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Useful plants referenced by the naturalist Richard Spruce in the 19th century in the state of Pará, Brazil

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ABSTRACT

The present work sought to study the biocultural collections made by the naturalist Richard Spruce in the 19th century while in the state of Pará, Brazil. The material is largely deposited in the Herbarium and the Museum of Economic Botany at the Royal Botanic Gardens, Kew, UK. Complementary studies were undertaken in Brazilian institutions to gather more information about the useful plants cited by Spruce for Pará and their respective vernacular names and uses in the 19th century. Information was also gathered concerning the current uses of the plants by analyzing contemporary ethnobotanical studies. A total of 54 vernacular names of useful plants were recovered, including 51 native species of which 33 are used for construction purposes, 18 as food resources, eight for medicinal purposes, and one species as an ichthyotoxin. It is interesting to note that 80 % of the uses described for these plants in the 19th century in Pará continue into the present day. It is hoped that the present work will serve to promote future studies involving biocultural collections that document the history of local populations and recognize the importance of traditional knowledge in the Amazon region.

Keywords: 19th century naturalists, Amazon region, biocultural collections, historic ethnobotany, useful plants

Introduction

The Amazon Region awakened the interest of European naturalists and scientists in the first decades of the 18th century because of its exuberant tropical forests and the exotic nature of its inhabitants, and thus it became the focus of many scientific expeditions (Ferreira 2004). Numerous Europeans undertook pioneering explorations in the area motivated by a mixture of scientific curiosity and quest for adventure (Cunha 1991; Belluzzo 1994). Antunes *et al.* (2015) also evidenced great economic interest on the part of the European governments in the exploration of the "New World". Brazil stood out as a destination for numerous travelers in the 19th century, not only because of its natural richness, but also because it was still largely unknown due to the protectionist policies of Portugal.

The English naturalist Richard Spruce traveled to South America in 1849 with the principal objective of investigating the Amazonian flora and sending specimens to the Royal Botanic Gardens at Kew. Spruce was self-taught in botany and widely recognized as one of the principal proponents of that field at the time. He described innumerable species from the Brazilian Amazon as well as the customs of the people inhabiting the region in the 19th century — he sought to understand their beliefs and practices and relate these to local knowledge about the properties and uses of plants (Seaward 2000). His dedication, knowledge and perception, as well as the impeccable organization of his collections and their descriptions, served as an inspiration for subsequent

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ethnobotanical research, such as that undertaken by the North American scientist Richard Schultes (Schultes 1983). Spruce collected approximately 14,000 plants in the Brazilian Amazon as well as 350 artifacts (and/or the raw materials used in their confection) that were carefully described in his field notes, publications, correspondence, and diaries. This set of information constitutes what is called the Spruce Biocultural Collection (Cabalzar *et al.* 2017). The collection is of great importance to botanists interested in studying the flora of South American (Seaward 2000), as well as to ethnobotanical researchers who wish to know more about the uses of plants and the preparation techniques employed by the indigenous populations of the time (Schultes 1983; Wallace 2004). This large collection was the subject of a study by Knight (2016), who aimed to relate the artifacts collected by the naturalist in South America to herbarium exsicates and personal notes.

The present study aims to analyze digital information available concerning the plants (herbarium samples) and artifacts collected in the state of Pará by Richard Spruce, especially those gathered during his travels near Belém and Santarém. The analyses were integrated with information gathered from national and international biological collections, publications, and annotations by Spruce concerning expeditions throughout the region. The goal was to determine whether there has been significant change in the uses and/or folk knowledge regarding the plants cited by Spruce by comparative analysis with ethnobotanical research conducted in the 20th and 21st centuries.

Materials and methods

The Brazilian Amazon encompasses vast biological diversity associated with a rich cultural diversity, and so it is of enormous relevance in terms of potentially useful plants (Schultes 1977) and the presence of approximately 254 indigenous peoples (ISA 2018). The state of Pará alone has 37 ethinic groups representing 14 distinct linguistic families (ISA 2018), as well as numerous traditional river populations and small holding farmers, fishermen and remnant ex-slave communities ("quilombolas"), among others. This biological and cultural diversity stimulated European naturalists to undertake scientific expeditions into the Amazon Region during the 19th century (Lima 2013), a period characterized by a quest for knowledge, which resulted in the documentation of hundreds of useful species.

The present study was thus the result of an extensive review of the information contained in the Biocultural Collection of Spruce about the useful plants of the 19th century in the state Pará. Spruce arrived in Belém (or Pará City, as it was recorded in his documents) in July 1849. He stayed there for about a year, undertaking visits and making collections in localities known as Caripi and Tauaú in the Amazon River estuary (Fig. 1). He later travelled to the city of Santarém where he lived for approximately eleven months, collecting in and around the city of Óbidos at localities such as Cachoeiras do Aripecuru (Spruce 1908; 2006), according to Prance (1972).

