Ethnobotanical Survey of Cerrado Plants Used as Antihypertensives for the Elderly in Rondonópolis, MT, Brazil.

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Abstract

Ethnobotany studies the aspects by plant utilization by societies, encompassing principally the medicinal utility. Consequently, it helps in the development bioactive natural products. This ethnobotanical study was focused medicinal plants to the Cerrado, as used by elderly in Rondonópolis-MT, Brazil for hypertension treatment. Initially, two institutions supporting elderly in Rondonópolis were chosen: *Recanto do Idosos* and the *Associação de Apoio à Terceira Idade*. A questionnaire, comprising open and closed questions covering personal data, general plant-use information, and knowledge about species with anti-hypertensive properties, was used. Plants cited as anti-hypertensive and originating from the Cerrado were collected and submitted for taxonomic classification. A total of 41 elderly participated in the study, with 60.08% women, and 39.02% having incomplete elementary education. Notably, mothers played a prominent role, accounting for approximately 38.71% of the influence on plant use. Among the respondents, 58.06% believed that plants exhibit a moderate effect, while 100% claimed that plants do not cause adverse effects, and 93.5% affirmed the transmission of this knowledge to younger generations. In conclusion, 11 medicinal plants with anti-hypertensive activity were identified, with only 4 classified as belonging to the Cerrado post-bibliographic research. Following collection and botanical classification, the scientific names obtained were: *Costus arabicus* L.; *Solanum paniculatum L.*; *Acrocomia aculeata* (Jacq.) Lodd. Ex Mart.; and *Bixa orellana* L. The limited number of plants mentioned raises concerns about the potential loss of traditional knowledge about plant among elderly. Hence, undertaking new ethnobotanical investigations becomes crucial for documenting this culturally significant knowledge.

INTRODUCTION

Ethnobotany is the science that researches how individuals interact with the environment and obtain plant resources to meet their cultural and physical needs, that is, it deals with the study and concepts developed by any society regarding the plant world, encompassing the way in which a social group classifies plants and the usefulness they give them, therefore, represents a very important path to the discovery of bioactive natural products [1, 2].

Specifically, ethnobotanical studies entail the careful selection of plant species based on recommendations from distinct population groups within specific usage contexts. These studies underscore the significance of local knowledge concerning natural resources and their applications in both health and disease scenarios. Consequently, ethnobotany is centered on exploring the intricate interplay between human groups and nature [3, 4].

In Brazil, numerous ethnobotanical studies have been undertaken across diverse populations. Noteworthy examples encompass investigations into medicinal plant knowledge and usage by the users of a basic health unit in the Colombo – PR region [5]; use of medicinal plants during pregnancy and breastfeeding [6]; ethnobotanical survey on knowledge and use of medicinal plants and their applications in the Brenha community, Redenção – CE [7]; profile of consumers of medicinal plants and herbal medicines in Brazil and its relationship with the Covid-19 pandemic [8]; and use of medicinal plants in the Barreirinhos community, Santo Antônio de Leverger, Mato Grosso [9].

Research often focusses on medicinal plants specifically employed in treating various health conditions. For instance, Silva et al. [10] delved into plants exhibiting anti-hyperlipidemic and anorexigenic properties. Santos et al. [11] explored plants recommended for addressing oral pathologies. Jesus et al. [12] conducted an ethnobotanical investigation focusing on plant species traditionally used for treating ulcers and inflammation. Lopes et al. [13] compiled a list of plants commonly suggested for managing hypertension as per recommendations from patients at a healthcare facility in the state of São Paulo.

In the context of hypertension, beyond the study mentioned above, data published by Rodrigues and Sobreira [14], in a city in the state of Ceará, Brazil, indicated the use of medicinal plants to control blood pressure (BP) by hypertensive or diabetic patients registered in a unit basic health, and obtained the following plants mentioned: *Allium sativum* L. (garlic), *Ocimum gratissimum* L. (alfavaca), *Matricaria chamomilla* L. (chamomile), *Cymbopogon citratus* (holy-grass), *Annona muricata* (soursop), *Mentha spicata* L. (mint), *Passiflora alata* (passion fruit), *Scoparia dulcis* L. (little broom), *Sechium edule* L. (chayote). Costa et al. [15] also investigated medicinal plants used by hypertensive elderly people.

