

## ANALOGY OF THE USES OF MEDICINAL SPECIES IN CUBA AND THE STATE OF BAHIA, BRAZIL IN THE LAST DECADE

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### Resumo:

*Analogia dos usos de espécies medicinais em Cuba e no estado da Bahia, Brasil na última década.* Desde os primórdios da humanidade, as plantas são utilizadas para aliviar e curar doenças. Sendo que a diversidade biológica é justamente diferente em cada local por depender principalmente do clima e relevo e por isso assume-se que o desenvolvimento da fitoterapia ou medicina alternativa baseada em plantas desenvolvidas de forma desigual a partir das plantas que tiveram sua disposição bem como as prioridades de tratamento precisava. Tendo em conta que Cuba e o estado da Bahia têm um clima semelhante, bem como o número de habitantes semelhante, foram tomados como objetivo neste estudo, com maior discrepância em termos de extensão territorial. O principal objetivo deste estudo é compreender as relações etnobotânicas de plantas medicinais no estado da Bahia, Brasil e Cuba. Utilizou-se o método de revisão bibliográfica das publicações disponíveis da última década e que estavam acessíveis nas bases Scopus, Google Acadêmico, SciELO, PubMed, levando em consideração que estas devem ser gratuitas e referir-se ao assunto de estudo em questão para ser selecionado. O resultado mostra que as publicações colocam Cuba bem acima dos números de estudos publicados sobre o assunto quando a comparação é feita. Também há coincidências em ambos os territórios em relação às doenças mais tratadas com plantas medicinais, as partes mais utilizadas das plantas e as famílias que abrangem a maioria das espécies descritas na pesquisa revisada. Obtendo um total de espécies (247), 111 em Cuba e 136 mencionadas nos estudos revisados na no estado brasileiroAs folhas são as partes mais utilizadas e a família Lamiaceae a mais popular.

*Palavras-chave:* Plantas medicinais, Etnofarmacologia, estudos bibliográficos, etnobotânica, fitoterapia

### Abstract:

Since the dawn of humanity, plants have been used to alleviate and cure diseases. Since biological diversity is precisely different in each location as it depends mainly on the climate and relief and therefore it is assumed that the development of phytotherapy or alternative medicine based on plants developed unevenly from the plants that had their disposal as well as the treatment priorities needed. Taking into account that Cuba and the state of Bahia have a similar climate, as well as a similar number of inhabitants, they were taken as the objective in this study, with a greater discrepancy in terms of territorial extension. The main purpose of this study is to understand the relationships of ethnobotany in medicinal plants in the state of Bahia, Brazil and Cuba. The method of bibliographical review of publications available from the last decade and which were accessible in the Scopus, Google Scholar, SciELO, PubMed databases was used, taking into account that these must be free and refer to the subject of study in question to be selected. The result shows that the publications place Cuba well above the number of studies published on the subject when the comparison is made. There are also coincidences in both territories in relation to the diseases most treated with medicinal plants, the most used parts of the plants and the families that cover most of the species described in the reviewed research. Obtaining a total of species (247), 111 in Cuba and 136 mentioned in the studies reviewed in the Brazilian state. Leaves are the most used parts and the Lamiaceae family is the most popular.

*Keywords:* Medicinal plants, Ethnopharmacology, bibliographic studies, ethnobotany, phytotherapy

## INTRODUCTION:

Since the beginning of humanity, medicinal plants have been used to treat different pathologies. Since much of the world's biodiversity is made up of plants with medicinal potential, and with scientific advances, herbal medicines are becoming safer and more effective, leading to an increase in demand for these products as a way of prevention. Its therapy is characterized by the use of medicinal plants in their different pharmaceutical forms without the use of isolated active ingredients and according to the WHO, 65-80% of the population in developing countries depends on medicinal plants as the only form of treatment access essential health care (CRUZ, *et al* 2022). Over the years, studies on medicinal plants have been of great importance in towns with difficult access to the most expensive methods of relieving different ailments and diseases. Studies on the use and availability of these natural medicinal products have come to provide great support for the development of medicines and medications as well as the initial and alternative treatment of various diseases.