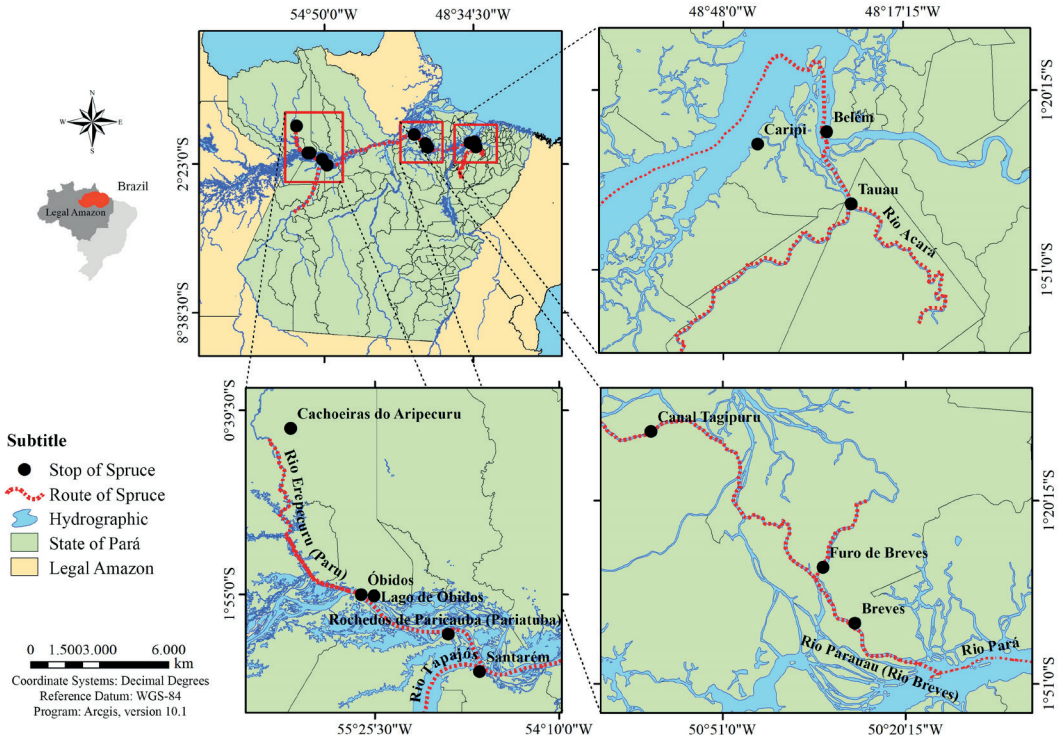

Figure 1. Main localities where Richard Spruce performed botanical collections in Pará State in the Amazon Region of Brazil.

The present review consulted the following publications: *Notes of a Botanist on the Amazon and Andes* (written by R. Spruce 1908); *Notas de um botânico na Amazônia* (a partial version of the preceding work, translated by Eugênio Amado 2006); and *Richard Spruce (1817-1893): Botanist and Explorer* (Seaward & Fitzgerald 1996). Complementary consultations were undertaken using *JSTOR* (http://plants.jstor.org.); examining letters written by R. Spruce in Santarém (PA) and sent to William Hooker (Kew); and consulting *Biodiversity Heritage Library* (https://www.biodiversitylibrary.org/) and Spruce's publications in *Hooker's Journal of Botany* and *Kew Garden Miscellany*. Each publication and/or document was carefully studied, and information concerning vernacular names, plant uses, and the artifacts collected by Spruce were noted.

The following digital databases were subsequently consulted: *Reflora - Herbario Virtual* (http://reflora.jbrj.gov.br/reflora/herbarioVirtual/), *Specieslink* (splink.cria.org.br/), and the *Economic Botany Collection, Kew Gardens* (http://www.kew.org/science/collections/economic-botany-collection), to search for high-resolution images of herbarium specimens of the angiosperms and/or artifacts from Pará described in the above mentioned works. Through these searches herbarium specimens of species encountered at the study sites that had the collector's number as well as taxonomic determinations were selected. Information concerning the plants and artifacts was then organized in a spreadsheet containing the collection number, locality, collection date, botanical family, species, vernacular name, the uses cited for plants (plant parts used, etc.), the name of each artifact and its uses, ethnographic information concerning each locality, and the institution where the material was deposited. Scientific names of the species were confirmed and updated by consulting the Flora do Brasil 2020 (http://floradobrasil.jbrj.gov.br/).

The information obtained was integrated with, and compared to, additional data obtained from herbarium and artifact labels and other historical documents (notes, publications, manuscripts). Contemporary literature — ethnobotanical studies conducted in local communities and public markets in Pará or elsewhere in the Amazon region, and classical papers about useful Amazonian plants — was then consulted to determine if the plants continued to be used in the same way as they were in earlier centuries, or if additional uses been attributed to them recently. Data concerning the origin of each species and its current conservation status were obtained from the *Redbook of the Brazilian Flora* (Martinelli & Moraes 2013).

