Appropriation of biodiversity and traditional knowledge: a case study of two rural communities in Rio de Janeiro state, Brazil.

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Brazil is the largest holder of biological diversity in the world and has also a significant number of local communities and indigenous people who hold great knowledge of their habitats. This study aimed to identify the potential of commercial rights appropriation of native Brazilian plants raised in a ethnobotany research in two communities in the mountainous region of the state of Rio de Janeiro by searching patent databases. The monitoring of patent documents allows the search of several kinds of information, including indicators of technological researches of countries. This research was conducted using native plants cited by communities during 2009 and 2010, for its scientific and common names. This search was carried out in the documents of the following offices: European Patent Office, Japan Patent Information Organization, States Patent and Trademark Office, Word Intellectual Property Organization and the Instituto Nacional da Propriedade Industrial. It was found that the number of patent applications involving Brazilian plants is great. It is necessary to establish biodiversity management plans to ensure national sovereignty in terms of access to genetic resources. Furthermore, conservation programs of flora and endangered species should be prioritised.

K*eywords: Intellectual Property, Traditional Communities, Ethnobotany*

Apropriação da Biodiversidade e dos Conhecimentos Tradicionais: um estudo de caso de duas comunidades rurais no estado do Rio de Janeiro, Brasil.

O Brasil é o maior detentor de diversidade biológica do mundo e tem também um número significativo de comunidades locais e povos indígenas que possuem grande conhecimento de seus habitats. Este estudo teve como objetivo identificar o potencial de apropriação dos direitos comerciais de plantas nativas brasileiras levantadas em uma pesquisa etnobotânica em duas comunidades da região serrana do estado do Rio de Janeiro, pesquisando as bases de dados de patentes. O monitoramento de documentos de patentes permite a busca de diversos tipos de informação, incluindo indicadores de pesquisas tecnológicas dos países. Esta pesquisa foi realizada utilizando plantas nativas citadas pelas comunidades ao longo de 2009 e 2010, por seus nomes científicos e comuns. Esta pesquisa foi realizada nos documentos dos seguintes escritórios: European Patent Office, Japan Patent Information Organization, States Patent and Trademark Office, Word Intellectual Property Organization and the Instituto Nacional da Propriedade Industrial. Verificou-se que o número de pedidos de patentes envolvendo plantas brasileiras é grande. É necessário estabelecer planos de gestão da biodiversidade para garantir a soberania nacional em termos de acesso aos recursos genéticos. Além disso, devem ser priorizados programas de conservação para flora e espécies ameaçadas.

Palavras-chave: Propriedade Intelectual, Comunidades Tradicionais, Etnobotânica

1. INTRODUCTION

Brazil is the largest holder of biological diversity in the world and has also a significant number of local communities and indigenous peoples who hold great knowledge of their habitats [1].

Traditional knowledge associated with biodiversity (TKA) have been researched and utilized as a faster way of achieving results for the industry in the development of commercial products. The ethnobotany research is the method that undoubtedly offers the best conditions for success, increasing the possibility of results between 50 and 75%, which, in turn, reduces research costs [2].

Others data show that of 119 medicines derived from plants, 74% were developed through research with drugs used in traditional medicine. However, economic benefits are rarely shared with the communities who provide these information [3]. Many bioprospecting activities are carried out without any control. Currently, freely samples of species and microorganisms are collected in biodiversity rich regions, which are availed in technological and industrial development programs in other countries. Surveys indicate that most of these bioprospecting activities are being conducted in developing countries [4].

In Brazil, since the 1990s, has begun the development of legal framework related to the protection of traditional knowledge and defense of the integrity of all involved in research with humans [5]. Examples of these initiatives has been the development of bioethics, with the creation of the National System of Ethics, the evaluation of the projects by the Ethical Committee in Research and *Medida Provisória* (MP 2.186-16/01) [6]. This MP covers the use of genetic resources derived from areas inhabited by traditional communities, regulating the provisions of such goods, primarily emphasizing the need for prior and informed consent, beyond the legal provision for the payment of royalties and benefit-sharing, including the requirement for access to technology and training of local human. It creates the *Conselho de Gestão do Patrimônio Genético* (CGEN), which aims to coordinate the implementation of public policies for the management of genetic resources and TKA. Also competes CGEN the establishment of guidelines to establish contracts of the use of genetic resources and sharing of benefits in the name of the Brazilian state. In parallel, actions to curb the practice of biopiracy became more systematic with the support and partnership of the Federal Police and *Instituto Nacional do Meio Ambiente e dos Recusos Nacionais Renonáveis* (IBAMA) [7]. National governments need to establish actions to ensure the communities more control over their lands and resources as well as create legal instruments that protect the intellectual and cultural property. The absence of such protection to TKA has generated the most diverse forms of misappropriation.