Thus, worldwide, interest in organic production has increased and its growth has accelerated, especially since the beginning of the last decade of the 20th century. For this reason, this type of product is taking on the nuances of a million-dollar business on a global scale, driven by excess demand from industrialized countries. Natural products are generating high demands throughout the world and it is estimated that the expenses incurred in the purchase of natural products exceed 50% in relation to allopathic products; Furthermore, in some countries sales of herbal medicines increased by 101% in street markets (CIEZA IRRAZABAL, 2021).

According to the World Health Organization (WHO), traditional medicine is the entire set of knowledge, skills and practices based on indigenous theories, beliefs and experiences of different cultures, whether explainable or not, used for the maintenance of health, as well as for the prevention, diagnosis, improvement or treatment of physical or mental illnesses (WHO, 2020). Quoted by (CIEZA IRRAZABAL, 2021) therefore it has a lot to do with the biodiversity of each place as well as with their cultures and beliefs.

The use of medicinal plants is widely spread in the countries of South America, due to the heritage of their ancestors and the poverty that plagues a large percentage of their inhabitants, a reason that forces them to resort to less expensive and quality resources, easy access, although sometimes its use does not have a supported scientific basis (CARDONA, *et al* 2020)

In that logical order Brazil, the South American giant, which is the focus of this study, is recognized as the country with the greatest biodiversity of flora and fauna in the world. According to the Aquae Foundation, there are 2.4 million species in the country, between 15% and 20% of the world's biodiversity, many of them survive in the Amazon. To these figures are added the species of animals and plants that are not yet classified. (INFOBAE 2021). On the other hand, Cuba, which has a rich flora with 51% endemism, more than 1,300 plant species have some degree of threat, most of which has not been studied from a medicinal point of view, nor other possible uses (FUENTES FIALLO 2004).

Taking into account the diversity of both countries that are the object of study in the development of this paper, the importance and relevance of the topic and the risks of loss of knowledge related to medicinal plants, the importance of the research topic is justified. Therefore, knowing the importance and impact of ethnobotanical research on the documentation and rescue of empirical knowledge, the purpose of this work is to contribute to the documentation, recognition, appreciation and rescue of the local biocultural heritage related to the current use of medicinal plants in the communities of Cuba and the state of Bahia, Brazil.

Given the above, the problem of this research is: Does the biological and social diversity of both countries allow the use of medicinal plants or the care of different diseases, in an unequal and heterogeneous way? To respond to this problem presented, several purposes must be met, starting with the general purpose: Identify the ethnobotanical relationships of species for medicinal purposes in the state of Bahia, Brazil and Cuba, as well as their implementation. Finally, by meeting different goals, the necessary answers are obtained to solve the problem and meet the research purposes.

## MATERIALS AND METHODS:

This paper was developed through the bibliographic review method in which the purpose was to collect and summarize scientific information related to the topic investigated, thus contributing to knowledge of the topic (BEZERRA, 2019). The processing of bibliographic data was carried out thanks to the VOSviewer application, which is designed especially for this type of procedures. To construct the review, the following steps were taken into account: definition of the problem and research purposes; establish the inclusion and exclusion criteria for publications; sample selection; categorize and evaluate studies; present and interpret the results (BEZERRA 2019). The review had as its starting point the identification of the knowledge gap that we wanted to fill: Are there differences in the use and implementation of medicinal plants when comparing the state of Bahia and Cuba?

Based on this questioning, the following inclusion criteria were adopted: scientific papers, available in their entirety in Portuguese, English and Spanish, and published in national and international journals in the period from 2012 to 2022. The following were used as exclusion criteria: papers requiring paid access, dissertations, papers not related to the topic, or duplicates in the database. During the selection of the research papers, the titles of each of them and their respective summaries were read, in order to examine the relationship between the study and the guiding research question. After selecting the inclusion and exclusion criteria, the collection was carried out in the following databases: Directory of Open Access Journals (DOAJ), SCOPUS, PubMed, American Chemical Society (ACS), Biomed central (BMC), Network de Revistas Científicas de América Latina y el Caribe, España y Portugal (REDALYC) and on the CAPES portal in the SCOPUS database. The following descriptors were used: "Medicinal plants & Cuba", "Medicinal plants & Bahia" and "Ethnobotany and Cuba", "Ethnobotany and Bahia"; using these expressions in Spanish, Portuguese and also in English. During the bibliographic search, a logical order was followed for each case in Cuba and Brazil. The search was carried out in the works, previously selected for the

dissertation, to obtain data on the plants that are used as medicine in each of the countries in order to create a summary table with this information and be able to compare the results.