Results and discussion

Useful plants cited and described by Spruce

A total of 426 specimens of vascular plants (with the collector's number and taxonomic determinations) and 64 objects (artifacts and raw materials) were collected by Spruce in the state of Pará. This material represents 51 useful plant species native to Brazil (Tab. 1) and one naturalized species – *Dysphania ambrosioides* (mastruz); 41 of these species were associated with herbarium specimens and/or artifacts, for which uses were discussed. Eleven species could not be associated with any herbarium specimen or artifact (i.e., they were only described in notes and/or manuscripts) (Tab. 1).

Another important result is that seven of the useful species are represented by nomenclatural type specimens: *Himatanthus fallax*, from which latex is extracted and used to treat parasite infections; *Protium heptaphyllum*, whose resin is used to seal the hulls of boats; *Licania octandra*, whose bark is used by indigenous people in making caraipé-style ceramics; *Mezilaurus itauba*, whose wood was used in construction and the fruits to make local wine; and *Bellucia dichotoma*, *Mouriri apiranga*, and *Talisia cerasina*, which produce edible fruits.

A total of 54 vernacular names (including nomenclatural variations) were recorded. Sometimes a single species was known by more than one name, such as: *Protium heptaphyllum* ("breu-branco", "breu-nativo"); *Hymenaea courbaril* ("jutaí-icica", "copal", "jutaí"); and *Smilax* sp. ("sarsaparilha", "salsaparrilha"). Common names were not, however, attributed to five species: *Cyperus articulatus*, *Campsiandra laurifolia*, *Pombalia oppositifolia*, *Tachigali tinctoria* and *Sapindus saponaria*.

The largest number of useful plants collected by Spruce (18 species) were found near Santarém: *Attalea spectabilis*, *Bellucia dichotoma*, *Bromelia* sp., *Copaifera martii*, *Curatella americana*, *Dysphania ambrosioides*, *Doliocarpus brevipedicellatus*, *Genipa americana*, *Gynerium sagittatum*, *Haploclathra paniculata*, *Himatanthus fallax*, *Mezilaurus itauba*, *Spondias mombin*, *Mouriri apiranga*, *Psidium densicomum*, *Paullinia cupana*, *Talisia cerasina*, and *Sapindus saponaria*.

In terms of the uses described for the plants collected in Pará, 33 species were used in construction (raw materials), 18 as food resources, eight as medicinal species, and one as an ichthyotoxin (*Tephrosia nitens*).

Spruce (1850a; b; 1908; 2006) recorded interesting uses of plants by the Amerindians of Pará. The leaves of *Geonoma* sp., for example, were used by indigenous peoples make roofs that were quite resistant; the stems and petioles of *Mauritia flexuosa* were used to make staffs and as raw materials for building canoes; the stems of *Mabea fistulifera* were used to make pipe stems (widely used and sold at that time); *Genipa americana*, *Tachigali tinctoria*, and *Byrsonima spicata* were used to make paints and dyes; the resin extracted from *Vismia guianensis* var.*guianense* was used as a sealant; the bark fibers of Marantaceae ("uruma-miri") were used to make "tipiti", an artifact used in preparing manioc flour; and the peduncle of *Gynerium sagittatum* was used to make arrow shafts.

Licania octandra ("caraipé") presents an especially interesting story: Spruce was recommended by George

Table 1. Useful plants collected and described by Richard Spruce in Pará State in the Amazon Region of Brazil. CO= construction; FO= food; ME= medicinal; TO= toxic; BA= bark; ST= stem; LE= leaf; FR= fruit; PE= peduncle; SP= spathe; RO= root; EX = exudate; HL= herbarium label of voucher material; RF= bibliographic reference/book (Notes of a Botanist on the Amazon and Andes); SJ= scientific journals (Hooker's Journal of Botany and Kew Garden Miscellany); acronyms of the herbariums and collections consulted: K - Royal Botanic Gardens, Kew; MG - Museu Paraense Emílio Goeldi; NY - The New York Botanical Garden; P - Muséum National d'Histoire Naturelle; W - Naturhistorisches Museum Wien; S - Swedish Museum of Natural History; EBC - Economic Botany Collection, Kew Gardens.

