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(ENG) REPORTS OF KNOWLEDGE AND THE USES OF CACTACEAE SPECIES IN THE HISTORIA NATURALIS BRASILIAE (1648): COMPARATIVE PAST-PRESENT ANALYSES **(POR)** RELATOS DE CONHECIMENTO E USO DE ESPÉCIES DA FAMÍLIA CACTACEAE JUSS. NA OBRA *HISTORIA NATURALIS BRASILIAE* (1648): UMA ANÁLISE COMPARATIVA PASSADO-PRESENTE	**Title**
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RESEARCH ARTICLE

REPORTS OF KNOWLEDGE AND THE USES OF CACTACEAE SPECIES IN THE *HISTORIA NATURALIS BRASILIAE* (1648): COMPARATIVE PAST-PRESENT ANALYSES

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ABSTRACT

Cactaceae species have diverse uses in Brazil, principally in the northeastern region of that country, and show morphological and physiological characteristics adapted to different environments and being useful to the man as well to the animals. In general, cacti are perennial and present in all stations, and demonstrate specialized survival characteristics, and may present leaves modified to form spines, and these species are generally suculent. These plants have significant biological and ecological value in the northeastern of Brazil being present in the Caatinga environment which is characterized as an ecosystem presenting adverse environmental conditions in terms of both its climate and soils. Cactaceae are cited in the historical tome of the 17th century, *Historia Naturalis Brasiliae* (1648), by Piso and Marcgrave which contains one of the first considered scientific records of the Brazilian flora. In light of the singular value of this work, seven species of Cactaceae cited by those naturalists were examined in detail. It was also aimed to establish past-present timelines of Cactaceae species comparing their historic and present qualitative and quantitative uses. It was utilized as methodological path: documental, qualitative and quantitative researches. It was observed that six of the seven species described in that work are still utilized for different uses or/and conservative uses by human populations. The use-categories of Cactaceae cited in the original work and in more recently documents are: medicinal, ornamental, food resources, accessories, shade, bio-indicators, construction, magic-religious, fuel, forage, living fences, technology, and veterinary. It is remarkable that the categories medicinal, forage and living fences are cited in both past and present records. The records of Piso and Marcgrave are of significant importance in terms of understanding the temporal dynamics of the use of Cactaceae species, and the wellspring of this work ensures its continued contribution to future research in different areas.

KEYWORDS: Flora, historical ethnobotany, naturalists, northeastern Brazil, 17th century

ARTIGO DE PESQUISA

RELATOS DE CONHECIMENTO E USO DE ESPÉCIES DA FAMÍLIA CACTACEAE JUSS. NA OBRA *HISTORIA NATURALIS BRASILIAE* (1648): UMA ANÁLISE COMPARATIVA PASSADO-PRESENTE

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RESUMO

Cactaceae reúne espécies empregadas em diversos usos no Brasil, principalmente no Nordeste, e apresentam características morfológicas e fisiológicas que lhes permitem adaptação em diferentes ambientes, tornando-se úteis para o homem, bem como para os animais. Em geral, são plantas perenes de expressão em todas as estações e apresentam formas de sobrevivência especializadas, podendo apresentar folhas modificadas em espinhos e sendo geralmente suculentas. Este grupo botânico apresenta um grande valor biológico e ecológico para a região Nordeste do Brasil por estar presente no ambiente de Caatinga, que é caracterizado como um ecossistema de condições ambientais adversas em termos de clima e solo. Inseridas na *Historia Naturalis Brasiliae* de Piso e Marcgrave, as Cactaceae, portanto, figuram nesta obra seiscentista que apresenta o primeiro registro considerado científico da flora brasileira. Diante da singularidade desta obra, objetivou-se resgatar informações acerca de sete espécies de Cactaceae estudadas pelos citados naturalistas. Além disso, buscou-se estabelecer um paralelo passado-presente comparando-se o uso destas espécies de Cactaceae com o registro atual das mesmas. Utilizou-se como percurso metodológico: pesquisa documental, qualitativa e quantitativa. Constatou-se que das sete espécies descritas na obra, seis delas ainda são utilizadas, para usos distintos e/ou usos conservativos. No que diz respeito às categorias de uso que envolvem o elenco de Cactaceae mencionado tanto na fonte primária quanto em registros atuais, são elas: medicinal, ornamental, alimentícia, acessório, sombra, bioindicação, construção, mágico-religioso, combustível, forragem, cerca-viva, tecnologia e veterinário. Vale ressaltar que as categorias medicinal, forrageiro e cerca-viva foram as que se fizeram presentes no conjunto de registros passado-presente considerados nesta pesquisa. Diante do exposto é interessante observar que os registros de Piso e Marcgrave são de suma importância para a compreensão da dinâmica de uso das Cactaceae em uma escala temporal, tornando-se assim uma fonte que contribui para o estabelecimento de futuras pesquisas em diferentes áreas.