This misappropriation, often exacerbated by patent filings, has occurred throughout the history of Brazil. Among the examples are the use of pau-brasil (*Caesalpinia echinata* Lam.) wood as colorants in Europe in the sixteenth century; the traffic of seedlings rubber for Malaysia, which led to economic ruin of this culture in the north of Brazil, and the use of jararaca snake (*Bothrops*) venom as a base for one of antihypertensive drugs most traded in the world, with annual sales of 500 million dollars. In addition, there is a request for patents for biodiversity elements traditionally used by indigenous and local communities as curare, ayahuasca, Kambô, quinine and others [8].

Patents are part of intellectual property, and its object is the creation of the human mind. It seeks to publish ideas, inventions and creations to make them available to third parties that, subsequently, enhance them, contributing for technical development and artistic inspiration. In addition, patents create the economic incentive for people who are involved in creative efforts, so that these creators can earn financial returns arising from this employment [9].

Brazil recognizes that TKA is part of Brazilian cultural patrimony and, not only they ascertain rights to local communities, such as preventing unauthorized parties to use, distribute, or exploit such knowledge; but also they allow these communities to receive benefits for their economic exploitation. Furthermore, TKA has indicated the origin of access to traditional knowledge in all publications, uses, disclosures and holdings. One of the greatest current challenges is to ensure local communities the full exercise of those rights.

This study aimed to identify the potential of commercial rights appropriation of native Brazilian plants raised in a ethnobotany research in two communities in the mountainous region of the state of Rio de Janeiro by searching patent databases.

2. METHODOLOGY

2.1 Etnobotany Research

The ethnobotany research was developed in Rio de Janeiro state, Nova Friburgo city (22°16'55 "S 42°31'51" W), within two communities, Rio Bonito and Galdinópolis. This is an rich area in remnants of Atlantic Forest, where two protected areas are located, the Parque Estadual dos Três Picos (PE) and Área de Proteção Ambiental (APA) de Macaé de Cima [10].

The two communities are rural villages with physical traits of Swiss and German ascendance, and their residents are mostly of local origin, dependent on their agricultural production. Their relative isolation from other urban areas, mainly due to transport difficulties worsened by limited hours of public buses, favored the maintenance of local knowledge.

Fieldwork was conducted between August 2006 and December 2009. For the selection of informants, contacts were made with the locals who have demonstrated knowledge about the uses of plants. These informants then indicated other informants, characterizing the "snowball" technique [11]. Interviews were done with 18 selected informants, including 9 men and 9 women, the age range is between 38 - 90 years. The cited plants were collected, pressed, herborized [12] and deposited in the National Museum Herbarium (R). For the identification of the collected material, a stereoscopic microscope was used and analytical keys and specialized taxonomic literature were consulted. The classification system adopted was APG III [13].

2.2 Identification of potential for commercial rights appropriation on plants raised during the interviews in Galdinópolis and Rio Bonito.

The monitoring of patent documents allows searching various kinds of information as indicators of technological researches of countries and corporations and appropriation of commercial products from the Brazilian biodiversity.

2.3 The search for the filing documents of patents applications

Was carried out during 2009 and 2010, using native plants (scientific and common names) cited by communities. This search was conducted in the documents of the following offices:
1) European Patent Office (EPO)
Available at: http://ep.espacenet.com/quickSearch?locale=en_EP
2) Japan Patent Information Organization (JAPIO)
Available at: http://www19.ipdl.inpit.go.jp/PA1/cgi-bin/PA1INDEXUnited
3) States Patente and Trademark Office (USPTO)
Available at: http://patft.uspto.gov/netahtml/PTO/search-bool.html
4) Word Intellectual Property Organization (WIPO)
Available at: http://ep.espacenet.com/quickSearch?locale=en_EP
5) Instituto Nacional da Propriedade Industrial (INPI)
Available at: http://www.inpi.gov.br/menu-esquerdo/patente/copy_of_index_html

The following fields were identified in the retrieved documents in order to identify the appropriation of commercial rights involving plants from Brazilian biodiversity: Use; Holders; Request Number and deposit date.