Family name	Scientific name	Vernacular name	Use category	Part used	Source		
					Origin	Locality	Scientific Collection
Amaranthaceae	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	mastruz	ME	LE	HL	Santarém	K
Anacardiaceae	*Spondias mombin* L.	tapiribá	FO	FR	RF	Santarém	-
Apocynaceae	*Himatanthus fallax* (Müll. Arg.) Plumel	sucaúba	ME	EX	RF	Santarém	P, K, EBC
Arecaceae	*Astrocaryum aculeatum* G.Mey.	tucumã	FO, CO	FR, SE	SJ	-	EBC
	Attalea compta Mart.	pindoba	CO	LE	SJ	Belém	-
	Attalea spectabilis Mart.	curuá	FO, CO	FR, LE	HL	Santarém	EBC
	Euterpe oleracea Mart.	assai	FO	FR	SJ	Belém	EBC
	Geonoma sp.	ubim	CO	LE	RF	Caripi	-
	Mauritia flexuosa L.f.	miriti	FO, CO	ST, FR, LE	RF, SJ	Caripi	EBC
	Maximiliana regia Mart.	inajá	CO	SP	SJ	Caripi	-
	Socratea exorrhiza (Mart.) H.Wendl.	paxiúba	CO	RO	RF, SJ	Tauaú	EBC
Bignoniaceae	*Handroanthus barbatus* (E.Mey.) Mattos	tauari-do-igapó, pau-d'arco	CO	ST	HL	Tauaú	K
Bixaceae	*Bixa orellana* L.	urucu	FO	FR	SJ	Belém	-
Bromeliaceae	*Bromelia* sp.	curana, curauá	CO	LE	HL	Santarém	EBC
Burseraceae	*Protium heptaphyllum* (Aubl.) Marchand	breu-branco, breu nativo	CO	EX	RF, SJ	Caripi	EBC, S
Calophyllaceae	*Haploclathra paniculata* (Mart.) Benth.	mura-piranga	CO	ST	HL	Santarém	EBC
Chrysobalanaceae	*Licania octandra* (Hoffmanns. ex Roem. & Schult.) Kuntze	caraipé	CO	BA	RF, SJ	Caripi	EBC, MG, K, P
Clusiaceae	*Symphonia globulifera* L.f.	anani	ME, CO	EX	SJ	Caripi	EBC, P
Cyperaceae	*Cyperus articulatus* L.	-	CO	RO	SJ	-	-
Dilleniaceae	*Curatella americana* L.	caimbé	CO	LE	RF	Santarém	K
	Doliocarpus brevipedicellatus Garcke	cipó	FO	ST	RF	Santarém	MG, P
Euphorbiaceae	*Hevea guianensis* Aubl.	seringueira	CO	EX	SJ	-	EBC
	Mabea fistulifera Mart.	tacuari	CO	BA	RF, SJ	Caripi	EBC, MG
	Manihot esculenta Crantz	mandioca	FO	RO	RF	Caripi	NY
Fabaceae	*Swartzia grandifolia* Bong. ex Benth.	mirapixuma	CO	ST	RF	Forest Aripecuru	-
	Campsiandra laurifolia Benth.	-	FO	FR	RF	-	-
	Copaifera martii Hayne	copaíba	ME	EX	RF	Santarém	RB
	Hymenaea courbaril L.	jutaí-icica, copal, jutaí	CO	EX	HL	-	EBC
	Tachigali tinctoria (Benth.) Zarucchi & Herend.	-	CO	BA	SJ	Caripi	K, P
	Tephrosia nitens Benth.	ajari	TO	LE	RF	Óbidos	P, K
Humiriaceae	*Humiria balsamifera* (Aubl.) A.St.-Hil.	umiri	CO	BA	SJ	Caripi	EBC
Hypericaceae	*Vismia guianensis* var.*guianense* (Aubl.) Pers.	pau-de-lacre	CO	EX	RF	Belém	MG, W
Lauraceae	*Mezilaurus itauba* (Meisn.) Taub. ex Mez	itaúba	CO	ST	RF	Santarém, Forest Aripecuru	EBC, K
Lecythidaceae	*Bertholletia excelsa* Bonpl.	castanheira-do-pará	FO, CO	FR, BA	RF, SJ	Tauaú	EBC
	Lecythis sp.	tauari, pau-d'arco	CO	BA	SJ	Tauaú	EBC, K, RB

Table 1. Cont.