PALAVRAS-CHAVE: Etnobotânica histórica, flora, naturalistas, Nordeste do Brasil, século XVII

1. INTRODUCTION

The family Cactaceae comprises approximately 1500 species with distributions concentrated in the Americas (SOUZA and LORENZI, 2008) that demonstrate specific morphological and physiological adaptations to the environmental conditions of the habitats in which they occur (HUNT, 1999; LENZI, 2008).

The Cactaceae are particularly visible in the semiarid Caatinga biome of northeastern Brazil (SOUZA and LORENZI, 2008), with many endemic species (TAYLOR and ZAPPI, 2004; LUCENA et al., 2013).

Cacti were extensively cultivated in Europe starting in the 16th century after their introduction by English, Dutch, and Spanish commercial agents and botanists returning from the Antilles, Mexico, and Central and South America (CERUTTI, 1998).

This family has very unique characteristics that have been appropriated by humans for many purposes, depending on the species, region, and local culture (e.g., HOLLIS and SHEINVAR, 1989; CASAS et al., 1999). Many cactus species therefore have great cultural and commercial value, and are used in many different ways, including as food resources for both humans and cattle during periods of extended droughts, as sources of wood products and water, in landscaping and traditional medicine – in addition to their ecological functions, including promoting vertebrate and invertebrate diversity (e.g., SILVA, 1984; LIMA, 1996; CERUTTI, 1998; ZAPPI et al., 2011). Although these plants are greatly valued, principally in northeastern Brazil, there are certain factors that limit their usefulness, such as the low protein content found in some species and the fact that their consumption is culturally associated with periods of economic difficulties and food scarcity (ARAÚJO, 2004; ALMEIDA, 2007;), thus causing a local devaluation of these resources (GUINANDE LEMESSA, 2000).

Numerous authors have examined the interactions of human cultures with the Cactaceae in countries such as Brazil (ANDRADE et al., 2006a, 2006b; PEREIRA, 2009; LUCENA et al., 2012a, 2012b, 2013, 2014, 2015; NUNES et al., 2015), Colombia (FERNÁNDES-ALONSO, 2006; VILLALOBOS et al., 2007), Cuba (FUENTES, 2005), Mexico (CASAS et al., 1997, 2001, 2014; LANSKY et al., 2008; LIRA, 2009; BLANCAS et al., 2010; MORENO-CALLES et al., 2012; PARRA et al., 2012), the United States (APODACA, 2001), Ethiopia (ASSEFA and ABEBE, 2001; YINEGER et al., 2008), South Africa (RASETHE et al., 2013), and India (KALITAET al., 2014), but there are still shortfalls in our knowledge of the past uses of many species.

In light of the traditional importance of cacti to the inhabitants of the semiarid region of northeastern Brazil (PICKEL, 2008), historical documentation of the use of these plants, as described by George Marcgrave and Guilherme Piso in the *Historia Naturalis Brasiliae* in the 17th-century, is important to consider. They are considered the first naturalists to record species of cactus as part of the floristic diversity of northeastern Brazil in documentation produced between 1630 and 1654 when in the service of the Dutch East India Company.

In order to generate information that could contribute to our better understanding of species of the Cactaceae family as reported for the 17th-century in northeastern Brazil, the present work addressed the following questions: Which cactus species were observed and documented in the 17th century by Dutch naturalists in northeastern Brazil? What types of information were recorded, in terms of the popular names of those plants, their morphological

characteristics, occurrence, and utility? Which species, among those cited in the past, continued to be used by the inhabitants of that dryland region?

2. MATERIALS AND METHODS

2.1 Interpretation of primary and secondary sources

Research focusing on the historical information available about species of the family Cactaceae occurring in northeastern Brazil was undertaken by reading and interpreting the records contained within the tome *Historia Naturalis Brasiliae* (PISO and MARCGRAVE, 1648). Two works derived from the original manuscript were examined after translation to Portuguese from the original manuscript by the Companhia Editora Nacional: the first volume (published in 1942) contained the writings of Marcgrave; the second volume (published in 1948) contained the writings of Piso. A second source was the *Flora do Nordeste do Brasil Segundo Piso e Marcgrave*, written by Pickel, and published in 2008.

