



“Wild cashew brings many benefits and even beauty”: use and extraction of *Anacardium occidentale* L. (cajuí) by communities in the Parnaíba River Delta, Northeastern Brazil

“O cajuzeiro traz muitos benefícios e até beleza”: uso e extrativismo de *Anacardium occidentale* L. (cajuí) em comunidades na APA do Delta do Parnaíba, Nordeste brasileiro

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ABSTRACT: Natural populations of cajuí (*Anacardium occidentale* L.) are ecologically and socioeconomically important for many people in Northeastern Brazil. This study focuses on the use and management of wild cashew in the communities Canárias, in Maranhão, and Labino and Barrinha, in Piauí. Semi-structured forms were applied to 88 participants. The Use Diversity (UDs) and Plant Part Value (PPV) indexes were calculated and a multivariate linear regression analysis was performed. Most (73%) the interviewees were women. Cajuí was mainly used for food (UDs: 0.87), forage (0.08), medicinal preparations (0.03), and fuel (0.02). The hypocarp had the highest PPV (0.76). Cajuí fruits are collected by groups, in the forest (50%), during the harvest season (July to October). Cajuí has great socioeconomic importance for the communities studied and allow the continuity of the cultural identity associated with socio-biodiversity.

Keywords: ethnobiology; local knowledge; use of natural resources.

RESUMO: Os cajuzeiros (*Anacardium occidentale* L.) têm importância ecológica e socioeconômica para várias comunidades do Nordeste brasileiro. Assim, objetivou-se conhecer os usos e o manejo do cajuí nas comunidades Canárias, no Maranhão, em Labino e na Barrinha, no Piauí. Foram empregados formulários semiestruturados a 88 pessoas para a obtenção dos dados, e foram analisados os índices: valor de diversidade

de uso (UDs), o valor para a parte da planta (PPV) e a análise de regressão linear multivariada. A maioria (73%) dos entrevistados são mulheres. O cajuí é empregado principalmente como produto alimentício (UDs: 0,87), forrageiro (0,08), medicinal (0,03) e combustível (0,02). O hipocarpo tem maior diversidade de uso (PPV: 0,76). A obtenção dos cajuís para utilização ocorre em grupo na mata (50%), eles são coletados manualmente durante o período de safra (segundo semestre do ano, julho a outubro). Portanto, o cajuizeiro tem grande importância socioeconômica para as comunidades estudadas e permitem a continuidade da identidade cultural associada à sociobiodiversidade.

Palavras-chave: etnobiologia; saber local; uso de recursos naturais.

1. Introduction

The availability of plant genetic resources supports food and economic security (Coradin *et al.*, 2018), besides performing ecosystem services. Brazil has a diverse flora, with 49,989 recognized (native, cultivated and naturalized) species, of which 35,549 are Angiosperms (Flora do Brasil 2020, under Construction, 2021). Of the latter, 32,086 are native to Brazil (The Brazil Flora Group, 2015) and many are part of the human diet. These plants provide edible fruits, which are acquired by extraction and as alternative subsistence resources for local communities, contributing to the local and regional economy (Nesbitt *et al.*, 2010).

The people in the Northeast region of Brazil use traditional foods from native plants as an intrinsic characteristic of their way of life (Coradin *et al.*, 2018). This is an attribute of sustainable diets, i.e. those that employ local fruits (Jacob & Albuquerque, 2020). In this context of use of food plants, the extraction of cajuí (*Anacardium occidentale*) and other fruit plants stand out in the Parnaíba River Delta Environmental Protection Area (EPA) (Andrade *et al.*, 2012; Souza & Crespo, 2015). Cajuí contributes to family income, not only as a source of food but also of fuel, and is part of the culture of native populations living in northeastern restinga (sandbank) areas. 80% of the nuts traded

on the coast of Piauí are estimated to be from cajuí trees (Rufino *et al.*, 2008).

The quality and potential use of fresh cajuí for consumption and industrial use in Parnaíba and Ilha Grande in Piauí are indicated by their high levels of sugar, low levels of phenolics, and greater firmness of the fruits compared to cultivated cashew, which contributes to greater postharvest resistance (Rufino *et al.*, 2007). Even so, cajuí has little participation in the national economy due to the small size of the hypocarp that makes it unfavorable for the cashew industry.

