Living pharmacy in urban yards: Health care in the Amazon

Farmácia viva em quintais urbanos: Atenção à saúde na Amazônia

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INTRODUCTION

Ethnobotanical surveys in local communities can investigate the potential of plant resources and forms of use by human societies, obtaining a wealth of information to pass on to future generations, providing for their survival needs (SILVA et al., 2015).

According to the World Health Organization (WHO), the traditional system based on medicinal plants is supported by about 75-80% of the world population, especially in developing countries, for primary health care due to better cultural acceptance, better tolerance by the human body and lower side effects (WHO, 2008). Moreover, plants used for...
medicinal purposes are believed to be favorable to health, since people who use them have prior knowledge of their purpose, risks and benefits (ANTONIO et al., 2013; BADKE et al., 2012).

Many species with medicinal, food and, wood purpose could be cultivated in a portion of land near the house with easy access, which is defined, according to Siviero et al. (2011), as home yards. This type of cultivation is a promising approach to enhancing household food security and well-being (GALHENA et al., 2013), biodiversity conservation (GALLUZZI et al., 2010), socio-cultural preservation (MAZUMDAR; MAZUMDAR, 2012).

In the Amazon, the maintenance of urban yards is related in various ways to the daily life of communities, with multiple meanings for private and collective life, representing much more than a functional and utilitarian space (LOBATO et al., 2017; TOURINHO; SILVA, 2016). Siviero et al. (2011) highlights the importance of maintaining home yards in large centers in the supply of food directly through the yards or via exchanges with neighbors and relatives.

The diversity of medicinal plants found in home yards in the Amazon is the source of life and survival for residents of communities in the municipality of Abaetetuba, Pará (MOURA et al., 2016). The health disorders that most affect the residents of Bairro Mutirão include skin inflammation, wound healing difficulties, lack of sleep, nervous behavioral states and skin and stomach cancer. These diseases indicate the needs of the population, and as recorded in the publication Brasil (2012), traditional medicine using plants is the recommended strategy to meet such demands. This study aimed to identify the medicinal plants around the home most used in Bairro Mutirão, Abaetetuba, Pará, Brazil to correlate the ethnopharmacological data with previous phytochemical studies, evaluating the contribution of these species to promoting health in poor communities in the Amazon.

MATERIAL AND METHODS

The study was conducted in the Amazon municipality of Abaetetuba, Pará, Brazil (01°43’24”S 48°52’54”W, altitude 10 m – Figure 1), in the period of August 2013 to October 2014. Data were collected in 189 home yards using non-participant observation techniques, semi-structured interviews, guided tours and notes in field diary (ALBUQUERQUE et al., 2010).

**Figure 1.** Location map of the study area with a description of the streets of Bairro Mutirão.

Bairro Mutirão was selected because it has more than 10 years of existence, allowing the study of formed and established yards, presence of vegetation around the houses and because the accessibility to residences. Authorization was requested with the community leadership to carry out the research, which culminated in the signing of the Term of Prior Consent (TAP) during a meeting with the residents.

The interviews were held with experts in the use of medicinal plants for healthcare in Bairro Mutirão in the guided tours, it was possible to go over the area for cultivating medicinal plants with the local experts to find out about the use of each species (ALBUQUERQUE et al., 2010).

The plants of the yards were photographed and identified by comparison with the images of plants deposited in MFS (herbarium of Universidade do Estado do Pará - UEPA), and the scientific names were determined according to the Species List of the Flora of Brazil (2020). Phytochemical information was obtained from databases (ScienceDirect, Scinfinder, Scopus, DataPlant, Hindawi Publishing Corporation) and scientific journals as well.

The databases consultation occurred through the insertion of keywords (therapeutic indication, chemical composition, biological potential) in the search areas. Only the articles that presented information for the species most found in the backyards of the Bairro Mutirão were selected. After this initial screening, a table was created, using the software Microsoft Excel® - 2010 to organize the data collected.

**RESULTS AND DISCUSSION**

Forty-six therapeutic species (Table 1) were found in the yards, particularly Aloe vera L. Burman. f., Anacardium occidentale L., Bixa orellana L., Kalanchoe pinnata (Lam.) Pers., Lippia alba (Mill.) N.E.Br. ex P. Wilson and Morinda citrifolia L., the most cited by the local experts. They are species originating from various parts of the world, including Brazil, Asia, Madagascar and Africa. The ethnobotanic studies by Freitas et al. (2012), Silva et al. (2015) and, Moura et al. (2016) demonstrated the efficacy of these plants in the treatment of the illnesses mentioned here.