Attention was immediately focused on collecting information on the most used plant parts and the main uses of these plants to compare again the diseases most treated with medicinal plants, as well as which plant parts are the most popular in their uses to infer a justification for the popularity of certain specific parts of medicinal plants.

## RESULTS:

As part of the review of this last decade regarding scientific production on the use of medicinal plants, the following results were obtained (Figure 1). A visible difference is reflected between the studies published in Cuba with those published referring to the state of Bahia (Brazil), with the number of publications of Cuban origin being always greater each year.

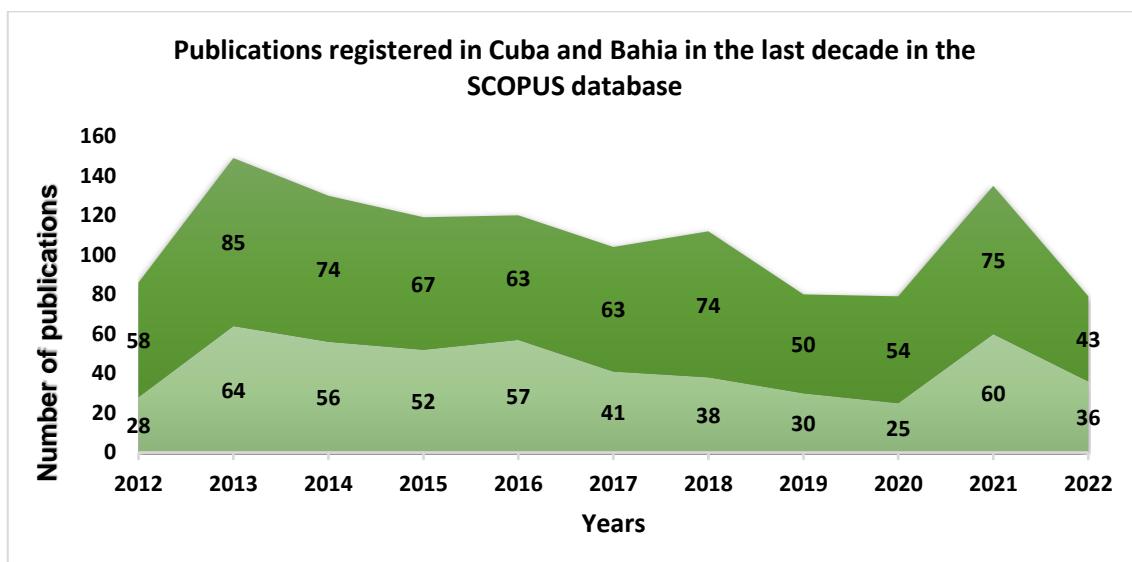


Figure 1: List of publications of the last decade Bahía (light green), Cuba (dark green).  
 Figura 1: Lista de publicações da última década Bahía (verde claro), Cuba (verde escuro).

As shown later in Figure 2, the result of the data processing in the VOS-viewer, the main topic is always in first order of importance, that is, the words medicinal plants, whose studies are published as shown in the image, mainly in scientific papers.

