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MEDICINAL PLANTS IN RURAL SETTLEMENTS OF A PROTECTED AREA IN THE LITTORAL OF NORTHEAST BRAZIL

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Introduction

The ongoing human expansion and the resulting urbanization of ecologically important areas result in increased changes on the life styles of local communities, such as fishermen and farmers which, to a certain extent, were isolated and preserved old traditions (GANDOLFO; HANAZAKI, 2011). Ethnobiological studies provide a central means to recover and document local practices, given that their ecological knowledge, build up from field activities and direct contact with natural elements, is being replaced by new technologies which threaten traditions within this 'new environment' (GANDOLFO; HANAZAKI, 2011). As a result, human knowledge and perception of the natural world are documented via ethnobiological approaches (BORGES; PEIXOTO, 2009).

Scientific investigations seeking knowledge based on the use and application of plants, a field known as ethnobotany, specifically evaluates the interaction, use and handling of plants by different human populations and their overall perception of natural resources (GUARIM NETO, 2000).

In the Conservation Units where human presence and influence are permitted, this traditional knowledge may be useful to environmental planning, species preservation and sustainable development. Traditional knowledge is, therefore, a powerful tool to plan and preserve these areas, complementing scientific knowledge by providing practical experiences based on ecosystem perception and, thus, aiding to the comprehension of environmental changes (BORGES; PEIXOTO, 2009).

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Despite being amongst the most prominent biodiversity hotspots in the world (MYERS *et al*., 2000) and having lost a great share of its original forest cover due to human impacts, the Atlantic Forest is home to several human communities which, in their own particular ways, exploit the natural resources for survival. Several studies were conducted in this biome aiming to understand the use of medicinal plants, and to systematize local knowledge on the use of phytoterapic compounds (BEGOSSI; HANAZAKI; TAMASHIRO, 2002; PINTO; AMOROZO; FURLAN, 2006). Rural communities have also received attention from ethnobotanical surveys (AMOROZO, 2004; CUNHA; BORTOLOTTO, 2011; SILVA; ANDRADE, 2005), and are characterized by the summed knowledge of farmers from several areas sharing different practices.

Rural settlements spread throughout the country as new social spaces. Ethnobotanical studies within these communities allow the evaluation of how the residents assemble the knowledge brought from their local of origin with knowledge acquired in the local where they are settled now. Therefore, to adapt to the new local, residents must be able to distinguish the new species which are useful for their needs (CUNHA; BORTOLOTTO, 2011).

The southern coast of Paraíba has several rural settlements and some of them are located within a State Conservation Unit, the Tambaba Environmental Protected Area, which is a remnant of Atlantic Forest spread throughout three cities. Agriculture is the major source of income and the activity mostly responsible for the reduced forest cover in this protected area. Five of these settlements occupy two cities (Conde and Pitimbu) and are dependent upon family farming and livestock cultivation.

This study aimed to investigate the traditional ethnoecological knowledge regarding the use of medicinal plants by residents of five settlements located in the Tambaba Environmental Protected Area, Paraíba. Specifically, we aimed to survey the species with putative medicinal potential and determine the range of diseases they treat, based on local knowledge; identify the species diversity with medicinal purposes in each settlements; evaluate the similarity of the knowledge among the communities; determine the use value of each species; estimate the informant consensus factor based on the most cited corporal systems, and evaluate how knowledge is transmitted within each community.

Materials and Methods

Study area

Settlements visited in the present study are located in the Tambaba Environmental Protected Area (EPA), a Sustainable Use Conservation Unit created in 2012 (area of 11,500 ha) and comprising three cities: Conde, Pitimbu and Alhandra. The weather is As' (tropical/megathermal, sensu Köppen) and forest cover is located on the coastal plain geomorphological unit (i.e. Tabuleiros Costeiros), composed by a mosaic of forests and grasslands (PEDROSA, 2006).

Within the communities, each family legally settled by the INCRA (National Institute of Colonization and Land Reform) was granted a house and a land lot of ap-

proximately 5 ha. The settlements are comprised of a central agro-village with a school, the administrative office of the association, commercial establishments, churches and the local cooperative administrative center, and are managed by a local association comprised by a board of directors. The parcels, or lots, are used for agropecuary activities of a family economy regime.

The Pitimbu town includes the Nova Vida and APASA settlements. The Nova Vida settlement was established in 1993, and currently includes 135 families. The APASA settlement occupies a 1,110 ha area, and was established in 1995 on the former APASA Farm location, includes 150 settled families and approximately 56 other families living in agro-villages.

The other three studied settlements are located within Conde city. The Dona Antônia settlement was established in 1996 and currently includes 110 families occupying an area of approximately 1,200 ha. The Frei Anastácio settlement was established in 1999, with 21 families living within a 220 ha area. Finally, the Tambaba settlement was established in 1989, is the smallest of the studied settlements and currently includes 18 families settled within a 90 ha.

Data collection

Data were collected between July 2012 and May 2013. First, the communities were visited to present and divulge the project to the inhabitants, and obtain their acceptance to conduct the research. Therefore, all the participants signed a Free and Clarified Consent Term, as requested by the research ethics committees of the Conselho Nacional de Saúde (National Health Council) and following what is established by its resolution (Resolução 196/96). The present study was approved by the Human Research Ethics Community (HREC) of the Centro de Ciências da Saúde (Health Sciences Center) of the Universidade Federal da Paraíba, and is registered under the CAAE (Certtificate Presentation and Ethics Assessment) protocol number 03611812.6.0000.5188.