Family name	Scientific name	Vernacular name	Use category	Part used	Source		
					Origin	Locality	Scientific Collection
Malpighiaceae	*Byrsonima spicata* (Cav.) DC.	murexi	ME, CO, FO	BA	SJ	-	EBC, NY
Malvaceae	*Theobroma speciosum* Willd. ex Spreng.	cacau	FO	FR	RF	Óbidos	K
Marantaceae	-	uruma-miri	CO	LE	SJ	Tauaú	EBC
Melastomataceae	*Bellucia dichotoma* Cogn.	tapira-goiaba	FO	FR	RF	Santarém	K
	Mouriri apiranga Spruce ex Triana	apiranga	FO	FR	RF	Santarém	K
Moraceae	*Brosimum* sp.	maçaranduba	FO, CO	BA	RF	Belém	-
Myristicaceae	*Virola sebifera* Aubl.	ucú-uba	CO	EX, BA	SJ	Caripi	-
Myrtaceae	*Psidium densicomum* Mart. ex DC.	araçá	FO	FR	RF	Santarém	K
Poaceae	*Gynerium sagittatum* (Aubl.) P.Beauv.	cana-brava	CO	PE	HL	Santarém	EBC, K
Rubiaceae	*Cephaelis* sp.	ipecacuanha	ME	RO	RF	Forest Aripecuru	-
	Genipa americana L.	jenipapo	CO	FR	RF	Santarém	K
Sapindaceae	*Paullinia cupana* Kunth	cupana, guaraná	ME	FR, SE	RF	Santarém	EBC
	Sapindus saponaria L.	-	CO	FR	RF	Santarém	EBC, P
	Talisia cerasina (Benth.) Radlk.	pitomba	FO	FR	RF	Santarém	P
Sapotaceae	*Manilkara elata* (Allemão ex Miq.) Monach.	massaran-duba	CO, FO	EX, FR	SJ	-	EBC, K
Smilacaceae	*Smilax* sp.	sarsaparilha, salsaparrilha	-	-	RF	-	EBC, K
Violaceae	*Pombalia oppositifolia* (L.) Paula-Souza	-	ME	RO	RF	Forest Aripecuru	P

Bentham (one of the greatest English systematists of the 19th century) to undertake the survey in Pará and to send back collections of *L. octandra* (Fig. 2). This species was of great economic interest at that time due to the fact that its bark contained silex — a valuable raw material used for making ceramics (Spruce 1908; 2006). During his expedition, Spruce visited an indigenous Caripi village in 1849 and noted the use of the bark of *L. octandra* for manufacturing kitchenware (Fig. 3). The process involved burning the bark of *L. octandra* to ashes and then mixing the ash with a fine clay found in lowland areas (Spruce 1850a; 1908; 2006). According to IBGE (2017), Caripi is now a tourist beach in the municipality of Barcarena, whose first inhabitants were the Aruans Indians.

Another species of interest was *Licania turiuva* (a synonym of *L. octandra*), called "caraipé-das-águas" by indigenous peoples. The species was collected by Spruce in floodplain forest ("várzeas") along the Trombetas River during a survey near Óbidos in 1849. Although the plant was used in the same way as *L. octandra*, Spruce indicated that the local inhabitants considered its bark and wood (as well as other products extracted from seasonally inundated forests), as being inferior to those harvested from upland forests (Spruce 2006). Schultes (1983) reported the use of its ashes (burnt bark) in the preparation of ceramics throughout the Amazon Region, exactly as was observed by the naturalist Spruce (Pio Corrêa 1969-1978; Arroyo-Kalin *et al.* 2009).

Plants used as food resources were also of great interest to Spruce, and he closely observed the eating habits of the local population during his stay in Santarém, especially with regard to fruits. The fruits most mentioned in Spruce's notes were: *Spondias mombin* ("tapiribá"), *Attalea spectabilis* ("curuá"), *Bellucia dichotoma* ("tapira-goiaba"), *Mouriri apiranga* ("apiranga"), *Psidium densicomum* ("araçá"), and *Talisia cerasina* ("pitomba"). Spruce tried the fruits of *Sapindus saponaria*, which appear to have a very agreeable pulp, but noted that his friends in Santarém chastised him for eating it because they were unsure of whether it was edible or not — the plant family was known to contain a number of poisonous species (Spruce 1908; 2006).

Spruce's notes reflect his experiences in Pará, and consequently reflect the regional cultures and customs he encountered. One of those experiences was his first contact with a typical regional drink produced from the macerated fruits of "assai" (*Euterpe oleracea*). He found the flavor insipid, although it became agreeable with the addition of manioc flour and sugar; its purple color reminded Spruce of wild blackberries (Spruce 1850a). The process described by Spruce for extracting the pulp is still used throughout the region, although machines are now employed for that purpose in large urban centers. The pulp is used in artisanal and industrial processes to produce jellies, ice cream, cream, yogurt, cakes, and sweets, as well as plant extracts (Shanley & Medina 2005). Pasteurized

"açaí" can be acquired in regional or national markets, in combination with guaraná syrup and "doce de leite" sweets, or even as a powder (Nascimento 2008), and is deemed to be a 'superfood'. Extracts of the fruits are used to prepare hydrating creams, shampoos and perfumes, and since the fruits contain high levels of vitamins and antioxidants, they are included in many dietary supplements and vitamin complexes (Borges & Stefanini 2015).

