

Technological Forecasting of Traditional Knowledge Associated with Babassu

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Abstract

Babassu is a native palm tree from Brazil traditionally used by Indigenous Peoples (IP) and Traditional Communities (TC), in order to produce medicines applied in different treatments. Some of these medicinal applications have been scientifically analyzed in order to prove their pharmacological potentialities and have also been an object of interest for the protection of Intellectual Property Rights. The objective of this work was to carry out the technological forecasting of traditional knowledge associated with babassu related to the treatments applied by traditional medicine and to analyze the indicators connected with to the protection of Intellectual Property Rights. Initially, we conducted a survey of ethnobotanical and ethnopharmacological studies, presenting applications of babassu performed by traditional medicine. Subsequently, we presented a literature review, focused on analyzing the effects of babassu according to the practices of traditional medicine. Finally, we analyzed the records of filed patents made in World Intellectual Property Organization (WIPO), European Patent Office (EPO) and Latin American Base of the European Patent Office (LATIPAT) in relation to previously identified Traditional Knowledge Associated (TKA). There were different types of babassu applications used by traditional medicine, according to the results of the ethnobotanical and ethnopharmacological studies carried out in Brazil. The applications that stood out were related to anti-inflammatory and cicatrizant treatments. Most of the pharmacological

research that focused on proving the medicinal potential associated with the use of babassu, analyzed applications in anti-inflammatory and cicatrizant treatments, which mostly demonstrated these potentialities. It was verified that the interests for the protection of Intellectual Property Rights of the TKA with babassu, and the anti-inflammatory and cicatrizant treatments, presented a growth. This study contributes with positive evidence for the medicinal and cosmetic potentialities of babassu presented by traditional medicine. However, it also shows that holders of TKA have not been involved in the processes of protection of Intellectual Property Rights of inventions that apply TKA with babassu. In view of the related conflicts, it is suggested that TKA be valued in management and conservation practices.

Keywords: *babassu; orbignya phalerata; orbignya oleifera; attalea speciosa; attalea phalerata; Intellectual Property Rights; filed patents.*

1. Introduction

The term Traditional Knowledge Associated (TKA) refers to traditional knowledge that is related to the use of genetic resources of biodiversity, characterized by the production of intellectual activity (CHOUHAN, 2012). The TKA is observed in Indigenous Peoples (IP) and Traditional Communities (TC)'s knowledge and tasks in different contexts, such as agricultural, food, medicinal and technological (SOUZA *et al*, 2015). In literature, several studies are interested in identifying IP and TC's TKA (LIU *et al*, 2016; IJAZ *et al*, 2016; BRADAIA *et al*, 2015; SILVA *et al*, 2006), while other branches of the research are focused on scientifically proving the potentialities presented by TKA (MIRANDA *et al*, 2006; SILVA *et al*, 2006; BRITO FILHO *et al*, 2006; ASSUMPÇÃO *et al*, 2014; GUILLON *et al*, 2011).

Among many species of Brazilian biodiversity that present alimentary, medicinal and technological potentialities, one of the most remarkable is Babassu (*Orbignya speciosa*) (CARRAZA *et al*, 2012; BALICK and PINHEIRO, 2000).

According to IP and TC in Brazil, babassu has different pharmacological applications. Ethnobotanical and ethnopharmacological studies have shown benefits associated with the use of babassu in cutaneous cicatrizant processes (RUFINO, 2008; SILVA, 2013), in anti-inflammatory processes (BRAGA, 1960; MATOS, 1989) and in the treatment of kidney disorders (POVH *et al*, 2014). Some of these applications of traditional medicine have been scientifically confirmed (MAIA, 1987; CAETANO *et al*, 2002; BRITO FILHO *et al*, 2006; MARTINS *et al*, 2015).

In view of this reality, it is considered that the TKA with babassu has a great scientific and technological value and the realization of Technological Forecasting (TF) makes it possible to verify the technological advances related to the applications of TKA with babassu.