Semi structured interviews were conducted with 59 key-informants (43 females; 16 males), separated as follows: Dona Antônia (13), Nova Vida (20), APASA (12), Frei Anastácio (06) and Tambaba (08). The snowball procedure was used to select all the informants (BERNARD, 1995). During the interviews, we inquired about the socioeconomic profile of the inhabitants and their knowledge regarding which local species are used for medicinal purposes and, specifically, for what diseases. Interviews were conducted with the informant alone, as a means to avoid the answers being influenced or altered.

Regarding the botanical aspect, growth habits (herbs, shrubs, arboreous and lianas) and used parts (whole plant, root, stem, latex, leaf, flower, fruit and seed) were considered. The botanical material cited by the participants was collected during or after the interviews by employing the "guided-tour" technique (ALBUQUERQUE; LUCENA; ALENCAR, 2010). The collected samples were herborized and deposited at the Lauro Pires Xavier Herbarium – JPB (Universidade Federal da Paraíba – UFPB). Plants were identified by comparing the collected material with deposited samples and by consulting appropriate literature and taxonomy experts. Orthography of scientific names was verified

by consulting the The International Plant Names Index. Habits of species were classified following the List of Plant Species from Brazil.

Data analysis

Qualitative and quantitative procedures were conducted from the data obtained. The diseases cited were grouped into categories following the ICD-10 International Statistical Classification of Diseases and Related Health Problems (OMS, 2008).

For each of the cited species a Use Value index (UV) was estimated, where the importance of a species is given by the number of uses attributed to it Rossato *et al.* (1999), and following $UV = \sum U_{is}/n_{is}$, where, UV: use value of species *s* by informant *i*, U_{is}: number of uses of the species mentioned by informant *i*, and n_i: number of events in which informant *i* cited species *s*.

To determine which corporal systems had the highest local importance, the Informant Consensus Factor (ICF) was estimated. The maximum value for the ICF is 1, suggesting a complete consensus among informants regarding a specific category of medicinal plants. The ICF follows ICF = Nur-Nt/Nur-1, where, ICF: Informant Consensus Factor, Nur: sum of uses recorded for each informant for a given category and Nt: number of species indicated for each category.

To determine the diversity of ethnobotanical knowledge, diversity of the five communities was estimated based on the Shannon-Wiener index, where higher H' values correspond to higher diversity of local medicinal flora diversity. The ANOSIM-oneway permutation test, using the Bray-Curtis distance with 9,999 permutations, was used to evaluate differences in species cited among the communities. This test results in a R value that varies from -1 to +1 and can indicate four conditions: a lack of significant difference among groups ($R < 0.25$), some degree of difference and data overlap ($0.25 < R < 0.5$), obvious distinction among groups ($R > 0.75$) or complete distinction ($R = 1$). The Similarity Percentage analysis (SIMPER) determined the percent contribution of species within and among the employed corporal systems. Software used to carry out the analyses was Past 2.17.

Results and Discussion

Traditional knowledge of medicinal plants

Age of the interviewees varied between 28 and 83 years. Most (51%) were retired, but several continue to work as farmers to complement their monthly incomes. The majority of the interviewees (70%) receive a minimum wage. Only one of the visited houses was not made of concrete and all the others had between five and seven rooms, a bathroom, rudimentary sewage system, access to potable water, an electric network and garbage collection. Catholicism is the predominant (72%) religion among the interviewees, Protestantism represents 27% and 5,1% did not declare a religion.

The interviews revealed that 71 local species from 63 genera and 44 families of

plants are used for medicinal purposes (Table 1). Number of species varied among settlements, with 53 species recorded at Nova Vida, 44 at APASA, 48 at Dona Antônia, 47 at Frei Anastácio and 25 at Tambaba. The family Leguminosae (9 species) was the most cited, followed by Lamiaceae (8 species) and Myrtaceae, Apocynaceae, Rubiaceae, Annacardeaceae e Amaranthaceae (3 species each). Previous studies also acknowledged Leguminosae and Lamiaceae as fairly representative families of medicinal plants (e.g. BOTREL *et al.,* 2006; GANDOLFO; HANAZAKI, 2011; GIRALDI; HANAZAKI, 2010; PASA, 2011; PINTO; AMOROZO; FURLAN, 2006). Guarim Neto and Moraes (2003) suggested that species-rich families are most likely to be used for therapeutic purposes at a given moment in human communities exploiting resources from the native flora.

Table 1. List of species and morphospecies, habits and number of citations in the five rural settlements of the Tambaba EPA, southern coast, Paraíba. Abbreviations: Ar: arboreous; Sh: shrubs; He: herbs; Tr: trees.