After a complete survey, the titles inserted in "Use" were transformed into categories such as: Medical, Food, Cosmetics, among others. This procedure was done to standardize the information and facilitate analyses.

All species with associated patents were investigated in two lists: The official flora species endangered list [14] e The IUCN Red list of threatened species [15].

This search was designed to discover which threatened plants are being commercialized.

3. RESULTS AND DISCUSSION

The research with native plants, 239 in total, conducted in five offices, 111 plants showed related deposit request [16]. 4.710 patent documents were surveyed until January 2011 [16].

Of the investigated offices, the USPTO (USA) holds the largest number (45%) of filing patent applications with Brazilian biodiversity, followed by the European Office (EP) (33%), Office of Japan, JAPIO (12%), Office of Brazil (INPI) (6%), the International Office and WIPO (4%) (Figure 1).

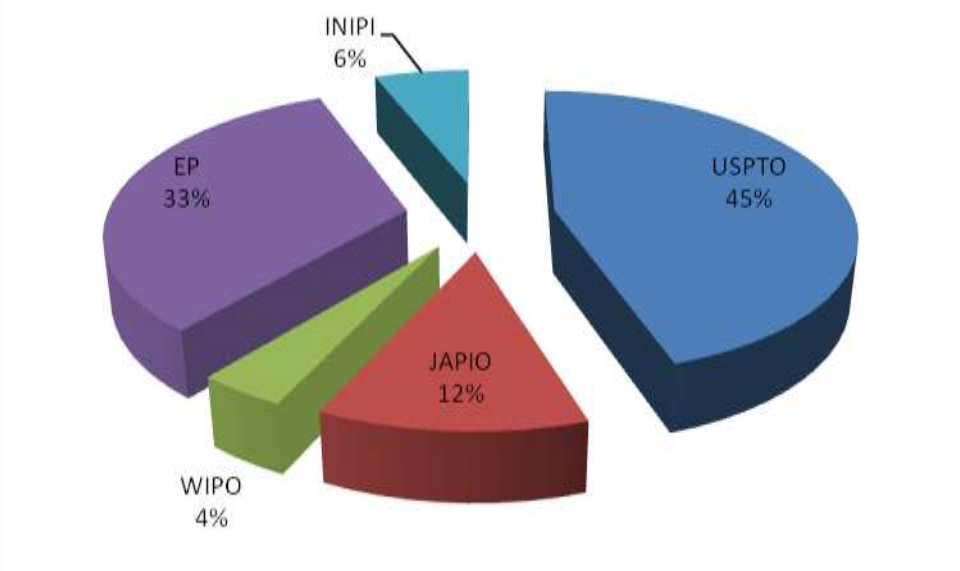

Figure 1: Researched offices and respective numbers of patent applications.

In 2002, when investigating Brazilian plants, Fernandes found that the Japanese office was the first in number of deposits (592), followed by the USPTO (254), WIPO (4) and EP (36). 1924 holders were found among companies, institutions or individuals [16]. Shiseido and Lion Companies (both Japanese) also appear as major holders in the work of Fernandes [17].

The five largest holders and the plants that they have related patents can be seen in Table 1. Pioneer Inc. appears as the largest holder with 6.6%. The second largest holder (1.9%) is Lion Corporation. The American multinational Du pont, came in third place as one of the largest holders with 1.7%. Fourthly (1.6%) was Shiseido Company, Ltd. and Monsanto was fifth, with 1.3%.

Table 1: Companies holders and their respective plants patents related.