Research on the use of resources in the sandbank vegetation of the Parnaíba River Delta EPA is scarce and recent. This is the case of studies on cajuí, an ecotype of *A. occidentale* (Mitchell & Mori, 1987; Andrade *et al.*, 2019) that differs from the cultivated plant known as cashew (Rufino *et al.*, 2007) in different characteristics including the smaller size of the fruits and hypocarps. The vernacular name “cajuí” is used for several natural forms of *A. occidentale* in Brazil and even for other species of *Anacardium* (Andrade *et al.*, 2019). The cajuí native to the sandbank vegetation of the coastal region of the states of Piauí, Maranhão and Ceará is recognized as the sandbank ecotype of *A. occidentale* by Andrade *et al.* (2019), Mitchell & Mori (1987), and Santos *et al.* (2019), and has both ecological (stabilizing mobile dunes) and socioeco-

conomic importance for local residents. The plants are characterized by their low tree size with very wide crowns, resistant to burying by mobile dunes, often with very short trunks and main branches close to the ground, with leathery leaves, 14 to 20 cm long, flowers arranged in panicles, and fruits normally not exceeding 3 grams and producing a light yellow to red acidic hypocarp (Mitchell & Mori, 1987; Rufino *et al.*, 2007).

The coastal sandbanks of Piauí and Maranhão have a fragile vegetation and have undergone numerous anthropic changes (Cavalcanti & Camargo, 2002; Santos-Filho *et al.*, 2010; Araújo *et al.*, 2016). In this phytophysiognomy, cashew trees have suffered environmental damage similar to that described in the literature for the entire northeastern coastal zone, including fires, vegetation removal for the establishment of agricultural crops, urbanization, land use by civil construction, disorderly occupation, and real estate speculation (Cavalcanti & Camargo, 2002; Dias & Soares, 2008; Araújo *et al.*, 2016).

Piauí and Maranhão offer an excellent context for developing studies on the interactions between people and plants, from a broader perspective, using biocultural and natural data. Thus, in order to contribute to a better understanding of the functioning of the local economy of cajuí, including data on the use and management of this plant, and to the creation of public policies aimed at protecting and conserving sandbanks, besides preventing genetic erosion of native populations of *A. occidentale* (cajuí), the present study aimed to investigate the uses of cajuí of the sandbank ecotype, the form of collection, and the socioeconomic profile of collectors in the Parnaíba River Delta EPA.

2. Material and methods

2.1. Study area

The research was carried out in the Parnaíba River Delta EPA, classified into the category of sustainable use conservation units by SNUC (ICM-BIO, 2020). In this place, known for the extraction of cajuí, communities whose culture and income depend on the extraction of this resource were sought. The Canárias (Araioses city, Maranhão State, Brazil); Labino (Parnaíba city, Piauí State, Brazil) and Barrinha (Cajueiro da Praia City, Piauí State, Brazil) communities were selected.

Sandbank vegetation is one of the main types found in the coast of Piauí and Maranhão, which also have large areas of mangroves, floodplains, and coastal flatlands, with a marked presence of *A. occidentale*. Sandbanks are a vegetation mosaic developed on sandy substrates and composed of herbaceous, fruit-bearing plants interspersed with trees, extensive areas covered with carnauba, and forest formations (Santos-Filho, 2009). Many species are also characteristic of other plant communities, such as Caatinga, Cerrado, and coastal flatlands, which mix in transitional complexes typical of much of the northern region of Piauí (Silva, 2004; Santos-Filho *et al.*, 2010).

The Canárias community (02°46'1.544" S; 041°50'47.422" W) is located on an island that corresponds to the Parnaíba Delta Marine Extractive Reserve (RESEX). Information collected at the community's Family Health Center revealed that the cultural and subsistence roots of 381 families are linked to fishing and extractivism.

Data provided by the Family Health Post showed that 90 families lived in Labino

(02°50'39.981" S; 41°45'45.0793" W). The economy of this community is based on artisanal fishing, crab and shellfish harvesting, plant extraction, subsistence agriculture, livestock, tourism, bar and restaurant trade, home hostels, cajuí processing, and sale of handicrafts made with supplies from *Copernicia prunifera* HE Moore and clay (Piauí, 2007).