These six species are cultivated in yards and prepared using home recipes for health-related problems, such as wound healing, insomnia, for soothing and treating cancer (Table 2). These benefits have been described Freitas et al. (2015) for Anacardium occidentale L. (inflammation, injuries, flu); Aloe vera (L.) Burman. f. (wound healing; inflammation; hemorrhoids, injuries, lice, cancer, stimulant), and Morinda citrifolia L. (diabetes, cholesterol, infections, inflammation). These data reveal and emphasize that humans conserve transgenerational knowledge to maintain their natural pharmacopoeias, even if they are in urbanized areas.

**Table 1.** Medicinal species found in the yards of Bairro Mutirão, Abaetetuba, Pará, Brazil.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of citations</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bixa orellana L.</td>
<td>39</td>
<td>11.5</td>
</tr>
<tr>
<td>Anacardium occidentale L.</td>
<td>26</td>
<td>7.7</td>
</tr>
<tr>
<td>Lippia alba (Mill.) N.E.Br. ex P. Wilson</td>
<td>23</td>
<td>6.8</td>
</tr>
<tr>
<td>Morinda citrifolia L.</td>
<td>18</td>
<td>5.3</td>
</tr>
<tr>
<td>Aloe vera (L.) Burman. f.</td>
<td>16</td>
<td>4.7</td>
</tr>
<tr>
<td>Kalanchoe pinnata (Lam.) Pers.</td>
<td>16</td>
<td>4.7</td>
</tr>
</tbody>
</table>
Cymbopogon citratus (DC.) Stapf 15 4.4  Portulaca pilosa L. 3 0.9
Arrabidaea chica (Bonpl.) B. Verl. 15 4.4 Ocimum gratissimum L. 3 0.9
Eleutherine plicata Herb. Ex Klatt 14 4.1 L.P. Queiroz 3 0.9
Cinnamomum zeylanicum Blume 13 3.8 Jatropha gossypifolia L. 3 0.9
Mentha pulegium L. 12 3.6 Coffea arabica L. 2 0.6
Veronica condensata Baker 10 3.0 Coix lacryma-jobi L. 2 0.6
Ocimum campechianum Mill. 9 2.7 Pogostemon heynanus Benth. 2 0.6
Costus spirali (Jacq.) Roscoe 9 2.7 Jatropha curcas L. 2 0.6
Pedilanthus tithymaloides (L.) 8 2.4 Coleus sp. 1 0.3
Poit.
Zingiber officinale Roscoe 8 2.4 Ocimum microanthum Willd. 1 0.3
Ruta graveolens L. 7 2.1 Sesamum orientale L. 1 0.3
Mansoa alliacea (Lam.) A. H. Gentry 7 2.1 Plectranthus amboinicus (Lour.) 1 0.3
Chenopodium ambrosioides L. 4 1.2 Vismia guianensis (Aubl.) Choisy 1 0.3
Phyllanthus niruri subsp. Hallier f. 3 1.0
Phyllanthus niruri (Kunth) G. L. Webster 2

Table 2. Pharmacological data of the most cited species found in the yards of Bairro Mutirão, Abaetetuba, Pará, Brazil.

<table>
<thead>
<tr>
<th>Species/Family/Ethnospecies</th>
<th>Therapeutic indication</th>
<th>Part used/form of use</th>
<th>Pharmacology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe vera (L.) Burman. f./Xanthorrhoeaceae/ Babosa</td>
<td>Skin and stomach cancer</td>
<td>1. Leaves. Wash well, and then heat over a flame until wilted. Next, place leaves in a tea of cashew tree leaves. Use this mixture to wash the skin. 2. Leaves. Juice of leaves to treat stomach cancer.</td>
<td>Antimicrobial (FREITAS et al., 2014; GUPTA et al., 2010). Antigenotoxic and antitumorigenic (ESMAT et al., 2006; KIM et al., 1999).</td>
</tr>
<tr>
<td>Anacardium occidentale L./Anacardiaceae/Caju</td>
<td>Wound healing</td>
<td>Bark. Tea.</td>
<td>Anti-inflammatory; Antimicrobial (CHAVES et al., 2010; SILVA et al., 2007).</td>
</tr>
<tr>
<td>Kalanchoe pinnata (Lam.) Pers./Crassulaceae/Pirarucu</td>
<td>Wound healing</td>
<td>Leaves. Place on wound.</td>
<td>Antimicrobial (FLEISCHER et al., 2003). Anti-inflammatory (SUSA et al., 2005); Leishmanicide (MUZITANO et al., 2006).</td>
</tr>
</tbody>
</table>