Common name / Scientific name	Botanical family	Companies holders and patents related
Abacaxi (*Ananas comosus* (L.) Merr.)	Bromeliaceae	Du Pont, Monsanto
Aipim/Mandioca (*Manihot esculenta* Crantz)	Euphorbiaceae	Du Pont, Pioneer Inc.
Arnica (*Solidago microglossa* DC.)	Asteraceae	Shiseido
Bromelia (Bromeliaceae)	Bromeliaceae	Pioneer Inc., Shiseido
Cacheta (*Tabebuia cassinoides* (Lam) DC.	Bignoniaceae	Shiseido
Cashew tree (*Anacardium occidentale* L.)	Aacardiaceae	Du Pont, Pioneer Inc., Shiseido
Yam (*Dioscorea sp.*)	Dioscoreaceae	Du Pont, Monsanto, Pioneer Inc., Shiseido
Carqueja (*Baccharis trimera* (Less.) DC.)	Asteraceae	Shiseido
Cavalinha (*Equisetum hyemale* L.)	Equisetaceae	Shiseido

Cedro batata (*Cedrela fissilis* Vell.)	Meliaceae	Lion Corporation
Hat leather (*Echinodorus grandiflorus* (Cham. & Schltdl.) Micheli)	Alismataceae	Shiseido
Cidreira (*Lippia Alba* (Mill.) N. E. Br.)	Verbenaceae	Lion Corporation
Copaíba (*Copaifera trapezifolia* Hayne.)	Fabaceae	Lion Corporation, Shiseido
Coconut (*Cocos nucifera* L.)	Asteraceae	Du Pont, Monsanto, Pioneer Inc., Shiseido
Eritrina (*Erytrina sp.*)	Fabaceae	Shiseido
Button herb (*Eclipta alba* (L.) Hassk.)	Asteraceae	Du Pont, Shiseido
Lemon herb (*Cymbopogon citratus* (DC) Stapf.)	Poaceae	Lion Corporation
Rat herb (*Palicourea sp.*)	Rubiaceae	Du Pont
Santa Maria herb (*Chenopodium ambrosioides* L.)	Chenopodiaceae	Lion Corporation
São João herb (*Ageratum conyzoides* L.)	Asteraceae	Du Pont, Shiseido
Thick herb (*Elephantopus mollis* Kunt)	Asteraceae	Shiseido
Wonder herb (*Mirabilis jalapa* L.)	Nyctaginaceae	Pioneer Inc.
Moura herb (*Solanum americanum* Mill)	Solanaceae	Du Pont, Shiseido
Breaking stone (*Phyllanthus niruri* L.)	Phyllanthaceae	Lion Corporation, Shiseido
Saracura herb (*Begonia sp.*)	Begoniaceae	Shiseido
Guava (*Psidium guajava* L.)	Myrtaceae	Du Pont, Lion Inc., Pioneer
Guaco (*Mikania laeviagata* Sch. Bip. Ex Baker)	Asteraceae	Shiseido
Ipê (*Tabebuia sp.*)	Bignoiaceae	Lion Corporation, Shiseido
Jacarandá (*Dalbergia sp.*)	Fabaceae	Lion Corporation
Jepicanga (*Smilax sp.*)	Smilacaceae	Du Pont, Lion Inc., Shiseido
Jurubeba (*Solanum paniculatum* L.)	Solanaceae	Lion Corporation, Shiseido
Macela / Marcela (*Achyroline satureioides* (Lam.) DC.)	Asteraceae	Lion Corporation, Shiseido
Mal me quer (*Lantana camara* L.)	Verbenaceae	Du Pont, Lion Inc.
Papaya (*Carica papaya* L.)	Caricaceae	Du Pont, Lion Inc., Pioneer
Passion fruit (*Passiflora edulis* Sims)	Passifloraceae	Monsanto
Mijolo (*Piptadenia gonoacantha* (Mart.) Macbr.)	Fabaceae	Shiseido
Pau brasil (*Caesalpinia echinata* Lam.)	Fabaceae	Shiseido
Picão (*Bidens pilosa* L.)	Asteraceae	Du Pont, Lion Inc., Monsanto
Pepper (*Capsicum sp.*)	Solanaceae	Lion Corporation, Pioneer, Shiseido
Fern (*Pteridium aquilinum* (L.) Kuhn)	Pteridaceae	Monsanto
Serralha (*Erechtites hieracifolia* (L.) Raf ex. DC.)	Asteraceae	Du Pont
Sete Sangrias (*Mikania smilacina* DC.)	Asteraceae	Du Pont, Shiseido
Taboa (*Typha domingensis* Pers.)	Thyphaceae	Du Pont
Urucum (*Bixa orellana L.*)	Bixaceae	Shiseido
Sweeper bush (*Sida rhombifolia* L.)	Malvaceae	Du Pont