Family/Species	Common Name	Habit	Number of citations	Voucher
ACANTHACEAE				
Justicia pectoralis Jacq.	Chachambá	He	11	52455
Justicia sp.	Anador	He	9	52464
ADOXACEAE				
Sambucus australis Cham. & Schltdl.	Sabugo	Sh	45	52461
AMARANTHACEAE				
Chenopodium ambrosioides L.	Mastruz	He	77	51083
Gomphrena sp.	Pepeta branca	He	3	53249
ANACARDEACEAE				
Anacardium occidentale L.	Cajú roxo	Ar	25	51082
Mangifera indica L.	Manga espada	Ar	3	51877
Schinus terebinthifolia Raddi	Aroeira	Ar	41	51089
APIACEAE				
Eryngium foetidum L.	Coentro maranhão	He	2	53247
Pimpinella anisum L	Erva doce	He	22	52460
APOCYNACEAE				
Hancornia speciosa Gomes	Mangaba	Ar	14	51093
Nerium oleander L.	Espirradeira	Ar	1	52453
Apocynaceae sp1	Vapor	Ar	1	52468
ARACEAE				
Araceae sp1	Imbé	Tr	1	53232
ASTERACEAE				
Acanthospermum hispidum DC.	Espinho de cigano	He	16	53237
Vernonia condensata Baker	Alcachofra	Sh	10	53245
BORAGINACEAE				
Boraginaceae sp1	Malva ferro	He	1	53246

CAPPARACEAE *Tarenaya spinosa* (Jacq.) Raf.	Muçambê	Sh	4	52467
CHRYSOBALANACEAE *Chrysobalanus icaco* L.	Guajiru	Sh	4	41324
CONVOLVULACEAE *Ipomoea* sp.	Salsa	Tr	1	53239
CRASSULACEAE *Kalanchoe pinnata* (Lam.) Pers.	Saião	He	15	53248
CUCURBITACEAE *Momordica charantia* L.	Melão de são Caetano	Tr	4	42223
CYPERACEAE *Scleria bracteara* Cav.	Tiririca	He	1	53230
EUPHORBIACEAE *Jatropha gossypiifolia* L. *Ricinus* sp.	Pinhão roxo Carrapateira	Sh Sh	3 1	51091 53244
FABACEAE – CAES *Apuleia leiocarpa* (Vogel) J.F.Macbr. *Hymenaea courbaril* L. *Senna occidentalis* (L.) Link *Senna* sp. *Tamarindus indica* L.	Jitaí Jatobá Mangirioba Mata pasto Tamarindo	Ar Ar Sh He Ar	5 15 13 2 2	51880 51876 53235 52235 52462
FABACEAE – FAB *Bowdichia virgiliodes* Kunth *Periandra mediterranea* (Vell.) Taub.	Sucupira Alcançu	Ar He	2 5	52449 51081
FABACEAE – MIM *Abarema cochliacarpos* (Gomes) Barneby & J.W.Grimes *Mimosa*sp.	Babatenon Malícia	Ar He	45 5	51090 42944
IRIDACEAE *Cipura* sp.	Alho do mato	He	1	42928
LAMIACEAE *Aeollanthus suaveolens* Mart. ex Spreng. *Mentha* sp1. *Mentha* sp2. *Ocimum basilicum* L. *Ocimum gratissimum* L. *Plectranthus* sp. *Plectranthus amboinicus* (Lour.) Spreng. *Rosmarinus officinalis* L.	Macassá Hortelã miúdo Vick Manjericão Alfavaca Hortelã de homem Hortelã grande Alecrim	He He He He He He He He	22 62 4 17 11 12 58 32	52459 51086 52469 52458 52459 52458 53242 42941
LECYTHYDACEAE *Eschweilera ovata* (Cambess.) Miers	Embiriba	Ar	4	51094

LYTHRACEAE *Punica granatum* L.	Romã	Ar	51	51087
MALPIGHIACEAE *Malpighia emarginata* DC.	Acerola	Ar	8	42215
MALVACEAE *Gossypium* sp. *Urena lobata* L.	Algodão preto Malva rosa	Ar Sh	1 8	53238 42873
MORACEAE *Morus* sp.	Amora	Sh	2	53243
MYRTACEAE *Eucalyptus globulus* Labill. *Psidium cattleianum* Sabine *Psidium guajava* L.	Eucalipto Araçá Goiaba	Ar Ar Ar	34 3 18	51085 53387 51875
NYCTAGINACEAE *Boerhavia* sp	Pega-pinto	He	9	53236
OLEACEAE *Ximenia americana* L.	Ameixa	Sh	7	53240
OXALIDACEAE *Averrhoa carambola* L	Carambola	Ar	8	51081
PHYLLANTHACEAE *Phyllanthus amarus* Schumach. & Thonn.	Quebra-pedra	He	10	53241
PHYTOLACACEAE *Petiveria alliacea* L.	Tipi	He	5	52465
POACEAE *Cymbopogon citratus* (DC.) Stapf *Imperata brasiliensis* Trin.	Capim santo Sapé	He He	41 2	53233 42955
POLYGALACEAE *Polygala* sp.	Esquentai	He	1	53234
RUBIACEAE *Borreria verticillata* (L.) G.Mey. *Guettarda angélica* Mart. ex Müll. Arg. *Tocoyena formosa (Cham. & Schltdl.)* K. Schum.	Vassoura de botão Angélica Jenipapo bravo	He Sh Ar	13 3 4	42954 41405 51092
RUTACEAE *Ruta graveolens* L.	Arruda	He	22	53385
SAPINDACEAE *Cupania revoluta* Radlk.	Cabatã de rego	Ar	6	41319
SMILACACEAE *Smilax japicanga* Griseb.	Japeganga branca	Ar	3	41305
SOLANACEAE *Solanum paniculatum* L.	Jurubeba	Sh	3	52454
TURNERACEAE *Turnera subulata*	Chanana	He	5	51078