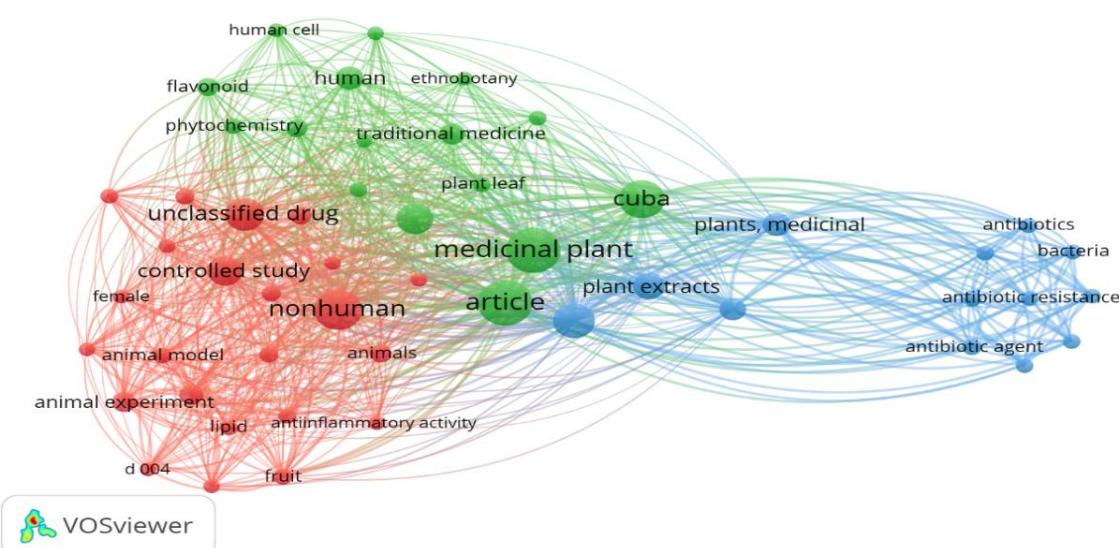


Figure 2: Cluster distribution of terms of interest.  
 Figura 2: Distribuição de cluster de termos de interesse.

Below and paying more attention to the lines of relationship between each relevant term cluster, such as papers on medicinal plants in Cuba have a close relationship with terms such as ethnobotany, traditional medicine and others represented by the color green while in the color red the terms related to unclassified drugs, controlled studies, human, among others, respond to the most outstanding. Already in the blue color with a representation of the most voted terms in the area of medicine we can see terms such as antibiotics, bacteria, among others.

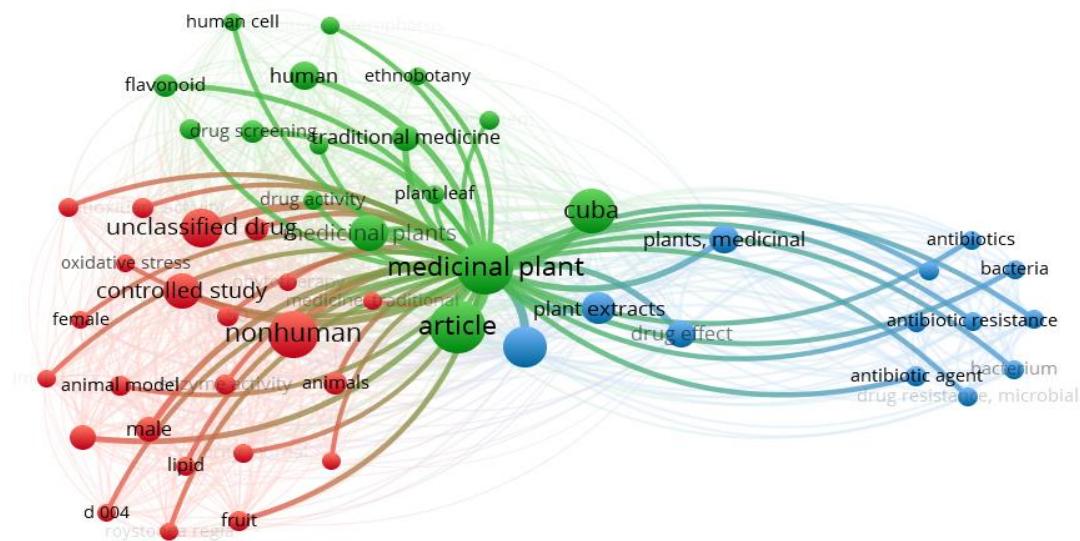


Figure 3: Interaction of the term clusters.

Figura 3: Intereração de grupos de termos.

Figure 3 shows a density distribution showing in the most intense colors the terms of greatest study and significance in this research, highlighting the papers, controlled studies, unclassified drugs, plant extracts and plant leaves, being this in many studies the most used parts, and Cuba also as a representative country in studies on the subject.