Regarding the 253 documents retrieved by INPI, 35 belong to foreign holders [16]. From these, two are Research and Development institutions (R&D), the Institute of Ecology (Mexico) and the University of Southampton (UK) together with the Reckitt Benckiser Limited company.

13 R&D Brazilian institutions holders appeared in the search [16]. Of these, the Universidade Estadual de Campinas (UNICAMP) has four patents, the Universidade de São Paulo (USP) has three and the Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP), two. The search showed that two patents were shared between Brazilian institutions R & D: União Brasiliense de Educação e Cultura with the Associação Civil Confessional of Universidade Católica de Brasília and Brazilian Agricultural Research Corporation, and the Universidade Federal de Minas Gerais with the Centre for Development Nuclear Technology. Only one patent was found of which its holders are an R & D institution and a company, in this case the National Institute of Technology and Portobello Resort Ltda.

Fernandes [17] found 111 deposits in INPI until the year 2002 and foreign firms were also the largest holders.

The predominance of commercial property rights is greater in the technological area (31.6%) followed by medicinal area (28.7%) (Figure 2), in contrast to that found in Fernandes [17] and Boscolo *et al*. [18]. In the first study, the cosmetics category was more patented and the second showed that the category that most stood out was medicinal.

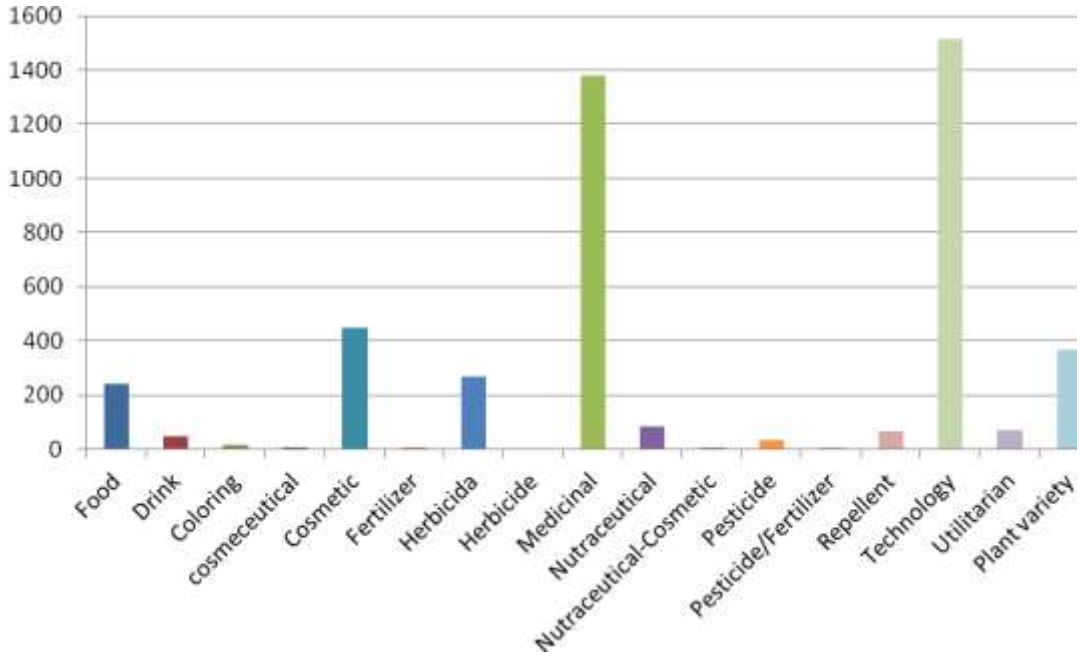

Figure 2: Number of patent documents by type of use.