In order to contextualize the data obtained through the systematization of the information contained in the above mentioned works, we consulted more recent bibliographic material concerning the family Cactaceae and species mentioned in the primary sources.

Consultations were made in the Bibliotecas do Centro de Educação e Saúde of the Federal University of Campina Grande and in the Instituto de Pesquisas Jardim Botânico in Rio de Janeiro. Additional consultations were made of the following databases: JSTOR Global Plants (http://plants.jstor.org/), Biodiversity Heritage Library (http://www.biodiversitylibrary.org/), Herbário Virtual A. de Saint-Hilaire (http://hvsh.cria.org.br/), Flora Brasiliensis (http://florabrasiliensis.cria.org.br), Open Library (http://openlibrary.org/), Tropicos.org Missouri Botanical Garden (http://tropicos.org/), and the Lista da Flora do Brasil (http://floradobrasil.jbrj.gov.br/). The appropriate articles were selected using the following key-words: “Cactaceae”, “geographic distribution”, “habitat”, “occurrence”, “use”, “utility” and “knowledge”. The species mentioned in the primary sources (and their botanical synonyms) were also included among the key-words during searches for published articles.

2.2. Systematization of the information

After consulting the primary sources, the information was integrated into a database using Microsoft Excel® software. This database included information concerning the species in question, their popular names, localities of occurrence, and indications of their utility. Use-indications considered 13 categories: accessory, food resource, bio-indicators, living fences, fuel, construction, forage, magic-religious, medicinal, ornamental, shade, technology, and veterinary uses. The descriptive data, as well as any additional information concerning the species as mentioned in the primary sources, were updated and adjusted to current orthographic norms. After including the relevant information provided by the primary sources, more current information concerning those same Cactaceae species was incorporated into the databank to provide past-present comparisons.

The scientific names cited in the primary sources were altered when necessary to conform to current designations as listed in the Tropicos.org Missouri Botanical Garden (2016), The International Plant Names Index – IPNI (2016), the Lista da Flora do Brasil do

Jardim Botânico do Rio de Janeiro (TAYLOR et al., 2016), as well as the specialized literature.

3. RESULTS AND DISCUSSION

Seven cactus species occurring in northeastern Brazil were cited in the *Historia Naturalis Brasiliae* written by Piso and Marcgrave in the 17th century. Those naturalists described the botanical characteristics of the plants and noted their various uses - indicating the importance of those species to the inhabitants of that region even at that early time after colonization.

3.1 Records of the botanical characteristics of the Cactaceae as cited in the *Historia Naturalis Brasiliae*

The descriptive and illustrative data of the Cactaceae, as recorded by Piso and Marcgrave (1648), are presented in table 1 and presented in figure1. Those authors took special interest in recording the popular names of the species, often indicating their ethnic origins, as in the case of *Cereus jamacaru* DC. The anatomical characteristics they noted included all of the plant organs, and comparisons were made with other plant groups (drawing analogies for example, between *Opuntia brasiliensis* (Willd.) Haw. and *Pinus* sp.). Comparisons were also made between the Cactaceae themselves, with the authors citing, for example, the linguistic style used in their description of *Harrisia adscendens* (Gürke) Britton & Rose. It is relevant to note that Piso mentioned "*brasilianos*" who accompanied their expedition, citing them especially in reference to *O. brasiliensis* and noting that they had not yet seen its fruits. Interestingly, these naturalists made use of analogies to human typologies in describing some of the plants, with Marcgrave using the word "rotund" to describe the cylindrical nature of that plant, for example.

Figure 1: From right to left a) General aspect of *Cereus fernambucensis* Lem. presented in the *Historia Naturalis Brasiliae*; b) General aspect of *Cereus jamacaru* DC. presented in the *Historia Naturalis Brasiliae*; c) General aspect of *Hylocereus undatus* (Haw.) Britton & Rose presented in the *Historia Naturalis Brasiliae* (PISO and MARCGRAVE, 1648).

Table 1: Descriptive data of the Cactaceae as recorded by the naturalists Piso and Marcgrave in *Historia Naturalis Brasiliae* (1648), organized in alphabetical order of the species.