Another report records Spruce's visit to a small village near Caripi, where he had the opportunity to observe the wide utility of manioc (*Manihot esculenta*), whose roots are used to produce different types of flour — "farinha seca", "farinha-d'água", and tapioca — which remain staples of the diets of both indigenous and regional present-day populations. Spruce was also impressed by the ability of an old Amerindian resident to distinguish between eight or nine varieties of manioc based simply on characteristics of the leaves (whereas Spruce himself could only differentiate them by examining the roots) (Spruce 1908; 2006).

Figure 2. Herbarium specimens of *Licania octandra* (Hoffmanns. ex Roem. & Schult.) Kuntze. **A.** Specimen from the P herbarium collected by Richard Spruce, n. 133, in Caripi, 1849, Det. G.T. Prance. **B.** Duplicate (isotype) from K (Royal Botanic Gardens, Kew); **C.** Detail of the herbarium label describing the uses of the bark**.** Source: Reflora - Herbário Virtual/Economic Botany Collection, Kew Gardens.

An extremely valuable plant reported by Spruce (1850a) was the Brazil nut tree or "castanheira" (*Bertholletia excelsa*). He pointed out that the tree was one of the largest he had ever seen (together with "breu branco" [*Protium heptaphyllum*], which is used as a sealant for boats). Spruce recorded in his notes that Brazil nuts were consumed by animals typical of the region, such as monkeys and lowland pacas (*Cuniculus paca*), and were of great commercial value in the 19th century. Historical records indicate that the seeds of that plant were consumed in Europe as early as 1633, and slightly later in North America (Pio Corrêa 1969-1978; Pesce 2009). The high international commercial value of these seeds is related to their high nutritional value and considerable selenium content (a mineral that helps prevent cerebral aging) (Cavalcante 2010). The wood of *B. excelsa* is used in both civil and naval construction, although intense

Figure 3. Artifacts and sample materials of *Licania octandra* (Hoffmanns. ex Roem. & Schult.) Kuntze collected by Richard Spruce in Pará State (1849-1850) deposited in the *Economic Botany Collection, Royal Botanic Gardens (Kew)* **A.** Bark; **B.** Stove; **C**. Vessels; **D.** Pot. Source: Reflora - Herbário Virtual/Economic Botany Collection, Kew Gardens.

predatory harvesting has since been prohibited (Shanley & Medina 2005).

Spruce (1850a; b; 1908) noted various plant species with medicinal value in Pará, such as: *Dysphania ambrosioides* ("mastruz"), which is used as a purgative and diuretic; *Himatanthus fallax* ("sucaúba"), which is used as an anti-helmintic; *Symphonia globulifera* ("anani"), which produces a gum used by native populations for treating the thoracic region; *Copaifera martii* ("copaíba") with medicinal oil and *Byrsonima spicata* ("murexi") have astringent properties; *Cephaelis* sp. ("ipecacuanha") roots have emetic properties; and *Pombalia oppositifolia*, has an emetic effect even greater than "ipecacunha".

Spruce noted "Guaraná" for its medicinal use by the Manhe Amerindians who lived on the margins of the Manhe River (which drains into the Amazon River between the Tapajós and Madeira Rivers) (Spruce 1908; 2006). Toasted and ground "guaraná" seeds are used throughout Pará to prepare a refreshing drink that is considered useful for preventing many types of illnesses. Spruce noted that a mass of seeds would be shredded and mixed with manioc flour, packaged in leaves, and then left to ferment until acquiring a saffron-yellow color. The resulting paste would then be dried in the sun; in the morning, small amounts are then diluted in water to be drank as a tea to treat malignant bilious fevers — one of the severe illnesses plaguing that region (Spruce 1908). The name "Manhe" used by Spruce probably corresponds to "Mauhé" — one of the many names given by explorers, woodsmen, missionaries, and naturalists to the indigenous Sateré-Mawé people who inhabited the middle region of the Amazon between the states of Amazonas and Pará (ISA 2015).

Research conducted by Coelho-Ferreira (1994) reaffirmed the importance of "guaraná" to the social and economic organization of the Sateré-Mawé. It represents a natural resource that is intimately associated with their cultural identity, as the Sateré-Mawé were responsible for the cultivation and processing of "guaraná" (*Paullinia cupana* var. *sorbilis*), which is the most economically important product they commercialized. The traditional production process described by Coelho-Ferreira (1994) is quite complex, and involves collecting and washing the fruits, baking the seeds and then removing the seed coats; the seeds are subsequently ground to a homogeneous mass that is kneaded to exclude any air bubbles; the mass is then molded into small cylinders ("bastões") or small loaves. The cylinders of "guaraná" are left for a few hours on top of banana leaves, and later washed in a small gourd to smooth their surfaces; subsequent slow smoking brings out the organoleptic qualities of "guaraná". In describing a similar process used in the region, Cavalcante (2010) added the observation that the cylinders were placed over a small grill ("fumeiro") to expose them to smoke, where they remained for approximately 30 days until ready for sale. It is worth noting that in describing the process, Coelho-Ferreira (1994) did not make any mention of adding manioc flour to the seed mass as was described by Spruce. According to the former author, the different steps used by the Sateré-Mawé to process "guaraná" are based on knowledge acquired and passed down over centuries, which gives the cylinders produced by them the reputation of being the best in the region. Traditionally, the "bastão" is scraped on the dried tongue of a "pirarucu" fish or on a piece of basalt rock held in a small gourd with water, resulting in an everyday drink, for both Sateré-Mawé adults and children, called "çapó". "Capó is consumed in large quantities and is considered a fortifying stimulant; it is also indicated for stomach problems, diarrhea and dysentery and can serve as a food substitute during periods of scarcity. The drink is commonly offered to visitors to villages as a sign of welcome.