The nutraceuticals area has grown significantly in the past five years. Japan and the United States are the largest holders of patents related to nutraceuticals (30 and 26 respectively) [16], whereas Brazil has only eleven, with only two of them being companies: Chemyunion Química Ltda. and Saúde Laboratories Ltda. The Universidade Federal University do Pará appears with one patent. This difference in the number of detention between the USA, Japan and Brazil may be due to the fact that in the Northern Hemisphere, countries using food with nutraceutical or functional properties come from a very remote past, and for this reason, scientific research in this area is very advanced.

In Japan, for example, the use of nutraceuticals is a widespread millenary culture and there are relevant standards for the registration and commercialization of foods for specific health use [19]. The nutraceutical field is very recent in Brazil and there are still many gaps in the chemical study of various nutraceuticals, especially targeting the Brazilian reality (food habits, farming conditions and others).

Although only seven documents related to cosmeceuticals have been found, this is the fastest growing segment of the personal care industry.

The ten plants with more related patents are in Table 2. The pepper (*Capsicum*) had the highest number of patent applications (523). This may be due to the fact that this genus is widespread around the world and, consequently, many related works in various areas of science has been done with this plant. The offices that most protect this plant are the USPTO with 214 patents, followed by JAPIO (156), WIPO (52) EP (20), and INPI (16). Arnica (*Solidago microglossa*) ranks second with 311 patents. These patents are filed in the office: WIPO (18 patents), INPI (12) and EP (9). The jepicanga (*Smilax*) was third (220), and USPTO, JAPIO and INPI are the offices that protect it with 79, 24 and one patent respectively. Plants such as Saracura herb and bromelias appeared between species more deposited because they have many varieties developed.

Table 2: More patented plants and their patented uses

	Pepper	**Arnica**	**Jepicanga**	**Saracura herb**	**Yam**	**Papaya**	**Coconut**	**Cassva**	**Jacarandá**	**Guava**
Technology	145	32	30	40	99	105	89	130	42	86
Medicinal	124	195	138	15	48	34	49	11	123	35
Cosmetic	58	77	16	3	17	14	16	0	6	10
Food	113	2	22	2	24	14	4	23	1	14
Plant variety	19	0	0	142	1	3	0	0	0	0
Herbicide	3	0	3	0	0	2	7	9	0	3
Utilitarian	22	4	4	5	4	1	3	2	0	0
Repellent	19	0	1	2	0	3	6	1	0	6
Drink	9	1	5	0	0	2	0	0	0	5
Pesticide	9	0	0	1	1	5	1	2	0	1
Coloring	2	0	1	0	1	0	1	0	0	0
Fertilizer	0	0	0	0	1	0	0	1	0	0
Total	**523**	**311**	**220**	**210**	**196**	**183**	**179**	**176**	**172**	**160**

Even with patents dating back to 1889 and some of the early twentieth century, the number of filing of patent applications has dramatically increased from only mid 1990s. This trend seems to follow a pattern: technology and medicinal appear as the largest deposits, followed by plant variety, food and cosmetics, with almost the same proportion [16].

Fernandes [17] commented that in the face of no patent protection in the area of drug in force in Brazil until 1996, the occurrence of patent applications was not significant. The New Industrial Property Law [20] granted patent for pharmaceutical products and processes, which has made the Brazilian market attractive for international companies, increasing the number of deposits in the pharmaceutical field. Patenting in the phytotherapic industry has displayed a characteristic behavior signaling the growing interest of companies that develop technology and protect their products through patents. This growth can also indicate interest in the marketing of phytotherapic products in Brazil. The countries that most deposit patent can be seen in Figure 3. The United States is arguably the most depositors in the own offices as well as in others, with 42.7%. Japan, which ranks second, deposited less than half the United States, i.e. 20%. The Brazil ranks fifth with 5%.