TF is a systematic way of mapping scientific and technological development that can significantly influence industry, economy or society in general (KUPFER and TIGRE, 2004). According to Souza *et al* (2015), TF presents itself as a strategy that allows the identification of emerging opportunities, trends and priorities, which are considered of high relevance for the promotion of technological innovation and sustainability. Important technological information is found in the patent bases, which present numerous information in connection with the applications submitted and the granted patents. It is possible to find, for example:

publication number, application number, title of the invention, inventor's name, name of the field, international patent classification, abstract, a detailed description of the invention and claims (MONTECCHI *et al*, 2013).

In view of the above context, the objective of this work was to carry out the Technological Forecasting of Traditional Knowledge Associated (TFTKA) with babassu connected with ethnopharmacological treatments and analyze the indicators related to the protection of Intellectual Property Rights.

2. Methodology

We conduct the descriptive research to carry out the Technological Forecasting of Traditional Knowledge Associated with Babassu. We handled official documents and scientific bibliography. The identified data was qualitatively and quantitatively analyzed.

We identified TKA with babassu in relation to traditional medicinal treatments and their respective scientific evidence based on the information presented by books, dissertations, theses and scientific articles presented in the bases Science Direct, Elsevier and Scielo. Regarding TFTKA with babassu, we identified information linked to traditional medicinal treatments based on the material found in the following patent bases: European Patent Office (EPO), Latin American Base of the European Patent Office (LATIPAT) and World Intellectual Property Organization (WIPO). The following keywords were used in the scopes of the research in order to identify TKA and the scientific evidence related to TKA and TFTKA: “babaçu”, babassu, *orbignya*, *orbignya phalerata*, *orbignya oleifera*, *attalea*, *attalea phalerata*, and *attalea speciosa*. In order to identify TFTKA with babassu, we selected the sub-classification A61 of the International Patent Classification (IPC), which is related to the patents of medical products, hygiene and cosmetics, in order to detect patents in the field of medicine and pharmacology areas. The TFTKA was held in July 2016 and the previously indicated keywords were applied in the "Title" and “Abstract” fields during the search in the patent bases.

All patent filed records published until June 2016 were individually analyzed by discarding duplicated documents. The following fields were analyzed: patent application number; title; abstract; inventors; applicants; year of filed; country of filed; International Patent Classification (IPC); and product and/or process. Subsequently, the incidence of TKA applications to babassu was analyzed in all the filed patents considered in this research.

3. Results and Discussion

The results of the ethnobotanical and ethnopharmacological research were a total of eight different applications of babassu carried out by traditional medicine. The treatments that stood out quantitatively were the cicatrizant treatments (50%) and anti-inflammatory treatments (37.5%) (Table 1). At least two medicinal applications of babassu were presented in six different studies.

Table 1. TKA with babassu applied by traditional medicine.

Treatment	Plant Part	Authors	Publication Type	Country
Anti-inflammatory	N.S.*	Braga (1960)	Book	Brazil
Anti-inflammatory and cicatrizant	Mesocarp	Pires (1974)	Book	Brazil
Vermifuge and anti-influenza	Oil	Balick (1984)	Scientific Article	Brazil
Anti-inflammatory	N.S.*	Matos (1989)	Book	Brazil
Laxative and treatment of amenorrhea	N.S.*	Martins (2001)	Book	Brazil
N.S.*	N.S.*	Pinheiro <i>et al</i> (2005)	Scientific Article	Brazil
Cicatrizant and antiseptic	Oil	Azevedo (2007)	Thesis	Brazil
Analgesic, cicatrizant and laxative	Almond and oil	Rufino (2008)	Scientific Article	Brazil
Cicatrizant	Leaf and fruit	Silva (2013)	Thesis	Brazil
Kidney treatment	N.S.*	Povh <i>et al</i> (2014)	Scientific Article	Brazil
Antiseptic and cosmetic	Almond and oil	Arruda (2014)	Scientific Article	Brazil
Antiseptic	Stem, leaf, mesocarp and almond	Arruda (2013)	Thesis	Brazil

Source: Prepared by the authors. / N.S*: Not specified.

