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KNOWN AND UNKNOWN MEDICINAL PLANTS USED IN RESPIRATORY DISORDERS IN BRAZILIAN FOLK MEDICINE: A BRIEF REVIEW

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Abstract

This review aimed to describe some plants used in Brazilian folk medicine in respiratory disorders, highlighting species not well known to the Brazilian citizens. The articles were surveyed in the MEDLINE / PubMed, Web of Science, SCOPUS / Elsevier, SciELO and Cochrane with the descriptors in Health Sciences (DeCS) databases: Medicinal plants, herbal medicine and respiratory diseases with the keywords: secondary metabolites and pulmonary disorders, considering the period from June 2010 to June 2020. The results indicated that species known as *Mikania glomerata* and *Allium sativum*, are well studied, presenting a large volume of publications and results on phytochemical and pharmacological aspects. In contrast, lesser-known species of the Brazilian population, such as *Amburana cearensis*, *Hybanthus ipecacuanha* and *Jatropha curcas*, need more studies, which explore their potential in the medical field. Brazilian biodiversity offers a wide variety of medicinal plants, some of which are better known and studied; others less known and little studied, requiring further investigation in order to provide a scientific basis, both for the isolation and synthesis of molecules, and for possible therapeutic applications in different respiratory diseases.

Keywords: Medicinal plants; respiratory disorders; Brazilian folk medicine; Biodiversity.

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Introduction

Chronic Respiratory Diseases (CRD) can affect both upper and lower airways. The CRD represents approximately 7% of the global mortality that is 4.2 million annual deaths. In Brazil, the CRD already has been the third biggest death cause speaking on non-communicable respiratory diseases [1]. Allergic rhinitis, asthma and Chronic Obstructive Pulmonary Disease (COPD) are the most common CRD, being allergic rhinitis the most common one, afflicting approximately 20 to 25% of the population [1,2]. According to a study made by International Study of Asthma and Allergies in Childhood, conducted in Brazil, indicates that the rhinitis symptoms are present in 29.6% of teenagers and 25.7% of kids, indicating that the country has the world's highest rates of rhinitis. Regarding asthma, Brazil stands on the eighth worldwide position, having internated 273 thousand people and generating a cost of approximately R$ 98 million to the SUS (the Brazilian unified health system) [3]. In relation to COPD the morbidity and mortality has been increasing in many regions, representing 4.8% of deaths by respiratory diseases. The COPD has already afflicted approximately 7.5 million people that is 5% to 10% of the population [4].

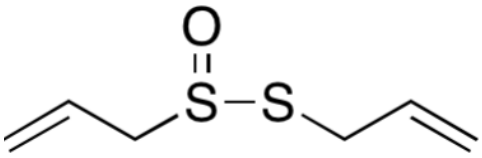
Brazil has a wide biodiversity, with about 60,000 known species of plants [5]. The use of plants for therapeutic purposes has been present in Brazilian culture since ancient times and comes from different traditional cultures, mainly from Brazilian indigenous peoples. This practice was motivated by the growing demand for improvements in health and is present in primary health care in Brazil until today [6]. In the last decades, records of the use of herbal medicines indicate a considerable increase in this practice [7]. Before, in 2006, the National Program of Medicinal Plants and Phytotherapics was created [8], generating improvements for primary care and providing 12 phytotherapics for the population [6,8]. Recently, according to the Brazilian Ministry of Health, the issuing of National Relation of Essential Medicines pharmaceutical units for herbal medicines in the 26 states grew by 239,11% between 2012 and 2018 [7].

The literature provides many references about medicinal plants used in the treatment of respiratory disorders. For example, *Eucalyptus globulus*, for sinusites, bronchitis, and asthma [14,15]; *Illicium verum* for bronchitis [14]; *Mikania glomerata* and/or *Mikania laevigata* [14,15] for bronchitis and asthma; *Allium sativum* [14,16,17] for chronic bronchitis and asthma; and *Hedera helix* [18,19] for bronchitis and asthma (figure 1). However, due to the diversity of Brazilian flora, other plant species are popularly used, but not known in other regions of Brazil.