URTICACEAE *Cecropia palmata* Willd.	Embaúba	Ar	4	53390
VERBENACEAE *Lippia alba* (Mill.) N.E.Br.	Cidreira	Sh	35	52452
ZINGIBERACAEA *Alpinia zerumbet* (Pers.) B.L.Burtt &R.M.Sm.	Colônia	Sh	68	51079

In general, the surveyed species were characterized as having predominantly herbaceous habits (41%), followed by arboreous (35%), subshrub (13.2%), shrub (8.4%) and liana (2.4%) habits. Studies conducted in the Atlantic Forest also highlighted the medicinal use of herbaceous plants, mostly due to the use of leaves (PINTO; AMOROZO; FURLAN, 2006; SILVA; ANDRADE, 2005). The widespread use of herbs in traditional ecological knowledge may be a consequence of their easy cultivation in gardens and backyards, as observed in the present study for some of the most cited species (e.g. *Mentha* sp., *Cymbopogon citratus*, *Plectranthus amboinicus* and *Chenopodium ambrosioides*). Amorozo (2002a) suggests that knowledge and use of a species is directly influenced by its availability in the area and the cultivation methods employed, as observed in the present study (Table 1).

All plant parts were cited as important for medicine production, with leaves being the most used part (45.7%), followed by the whole plant (19.2%), barks and latex (8.4% each), roots (7.2%), fruits and seeds (6%) and flowers (4.8%). Preference of leaves for medicinal production is a positive outcome for the conservation of plant resources, given that, when collected moderately, these practices often do not kill or harm the plants and, thus, do not compromise their development and reproduction. This practice is related to the abundance and convenience in the use of leaves, when compared to other plant parts and to the confidence in the efficiency of its application (SANTOS; AMOROZO; MING, 2008).

All the visited houses had gardens and backyards, and all of them cultivated plants for food, ornamentation and medicinal use. Concern and attraction to plants is a central feature of the informers, which cultivate plants in their gardens and backyards, but also use native species found within their properties. Amorozo (2002) highlights the role of backyards for traditional communities, emphasizing that, due to their easy accessibility, residents relocate useful native species, which become promptly and constantly available. Furthermore, seedlings from the farms are also stored at these locals, thus creating a mosaic of different habitats: livestock production, and cultivation of fruit, medicinal and ornamental plants. Backyards are also locals where social bonds are strengthened, since they are barrier-free areas which allow direct interactions amongst the families. One of the residents of the Dona Antônia settlement habitually cultivates medicinal plants on her backyard and shares the seedlings with her neighbors. She dedicates a great deal of time to this practice, for she believes in the healing power of plants and is concerned about providing attention for the under privileged. These are the accomplishments that

introduce new information, thus complementing local knowledge (EYSSARTIER; LADIO; LOZADA, 2008).

Medicinal plants are prepared as simple teas to treat everyday mild diseases, or as compounds such as concentrated bottleful, syrups and 'lambedores' (cough syrups). The most main addmnistration method was oral (87,1%), and external use (12,8%). The most cited preparation form were teas (58%), 'lambedores' (12,4%), natural (8,5%), macerated in alcohol (4,5%), grinded (4,6%) and macerated in water (5.8%). Other modes, including mixed bottlefuls, inhalation bath and juice, accounted for 6,1%. Tea as the most common mode of preparation was also highlighted in studies (AMOROZO, 2002; CARVALHO *et al.,* 2013; CUNHA; BORTOLOTTO, 2011; PINTO; AMOROZO; FURLAN, 2006).

Considering the 1,072 therapeutic indications, 26.5% corresponded to the treatment of miscellaneous illnesses, including inflammation, infection, cicatrization and fever symptoms. Similar observations were made by Silva *et al.* (2009) in a rural community of the Serra do Itajaí. Respiratory disorders (i.e. flu, cough and cold) were the most remarkable corporal system amongst the five settlements, with 24.8% of all citations. This was also acknowledged as the most commonly indicated in other studies (e.g. AMOROZO, 2002; BEGOSSI; HANAZAKI; TAMASHIRO, 2002; CUNHA; BORTOLOTTO, 2011). Furthermore, gastrointestinal disorders (11.1%), undefined illnesses (8.3%), contagious and parasitic diseases (7.2%) and nervous disorders (6.1%) were also important indications (Table 2).

Table 2. Corporal system, therapeutic indications and Informant Consensus Factor for five rural settlements of the Tambaba EPA.

Corporal System (Citations)	Use Form	Diseases	Settlements				
			NV	AP	DA	FA	TB
Disorders of the gastrointestinal system (119)	T, Cs, G, J, M, N, To	gastric reflux, diarrhoea, bad digestion, gastritis, liver diseases, stomach ulcer, nausea, vomiting, gallbladder disease, belch, colic.	0.57	0.68	0.44	0.58	0.25
Other indications (285)	T, N, M, To, Ma, B, Cb, Cs, I, Mw, J	Anti-inflammatory, cicatrizant, fever, sinusitis, nodules, cysts, liver diseases.	0.75	0.69	0.55	0.52	0.6
Disorders of the respiratory system (266)	T, I, Cs, TR, M, Ma, N, J, B,	Fatigue, catarrh, coughsand sore throats, flu, pneumonia, tuberculosis, whooping cough.	0.77	0.92	0.6	0.5	0.74
Pains not defined (89)	T, N, B, M	Paind, earache, toothache, headache, colic.	0.59	0.41	0.5	0.26	0.22
Infectious and parasitic diseases (78)	T, M, B, N, Cs	Measles, intestinal worms, ameba, scabies, chicken pox, mycosis, itching.	0.82	0.72	0.56	0.5	0.66