In the present study, it was verified that 92.30% of the scientific research identified in the literature review, in Section 2, addressed the TKA with babassu, and, mostly confirmed the efficacy of the treatments (Table 2).

It was also verified that all the scientific research identified in Section 2, applied the mesocarp of the fruit for the accomplishment of the experiments (Table 2). The only exception observed in present research was in relation to the analgesic treatment, which had not been identified in any of the results of the ethnobotanical or ethnopharmacological surveys that were analyzed.

Table 2. Results of the review of identification of scientific researches that prove the efficacies of TKA with babassu applied by traditional medicine in Brazil.

Treatment	Plant Part	Authors	Publication Type
Anti-inflammatory	Mesocarp	Maia (1987)	Thesis
Cicatrizant	Mesocarp	Barroqueiro <i>et al</i> (2001)	Scientific Article
Anti-inflammatory and Immunomodulator	Mesocarp	Silva (2001)	Scientific Article
Immunomodulator	Mesocarp	Barroqueiro (2001)	Scientific Article
Antimicrobial	Mesocarp	Caetano <i>et al</i> (2002)	Scientific Article
Anti-inflammatory and cicatrizant	Mesocarp	Moura (2002)	Scientific Article
Gastric and duodenal ulcers	Mesocarp	Carvalho (2003)	Scientific Article
Cicatrizant	Mesocarp	Amorim <i>et al</i> (2006)	Scientific Article
Anti-inflammatory and analgesic	Mesocarp	Baldez (2006)	Scientific Article
Cicatrizant	Mesocarp	Brito Filho <i>et al</i> (2006)	Scientific Article
Cicatrizant	Mesocarp	Martins (2006)	Scientific Article
Cicatrizant	Mesocarp	Ferreira (2006)	Scientific Article
Cicatrizant	Mesocarp	Silva <i>et al</i> (2015)	Scientific Article

Source: Prepared by the authors.

The results of TFKKA presented filed patents linked to technological applications of babassu in all bases analyzed. In general, filed patents connected with alimentary, medical, cosmetical, chemical, pharmaceutical or biotechnological products were verified. A total of 50 filed patents were found in the EPO, LATIPAT and WIPO databases, which occurred within the period from 1953 to 2016. The quantitative results of TFKKA defined in the methodology of this research are presented in Table 3.

Table 3. Total patent filed records.

Keywords	EPO	LATIPAT	WIPO	Total
"Babaçu"	0	7	0	7
<i>Babassu</i>	33	1	1	35
<i>Orbignya</i>	3	5	0	8
<i>Orbignya phalerata</i>	0	0	0	0
<i>Orbignya oleifera</i>	0	0	0	0
<i>Attalea</i>	0	0	0	0
<i>Attalea phalerata</i>	0	0	0	0
<i>Attalea speciosa</i>	0	0	0	0
Total	36	13	1	50

Source: Prepared by the authors.

Since 1953, according to the filed patent for an injectable pharmaceutical composition containing trypsin,

babassu by-products have been considered to be of commercial interest and protection of Intellectual Property Rights.

In view of all the data of this research, we confirmed that companies show a great interest in patenting products and processes related to babassu, which is a 60% of the total number of the filed patents. The patent applications from natural persons constitute the 22% of the total number of the filed patents, while the Scientific, Technological and Innovation Institutions (STIs) represent just the 16% of the total number and, finally, the 2% corresponds to the third sector (Figure 1).