To understand how the medicinal plants exert their effects on the human organism, we need to understand the secondary metabolite concept. The interaction of plants with the environment can be used as a support for the production of secondary metabolites for the maintenance and survival of species [9,10]. Secondary metabolites participate in the inter and intracellular interactions of the organism

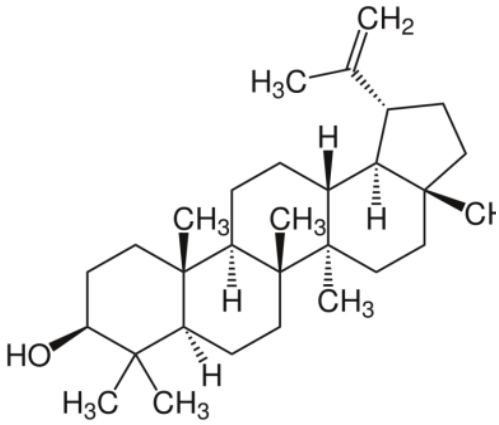
itself and/or with cells of other organisms, contributing to the coexistence and environmental survival [11,12]. The isolation and structural determination of the substances produced by these metabolites are of great relevance, mainly for chemistry and medicine [13] as they serve as a model for structural modification and optimization of properties pharmacological and biochemical, in addition to inspiring organic chemistry in the challenge of synthetic construction of new molecular architectures [11].

Allium sativum



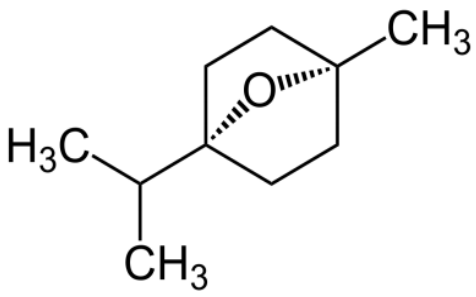
Allicin
S-Prop-2-en-1-yl prop-2-ene-1-sulfinothioate
$C_6H_{10}OS_2$

Mikania glomerata or Mikania laevi



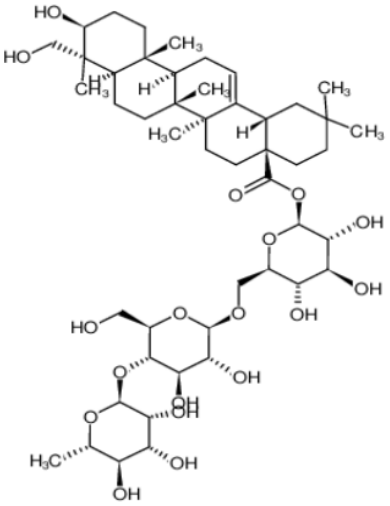
Lupeol
(1R,3aR,5aR,5bR,7aR,9S,11aR,11bR,13aR,13bS)-1-Isopropenyl
3a,5a,5b,8,8,11a-hexamethyl-icosahydro-cyclopenta[a]chrysen-9-

Eucalyptus globulus



1,4-Cineol
1-Isopropyl-4-methyl-7-oxabicyclo[2.2.1]heptan
$C_{10}H_{18}O$

Hedera helix



Hederagin
3β,23-dihydroxyolean-12-en-28-oic acid O-α-L-rhamnopyranosyl-(1->4)-
O-β-D-glucopyranosyl-(1->6)-β-D-glucopyranosyl ester
$C_{48}H_{78}O_{18}$

Figure 1: Examples of plants secondary metabolites with pharmacologic effects on biologic systems. (source: The Authors).

Thus, the biological activity of medicinal plants is associated to secondary metabolites, responsible for anti-inflammatory, analgesic and antimicrobial activities, etc. [20]. The present study aimed to document the traditional uses of medicinal plants known and unknown in Brazil in the treatment of respiratory disorders, correlating, whenever possible, their pharmacological action with the presence of secondary metabolites.