The Barrinha community (02°54'50.097" S; 41°23'7.17" W) is located close to the sea and the economic activities developed by the residents are mainly fishing, shellfish extraction in mangroves, handicrafts, extractivism, and subsistence agriculture. According to a direct survey in Family Health Posts, there are 194 families in this community.

2.2. Collection and analysis of ethnobiological data

This research was approved by the Research Ethics Committee (REC) of the Federal University of Piauí (UFPI) under Consubstantiated Opinion number 2,708,265 and registered in the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (SIGEN) with code A8B44BB. The collection license was granted by the Biodiversity Authorization and Information System (SISBIO) of the Chico Mendes Institute for Biodiversity Conservation (ICMBio) (number 64340-1).

Prior to data collection, the Rapport technique (Bernard, 2017) was used to establish a relationship of trust, embracement, and understanding of the research by the communities. Cajuí collectors over the age of 18 and residents of the communities were found using the snowball technique (Bailey, 1994). This technique is used for intentional sampling a non-probabilistic sample universe in groups that

have experience in and knowledge of the researched data (Albuquerque *et al.*, 2014). The action consisted in identifying the first cajuí collector in the community evaluated and each interviewee indicating another, until all informants were interviewed. Before starting the interviews, the Informed Consent Form (ICF) was read, explained and signed by the residents as required by the current legislation (National Health Council, Resolution 466/2012). In the case of interviewees who could not read and write, fingerprints were collected.

The interviews were carried out from June 2018 to December 2019 using semi-structured forms (Martin, 1995) with questions about the socioeconomic profile and factors related to the culture and collection of cashew fruits. Data collection methods also included direct observation, interviews with the aid of standardized semi-structured forms, “guided tours” (Bernard, 2017), photographic records, consented recordings of the interviews, and field journal notes (Albuquerque *et al.*, 2014). Twenty-nine residents from Canárias, 35 from Labino, and 24 from Barrinha accepted to be interviewed, totaling 88 participants.

The uses cited by the participants were grouped into categories (food, medicine, forage, and fuel). To understand which uses were the most common, “The Use Diversity” (UDs) index was used. The UD value was obtained from the number of indications within each use category divided by the total number of citations among all use categories (Silva *et al.*, 2014). To identify which parts of the plant were the most extracted, the Plant Part Value (PPV) index was used, calculated as the ratio between the total number of reported uses for a given plant part divided and the sum of the reported uses for all of the parts of the plant (Silva *et al.*, 2014).

Differences between places regarding the use made were examined by ANOVA preceded by the Shapiro-Wilk test. Multivariate linear regression analyses were used to verify whether the independent variables (socioeconomic factors) were correlated with the number of known uses. Statistical tests were performed using the BioEstat 5.0 software (Ayres *et al.*, 2007), with $p < 0.05$ considered to indicate statistical significance.

3. Results and discussion

3.1. Socioeconomic characterization

The interviewees were between 18 and 85 years old, most of whom (73%), female. This finding can be attributed to the fact that women are providers in their families, since they are family heads in the communities studied. This result may be related to the cultural role of women as responsible for meeting the health care and food needs of their families. In addition, in the food tradition, they perform various activities besides those associated with domestic tasks, including food production, management and sowing seeds (Oliveira & Dalcin, 2008). The participation of women in plant extraction was also reported in other ethnobiological studies in Northeastern Brazil (Vieira & Loila, 2014; Santos & Souza, 2016; Vieira *et al.*, 2016; Paodjuenas *et al.*, 2019).

Most respondents (54%) had not finished elementary school; 14% completed high school; 10% were illiterate; 9% completed elementary school; and 3% had university education. This result can be explained by the socioeconomic conditions of the residents, who had to work during the school age in order to meet the needs of their families.

Low schooling is recurrent in the rural context of Brazil (Almeida Neto *et al.*, 2015; Cavalcante & Bomfim, 2020).

Family income reflected the level of education of the respondents: most (41%) had an income below the minimum wage, and 14% had no income. The others received from one (37%) to two minimum wages (8%). The minimum wage considered here corresponded to that of the year 2019, which was R\$ 998.00. Low income is common among families working on extractivism (Medeiros *et al.*, 2018).

In general, all the productive activities developed in the communities Canárias, in Maranhão, and Barrinha and Cajueiro da Praia, in Piauí, including the extraction of cajuí, do not guarantee a regular source of resources. The sources of livelihood that provide residents with some stability during the periods when agriculture, fishing and extraction are unfavorable and bring no profit are retirement (25%) or assistance programs (52%).