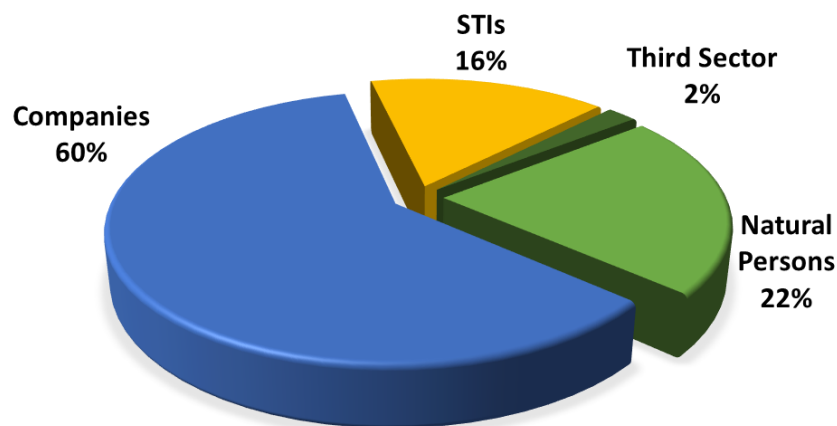


Figure 1. Relation between “Number of Filed Patents” and “Applicants Category”.

Source: Prepared by the authors.

Figure 2 shows the time series of filed patent applications for products and/or processes related to babassu per decade, found in patent databases. The data demonstrates a recent interest in patenting products and/or processes in relation to babassu, since the largest number of filed patents has occurred in the present decade.

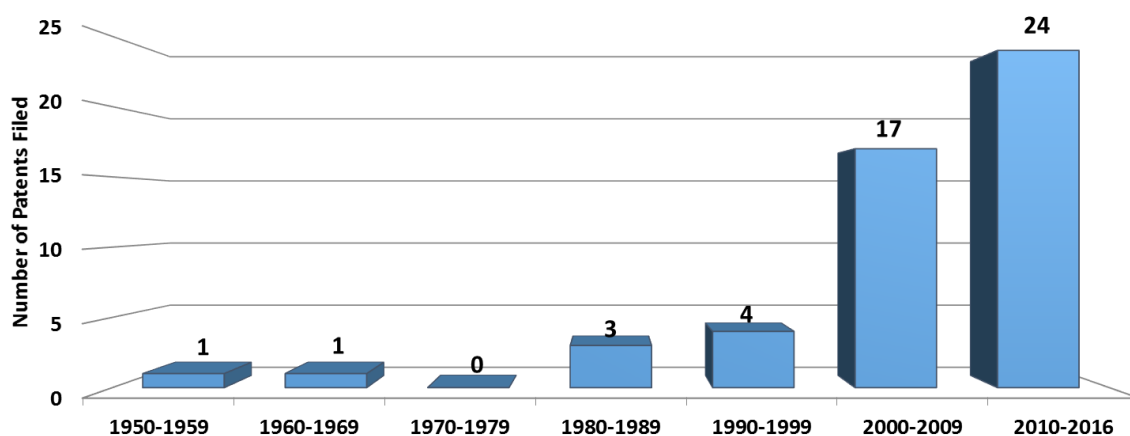


Figure 2. Evolution of the number of filed patents per decade from 1950 to 2016.

Source: Prepared by the authors.

It is worth noting that not all filed patents have been published due to the confidentiality period. There are still filed patents pending to be published corresponding to the last three years of the present decade. However, there is already a high number of filed patents linked to babassu, which shows that products

and/or process involving babassu are still an important market niche to be explored by companies with regard to the research and development of new technologies or products. This finding, obtained by means of the technological survey conducted, corroborates the results observed in the ethnobotanical and ethnopharmacological review presented in this paper.

Regarding the origin of the filed patents (Figure 3), the main applicants are Brazil and China, which lead the ranking with a total of 13 filed patents by each country, followed by the USA with 08 filed patents. It has been found that a large part of the filed patents made by Brazil and China is connected with pharmacological and cosmetic products and processes.

