2025). In addition, the disposal of residues from these fruits may represent a challenge for the industry. However, this waste can be reused as byproducts for biomass production, allowing the use of the remaining bioactive compounds that can be applied in different industrial areas (Hussain; Kalhoro; Yin, 2023; Kaushik et al., 2025). Thus, plant species constitute important sources of compounds used in the production of medicines, dyes, fibers, and fuels, being employed in the pharmaceutical, food, chemical, and cosmetics industries (Bibi et al., 2024; Maroyi, 2023).

FINAL CONSIDERATIONS

Considering the presented data, it can be concluded that fruits of the genus Swartzia contain many compounds of interest distributed across their different fractions (pulp, peel, and seed). However, many of these fruits are still poorly explored scientifically, such as Swartzia multijuga, especially regarding the characteristics of their fruits. Studies on similar species demonstrate the presence of carbohydrates, fibers, nutritional compounds, and bioactive compounds, some of which are associated with antioxidant properties. In addition, the residues generated after the processing of these fruits show potential for reuse, contributing to sustainable practices and value addition in different industrial sectors. Thus, there is a need to expand studies on this species in order to consolidate knowledge about its properties.

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