In the reviews analyzed, a total of 247 species from 85 families were collected, with 111 species collected from Cuba and 136 from Bahia, as well as the family that stood out the most is the Lamiaceae family with 26 species. As shown below in the Figure 4, the use of the parts of medicinal plants is reflected in a joint graph taking into account that both separately presented a very similar graphic distribution.

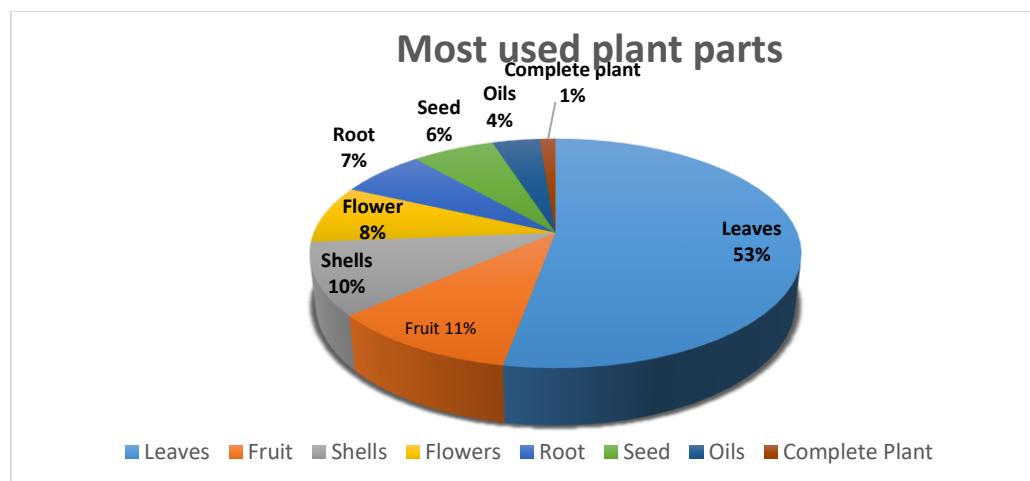


Figure 4: Representation of parts of poorly used plants.

Figura 4: Representação de partes das plantas mais utilizadas.

The different conditions to treat in each place are very varied and can depend on many factors, from the region's climate to eating habits. In this particular case, the uses in each of the places compared are in sync, so all the data is collected in a single figure (Figura 5).

## Most notable uses

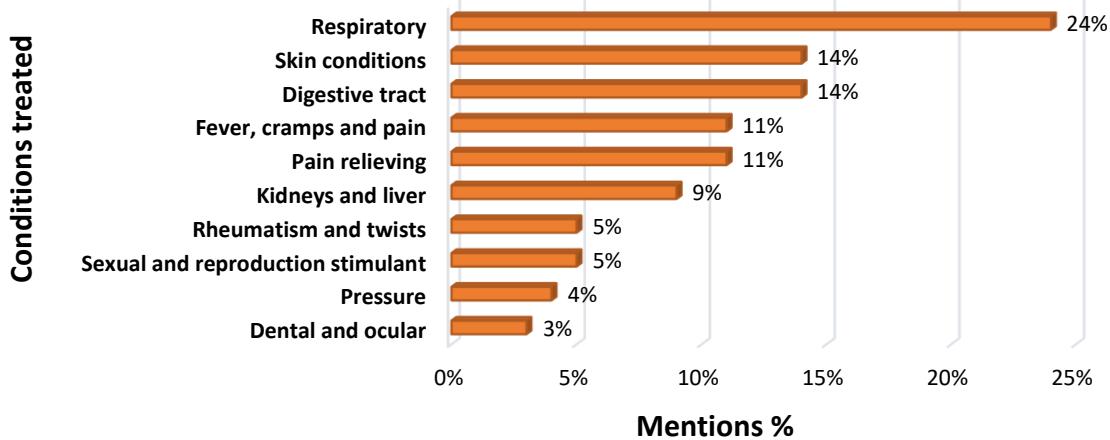


Figure 5: Grafic representation of ill-treated illnesses and diseases with medicinal plants.

Figura 5: Representação gráfica das doenças e enfermidades mais tratadas com plantas medicinais.