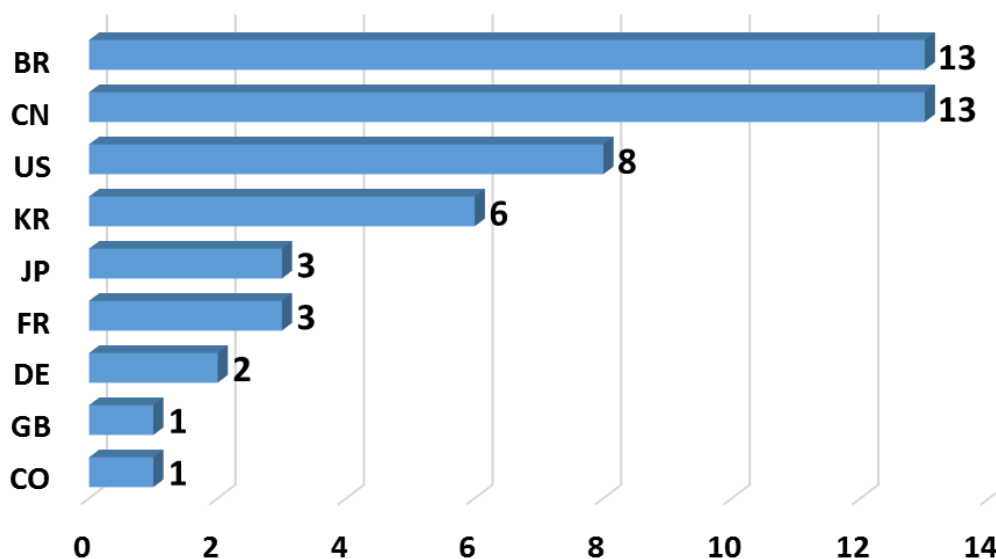


Figure 3. Distribution of the number of filed patents in relation to the countries of origin of the filed.

Subtitle: BR: Brazil; CN: China; CO: Colombia; DE: Germany; FR: France; GB: United Kingdom; JP: Japan; KR: South Korea; US: United States of America.

Source: Prepared by the authors.

In the 50 filed patents analyzed in this research with respect to IPC classifications, the four subclasses that stand out quantitatively (Figure 4) are: A61K (Preparations for Medical, Dental, or Toilet Purposes); A61Q (Specific use of Cosmetics or Similar Toilet Preparations); A61P (Specific Therapeutic Activity of Chemical Compounds or Medicinal Preparations); C11D (Detergent Compositions; Use of Single Substances as Detergents; Soap or Soap-Making; Resin Soaps; Recovery of Glycerol).

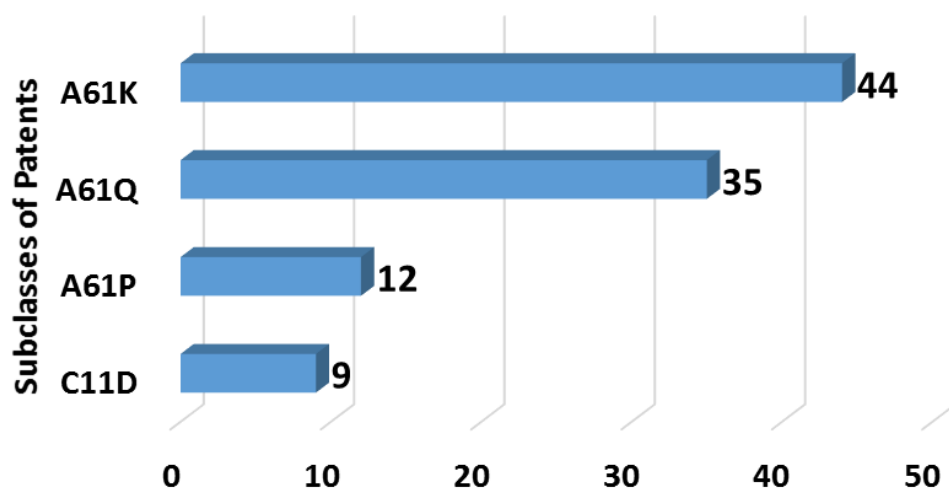


Figure 4. The most frequent IPC subclasses of filed patents.