Hence, based on the afore mentioned data, it becomes apparent that the individuals rely on and affirm the efficacy of specific plants in managing hypertension — a condition of significant concern due to its alarming morbidity and mortality rates. This

medical condition is characterized by elevated BP, with systolic BP equal to or exceeding 140 mmHg and diastolic BP equal to or exceeding 90 mmHg. It is frequently linked to functional and/or structural changes in vital organs (heart, brain, kidneys, and blood vessels) and metabolic shifts, thereby heightening the susceptibility to fatal and non-fatal cardiovascular events [16].

While ethnobotanical studies have been published, as evidenced in this text, there remains a notable absence of research on anti-hypertensive plants within the Cerrado. As the second-largest biome in the country, the Cerrado is basically located on the central plateau, being recognized for its high biodiversity, as it contributes with around 5% of the world's fauna and flora diversity and with around 1/3 of Brazilian biodiversity. However, despite its recognized ecological importance, much of its vegetation cover has been lost, mainly due to rampant deforestation with the advancement of agriculture and animal husbandry, urbanization and road construction [17]. Consequently, investigations into medicinal plants in the Cerrado are imperative, offering insights into the biome's richness and contributing to its conservation by catalyzing the development of mechanisms to safeguard its medicinal resources.

Recognizing the significance of data derived from ethnobotanical studies, coupled with the escalating prevalence of hypertension and its associated complications in the broader population, the abundant biodiversity found in the Cerrado, and the accumulated knowledge of distinct demographic groups, the rationale for undertaking this study becomes apparent. The aim was to provide data on Cerrado plants utilized by the elderly in the treatment of hypertension. The anticipation is that the compiled information will prove invaluable for subsequent research endeavors directed towards formulating more efficacious therapeutic alternatives for disease management.

MATERIALS AND METHODS

This study, conducted between April 2022 and May 2023, is an ethnobotanical, cross-sectional observational investigation in the city of Rondonópolis. Located in the southern region of the state of Mato Grosso, approximately 220 km from the capital, Cuiabá, Rondonópolis is situated within the Cerrado biome. The region prominently features Cerrado *stricto sensu*, characterized by a distinct savanna-like phyto-physiognomy marked by the thriving coexistence of a tree-shrub stratum and a well-developed herbaceous-grass stratum.

The research encompassed two institutions dedicated to elderly care in the city: *Recanto dos Idosos São Jose Operário* and the *Associação de Apoio à Terceira Idade* (AATI). The first one provides housing, leisure pursuits, and health promotion initiatives for the elderly, whereas the latter concentrates exclusively on health promotion and recreational activities like sports, crafts, and dance. All individuals aged 60 or above, in accordance with the "*Estatuto do Idoso*" (Statute of the Elderly) and receiving services from these institutions during the data collection phase were invited to participate in the study.

The data collection process initiated with interviews conducted among elderly individuals from the selected institutions. A semi-structured questionnaire was utilized, encompassing both closed and open-ended questions organized into three distinct sections: 1) personal information (age, gender, origin, and education); 2) general insights into the utilization of medicinal plants (frequency, influence of use, therapeutic and adverse effects); and 3) specifics concerning plants referenced as anti-hypertensives (part used, preparation method, collection, and dosage).

Following the interviews, plants mentioned as anti-hypertensives underwent an extensive bibliographic search across diverse databases to establish connections between popular names and potential scientific nomenclature within the Cerrado domain.

The plants recognized as belonging to the Cerrado, based on this bibliographic research, were then chosen for the study's second phase: the collection of botanical materials. Reproductive parts of the plants were meticulously gathered and preserved in exsiccates. The botanical material was collected following the guidance of the interviewed individuals. Involving individuals with profound regional knowledge and familiarity with the plants common names is prudent, considering the variations these names may exhibit across diverse regions.

The meticulously prepared exsiccates were transported to the Herbarium of the Federal University of Mato Grosso, situated at the Araguaia University Campus, for the comprehensive botanical identification of the species. Following this step, the identified species underwent an additional in-depth bibliographic search, with a specific focus on popular use, chemical composition,

toxicity, and pharmacological activity. This phase was particularly geared towards exploring potential anti-hypertensive properties associated with the identified plant species.

In strict adherence to ethical principles and in accordance with Resolution 466/12 of the National Health Council, governing research involving human subjects, data collection for this study initiated only upon obtaining approval from the Research Ethics Committee (CEP) of the Federal University of Rondonópolis, under approval number 1.635.592. Comprehensive information regarding the research objectives and methodology was provided to all participants, and those who consented to participate formally signed the informed consent form.