### Chemical composition of species and proven biological activity

**Aloe vera (L.) Burman f. (Xanthorrhoeaceae)**

*Aloe* L. genus is a monoecious, perennial species with shallow roots. *Aloe* species are mostly inhabitants of arid climates, and are widely distributed in Africa, India, and other arid areas (SALEHI et al., 2018). It is used by the population of Bairro Mutirão for the prevention and treatment of cancer. The parenchymatous cells, in the fresh leaves of *Aloe vera*, secrete a colorless mucilaginous gel that contains 98-99%...
water and 1-2% active compounds like Aloesin, Aloin, Aloe-emodin, Aloe-mannan, Flavonoids, Saponin, Sterols, Amino acids, Vitamins, anthraquinones, quinones, pyrimidines, alkaloids, and mucopolysaccharides (FREITAS et al., 2014; JAIN et al., 2016; NEJATZADEH-BARANDOZI, 2013). The species has been reported for multiple biological properties such as antibacterial and antimicrobial, antitumor, anti-inflammatory, anti-arithmetic, anti-rheumatomid, anticancer, and antiadiabetic activities (BOUDREAU et al., 2013; KAMMOUN et al., 2011; RADHA; LAXMIPIRIYA, 2015).

The extract of Aloe vera leaves tested by Kim et al. (1999) in rat liver cells against the action of benzopyrene demonstrated an antigenotoxic and antitumorgenic effect in vitro and thus may be considered for its potential in cancer chemoprevention. Esmat et al. (2006) discussed the cytotoxic activity of aloin, an Aloe natural anthraclycene, against two human breast cancer cell lines, suggesting that this substance may be used in the treatment of tumors.

**Anacardium occidentale** L. (Anacardiaceae)

This is a native tree characteristic of North and Northeast Brazil. The leaves are used as infusion in the treatment of gastrointestinal disorders, mouth ulcers and throat problems, in West Africa and South America (AJILEYE et al., 2015). This species has phenolics and catecholates, catechin, epicatechin, tannins, alkaloids, cardol, cardanol, anacardic acid, catechin, epicatechin, carotene (CHAVES et al., 2010; TROX et al., 2011; YULIANA et al., 2014).

Fractionation of the ethanol extract of the stem bark of *Anacardium occidentale* resulted in the isolation of anacardics with an unsaturated side chain (monoene and diene), as free steroids, glycosylated and esterified with fatty acids, while the ethanol extract of the seed coat showed the steroids sitosterol and stigmastrol, the pentacyclic triterpenoids lupeol and β-amyrin and the flavonols catechin and epicatechin, substances that significantly indicate the antioxidant potential of this species (CHAVES et al., 2010).

Bioactive compounds from irradiated leaf extracts of *Anacardium occidentale* showed high antimicrobial activity against *Staphylococcus aureus* and multidrug-resistant, in vitro (SANTOS et al., 2018). Blood glucose levels in rats showed that treatment with the extracts of *A. occidentale* leaves was more effective than with glyburide (synthetic anti-diabetic drug), confirming its anti-diabetic effect of this species (OKPASHI et al., 2014). Trabulsi Filho et al. (2013) reported that the hydroalcoholic extracts of *A. occidentale* leaves not only had strong antioxidant activity but also a moderate cytotoxic effect on trophozites of *Giardia lamblia*. It was also demonstrated that extractive procedure and solvent are variables that influence the extracts obtained and thus yields and antioxidant and giardicidal activities.

**Bixa orellana** L. (Bixaceae)

This species is native to Brazil and is cultivated in other parts of South and Central America (VILLE et al., 2014). It is commonly found as an ornamental plant in Brazil (CUSTODIO et al., 2002), and its seeds produce one of the most widely used dyes worldwide, not only in food but also in the textiles, paints and cosmetics (VILLE et al., 2014).

Red and yellow pigments extracted from seed arils are rich in carotenoids including α-bixin, β-bixin, α-norbixin and β-norbixin, besides a volatile oil rich in all-E-geranylgermanol, oxygenated monoterpens and sesquiterpenes, and flavonoids (LORENZI; MATOS, 2008; MORS et al., 2000; SOUSA et al., 1991). Bixin, first isolated from *Bixa orellana* seeds in 1875 and 1961 belong to the class of natural apocarotenoids (VILLE et al., 2014). With regard to pharmacological properties, it has been described antifungal, antibacterial, antimalarial and anti-inflammatory activities (GIORGI et al., 2013; MARIATH et al., 2009; YOKE KEONG et al., 2011).