According to Schultes (1953), Spruce was very interested in ethnobotany as a naturalist, but his efforts were focused more on making botanical collections. The writings left by Spruce concerning local knowledge and the uses of plants, however, are still of great interest and importance.

Past and present uses of plants

Seven of the useful plants described by Spruce continue to be used in the same manner: *Bromelia* sp., with the leaves of the species of the genus providing fibers useful in rope making (Mondragón *et al*. 2011); *Haploclathra paniculata*, whose wood is used in the manufacture of walking sticks (Pio Corrêa 1969-1978); *Manilkara elata*, which provides high quality wood (Cavalcante 2010); *Psidium densicomum*, whose fruits are edible (Cavalcante 2010; Pio Corrêa 1969-1978); as well as of *Tephrosia nitens*, *Paullinia cupana* and Marantaceae ("uruma-miri") whose uses have already been discussed above.

Twenty-eight other plants were recorded by Spruce along with their traditional uses, although other applications, principally medicinal uses, were adopted over time (*Attalea spectabilis*, *Bertholletia excelsa*, *Bellucia dichotoma*, *Curatella americana*, *Doliocarpus brevipedicellatus*, *Genipa americana*, *Hymenaea courbaril*, *Lecythis* sp., *Licania octandra*, *Mabea fistulifera*, *Socratea exorrhiza*, *Theobroma speciosum*, *Vismia guianensis*, and *Talisia cerasina*). The current medicinal uses of some of these plants deserve emphasis: the bark of *B. dichotoma* is used in local communities of Santarém to treat snake bites (Moura *et al*. 2015); *G. americana* has been used for medicinal purposes due to its antidiarrheal, anti-inflammatory, aphrodisiac, tonic, diuretic, antianemic, antihemorrhagic and insetrifuge activities (Pimentel 1994; Souza *et al*. 1996); the peel and resin of *H. courbaril* is commonly marketed at fairs in Santarém (Lima *et al*. 2011) and Belém for the treatment of colds and headaches (Berg 2010), as well as bronchitis, diarrhea, worms, colic, and cancer treatment (Shanley & Medina 2005); and reports

of astringent properties for the bark of *L. octandra* (Pio Corrêa 1969-1978).

There are also five species found to have different uses than those documented by Spruce (*Byrsonima spicata*, *Handroanthus barbatus*, *Humiria balsamifera*, *Smilax* sp. and *Tachigali tinctoria*). According to Spruce, strips of the bark of *H. barbatus* were used to roll cigarettes and the wood was used to manufacture cigars. However, Pio Corrêa (1969-1978) points out that this plant is potentially poisonous, is abundant in flooded forests ("igapós") of the Amazon, and has not been reported as a good source of wood due to its low durability. The bark of *H. balsamifera* was reported to be aromatic, and was highly appreciated in Pará in the 19th century for purposes of domestic carpentry (Spruce 1850b). This species is also currently used by fishing communities along the coast of Pará for its aromatic resin, which is used in rituals to attract good fluids, and for its bark, which is consumed as an infusion to combat hepatitis (Coelho-Ferreira 2009) and urinary infections (Carneiro *et al.* 2010). The species *Smilax* sp. was widely commercialized to Europe and North America from Pará State, in about 1849 (Spruce 1908; 2006), the leaves and fruits have commercial value as condiments used by native Americans, while the roots have medicinal properties (Medeiros *et al.* 2007), and is reported as still being used by the Tiriyó Amerindians to treat enlarged lymph nodes ("inguá") (Cavalcante & Frikel 1973).

Spruce noted that several species of the genus *Pombalia* occur in the Amazon and that their roots provide emetine (Spruce 2006), however, no use was found for *Pombalia oppositifolia* in contemporary literature. This finding is similar to what was observed by Brandão *et al.* (2008) in a study that sought to determine if the medicinal plants described by European naturalists traveling along the traditional Royal Road ("Estrada Real") in Minas Gerais State in the 19th century were still being used in their traditional manners. These authors attributed the loss of folk knowledge to the lack of continuity of information transmitted orally through successive generations. Although this may also be happening in the Amazon, additional studies are needed to confirm whether such losses are indeed occurring in such a vast region.