The data obtained from the interviews were inputted into Epi. Info software version 7.7.5.0 to facilitate descriptive analyses encompassing absolute and relative frequency. Following this, the results were meticulously translated into tables for presentation.

RESULTS

Regarding sociodemographic characteristics, it is noteworthy that 63.41% of the interviewees were of urban origin, 60.98% were female, 39.02% had incomplete elementary education, and 87.8% belonged to the age group of 60 to 80 years (Table 1).

Table 1
Sociodemographic characteristics of interviewed elderly individuals, Rondonópolis - MT, Brazil, 2022.

Variables	N	%
Birthplace		
Rural	15	36.59
Urban	26	63.41
Sex		
Female	25	60.98
Male	16	39.02
Education		
Illiterate	3	7.32
Literacy only	1	2.44
Elementary education	1	2.44
Incomplete elementary education	16	39.02
High school	2	4.88
Incomplete high school	10	24.39
Higher education	8	19.51
Age group		
60–70	18	43.90
70–80	18	43.90
80–90	4	9.80
90–100	1	2.40

As illustrated in Table 2, it was noted that 75.61% acknowledged the use of medicinal plants, with maternal influence being prominent (38.71%). For 58.06% of the participants, the observed effect of the plants was considered moderate, and 72.42% asserted that plants are more effective than pharmacy medications (allopathic). The majority (93.55%) reported recommending

the use of plants to younger individuals, and all affirmed never experiencing adverse effects after using medicinal plants. Additionally, a notable finding reveals that 78.05% either did not use or were unaware of medicinal plants from the Cerrado employed in the treatment of hypertension. Table 2 further provides information that 58.06% of the respondents confirmed being diagnosed with hypertension.

Table 2
General characteristics regarding the use of medicinal plants by the interviewed elderly and the percentage of hypertensive elderly individuals, Rondonópolis – MT, Brazil, 2022.

Variables	N	%
Medicinal plant use		
Yes	31	75.61
No	10	24.39
Influence for medicinal plant use		
Mother	12	38.71
Father	7	22.58
Grandparents	2	6.45
Friends	4	12.90
Others	6	19.34
Effect of plants		
Weak	1	3.23
Moderated	18	58.06
Strong	12	38.71
Adverse effect after using medicinal plant		
Yes	00	00
No	31	100
Medicinal plant more effective than pharmacy medications		
Yes	24	77.42
No	7	22.58
Advises the use of medicinal plants to younger individuals		
Yes	29	93.55
No	2	6.45
Hypertension		
Yes	18	58.06
No	13	41.94
Awareness of Cerrado plant with anti-hypertensive effect		
Yes	9	21.95
No	32	78.05

It is important to mention that, in Table 2, the variables associated with the overall use of plants - such as the influence on the use of medicinal plants, the effect of plants, adverse effects after using medicinal plants, the perceived efficacy of medicinal plants

compared to pharmacy medications, and advising the use of medicinal plants to younger individuals - were exclusively applied to the 75.61% of respondents who affirmed their use of medicinal plants.

The individuals who claimed to be familiar with the Cerrado plants having anti-hypertensive effects mentioned 10 medicinal plants (common names) that, according to them, are used for this therapeutic purpose. These plants are: 1) Monkey Cane, 2) São Caetano Melon, 3) Achiote, 4) Macauba Palm, 5) Caiana Cane, 6) Soursop, 7) Jurubeba, 8) Alfavaca, 9) Ginkgo Biloba, and 10) Dark Purple Quina. As shown in Table 3, these common names underwent a rigorous bibliographic search across various databases to find scientific names related to them [18, 19, 20, 21, 22, 23, 24, 25, 26, 27].

Additionally, bibliographic searches were carried out to cross-reference literature data, correlating the common names of the mentioned plants with plant species identified within the Cerrado domain. Following this investigation, the gathered information disclosed that only 4 of the plants cited by the participants had bibliographic records associating the common names with plant species present in the Cerrado domain [18, 19, 20, 21, 22].

As indicated in Table 3, the four plants are Monkey Cane, Achiote, Macauba Palm and Jurubeba. Regarding Jurubeba, the individual who mentioned this plant reported that someone else had suggested it to them for managing hypertension. However, they did not observe any noticeable changes in their blood pressure when using it for this therapeutic purpose.