**Kalanchoe pinnata** (Lam.) Pers. (Crassulaceae)

This species is a succulent herb from Madagascar, and the *Kalanchoe pinnata* specie possess polyphenolic compounds such as flavonoids and phenolic acid as the main compounds (BOGUCKA-KOCKA et al., 2018; COSTA et al., 2008). The chemical composition *K. pinnata* is characterized mainly by the presence of quercetin glycosides (MUZITANO et al., 2011).

Muzitano et al. (2006) analyzed the aqueous extract of *Kalanchoe pinnata* leaves and found the presence of a kaempferol diglycoside called kapinnatoside, identified as kaempferol-3-O-α-L-arabinopyranosyl (1→2) α-L-ramnopyranoside (1), and two uncommon flavonols and flavone glycosides, namely quercetin 3-O-α-L-arabinopyranosyl (1→2) α-L-ramnopyranoside (2) and 4',5-dihydroxy-3',8-dimethoxyflavone 7-O-β-d-glucopyranoside (3). These constituents appear to be important in the leishmanicidal activity of *K. pinnata*. The aqueous extract of *K. pinnata* flowers has been shown to produce dose-dependent inhibition of acetic acid-induced writing in rats, indicating antinociceptive activity (FERREIRA et al., 2014).

**Lippia alba** (Mill.) N.E.Br. ex P. Wilson (Verbenaceae)

This aromatic shrub is found throughout tropical and subtropical America, widely distributed throughout Brazil, growing spontaneously on abandoned land or cultivated medicinal gardens (AGUIAR; COSTA, 2005). It has essential oils rich in mono- and sesquiterpenes (AGUIAR et al., 2008), and the chemical composition *Lippia* L. shows volatile constituents, alkaloids, tannins, flavonoids, naphthoquinones and iridoids (GOMES et al., 2011).

Its aromatic metabolites have been characterized in the country, presenting different chemical markers with pharmacological properties already known, such as analgesic, sedative and antifungal (CAMILLO et al., 2016). Actions of citral, limonene and myrcene (essential oil constituents of a *Lippia alba* chemotype) on the central nervous system, evaluated by Vale et al. (2002), showed that all these components have sedative and motor relaxing effects. At high doses, produced a potentiation of pentobarbital-induced sleep in mice, more intense in the presence of citral, but none of the components showed an anxiolytic effect (VALE et al., 2002).

**Morinda citrifolia** L. (Rubiaceae)

Originally from Southeast Asia, this plant was recently introduced in Brazil with strong commercial appeal because of the beneficial features attributed to it (MATOSO et al., 2013). It is known for producing alkaloids, iridoids, anthraquinones, and flavonoids (ROSA et al., 2010; TINTINO et al., 2015). *Morinda citrifolia* has phenolic groups in the form of anthraquinones and their glycosides (darnacanthal, morindone, morindine, scopoletin, alizarin, austrocoritin, rubidain).
A fraction rich in polysaccharides, obtained from fruit juice by ethanol precipitation, showed antitumor activity in Lewis lung carcinoma model in rats. The precipitate also stimulated the release of certain cytokines, such as TNF-α, IL-1β, IL-10 and IF-γ (HIRAZUMI; FURUSAWA, 1999). Arpornsuwan and Punjanon (2006) showed the growth-inhibition of breast cancer and neuroblastoma cell lines in vitro by a methanol extract of the fruits of Morinda L. at a concentration of 0.1 mg/ml. Pharmacological investigations have demonstrated that the roots of Morinda citrifolia possess an antihypertensive action and that an alcoholic extract has an in vitro antispasmodic effect (MOOKHTIAR et al., 2018).

CONCLUSION

A total of 46 medicinal species were identified, of which Aloe vera L. Burman. f.; Anacardium occidentale L.; Bixa orellana L.; Kalanchoe pinnata (Lam.) Pers.; Lippia alba (Mill.) N.E.Br. ex P. Wilson and, Morinda citrifolia L., were observed in the scientific literature with antitumor, soothing, anti-inflammatory and antimicrobial potential, confirming its ethnomedicinal use by residents of Bairro Mutirão.

There are a variety of substances that range from the compounds most frequently found in plants to others of highly specific molecular formulas, a fact that contributes to the knowledge of pharmacological properties still unknown or little studied. Thus, the medicinal flora in the yards of Amazon people also represents a way for the discovery of new drugs, or extension of their use.

REFERENCES


ESMAT, A. Y.; TOMASSETO, C.; RIO, M. C. Cytotoxicity of a natural anthraquinone (Aloin) against human breast cancer cell lines with and without ErbB-2: topoisomerase