Disorders of the nervous system (66)	T, M, N, J, To	Calming medicine, cerebrovascular accident, seizures, trombosis, insomnia, epilepsy.	0.65	0.57	0.14	0.55	0.5
Disorders of the circulatory system (49)	T, M, TR, J,	Hypertension, heart diseases, blood circulation problems, bleeding.	0.58	0.69	0.5	0	0
Disorders of the genitourinary system (45)	T, Cb, M, N, To	Urinary infection, kidney stones, menopause, sexually transmitted disease, colic, urinary incontinence, sexual impotence, candidiasis, prostate disease.	0.53	0.12	0.22	0.33	0
Endocrine, nutritional and metabolic diseases (31)	T, M, J, G	Cholesterol, diabetes, high blood glucose levels, weight-loss, jaundice.	0.5	0.28	0	0	0
Diseases of the musculoskeletal system (18)	Ma, N, T, G, Cb, Cs	Joint pain, fracture, arthritis, arthrosis, muscle stretching, muscular spasms, bruising, column pain, Herniated disc.	0.33	0	0.75	0	0.5
Skin Diseases (10)	N, To, T, B,	Furuncle, warts, flesh wounds.	0	0	0.66	0.5	0
Injury, poisoning and certain other consequences of external	T, N, G	Injury, snakebite.	0	0.8	0	0	0

Abbreviations for the method of utilization: CT: tea; Cs: cough syrup; B: bathing; Cb: concentrated bottleful; I: infusion; N: *in natura*; J: juice; M: macerated in water; Ma: macerated in alcohol; Mw: macerated in wine; G: grinded; To: toasted. Settlements: NV = Nova Vida; AP = APASA; DA = Dona Antônia; FA = Frei Anastácio; TB = Tambaba.

Life outside the city and the poor quality of basic health care may justify the higher indication of common, everyday diseases such as fevers, inflammations and wound cicatrizations. Very familiar and commonly used in all settlements is *Abarema cochliacarpus* (babatenom or babatimão) due to its anti-inflammatory, anti-septical and cicatrizing properties (SILVA, N., 2009; SILVA, M., 2010). This species is an endemic tree to the Atlantic Forest and is common on woods surrounding the communities. Aside from indications to treat inflammations and wound cicatrization, this species was also indicated to treat diarrhea, flu and cancer. Participants who cited babatenom use this species in concentrated bottlefuls, by combining barks from this species with two others, *Schinus terebinthifolia* and *Anacardium occidentale* immersed in alcohol or water. After preparation, the red-colored liquid is stored and used to wash-off wounds.

Deficient basic sanitation may also justify the large number of citations for the respiratory and digestive disorders categories, given that none of the evaluated settlements have health clinics or basic sanitation. In fact, the backyards of several of the

residences visited showed exposed raw sewage that stimulates disease proliferation. Lack of access to basic health care may, therefore, be responsible for converting mild diseases into severe conditions, creating a negative feedback and deteriorating the health within these communities.

In 2008, the Sistema Único de Saúde or SUS (Unified Health System; Brazil's public healthcare system) created the Programa Nacional de Plantas Medicinais e Fitoterápicos (National Program of Medicinal Plants and Phytotherapics). The program is an attempt to increase therapeutic alternatives offered to SUS users by implementing, with safety and quality, the use of medicinal plants and phytotherapics, thus promoting and recognizing popular and traditional practices in the use of medicinal species (MINISTÉRIO DA SAÚDE, 2009). Along with the program, the national list of medicinal plants (called Relação Nacional de Plantas Medicinais de Interesse do SUS - Renisus) was published. This Renisus (MINISTÉRIO DA SAÚDE, 2009) lists 71 medicinal species released to be used as phytotherapic medicine by the SUS. In the present study, 16 species from this list were cited by the participants. Ethnobotanical researches may contribute with these implementations by listing recognized and employed medicinal plants from particular areas, thus increasing their potential to be included as alternative treatments in public healthcare systems (GIRALDI; HANAZAKI, 2010).

Knowledge transmission

Traditional ecological knowledge is the set of knowledge and knowhow practices about the natural and supernatural worlds transmitted orally from one generation to another (SILVA, M., 2006). This knowledge is acquired and passed on throughout the lifetime and at various instances. Oral transmission is the basic difference between this type of knowledge and scientific knowledge. Therefore, traditional knowledge is best interpreted when examined under the cultural context in which it was first generated in each community. For the studied communities herein, it was very clear that the understanding of nature is conserved by knowledge transmission among generations and continuously flows amongst locations. Constant contact among farmers on their farm, when visiting relatives and acquaintances, and/or during commerce, leads to knowledge being shared and, consequently, the assimilation of new techniques and species importance.

Knowledge transmission and learning can take place via socialization amongst family members, acquaintances and neighbors. These social interactions improve personal knowledge regarding the use and applications of natural resources (CUNHA; BORTOLOTO, 2011). When asked about how their understanding of the use and application of medicinal species originated, the majority of informants replied that information was received from their own families. Amongst the 59 interviewed members, 53.4% stated that their understanding of medicinal plants derived from their parents or close relatives, describing a horizontal knowledge transmission. Casual conversation amongst family members is an important means of disseminating knowledge and, specifically, information about healthcare, and the use of medicinal plants, therefore contributing to the overall life quality of these families throughout time. This cultural inheritance has gradually declined

in face of the influence of modern culture and the devastation of natural environments.