To supplement their earnings, 61% of the informants sold nuts, 17% sweets, and 2% cajuína (typical non-fermented and undiluted beverage made of cajuí, clarified and sterilized inside containers, presenting a yellow color) and wines from cajuí during the harvest period. Only 2% sold nuts throughout the year. The values informed by the interviewees adopted in the commercialization of fresh cajuí and cashew nuts in 2019 ranged from R\$ 1.00 to R\$ 1.50 per kg. The low price of the nuts is a consequence of low profitability and production, and it is still a reflection of the long drought that occurred in the region between 2012 and 2016 (Vidal, 2017).

Cajuí nuts are very important because they are one of the products most sold by the communities;

the nuts can be acquired through extraction during and after the harvest; in the latter case, they are found among or under dehydrated leaves in the soil. The fruit (nut) can be sold unpeeled to stores in the center of Parnaíba or Cajueiro da Praia, or the peel is removed after the fruit is roasted in wood fire and only the kernel of the nut is sold to stores or in the homes of some residents. The processing of cajuí nuts and hypocarps is artisanal and carried out by people in the community.

More than 80% of the commercialization of *A. occidentale* nuts in the coastal zone of Piauí are estimated to originate from the extraction of cajuí trees (Rufino *et al.*, 2008), which demonstrates the relevance of the contribution of this plant and the functioning of the local economy.

The price of fresh cajuí nuts sold wholesale by producers is expected to remain low in the near future as a result of the SARS-CoV-2 (Covid-19) pandemic, because of the reduced processing capacity or stoppage of activities in addition to the increase in stocks of fresh unpeeled nuts. This, in turn, makes the consumer market of nuts scarce, contributing to the increased market prices (Brainer & Vidal, 2020). These consequences will also affect the financial structure of cajuí, as the values adopted for the nut are based on the domesticated cashew agribusiness. Thus, the value obtained by the community for commercializing cajuí fruits is likely to be low because of the large stocks of cashew fruits.

The number of uses mentioned by the informants for the plant structures was estimated for calculating the PPV. The hypocarp and the fruit were the most used as human and animal food source, followed by leaves, branches, and barks to

treat diseases (Table 1). Fruits are usually the most collected structures, although the other organs of the plant have other uses (Lima *et al.*, 2019; Porro, 2019).

The UDs index, used to analyze the significance of the categories of uses and their local importance, highlighted the food category as the one presenting the highest diversity of use, followed by forage, medicinal, and fuel. The hypocarp is consumed as fresh product, in the form of juices, sweets, and seasoning, and it is used in the production and commercialization of wines, cajuína, candied fruits, sweet bars, and jams (Figure 1).

The fruit is eaten after roasted or is used in sweets. The consumption of fresh hypocarps as jams and sweets was recorded in a study on eating practices based on wild plants in the municipalities of Buriti dos Montes and Cocal, in Piauí, in which the kernels were roasted and often included in preparations of cakes and paçocas (typical Brazilian candy) (Chaves *et al.*, 2017).

TABLE 1 – Indices Plant Part Value (PPV), Use Diversity (UDs), and categories of use of *Anacardium occidentale* (cajuí) in the Canárias (Araioses city, Maranhão State, Brazil); Labino (Parnaíba city, Piauí State, Brazil) and Barrinha (Cajueiro da Praia city, Piauí State, Brazil) communities.

Plant parts	Plant Part Value (PPV)
Hypocarp	0.76
Nut	0.23
Leaf, branch, and bark	0.01
Use categories	Use Diversity (UDs)
Food	0.87
Forage	0.08
Medicine	0.03
Fuel	0.02

SOURCE: Direct research, 2019-2020.