Following the collection of these four plants in the Cerrado region of Rondonópolis and undertaking botanical identification procedures for the samples, the identified species were *Costus arabicus*, *Bixa orellana*, *Acrocomia aculeata*, and *Solanum paniculatum*. Table 3 presents further details provided by the participants regarding these plants and others mentioned, encompassing parts utilized, preparation methods and dosages. The predominant preparation method emphasized is the use of tea or boiling, with leaves being the most frequently employed plant parts.

Table 3
Medicinal plants mentioned as anti-hypertensive by interviewed individuals, Rondonópolis – MT, Brazil, 2022.

Cited Plants (Common Name)	Scientific name Literature	Native to Cerrado	Botanical identification Family/Species	Parts used	Preparation method	Dose	Regime	Reduction in blood pressure	
								Yes	No
Achiote	*Bixa orellana*	Yes	Bixaceae / *Bixa orellana* L.	Seed	Tea/Boiling or seed consumption	4 seeds	Twice a day	X	-
Alfavaca	*Ocimum basilicum* L.	No	-	Leaf	Tea/Boiling	Not aware	Not aware	X	-
Caiana Cane	*Saccharum officinarum* L.	No	-	Root	Infusion	Medium-sized root	Once a day	X	-
Dark Purple Quina	Not found	No	-	Bark	Infusion or maceration	Not aware	Not aware	X	-
Ginkgo Biloba	*Ginkgo biloba* L.	No	-	Whole plant	Tea/Boiling or Tincture/Infusion	1 handful	Not aware	X	-
Jurubeba	*Solanum paniculatum*	Yes	Solanaceae / *Solanum paniculatum* L.	Leaf	Infusion	1 leaf	Not aware	-	X
Macauba Palm	*Acrocomia aculeata* (Jacq.) Lodd	Yes	Arecaceae / *Acrocomia aculeata* (Jacq.) Lodd. Ex Mart.	Leaf	Tea/Boiling	1 handful	Twice a day	X	-
Monkey Cane	*Costus spiralis* (Jacq.) Roscoe	Yes	Costaceae / *Costus arabicus* L.	Whole plant	Tea/Boiling	3 buds or leaves	Twice a day	X	-
São Caetano Melon	*Momordica charantia* L.	No	-	Leaf	Infusion	1 cup of tea	Twice a day	X	-
Soursop	*Annona muricata* L.	No	-	Leaf	Tea/Boiling	Not aware	No restrictions	X	-

DISCUSSION

The findings indicate a potential decline in the traditional knowledge of medicinal plants in the Rondonópolis region, as only 10 medicinal plants were mentioned, with only 4 confirmed to belong to the Cerrado domain. The study's specific focus on hypertension narrowed the range of possibilities for citing a more diverse array of plants. Nevertheless, it is expected that the elderly population possesses extensive knowledge regarding medicinal plants, especially those that are native or commonly found in the biome where they live. This was not the case for the elderly individuals interviewed in Rondonópolis.

This attribute could be linked to the background of the participants, the majority of whom hail from urban areas. This might have led to limited exposure to medicinal species of the Cerrado, fostering a diminished inclination towards acquiring traditional knowledge from preceding generations. Such a trend is disconcerting, posing a risk to the transmission of this valuable knowledge to future generations and potentially resulting in the loss of significant information regarding the medicinal properties of plants over time.

Another noteworthy trait of the participants is the predominance of females. This aligns with findings in the study by Penido et al. [28], despite their research not specifically targeting the elderly. The prevalence of women in Rondonópolis is anticipated, reflecting

the broader demographic trend in the Brazilian population, where females constitute the majority, as reported by the Brazilian Institute of Geography and Statistics (IBGE). This superiority, especially in the age group studied (above 60 years), can be attributed to the higher life expectancy of women compared to men in Brazil, reaching 79 years according to the IBGE's 2022 population census [29].

Throughout history, women have traditionally assumed the role of primary health providers, inheriting a caregiving role culturally. Frequently, they take on the vital role of preparing medicinal plants for the well-being of their families [30].