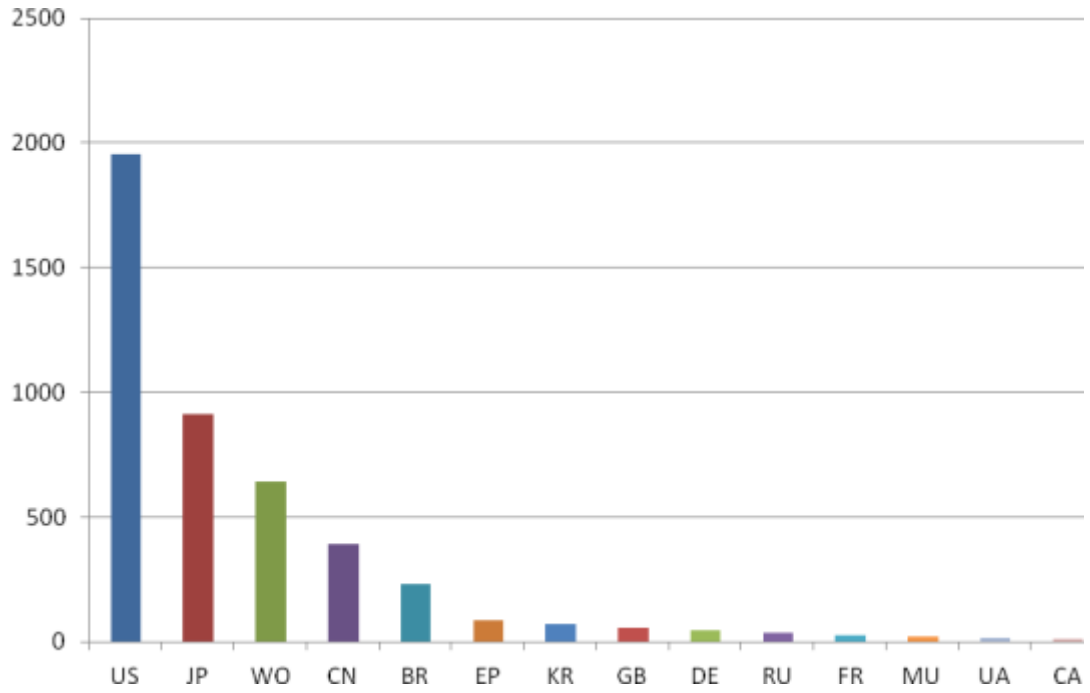

Figure 3: Countries that more deposit patents. (Countries: BR-Brazil, CA-Canada, CN-China, DE-Germany, EP- European Office, FR-France, GB-Great Britain, JP-Japan, KR-South Korea; MU-Mauritius, RU-Russia; UA-Ukraine, US-United States, WO-WIPO).

There are two native species that are patented in the official flora species endangered list [14]: *Araucaria angustifolia* Category: Vulnerable and *Caesalpina echinata* Category: in danger. And eight were found at The IUCN Red list of threatened species [15]: *Araucaria angustifolia*: Critically Endangered; *Caesalpinia echinata*: Endangered; *Cedrela fissilis*: Endangered; *Cedrela odorata*: Vulnerable; *Couratari pyramidata*: Endangered; *Myrocarpus frondosus*: Insufficient data; *Syagrus botryophora*: Low Risk; *Terminalia januariensis*: Vulnerable.

4. CONCLUSION

At the same time that the creation of mechanisms that make possible the commercialization of TKA are stimulated, there is a strong cultural pressure for this same knowledge not to be brought in the market. The management of local knowledge is extremely important both economically and utilitarian, not only due to the possibility of generating new knowledge and new drugs to society, but also as a source in providing means of subsistence for local people.

It was found that the number of patent applications involving Brazilian plants increased considerably and that foreign companies are using these plant species. Again, it must be emphasized the urgency of establishing biodiversity management plans to ensure national sovereignty in terms of access to genetic resources. It is also necessary to promote the creation and strengthening of technology-based companies that link universities, research institutes, local populations and their knowledge. In addition, it is essential to structure a database that combines data from Brazilian plants, deposits patent application data and local knowledge. This should be done without forgetting prioritization of conservation programs of flora and endangered species.

In parallel to the creation and improvement of laws about access to genetic resources that aim the protection and access to TKA, it is crucial that countries like Brazil (which has the largest biodiversity, hold a significant scientific development in the field of natural products, some industries trained to do R & D and market potential consumer) properly utilize the intellectual property system to protect natives inventions, turning them into profitable innovations that add value to products from its biodiversity.