Species	**Descriptive data**
Cereus fernambucensis Lem.	"The species "Iamacarú" is a "spiny fig tree", with thin roots, not deeply buried, producing tri- or quadrangular leaves, one, two, three or four feet long, from which others originate here and there, much like the "figueira-da-índia" [O. ficus-indica]; each side is two, three or four finger widths' wide, being twice as thick as those of "Iamacarú" [Hylocereus sp.], climbing on shrubs and trees, although they are longer in the extremities than angular, having thorns that are one, two or three finger thicknesses long, yellowish or wood colored, numbering six, seven or eight, juxtaposed, and of unequal lengths. The leaves are green, as were those we described among the herbs [Hylocereus sp.], and their flowers were identical, although half the size. The fruit was approximately 3 finger widths long by four in circumference, with an oblong shape, with a thick covering the same thickness as the pericarp of a banana [Musa paradisiaca L.], succulent and quite red; it would easily split under compression, and could be pealed; inside was a white, succulent, friable pulp in the form of small rounded masses, like frozen snow; the pulp is mixed with many bright black seeds similar to those of "Aquilegia" [Aquilegia vulgaris L.], although smaller. The leaves of this plant are succulent and produce a sap that tastes like herbs, or similar to that of "couve" [Brassica oleracea L.].
Cereus jamacaru DC.	"Iamacarú", also called "Caxabú" by the Brasilienses and "Cardon" by the Portuguese, is a tall tree. The lowest part, leaving the ground, is octagonal, whose corners are rounded and all of the same thickness, as if it was sculptured, armed with spines arranged in the form of a star. Between two of the stars there is always a type of subtle but salient transversal line. From this initial leaf others emerge having the same general shape, creating a "Tuna" form; each of them is one, two, three and sometimes up to 6 feet long, in a usually ascending direction, with the lower leaf acquiring a gray covering, becoming transformed into a thick and woody trunk, although spongy internally and easy to cut; the leaves, however, remain close to the trunk, sometimes producing branches and other times leaves. The old trunk and the branching leaves will finally lose their spines, no longer being thorny, a trait only noted on the leaves. The flowers are

Species	**Descriptive data**
	produced isolated and white on this stem; later the fruit appears, being twice as large as a goose egg, oval, dark red outside, and edible. The trees sometimes attains the height of a "Mamaoeira" [Carica papaya L.] and even a "Genipapeiro" [Genipa americana L.].
Epiphyllum phyllanthus (L.) Haw.	"The "Canambaya", as it is called by the Brasilienses, is a shrub with a gray woody exterior, with thick leaves with a consistency similar to that of "Erva babosa" [Aloe sp.], a half a foot or more long, two finger-widths wide, and excised along the edges, much like leaves made of wax. Through the middle of the leaf extends, within it, a longitudinal woody fiber, with the leaf being very green, as in "Erva babosa" and, along its borders, almost brownish".
Harrisia adscendens (Gürke) Britton & Rose	"Another species of "Cardon" having rotund and nodular branches, in the form of a nodular cane, in its nodes are spines as in the others, being therefore similar to the others". [D. Bento Pickel (2008, p. 164) adds that this Cactaceae occurs in Pernambuco from the Caatinga to the Sertão, with specimens found in the Zona da Mata, where it grows on rocks, whether horizontal or next to trees. Forms impenetrable clumps in the interiors of those forests].
Hylocereus undatus (Haw.) Britton & Rose	"Called "Iamacarú" by the Brasilienses and "Cardon" by the Portuguese. This spiny cactus grows in close association with shrubs and trees and has thin roots that hold to them. Its leaves are thick, triangular, attached one to the other in various manners, as in the "figueira-da-índia"; each side of a leaf has the thickness of a finger and its component material is solid, as in "erva-babosa" or "Tuna". The leaves are green and succulent, full of a viscous sap, although without any particular flavor except that of a herb. On the extremities of the angles of the leaves, at intervals of a finger's thickness and a half, there are four juxtaposed grayish spines. On the same extremities fruits are produced, with the length of a finger thickness, emerges from the top of a flower that is composed of, on the outside, some 40 narrow green sepals, three to four finger thicknesses long, and within some 20 white petals larger than the green sepals, and in the middle are numerous yellow stamens with yellow and spongiform apices (i.e., the anthers!) and, in the midst of those, a yellow rotund column, split at the top into many diverging parts. The flowers have a sweet and sickly smell. It