Concerning education, the prevailing circumstance of the interviewed elders, with the majority having completed only primary or incomplete secondary education, represents a low level of education in the studied population. A parallel observation of low education was also noted in the research conducted by Silva et al. [10] when investigating the utilization of anti-hyperlipidemic and anorectic plants in the population of Nova Xavantina, MT, Brazil. The modest educational background is thought to be associated with an economically less favorable situation, prompting the recourse to medicinal plants [31]. Nonetheless, despite this educational context, the respondents in Rondonópolis mentioned a low number of plants. This outcome may be attributed to the specificity of the inquiry, focusing on Cerrado plants used for a particular condition, hypertension.

Most of the interviewed elders in Rondonópolis reported utilizing medicinal plants for addressing various health conditions. This outcome highlights the intimate connection between the elderly and plants, aligning with the anticipated pattern where knowledge of therapeutic applications of medicinal plants is commonly found among the older demographic. Nevertheless, approximately 25% claimed that they do not engage in the use of medicinal plants. This percentage, to some extent, was unexpected and might be linked to the skepticism of the respondents regarding the efficacy of plants, a lack of interest, or even apprehensions about potential adverse reactions.

Regarding the general use of plants, it was noted that mothers exert the most significant influence on the use of medicinal plants among the interviewed elders in Rondonópolis. Ferrão et al. [32] emphasized that women are responsible for teaching and influencing the use of medicinal plants, a finding also reported frequently in ethnobotanical studies. Similarly, in their research, Ribeiro et al. [33] identified parents and grandparents as key figures in transmitting this knowledge. Thus, these findings reinforce the pattern of intergenerational knowledge transfer about plants, contributing to the enduring tradition of herbal medicine.

Regarding the individual perception of the plant's effects, a substantial proportion of the interviewed elders in Rondonópolis perceived the effect as moderate. Similarly, Santos et al. [34] observed in their study that 54% of respondents considered the effect of plants to be moderate. In the study conducted by Silva et al. [10], most participating elders regarded the effect of plants as strong. These findings suggest that plants indeed possess medicinal efficacy in the treatment of various health conditions, as affirmed by those who regularly use them and hold traditional knowledge about their therapeutic properties. Thus, this underscores the therapeutic potential inherent in the Brazilian flora, accessible to the population.

Ideally, this therapeutic effect must be devoid of adverse reactions. Concerning this aspect, all interviewed elders in Rondonópolis asserted never having experienced adverse effects after using plants. This outcome concurs with that of Góes et al. [35], where most participants reported the absence of adverse effects from the use of medicinal plants. However, this finding warrants careful consideration, as it is well-established that plants can induce adverse effects, which, depending on the dosage, may lead to severe issues and disrupt the efficacy of allopathic medications, thus affecting the continuous treatment of chronic conditions such as hypertension and diabetes. It is imperative to implement initiatives focused on educating the population, particularly the elderly, about the potential toxic effects of plants to avoid the cultural notion that, being of plant origin, they are inherently benign and pose no harm.

The prevailing belief among respondents in Rondonópolis is that medicinal plants surpass allopathic medications available in pharmacies in terms of efficacy. However, this result warrants careful consideration. It is well-established that the elderly are very prone to using many medications, and non-communicable chronic diseases play a significant role in this pattern. The increased accessibility of medicinal plants, primarily due to their lower cost, combined with the conviction that plants are more effective than commonly prescribed medications, may foster a shift from allopathic treatment to traditional plant-based therapy. While acknowledging the efficacy of plants, it is crucial to recognize that substituting or concurrently using them with allopathic medications can pose health risks.

As observed throughout human history, knowledge surrounding medicinal plants persists today through the transmission of knowledge from one generation to the next. In Rondonópolis, a notable segment of the elderly interviewees expressed their role in counseling, guiding, and instilling encouragement in younger generations regarding the use of medicinal plants. This outcome resonates with the discoveries of Silva et al. [10]. Yet, the efficacy of such guidance remains uncertain, given the prevailing disinterest among the younger population.

Despite over half of the surveyed elderly reporting a diagnosis of hypertension, a significant proportion had never employed or were unaware of any Cerrado medicinal plants with anti-hypertensive properties. It is crucial to clarify that, even among the participants who refrained from using plants, they were queried about their knowledge or awareness of Cerrado plants recognized for reducing blood pressure. To some extent, this outcome was unforeseen. Considering that elderly individuals typically possess broad knowledge of the medicinal properties of plants, it was expected that a greater variety of medicinal species would be mentioned by the interviewees. However, it is imperative to acknowledge that confining the study to plants exhibiting anti-hypertensive activity limited the range of potential plant mentions by the interviewees.