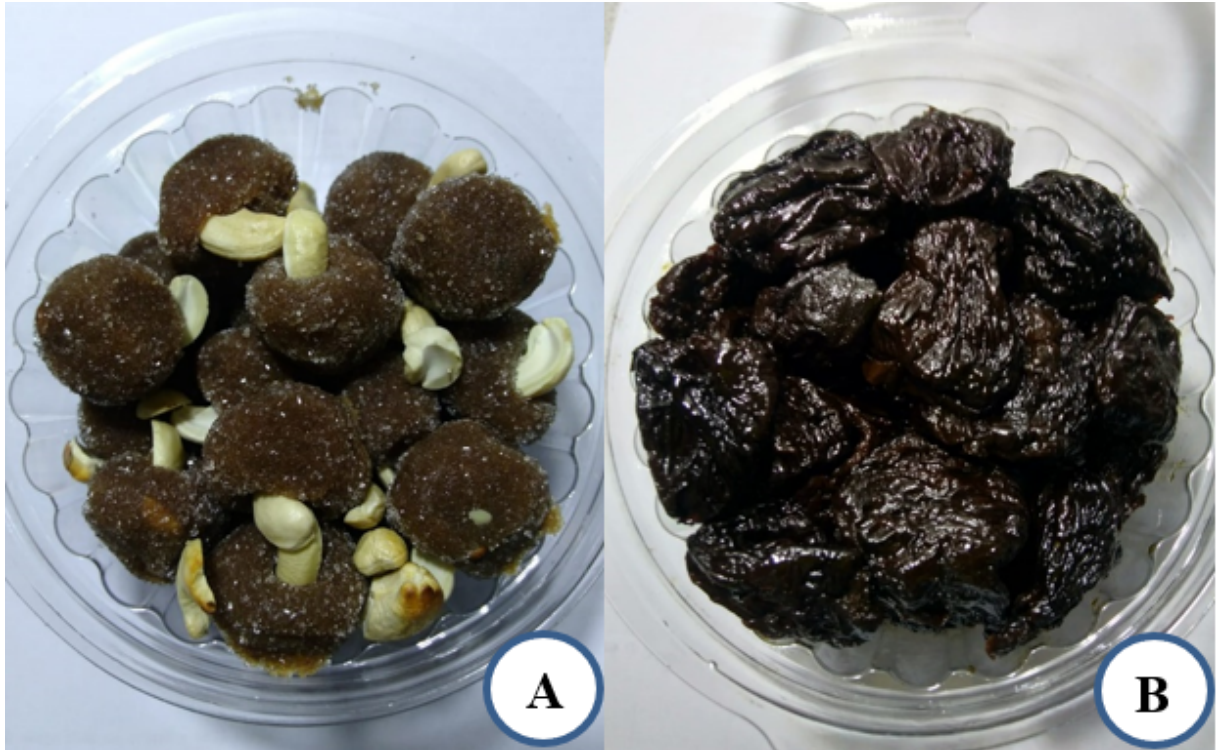


FIGURE 1 – Types of cajú (*Anacardium occidentale* L.) sweets produced and sold in Labino (Parnaíba city, Piauí State, Brazil) A) Candied cajú fruits (the sourest fruits are used to this end); B) Plum type sweet (the sweetest fruits are used to this end, which are cooked in water with sugar only).

SOURCE: The authors (2019).

As a food resource, cajú is preferred over common cashew according to the taste of the residents. They informed that there are two types of cajú, the sweet one and the sour one. Flavor is one of the main factors that interfere with the use and selection of food plants, as the flavor can be pleasant or not, leading to their acceptance or rejection (Ghirardini *et al.*, 2007). On the coast of Piauí, cajú stands out for its shape, color and flavor. It is a nutritious food, as it contains vitamins, minerals, carbohydrates, and organic acids (Rufino *et al.*, 2008). Analysis of the chemical and physical

quality of this plant highlighted high sugar content and low astringency, which makes it more palatable. Furthermore, cajú has greater firmness compared to the domesticated cashew (Rufino *et al.*, 2007).

Ripe sweet cajú fruits are more consumed than the sour ones. Their skin is very rich in tannins (Rufino *et al.*, 2002). They are used as a forage resource, as food source for pigs, chickens, cattle, and goats. The sour fruits are more often used for these animals, while the sweet ones are used in recipes, such as sweets and cajuína.

Leaves are also used in the diet of animals in the semiarid region of northeastern Brazil (Nunes *et al.*, 2015). As for medicinal applications (UDs = 0.03), leaves are used less frequently to this end. Barks and leaves are the plant organs used in therapeutic preparations, separately or not. The barks are soaked in a liquid so that the secondary metabolites present in the plant are imbued in it for later oral consumption, and the leaves are used to prepare teas, both for healing purposes. Healing and anti-inflammatory effects as well as applications to intestinal problems have been reported in other studies (Almeida Neto *et al.*, 2015; Silva *et al.*, 2015; Sousa *et al.*, 2015; Ribeiro, 2016; Santos *et al.*, 2021).