It is important to highlight the main forest species that stand out in both countries in this research, being the same:

- *Mangifera indica* L
- *Eucalyptus* sp. L'Hér.
- *Cedrela odorata* L
- *Citrus limon* (L.)
- *Anacardium occidentale* L.
- *Cocos nucifera* L.
- *Citrus sinensis* Pers
- *Citrus limon* (L.)
- *Psidium guajava* L
- *Tamarindus indica* L

These species were the most used in both countries and are of wide use and forestry interest. It should also be noted that *Hymenaea courbaril* L., is a species of great importance and relevance for Cuba and that, however, is not reflected in the documents that were selected for research for medicinal purposes, when, in the state of Bahia, Brazil, its use has been identified in remedies for coughs and respiratory conditions in general, as well as food and base for making flour, sweets and drinks. I consider, for these reasons, a good contribution to food cultures, and traditions of green medicine to include this species and increase its dissemination in Cuba.

The figure below (Figure 6) shows that of the total species (247), 111 are identified in Cuba as medicinal as well as 136 are mentioned in the studies reviewed in the state of Bahia. It should be noted that of the total number of species, only 37 were mentioned as species identified as medicinal in common in both places, so there is uncertainty about which species were left out of this relationship.

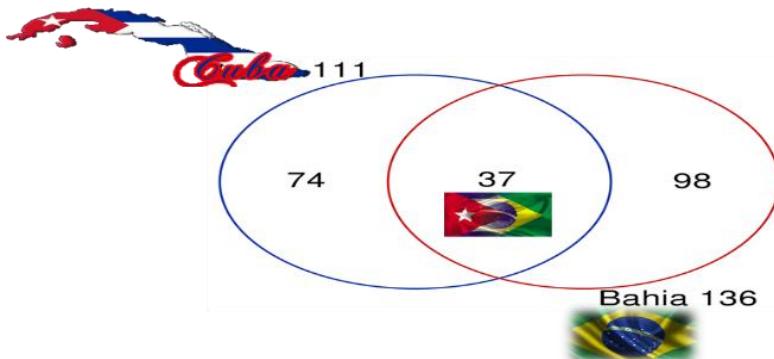


Figure 6: Venn diagram representative of the distribution of uses of the species.

Figura 6: Diagrama de Venn representativo da distribuição de usos da espécie.

## DISCUSSION:

Figure 1 shows the superiority in publications of Cuban papers on the use of medicinal plants with respect to those from the Bahia, which can be explained by the effective form of dissemination of traditional knowledge in Cuba that reaches, indiscriminately, each resident, and on many occasions, by the doctor's own guidance; as well as the insufficiency of medical products in pharmacies that drives the study of other ways to alleviate common and frequent diseases. It is ruled out that this result is due to the comparison of a country with a state because in conditions of territorial superiority the state of Bahia is almost 5 times larger than Cuba and in terms of population, the number is also higher by 4 to 5 million more inhabitants in the state of Bahia than in Cuba and even with these figures the quantities of publications are higher in Cuba.

However, it is valid to highlight that in the years 2013, 2016 and 2021 there was a peak in publications that was evident in both countries, which meant a period of boom in scientific interest on this topic, showing that the largest number of publications is collected in the 2021 which is directly related to the search for solutions and relief for the symptoms of Covid 19.

In Figure 3 of the entire network of keywords and of great significance that the program manages to distinguish, Cuba stands out as a country that is already recognized in the use and study of medicinal plants, as well as other aspects of interest such as: Drugs unclassified, controlled studies, plant extracts, among others that are gradually decreasing in relevance. In this way, the relationship of these terms in the papers selected for the study becomes evident.

We can observe (Figure 3) the representation of these three clusters and their interaction, showing in a first cluster (red) 23 terms focused on laboratory studies and experiments. A second cluster (green) reflecting 16 terms on ethnobotany and studies of medicinal plants while the last cluster (blue) with 13 terms is more focused on the use of plants and their derivatives in medicine. This distribution of research reflects the various fields of science that show interest in the use of medicinal plants and the different ways that exist to find the best options to combat diseases and illnesses in the most natural and least invasive way possible.