The four plants identified as having anti-hypertensive properties by the elderly in Rondonópolis, commonly present in the Cerrado biome and scientifically collected and identified, are Monkey Cane (*Costus arabicus* L.), Achiote (*Bixa orellana* L.), Macauba Palm (*Acrocomia aculeata* (Jacq.) Lodd. Ex Mart), and Jurubeba (*Solanum paniculatum* L.).

The Monkey Cane (*Costus arabicus* L.) belongs to the Costaceae family. Its aqueous extract has demonstrated effectiveness in inhibiting the growth of calcium oxalate crystals when in contact with canine kidney cells, suggesting its potential in preventing kidney stones. The interaction between calcium oxalate crystals and renal epithelium is pivotal in calculogenesis [36]. Additionally, the plant exhibits antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* [37]. However, no study has been found associating this plant with antihypertensive activity.

Regarding the species *Bixa orellana* L., belonging to the Bixaceae family, and popularly known as Achiote, the literature indicates its correlation with various activities, including anti-inflammatory, antioxidant, antibacterial, nephroprotective, anti-hyperglycemic, anti-osteoporotic, anti-histaminic, anticancer, and antimalarial properties [38, 39, 40]. Lopes et al. [13] investigated the spontaneous use of medicinal plants by hypertensive volunteer patients in the treatment of hypertension and identified Achiote as a plant cited for its anti-hypertensive properties. Thus, it is evident that the knowledge of the elderly in Rondonópolis regarding Achiote aligns with the findings in other studied populations.

Another plant cited by the interviewed population is Macauba Palm (*Acrocomia aculeata* (Jacq.) Lodd. Ex Mart), a member of the Arecaceae family. Research by Monteiro-Alfredo et al. [41] demonstrated the antioxidant activity of *Acrocomia aculeata*. Additionally, Sampaio et al. [42] demonstrated antifungal and antimicrobial activities. Furthermore, *Acrocomia aculeata* was associated with hypoglycemic effects and the reduction of triglycerides [43]. Despite these studied effects, no research specifically addressing the treatment of hypertension was found for *Acrocomia aculeata* or other plants of the same genus.

Jurubeba (*Solanum paniculatum* L.) is a member of the Solanaceae family. Literature studies highlight its anti-inflammatory [44, 45, 46] antioxidant [45, 47], gastroprotective [48], and hepatoprotective activities [49]. Souza et al. [50] suggest its potential in preventing overdoses of paracetamol. However, no studies specifically related to the treatment of hypertension were found for this plant.

CONCLUSION

While the participants mentioned a limited number of plants, it is believed that the data collected in this study will be of great value for preserving the crucial knowledge of traditional medicine concerning the therapeutic properties of medicinal plants. The limitation to plants with anti-hypertensive effects and the requirement to mention species commonly found in the Cerrado, contributed to the reduced number of plants cited.

Nevertheless, it should be considered that these individuals may be affected by a discontinuity or weakening of traditional knowledge passed down from generation to generation. It is hoped that the results of this work can serve as a foundation for other studies aiming at the development of new molecules used as anti-hypertensive drugs.

Declarations

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Authors contributions

All authors contributed to the work presented in the present paper. Gleyciany Santos collected the plants and applied the questionnaires, analysed, interpreted and organized the data and wrote the paper. Paulo Piza and Isabela Toniasso assisted in collecting data and organizing results. Maryland Lacerda identified and catalogued the collected plants and assisted in writing the article. Laura Melo and Marcondes Silva coordinated and mentored the project execution and wrote the paper. All authors approved the paper for publication.

ETHICS DECLARATIONS

Competing interests

The authors declare no competing interests.

Data Availability statement

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The plants collected in this study were deposited and catalogued by the Herbarium of the Federal University of Mato Grosso, Araguaia University Campus, located in the city of Pontal do Araguaia, state of Mato Grosso, Brazil. The identification process was led by Dr. Maryland Lacerda (one of the authors), who was the director of the Herbarium at the time the plants were collected and is therefore qualified to perform the identification procedures. We hereby declare that the collection of the plants for this study complies with local or national guidelines, without the need for further confirmation. The registration number of each species collected is: *Acrocomia aculeata* – 10410; *Bixa orellana* – 10408; *Costus arabicus* – 10411 and *Solanum paniculatum* – 10409.

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