Species	Descriptive data
	produces an oval fruit, the size of a pine cone and of the same shape, with triangular protuberances. The fruit is covered by a pericarp very similar to that of an orange [Citrus sp.], inside and out, being the color of moist Florentine lacquer, elegant, (the triangular, or pointed, protuberances are greenish yellow, however) or the color of lacquer mixed with cinnabar; within is a grayish white pulp, succulent, flavorful, full of brilliant black seeds, of similar sizes and coloring of those of Aquilegia, which are eaten together with the pulp".
Opuntia brasiliensis (Willd.) Haw.	"The "Iaracatiá", which is also a species of "Iamacarú", has a spiny and straight trunk that could be mistaken for a "Pinheiro" [Pinus sp.] in terms of that trunk being straight and by its size, varying, however, in the rest, because the leaves are pressed together and festoon the branches at the extremities of the tree, which by their rounded form and thickness imitate the palm of one's hand, and the long spines the fingers". In terms of the aspects characterized here, Marcgrave noted that: this "Iamacarú", which has a gray rotund stem, armed with spines disposed in a star form and, above, hanging branches, whose stalks are rotund prolongations with star-shaped spines as on the trunk, and on these branches leaves are arranged as seen in "Tuna", oval, long, although not as thick as those of "Tuna", having sharp isolated spines along their edges. Tubercles (i.e., areolas!) Are found on the surfaces of both sides of the leaves; the branches and leaves are green. Flowers are produced". Piso continues with his descriptions, stating that "concerning the fruits of this tree, which grows far from here, and was discovered by us recently, neither I nor the old Brasilianos who traveled with me had any information. The medula of the stem is of a deeper green than that of "Sabugueiro" [Sambucus sp.], which splits soon after it dries and forms a very light dust that is carried away by the wind'.
Opuntia ficus-indica (L.) Mill.	"Both I and my diligent servant were in agreement that the sixth and last "Iamacarú" received, as did many others, a peculiar name by the indigenous peoples: "Ururumbeba". It is of the families of the "Tunas" or "Figueiras da Índia". It is encountered only in the interior lands, and although it has not until now been used for medicinal purposes, it should perhaps be investigated for that purpose, and

Species	Descriptive data
	it should not be, for that reason, be omitted here. It has a straight and solid trunk, armed with strong spines distributed without any order, being produced on the upper extremities of very thick leaves, covered with spines, in the form of the palm of the hand, which often produces branches".

Published information concerning the geographical distributions of the seven cactus species cited in the *Historia Naturalis Brasiliae* by Piso and Marcgrave (1648), updated using the Lista de Espécies da Flora do Brasil do Jardim Botânico do Rio de Janeiro (TAYLOR et al., 2016), indicated that they have ample distributions throughout Brazil (Table 2).

In terms of their habitats, the species are distributed in six phytogeographical domains: Caatinga (*C. jamacaru*, *Epiphyllum phyllanthus* (L.) Haw., *H. adscendens*, *O. brasiliensis*, and *Opuntia ficus-indica* (L.) Mill.); Amazon and Atlantic forests (*Cereus fernambucensis* Lem., *E. phyllanthus*, *Hylocereus undatus* (Haw.) Britton & Rose, *O. brasiliensis* and *O. ficus-indica*); Cerrado (neotropical savanna) (*C. jamacaru*, *O. brasiliensis* and *O. ficus-indica*); the Pantanal wetlands (*E. phyllanthus*, *O. brasiliensis* and *O. ficus-indica*); and Pampa (*O. brasiliensis* and *O. ficus-indica*) (TAYLOR et al., 2016).

Comparing the localities of occurrence cited by Piso and Marcgrave (1648) with current information (based on TAYLOR et al., 2016), it can be noted that the seven species cited and described by those naturalists in the primary source continue to flourish in the northeastern region of Brazil. These comparisons of occurrences between distinct epochs indicate that, even though this family is considered one of the most threatened plant groups in Brazil (CAVALCANTE et al., 2013), principally due to anthropogenic impacts, they continue to integrate the flora of the northeastern region of that country. It is interesting to note that this group of plants demonstrates physiological and morphological adaptations that allow them to inhabit diverse environments and to survive under different types of stress situations (DUQUE, 2004), even in a region with a long history of human occupation and environmental modification that is currently experiencing accelerated processes of desertification.