Methods

The search for manuscripts was carried out in the main databases, PubMed, Web of Science, SCOPUS/Elsevier, SciELO, and Cochrane. The descriptors in Health Sciences (DeCS) were: Medicinal plants, herbal medicine, and respiratory diseases with the keywords: secondary metabolites, respiratory disorders, and pulmonary disorders, considering the period from July 2010 to July 2020, except for publications relevant to understanding and describing the proposed mechanism of action. For the eligibility criteria, the original articles "clinical trials, case-control, systematic review and meta-analysis, studies in animals and in vitro" in adult patients, and non-inclusion, annals and journals were considered as inclusion articles; case reports, opinion articles and letters to the editor.

Results and Discussion

Mikania glomerata, popularly called "guaco", has been used in herbal medicine as an effective, expectant and cough suppressant natural bronchodilator for all types of upper respiratory problems, among them: bronchitis, pleurisy, colds and flu, cough and asthma [23]. However, Mikania species are often used interchangeably, due to the erroneous identification of the species or plant part used, which leads to changes in their functionality in the organism [22]. Thus, it is important to identify some diversity present in the species *Mikania glomerata*, in relation to the species *Mikania laevigata*. The medicinal properties are due to its content of coumarin, O-coumaric acid and kaurane type diterpenes, being considered bioactive constituents, which form a phytocomplex responsible for the therapeutic activity of the Mikania species [24,25]. Besides, studies show that both species (*Mikania glomerata* and *Mikania laevigata*) has a considerable therapeutic potential, being possible to identify properties such as bronchodilator, anti-ulcerogenic, and anti-parasitic activity. [23]

Amburana cearensis is a tree known as "cumaru", geographically established in Northeast Brazil and widely used in traditional medicine to treat asthma. Its medicinal property is due to the composition of the bark of its trunk, where the following substances can be found: coumarin, flavonoids

(isocaempferida, caempferol, afrormosina and 4'-methoxyphysetine), and the phenol glycosides, amburosides A and B. Among its properties most noteworthy is its anti-inflammatory effect, explained by the ability of the substances mentioned above to reduce neutrophil degranulation, myeloperoxidase activity, TNF-α secretion, and inhibition of the synthesis, release or action of inflammatory mediators, such as histamine, serotonin, and prostaglandin E2 [26].

Allium sativum is a medicinal plant that belongs to the Amaryllidaceae family and has broad therapeutic properties widely used in Brazil [27]. Known as "alho" or garlic (in English), it was an important medical plant for the ancient Egyptians and confers many therapeutic benefits until today [28]. *Allium sativum* has numerous known biological properties, including anticarcinogenic, antioxidant, antidiabetic, renoprotective, anti-atherosclerotic, antibacterial, antifungal and antihypertensive activities, as well as, carminative, antipyretic, sedative, and diuretic effects [27]. Also, it is widely used to treat indigestion, cardiac disorders and respiratory and urinary tract infections, being its acting in respiratory disorders one of the most relevant nowadays [27]. The antiasthmatic effect of *Allium sativum* extracts on the Th1, and Th2 cytokine profiles showed that *Allium sativum* was able to reduce total inflammatory cell counts and eosinophil infiltration and decreased the production of *Dermatophagoides pteronyssinus* IgE in serum and cytokine in bronchoalveolar fluid [29]. Allicin, the main active constituent of garlic, is a sulfenic acid thioester that has its pharmacological effect attributed to its antioxidant activity as well as its interaction with proteins containing thiol [27]. The *Allium sativum* also contains S-Allyl cysteine (SAC) in its constitution, an active compound that has anti-inflammatory, anti-oxidant, and anti-cancer activity [30]. The SAC attenuated airway hyper-responsiveness, reducing inflammatory cells and mucus production, besides decreasing Th2 type cytokines, and IgE levels in bronchoalveolar lavage fluid and serum, as well as reducing MUC5AC activity and expression in lung tissue in OVA challenge mice.[30]

Ocimum gratissimum is a medicinal plant that belongs to the Lamiaceae family and contains properties that are widely used by phytotherapy and by Brazilian communities to treat various conditions, including inflammatory disorders, such as asthma [31,32]. Known as "alfavaca-cravo","manjericão-cheiroso"or"alfavacão",this plant belongs to the National List of Medicinal Plants of Interest to the SUS [31]. Plants of the Ocimum species are traditionally used to treat upper respiratory tract infections, bronchitis, coughs, sore throat and wound healing [33]. *Ocimum gratissimum* contain large amounts of polyphenolic compounds (i.e., rosmarinic acid) which showed antiallergic, anti-inflammatory, and bronchodilator properties, by reducing the levels of inflammatory cytokines, chemokines, eosinophils, and anti-allergen antibodies [32]. The airway anti-allergic activity of the rosmarinic acid can be justified, at least in part, by inhibition of the lipoxygenase and cycloxygenase pathways, interference with the complement cascade, and suppression of T-

cell antigen receptor signaling [32].