The knowledge of traditional populations has been used in studies aimed at identifying new drugs, and satisfactory results have been obtained. Studies on the phytochemical screening of *A. occidentale* stem bark also make reference to the presence of secondary metabolites. Thus, there is an association between the role of this metabolite and the action attributed to the species according to the knowledge of local communities (Silva & Almeida, 2013; Barbosa-Filho *et al.*, 2014). Vitamin C, polyphenols, and superior flavonoids have been registered in the hypocarp of this species, further confirming its properties (Barbosa-Filho *et al.*, 2014), in addition to tannins, saponins, catechins and steroids, flavonols and xanthones in the ripe pseudofruit bagasse and stem bark, and phenols in the leaves (Santos *et al.*, 2018).

Collections of vegetative structures for medicinal use occur occasionally throughout the year depending on the needs of the collectors. The leaves are collected manually, while branches and barks are removed with the aid of machetes. Only 1% of

respondents use leaves and branches, and 2% use the bark. The infrequent use of these structures may be associated with the easy access to substitute products such as fuel and medicines sold at commercial points at affordable prices.

In addition to food, medicinal, fuel and forage purposes, the species has ritualistic importance in Afro-Brazilian cults (Albuquerque & Andrade, 2005) and for the Ka'apor indigenous group. In the latter, kawĩ, a fermented drink used to celebrate the girls' menarche, weddings, and nomination of new chiefs, is prepared with the hypocarp of cajuí (Garcés, 2016).

The communities did not differ significantly as to the number of uses (F: 0.0031; p: 0.997). Ethnobiological studies to understand the use of plant resources have revealed a gender relationship with the social roles of extractivists (Voeks & Leony, 2004; Viu & Viu, 2011). In this context, it appears that knowledge is greater among that gender culturally responsible for the activity developed (Figueiredo *et al.*, 1993; Fonseca Filho *et al.*, 2016; Santos *et al.*, 2019). Such data is contrary to our present findings, because there were no correlations between the number of known uses and gender, age, education, income, and time of residence of the informants in the Labino (F of significance: 0.567339, R²: 0.089; P > 0.05), Barrinha (F of significance: L 0.380511; R²: 0.23885; P > 0.05), or the Canárias (F of significance: 0.213159; R²: 0.252286; P > 0.05) communities. In the Canárias community, there was an observed tendency for those who had lived there longer to mention more uses (p: 0.041). This can be explained by the fact that the interviewees have practiced their activities for a longer time, recognizing a greater number of uses of the plant. This same tendency was registered in the south of

Brazil (Melo *et al.*, 2008). Overall, ethnobotanical findings indicate that the age of the interlocutors is directly associated with knowledge of the local flora acquired over time and from practice (Almeida Neto *et al.*, 2015; Bastos *et al.*, 2018; Santos *et al.*, 2019).

Accompanied by their children and partners, or in groups of the same gender, women collect fruits and hypocarps of cajuí during the fruiting months of the species (July to October) in the morning period, when the temperature is milder. Some informants said the fruits and hypocarps are collected after their senescence in the soil (3%); others said they removed them from the plant with the aid of sticks with hooks or by shaking branches (54%), and some said to collect them using both ways (43%). The use of hooks attached to long sticks to collect fruits is a practice also used to collect mangaba (*Hancornia speciosa* Gomes, Apocynaceae) (Lima *et al.*, 2019) and allows reaching fruits in higher canopies, facilitating access and collection.

According to the interviewees, fruits fallen to the ground are collected because this avoids causing damage or dropping of flowers of the species, and consequent lower fruit productivity. It is interesting that this care to avoid the breaking of branches and dropping of flowers is also recommended by Kramer & Kozłowski (1972) in an agrotechnological context. Those authors advocated that fruit production is negatively affected by the elimination of leaves and flowers, as this leads to a reduction in photosynthetic production and, consequently, a decrease in the amount of carbohydrates.

The fruits together with hypocarps are collected in the forest (50%), in yards (20%), in both places (26%), or are purchased (4%). Purchase is performed preferably by elderly people or people who have health problems, due to their difficulty in

carrying out the collection. Among the factors that explain the use, selection and collection of food resources, the availability, abundance and proximity of the collection sites are the main elements (Nascimento *et al.*, 2018); these three aspects were present in the study areas. The proximity of the cajuí trees in the field can explain the number of respondents who collected cajuí fruits in yards.