There is an urgency to protect local knowledge which has been threatened by the accelerated process of urbanization and abandonment of rural areas by local communities; the extension of the use of manufactured products, making those produced locally become relegated to background and the oral nature of such knowledge, which means that they tend to be lost in time and memory.

Finally, the best way to access regulation of the TKA would be to conciliate the protection of these TKA with strict compliance of the rules of intellectual property and international agreements, denying access to these products when this is contrary to the national interest and providing the fair and equitable sharing of benefits arising from the commercial use.

1 Filho AGB, Sparemberger RFL. Os direitos das populações tradicionais na ordem constitucional brasileira e sua relação com o acesso aos recursos genéticos. Dir deb. 2008; 29:3-34.

2 Bastos Jr LMP. A convenção sobe diversidade biológica e os instrumentos e controle das atividades ilegais de bioprospecção. Rev Dir Amb. 2001; 23:207-208.

3 MMA. Ministério do Meio Ambiente [Internet]. 2013 [cited 2013 Aug 11]. Disponível em: http://www.mma.gov.br/index.php?ido=conteudo.monta&idEstrutura=85&idConteudo=4403

4 Bessa AP. Diversidade biológica e conhecimento tradicional associado. Rio de Janeiro: Ed Lúmen Júris; 2002.

5 Goldim JR, Pithan CA, Fonte OJ, Ghisleni R, Mocelin OM. Processo de consentimento livre e esclarecido em pesquisa: uma nova abordagem. Revi. Assoc. Med. Bras. 2003; 49(4):1-54.

6 Platiau AFB, Varella MD. Diversidade biológica e conhecimentos tradicionais. Belo Horizonte: Del Rey; 2004.

7 Garay I, Becker B. Dimensões Humanas da Biodiversidade: o desafio de novas relações sociedade-natureza no século XXI. Petrópolis: Editora Vozes; 2005.

8 Lima ACS, Hoffman MB. Além da Tutela: biodiversidade e conhecimentos tradicionais associados. Rio de Janeiro: LACED; 2002.

9 ASEAN- Association of Southeast Asian Nations. The TRIPs agreement and pharmaceuticals: report of an ASEAN Workshop on the TRIPs agreement and its impact on pharmaceuticals. In: ASEAN Workshop; Jakarta: Indonesia; p. 81.

10 Prefeitura de Nova Friburgo/RJ [Internet]. 2012 [cited 2012 Jan 26]. Disponível em: www.pmnf.rj.gov.br.

11 Bailey K. Methods of social research. New York: The Free Press; 1994.

12 Mori AS, Silva LA, Coradin L. Manual de manejo do Herbário Fanerógamo. Ilhéus: Centro de Pesquisas do Cacau; 1989.

13 APG III. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Botl J Lin Soc. 2009; 161:105-121.

14 IBAMA. Lista oficial da flora brasileira ameaçada de extinção [Internet]. 2013 [cited 2013 Jul 3]. Disponível em: http://www.ibama.gov.br/flora/extincao.htm.

15 IUCN. The IUCN Red list of threatened species [Internet]. 2013 [cited 2013 Aug 10]. Disponível em: http://www.iucnredlist.org/apps/redlist/search.

16 Boscolo OH. Estudos etnobotânicos em área de Mata Atlântica, nas Comunidades de Galdinópolis e Rio Bonito, Nova Friburgo, Rio de Janeiro, Brasil [PhD thesis]. Rio de Janeiro: Universidade Federal do Rio de Janeiro; 2011. Portuguese.

17 Fernandes LRRMV. A gestão do conhecimento aplicada à biodiversidade com foco em plantas medicinais brasileiras [PhD thesis]. Rio de Janeiro (Brasil): Universidade Federal do Rio de Janeiro; 2002. Portuguese.

18 Boscolo OH, Fernandes LRRMV, Senna-Valle L. An ethnobotanical survey as subsidy for the generation of researches related to biotechnology. Int Res J Biotech. 2010; 1(1):01-06.

19 Buttriss J. Is Britain ready for FOSHU? Nutr Bull. 2000; 25: 159-161.

20 Brazil. Law # 9.279. Regulates the rights and obligations relating to industrial property. [Internet]. 1996 [cited 2013 May 23]. Disponível em: http://www.planalto.gov.br/ccivil_03/Leis/L9279.htm.