Jatropha curcas is known for several medicinal uses, such as antimicrobial, anticancer, and anti-HIV [34]. Regarding respiratory disorders, the effects of the aqueous and methanolic fractions of the leaf extract of *Jatropha curcas* were evaluated suggesting potential inhibition of influenza virus hemagglutinin [35].

Hybanthus ipecacuanha is a source of emetine, an alkaloid found at its root [36]. Emetine is used predominantly as a vomit inducer in the treatment of intoxications, and currently, as a possible agent against COVID-19 [37].

Mentha pulegium *[38]*, popularly known in Brazil for combating various symptoms of flu and cold as well as bronchitis, asthma and other symptoms and or diseases, there is little information in the literature on the use of pennyroyal in respiratory conditions. The compound altersolanol A, a metabolite product of the *Stemphylium globuliferum* fungus, isolated in the *Mentha pulegium* species, showed cytotoxic, cytostatic, anti-inflammatory and anti-metastatic activity against the chronic myeloid leukemia K562 and cancer strains of lung A549, without affecting the viability of non-cancer cells [39]. Altersolanol A induces cell death by apoptosis by cleaving caspase-3 and 9 and by decreasing the expression of anti-apoptotic protein [39].

Gossypium hirsutum (cotton) has been used for thousands of years and recently has been discovered phytotherapic effects, such as, anti-inflammatory, antidysentery, and bactericidal effects among others [40]. One of the most recent discovery in pulmonary action about *Gossypium hirsutum* is its capability in induce apoptosis in carcinoma cell line A549. The silver nanoparticle, extracted from *Gossypium hirsutum*, has stressful effect over cell A549 mitochondrial membrane. This mitochondrial stress acts as a cytochrome-c channel releaser from the mitochondria to the cytosol and activates the -9 and -3 caspases, therefor inducing carcinoma into apoptosis. [41]

Adiantum capillus-veneris grows in all countries (except for Antarctica). It is used for medical intentions for ages, in which pulmonary activities its where most used. Recent studies indicate Anti-bacterial, anti-fungal, anti-viral, anti-inflammatory, hypoglycemic, expectorant, diuretic and others actions [42]. The anti-inflammatory activity of *Adiantum capillus-veneris* extract is associated with inhibition of inflammatory mediators, such as NO, TNF-a, as well as cyclooxygenase enzyme [43]. Administration, in children with severe asthma, of an herbal mixture (*Matricaria chamomilla, Althaea officinalis, Malva sylvestris, Hyssopus officinalis, Adiantum capillus-veneris, Glycyrrhiza glabra, Ziziphus jujuba*) at the onset of viral respiratory tract infection has significant results in reducing day cough, night cough and night awakenings [44]. Study in pulmonary apoptosis post-training, showed that *Adiantum capillus-veneris* extract reduce apoptosis activities from hypoxia exposure or intense exercise training modulating this state by increasing the pneumocytes I and reducing Bax/Bcl-2 ration. [45]

Bixa orellana L. or popularly, “colorau”, “urucú”, “tintória”, and “urucum”, is originally from tropical America, including the Brazilian Amazon. The essential oil from the seeds of its fruit is

rich in all-E-geranylgeraniol, monoterpenes, oxygenated sesquiterpenes, and carotenoids bixin and norbixin (containing less alpha and beta-carotene). These substances found in the *Bixa orellana L.* seed have a laxative, cardiotonic, hypotensive, expectorant, antimicrobial and anti-inflammatory effect, also presenting internal use in curing bronchitis and external use in burns [46, 47, 48]. Extract of *Bixa orellana L.* have shown that norbixin-based fractions are responsible for the antibacterial activity, especially in relation to microbial agents such as, *Escherichia coli, Staphylococcus aureus, Enterococcus faecalis*, and *Listeria monocytogenes* [47,48].