Cajuí trees are native plants in the areas the interviewees live, and they were preserved even after their houses were built. The collection of cajuí in the forest, far from the collectors' homes, can be explained by the theory of optimal foraging (MacArthur & Pianka, 1966), according to which the time and effort spent to acquire a given species are compensated by a satisfactory benefit, such as the nutritional value. In the case of the communities in the present study, the benefit seems to be the complement to the families' income and/or the cultural value of cajuí trees. Such pattern is observed in other species of the semiarid such as *Anadenanthera colubrina* (Vell.) Brenan (angico), of the Fabaceae family (Soldati & Albuquerque, 2012; Prado *et al.*, 2019).

After collection, the hypocarps and fruits are stored in containers, such as buckets or urus (baskets) and taken to the collectors' residence, where they are washed and sorted. Subsequently, the nuts are exposed to the sun, while the pseudofruit is reserved for various purposes or discarded and sometimes buried in the soil, when the collector is interested in using solely the kernels.

The harvesting of *A. occidentale* has been part of Brazilian socio-biodiversity since the 16th century. The use of this species by the native indigenous people was described and illustrated in the work of Thevet in 1558. He reported the way in which the

natives used this species, which they called acaiou, and its fruit acaiou. There are also records of its use by Ka'apor groups in the Alto Turiaçu Indigenous Land, located in the Amazon Forest in Maranhão. This indigenous group still employs a wide variety of cashew (Akaju) in their daily lives: Tawa, Hu, Pinã, Howi, Ipihũ, Minhã and Kajuaçu or caju-do-mato (Garcés, 2016).

The frequency of collection of cajuí nuts and hypocarps in the communities varied widely. During the harvest period (July to October), 1% collected them biweekly; 4% every four days; 11% routinely; 31% every three days; 21% every two days; and 32% daily. In a study of a similar nature with *Hancornia speciosa* Gomes, extractivists also made collections on a daily basis, dedicating most of their daytime to this practice (Lima *et al.*, 2019).

3.2. Human impacts and/or pressures

When informants were asked about the damage that cajuí trees suffer, they mentioned cutting (15%) for wood production, plant fuel, establishment of enterprises, and real estate speculation (25%). Then they also mentioned the lunar eclipse (22%) that causes a reduction in production due to damage to flowers, hypocarps and fruits (Table 2). The use of cajuí trees as firewood, resulting from pruning, was also recorded in a study on the adequate use of cajuí trees on the coast of Piauí (Rufino *et al.*, 2007). As it is a species that has multiple uses in the context of extraction, for producing timber, food, forage, and medicinal preparations, it can generally suffer pressure from use (Campos *et al.*, 2018), requiring sustainable management.

The impact of the exploitation of plant resources depends on several elements, such as the potential for regeneration, the frequency and inten-

sity of collection, the period of the year in which the extraction of plant structures takes place, and the plant life stage (Ticktin & Shackleton, 2011). It is thus pertinent to evaluate the capacity of cajuí trees to withstand the pressures and the damage they suffer to assess the level of degradation and its consequences.

Native populations of *A. occidentale* are typical pioneers and important facilitators of the fixation of active dunes (Santos-Filho *et al.*, 2010). The damage caused to coastal vegetation includes the loss of biodiversity due to the impacts caused by livestock, burning, removal of sandy sediments for use in civil construction, and advance of dunes due to the removal of wood (Cavalcanti & Camargo, 2002; Souza & Crespo, 2015).

The relevance of cajuí as a source of inputs for the cultural, food and economic reproduction of local residents is evident. When asked about the sociocultural value of this fruit tree, the interviewees highlighted cajuí trees as a unique cultural element throughout the landscape, being a source of food (45%), income (27%), food and income (18%), nutritious and medicine products (7%); 3% of the participants had no information about this question. The following reports illustrate the above:

It serves as food and generates income with the nuts (I13, 30 years old).

It is very important; it brings many benefits and even beauty. It is beautiful to see a lot of cashew trees together [...] I use them to prepare fish, I make juice and there are the nuts (I22, 41 years old).

It is food; when the harvest time comes, there is juice; it is a snack; it used for sweets, and there are the nuts (I16, 42 years old).