The most representative terms in these clusters (Figure 3) are proof of the importance of studying the characteristics of medicinal plants and their active ingredients to guarantee their appropriate use in populations that are dependent on them in some way. So much so that Cañigueral *et al* (2003) state that: The possibility of using Phytotherapy in therapeutic practices, with scientific support, requires multisectoral actions that involve from the primary production of medicinal plants to the establishment of control processes of quality of raw materials and medicines. These activities necessarily imply investments in research, especially focused on the native plants present in the diverse ecosystems existing in the region, while involving a wide spectrum of areas of knowledge, from Biology and Agronomy, to technological research with emphasis in Chemistry and Pharmaceutical and Medical Sciences

The species identified in the compilation of information on the uses of medicinal plants in this research, as well as the most used botanical families, show great relationship with those of other authors who have addressed the topic such as Bezerra (2019) "...the emphasis on the local use of species of the Lamiaceae family is associated with its wide geographical distribution and its vast therapeutic use and, consequently, its species stand out in terms of the potential for medicinal use", coinciding with him as well as with other authors such as Sánchez-Robles *et al* (2020) who affirm that this is the botanical family that shows the greatest representatives in the studies they carried out.

In the figure 5, the different parts used are grouped, gaining in popularity, with more than 50%, the leaves of the plants. These results agree with those of many authors who publish similar results where always the highest percentage of the parts used refers to the aerial parts of plants, specifically the leaves, such as (BOTANICA MEXICANA, 2017; TABAKIAN, 2019), (SÁNCHEZ-ROBLES *et al* 2020), (JIMÉNEZ *et al*. 2021).

The fact that they have the most mentions is due to the easy harvesting of the leaves as well as the ability to be available for harvest all year round or most of the year. On the other hand, they are also nutrient storage organs. Therefore, they often contain the necessary active ingredients to use them in the different forms of preparation. In contrast to the results obtained in this research, there are others carried out by other authors such as Botánica Mexicana (2017), Zambrano Cuadros (2021), which confirmed that 61.94% of residents of Huambocancha Alta report that the use of medicinal plants against diseases of the respiratory system due to economic factors; for the same reason, because these are cheaper than medicines and justifying that they receive low salaries below the minimum.

The conditions most treated with medicinal plants (Figure 5) are respiratory, this could be explained by the humid and hot climate of both study sites, which makes the population prone to developing allergies and frequent colds derived from changes in climate and humidity as confirmed by Romero Placeres, *et al* (2007) pointing out that some natural environmental factors can be cited such as extreme temperatures, high humidity,

wind speed, topography of the terrain and barometric pressure, which have proven effects on health respiratory and cardiovascular of individuals". Other more recent authors also affirm these results, such as Malagón-Rojas, *et al* (2017), stating that the association of respiratory pathology is not exclusively related to exposure to air pollutants but that it has been observed that an increase in temperature generates a greater and earlier release of pollen particles and fungal spores, involved in the genesis of allergic respiratory pathology. In this way, the climate of both regions and their similarity may be the main factor for identifying respiratory system disorders in both study sites, the most mentioned as conditions to be treated by medicinal plants.

In an in-depth analysis of the uncertainties that remained after analyzing. Figure 6 and compiling the information in Table I, it is shown that the species not mentioned or not identified in the target study sites do not necessarily have to do with the absence of the species in the area. As shown in table I, of the 98 species mentioned from Bahia, 37 can be found in Cuba, as well as of the 74 species mentioned from Cuba, 62 can be found in Bahia, so it is inferred that these species may not be included in the literature, until now as medicinal plants or were not identified in the literature that was studied according to the selected filters. Whatever the case, it is a potential that will be promoted through this paper.

Table 1: Confirmation of absence or presence of species not mentioned as medicinal in each case.

Tabela 1: Confirmação de ausência ou presença de espécies não mencionadas como medicinais em cada caso.

Information on uses	Totals	Percentage
Bahía	98	100%
They exist in Cuba	37	38%
Cuba	74	100%
They exist in Bahía	62	84%

## CONCLUSION:

- The publications from Cuba exceed by 20 (or in some cases close to 20) the publications from the state of Bahia;
- Leaves were, in both study sites, the most used plant parts;
- Diseases and conditions associated with the respiratory system are the most treated with medicinal plants;
- The uses of medicinal plants for each study site vary, so much so that there are species in both cases that, despite their existence being proven in these sites, are not reported in the reviewed literature a medicinal.

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