Bryophillum calycinum Salisb. is a wild plant native to Africa that belongs to the family Crassulaceae [50, 52, 53]. Known in Brazil as "pirarucu", "folha da fortuna", "coirama", "folha-da-vida", "roda-de-fortuna", and "saião" [50]. It leaves are used in folk medicine for the treatment of wounds, bruises, burns, scratches, abscesses among other skin diseases, insect bites, diseases of the respiratory tract, treatment of cough, sore throat, inflammation, bruising, glaucoma and topical medication for skin disorders of an allergic nature [51, 54]. The medicinal properties of *Bryophillum calycinum* Salisb. come from the various chemical substances present in its composition, such as: flavonoids, calcium, succinic acid, malic acid, sterols, citric acid, lactic acid, triterpene, tannins, arginine, glycine, histidine and terpenes. In an experimental study, the juice obtained from the pressed leaves showed, through its flavanoid action, anti-inflammatory and antihistamine activity as a histamine (H1) receptor antagonist in the ileum, vasculature and bronchial muscle [51,52].

Anadenanthera colubrina is native to South American and known as "Yopo", "Cohoba", "Vilca" and "Angico" [56]. *Anadenanthera colubrina* produces an arabinogalactan-rich exudate, which is reputed to be a medicament for respiratory problems [55]. The chemical profile of the extract of *Anadenanthera colubrina* show a new flavonoid named anadanthoflavone, and others compounds as alnusenol, lupenone, lupeol, betulinic acid, alfa-amyrin, beta-amyrin, beta-sitosterol, stigmasterol, apigenin, 4-hydroxy-benzoic acid and cinnamic acid through analysis of their NMR spectra [56]. *Anadenanthera colubrina* is known to treat diarrhea, cough, bronchitis, the flu, inflammation and tissue damage, allergy, rash, constipation, gastritis, among other uses [57]. Lastly, *Anadenanthera colubrina* extract treatment significantly reduced mice orofacial nociception [58].

Achillea millefolium L. is originally from Europe and Asia, but adapts to climatic conditions in tropical countries. It is popularly known as "mil-folhas", "milefólio", "mil-em-rama", "pronto-alívio", "erva-dos-carpienteiros", and "alevante" [59]. The majority components of the plant are flavonoids, phenolic acids, alkaloids, terpenes, and tannins. The pharmacological effects for *Achillea millefolium* L. comprising,

anti-inflammatory, antihypertensive and bronchodilator activities, justifying the use in cardiovascular and respiratory disorders [60,61].

Cajanus indicus L., cultivated in the tropics and subtropics mainly in Asia and Africa [62]. Currently, its medical applications comprise anti-inflammatory, anti-bacterial, irritating abirritative properties and inhibits capillary permeability. [63]. Phytochemical studies showed that their seeds possess secondary metabolites such as saponins, tannins, anthroquinone, triterpenoids, alkaloids, phenols, and flavonoids [64]. *Cajanus indicus* L. is used in the treatment of pain, inflammation, ulcer, asthma, bronchitis, and studies showed that *Cajanus indicus* presented immunomodulatory activity, antioxidant effects and free radical scavenging activity [63]

Davilla rugosa is employed like analgesic, vasoconstrictor, antiulcer, and diuretic [65]. It chemical profile presented betulinic acid, narigenina, quercetin and taxifoline [66]. Although used by the population to treat respiratory disorders, we have not found studies that justify this medicinal use.

Pulmeria lancifolia has in its chemical composition glycosides, pulmerine, plumeritanic acid, essential oils and resin [67]. In the respiratory system, the *P. lancifolia* is used to asthma [67,68] treatment and chronic bronchitis [67].

Conclusions

Brazilian biodiversity allows us to understand the different options of plant species used in the treatment of respiratory disorders, which are known to the majority of the Brazilian population. However, this same biodiversity shows us that other range of medicinal plants, less known to the majority of the population, is present in the daily life of part of the Brazilian population. Thus, ethnobotanical and ethnopharmacological studies are necessary in order to elucidate mechanisms and suggest therapeutic indications for species in respiratory disorders, increasing the potential for applications not only in medicine, but also in the knowledge of other areas.