Among the seven species of Cactaceae cited in *Historia Naturalis Brasiliae*, three have distributions that extend beyond the geographical limits of Brazil (Table 3), with considerable representivity throughout the American continent and in a number of different biomes. These species have since been transported to other parts of the world, with *O. fícus-indica* now growing on five continents.

Table 2: Cactaceae species cited in the *Historia Naturalis Brasiliae* (PISO and MARCGRAVE, 1648) and their respective regions of occurrence in Brazil according to that primary source and the Lista de Espécies da Flora do Brasil - Cactaceae (TAYLOR et al., 2016).

Regions of Occurrence in Brazil																											
Species	N							NE									SE				S			CW			
	AC	AP	AM	PA	RO	RR	TO	AL	BA	CE	MA	PB	PE	PI	RN	SE	ES	MG	RJ	SP	PR	SC	RS	DF	GO	MT	MS
Cereus fernambucensis Lem.						■		■	■	■		■	■		■	■	■		■								
Cereus jamacaru DC.							■	■	■	■	■	■	■	■	■	■		■								■	
Epiphyllum phyllanthus (L.) Haw.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harrisia adscendens (Gürke) Britton & Rose								■	■	■		■	■	■		■											
Hylocereus undatus (Haw.) Britton & Rose								■	■	■		■	■				■	■	■	■		■					
Opuntia brasiliensis (Willd.) Haw.					■			■	■	■		■	■		■	■	■	■	■	■	■	■	■			■	■
Opuntia ficus-indica (L.) Mill.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Legend: N = North: AC = Acre; AP = Amapá; AM = Amazonas; PA = Pará; RO = Rondônia; RR = Roraima; TO = Tocantins. NE = Northeast: AL = Alagoas; BA = Bahia; CE = Ceará; MA = Maranhão; PB = Paraíba; PE = Pernambuco; PI = Piauí; RN = Rio Grande do Norte; SE = Sergipe; SE = Southeast: ES = Espírito Santo; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo. S = South: PR = Paraná; SC = Santa Catarina; RS = Rio Grande do Sul; CW = Central-West: DF = Distrito Federal; GO = Goiás; MT = Mato Grosso; MS = Mato Grosso do Sul.

Table 3: Cactaceae species cited in *Historia Naturalis Brasiliae* (PISO and MARCGRAVE, 1648) with indications of their geographic distributions outside of Brazil.

Species	Geographic distribution outside of Brazil
Epiphyllum phyllanthus (L.) Haw.	Originally from Brazil. It is encountered in North America (Mexico), Central America (Ecuador, Guatemala, Honduras, Nicaragua, Suriname and Panama) and South America (Argentina, Bolivia Columbia, French Guiana, Paraguay, Peru and Venezuela)
Opuntia brasiliensis (Willd.) Haw.	Originally from Brazil. It is encountered in Africa (Madagascar), North America (United States), Central America (El Salvador and Honduras) and South America (Argentina, Bolivia, Paraguay and Peru)
Opuntia ficus-indica (L.) Mill.	Originally from Mexico. It is now encountered in Europe, as well as in Africa, Asia, Oceania and South America

Taking into consideration that cacti are native to the American continent, the species distributed to other areas the world was probably introduced by migrating birds or by human cultivation (CERUTTI, 1998; CAVALCANTE et al., 2013). *O. ficus-indica* is an example of a species introduced into Brazil. This plant is endemic to Mexico but was brought to Brazil and has become one of the most widely recognized species in that country, with enormous economic importance in the northeastern region of that country (FONSECA and MARTUSMELO, 2010).

3.2 Reports of past-present analyses of common names, folk knowledge, and uses of species of the family Cactaceae

Cacti have been of great importance to both humans and animals throughout history, and all of the seven species cited in the primary source are utilized by human populations in some manner according to those 17th century naturalists and/or modern records (Table 4). Information presented in the *Historia Naturalis Brasiliae* and in modern publications (which cover a wider spectrum of species of the Cactaceae) indicate that these plants can be used as food sources for animals (PICKEL, 2008; LUCENA, 2013; KINUPP and LORENZI, 2014) and humans (CERUTTI, 1998; SANTOS et al., 2012; CAVALCANTE et al., 2013; KINUPP and LORENZI, 2014), for medicinal purposes (ANDRADE et al., 2006b; LUCENA, 2013), as ornamental plants (KINUPP and LORENZI, 2014; LIMA, unpublished data), as living fences (CRUZ, 1982; BARROS, 1985; ANDRADE-LIMA, 1989; CERUTTI, 1998; LIMA, unpublished data), as fuel (CERUTTI, 1998; PICKEL, 2008), as sources of building materials, hallucinogens, charms, and for religious purposes (CERUTTI, 1998), and even as accessories (PICKEL, 2008).