Source: Prepared by the authors.

The medicinal treatments based on TKA with babassu that have been stood out as main objectives for the protection of Intellectual Property Rights, are linked to the application of by-products in cicatrizant (LATIPAT, EPO and WIPO) and anti-inflammatory (EPO and WIPO) treatments. Product records in relation to antimicrobial, antiseptic and antidiarrheal effects were also identified in the WIPO database.

In addition to the applications of traditional medicine identified in this study, other patenting processes related to applications of babassu for the treatment of neoplasms (LATIPAT and WIPO), the regulation of immunomodulatory activity (LATIPAT) and the moisturizing effect (LATIPAT).

The importance that biodiversity has assumed as a source of raw material and new solutions for the pharmaceutical industry has been growing constantly during the last decades (ALIER, 2012). According to Calixto (2003), about 40% of the medicines available in 2003 were developed from natural resources. Subsequently, according to Saccaro Júnior (2011), this percentage reached 50% in 2011 and, in the case of anticancer drugs and antibiotics, the percentage reached up to 70%.

As genetic resources for biodiversity, TKA has also been consolidated as an important source of information applied by research centers and pharmaceutical and biotechnological industries in drug development (ALIER, 2012). According to Santilli (2005), TKA has a particular importance for the biotechnological, pharmaceutical, chemical and agricultural industries because they present useful information to identify active principles of biomolecules or functional characteristics of cells and microorganisms, regardless of whether the traditional application coincides or not with industrial application.

However, the relations between IP and TC holding the TKA and those that access and commercialize technological products developed with information from TKA have presented different types of conflicts related to the recognition of the origin of the TKA, with the benefit distributions arising from the commercial activities, with the misappropriation of the Intellectual Property Rights and the preservation and sustainable use of genetic resources (ALIER, 2012).

In this sense, it is considered that the commercial exploitation of babassu genetic resources and its respective TKA should be accompanied by actions that contribute to the three main pillars of the 1992

Biodiversity Convention: biodiversity conservation, sustainable use of natural resources and fair and equitable allocation of benefits arisen from commercial applications with IP and TC that hold the TKA.

According to Pereira and Diegues (2010), the current global environmental scenario, which has been a cause of concern for different segments of society, has led to the emergence of new concepts that have been adopted with the aim of achieving effective protection of natural resources. Therefore, IP and TC and their respective knowledge came to be covered by the ethnoconservation perspective, which associates the conservation of nature with the valuation of TKA.

Thereby, in order to achieve a level of rational, sustainable, fair and equitable exploitation of local genetic resources and TKA, it is considered necessary to anticipate actions that contribute to the preservation of the local, social and cultural contexts in which they transmit and innovate the TKA. Also, it is essential to predict actions that contribute to the preservation and diffusion of traditional practices for a sustainable management of natural resources, as well as preservation, diffusion and management actions of TKA related to medicinal, biotechnological and alimentary potentialities.

5. Conclusion

The findings of the ethnobotanical, ethnopharmacological and pharmacological review carried out in this paper, as well as TFTKA with babassu, contribute with positive evidence for medicinal and cosmetic potentialities associated with babassu that are identified in the popular orality of IP and TC in Brazil.

It can be confirmed that TKA with babassu and the actions that relate the medicinal applications of babassu identified in the review conducted in the present study, have been object of interest of the protection of Intellectual Property Rights in different countries.

It has also been found that none of the processes of the protection of Intellectual Property Rights of inventions making use of TKA with babassu, presented by Patent Offices, mention the IP and TC participation in any stage of technological development, and not even in Applicants or Inventors conditions.

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