Table 1. Summary of some medicinal plants in respiratory diseasesTable 1. Summary of some medicinal plants in respiratory diseases

Common name	Scientific name	Secondary metabolites	Evidences	References
Guaco	*Mikania glomerata* *Mikania laevigata*	Coumarin O-coumaric Acid Diterpenes (kurane)	Used in herbal medicine as a bronchodilator, expectorant and cough suppressant for bronchitis, pleurisy, colds and flu, cough and asthma. It also has anti-inflammatory, anti-ulceric, anti-phallic and anti-parasitic therapeutic potential.	COSTA, 2017. NAPIMOGA, 2010. BERTOLUCCI, 2013. SANTOS, 2006
Cumaru	*Amburana cearensis*	Coumarin Flavonoids (isocaempferida, caempferol, afrormosina and 4'-ethoxyphysetine) Phenol glycosides, amburosides A and B	Used in traditional medicine to treat asthma. It reduces neutrophil degranulation, myeloxidase activity, the secretion of inflammatory mediators (histamine, serotonin and prostaglandin E2 and TNF-alpha). Studies indicate that they control the activation of the kappa B factor or the remodeling of chromatin via modulation of histone deacetylase and the inflammatory gene expressed in pulmonary epithelial cells.	LEAL, 2008.
Alho	*Allium sativum*	Sulfenic Acid Thioester (Allicin) S-Allyl Cysteine (SAC)	It has anticarcinogenic, antioxidant, antidiabetic, renoprotective, anti-atherosclerotic, antibacterial, antifungal and anti-hypertensive properties. Used to treat indigestion, heart disorders, respiratory and urinary tract infections. Invitro studies show that there was a reduction in the total inflammatory cell count and a decrease in eosinophilic infiltration, as well as in IgE *Dermatophagoides pteronyssinus* in serum and cytokine in bronchoalveolar fluid. In animals, attenuation of airway hyperresponsiveness, reduction of inflammatory cells, production of mucus, levels of Th2 and IgE cytokines, as well as reduction of MUC5AC in the lung tissue of mice was observed from the SAC.	BATHIA et al., 2020. HSIEH et al., 2019. SHIN et al., 2019.

Alfavacão	*Ocimum gratissimum*	Polyphenolic (Rosmarinic Acid)	Used to treat infections of the upper respiratory tract, bronchitis, cough, sore throat and wound healing. Attenuates inflammation caused by allergies in the airways by inhibiting Th cytokine and eosinophil infiltration. It has anti-allergic, anti-inflammatory and bronchodilator action. in addition to inhibiting the lipoxygenase and cycloxygenase routes, interfering with the complementary cascade and suppression of T cell antigen receptor signaling.	VILANOVA et al., 2019. COSTA et al., 2012. EFTEKHAR et al., 2019.
Pião Branco	*Jatropha curcas*	Diterpenes Saponins	It has antimicrobial, anti-cancer and anti-HIV properties. Despite its broad-spectrum activity, there are no studies that report its anti-influenza action, as well as in combating other inflammatory diseases.	DEEPAK, et al., 2013.
Pecaconha	*Hybanthus ipecacuanha*	Emetine	There are reports that emetine is a potent therapeutic agent against COVID-19, since high concentrations of this metabolite have been observed in lung tissues to the detriment of other tissues.	SOUZA et al., 2020. MATIN, et al., 2020.
Poejo	*Mentha pulegium*	Altersolanol A	Used to combat the symptoms of flu, cold, bronchitis and asthma. The metabolite in question, when isolated in this species, demonstrated cytotoxic, cytostatic, anti-inflammatory and antiemetic activity against Chronic Myeloid Leukemia (K562) and cancerous strains of the lung (A549), inducing cell death by apoptosis by spiking caspase-3 and caspase- 9 thus decreasing the expression of the anti-apoptotic protein.	TEITEN et al., 2009.