It can be seen in table 4 that of the seven species analyzed, six (86%) were cited as useful in the primary source (excepting only *H. adscendens*). In terms of modern records, six (86%) of the seven species were likewise cited as useful (excepting only *O. brasiliensis*). It is important to note that the species identified as not having any reported modern use is not the

same as that cited in the primary source – indicating a possible loss of knowledge, or the loss of the necessity of its use over time. The opposite occurred with the species that had no indicated use in the primary source, but has utility attributed to it in modern publications – indicating a change in its appropriation by humans over time. It is also important to note that knowledge about these plants and their uses have evolved over time, changing the attributes of their past-present utility (Table 4): only *C. jamacaru, C. fernambucensis* and *O. ficus-indica* retained the same modern utilization as cited for the 17th century (e.g., ANDRADE et al., 2006b; PICKEL, 2008; *SOUZA, unpublished data)*.

In terms of the use-categories of the seven Cactaceae species, 57% (four species) were indicated as having medicinal value in the primary source (PICKEL, 2008). Medicinal value has been attributed to an equal number of species (four) in modern publications, although not to all of the same species (Table 4). On the other hand, 50% of the current records cite ornamental uses for those seven species (LIMA, 2012; KINUPP and LORENZI, 2014; LUCENA et al., 2015), while the original source did not mention this utility for any of them. Similarly, in relation to their use as food resources, the species *C. jamacaru*, *O. ficus-indica*, *H. undatus,* and *E. phillanthus* are recognized in the current literature (SANTOS et al., 2012; CAVALCANTE et al., 2013; KINUPP and LORENZI, 2014; LUCENA et al., 2015), while the primary source did not consider this utility. Shade uses were cited for *C. jamacaru* and *O. ficus-indica* only in the current literature (LUCENA et al., 2015). *C. jamacaru* was the only species cited in the current literature for the use-categories of bio-indicator, construction, magic-religious, and veterinary utility (LUCENA et al., 2015). The fuel category was only cited for *O. brasiliensis* in the primary source, while only *C. jamacaru* is attributed with this utility in the current literature. Only *O. ficus-indica* was indicated as a forage plant in both the primary and current sources (PICKEL, 2008; CAVALCANTE et al., 2013; LUCENA et al., 2015). *H. undatus* and *H. adscendens* were likewise cited as being used as living fences in both the primary and current sources (PICKEL, 2008; LIMA, unpublished data).

It is interesting to note that almost all of the parts of the cactus plants had some form of utility to human populations. The plant part most frequently cited in both the primary and modern sources was the fruit; fruits were not mentioned as being useful only for *H. adscendens* and *O. brasiliensis* (Table 4).

In terms of the popular names of the species, 71% became modified over time; only "mandacaru" (*C. jamacaru*) and "palma-gigante" (*O. ficus-indica*) retained their original names from the 17th century onward (Table 4). Additional names were acquired over time by these same species, however, varying according to specific cultures and regions (ALBUQUERQUE et al., 2010).

Table 4: Past-present comparisons of the information available about the seven Cactaceae species cited in the *Historia Naturalis Brasiliae* (PISO and MARCGRAVE, 1648) and in the current specialized literature.