Conservation status of useful plants

According to Martinelli & Moraes (2013), the conservation status of the Brazil nut (*Bertholletia excelsa*) is Vulnerable. In the 19th century, Spruce (2006) observed that its fruits had great commercial value, while already in the 20th century logging of the species increased, which explains its current state of conservation. The Brazil nut tree (*B. excelsa*; "castanheira-do-pará" or "castanha-do-Brasil") is native to the Amazon Region, where it occurs in upland forests. It is considered a symbol of the region due to its significant social, ecological, and economic importance (Lorenzi 2000; Scoles *et al.* 2008). In spite of legal protection, this large and commercially viable tree has experienced especially strong exploitation by the lumber industry, along with the intensive harvesting of its seeds for industrial and food demands, which threaten its long-term survival (Martinelli & Moraes 2013). Homma *et al.* (2000) reported that Brazil nuts have been exported since 1920, but Spruce (2006) recorded their widespread commercialization when he was in Pará (1849-1850). It is estimated that the species will experience a population decline of at least 30 % over the next hundred years (Martinelli & Moraes 2013).

Homma *et al.* (2000) likewise reported that *B. excelsa* experienced significant destruction over the last 30 years in southeastern Pará State, a situation that Homma & Carvalho (1998) associated with a set of macroeconomic policies of that the Brazilian government established for the Amazon Region, which restricted the microeconomic prospects of groups that manually harvest its seeds. The events and outcomes associated with these macroeconomic policies have induced a shift an extractive economy and a situation where control over the management and use of the region are lost.

It should be noted that Spruce was often obliged to cut down many trees to collect his samples during his travels, as there were no Amerindian helpers available to climb them (even though such field assistants were common at the time). Similar difficulties were reported by Alexander von Humboldt (considered the father of geography and natural sciences) during his trip through South America (1799-1804). Spruce noted his displeasure with having to cut down trees, which reveals his concern for preserving undisturbed natural environments. He never could fathom the destruction to follow. Environmentalists only realized that 100 years after Spruce´s visit.

Although cutting has become more acceptable, since removing a single tree does not open a significant clearing in the forest (and cutting trees is, and was, a common practice among local residents), Spruce rationalized that his specimens would be important additions to herbaria and museums, would serve to identify the plants and their products used in the region, and aid anatomical and structural studies (Spruce 2006).

The records of the observations of 19th century naturalists associated with collected material (plants and/or artifacts) constitute an important body of evidence to be studied and integrated with contemporary data to trace the history of the use of plants. This integration of information can help to better understand the relationship between people and nature, and aid the conservation of useful Brazilian species. This integration of information can also contribute to exchanges of information and records, and the recognition of the importance of folk knowledge in the management and use of plant resources by connecting the past with the present.

Conclusion

Spruce's expedition in Pará State lasted a year (1849-1850), which was is relatively short compared to the time he spent in the upper course of the Negro River (Amazonas State) and the Andes. This, however, does not diminish his contributions to our understanding of the utilitarian importance of plants, in both cultural and economic contexts. The present work confirms and highlights Spruce's dedication to science, which allowed him to make great contributions to knowledge of the natural world in spite of significant limitations regarding finances and health.

The collections of plants and artifacts gathered by Spruce from Pará demonstrate in rich detail the voluminous botanical and historical-cultural information he gleaned from the region. His valuable historical-cultural contributions still represent important sources of information about the uses of plants by indigenous tribes and local populations in the 19th century, with special emphasis on the Sateré-Mawé, who were pioneers in the domestication and use of "guaraná". Allied to Spruce's contact with native populations in Pará State, his observational skills and curiosity allowed him to record the close relationships between human populations in the Amazon and its flora, as reflected in their eating habits, medicinal practices, traditional construction techniques, and artisanal productions. Among these, the fabrication of ceramics and the production of manioc flour represent two practices that continue to the present day throughout the Amazon region.

It is important to note that local knowledge of useful plants in the Amazon continues to thrive, since 80 % of the uses described in the 19th century in Pará continuing into the present day.

Spruce was an exceptional botanist, whose organized and detailed notes are exemplary, even though information associated with his plant collections, artifacts, and other documents were not always well cross-referenced, and sometimes limited to just one of the three categories. As such, specimens deposited in various herbaria are very important because a good deal of information recorded on herbarium labels is available nowhere else. Furthermore, when this information is associated with artifacts and documents, it can contribute to a more detailed understanding of plants and their uses.

Finally, the present research contributes to our understanding of the native flora of the state of Pará and the uses of many of its plants during the 19th century, thus allowing a dialogue between the past and the present, with the goal of contributing to the future.

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