Some informants (27.6%) stated that, aside from what is inherited from family members, acquaintances and neighbors, knowledge about medicinal plants was a further consequence of specific courses offered by entities acting on the settlements, such as INCRA, EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária; Brazilian Agricultural Research Agency) and SEBRAE (Serviço de Apoio *às* Micro e Pequenas Empresas; Brazilian Support Service for Micro and Small Enterprise), which aim to improve life quality within these communities. A smaller group (19%) learned the use and application of medicinal species from neighbors and acquaintances.

On all settlements studied, it is possible to find men and women who have a sound understanding about the use of local plants, whether cultivated on their gardens and backyards or those which grow spontaneously on surrounding grounds. Cultivating and taking care of plants are passed on early during fieldwork and everyday rural activities (AMOROZO, 2002). In other words, men and women, farmers, housekeepers, midwives and healers gain an increased knowledge about the local flora, given that they spend most of their time in direct contact with these species. These are distinct types of knowledge, nonetheless acknowledging that plants offer an immediate solution to health issues. One such example was found on the APASA settlement, a 74 years old man who learned through his lifetime about the use of medicinal herbs to exclusively treat his livestock, but due to adverse occasions, he became a midwife and implemented his understanding to take care of people from the community.

Considering the occupation period of the settlements (i.e. slightly higher than 10 years) and that several inhabitants came from foreign rural areas, we recognize that, aside from horizontal knowledge transmission, there were several knowledge opportunities via oblique transmission, due to social coexistence, participation in lectures, courses and from other sources of communication from periodic courses offered to the community by public institutions (INCRA, SEBRAE, EMEPA – Empresa Estadual de Pesquisa Agropecuária da Paraíba; Company of Agricultural Research of the State of Paraíba). The composition of a traditional pharmacopeia is a dynamic process and during its construction, both loss and acquisition may take place (AMOROZO, 2002). In this context, detailed ethnobotanical studies emerge to support the understanding of how traditional knowledge is preserved and transformed throughout time.

Use Value Indexes and Informant Consensus Factor

Species identified in the present study showed use values (UV) ranging from 0.05 to 2.5. Most of the recorded species showed somewhat low UV, with only nine species (10.8%) scoring over 1.0 (Table 3), suggesting that species are not used for specific purposes.

Table 3. Species which showed higher Use Values on the studied settlements

Species	Common Name	Use Valor				
		DA	FA	TB	NV	AP
Alpinia zerumbet	Colônia	1,07	1,33	0,87	1,15	1,3
Plectranthus amboinicus	Hortelã grande	0,39	1,0	1,62	1,05	1,0
Menthasp.	Hortelã miúdo	0,54	1,0	0,87	1,25	1,4
Chenopodium ambrosioides	Mastruz	0,9	0,67	2,50	1,3	1,2
Punica granatum	Romã	0,9	1,1	1	0,9	0,5
Eucalyptus globulus	Eucalipto	0,54	1	0,75	0,5	0,41
Cymbopogon citratus	Capim santo	0,54	0,33	1,12	0,95	0,33
Abarema cochliacarpos	Babatenon	0,54	0,83	1	0.85	0,67
Sambucus australis	Sabugo	0,7	0,83	0,25	1	0,75

DA = Dona Antônia; FA = Frei Anastácio; TB = Tambaba; NV = Nova Vida; AP= APASA.

Furthermore, UV differed significantly amongst settlements for species such as the mastruz (*Chenopodium ambrosioides*), which showed a high value in Tambaba (UV=2.5) and a somewhat low value in Frei Anastácio (UV=0.67) and the hortelã grande (*Plectranthus amboinicus*) in Tambaba (UV=1.62) and Dona Antônia (UV=0.39) (Table 3). On the other hand, UV for the colônia (*Alpinia zerumbet*), showed somewhat low fluctuations among communities. This disparity is a direct consequence of the most cited corporal systems within each community and to which the species are linked. The *C. ambrosioides* and the *P. amboinicus* are strongly indicated to treat respiratory disorders, and at the Tambaba settlement, these species together received 30% of the total 110 citations.

Respiratory system disorders is the most cited category at the Frei Anastácio and Tambaba settlements, and the second most at the other settlements. These results are supported by the Informant Consensus Values from the communities for the Respiratory system disorders category (Table 2). This corporal system was, normally, amongst the most common with peak values of 0.92. At the Tambaba settlement, Respiratory system disorders category showed the highest values of ICF (ICF=0.74), which was further supported by the highest number of citations and species for this category. This category also showed high values at the APASA settlement (ICF=0.92).

A low number of plants with high UV was also observed in other studies which recorded less than five species with values higher than 1.0 (ALBUQUERQUE; ANDRADE; SILVA, A., 2005; BORGES; PEIXOTO, 2009; GALEANO, 2000). This supports the idea that each informant bears a unique set of experiences on the roles played by plants to their well-being. As a result, the most cited species at each community are those most familiar to the local inhabitants, but these are not necessarily the most abundant or important species to that particular region, from an ecological point of view (ALBUQUERQUE; ANDRADE, 2002).