Species	PN_{HNB}	PN_c	PU_{HNB}	PU_c	UI_{HNB}	UI_c	Reference
Cereus fernambucensis Lem.	lamacarú, urumbeba, cardo-do-litoral, cardo	mandacaru	Fr (pulp)	-	Me	Me	*Souza (unpublished data)*
Cereus jamacaru DC.	cardo, cardon, caxabú, figueira-indica-fragrante, figueira-silvestre, lamacaru, mandacaru, cardeiro	mandacaru, mandacaru-de-boi, cardeiro, jamacaru	Fr (pulp)	Fr; R/S	Me	Fs/Fo; Or; Me; Bi/Fu/Ct/Mr/So/Tc/Vt	Andrade et al. (2006b), Lima (2012), Cavalcante et al. (2013), Lucena et al. (2015)
Epiphyllum phyllanthus (L.) Haw.	canambaya	pitaia-rosea, pitainha	Le	Fr	Ac (head decorations)	Fs	Santos et al.
Harrisia adscendens (Gürke) Britton & Rose	cardon	rabo-de-raposa	-	-	-	L-f/Me	Lima (dados não publicados)
Hylocereus undatus (Haw.) Britton & Rose	cipó-cacto, lamacarú	dama-da-noite, pitaia, pitaia-branca, pitaia-vermelha, pitaia-rosa, dragonfruit	-	Fl/Fr/SFr/C	Me/L-f	Or/Fs	Cerutti (1998), Kinupp and Lorenzi (2014)
Opuntia brasiliensis (Willd.) Haw.	lamacarú, laracatiá, urumbeba, ururumbeba	-	Ca	-	Fu (used as torches for traveling at night)	-	-
Opuntia ficus-indica (L.) Mill.	ururumbeba, palma-gigante	figo-da-índia, figo-de-piteira, palma, palmatória, palma-gigante, palma-forage, jamaracá, jurumbeba, palma-de-gado	M/C/R/Fr	Fr; R/C	Me/Fo	Fs/Or; Me; Fo; So	Cerutti (1998), Andrade et al. (2006b), Cavalcante et al. (2013), Kinupp and Lorenzi (2014), Lucena et al. (2015)

Legend: HNB = *Historia Naturalis Brasiliae*; PN_{HNB} = popular name; PNc = current popular name; PU_{HNB} = plant part utilized; PU_c = plant part currently utilized; C = cladode; Ca = stem; SFr = skins of the fruits; S = spine; Fl = flowers; Le = leaves; Fr = fruits; M = mucilage; R = root; UI_{HNB} = use indication; UI_c= current use indication; Ac = Accessory; Fs = food resource; Bi = bio-indicator; Fu = fuel; Ct = construction; L-f = living fences; Fo = Forage; Me = medicinal; Mg = magic-religious; Or = ornamental; So = shade; Tc = technology; Vt = veterinary uses.

4. CONCLUSIONS

The present study examined only a limited portion of the 17th century tome *Historia Naturalis Brasiliae* in a demonstration of its importance for historical plant studies in Brazil. In terms of the Cactaceae family, the naturalists Piso and Marcgrave made significant botanical contributions and also added to our understanding of the cultural importance of the seven focal species.

The information presented here clearly indicates that the acquired knowledge concerning the seven widely occurring Cactaceae species cited in the primary sources was not lost over the centuries, as these plants continue to be used for many traditional purposes – thus remaining permanent features in the Brazilian culture since at least the 17th century.

It was also possible to determine based on the informations presented in the sources considered in this work that the folk knowledge concerning these plants and their forms of use have changed over time, as well as their popular names. It is therefore apparent that those human populations evolve in their perceptions of the use-potentials of those plant resources in light of their changing necessities – processes that occur within a past-present continuum.

The most cited use-categories were medicinal, ornamental, and food resources. These categories included species that have long demonstrated significant cultural and economic importance to the populations occupying northeastern Brazil (as well as other parts of that country, as these species are widely distributed).

The use-categories examined in the texts consulted in the present work exhibit a pattern of presence/absence of information. The medicinal, forage, and living fences categories demonstrated patterns of past-use and present-use, with the latter two categories including the same species in both the 17th and 21st centuries. We also identified (for example) a pattern of past-use for the category "accessory", and of present-use for the food resource and ornamental categories.

It is possible that folk knowledge concerning the cactus species mentioned (and their uses) attracted the attention of the 17th century naturalists and more modern researchers due to specific innate cultural biases, leading them to concentrate on those categories but, in spite of this potential limitation, *E. phyllanthus*, *H. undatus* and *O. brasiliensis* clearly merit more directional studies as these species have the potential for further utility for contemporary populations.

The present study could not present all of the accumulated knowledge relevant to these species of Cactaceae, nor an exhaustive list of their potential uses, particularly in northeastern Brazil - but it hopefully provides subsidies for more detailed examinations of these species, especially those that do not have apparent current uses (e.g., *O. brasiliensis*), those that did not continue in the same use-category to the present day (*E. phyllanthus*, *H. undatus* and *O. ficus-indica*), and those that remained in (or even amplified) their traditional use-categories but could perhaps be more efficiently appropriated if examined in more detail (*C. fernambucensis*, *C. jamacaru* and *O. ficus-indica*). As such, it will be important to promote additional in-depth studies that can discover better ways to use these cacti to benefit human populations – while at the same time protecting them and their natural habitats.

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