Cajuí is medicinal, its tea is good for inflammation; the barks are soaked and that washes the disease, you can drink it, too, but it is "travoso" [= astringent] [...] it is richness, my sadness is to see the cajuí trees being

cut (I01, 70 years old).

If it weren't for it, there would be no income. My income really comes from the nuts. We used to get it here, but because it is small, now we buy the big nuts. Goats eat cajú fruits and the nuts they burp; I pick them up and sell the small nuts (I11, 32 years old).

The positive elements that mostly promote the use of this resource are the continuity of the food diet learned in childhood, the need to seek alternative food sources, as they complement the family economy, the fact that the plant is adapted to low rainfall, and that the fruits can be collected

during the off-season. Some authors argue that the main characteristics that mostly promote the use of food plants and amalgamate complex natural and social systems are cultural acceptance, economic benefits, storage capacity, and pleasure in consumption (Ladio, 2001; Cruz *et al.*, 2014; Andrade *et al.*, 2015), as well as medicinal and nutritional properties combined with feelings of well-being (Hora *et al.*, 2020).

The relationship of collection and use of plant resources also contributes to strengthen the cultural identity and to promote the well-being of collectors in ecosystem contexts (Porro, 2019).

TABLE 2 – Threats to the permanence of cajú (*Anacardium occidentale L.*) in the Canárias (Araioses city, Maranhão State, Brazil); Labino (Parnaíba city, Piauí State, Brazil) and Barrinha (Cajueiro da Praia city, Piauí State, Brazil) communities.

Communities	Problems/Impacts	Number of citations (%Percent)
Canárias	The participant did not know	07 (24%)
	Lunar eclipse	07 (24%)
	Cutting	06 (22%)
	Drought	04 (14%)
	Diseases	03 (10%)
	Fences that prevent collection	01 (03%)
	No appreciation of cajú, and therefore few people interested in collecting it	01 (03%)
Labino	Cutting of cajú trees for construction of wind farms	12 (35%)
	Lunar eclipse	09 (26%)
	Cutting to make charcoal	07 (20%)
	The participant did not know	02 (05%)
	Burning	03 (08%)
	Diseases	01 (03%)
	Native cashew trees are not being replanted	01 (03%)
Barrinha	Cutting	10 (41%)
	The participant did not know	08 (33%)
	Lunar eclipse	03 (13%)
	Fences that prevent collection	02 (09%)
	Burning	01 (04%)

SOURCE: Direct research, 2019-2020.

It should also be noted that the conservation of natural populations is of great relevance for future genetic studies of this species, which has global economic importance (Andrade *et al.*, 2019; Santos *et al.*, 2019; Brainer & Vidal, 2020). One of the most promising possibilities in this regard is the maintenance and promotion of the current relationship between the cajuí tree populations and the coastal communities that depend on them as a reliable source of income and of other resources (Rufino *et al.*, 2007). Furthermore, it is also worth noting that the sustainability of natural resources is the result of complex interactions between the ecological, cultural, economic and political spheres (Virapongse *et al.*, 2016).

4. Conclusion

Of the total number of residents interviewed, the majority were women who collected cajuí fruits mainly in groups. Among the productive activities developed in the communities, the extraction of this species does not guarantee a regular source of financial resources, since retirement and/or assistance programs were the main reliable sources of livelihood.

The uses reported by the interviewees were mainly food, forage, and medicinal preparations. The most used parts were the hypocarp, followed by the nuts, leaves, branches, and bark. The hypocarp was usually consumed fresh or in the form of sweets, juices, wines, cajuína, and spices. Most fruits along with the hypocarps were collected in the forest, during the harvest season (July to October), mainly on a daily basis or every two days. The leaves were obtained manually, while the branches and barks were removed with the aid of machetes.

The main impacts mentioned by the informants were the eclipse of the moon and cutting for the production of firewood. The construction of projects, gardens, and increasing real estate speculation are other problems that lead to the cutting of native populations of *A. occidentale*.

Therefore, *A. occidentale* is a source of income and food, guaranteeing the livelihood of many families during the off-season, in addition to allowing the continuity of the cultural identity of the interlocutors who collect cajuí products. Added to this, the use and application of this species as food and other resources is significant in the process of conserving the genetic resources and for bio-prospecting research.

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