From the list of species recognized by the National Program of Medicinal Plants and Phytotherapics, the following species were cited in the present study: *A. zerumbet* (colônia), *A. occidentale* (cajú), *C. ambrosioides* (mastruz), *P. granatum* (romã), *P. guajava* (goiaba), *Phyllanthus* spp. (quebra-pedra), *O. gratissimum* (manjericão), *M. charantia* (melão de São Caetano), *Mentha* spp. (hortelã pequeno), *S. paniculatum* (jurubeba), *E. globulus* (eucalipto), *J. gossypiifolia* (pinhão roxo), *J. pectoralis* (chachambá), *V. condensata* (alcachofra) and *K. pinnata* (saião). Of the former list, we highlight seven species which showed high use values (*A. zerumbet, A. occidentale, C. ambrosioides, P. granatum, O. gratissimum, Mentha sp.* and *E. globulus*).

Although the UV was somewhat low for Myrtaceae, this family is highlighted for its use as tea used to treat diarrhea. *Psidium guajava* and *P. cattleianum* are cited for this purpose in the present study and in other studies conducted on the Brazilian coast (MARTINS *et al.*, 2005; SILVA, M., *et al.*, 2006).

Despite the application of the Use Value index, the results preclude us to make a confident conclusion that local communities are, in fact, impacting plant resources of the Tambaba EPA, given that the Use Value did not distinguish between the potential and the actual utilization. Nonetheless, gathered data suggest that all communities make a substantial use of a high number of native species from the area. Over the years, factors like perception of the surrounding environment, restricted access to healthcare, difficulties experienced during settlement establishment and the particular cultural inheritance contributed to develop the knowledge of inhabitants. This allowed the inhabitants to incorporate new information and techniques on the use of local medicinal species, therefore, improving use of species in these areas. Some of the categories showed somewhat similar consensus values (Table 2) as well as species with common or similar UV, suggesting a high consensus on the answers given by the informants. Therefore, these species, traditionally more important to the communities, deserve further scientific attention from a pharmacological point of view.

The species *P. amboinicus, Mentha* sp. and *C. ambrosioides* were strongly familiar and used at the Nova Vida and APASA settlements. These three species are particularly important to treat symptoms and diseases on the respiratory system disorder category, which was the category that received more indications and with higher Informant Consensus Factor value at the APASA settlement (ICF=0.82) and the second most at Nova Vida (ICF=0.82). These two settlements are located in the same town, the closest to each other in the study area. This proximity should be the feature which mostly contributed to the sharing of local knowledge among these communities.

Diversity and Similarity

All settlements showed high diversity and equitability values (Table 5), particularly at Nova Vida (H'=4.31; J'=0.89) and Dona Antônia (H'=4.21; J'=0.93). Values observed in the other settlements were: APASA (H'=4.04; J'=0.91), Frei Anastácio (H'=4.00; J'=0.94) and Tambaba (H'=3.21; J'=0.87). High diversity values suggest that a great fraction of the local diversity is explored by the population. Therefore, it is expected that an increase in local

floristic diversity further increases the number of species used (BEGOSSI, 1996; BOTREL *et al.,* 2006). In this case, proximity among settlements creates a high overlap of species used among communities and, thus, the only factors responsible for the observed variations seem to be community size and the intrinsic knowledge of the inhabitants. These results also reflect three particular features: the broad availability of resources in the area, familiarity and the ability of inhabitants to identify and use these resources, and ease of cultivation.

This result illustrates the extent to which informants at the Nova Vida settlement contributed to the majority of citations regarding the use of medicinal species. The smallest community studied (Tambaba) least contributed to the diversity of species citations. This is further supported by a small number of families occupying this settlement and their life history, because the rural activity is not the main source of financial income, and a substantial number of inhabitants are closely related. Many inhabitants have formal jobs in town's industrial and commercial zones, or worked there in the past, and this may have influenced the knowledge and practice of natural medicine within this community.

Comparing diversity values with those of studies also conducted in communities located in the Atlantic Forest or in rural settlements, Shannon-Wiener and equitability values were somewhat high, with similar values to those of the other studies (Table 4) (AMOROZO, 2002; BORGES; PEIXOTO, 2009; PINTO; AMOROZO; FURLAN, 2006). High values of these indices link the areas to the populations with significant ethnobotanical knowledge (LIMA, *et al.,* 2000), and were observed among the studied communities, because the Shannon index indicated the extent to which local diversity was explored by the population. The high knowledge of the informants (selected by snow ball methodology) in this research influenced the high diversity and equitability values observed, given that other factors were very similar to those of other studies (Table 4).

Table 4. Comparative table for diversity index values among Brazilian settlements.

Informations	EPA Tambaba, PB	Santo Antonio do Levenger, MT	Itacaré, BA	Paraty, RJ
Authors	This work	Amorozo, 2002	Pinto *et al.*, 2006	Borges e Peixoto, 2009
Biome	atlantic Forest	Cerrado	Atlantic Forest	Atlantic Forest
Shannon-Winier	H' = 3,95	H' = 2,21	H' = 1,83	H' = 1,81
Equitability	J' = 0,90	J' = 0,94	J' = 0,92	Not informed
Number of informants	54	24	26	10
Financial activity	Agriculture	Agriculture, fishing, manioc flour, tourism	Agriculture	Fishing e agriculture
Community	Rural settlement	Rural settlement	Rural community	Caiçara community

Despite the high floristic diversity, the Tambaba Environmental Protect Area is suffering strong environmental impacts, but it is noteworthy that the community has such a significant knowledge on the types and uses of medicinal plants. The five studied communities showed an overlap of 66 species. Multivariate ANOSIM analyses indicated that communities, when compared in relation to species and their therapeutic uses, were very similar ($R=0.038$; $p < 0.0001$), with the Tambaba settlement sharing the least number of species. Similar results were observed by comparing species groups within each community by means of pairwise ANOSIM (Table 5).