Algodão	*Gossypium hirsutum*	Silver Nanoparticle	It has anti-inflammatory, antidisentery and bactericidal effects. It induces apoptosis in carcinoma cells (A549) and the metabolite in question induces a stressful effect on the mitochondrial membrane of cells of the A549 lineage, releasing Cit C channels from mitochondria to the cytosol, thus activating the capases 9 and 3, inducing apoptosis of the carcinoma.	MELLO et al., 2008. KANIPANDIAN et al., 2019.
Avenca	*Adiantum capillus-veneris*	Phenolics (gallic acid, tannins, cumaric acid)	Studies indicate antibacterial, antifungal, antiviral, anti-inflammatory, hypoglycemic, expectorant and diuretic actions. Inhibits inflammatory mediators, such as NO and TNF-alpha, as well as cyclooxygenase enzymes. It also reduces the activity of apoptosis due to exposure to hypoxia or intense exercise training, modulating this state by increasing type I pneumocytes and reducing the Bax / Bcl-2 ratio.	DEHDARI et al., 2018. YADEGARI et al., 2019.
Urucu	*Bixa orellana L.*	All-E-geranylgeraniol Monoterpenes Sesquiterpenes Carotenoids (bixin e norbixin)	It has laxative, cardiotonic, hypotensive, expectorant, antimicrobial and anti-inflammatory properties and can be used in bronchitis. Studies indicate that its main antimicrobial activity is related to *Salmonella Enteritidis, Escherichia coli, Staphylococcus aureus, Enterococcus faecalis and Listeria monocytogenes*.	ANSELMO et al., 2008. MAJOLO et al., 2013. VILAR et al., 2015.
Pirarucú	*Bryophillum calycinum Salisb.*	Flavonoids Calcium Succinic acid Malic acid Sterols Citric acid Lactic acid Triterpene Tannins Aminiacids Terpenes	It is used in the treatment of skin diseases, such as burns and abscesses, as well as for diseases of the respiratory tract, treatment of cough, sore throat, inflammation, among others. Studies show that its flavonoid action is anti-inflammatory and antihistamine as a histamine (H1) antagonist in the ileum, vasculature and bronchial muscle.	BRAZ et al., 2013. NASCIEMNTO et al., 2014. SOUSA et al., 2005.

Angico Branco	*Anadenanthera colubrina*	Arabinogalactan-rich Flavonoid (anadanthoflavone)	Used to treat diarrhea, cough, bronchitis, flu, inflammation, tissue damage, allergy, rash, constipation and gastritis. In animal studies, a significant reduction in orofacial nociception in mice has been demonstrated.	MORETÃO et al., 2003. MARIA et al., 2004.
Mil-Folhas	*Achillea millefolium L.*	Flavonoids Phenolic acids Alkaloids Terpenes Tannins	It has anti-oxidant, antimicrobial, anti-inflammatory, anti-hypertensive, bronchodilator, gastrointestinal, antispasmodic, diuretic, antiseptic, urinary, astringent, antidiabetic and anti-hemorrhagic effects.	FERRAZ et al., 2010. KHAN et al., 2010. ARIAS et al., 2020.
Guandu	*Cajanus indicus L.*	Saponins Tannins Anthroquinone Triterpenoids Reducing sugars Alkaloids Phenols Flavonoids	It has anti-inflammatory, antibacterial, abirritative properties and inhibits capillary permeability. It is used in the treatment of asthma and bronchitis, in addition to having immunomodulatory activity, antioxidant effects and free radical scavenging activity.	SARKAR et al., 2011. BHAMRE et al., 2011. ABO-ZEID et al., 2018.
Carixió	*Davilla rugosa*	Betulinic acid triterpene) Narigenina (flavonoid) Quercetin Taxifoline	Used as an analgesic, vasoconstitor, anti-ulcer and diuretic. In the literature of the researched bases, there are no reports of its use associated with the respiratory system.	JÁCOME et al., 2010. DAVID et al., 2006.
Sucuúba	*Plumeria lancifolia*	Glycosides Pulmerine, Plumeritanic acid	It is used for asthma and for the treatment of chronic bronchitis.	GRANDI, 2014. BARATTO et. al., 2010.

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