Table 5. Results for an analysis of ANOSIM by a pair comparing groups of species among the settlements.

	Nova Vida		Apasa		Dona Antônia		Frei Anastácio	
Apasa	R=0,037	p<0,0001						
Dona Antônia	R=0,019	p<0,011	R=0,0004	p<1				
Frei Anastácio	R=0,064	p<0,001	R=0,003	p<0,686	R=0,010	p<0,071		
Tambaba	R=0,143	p<0,001	R=0,036	p<0,001	R=0,054	p<0,001	R=0,013	p<0,01

Results of the SIMPER analysis showed that the corporal systems which mostly contributed to the observed similarities among communities were respiratory system disorders and diverse disorders. The Nova Vida and Dona Antônia settlements showed higher similarity (81.4%), whereas the APASA and Tambaba settlements shower lower similarity (57.7%). Explanations for the high observed similarity indices are twofold: the geographical proximity among communities and the higher proportion of species used for medicinal purposes. Local agricultural activities, fair-trade commerce, and parental and friend relationships all contribute to spread and homogenize knowledge.

The present study documented, for the first time, the therapeutic use of plants by rural communities on the Paraíba coast. The results showed that inhabitants most frequently use herbaceous species which are commonly cultivated in areas adjacent to their homes, like gardens and backyards. Traditional practices and the knowledge inherited from ancestors were not abandoned by the population. Results also revealed the extent to which medicinal species are valued in terms of their usefulness and how the traditional knowledge is passed and improved, throughout the generations and based on an everyday experience.

For being located within a common area and for sharing resources from a similar ecosystem, the five communities are very similar regarding the use and application of resources. The lack of adequate basic health care may be responsible for the observed similarities in the use of species and corporal systems for which they are indicated. Data on the use and application of medicinal plant resources from the five studied communities provide information based on traditional knowledge, useful for conservation programs which endeavor to preserve the native flora.

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MEDICINAL PLANTS IN RURAL SETTLEMENTS OF A PROTECTED AREA IN THE LITTORAL OF NORTHEAST BRAZIL

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Resumo: O objetivo deste estudo foi realizar um levantamento etnobotânico sobre o conhecimento e uso de plantas medicinais em cinco comunidades rurais localizadas na Área de Proteção Ambiental Tambaba, litoral sul paraibano. Os dados foram coletados através de entrevista semiestruturada com 58 informantes-chave com idade entre 28 a 83 anos. Foram registradas 71 espécies distribuídas em 47 famílias, sendo Leguminosae a mais citada. As folhas foram as partes mais citadas e o chá o modo de preparo mais comum. O índice de Valor de Uso revelou um grupo de nove espécies mais utilizadas pelas comunidades. O Fator de Consenso do Informante indicou as doenças do sistema respiratório como as mais tratadas. O teste de permutação ANOSIM-oneway mostrou a semelhança entre as comunidades ao comparar as relações entre as espécies e seus usos terapêuticos. Essas comunidades usam as plantas medicinais como uma alternativa eficiente e imediata para o tratamento de doenças cotidianas.

Palavras-chave: Etnobotânica, Mata Atlântica, Unidades de Conservação, Conhecimento tradicional, Comunidade rural.

Abstract: The goal of the present study was to conduct an ethnobotanical survey on the knowledge and the use of medicinal plants by five rural communities located within the Tambaba Environmental Protection Area, State of Paraiba. Data were collected by semi structured interviewing 58 key-informants aged 28 and 83 years. A total of 71 medicinal species, from 47 families, was identified and Leguminosae being the most cited. The leaves were the most used parts and the tea was the most common mode of use. Use Value index reveals the group of nine species mostly used by the communities. The Informant Consensus Factor indicated respiratory system disorders as the most commonly treated. The ANOSIM-one way permutation test revealed that the communities are very similar when compared in relation to the species and their therapeutic uses. These communities used medicinal plants as an efficient and immediate alternative to treat various everyday diseases.

Key-words: Ethnobotany, Atlantic forest, Conservation Unit, Traditional knowledge, Rural community.

Resumen: El objetivo de este estúdio fue realizar um levantamiento botánico sobre el uso de las plantas medicinales, em cinco comunidades rurales del Área de Protección Ambiental Tambaba, en la costa sur, Estado de Paraíba. Los datos fueron colectados aplicando entrevistas semiestructurada a 58 informantes clave entre los 28 y los 83 años de edad. Su resgistraron 71 especies pertencientes a 47 familias siendo Leguminosae la más citada. La parte más usada fu elas hojas y el té, la forma de preparación más común. El índice de valor de uso evidenció 9 especies más utilizadas, de igual manera, el fatcor de consenso del informantes indicó las enfermidades del sistema respiratório como las más tratadas. La prueba ANOSIM de uma via, reveló semejanza entre las comunidades cuando se compararom las especies y sus usos terapêuticos. Las comunidades estudiadas usan las plantas medicinales como uma alternativa eficiente para el tratamento de enfermidades cotidianas.

Palabras clave: Etnobotánica, Mata Atlántica, Unidades de Conservación, Comunidad rural, conocimientos tradicionales.